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**TECHA2008, Technologies Exploitation for the Cultural Heritage Advancement**

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Consiglio Nazionale delle Ricerche

**Dipartimento Patrimonio Culturale**

**TECHA 2008**

Technologies exploitation for the cultural heritage  
advancement

# Indice

## Relazioni

- 10 S. Di Marcello  
Premessa
- 10 M. Mautone  
Il Dipartimento Patrimonio Culturale del CNR a TECHA2008
- 10 L. Cessari  
Presentazione
- 10 S. Styliani Fanou  
Presentazione

### ANALYSIS, DIAGNOSTICS AND MONITORING

- 10 G. Monti  
Tutela e valorizzazione un binomio difficile
- 10 P. A. Vigato  
Diagnosis, monitoring, maintenance: results and perspectives
- 10 R. Ginanni Corradini  
Conoscere e conservare: dalla diagnostica all'innovazione
- 10 G. Caligo  
U-read, una metodologia brevettata basata su Lidar per il rilevamento, anche su territori coperti da vegetazione, di aree d'interesse naturalistico e antropologico
- 10 A. Pasetti  
Costruzione di un "manuale di diagnostica" informatizzato per la gestione degli interventi di diagnosi e conservazione sui beni culturali lapidei

### MATERIALS AND INTERVENTION TECHNIQUES

- 10 M. Matteini  
Materials and methods for conservation: criteria and innovation
- 10 E. Niero  
Approccio e clusterizzazione per tecniche di intervento nel settore dei beni culturali

### INFORMATION AND COMMUNICATION TECHNOLOGIES FOR CULTURAL HERITAGE

- 10 L. Moltedo  
Tecnologie dell'informazione e della comunicazione e beni culturali: scenari di collaborazione al CNR

- R. Caffo  
10 The national and international initiatives of the Ministry for Culture Heritage and Activities (MiBAC) within the digitalisation of cultural heritage and access in internet
- L. Ungaro  
10 Il Sistema di Comunicazione Integrato del Museo dei Fori Imperiali a Roma
- L. Bordoni  
10 Esperienze di un percorso di interazioni tra cultura e tecnologia informatica
- F. S. Nucci  
10 Nuove tecnologie e beni culturali: i media interattivi come esperienza culturale
- M. Pappagallo  
10 La comunicazione multicanale del patrimonio come strumento a servizio della salvaguardia dei beni culturali e come sistema per favorire la convergenza tra turismo ed economia della cultura
- Francesco M. Sacerdoti  
10 New user interfaces for the fruition of cultural heritage

#### SUSTAINABLE TECHNOLOGIES FOR CULTURAL HERITAGE

- S. Styliani Fanou  
10 Tecnologie sostenibili per il patrimonio culturale
- L. Cessari  
10 Tecnologie integrate per il restauro sostenibile degli edifici storici
- G. Fasano  
10 I materiali trasparenti per la conservazione e la valorizzazione dei beni culturali
- R. Tedeschi  
10 Nuove tecnologie a supporto dello studio e della valorizzazione del patrimonio architettonico: il software cloudCUBE
- F. Ceccaroni  
10 Zscan: generazione di modelli 3D per la ricognizione metrica e radiometrica dei beni culturali tramite immagini
- A. Paravicini  
10 Tecnologie informatiche e strumentali per la progettazione energeticamente consapevole di complessi storici e museali
- F. Balzan  
10 Reducing our carbon footprint: environmental measures at Palazzo Falson historic house museum, Malta

# Indice

## Tecnologie

10 S. Di Marcello, F. Ammirati  
Introduzione

### 1. ANALYSIS, DIAGNOSTICS AND MONITORING

#### *Technology offers*

##### **ART TEST (ITALY)**

Planar scanner for high definition infrared reflectography (to7it721735)  
Multilayer painting analysis (to7it722511)

##### **CARLO GAVAZZI SPACE SPA (ITALY)**

New advanced technologies applied to the cultural heritage conservation (to7it722112)  
Earth observation technologies applied to archaeology (to7it722113)

##### **CNR, ISTITUTO DI ACUSTICA "O. M. CORBINO" (ITALY)**

Non-destructive acoustic method and device for the determination of detachments of mural  
Paintings (to7it721532)

##### **CNR, ISTITUTO PER IL RILEVAMENTO ELETTROMAGNETICO DELL'AMBIENTE (ITALY)**

Synthetic aperture radars (sar) for non-invasive monitoring and diagnostic of the cultural  
Heritage (to7it722052)

##### **CNR, ISTITUTO DI SCIENZA E TECNOLOGIA DEI MATERIALI CERAMICI (ITALY)**

Characterization of archaeological and architectural ceramics (to7it722313)

##### **CNR, ISTITUTO PER LE TECNOLOGIE APPLICATE AI BENI CULTURALI (ITALY)**

High performance portable x-ray fluorescence spectrometers (to7it721887)

##### **CONSIGLIO PER LA RICERCA E LA SPERIMENTAZIONE IN AGRICOLTURA (ITALY)**

Magnetic resonance imaging (mri) for analysis of lapideous materials (to7it722159)

##### **CONSORZIO CETMA (ITALY)**

Infrared thermography for the non-destructive assessment and diagnosis of historic structures  
(to7it722256)

##### **D'APPOLONIA SPA (ITALY)**

Prism-grating-prism (pgp) spectrographic optics (to7it722132)

##### **DEMETRA SCS ONLUS (ITALY)**

Green management (to7it722107)

##### **DIASIS SRL (ITALY)**

The sonic imprint, a new non-invasive technique able to univocally identify and monitor the  
Integrity of precious works of art (to7it722289)

##### **ENEA (ITALY)**

Laser induced fluorescence (lif): applications to environmental monitoring, cultural heritage  
Preservation, medical diagnostics and terrorism protection (to7it721852)

The enea's triga reactor offers a service of neutron radiography/tomography applications,  
With a continuous improvement program of the hardware and software tools, for industrial and Cultural  
heritage applications (to7it722535)

##### **INFN, CENTRO DI ELETTRONICA (ITALY)**

A system to perform computerized tomography for objects interesting the cultural heritage and Industrial fields (to7it722558)

**INNOWEP GMBH (GERMANY)**

Standardised measurement, evaluation and documentation of the visual impression of surfaces (to7de722557)

**IRIDIUM SCIENTIFIC (ITALY)**

Systems for dating in archaeological geological fields and measuring personal and environmental Radiation dose (to7it722551)

**ISOLCELL ITALIA SPA (ITALY)**

Technical module for atmospheric climatic control of showcases (to7it721596)

**LABORATOIRE D'ETUDES ET DE RECHERCHES SUR LES MATÉRIAUX (FRANCE)**

Non-destructive tests and laboratory analysis for building and material pathologies (to7fr722006)

**MENCI SOFTWARE SRL (ITALY)**

Photographic tridimensional scanning till micrometric scale for cultural heritage measure monitoring (to7it721940)

**POLITECNICO DI TORINO, DIPARTIMENTO DI SCIENZA DEI MATERIALI E INGEGNERIA CHIMICA (ITALY)**

Hand held impedance measurement system for metallic artefacts (to7it722568)

**"SAPIENZA" UNIVERSITÀ DI ROMA, DIPARTIMENTO DI CHIMICA (ITALY)**

A specific *in situ* analysis of soluble salts (to7it722462)

**"SAPIENZA" UNIVERSITÀ DI ROMA, DIPARTIMENTO DI ENERGETICA (ITALY)**

Detection of topographical features over wide areas using a shear-force microscope (to7it721969)

**Siti (ITALY)**

Innovative monitoring systems for the safety of cultural heritage (to7it722266)

**SOCIETÀ ITALIANA BIOTECNOLOGIE (ITALY)**

Software and website for rapid diagnostic of microbial biodeterioration of cultural property (to7it72248)

**SRS ENGINEERING DESIGN SRL (ITALY)**

Reliable monitoring system for the detection of changes in physical parameters (to7it722478)

**T&T (ITALY)**

Lidar, hyperspectral data for archaeological and environmental surveys (to7it722524)

**TECNO FUTUR SERVICE SRL (ITALY)**

Diagnostic analysis and engineering (to7it722488)

**TOMOGEO SRL (ITALY)**

Electromagnetic non-invasive measurements for investigating environment and cultural heritage (to7it722454)

**UNIVERSITÀ DEGLI STUDI DI BARI, DIPARTIMENTO INTERATENEO DI FISICA "MICHELANGELO MERLIN" (ITALY)**

Laser innovation in artworks conservation and education (liace) (to7it722180)

**UNIVERSITÀ DEGLI STUDI DI FIRENZE, DIPARTIMENTO DI INGEGNERIA CIVILE E AMBIENTALE (ITALY)**

Early-warning monitoring system (to7it722527)

**UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II, DIPARTIMENTO DI PROGETTAZIONE URBANA E DI URBANISTICA (ITALY)**

Mobile laboratory for safety, conservation and promotion of the architectural heritage (to7it722270)

**UNIVERSITÀ DEGLI STUDI DI PADOVA, DIPARTIMENTO DI INNOVAZIONE MECCANICA E GESTIONALE (ITALY)**

Ladimo: a laboratory network for a multidisciplinary analytical and technological characterization of Cultural heritage materials and objects (to7it722503)

**UNIVERSITÀ DEGLI STUDI DI PARMA, DIPARTIMENTO DI INGEGNERIA INDUSTRIALE (ITALY)**

10 Instruments and non-destructive technologies for the structural integrity assessment of buildings (to7it722219)

**UNIVERSITÀ DEGLI STUDI DI ROMA TOR VERGATA, DIPARTIMENTO DI ENERGIA MECCANICA (ITALY)**  
Structural investigation of parchment and paper-made artefacts (to7it721588)

**UNIVERSITÀ DI CASSINO, DIPARTIMENTO DI MECCANICA, STRUTTURE, AMBIENTE E TERRITORIO, LABORATORIO DI ROBOTICA E MECCATRONICA (ITALY)**  
Mechanics of manipulation and industrial robotizations to carry out architectural surveys (to7it721991)

**CENTRO LASER SCARL (ITALY)**  
Laser techniques for cleaning (khe7it722481)

**CNR, ISTITUTO DI SCIENZE MARINE (ITALY)**  
*In situ* corrosion monitoring on metal surfaces by electrochemical methods (khe7it722283)

**CNR, ISTITUTO PER LA PROTEZIONE DELLE PIANTE (ITALY)**  
Denaturant gradient gel electrophoresis (dgge) for the identification of environmental microorganisms (khe7it722203)

**CNR, ISTITUTO PER LE TECNOLOGIE APPLICATE AI BENI CULTURALI (ITALY)**  
Integrated ground methods for archaeological prospections (igmap) (khe7it722307)

**ENEA (ITALY)**  
Diagnostic technology based on scanning electron microscopy and microanalysis (khe7it722447)

**FRAUNHOFER INSTITUT FOR SILICAT RESEARCH (GERMANY)**  
Research on cultural heritage preservation (khe7de722324)

**INSTITUT FÜR TECHNISCHE OPTIK, UNIVERSITÄT STUTTGART (GERMANY)**  
Optical sensors for cultural heritage structural diagnostics applications (khe7de722459)

**LABORATORIO DE DOCUMENTACIÓN GEOMÉTRICA DEL PATRIMONIO (SPAIN)**  
Geometric documentation, information transcendence, metadata (khe7es722191)

### *Know-how expertises*

**PÔLE INDUSTRIES CULTURELLES ET PATRIMOINES (FRANCE)**  
Experience sharing from the french industries and heritage cluster association (khe7fr722282)

**"SAPIENZA" UNIVERSITÀ DI ROMA, DIPARTIMENTO DI ENERGETICA (ITALY)**  
Non-destructive *in situ* investigations on cultural heritage (khe7it722273)

**UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II, DIPARTIMENTO DI SCIENZE FISICHE (ITALY)**  
Energy dispersive x-ray fluorescence (ed-xrf) elemental analysis with portable apparatus (khe7it722550)

**UNIVERSITÀ DI BOLOGNA, DIPARTIMENTO DI FISICA (ITALY)**  
Combined magnetic resonance techniques for diagnostic investigations of cultural heritage Porous materials (khe7it722321)

**UNIVERSITÀ DEGLI STUDI DI ROMA TOR VERGATA, DIPARTIMENTO DI BIOLOGIA (ITALY)**  
Methods for control and monitoring of stone bio-deterioration in archaeological sites (eurtd7it721587)

**ARKHEÏA (FRANCE)**  
New artificial and mineral material for art restoration or moulded works of art (to7fr721795)

**B&C SPEAKERS (ITALY)**  
Outdoor sonorous parks specifically designed to enrich urban areas and parks (to7it722428)



BOSSONG SPA (ITALY)

Technology of injected anchors with sock as a versatile method of structural reinforcement and Strengthening for masonry structures (to7it722355)

CNR, ISTITUTO DI SCIENZA E TECNOLOGIA DEI MATERIALI CERAMICI (ITALY)

Compatible mortars for the conservation of the architectural and archaeological heritage (to7it722322)

COMPLEXUL MUZEAL NATIONAL "MOLDOVA" IASI (ROMANIA)

The conservation of patrimony objects in high frequency cold plasma (to7ro722475)

CENTRO RECUPERO E RESTAURO CAMPANO SRL (ITALY)

Innovative materials and new products for the restoration of historical building walls and paving for urban areas with low environmental impact (to7it722409)

EMITECH SRL (ITALY)

Alternative disinfestations technology for the conservation of the wooden cultural heritage (to7it721917)

Alternative disinfestations/sterilization technology for cloth (to7it721921)

Alternative disinfestations/sterilization technology for paper and for the archival heritage

Conservation (to7it721922)

*EU RTD results*

ENEA (ITALY)

Non-invasive, non-contact seismic early warning-protection system for statues and museal objects (to7it722485)

## 2. MATERIALS AND INTERVENTION TECHNIQUES

ERGONIXART SRL (ITALY)

Multi-sensorial pathways for exhibitions, museums or public areas (to7it722245)

*Technology offers*

GEODAG SAS (ITALY)

New anchorage system for structural and geotechnical application (to7it722216)

GLASWERKSTATTE ROTHKEGEL E.K. (GERMANY)

More security through optimized radiance filtering (uv and ir) protective glazing and lighting concepts for the protection of art in museums (to7de722430)

GRAFICA DESIGN ANNA LAURA BACHINI (ITALY)

Decorative urban panels fully customizable (to7it722252)

IL CENACOLO SRL (ITALY)

Leonardo: the permanent constant-strain frame for paintings (to7it722178)

INSTITUTE FOR MECHANISED CONSTRUCTION AND ROCK MINING (POLAND)

Silica sol from waste chalcedonite used in order to improve the construction products' properties (to7pl722360)

Nanotechnology applications in building industry (to7pl722406)

ITEMA SAS (ITALY)

Air shelf (to7it722556)

MBL SOLUTIONS SRL (ITALY)

Innovative microwaves technology for restoration and pest control in wooden immovable structures (to7it721869)

UNIVERSITÀ DEGLI STUDI DEL MOLISE, DIPARTIMENTO DI SCIENZE E TECNOLOGIE PER L'AMBIENTE E IL TERRITORIO (ITALY)

Bioclean-art: process for the bio-cleaning of the surfaces of objects of various chemical natures and buildings, including cultural heritage (to7it722343)

UNIVERSITÀ DEGLI STUDI DI BARI, CENTRO INTERDIPARTIMENTALE LABORATORIO DI RICERCA PER LA DIAGNOSTICA DEI BENI CULTURALI (ITALY)

Techniques and methodologies for diagnostics of cultural heritage (to7it722280)

UNIVERSITÀ DEGLI STUDI DI BRESCIA, DIPARTIMENTO DI INGEGNERIA CIVILE, ARCHITETTURA, TERRITORIO (ITALY)

Experimental investigation on mechanical behaviour of natural pozzolana lime mortars as a fundamental step for the design of structural repair of historical buildings (to7it722306)

**WOJSKOWA AKADEMIA TECHNICZNA (POLAND)**  
Laser cleaning of monuments and works of art (to7pl722249)

**A-CORROS (FRANCE)**  
Expertise and diagnosis in corrosion and conservation of metallic cultural heritage, either terrestrial or submarine (khe7fr722253)

**CNR, ISTITUTO DI BIOLOGIA E PATOLOGIA MOLECOLARI (ITALY)**  
Biotech production of enzymes in microorganisms (khe7it722482)

**CNR, ISTITUTO PER LA CONSERVAZIONE E LA VALORIZZAZIONE DEI BENI CULTURALI (ITALY)**  
Fluorinated polymers for conservation and restoration of stone artifacts (khe7it722316)

**POITECNICO DI TORINO, DIPARTIMENTO DI SCIENZA DEI MATERIALI E INGEGNERIA CHIMICA (ITALY)**  
Plasma enhanced chemical vapour deposition (pecvd), coatings for protection of metallic artefacts (khe7it722567)

**UNIVERSITÀ DEGLI STUDI DI BARI, CENTRO INTERDIPARTIMENTALE LABORATORIO DI RICERCA PER LA DIAGNOSTICA DEI BENI CULTURALI (ITALY)**  
Bioactive nanoparticles to fight microbial communities on stone artworks (khe7it722281)

**ALPHA CONSULT SRL (ITALY)**  
Webgis applications for cultural heritage mapping and advancement (to7it722331)

**APPLIDEA EDITRICE SRL (ITALY)**  
Web-based archives on human skeletal material with tridimensional representations (to7it722387)

**BCAA SRL (ITALY)**  
KilykÄ interactive system (kis): the naked way for multimedia applications (to7it722492)

**BOVIAR SRL (ITALY)**  
Supervisory control and data acquisition (scada), systems for monitoring and diagnosis of structures and territory (to7it722515)

**CARLO GAVAZZI SPACE SPA (ITALY)**  
Traceability of moveable cultural assets (to7it722098)  
Earth observation technologies applied to cartography and tourist guidance (to7it722100)  
Cultural heritage surveillance (to7it722146)

**CENTRICA SRL (ITALY)**  
An innovative tool to deliver high quality images in the world wide web (to7it722105)  
Digital asset management/digital rights management (dam/dar): a web-based  
Software designed for digital image collections (to7it722108)

### *Know-how expertises*

**CNR, ISTITUTO DI STUDI SUI SISTEMI INTELLIGENTI PER L'AUTOMAZIONE (ITALY)**  
A geographically distributed system for the aided recombination of fragments (to7it722290)  
Omero: a system to allow blind people to touch virtual reality (to7it722291)

**CNR, ISTITUTO PER I BENI ARCHEOLOGICI E MONUMENTALI (ITALY)**  
Real time 3d platform for remote visiting of cultural heritage (to7it722315)

**CREALAB SRL (ITALY)**  
Crea-re, a flexible remote management platform applicable to all domain (to7it721727)

**DEMETRA SCS ONLUS (ITALY)**  
DidÄ, gps guide and walkie pod: multimedia video-guide systems for tours in parks and cities (to7it722104)  
Smart botanical garden system (to7it722303)

### 3. INFORMATION AND COMMUNICATION TECHNOLOGIES FOR CULTURAL HERITAGE

#### *Technology offers*

##### **ECOMEDIA SCARL (ITALY)**

Must system: multilingual simultaneous transmission for automatic commentaries (to7it722172)

##### **ENEA (ITALY)**

Multipurpose digital archive (to7it722574)

##### **GEORENDER SRL (ITALY)**

3d laser scanner surveying and modelling (to7it722404)

##### **HYPERBOREA SRL (ITALY)**

Arianna3: software for historical archives description. International standard archival description (isad) compliant (to7it722411)

Ariannaweb: solution for historical archives online publishing. Encoded archival description (ead) compliant (to7it722414)

##### **ID TECHNOLOGY SRL (ITALY)**

Oliweb: integrated access metaweb to heterogeneous cultural heritage asset (to7it722272)

A scalable distributed open archival information system (oais) (to7it722284)

##### **IN TARGET CONSULTING SERVICES SRL (ITALY)**

An information system for the management and the valorization of cultural assets (to7it722538)

##### **INSTITUTE FOR MECHANISED CONSTRUCTION AND ROCK MINING (POLAND)**

Alarm sender using local or virtual area network for museums (to7pl722407)

##### **INTERAGENS SRL (ITALY)**

Interactive animated characters for cultural heritage (to7it722415)

##### **IPT SRL (ITALY)**

Webgis for cultural heritage (to7it722561)

##### **LABEIN-TECNALIA (SPAIN)**

Augmented reality for the diffusion, promotion and learning of cultural heritage (to7es722278)

Integration of information technologies for management and revalorisation of historical surroundings (to7es 722279)

##### **LIBEROLOGICO SRL (ITALY)**

A webgis for planning, managing and documenting of restoration works (to7it722302)

Gsm audio-guide for arts, tourism and environment (to7it722304)

Platform for multi-schema cataloguing (to7it722305)

##### **MAGIT SP. Z O.O. (POLAND)**

3d interactive visualisations of museums, buildings and cities (to7pl722224)

The multimedia kiosks, information points for museums, galleries, monuments (to7pl722239)

##### **META SRL (ITALY)**

Meta3d: an engine for high quality 3d real-time rendering and simulation (to7it722341)

##### **METIS SYSTEMS SRL (ITALY)**

Digital reproduction systems for extreme high quality reproduction of large originals and books (to7it722335)

##### **P-CULTURE WORKING GROUP (ITALY)**

Admire: personalized cultural tourism system on mobile device (to7it722129)

##### **RADIOLAN SRL (ITALY)**

Low-cost device for wireless telemetry and remote control of systems (to7it721658)

##### **SMARTTECH SP. Z O.O. (POLAND)**

Scanbright: mobile system for 3d measurements (to7pl722312)

##### **TECNOLAB SRL (ITALY)**

Handheld informational platform for museums (to7it721700)

**TOGUNÀ INTERACTIVE SRL (ITALY)**

I-musee: INTERACTIVE MUSEUM (to7it722429)

**UNIVERSITÀ DEGLI STUDI DI MILANO (ITALY)**

New accessibility towards cultural heritage (to7it722122)

**UNIVERSITÀ DEGLI STUDI DI MILANO, DIPARTIMENTO DI INFORMATICA E COMUNICAZIONE (ITALY)**

Music processing technology (to7it722220)

**UNIVERSITÀ DEGLI STUDI DI PALERMO, DIPARTIMENTO DI INGEGNERIA INFORMATICA (ITALY)**

Robot acting as a guide in cultural areas (to7it721649)

**UNIVERSITÀ DEGLI STUDI DI SIENA, CENTRO DI GEOTECNOLOGIE (ITALY)**

Geotechnologies for cultural heritage: remote sensing, digital photogrammetry, gis, webgis, 3d Modelling, laser scanning, geophysics (to7it722340)

**UNIVERSITÀ DEGLI STUDI DI SIENA, DIPARTIMENTO INGEGNERIA DELL'INFORMAZIONE (ITALY)**

Wireless sensor network for real-time monitoring of cultural heritage assets (to7it722359)

**UNIVERSITÀ DEGLI STUDI DI TRIESTE, GEONETLAB (ITALY)**

Road and environment survey by global navigation satellite system (gnss) static and mobile mapping system. Personal digital assistant (pda) tourist guide for archaeological and cultural heritage (to7it722350)

**UNIVERSITÀ DELLA CALABRIA, DIPARTIMENTO DI MECCANICA (ITALY)**

Low-cost system for the stereoscopic visualization of 3d digital model (to7it722211)

**VIRTUAL ITALIAN PARKS SRL (ITALY)**

Virtual reality platform and 3d graphical engine (to7it722412)

**VIRTUALWARE (SPAIN)**

Recreation of heritage sites using virtual reality technology (to7es722096)

**CERERE, CENTRO REGIONALE PER IL RECUPERO DEI CENTRI STORICI CALABRESI (ITALY)**

Sidi, system of diagnosis and intervention for the restoration of architectonic heritage (khe7it722554)

**CNR, ISTITUTO DI RICERCHE SULLE ATTIVITÀ TERZIARIE (ITALY)**

Placemaker software: a flexible and interactive tool for complex analysis and sustainable planning (khe7it722175)

**CNR, ISTITUTO DI STUDI SUI SISTEMI INTELLIGENTI PER L'AUTOMAZIONE (ITALY)**

A system to automatically monitor archaeological sites and museums (khe7it721995)

**CNR, ISTITUTO PER I BENI ARCHEOLOGICI E MONUMENTALI (ITALY)**

Satellite imagery processing for archaeology (khe7it722247)

**CNR, ISTITUTO PER LE TECNOLOGIE APPLICATE AI BENI CULTURALI (ITALY)**

Virtual reality application for cultural heritage, off and on line (khe7it722255)

**CNR, ISTITUTO PER LE TECNOLOGIE DELLA COSTRUZIONE (ITALY)**

Open source webgis (khe7it722536)

**E-VOLUZIONE SRL (ITALY)**

Technology for museal exhibits, man machine interfaces (khe7it722445)

**FORUS SRL (ITALY)**

Seaward: underwater archaeology system (khe7it722264)

**Geographike srl (italy)**

Webgis and database management system (dbms) solutions for cultural heritage advancement (khe7it722416)

**HOMEGATE SRL (ITALY)**

New technologies and innovation for the cultural heritage (khe7it722332)

**MEOGEO SRL (ITALY)**

Advanced technologies for risk assessment and management of cultural resources (khe7it722502)

**OFFICINA PER LE ARTI OPERA SRL (ITALY)**

3d digital textured models from laser scanning data, suitable for interactive navigation (khe7it722463)

**PLANETEK ITALIA SRL (ITALY)**

Webgis 3d and permanent scatterers technique for monitoring and management of cultural heritage (khe7it722455)

**SRS ENGINEERING DESIGN SRL (ITALY)**

Development of technical software for engineering design and control systems (khe7it722155)

**TEA SAS (ITALY)**

Techniques and methodologies for non-invasive diagnostic of the cultural heritage (khe7it72172)

**UNIVERSITÀ DELLA CALABRIA, EVOLUTIONARY SYSTEM GROUP (ITALY)**

Graphical and virtual reconstruction of archaeological environments (khe7it722319)

**VICOMTECH, VISUAL COMMUNICATION TECHNOLOGIES (SPAIN)**

Valorisation of cultural heritage (khe7es722300)

**CNR, ISTITUTO PER LE TECNOLOGIE APPLICATE AI BENI CULTURALI (ITALY)**

3D WEBGIS JAVA-BASED SYSTEM (eurtd7it722329)

**SUPO CERBER SP. ZO.O. (POLAND)**

Automatic water fog system for fire extinguishing (to7pl721641)

**XEWER SRL (ITALY)**

Micro photovoltaic system for small and medium electric uses (sun spark) (to7it721779)

Electric generation systems with accumulation fuelled by photovoltaic or aeolian energy (to7it721781)

**CNR, ISTITUTO PER LE TECNOLOGIE APPLICATE AI BENI CULTURALI (ITALY)**

Sustainable integrated technologies for documentation and conservation of the built heritage (khe7it726492)

**LUIGI FIORAMANTI ARCHITETTURA (ITALY)**

Professional services in favour for sustainable architectural planning (khe7it722379)

**UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II, DIPARTIMENTO DI PROGETTAZIONE URBANA E DI URBANISTICA (ITALY)**

Decision support and tools for eco-efficiency in rehabilitation works using fiber reinforced materials technologies (khe7it722261)

**"SAPIENZA" UNIVERSITÀ DI ROMA, DIPARTIMENTO DI ARCHITETTURA, OSSERVATORIO SUL MODERNO A ROMA (ITALY)**

Territory sustainable development: urban project for an environmentally accepted recuperation and reuse of modern and contemporary architecture (eurtd7it722380)

TECHA

# Premessa

*Questo lavoro è il frutto di un evento internazionale svoltosi a Roma il 10 e l'11 marzo del 2008 dal titolo TECHA2008 (Technologies exploitation for the cultural heritage advancement), dedicato alla presentazione delle nuove tecnologie per la conoscenza, la conservazione e la valorizzazione del patrimonio culturale.*

*La manifestazione è stata pensata dagli organizzatori con lo scopo di dare vita a fecondi momenti di discussione tra i diversi operatori del settore (istituzioni, centri di ricerca, aziende), sulle metodologie, le innovazioni e le problematiche inerenti il restauro e la fruizione del patrimonio culturale, e di favorire, al tempo stesso, la divulgazione delle migliori metodologie e tecnologie esistenti sul mercato o in via di sviluppo. L'evento ha rappresentato, inoltre, il coronamento di una lunga serie di attività volte alla promozione dell'innovazione e al trasferimento tecnologico portate avanti dal Cnr per oltre 10 anni nell'ambito del progetto europeo CIRCE (Central Italy Innovation Relay Centre).*

*Il volume si articola in due sezioni. La prima presenta le relazioni di esperti italiani e stranieri invitati per l'occasione a dare il loro contributo ai quattro workshop tematici organizzati nel corso della prima giornata; la seconda parte raccoglie le schede di descrizione di tecnologie innovative illustrate da ricercatori e imprenditori di tutta Europa in occasione del technology transfer day svoltosi il secondo giorno. Sia i testi delle relazioni sia le descrizioni delle tecnologie sono stati gentilmente forniti dai relatori e dai titolari delle tecnologie stesse e il contenuto di tali contributi ricade sotto la responsabilità dei rispettivi autori. I curatori del volume hanno provveduto all'organizzazione e revisione di tutto il materiale affinché il contenuto scientifico fosse fruibile anche ai non addetti ai lavori.*

*A conclusione di questo lavoro, che rappresenta anche l'ultimo atto di un lungo periodo (otto anni) in cui ho coordinato il progetto CIRCE, desidero ringraziare tutti coloro che in questo arco di tempo mi sono stati vicino, che mi hanno su(o)pportato e che hanno creduto in me, facendomi crescere professionalmente e umanamente. Desidero ricordare prima di altri Maria Saveria Cinquegrani, Andrea Lapicciarella, Diassina Di Maggio, ma anche i colleghi di "stanza", Alessandra, Sara e Stefania, con i quali ho condiviso tanti anni di lavoro.*

*Un grazie particolare va poi a quanti hanno contribuito, ciascuno con le proprie risorse, competenze e professionalità, alla buona riuscita di TECHA2008. In primo luogo i partner istituzionali: la Commissione Europea, l'Enea, il Comune di Roma e la Provincia di Roma, APRE (Agenzia per la Promozione della Ricerca Europea). In secondo luogo, i colleghi italiani della rete degli Innovation Relay Centre e del Gruppo Tematico Ambiente/Beni culturali: Angela, Caterina, Francesca, Filippo, Fulvio, Gianluca, Giovanna, Mara, Paola, Salvatore, Susanna, ai quali va tutta la mia riconoscenza. Infine i colleghi del Dipartimento Patrimonio Culturale con i quali ho condiviso tutti i momenti gravosi e leggeri della preparazione dell'evento fino alla revisione dei testi: Vania, Natale, Nicoletta, Marta, Paola.*

*Un sentito ringraziamento al mio Direttore, Prof. Maria Mautone per la fiducia che ha riposto in me e per avermi incoraggiato nei momenti più difficili.*

*Solo attraverso un lavoro di équipe è possibile raggiungere risultati così importanti.*

SARA DI MARCELLO  
Cnr, Dipartimento Patrimonio Culturale

TECHA



# Il Dipartimento Patrimonio Culturale del CNR a TECHA2008

MARIA MAUTONE  
Direttore del Dipartimento  
Patrimonio Culturale

Il 10 e l'11 marzo del 2008 si è svolto a Roma il convegno internazionale dedicato alle nuove tecnologie applicate ai beni culturali.

L'evento – organizzato da CNR, Dipartimento Patrimonio Culturale, ENEA, Comune di Roma, Provincia di Roma, APRE e network degli Innovation Relay Centre (IRC), pur inserendosi a pieno titolo nella lunga e fruttuosa tradizione degli eventi promossi dagli IRC, ha rappresentato una prestigiosa novità per il settore.

La manifestazione si è articolata in due momenti successivi: nel corso del primo giorno un convegno e quattro *workshop* tematici hanno posto le basi per una piattaforma comune di discussione e di condivisione del pensiero contemporaneo sulle questioni teorico-metodologiche, le innovazioni e le problematiche inerenti il patrimonio culturale. Il secondo giorno un *technology transfer day* ha reso possibile la realizzazione di molteplici incontri bilaterali tra ricercatori e imprenditori, offrendo agli imprenditori una concreta opportunità di conoscere e acquistare le più recenti tecnologie sviluppate da Università e centri di ricerca di tutta Europa e ai ricercatori l'occasione di avviare collaborazioni internazionali con partner industriali per nuovi progetti di ricerca.

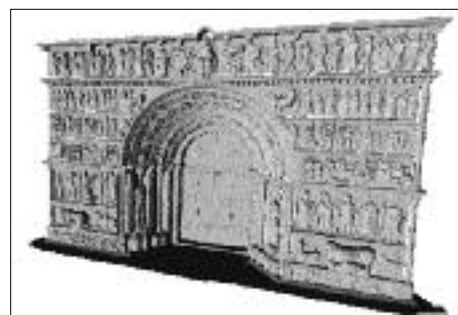
Le tematiche oggetto dei *workshop* e del *technology transfer day* hanno riguardato le nuove metodologie e tecnologie per l'analisi, la diagnostica e il monitoraggio, i nuovi materiali e le tecniche di intervento per il restauro e la conservazione, le più recenti tecnologie informatiche per la fruizione e la valorizzazione del patrimonio artistico e archeologico e, infine, le tecnologie sostenibili per la diagnostica e il restauro del patrimonio architettonico. Sia il dibattito sia gli incontri bilaterali hanno reso possibile un confronto fecondo tra il mondo accademico, quello imprenditoriale e quello istituzionale.

A tutto ha fatto da corollario un'esposizione in cui sono stati presentati i risultati della ricerca più all'avanguardia del Cnr, dell'Enea e delle aziende italiane e internazionali operanti in questo settore e presenti alla manifestazione.

Le numerose adesioni da parte di enti e imprese all'evento romano hanno testimoniato come, anche a livello internazionale, vi sia una diffusa consapevolezza sul fatto che il settore dei beni culturali rappresenta sempre più un vantaggio per quei Paesi che sanno meglio conservarlo, valorizzarlo e gestirlo. Di qui gli sforzi congiunti della comunità scientifica per far sì che l'innovazione tecnologica costituisca un'irrinunciabile opportunità, non solo di sostegno, ma anche di progresso nella tutela e nella valorizzazione dello straordinario patrimonio storico-artistico del nostro Paese e dell'Europa tutta.

In questo settore il Cnr si presenta come una fonte di tecnologie sempre nuove e all'avanguardia. La diffusione e il trasferimento sul mercato è per l'Ente il naturale sbocco dei numerosi progetti nazionali e internazionali che - oltre ai gruppi di ricerca operanti all'interno di Istituti propriamente dedicati allo studio di civiltà antiche e allo sviluppo di tecnologie applicate ai beni culturali per la loro conservazione e valorizzazione - vedono coinvolti ricercatori attivi in molteplici settori: dalla chimica alla fisica, dalla biologia alle nanotecnologie, dalle scienze dell'atmosfera e del clima alle tecnologie informatiche, dalle tecnologie delle costruzioni ai sistemi per l'automazione.

Portale del Monastero di Ripoll.  
Modello digitale 3D ottenuto per  
scansione laser a triangolazione



I progetti di ricerca del Dipartimento Patrimonio Culturale trovano, infatti, il loro punto di forza nell'approccio multidisciplinare e sinergico fra le scienze umanistiche e quelle dell'area scientifico-tecnologica. Molti sono i prodotti di eccellenza (metodologie e tecnologie) scaturiti dall'intenso lavoro dei ricercatori in un connubio tra arte e scienza, tra antico e nuovo. Attraverso tali progetti di ricerca il Dipartimento persegue la trasversalità delle competenze in tutte le fasi della filiera che raccorda conoscenza, diagnosi, conservazione, valorizzazione, fruizione, gestione e formazione. Per ciascuno di questi segmenti è possibile riportare risultati di eccellenza.

Nel campo della diagnostica e del monitoraggio, le tecnologie presentate e promosse dai ricercatori del Cnr nell'ambito dei *workshop*, del *technology transfer day* e dell'esposizione di TECHA2008 sono di tipo non-invasivo e volte a monitorare ed indagare lo stato di conservazione e la composizione dei materiali dei beni storico-artistici. Dal metodo acustico non invasivo per la rilevazione dei distacchi degli affreschi dalle pareti (*Non-destructive acoustic method and device for the determination of detachments of mural paintings*), brevettato dall'Istituto di Acustica, al metodo di misurazione elettrochimica per il monitoraggio in situ della corrosione delle superfici metalliche (*EIS – Electrochemical Impedance Spectroscopy*) sviluppato dall'Istituto di Scienze Marine; dallo spettrometro portatile a raggi X ad alte prestazioni (*X-Ray Fluorescence*) utilizzato per la caratterizzazione dei materiali, alle indagini geofisiche ad alta risoluzione per la localizzazione e l'analisi di siti archeologici (*IGMAP – Integrated Ground Methods for Archaeological Prospection*) proposti entrambi dell'Istituto per le Tecnologie Applicate ai Beni Culturali. Sempre per la diagnostica, l'Istituto per il Rilevamento Elettromagnetico dell'Ambiente ha presentato vari sistemi elettronici di telerilevamento mediante l'utilizzo di onde elettromagnetiche come il *SAR – Synthetic Aperture Radar*, il *Ground Penetrating Radar* e l'*Optic fiber sensors*. L'uso integrato di queste tre tecnologie consente indagini geofisiche e il monitoraggio non-invasivo 3D e 4D del territorio, al fine di determinare le proprietà morfologiche, fisiche e chimiche di strutture antropiche non direttamente accessibili. Infine, l'Istituto di scienza e tecnologia dei materiali ceramici ha sviluppato una nuova sequenza analitica per la caratterizzazione dei materiali ceramici archeologici e architettonici.

Nell'ambito dei nuovi materiali e delle tecniche di intervento non distruttive l'Istituto per la Conservazione e la Valorizzazione dei Beni Culturali ha prodotto dei polimeri fluorurati per la conservazione e il restauro di manufatti in pietra, mentre l'Istituto di Scienza e Tecnologia dei Materiali Ceramici ha presentato delle nuove malte compatibili, per il restauro del patrimonio architettonico e archeologico; infine, l'Istituto di Biologia e Patologia Molecolari ha illustrato delle tecniche per la produzione di enzimi da microrganismi per la pulitura e il restauro di legno, carta e affreschi.

Sul tema di una energia efficiente e alternativa per gli edifici antichi e della loro tutela sostenibile, il Built Heritage Lab dell'Istituto per le Tecnologie Applicate ai Beni Culturali ha sviluppato il tema della Green conservation, un approccio innovativo per l'adeguamento funzionale del patrimonio architettonico e per il recupero eco-compatibile dei nostri centri storici. Per quanto riguarda le applicazioni ai beni culturali delle tecnologie informatiche, il Virtual Heritage Lab dell'Istituto per le Tecnologie Applicate ai Beni Culturali ha sviluppato applicazioni di realtà virtuale per la fruizione on e off line di siti archeologici e sistemi *WebGIS 3D* di ricostruzione virtuale per la diagnostica. L'Istituto di Studi sui Sistemi Intelligenti per l'Automazione ha presentato un sistema per la ricomposizione virtuale di frammenti di opere d'arte, utilizzato per la ricostruzione elettronica dei 120.000 frammenti della vela di San Matteo della Basilica Superiore di S. Francesco in Assisi distrutta dal terremoto del 1997, ma applicabile anche a opere su carta, pietra e legno. Lo stesso istituto ha realizzato un sistema che permette ai non vedenti di toccare la realtà virtuale (*OMERO*). L'Istituto per i Beni Archeologici e Monumentali ha realizzato delle piattaforme *3D in RealTime* per la fruizione a distanza del patrimonio archeologico e la modellazione tridimensionale di edifici antichi e tecniche di *Remote sensing* per l'individuazione spaziale di siti archeologici sepolti, attraverso l'uso di immagini aeree, dati satellitari multispettrali e *LIDAR (Laser Imaging Detection and Ranging)*. Infine, l'Istituto di Ricerche sulle Attività Terziarie ha predisposto uno strumento informatico (*Place Maker software*) per la realizzazione di mappe dinamiche e interattive per il monitoraggio e la pianificazione sostenibile delle trasformazioni urbane e dei flussi turistici. Tutte queste tecnologie di realtà virtuale e ricostruzioni 3D ampliano il quadro conoscitivo del bene e favoriscono la fruizione con un significativo impatto sia sulla conoscenza dell'opera d'arte, sia sulla fruizione del bene e quindi sullo sviluppo locale.

La manifestazione così articolata (workshop, technology transfer day e esposizione) ha dimostrato di essere un efficace momento di incontro e un necessario punto di partenza per scelte strategiche e sostenibili indirizzate alla tutela e alla valorizzazione del patrimonio culturale, nonché un'opportunità di scambio tra domanda e offerta di innovazione in questo settore. In quest'ottica si inserisce la seconda edizione della manifestazione che sarà ospitata a settembre 2010 nella storica cittadina francese di Arles. In occasione di *TECHA2010*, la tutela, la conservazione e la valorizzazione del patrimonio culturale saranno affrontate nella prospettiva di nuove tematiche fortemente legate alla storia e alla tradizione dei luoghi quali il "paesaggio naturale" e il "patrimonio costruito".

# Un nuovo umanesimo per le tecnologie applicate ai beni culturali

LUCIANO CESSARI  
Qualifica

In un'epoca in cui proliferano convegni, fiere, mostre e progetti di comunicazione e disseminazione dei risultati in tutti i settori della ricerca scientifica, della produzione industriale e dei vari servizi a supporto dell'economia, l'idea di proporre un nuovo Workshop nel campo dei beni culturali doveva scontare lo scotto di questo affollamento di eventi e iniziative, con il rischio di ripetizioni e sovrapposizioni di tematiche già affrontate. Nel caso di TECHA 2008 questa sfida è stata vinta, non solo per il successo raggiunto con la straordinaria partecipazione di esperti e imprese provenienti da tutta Europa, ma per la multiforme e alta qualità dei contributi scientifici presentati. Ma la specificità di TECHA si è consolidata già nell'ideazione dell'iniziativa, quando abbiamo puntato su due concetti cardine tra loro collegati: *exploitation* delle tecnologie, come valorizzazione non solo tecnica, economica, ma anche epistemologica e metodologica delle stesse; e *advancement* del patrimonio culturale inteso come progresso e promozione non solo economica, ma soprattutto culturale e sociale.

Oggi la promozione si coniuga inevitabilmente con il tema della sostenibilità. In un'epoca di globalizzazione spinta anche in campo culturale, questo significa innanzitutto rispettare l'identità culturale dei luoghi e considerare la compatibilità dei nostri interventi con le particolari strutture sociali, gli apparati culturali, le concezioni filosofiche e i sentimenti religiosi ed estetici del luogo nel quale si interviene.

Ma soprattutto sostenibilità significa rispettare la qualità materica, autentica e artistica dei beni quando li conserviamo, ma anche quando operiamo le nostre azioni diagnostiche, di monitoraggio e di documentazione.

Più complesso appare l'obiettivo di una valorizzazione tecnologica in un'epoca nella quale la tecnologia si allontana sempre più dalla scienza, per rispondere alle richieste del mercato e spesso per orientare le strategie delle nostre economie. Nel campo della conoscenza e conservazione del patrimonio culturale la nuova frontiera scientifica e imprenditoriale deve indirizzarsi verso tecnologie e prodotti per la diagnosi, la protezione, la conservazione, il restauro e lo sfruttamento sostenibile dei beni culturali mobili e immobili europei, per la promozione del loro valore e della qualità della vita.

Tale prospettiva si fonda sulla convinzione che sia l'innovazione tecnologica, con nuove tecniche di indagine e nuovi materiali, che quella di processo, con nuovi metodi di prevenzione e conservazione, potrebbero consentire di ridurre o ritardare il degrado, o, almeno, i costi degli interventi di manutenzione e restauro, in linea con una filosofia di sviluppo di tecnologie sostenibili.

Ecco che anche le tecnologie devono divenire sostenibili, senza chiudere il campo a tutte le tecnologie innovative costituite da metodologie, materiali e strumenti già messi a disposizione dalla ricerca, per azioni di diagnostica, monitoraggio e pianificazione della conservazione. L'obiettivo è quello di migliorare la qualità dei processi di conservazione e renderne maggiormente sostenibili i costi nel lungo periodo, con applicazioni innovative anche con riferimento al basso impatto ambientale degli interventi (materiali ecologici, controllo di emissioni, prestazioni energetiche). Processi che riguardano anche metodi non invasivi di analisi, documentazione e di monitoraggio, con particolare riferimento alla sostenibilità della diagnosi per immagini.

# TECHA

Le linee da sviluppare sono molteplici. Possiamo pensare alla frontiera che sempre più connette infrastrutture fisiche e infrastrutture digitali e che ci può consentire di controllare e regolare, attraverso una rete immateriale di natura informatica tutto il processo di conoscenza del patrimonio antico e regolarne la conservazione e persino il funzionamento nella società. E prestare attenzione ai temi energetici e ambientali per tenere in considerazione gli impatti dei cambiamenti climatici, determinati dai consumi energetici incontrollati, al fine di sviluppare, anche nel campo dei beni culturali, una specificità nel settore tecnologico della *ET (Energy Technology)* che oggi prepotentemente affianca quello della *IT (Information Technology)* che ha dominato il panorama scientifico e industriale degli ultimi vent'anni.

Quali conclusioni trarre? E' la cultura la vera protagonista dell'avanzamento della tecnologia, in base al ruolo che riusciremo a darle, aprendo la strada a un nuovo Umanesimo scientifico dove la tecnologia costituisca lo strumento per una visione e una realizzazione sostenibile della società futura, piuttosto che uno strumento di potere economico e accademico.

# Presentazione Stella Styliani Fanou ENEA

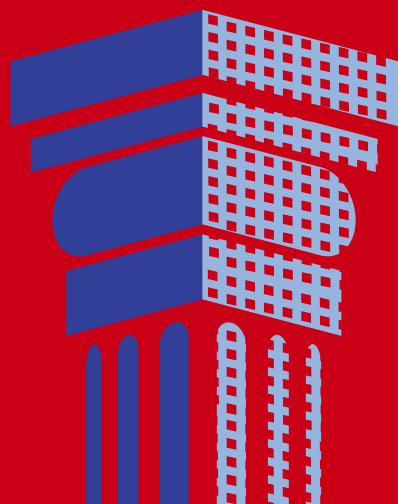
TECHA

2008

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# Analysis, diagnostics and monitoring



2008

## Tutela e valorizzazione un binomio difficile

Guglielmo Monti

*Soprintendenza per i Beni Architettonici del Veneto Orientale*

L'attuale concezione economica del patrimonio culturale, all'origine dello stesso termine "bene culturale" e della creazione di un Ministero che l'amministra come risorsa, stenta a trovare un impegno pianificatorio adeguato alla sua importanza in un Paese che si vanta peraltro di possederne in quantità.

Se questo avviene, al di là della miopia politica e dell'insensibilità dei cittadini, c'è anche la difficoltà di intendere correttamente il particolare valore economico dell'eredità storico-artistica. Resta spesso in ombra la sua specificità legata all'insostituibilità dei beni che ne fanno parte e alla loro conseguente fragilità. Per considerare il loro valore, devono essere tutelati in maniera da non perdere quelle caratteristiche che li rendono validi testimoni del tempo.

Il conseguente rapporto di un simile oggetto d'attenzione con il tempo è opposto a quello che caratterizza la merce, per definizione scambiabile e consumabile, tanto più valida economicamente quanto più è assimilabile ad altra merce e quindi esprimibile in denaro. La cultura al contrario dà valore ai propri reperti per le loro caratteristiche peculiari, irriducibili ad altri prodotti e degne d'essere protette per durare il più a lungo possibile. La durata si oppone perciò al consumo, come la qualità specifica si situa all'estremo opposto rispetto all'omogeneità che rende facili gli scambi.

In queste condizioni, che hanno reso problematico l'inserimento della cultura tra gli elementi di negoziazione della Comunità Europea, tutela e valorizzazione, costituenti generalmente un binomio sui documenti programmatici sui beni culturali, rischiano di trasformarsi in attività confliggenti. Se infatti la prima è intesa come massima preservazione possibile nel tempo con conseguenti condizioni ideali d'ambiente, è chiaro che non tollera una frequentazione eccessiva né presenta gran tolleranza ai cambiamenti d'uso e di collocazione. D'altro canto la valorizzazione, per ottenere esiti ottimali, esige oggetti duttili e tali da offrire almeno a quella forma di consumo che è l'esposizione a un vasto pubblico.

Il problema si complica ulteriormente se ci riferiamo in particolare all'architettura che, rispetto agli altri settori culturali, presenta un rapporto più intenso con l'uso e il contesto. Ogni aspetto della cultura ha infatti bisogno di essere collocato nelle corrette condizioni fruibili per essere inteso ma, mentre un quadro o una scultura possono essere ammirati anche al di fuori del loro ambiente d'origine, un edificio ha fisicamente bisogno di essere utilizzato e il suo apprezzamento non può prescindere dai riferimenti paesaggistici che ne formano il quadro di riferimento. La correttezza dell'uso e della collocazione sono quindi condizioni indissolubilmente legate alla conservazione degli immobili storici e quindi a una loro valorizzazione che non ne stravolga il senso.

Per comprendere quanto queste considerazioni rendano difficile l'abbinamento tra tutela e valorizzazione basti considerare l'impiego turistico dell'architettura che peraltro è all'origine della concezione economica del patrimonio culturale. L'ottimizzazione dei servizi al turismo tende infatti a stravolgere con infrastrutture stradali, alberghiere e impiantistiche, il contesto ambientale e spesso la stessa materia del monumento per adeguarlo a condizioni fruibili molto lontane da quelle che ne hanno contrassegnato le vicende storiche. D'altronde anche i cambiamenti d'uso necessari a garantire la

sopravvivenza delle antiche fabbriche sono il più delle volte inconciliabili con la loro conservazione intesa come puro e semplice mantenimento dei caratteri trasmessi dal tempo. Si pensi soltanto all'uso delle macchine nei centri storici, all'introduzione di impianti di risalita, di illuminazione, di condizionamento, per non parlare che di quegli elementi generali d'attualizzazione ormai imprescindibili.

Eppure è proprio a partire dalla difficoltà dell'architettura che si delinea un percorso capace di avviare tutti i beni culturali al superamento delle contraddizioni tra la necessità di non snaturarli e l'impegno di utilizzarli come risorse. Una serie di esperienze condotte in diversi Paesi europei sulla riutilizzazione dei centri storici porta nel 1975 alla formulazione del principio di "conservazione integrata", introdotto nella *Carta europea del patrimonio architettonico*. L'obiettivo che la nuova concezione si prefigge è quello di conciliare protezione e valorizzazione tramite un'epurazione progettuale che le integri.

L'ottica del progetto sposta significativamente entrambi i termini del binomio in maniera da renderli compatibili e provoca cambiamenti considerevoli sulla prassi conservativa. La tutela cessa di presentarsi come sottrazione dei beni al flusso di tempo in una sorta d'imbalsamazione e si trasforma in una conservazione attiva capace di accompagnarli nella prosecuzione del loro destino tenendo conto di tutta la loro storia. D'altra parte la valorizzazione non persegue l'obiettivo del massimo sfruttamento e dell'adeguamento degli antichi manufatti a condizioni dettate unilateralmente dall'attualità ma tende, attraverso una modificazione reciproca delle esigenze del presente e dei presupposti passati, a rendere fruibile all'uomo di oggi la ricchezza di ieri. Così la storia diviene oltretutto ammaestramento per riconsiderare, alla luce della continuità con la tradizione, alcune odierne abitudini dissennate, in un'operazione che si può ridefinire come *cura critica*.

Nella pratica questa strategia di continuo adeguamento di depositi del tempo trascorso e di avvenire non trova facili applicazioni all'economia e alla pianificazione. Siamo ancora troppo legati a criteri economici connessi all'immediato arricchimento e allo sfruttamento intensivo, a cui corrisponde una tutela limitata e specialistica, sostanzialmente sottratta ai processi vitali.

Nonostante gli oltre trenta anni trascorsi dalla loro chiara formulazione, i criteri esposti sopra non sono affatto acquisiti, come dimostrano i continui tentativi, ripetuti anche di recente, di separare la questione della protezione da quella della valorizzazione. È quindi quanto mai opportuno ribadire e aggiornare continuamente la concezione di conservazione attiva e *cura critica*, viste come due facce della stessa medaglia. È d'altronde questa l'unica moneta spendibile per una reale presa in considerazione dei valori culturali come beni economici, che comporta un loro pieno inserimento, con la priorità che meritano, nella vita nazionale. Viceversa la vecchia tutela sarà sempre perdente nei confronti dei processi di spietata valorizzazione del territorio e dovremo continuare ad assistere alla decadenza della nostra unica vera ricchezza.

## Diagnosis, monitoring, maintenance: results and perspectives

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### Abstract

*In the following presentation, are reported through explanatory cases, non destructive, micro-invasive or destructive diagnostics methodologies in describing the properties at molecular, nano, micro or macro level of the organic and inorganic constituent materials of works of art, as well as their modification in consequence of decay processes. Furthermore, an integrated approach, aimed at combining together the specific outputs offered by each of these specific methodologies, is presented with the help of a couple of examples, that prove, in turn, the need for mutual collaboration between artistic and scientific research activity.*

*Art is now subject to more scientific scrutiny than before as dedicated scientific tools in conservation science are rapidly growing. These provide the essential knowledge and means to ensure conservation strategies. This mutual relationship represents an extraordinary opportunity to open new stimulating research frontiers.*

### Presentation

A recent book illustrates briefly the most relevant technologies set up by Consiglio Nazionale delle Ricerche (CNR) on the different aspects (knowledge, diagnosis, restoration, conservation, valorization and benefits) of the Science and Technology for Cultural Heritage [9].

Appropriate non-destructive, micro-invasive or destructive methodologies have been developed in order to obtain a comprehensive description of constituent materials at different dimensions (molecular, nano, micro or macro-scale), according to the employed methodology. Furthermore, an integrated approach was also employed in order to overcome the partial knowledge of the material properties (i.e. composition, reactivity, modifications, etc.), afforded by a single, specific physico-chemical, analytical, mineralogical or petrographic investigation.

The mutual relationship among different disciplines allows to open new stimulating research frontiers, providing the essential knowledge and tools to make restorers' works more efficient and durable.

The scientific pathway for the preservation of each work of art required the following steps: 1) acquisition and evaluation of documents and knowledge of the history, manufacture and past treatments; 2) identification of the material components and evaluation of the conservation state; 3) identification of decay processes also with the aid of laboratory simulation; 4) restoration design and intervention; 5) monitoring and maintenance. Some examples of these different steps are reported hereunder.

Transmission electron microscopy (TEM) was successfully applied to the identification of size, crystallographic properties and chemical composition of chromophore nanoparticles inside a Renaissance opaque-red glass (Bianchin et al., 2005, 165-182), and, more recently, scanning electron microscopy (FEG-SEM), equipped with an EBSD facility, showed how versatile and valuable it can be in the determination of the structure

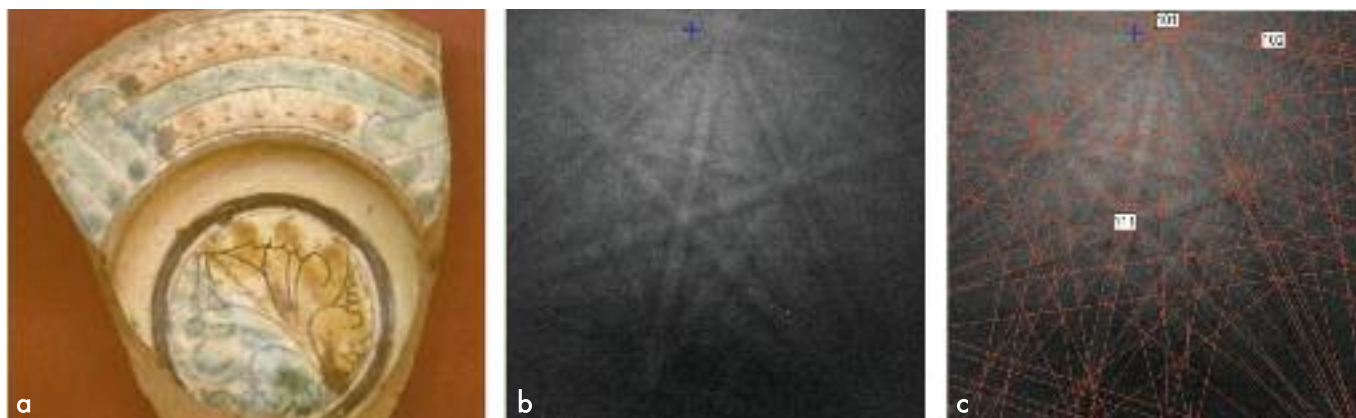


Fig. 1. Fragment of Florentine graffiti slipware ceramics (a), EBSD diffraction pattern of the synthetic pigment in the yellow decoloration (b) and its best fit matching with that of bindehimitite (c)

of micro- and nano-particles of the yellow polychromy of a Florentine graffiti slipware ceramic (15<sup>th</sup>-17<sup>th</sup> century), undetectable through XRD diffraction techniques (Fig. 1) [3].

Infrared (m-FT-IR), nuclear magnetic resonance (<sup>1</sup>H or <sup>13</sup>C NMR) spectroscopies and SEC separation methodology combined with optic and electronic microscopies were successfully employed to evaluate the conservation state of the polymers used in past treatments of stones. In order to identify correctly the decay pathway of these polymers, laboratory simulations of polymer deterioration were carried out using climate chambers and appropriate ageing procedures. It was verified that the acyclic polymers mainly suffer chain scission with the formation of double bonds and g-lactones, coupling reactions leading to cross linked species, hydrolysis of the ester groups with the formation of the related acids, while silicone-containing polymers undergo crosslinking reaction and hydrolytic breakage of the Si-O-Si bonds. These new groups, occurring in consequence of the decay processes, can be used as specific markers for a fast, and unexpensive identification of the polymer degradation processes and the validation of these decay markers came from their identification in several outdoor heritage treated stones [4, 5, 6]. An interdisciplinary approach to understand, to conserve, to exploit and to promote works of art is represented by the scientific investigations and the preliminary restoration works carried on the frescoes of the Great Hall of Casa Vasari in Florence [1]. The entire cycle was in an extremely bad state of preservation due to numerous cracks in the plaster, to the dangerous instability of the wall, to the detachment of the painted plaster from the beneath arriccio and to the heavy-handed repainting carried out during numerous attempts at restoration. These works have also unfortunately diminished the work's integrity. A comprehensive scientific investigation was carried out on the wall paintings and its environment, in order to aid and answer the conservators' questions. The cracks, even those not yet visible to the naked eye, were located using acoustic and thermographic investigations. Magnetic resonance was employed to examine the damp beneath the wall surfaces and in the mortar. The decay of the structure was also investigated in order to provide a sound basis of knowledge so to assess and assist works to secure and to stabilize it. The microclimate of the environment provided information on the interaction between the pollutants and the surfaces. Furthermore, morphological studies of the decayed materials were carried out with non-invasive methods and employing innovative portable equipment which could be used quickly. It also allowed a continuous monitoring of the restoration. This survey improved the quality of the restoration slowing down further deterioration.

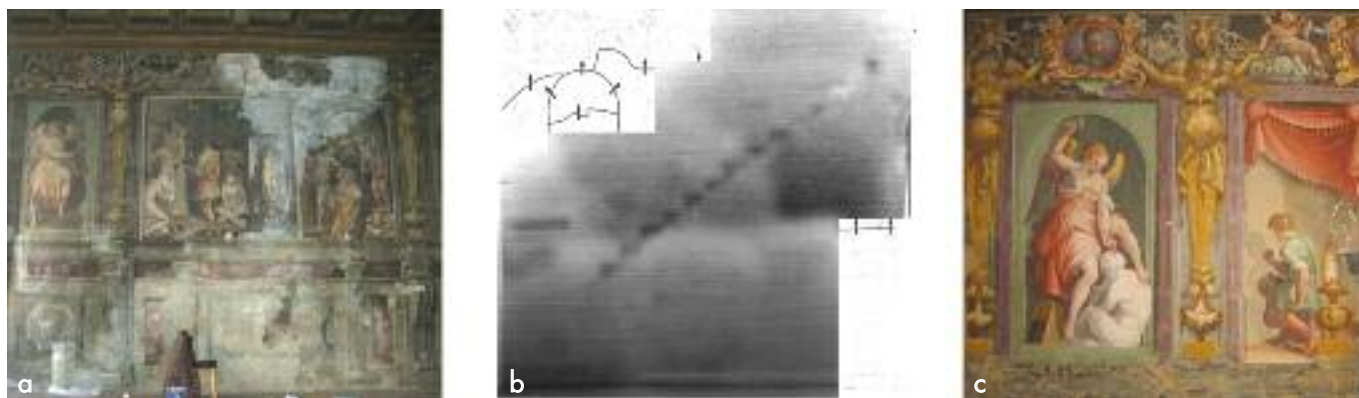


Fig. 2. Partial view of the Vasari Hall paintings in Florence before (a) and after restoration (c) and a thermographic image of the same surface showing the fissuring network and the shadow of a removed staircase (b)

This work has already been used as basis for the first intervention procedures. The quality of the results acquired can be appreciated in Fig. 2.

The development of the "Vasari Project" has contributed significantly to the enhancement of the processes of mutual collaboration between artistic and scientific activity and research by helping to consolidate the relationship between human and material sciences, providing data and practical solutions that are connected with three fundamental aspects connected to the safeguard of our cultural heritage; 1) investigation to acquire a comprehensive knowledge of the work of art; 2) information and intervention to solve problems of conservation and decay; 3) final management to provide the correct museum benefits.

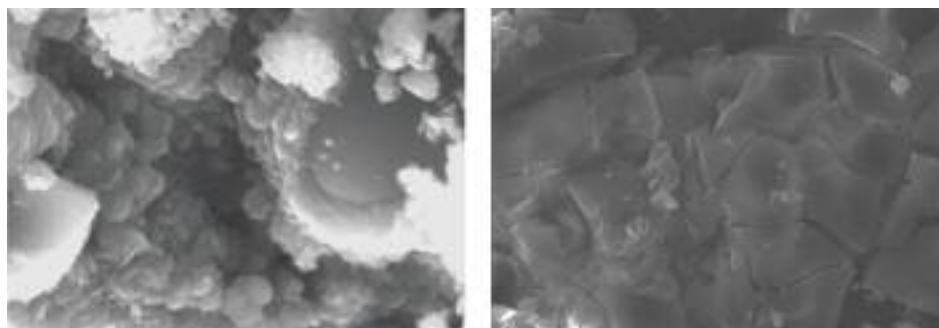
For this last purpose an appropriate has been planned to offer a guided visit to Casa Vasari revealing or rediscovering treasures and testimonies often neglected or forgotten. Furthermore, an accurate description of the state of conservation of this pictorial cycle allows an appropriate maintenance program, providing a non-invasive and non-destructive methodology that reduces the potential for deterioration at a much earlier stage and avoid more radical and traumatic restoration interventions.

Micro analytical investigations can provide information on original material used and on their conservation state. For example this approach applied to the study of *La Medusa* by Caravaggio showed the technical method used to prepared green pigments [8].

SEM-EDS and micro-XRD measurements on the fresco *The Virgin with the Child Jesus and Devotee* on the apses of Cremona Cathedral, were quite helpful to solve the different point of view among art historians about the chronological sequence of the restoration works and the authors of these repaintings. The stylistic analysis of the images was also difficult because some parts were completely repainted. Appropriate scientific analyses on a limited numbers of samples allowed for a comprehensive understanding of the sequence and type of interventions; while the retouched Virgin stands up with a completely repainted devotee, the original painting represents the Virgin in a seated position with a knelt devotee praying (14<sup>th</sup> century), a subsequent repainting by Boccaccio Boccaccino, dated at the beginning of the 16<sup>th</sup> century, was detected and also more recent retouchings (18<sup>th</sup> and 19<sup>th</sup> centuries) were identified.

New methods have also been explored on the development of inorganic compounds to act as conservative nanomaterials for heritage stone. The promising properties of this material is under investigation to improve their stability and solubility in order to better replace the currently used materials employed as durable and compatible stone consolidants (Fig. 3) [7]. These examples demonstrate that high synergic collaboration between professionals of

Fig. 3. Secondary electron images of  $\text{CaCO}_3$  nanolayer on porous substrates (left image) and  $\text{SiO}_2$  coating on the same substrate (right image). The  $\text{CaCO}_3$  coating from alkoxides appears more homogeneous and more adherent to the substrate in comparison to the silica cracked coating from TEOS deposition and the incoherent deposition of  $\text{CaCO}_3$  from the treatment with water suspension of slaked lime. Magnification: 5000x



different disciplines operating in the field of cultural heritage can address correctly the conservative and the scientific issues that are intended to be problem-oriented rather than object-oriented.

The future challenges for the diagnosis of the cultural heritage will be, from the scientific and applicative aspects, the development of fast and not expensive suitable protocols for monitoring and maintenance procedures and from the technological point of view, the set up of physico-chemical and analytical investigations capable of describing the products and the associated phenomena at a progressively reduced scale.

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## Conoscere e conservare: dalla diagnostica all'innovazione

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### Abstract

*Il Cenacolo Srl has been founded in Rome in 1988 as research laboratory and support for technicians who work in the field of Cultural Heritage. It now operates in the fields of conservation and restoration. The on-field long-dating experience, its technically skilled team and the collaboration with well-known experts allow Il Cenacolo to face and solve each conservative problem, concerning architectural, archaeological and historical-artistic heritage. The development of technical innovations, the constant definition and application of new methodologies based on an interdisciplinary approach and always including preliminary diagnostic studies, are trademarks of this company. This presentation will give a short overview on the most representative experiences carried out in the last 20 years for the protection and conservation of the Cultural Heritage.*

### Presentazione

Il Cenacolo è una società che lavora da circa vent'anni nell'ambito dei beni culturali ed essendo nato come laboratorio di diagnostica, ha sempre basato la propria attività sul "conoscere per conservare".

La grande esperienza acquisita nel settore ha permesso di formare una équipe valida e tecnicamente preparata, tanto da avviare un processo di evoluzione e trasformazione della società in impresa di restauro, con un ufficio tecnico per la progettazione e direzione dei lavori, un laboratorio di analisi per la diagnostica e un team di tecnici e operatori specializzati per intervenire direttamente sui beni culturali architettonici, archeologici, storico-artistici e cartacei.

Gli interventi svolti sono stati realizzati principalmente in ambito nazionale coprendo praticamente tutto il territorio (Fig. 1); ciò ha permesso di acquisire una significativa esperienza – successivamente ampliata con alcuni lavori all'estero – basata sullo studio, la progettazione e gli interventi che hanno interessato materiali lapidei, da compatti a teneri, e che sono ubicati in diversi contesti: urbano, costiero, continentale.

L'esperienza acquisita ha dimostrato che ogni lavoro comporta "un'innovazione ad hoc", sia piccola che significativa, perché ogni bene culturale richiede un'attenzione particolare e specifica. Queste innovazioni riguardano lo sviluppo di nuove tecniche e metodologie sia di diagnostica che di intervento.



- BENI ARCHITETTONICI
- BENI ARCHEOLOGICI
- BENI STORICO-ARTISTICI
- BENI ARCHIVISTICI

Fig. 1. Interventi realizzati dal Cenacolo in Italia

### Alcuni esempi di innovazione

Un primo caso di innovazione sia tecnica che metodologica riguarda il "telaio estensibile Leonardo". Si tratta di un telaio (ideato, sperimentato, brevettato e realizzato da Il Cenacolo nel 1990 e costantemente implementato) in lega leggera e a tensione costante; è nato come soluzione tecnica innovativa per l'intervento di sostituzione dei tradizionali telai lignei di supporto ai dipinti su tela. L'impiego del legno, un materiale che ha un comportamento decisamente più rigido rispetto al tessuto, può infatti



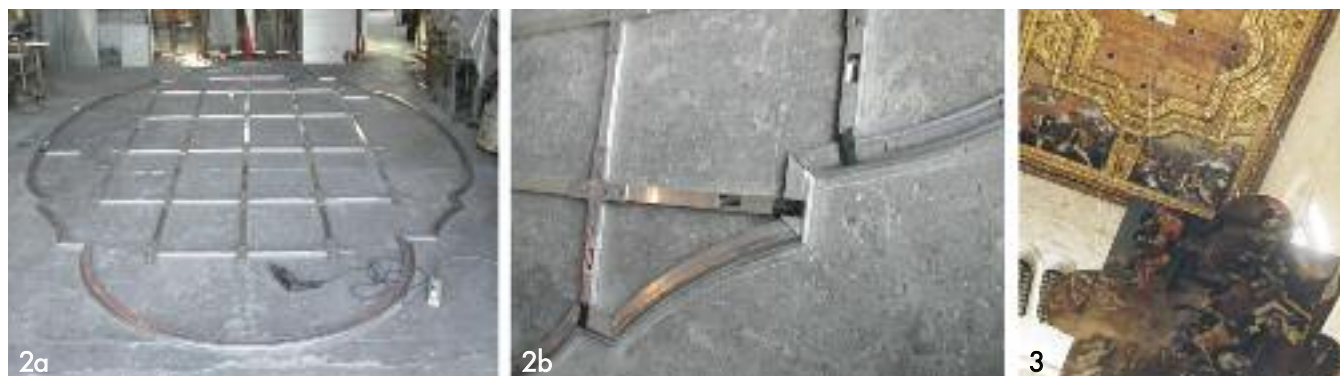


Fig. 2a-b. Telaio Leonardo  
Fig. 3. Ricollocazione dei dipinti sul soffitto della basilica

innescare fenomeni di degrado sulla tela e sullo strato pittorico, legati alle differenti caratteristiche fisiche e meccaniche dei materiali e ad altri fattori esterni.

La caratteristica principale del telaio Leonardo (Fig. 2a-b) è la capacità intrinseca di adattarsi automaticamente alle variazioni di tensione della tela, dovute a molteplici cause come ad esempio i mutamenti del microclima, mantenendo il sistema tela/telaio alla tensione più idonea per la conservazione. Si evitano in tal modo pericolose sovratensioni e rilassamenti della tela che possono generare sulla superficie pittorica crepe, crenature e conseguenti sollevamenti, con eventuali perdite di materia pittorica. Nel caso specifico del restauro delle tele del soffitto della basilica di San Nicola a Bari (1989), oltre al telaio Leonardo, è stato applicato un innovativo sistema di ancoraggio delle tele, leggero e resistente, che ha permesso una sicura e comoda ricollocazione dei dipinti sul soffitto della basilica con l'impiego di un insieme di argani finalizzato a una più agevole manutenzione degli stessi (Fig. 3).

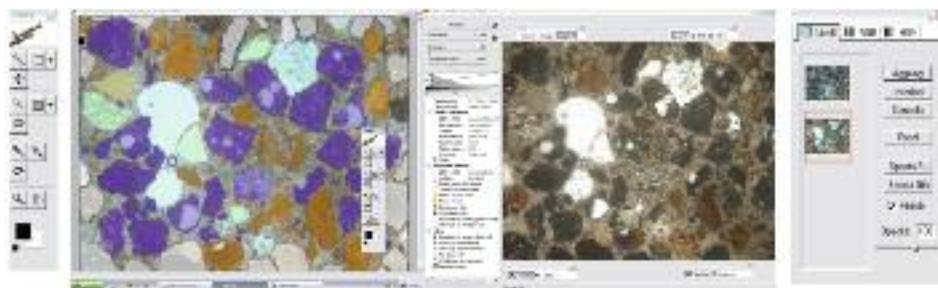
Un secondo esempio di innovazione metodologica è quello condotto in occasione dello studio diagnostico svolto sul Tempio della Concordia nella Valle dei Templi di Agrigento (1998-2001). In questa occasione, oltre alla caratterizzazione dello stato di fatto delle superfici e delle strutture, è stata eseguita una diagnostica per la verifica dei trattamenti consolidanti, protettivi e di incollaggio.

Secondo Il Cenacolo, le analisi di laboratorio sui prodotti per incollaggio e stuccatura devono confermare un criterio principale: devono essere sufficientemente resistenti, ma non in modo eccessivo, e si devono disgregare, comunque, prima della pietra antica originaria.

La metodologia messa a punto per questo intervento, prevedeva di effettuare delle prove in laboratorio che, insieme con le prove di valutazione dei trattamenti protettivi e consolidanti, sono state svolte su n. 379 provini normalizzati e n. 68 campioni. Ciò ha consentito di valutare, mediante prove di ritiro, prove di trazione diretta su provini incollati e prove di invecchiamento artificiale mediante cristallizzazione dei sali, il prodotto di incollaggio e stuccatura più idoneo.

Una tecnica innovativa di indagine dei materiali lapidei (terzo caso) è stata ideata, progettata e realizzata da Il Cenacolo nel 2007. Si tratta di un sistema di elaborazione di immagine, su sezioni lucide e sottili, chiamato EIMA (Elaborazione d'Immagine dei Materiali Antichi). Il sistema EIMA (brevettato) è adatto, oltre che a differenti settori della geologia (es. sedimentologia, mineralogia, petrografia) anche alla caratterizzazione applicata a materiali lapidei (naturali e artificiali) nel settore dei beni culturali. Infatti, proprio in questo settore, visto l'elevato pregio dei beni da restaurare, è richiesto un

Fig. 4. Sistema EIMA



elevato dettaglio di analisi. Proprio per questo motivo EIMA utilizza e amplia, come sistemi di riferimento, le carte visive riportate nelle normative UNI 11176 (ex Racc. NorMaL 12/83).

Il sistema prevede l'utilizzo innovativo di due monitor (Fig. 4) in modo da poter visionare sul primo le immagini acquisite da elaborare (es. immagine a Nicols paralleli e incrociati in sovrapposizione su differenti livelli ed eventuale trasparenza con le immagini possibili elaborate con filtri) e sull'altro la stessa immagine *in live* in modo da poter identificare eventuali differenti fasi mineralogiche.

Un quarto caso di innovazione metodologica analitica è quello svolto sulla facciata principale di Ca' Vendramin Calergi (Casinò di Venezia, 2003-2004). Lo studio diagnostico svolto da Il Cenacolo in quella occasione ha riguardato l'identificazione dei trattamenti pregressi e la valutazione dell'efficacia di prodotti consolidanti e protettivi. Lo studio ha fatto parte di un progetto completo riguardante il rilievo geometrico, l'identificazione dei materiali e dei processi di degrado (Arcadia Ricerche) e la definizione dello spessore dei rivestimenti lapidei (Tecniter).

L'intervento innovativo condotto da Il Cenacolo, ha ripreso e adeguato quanto già precedentemente sperimentato per la Torre di Pisa dal professor Ulderico Santamaria. L'esigenza fondamentale era quella di poter valutare in laboratorio (su n. 183 provini normalizzati) la dannosità e l'efficacia dei prodotti consolidanti che si sarebbero dovuti impiegare sulle lastre, fortemente disgregate di "pavonazzetto", di marmo di Carrara venato e di "nero" del Belgio. Tuttavia, una volta reperito il marmo di cava simile a quello delle facciate, non era possibile consolidare dei provini compatti e sani che, benché sottoposti a numerosi cicli artificiali di gelo-disgelo, non hanno mostrato alcun segno di invecchiamento. Per tale motivo la valutazione in laboratorio dei trattamenti consolidanti non ha utilizzato solamente i provini sani di cava ma, sull'esperienza della Torre di Pisa, ha simulato il consolidamento di marmi completamente disgregati. A tale fine è stata eseguita un'analisi modale in sezione sottile che ha permesso di ricostruire la distribuzione granulometrica dei blasti. Una volta disgregati artificialmente i suddetti marmi, sono stati ricostruiti dei provini con polveri di marmo e con la distribuzione granulometrica sopra menzionata, e sono stati consolidati per impregnazione. La valutazione in questione è stata condotta mediante il controllo delle variazioni cromatiche, della traspirabilità e della resistenza meccanica.

Un altro esempio di innovazione metodologica di intervento è relativo al ripristino virtuale di testi particolarmente degradati e non più restaurabili come quelli della pergamena miniata di Tristano e Isotta del XIII sec. (Archivio di Stato di Viterbo), del Fondo Armani e, in particolare, della Cronaca di Pietro Cantinelli del XIII sec. e dei codici miniati notarili (Archivio di Stato di Perugia).



Fig. 5. Esami eseguiti con la sonda Bips

Il lavoro, eseguito tra il 2000 e il 2001 è stato prezioso per la definizione e l'applicazione di una metodologia per il restauro virtuale di libri e documenti che si poneva l'obiettivo di rendere leggibili testi compromessi dal degrado e quindi non consultabili con i metodi tradizionali. Il procedimento, basandosi sull'impiego delle tecniche di indagine multispettrale quali la fotografia sensibile all'infrarosso, la fotografia della fluorescenza Uv, la riflettografia Nir, la radiografia ecc, permette, sovrapponendo ed elaborando i dati ottenuti, di ottenere un'unica immagine rappresentativa degli strati non visibili all'occhio umano e dunque di migliorare la leggibilità in caso di manufatti gravemente degradati. Inoltre, l'analisi fornisce informazioni utili sullo stato di conservazione e sulle diverse forme di degrado riscontrabili sui materiali costitutivi e sui processi tecnici di stesura del materiale scrittorio e decorativo.

Alla fine del lavoro, la metodologia è stata codificata come "Procedimento per il ripristino di materiale scrittorio e decorativo su supporti cartacei e membranacei" e può essere ora impiegata dai conservatori responsabili degli archivi e delle biblioteche per avere una completa conoscenza testuale e materiale del documento, tracciare la sua storia conservativa, pianificare gli eventuali interventi di restauro e garantire l'accessibilità e la fruibilità per il grande pubblico attraverso l'immissione in rete.

Infine, una tecnica innovativa di indagine strutturale è stata applicata nel recente studio diagnostico, svolto nel 2005-2006 in collaborazione con CESI SpA, Geogrà srl, Arcadia Ricerche srl e Tecno Futur Service srl, sulla cappella della SS. Sindone, o del Guarini, ubicata nel duomo di Torino.

Il Cenacolo ha eseguito la caratterizzazione strutturale con carotaggi, esami baroscopici ed esami videoendoscopici con sonda Bips (Fig. 5).

L'innovazione della tecnica analitica mediante impiego della sonda Bips determina una restituzione diretta e chiara della struttura muraria osservabile sulle pareti del Foro del carotaggio con conseguente maggiore qualità della restituzione e minore incertezza circa l'analisi delle strutture.

### Considerazioni conclusive

Nel campo dei beni culturali le innovazioni, piccole o rilevanti che siano, devono e possono essere sviluppate costantemente, attraverso una specifica e completa attenzione a ogni singolo caso, per poter risolvere le problematiche che di volta in volta si pongono in fase progettuale e di intervento.

Questo è l'approccio metodologico che Il Cenacolo ha sempre proposto e che intende seguire nei futuri lavori di diagnostica, progettazione e intervento di restauro.

## U-read, una metodologia brevettata basata su Lidar per il rilevamento, anche su territori coperti da vegetazione, di aree d'interesse naturalistico e antropologico

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### Abstract

*With Lidar it is possible to acquire high density three-dimensional geographic data. The data is then processed at the first level, providing 3D position and returned impulse intensity information for each acquired point.*

*During post-processing this new method enables archaeologists and cultural resource managers to analyze cultural vestiges hidden under the vegetation canopy. It leverages all the often disregarded secondary data delivered by the Lidar, performing a multidimensional analysis and object classification in order to map all possible features, which are directly extracted as three dimensional, geo-referenced vectorial objects suitable for use in Gis or Cad.*

*There is also a further multi-parametric classification associated with every recognized 3D object, which permits performance of specific database-like queries to highlight entities which most probably represent features of archaeological interest.*

*Finally the conjunction of Lidar survey and the new processing system enables the accurate mapping of the most probable areas and single objects for ground investigation, reducing the time and costs of ground survey.*

### Presentazione

Il presente documento intende aggiornare sull'utilizzo di una tecnologia all'avanguardia per lo screening preliminare e per l'indagine effettiva di vasti territori con finalità di individuazione di vestigia archeologiche, aree di interesse antropologico e, in genere, zone modificate nel corso dei secoli dall'attività umana.

Tale tecnologia, basata su sistemi di scansione laser da elicottero, permette infatti di risolvere tre aspetti che da sempre rendono difficoltosa l'attività degli operatori:

1. la rapidità di copertura di aree estremamente vaste (nell'ordine di circa 100 kmq o 10.000 ettari al giorno);
2. l'accuratezza (decimetrica o addirittura centimetrica) dei rilievi;
3. la capacità di penetrare sotto la copertura vegetativa, ovvero là dove le classiche foto aeree o satellitari non riescono.

Quanto verrà descritto è stato sviluppato da TTA, Inc. assieme all'università di Harvard, Massachusetts, in una serie di algoritmi brevettati, informalmente noti come "U-Read" (dove *U* sta per *Undercanopy*, ovvero "sottochioma", e *read* si riferisce alla capacità di lettura del territorio).

Vengono esposti due argomenti:

- una rapida introduzione sul funzionamento di un'acquisizione Lidar;
- il metodo U-Read e una serie di risultati di interesse per la comunità scientifica.

### Concetti di base sulla tecnologia Lidar

Pur senza addentrarsi nelle caratteristiche tecniche, valga che il Lidar è uno strumento di rilevamento attivo, costituito da uno scanner laser montato a bordo di un elicottero

(o aereo) dotato anche di Gps di geodetico (per collocarsi nello spazio tridimensionale con la precisione dell'ordine del centimetro) e di unità inerziale (per misurare l'orientamento angolare sui tre assi).

Da un sistema Lidar è possibile ottenere dati estremamente dettagliati e densi (tipicamente si acquisiscono almeno 1-2 milioni di punti per kmq) in tempi rapidissimi (una tipica giornata di acquisizione può fornire oltre 100 kmq di territorio a seconda della densità di punti da rilevare). La copertura del territorio risulta inoltre uniforme e continua, si possono estrarre in forma automatica elementi di interesse (strade, edifici ecc.). È infine possibile individuare edifici, strade e infrastrutture, il tutto consultabile da data-base, oltre che restituire modelli del terreno che attualmente sono i più accurati ottenibili tra tutte le tecnologie esistenti.

Il percorso ottico di un impulso laser si sviluppa in una progressione schematizzabile come segue:

- un segnale ottico coerente, concentrato e ad alta intensità viene emesso naturalmente dal laser a bordo dell'elicottero, prima di abbandonare il quale viene deflesso di un certo angolo (variabile, a seconda della tecnologia impiegata, di moto sinusoidale o con andamento a onda triangolare) onde permettere l'illuminazione di punti a terra in sequenza. Nel momento dell'emissione (*time reference*) un comparatore inizializza un contatore di tempo relativo che viene fermato al rientro del raggio riflesso;
- il raggio prosegue sostanzialmente rettilineo (in realtà subendo una piccola apertura angolare, che risulterà utile come si vedrà in seguito) fino a essere intercettato da un oggetto solido a terra.

Al termine della prima fase possono avvenire due fenomeni:

1. il cono luminoso viene completamente intercettato dal corpo opaco (terreno, albero, edificio ecc.). Questo assorbe parte dell'energia e riflette la rimanente in guisa emisferica (come una sorgente luminosa qualsiasi) o, se la propria superficie risulta parzialmente specchiante, con distribuzione lobica. In ogni caso, parte di quest'onda luminosa riflessa raggiunge il sensore a bordo dell'aviomezzo dove il comparatore ferma il contatore e calcola la distanza di volo dell'impulso;
2. il cono luminoso viene intercettato solo parzialmente dal corpo opaco, venendone in parte riflesso (e generando pertanto un primo rientro al sensore, detto *First Pulse*) mentre parte prosegue il proprio percorso. A sua volta tale frazione energetica residua potrà essere intercettata parzialmente (generando così dei *pulse* intermedi) o completamente (in tal caso si parla di *Last Pulse*).

Una volta noto il tempo di volo (ovvero il tempo intercorso tra l'istante dell'emissione e quello del rientro) è possibile calcolare la distanza (essendo nota la velocità della luce). Conoscendo, pertanto, la posizione assoluta dell'aviomezzo, l'orientamento tridimensionale dello stesso, l'angolo di deflessione iniziale del raggio e la distanza tra sensore e oggetto a terra, è possibile ottenere la posizione assoluta del punto a terra, che normalmente viene restituita nel sistema di riferimento nativo WGS84.

Il processo appena descritto avviene fino a 100.000 volte al secondo per ogni sensore impiegato, generando in tal modo una quantità di informazioni e un dettaglio che non ha paragoni in altre tecnologie di rilevamento attivo.

I *pulse* intermedi infine sono utili soprattutto per zone urbane e aree vegetate, in quanto ci permettono di ottenere informazioni su cosa si trova sotto di esse, anche dove da



Fig. 1. Individuazione automatica dei contorni degli oggetti su una mappa in *Edge Detection*

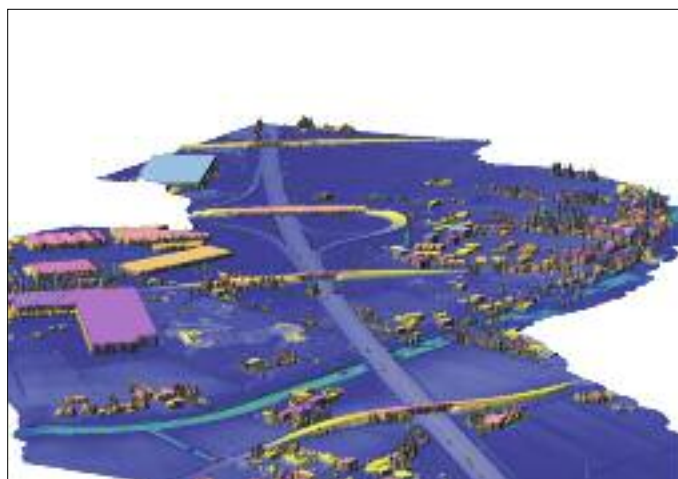


Fig. 2. Il DTM (*Digital Terrain Model*) con estrazione delle isopse

satellite o con l'aerofotogrammetria tradizionale non sarebbe possibile vedere né arguire alcunché.

#### Data post processing

Impiegando i milioni di punti acquisiti durante il sorvolo è possibile procedere con degli algoritmi per l'individuazione delle caratteristiche che interessano gli aspetti archeologici, morfologici e dimensionali del territorio. Tali algoritmi consentono di eliminare parte degli alberi, mentre la maggior parte rimane ancora presente e va trattata con appositi procedimenti. Nelle aree urbane risulta inoltre facile individuare le caratteristiche degli edifici.

Un altro passaggio preliminare è ad esempio l'individuazione automatica dei contorni degli oggetti, qui rappresentata con una mappa in *edge detection* (Fig. 1).

Si propone anche una rappresentazione del DTM (*Digital Terrain Model*) con estrazione delle isopse (Fig. 2).

La vista a schermo è un oggetto completamente tridimensionale, che permette di esplorare virtualmente un territorio, con dati estremamente dettagliati e precisi. È ovviamente possibile aggiungere strati informativi a piacimento, sia estratti in automatico sia da operatore.

Il dettaglio di tale oggetti 3D è notevolmente più elevato rispetto ad esempio a quello usuale delle carte tecniche.

#### Il metodo U-Read

Passiamo ora ad alcuni risultati di interesse prettamente archeologico o "Cultural Heritage". Applicando ai dati Lidar delle comuni tecniche di estrazione si può passare con facilità dalle superfici (DSM – *Digital Surface Model*) a ottenere il terreno (DTM), ovvero rimuovendo virtualmente sia la vegetazione sia gli artefatti di origine antropica. Nel caso proposto di seguito diventano evidenti le infrastrutture di percorramento sia recenti (strade asfaltate) sia in disuso (sentieri montani ormai abbandonati), la maggior parte dei quali non è visibile né da aerofotogrammetria e nemmeno, spesso, con un sopralluogo.

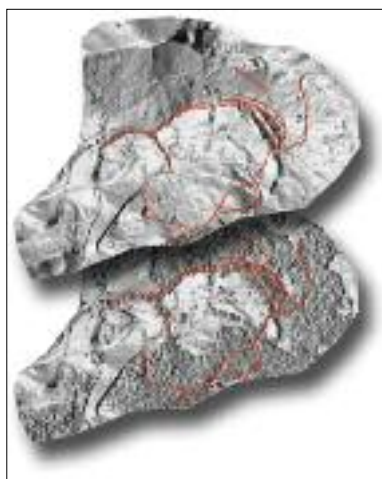


Fig. 3. Individuazione automatica dei tracciati sottochioma

Nella figura 3 si iniziano a intuire le vere potenzialità del sistema con l'individuazione dei tracciati sottochioma, che sarebbero assolutamente non visibili anche agli occhi di un esperto. Come risulta anche sovrapponendo i tracciati ottenuti dagli algoritmi al dato originale, a parte la strada moderna che serpeggia a sinistra, la maggior parte dei percorsi non risulta visibile ma nemmeno intuibile.

Volendo analizzare una delle tracce per rendersi conto della qualità dei dati e delle possibilità che questo sistema dischiude, è possibile chiedere di tracciare il profilo per capire, dalla pendenza e dalla regolarità, se si tratta di una mulattiera o di una strada carrabile, di un sentiero o di un camminamento parallelo a un ruscello, ecc. Si può chiedere inoltre di estrarre le sezioni trasversali per valutare se il tracciato era percorribile da carri o solo da bestiame, e poi passare alla meta-analisi di più percorsi e individuare incroci, possibili punti di scambio, interazioni con aree edificate (anch'esse individuabili sotto chioma) e così via, proponendo in definitiva un notevole aiuto nella classificazione archeologica del territorio sia come screening iniziale sia per indagini approfondite.

### Conclusioni

Dopo un'introduzione concettuale al sistema di acquisizione Lidar è stato proposto un approccio archeologico nella trattazione dei dati ad alta densità pervenendo a risultati di elevato interesse settoriale, in particolare per le aree sottochioma, che permettono di indagare aree ampie sia in indagine preliminare (o di screening iniziale) sia con finalità di studio approfondito delle relazioni che intercorrono tra il territorio e l'uso cui è stato sottoposto da parte dell'umanità nel corso della propria evoluzione storica, commerciale, economica e sociale.

## Costruzione di un “manuale di diagnostica” informatizzato per la gestione degli interventi di diagnosi e conservazione sui beni culturali lapidei

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### Abstract

*Thanks to funding received from the Ministry of Education, the University of Cosenza, Syremont Spa and Space Spa have developed a Diagnostic Manual (DIMA). Their aim is to give a contribution to the conservation of the monumental and archaeological heritage, optimizing the diagnostic process and making possible the application of new methods for the planning and the management of conservative interventions.*

### Presentazione

DIMA (Diagnostic Manual) è un programma di ricerca, finanziato dal Ministero dell'Istruzione, dell'Università e della Ricerca, che intende fornire un contributo alla conservazione del patrimonio monumentale e archeologico, rendendo disponibili nuove metodologie e soluzioni di *information technology* per la pianificazione e la gestione degli interventi di diagnostica e conservazione sui beni culturali lapidei.

Lo sviluppo del progetto è stato affidato a tre partner: Syremont Spa, Università di Cosenza, Space Spa. Il risultato è stato un *Manuale di Diagnostica* innovativo che, attraverso opportuni supporti informatici, permette l'elaborazione dei due progetti che costituiscono l'ossatura degli interventi conservativi: il Progetto diagnostico e il Progetto d'intervento.

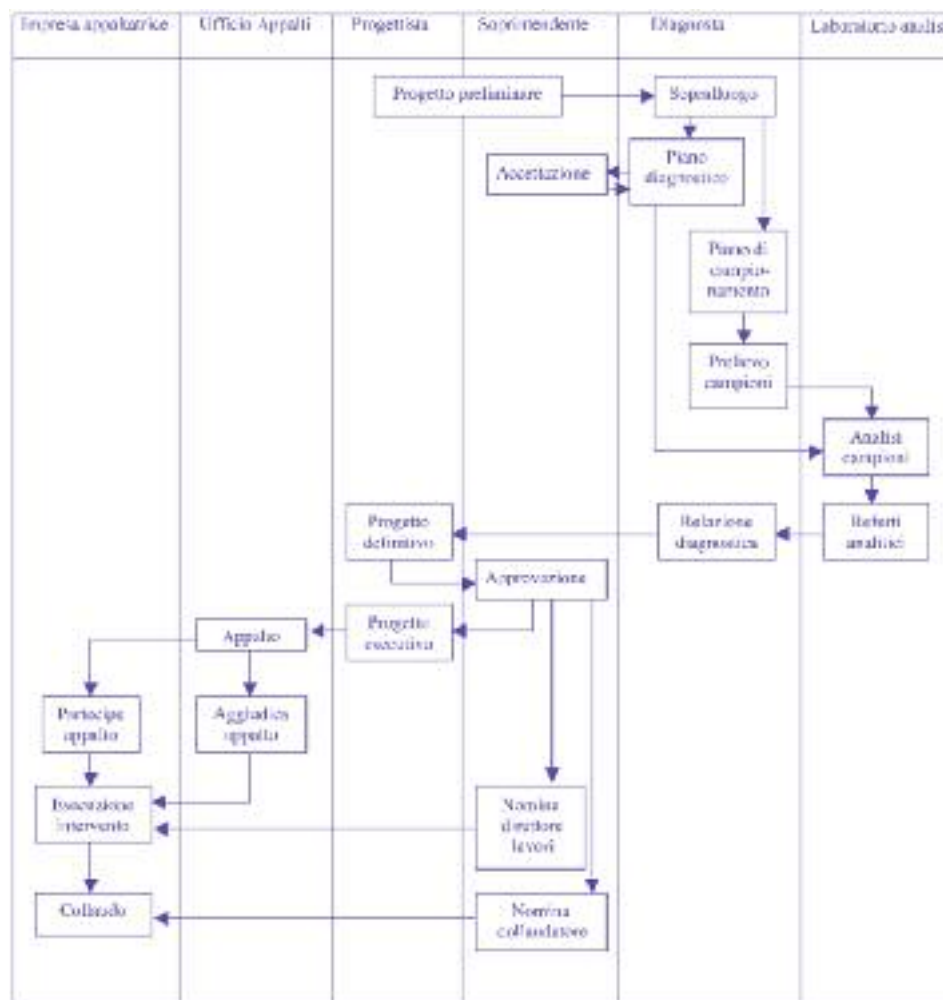
Il progetto ha permesso la messa a punto dei due software DIMA Manager e DIMA Planner per la gestione e la memorizzazione dei dati relativi agli interventi di diagnosi, restauro e/o conservazione subiti da ciascun bene. In un settore, quello della diagnostica a fini conservativo-ristaurativi, dove il ricorso all'informatica è troppo spesso episodico ed estemporaneo, il progetto DIMA traccia una strada sistematica e standardizzata, tale da garantire agli operatori del settore un livello base di tecnologie e informatizzazione. DIMA distingue nettamente la fase diagnostica da quella di intervento conservativo.

### Schema delle mansioni

È stato costruito uno schema che descrive in dettaglio i vari passaggi sui quali si basa l'intero processo di diagnosi, quello della conservazione del bene e le funzioni richieste agli "attori" dell'intervento dalla soprintendenza responsabile fino all'impresa appaltante. È su questo schema che si basa il DIMA Manager, che distribuisce le mansioni e ne raccoglie e memorizza i risultati (Fig. 1).



Fig. 1. Schema delle mansioni



### Progetto diagnostico

Allo stesso modo è stato costruito uno schema (Fig. 2, DIMA Manager) che illustra gli obiettivi e le informazioni che devono essere raccolte nel corso della fase diagnostica; importante a questo proposito osservare che DIMA ha come obiettivi la conoscenza dei materiali lapidei presenti (ed eventualmente della loro provenienza) e del loro stato di conservazione (forme di degrado presenti ed entità del degrado) allo scopo di procedere a un intervento conservativo della superficie dell'edificio.

### Progetto di intervento

Infine si è costruito uno schema che mette in evidenza il piano delle decisioni che il progettista, con l'aiuto del DIMA Planner, deve prendere nel corso della progettazione dell'intervento conservativo (Fig. 3).

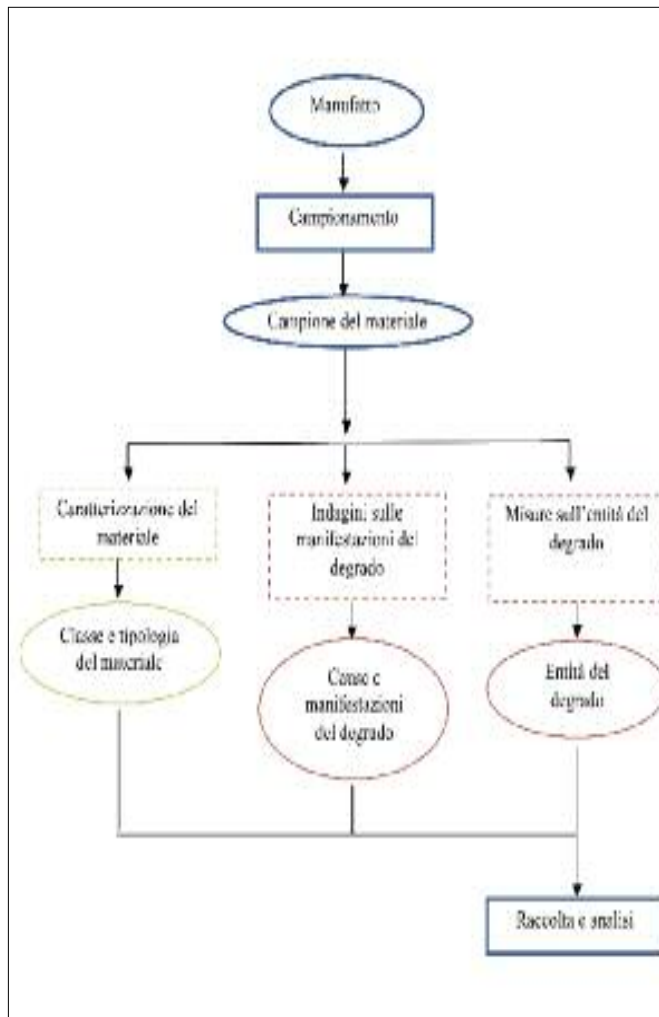


Fig. 2. Processo diagnostico

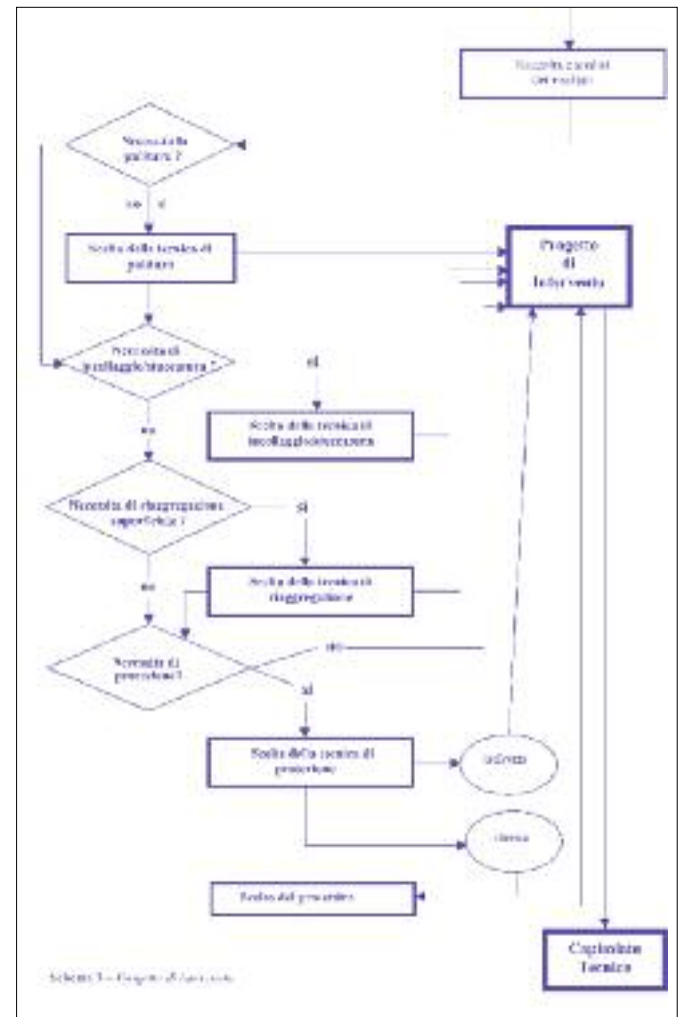


Fig. 3. Progetto di intervento

I software di DIMA costituiscono un aiuto fornendo una serie di ipotesi basate sulla elaborazione di opportune banche dati ed evidenziando i "punti decisionali".

La raccolta e l'elaborazione dei "data-base". Per alimentare il sistema informatico con tutti gli elementi conoscitivi sono stati sviluppati una serie di data-base relativi ai campi che devono contribuire alle scelte:

- Materiali lapidei naturali e artificiali;
- Forme di degrado;
- Metodologie analitiche;
- Normativa sulle metodologie;
- Metodi di pulitura;
- Metodi di consolidamento superficiale;
- Metodi di protezione;
- Nobiltà delle superfici.

Per ognuno di questi data-base sono state compilate schede descrittive mutuata dalla letteratura o costruite con un lavoro originale e "aperto" ai contributi degli operatori che vogliono utilizzare il sistema.

### Costruzione della "matrici"

Per ogni "coppia" di data-base sono state costruite "matrici" che opportunamente compilate sono alla base delle scelte informatiche del sistema.

Materiali lapidei-Forme di degrado; Forme di degrado-Metodologie analitiche; Materiali lapidei-Metodi di pulitura; Forme di degrado-Metodi di pulitura; Nobiltà delle superfici-Metodi di pulitura; Materiali lapidei-Metodi di consolidamento superficiale; Forme di degrado-Metodi di consolidamento superficiale; Materiali lapidei-Metodi di protezione; Forme di degrado-Metodi di protezione.

### Lo sviluppo informatico

L'impiego dell'*information technology* in DIMA risponde a due esigenze fondamentali:

- gestire l'informazione relativa alle "preesistenze" dell'intervento (sistematica dei materiali, sistematica degli interventi diagnostico-conservativi, librerie di procedimenti base);
- selezionare, con specifici supporti di ausilio alle decisioni, i percorsi di intervento, effettuarne un planning dettagliato e quindi gestire le successive modificazioni cui il bene viene assoggettato consentendo il salvataggio di un completo "dossier di intervento" multimediale.

L'intervento tecnologico ha prodotto due prototipi software denominati DIMA Manager e DIMA Planner.

Il DIMA Manager è un sistema per la gestione dei progetti di intervento diagnostico-conservativo e si basa su un motore di *workflow open-source* (OpenFlow). DIMA Manager è un ambiente di lavoro collaborativo dove gli attori del processo vengono informati delle azioni intraprese dagli altri e messi al corrente dei compiti ai quali sono chiamati, oltre a garantire il buon governo del flusso decisionale consente l'archiviazione di tutti i documenti prodotti nel corso di un progetto di diagnosi e di intervento associando allegati di qualsiasi tipo.

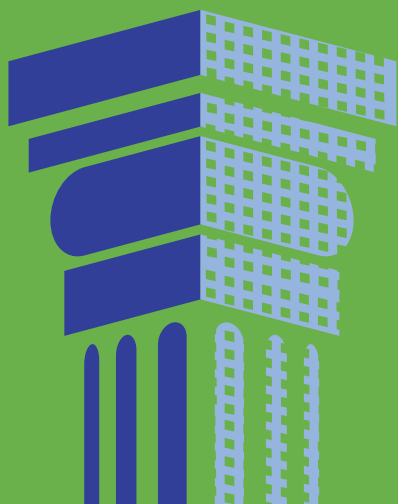
Il DIMA Planner aiuta a definire le procedure e gli scenari di intervento ottimizzando le attività di diagnosi e conservazione del bene lapideo. A tal fine, il prototipo software elabora i dati attraverso un motore di calcolo inferenziale che mette in relazione tutti i data-base disponibili e le relative matrici aiutando a scegliere la tecnica di intervento più adatta. Dal punto di vista tecnologico il software (scritto interamente in linguaggio Python con l'ausilio della libreria Gtk) ha fatto ricorso in sede progettuale a tecniche di analisi object-oriented, all'uso del formalismo Uml e alla definizione di un modello Xml per l'interscambio dei dati con applicazioni esterne. L'applicativo DIMA Planner è stato realizzato facendo ricorso a soluzioni open source, in particolare facendo riferimento al framework Zope (data base a oggetti ZoDB). Grazie a queste scelte, l'applicativo è multipiattaforma e intrinsecamente orientato alla rete.

### Risultato finale

I due prototipi DIMA Manager e DIMA Planner serviranno sia alle scelte relative al progetto di intervento, sia alla memorizzazione e alla gestione di tutti i dati relativi agli interventi stessi. La memorizzazione di tutti i vari passaggi nei quali si articola un intervento conservativo è uno dei risultati positivi attesi dal progetto; è infatti ben noto che difficilmente sono reperibili presso gli uffici degli Enti proprietari o responsabili del bene su cui si deve intervenire, tutte le informazioni sulle indagini e sugli interventi effettuati, a volte, in tempi anche recenti.

TECHA

# Materials and intervention techniques



2008

## Materials and methods for conservation: criteria and innovation

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### Abstract

*The theme “Materials and methods for restoration-conservation work” is really huge. Its vastness is due, on one side, to the variety of different existing typologies of artifacts and monuments and, on the other, to the various kinds of operations that are usually carried out in a restoration work. For each of them specific restoration materials and/or methods are required.*

*Therefore, it would be meaningless to speak at a general level of materials for restoration. What can be done is to discuss some criteria of innovation and to illustrate some significant examples.*

*When speaking of materials and methods for restoration, two important points have to be considered: the criteria to be adopted and the requisites that are needed when a choice has to be made and a decision to be taken.*

*For decades reversibility has been the eminent principle adopted in conservation treatments. When the experience showed that only in a few situations reversibility is possible, other criteria were claimed: compatibility, durability, minimum invasiveness, retreat-ability. As a matter of course, the above situation re-addressed research towards new directions new solutions.*

*Before considering that point, let us focus our attention to the concept of treatment that, better than “materials and methods”, fits the actual needs of restoration, simply because it implies both materials and procedures. In many cases treatment innovation is not a matter of materials but of the way materials are used. Sometimes traditional materials may be “renewed” by using them with a new different procedure.*

### Presentation

#### *The case of Barium Hydroxide*

Among the inorganic treatments the outstanding importance of *Barium Hydroxide* is well known. It has been used for decades dispersed as a water solution in a cellulose poultice and applied for some hours on the frescoes surfaces. Extraordinary success of this method ideated by E. Ferroni and D. Dini in the '60 was obtained, especially over time (due to compatibility and durability of the product with the mineral substrata) for the conservation of frescoes. It can be considered a revolutionary method, more than

Fig. 1. *The famous Crucifixion by Beato Angelico in St. Mark (Florence) treated in 1969 with the ‘Barium Process’ for desulfation and consolidation (left: during treatment; middle: detail before treatment; right: the same detail 20 years after the treatment)*





Fig. 2. *The Crucifix by Beato Angelico in St. Mark (Florence) treated in 1970 with the 'Barium Process' for desulfation and consolidation (left: during treatment; middle, right: the same detail 20 years after the treatment)*

innovative, in a very praecox time. Excellent examples of the results obtained are the frescoes by Beato Angelico in Saint Mark Church in Florence (Fig. 1, 2).

Nevertheless, the same agent can be an efficient and appropriate consolidant for marble and stone statues if used following a quite different procedure. Instead of applying it as a poultice on the object surface, the statue itself, enclosed in a plastic envelope, can be soaked in a water solution of barium hydroxide which is let to penetrate under vacuum in the porosity. In this way permeation is much more efficient. The consolidant is better distributed in pores. Experiments are ongoing to monitor the effects of this procedure. The same material used in an innovative way can become a valid treatment also for a three-dimensional object as a statue.

As anticipated, the above examples point out how innovation, in this area, may be a matter of new procedures rather than new materials. This is possible through a close interaction between chemist conservation scientists and expert conservators/restorers.

### *The inorganic consolidants*

For a long period, till the beginning of the '60, most of the consolidants and protective agents for marble and stone artefacts as well as for mural paintings were made of organic natural substances. Among them the classes of proteinaceous materials (animal glue, casein and egg), polysaccharides (vegetable gums, dextrin), drying oils (linseed oil mainly) may be mentioned.

After the '60, many new materials introduced by the chemical industry and known as synthetic resins came in use in the field of restoration. They are polymeric substances mainly soluble in organic solvents. Most of them show cohesive, adhesive, film-forming and hydrophobing properties. Vinyls, acrylics, silicon resins, epoxy resins are some of the principal classes of this category of products.

Since the beginning and over more than 3 decades, due to the mentioned multiple properties, they have been widely and freely used as ideal consolidants, adhesives, protecting coatings, binders of fillers, etc., in the conservation of stone materials and architectural surfaces.

The reasons of that are various: they are very easy to be applied in solution form; positive effects of their action are immediately visible; they are usually free from immediate secondary negative effects; they are said to be reversible; the protective products satisfy the general concept that the protection has to be assured with respect to external decay agents.

Nevertheless problems in their long term behavior became gradually evident, particularly in some situations. While short-term effects are generally good, long-term behavior is often not satisfying (because of alteration of aspect and loss of performance); reversibility was often misunderstood (consolidation is itself an irreversible operation) or resulted impossible (many synthetic protective agents are irreversible: poly-siloxanes, for instance). The most serious problems come out in case of artifacts made of porous stone materials, exposed outdoor and affected by soluble salts migration from inside the object and crystallization. For these reasons in the last decade attention has been progressively given to inorganic materials.

Inorganic materials were first used in the second half of 19<sup>th</sup> century and, some of them, also in the first half of the 20<sup>th</sup> century. Nevertheless, very negative results observed in a lot of cases induced restorers to abandon them.

Today scientific knowledge shows that the inorganic approach may be the most appropriate at the condition that materials are well selected and properly used. The already mentioned case of barium hydroxide is a quite significant example.

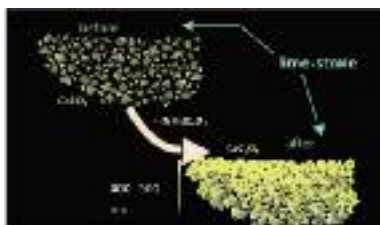


Fig. 3. A possible interpretation of the passivating process of the 'artificial calcium oxalate' obtained by treating the limestone with a poultice of water solution (5%) of ammonium oxalate



Fig. 4. The marble statue *Eterno Padre* by Baccio Bandinelli (detail) in the cloister of Santa Croce, Florence. Left, before restoration and, right, after the cleaning and the passivating treatment with ammonium oxalate (1989)



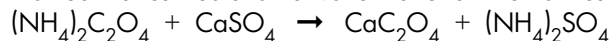
Fig. 5. Measurements of cohesion in a deteriorated marble (a 'tortiglione' column fragment from the Florence Cathedral) before and after treatment with the AmOx consolidating treatment

### *The artificial calcium oxalate (or treatment with ammonium oxalate)*

A more recent excellent example is that of artificial calcium oxalate (Fig. 3). In the present paper there is not space to explain the mechanisms on which it is based. It is sufficient to know that its use was inspired by the extremely resistant calcium oxalate patinas naturally formed all over monuments and objects. The artificial calcium oxalate, which is an innovative result of modern science for conservation, initially has been proposed as a passivating (protective) agent. Successively it showed to have also consolidating properties, desulfating action, and aesthetical action (improvement of colour saturation) on surfaces whitened by deterioration (increase of micro-roughness). The first laboratory and *in situ* testing were carried out about 25 years ago. Successively, many old objects (statues, façades) exposed outside have been treated with the passivating method of the ammonium oxalate (AmOx) in order to protect their surface from corrosion caused by acid rains and fogs. As significant examples of this passivating action against acid rains and fogs we may mention the cases of a big marble statue *Eterno Padre* by Baccio Bandinelli in the cloister of Santa Croce (Fig. 4) and the graffiti façade of Palazzo Barbolani di Montauto (via Ginori), both in Florence.

The consolidating action of AmOx was first observed on highly disaggregated marble (the so called 'sugar-like' marble) by some restorers while they were applying it as a passivating agent. In this case also pilot laboratory experiments and *in situ* tests on small areas were carried out. Currently most research in this direction is in progress. Some preliminary measurements of the increased cohesion that can be achieved with the treatment on deteriorated marble were carried out by means of the drilling method (Fig. 5).

Ammonium oxalate shows also a significant desulfating action towards gypsum, a method that can be alternative to that of ammonium carbonate:



The reaction with AmOx (Fig. 6) is theoretically favored – compared to that with ammonium carbonate – by the higher lowering of water-solubility from gypsum into oxalate instead of carbonate.

A further very interesting action that is sometimes obtainable on calcareous substrates after treatment with AmOx is an aesthetical action of colour saturation. Such an optical effect seems to be due to a lowering of the scattered light of stone or plaster surfaces affected by micro-roughness caused by decay, caused by the treatment. An example is that of some kinds of greyish limestone (marbles) that are inclined to fade with exposure to rain. In other cases colour saturation is obtained with the AmOx treatment after an unsuccessful removal of light-scattering (whitish) natural oxalate or carbonate patinas. Excellent results were achieved on the black and dark limestone mosaics tesserae of Piazza Armerina (Sicily), the famous archaeological site (Fig. 7).

### *The per-fluoro-ethers consolidants*

Before leaving the field of materials for stone consolidation let us mention a further different approach of innovation. Innovation, in facts, may be also interpreted as re-addressing a material used for a certain category of objects to a different one. An excellent example is given by the per-fluoro-ethers polymers. The exceptional properties of these organic polymers came to the attention of the Cultural Heritage in the '80. They are almost the only organic polymers that don't change their composition over time (they are chemically resistant), don't change their color and don't change the optical



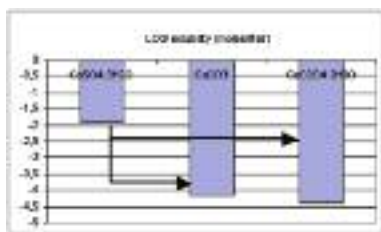


Fig. 6. Desulfating action of AmOx is theoretically higher than that of AmCarb due to the lower water solubility of calcium oxalate compared to that of calcium carbonate

appearance of the treated objects. They have optimal elastic properties and are easily reversible (can be removed simply with acetone). During the '80 and '90 F. Piacenti and his team at the CNR Center for Works of Art in Florence were the promoters and the most outstanding researchers who studied their properties, developed their synthesis and their application to works of art.

Since the beginning and all over the '80 and the '90, the per-fluoro-ethers polymers were constantly addressed to the conservation of marble and stone objects, as consolidants and protective agents. We said they don't change color. Nevertheless the color of the treated areas rapidly changes due to the accumulation and retention of atmospheric particulate (carbon particles above all) favored by the affinity of the polymer to the fat components dispersed into the particulate. In a few months the treated areas change to an intense grayish tone. After the '90 their use in conservation of marble and stone objects and monuments has been practically abandoned.

On the other hand, the unique properties of the per-fluoro-ethers described above perfectly fit the needs of conservation of textiles, paper and parchment objects. The large majority of these kinds of old artworks is conserved in show-cases protected from particulate contamination, the only aspect for which these polymers are not good. The above cited case can be a really significant example of innovation by re-addressing a product to the appropriate context.

#### *Innovation in the field of cleaning of paintings*

Let us consider now a different field, "cleaning of paintings" in which in the last two decades innovation has been particularly important. Only a few decades ago cleaning of paintings was traditionally carried out by organic solvents freely applied on the painting surface by the restorer with a brush or a swab. No selective control of the solvent in the paint layers was allowed. No (or only scarce) safety conditions were possible for the operator.

With the appearance of solvent gels and resin-soaps, developed and promoted by the American chemist R. Wolbers and, in Italy, by the chemist P. Cremonesi, the situation significantly changed and improved. A calibrated solvent mixture is dispersed in appropriate gels which inhibit uncontrolled penetration of the solvents in the painting layers. In this way the cleaning action is selectively limited to the varnish or to the surface deposits to be removed, without affecting the paint layers. Solvent evaporation is also inhibited by the gel. Restorers can operate much more efficiently and in much safer conditions. Some drawback remains for which research and improvement is expected: at the end of the cleaning operation sometimes difficulty is encountered by restorers in removing the gel. More appropriate gel agents have to be researched.

With resin soaps a different cleaning approach is adopted: the removal of an old deteriorated varnish is based on a surface tension action rather than on a pure solubilization process. Thanks to the action of special resin-similar surfactants the varnish is removed in a selective and efficient way through the formation of an emulsion.

Scientific analysis of the problem and deep knowledge of conservation chemistry, significantly contributed, in that case, to innovation.



Fig. 7. Aesthetical effect of colour saturation obtained with AmOx treatment on greyish limestone mosaic tesserae of the famous Piazza Armerina archaeological site (2007). The greyish patina was due to previous cement consolidating treatments

#### *Nanostructured materials for restoration*

This rapid survey on materials and methods for restoration cannot be concluded without saying a few words on nano-structured materials, a very promising field which already contributed and is expected to give innovative solutions to the conservation of works of art.

The development of new nano-structured materials for Cultural Heritage is not yet sufficiently developed in conservation of works of art. Nevertheless significant examples already exist and special materials are already available. Among these it is worth recalling, first of all, the so called nano-limes, developed about a decade ago by the team of P. Baglioni and L. Dei of the Department of Chemistry at the University of Florence. It was a big effort of these researchers to make available the scarcely water soluble lime in a higher concentration thanks to the nano-dispersion they are able to formulate. The higher concentration is able to accomplish efficient consolidation and most of all pre-consolidation (a delicate operation) of lime based plasters, frescoes and mural paintings in general, of course keeping properties of transparency.

The same researchers also developed special nano-emulsions through which it is possible to remove old acrylic consolidants and other artificial resin based products in a selective and efficient way from various supports.

Finally, we have also to mention the nano-structured and nano-dispersed-silicas proposed by several groups of researchers, especially as protective agents for stone artifacts and other objects. Silica – just to remind – is a very inert material which can result very useful for surface protection of objects exposed outdoors, from environmental impact.

### Conclusions

The above given examples are only a minimal part of the big number of “new” materials and methods that conservation scientists, together with restorers, were able to find out for the delicate and complex problems of conservation.

However, in the last decade, every year innovating materials and methods are produced by chemistry and physics. They are usually addressed to a quantity of different fields of application among which Cultural Heritage is often absent. Brokerage events between industry and researcher of innovative materials on one side and the world of Cultural Heritage on the other, should be much more frequently organized in order to significantly enhance the possibility that technological progress in the field of conservation can be achieved.

## Approccio e clusterizzazione per tecniche di intervento nel settore dei beni culturali

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### Abstract

*The cluster of the enterprises, research centres and universities, is an important solution in order to stimulate the competitiveness and the growth of the companies and the development of local economy, also in the field of cultural heritage.*

*The cultural heritage needs to be preserved and promoted. The project "NANOLEGANTI, Experimentation of new nanostructured ligants for the restoration" has been developed with the aim to speriment new materials for restoration, combining tradition and innovation.*

### Presentazione

Mettere in rete le competenze e favorire la sinergia fra imprese, centri di ricerca e università, appare oggi una soluzione irrinunciabile per stimolare la crescita delle aziende, incentivando lo sviluppo economico locale. D'altro canto per favorire la competitività delle imprese e l'individuazione di nuove strategie di sviluppo è necessario promuovere attività atte a favorire il trasferimento di conoscenze e tecnologie dal mondo della ricerca verso le aziende, divulgando metodologie e soluzioni innovative e talvolta radicali, capaci di rinnovare interi settori.

Il campo dei cosiddetti "beni culturali", inteso nella sua accezione più vasta, appare in perfetta sintonia con questa tendenza, considerando come il patrimonio artistico, storico e culturale italiano e non solo, sia in grado di veicolare numerose attività e professionalità: dal restauro delle opere, alla produzione dei materiali, dalla valorizzazione con strumentazioni innovative al turismo. I beni culturali, siano essi monumenti, edifici storici e religiosi o manufatti artistici, richiedono interventi e una cura costante nel tempo, a cui vanno ad affiancarsi numerose attività dedicate alla promozione e alla fruizione delle opere stesse, come la messa a punto di sistemi multimediali per i contesti museali.

All'interno di tali ambiti di attività si intrecciano pratiche e saperi tradizionali con strumentazioni e metodologie all'avanguardia. Il restauro, in particolare, richiede e stimola la ricerca di nuove soluzioni e materiali, capaci di rispondere alle immediate esigenze di conservazione, risolvendo alle problematiche che emergono di volta in volta, preservando l'integrità e la durata di monumenti e manufatti artistici.

Dall'apertura verso nuove soluzioni per il restauro e dalla volontà di unire ricerca e mondo imprenditoriale, si è originato il progetto di ricerca per l'applicazione delle nanotecnologie alla conservazione delle superfici lapidee: "NANOLEGANTI Sperimentazione nuovi leganti nanostrutturati per il restauro", promosso dal Metadistretto veneto Veneto dei Beni Culturali.

Il progetto, attualmente in fase di realizzazione, vede la collaborazione di due importanti atenei veneti: dell'Università Ca' Foscari di Venezia, dell'Università di Padova e di Nanofab. Nanofab Scarl è la società localizzata all'interno di Vega Parco Scientifico Tecnologico di Venezia che gestisce uno dei primi laboratori italiani dedicati al



Fig. 1. Torre Hammon, sede di Nanofab. Vega Parco Scientifico Tecnologico di Venezia



Fig. 2. Laboratorio di Nanofab. Vega  
Parco Scientifico Tecnologico di Venezia

trasferimento di conoscenze nel campo delle nanotecnologie, con oltre trenta ricercatori e una strumentazione all'avanguardia nel settore (Figg. 1-3).

Il Metadistretto veneto Veneto dei Beni Culturali si è fatto inoltre promotore dell'iniziativa coinvolgendo all'interno dell'attività ben 13 aziende impegnate nel campo del restauro e della conservazione degli edifici.

Favorire la collaborazione fra imprese e promuovere progetti di ricerca sono infatti alcuni degli obiettivi del Metadistretto veneto Veneto dei Beni Culturali, un esempio significativo di cluster che aggrega aziende impegnate nel campo dei beni culturali. Il Metadistretto, riconosciuto dalla regione del Veneto in base alla legge n. 8 del 4 Aprile 2003 e successive modifiche, appare come un unicum all'interno del panorama dei distretti produttivi italiani, in quanto unico distretto produttivo legato al settore dei beni culturali.

I distretti produttivi (realtà composte da almeno 100 aziende legate a un settore produttivo in un dato territorio) e i metadistretti (organismi che affiliavano oltre 250 imprese dislocate in un ambito territoriale più vasto) nascono proprio con l'obiettivo di incentivare la competitività delle aziende attraverso la collaborazione fra imprese ed enti, per la realizzazione di progetti comuni. Il Metadistretto Veneto dei Beni Culturali con 270 imprese attive in tutto il Veneto (restauro, allestimenti museali, valorizzazione ecc.) e 22 istituzioni aderenti, promuove e veicola progetti e attività in ambito nazionale e internazionale. L'aggregazione di imprese coordinate dal Metadistretto ha permesso la sperimentazione di nuovi materiali per il restauro e la diffusione dei risultati, oltre a supportare aziende impegnate in bandi e attività all'estero. Il Metadistretto ha promosso accordi internazionali, corsi di formazione specializzati nel settore e interventi di restauro e valorizzazione.

Il Metadistretto ha trovato sede presso il Vega, Parco Scientifico Tecnologico di Venezia, realtà che si presenta come un nuovo modello di sviluppo che aggrega e coinvolge imprese, università e centri di ricerca, favorendo la ricerca scientifica e il trasferimento tecnologico verso le aziende. Vega sostiene e accoglie oggi nei suoi spazi 200 aziende per un totale di 2000 addetti. Sorto nella metà degli anni '90 sul sito industriale dismesso di Porto Marghera, Vega rappresenta oggi un'importante testimonianza di recupero industriale e riqualificazione ambientale.

Il valore riconosciuto da Vega alla ricerca e all'aggregazione di imprese si concretizza nella definizione di sentieri di sviluppo, gli ambiti di attività a cui sono riconducibili le varie realtà insediate: nanotecnologie, ICT e Digital Mediale, ambiente e sviluppo sostenibile, tecnologie e servizi per i beni culturali, aerospazio, biotecnologie, formazione, servizi avanzati.

Presso Vega è localizzata anche Nanofab, la società che gestisce uno dei primi laboratori italiani dedicati al trasferimento di conoscenze nel campo delle nanotecnologie, con oltre trenta ricercatori e una strumentazione all'avanguardia nel settore.

La compresenza all'interno di Vega, Parco Scientifico Tecnologico di Venezia, del Metadistretto Veneto dei Beni Culturali e di Nanofab e la possibilità di interrelazione hanno permesso la stesura del progetto "NANOLEGANTI Sperimentazione nuovi leganti nanostrutturati per il restauro", mettendo di fatto in comunicazione i due settori. Le nanotecnologie presentano infatti una moltitudine di possibilità di applicazione all'interno di diversi ambiti, tra cui i beni culturali per:

- l'utilizzo delle metodologie diagnostiche e l'acquisizione dei dati per l'approfondimento conoscitivo dello stato di conservazione delle opere d'arte;



Fig. 3. Laboratorio di Nanofab. Vega  
Parco Scientifico Tecnologico di Venezia

- lo sviluppo di nuove strategie per la rimozione delle cause di origine biologica di degrado (biotecnologie e nanotecnologie);
  - l'utilizzo di nuovi formulati nanostrutturati per la conservazione e il consolidamento.
- Nello specifico il progetto mira alla realizzazione di particolari materiali per la creazione di nuovi composti consolidanti e protettivi per superfici naturali e/o di diversa natura, da applicare in determinati contesti, per combattere i danni e le trasformazioni subite dalle superfici lapidee degli edifici storici a causa degli agenti atmosferici o dell'inquinamento.

La ricerca intende produrre dei materiali capaci di assicurare un comportamento ottimale, producendo i seguenti risultati:

- effetto rinforzante;
- resistenza all'erosione;
- durabilità nel tempo.

Verranno quindi individuati appositi leganti nanostrutturati, quali iniezioni consolidanti, ristilature e intonaci, in grado di rispondere alle caratteristiche richieste, offrendo un valido supporto nel campo del restauro.

I risultati che si attendono da tale progetto sono:

- lo sviluppo di un processo produttivo che, rispetto a quello relativo alla produzione di leganti a base cementizia, presenti una riduzione del fabbisogno energetico in quanto le temperature necessarie nella fase di produzione sono minori;
- la prototipizzazione di un legante a base di calce idraulica (microcalce) dotato di una maggiore durabilità ai fenomeni di erosione chimico-fisica in ambienti aggressivi e umidi, come quello marino, e che presenti un'elevata compatibilità con elementi da costruzione tradizionali (laterizi, materiali lapidei ecc.);
- l'identificazione dei possibili campi di impiego nell'ambito degli interventi di restauro o di nuova realizzazione;
- la verifica sperimentale del prodotto attraverso la sua applicazione nell'ambito di un intervento di recupero di manufatti storici in ambiente marino (es. strutture dell'Arsenale di Venezia).

TECHA

# Information and communication technologies for cultural heritage



2008

## Tecnologie dell'informazione e della comunicazione e beni culturali: scenari di collaborazione al CNR

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### Abstract

*The present contribution aims to describe initiatives in which the CNR researchers coming from the Information and Communication Technologies and the Cultural Heritage fields cooperated during the last twenty years. It is actually clear that applications of the ICT technologies allows significant advancements in the CH fields and, at the same time, problems opened by the CH allow methodological progress in the ICT sector.*

### Presentazione

In tre sezioni vengono brevemente accennati scenari di collaborazione che al CNR hanno visto in campo nell'ultimo ventennio le tecnologie dell'informazione e della comunicazione (ICT) e i beni culturali (BC).

Una delle prime iniziative, a carattere prevalentemente metodologico dall'angolazione ICT, prese corpo con il workshop "Conoscenza per immagini '92" [1] che ha approfondito gli aspetti di sinteticità e interattività dell'immagine quali veicolo di conoscenza, scoperta scientifica e comunicazione umana.

Nel 1994 prese l'avvio il progetto strategico CNR "Conoscenza per immagini: un'applicazione ai Beni Culturali" dove l'area di validazione delle metodologie prodotte con riferimento ai settori dell'analisi e della sintesi di immagini è stata quella della tutela, recupero e fruizione dei beni culturali [2]. In particolare, la problematica della salvaguardia dei beni culturali è stata circoscritta agli aspetti dell'analisi e della rappresentazione di processi di degrado di alcuni materiali tipici dell'edilizia storica, i materiali lapidei. In tale contesto, il progetto ha fornito un contributo all'automazione di processi di analisi del "restante" da conservare, di simulazione di ulteriore degrado e di controllo di procedure di restauro effettuate realmente o virtualmente.

Una delle prime e più significative iniziative a livello nazionale a testimonianza del crescente coinvolgimento ICT-BC, è stato il progetto finalizzato CNR "Beni Culturali", iniziato nel 1996 [3]. Il progetto articolato in cinque sottoprogetti (Individuazione delle risorse nello spazio e nel tempo; Diagnosi dello stato di conservazione e metodologie di intervento; Patrimonio documentale e librario; Archivio biologico ed etnoantropologico; Museologia e museografia) ha avuto una partecipazione di oltre 250 unità operative, tra le quali oltre il 50% ha trattato, anche se a diverso livello di utilizzazione e/o innovazione, aspetti delle ICT applicate ai BC. Tra gli altri si citano: sistemi dedicati e a microprocessori operativi in tempo reale per il controllo di processi e l'elaborazione di segnali, compressione, strutturazione, protezione e trasmissione di dati, gestione di basi di dati eterogenee distribuite e accessibili in rete, interfacce per l'interazione e la presentazione di informazioni multimediali e di ipertesti, modellistica matematica, simulazione e tecniche del calcolo probabilistico e statistico, analisi e sintesi di immagini [4].

Quasi in contemporanea al sopraddetto progetto finalizzato CNR si svolgeva il progetto MURST 5% "Applicazioni delle tecnologie multimediali ai Beni Culturali", condotto negli anni 1998-2001 in collaborazione tra CNR, università, aziende e pubblica



amministrazione [5]. Come risulta dalla pubblicazione conclusiva, i risultati delle attività in esso svolte, che coinvolgono i settori ICT e BC, sono distinti con riguardo a due modalità: ricerche su BC, mediante l'impiego di strumenti della ICT, e ricerche sulla ICT nelle quali i BC costituiscono degli ambiti di validazione.

Nel 2000 sono diventati operativi i progetti approvati nel piano di ricerca nazionale "Parnaso" emanato dall'allora Ministero dell'Istruzione, Università e Ricerca. Tra questi un impegnativo progetto è stato quello presieduto e diretto dal CNR nell'ambito del Consorzio SIINDA a carattere pubblico-privato [6]. Il progetto ha sviluppato un sistema integrato di conoscenza per l'indagine e la diagnosi assistita dello stato di conservazione di un monumento contestualizzato nel suo ambiente. Il sistema si compone di diversi moduli: importazione e strutturazione dei dati acquisiti da fonti eterogenee, pre-elaborazione delle immagini (correzione cromatica e radiometrica, concatenamento e compressione), elaborazione del modello tridimensionale tessiturato del monumento oggetto di studio che costituisce la metafora di interazione con l'utente, selezione e segmentazione delle immagini per il dimensionamento di forme di degrado, sintesi visuale con tematizzazione dinamica dei valori dei parametri ambientali sul modello tridimensionale, scheda di valutazione dello stato di conservazione del monumento.

Parte delle competenze scientifiche maturate nel sopraddetto progetto di ricerca applicata, sono quindi confluite in un progetto di ricerca di base FIRB, ancora a coordinamento CNR, dedicato alla progettazione di un modello basato sulla conoscenza per il *restauro digitale* di foto di interesse storico che ha portato all'individuazione di descrittori di degrado e alla pubblicazione di algoritmi allo stato dell'arte per l'eliminazione semi-automatica di danni quali macchie, fading, foxing e tracce di strappi [7].

Una recente vetrina decisamente esaustiva del panorama nazionale italiano nell'ambito ICT-BC, sotto il coordinamento CNR del Comitato organizzatore, è stata presentata a Tokyo nel 2007 in occasione dell'evento "Tecnologie dell'Informazione e della comunicazione culturale" promosso dal Ministero degli Affari Esteri e inserito nelle iniziative per la "Primavera Italiana in Giappone" [8]. I contributi, presentati da enti di ricerca, università, aziende e pubblica amministrazione, hanno proposto una molteplicità di approcci attraverso i quali in forma integrata vengono affrontati lo studio e la salvaguardia dei beni culturali con riferimento alla filiera completa che raccorda conoscenza, diagnosi, conservazione, valorizzazione, gestione, fruizione e formazione.

Con riferimento al piano triennale 2008-2010 del Dipartimento Patrimonio Culturale del CNR e, in particolare alle linee del progetto interdipartimentale "Cultura e Territorio" [9], si può affermare che lo studio del patrimonio culturale viene considerato nei suoi insiemi di beni materiali e immateriali con riferimento alla dimensione territoriale, e coinvolge una rete di processi di un sistema complesso e dinamico [10].

In particolare, allo stato attuale è sempre più evidente che significativi avanzamenti di ricerca possono attuarsi con l'applicazione delle tecnologie dell'informazione e della comunicazione che consentendo, fondamentalmente, di acquisire, organizzare, elaborare e trasmettere dati eterogenei realizzano condizioni di "aumento di conoscenza multi e inter-disciplinare".

Lo sviluppo di strumentazione hw/sw per l'acquisizione, avente prerogative di non invasività, trasportabilità in situ, sensoristica virtuale, tecnologie iperspettrali, multidimensionali, multimodali e multirisoluzione, porta vantaggi di massimizzazione del contenuto informativo acquisito e di condizioni di fruizione reale del bene culturale, minimizzazione del danno al bene e diminuzione dei costi del processo stesso di

acquisizione. La realizzazione di strumenti software di supporto all'operatore consentono l'archiviazione, da un lato, di informazioni strutturate e non, dall'altro, la proposizione di protocolli di acquisizione che garantiscano efficienti processi di monitoraggio.

L'organizzazione in sistemi informativi in grado di integrare e gestire dati adeguatamente compressi e codificati con riferimento a classificazioni universalmente riconosciute, aprono percorsi di inter-operabilità nella direzione di migliorare, ad esempio, sia la localizzazione dinamica del bene culturale sia la qualità del supporto al decisore che su di esso ha competenza.

Elaborazioni statistiche, modellistica numerica e simulazione, tecniche dell'intelligenza artificiale e della computer vision sono metodologie che "aumentano la conoscenza", ad esempio dei meccanismi di degrado, del raggiungimento di situazioni di rischio e della vulnerabilità sismica così come costituiscono possibili rappresentazioni di scenari di intervento per la conservazione, la valorizzazione e la fruizione dei beni culturali. Visualizzazioni multidimensionali del modello dell'oggetto culturale "immerso nel tempo e nei suoi fattori ambientali" consentono di leggere in una sola immagine, o sequenza di immagini, l'andamento di più parametri che influenzano condizioni di degrado con riferimento alla ricostruzione bi-tridimensionale dell'oggetto in studio.

La trasmissione del patrimonio culturale, al di là di aspetti inerenti il valore sociale della diffusione e della formazione, apre, attraverso le frontiere della realtà virtuale e della immersività, ai nuovi paradigmi di una moderna fruizione arricchendone la contestualizzazione in base a una conoscenza diversa e più ampia rispetto al passato.

In conclusione, l'acquisizione, l'elaborazione e la trasmissione dei dati che descrivono i beni culturali nel loro contesto identitario e territoriale – dando espressione alle fasi fondamentali della filiera completa dei processi di conoscenza, diagnosi, conservazione, valorizzazione e fruizione – consentono una co-evoluzione degli ambiti del patrimonio culturale e delle tecnologie dell'informazione e della comunicazione: mentre la qualità della domanda cresce sulla base dell'offerta, l'avanzamento della ricerca in uno dei due ambiti offre nuovi spunti di indagine nell'altro.

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## The national and international initiatives of the Ministry for Culture Heritage and Activities (MiBAC) within the digitalisation of cultural heritage and access in internet

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### Abstract

*MiBAC is the coordinator of MINERVA and MINERVA EC projects with the aims of creating a network of the European Ministries of Culture to discuss, correlate and harmonise the activities carried out in digitisation of cultural content and establishing shared set of recommendations and guidelines about digitisation, metadata, interoperability, cultural websites. MICHAEL project, and its extension, MICHAEL Plus, coordinated by MiBAC, have realised a European multilingual portal which provide an integrated access to the European Cultural Heritage through the collections of museums, libraries archives and other cultural institutions and organisations. In Italy, MICHAEL proceeds in close coordination with CulturalItalia, the unique, multilingual and integrated point of access to the Italian Cultural Heritage. It aggregates metadata from the existing digital libraries creating the Digital Library of the Italian Cultural Heritage. Finally, the Ministry is working with other European countries to a new project called ATHENA.*

### Presentation

The activity of the Ministry for the Cultural Heritage and Activities (MiBAC) aims at fostering and improving integrated services among archives, libraries and museums.

The MINERVA project, Ministerial NETwork for Valorising activities in digitisation, coordinated by MiBAC was funded in 2002 in the framework of the IST Programme. Its goal was to create a network of the European Ministries of Culture to discuss, correlate and harmonise the activities carried out in digitisation of cultural content and create a shared set of recommendations and guidelines about digitisation, metadata, interoperability, cultural websites. From October 2006 the MINERVA and MINERVA Plus projects, started in 2002 and 2004, evolved into the new initiative MINERVA EC, Ministerial NETwork for Valorising Activities in digitisation, eContentplus – Supporting the European Digital Library. MINERVA EC is a Thematic Network in the area of cultural, scientific information and scholarly content. The consortium brings together stakeholders and experts from 20 Member States and more than 100 European cultural institutions. MINERVA EC gives visibility to national initiatives, promotes the exchange of good practices, ensures the diffusion and awareness of community policies and programmes at both national and local levels. In order to support this work, MINERVA EC implements tools and guidelines shared at European level that supports decision makers and experts of digitisation in the realisation of the digitisation initiatives, from the creation of digital libraries to the publication on the web.

The Ministry for Cultural Heritage and Activities is also the coordinator of the current MICHAEL project, Multilingual Inventory of Cultural Heritage in Europe, and its extension MICHAEL Plus, both funded by the European Commission's eTEN programme. MICHAEL is a multilingual online catalogue which aims to provide quick and simple access to the digital collections of museums, libraries and archives from European countries. The MICHAEL project began in June 2004 as a partnership between NRG

members from Italy, France and the United Kingdom. MICHAEL has created a pan-European on-line service to enable European Cultural Heritage to be promoted to a worldwide audience. The 1<sup>st</sup> June 2006, started the MICHAEL Plus project which extended the participation to MICHEL to other 11 countries: Czech Republic, Finland, Germany, Greece, Hungary, Malta, the Netherlands, Poland, Portugal, Spain and Sweden and now four new countries have joined MICHAEL, Bulgaria, Belgium-Flanders, Estonia and Slovakia.

The MICHAEL consortium comprises currently 18 countries. The key objectives of MICHAEL are to add value to the European Cultural Heritage and to encourage interoperability and the use of common standards across major national digital Cultural Heritage initiatives. MICHAEL is providing an innovative contribution to the creation of the European digital library.

In Italy, MICHAEL proceeds in close coordination with the Italian Culture Portal Culturaltalia, an integrated and multilingual access tool that allows for the first time to reach and interconnect the digitised cultural resources of the country. The development strategy of Culturaltalia is based on a tight cooperation among the widest public and private sectors, including: museum, libraries, archives, preservation and administrative offices, national, regional and local institutions as well as universities and other ministries. From the technical point of view, Culturaltalia is based on the MINERVA recommendations and guidelines and aligned with MICHAEL, through its integration with MICHAEL-IT.

Finally, the Ministry is working with other European countries to a new project called ATHENA, which will support and encourage the participation of Museums and institutions coming from the sectors of Cultural Heritage to contribute to the creation of the European Digital Library on the basis of shared standards and with the function of service and content provider.

## Il Sistema di Comunicazione Integrato del Museo dei Fori Imperiali a Roma

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Sovrintendenza ai BB.CC. del Comune di Roma, Museo dei Fori Imperiali nei Mercati di Traiano – info@mercatiditraiano.it

### Abstract

*The Museum of Imperial Fora, started on October 17<sup>th</sup>, 2007, inside the Trajan's Markets monument, offers to its visitors an innovative communication and set-up model. Visit route was conceived as a continuous itinerary between the archaeological areas of the Imperial Fora and the monument that hosts the architectural and decorative reconstructions of ancient buildings. The aim of the Museum is not the exhibition of the individual fragments of a splendid decorative past, but to physically reconstruct their original function and the decorative motifs of which they were part of. So the new Integrated Communication System, with the use of the latest technologies in graphic and 3D reconstructions, lets the visitor to really understand the ancient urban-architectural point of view of the Imperial Fora. Multimedia products can be seen on LCD displays and show the virtual reconstructions of the single fragments, inserted in their original building, and then, in a wider view, the urban context in the area of the Fora and of the ancient city of Rome. It's a choice to recreate the now lost three-dimensionality proportions and decorative magnificence of the Imperial Fora.*

### Presentazione

Il museo dei Fori Imperiali, inaugurato il 17 ottobre 2007, all'interno del complesso monumentale dei Mercati di Traiano, propone al pubblico un sistema di allestimento e di comunicazione innovativo.

Si tratta, infatti, di un museo archeologico di nuova generazione costituito non solo da una prestigiosa collezione di reperti archeologici provenienti dai cinque Fori Imperiali, ma anche, questa è la grande novità espositiva, un ricco numero di ricomposizioni architettoniche.

Le diverse tipologie di marmi, i diversi ordini architettonici, i loro rapporti dimensionali, nonché la funzionalità degli edifici e le loro antiche volumetrie danno vita a un museo dedicato all'architettura e alla decorazione architettonica romana che, in antico, era parte fondamentale e significativa per tutti gli edifici che componevano ogni singolo Foro.

In questa sede non verranno prese in considerazione le dinamiche e le problematiche allestitiive, seppur di grande importanza viste le notevoli dimensioni di alcuni reperti esposti e assemblati, sempre in maniera reversibile, nelle varie ricomposizioni; piuttosto si vuole evidenziare progettazione e realizzazione di un sistema di comunicazione concepito *ad hoc* in funzione dei nuovi contenuti che contraddistinguono l'allestimento museale.

L'apparato comunicativo del museo dei Fori Imperiali si compone, oltre che della tradizionale pannellistica contenutistica e direzionale, di un ricco sistema multimediale che accompagna il visitatore e lo aiuta alla comprensione, attraverso una comunicazione "semplice e immediata", specie negli snodi contenutistici focali del percorso espositivo (Fig. 1).

La progettazione e realizzazione dei prodotti multimediali è avvenuta sfruttando diversi eventi, antecedenti l'apertura del museo, che hanno permesso di testare sul pubblico la loro efficacia comunicativa. Da ultimo la "Notte bianca" del 2006, durante la quale è stato sottoposto al pubblico, con un ottimo riscontro, il prototipo di un prodotto multimediale



Fig. 1. Sezione dedicata al Foro di Nerva, esempio del Sistema di Comunicazione Integrato in cui l'allestimento museale convive con pannelli didattici e apparato multimediale. Sovrintendenza ai BB.CC. del Comune di Roma, Museo dei Fori Imperiali, archivio fotografico dei Mercati di Traiano (foto Stefano Castellani)



Fig. 2. Veduta della taberna in cui è stata allestita la sala multimediale. Sovrintendenza ai BB. CC. del Comune di Roma, Museo dei Fori Imperiali, archivio fotografico dei Mercati di Traiano (foto Paolo Vigliarolo)

rappresentativo di tutto il ventaglio di filmati che, effettivamente, si intendeva realizzare e che oggi compongono il sistema di comunicazione integrato del museo.

Tali test hanno determinato la scelta della tecnica con la quale realizzare i prodotti video. Si è utilizzata quindi una "tecnica mista", un sistema di montaggio che fa uso di tutte le potenzialità comunicative dell'immagine: dalla ripresa diretta alle foto d'epoca alle ricostruzioni archeologiche realizzate ad acquerello e anche al 3D e alle più evolute tecnologie per l'elaborazione dell'immagine.

Attualmente il museo consta, dislocati nei due piani del percorso espositivo, di una sala multimediale, in prossimità dell'ingresso, che introduce il pubblico alla visita, e di dieci postazioni video (o video pannelli) dislocati lungo tutto il percorso museale.

La sala multimediale, allestita in una delle *tabernae* più profonde del piano terra della Grande Aula, è caratterizzata da un maxischermo retroproiettato per mezzo di un sistema video, dotato al suo interno di un computer ed equipaggiato con un impianto audio; i visitatori possono sedersi in una sorta di piccolo "cinema" e prendere visione del video (Fig. 2).

Il prodotto nella sala multimediale è stato realizzato con criteri differenti dagli altri. Innanzitutto, il suo scopo introduttivo, sia ai Mercati di Traiano che ai cinque Fori Imperiali, ne ha determinato una durata di circa venti minuti. L'esigenza di trasmettere le informazioni di base alla visita del museo, rivolgendosi a tutto il pubblico possibile, quindi anche ai giovanissimi, ha reso necessaria l'ideazione di uno *storyboard* molto particolare, dagli aspetti documentaristici e didattici.

Si è scelto di portare l'utente in un viaggio a ritroso nel tempo, mediante l'utilizzo della mascotte *Columnus* che, dalla Roma dei nostri giorni, accompagna il visitatore lungo un percorso che approda all'età imperiale attraverso la visione dei Mercati di Traiano e di tutti i Fori, nelle loro varie epoche storiche. *Columnus* ritrova poi se stesso nell'allestimento museale del Foro di Augusto, riconoscendosi come parte di una delle ricomposizioni architettoniche più significative, quella dell'ordine del portico del Foro, introducendo così il pubblico agli spazi espositivi dei Mercati di Traiano, dopo avergli fatto prendere conoscenza di tutta l'area archeologica.

Il prodotto, anch'esso realizzato in tecnica mista, è dotato di sottotitoli in italiano e in inglese; il suo ritmo narrativo, chiaro e cadenzato, accompagnato da una colonna sonora che varia al variare delle epoche storiche narrate, sta riscuotendo un grande successo di pubblico. L'utilizzo poi di una mascotte che fa da filo conduttore e accompagna "per mano" l'utente nel passato, è stata una scelta che si è rivelata ottimale per il coinvolgimento dei più piccoli che, troppo spesso, non vengono presi in considerazione dagli allestimenti museali.

Completamente diversa è invece la struttura e la caratteristica comunicativa degli altri nove prodotti video dislocati in varie sale espositive del museo.

Le postazioni sono composte da schermi Lcd collegati a mini-player tramite un cavo s-video. Tutto l'hardware è stato inserito all'interno di pannelli del tutto simili a quelli didattici presenti nel percorso museale, creando uniformità e riducendo al minimo l'impatto visivo sul monumento. Il video è compresso in qualità Dvd (formato mpeg2) ed è contenuto in una flash card inserita nel mini-player stesso.

Per la realizzazione di questi prodotti si è lavorato secondo un vero e proprio ragionamento semiotico-strutturale dell'immagine in movimento, assunta come linguaggio assolutamente autonomo, autosufficiente e universale.

I prodotti hanno una durata massima di tre minuti ciascuno. Non hanno né audio né colonna sonora di accompagnamento, né sottotitoli. La loro realizzazione è l'esito di un lungo e accurato lavoro sulla messa a punto degli *storyboard*, che partono tutti da una base comune. I video hanno inizio con la collocazione dell'antica valle dei Fori in relazione alla moderna situazione urbanistica di Roma, evidenziando come, oggi esattamente come



Fig. 3. Video dedicato alla visita virtuale della Grande Aula all'ingresso della taberna che ospita il guardaroba. Sovraintendenza ai BB.CC. del Comune di Roma. Museo dei Fori Imperiali, archivio fotografico dei Mercati di Traiano (foto Paolo Vigliarolo)

allora, i Fori imperiali fossero collocati nel cuore della città. Tali informazioni geografiche sono ottenute con tecniche di dissolvenze e sovrapposizioni tra immagini moderne e ricostruzioni della fase romana; ogni singolo prodotto poi illustra, in funzione del materiale e delle ricomposizioni architettoniche presenti nella sala in cui è collocato, la ricontestualizzazione fisica dei frammenti architettonici o statuari nell'edificio di appartenenza. Di qui si mette in luce la funzione dell'edificio in cui è inserito il frammento e il suo stesso rapporto con il relativo Foro e con quelli attigui.

Questo processo narrativo circolare, comune a tutti i video pannelli, da un lato determina un *leitmotiv* che orienta il visitatore, il quale ritrova in qualsiasi sezione del museo le informazioni essenziali alla comprensione dei Fori in antico e, nel caso specifico, le notizie necessarie alla comprensione di ciascuna sala museale e delle peculiarità, estetiche e funzionali, dei reperti esposti in essa.

All'interno della Grande Aula, e più precisamente in corrispondenza dell'entrata del guardaroba, è presente un altro video, la cui struttura e finalità si discosta dal sistema di comunicazione del museo (Fig. 3).

Partendo dalle planimetrie, dai prospetti e dalle sezioni rilevate, nel corso di vari anni, in tutto il monumento, si è costruito un modello 3D georeferenziato, completo di texture ricavate in maniera originale dai vari materiali di costruzione (ad esempio laterizi per le pareti, conglomerati per le volte, *opus spicatum* per i pavimenti) presenti nei Mercati di Traiano. Grazie all'utilizzo di questo modello, completamente navigabile, si è scelto di visualizzare un percorso all'interno della Grande Aula dei Mercati di Traiano, in età romana, in cui la camera ci guida, per la durata di meno di quattro minuti, attraverso i due livelli del grande ambiente voltato; il visitatore può così notare le numerose differenze che esistono con la fase originale, confrontandole direttamente con lo spazio che lo circonda: dalle balaustrate all'entrata, contraddistinta da un portale, fino alla ricostruzione di un corpo scala non più esistente e in antico adiacente all'ingresso.

Inutile dire che la realizzazione dei prodotti filmici per i video pannelli ha determinato lo sforzo maggiore nella concezione del sistema di comunicazione del museo. La loro breve durata, la scorrevolezza dei passaggi, dai frammenti alla loro ricollocazione negli edifici antichi di appartenenza, unita all'ambizione di volerne rendere comprensibile il contenuto per un pubblico di qualsiasi età ma, soprattutto, di qualsiasi provenienza geografica, eliminando quindi sottotitoli o speakeraggio, ha determinato un traguardo il cui superamento è stato confermato dai primi monitoraggi effettuati sul pubblico.

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## Esperienze di un percorso di interazioni tra cultura e tecnologia informatica

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### Abstract

*The need to fulfil a fruitful point of contact between Cultural Heritage and advanced informatics, become a concrete reality in the last decade through both several discussions and the development of new applications of informatics and artificial intelligence to specialized themes of Cultural Heritage. In this way a sort of itinerary, oriented to catalyse possible interactions and aggregations among people operating in both areas, has been outlined.*

*In this paper the most significant results will be revive together with the recent experiences in modelling fruition and exploitation of cultural assets.*

### Presentazione

L'esigenza di realizzare un fruttuoso incontro tra il settore del patrimonio culturale e quello dell'informatica avanzata, concretizzatosi nell'ultimo decennio in numerosi incontri di discussione e nello sviluppo di applicazioni delle tecnologie informatiche innovative e di intelligenza artificiale, su temi specialistici caratterizzanti l'area dei beni culturali, ha di fatto disegnato un percorso, per molti aspetti evolutivo, finalizzato a catalizzare possibili interazioni e aggregazioni fra operatori e istituzioni operanti nei rispettivi settori.

Obiettivo del presente lavoro è di mostrare come alcune tra le più significative metodologie e tecniche informatiche dell'intelligenza artificiale rappresentino strumenti ormai insostituibili per l'analisi, la conservazione, la fruizione, il restauro e la tutela dei beni culturali.

Nel seguito vengono riproposti alcuni risultati significativi di tale percorso e illustrate le più recenti esperienze progettuali di costruzione di modelli specialistici per la fruizione e la valorizzazione del patrimonio culturale.

Nell'ambito del trattamento e fruizione dell'informazione, i sistemi di gestione di basi di dati e le tecnologie dei sistemi informativi hanno supportato la realizzazione di grandi *repository* di informazioni anche eterogenee, per l'archiviazione, la memorizzazione e l'accesso organizzato a informazioni appartenenti all'ambito dei beni culturali.

Archivi, biblioteche e musei traggono vantaggio dall'enorme potenziale che l'uso delle tecnologie dell'informazione e della comunicazione consentono. La conversione di tutte le tipologie di contenuti culturali in digitale apre una dimensione completamente nuova per chi voglia raggiungere sia il pubblico tradizionale che quello "nuovo", offrendo l'accesso a risorse culturali secondo modalità inimmaginabili fino a un decennio fa. In tale direzione, oltre alle specifiche realizzazioni applicative e all'utilizzo di modelli e tecnologie, si deve registrare la crescente diffusione di progetti di ricerca finalizzati alla realizzazione di portali, network di ricerca e strumenti per il lavoro collaborativo e la condivisione di dati e informazioni. Il mondo del web e le tecnologie Internet correlate possono supportare la realizzazione di un vasto spettro di modalità di accesso personalizzato per differenti tipi di utenti e per finalità che vanno dall'interpretazione e ricerca scientifica fino alla fruizione da parte del vasto pubblico. La ricerca on-line è





Fig. 1. Home page del sistema

quindi in piena evoluzione verso strategie intelligenti e personalizzate e lo sviluppo di sistemi per l'accesso intelligente a *repository* di documenti testuali ne è una conferma [1].

Nell'ambito del progetto PrestoSpace [2, 3, 4] dedicato allo sviluppo di tecnologie per il supporto informatico, alla conservazione degli archivi multimediali televisivi, radiofonici e audiovisivi che fanno dell'Europa un fulcro culturale globale, è stata sviluppata una piattaforma MAD (Metadata Access and Delivery), per l'accesso e la diffusione di metadati semantici. Il sistema MAD è dedicato alla generazione automatica, validazione e diffusione dei materiali d'archivio attraverso la creazione di metadati basata sulla sintesi dei contenuti semantici a partire dai dati digitali. Tecnologie quali il riconoscimento automatico del parlato, l'analisi delle immagini e l'estrazione automatica di informazioni convergono qui all'automazione del processo di documentazione dei dati degli archivi multimediali e trovano un'integrazione armonica nella piattaforma MAD. Strumenti intelligenti per il recupero delle informazioni sono quindi un effetto collaterale dei processi di analisi e aprono possibilità nuove all'automazione dei processi di accesso distribuito all'informazione multimediale. L'utilizzo di un'ontologia, strumento divenuto indispensabile per la disambiguazione di un testo e che costituisce il primo passo per l'ingresso della semantica nel web, risulta essere anche una risorsa non trascurabile nell'ambito della traduzione letteraria. Ci consente di istituire una rete semantica di concetti in cui il termine è correlato e apre, a ventaglio, le possibilità, la gamma di significati e di rimandi che un termine porta con sé in un certo contesto culturale. È quanto si sta tentando di fare presso l'ENEA in collaborazione con la "Sapienza" Università di Roma sulle principali fonti dei proverbi europei (progetto Gnome, <http://www.gr-gnome.eu/>).

Anche i sistemi informativi geografici (Gis), data la natura intrinsecamente spaziale delle risorse culturali, rappresentano un supporto adeguato alla memorizzazione e gestione di dati georeferenziati. Numerose le applicazioni [5] di tali sistemi ai contesti culturali (archeologia, architettura, paesaggio); in particolare l'ENEA in collaborazione con la Soprintendenza archeologica di Roma ha realizzato "un caso" di itinerario virtuale tra le epigrafi della via Appia [6]. Il sistema (Fig. 1), costituito da una base di dati contenente le informazioni riguardanti i reperti epigrafici presenti su tale via, si integra con un applicativo WebGis che consente l'accesso e la fruizione di questo materiale. L'interrogazione e l'analisi di dati su base cartografica, avvalendosi di cartografia regionale digitale, permette di analizzare e rappresentare la distribuzione spaziale dei reperti e di ricostruire gli spostamenti che hanno subito le epigrafi nel corso dei secoli.

Inoltre la tecnologia mobile orientata alla comunicazione e le nuove ricerche nel campo dell'intelligenza artificiale, per la modellazione utente e la rappresentazione della realtà, forniscono un enorme contributo allo sviluppo di sistemi in grado di offrire una contestualizzazione e una personalizzazione delle informazioni. La generazione di un percorso di visita culturale rappresenta un'attività di personalizzazione in quanto deve essenzialmente assolvere al problema di rispondere alle precise esigenze di un utente che si trova a rapportarsi con un contesto per lui non usuale.

Alla tipologia di servizi fruibili solo in loco, o in alcuni casi dalla propria abitazione (musei virtuali visitabili da Web, chioschi interattivi, ricostruzioni 3D ecc.), se ne affianca un'altra che ha come scopo l'assistenza dell'utente durante un percorso di visita. In questo caso viene consentito al visitatore di avere a disposizione delle mappe digitali con navigazione Gps in modo da poter raggiungere facilmente il sito oggetto della visita.

Partendo dall'esigenza di personalizzare i percorsi culturali, e considerando il valido supporto della tecnologia mobile nella fornitura di applicazioni *service oriented* presso l'ENEA in collaborazione con l'università di Salerno, si è realizzato un sistema per percorsi culturali personalizzati [7] che consente di fornire all'utente contenuti e servizi che si basano su quattro criteri fondamentali: 1) la sua localizzazione, 2) il tempo a disposizione, 3) il suo profilo culturale, 4) la conoscenza culturale acquisita. Tale sistema è inteso come un'applicazione intelligente, contenuta nel palmo di una mano, in grado con un semplice *touch* di generare un percorso di visita comprendente solo gli oggetti culturali adeguati agli interessi, alle preferenze, all'esperienza e a quanto c'è di personale nello stile di vita dell'utente. In questo caso la componente intelligente del sistema assolve al compito di adattare un percorso di visita al profilo culturale dell'utente, con la condizione però che un esperto del dominio informativo abbia precedentemente definito *quali siano* i siti culturali di un territorio e per ogni oggetto culturale *quali interessi dell'utente* può coinvolgere. Il gruppo di lavoro P-Culture (<http://www.pculture.it/italiano.html>) ha proposto la realizzazione di un'applicazione di tale sistema. Il progetto, denominato ADMIRE si propone come guida turistica personalizzata (fruibile tramite Pocket PC con localizzazione Gps) per la città di Salerno e ha tra le sue molteplici finalità l'intento di integrare le nuove tecnologie e i fabbisogni economico-culturali di una realtà territoriale ad alto potenziale turistico.

I beni culturali, pertanto, rappresentano un utile banco di prova per le attuali e future tecnologie di rappresentazione e di gestione della conoscenza. Una sfida necessaria sarà quella di permettere la transizione da sistemi informativi e *repository* di dati e informazioni verso la condivisione di conoscenze utili a utenti e operatori del settore.

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## Nuove tecnologie e beni culturali: i media interattivi come esperienza culturale

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### Abstract

*The following reports summarises the experiences done inside Engineering Ingegneria Informatica Spa Research Lab in the Cultural Heritage domain. This experiences is based on the participation (and often coordination) of many R&D Projects, funded by the European Commission. These are BRICKS ([www.brickscmmunity.org](http://www.brickscmmunity.org)); CASPAR ([www.caspar-preserved.eu](http://www.caspar-preserved.eu)) and PHAROS ([www.pharos-audiovisual-search.eu](http://www.pharos-audiovisual-search.eu)). In the paper a vision for the integration of technology-based innovation, cultural perspective and user centric applications in Cultural Heritage is presented with a particular attention to the possibility to generate value for citizens and people.*

### Presentazione

Il processo di innovazione delle tecnologie dell'informazione e della comunicazione e il conseguente avvento dei *New Media* (o media digitali) sta innescando profondi cambiamenti in tutte le sfere delle attività umane, dal lavoro al tempo libero, dalla formazione, alla nostra identità culturale. D'altra parte questo processo pone le basi per la creazione di una rete diffusa del sapere e per una partecipazione più attiva e consapevole degli utenti alle esperienze culturali. Lo scenario si fa sempre più complesso e articolato, componendosi di diverse sfaccettature relative sia alle tecnologiche sia agli aspetti economici e mercantili. La semplice elencazione di queste sfaccettature richiede uno sforzo di sintesi: tecnologie interattive, Digital Libraries, New Media, Interfacce, Intelligent Heritage sono tutti termini che si riferiscono a questo contesto senza tuttavia esaurirlo.

In questo ambito, e sulla base di una pluriennale esperienza nel settore dei media digitali e dei contenuti elettronici, la società Engineering sta spostando l'attenzione da applicazioni e progetti appartenenti al mondo della ricerca e dello sviluppo a quelli più prettamente industriali e del business. Come accade allorché ci si trova di fronte a fenomeni e/o prodotti nuovi, di cui non si conoscono appieno le potenzialità, per comprendere le novità si fa riferimento a paradigmi vecchi; in questo senso i contenuti culturali, finora, sono stati utilizzati secondo modelli "di tipo "broadband" e "blockbuster" propri dei media (giornali, radio, televisione), in cui l'utente è fruitore passivo di contenuti. Oggi, tuttavia, stiamo assistendo a un salto di paradigma nelle applicazioni delle tecnologie dell'informazione e della comunicazione, accentuando soprattutto come caratteristiche principali dei contenuti digitali l'*interattività* e la *personalizzazione*; questo fa sì che un sistema tecnologico, che integra innovazione e cultura, vada visto come una esperienza culturale *in toto* e non come mera appendice tecnologica a un apparato culturale.

Questa semplice asserzione, nasconde quindi un'opportunità precisa di sviluppo e di valorizzazione, opportunità che tuttavia non è stata sfruttata, se non in minima parte; ecco perché possiamo parlare di esperienza culturale: non si tratta di aggregare semplicemente altri media digitali, bensì di iniziare un processo di ripensamento dei media digitali per sfruttarne appieno le potenzialità. È con questo utilizzo consapevole

dei media digitali, infatti, che l'utente si trasforma, da fruitore passivo di contenuti standardizzati, in elemento centrale in grado di partecipare alla loro creazione, di elaborarli autonomamente o di crearne di nuovi, rendendoli disponibili per altri utenti. Si parla sempre più, quindi, di "prosumer" come sintesi dei termini *provider* e *consumer*, tanto che ciascuno di noi tende a diventare un *personal media* o *my-media*.

Il laboratorio di ricerca e sviluppo di Engineering Ingegneria Informatica Spa si muove in questo ambito da diversi anni, partecipando e coordinando iniziative e progetti di ricerca cofinanziati dalla Comunità europea, i principali dei quali vengono di seguito brevemente discussi.

Il progetto BRICKS ha costituito uno dei principali progetti finanziati dalla Comunità europea nell'ambito del VI Programma Quadro. Hanno partecipato al progetto molteplici e importanti partner europei come gli Uffici, l'Archivio Segreto Vaticano, il Ministero dei Beni Culturali inglese e quello italiano. Il progetto ha per la prima volta realizzato una piattaforma aperta e flessibile per l'interoperabilità dei contenuti culturali, in declinazioni che vanno dalla memoria digitale "vivente" alle possibilità tecnologiche per i piccoli e medi musei, alla possibilità di integrare contenuti e manoscritti antichi con tecniche digitali.

Il progetto CASPAR è un importante progetto finanziato dalla Commissione Europea per la conservazione digitale degli archivi e dei contenuti attraverso lo sviluppo di metodologie, di tecnologie e la loro integrazione in una piattaforma unica. Al progetto partecipano importanti istituzioni europee quali l'Unesco, l'Agenzia Spaziale Europea ma anche produttori di contenuti e gestori di archivi.

Il progetto PHAROS (Platform for search of Audiovisual Resources across On-line Spaces) ha l'obiettivo di sviluppare una piattaforma innovativa per la ricerca di contenuti digitali audiovisivi e, quindi, appartiene a un ambito prettamente tecnologico ma con importanti ricadute sui contenuti culturali e sull'accesso degli utenti ai contenuti stessi. Il progetto, della durata di tre anni, si prefigge di produrre un significativo avanzamento dello scenario di business nella filiera dell'audiovisivo europeo, realizzando una piattaforma tecnologica integrata e interattiva che possa consentire lo sviluppo di applicazioni audiovisive di nuova generazione. Entro il 2010, grazie alle tecnologie abilitanti sviluppate all'interno della piattaforma PHAROS, imprese e utenti finali potranno non solo accedere in modo intelligente alle informazioni necessarie al proprio lavoro, ma anche gestire i contenuti audiovisivi, relativi al contesto e al modello di business, e identificare le informazioni corrette oggetto della ricerca.

In un contesto globale in cui la mole di informazioni cresce in modo esponenziale e gran parte di queste informazioni è costituita da contenuti audiovisivi, la possibilità di utilizzare tecniche di ricerca efficienti per la gestione intelligente del patrimonio audiovisivo costituisce un traguardo tecnologico importante per il prossimo futuro. L'obiettivo spinge la comunità scientifica a sviluppare tecniche di ricerca sempre più sofisticate per fornire l'accesso a quantità di informazioni eterogenee e distribuite con modalità scalabile e integrata. L'architettura della piattaforma PHAROS permetterà, alla prossima generazione di motori di ricerca, di accedere alle informazioni distribuite su sistemi diversi, ricevendo *feed-back* dagli utenti e utilizzando modalità di "ranking" e di classificazione innovative. Organizzazioni culturali, pubbliche e private, si trovano sempre più in difficoltà nel gestire l'enorme volume di dati e di informazioni nei diversi formati audiovisivi. Le tecnologie dei motori di ricerca stanno progressivamente sostituendo i data-base tradizionali nella gestione dei dati. Alcune previsioni indicano

che circa il 50% delle future applicazioni informatiche possiederanno un motore di ricerca per gestire un volume di contenuti digitali che in tutto il mondo cresce del 1% alla settimana. Appare quindi evidente come, nei futuri progetti e applicazioni culturali, non si possa prescindere da tecnologie e sistemi che utilizzino tecniche di ricerca sempre più sofisticate; questo è ancora più chiaro se si considera che i contenuti audiovisivi vanno conservati e resi accessibili come parte fondamentale del patrimonio culturale di una nazione e di un popolo, sia dal punto di vista della memoria storica sia da quello della memoria artistica.

Come si vede tutte queste esperienze costituiscono un corpus in crescita nella direzione dello sviluppo di una nuova modalità di collaborazione, convergenza e interazione fra tecnologia, creatività, innovazione e cultura. Nei citati progetti l'ottica è sempre stata quella di porre il cittadino e l'utente al centro, non solo per disegnare specifiche funzionalità ma, soprattutto, per partecipare attivamente alla creazione di quella che vogliamo chiamare un'esperienza culturale.

## La comunicazione multicanale del patrimonio come strumento a servizio della salvaguardia dei beni culturali e come sistema per favorire la convergenza tra turismo ed economia della cultura

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### Abstract

*ENG Multichannel technology increases the potentiality of communication, advertising, educational and entertainment projects, extending the access to digital content by different devices (smartphone, PDA, iPhone, laptop, desktop ...), media (web, web, wap, DVB-T, IPTV ...) and integrated systems (Virtual Reality Center, Roadshow, Infopoint Network, Learning System) and allowing everybody to choose the appropriate device.*

### Presentazione

La valorizzazione del patrimonio culturale si basa soprattutto sulla capacità di trasformare le informazioni relative ai beni culturali in contenuti accessibili, dinamici e interoperabili. Questo processo di virtualizzazione del contenuto informativo si sviluppa attraverso l'utilizzo di formati e tecnologie digitali. Si tratta di procedimenti complessi che richiedono, all'interno di una solida catena produttiva, l'integrazione di varie professionalità. Fulcro di tale catena produttiva è la disponibilità dei contenuti da comunicare, mentre lo strumento per diffonderli in maniera capillare è la tecnologia.

Nel caso dei contenuti, il valore aggiunto, fondamento dell'intero processo, è dato dalla qualità e dalla scientificità delle ricerche e degli studi i cui risultati si intende veicolare. In questo ambito il MiBAC, con tutta la sua struttura organizzativa territoriale, rappresenta una fonte privilegiata di informazioni di varia tipologia. Gli organi istituzionali di ricerca come il CNR e l'ENEA sono i naturali detentori dello studio/sperimentazione di nuove tecniche di rilevazione, di gestione e di canalizzazione dei contenuti anche attraverso l'istituzione di una centrale, o di una sorta di incubatore delle informazioni, oltre che di modelli alternativi di fruizione.

Nel caso delle tecnologie il valore aggiunto è prodotto dalla capacità didattica ed educativa, dal grado di accessibilità e usabilità, dal livello di interazione, dalla capacità di coinvolgimento e intrattenimento di target differenziati. Come esempio di produzione e ottimizzazione dei contenuti multimediali ricordiamo le più note ricostruzioni del Colosseo, della tomba di Nefertari e le più recenti riproduzioni virtuali inserite all'interno del nuovo museo archeologico di Olbia; per la realizzazione di sistemi di visualizzazione immersiva segnaliamo il Virtual Reality Center di Brindisi; per l'integrazione di piattaforme per la fruizione multicanale citiamo GITA, progetto che prevede la visita guidata di musei e aree archeologiche attraverso dispositivi portatili.

È ovvio che occorre anche il coinvolgimento di reti di istituzioni territoriali, operatori turistici e culturali interessati a promuovere e veicolare contenuti qualificati, attraverso tecnologie innovative all'interno dell'offerta dei propri servizi.

A livello locale funziona l'utilizzo di tematismi rappresentativi del territorio: un esempio è costituito dagli studi sull'archeologia subacquea promossi attraverso il Distretto Tecnologico dei Beni Culturali della Regione Calabria "Cultura & Innovazione" che sta



Fig. 1. Sala per la fruizione immersiva

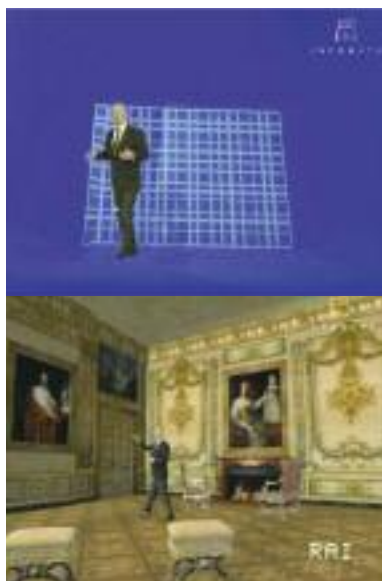


Fig. 2. *Virtual Set per la produzione di contenuti formativi e informativi*



Fig. 3. *Augmented reality da fruire tramite cellulare in modalità context-aware*

diventando un riferimento nel Mediterraneo in grado di rappresentare un centro di restauro e di ricerca, un osservatorio ma anche uno strumento di valorizzazione del patrimonio culturale territoriale.

Dunque, la promozione dell'attività di virtualizzazione di informazioni dedicate al patrimonio culturale tangibile (reperti museali, chiese, borghi ecc.) e intangibile (tradizioni popolari, folclore, artigianato, dialetti, feste popolari e riti religiosi, musica popolare, spettacoli, tradizione orale, usi e costumi ecc.) consente la raccolta e catalogazione dei contenuti collegati al patrimonio.

Tali attività rappresentano un modello di presidio del territorio e uno strumento di tutela e conoscenza delle attrazioni. La comunicazione delle attrazioni in modalità multicanale, accessibile a tutti compresi molti portatori di bisogni speciali, favorisce l'utilizzo delle tipicità a finalità turistiche e l'attivazione di meccanismi di autentica convergenza con l'economia della cultura.

Perciò la digitalizzazione di quanto rientra nel concetto di patrimonio di un territorio, inteso come identità locale, deve essere promossa, progettata e realizzata con tecnologie fruibili alla fascia più ampia possibile di pubblico perché possa essere realmente migliorata la visibilità delle attrazioni, in particolare quelle appartenenti a tematismi o località meno note o più difficilmente raggiungibili. A questa deve essere affiancata un'azione di promozione degli eventi e di rilevamento e diffusione di informazioni turistiche qualificate e attendibili (servizi di accoglienza, assistenza, ristorazione comprensivi di prezzi, orari, percorsi, numeri telefonici ecc.) destinate a:

- supportare i turisti durante il viaggio rendendo autenticamente fruibile il territorio;
- incentivare i flussi e migliorare le presenze mettendo a sistema la promozione e la comunicazione dell'offerta territoriale nella quale attrazioni storico-culturali, paesaggistiche, naturalistiche, enogastronomiche ed etnoantropologiche sono collegate in maniera chiara a un'efficace rete di servizi turistici.

Solo i sistemi tecnologici di gestione dei contenuti e di fruizione in modalità multicanale (Fig. 1, sale immersive; Fig. 2, roadschow, web, portale vocale, cellulare; Fig. 3, smartphone, Ipod, PsP, canale web tv, piattaforma e-learning) riescono a perseguire obiettivi informativi, promozionali, educativi e di intrattenimento rivolti a "tutti". Difatti la multicanalità consente a ciascuno di scegliere lo strumento che utilizza più facilmente per ricevere, ma anche per richiedere, contenuti.

Un tale sistema di gestione e fruizione costituisce un archivio multimediale del territorio nel quale convergono e convivono, restando suscettibili di continuo aggiornamento, informazioni sulle attrazioni del patrimonio culturale, sugli eventi e sui servizi turistici del territorio.

## New user interfaces for the fruition of cultural heritage

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### Abstract

*This paper aims to present problems that need to be solved, designing Man Machine Interfaces dedicated to non-expert users. It describe some possible solutions and criteria to design effective User interfaces for the spectators. Furthermore it describe some examples e-voluzione has realized for the International Forum of Culture 2007 in Monterrey (Mexico).*

### Presentation

The User interface is a software which allows non-expert users to use a complex machine. Hereunder are described the specific features that must be coped in the designing phase.

### Data Comprehension

The main goal it is to give a good comprehension of the incoming data. Sometimes the User Interface presents the data with tables and tables of numbers very hard to understand. The use of graphs and histograms helps on comprehension of data, mainly if the specific system requires a fast feedback on incoming data. F. M. Sacerdoti realized the control centers for four Space Shuttle missions in which a fast understanding is mandatory.

### Users

The design of effective User Interfaces is a very complex item since it is strongly dependent by the typology of users which must use the system. Different users means different User Interfaces. As an example, we developed control system for complex instruments. In respect of the user, from the engineer, to the plant operator, to the plant director, the system had different user interfaces: the former was the most flexible and configurable, the middle was very easy with only three buttons, the latter was dedicated to statistical comprehension of the same data. The fruition of Cultural Heritage has a difficulty to a higher degree: several users at the same time, all with different experience and skills. Sometimes no skill at all. In that case the interface must be very easy with the maximum level of interactivity on the base of the “day by day” operation every person do in their life. The best interface can be sketched as in the follow table 1.

User Skill	Interface type
Computer Master	Keyboard and Mouse
Information Technology Primer	Touch Screen
New User no Computer experience	Other....

The “other...” could be touch pads, rotary controls, vision systems, etc. As example, we can describe the applications we used for the realization of “Comune





Fig. 1. *The interactive Multimedia Book*



Fig. 2. *The telescope*



Fig. 3. *The interactive table*

di Napoli” stand in the International Forum of Culture which was held in Monterrey (Mexico) in 2007. The 1<sup>st</sup> application was a Multimedia Book (Fig. 1) The book is a “real” book with only one page turnable with an easy movement of the hand, as you would like to turn the page of a real book. There is a projector which creates the multimedia contents in the book, and every time you pass your hand over the book, the page will change (backward or forward). The contents of each page can have pictures, texts, video or both. The system is also equipped with an audio amplifier to have also a sound experience from the book.

The 2<sup>nd</sup> application (Fig. 2) is a special telescope which project on an external cylinder a slice from a video at 360° point of view. The video, in the Monterrey installation, was a viewing of city of Naples from its topmost hill. The total duration of video is about two minutes, but it is an accelerated view from sunrise to sunset of a complete day. The user, turning the telescope, can change the point of view. Furthermore, inside the eyepiece there is the same video on a small monitor to give a more impressive emotion on living the stand.

The 3<sup>rd</sup> application is a special interactive table (Fig. 3). In front of the user there is a backprojected screen with a map of Naples. The user, positioning a small statue on the screen, can change the map on the original situation in the city in that particular time frame in history. The map has some yellow sensitive areas. If the user put the statue in those specific areas, the video on the the wall displayed information on that particular Naples Area in that particular period. If the user select the actual statue, it will perform some walking in Naples street in self view, with sounds of the city. The realization of Cultural Heritage stands for museum users, required special User Interfaces.

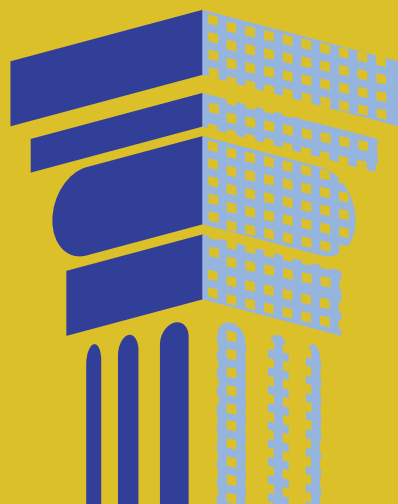
The main characteristics must be user friendly; clear comprehension of contents; amusing use; contemporary viewing by several people; hardness and durability.

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TECHA

# Sustainable technologies for cultural heritage



2008

## Tecnologie sostenibili per il patrimonio culturale

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### Abstract

*The present paper is appropriated to the chairperson's lecture of the 4<sup>th</sup> TECHA workshop Sustainable Technologies for Cultural Heritage and is aimed to orient and advice the discussion taking into consideration some new and emerging cultural aspects integrating them into adapted conservation procedures.*

*Nowadays, the Protection and Conservation of Cultural Heritage buildings through Sustainable Technologies, Tools and Materials represent a conceptual innovation. Scientific research is playing a rapidly changing role in the conservation sector, in particular in the field of the energy related methods and techniques for the preservation of historical centers, monuments and build environment in general. The emerging interdisciplinary of scientific and technical aspects, generated by research institutions and public bodies in synergy with small and medium enterprises, represents the core of this innovation, in order to increase the life cycle of materials and structures, maintain the performance characteristics of buildings with historic importance, improve its conservation through applied research and in the mean time to improve their indoor comfort and conditions and optimize their energy efficiency level.*

### Presentazione

L'obiettivo di questo evento è quello di offrire una piattaforma di discussione e di condivisione del pensiero contemporaneo sugli aspetti concettuali, sulle tendenze innovative e sulle operazioni sostenibili che riguardano la valorizzazione del patrimonio culturale.

Tutto ciò in un ambito relativamente nuovo: infatti, le linee guida dell'Europa propongono come obiettivo per il comune futuro europeo la cosiddetta società della conoscenza, da realizzare attraverso lo sviluppo dell'imprenditorialità, dell'innovazione e della ricerca; tre tematiche fortemente interconnesse tra di loro, applicate nell'ambito dei beni culturali, il quale pur essendo un settore strategico – sia per la società europea in generale, che per la società italiana – non riesce ad affrontarle in maniera sufficientemente efficace ed integrata.

Inoltre, per realizzare effettivamente questa società della conoscenza attraverso lo sviluppo dell'imprenditorialità, dell'innovazione e della ricerca bisogna fare uno sforzo significativo per superare l'attuale distacco tra risorse scientifiche ed applicazioni concrete: questo sforzo, non facile, deve in parte riformulare il ruolo delle tecnologie applicate nel settore dei beni culturali, rispettando nel contempo i concetti di fruizione dei beni e della loro trasmissione al futuro. A questi concetti, fondamentali e irrinunciabili per un organismo storico, si affiancano temi altrettanto ardui, quali quelli di sostenibilità ambientale, di sostenibilità sociale e di sostenibilità economica, i quali si traducono in interventi, che a volte incidono fisicamente sulle preesistenze, atti non solo a determinare la protezione e conservazione, ma anche l'esaltazione dei valori culturali che questi beni posseggono ed esprimono in vario modo.

In realtà, tutto l'ambito disciplinare delle tecnologie sostenibili si è sviluppato secondo criteri propri, inizialmente adattabili alle nuove costruzioni, e quindi, in qualche modo autonomi sino a che non vanno ad interessare le testimonianze storico-artistiche. Fino a poco tempo

fa, si può affermare che questo nuovo indirizzo, della sostenibilità e a maggior ragione delle tecnologie sostenibili, rimaneva in seconda fila. Solo di recente, si è configurato nell'ambito della conservazione, in maniera vivace e promettente. Ciò era inevitabile, dal momento che il campo ha interessato le testimonianze storico- artistiche, condizione che lo ha messo di fatto sotto la tutela dei principi della conservazione.

In ragione proprio della molteplicità della materia beni culturali, deriva l'esigenza di ridefinire il campo e quindi identificare l'ambito nel quale le tecnologie sostenibili sono attualmente applicabili. Faccio un esempio: i cosiddetti centri storici minori e i piccoli borghi (che sono complessivamente circa ventimila in Italia) fanno parte a pieno titolo di questo patrimonio dei beni culturali, anche se, effettivamente, restano in ombra rispetto alle opere d'arte maggiori, ai monumenti dell'architettura, alle città storiche e alle città d'arte. In molti casi, questo importante patrimonio si degrada e la causa è principalmente antropica. Da non dimenticare, inoltre, che il patrimonio culturale comprende realtà di ogni genere: non solo interi centri storici, ma anche edifici chiesastici, museali, ville, palazzi, siti archeologici, edifici sacri, ma anche pitture, sculture, architetture di epoca moderna ed opere di urbanistica.

Comprimendo, non per necessità ma solo per convenienza il campo nell'ambito dell'edificato di ogni epoca, in modo da includere emergenze come i siti archeologici fino alle opere architettoniche ed urbanistiche più recenti, si può affermare che destano particolare interesse queste tecnologie per mantenere l'istanza propriamente conservativa dei beni in questione.

Di conseguenza tratteremo tecnologie che abbiano come finalità quella di supportare temi quali il restauro che non consente né semplificazioni, né banalizzazioni, né schematismi, il recupero conservativo ma anche di trasformazione nonché tutta la problematica conservativa con le varie sfumature che attorno ad essa ruotano, come per esempio le operazioni di prevenzione e di tutela. Mentre, trasferire il concetto generale dello sviluppo sostenibile e delle tecnologie sostenibili nell'ambito degli edifici di recente costruzione significa porre al centro dell'attenzione l'interazione tra l'opera e il sito e quella tra entrambi e l'ambiente, intervenendo in questo caso, con tecniche e metodi anche invasivi per ottenere un effettivo e sostenibile recupero, per gli edifici storici i gradi di libertà sono ben minori. Infatti, si richiede un ulteriore approfondimento, attento sulle implicazioni metodologiche e sulle ricadute operative concrete, fermo restando che l'interazione tra opera, sito ed ambiente sia sempre opportuna e valida. Inoltre, le ragioni della fruizione - e delle componenti funzionali, economiche e sociali ad esse connesse - sono ovviamente poste in subordine rispetto alle istanze conservative, in piena coerenza con principi propri della conservazione.

In sostanza le tecnologie sostenibili per i beni culturali si possono applicare in tutti gli ambiti di studio e/o di restauro di questi: si parte dalla conoscenza della 'materia' degli antichi edifici, per passare alle modalità di analisi, poi a quelle dell'intervento per infine arrivare alla fase della loro tutela, gestione e prevenzione fino alle normative che dovrebbero regolare la loro conservazione.

Nell'applicazione delle metodologie sostenibili utilizzate nel campo dell'edificato non mancano ambiguità ed equivoci. Infatti, mentre fino ad oggi si citava solo il consolidamento strutturale, come quel settore che richiedeva un ulteriore grado di consapevolezza, attualmente si pone l'attenzione anche nel campo dell'impiantistica applicata negli antichi edifici, in quanto presenta caratteri di invasività che rischiano di vanificare i principi della corretta conservazione. E' ben noto come il campo dell'impiantistica si è allineato, in qualche modo, con quello delle tecnologie sostenibili, di conseguenza il rischio di confusione esiste.

A questo delicato campo, non ancora sviluppato e definito correttamente dalla pratica tradizionale del restauro, si richiede l'ulteriore sforzo di applicare le tecnologie sostenibili. Bisogna ammettere che il compito risulta arduo.

Inoltre, per le nuove costruzioni il LCA (*life circle assessment*) deve essere ottimizzato mentre nelle costruzioni storiche il LCA deve essere massimizzato.

Tentiamo un ulteriore chiarimento di termini: la dizione stessa del "bene culturale" è così ambigua che spesso le antiche testimonianze possono considerarsi, con tutte le cautele, anche come beni economici, a causa dell'importanza che sempre più rivestono nell'economia delle nazioni.

L'Europa dispone di un patrimonio monumentale molto vasto. Il grado di protezione e dei vincoli di questo patrimonio è ancora molto vario tra i vari stati membri. Intorno ai monumenti primari di inestimabile valore esistono i cosiddetti *beni serventi il bene principale*, che sono manufatti anch'essi storici, con o senza particolari caratteristiche artistiche o architettoniche. Essi costituiscono insediamenti di carattere tradizionale e dovrebbero essere analogamente vincolati dalle leggi di tutela. Questa massa critica di edifici richiede profondi miglioramenti dal punto di vista energetico e a volte anche morfologico, per rispondere in modo adeguato alle sempre crescenti esigenze del *comfort* termoisolometrico degli utenti, del *comfort* acustico e non ultimo rispondere alle normative che riguardano il risparmio energetico. (Direttiva Europea sul rendimento energetico degli edifici). Oltre a ciò, la competizione economico-sociale globale in atto richiede una serie di interventi indispensabili affinché questi edifici restino vivi e anche appetibili al mercato immobiliare. Di fronte a questo quadro esigente, l'unica risposta che si può dare e che può definire il tipo di intervento riguarda i *recuperi conservativi sostenibili ed energeticamente consapevoli*, i quali hanno come comune denominatore le tecnologie sostenibili.

Di fronte a questo scenario gli attori maggiormente coinvolti in questo processo devono essere pronti a cogliere il mutamento del quadro di esigenze alle quali dovrà rispondere la prossima generazione di norme. In questo *workshop* diversi attori che rappresentano le Istituzioni, il mondo della Ricerca e il mondo dell'imprenditoria esprimeranno il proprio punto di vista ed evidenzieranno le implicazioni e le opportunità dell'inserimento delle tecnologie sostenibili nel Patrimonio Culturale.

Si dice che la spinta dell'innovazione nasce sempre dal basso e avviene in risposta ad esigenze reali. Intorno al patrimonio culturale e in particolare, intorno agli interventi di restauro, di operazioni di prevenzione e di tutela esiste una serie di imprese che hanno tratti di forte innovazione. Infatti, il sistema beni culturali, che parte dalla gestione e dalla tutela del territorio (nel quale si focalizza il bene vero e proprio), rappresenta un'area in cui si sta sviluppando un mercato caratterizzato da piccole e medie aziende dai forti contenuti tecnologici, nonché di grandi gruppi con una spiccata vocazione all'innovazione. Le tecnologie sono numerosissime e molto differenziate: nuovi materiali, tecniche costruttive innovative, strumenti di misura e di diagnosi, modellistica, piattaforme digitali e quant'altro. Questa enorme potenzialità si esprime in maniera dispersa e frammentata.

Un altro attore fortemente coinvolto al raggiungimento dell'obiettivo è rappresentato dal mondo della Ricerca. Un esempio di competenza e di affidabilità è rappresentato dal fatto che mentre nel settore dell'edilizia in generale, non si può parlare di una innovazione tecnologica in senso assoluto, nel settore di restauro o di recupero conservativo si può parlare se non altro di un pacchetto di tecnologie, articolate tra di loro in tal modo, che possono permettere operazioni di elaborazione metodologiche, di sperimentazioni scientifiche e di verifiche attuative.

Inoltre, gli sviluppi avvenuti in ambito tecnico - scientifico, nella scienza dei materiali, nei metodi strumentali di indagine, nel controllo del microclima di ambienti - sono limitati

ad alcune istituzioni e non sono abbastanza diffusi. In particolare molto si può fare in tema di recupero delle strutture, degli impianti, dell'uso efficiente dell'energia, del controllo del microclima, della ventilazione, della qualità dell'aria interna, dell'efficacia gestionale, della sicurezza e protezione nei grandi edifici storici destinati a funzioni pubbliche o a contenitori museali. Le tecnologie informatiche e strumentali che possono essere impiegate sono già state sviluppate per applicazioni scientifiche o industriali e, con modesti adattamenti, rispondono perfettamente alle esigenze di un edificio anche complesso e multifunzionale. Si tratta in sostanza di innovazione da trasferimento tecnologico. In fondo, la vera innovazione nel campo tecnologico, proviene (a) dalla reale sinergia fra ricerche in discipline diverse (b) dalla combinazione efficace di teoria e di esperimento (c) dai cambiamenti rivoluzionari (ossia le nuove invenzioni) seguiti da cambiamenti evolutivi (vale a dire dall'ingegnerizzazione e lo sviluppo).

Il terzo attore coinvolto è l'Istituzione Pubblica che di solito rappresenta la Committenza per il mondo della Ricerca e dell'Imprenditoria. Le Istituzioni, se non rappresentate a livello Centrale, sono rappresentate a livello Regionale o Comunale. Restano comunque gli organi periferici del Ministero, ossia le Soprintendenze a formulare le regole e a dare gli indirizzi sull'operatività nel campo anche se l'iniziativa di intervenire sul patrimonio a volte deriva da un Comune o da una Regione.

In ogni caso, il Codice dei Beni Culturali e del Paesaggio del 2004 impone di ripensare le scale, le logiche e i criteri dell'intervento. In questo senso le realtà Regionali e Comunali sono maggiormente coinvolte a partecipare al processo fruitivo e conservativo dei beni. Inoltre, il richiamo alla sostenibilità della fruizione e quindi dei progetti di valorizzazione, comporta conseguenze operative che vanno dalla scala della pianificazione fino alla scala dell'esecuzione. Ciò non può prescindere dalla complessità di un processo e di una visione che solo l'Amministrazione locale è in grado di attivare.

Come è noto e come abbiamo finora affermato l'applicazione di tecnologie sostenibili nel settore dei beni culturali coinvolge sempre numerose competenze (cultura, ambiente, lavori pubblici, protezione civile, promozione sociale, turismo): questo fatto rappresenta di per se una grossa difficoltà per l'Amministrazione Pubblica che deve non solo mobilitare ma anche utilizzare efficacemente le risorse di cui dispone e che a volte sono trascurabili.

Per chiudere questo discorso, mi appello alle parole della dott.ssa Recchia del Ministero dei Beni e Attività Culturali, la quale in un evento precedente, molto efficacemente aveva sintetizzato il rapporto patrimonio culturale - tecnologie - innovazione- sviluppo economico in una prospettiva di valorizzazione di tutto il comparto e delle sue potenzialità di crescita.

Il settore economico che orbita intorno al patrimonio culturale e alla cultura in genere presenta tutti i caratteri positivi di un settore che ha rilevanza e centralità ai fini della competitività: contribuisce in misura consistente al PIL; cresce con ritmi superiori a quelli medi del PIL; ha una grande potenzialità di incidere significativamente sull'export; presenta una qualità degli addetti superiore alla media; presenta un livello di crescita tecnologica superiore alla media con una notevole propensione a sperimentare e a sviluppare ricerca; presenta nei suoi addetti un tempo di assorbimento dell'innovazione tecnologica decisamente superiore alla media e capace di stare al passo con l'innovazione stessa.

In effetti la qualità e quantità di patrimonio culturale, il sistema di gestione, le modalità e le metodologie di conservazione, costituiscono un insieme non separabile di eccellenze del Paese, che ne rafforza l'immagine, la credibilità e l'affidabilità. Occorre trasformare in scelte coerenti della parte pubblica e del sistema produttivo, il concetto generalmente condiviso ma solo convenzionale che il Patrimonio Culturale sia una importante componente del sistema economico e un fattore di competitività del "Sistema Italia".

## **Green conservation, un nuovo approccio scientifico per l'uso di tecnologie sostenibili negli edifici storici**

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### **Abstract**

*The scientific and technological research for the conservation and reuse of historic monuments have today to promote and test appropriate strategies for the environmental-energy sustainability of this cultural heritage. The research should tackle the functional and equipment adaptation of the architectonic heritage with technological interventions able to improve the comfort and energy efficiency level, realized in the full respect of the historical and artistic characteristics of the buildings. The industry in the new building materials and energy systems sectors offers a lot of innovative products, with good results that applied to the monuments not always are able to satisfy the "compatibility", "minimum intervention" and "reversibility" criteria.*

*The paper presents a new scientific approach defined "Green Conservation" for the sustainable restoration of historical buildings, with the aim of developing compatible planning procedures and testing new products with energy saving performance to apply to the monumental heritage.*

da rivedere cessari

### **Introduzione**

Il settore del restauro in Italia oscilla tra il dibattito teorico-metodologico interno alla disciplina e le esigenze edilizie di un paese che si trova a possedere un patrimonio immenso di costruzioni storiche, di valore artistico senza paragoni, le quali devono essere usate per attività attuali, mettendo così in moto un processo fatto di progetti di conservazione, cantieri di riqualificazione e lavori di rifunzionalizzazione, che ogni anno interessa migliaia di palazzi, chiese, musei. Un processo che riguarda in realtà tutta l'Europa e che oggi si intreccia inevitabilmente con le questioni legate ai temi più generali della salvaguardia di un ambiente sempre più a rischio e della gestione di una energia che è diventata la risorsa che può scatenare conflitti e tensioni mondiali senza precedenti. Ecco perché oggi, dovendo affrontare il restauro di un monumento, diviene centrale il tema di come realizzare l'adeguamento funzionale di questo bene e di come scegliere quegli interventi conservativi ma anche tecnologici in grado di migliorare i livelli di comfort abitativo e di efficienza energetica che siano in grado di garantire il pieno rispetto delle caratteristiche storiche e artistiche degli edifici stessi. Se guardiamo infatti a quello che la ricerca tecnologica e la produzione industriale propongono nel campo impiantistico e del risparmio energetico rileviamo una offerta di prodotti eccezionale, in continuo sviluppo, con risultati però che se applicati ai monumenti non sempre riescono a soddisfare quei caratteri di compatibilità con l'esistente e con i criteri ormai condivisi di "minimo intervento" e di "reversibilità".

A questa problematica risponde una linea di ricerca avviata nel 2005 dal Built Heritage Lab dell'Istituto per le Tecnologie Applicate ai Beni Culturali (ITABC) del Cnr, con l'obiettivo di lanciare e sperimentare il tema della *Green Conservation*, un approccio fortemente innovativo al tema del restauro architettonico.

Su questo argomento sono stati avviate numerose iniziative scientifiche, tra le quali il progetto SOCRATES (Sistema Operativo Coordinato di Ricerca sull'Adeguamento



Tecnologico degli Edifici Storici), finanziato dalla soc. VIVECA e coordinato scientificamente dall'ITABC che lo ha sviluppato in collaborazione con alcuni Dipartimenti universitari (Ditag-Sir Politecnico di Torino; Dipartimento di Archeologia, Università di Bologna; Dipartimento di Energetica, Politecnico di Milano) e con Istituti CNR (IBAM, ISTEK).

Il caso di studio è rappresentato dal Castello di Zena, un edificio monumentale situato nella pianura padana in provincia di Piacenza. Questo complesso architettonico, grazie al progetto innovativo di conservazione sostenibile, si propone come grande vetrina di soluzioni tecnologiche ed impiantistiche non meno che di restauro, e costituisce una grande opportunità di aggregazione di partner industriali interessati ai vari temi concernenti la valorizzazione del patrimonio edilizio.

Ma soprattutto questo progetto rappresenta una occasione fondamentale per sperimentare, applicare e diffondere questa visione nuova del restauro architettonico, ampliato al concetto di *Green conservation*, un approccio al tema conservativo che vuole essere in grado di affrontare l'arduo compito di difendere l'esistente nel delicato equilibrio tra passato e presente, conciliando tradizione e innovazione, linguaggi multiculturali ed espressioni tecnologiche, elementi storici e ritrovati contemporanei. Ma soprattutto *Green conservation* come metodologia scientifica e operativa per affrontare e vincere la sfida della sostenibilità energetica e ambientale dell'ambiente costruito.

### **La ricerca sulle tecnologie sostenibili per la *Green conservation***

Il progetto sul Castello di Zena si è articolato in più fasi, la prima riguardante lo stato della ricerca tecnologica, seguita da una fase fondamentale di conoscenza del monumento, da uno studio sulla compatibilità e criticità degli interventi, fase propedeutica al progetto generale di conservazione. Parallelamente si è sviluppato lo studio dei criteri progettuali impiantistici, delle criticità, delle specifiche tecniche e normative per le soluzioni da adottate per l'uso di energie rinnovabili e per il risparmio energetico.

Per quanto riguarda la valutazione dello stato della ricerca tecnologica in questo settore va subito detto che anche qui si ripropone uno dei fattori che hanno caratterizzato lo sviluppo della cultura occidentale: la settorializzazione delle competenze che porta ad isolare i vari campi della conoscenza e, quindi, a ridurre le possibilità di interazioni costruttive indotte dalla possibile collaborazione.

La ricerca sulla *Green Conservation* privilegia invece un approccio «olistico» alla conoscenza del bene culturale, dell'edificio visto come un sistema complesso di funzioni e di componenti integrati tra di loro. Un approccio olistico che viene applicato anche alla ricerca tecnologica puntando sostanzialmente ad una integrazione tra tecnologie tradizionali e tecnologie innovative. Un obiettivo che si orienta soprattutto a trasferire nei nuovi prodotti le caratteristiche prestazionali di quelli antichi così come la filosofia operativa. Quindi lo studio di queste conoscenze tradizionali non deve essere un mero catalogo documentario, ma uno strumento di supporto alla ideazione e al miglioramento compatibile delle innovazioni produttive attuali. Per lo sviluppo di nuovi materiali e nuovi componenti edilizi lo sforzo deve indirizzarsi a trovare soluzioni adatte al contesto di applicazione, vale a dire al costruito monumentale.

Un processo che non deve puntare necessariamente alla rincorsa verso nuove scoperte tecnologiche, ma indirizzarsi a ottimizzare competenze, prodotti e soluzioni utili a superare le inefficienze nel risparmio energetico degli edifici storici. La tecnologia

fotovoltaica ad esempio è oggi considerata a ragione piena di promesse e di opportunità, ma ci rendiamo conto che i componenti e i pannelli attualmente usati per le nuove costruzioni non sono adattabili alle coperture dei nostri centri storici. Ma grande attenzione viene prestata al possibile impiego delle pellicole energetiche, prodotti innovativi ultrasottili che applicati a tetti, intonaci, finestre possono evitare l'impatto dimensionale ed estetico delle celle solari attualmente disponibili sul mercato. Il tema dell'acqua rientra prepotentemente nella riconfigurazione architettonica e funzionale del costruito, spingendo a soluzioni di efficienza idrica che ne consentano un uso domestico più razionale. Anche in questo caso le tecniche antiche sviluppate nei paesi aridi ci possono aiutare a rinnovare metodi secolari di recupero dell'acqua ma soprattutto a riappropriarci di una mentalità basata sul risparmio e sul riciclo di questo elemento sempre più a rischio.

Sul fronte dei materiali la sfida riguarda la capacità di dotare materiali tradizionali quali ad esempio gli intonaci e le pitture di prestazioni che migliorino l'isolamento senza penalizzare la traspirazione, né compromettere il controllo della fluidità capillare, magari garantendo la automanutenzione delle superfici, come avviene già oggi con il biossido di titanio additivato alle pareti esterne di edifici moderni. E così anche per materiali quali gli isolanti l'uso di tecniche e prodotti antichi per i nuovi componenti riescono a rispondere bene a principi di compatibilità.

Tutti questi temi sono al centro della linea di ricerca dell'ITABC sulla *Green Conservation* così come lo studio di prodotti e soluzioni sostenibili è in corso per valutare altri materiali e componenti, quali infissi, vetri, sistemi di copertura, impianti elettrici, idrici e di sicurezza.

Ma tutto questo non avrebbe senso se non ci fosse quel corretto approccio al tema del restauro che anche sotto il profilo impiantistico prevede una analisi accurata della storia e dell'architettura dell'edificio.

### **Il caso di studio: il Castello di Zena**

E' utile ripercorrere a grandi linee i rilievi le indagini e i risultati realizzati sul caso di studio. L'obiettivo è stato quello di acquisire elementi di conoscenza del manufatto sotto l'aspetto storico, costruttivo e artistico, per comprenderne l'evoluzione, migliorarne le condizioni di fruibilità e per valorizzare la struttura riuscendo a controllare la sostenibilità di tutte le opere da realizzare.

Le indagini storiche e evolutive del monumento attraverso una analisi stratigrafica delle murature - integrata con i dati desunti dalla documentazione d'archivio e con i risultati delle analisi dei materiali edilizi hanno permesso di riconoscere 12 fasi costruttive, che scandiscono lo sviluppo edilizio del castello di Zena.

Di particolare interesse è stato la scoperta di una antica fornace di laterizi, utilizzata nel 400 per la ricostruzione della residenza, che ha fornito informazioni utili sulle tecniche costruttive e sulla datazione dei materiali fittili.

Il rilievo del Castello di Zena rappresenta la descrizione completa, georeferenziata e metricamente corretta dell'edificio. Le informazioni rilevate sono integrate in un modello tridimensionale multiscala che contiene al proprio interno e permette di gestire tutte le informazioni raccolte, consentendo l'estrazione di informazioni geometriche 2D e 3D di supporto alle attività di progettazione e di analisi svolte dai diversi gruppi di lavoro, nonché l'aggiornamento e l'integrazione delle informazioni.

Quanto alla valutazione dello stato di conservazione la campagna di analisi architettonica e di indagini diagnostiche integrate con le conoscenze storiche, effettuata

attraverso l'esecuzione di rilievi su diversi fronti e l'analisi dei materiali, ha permesso di evidenziare e catalogare le tecniche impiegate nella realizzazione delle strutture verticali e orizzontali e quindi le caratteristiche costruttive delle murature, dei solai di piano e delle volte, nonché delle strutture del tetto. Le volte costituiscono degli elementi costruttivi che sottolineano il carattere monumentale dell'edificio per la varietà delle soluzioni geometriche.

Il rilievo attento di tutti i componenti architettonici di completamento, quali infissi esterni e interni, elementi importanti in chiave figurativa e tecnologica, è stato finalizzato allo studio di procedure per la loro conservazione, per una eventuale integrazione funzionale e per l'inserimento soprattutto di nuovi impianti. Le linee guida di conservazione e rifunzionalizzazione discendono da questi studi e rilievi.

Gli interventi sul castello di Zena si dividono in tre grandi famiglie:

- il restauro architettonico con consolidamento statico e miglioramento sismico delle strutture
- l'adeguamento funzionale e le nuove destinazioni di ambienti dismessi
- il restauro energetico del monumento e impiego di fonti energetiche rinnovabili.

Attraverso una analisi esigenziale sono state definite le tipologie degli interventi conservativi, valutandone compatibilità e criticità. Uno studio approfondito è stato sviluppato per definire le tipologie delle opere di consolidamento strutturale e la sostituzione di parte delle capriate di copertura con nuovi elementi portanti di tipo Polonceau.

Le soluzioni tecnologiche sviluppate per il restauro energetico riguardano:

- Isolamento delle pareti
- Isolamento delle coperture
- Isolamento dei pavimenti
- Intervento sui serramenti
- Interventi di ventilazione e riscaldamento

Per quanto riguarda l'isolamento dell'involucro sono stati testati prodotti e tecnologie relative a:

- Isolamento termico delle pareti e in particolare materiali per l'isolamento dall'interno
- Isolamento termico delle coperture
- Isolamento termico con intervento sui solai a contatto con locali non riscaldati

Per le finestre da rifunzionalizzare gli interventi riguardano l'utilizzo di vetro basso emissivo a isolamento termico rinforzato. Infine per trattamento aria e riscaldamento è prevista ventilazione meccanica controllata con recupero di calore ad elevata efficienza.

Per le fonti di approvvigionamento energetico da utilizzare sono state analizzate diverse possibilità di integrazione impiantistica, con l'obiettivo di ridurre il consumo energetico per la climatizzazione estiva ed invernale, la produzione di acqua calda sanitaria e l'illuminazione degli ambienti interni ed esterni.

L'accento è stato posto su sistemi innovativi di produzione di energia e sull'utilizzo di fonti rinnovabili, ricercando nella loro combinazione la soluzione di ottimizzazione anche economica. Il comprensorio di Zena è diviso in due gruppi di edifici: il Castello, con gli edifici ad esso annessi, e un complesso di edifici agricoli.

Per la produzione di energia elettrica, calore e freddo è stata analizzata la fattibilità delle seguenti soluzioni:

- Impianto di cogenerazione o di trigenerazione con differenti configurazioni impiantistiche;
- pompe di calore acqua-acqua utilizzando acqua di falda.

È stata valutata infine la possibilità di sostituire parte dei consumi di gas o gasolio con biomassa prodotta dall'azienda agricola stessa, o da zone limitrofe, con benefici per l'ambiente e per l'economia locale. L'uso di differenti fonti energetiche e la produzione simultanea di energia elettrica e termica permette di migliorare l'efficienza energetica, migliorandone al contempo la sicurezza dell'approvvigionamento.

La ricerca viene sviluppata in forte collaborazione con le imprese che operano nei diversi comparti che caratterizzano gli interventi di recupero e funzionalizzazione degli edifici e degli ambienti naturali ad essi collegati ed in particolare con quelle interessate a proporre sistemi tecnologici ed impiantistici avanzati. Con questo progetto il Castello di Zena si trasforma in un sistema ecosostenibile, che verrà certificato secondo gli standard Leed, e che permetterà di risparmiare, nelle parti rinnovate, fino al 15 % dell'energia, grazie ai vantaggi ottenuti con l'impiego di isolamento interno di pareti, di coperture e di finestre e con sistemi di gestione della climatizzazione ambientale a basso impatto e a consumo ridotto.

### Conclusioni

Se pensiamo a quanta energia disperdiamo negli ambienti monumentali in cui viviamo, ci rendiamo conto che questi manufatti, straordinari nella loro testimonianza di storia e di arte, sono certamente antiquati per i nostri bisogni di vita così diversi da quelli degli uomini che li hanno costruiti secoli fa.

Fare leva sulla ricerca, sull'innovazione tecnologica e sull'efficienza energetica è oggi un dovere del settore scientifico, ma anche produttivo che si occupa di questo patrimonio.

Con la linea scientifica che è stata esposta la frontiera del restauro diventa "verde" e si muove verso il concetto di *Green Conservation*, un approccio teorico, metodologico e tecnologico che impiega principi innovativi nella progettazione di interventi di conservazione e nel recupero funzionale degli edifici di alto valore storico e architettonico. Questo indirizzo rappresenta uno strumento essenziale per conseguire un restauro compatibile con le nuove esigenze di riuso di questo patrimonio, ma tende soprattutto a costruire una metodologia di progettazione e di esecuzione che vuole essere un "modello di intervento tecnologicamente sostenibile". Una ricerca che vuole affrontare la sfida di una energia efficiente e alternativa per gli edifici storici senza comprometterne la tutela, anche attraverso il monitoraggio sistematico dei degradi estremi, indotti dall'ambiente, per studiarne la prevenzione e la mitigazione.

## Nuove tecnologie a supporto dello studio e della valorizzazione del patrimonio architettonico: il software cloudCUBE

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### Abstract

*Laser scanning technology offers a 3D survey system capable to acquire complex surfaces rapidly and to deliver data with density, precision and completeness much better than traditional survey instruments. Virtualgeo has been applying laser scanning for years to survey architectural and archaeological heritage. The company considers laser scanning an extraordinary technology for the richness of its potentialities, about which thinks it is necessary to strengthen the scientific dissemination.*

*Laser scanning potentialities require a dedicated software. Virtualgeo developed CloudCUBE, a modular software on AutoCAD® platform to manage and 3D model the point clouds delivered by laser scanner (www.cloud-cube.com). It allows to import, visualize and arrange the point clouds and to 3D model with three different integrated techniques.*

*A complete example of the laser scanning technology application on architectural heritage is the work carried out by Virtualgeo on a 14<sup>th</sup> century chapel.*

### Presentazione

#### *Rilievo 3D laser scanning*

La tecnica di rilievo laser scanning si caratterizza per la capacità di acquisire molto rapidamente, sotto forma di “nuvole” costituite da milioni di punti, la geometria tridimensionale degli oggetti rilevati. Il laser scanner acquisisce le coordinate spaziali tridimensionali e, grazie alla presenza di una fotocamera integrata, il valore cromatico RGB di ciascun punto rilevato. Tali informazioni costituiscono un database tridimensionale di alta precisione, non legato a modalità di rappresentazione predefinite, sulle caratteristiche dimensionali, morfologiche e qualitative del rilevato.

Il laser scanning non implica contatto diretto con le superfici interessate, condizione indispensabile quando le caratteristiche materiche o le condizioni conservative lo richiedono, come nel caso di manufatti o immobili di interesse artistico, storico, archeologico ed etnoantropologico.

I laser scanner terrestri in commercio sono classificabili in base al sistema di ricezione e alla modalità di elaborazione del segnale: a tempo di volo, a differenza di fase, a triangolazione. Le dimensioni e la distanza dell’oggetto da rilevare sono fattori determinanti per scegliere quale laser scanner sia più opportuno impiegare. Parallelamente è necessario considerare che ciascun tipo di laser scanner ha caratteristiche intrinseche che ne condizionano la scelta in base alle esigenze di rilevamento: accuratezza, velocità di acquisizione, range di misura, lunghezza d’onda del segnale, campo visivo, oltre a dotazione di camere digitali, facilità di trasporto e tipo di alimentazione. Da parte dei fruitori dei servizi di scansione laser offerti sul mercato, è necessaria un’adeguata preparazione per procedere a una valutazione corretta della strumentazione laser scanner più adatta allo specifico caso. Solo in questo

modo è possibile un uso razionale, anche dal punto di vista delle risorse finanziarie da impegnare, delle potenzialità offerte dalla tecnologia laser scanning.

Il laser scanning è una tecnologia potentissima applicabile in tutti quei settori in cui esiste la necessità di effettuare rilievi di alta precisione, con un elevato dettaglio, in tempi brevi, anche su grandi superfici con una notevole complessità morfologica.

Da anni Virtualgeo impiega il laser scanning per il rilevamento di aree archeologiche, edifici di valore architettonico-artistico, complessi urbani di interesse storico, oltre che per applicazioni nei settori ambientale e industriale.

### *CloudCUBE*

CloudCUBE è il software modulare, sviluppato da Virtualgeo in ambiente AutoCAD®, per la gestione e la modellazione 3D dei milioni di punti restituiti da laser scanner ([www.cloud-cube.com](http://www.cloud-cube.com)). Il software permette di importare, visualizzare e organizzare milioni di punti in AutoCAD® e mette inoltre a disposizione gli strumenti necessari per ottenere tutte le informazioni dimensionali e le rappresentazioni grafiche desiderate (curve di livello, sezioni e piante architettoniche ecc.). CloudCUBE, inoltre, fornisce differenti tecniche di modellazione 3D, perfettamente integrate tra loro, per realizzare dalle nuvole di punti il modello tridimensionale del rilevato con il voluto grado di dettaglio, ad esempio per applicazioni di realtà virtuale e prototipazione rapida.

Il modulo Manager è alla base dell'applicativo CloudCUBE: importa nuvole di punti da vari formati di file, visualizza tali punti in modo ottimizzato rispetto al computer in uso e permette di organizzare le nuvole in sottoparti sulle quali lavorare in modo agevole. Il modulo Mesh permette di costruire in automatico una mesh a maglia triangolare sulla nuvola di punti selezionata e fornisce strumenti di decimazione e smussatura. Il modulo Draw fornisce strumenti per il disegno bidimensionale (per la produzione di piante, sezioni e prospetti architettonici) e un secondo metodo di modellazione 3D, utile per restituire particolari "regolari". Con il modulo Surface è possibile proiettare sulle nuvole di punti una mesh a maglia quadrangolare con passo regolare personalizzabile in base al livello di dettaglio con cui si intende approssimare la morfologia della nuvola. In Surface sono disponibili dei comandi per unire mesh create con diverse tecniche permettendo così di modellare anche morfologie complesse.

CloudCUBE ha potenziato le proprie funzionalità, aggiungendo una serie di strumenti per produrre in tempi ridotti un'ampia gamma di rappresentazioni architettoniche (piante, prospetti, sezioni, viste assonometrie e spaccati prospettici) direttamente dal modello 3D.



Fig. 1. *Gli interni dell'oratorio dei SS. Lorenzo e Marco a Vittorio Veneto (TV) in un'immagine di realtà virtuale elaborata da Virtualgeo*

### *Nuove tecnologie a supporto dello studio e della valorizzazione del patrimonio architettonico*

L'oratorio dei SS. Lorenzo e Marco della Confraternita di S. Maria dei Battuti di Serravalle appartiene alla rete dei musei civici di Vittorio Veneto (TV). In accordo con l'amministrazione comunale di Vittorio Veneto, Virtualgeo ha condotto una campagna di rilevamento sull'edificio (Fig. 1). L'oratorio, le cui superfici interne sono completamente affrescate, è stato rilevato con sistema laser scanning eseguendo, tra interni ed esterni, dodici scansioni con cui sono stati acquisiti circa 32 milioni di punti. Contemporaneamente alle scansioni è stato effettuato il rilievo fotografico degli interni che sulla base delle acquisizioni del laser scanner, ha consentito di ottenere i fotopiani delle superfici affrescate. Tali elaborati, oltre a costituire una rappresentazione ad alta

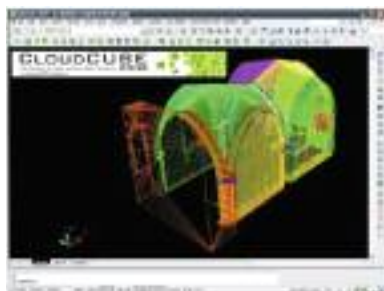


Fig. 2. Elaborazione del modello tridimensionale dell'intero oratorio dei SS. Lorenzo e Marco in ambiente AutoCAD® con il software CloudCUBE di Virtualgeo



Fig. 3. Plastico dell'oratorio dei SS. Lorenzo e Marco, di cui è stata resa visibile la struttura architettonica interna, e degli edifici adiacenti (scala 1:100). Realizzato da Virtualgeo con stampante a prototipazione rapida

definizione dell'apparato iconografico della cappella, ne documentano lo stato conservativo delle superfici.

In fase di post-processamento dei dati, le scansioni sono state georeferenziate e allineate. In seguito le nuvole di punti sono state trattate per eliminare rumore e punti non significativi e, infine, impiegate per modellare in 3D l'oratorio (Fig. 2). Tale modello digitale 3D ha fornito la base sia per la produzione di immagini e filmati di realtà virtuale (impiegando i citati fotopiani per la texturizzazione del modello) sia per la realizzazione di plastici a diverse scale (1:100 e 1:75) con stampante 3D a prototipazione rapida (Fig. 3). Virtualgeo ha elaborato anche una versione dei filmati di realtà virtuale da visualizzare in stereoscopia, permettendo una visita "virtuale", in tre dimensioni, dell'oratorio dei Battuti.

Il materiale prodotto dalle indagini e dalle successive elaborazioni sull'oratorio dei SS. Lorenzo e Marco è stato raccolto in un Cd-rom multimediale interattivo. Il Cd-rom illustra, oltre alle fasi del lavoro di rilievo, le origini e le vicende storiche dell'edificio. Inoltre, a ciascuno dei soggetti affrescati è dedicata una scheda analitica, visualizzabile cliccando la "zona attiva" dello schermo che corrisponde alla porzione di affresco di interesse. Il supporto multimediale comprende sia un filmato, con un percorso predefinito attraverso l'edificio virtuale, sia una sezione dedicata alla navigazione interattiva dello stesso, da dove è possibile accedere ai contenuti informativi (con testi abbinati a parlato) attivando le "aree sensibili" dell'interfaccia.

Le riproduzioni digitali dell'architettura e degli affreschi, insieme con i contenuti testuali e sonori sull'oratorio dei Battuti, sono stati impiegati anche per implementare un sito web monografico (presto on-line): una sorta di "museo virtuale" che permette di accedere in modo interattivo alle varie risorse disponibili, compreso il download di materiale (digitale e non) relativo all'edificio (fotopiani, nuvole di punti, modello 3D, plastici in scala, pubblicazione monografica con Cd-rom allegato).

### Conclusioni

L'aspetto qualificante della tecnologia laser scanning per il rilevamento risiede nella ricchezza delle potenzialità d'impiego che questa offre per lo studio e la valorizzazione del patrimonio culturale.

Virtualgeo ha sviluppato il software CloudCUBE in ambiente AutoCAD® ([www.cloud-cube.com](http://www.cloud-cube.com)) per sfruttare appieno le potenzialità messe a disposizione dalla tecnologia laser scanner permettendo il trattamento dei milioni di punti acquisiti, la loro organizzazione ottimizzata e la modellazione, direttamente sulle nuvole di punti, del relativo modello 3D. I modelli digitali 3D ottenuti costituiscono una banca dati da cui è possibile estrarre qualsiasi tipo di informazione dimensionale e forniscono la base per la produzione di elaborati grafico-numeric (piante, prospetti, sezioni, viste assonometriche e spaccati prospettici), immagini e animazioni di realtà virtuale, plastici in scala.

Il lavoro eseguito da Virtualgeo sull'oratorio dei SS. Lorenzo e Marco mostra come, a partire da un rilievo architettonico, sia possibile realizzare prodotti (elaborati tecnici grafico-numeric, modello digitale 3D, plastici in scala, applicazioni di realtà virtuale anche stereoscopiche, sito web) destinati a finalità di carattere sia divulgativo sia operativo, diversificabili in base a diversi livelli di complessità e approfondimento (valorizzazione, didattica, ricerca scientifica ecc.).

## ZScan: generazione di modelli 3D per la ricognizione metrica e radiometrica dei beni culturali tramite immagini

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### Abstract

*ZScan is a metric instrument composed by hardware and software. The system allows generation of 3D point cloud directly from images. It's easy to use and to manage.*

### Presentazione

Lo strumento composto da hardware e software consente di generare nuvole di punti tridimensionali con grande accuratezza. ZScan consente il rilievo metrico indiretto, ovvero senza "toccare" l'oggetto senza necessità di punti di controllo. Non è pertanto necessario alcun altro strumento per completare il rilievo. Il sistema è completamente autonomo: dalle immagini alle misure utilizzando software proprietari e interamente progettati e sviluppati da MenciSoftware. Esso richiede una camera fotografica appositamente calibrata presso il nostro laboratorio. In funzione dell'ottica utilizzata si può ampliare il campo di azione dello strumento. La configurazione proposta prevede una camera digitale Canon o Nikon. Le precisioni sono funzionali alla distanza di presa e all'ottica utilizzata. Lo strumento può avere più ottiche calibrate (Fig. 1). Il sistema è stato progettato per la misura tramite immagine dei beni culturali e può essere adottato anche a scopo documentario per conoscere con esattezza il bene da rilevare in 3D. L'ausilio delle immagini rende lo strumento particolarmente appetibile per il rilievo dei beni culturali dove la componente informativa dei colori ha una grande importanza. Il risultato è una griglia di punti 3D ad alta precisione con la texture dell'immagine applicata: ovvero un *raster* 3D. È possibile prendere misure, graficizzare tematismi, fare rappresentazioni 3D nel Cad a disposizione, generare ortofoto e ortomosaici ad alta risoluzione.



Fig. 1. Strumento ZScan

Il dispositivo di acquisizione dati è supportato da un software, ZScan, sviluppato dalla MenciSoftware, per la generazione di nuvole di punti.

ZScan basa il proprio funzionamento su un sofisticato algoritmo di rettifica multifocale mediante il quale le immagini vengono ricampionate epipolarmente secondo piani variabili in funzione della morfologia dell'oggetto da ricostruire. La rettifica è seguita da un processo di *image matching* multioculare che consente di ottenere un'elevata qualità ricostruttiva sia della forma che del colore della nuvola di punti. Le fasi del processo di elaborazione sono suddivisibili in due grandi categorie: la preparazione della tripletta (per tripletta si intende lo scatto in successione sulla camera digitale) e la ricostruzione della superficie. La preparazione inizia con la contro-distorsione delle immagini per l'eliminazione delle aberrazioni ottiche. Le immagini vengono analizzate mediante un operatore d'interesse per la ricerca di un numero di *features* dipendente dalle loro dimensioni, ma che di solito non è inferiore alle 1500 *features*. La disposizione delle *features* influenza le fasi successive del calcolo. È necessario che esse siano distribuite su tutto il fotogramma e che quest'ultimo sia omogeneamente *texturizzato*. Un algoritmo di ricerca delle *features* omologhe e del loro filtraggio mediante geometria epipolare, conduce alla ricostruzione degli orientamenti dei tre





Fig. 2. Modello 3D ZScan: Madonna della Misericordia, Arezzo



Fig. 3. Modello 3D ZScan: Fontana dei Fiumi, Roma

fotogrammi. I valori angolari ottenuti per l'assetto di presa sono prossimi a zero e la loro entità dipende dalle tolleranze costruttive della slitta, dal posizionamento della camera sul carrello, dall'oscillazione della barra ed eventualmente del supporto che la sostiene. La correttezza dell'orientamento è il presupposto indispensabile per la buona riuscita del processo di ricostruzione.

Noto l'orientamento, si procede alla fase di rettifica trinoculare al fine di annullare simultaneamente la parallasse verticale sui tre fotogrammi. La rettifica è particolarmente complessa in quanto le condizioni di presa sono prossime a quelle di perfetto allineamento che costituisce una condizione degenera per il tensore trifocale. A tale scopo è stato messo a punto un algoritmo di rettifica trinoculare senza l'uso del tensore trifocale. La ricostruzione della superficie avviene per *image matching* mediante metodi di programmazione dinamica. Il calcolo della cross-correlazione è simultaneo sulle tre immagini e sfrutta le componenti cromatiche Rgb.

Nelle figure 2 e 3 sono visibili due modelli 3D Rgb generati con ZScan.

## Tecnologie informatiche e strumentali per la progettazione energeticamente consapevole di complessi storici e museali

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### Abstract

*The paper represents technologies applied by Tecno.EL for defining and controlling microclimatic conditions, which can improve comfort standards of cultural heritage buildings and/or objects and increase users of cultural heritage buildings. Microclimate monitoring is an important tool for characterization indoor and outdoor environment, which should lead to prioritization for conservation of archaeological sites, historical buildings and museums. The work will give interesting concepts of the relationships between SME's and Institutions and of the important role of financial issues.*

### Presentazione

Tecno.EL è una società che opera nel campo delle tecnologie elettroniche applicate al settore dei beni culturali da oltre 20 anni. Questa attività ha determinato la creazione, all'interno dell'azienda, di un'area orientata allo sviluppo e alla realizzazione di strumenti atti a migliorare lo studio e il controllo dell'ambiente in cui le opere sono inserite. Il suo *core business* è orientato alla produzione e all'installazione di sistemi per il monitoraggio micro-macro strutturale e climatico di edifici di interesse storico, artistico, di ambienti museali e di siti archeologici.

Le costituenti fondamentali di un sistema di monitoraggio sono sostanzialmente quattro:

- la sensoristica;
- il/i sistemi di acquisizione e trasmissione dati;
- i cavi per gli intercollegamenti e il *software* di gestione;
- la presentazione e archiviazione dei dati.

Tecno.EL produce al suo interno sia la sensoristica, generalmente derivata da quella utilizzata per misure in fisica tecnica e fisica ambientale, sia i sistemi di acquisizione e trasmissione dati. Per quanto riguarda i cavi di intercollegamento sensori-acquisitori, lavorando prevalentemente in ambienti di pregio artistico e storico, l'azienda ha sviluppato al massimo le tecniche *wireless* per minimizzare l'impatto ambientale delle installazioni; di conseguenza, la trasmissione del dato dal sensore all'acquisitore avviene via radio o via infrarosso e così via.

Per ciò che concerne i sistemi di acquisizione dati, Tecno.EL ha sviluppato recentemente delle unità di acquisizione più comunemente definite *INTERNET ORIENTED* in grado di 'leggeré' i sensori e trasmettere le informazioni direttamente ad un server dedicato utilizzando una connessione Internet via *GSM-GPRS (General Packet Radio Service)*. Sul server dedicato è inoltre installata una *WEB application*<sup>1</sup> che consente all'utente del sistema di monitoraggio di accedere ai dati e di conseguenza al sistema, effettuando una semplice connessione *internet* a un sito che è stato chiamato con estrema semplicità [www.imieidati.it](http://www.imieidati.it), l'accesso al quale è ovviamente protetto da *password*. Questa architettura di sistema assicura la disponibilità del dato in una qualunque postazione periferica, dotata di PC connesso alla rete *internet* e la possibilità di installare un sistema di monitoraggio in qualunque punto del globo ove sia presente il segnale *GSM-GPRS*. Naturalmente i sistemi non hanno necessità di alimentazione da rete elettrica ma sono alimentati a batterie o pannelli fotovoltaici per cui il loro utilizzo in siti disagiati (Fig. 1) non ne risulta limitato e possono essere dislocati anche in siti e scavi archeologici estesi su vaste aree.



Fig. 1. Arco di Augusto, Aosta: monitoraggio microclimatico e strutturale con unità Grillo connesse a OLINDA\*

\* La web application, denominata OLINDA (*On Line INteractive Data Acquisition*), è stata sviluppata in seno alla TECNO.EL a partire dal 2006. OLINDA trova applicazione nel monitoraggio distribuito su larga scala e supporta varie tipologie di protocolli trasmissione dati (FTP, TCP/IP, Modbus etc.).



Fig. 2. Manufatto in conglomerato cementizio: monitoraggio microclimatico e strutturale con Grillo MMTS connesso a OLINDA

Per assicurare un continuo adeguamento tecnologico ai propri prodotti Tecno.EL si affida a una ricerca delle tecnologie disponibili o in fase di sviluppo a livello globale. Lo sviluppo di nuovi prodotti, sistemi e tecniche può anche derivare come risposta alle esigenze manifestate dagli operatori di settore che sono anche i nostri committenti. Talvolta, le esigenze dei committenti vengono individuate dai nostri tecnici specialisti attraverso l'osservazione delle modalità operative degli operatori del settore.

La nostra struttura aziendale, pur non essendo originariamente nata per il settore dell'edilizia storica ha come bagaglio culturale numerose esperienze maturate in altri settori che vanno dalla fisica tecnica ambientale, alle scienze agronomiche, al settore industriale e all'ICT (*Information and Communication Technology*). Molte delle tecnologie informatiche e strumentali (Fig. 2) che sono state sviluppate da Tecno.El per applicazioni scientifiche e/o industriali nei sopra menzionati settori, possono essere impiegate, con modesti adattamenti, nel campo dei beni culturali rispondendo perfettamente alle particolarissime esigenze di questo settore. Si tratta in sostanza di un'operazione di innovazione da trasferimento tecnologico.

### Possibilità di utilizzo dei sistemi di monitoraggio

Negli anni Settanta c'è stata una fase di presa di coscienza della necessità di caratterizzare meglio, rispetto a quanto era stato fatto fino ad allora, il comportamento strutturale e il microclima interno agli edifici destinati ad accogliere opere d'arte in genere. Nello stesso periodo sono stati mossi i primi passi volti a migliorare le caratteristiche del micro-clima interno degli edifici di pregio e la qualità del comfort dell'utenza anche se, in un museo che ospita capolavori d'arte, il comfort dell'utente e l'eventuale risparmio di energia dovrebbero essere una necessità marginale. Abbiamo assistito a installazioni di gruppi di condizionamento, gruppi di illuminazione e altro, molto spesso con risultati non proprio soddisfacenti. Ciò era conseguenza del fatto che l'integrazione degli usi finali dell'energia nel settore dei beni culturali era solo agli inizi e molto spesso operata solo da uno specialista di queste due diverse discipline. Si è iniziato comunque a fare qualcosa e soprattutto a raccogliere dati e informazioni.

Negli anni successivi sono state realizzate le prime applicazioni sistemiche sulle tecniche di monitoraggio, la creazione di *data base* più vasti relativi ai comportamenti dei materiali in diversi contesti microclimatici, l'approfondimento delle ricerche sugli standard di conservazione, ecc. Oggi siamo forse in grado di gettare le basi per la creazione di strutture pubbliche o miste pubblico-private, che utilizzando le tecniche descritte siano in grado di assicurare i migliori "ambienti" per la conservazione delle opere d'arte e in particolare il controllo nel tempo che risulta vitale per la loro trasmissione al futuro, alla luce anche del non trascurabile impatto antropico sulle opere dovuto al notevolissimo incremento del pubblico registratosi negli ultimi 5-10 anni: il cosiddetto turismo culturale.

### I benefici che possono derivare dall'applicazione delle tecniche di monitoraggio

Riferendoci come esempio ad un progetto di restauro complesso di un edificio museale o di un sito archeologico, l'utilizzo di tecniche di monitoraggio consente la conoscenza *ante operam* delle condizioni strutturali e microclimatiche di siti e ambienti sia *indoor* che *outdoor*, conoscenza che, in seguito ad analisi e conseguenti valutazioni interdisciplinari dei dati, può fornire degli indirizzi progettuali circa gli interventi tecnologici al fine di assicurare fundamentalmente:

- il corretto ambiente *indoor* di conservazione (Fig. 3);



Fig. 3. Villa di età romana ad Ascoli Satriano (FG): monitoraggio delle superfici a mosaico con unità Grillo MMTS connesse ad OLINDA

- la gradevole fruibilità del bene dal pubblico e dal personale addetto;
- la sostenibilità dal punto di vista energetico, ambientale e economico delle soluzioni adottate.

In particolare, la fase di indirizzo nel caso siano da realizzare interventi di restauro statico- strutturale può riguardare:

- l'integrazione di nuovi intonaci con i preesistenti;
- la disposizione delle suddivisioni interne;
- la scelta dei diversi materiali di integrazione, compatibili e tollerabili con l'antica struttura e con i materiali originari.

Scelte da effettuare con intenti mirati ad assicurare la validità dell'intervento che si intende svolgere nel suo complesso e a tal fine le imprese implicate potrebbero utilemente partecipare al percorso progettuale sia nella fase di valutazione che esecutiva del progetto.

Per quanto riguarda il monitoraggio *post operam* di controllo e validazione delle operazioni svolte, questo potrà essere ridotto quantitativamente (in particolare dopo una attenta fase di monitoraggio ed elaborazione dati *ante operam*) e risulterà più mirato per effetto di quanto emerso in termini di risultati nella prima fase. Il monitoraggio *post-operam* assicura la possibilità di stimare, nell'immediato e nel lungo periodo, la validità dell'intervento di restauro e/o risanamento del bene in questione.

Tutti i dati raccolti nella fase *ante operam* e *post operam*, uniti ai dati acquisiti nel lungo periodo possono costituire un archivio storico di particolare interesse e importanza creando una specie di 'cartella clinica del manufatto storico'.

Attraverso l'uso di questi strumenti è possibile uscire dalla logica degli interventi provvisori o di emergenza ed operare per il restauro, recupero e/o risanamento di questi organismi di pregio storico, artistico e monumentale nell'ambito dell'integrazione di discipline e tecnologie, rispettando le diverse esigenze architettoniche, archeologiche, energetiche e ambientali.

### Conclusioni

La tecnologia del monitoraggio è in grado di offrire oggi prodotti e sistemi di ottimo livello tecnologico per tutte le applicazioni nel settore dei beni culturali. Una limitazione a una maggior diffusione viene soprattutto dalla mancanza di figure professionali intermedie e di ruolo tecnico specialistico (fisici o ingegneri della conservazione) all'interno delle Istituzioni che rappresentano anche la committenza per le imprese. Le figure intermedie in questione sarebbero in grado di assicurare una gestione, utile nel tempo, dei sistemi e degli strumenti di monitoraggio. Attualmente questa funzione viene ricoperta da figure professionali provenienti prevalentemente da settori non specifici e spesso da settori non tecnici.

Nel campo della conservazione dei beni storici e artistici la cosa più semplice è d'installare un sistema di monitoraggio e acquisizione dati riguardante il benessere di questi beni. La cosa che risulta più difficile è seguire il sistema in questione, mantenerlo in efficienza e, non per ultimo, utilizzare con profitto le informazioni raccolte. Queste devono essere recepite e controllate assiduamente dal tutore dei beni che sorveglia sulla loro trasmissione nel tempo.

Un altro ostacolo per il vasto utilizzo di queste tecnologie è rappresentato dalle limitate risorse economiche disponibili nel settore dei beni culturali. Probabilmente, quest'ostacolo potrebbe essere in parte superato attraverso un maggior ricorso alle sponsorizzazioni e, non per ultimo, a una diversa definizione dei capitoli di spesa.

## Reducing our carbon footprint: environmental measures at Palazzo Falson historic house museum, Malta

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Fig. 1. The lit façade of Palazzo Falson Historic House Museum in Mdina

### Abstract

*This presentation describes the measures adopted at the recently restored and re-opened Palazzo Falson Historic House Museum, which seek to reduce the impact of the operation of the Museum on the environment.*

### Presentation

Palazzo Falson Historic House Museum re-opened to the public in May 2007, after a major restoration intervention which lasted five years (Fig. 1). With a new team in place we started immediately to operate the Museum along eco-friendly lines.

Granted that a Museum has few emissions and does not greatly impact on the environment, nonetheless we decided to analyze all our present and future activities and reduce, wherever possible, any deleterious effects on the environment.

We introduced a number of practices which were completely new to Malta and to our great satisfaction, our pioneering activities in the fight against climate change have been recognized and we have just been awarded the Conservation Award for Sustainable Development by the Cleaner Technology Centre, Malta.

We advertise the fact that we run the museum with an environmental conscience and we try to disseminate knowledge and encourage practices consistent with our philosophy.

### History of Palazzo Falson

Palazzo Falson is located in the ancient city of Mdina, a high plateau at the centre of the island of Malta which commands sweeping views of the Maltese islands. Palazzo Falson is one of the oldest and most notable buildings to survive in Mdina, and an exemplar of late Medieval architecture in Malta. The palazzo underwent various changes throughout the centuries, and a mere glance at its architecture shows a cross-section of the eight centuries of its existence, evidencing the organic growth and shrinkage of the house, the additions and changes it underwent, with styles ranging from authentic 13<sup>th</sup> century medieval to early 20<sup>th</sup> century mock-Renaissance interpolations. In 1927, the Palazzo was bought by Capt. Olof Frederick Gollcher, who was a painter, scholar, philanthropist, as well as an avid collector of *objets d'art* and historical items. Gollcher wanted his house to be preserved with its contents as a museum for the cultural enrichment of the nation. In his will he left instructions for the setting-up of a foundation bearing his name to carry out this wish.

The building, an architectural attraction in itself, houses a splendid private collection of over 3700 *objets d'art* which Capt. Olof Gollcher managed to amass during his lifetime. These include a very fine collection of paintings, some wonderful examples of antique Maltese furniture, a vast collection of silver, and collections of jewellery, armour, coins, glassware, oriental rugs and so much more.



Fig. 2. Blinds which filter out harmful UV rays help to protect the precious artifacts in the landing area of Palazzo Falson

In 2001 *Fondazzjoni Patrimonju Malti* entered into a management agreement with the owners of this historical building, the Capt. Olof Gollcher O.B.E. Art and Archaeological Foundation, whereby *Patrimonju* undertook to restore the Palazzo and its valuable contents to their former glory, with the ultimate aim of opening up the Palazzo to the public as an Historic House Museum. The project commenced in earnest in 2002 and the Museum was opened to the public on the 4<sup>th</sup> May, 2007.

Despite the antiquity of the building, we have made use of modern technology in various ways. For example, we use audioguides which use Swedish technology. They take the shape of small MP3 players and the data is stored in their memory card. The recording is triggered off, by means of infra red signals, from the various hot-spots in the display cabinets and rooms. In that way people can self-guide themselves around the Palazzo. We have put up flat screen monitors which relay the footage recorded during the 5 year restoration. We have also recently had a robot (VideoRay mini ROV and two types of sonar technologies which translated the results into spatial information) placed down our ancient wells. This was able to explore the various chambers leading off from the main chamber, probably dating to the pre-Roman period, and produced footage and sonar mapping of both our wells. Clips from this footage will be put on our website, which is about to be launched, so that we can share this information with the rest of the world.

#### *Environmental measures we have adopted*

From even before the opening of the museum to the public in May 2007, the conservation-restoration of the museum and its numerous collections were conducted in a manner which minimized the impact on the environment. A modern environmentally-conscious approach was adopted by the project manager and team of workers directly involved in the restoration of the building and its products.

A new electricity system was installed and new plumbing put in, thereby modernizing the essential services and reducing wastage which occurs when old, tired systems are adapted to cope with modern demands. In doing so, dimmers were installed in all the rooms in order to keep the intensity of the light to a minimum. In the case of the bathroom, sensors were put in, in order to ensure that electricity was only used when human presence was detected.

Practical measures such as blinds which filtered out harmful UV rays were installed, primarily to conserve the artworks at the recommended light level, but also to lessen the intensity of heat streaming in through large glazed areas in the summer (Fig. 2). This resulted in reductions in usage of electricity as air conditioners were used for fewer hours.

A new system of membrane (Evalon V-Solar membrane), which incorporates photovoltaic elements, was installed on the large roof areas (Fig. 3). This was the first time this system was used in Malta. It is pollution-free and converts solar energy into electricity to supplement the energy needs of the Museum. When the electricity generated exceeds the needs of the Museum, particularly during hours when the Museum is closed, the surplus electricity generated is fed into the national grid. Another benefit of this new system is that the PV elements are integrated into the membrane and therefore are completely flat with the roof surface. Unlike conventional mono or multi crystalline solar panels usually used in Malta, they do not cause any projections from the roof which



Fig. 3. The membrane incorporating PV elements as installed on the roof of Palazzo Falson

would have been aesthetically unacceptable amongst the lovely roofscape of Mdina. The inverter itself logs all the data, which we note every day, and we will therefore be able to draw up statistics for the long term.

The staff complement of Palazzo Falson are actively collaborating on environmentally friendly mini-projects, such as re-cycling of paper, switching off of light and air conditioning units and closing of doors to maintain an ideal environment, during lulls in visitor attendance. Moreover, an environment officer has been appointed from amongst the permanent museum staff. His task is to constantly monitor all the practices within the museum and where certain practices are considered to have a negative impact on the environment, he must research and suggest alternatives which would reduce this problem. This environment officer also logs on a daily basis the energy consumed by the museum and the 'green' energy created by the new membrane. The savings made can thus be calculated. The environment officer reports to the Curator.

Together we are devising a long-term strategy to increase the energy efficiency of the Museum, as well as to ensure that this strategy is linked to the name of the Museum. The intention is that the Museum becomes increasingly known for its eco-friendly approach and becomes a centre for learning about how an operator in the cultural sphere can effectively be a knowledge hub about the environment.

Museum merchandise such as the printing of Children's Activity Books has been effected on recycled paper. We have also run children's art workshops where re-cycled materials were used almost exclusively, and this was brought to the children's attention.

New projects are in the pipeline. These include running children's workshops about the fauna and flora found in the Museum (which we are constantly logging), workshops on aspects of good practice in the environmental sphere, and starting to grow our own produce in an organic manner for use in the museum café.

#### *Main benefits and significance*

The benefits of our eco-friendly approach have been multifold. Firstly we have been able to cut down on costs because of our lower consumption of electricity and our use of re-cycling. Secondly, the environmental practices we have introduced have spread knowledge and awareness amongst our own staff. As a result the various staff members have adopted these practices in their own homes.

Another benefit that has emerged, is that in actively promoting our 'green' status to other companies and the public in general we have received a number of enquiries by companies who wish to replicate our initiatives in their own organizations. This is very positive promotion which ultimately benefits the museum in terms of increased visitor attendance, and spreads the message of environmental consciousness to a wider audience.

The significance of all these, perhaps small, initiatives is, we believe, considerable within the Maltese context. I hope that I have managed to demonstrate that a holistic approach, combining a lot of mini-projects, can together form a project which really makes a difference.

In Conclusion my message is this: It is perfectly possible to combine culture, technology and eco-friendliness. It benefits the museum because it results in great PR and considerable savings and it benefits us all because it cares for the environment we live in.

# CATALOGUE OF

SARA DI MARCELLO, CNR  
FILIPPO AMMIRATI, ENEA

La sezione dedicata alle tecnologie contiene **179** schede con la descrizione delle innovazioni più rilevanti nel settore della diagnostica, dei materiali, delle tecnologie informatiche e delle tecnologie sostenibili per la conoscenza, il restauro e la valorizzazione del patrimonio culturale.

Ben 149 tecnologie sono state presentate da aziende e centri di ricerca italiani, 9 dalla Polonia, 5 dalla Spagna, 4 dalla Germania, 4 dalla Francia, 3 dal Portogallo, 2 dalla Romania, 1 dall'Ungheria. In testa si collocano le tecnologie multimediali e dell'informazione con il 40% dei prodotti, al secondo posto le strumentazioni per la diagnosi delle opere d'arte e per il monitoraggio ambientale (24%), a cui seguono i nuovi materiali (21%) e le tecnologie per la costruzione (15%).

La preponderanza di tecnologie italiane dimostra come il nostro Paese si pone al primo posto nella progettazione, realizzazione e applicazione di tecnologie non-distruttive, non-invasive e compatibili con la storia e con il materiale del bene da conservare. Sono soprattutto i due enti nazionali di ricerca, il Cnr e l'Enea, a farla da padrone in questo settore, vere e proprie miniere di tecnologie, metodologie e materiali sempre nuovi e all'avanguardia.

La promozione alle aziende e il trasferimento sul mercato delle nuove tecnologie sviluppate dai laboratori di ricerca rappresentano, infatti, per il Cnr e l'Enea il naturale sbocco dei numerosi progetti nazionali e internazionali che vedono coinvolti gruppi di ricerca attivi in molteplici settori tra i quali quello del patrimonio culturale. Il trasferimento di una tecnologia innovativa sul mercato presenta, inoltre, un duplice vantaggio: da un lato permette ai ricercatori di constatare il valore sociale ed economico dell'applicazione dei risultati delle loro ricerche, dall'altro consente alle imprese che acquistano e utilizzano le nuove tecnologie di migliorare la qualità e il valore dei loro servizi e quindi di essere più competitive.

## *CNR – Dipartimento Patrimonio Culturale*

Il Dipartimento Patrimonio Culturale del Cnr, con il suo modello di rete scientifica integrata e multidisciplinare che raccorda in progetti specifici di ricerca conoscenze storico-umanistiche e tecnologiche, è una miniera di saperi e nuove tecnologie che attendono di essere portate alla luce, ottimizzate e utilizzate dalle numerose aziende che in Italia lavorano nel settore della conoscenza, della conservazione e della gestione del patrimonio culturale. Dagli studi archeometrici per la conoscenza dei materiali, alle tecnologie sostenibili e non invasive per la diagnosi e la conservazione, fino agli strumenti ICT per la ricostruzione virtuale per una migliore fruizione di monumenti e opere d'arte, il Dipartimento è detentore di un ampio ventaglio di saperi che, attraverso spin-off, licenze e accordi di collaborazione per lo sviluppo di nuovi progetti innovativi, contribuisce all'avanzamento delle attuali metodologie e tecnologie di lavoro per gli interventi sul patrimonio culturale.



# TECHNOLOGIES

## *ENEA – Progetto Patrimonio Culturale*

Il progetto Enea per il Patrimonio Culturale integra e coordina più di 130 ricercatori che operano in molteplici ambiti di ricerca e si caratterizza per la sua struttura modulare e il forte riferimento alle attività sul territorio, con ricadute tecnologiche. Nell'ambito della sezione viene delineata la mappa delle competenze dell'ente nel settore delle tecnologie applicate al patrimonio culturale: diagnostica per la conservazione e il restauro, caratterizzazione strutturale e prevenzione dei rischi naturali, uso sostenibile e gestione dei rischi ambientali e antropici, tecnologie dell'informazione e delle comunicazioni, formazione e aggiornamento professionale. Un patrimonio di competenze e tecnologie disponibili per il trasferimento a tutti coloro che operano nel settore con l'obiettivo della creazione di un network di laboratori, che sviluppino tecnologie di eccellenza, e di istituzioni nazionali ed europee (musei, siti archeologici, soprintendenze, piccole e medie imprese, ecc.), utenti e utilizzatori di tali tecnologie.

Scopo del presente catalogo è, dunque, far emergere quanto di meglio la ricerca offre per la salvaguardia del patrimonio culturale.

Su questa offerta di prodotti, nel corso del *technology transfer day* del secondo giorno, hanno ruotato ben 500 tavoli di lavoro durante i quali i ricercatori si sono confrontati con il mercato e il mercato ha incontrato i ricercatori. Compito di questa giornata è stato infatti quello di offrire agli imprenditori l'opportunità di conoscere e acquistare le più recenti tecnologie sviluppate dai laboratori e dare ai ricercatori l'occasione di avviare collaborazioni internazionali con partner industriali per nuovi progetti di ricerca. A un anno dall'evento, sappiamo di essere riusciti, almeno in parte, in questo intento.

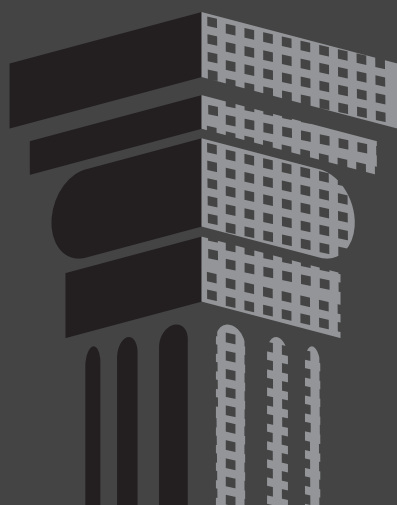
Per informazioni sulle tecnologie inviare una e-mail a: [info@techa.eu](mailto:info@techa.eu)

### LEGENDA

- |  |  |
|--|--|
| ① Analysis, diagnostics and monitoring                             | ② Materials and intervention techniques          |
| ③ Information and communication technologies for cultural heritage | ④ Sustainable technologies for cultural heritage |

TECHA

# 1 Analysis, diagnostics and monitoring



2008

## Technology Offer TO\_IT\_21735

[ ITALY ]

## Art Test

www.art-test.com

<b>Sector</b>	Diagnostics applied to cultural heritage. Advanced technologies for study and preservation of artworks.
<b>Activities</b>	Optical non-invasive diagnostics services targeted at art works, combining state of the art technologies with strong academic background, specialized competencies and long experience in the field.
<b>Contact</b>	

<b>Title</b>	PLANAR SCANNER FOR HIGH DEFINITION INFRARED REFLECTOGRAPHY
<b>Abstract</b>	An Italian company specialised in optical non-invasive diagnostics services targeted at artworks, has developed an actuated planar Infrared (IR) scanner, with sensitivity till 1700 nm, and a radiation source with rich continuous emission spectrum in the long wavelength range. The company is looking for partners and customers to promote sales in other European countries.
<b>Detailed description</b>	<p>Infrared Reflectography is an imaging technique, mainly used in the fields of documentation and conservation of easel paintings.</p> <p>IR Reflectography is an a unobtrusive technique, which makes it specially suitable for the investigation of artworks. It generally makes underdrawing and underpainting visible (Underdrawing is the preparatory sketch that precedes the application of color paint).</p> <p>This is because infrared light generally penetrates the upper layers and is then reflected by the ground and absorbed by the underdrawing. This differential absorption can be imaged by an infrared-sensitive camera.</p> <p>IR Reflectography is used by conservators and art-historians before the restoration work, and during any documentation phase.</p> <p>Nowadays the traditional IR film has been mostly replaced by digital systems, which allow more reliable database creation, a better image processing and enhancing, easy reproducibility of the reflectograms, and, most important, a higher image quality, in particular as far as paint penetration goes.</p> <p>The developed device consists of a motorised planar scanner equipped with an InGaAs (indium gallium arsenide) sensor. It can acquire high resolution digital reflectographies with high tonal dynamics. It features a light modular structure, with respect to the wide surface that can be acquired with one single scan (up to 6.5 sq. mt.). The acquisition is performed with a standardised procedure, implying the device prior lab calibration, an on-site calibration, stable set-up, sensitivity, filter system and radiation source, whose characteristics are mentioned in the technical data. This will be provided together with the acquired and processed data.</p>

	<p>Technical data:</p> <ul style="list-style-type: none"> <li>• IR sensor: InGaAs Photodiode, spectral sensitivity 0.8 - 1.7 micron</li> <li>• Lighting: 2 halogen lamps 10 W</li> <li>• Spatial Resolution of Scanned Area 101,6 dpi (on painted surface)</li> <li>• Reflectogram gray levels: 12 bit/pixel resolution</li> <li>• Overall amplitude XYZ Area Analysis in a single acquisition: 1.8 x 3.8 m</li> <li>• Modular and transportable device, easy to assemble</li> <li>• Size: depending on the acquisition area chosen (in the actual prototype 200 or 400 x 230 cm; depth 70 cm)</li> <li>• Light structure, easy to transport</li> <li>• External stabilized power supply 24 V</li> <li>• Computer controlled</li> <li>• Proprietary software</li> <li>• Average acquisition time: 1h30'/m<sup>2</sup>.</li> </ul>
<b>Innovative aspects</b>	The performances of this system are much higher compared to a vidicon or CCD camera and enable a better readability of the acquired images. The resulting images do not require any post-processing since they do not suffer from any geometric distortion, uneven illumination effects, vignetting, etc.
<b>Main advantages</b>	Short scanning time. Large scanning area. Highly precise metrical referenced positioning; Reflectogram in 1:1 scale with the painting target. Radiometrically calibrated. Autofocussing system and combined acquisition of other optical diagnostics methods (in progress).
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems; Measurement methods. Customers: diagnostics labs (public and private); museums; art galleries; auction houses; art experts; collectors; antique dealers. Public and private projects (European, etc) for research, monitoring, exhibition in the Cultural Heritage field.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Diagnostics companies; public and private conservation labs; partners Cultural Heritage projects (es. Framework programmes, etc); museums, foundations, etc.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22511

[ ITALY ]

## Art Test

www.art-test.com

<b>Sector</b>	Diagnostics applied to cultural heritage. Advanced technologies for study and preservation of artworks.
<b>Activities</b>	Optical non-invasive diagnostics services targeted at art works, combining state of the art technologies with strong academic background, specialized competencies and long experience in the field.
<b>Contact</b>	

<b>Title</b>	MULTILAYER PAINTING ANALYSIS
<b>Abstract</b>	An Italian company specialised in optical non-invasive diagnostics services targeted at artworks, has developed a method to acquire separate images of varnish and paint layers which compose the external part of a painting. The company is looking for partners and customers to promote sales in other European countries.
<b>Detailed description</b>	<p>Painted surfaces are, generally speaking, multilayer structures. In the conservation field, a few methods are available to investigate such structures, and to permit to image layers which are normally hidden to the naked eye. One of these methods makes use of IR radiation. Analysing the IR radiation reflected by a painting's surface it is generally possible to see the underlying priming layer and possibly the preparatory underdrawing.</p> <p>The other methods currently used to investigate the various separate layers, imply microsampling of the painting surface and analysing the cross-section.</p> <p>However, in this way, there are two main drawbacks. The first is linked to the need of a (micro-)invasive action, the other is related to the fact that the results are valid only for that specific sample, and cannot be generally extended to the neighbouring surface.</p> <p>The method we propose is intended to provide a qualitative image stratigraphy of the varnish and superficial paint layers, overcoming some of the previously mentioned weak points of the currently used techniques. This new procedure makes use of UV induced visible fluorescence multispectral imaging and exploits the fact that different materials fluoresce, reflect and absorb light in different ways, and electromagnetic radiation in the visible range has a different penetrating power depending on its wavelength. The result of this process is a set of images. In each of them a different layer is visible.</p> <p>Technical data:</p> <ul style="list-style-type: none"> <li>• CCD cooled scientific camera;</li> </ul>

	<ul style="list-style-type: none"> <li>• interferential filter set;</li> <li>• Computer controlled;</li> <li>• Proprietary software;</li> <li>• Average acquisition time: 1h30'/m<sup>2</sup></li> </ul>
<b>Innovative aspects</b>	There is no other system which is capable of providing this sort of images. The method has been patented.
<b>Main advantages</b>	Having such data enables the conservators to map the presence of different varnish layers and inpaintings, and control the possible removal of them. This technique helps them in a new and powerful way in one of the most complex parts of a restoration intervention.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Diagnostics companies; public and private conservation labs; partners in Cultural Heritage projects (es. Framework programmes, etc); museums, foundations, etc.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22112

[ ITALY ]

## Carlo Gavazzi Space Spa

www.cgspace.it

<b>Sector</b>	Information processing, information systems.
<b>Activities</b>	Earth observation, satellite manufacturing, data collection, processing and distribution from ground terminal, environment monitoring, in situ instruments, security systems, robotics.
<b>Contact</b>	

<b>Title</b>	NEW ADVANCED TECHNOLOGIES APPLIED TO THE CULTURAL HERITAGE CONSERVATION
<b>Abstract</b>	The innovative technology of "Ground Based Synthetic Aperture Radar" is applied for detection of slow and fast structure displacements.
<b>Detailed description</b>	<p>The interferometric technique applied using the Ground Based SAR (GBSAR) provides data on object displacements by comparing phase information of the object detected in different times. The instrument provides high resolution images of the detected object (e.g. building facades, towers, etc.).</p> <p>Precision measurements of ground deformation allows understanding the dynamic characteristics of the investigated surface. Surface deformation in the buildings induced by instability or human activities can be easily detected by the ground based radar. During the last years, such considerations have motivated the development of ground based and portable instruments in the microwave domain. On one side, they can be considered as an alternative source of information with respect to spaceborne radar sensors, on the other hand they add some advantages such as their portability and acquisition repetitiveness.</p> <p>The innovative technology of "Ground Based Synthetic Aperture Radar" (GBSAR) provides unique performance in terms of measurements speed, displacement accuracy ease of transportation and operation. The GBSAR provides all-weather displacement monitoring capability exploiting an Interferometric approach.</p>
<b>Innovative aspects</b>	Use of innovative technologies for monitoring the stability of ancient buildings
<b>Main advantages</b>	Advanced technologies are more cost effective as compared with other traditional techniques.
<b>Current state of development</b>	



Intellectual Property Rights	Exclusive rights.
Application domains	Measurement methods.
Collaboration details	
Type of partner sought	Public Institutes (e.g., Public Institute for Conservation of Historic & Artistic Works, Local Administration, Township, etc.).
Tasks to be performed by the partner sought	
IRC Partner	IRC Lombardia

## Technology Offer TO\_IT\_22113

[ ITALY ]

## Carlo Gavazzi Space Spa

www.cgspace.it

<b>Sector</b>	Information processing, information systems.
<b>Activities</b>	Earth observation, satellite manufacturing, data collection, processing and distribution from ground terminal, environment monitoring, in situ instruments, security systems, robotics.
<b>Contact</b>	

<b>Title</b>	EARTH OBSERVATION TECHNOLOGIES APPLIED TO ARCHAEOLOGY
<b>Abstract</b>	A remote sensing approach applied to Archaeology to identify landscape features.
<b>Detailed description</b>	Painted surfaces are, generally speaking, multilayer structures. In the conservation field, a few methods are available to investigate such structures, and to permit access to image layers that are normally hidden to the naked eye. One of these methods makes use of IR (Infrared Spectroscopy) radiation. Analyzing the IR radiation reflected by a painting's surface it is generally possible to see the underlying priming layer and possibly the preparatory under drawing. The other methods currently used to investigate the various separate layers involve micro-sampling of the painting surface and analyzing the cross-section. However, with these methods, there are two main drawbacks. The first one is linked to the need of a (micro-)invasive action; the other one is related to the fact that the results are valid only for that specific sample, and cannot be generally extended to the neighbouring surface. The proposed method is intended to provide a qualitative image stratigraphy of the varnish and superficial paint layers, overcoming some of the previously mentioned weak points of the currently used techniques. This new procedure makes use of UV (Ultraviolet Visible) induced visible fluorescence multi-spectral imaging and exploits the fact that different materials fluoresce, reflect and absorb light in different ways, and electromagnetic radiation in the visible range has a different penetrating power depending on its wavelength. The result of this process is a set of images. In each of them a different layer is visible.
<b>Innovative aspects</b>	Use of innovative space technologies and remotely observed data for archaeology applications.
<b>Main advantages</b>	Satellite information can be integrated in the data traditionally collected through field surveys, thus giving them added value.

	Remote sensing techniques are an essential and cost effective tool for not accessible areas.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Public Institutes (e.g., Public Institute for Conservation of Historic & Artistic Works, Local Administration, Township, etc.).
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

## Technology Offer TO\_IT\_21532

[ ITALY ]

CNR, Istituto di Acustica "O. M. Corbino" (IA)

[www.idac.rm.cnr.it](http://www.idac.rm.cnr.it)

<b>Sector</b>	Research and studies in the field of acoustics.
<b>Activities</b>	Development, validation and application of innovative physical techniques applied to the study of the state of conservation of cultural heritage
<b>Contact</b>	

<b>Title</b>	NON-DESTRUCTIVE ACOUSTIC METHOD AND DEVICE, FOR THE DETERMINATION OF DETACHMENTS OF MURAL PAINTINGS
<b>Abstract</b>	An Italian research centre developed a portable instrument to detect and measure detachment extension in mural paintings. The invention gives a significant contribution to a very important sector of the Cultural Heritage conservation (i.e. frescos and mosaic works), where the expertise of the art restoration needs to closely link up with scientific and technical knowledge. The proponents look for technical collaboration with companies able to bring the prototype to an industrial level.
<b>Detailed description</b>	The invention concerns a portable instrument to detect and measure detachment extension in mural paintings. It is based on a novel non-invasive acoustical technique to reveal detachments and a pertinent apparatus to map them by means of acoustic imageries. These latter are correlated to the entity of the absorbed acoustic energy, when the painting is insonified by a proper acoustic wave. The method can reveal small and large-size anomalies, related to the degree of detachment, hidden in the interface between the first plaster ("arriccio") and the wall, as well as between "arriccio" and the last plaster ("intonachino"). A sophisticated signal processing algorithm allows the information contained in the reflected pulse to be extracted from the overall background due to the superposed direct pulse and to both environmental and electric noises. Measurement results represented by means of a map, i.e. by a planar or a 3D distribution of the value of a proper acoustical quantity, give the so called "acoustical images", which are directly correlated with the size and shape of the observed anomalies.
<b>Innovative aspects</b>	At present the method commonly used by the restores for the detection of separation zones in frescos is still an empiric and very invasive one, called "hammer" technique, based on the subjective perception of the human hearing in evaluating different pitches of sound, when tapping different points of the painted surface with fingers. Among non-destructive scientific techniques, the only one

which currently is suited to give some information on the presence of separation zones in frescos, is the so-called "thermovision", which, however, often gives results which are difficult to construe. Moreover, its complex instruments which are not easy to use and its very high cost, considerably limit the use of this technique. Other acoustic techniques, have not reached till now satisfying results (i.e. "ecospectrography"). The proposed acoustic technique uses a different acoustic parameter (the acoustic energy absorption coefficient) as physical indicator of the separation zones and it is a perfectly non-destructive method of analysis of the painting. In fact, the acoustic source used to excite the surface, and the sensor detecting the acoustic signal reflected by the same, are both positioned at an appropriate distance from the fresco, without need to "touch" it, while using acoustic waves of limited amplitude. The new proposed method utilizes an appropriate signal processing system allowing discrimination of the feeble signals indicating the detachment zone, from the other noise.

#### Main advantages

A precise damage definition and measurement before restoration and a successive measurement after restoration of mural paintings and mosaics, is fundamental in order to evaluate the efficiency of treatments used for their protection. The proposed technique seems to comply perfectly with the above requirements, such as to be considered a possible measurement standard in the practice of conservation and safeguard of the mentioned artistic handworks. The present technology is a non-invasive and non-destructive method and device for analysing the separation zones, that is, such as to avoid damage to a work of art.

#### Current state of development

#### Intellectual Property Rights

Patent(s) granted.

#### Application domains

#### Collaboration details

#### Type of partner sought

Industry, local administrations.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC CIRCE

## Technology Offer TO\_IT\_22052

[ ITALY ]

## CNR, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA)

www.irea.cnr.it

<b>Sector</b>	Research and studies in electromagnetic sensing of environment.
<b>Activities</b>	Research activities on remote sensing, diagnostic of territory, monitoring of environmental risk, with particular emphasis to the electromagnetic one.
<b>Contact</b>	

<b>Title</b>	SYNTHETIC APERTURE RADARS (SAR) FOR NON-INVASIVE MONITORING AND DIAGNOSTIC OF THE CULTURAL HERITAGE
<b>Abstract</b>	<p>The Institute for Electromagnetic Sensing of the Environment of the National Research Council (IREA-CNR) has long expertise and know-how in the following technologies: (1) Synthetic Aperture Radar on satellite platforms (2) Ground Penetrating Radar (3) Optic fiber sensors. For each one of these technologies, IREA has developed prototypical instrumentation and innovative measurement and processing techniques, able to overcome the limitations of the state of art.</p> <p>These technologies, and their possible combination, offer the possibility of a non-invasive (3D, 4D) monitoring and diagnostic of the Cultural Heritage and of the surrounding environment. In particular, combined with other ones, they can offer the advantage to perform a time continuous multi-sensing, multi-scale, multi-resolution, multi-depth monitoring.</p>
<b>Detailed description</b>	<p>Spaceborne Synthetic Aperture Radars (SAR) are sensors orbiting around the Earth that allow the acquisition of remote sensing data, day and night, and have all-weather imaging capabilities. The use of technique, known as SAR Interferometry (InSAR) based on the analysis of interference between signal acquired over repeated orbits and different view angles, make possible an accurate localization of ground targets, as well as the monitoring of possible displacements with a precision of the order of millimeter per year. As far as the monitoring of ground target displacements in urban areas, infrastructures and strategic structures (i.e.: historical buildings and monuments) are concerned, IREA has developed a technique based on 4D (space-time) imaging which is able to provide ground deformation velocity maps and deformation time series characterized by a high density of measurements points, high accuracy, and even able to super-resolve targets in the same image pixels. Satellite remote sensing allows monitoring specific structures, few meters wide, as well as imaging with synoptic characteristics, and hence detecting possible movements of the surrounding areas, for example induced by external sources such as, for instance, by underground sources.</p>

<b>Innovative aspects</b>	Innovative processing methodologies able to give 3D and 4D (3D spatial plus time behaviour) high resolution monitoring of the structures and of the surrounding environment.
<b>Main advantages</b>	Radar and the related processing offer the advantage of a non-invasive (3D, 4D) monitoring and diagnostics of the Cultural Heritage and of the surrounding environment. In particular, the combination of the SAR with GPR (Ground Penetrating Radar), optic fiber sensor and other possible ones, give the possibility to perform a time continuous, multi-sensing, multi-scale, multi-resolution, multi-depth monitoring.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for National patent applied in July 2007 – RM2007A000399.
<b>Application domains</b>	Information processing, information systems; Measurement methods. SAR technology is ready for the market and largely validated with real data in different contexts. The innovative data processing techniques of our concern has already been validated in many cases. As far as the application to the monitoring of areas of historical interest is concerned it worth to mention the results of the monitoring of the Colosseo area (ROMA) in the 1995-2000 period. The data processing techniques are ready for a technology transfer, although some aspect related to the systematic application of this technology, especially in terms of exploitation for Cultural Heritage monitoring, should be considered.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22313

[ ITALY ]

## CNR, Istituto di Scienza e Tecnologia dei Materiali Ceramici (ISTEC)

www.istec.cnr.it

<b>Sector</b>	Research and studies in the field of advanced ceramics (bioceramics, electroceramics and structural ceramics), traditional ceramics and cultural heritage (ceramics and mosaics).
<b>Activities</b>	Scientific analyses and diagnostics to support research, conservation and restoration of archaeological, historical and artistic materials, mostly pottery, architectonic ceramics, stones, bricks, mortars and mosaics.
<b>Contact</b>	

<b>Title</b>	CHARACTERIZATION OF ARCHAEOLOGICAL AND ARCHITECTURAL CERAMICS
<b>Abstract</b>	Application of different analytical sequences for characterising archaeological and architectural ceramics with various microstructural patterns including both pastes and coating layers. The proposed sequences permit to obtain the maximum result with the minimum amount of sample, also by using non-destructive investigation techniques.
<b>Detailed description</b>	The general sequence includes the following steps: representative sampling of the material to be analysed in a suitable quantity; determination of eventual pollutant elements (for example soluble salts and phosphorus); study of the microstructure, with particular reference to macropores and eventual secondary phases deposited inside them; determination of ignition loss and complete quantitative chemical composition; determination of the total mineralogical composition; measurement of the real density; determination of open porosity and of pore size distribution. Of course, depending on the type of sample to be analysed, this sequence is adapted in order to obtain the maximum result with the minimum consumption of material. In particular this objective is obtained by using, when possible, non-destructive analytical techniques such as Raman spectroscopy, EDS X-ray spectroscopy and FT-IR.
<b>Innovative aspects</b>	The innovative aspect is the proposal of an analytic sequence which permits to reduce the amount of sample destroyed for the preparation of the analytical specimen. Another aspect is the introduction of non-destructive investigation techniques in an analytical sequence together with invasive techniques.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Reduction of the amount of sample destroyed for the preparation of the analytical specimen;</li> <li>• Indirect and immediate verification of the compatibility the various results between them, so that</li> </ul>



	<p>it can be possible to intervent to discover the eventual mistakes;</p> <ul style="list-style-type: none"> <li>• Best reliability of the results and guarantee of the comparability of the results from different laboratories;</li> <li>• Reduction of the costs of the analyses due to the less amount of time needed for the complete characterisation of the sample.</li> </ul>
Current state of development	
Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	Materials technology.
Collaboration details	
Type of partner sought	Research organisation.
Tasks to be performed by the partner sought	
IRC Partner	IRC CIRCE

## Technology Offer TO\_IT\_21887

[ ITALY ]

## CNR, Istituto per le Tecnologie Applicate ai Beni Culturali (ITABC)

www.itabc.cnr.it

<b>Sector</b>	Research and studies in the field of technologies applied to cultural heritage.
<b>Activities</b>	Development of new technologies for cultural heritage conservation and promotion.
<b>Contact</b>	

<b>Title</b>	HIGH PERFORMANCE PORTABLE X-RAY FLUORESCENCE SPECTROMETERS
<b>Abstract</b>	Since long X-Ray Fluorescence (XRF) is being used for non-destructive characterization of cultural materials. Although many portable XRF spectrometers are commercially available, most of them are not sufficiently sensitive to analyse minor elements, which are essential to characterize cultural materials. The system presented here was designed and assembled at CNR's Institute for Technologies Applied to Cultural Heritage; it performs by far better than most portable spectrometers on the market. Detection limits range from 50 to 300 mg/kg depending on the analysed element, with a measurement time of only 120 s.
<b>Detailed description</b>	The portable XRF spectrometer is equipped with an X-ray tube working at 60 kV and 1.5 mA. The detector is of the Si-Drift type with an active area of 7 mm <sup>2</sup> and a thickness of 0.45 mm. A miniaturised closed-loop system provides tube liquid cooling. Reproducible positioning is guaranteed by two lasers impinging at 45° on the measurement point.
<b>Innovative aspects</b>	Combination of high-energy, high-intensity primary flux with a fast detector.
<b>Main advantages</b>	Efficient excitation of the K-lines of elements in the range 45<Z<60; detection limits 10 to 100 times lower than those of commercially available systems.
<b>Current state of development</b>	Already on the market.
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Measurement methods. In situ non-destructive XRF analysis of cultural materials. In situ XRF analysis of metals in biological materials.

Collaboration details

Type of partner sought

Tasks to be performed  
by the partner sought

IRC Partner

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Industry.

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IRC CIRCE.

Technology Offer TO\_IT\_22159

[ ITALY ]

## Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA)

[www.entecra.it](http://www.entecra.it)

<b>Sector</b>	Research in the fields of agriculture, agro-industry, food, fishery and forestry.
<b>Activities</b>	Magnetic Resonance spectroscopy, both Nuclear Magnetic Resonance and Magnetic Resonance Imaging.
<b>Contact</b>	

<b>Title</b>	MAGNETIC RESONANCE IMAGING FOR ANALYSIS OF LAPIDEOUS MATERIALS
<b>Abstract</b>	<p>A public Research Centre located in Rome focused on the use of Magnetic Resonance spectroscopy, both NMR and MRI. The latter is used as non-destructive technique to obtain high resolution images of any section or volume of porous materials. Using water contrast agent liquid, MRI technique allowed to produce detailed images of many lapideous materials.</p> <p>MRI is used to investigate the porosity of different stones and to the different consolidation procedures available.</p> <p>The obtained results indicate that MRI is a suitable technique for investigating porous materials such as walls of churches and monuments in a fully non-invasive fashion.</p>
<b>Detailed description</b>	<p>Spin density maps of mobile molecules, e.g. water protons, in a rigid matrix constitute one of the most straightforward MRI application. In principle, the amplitude of the NMR signal gives a quantitative measurement of the content of mobile molecules confined in a porous structure. Therefore, images of stones can be obtained through water-saturation of the stones themselves. MRI experimental parameters can be properly chosen in order to detect water molecules confined on pores of different dimension, i.e. to investigate on the porosity. The knowledge of water distribution inside the porous matrix of stones, enables to elucidate the degradation processes occurring and the consolidation procedures to be applied.</p> <p>Organic polymers as consolidating agents is preferred because of their hydro-repulsive properties, and when applied on a stone surface, the amount of water absorbed by the treated stone is lower with respect to the amount of water absorbed by the untreated one, therefore MRI signal decreases and the image becomes noisy. Thus, images of stones with different applied treatments depict the efficiency of hydro-repellent treatment. The distribution of polymers inside the different pores of the stone can be evaluated, and therefore the effect of consolidating is assessed.</p> <p>We perform analysis on both organic and inorganic compounds for consolidation and protective efficiency by detecting their effects within the various porous sizes.</p>

TECHA

<b>Innovative aspects</b>	Often the techniques used for study porous materials of historical-artistic value are Hg porosimetry and the drilling of a solid core. These methods are affected by the inevitable sampling of small pieces of material; therefore, in order to reproduce the stone's porosity, many sample of the same stone have to be investigated. Moreover both techniques are highly destructive. On the contrary, MRI can be carried out on large samples (5'5'2 cm <sup>3</sup> ) in a completely non-invasive and non-destructive fashion. MRI represents an inexpensive, simple and reliable technique for the non-invasive observation of the water uptake and of the effect of consolidation procedures effects in porous materials.
<b>Main advantages</b>	The Magnetic Resonance Imaging (MRI) is fully non-invasive and non-destructive technique, able of analysing objects of large dimensions (5'5'2 cm <sup>3</sup> ) with the possibility of selecting every area within the sample. Water uptake, degradation and consolidation effects can be precisely evaluated.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc). No copyright.
<b>Application domains</b>	Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Any
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22256

[ ITALY ]

## Consorzio CETMA

www.cetma.it

<b>Sector</b>	Research applied in the sector of advanced industrial engineering, especially materials and structures engineering, information technology, industrial design.
<b>Activities</b>	Modelling and prototyping, product design and environmental impact assessment, multimedia planning, Virtual Reality, Immersive Virtual Reality Based System, Information systems for the industrial engineering.
<b>Contact</b>	

<b>Title</b>	INFRARED THERMOGRAPHY FOR THE NON-DESTRUCTIVE ASSESSMENT AND DIAGNOSIS OF HISTORIC STRUCTURES (DISCONTINUITIES BENEATH THE SURFACE, HIDDEN STRUCTURE, MOISTURE GROWTH, CORROSION IN METALS, PLASTER DETACHMENT FROM A WALL OR WITHIN A FRESCO, DEBONDING IN FRP-RETROFITTED STRUCTURES, ...)
<b>Abstract</b>	An italian research organisation developed and calibrated an Infrared (IR) yard-friendly methodology for the non-destructive detection and evaluation of bonding defects on reinforced concrete structures externally reinforced with FRP materials. Infrared Thermography (IRT) is a wireless, contactless and smart technique potentially suitable for acquiring relevant information about hidden structures and for the long-term monitoring of moisture growth, plaster detachment from a wall, detachment within a fresco, cracks pattern evolution, temperature pattern evolution, microclimatic conditions mapping. For these reasons, IRT can be considered a useful tool for damage assessment diagnosis and monitoring for the preventive conservation and maintenance of the Cultural Heritage. Partners are sought for technical cooperation and financial support. The organisation is also available to deliver its services via service contract.
<b>Detailed description</b>	Infrared Thermography is a non-destructive investigation technique that is becoming more frequently employed in civil and architectural inspections, in the diagnostic phase, in preventive maintenance or to verify the outcome of interventions. On historic structures, it allows investigating details of construction, damage and material decay, and interventions. In theory, every combination of masonry structure type and object/defect to be investigated (different materials and with different building textures) needs a specific IR calibration. The set-up of IR technique for the detection of a particular object/defect (discontinuities beneath the surface, hidden structure, moisture growth, corrosion in metals, plaster detachment from a wall or within a fresco, debonding in Fiber Reinforced Plastics (FRP-retrofitted structures,...) in an ancient structure needs a specific IR calibration, leading to the proper definition of the operational parameters (active/passive technique, distances, time-windows). Such calibration is usually performed in laboratory, using different

“known” samples, made of different materials and with different building textures, simulating real structures. Nevertheless, every possible combination of masonry structure type and object/defect to be detected can require a specific parameters set, with the consequent need of a very extensive experimental campaign. Once defects have been identified and correlated in frescos and structures, the use of FRP materials is considered as a reference modern practice for repairing, retrofitting and strengthening of existing structures. However the application of FRP patches requires skilled operators (that not always are available) and the quality of the intervention must be evaluated to guarantee proper performance, as the effectiveness and correct working of the FRP patch is dramatically dependent on the quality of FRP-substrate adhesion. In fact, a bonding defect can cause, in the worst case, an unexpected debonding failure of the patch. As a consequence, the quality of the intervention must be accurately evaluated to guarantee proper performance. CETMA defined and calibrated an Infrared (IR) yard-friendly methodology for the non-destructive detection and evaluation of bonding defects on reinforced concrete structures externally reinforced with FRP materials. The work was carried out according to the following steps:

1. Calibration of the technique by the analysis of “known” defects in FRP-strengthened structures. Proper Fiber Reinforced Plastics (FRP)-reinforced concrete samples were prepared, imposing known defects with different shapes and dimensions at the FRP – substrate interface. The samples surfaces were analysed with the pulsed and lock – in thermography method and the operational parameters were investigated and defined in order to obtain the best defect visibility:
  - thermocamera – sample distance;
  - heating source – sample distance;
  - heating time;
  - observation time.
2. IR data post-processing. After the definition of acceptance criteria and reparation techniques for the defects, CETMA developed a post processing software tool able to clearly define the contour of defect. This allows to measure the area of the bonding defect and then to compare it with the acceptance criteria, in order to establish whether the defect is acceptable or not, and, in case, what is the best way to repair it.
3. In-situ validation. The in-situ validation of the technique was carried out on an reinforced concrete structure externally reinforced with FRP sheets. This step involved also the transfer of the technique from the lab-scale to the real-scale, with the necessary adaptations in the operational parameters. Besides the work on FRP-reinforced r.c. structures, CETMA also carried out non-destructive investigations on some important Italian historic masonry structures (Ercolano archeological excavations; S. Giovanni in Laterano Baptistery, Rome), aimed to detect and identify hidden structures, cracks, moisture, plaster debonding, etc.

**Innovative aspects**

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Infrared Thermography (IRT) has been applied for more than 35 years to the buildings monitoring in a qualitative or quantitative way; however, recording a good thermogram is not trivial, as well as, its interpretation. The use of wrong operative parameters can lead to coarse errors in the interpretation of the IR images, with possible catastrophic consequences for the architectural goods monitored. Moreover, even if the thermographic survey is performed in the right way, the IR images interpretation is not always simple. CETMA developed an IRT survey procedure that can be easily implemented on site and a software tool useful for the thermographic data analysis and interpretation. Even if a lot of other traditional techniques may be used to find out detachments in frescos, moisture growth, cracks pattern evolution, etc. it appears evident that IRT, allowing contactless inspections of large surfaces, is less invasive and more efficient in terms of measurement time.

**Main advantages**

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Infrared Thermography is a non-contact technique that allows a rapid data acquisition, as each IR-camera frame permits inspecting large areas of the construction. Moreover, being contactless, it keeps the user out of danger and it does not intrude upon or affect the investigated object at all, provided that a proper preventive analysis of the temperature field and of its possible interactions with the investigated object is performed (for example, for frescoes inspections). Furthermore, preliminary data interpretation can be performed on site, as thermograms are visualised in real time. Producing two-dimensional images resembling the visible situation has the further advantage of making the Non-Destructive Testing (NDT) results more easily understood even by non-NDT-specialists, with the positive consequence of a more widely acceptable use of NDTs in the evaluation of structures. The above described advantages are recognised to be particularly useful when the object of investigations is a historic or ancient structure, benefiting from high level of protection, on which the application of NDT techniques for assessment purposes is strongly encouraged. On Cultural Heritage, even the contact between material surface and testing instrumentation might not be allowed, whilst the possibility of combining NDTs with invasive or destructive methodologies for calibration purposes must be kept to a minimum.



Current state of development	
Intellectual Property Rights	Secret know-how
Application domains	Construction technology; Information processing, information systems; Measurement methods.
Collaboration details	
Type of partner sought	Technical co-operation: industry, academy, research organisation. Service Contract: industry. Financial resources: industry
Tasks to be performed by the partner sought	
IRC Partner	IRC IRIDE

## Technology Offer TO\_IT\_22132

[ ITALY ]

## D'Appolonia Spa

www.dappolonia.it

<b>Sector</b>	Engineering consultancy in the field of energy, environment and infrastructures, industry and transportation.
<b>Activities</b>	Engineering, scientific and construction management services.
<b>Contact</b>	

<b>Title</b>	PRISM-GRATING SPECTROGRAPHIC OPTICS
<b>Abstract</b>	A North Italian company developed a PGP (Prism-Grating-Prism) spectrographic optic device, originally developed for remote sensing applications in the aerospace field, able to analyse the light spectrum independently from light polarisation. It can be used in many industrial fields for quality control. The company is looking for opportunities concerning technical cooperation/licensing/joint ventures able to exploit the technology in the textile/plastic/wood/paper-machinery manufacturing sector.
<b>Detailed description</b>	<p>PGP (Prism-Grating-Prism) spectrographic optics, originally developed for remote sensing applications in the aerospace field, is based on the application of a highly efficient PGP spectrograph able to analyse the light spectrum – from Infrared to Ultraviolet – independently from light polarisation. The spectrometer, obtained by combination of the spectrograph with the matrix optical sensor, allows colour measurement along a line on a large number of points, with both high spatial and spectral resolutions.</p> <p>A specific application has been developed for the textile industry, where quality control is still carried out manually by specialised personnel. An automatic system has been developed to identify colour defects in real time on orthogonal-yarn textiles both during the dyeing process and on the finished product. This will allow fast (potentially up to 100 m/min) and reliable quality control, enabling the increase of the production rate (which will at least duplicate), and limit the loss of fabrics that do not meet the quality standards.</p> <p>Besides the textile sector, applications are expected in sectors such as plastics, wood and paper, representing markets of similar magnitude to the textile one.</p>
<b>Innovative aspects</b>	<p>This particular approach has the following advantages:</p> <ul style="list-style-type: none"> <li>• Reduced measurement times;</li> </ul>

	<ul style="list-style-type: none"> <li>• Simpler mechanisms with no need for scanning movements;</li> <li>• Simultaneous measurements on a line or multiple points.</li> </ul>
<b>Main advantages</b>	<p>The technology provides good accuracy in spectral analysis measurements (typical of the spectrometer) and a high amount of performed measurements (typical of common cameras). This technology is able to provide high-quality real-time control by constantly monitoring possible defects along the production line, thus avoiding the costly and useless processing of not-standard materials.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Measurement methods. Quality inspection for textiles, plastic, wood, etc.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	The proponent is looking for opportunities to license the technology.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	ALPS IRC

## Technology Offer TO\_IT\_22107

[ ITALY ]

## Demetra Scs Onlus

www.demetra.net

<b>Sector</b>	Environment, information and communication technology for environment and cultural heritage.
<b>Activities</b>	Survey, maintenance, conservation and valorisation of landscape.
<b>Contact</b>	

<b>Title</b>	GREEN MANAGEMENT
<b>Abstract</b>	<p>The inventory regards private and public green areas, using D-GPS technology for GIS data collection and data Maintenance. The aims of this service are:</p> <ul style="list-style-type: none"> <li>• to develop ordinary and extraordinary green management plans;</li> <li>• to provide the basis for territory planning, in particular regarding the environmental resources for sustainable development;</li> <li>• to reduce the operating costs considerably, in the respect of the principles of protection of the green patrimony previewed from the enforced laws.</li> </ul>
<b>Detailed description</b>	<p>All the collected data are delivered into a customized software in order to:</p> <ul style="list-style-type: none"> <li>• catalogue every entity of the green area surveyed (trees, flower-beds, shrubs, bushes, furnishings, tree-lined avenues);</li> <li>• find immediatly the information;</li> <li>• identify the current conditions of every entity;</li> <li>• carry out the cartographic acknowledgment of every entity;</li> <li>• plan all the tasks;</li> <li>• manage the contract for the green areas;</li> <li>• define a maintenance plan, with the description of all the forecast operations and costs;</li> <li>• directly manage the informative systems of maintenance of the green areas in global service operations.</li> </ul> <p>Through GPS system it is possible to carry out the relief of the infrastructural net of underground services.</p> <p>The data collected allow a systematic management of underground services.</p>
<b>Innovative aspects</b>	Environmental friendly green management system.

Main advantages	
Current state of development	
Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	Information processing, information systems; Measurement methods.
Collaboration details	
Type of partner sought	City councils, Tourist Agencies, Parks, Botanical Gardens.
Tasks to be performed by the partner sought	
IRC Partner	IRC Lombardia

## Technology Offer TO\_IT\_22289

[ ITALY ]

## Diasis Srl

www.diasis.it

<b>Sector</b>	Diagnostics and monitoring in the field of cultural heritage.
<b>Activities</b>	Development of new non-invasive techniques to study the cultural heritage conservation.
<b>Contact</b>	

<b>Title</b>	THE "SONIC IMPRINT", A NEW NON-INVASIVE TECHNIQUE ABLE TO UNIVOCALLY IDENTIFY AND MONITOR THE INTEGRITY OF PRECIOUS WORKS OF ART
<b>Abstract</b>	A new non-invasive technique, called "Sonic Imprint", has been developed to univocally identify and monitor the integrity of precious artefacts, like potteries, statues and objects, generally made of stone, metal or wood. The technique consists in inducing vibrations in the analyzed artwork, and in analyzing its resonance frequencies. The Sonic Imprint depends on the distribution of the mechanical parameters of the object (e.g. density, elastic moduli, damping parameters), and it is practically unique for each object. Moreover this technique is totally non-invasive, very fast, cheap and its acquisition doesn't need any specialized personnel.
<b>Detailed description</b>	A new non-invasive technique, called "Sonic Imprint", has been developed to univocally identify and monitor the integrity of precious artefacts, like potteries, statues and objects, generally made of stone, metal or wood. The technique consists in inducing vibrations in the analyzed artwork, and in analyzing its resonance frequencies. The vibrations are closely linked to the geometry of the artefacts as well as to the spatial distribution of its elastic parameters: therefore, the analysis of the propagation of elastic waves in the artefacts may allow the construction of a sort of DNA, called "Sonic Imprint", which identifies the objects and, eventually, establishes their mechanical consistency (or integrity). The resonance frequencies present a significant variability even in presence of small structural modification of the object: it is then possible, by means of the Sonic Imprint, to well distinguish even objects with the same shape and composition (e.g. potteries produced with industrial methods).
<b>Innovative aspects</b>	Nowadays, the general characteristics for the identification of an object – such as its shape, dimension, aspect, colours and texture of the surface, etc. – are well imitable with use of laser technologies so that it is possible to obtain quasi – perfect copies of any artefact. Nevertheless other physical parameters, dependent on internal non-observable-properties (chemical composition,

	atomic structure, internal defects, etc.), are practically impossible to be cloned: the Sonic Imprint depends on the distribution of the mechanical parameters of the object (e.g. density, elastic moduli, damping parameters), and it is practically unique for each object. Furthermore this analysis depends on the whole distribution of the mechanical properties, and then it is representative of the entire work of art.
<b>Main advantages</b>	The Sonic Imprint technique is totally non-invasive, very fast (few minutes are necessary for measurements and analysis), cheap (in comparison with the current chemical/physical methods of identification) and its acquisition doesn't need any specialized personnel.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for 6/02/2007 Italian application 6/02/2008 European application
<b>Application domains</b>	Measurement methods. This technique responds to the demand, especially felt among the museum managers, of an art collection cataloguing that allows the identification of artefacts and to establish their physical conditions. This is also linked to the international loan of precious artefacts, which are then subjected to transport stresses and to the connected risks (damages, substitutions, physical deterioration, etc.). Furthermore, nowadays many art exhibitions are itinerant, and the artefacts are continuously subjected to transport and/or displacement.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Investors, commercial and marketing partners, licensees.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC MED.I.A.

## Technology Offer TO\_IT\_21852

[ ITALY ]

ENEA

www.enea.it.

<b>Sector</b>	Research and study in the field of cultural heritage.
<b>Activities</b>	Research and innovation in the field of cultural heritage knowledge and conservation.
<b>Contact</b>	

<b>Title</b>	LASER INDUCED FLUORESCENCE (LIF): APPLICATIONS TO ENVIRONMENTAL MONITORING, CULTURAL HERITAGE PRESERVATION, MEDICAL DIAGNOSTICS AND TERRORISM PROTECTION
<b>Abstract</b>	An Italian research centre near Rome has developed Laser Induced Fluorescence (LIF) systems since the nineties. They have been applied to vegetation remote sensing, natural waters monitoring and artwork diagnostics. Recently, it has been shown that LIF can be applied to cancer recognition and explosive detection. Manufacturers of innovative sensors or a research centre in electro-optics are sought for technical cooperation to develop a pre-competitive prototype and joint venture agreement.
<b>Detailed description</b>	Laser Induced Fluorescence (LIF) is the optical emission from molecules that have been excited to higher energy levels by absorption of electromagnetic radiation. The main advantage of fluorescence detection with comparison to absorption measurements is the greater sensitivity achievable because the fluorescence signal has a very low background. For molecules that can be resonant-excited, LIF provides selective excitation of the analyte to avoid interferences. LIF is useful to study the electronic structure of molecules and to make quantitative measurements of analyte concentrations. Analytical applications include monitoring gas-phase concentrations in the atmosphere, flames and plasmas; and remote sensing using Light Detection And Ranging (LIDAR). The excitation source for molecular LIF is typically a tuneable dye laser in the visible spectral region. The innovation proposed consists of developing miniaturised systems for cancer recognition (endoscopes) and explosive detection (portable systems with scanning beams for indoor and outdoor inspection in buildings like airports or stations, and means of transportation like trains or buses). The excitation source could be a diode laser (with a beam delivery based on fibre optics). The scanning could be achieved by a computer-controlled moving mirror. The detection could be performed by small monochromators or interference filters coupled to solid-state detectors or photomultipliers minimodules. Fast analogue-to-digital converters could sample the signal that



	<p>would be displayed in real time on the computer display. Sensitivity in the parts-per-million range can be achieved in explosive detection. In the framework of LIF, the research has developed:</p> <ul style="list-style-type: none"> <li>• a LIDAR fluorosensor for vegetation remote sensing;</li> <li>• three LIDAR fluorosensors, employed in several oceanographic campaigns (five in Antarctica, two in the Italy-New Zealand transect);</li> <li>• a compact LIDAR fluorosensor for artwork diagnostics, employed in an international field campaign.</li> </ul>
<b>Innovative aspects</b>	The main innovative aspect of LIF is that it is based on electro-optics techniques. This allows the diagnostics to be remote and fast, so that the sampled object is not disturbed at all.
<b>Main advantages</b>	<p>LIF offers the advantage of being:</p> <ul style="list-style-type: none"> <li>• Fast (detection of a substance can be performed in a fraction of a second), remote (the system and the target can be some meters far apart);</li> <li>• Sensitive (better than parts-per-million);</li> <li>• Specific (substances can be recognised by their spectroscopic fingerprint);</li> <li>• User-friendly (the system can be deployed in a few minutes and does not require a specifically trained user).</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	<p>Measurement methods</p> <p>The potential market applications of LIF ranges from environmental monitoring to Cultural Heritage Preservation, from medical diagnostics to homeland security. LIF systems or services could be offered to customers.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	The partner could be an industry or a research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22535

[ ITALY ]

## ENEA

www.enea.it - <http://info.casaccia.enea.it/triga/TRITON>

<b>Sector</b>	Research and study in the field of cultural heritage.
<b>Activities</b>	Research and innovation in the field of neutron radiography and tomography.
<b>Contact</b>	

<b>Title</b>	THE ENEA'S TRIGA REACTOR OFFERS A SERVICE OF NEUTRON RADIOGRAPHY/TOMOGRAPHY APPLICATIONS, WITH A CONTINUOUS IMPROVEMENT PROGRAM OF THE HARDWARE AND SOFTWARE TOOLS, FOR INDUSTRIAL AND CULTURAL HERITAGE APPLICATIONS
<b>Abstract</b>	<p>The TRIGA Mark II reactor named "RC-1" is a pool nuclear reactor that has a power of 1 MW. The reactor offers several experimental channels for many kinds of research. In particular, two experimental channels are devoted to materials investigation using neutron radiography and tomography.</p> <p>Neutron Radiography and Tomography facilities are equipped with hi-sensitivity cameras and digital equipments. Partners are sought for technical collaboration.</p>
<b>Detailed description</b>	<p>TRIGA RC-1 Research Reactor General Description.</p> <p>The TRIGA Mark II nuclear reactor, named "RC-1" as Reactor Casaccia 1, was build in the early sixties from General Atomics. The reactor power is 1 MW.</p> <p>It is a pool thermal reactor having a core contained in an aluminum vessel and placed inside a cylindrical graphite reflector, bounded with lead shielding. The biological shield is provided by concrete with an average thickness of 2.2 m. Demineralised water, filling the vessel, ensures the functions of neutron moderator, cooling mean and first biological shield.</p> <p>The reactor control is ensured by four rods: two shims and one safety fuelled follower rods, and one fine regulating rod.</p> <p>The thermal power produced by the core is removed by natural water circulation trough a suitable thermal hydraulic loop comprehending heat exchangers and cooling towers.</p> <p>Irradiation Facilities</p> <p>The main reactor irradiation facilities are:</p> <ul style="list-style-type: none"> <li>• Rotating rack (40 positions) <math>2.00 \cdot 10^{12}</math> (n/cm<sup>2</sup>s)</li> <li>• Pneumatic transfer system <math>1.25 \cdot 10^{13}</math> (n/cm<sup>2</sup>s)</li> </ul>

- Central channel  $2.68 \cdot 10^{13}$  (n/cm<sup>2</sup>s)
- Thermal Column collimator  $1.20 \cdot 10^6$  (n/cm<sup>2</sup>s)
- Tangential Port collimator  $2.70 \cdot 10^6$  (n/cm<sup>2</sup>s)

#### REACTOR CORE

The reactor and the experimental facilities are surrounded by a concrete shield structure. The core and the reflector assemblies are located at the bottom of an aluminum tank (190.5 cm diameter). The overall height of the tank is about 7 m, therefore the core is shielded by about 6 m of water. The core, surrounded by the graphite reflector, consists of a lattice of fuel elements, graphite dummy elements, control and regulation rods. There are 127 channels divided in seven concentric rings (from 1 to 36 channels per ring). The channels are loaded with fuel rods, dummy elements and regulation and control rods depending on the power level required. One channel houses the start-up Am-Be source, while two fixed channels (the central position and a peripheral) are available for irradiation or experiments. A pneumatic transfer system allows fast transfer from the peripheral irradiation position and the end station.

The diameter of the core is about 56.5 cm while the height is 72 cm. Neutron reflection is provided by graphite contained in an aluminum container which is surrounded by 5 cm of lead acting as a thermal shield. The core components are contained within a top and bottom aluminum grid plates: the top grid has 126 holes for fuel elements and control rods and a central thimble for high flux irradiations. The reactor core is cooled by natural convection of the water in the reactor pool.

#### FUEL

The standard fuel element consists of a stainless steel clad (AISI-304, 0.05 cm thick, 7.5 g/cm<sup>3</sup> density) characterized by an external diameter of 3.73 cm and a total height of 72 cm end cap included. The fuel is a cylinder (38.1 cm high, 3.63 cm in diameter, 5.8 g/cm<sup>3</sup> of density) of a ternary alloy uranium-zirconium-hydrogen (H-to-Zr atom ratio is 1.7 to 1; the uranium, enriched to 20% in <sup>235</sup>U, makes up 8.5% of the mixture by weight: the total uranium content of a rod is 190.4 g, of which 37.7 g is fissile) with a metallic zirconium rod inside (38.1 cm high, 0.5 cm in diameter, 6.49 g/cm<sup>3</sup> of density). There are two graphite cylinders (8.7 cm high, 3.63 cm in diameter, 2.25 g/cm<sup>3</sup> of density) at the top and bottom of the fuel rod. Externally two end-fittings are present in order to allow the remote movements and the correct locking to the grid system.

The regulation rod has the same morphological aspect as the fuel rod: the only difference is that instead of the mixture of the ternary alloy Uranium-Zirconium-Hydrogen there is the absorber (graphite with powdered boron carbide). The control rods are "fuel followed": the geometry is similar to that of the regulation rod with the bottom graphite cylinder replaced with fuel 38.1 cm in length. The dummy elements are similar to the fuel rod but with graphite inside and aluminum cladding.

#### REACTOR OPERATION

The reactor can be operate, at full power of 1 MW, on a daily cycle of 6 hours for 5 day per week.

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### Neutron Radiography and Tomography Stations

Two tomography systems are operating at the two neutron collimators. A small home made neutron tomography system is operating at the thermal column. The radiography facility is based on a neutron collimator with a measured L/D ratio of 44, a circular aperture of 4 cm as diameter, a neutron flux of  $1.2 \cdot 10^6 \text{ n cm}^{-2} \text{ s}^{-1}$  with Cd ratio of about 3. A cooled CCD (192x165 pixels) and an intensifier for light from a NE426® neutron scintillator with traditional optical coupling ensure the imaging with a typical acquisition time of about 5 s/frame. A complete set of 200 tomographic projections is acquired in about 1200 seconds, including data transfer time. The limitation in diameter allows to examine only small objects.

To encompass this restriction, a new facility (including a heavy duty rotating table for tomography and a system for large objects displacement is under completion at the TP2 tangential channel having 23 cm as diameter. A high sensitivity CCD system (1344x1024 pixel, 6.45x6.45 mm pixel size) will permit the image acquisition avoiding the intensifier for the light coming from a NE426® neutron scintillator. That station is under integration with an industrial type X-ray generator combined with a Thomson tube coupled with a CCD system.

A software package including filtered back-projection algorithms allows the tomographic reconstruction for 3D visualization. The double analysis with neutron and X-rays allows complementary inspections on the investigating items.

Examples of neutron tomographies and radiographies are available at: [www.triga.enea.it/TRIGA](http://www.triga.enea.it/TRIGA) or [www.triga.enea.it/TRITON/](http://www.triga.enea.it/TRITON/)

#### CULTURAL HERITAGE INVESTIGATION

The neutron radiography technique and the tomographic reconstruction allow the virtual sectioning and inner visualization preserving the investigating object. This powerful methods are very appropriate for Cultural Heritage object inspection where non-destructive procedures are essential. The availability of non-destructive techniques at the Casaccia Center can extend the complementary of information on the examined objects. Among these:

- X-fluorescence, for surface composition assessment;
- Weak X and gamma radiography, for structural analysis manufacturing technique evaluation;
- Infra-red reflectography, for underwriting appraisal in paints;
- Neutron activation analysis, for elemental track assessment;
- Radiative neutron capture, for original and polluted material evaluation.

#### WINES – Remote Control of Neutron Experiments

All acquisition instruments operating at the experimental facilities are remotely controlled by a server and dedicated software packages. A client-server strategy allows the control via Internet connection. With WINES (Web Interactive Neutron Experimental Structure) all registered user has access to the experiment controlling computer, with the control of acquisition parameters and real-time data access. A plant supervisor can temporary inhibit the access or the interaction with the instruments as a function of the plant status or other user priority.

<b>Innovative aspects</b>	<p>Since neutrons penetrate matter very well, they are very useful to look at the interior of technical components or Cultural Heritage objects by transmission measurement without destroying the samples. Some light elements as for example hydrogen or boron can be easily traced by neutron radiography, while they are practically invisible in a common X-ray picture.</p> <p>Neutron radiography has become a standard method for various applications, e.g. the inspection of adhesive joints in aircraft construction.</p> <p>Neutron transmission radiography (NR) is based on the attenuation of the radiation during the passage through matter according to an exponential law. Since different materials have different attenuation performance, the neutron beam can be interpreted as information carrier about composition and structure.</p>
<b>Main advantages</b>	<p>The main advantage of the “non-destructive investigation method”, is emphasized the by the contemporary use of Neutron and X-ray investigations.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Others (registered design, plant variety right, etc).</p>
<b>Application domains</b>	<p>Materials technology.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>The expected partners are identified as private and public owners of works of art willing to carry out some experiments on the goods on site.</p> <p>– For improving the neutron imaging, research institution operating in the specific field.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC IRIDE</p>

## Technology Offer TO\_IT\_22558

[ ITALY ]

## INFN, Centro di Elettronica

www-ceb.bo.infn.it

<b>Sector</b>	Design, development, testing and installation of front-end, trigger and data acquisition electronics for physics.
<b>Activities</b>	Computerized Tomography for cultural heritage.
<b>Contact</b>	

<b>Title</b>	A SYSTEM TO PERFORM COMPUTERIZED TOMOGRAPHY FOR OBJECTS INTERESTING THE CULTURAL HERITAGE AND INDUSTRIAL FIELDS
<b>Abstract</b>	A small Italian company (NECTAR s.r.l.), mainly composed by young people, together with the University of Bologna (Italy), has developed equipments to do X-ray computerized tomography (CT) of objects of interest for cultural heritage and industry. The equipments, developed in different models, are an extension of X-ray CT used in hospitals. By them it is possible to analyse either very small objects or big objects (larger than 1 m). In some cases the equipments can be transported "in situ", i.e. museums. The company is looking for companies/industries interested in this kind of technology.
<b>Detailed description</b>	<p>The X-ray Computed Tomography is a well known diagnostic method able to see "inside" the objects. For non-medical applications, it is very useful for planning restoration and conservation actions, to see the defects of the object as well as for studying the technique of its construction. For the application of CT to cultural heritage and industrial field see <a href="http://www.xraytomography.com">www.xraytomography.com</a>. In the frame of collaboration with the University of Bologna, with the developed equipments many measurements were performed in the laboratory and outside. A brief list of what has been done out of the laboratory is the following:</p> <ul style="list-style-type: none"> <li>a) an ancient big globe (210 cm in diameter, done in 1570), in Palazzo Vecchio in Florence;</li> <li>b) a prehistoric skull (1 million year old) in the National Museum of Asmara (Eritrea);</li> <li>c) many measurements at Getty Conservation Institute (Los Angeles). We supplied a CT system to GCI, using their 450 kV x-ray tube;</li> <li>d) a pot full of bronze Roman coins at FIAT Avio plant using a 9 MV linac;</li> <li>e) at the synchrotron laboratory with an innovative system for high resolution CT (voxel of 25 micron) (patent of UNIBO).</li> </ul>
<b>Innovative aspects</b>	Two are the main features of the developed CT systems:

	1) the possibility to do CT with high spatial resolution even for relatively large objects (up to 12 cm); 2) the possibility to perform measurements "in situ".
<b>Main advantages</b>	The company can provide expertise to develop new systems customized to the customer's need.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems; Measurement methods.
<b>Collaboration details</b>	Commercial Agreement.
<b>Type of partner sought</b>	Industry.
<b>Tasks to be performed by the partner sought</b>	Application of non-destructive evaluations.
<b>IRC Partner</b>	IRC IRENE

## Technology Offer TO\_DE\_22557

[ GERMANY ]

## Innowep GmbH

www.innowep.com

<b>Sector</b>	Surface, material testing and documentation.
<b>Activities</b>	Service measurements, service testing and instrumentation training.
<b>Contact</b>	

<b>Title</b>	STANDARDISED MEASUREMENT, EVALUATION AND DOCUMENTATION OF THE VISUAL IMPRESSION OF SURFACES
<b>Abstract</b>	A German SME developed a technology to document, analyse and evaluate the visual impression, the appearance and the perceived quality of product surfaces in a reproducible way for the first time. It is portable and can be applied to any surface where optical appearance is important, e.g. buildings, sculptures, furnitures, car interieurs, paper products etc, and even to the human skin (medicine, cosmetics). Application partners are sought to further utilize the technology.
<b>Detailed description</b>	<p>The patented technology is the first that documents, analyses and evaluates the visual impression, the appearance and the perceived quality of the product surface in a reproducible way. It enables a reproducible visual documentation of structure and optical surface properties, similar to the evaluation of the human eye. Besides this, the user can measure the 3D-topography and analyse the roughness values in x- and y-direction as well as along a freehand line based on international standards.</p> <p>The technology can be applied widely in any sector or industry where the optical appearance of surfaces is important. Besides paper industry (quality of papers and tissues), automotive industry (materials and components for the car interieur), building industry (facades, wall-papers) and so on, the technology can also be applied in the field of medicine (scar formation, skin diseases) and in cosmetics (skin structure, homogeneity of products).</p> <p>New application fields and potential users are sought to expand the use of the technology.</p>
<b>Innovative aspects</b>	<p>The patented technology is the first that documents, analyses and evaluates the visual impression, the appearance and the perceived quality of the product surface in a reproducible way. It enables a reproducible visual documentation of structure and optical surface properties, similar to the evaluation of the human eye. Besides this, the user can measure the 3D-topography and analyse the roughness values in x- and y-direction as well as along a freehand line based on international standards.</p>



<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Reproducible documentation, analysis and evaluation;</li> <li>• Portable, no large stationary equipment required;</li> <li>• Accesses both topography and visual impression;</li> <li>• Surfaces of any shape and structure can be tested;</li> <li>• Suitable also for wear and damage analysis.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Construction Technology; Information processing, information systems; Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Companies and institutes.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Technology Offer TO\_IT\_22551

[ ITALY ]

**Iridium Scientific**

www.iridiumscientific.eu

<b>Sector</b>	Cultural heritage diagnostics.
<b>Activities</b>	Archeological finds dating and material properties investigation.
<b>Contact</b>	

<b>Title</b>	SYSTEMS FOR DATING IN ARCHAEOLOGICAL GEOLOGICAL FIELDS AND MEASURING PERSONAL AND ENVIRONMENTAL RADIATION DOSE
<b>Abstract</b>	<p>Iridium scientific has developed several instrumentations and software for:</p> <ul style="list-style-type: none"> <li>• dating the archeological finds;</li> <li>• Investigating material properties;</li> <li>• measuring the dose of absorbed radiations in the field of dosimetry.</li> </ul> <p>These instruments use the technique of thermoluminescence and optical stimulation with an innovative system of heating.</p>
<b>Detailed description</b>	<p>There are several dating methods which allow to date practically every natural compound. While the radiocarbon is dominating in the field of organic compounds, luminescence is surely the main dating technique for silicates (like ceramics, bricks, tiles and porcelains). IRIDIUM Scientific developed two measurement systems: the first one based on TL (Thermo Luminescence) is called Arthemis, the other one based on OSL (Optically Stimulated Luminescence) is called Persephone. Both of them allow to estimate the age of the sample and to investigate the material properties and to measure the dose of absorbed radiations in the field of dosimetry.</p> <p>Moreover, a device called Eurydice allows to drive the photomultiplier necessary for the measurement.</p> <p>Arthemis is the ideal system for dating measurements of ceramic materials via thermoluminescence technique.</p> <p>Arthemis is a full-scale instrument for Thermally Stimulated Luminescence (Thermoluminescence) measurements. This technique is used within the study of ceramic finds age. Thanks to advanced electronics and a new concept sample-heating lodge, it is characterized by a small size (20x15x5 cm), low peak consumptions (50W) and elevated reliability.</p> <p>Furthermore, a powerful software was developed to control the temperature which allows high precision measures. Noise level is reduced to minimum thanks to the low heating current (4A peak).</p>

TECHA

Artemis is the first real portable thermoluminescence system, able to help, directly on the field, archaeologists, geologists and art historians.

Persephone is a full-scale instrument for luminescence analysis, both thermally and optically stimulated, suitable for ceramic handiwork dating and Stratigraphy, Persephone was projected for Optically Stimulated Luminescence measurements (OSL). It consists in a high versatile instrument that thanks to the double stimulating system (optical and thermal) allows several kinds of measures, from a simple TL (Thermally Stimulated Luminescence) to a more delicate OSL. Moreover the flexible nature of the software makes Persephone unique in the study and characterization of luminescent materials. Mixed type measures (TL-OSL) are easily managed by the software that freely acts on the experimental conditions the sample is subjected to (temperature and stimulating wavelength). Eurydice is the solution for the determination of Uranium and Thorium concentration. This alpha decays meter, able to determine the annual dose of radiation absorbed by the sample, + combines a reliable phototube power supply unit with a modern electronics for photon counting. A voltage digital control and a smart control software make the use of this instrument extremely comfortable.

<b>Innovative aspects</b>	By using a new heating element, with a low power consumption, any temperature between room temperature to 500°C (at hi rate 500°C into 23 sec) can be guaranteed . The low power needed makes possible to have portable size instruments.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Sharp and fast temperature control.</li> <li>• Hi speed and accurate photoncounter system. The instrumentation uses a USB protocol to communicate data from/to PC.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC LOMBARDIA

## Technology Offer TO\_IT\_21596

[ ITALY ]

## Isolcell Italia Spa

www.isolcell.it

<b>Sector</b>	Controlled and generated atmosphere.
<b>Activities</b>	Manufacturer of showcases for museums exhibitions.
<b>Contact</b>	

<b>Title</b>	TECHNICAL MODULE FOR ATMOSPHERIC CLIMATIC CONTROL OF SHOWCASES
<b>Abstract</b>	An Italian company has designed and patented a module for atmospheric climatic control suitable for all types of exposition showcases. It is composed by a series of technical elements, which allow producing, managing and controlling temperature, relative humidity and preservation gas mixture, and can pull down thin/ultra-thin dusts and bacterial charge, guaranteeing the most suitable microclimate for the objects protection. In particular, the technology can be applied to Cultural Heritage Preservation. Partners are sought for development of further applications.
<b>Detailed description</b>	<p>Nowadays the market offers atmospheric control systems able to realise only passive controls and without the multiple function of humidifier, dehumidifier and air depurator.</p> <p>An Italian company's specific know-how in innovative controlled and generated atmosphere techniques and its continuous engagement in R&amp;D area led to the development of protecting technical modules that guarantee active control of atmospheric-climatic conditions.</p> <p>The items, developed to be customised for various exposition systems with showcases, have been conceived for an airtight environment, necessary in order to reproduce well-defined, constant and ideal protective atmospheric-climatic conditions. The basis of the protecting exposition modular system is a series of technical and mechanical devices that neutralise environmental thermal-hygrometric fluctuation on the objects preserved inside the showcase. The chemical/physical/biological parameters – those related to chemical compatibility with the displayed material – as well as the non-emission of VOC (volatile organic components) have been estimated. Moreover, the fact of being microbiologically aseptic, unassailable by xylophagous insects and not colonisable by microorganisms have also been taken into consideration.</p> <p>The module for atmospheric climatic control is composed of a unique functional block with reduced dimensions, mm 650 x 650 x 750 h, which can be inserted directly in the technical compartment of the showcase, suiting all types of exposition showcases and transforming the same into a protecting shield.</p>

	To sum up, the principal features are: air-conditioning, humidity regulation, control system, sensors and probes, atmosphere generation, breaking-down of thin and ultra-thin dusts, sterilisation device, oxygen extraction and nitrogen introduction, air filtering system, UV lamp for bacterial charges.
<b>Innovative aspects</b>	The module for atmospheric climatic control is able to guarantee the conservation of a controlled microclimate, which is very important for preservation of the objects. Temperature, humidity and air quality are actively controlled thanks to an integrated system that works as humidifier, dehumidifier and air depurator. The module transforms each showcase in an insurmountable protective barrier against biological agents, dusts, atmospheric pollution, oxidation and ageing.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Atmospheric climatic control with microclimate preservation;</li> <li>• Suitability to all types of showcases and display windows.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted. Italian patent granted and PCT application.
<b>Application domains</b>	Museum, showcases factory, library, architect.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, Cultural bodies.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRENE

Technology Offer TO\_FR\_22006

[ FRANCE ]

## Laboratoire d'Etudes et de Recherches sur les Matériaux (LERM)

www.lerm.fr

<b>Sector</b>	Characterization of material components and non-destructive diagnostics.
<b>Activities</b>	Diagnostic analysis for conservation, new materials and treatment processes.
<b>Contact</b>	

<b>Title</b>	NON-DESTRUCTIVE TESTS AND LABORATORY ANALYSIS FOR BUILDING AND MATERIAL PATHOLOGIES
<b>Abstract</b>	A french independant laboratory realizes surveys about pathologies of Building and materials used in historic buildings and offers conservation treatments and application procedures (Polychromies and wall paintings) by means of analysis technical and scientific expertise combination: non-destructive tests and laboratory analysis (physical tests, microstructure, chemical analysis).
<b>Detailed description</b>	<p>Main activities:</p> <ul style="list-style-type: none"> <li>• Control and characterization of materials used in construction: raw material, binder, cements, aggregates, building stones, rocks and sols, varying additions,...;</li> <li>• Expert advice and diagnosis : materials and buildings pathologies survey, advice to reparation (materials durability, technic choices, conservation, restoration,...) bibliographic survey,...;</li> <li>• Technical assistance and advice: preconisation of treatment solutions, restoration building site coaching, operation estimation,...;</li> <li>• Research department: materials durability, new binder, ancient buildings treatment.</li> </ul> <p>The laboratory uses the following techniques:</p> <ul style="list-style-type: none"> <li>• Non-destructive tests: geophysical radar, pachometer, electrodes potential measures, corroding measures, humidity tests,...;</li> <li>• Physical tests: quality control and performances tests, durability tests (salts sensibility, frost sensibility) ...;</li> <li>• Microstructure: image analysis, scanning electronic microscopy (SEM), optic microscopy, X ray diffractometry,...;</li> <li>• Chemical analysis: mineral quantification et proportioning, ionic chromatography, thermic analysis,...).</li> </ul>

<b>Innovative aspects</b>	This global approach (Non-destructive tests, Physical tests, Microstructure, Chemical analysis) is an innovative and specific aspect in Cultural Heritage and historic buildings. The use of non-destructive tests in historic building is also quite innovative. The french laboratory is constantly developing specific equipment by its own research development (geophysic radar, electric capacimetry, thermography,...).
<b>Main advantages</b>	Global approach for analysis in Cultural Heritage.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Construction technology; Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Architects, restorers, public services, materials industry, other research organisation, all firms involved in Cultural Heritage.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	MedIN (French Mediterranean)

## Technology Offer TO\_IT\_21940

[ ITALY ]

## Menci Software Srl

www.menci.com

<b>Sector</b>	Archeology, architecture, cultural heritage documentation and monitoring.
<b>Activities</b>	Software production and photogrammetry.
<b>Contact</b>	

<b>Title</b>	PHOTOGRAPHIC TRIDIMENSIONAL SCANNING TILL MICROMETRIC SCALE FOR CULTURAL HERITAGE MEASURE MONITORING
<b>Abstract</b>	ZScan is a system due to generate a cloud point using digital camera: include hardware and software.
<b>Detailed description</b>	<p>The system allows to acquire digital image triples through a calibrated reflex camera that scrolls on a precision calibrated slider bar.</p> <p>The system allows point cloud generation of objects represented into an image triple, without any control point or well-known measurements. Ther system is characterized by geometric and chromatic point cloud accuracy and above all by using easy and by components hardiness.</p> <p>Menci realize and commercialize software and hardware kit.</p>
<b>Innovative aspects</b>	<p>Zscan generates cloud points without laser scanner.</p> <p>Everybody can operates with success; time and special skills saving thanks to ZScan user friendly interface.</p>
<b>Main advantages</b>	<p>No other direct measure needed on Cultural Heritage.</p> <p>No other instrument needed for metric survey.</p> <p>Easy to use and to carry everywhere.</p> <p>No electrical battery needed.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).



**Application domains**

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Measurement methods.  
Archeology, Architecture, Cultural Heritage Documentation and Monitoring.

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**Collaboration details****Type of partner sought**

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Industry-Academy-Research Organization.

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**Tasks to be performed  
by the partner sought****IRC Partner**

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IRC RECITAL

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## Technology Offer TO\_IT\_22568

[ ITALY ]

## Politecnico di Torino, Dipartimento di Scienza dei Materiali e Ingegneria Chimica (DISMIC)

www.dismic.polito.it

<b>Sector</b>	Research, materials science and electronics.
<b>Activities</b>	Corrosion mechanisms, innovative materials for corrosion and protection of metallic artefacts and low pressure plasma coatings for protection of cultural heritage.
<b>Contact</b>	

<b>Title</b>	HAND HELD IMPEDANCE MEASUREMENT SYSTEM FOR METALLIC ARTEFACTS
<b>Abstract</b>	A new impedance measurement system for non-linear devices that exhibits a seven decade range and works down to 0.01 Hz frequency has been realized. The system is designed to be suitable for electrochemical measurements so that it can work with a few millivolt stimuli still compensating electrochemical voltages of several volts, but the proposed architecture can be employed in many other fields where a flexible signal generation and analysis is required.
<b>Detailed description</b>	The system employs an unconventional signal generator based on two PWM oscillators and an autocalibration system that allows uncertainties of less than 1% to be obtained over a range 10 <sup>-1</sup> to 10 <sup>3</sup> . A synchronous demodulation processing allows the noise connected to the low amplitude employed signals to be greatly reduced. The proposed system is able to work both as a stand-alone device or in connection with a personal computer. In this latter case, thanks to the internal architecture, the personal computer can set almost any parameter, has access to the raw acquired data and can implement new data processing and analysis.
<b>Innovative aspects</b>	The DSP based architecture give power users the ability of remotely controlling all the instrument operations to enhance the range of applications, while still leaving a simple operation mode for ordinary users.
<b>Main advantages</b>	Several techniques can be used to carry out these tests as well as to investigate the corrosion conditions of the surface. Examples of techniques include Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Raman Infrared Spectroscopy (RIRS), Fourier Transform Infrared Spectroscopy (FTIR), and Electrochemical Impedance Spectroscopy (EIS). This last technique is the only that can be carried out in the field with compact and portable instruments.

Current state of development

Intellectual Property Rights

Application domains

Collaboration details

Type of partner sought

Tasks to be performed  
by the partner sought

IRC Partner

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Secret know-how.

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Measurement methods.

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Research organization.

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ALPS IRC

## Technology Offer TO\_IT\_22462

[ ITALY ]

"Sapienza" Università di Roma, Dipartimento di Chimica

www.chem.uniroma1.it

<b>Sector</b>	Research in the chemical field.
<b>Activities</b>	Chemistry applied to cultural heritage.
<b>Contact</b>	

<b>Title</b>	ASPECIFIC IN SITU ANALYSIS OF SOLUBLE SALTS
<b>Abstract</b>	Two different prototypes for a non-specific "in situ" analysis of soluble salts were developed, both based on a conductivity measure. Two different prototypes differ in the extraction procedure. The main advantage bases on the noninvasive-nondestructive nature of the analysis. In order to optimize the instruments, is needed a support from industries.
<b>Detailed description</b>	Both the two prototypes couples an extraction system, that is different in the two cases, with a conductivimeter as detector. The first extraction system consists of a silicon pad hosting a japanise paper sheet; a peristaltic pump let distilled water to flow on the paper that is in contact with the wall to be investigated and reach the detector. A commercial software, suitably depicted, allows to obtain on a PC a curve indicative of the salts content. The engineering of the two prototypes can be improved as well as the pad composition.
<b>Innovative aspects</b>	The presence of soluble salts in stone materials causes aesthetic and structural damage. At present their analysis foresees an invasive-destructive method consisting in a sampling by coring and in the successive ionic chromatographic (IC) analysis to be performed in a laboratory after an extraction procedure. The proposed instruments allows to perform a noninvasive-nondestructive "in situ" analysis even if nowadays it can be applied only on materials in a good conservation state. By the proposed method we cannot "in situ" identify the single salts but the samples can be collected and, when a risk situation is evidenced, analyzed in lab. More, the classic procedure gives information on the stratigraphic position of the salts while in our case an evaluation can be done but a systematic study is needed in order to correlate such data with one or more indexes from the signal curve.
<b>Main advantages</b>	All the advantages are bound to the noninvasive-nondestructive nature of the procedure; so a

statistically significant view of the conservative state of the investigated object can be obtained in a relatively short time as each measure requires no more than 30 minutes. The application of the classical method surely require a longer time to attain the same results and overall cannot be applied in the case of Cultural Heritage as a statistical sampling is not compatible with the need to drill everywhere and to left too many holes. A map of the "risk zones" can be used in order to reduce the lab analysis. Both the prototypes are cheap and enough simple to use; their use involve no risk for the worker and for the investigated object as only distilled water must be used.

<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc) running research.
<b>Application domains</b>	Measurement methods. The two prototypes can be of interest in the field of the building trade and Cultural Heritage.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industries, instrument manufacturers, rubber producers.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_21969

[ ITALY ]

"Sapienza" Università di Roma, Dipartimento di Energetica

[www.uniroma1.it/energ](http://www.uniroma1.it/energ)

<b>Sector</b>	Archaeometry.
<b>Activities</b>	Development and validation of non-invasive in situ analysis to study cultural heritage.
<b>Contact</b>	

<b>Title</b>	DETECTION OF TOPOGRAPHICAL FEATURES OVER WIDE AREAS USING A SHEAR-FORCE MICROSCOPE
<b>Abstract</b>	A research group of the "Sapienza" University of Rome, in collaboration with the CNR Institute has developed a device for detecting topographical features of an almost flat surface of several square centimetres using a modified shear-force microscope. A prototype has already been tested successfully. The instrument can be used for several applications in the fields of Cultural Heritage, microelectronics, micromachining, etc. The research group is looking for technical and commercial agreement.
<b>Detailed description</b>	<p>Getting the 3D topographic image of a surface is very important for:</p> <ul style="list-style-type: none"> <li>• the measuring of a surface roughness;</li> <li>• the recognition of the form of traces left by tools used in the manufacture of the surface;</li> <li>• to highlight figures and shapes that are not recognisable with the naked eye.</li> </ul> <p>The instrument necessary to get a topographic image of a surface is called profilometer. A profilometer is a measuring instrument for surface's profiles, in order to quantify its roughness. The vertical resolution is usually in the nanometre level, though lateral resolution is usually poorer. Microscopic topographic measures are performed by very fine instruments such as Scanning Tunnelling Microscopes or Atomic Force Microscopes.</p> <p>Large surfaces measures are performed by contact profilometer (a device similar to a phonograph that measures a surface as the surface is moved relative to the contact profilometer's stylus) or optical profilometer that are a non-contact method for providing much of the same information as a stylus based profilometer.</p> <p>A research group of the "Sapienza" University of Rome has developed a profilometer for large surfaces modifying a shear force microscope.</p> <p>This instrument is composed by three dc precision motors that move the sample holder: two of them perform the surface scanning and the third one performs the vertical motion. The latter is stopped when the sensor tip experiences a sufficiently high shear force before touching the sample</p>

surface. The horizontal scanning is controlled by software either for scanning a microscopic surface with very high resolution or for scanning wide surfaces.

A prototype has been tested successfully. During the test the research group have observed images of a few square millimetres whose height was 2 mm from the surface of the object scanner.

<b>Innovative aspects</b>	<ol style="list-style-type: none"> <li>1.The instrument use the atomic shear-force sensivity to bring the point of the instrument to the surface;</li> <li>2.The instrument does not touch the surface like optical profilometers do;</li> <li>3.For microscopic surfaces (<math>\mu\text{m}^2</math>) the sensivity of this instrument is less than 0.1 micron for vertical and horizontal resolution;</li> <li>4.For large surfaces (<math>\text{mm}^2</math> or <math>\text{cm}^2</math>) the vertical resolution is in the micron level.</li> </ol>
<b>Main advantages</b>	The instrument here offered is very useful in the field of Cultural Heritage where it's very important that every analysis of the object is done without destructive techniques. With respect to other topographical instruments, the device proposed has the advantage of i) scanning a wide area; ii) no contact between the surface and the device tip, iii) excellent vertical resolution; iv) very good lateral resolution.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc). The technology was developed from academic research. The research group is considering the possibility of patent this technology.
<b>Application domains</b>	Materials technology; Measurement methods. The profilometer was designed to draw with nanometric precision a profile of a surface (plain) of an object with a size of several tens of $\text{cm}^2$ in order to highlight almost disappeared traces from drawings or from corrosion, as on coins.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Companies interested in technical and commercial development.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22266

[ ITALY ]

## SiTI

www.siti.polito.it

<b>Sector</b>	Highly strategic and innovative projects supporting economic development, environmental safeguarding, sustainability and quality of life.
<b>Activities</b>	Professional advice and technical support for preservation, conservation and valorisation of historical heritage.
<b>Contact</b>	

<b>Title</b>	INNOVATIVE MONITORING SYSTEMS FOR THE SAFETY OF CULTURAL HERITAGE
<b>Abstract</b>	Innovative monitoring systems for the safety of Cultural Heritage.
<b>Detailed description</b>	A non profit research Institute in Northern Italy is performing applied research in the field of Security and safety of Cultural Heritage, with special focus upon innovative technologies (sensors and data loggers), detection networks, indoor safety, transport safety for temporary exhibitions, smart cases, and remote on-line control centres.
<b>Innovative aspects</b>	Remote, on-line monitoring centres for museums and temporary exhibitions. Safety solutions for the transport of Cultural Heritage. Wireless sensor networks. Sensors. Intergration. Safety risk reduction.
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Information processing, information systems; Measurement methods venture agreement; Other.
<b>Collaboration details</b>	



Type of partner sought

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Industries (SMEs as well), research organisations, end users for field tests.

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Tasks to be performed  
by the partner sought

IRC Partner

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ALPS IRC

## Technology Offer TO\_IT\_22248

[ ITALY ]

## Società Italiana Biotecnologie (SIB)

www.societaitalianabiotecnologie.it

<b>Sector</b>	Safety, environment and biodegradation.
<b>Activities</b>	Studies and prevention of works of art by microbial biodegradation.
<b>Contact</b>	

<b>Title</b>	SOFTWARE AND WEBSITE FOR RAPID DIAGNOSTIC OF MICROBIAL BIODETERIORATION OF CULTURAL PROPERTY
<b>Abstract</b>	An Italian SME has acquired a relevant experience in the field of environmental microbiology, thanks also to collaborations and study with scientific research bodies (universities, CNR, EMPA) and technical-scientific know-how for the specific microbial Biodeterioration of Cultural Property. The company developed a Software and website for rapid diagnostic of microbial biodeterioration of Cultural Property and it is seeking partners with whom to develop scientific research programmes for the 7 Framework Programme in the field of Cultural Heritage, seek private (commercial) partners for the development and promotion of the website and rapid diagnostic system in other areas of Europe; it is also looking for end-users interested in utilising the software.
<b>Detailed description</b>	The company has committed over the past five years resources, human and financial, where, assisted by major Research Institutes and University Departments, has gained a unique experience in the field that make them privileged under the protection of Cultural Heritage. The company realized and patented an innovative rapid diagnostic system for the prevention of microbial biodeterioration of Cultural Heritage.
<b>Innovative aspects</b>	Portal developed <a href="http://www.biodeterioramento.it">http://www.biodeterioramento.it</a> besides containing a vast technical database for specific theme, contains the diagnostic system which rapidly, through the insertion of three environmental parameters, is able to give an overview about the likely biodeteriorants present on the work of art.
<b>Main advantages</b>	The Biodeterioration of works of art still remains an issue that is still very basic given the extreme difficulty of obtaining the data and the difficulty of sampling techniques isolation and identification microbial growth. The diagnostic system developed can be useful in the process of prevention and restoration, the diagnostic system that also may be calibrated in a specific-site to obtain information very close to reality of the state of art-work.

Current state of development	
Intellectual Property Rights	Copyright protected.
Application domains	Measurement methods.
Collaboration details	
Type of partner sought	Seek European partners with whom to develop scientific research programmes for the 7 Framework Programme in the field of Cultural Heritage, seek private (commercial) partners for the development and promotion of the website and the rapid diagnostic system in other areas of Europe; end-users interested in utilising the software.
Tasks to be performed by the partner sought	
IRC Partner	IRC IRIDE

## Technology Offer TO\_IT\_22478

[ ITALY ]

## SRS Engineering Design Srl

www.srs.it

<b>Sector</b>	Software development and system design.
<b>Activities</b>	Software development for the detection of changes in physical parameters.
<b>Contact</b>	

<b>Title</b>	RELIABLE MONITORING SYSTEM FOR THE DETECTION OF CHANGES IN PHYSICAL PARAMETERS
<b>Abstract</b>	An italian engineering company specialized in software development and system design has developed a user-friendly, reliable monitoring system to be placed on works of art and archeological site, able to detect changes in physical parameters such as temperature, humidity, solar exposition and vibration by using a remote control trough Internet, e-mail and portable phones. They are looking for technical co-operation and commercial agreement partners.
<b>Detailed description</b>	<p>The system detect changes in physical parameters of the object or archeological site by using sensors:</p> <ul style="list-style-type: none"> <li>• the system can monitor and record temperature and humidity changes and the data are remotely accessible in real time connecting to a dedicated website;</li> <li>• through eliophany sensors we can record solar radiation hours and collect different solar threshold;</li> <li>• with accelerometers located either on work of art basements or on holders during transport, the system is able to monitor natural and occurring vibration.</li> </ul>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• this innovative system can be managed for the whole data history display and real time statistical evaluation.</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• the system drive the heating, ventilation and air conditioning (HVAC) system using automatic logic and also allow remotely interaction with portable phones and Internet;</li> <li>• alarm signal can be remotely transmitted when the parameters exceed the forecasted ranges.</li> </ul>
<b>Current state of development</b>	

<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Materials technology; Measurement methods From Computer Software to Data Base and file managemet. In the field of Cultural Heritage this offers is applied in every application that need Remote monitoring of Physical parameters of an archeological site.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<ul style="list-style-type: none"> <li>• Companies that work in the field of Cultural Heritage.</li> <li>• Software house.</li> </ul>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22524

[ ITALY ]

## T&amp;T

<b>Sector</b>	Archaeological mapping.
<b>Activities</b>	Hyperspectral data for archaeological and environmental surveys.
<b>Contact</b>	

<b>Title</b>	LIDAR/HYPERSPECTRAL DATA FOR ARCHAEOLOGICAL AND ENVIRONMENTAL SURVEYS
<b>Abstract</b>	TTA, inc., a sister company to Tommasi & Tommasi S.r.l. Italy, developed with semitic Museum of Harvard University a patented system to extract undercanopy features for archaeological mapping from LIDAR data. The method leverages all the often disregarded secondary data delivered by the LIDAR, performing a multidimensional analysis and object classification in order to map all possible features, which are directly extracted as three dimensional, geo-referenced vectorial objects suitable for use in GIS or CAD.
<b>Detailed description</b>	<p>In order to reach a meaningful classification of the available data, we need to apply some filters, or anyway some kind of automatic interpretation. Beyond the traditional classification, which exploits various geometrical properties, first-last pulse difference, intensity value and so on, we need to perform a step further, enabling the system to comprise/conceive the data as a structure, thus allowing it to individuate further (manmade) substructures, which are our final aim.</p> <p>In principle we need to perform a topologic connection of the acquired points, in order to establish a spatial relation between the points and to do an analysis of relevant morphologic parameters of the 3D structured dataset. A subset of filters derived from the traditional approach have also been implemented, especially the smart flagging of vegetation points, which takes place considering both first-last instances and topologic connections. Next the possible discontinuity are identified and classified in terms of probability, discontinuity grade, 3D orientation, extension, left and right side morphologic characterization and so on.</p> <p>This approach leads to a generalized model, featuring in the same data structure three dimensional information as well as quantitative and qualitative data, which we called n-dimensional discontinuity space. Once the classification of the three dimensional discontinuities has been performed, the connection of the various discontinuities is computed in the n-dimensional parameter space, and this allows to find out features, intended both as longitudinally extended ones (like roads, paths, rails, rivers and so on) and self connected ones (buildings, perimetric walls, old structures, vestiges and so on).</p> <p>The n-dimensional approach, as opposed to the usual two or three dimensional, allows to simultaneously</p>

take into account  $n$  parameters to determine if there is an interconnection between a given set of discontinuity and, if so, its  $n$ -dimensional grade. In addition the availability of an organized, georeferenced, multidimensional data structure gives access to the user to multilevel database-like queries, whose outputs can be directly integrated into common GIS or CAD applications.

#### Innovative aspects

The added value delivered by this method lies in its ability to detect complex properties and assign meanings to acquired points based on the surrounding topology, i.e. by observing points not as single entities, and even not as part of a simple neighbourhood but as part of a whole object, the definition of which is found out by quantifying several parameters in the surrounding area through an ordered structure. This is performed using a peculiar combination of interconnective semantics. Depending on the required output data, one or more of the following algorithms can be used to produce the classification of the points. The strength and innovative trait of this method is that points are observed and treated as part of a structure, and not as single measured data; this enables to define an intrinsic semantic without the need to input a rigid library of shapes to be looked after. The feature following algorithm is specialized to identify entities based not only on the usual slope/aspect/intensity/color approaches but taking into account other characteristics: 3D discontinuity analysis, 3D vectorial skeletonization, 3D vectorial connection, 3D feature following, 3D neighbourhood analysis and final classification of the points belonging to the identified object. By mean of these capabilities, it is possible to pinpoint not only recognized entities, but also to deduct the presence of other – possibly buried – high probability areas, therefore delivering an exhaustive integration to any existing archaeological probability model. At the very end the use of an extensive high density survey in conjunction with an advanced processing system enables to accurately identify most probable areas and single objects, thus cutting down the field recognition times and costs.

#### Main advantages

By using the approach described above, it is possible to exploit LIDAR data at a new level, associating to each point not only the traditional classification flags, but also an handle to an object (or to a set of objects) which it belongs to, i.e. the extracted information doesn't concern single points, but produces object-wise data, far more suitable for the use in any GIS application (and for the data management in general) than the million of independent points of the acquired data cloud. This can be used, for example, to identify buildings, anthropogenic structures, roads, paths and ruins even if covered by canopy; since the classification process is not based on some rigid predefined criteria, it is able to deliver also a "soft" classification of objects and structures. This approach proves to be particularly interesting when used as an archaeological tool, since it detects also partially survived structures, ruins and all that isn't likely to be a natural object, in the end allowing the archaeologist to have the final word on whether to keep the identified object or not.

#### Current state of development

#### Intellectual Property Rights

Patent(s) applied for. Patented in 2006 (TTA and Semitic Museum, Harvard University) – Italy

#### Application domains

Materials technology; Information processing, information systems.

#### Collaboration details

#### Type of partner sought

1. Commercial/business partner. 2. Government/Regional Institution. 3. Academy/Research.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC IRENE

## Technology Offer TO\_IT\_22488

[ ITALY ]

## Tecno Futur Service Srl

www.tecnofuturservice.com

<b>Sector</b>	Investigations, diagnostic surveys, engineering support for static verifications and planning of restoration and consolidation.
<b>Activities</b>	Topographical and photogrammetric surveys; Geotechnical surveys; Chemical-physical and mechanical tests; Static and dynamic analyses on elements and/or structures; Static verifications.
<b>Contact</b>	

<b>Title</b>	DIAGNOSTIC ANALYSIS & ENGINEERING
<b>Abstract</b>	TecnoFuturService has for over 27 years been providing a global support service using the most advanced technologies:from preliminary fact-finding surveys to restoration and reinforcement projects to specific tests on installation techniques and test activities on structures. Our team of experts systematically works with professionals,public and private customers making use of a wide variety of diagnostic instruments. It boasts consolidated experience in the historical, archeological, geophysical and structural sectors and is supported by a chemical/physical/mechanical analysis laboratory.
<b>Detailed description</b>	TecnoFuturService srl operates in Italy through various operating centres that provide local technical service in specific activities, such as site inspections, specialised assistance in planning geognostic surveys, drawing up special specifications, metric calculations, technical service during diagnostic surveys, engineering support for static tests and planning of restoration and reinforcement operations. Over the past 25 years we have operated to support our customers with surveys, geognostic surveys, non-destructive tests, monitoring, laboratory tests, static tests and modelling in civil building (restructuring, scedule maintenance, emergency operations, post earthquake events, building dossiers), industrial buildings (structure salvage, building conversion for different use, technical inspections and tests), monuments (salvage and restoration of archeological, architectural and artistic works).In particular, we have developed an expertise on monitoring the state of conservative wooden structures and test injection mixture consolidating in the masonry.
<b>Innovative aspects</b>	With respect to investigations on wooden structures have developed a technique, using different analysis and testing, we can monitor the status of all conservative wooden structural components. With regard to the tests of injection mixture in consolidating walls have developed different technologies to measure the absorption of malta consolidating in a cubic metre of the wall and then



	outline a qualitative classification to optimize the intervention of consolidation also from an economic standpoint.
<b>Main advantages</b>	Our techniques are intended to provide, through non-invasive investigations, the basic design parameters of the recovery and restoration of the structures and to optimize the assessment of the economic burdens have for the next intervention.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Construction technology; Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Academy, research organisations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRENE

## Technology Offer TO\_IT\_22454

[ ITALY ]

## Tomogea Srl

www.tomogea.it

<b>Sector</b>	Advanced geo-physical solutions.
<b>Activities</b>	Diagnostics solutions for environment, geology and archeology.
<b>Contact</b>	

<b>Title</b>	ELECTROMAGNETIC NON-INVASIVE MEASUREMENTS FOR INVESTIGATING ENVIRONMENT AND CULTURAL HERITAGE
<b>Abstract</b>	Tomogea S.r.l. is a spin-off Society of the CNR operating in the framework of non-destructive electromagnetic measurements applied to environment and Cultural Heritage. The suitable technologies are: Ground Penetrating Radar, Electrical Resistivity Tomography, Magnetic and Electromagnetic methods. These technologies and their possible combinations allow to solve 2D and 3D diagnostic problems concerning, for the Cultural Heritage: the localisation of buried remains and the evaluation of the preservation state of the materials and structures; for the environment: the geometric reconstruction of the investigated subsoil, the description of a landslide body, the location of fault or other buried structure, etc. The partners sought are: industries, SMEs and public companies in order to adopt the technologies proposed.
<b>Detailed description</b>	Non-destructive electromagnetic methods use natural or artificial energy sources for investigating subsoil or structures. The energy source can be an electromagnetic wave (Ground Penetrating Radar), an electrical current (Electrical Resistivity Tomography) or a natural field (Magnetic Method). Magnetic method is based on the measure of the natural geomagnetic field onto the ground surface. In fact, geomagnetic field is not uniform but presents some variations named "magnetic anomalies" depending on the composition of the underground. Then, buried remains can be located starting from its related magnetic anomalies. Modern caesium sensors allow to map the geomagnetic field of the area of interest with a sensitivity of 0.01 nT. This consent to detect a large class of objects as well as buried metals and fragments of pottery, buried walls, cavities, tombs, kilns, foundations of huts and even pile holes and ancient ploughings. Electromagnetic (EM) method measures ground conductivity by the process of electromagnetic induction. The system consists of transmitter and receiver coils spaced at standard configurations. The transmitting coil outputs a primary electromagnetic field which in turn induces a secondary field in the ground. The receiving coil measures both the magnitude of the secondary field (quadrature component) and the ratio between

the primary and secondary fields (in-phase component). Quadrature fields are proportional to ground conductivity, which is sensitive to bulk changes in lithology, groundwater or ground contamination. Metal produces strong secondary fields making the in-phase component useful for finding buried metal targets. Ground Penetrating Radar (GPR) uses a transmitting antenna to send a pulsed signal into the ground or into an object and a receiving antenna to receive the echoes reflected to the interfaces. The time elapsed between a transmission and a reception allows to locate an embedded object. The GPR method uses several antennas to adapt the frequency to the dimensions of the target or penetration depth: high frequencies are useful for small targets; low frequencies ensure a good penetration depth. Then, the GPR is a very flexible method: it can be used in combination or in substitution of Magnetic method to locate buried remains but also in the non-destructive structural controls interesting a large class of objects like walls, floors, frescoed walls, columns, etc. Special survey designs allow to obtain 3D acquisitions. Electrical resistivity tomography (ERT) is a geophysical technique for imaging sub-surfaces structures from electrical measurements made at the surface by means of iron still electrodes. It is closely related to the medical imaging technique electrical impedance tomography (EIT), and mathematically is the same inverse problem. Varying the electrode spacing is possible to perform acquisitions with different spatial resolutions which ranges between a few centimetres and hundreds of meters. Recently, the use of medical electrodes allowed to apply this technique onto valuable objects. This technology can be used for detection of buried objects or for structural controls in 2D and 3D configuration.

<b>Innovative aspects</b>	The combination of different non-destructive electromagnetic techniques is very important to study some complex phenomena. Actually, the integration of methodologies allows to overcome the gaps and the critical aspects characteristics of each method. Moreover, it is always possible to perform a multi-sensing, multi-scale, multi-resolution, multi depth survey.
<b>Main advantages</b>	All techniques allow fast and absolutely non-intrusive surveys. These technologies can be easily integrated with classical in-field approaches allowing a reduction of the land reconnaissance time and an increase of the investigated area. Moreover, for the archaeological investigations, they provide fast data directly verifiable by excavation tests. All techniques can be applied also for non-destructive structural controls on a large class of objects in order to provide accurate images of their inner state.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, SME, Public Companies.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22180

[ ITALY ]

## Università degli studi di Bari, Dipartimento Interateneo di Fisica "Michelangelo Merlin"

www.fisica.uniba.it

<b>Sector</b>	Research on the application of laser innovative technologies.
<b>Activities</b>	Diagnostic of cultural heritage by $\mu$ -Raman spectroscopy, FT-IR spectroscopy, X-ray fluorescence (XRF) and laser technologies for the restoration of cultural heritage.
<b>Contact</b>	

<b>Title</b>	LASER INNOVATION IN ARTWORKS CONSERVATION AND EDUCATION (LIACE)
<b>Abstract</b>	<p>The application of the laser to Cultural Heritage field represents a significant example of the cooperation of originally distant worlds, as the conservation, the basic research and the industry of advanced technologies, that find a field of common interest and cooperate to produce innovative methodologies and instrumentations of practical and advantageous use in diagnostic and restoring procedures.</p> <p>At the Physics Department of the University of Bari there are the following research lines on the application of laser innovative technologies on the Diagnostics and Restoration of Cultural Heritage:</p> <ol style="list-style-type: none"> <li>1. Diagnostic of Cultural Heritage by <math>\mu</math>-Raman spectroscopy - FT-IR spectroscopy, X-ray Fluorescence (XRF);</li> <li>2. Laser technologies for the Restoration of Cultural Heritage.</li> </ol>
<b>Detailed description</b>	<p>At the Physics Department of the University of Bari there are the following research lines on the application of laser innovative technologies on the Diagnostics and Restoration of Cultural Heritage:</p> <ol style="list-style-type: none"> <li>1. Diagnostic of Cultural Heritage by <math>\mu</math>-Raman spectroscopy - FT-IR spectroscopy, X-ray Fluorescence (XRF);</li> <li>2. Laser technologies for the Restoration of Cultural Heritage.</li> </ol> <p>1. Diagnostic of Cultural Heritage by <math>\mu</math>-Raman spectroscopy, FT-IR spectroscopy and X-ray Fluorescence (XRF)</p> <p>In this research line we carry out, by <math>\mu</math>-Raman spectroscopy, FT-IR spectroscopy and X-ray fluorescence (XRF), detailed studies of pigments used on various types of art-historical artefacts such as manuscripts, gems, paintings, icons, polychrome sculptures. In the recent past, this study focused on paintings of historic and artistic value, on different substrates (wood, canvas, frescoes and other). The analysis includes in situ measurements, using portable instrumentation. The scientific characterisation of these artworks requires the identification of chemical species and</p>

the complete classification of the used pigments. This classification is done through study of vibrational Raman spectra, Fourier transform IR spectra and XRF spectra.

Among others, have been carried out studies on the Crucifix of San Pio (San Giovanni Rotondo), on thirteenth century icons, twelfth century wooden paintings and very important Frederic II period ceramics including the only mosaic card of Castel Del Monte, as well as various artworks of historical and artistic value.

## 2. Laser technologies for the Restoration of Cultural Heritage

In this research line we carry out studies to evaluate the application of innovative laser technologies to the restoring of different artistic finds: stone, wood, ceramic, metal. The aim is to identify the optimal parameters for laser radiation to safely remove the degradation layers from the artworks. Particularly for the stone materials we are studying the application of lasers for the removal of graffiti, colored synthetic systems whose purpose is to be visible (bright, fluorescent and therefore highly reflective) and especially indelible. The research has a great interest at international level because of the many problems related to the removal of graffiti without causing any damage to the substrate. The study covers different Apulian stone substrates and multiple types of spray dyes. This research implies the use of different Nd:YAG laser systems: Short Free Running ( $t = 40 \text{ ns} \times 100 \text{ r s}$ ), Q-Switch ( $t = 8 \text{ ns}$ ) and Normal Mode ( $t = 120 \text{ r s}$ ,  $300 \text{ r s}$  and  $500 \text{ r s}$ ).

In the field of the restoring of metallic artworks, there is a new laboratory on innovative laser technologies, equipped with three Nd:YAG laser sources, at the Diocesan Museum of Bisceglie (BA), which deals with micro-welding, cleaning and classification by laser marking of precious metallic finds.

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### Innovative aspects

### Main advantages

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In the conservative restoring of Cultural Heritage, the cleaning is a difficult and irreversible operation, that represents the moment of interaction with the surface that can modify its equilibrium, it is an intervention oriented to recover the artwork's readability. All the existing cleaning methods (methods with the use of the only water, mechanical methods and chemical methods) have negative collateral consequences. Considering that the traditional restoring operations are valid, the laser advantages can be schematized as follows:

- minimum invasivity: it isn't necessary to use chemical products and abrasive materials. That allows to treat extremely fragile structures in advanced alteration state. In these cases the cleaning can be carried out before the consolidation;
- high control level: the removal of the deterioration layer takes place progressively interesting a few micron thicknesses for impulse. The operator controls directly the laser action and he/she can interrupt the cleaning at whichever level;
- high precision: the cleaning process interests only the area that is illuminated by the laser; this area can be made small as one wishes. The use of optical fibres for the transmission of the laser radiation allows furthermore to treat also complex surfaces;
- selectivity: the different absorption of laser radiation by materials, dependent on their peculiar optical properties, can be used to make the laser cleaning highly selective. This is perhaps one of the most qualifying aspects of the laser technique. In fact, selecting opportunely the radiation parameters, it is possible, for example, in the case of black crusts, to obtain an efficacious removal of alteration layer, that stops automatically when the brighter substrate, characterized by different optical properties, comes to light.

For the Diagnostic, the use of laser radiation in the *r*-Raman spectroscopy allows directly the molecular identification of the artwork's pigments, with a not-invasive approach. Furthermore, it offers the possibility of carrying out the analysis in situ with portable spectrometers. These analysis are very important for a correct restoring operation of artworks.

Current state of development	
Intellectual Property Rights	Copyright protected.
Application domains	Materials technology; Measurement methods.
Collaboration details	
Type of partner sought	Industry, Academy, Universities, Research organisations, Superintendents of Cultural Heritage, Museums and Cultural Associations.
Tasks to be performed by the partner sought	
IRC Partner	IRC IRIDE

Technology Offer TO\_IT\_22527

[ ITALY ]

Università degli studi di Firenze, Dipartimento di Ingegneria  
Civile e Ambientale (DICEA)

[www.dicea.unifi.it](http://www.dicea.unifi.it)

**Sector** Civil and environmental engineering.

**Activities** Monitoring systems.

**Contact**

<b>Title</b>	EARLY-WARNING MONITORING SYSTEM
<b>Abstract</b>	A methodology for a real-time threshold monitoring of the thermoelastic behavior of cracked domes is proposed as a tool for an early warning. By using wavelet analysis of the thermoelastic energy, one is able to detect rare events, in particular the occurrence of anomalous displacements. Distinction with instrumental errors is pointed out. Application to Brunelleschi dome in Florence has been done.
<b>Detailed description</b>	Monumental structures that have a particular historical, cultural importance could be embedded with a monitoring system when they present a warring crack pattern. Usually these structures present a normal behaviour represented by cracks movement around a fixed value, a movement induced for example by temperature variations, that represent a reversible phenomenon. In order to check in real-time that no dangerous deformations (as a anomalous crack opening) is passing, due for example to restoration works, a threshold monitoring is here presented. Anomalous signals can arrive also because of a malfunction in the acquisition system; in this case also temperature signals would be irregular. A methodology in which alarm signal is give only when deformation signals (not due to acquisition errors) has been studied with a particular application to Brunelleschi dome.
<b>Innovative aspects</b>	Early-warning methodology based only on displacements and temperatures acquisitions. Use of wavelet analysis on thermoelastic potentials to detect isolated events. Alarm signal is given only for anomalous displacement values not in case of acquisitions problems.
<b>Main advantages</b>	Real-time monitoring of structures. Particular applicability in case of restoration works in order to give an alarm signal that could avoid causalities.
<b>Current state of development</b>	



Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	Measurement methods.
Collaboration details	
Type of partner sought	Industry, research organization.
Tasks to be performed by the partner sought	
IRC Partner	IRC RECITAL

## Technology Offer TO\_IT\_22270

[ ITALY ]

## Università degli studi di Napoli Federico II, Dipartimento di Progettazione Urbana e di Urbanistica

www.innova.campania.it

<b>Sector</b>	Research and technology transfer.
<b>Activities</b>	Research in the field of architectural heritage conservation.
<b>Contact</b>	

<b>Title</b>	MOBILE LABORATORY FOR SAFETY, CONSERVATION AND PROMOTION OF THE ARCHITECTURAL HERITAGE
<b>Abstract</b>	A flexible, modular vehicle, energetic autonomous, able to accommodate and facilitate the use of instruments needed for analyzing and monitoring soils and the architectural heritage. Able to change, with simple manual operations, its own configuration with a considerable increase in useable space so as to facilitate the many activities to be performed in situ, in different weather and environmental conditions.
<b>Detailed description</b>	<ul style="list-style-type: none"> <li>• flexible and modular vehicle for the analysis and the monitoring of soil and historical and archaeological heritage;</li> <li>• four-wheel driven truck (designed for both on-road and off-road use) with a fibreglass chassis;</li> <li>• tows a single axle trailer equipped with a diesel generator unit;</li> <li>• divided into three areas: a reception and storage area, a laboratory and a sleeping compartment for two people. An air conditioning system services the laboratory area (23 C with a relative humidity of 60% for an ambient temperature of 40 C, relative humidity 100%);</li> <li>• car generator + 2 x 100 ampere-hour batteries + 1 x 3kWh mixture generator + 1kWh photovoltaic system on spoiler and cabin roof;</li> <li>• dimensions during transport (net of guide cabin): 4.5 m x 2.2 m (about 10 mq);</li> <li>• dimensions in use: 4.5 m x 6.2 m (about 17 mq);</li> <li>• generally scheduled to be on-site for a period of several months to several years: the unit arrives on-site with all the instrumentation and other facilities installed, ready to meet different analytical needs.</li> </ul>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• minimal space during transport;</li> <li>• maximum space in use;</li> <li>• energetic autonomous, equipped with different systems able to generate the necessary energy</li> </ul>

	<p>to realize the programmed activities;</p> <ul style="list-style-type: none"> <li>• small sized structure, easily used in different contexts;</li> <li>• equipped by a traction system both for urban roads and archaeological sites;</li> <li>• dimensioned to allows the introduction, within the equipments of general employment, also those useful to activities in case of need;</li> <li>• variable configuration structure that can be modified during the use;</li> <li>• equipped with elevators systems able to catch up with photos or videos kit or directly with an operator.</li> </ul>
<b>Main advantages</b>	<p>A small easily transportable structure, of easy access in various building contexts: equipped with a traction control system, allowing it to be moved in various soil conditions; from road to archaeological site. The right size to accommodate not only commonly used equipment, but also what is deemed indispensable on each occasion for in situ activities. Variable configurations allowing it, if necessary, its own volume to be extended from its transport phase to the operative phase; can be equipped with elevator systems to be able to reach, with cameras or directly with an operator, normally inaccessible heights. Autonomous in terms of energy, being equipped with systems to generate energy requires for carrying out all planned activities.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Construction technology. Useful to Public Administration in research, rehabilitation and conservation works on the architectural heritage. It can be used also by the Red Cross (mobile operating room, first aid, etc.), Civil Protection (refectories, coordination and information station, etc.), Army (command module, mobile offices, etc.), playtime and sport competitions.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Automotive industry.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22503

[ ITALY ]

Università degli studi di Padova, Dipartimento di Innovazione  
Meccanica e Gestionale (DIMEG)

www.dimeg.unipd.it

Sector Research on materials sciences.

Activities Metallurgy diagnostics.

Contact

## Title

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A LABORATORY NETWORK FOR A MULTIDISCIPLINARY ANALYTICAL AND TECHNOLOGICAL CHARACTERIZATION OF CULTURAL HERITAGE MATERIALS AND OBJECTS (LADIMO)

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## Abstract

An Italian university research group has developed a network of interdisciplinary laboratories and expertises focused on a complete characterization of potteries, metals, glass and stones by the close cooperation among material science and museum researchers. The research is aimed at improving the knowledge of Cultural Heritage objects and at investigating their degradation state in order to preserve and restore.

All the usual analytical (SEM-EDS, XRD, ICP, GDOS, XRF, PIXE) and spectroscopy (NMR, FT-IR, Raman, XPS) techniques are available in several labs, under the supervision of chemists, geologists, physics and engineers.

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## Detailed description

The proposed activity is based on the close cooperation among different researchers which are involved both in Cultural Heritage studies and in materials science studies for more than 10 years. The expertises and technologies include a metallurgical laboratory, a glass and pottery laboratory and a mineralogical laboratory. The laboratories are equipped with Optical (metallurgical and mineralogical) microscopies, sample preparation facilities, Scanning electron microscopy (SEM) with microanalysis (EDS-WDS), Electron probe (EPMA), X ray diffraction (XRD), Nuclear magnetic resonance (NMR), X photoelectron spectroscopy (XPS), Raman, FT-IR, gas-chromatography, and corrosion tests. Chemical analysis can be performed by absorption (AAS) and emission (ICP) spectroscopy by dissolution of about 100 milligrams and by XRF in a totally non-destructive way. A portable XRF is also available.

Each group has been involved in the field of Cultural Heritage studies for many years and the network of labs allows an interdisciplinary approach, which can be summarised for metals and potteries as follows:

- the chemical and microstructural characterization of metals and alloys gives information on technology of production (casting, mechanical working), joining process, heat and surface

	<p>treatment and degradation state;</p> <ul style="list-style-type: none"> <li>• the pottery characterization allows to determine the firing temperature and atmosphere (oxidation-reduction) and the mineralogical constituents.</li> </ul> <p>All the studies are performed and monitored step by step in close cooperation with museum researchers.</p>
<b>Innovative aspects</b>	<p>The innovative aspects of the network consist of. Multidisciplinary and consolidated expertises in material science; close cooperation among scientists and museum researchers, the availability of laboratory and portable instruments.</p>
<b>Main advantages</b>	<p>An interdisciplinary group and a network of laboratories equipped with the most important technologies and techniques for cultural heritage material studies.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Others (registered design, plant variety right, etc).</p>
<b>Application domains</b>	<p>Materials technology; Measurement methods.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Academy, museums, industry.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC IRENE</p>

## Technology Offer TO\_IT\_22219

[ ITALY ]

## Università degli studi di Parma, Dipartimento di Ingegneria Industriale

<http://cdm.unipr.it>

<b>Sector</b>	Structural integrity monitoring.
<b>Activities</b>	Inspection of health status of ancient buildings.
<b>Contact</b>	

<b>Title</b>	INSTRUMENTS AND NDT TECHNOLOGIES FOR THE STRUCTURAL INTEGRITY ASSESSMENT OF BUILDINGS
<b>Abstract</b>	<p>The knowledge of the health conditions of historical buildings is essential for their preservation and maintenance. In many Italian towns we all can admire churches, palaces and monuments sometimes older than one thousand years. Churches, masonry towers and bell towers are among the structures subjected to the higher risk, due to their age, elevation and low base area on height ratio. The interferometric radar, and laser Doppler vibrometer techniques, are non-destructive, non-invasive, non-contact technique applied to the monitoring of the structural integrity of historical buildings. This type of technique is therefore of great concern for the preservation of the cultural and artistic inheritance from the past.</p>
<b>Detailed description</b>	<p>Two instruments are currently used to monitor the dynamic response of structures (towers, churches, bridges). The microwave interferometer is a radar sensor able to simultaneously monitor the response of several points belonging to a large structure, providing for each point the displacement response. Here are given some operational characteristics:</p> <ul style="list-style-type: none"> <li>• Maximum operational distance (for minimum 40Hz sampling frequency) 500.00 m;</li> <li>• Maximum sampling frequency 100.00 Hz;</li> <li>• Displacement sensitivity (accuracy) 0.01 mm;</li> <li>• Operative weather condition: All.</li> </ul> <p>Another suitable, non-contact, instrument is one of the most modern available in the field of vibration measure and control, the Laser Doppler Vibrometer (LDV). The LDV technique significantly extends measurement capabilities with respect to traditional vibration sensors (such as accelerometers, strain gauges, etc.), as it allows remote non-intrusive, high spatial resolution measurements with reduced testing time and increased performances (high frequency up to 20MHz, velocity range of 730m/s, resolution of about 8nm in displacement and 0.5mm/s in velocity). Using a laser vibrometer simply as a single point transducer it is possible to perform accurate and flexible non-intrusive measurements.</p>

	The LDV at the University of Parma, laboratory of vibrations measurement, is a Polytec PSV300 single point axial laser vibrometer, since it measures only the component of the velocity along the laser line-of-sight.
<b>Innovative aspects</b>	The detection of damages in a structure by the modal analysis of its dynamic response.
<b>Main advantages</b>	Usage of a non-contact technique, direct and quick measurement, great accuracy, possibility of measuring from long distance.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, Ministerial Institution.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRENE

Technology Offer TO\_IT\_21588

[ ITALY ]

Università degli studi di Roma Tor Vergata, Dipartimento di  
Energia Meccanica

<http://mercurio.mec.uniroma2.it>

<b>Sector</b>	Design, manufacturing and testing of mechanical systems.
<b>Activities</b>	Infrared Thermography and Electron Microscopy to study the preservation state of parchment and paper-made artefacts.
<b>Contact</b>	

<b>Title</b>	STRUCTURAL INVESTIGATION OF PARCHMENT AND PAPER-MADE ARTEFACTS
<b>Abstract</b>	An Italian university research group has developed a new method for studying the preservation state of parchment and paper-made artefacts by Infrared Thermography and Electron Microscopy – in particular: analysis of the component materials, preservation state and degradation processes of the fibre microstructure related to the measured thermal properties variation. The partner should be either suppliers of artefacts or able to integrate the present method using other imaging diagnostics.
<b>Detailed description</b>	<p>The proposed method based on Infrared Thermography combined with Electron Microscopy provides a new non-destructive procedure for the quantitative assessment of the modern and historical parchment deterioration processes.</p> <p>The analysis of the thermal diffusivity along specific directions represents a new tool to assess the impact of aging on parchment, which is proved to affect the thermal transport properties.</p> <p>The method provides extended maps (thermograms) of the macroscopic defect distribution in a sample. Specific parts of the sample can be therefore pre-selected and, therein, the thermal diffusivity can be measured along different directions in the sample. This method can be also applied to other kind of fibrous structure (paper, wood, textile, etc.) where non-destructive evaluation would be required.</p> <p>The method is based on two different configurations of Infrared Thermography: the heat pulse and the lock-in ones, where pulsed and periodic heating, respectively, is generated in the sample by light absorption. The induced temperature variation of the sample can be smaller than 1 C.</p> <p>The application has been working for more than two decades in the field of thermal properties and photothermal techniques.</p>



<b>Innovative aspects</b>	<p>The innovative aspects of the proposed method consist of:</p> <ul style="list-style-type: none"> <li>• Having exploited the thermal transport properties measured along different sample directions as a new tool to quantitatively evaluate the deterioration processes in parchment;</li> <li>• Having developed Infrared Thermography configurations to perform the above-mentioned measurements on parchment in a non-destructive fashion;</li> <li>• Having combined results of Infrared Thermography with those of Electron Microscopy in order to correlate the behaviour of the thermal transport properties to the micro-scale damage evolution.</li> </ul>
<b>Main advantages</b>	<p>Advantages: the method is non-destructive and non-contact, providing depth-profile images of the buried structure. It is also relatively simple to adopt.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Secret know-how. The obtained results are exclusive of the present method and can be complimentary to the ones obtained with other integrated methods such as, for example, X-ray diffraction combined with transmission electron microscopy, etc.</p>
<b>Application domains</b>	
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>The sought deal is addressed mainly to academy, research organisation, parchment and paper preservation institutes, archives, libraries, museums, etc.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC CIRCE</p>

## Technology Offer TO\_IT\_21991

[ ITALY ]

Università di Cassino, Dipartimento di Meccanica, Strutture, Ambiente e Territorio, Laboratorio di Robotica e Meccatronica (LARM)

<http://webuser.unicas.it/weblarm/larmindex.htm> – [www.unicas.it](http://www.unicas.it)

<b>Sector</b>	Robotic systems.
<b>Activities</b>	Design and operation of robotic systems for restoration activities.
<b>Contact</b>	

<b>Title</b>	MECHANICS OF MANIPULATION AND INDUSTRIAL ROBOTIZATIONS TO CARRY OUT ARCHITECTURAL SURVEYS
<b>Abstract</b>	An Italian University research team: Laboratory of Robotics and Mechatronics (LARM) has developed the possibility of using mechanical systems and robots in restoration activities.
<b>Detailed description</b>	<p>The Laboratory of Robotics and Mechatronics (LARM) founded in 1990 at the School of Engineering of the University of Cassino has developed experience, teaching, and research in the fields of Automation, Robotics and Mechatronics with main focus on aspects of Mechanical Engineering. The activities of LARM are directed and available for collaborations in industrial and professional activity with the purpose to study, to plan, and to improve mechanical systems, with traditional and innovative types.</p> <p>The LARM team has the aim to investigate the design problems and operation feasibility of using mechanical systems and robots in restoration activity that usually is performed by human operators, even when the operations are repetitive or are carried out in unhealthy environment. Tasks that cannot be performed by humans, will be considered for innovative solutions too. The activity will be focused in the integration of design problems and solutions for the many aspects of restoration activity of goods of different scales. The engineering activity will be finalized to the construction and testing of automatic mechanical systems and robots that can be used by no-roboticists in doing jobs in historical sites with suitable autonomy and supervisor levels. The design and operation of robotic systems will be developed in collaboration with architects and restoration operators, who are expert in restoration of historical goods, even of monumental size, with the aim to provide them with suitable robotic systems with proper low-cost easy-operation features. Design requirements will be defined in strict collaboration with the final users and with the aim to design systems with a user-oriented operation.</p>

<b>Innovative aspects</b>	The innovative aspects of the technology is the possibility to use the robots to perform tasks that cannot be do it by humans.
<b>Main advantages</b>	The design and operation of the robots can be developed in collaboration with architects and restoration operators, who are expert in restoration of historical goods, even of monumental size, with the aim to provide them with suitable robotic systems with proper low-cost easy-operation features.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Construction technology. Art restoration, architectural surveys
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Academy, research organization, architects and restoration operators.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_22481

[ ITALY ]

**Centro Laser Scarl**

www.centrolaser.it

<b>Sector</b>	Research and technology transfer.
<b>Activities</b>	Research on laser applications, sensors, micro technologies, environment, rapid prototyping, computer vision.
<b>Contact</b>	

<b>Title</b>	LASER TECHNIQUES FOR CLEANING
<b>Abstract</b>	<p>An Italian research centre with expertise in laser applications, offers know-how in laser techniques for diagnostic and cleaning. They are:</p> <ul style="list-style-type: none"> <li>• Optical microscopy equipped with image acquisition, storage and elaboration;</li> <li>• Laser induced breakdown spectroscopy (LIBS);</li> <li>• Scanning Electron Microscope (SEM)/ Energy-dispersive X-Ray Spectroscopy (EDXS) analysis.</li> </ul> <p>Partners for manufacturing agreements or technical cooperation for testing of new applications are sought.</p>
<b>Detailed description</b>	<p>In the context of artworks conservation and restoration using laser-based techniques, on-line monitoring and possibly closed-loop control are necessary to avoid the extremely undesirable over-cleaning that may arise due to an excessive intensity of the treatment.</p> <p>Laser-induced breakdown spectroscopy (LIBS) elemental analysis is particularly suited to deal with this problem. In particular it can be applied as a real-time diagnostic technique in order to monitor and control laser cleaning processes with the aim of drastically reducing the risk of potential damages to the substrate.</p> <p>As to Scanning Electron Microscope (SEM) technique, an electron beam is generated by electronic gun (cathode) and attracted on the anode. The electronic beam hits the target and back diffusion secondary electrons are generated, collected, converted and amplified in electric signals for computational elaboration. The main advantage is that no damage and structure modification can occur.</p> <p>An Italian research centre has gained know-how and expertise in the application of the above cleaning techniques. The laser systems used have been developed together with control software based on Soft Computing tools (fuzzy logic, neural network).</p> <p>Industrial development of the cleaning laser system is required in order to obtain a commercial device. Also, new applications could be investigated in cooperation with research organizations</p>

	<p>or companies playing the user role.</p> <p>An Italian research centre has gained know-how and expertise in the application of the above cleaning techniques. The laser systems used have been developed together with control software based on Soft Computing tools (fuzzy logic, neural network).</p> <p>Industrial development of the cleaning laser system is required in order to obtain a commercial device. Also, new applications could be investigated in cooperation with research organizations or companies playing the user role.</p>
<b>Innovative aspects</b>	The main innovation of the offered technique is in the complementary approach adopted, both for diagnosis and cleaning. In fact the real-time diagnosis allows the control of the treatment intensity, so reducing the risk of substrate damaging.
<b>Main advantages</b>	<p>The main advantages of laser cleaning are:</p> <ul style="list-style-type: none"> <li>• Non invasive technique;</li> <li>• Instantaneously qualitative analysis for elements detection and process monitoring;</li> <li>• auto controlled process;</li> <li>• calibration free method useful for unknown materials.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Development phase laboratory tested.
<b>Application domains</b>	Materials technologies; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, research organization.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Know-how/expertise KHE\_IT\_22283

[ ITALY ]

## CNR, Istituto di Scienze Marine (ISMAR)

www.ismar.cnr.it

<b>Sector</b>	Research and studies of physical, biophysical and ecological processes linked to marine environment.
<b>Activities</b>	Electrochemical techniques for characterisation and monitoring of conservation state of metallic artworks.
<b>Contact</b>	

<b>Title</b>	IN SITU CORROSION MONITORING ON METAL SURFACES BY ELECTROCHEMICAL METHODS
<b>Abstract</b>	A Cultural Heritage research group based in the north-west of Italy and involved since a long time in conservation state characterisation of artistic metal surfaces has developed a specially designed contact probe for in situ Electrochemical Impedance Spectroscopy (EIS) measurements on metal Cultural Heritage objects.
<b>Detailed description</b>	<p>The concern for the wide deterioration of outdoor bronze sculptures has greatly increased during the second part of the XX century, mainly due to the severe environmental modification brought about by the "industrial revolution". In the field of corrosion research and protective coatings characterisation, electrochemical measurement methods have been applied on a wide number of systems. Only recently they obtained an increasing attention in the field of metal cultural heritage objects.</p> <p>The Italian lab has developed an in situ Electrochemical Impedance Spectroscopy (EIS) measurements method suitable for metal cultural heritage special needs. The technique has been applied on several outdoor bronze monuments. On the <i>Monumento ai Mille</i> (E. Baroni, 1915, Genoa-Italy) the behavior of six protective coatings has been monitored for several years and compared with the behavior of the same coatings on clean bronze coupons. On the <i>Cristo degli Abissi</i> (G. Galletti, 1950, S. Fruttuoso-Italy) the homogeneity of patina and the cleaning procedure effectiveness has been evaluated. On the <i>Bartolomeo Colleoni</i> statue (A. Verrocchio, 1496, Venice-Italy) the electrochemical behavior of the different patinas present on the statue has been characterized along with the effectiveness of protective coating systems.</p> <p>The electrochemical spectroscopy is used in conjunction with other in situ (colour, thickness) or lab (XRD, microscopy) techniques for a whole characterization of conservation problems.</p>
<b>Innovative aspects</b>	Electrochemical methods provide a valuable tool to properly compare and quantify both conservation state and restoration treatments efficacy on metal objects by measuring corrosion

	rate. The availability of the Contact-Probe EIS measurements method allows to compare laboratory studies with real-life objects.
<b>Main advantages</b>	Non-destructive corrosion rate measurement and monitoring. The technique allows to address several issues relevant for artwork conservation: patina properties and protectiveness, effectiveness of cleaning procedures, evaluation of coating systems for corrosion protection.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Research organisations, industries, museums, restoration laboratories, public bodies.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	ALPS IRC

Know-how/expertise KHE\_IT\_22203

[ ITALY ]

CNR, Istituto per la Protezione delle Piante (IPP)

www.ipp.cnr.it

<b>Sector</b>	Research and studies of the biological mechanisms underlying the complex relation between plants/woods and biotic and abiotic stress factors. Development of environmentally-safe forecasting models and implementation of control strategies.
<b>Activities</b>	Identification of the microorganisms on monuments and artworks.
<b>Contact</b>	

<b>Title</b>	DGGE FOR THE IDENTIFICATION OF ENVIRONMENTAL MICROORGANISMS
<b>Abstract</b>	In the aim of the Preservation of the Cultural Heritage, the identification of the microorganisms which are present on the monuments is a crucial point. Classical methodologies rely on isolation and in vitro growth of culturable organisms, therefore all the information concerning uncultivated, or more correctly probably just not-yet-cultured, microorganisms are missing. The new metagenomic approach, which is the study of the whole microorganism community found in nature, such as bacteria in a litre of ocean water or sample of soil, using the tools of genomics, encompasses this limit. In fact, this new discipline is based on the study of total nucleic acids (DNA or RNA) directly extracted from the environment. PCR-dependent techniques, as DGGE, are then applied for the separation of the microorganisms which are present in a sample.
<b>Detailed description</b>	The microbial components of any environmental sample can be separated on the basis of their sequences through denaturant gradient gel electrophoresis (DGGE). This technique generates a pattern of bands for each sample. Since it is generally assumed that each band corresponds to a microorganism, its identification is possible thanks to the purification and the sequencing of the given band.
<b>Innovative aspects</b>	The innovation of DGGE rely in the possibility of identifying culturable and unculturable organisms directly from a miscellaneous sample.
<b>Main advantages</b>	The technology allows the simultaneous processing of many environmental samples saving, therefore time and money.
<b>Current state of development</b>	



Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	
Collaboration details	
Type of partner sought	The partner could be any organisation interested in Preservation and Conservation of Cultural Heritage either through the founding of a project or by asking this expertise for an already financed project.
Tasks to be performed by the partner sought	
IRC Partner	ALPS IRC

Know-how/expertise KHE\_IT\_22307

[ ITALY ]

CNR, Istituto per le Tecnologie Applicate ai Beni Culturali  
(ITABC)

www.itabc.cnr.it

**Sector** Research in the field of technologies applied to cultural heritage.

**Activities** Research activities on remote sensing and ground methods.

**Contact**

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**Title**

INTEGRATED GROUND METHODS FOR ARCHAEOLOGICAL PROSPECTIONS – IGMAP

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**Abstract**

The G.Re.S.T. (Ground Remote Sensing Team) of ITABC has developed, through some specific research programmes, the acquisition and elaboration techniques for different methods of investigations: Electric Resistivity Tomography, Magnetic, Ground Penetrating Radar and high topographical surveys. All activities are based on two steps: the first is related to the enhancement of the acquisition and the modelling techniques with the aim to locate anomalous bodies, the sources of the geophysical anomalies; the second step is based on the real application to investigate the archaeological sites. At this moment, the team has the following instruments: Fluxgate and Optical pumping Gradiometer, high-resolution Ground Penetrating Radar equipped with different antennas, high resolution Total Station, a multifrequency D-GPS and 3D Laser scanner.

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**Detailed description**

The development of the ground remote sensing methods, for the location and analysis of the archaeological sites, involves a necessary reorganisation of them for the specific scale of investigation. Referring to the knowledge and safeguard of the archaeological and historical heritages, the questions about the employment of the non-destructive surveying methods are the following: a) the development of a topographical high resolution method, based on the employment of Total station, D-GPS and 3D laser scanner; b) the definition of the high-resolution acquisition techniques for the Geo-electro-magnetic methods; c) the development of the best high-resolution tomographic inversion technique; d) the definition of the quantitative integration technique; e) the development of the 2D and 3D representation and visualisation techniques; f) the integrated analysis of all data sets in the GIS.

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**Innovative aspects**

Nowadays, non-destructive ground remote sensing methods are increasingly used for the investigation of archaeological sites, implying detailed physical and geometrical reconstructions of hidden environments. The probability of a successful application rapidly raises if a consistent multimethodological approach is adopted, in accordance to the logic of objective complementary

	<p>of information and of global convergence towards a high quality multi-parametric imaging of the buried structures. The fine representation of the static configurations of the investigated areas and of the space-time evolutions of the interaction processes between targets and hosting materials, are fundamental elements of primary knowledge in the case of archaeological research, for which non-invasive ground remote sensing methods are to-date the only means available for local reconnaissance and discrimination, prior to any excavation work.</p>
<b>Main advantages</b>	<p>The IGMAP integrated system is thus aimed to operate according to the principle of potential correlation among all those methods that have demonstrated the highest efficacy in investigating inhomogeneous macro and micro media. The objective is developing a methodology allowing integrated interpretation and hence rational utilization of all the acquired data. Such a potential of global data evaluation is assumed to be the master key for the final 3D image reconstruction and tomographic representation of the explored spaces.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Others (registered design, plant variety right, etc). Know-how/ expertise.</p>
<b>Application domains</b>	<p>Information processing, information systems; Measurement methods.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Academy, Research organisation.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC CIRCE</p>

## Know-how/expertise KHE\_IT\_22447

[ ITALY ]

## ENEA

www.enea.it

<b>Sector</b>	Research and study in the field of cultural heritage.
<b>Activities</b>	Diagnostics based on Scanning Electron Microscopy and microanalysis.
<b>Contact</b>	

<b>Title</b>	DIAGNOSTIC TECHNOLOGY BASED ON SCANNING ELECTRON MICROSCOPY AND MICROANALYSIS
<b>Abstract</b>	An Italian national research institution has an advanced Scanning Electron Microscopy (SEM) for chemical analysis of different types of samples, which allows direct observation and microanalysis of non-treated sample surfaces (diam. 5-10 cm) at high magnification (3 nanometres). The laboratory is looking for partnerships with research institutions in order to apply SEM techniques in different domains (Cultural Heritage, industrial diagnostic, environmental pollution, medicine, nanotechnology).
<b>Detailed description</b>	<p>An Italian laboratory has carried out numerous projects in the Cultural Heritage domain applying SEM (Scanning Electron Microscopy) for restoration and conservation of artworks. The scanning electron microscope and microanalysis was applied to paintings by Vasari, Gandolfi, frescos by Giovanni da Modena, glasses by Duccio di Boninsegna, etc.</p> <p>SEM allows for accurate analysis of the sample surfaces, revealing their morphology and chemical composition. In the Cultural Heritage domain, information such as artistic techniques, paint materials, presence of cracks, damages or weaknesses can be obtained by applying SEM analysis. These data are essential for selecting the most appropriate restoration and conservation actions. Besides the described Cultural Heritage field, many other research and diagnostic areas can benefit from SEM with microanalysis techniques, such as analysis of other kinds of materials, environmental pollution, biological and medical sector, etc.</p> <p>The laboratory is looking for partnerships with research institutions in order to apply SEM techniques in different domains, in particular:</p> <ul style="list-style-type: none"> <li>• Material analysis and nanotechnologies: the laboratory is looking for industrial partners that need to analyse materials applied within their products or in their use (for example biomass analysis, welding processes, packaging suppliers, etc.);</li> <li>• Medical domain: the nano-scale of the SEM allows for carrying novel medical research and treatment technique. In particular, the laboratory looks for partners with extensive experience in research within medical oncology domain;</li> </ul>

	<ul style="list-style-type: none"> <li>• Cultural Heritage: the laboratory looks for organisations dealing with restoration and conservation of artworks and archaeological sites;</li> <li>• Environment: the laboratory looks for government bodies and other organisations responsible for monitoring air pollution.</li> </ul>
<b>Innovative aspects</b>	<p>The Italian laboratory has an advanced SEM, which, in addition to traditional SEM technologies, allows for:</p> <ul style="list-style-type: none"> <li>• Observing and analysing samples without preparation treatments (direct observation and microanalysis). That is, the samples are not destroyed and can be used accordingly;</li> <li>• High magnification capabilities of the order of 3 nanometres;</li> <li>• Large samples (up to 10cm) to be directly observed and analysed;</li> <li>• Integration of observation and microanalysis procedures within the same system.</li> </ul>
<b>Main advantages</b>	<p>The new microscopy technology can provide data of high scientific value, which cannot be obtained with traditional SEM.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Others (registered design, plant variety right, etc).</p>
<b>Application domains</b>	
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Research organisation, industry, museum, restoration laboratories, public bodies.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC IRENE</p>

Know-how/expertise KHE\_DE\_22324

[ GERMANY ]

Fraunhofer Institut for Silicat Research

www.fraunhofer.de

<b>Sector</b>	Research.
<b>Activities</b>	Research and development in the field of conservation of cultural heritage.
<b>Contact</b>	

<b>Title</b>	CULTURAL HERITAGE PRESERVATION RESEARCH
<b>Abstract</b>	A German research institute offers a. Scientific research in conservation, consolidation, cleaning, corrosion damage of glass, glazings, enamel, metals, etc. b. conservation materials development, instrumental analyses, environmental monitoring
<b>Detailed description</b>	a. Scientific research in conservation, consolidation, cleaning, corrosion damage of glass, glazings, enamel, metals, etc. b. Conservation materials development, instrumental analyses, environmental monitoring.
<b>Innovative aspects</b>	
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc)
<b>Application domains</b>	Materials technology; Information processing, information systems; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	

Tasks to be performed  
by the partner sought

IRC Partner

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IRC Bavaria

Know-how/expertise KHE\_DE\_22459

[ GERMANY ]

Institut für Technische Optik, Universität Stuttgart

www.uni-stuttgart.de

<b>Sector</b>	Higher education, cultural heritage.
<b>Activities</b>	Research and development of optical sensors.
<b>Contact</b>	

<b>Title</b>	OPTICAL SENSORS FOR CULTURAL HERITAGE STRUCTURAL DIAGNOSTICS APPLICATIONS
<b>Abstract</b>	The Institut für Technische Optik (ITO) has 8 50 scientists and is part of the Universität Stuttgart. It is headed by Prof. Wolfgang Osten and has a wide range of optics research and education activities. The Coherent Optical Metrology Group in ITO is active in applying holographic and speckle interferometry sensors to Cultural Heritage structural diagnostics. Recent studies have been on canvas and wooden panel paintings. ITO is a partner in the FP6 Cultural Heritage project MULTIENCODE.
<b>Detailed description</b>	<p>Our technology offer is:</p> <ul style="list-style-type: none"> <li>• DIGITAL HOLOGRAPHY is used for highly-sensitive (sub <math>\mu\text{m}</math>) full-field displacement and vibration measurement. ITO has been working in this field since the early 1990s and has extensive expertise in algorithm development, sensor development and prototype construction. Working systems developed for Cultural Heritage heritage measurements are available for demonstration in our laboratories;</li> <li>• SHEAROGRAPHY is used for strain measurement with interferometric accuracy (tens of <math>\mu\text{Strain}</math>) and is robust enough to be applied in outside the optics lab. ITO has also been working in this field since the early 1990s and has extensive expertise in sensor development and prototype construction. A prototype system developed for Cultural Heritage measurements is available for demonstration;</li> <li>• Many other types of optical sensors have been developed at ITO including spectroscopic, optical tweezers, fringe projection, flow measurement and adaptive optics. These sensors are not currently applied to Cultural Heritage measurement, but could be adapted. Please ask!</li> </ul>
<b>Innovative aspects</b>	ITO is at the leading edge of applied optics research internationally and is currently working on approximately 25 research projects with support from industry, the German Research Foundation (DFG), the German Ministry for Research and Education (BMBF), the region Baden-



Württemberg and the EU. Our work is published in the leading scientific journals and presented at international conferences. Please see our webpage for the latest information: <http://www.uni-stuttgart.de/ito/Institut/Veroffentlichungen/Publikationen.htm>

#### Main advantages

- DIGITAL HOLOGRAPHY is particularly suited to accurate measurements of objects in the mm to cm scale and for the measurement of dynamic events. In Cultural Heritage we have applied it to the measurement of thermally loaded canvas painting and wooden panel paintings up to a size of 8 10 cm square;
- SHEAROGRAPHY is an extremely robust interferometric sensor for strain measurement. We have applied our sensor to Cultural Heritage objects up to 8 50 cm square and have also performed measurements outside the optics laboratory.

#### Current state of development

#### Intellectual Property Rights

Secret know-how.

#### Application domains

Measurement methods.

#### Collaboration details

#### Type of partner sought

All categories for future FP7 projects.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC Stuttgart-Erfurt-Zürich

Know-how/expertise KHE\_ES\_22191

[ SPAIN ]

Laboratorio de Documentación Geométrica del Patrimonio

www.ldgp.es

<b>Sector</b>	Heritage, architecture, archaeology, surveying.
<b>Activities</b>	Geometric documentation of heritage.
<b>Contact</b>	

<b>Title</b>	GEOMETRIC DOCUMENTATION, INFORMATION TRANSCENDENCE, METADATA
<b>Abstract</b>	The Laboratory for Geometrical Documentation of Heritage will engage in the investigation and development of all kind of projects that put geometrical measuring to the service of heritage, ensuring that the highest quality in the processes and the products is reached and that the results obtained are published; fostering the awareness about the importance of heritage, its documentation, management and difussion.
<b>Detailed description</b>	Heritage is not static, on the contrary, it is subject to continuous modifications and transformations which, at worst, go as far as to their complete disappearance; for this reason, information referring to heritage must be considered in itself like heritage, which implies that it must be maintained able to be used for the future generations. Not only future users have to be able to accede to the information, but also they will need to understand it and even it should be foreseen that the new use could be different from the one which caused its creation. Bearing in mind that, nowadays, almost all the information is digital, we will be dealing with concepts such as time transcendence, metadata and re-use.
<b>Innovative aspects</b>	We are currently working in two main areas: 1.new methods for Geometric Documentation and representation, often related with low cost projects; 2.development of standards and process allowing the future (re)use of the stored data.
<b>Main advantages</b>	
<b>Current state of development</b>	

Intellectual Property Rights	Others (registered design, plant variety right, etc). Registered. Free availability.
Application domains	Measurement methods.
Collaboration details	
Type of partner sought	Research.
Tasks to be performed by the partner sought	
IRC Partner	BASQUE IRC

Know-how/expertise KHE\_FR\_22282

[ FRANCE ]

Pôle Industries Culturelles et Patrimoines

www.industries-culturelles-patrimoines.fr

<b>Sector</b>	Research and activities in the field of cultural heritage knowledge and conservation.
<b>Activities</b>	Development of innovative methodologies and products.
<b>Contact</b>	

<b>Title</b>	EXPERIENCE SHARING FROM THE FRENCH INDUSTRIES AND HERITAGES CLUSTER ASSOCIATION
<b>Abstract</b>	<p>This cluster is a non-profit organisation dedicated to Cultural Heritage actors' economic development.</p> <p>It is focused on grouping/ pooling of economic actors, mainly located in the Provence-Alpes Côte d'Azur area.</p> <p>It is specialized in valuation, conservation, restoration, preservation, transmission or diffusion of heritages and cultures.</p> <p>The Cluster is articulated around three themes: the built and Cultural Heritage, the Natural Heritage the engineering and the broadcasting of the culture.</p>
<b>Detailed description</b>	<p>"The only economic cluster in France and in Europe focused on culture and heritages".</p> <p>Three axes of intervention:</p> <ol style="list-style-type: none"> <li>1. Built and Cultural Heritages <ul style="list-style-type: none"> <li>Gathering structures which work in activities of restoration, conservation, reconstruction of works of art as monuments. <ul style="list-style-type: none"> <li>• Develop new specific products in the network restoration;</li> <li>• Promote sites, monuments by multimedia and numeric process.</li> </ul> </li> </ul> </li> <li>2. Natural Heritage <ul style="list-style-type: none"> <li>The objective is to stop the degradation of the landscapes and the natural ecosystems. <ul style="list-style-type: none"> <li>• Generate systems computerized by location, by follow-up and by analysis of the landscapes;</li> <li>• Conceive new modes of realization of works for example dikes etc.</li> </ul> </li> </ul> </li> <li>3. Engineering and broadcasting of the culture <ul style="list-style-type: none"> <li>The clusters activities facilitate the integration of the numeric technologies and the appeal to processes of industrial production for the broadcasting of the culture. <ul style="list-style-type: none"> <li>• Finalize new computerized systems by presentation (display) of the heritages (3D for example);</li> <li>• Create processes assuring a real-time information of the events.</li> </ul> </li> </ul> </li> </ol>

<b>Innovative aspects</b>	
<b>Main advantages</b>	<p>The cluster offers each of its members a structure allowing them: To introduce collaborative research projects. For exemple:</p> <ul style="list-style-type: none"> <li>• NeoPozzol: clarification of materials and neutral processes for the restoration of works of engineering;</li> <li>• Vigie: landscapes modeling and simulation of their evolutions.</li> </ul> <p>To benefit from a concrete assist to their development about :</p> <ul style="list-style-type: none"> <li>• information and communication technologies;</li> <li>• innovation;</li> <li>• development of the international activities;</li> <li>• training of the employees;</li> <li>• consideration of social and environmental responsibilities.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Construction technology; Materials technology; Information processing, information systems; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Any structure interested in sharing experience with the cluster or its members, or partners who want to collaborate on new projects.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	MedIN (French Mediterranean).

Know-how/expertise KHE\_IT\_22273

[ ITALY ]

"Sapienza" Università di Roma, Dipartimento di Energetica

w3.uniroma1.it/energ

<b>Sector</b>	Archaeometry.
<b>Activities</b>	Development of <i>non-invasive</i> and <i>in situ</i> analysis to study cultural heritage.
<b>Contact</b>	

<b>Title</b>	NON-DESTRUCTIVE IN SITU INVESTIGATIONS ON CULTURAL HERITAGE
<b>Abstract</b>	An University team is expert in non destructive in situ diagnostics of Cultural Heritage by means of a multipurpose station: multi-spectral reflectography from Infrared to Ultraviolet, energy dispersive X-ray fluorescence spectroscopy, visible spectroscopy, ...
<b>Detailed description</b>	<p>The Laboratory for Archaeometry and Non Destructive Analysis (LANDA) has been active for more than 30 years in the development, updating and use of a multipurpose transportable station for "in situ" non destructive analysis of Cultural Heritage. Presently the station consists of:</p> <ul style="list-style-type: none"> <li>a. energy dispersive X Ray fluorescence spectroscopy with a sensitivity better than 1g/kg for elements of low-medium atomic number;</li> <li>b. imaging with a high sensitivity, low noise digital camera from Infrared to Ultraviolet under different illumination conditions;</li> <li>c. reflectography from Infrared to Ultraviolet for color determination;</li> <li>d. micro-photography with variable magnification up to 200x.</li> </ul> <p>The instrumentation has been used for a large variety of investigations, from the frescoes of the Sistina Chapel to Roman frescoes to Caravaggio Paintings, to the bronze statue of the <i>Lupa Capitolina</i> to ceramic ware, etc.</p> <p>The team has acquired a strong experience in suggesting and performing the proper diagnosis on the Cultural Heritage, in collecting and organizing the data in a large databases, in analyzing the data with the most recent and sophisticated statistical tools, in collaborating with humanistic scholars (archaeologists, art historians, restorers, etc) as well as other scientific teams.</p>

<b>Innovative aspects</b>	<p>By years of experience, the research group provides:</p> <ul style="list-style-type: none"> <li>• high-quality of analysis services;</li> <li>• the capacity of identifying the type of analysis needed to client;</li> <li>• the capacity of directing appropriately the client and / or the capacity of offering to his client new technical developments to solve the problem.</li> </ul>
<b>Main advantages</b>	<p>Most artworks are unmovable either because they are too valuable for being transported or they are too big and heavy or even fixed (such as mural paintings). Thus diagnostics on them must be done either in situ or by taking small samples of the artwork to be analysed in laboratory with sophisticated instruments (mini-invasive analysis). In order to reduce the number of samplings, in situ analysis are mandatory for a first exploration of the artwork.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc) know-how/expertise of the research group.
<b>Application domains</b>	Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Academy, research organisation, museum, restoration laboratories, private companies, that work in the field of Cultural Heritage.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_22550

[ ITALY ]

## Università degli studi di Napoli Federico II, Dipartimento di Scienze Fisiche

www.fisica.unina.it

**Sector** Research and education in physics sciences.

**Activities** Applied physics methods.

**Contact**

<b>Title</b>	ENERGY DISPERSIVE X-RAY FLUORESCENCE (ED-XRF) ELEMENTAL ANALYSIS WITH PORTABLE APPARATUS
<b>Abstract</b>	The XRF laboratory of the "Dipartimento di Scienze Fisiche, Università Federico II di Napoli" has a portable apparatus for the Non Destructive elemental analyses with X-Ray Fluorescence technique. This apparatus is capable to reveal light elements (from the magnesium) with high efficiency and sensibility. It is suitable for surface analysis in the Cultural Heritage field and for degradation surface and pollution studies. Besides it can be used for the elemental composition determination.
<b>Detailed description</b>	The XRF Laboratory has an experience of many years in the study of the Cultural Heritage and in the materials characterization. Two portable apparatuses was developed to conduct elemental analyses in situ in Non Destructive condition. With these apparatuses we studied metal artworks (golden and bronze), mural paintings, mortars and ceramic finds. In the last year we were particularly interested to the measurement of the light elements. A portable apparatus has been assembled with the helium flux; it can reveal all the elements, beginning from the magnesium, with high sensitivity (from 0.5% to 0.01% in weight). In particular we measured the MDL (minimum detection limit) of the sulphur in a matrix of calcite and gypsum, obtaining a value of 0.08% in weight. Therefore the apparatus is effective for the study of the surface degradation due to the environmental pollutants and in the restoration processes. The apparatus is very versatile and it can be also used effectively in the elemental composition measurements. Therefore his portability and the Non Destructive technique make it particularly suitable to the use in the Cultural Heritage study.
<b>Innovative aspects</b>	Light elements (from Mg) measurement with portable apparatus. Surface analysis of light elements (S and Cl as pollutant elements) to pollution and degradation studies.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Non destructive elemental analyses;</li> <li>• Portable apparatus for in situ measurements.</li> </ul>



Current state of development	
Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	Measurement methods.
Collaboration details	
Type of partner sought	Public Institutions (Academy, Museum, etc.) and research organization.
Tasks to be performed by the partner sought	
IRC Partner	IRC IRIDE

Know-how/expertise KHE\_IT\_22321

[ ITALY ]

Università di Bologna, MRPM Laboratories

www.unibo.it - www.mrpm.org

**Sector** Research and higher education on applied physics.

**Activities** Nuclear Magnetic Resonance in porous media.

**Contact**

**Title** COMBINED MAGNETIC RESONANCE TECHNIQUES FOR DIAGNOSTIC INVESTIGATIONS OF CULTURAL HERITAGE POROUS MATERIALS

**Abstract** Starting from then years ago, an Italian academic institution, in collaboration with other Italian research centres, has applied Magnetic Resonance for fluids in Porous Media knowhow and technologies to porous media of interest to Cultural Heritage (stones, ceramics, mortar and bricks, wood and paper). In particular, Magnetic Resonance Relaxation (MRR) and Imaging (MRI) of water  $^1\text{H}$  nuclei confined in porous systems have been applied to quantify in non-destructive and non-invasive manner pore space structure and its decay due to water uptake, as well as performances of the products used to protect and/or consolidate litotypes and woods. By combining MRR and MRI it is possible to get a synergetic improvement in our understanding of water absorption kinetics, on the distribution of the filming agents on the pore walls and on the performance of the applied treatments. Researchers are looking for technical collaboration with companies interested in developing new portable Magnetic Resonance tools.

**Detailed description** Magnetic Resonance for Fluids in Porous Media is an interdisciplinary discipline, covering a wide range of magnetic resonance methods to improve the understanding of fluids confined within pores, probing structure, molecular motion and interface interactions. Starting from the end of the past decade the researchers have applied these non-invasive and non-destructive methods to the diagnostic investigations of materials related to Cultural Heritage and its Safeguard. MRI allows the visualization of heterogeneities and the diffusion of liquid water in treated and untreated porous materials, and allows evaluation of the penetration depth of the restoration products. MR Images of internal sections of porous media saturated by water can be quantitatively analyzed to get porosity and water content in selected regions of interest. Unlike MRI, MRR is usually a spatially-non-resolved technique, but gives relaxation time distributions related to the

	<p>pore structure at the pore-scale, furnishing along with porosity, pore-size distributions and transport properties like irreducible water saturation and water permeability. While imaging allows one to get information on the distribution of the polymer at the sample-scale, relaxation data give information on distribution of the polymer at the pore-scale. MRR and MRI can be combined in a technique, Relaxation Tomography, that furnishes relaxation time maps in such a way as to combine the advantages of both techniques.</p>
<b>Innovative aspects</b>	<p>In the case of treatment applied to protect and/or consolidate porous materials, by combining MRI and MRR indirect, but complete, information on the distribution of the polymer in the pore space and on the performance of the applied treatment at the pore and at the sample scales can be obtained. New developments are expected by the use of portable Magnetic Resonance tools, that can be applied as non-destructive diagnostic techniques for in situ analysis of materials like stone, wood, cements and paper, and for the determination of the performances of treatments.</p>
<b>Main advantages</b>	<p>Magnetic Resonance Techniques give information on structure and fluid distributions inside porous materials at both sample- and pore-scale. The development and improvement of performances of portable tools for in situ investigations will make these techniques unique in the study of water interaction with Cultural Heritage objects.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Others (registered design, plant variety right, etc).</p>
<b>Application domains</b>	<p>Construction technology; Materials technology; Measurement methods non-destructive analysis for diagnostic investigation on Cultural Heritage.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Companies specialized in developing portable scientific instruments; Institutions interested in applying this technology to Cultural Heritage.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC IRENE</p>

EU RTD Result EURTD\_IT\_21587

[ ITALY ]

Università degli studi di Roma Tor Vergata,  
Dipartimento di Biologia

www2.bio.uniroma2.it

**Sector** Research in the field of biology applied to cultural heritage preservation.

**Activities** Diagnosis, monitoring and prevention of stone bio-deterioration.

**Contact**

<b>Title</b>	METHODS FOR CONTROL AND MONITORING OF STONE BIO DETERIORATION IN ARCHAEOLOGICAL SITES
<b>Abstract</b>	An Italian university research group developed innovative methods to characterise, monitor and control biological attack to stone caused by cyanobacteria, microalgae and associated heterotrophic microorganisms in archaeological sites. Researchers are looking for a partner for technical cooperation or commercial agreement with technical assistance.
<b>Detailed description</b>	<p>Italian researchers developed tools and methodologies to provide conservation and restoration managers with a better understanding of the development of cyanobacteria-dominated biofilms in hypogeal sites affected by stone bio-deterioration. New strategies are becoming available for monitoring and control of rock bio-decay and to predict the development of bio-film-induced damage.</p> <p>Experimental data provided evidence (a) of the type of damage produced on rock surfaces through biological activity in hypogeum and (b) on the identity of the major factors that control the development and growth of biofilms, their biodiversity and function. The combination of all these data can be used to construct models of the complexity of the hypogeal environment, of deterioration processes, of biofilm architecture and of the biological activity occurring on stone faces. In addition, the research determined that changing the wavelengths used for illumination caused a decrease in the growth of unwanted cyanobacteria. Furthermore, the development of non-destructive and safety methods for monitoring of cyanobacterial biofilms can be accomplished through the construction of a "Portable Sensor Monitor" holding together different micro-sensors for the measurement of threshold values of chemical species on endangered stones, and the establishment of a promising new methodology based on the use of a portable spectro-radiometer to detect phototrophic biofilm development and to monitor growth.</p> <p>The method includes the study of microorganisms causing decay of stone surfaces in hypogeum. Most of them can be identified using new DNA amplification based on molecular tools, isolated and characterised in culture.</p>

TECHA

Innovative aspects	<p>Innovative aspects: Protection and management of the artistic legacy found in hypogeal monuments are addressed by a complete multidisciplinary scientific study:</p> <ul style="list-style-type: none"> <li>• to characterise the climatic conditions of sites colonised by photosynthetic microbial communities, and to evaluate possible preferences of cyanobacteria and associated micro organisms for specific lithologies;</li> <li>• to describe the architecture and functioning of biofilms built by cyanobacteria and associated microorganisms on different types of stone surfaces;</li> <li>• to ascertain the most critical physical, chemical and biological factors that control colonisation of rock surfaces;</li> <li>• to develop new physical methods to control and prevent biofilm growth using wavelengths in the visible part of the light spectrum that are, at best, poorly used by photosynthesis;</li> <li>• to develop a monitoring method based on a multi-parametric micro-sensor device to assess and quantify the damage caused by photosynthetic biofilms to stone.</li> </ul>
Main advantages	<p>Main advantages of the proposed methods are:</p> <ul style="list-style-type: none"> <li>• the understanding of biotransformation and biodecay processes of stone substrata caused by the growth of biofilm-forming photosynthetic micro-organisms on monuments;</li> <li>• the use of non-destructive portable spectroradiometry to monitor biofilm development;</li> <li>• the applicability of a physical strategy based on monochromatic lighting to decrease the growth of phototrophic and associated heterotrophic micro-organisms that cause severe damage to valuable rock surfaces in archaeological hypogeum;</li> <li>• the use of a non-invasive sensor-based portable tool for monitoring of stone damage.</li> </ul>
Current state of development	
Intellectual Property Rights	<p>Others (registered design, plant variety right, etc). At the moment IPR is not being considered.</p>
Application domains	
Collaboration details	
Type of partner sought	<p>The partner sought is a research organisation to develop data analysis for portable spectroradiometry; companies specialised in lighting systems and conservation of archaeological sites for technical cooperation or commercial agreement with technical assistance.</p>
Tasks to be performed by the partner sought	
IRC Partner	IRC CIRCE

TECHA

## 2 Materials and intervention techniques



2008

## Technology Offer TO\_FR\_21795

[ FRANCE ]

## Arkheïa

www.arkheia.fr

<b>Sector</b>	Materials.
<b>Activities</b>	Development, testing and validation of mineral materials.
<b>Contact</b>	

<b>Title</b>	NEW ARTIFICIAL AND MINERAL MATERIAL FOR ART RESTORATION OR MOULDED WORKS OF ART
<b>Abstract</b>	A french company has developed a new artificial and mineral material with very performant properties: workability, hardening, shrinkage, esthetic aspect,... This material can be used for art reproduction or specific esthetic production.
<b>Detailed description</b>	Arkheïa, French SME, has developed a composition including water and air hardenable binders that can be used notably for the realisation of moulded objects having the aspect and the properties of stone. These objects can be structures, statues, slabs, paving blocks, city or interior furniture, chimneys... These materials can be used for art reproduction or for any material with esthetic characteristics. The company can also realise finish-polishing mortar or finishing and decoration coats. The company is looking for industrial partners or partners working in the restoration field for a license agreement, a technical collaboration or a commercial agreement with technical assistance.
<b>Innovative aspects</b>	Any esthetic characteristics can be done and the material is adapted to each project. The properties of the new material can be similar to the material to be reproduced, or slightly different.
<b>Main advantages</b>	The composition of the material has many advantages compared to cement-based formulations. <ul style="list-style-type: none"> <li>• decrease of hardening time before drawing;</li> <li>• increase of drawing resistance;</li> <li>• better workability;</li> <li>• easier implementation;</li> <li>• no handover;</li> <li>• no drying stress;</li> <li>• no shrinkage;</li> </ul>

TECHA



	<ul style="list-style-type: none"> <li>• no bug holes;</li> <li>• decrease of production costs.</li> </ul>
Current state of development	
Intellectual Property Rights	Patent(s) granted.
Application domains	Construction technology; Materials technology.
Collaboration details	
Type of partner sought	<ul style="list-style-type: none"> <li>• Industrial sector: mold and precast factory manufacture;</li> <li>• Restorers and moulding plants /art gallery and museum curator, architect;</li> <li>• Art, design and decoration.</li> </ul>
Tasks to be performed by the partner sought	
IRC Partner	MedIN (French Mediterranean)

## Technology Offer TO\_IT\_22428

[ ITALY ]

## B&amp;C Speakers

www.bcspeakers.com

<b>Sector</b>	Audio and sound reinforcement.
<b>Activities</b>	Development, design and production of components of audio devices.
<b>Contact</b>	

<b>Title</b>	OUTDOOR SONOROUS PARKS SPECIFICALLY DESIGNED TO ENRICH URBAN AREAS AND PARKS
<b>Abstract</b>	A pool of Italian SMEs has developed a solution combining music and lights to create advanced experience for outdoor locations and for Cultural Heritage. The system could be used both in natural ambient like public gardens and in urban ambient like civil infrastructures, parkings and harbours. The tools developed could be used also in order to reduce the environment noise pollution. The SMEs involved in the project are looking for partners in order to joint further development, test new applications, transfer the knowledge in new raw materials and for commercial agreement with technical assistance.
<b>Detailed description</b>	<p>The pool is coordinated by a musician building sonorous parks project. With some years of experience in this matter, he works assembling the expertise developed by two SMEs specialized in loudspeaker and LED technologies. Together they have all the know-how necessary in order to build and customize olistic project for the complete valorisation of every type of outdoor experience. The solution could be built employing particular type of lights coordinated with sounds specifically designed for that particular kind of setting.</p> <p>Many other applications could be developed starting from this kit of technologies and competences. The SMEs involved are interested in evaluating every kind of collaboration that could be linked with it.</p> <p>Potential areas of application could be public and private gardens, amusement parks, civil infrastructures like urban roads, highways and car parkings, railway stations, urban areas and maritime infrastructures like harbours and especially marinas. The system could be used also to reduce the acoustic pollution produced in each particualr environment.</p> <p>They are looking for partners in order to joint further development, test new applications, transfer the knowledge in new raw materials and for commercial agreement with technical assistance.</p>

<b>Innovative aspects</b>	The main innovation aspects are linked with the possibility to realize a complete design concept of every location enriched with it. The coordination of sound and lights allow to engineer new experience according to the specific needs of the organizations and of the customers involved. The system will be useful also in the wellness sector. Its capacity to involve contemporary more senses will have a beneficial effect on end users. Significant contributions could be given by this system in the field of reducing environment noise pollution.
<b>Main advantages</b>	The system is fully customizable. Lights and sounds could be specifically designed for each type of application. The tools used have a low impact on the surroundings as they will be conceived in order to respect it.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Construction technology; Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Organization working in the Cultural Heritage segment.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22355

[ ITALY ]

## Bossong Spa

www.bossong.com

<b>Sector</b>	Building technologies: fastening and strengthening systems.
<b>Activities</b>	Development and production of mechanical and chemical fastening techniques. Reinforcement and restoration of wooden floors.
<b>Contact</b>	

<b>Title</b>	TECHNOLOGY OF INJECTED ANCHORS WITH SOCK AS A VERSATILE METHOD OF STRUCTURAL REINFORCEMENT AND STRENGTHENING FOR MASONRY STRUCTURES
<b>Abstract</b>	<p>During the restoring operations on existing buildings, strengthening works often involves the insertion of metal elements into the masonry or wooden structures: the stitching up of cracks, the joining of the supporting metal elements to existing structures, the connection between floor slabs to perimeter walls, the strengthening of wooden floors or roofs.</p> <p>Anchoring, connections and stitching can become one with the masonry or wood through grout or resin injections. Depending on the application and on the type of material involved, injection anchors could require different types of intervention: resin injections are fairly simple when the anchorage lengths are less than 1.00-1.50 meters while, for longer lengths, you need to use grout injections compatible with the original materials.</p> <p>Resin tixotropic used normally for injection anchors guarantees against excessive spreading in the wall cavity and voids, but the short curing time complicates the deep extrusion stage.</p> <p>On the contrary, grout which is more fluid, is easily injected, but can get lost in the wall voids, cavity and cracks thus hindering the filling up of the borehole and giving an inadequate anchorage.</p> <p>A solution to these problems can be found by applying innovative technology of injection anchors with sock.</p>
<b>Detailed description</b>	<p>The system is made of a steel bar enclosed in a mesh fabric sleeve into which a specially developed grout is injected under low pressure. The injection material is a specially designed fluid grout, containing graded aggregates and other constituents which, when mixed with water produce a pumpable grout that exhibits good strength without shrinkage. Installation is through precisely drilled holes produced by wet or dry diamond coring technology.</p> <p>The size and type of steel bar, the strength of grout and the diameter of the hole can all be varied to provide the required parameters and to provide an appropriate stiffness compatibility with the masonry.</p>

<b>Innovative aspects</b>	<p>The flexible sleeve restrains the grout flow and expands up to twice its previous diameter moulding itself into the shapes and spaces within the walls, providing a strong mechanical interlocking along the entire length of the anchor. Moreover the mesh of the sock is designed to contain the aggregates of the mixed grout allowing the cement enriched water to pass through the sock providing a chemical bond with the substrate.</p> <p>With the total control of grouting injection it is possible to guarantee that forces are transmitted by bond, both mechanical and chemical, between the anchor and the surrounding masonry, in axial direction, along the entire anchorage length.</p>
<b>Main advantages</b>	<p>Being force-transmission entirely devolved to the injection anchor system, it is possible to avoid the installation of anchoring plates at the ends, thus performing blind anchors. This is a typical application in the field of restoring of historical building and monuments where the first necessity is the preservation of manufacts such as old paints or precious plasters and other ornaments.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Exclusive rights.</p>
<b>Application domains</b>	<p>Construction technology; Materials technology.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Universities. Project Engineers and Architects. Cultural Heritage Authorities. Institutions.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC Lombardia</p>

## Technology Offer TO\_IT\_22322

[ ITALY ]

## CNR, Istituto di Scienza e Tecnologia dei Materiali Ceramici (ISTEC)

www.istec.cnr.it

<b>Sector</b>	Research and studies in the field of advanced ceramics (bioceramics, electroceramics and structural ceramics), traditional ceramics and cultural heritage (ceramics and mosaics).
<b>Activities</b>	Scientific analyses and diagnostics to support research, conservation and restoration of archaeological, historical and artistic materials, mostly pottery, architectonic ceramics, stones, bricks, mortars and mosaics.
<b>Contact</b>	

<b>Title</b>	COMPATIBLE MORTARS FOR THE CONSERVATION OF THE ARCHITECTURAL AND ARCHAEOLOGICAL HERITAGE
<b>Abstract</b>	<p>The use of mortars made of hydraulic limes (HL) for the conservation of Cultural Heritage is diffused by considering the low contents of soluble salts and the mechanical characteristics similar to the original mortars. The research has developed new materials of this type by using natural hydraulic lime (NHL) and natural hydraulic lime with hydraulic-like materials such as metakaoline and cocciopesto.</p> <p>These types of mortars are durable, removable and easily applicable.</p>
<b>Detailed description</b>	<p>The NHL mortars are obtained by the calcination of marly limestones and they acquire good hydraulic properties due to the presence of clay minerals in the raw materials.</p> <p>The metakaoline mortars are obtained with the introduction of pre-fired kaoline into the lime, so that the reaction between lime and kaoline gives rise to the special hydraulic properties of this mortar. The main technological aspect is to fire the kaoline at the right temperature in order to obtain a very reactive product.</p> <p>In the cocciopesto mortars the hydraulic properties are assured by the presence of cocciopesto. In this case it is important to produce cocciopesto with the most suitable composition and grain-size. In order to obtain the highest reactivity of the cocciopesto it is necessary to find the most efficacious firing temperature for each type of starting raw material.</p>
<b>Innovative aspects</b>	These types of mortars can be used in several cultural contexts because the use of natural products makes them compatible with the old building materials.
<b>Main advantages</b>	The use of NHL, NHL + cocciopesto and NHL + metakaoline mortars avoids the use of cementitious mortars which are very dangerous due to their high content of soluble salts.

Current state of development	
Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	Materials technology.
Collaboration details	
Type of partner sought	Industry and research organisation.
Tasks to be performed by the partner sought	
IRC Partner	IRC IRENE

Technology Offer TO\_RO\_22475

[ ROMANIA ]

Complexul Muzeal National "Moldova" Iași

www.muzeul-moldova.ro

**Sector** Restoration laboratory.

**Activities** Conservation.

**Contact**

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**Title**

THE CONSERVATION OF PATRIMONY OBJECTS IN HIGH FREQUENCY COLD PLASMA

**Abstract**

The study effectuated by a research and conservation institutions from Iasi Romania have had a new ecological technology of conservation of Cultural Heritage results. It means the conservation of cultural goods through decontamination, cleaning and coverage of protection with polymers in HF plasma treatments. The technology can be applied in other domains: the synthesis of polymers, surface modifications, medicine. We are interested in collaboration about the research institution and Museum.

**Detailed description**

The process allows the sequential or in a continuous flux realization of decontamination, cleaning and thin film deposition on mobile Cultural Heritage items, by utilizing different ionized gases (Ar, O<sub>2</sub>, H<sub>2</sub>, N<sub>2</sub>, air) in a high frequency cold plasma (13.5 MHz), with pre-established and monitored parameters (pressure – p, temperature – T, electric field – E, time – t) as a function of the nature of the objects and their deterioration degree.

The afferent installation to the process is composed by two specialized, modular, interchangeable reactors scheduled with an automatic system of gas and/or monomer admission, that are individually connected to 13.5 MHz high frequency generator, as a function of the item nature (flexible or rigid).

**Innovative aspects**

The technology is highly efficient, ecological and non-destructive with low specific consumptions. The realization of protective coatings by cold plasma deposition directly from monomer phase entails the advantages of a well-defined structure and composition of the deposited film, a better characteristic control and a better homogeneity of the material properties. Moreover, the cold plasma treatment permits a superior preparation of the support surface (decontamination and/or cleaning) which determines an excellent adherence of the coating material to the support, and a true reproduction of the details.



**Main advantages**

- Ecological and non-invasive process
- High degree of applicability
- In real-time control of item treatment
- Low price and safety in exploitation.

**Current state of development****Intellectual Property Rights**

Patent(s) granted.

**Application domains**

Materials technology.

**Collaboration details****Type of partner sought**

Research organisation.

**Tasks to be performed  
by the partner sought****IRC Partner**

Romanian IRC 4D

## Technology Offer TO\_IT\_22409

[ ITALY ]

## Centro Recupero e Restauro Campano Srl (CR&amp;RC)

www.crerc.com

<b>Sector</b>	Construction and materials technology for the conservation of building heritage.
<b>Activities</b>	Architectural conservation and restoration, technical consultancy, scientific analysis.
<b>Contact</b>	

<b>Title</b>	INNOVATIVE MATERIALS AND NEW PRODUCTS FOR THE RESTORATION OF HISTORICAL EDIFICE WALLS AND PAVING FOR URBAN AREAS WITH LOW ENVIRONMENTAL IMPACT
<b>Abstract</b>	This company manages the entire production cycle from extraction to production for material as lime, mortar, and plastering, through an innovative process of drying and micronization and tests, after years of studies on the main materials that characterize our buildings, as pozzolanic ash, so to provide materials in accordance with the ancient traditions of Campania.
<b>Detailed description</b>	An italian small enterprise, whose main activity sector is construction recovery, has developed innovative material and technology for production of mortar, plaster, paints and impregnating. The company manages the entire production cycle from extraction to production and develop new product solutions in the laboratory. Especially significant are some products of great interest in urban recovery as plastering, plastering D, Mortar I100 to consolidate injection and Mortar "Battuto ZL".
<b>Innovative aspects</b>	The innovative and competitive aspects of the option are to derive directly from the quarry and work materials through a process of drying and micronization. The new products are tested in laboratory through on the chemical and physical components like Tuff, Lapillo and Calcium Carbonate. The laboratory test is an important step in the production cycle since it assures ability to diversification of the product and a quick release on the market.
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how

Application domains	Materials technology. Our materials and products are designed for the restoration of historical edifice walls and paving for urban areas with low environmental impact.
Collaboration details	
Type of partner sought	Commercial company.
Tasks to be performed by the partner sought	
IRC Partner	IRC IRIDE

## Technology Offer TO\_IT\_21917

[ ITALY ]

## EMitech Srl

www.emitech.it

**Sector** Electromagnetic shielding, industrial microwave devices.

**Activities** Research, project and manufacturing.

**Contact**

<b>Title</b>	ALTERNATIVE DISINFESTATIONS TECHNOLOGY FOR THE CONSERVATION OF THE WOODEN CULTURAL HERITAGE
<b>Abstract</b>	An Italian SME with a twenty-year background in the field of electromagnetic energy applications has developed an innovative technology using microwaves for disinfestations of wooden handiworks, antiques and furniture pieces. It is an effective and ecological alternative to the unsafe, polluting chemical methods currently used in the field of disinfestations and restoration. The company is looking for companies and/or public organizations interested in the acquisition of the technology.
<b>Detailed description</b>	An Italian SME with a twenty-year background in the field of electromagnetic energy applications has developed an innovative technology using microwaves for disinfestations of wooden handiworks, antiques and furniture pieces. The technology derives from the observation that most infesting biological agents (woodworms, moulds etc.) do not survive over a certain temperature called lethal temperature, which generally ranges between 55 C-60 C. Generally, the current disinfestations methods involve the use of chemical agents, with significant problems of environmental pollution and of toxicity for operators due to the presence of chemical residues in the treated objects. Microwave treatments for disinfestations are achieved through absorption of electromagnetic energy by the pests present in the object to be treated. Microwave energy is transformed into heat by being readily absorbed by water molecules contained in the pests and leads to their mortality within a few minutes. This short treatment duration corresponds with the necessary time to reach the Lethal Temperature of pests in all life stages.
<b>Innovative aspects</b>	This technology represents an innovation with respect to the traditional methods used for disinfestations which are generally long, unsafe for operators, polluting for the environment and not totally efficacious.

<b>Main advantages</b>	<p>The improvements that this new technology introduces if compared to the traditional treatments are significant in terms of:</p> <ul style="list-style-type: none"> <li>• High efficacy of the disinfestations against all pests at each life stage;</li> <li>• Rapidity: the treatment takes a few minutes;</li> <li>• Safety for the operators;</li> <li>• Minimization of damage risks in the of treated objects;</li> <li>• Energy saving and better energetic efficiency;</li> <li>• Possibility to use the object immediately at the end of the treatment: no toxic residues are produced during the treatment;</li> <li>• The whole process is automated;</li> <li>• Compliance with the international environmental rules and with the requirements of the Montreal Protocol;</li> <li>• Cheaper treatment costs thanks to the process rapidity.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Private companies, public organizations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_21921

[ ITALY ]

## EMitech Srl

www.emitech.it

**Sector** Electromagnetic shielding, industrial microwave devices.

**Activities** Research, project and manufacturing.

**Contact**

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**Title**

ALTERNATIVE DISINFESTATIONS/STERILIZATION TECHNOLOGY FOR CLOTH

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**Abstract**

An Italian SME with a twenty-year background in the field of electromagnetic energy applications has developed an innovative technology using microwaves for disinfestations/sterilization of cloth and of antique handyworks and furniture pieces made of cloth. It is an effective and ecological alternative to the unsafe, polluting chemical methods currently used for disinfestations/sterilization. The company is looking for companies and/or public organizations interested in the acquisition of the technology.

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**Detailed description**

An Italian SME with a twenty-year background in the field of electromagnetic energy applications has developed an innovative technology using microwaves for disinfestations of wooden handiworks, antiques and furniture pieces.

The technology derives from the observation that most infesting biological agents do not survive over a certain temperature called lethal temperature, which generally ranges between 55 C - 60 C. Generally, the current disinfestations/sterilization methods involve the use of chemical agents, with significant problems of environmental pollution and of toxicity for operators due to the presence of chemical residues in the treated objects. Microwave treatments for disinfestations/sterilization are achieved through absorption of electromagnetic energy by the pests present in the object to be treated. Microwave energy is transformed into heat by being readily absorbed by water molecules contained in the pests and leads to their mortality within a few minutes. This short treatment duration corresponds with the necessary time to reach the Lethal Temperature of pests in all life stages.

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**Innovative aspects**

This technology represents an innovation with respect to the traditional methods used for disinfestations/sterilization which are generally long, unsafe for operators, polluting for the environment and not totally efficacious.

<b>Main advantages</b>	<p>The improvements that this new technology introduces if compared to the traditional treatments are significant in terms of:</p> <ul style="list-style-type: none"> <li>• High efficacy of the disinfestations against all pests at each life stage;</li> <li>• Rapidity: the treatment takes a few minutes;</li> <li>• Safety for the operators;</li> <li>• Minimization of damage risks in the of treated objects;</li> <li>• Energy saving and better energetic efficiency;</li> <li>• Possibility to use the object immediately at the end of the treatment: no toxic residues are produced during the treatment;</li> <li>• The whole process is automated;</li> <li>• Compliance with the international environmental rules and with the requirements of the Montreal Protocol;</li> <li>• Cheaper treatment costs thanks to the process rapidity.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Private companies, public organizations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_21922

[ ITALY ]

## EMitech Srl

www.emitech.it

**Sector** Electromagnetic shielding, industrial microwave devices.

**Activities** Research, project and manufacturing.

**Contact**

<b>Title</b>	ALTERNATIVE DISINFESTATIONS/STERILIZATION TECHNOLOGY FOR PAPER AND FOR THE ARCHIVAL HERITAGE CONSERVATION
<b>Abstract</b>	An Italian SME with a twenty-year background in the field of electromagnetic energy applications has developed an innovative technology using microwaves for disinfestations/sterilization of paper for the archival heritage conservation. It is an effective and ecological alternative to the unsafe, polluting chemical methods currently used in the field of disinfestations and restoration. The company is looking for companies and/or public organizations interested in the acquisition of the technology.
<b>Detailed description</b>	An Italian SME with a twenty-year background in the field of electromagnetic energy applications has developed an innovative technology using microwaves for disinfestations/sterilization of paper for the archival heritage conservation. The technology derives from the observation that most infesting biological agents do not survive over a certain temperature called lethal temperature, which generally ranges between 55 C - 60 C. Generally, the current disinfestations methods involve the use of chemical agents, with significant problems of environmental pollution and of toxicity for operators due to the presence of chemical residues in the treated objects. Microwave treatments for disinfestations are achieved through absorption of electromagnetic energy by the pests present in the object to be treated. Microwave energy is transformed into heat by being readily absorbed by water molecules contained in the pests and leads to their mortality within a few minutes. This short treatment duration corresponds with the necessary time to reach the Lethal Temperature of pests in all life stages.
<b>Innovative aspects</b>	This technology represents an innovation with respect to the traditional methods used for disinfestations/sterilization which are generally long, unsafe for operators, polluting for the environment and not totally efficacious.



<b>Main advantages</b>	<p>The improvements that this new technology introduces if compared to the traditional treatments are significant in terms of:</p> <ul style="list-style-type: none"> <li>• High efficacy of the disinfestations against all pests at each life stage;</li> <li>• Rapidity: the treatment takes a few minutes;</li> <li>• Safety for the operators;</li> <li>• Minimization of damage risks in the of treated objects;</li> <li>• Energy saving and better energetic efficiency;</li> <li>• Possibility to use the object immediately at the end of the treatment: no toxic residues are produced during the treatment;</li> <li>• The whole process is automated;</li> <li>• Compliance with the international environmental rules and with the requirements of the Montreal Protocol;</li> <li>• Cheaper treatment costs thanks to the process rapidity.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Companies, public organizations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22485

[ ITALY ]

ENEA

www.enea.it

<b>Sector</b>	Research and study in the field of cultural heritage.
<b>Activities</b>	Research and innovation in the field of cultural heritage knowledge and conservation.
<b>Contact</b>	

<b>Title</b>	NO INVASIVE – NO CONTACT “SEISMIC EARLY WARNING – PROTECTION SYSTEM” FOR STATUES AND MUSEAL OBJECTS”
<b>Abstract</b>	An Italian research group developed a new system of devices aiming to protect statues and other artistic objects by preventing the destroying seismic effects. The developers are looking for Industrial partners for manufacturing the devices, data fusion and control systems.
<b>Detailed description</b>	The system is composed by: <ul style="list-style-type: none"> <li>• a dedicated net of sensors nested within a regional Seismic Early Warning (SEW) network activating the protection system for statues or museal objects The sensors are located within 30-100 kilometers (depend on the geological conformation of the territory) from the structure to be protected;</li> <li>• a protection system composed by very low damped anti seismic devices and protective cage with airbags. The devices, blocked in normal condition beneath the floor, are activated by the SEW signal.</li> </ul> <p>When the SEW system detect the earthquake send immediately a triggering signal (by a repetition activation logic) to the protection system in order to unblock the devices aiming to protect the statue or museal objects.</p>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• The signal sent by the SEW system active the protection devises in a very short time (from 3,5 sec. to 30 sec. depend on the distance between the SEW system and the protection system);</li> <li>• The protection system is composed by ceramic, no invasive and hidden devises;</li> <li>• The airbags, which carry the artistic object in the cage during the seismic vibrations, are shaped according to the shape of the artistic object in order to delete the risk of catastrophic consequences.</li> </ul>

Main advantages

Current state of development

Intellectual Property Rights

Patent(s) applied for

Application domains

Collaboration details

Type of partner sought

Industry.

Tasks to be performed  
by the partner sought

IRC Partner

IRC IRIDE

## Technology Offer TO\_IT\_22245

[ ITALY ]

## ErgonixART Srl

www.ergonixart.it

<b>Sector</b>	High-tech consultancy in the field of ergonomics, especially for physical and sensory disability.
<b>Activities</b>	Design and engineering of high-tech products. Development of new materials and technologies, architectural and urban interventions to optimize the functionality of objects and environment for disabled people.
<b>Contact</b>	

<b>Title</b>	MULTI-SENSORIAL PATHWAYS FOR EXHIBITIONS, MUSEUMS OR PUBLIC AREAS
<b>Abstract</b>	An Italian society active in the disability sector (design, production and commerce of technological devices) proposes Multi-sensorial pathways for blind-people and cognitive disables. The pathways are defined to provide museums and exhibitors with a series of high-profile, interactive design solutions which discreetly integrate area delineators with the needs of sight impaired. The society is looking for both financial support to temporary installations and production and commerce agreements of standard equipment related to the idea.
<b>Detailed description</b>	<p>The company aims at improving and optimizing the functionality level of objects and environment conditions with the firm conviction that everything has to be usefully enjoyed by everybody, without exception.</p> <p>Based on free-form nanotechnologies, the "X-3De" Multi-sensorial pathways redefines intelligent design in public areas with interactive design solutions which discreetly integrate area delineators with the needs of the sight impaired.</p> <p>Comprehensive X-3De solutions include tactile guide rails in Braille, alternated with relief graphics or scale replicas of exhibited items (reproducing pictures, portraits and statues), and three-dimensional room models of the areas open to visitors. Audio recordings and smelling sensations, activated by push button or automatic controls working with virtual positioning technologies, complete the complex series of sensorial interaction.</p> <p>Comprehensive X-3De solutions also include accessible web sites (our standards give you higher levels of accessibility than W3C simple ones), consultancy services on interface-devices and effective wireless communication systems for deaf people, or blind, or the top end of motion disables. Finally the company's expertise includes solutions for Overcoming Architectural Barriers and training courses for tourist guides for handicapped people, in order to give a complete service.</p>

<b>Innovative aspects</b>	<p>Braille inserts for X-3De system guide rails are manufactured in photopolymers based on nanotechnology, using three-dimensional production methods. These technologies allow personalised and aesthetically superior solutions in a fraction of the time needed by traditional materials or production methods.</p> <p>Then the tactile guides, located on walls or standing supports, take advantages of the greater sensibility of fingers if compared to the one of a foot wearing shoes, in order to convey strips of information in Braille. So tactile guides can be used in schools, hospitals public offices and areas, in order to guide blind people and to inform them about risks they're going to face and give precise instructions and information about it.</p> <p>To use a complex multi-sensorial systems, working on voice explanations, smelling and tactile sensations, electronic devices and ICT technologies, gives an unique product, really effective for cognitive purposes (also by means of interactive solutions)</p>
<b>Main advantages</b>	<p>The main advantages in relation to the traditional system of production are:</p> <ul style="list-style-type: none"> <li>• blending of typical handcrafts' adaptment possibilities in order to meet the individual needs (capacity to produce different types and sizes of panels or strips);</li> <li>• low costs in spite of the small series production;</li> <li>• industrial precision, repeatability and reliability of performance levels;</li> <li>• possibility to use them alone or to insert them into larger traditional environments or elements made by means of traditional production technologies.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Patent(s) applied for. Patent applied for Italy.</p>
<b>Application domains</b>	<p>Materials technology Multi-sensorial pathways for blind-people and cognitive disables in museums, exhibitions and public areas, in order to improve their autonomy. Complete consulting services.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>The company is looking for partners both for financial support to temporary installations and production or commerce agreements of standard equipment related to the idea.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22216

[ ITALY ]

## GeodaG Sas

www.geodag.com

<b>Sector</b>	Geotechnical engineering.
<b>Activities</b>	Design, engineering and marketing of geotechnical systems.
<b>Contact</b>	

<b>Title</b>	NEW ANCHORAGE SYSTEM FOR STRUCTURAL AND GEOTECHNICAL APPLICATION
<b>Abstract</b>	A small Italian company has developed an innovative anchorage system, called Geodyx Geodinox QT80, to be used in structural and geotechnical application. The system is made of stainless steel, continuous specially threaded bars (20 to 40 mm diameter) with all necessary special devices as plates, nuts and couplers. It can be used both as temporary and definitive anchorage and it is suitable for structures situated in most aggressive environments. The company is looking for partnerships for the technology development and commercial exploitation.
<b>Detailed description</b>	<p>Geodyx Geodinox QT850 is an innovative system of anchorage which can be used in different fields and for many purposes, providing very resistant, convenient and good value solutions. It is suitable for structures situated in most aggressive environments, it resists corrosion and has strong mechanical resistance and wide adaptability. The company can provide consultancy and suggest appropriate applications.</p> <p>Geodyx Geodinox QT850 can be used either in structural and geotechnical applications. The system is particularly convenient for structural applications, when high mechanical reliability tension elements are requested in severe conditions. The easy combination of such elements makes it effective in case either steel and concrete must be jointed. It can be used in new buildings designed according to anti-seismic criteria, for structural improvement of historical buildings in accordance with the anti-seismic norms, and for tie-rods for static and dynamic consolidation.</p> <p>Geotechnical applications generally concern all foundations and improvement of mechanical characteristics of soil and rocks through retaining and diaphragm walls. Geodyx systems can be used as "Rock Bolts, Soil Nails, Ground Anchors and Micropiles" in consolidation works.</p> <p>It has been used for historical monuments (International Unesco project for Buddah statues in Afghanistan, Ue projects).</p>

<b>Innovative aspects</b>	Geodyx bars are made of special stainless steels through a new procedure of hot rolling, with controlled temperature and speed, which brings an improvement of mechanical characteristics and an optimization of couplings thanks to the particular thread's shape.
<b>Main advantages</b>	The technology shown is suitable for structures situated in most aggressive environments, it resists to corrosion and has strong mechanical resistance and wide adaptability.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

## Technology Offer TO\_DE\_22430

[ GERMANY ]

## Glaswerkstätte Rothkegel e.K.

www.rothkegel.com

<b>Sector</b>	Design and restoration of glass paintings.
<b>Activities</b>	UV and IR protective glazing and lighting concepts for the protection of art in museums and churches.
<b>Contact</b>	

<b>Title</b>	MORE SECURITY THROUGH OPTIMIZED RADIANCE FILTERING - UV&IR-PROTECTIVE GLAZING AND LIGHTING CONCEPTS FOR THE PROTECTION OF ART IN MUSEUMS ETC
<b>Abstract</b>	A German company offers UV&IR-protective glazing and lighting concepts for the protection of art in museums, e.g. an object-specific special protective glazing to ensure the shortwave radiance protection of up to 420 nm with 1% spectral transmission. The company is interested in commercial agreements.
<b>Detailed description</b>	<p>The UV-protection of all former customary LSGs with PVB-foils lead to no ideal actinic radiation protection for damageable materials. This glasses absorb in new condition highly energetic material-damaging radiance only up to 385 nm for foils up to 1,52 mm.</p> <p>With our object-specific special protective glazing the shortwave radiance protection of up to 420 nm with 1% spectral transmission can be ensured, not as an integrative data above a certain radiance area but as a defined dot in the spectrum.</p> <p>Continuous protection due to endowed PVB-foil</p> <p>With our object-specific special protective glazing the shortwave radiance protection of up to 420 nm with 1% spectral transmission can be ensured, not as an integrative data above a certain radiance area but as a defined dot in the spectrum.</p> <p>Beneath this data the transmission sinks within a few nm to 0%!</p> <p>This data is reached at a colour-rendering data of up to 99.8% (in dependence of the UV-edge).</p>
<b>Innovative aspects</b>	An additional advantage is, that if the board is prolonged to 430 nm our protective glazing offers protection against insects for lamp glass or window glass.
<b>Main advantages</b>	It is necessary, that our radiation physicist make an exact analysis on-site. This happens in historical buildings with a restorer and - if needed with another radiation physicist. In this analysis the on-site situation concerning lighting, climate, and room dimensions will be



recorded. This happens to enable us to give you the according recommendation for the actions that have to be taken. e.g. to develop custom-made glass-panes for this object. Also this includes the physical aspects.

This is the only way to ensure, that the many factors, which are significant for the choice of the right glass, are considered. It also ensures that through the advancement of one aspect no other aspect will be worsened (e.g. climate, colour-rendering).

**Current state of development**

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**Intellectual Property Rights**

Copyright protected.

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**Application domains**

Construction technology; Materials technology.

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**Collaboration details**

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**Type of partner sought**

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**Tasks to be performed  
by the partner sought**

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**IRC Partner**

IRC Bavaria

## Technology Offer TO\_IT\_22252

[ ITALY ]

## Grafica Design Anna Laura Bachini

www.bachinigraficadesign.it

<b>Sector</b>	Decorative urban panels.
<b>Activities</b>	Design and realization of decorative urban panels.
<b>Contact</b>	

<b>Title</b>	DECORATIVE URBAN PANELS FULLY CUSTOMABLE
<b>Abstract</b>	An Italian SME specialised in urban design has developed a system to print on cloth panel of every size high resolution pictures. The panels could be used both for interior and urban design. The SME can monitor every step of the process starting from the choice of the picture and from its retouch till to the delivery of them. The company is looking for possibilities of testing new applications, of transfer the knowledge in new raw materials and for commercial agreement with technical assistance.
<b>Detailed description</b>	<p>The process leading to the panel is completely engineered and controlled by the SME that offers the solution. The panels have been designed in order to be used as territorial marketing tools. The high quality of the materials used and the high resolution of the printing system guarantee an high standard of the product. These panels can be used to enrich the urban architecture without impacting it.</p> <p>They could be fully personalized, choosing the colours, the images and the wording of them. This technology can be used with panels of every dimensions. It could be applied to other new raw materials. New object for urban design could be developed with it.</p>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• The solution can be used with panels of every dimension;</li> <li>• It's fully customizable, it can be adapted to every use linked with urban design needs.</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• The process is fully controlled by the producer of the panel;</li> <li>• Many other object could be worked with this solution;</li> <li>• The technology has been thought in order to produce tools for urban design.</li> </ul>

Current state of development	
Intellectual Property Rights	Others (registered design, plant variety right, etc).
Application domains	Materials technology. These panels can be used to enrich the urban architecture without impacting it.
Collaboration details	
Type of partner sought	SMEs.
Tasks to be performed by the partner sought	
IRC Partner	IRC RECITAL

## Technology Offer TO\_IT\_22178

[ ITALY ]

## Il Cenacolo Srl

www.ilcenacolo.net

**Sector** Research and activities in the field of cultural heritage conservation.

**Activities** Diagnostics, conservation, restoration.

**Contact**

<b>Title</b>	LEONARDO: THE PERMANENT CONSTANT-STRAIN FRAME FOR PAINTINGS
<b>Abstract</b>	An important Italian company has developed a new frame for paintings that allows the strain control of canvas. The LEONARDO frame technology enable to follow the dimensions variation in order to prevent mechanical stresses. Other advantages include the lightness, the easy carriage, the corrosion and biologic agents resistance of frame aluminium structural. "Il Cenacolo" has a deeper knowledge of analysis, diagnostic and study of Cultural Heritage and is looking for marketing partners.
<b>Detailed description</b>	The frame configuration is designed to ensure a constant and homogeneous strain of paintings: the specific perimetrical edge, to which the canvas is mounted, follows automatically and with great precision the little movements of the canvas itself, caused by thermo-hygrometrical variations, relaxations, adjustments etc. This capability is assured by a series of spring-jacks linking the perimetrical edge to the internal hard structure and a system of sliding angle bars that assures the full planarity of all movements. The jacks can be set up in pre-load, to define the strain that will be continuously applied to the canvas. The whole structure is realized using aluminium draw pieces and simple joints, making carriage and assembly easy operations to perform, even in situ. LEONARDO can replace the traditional wooden frames, heavier and liable to fast deterioration due to their organic nature: employing the newest equipments is now possible to manufacture frames both with regular shape or centrings (minimum radius lower than 1 m).
<b>Innovative aspects</b>	Nowadays traditional cleats-frame are widely used by restorers: this kind of frame can only expand, operating on the cleats, and seems to be inappropriate to work the conservation problems out: increasing the strain every time the canvas appears relaxed could generate stresses, cracks, losses, craquelures and other damages. The "ideal" frame should be an elastic device, that allows the restorer to tend the complete surface of canvas in an homogeneous way during the mounting, and afterwards keeps the applied strain at a constant level.

LEONARDO moves in this direction, preventing damages thanks to its capability to follow the canvas movements (in extension and retraction), and its particular canvas mounting system, displaced along the entire perimetrical edge, that assure a smoother forces distribution than traditional punctual mounting systems.

### Main advantages

Traditional wooden frames undergo to a wide number of alteration, in great part related to the organic nature of the matter: an incorrect aging of wood, microclimate variations in the exposition room, stresses caused by the canvas itself could deform the frame; xylophagous insects, fungi, moulds induce the deterioration, reducing the mechanical properties of wood, and could be transmitted to the painting. The use of aluminum alloy, a light material with a great resistance, undeformability and durability trough the years, passive to corrosion and biologic deterioration, guarantee the best conservation condition.

The internal structure, consisting in modular elements, ease the equipment, the carriage and the assembly: the employment of aluminum draw pieces allow to contain considerably the overall weight of the frame (particularly for big frames), both thanks to the lightness of the material and the dimension reduction of the bearing sections. Furthermore, the possibility to directly assembly the frame in the exposition room eliminates the exigency to go through narrow passages like doors, corridors, etc.

At last is to notice that LEONARDO brings to a remarkable save of money compared to a traditional wooden frame, because of the lower cost of the material and the simple processing.

### Current state of development

### Intellectual Property Rights

Patent(s) granted.

### Application domains

Materials technology.

### Collaboration details

### Type of partner sought

Company, museums, local administrations, cultural institutions.

### Tasks to be performed by the partner sought

### IRC Partner

IRC CIRCE

## Institute for Mechanised Construction and Rock Mining (IMBIGS)

www.imbigs.org.pl

<b>Sector</b>	Research and development in the field of mechanized construction, industrial automation and construction industry.
<b>Activities</b>	New materials for construction.
<b>Contact</b>	

**Title** SILICA SOL FROM WASTE CHALCEDONITE USED IN ORDER TO IMPROVE THE CONSTRUCTION PRODUCTS' PROPERTIES

**Abstract** A Polish research institute has developed a technology of producing silica sol used to improve the construction products' properties. It can be used for protection of construction natural stone and concrete from degradation during exploitation, improvement of their physicochemical and endurance properties and renovation of already built constructions, especially historic ones. The partners for technical coop., joint venture or manufacturing agreement or further product development are sought.

**Detailed description** A Polish research institute working in the field of rock mining and building materials has developed a technology of producing silica sol from waste chalcedonite used in order to improve the construction products' properties. It is in the form of water colloidal silica dispersion. Impregnation process is based on transformation within impregnated part structure – silica sol enters inside the part and transforms itself into silica gel. The gelation is irreversible – creates artificial binding. Results of silica impregnation are filling and sealing of micro-cracks (gaps inside the structure) through constant silica compounds causing:

- decreasing absorbability;
  - limiting CO<sub>2</sub> and aggressive gases insertion inside the structure;
  - increase of mechanical strength of impregnated parts.
- Silica compounds, build-in inside the stone structure do not completely plug pores, allowing to remove water excess from the interior part of the stone.
- Final effects of the impregnant's using are:
- decreasing absorbability of about 10-20%;
  - increase of compressive strength of about 70%;
  - increase of chemical resistance to "acid rains" and CO<sub>2</sub> influence;
  - limiting capillary water migration and accumulation of salts;
  - limiting the increase of micro-organisms (fungus, moss, alga, lichens);

	<ul style="list-style-type: none"> <li>• lack of possibility to rinse out the introduced impregnant from the interior of the material. Costs of impregnation of 1m<sup>2</sup> of the building element is about 60-90 cents.</li> </ul>
<b>Innovative aspects</b>	A distinctive feature of the new method is that a specific type of crystallographic silica is used as a raw material to produce the impregnant – occurring in the natural deposits of chalcedonite – amorphous silica.
<b>Main advantages</b>	<p>Limiting investment, production and exploitation costs:</p> <ul style="list-style-type: none"> <li>• extending life of materials, parts and constructions;</li> <li>• limiting the construction costs;</li> <li>• simple and cheap technology of impregnant production and usage;</li> <li>• less machines and equipment;</li> <li>• limiting energy consumption for eco-impregnant production;</li> <li>• cheap waste initial raw material;</li> <li>• possibility of common usage, base for “anti-graffiti” preparation.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Construction technology; Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy or research organisation).
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

Technology Offer TO\_PL\_22406

[ POLAND ]

## Institute for Mechanised Construction and Rock Mining (IMBIGS)

www.imbigs.org.pl

<b>Sector</b>	Research and development in the field of mechanized construction, industrial automation and construction industry.
<b>Activities</b>	New materials for construction.
<b>Contact</b>	

<b>Title</b>	NANOTECHNOLOGY APPLICATION IN BUILDING INDUSTRY
<b>Abstract</b>	Our company has developed a new technology which allows to add silver powder - in this case atomic size of grains into building materials (e.g. industry flooring materials). Because the bactericidal action of silver, these materials are implemented in hospitals, clinics, nurseries purposes, production-storage rooms at medicines and drugs, production food areas, food storehouses in stores, discounts, etc.).
<b>Detailed description</b>	The invented technology allows producing the smallest size of grains for many different materials – silver for example. Because the bactericidal action of silver is connected with surface influence, it is obvious that the most interesting for that purpose is the silver with the smallest possible size. It can be imagined that the ball with some dimensions (i.e. the golf ball) is divided in mind to millions parts. It is still a ball of course with this same weight and volume – but the overall area of the divided parts is many, many times bigger than before. Right now, nanotechnology – the newest science trend – allows producing the nano-size of grains for many different materials. That is why due to the big area the silver powder is used with the smallest possible (today) dimensions 3-8 nanometers, which causes that its active area is expanded to the biggest possible size with connection with the highest quantity of silver parts in the volume unit. The fact increases significantly the antibacterial action.
<b>Innovative aspects</b>	Innovative aspect of our technology concerns silver production in nano-size of grains. As a result we are the only company in Europe and one of two in the World which has such technology. What is more, silver is only example. There are much more other materials which can be reduced to the nanoscale. For instance nanotubes (CNT) which exhibit extraordinary strength and unique electrical properties. Thanks to nanosize of tubes and their unique properties, they can be implemented in construction and electronic industry.



<b>Main advantages</b>	Our technology allows us to implement nanosilver inside materials. For this reason antibacterial properties of products which are made in use of our technology are much stronger than properties of products which surfaces are covered by nanosilver. Antibacterial properties of nanosilver are directly connected with the surface size of active area. For this reason our technology allows to reduce costs which concern nanosilver implementing.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy or research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

## Technology Offer TO\_IT\_22556

[ ITALY ]

## Itema Sas

<b>Sector</b>	Conservation of paper.
<b>Activities</b>	Conservation of paper.
<b>Contact</b>	

**Title**

AIR SHELF

**Abstract**

The present invention regards to the librarian sector and particularly a system to be installed on the suitable shelves in order to support the biografics materials of the libraries and the waste papers files which aims to eliminate or reduce the dust accumulated on the books themselves, and to air the surfaces of the facing librarian properties. In spite of the conservative providences carried out, actualy the libraries and the waste papers files warehouses are submitted to the degraded action prevailingly constituted by the two main factors:

- the dust, which, as time has goes by, stores itself inevitably in layers always more consistent over all the facing surfaces;
- the air humidity which, nevertheless controlled and needed, introduce itself into the present dust layers, except the materials themselves.

These two factors favour evidently a kind of microbic and mould vegetation development, as well as the microorganisms proliferation which has the serious, continuous and unarrestable degrade of the sheets and others deterioratable materials (for instance: wood, leather, fabrics, etc) always present, as the damaging effect.

Such microorganisms constitute besides a danger for the people health who keep in contact with the contaminated books, as by work need as by simple consultation.

Indeed, the cases of allergic kind reaction which involve the people skin and also the breathing vias in contact with the contaminated surfaces, are not rare.

Until now, with heavy Administration burden which is in charge of the librarian properties conservation, the reclamation interventions consiste of mechanical cleaning treatments, manual or assisted by mechanical devices which are carried out on the single volume.

**Detailed description**

According to the invention, the system allows to operate a continuity or by intervals kind treatment, with a programmable lenght intervals, which takes part in the beginning of the degrade process, removing the biggest part of the present dust and/or preventing to accumulate the dust on the

surfaces most sensible to the microorganisms attack.

A peculiar characteristic of the idea consists in the fact that the described system allows also to blow a gas or the steams over the mentioned waste paper or books facing surfaces in order to carry out preventive treatments and for the disinfection periodical interventions, also by means of a remote control procedure.

The preferred way of the described realization is constituted substantially of a set of shelves provided by means of directioned blowing comprising:

- a. A plurality of 11 shelves respectively actioned to define a support base for the books 10, having a double bottom, where the first is carried out with a grill or a holed sheet metal and is destined to the own weight support of the volumes, while the second one, under the precedent, is destined to the air flow channel which removes the deposited dust blowing it to the external of the shelf;
- b. A plurality of 6 tubes or conductors fixed to the mentioned set of shelves, actioned to convey and to store the pressure air nearby the books facing surfaces, such tubes are provided of appropriate 1-2 terminal pieces which act substantially as tanks, having 15-16 holes or cracks on a variable opening, suitable to carry out a uniform distribution of the 9 blowing flow;
- c. A plurality of 17 valves which allow, with a simple remote and/or automatic control, to control the internal pressure of the 6 conductors and their relative 1-2 terminal pieces or tanks, as well as to activate the 9 impulsive blowing flows only after the achievement of the pre-fixed pressure.

The 1-2 terminal pieces or tanks of each conductor, in correspondence of which the 15-16 blowing elements are predisposed, act as the pression accumulator and has an opportune capacity suitable to the piece of the served set of shelves, in order to allow an instantaneous unloaded of the accumulated air (or gas or mixture gas) assuring simultaneously an uniform distribution through all the served piece.

The 15 upper blowing elements are directionable and are prepared to act on the upper part of the books crowded on the set of shelves, which can have – obviously – different heights between them.

The 16 lower blowing elements, can evidently also not to be directionable since all the books lean over the same level.

To such purpose the terminal piece 1 of the upper conductors, which acts also as air accumulator, is fixed to the set of shelves in a height adjustable position, just to keep the same form of the terminal piece 2 corresponding of the lower tubes.

In order to adeguate the 9 jet direction and power to the shelves containing books with different heights, are foreseen also opportune changings in the cracks forms or blowing holes.

According to the present invention, the 17 valves system present in the internal of each single 1-2 terminal piece or tank of the fluid accumulator in pression allows, in the installation phase of the new sets of shelves, to adopt an air expulsion control single and contemporary for all the 15-16 blowing elements, or to adopt a differentiate controls, in order to be able to operate in succession. The possibility to carry out a remote control is excellently suitable for an automatic/electronic kind programmation which allows to vary to please the action procedure, also successively to the installation.

Favourably, for further safety and protection of the kept properties, the idea allows to eliminate totally the need of electrical conductors, as the 17 valves actions can be of pneumatic kind, with

the safe elimination of the dangers connected with the fire development because of short-circuits. In alternative, it could be foreseen, a 17 electro-pneumatic valves commanded in low pressure, limiting however the fire risk.

#### Innovative aspects

Usually, the mentioned cleaning is followed by the disinfection treatments which consist nowadays in to contain the waste paper modest quantity (about 0,5 m<sup>3</sup> or less) in sealed rooms where, with several methodologies, eliminate itself by periods more or less longing, the oxygen in order to suppress the present micro and macro organisms, as the use of strong poisons utilized in the past, such as the metylen bioxid, is forbidden.

Such operations, applied to the existing immense heritages, have understandably, high costs and very long time treatments.

The main objective of the present invention, then, is that of surpassing the mentioned problems eliminating the dust increase on the books and waste papers documents facing surfaces on the files and librarian shelves.

This has been obtained, according to our idea, foreseen a system provided by means of the emission of air, or other gaseous or gas mixture fluid, preferably with intervals, directed to the waste papers or books facing surfaces, of each emission competence.

#### Main advantages

A further advantage offered by the present invention consists of the possibility to get ready, in the installation phase, the 6 tubes connection of the air feeding or blowing fluid to the already existent systems or in development phase, act to the fire gas and/or gas or disinfectant volatile substances emission, whether by emergency or maintenance interventions of the librarian heritage.

Finally, still an advantage of the idea, is given from the fact that the presence of the 1-2 fluid in pression accumulation tanks in proximity of the 15-16 exit jets, allows also to employ 6 fluid in pression feeding tubes in a much reduced flow, as the action intervalls foreseen between one expulsion and the successive.

To this point, is opportune to emphasize that the system just described can be favourably installed, without any modification, also on the existent sets of shelves: in this case it is necessary that the books support level allows the air passage of the 16 lower cleaning jets. If this could not be, it is enough simply to use a grill of a well-known kind between the books lower side and their support level, which keeps them slightly lifted from the same level allowing just cleaning directioned jets passage.

According to the present invention, the system is particularly effective if the air where it is carried out is provided with filter means and air forced exchange, which allow to remove the books dust from the same air thanks to the directioned jets action just described.

The present invention has been described and illustrated in one of its preferred way of realization, but it is evident that any expert sector technician could bring modifications and/or substitutions technically and/or functionally equivalents.

Current state of development

Intellectual Property Rights

Application domains

Collaboration details

Type of partner sought

Tasks to be performed  
by the partner sought

IRC Partner

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Patent(s) applied for.

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Materials Technology.

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Academy

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IRC IRIDE

## Technology Offer TO\_IT\_21869

[ ITALY ]

## MBL Solutions Srl

www.mblsolutions.it

<b>Sector</b>	Design and production of innovative microwaves machines.
<b>Activities</b>	Microwaves technologies for pest control in wood artworks and restoration.
<b>Contact</b>	

<b>Title</b>	INNOVATIVE MICROWAVES TECHNOLOGY FOR RESTORATION AND PEST CONTROL IN WOODEN IMMOVABLE STRUCTURES
<b>Abstract</b>	An Italian SME developed a mobile microwaves device for pest control of wood. It is the first full optional industrial system coming from the most advanced Italian scientific and industrial research in the field of pest control. The system substitutes chemicals (mainly methyl bromide) having similar effects, without causing danger either for health or for environment. The SME is interested in commercial agreements with technical assistance with companies distributing systems for pest control.
<b>Detailed description</b>	An Italian company is devoted to identifying innovation needs and develop proper technological solutions satisfying the specific client's requirements. One of the solutions developed is an industrial microwaves mobile device for pest control of immovable wooden materials. It is completely transportable, light, strong and extremely efficient. Its modularity allows easy and rapid dismantlement and re-assembly even in very complex sites. The machinery is equipped with a mechanical system for rapid dismantlement, a microwaves generation device with an antenna the geometry whereof, if properly studied, ensures the best electromagnetic field uniformity, hence excellent uniformity of heating. Infrared temperature sensors, for real-time thermal monitoring of the treated materials, enable electromagnetic irradiation interruption as soon as the programmed temperature is reached (Thermal Monitoring System with Programmable Thresholds). The device is also endowed with an Electromagnetic Monitoring System that constantly checks the working environment and guarantees the respect of the EM (electromagnetic) human exposition limits, according to the EU standards in force. So, the operational area is completely safe both for operators and environment.
<b>Innovative aspects</b>	The system is the first full optional industrial mobile microwaves device, replacing the dangerous chemicals commonly used for pest control. It ensures:

TECHA

	<ul style="list-style-type: none"> <li>• 100% pest lethality;</li> <li>• Very short treatment time with comparison to other methods;</li> <li>• Very easy treatment conditions for both the premises residents and the pest control operators;</li> <li>• Electromagnetic safety;</li> <li>• No need of pre-treatment preparation, nor post-treatment work;</li> <li>• Logic controller with simple and intuitive man-machine interface.</li> </ul>
<b>Main advantages</b>	The method is completely safe and does not produce pollution. The machinery can be installed in a few minutes thanks to rapid joint electric connectors, with different layouts according to the client's needs. It ensures excellent concentration of electromagnetic field, thus allowing optimal heating uniformity in the material, which results in very fast and safe pest control treatment.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for. Patent(s) applied for but not yet granted.
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Companies.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22343

[ ITALY ]

## Università degli studi del Molise, Dipartimento di Scienze e Tecnologie per l'Ambiente e il Territorio (STAT)

www.unimol.it

<b>Sector</b>	Bio-clean applied to artworks.
<b>Activities</b>	Research and application of processes for biological removal of environmental pollutants on various of surfaces.
<b>Contact</b>	

<b>Title</b>	PROCESS FOR THE BIO-CLEANING OF THE SURFACES OF OBJECTS OF VARIOUS CHEMICAL NATURES AND BUILDINGS, INCLUDING CULTURAL HERITAGE (BIOCLEAN-ART)
<b>Abstract</b>	Biological removal of environmental pollutants (biocleaning) is efficient method to clean altered artistic stoneworks and surfaces of buildings. In particular, nitrates, sulphates and organic matters tested by denitrifying, sulphate-reducing and biodegradation activities of selected microbial cultures applied by inert support, in aerobic or anaerobic conditions, on the surfaces can be removed.
<b>Detailed description</b>	<p>Biological removal of environmental pollutants (bioclean-art) is efficient method to restore altered artistic stoneworks. In particular, nitrates, sulphates and organic matters tested by denitrifying, sulphate-reducing and biodegradation activities of selected microbial cultures applied on the stones can be removed. The biological process (bioclean-art), as a consequence of activities of microbial cultures selected, brings to release of nitrogen, H<sub>2</sub>S and carbon dioxide from pollutants tested without use of toxic compounds and, consequently, must be considered an environmental compatible fully method.</p> <p>Evaluation and the optimization of the parameters of the biological process, applications on real outdoor, employ in wider fields need the set up of a continue and abundant activated biomass production. on adequate matrices by fermentative reactor in pilot plant; then realising and maintenance controlled conditions, the use of a rapid and sensitive methods to monitor the biological activities; to avoid the undesired effects on the surface materials, and finally, the correct and complete removal of the residual biological activities.</p> <p>In the last five years, the researches and the results carried out in situ (Affreschi Camposanto Monumentale di Pisa, Duomo di Milano, Duomo di Matera) confirm us the capabilities of bioremediation methods on artistic stoneworks (bioclean-art) and to reduce the limit.</p>



<b>Innovative aspects</b>	Recently, bioremediation and bioaugmentation (bio-cleaning) became an alternative advanced way of recovery the surfaces of objects of various chemical natures and buildings, including Cultural Heritage by exploiting natural phenomena; it can be intend as a “new soft” bio-technology (bioclean-art) and represents helpful to the “traditional” physico-chemical technologies.
<b>Main advantages</b>	The biological process (bioclean-art), as a consequence of activities of microbial cultures selected, brings to release of nitrogen, H <sub>2</sub> S and carbon dioxide from pollutants tested without use of toxic compounds and, consequently, must be considered an environmental compatible fully method. The bacteria employed are not pathogens and are naturally present in the environment. The results confirm the potentiality of bioremediation and biocleaning processes as soft innovative technology based on the use of bacteria and their metabolic activity in the recovery of the artistic stoneworks and surfaces of objects of various chemical natures and buildings, degraded by atmospheric pollutants.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for. Italian Patent: Procedimento di biopulitura di superfici di manufatti di diversa natura chimica ed edifici. MI2006A000776 (2006) Titolare: Università di Milano & Università del Molise Inventore: Claudia Sorlini, Francesca Cappitelli, Elisabetta Zanardini, Giancarlo Ranalli.
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	1. Industry – Manufacturing/subcontracting agreement: industrial scale production of the bacteria-based products for cleaning; the products are not on the market yet; 2. Commercial Organisation: interest for the exclusive right to represent the products on the market; 3. Partners for financial resources in R&D.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRID

## Technology Offer TO\_IT\_22280

[ ITALY ]

## Università degli studi di Bari, Centro interdipartimentale laboratorio di ricerca per la diagnostica dei beni culturali

www.uniba.it

<b>Sector</b>	Research for new tools and methodologies for cultural heritage diagnostics.
<b>Activities</b>	Archaeometrics investigation, dating, laser cleaning.
<b>Contact</b>	

<b>Title</b>	TECHNIQUES AND METHODOLOGIES FOR DIAGNOSTICS OF CULTURAL HERITAGE
<b>Abstract</b>	<p>An Italian interdepartmental university research centre offers diagnostic activities and services for Cultural Heritage.</p> <p>Available techniques:</p> <ul style="list-style-type: none"> <li>• non-invasive transportable micro-Raman spectroscopy;</li> <li>• inductively coupled plasma mass spectrometry (ICP-MS);</li> <li>• (pyrolysis)-gas chromatography/mass spectrometry (Py-GC/MS);</li> <li>• optical microscopy and stereoscopy equipped with image acquisition, storage and elaboration;</li> <li>• high resolution electron transmission microscopy (HR-TEM);</li> <li>• thermoluminescence;</li> <li>• laser induced breakdown spectroscopy (LIBS);</li> <li>• X-ray photoelectron spectroscopy (XPS);</li> <li>• X-ray diffraction (XRD);</li> <li>• nuclear magnetic resonance spectroscopy (NMR);</li> <li>• transportable Nd:YAG laser systems for on site laser cleaning.</li> </ul>
<b>Detailed description</b>	<p>The research laboratory performs archaeometric investigations and studies on Cultural Heritage artefacts.</p> <p>Diagnostic activities and services:</p> <ul style="list-style-type: none"> <li>• characterisation of paint layers;</li> <li>• analysis of proteic, lipidic, saccharidic and polymeric materials;</li> <li>• analysis of pigments;</li> <li>• chemical element analysis;</li> <li>• trace and ultra-trace analysis;</li> <li>• structural analysis of crystalline phases;</li> <li>• dating of artefacts;</li> </ul>

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	<ul style="list-style-type: none"> <li>• authenticity studies;</li> <li>• chemical characterisation of surfaces;</li> <li>• optical and electronic microscopy;</li> <li>• preparation and embedding of thin and macro-micro metallographic sections and characterisation by optical and electronic microscopy;</li> <li>• high resolution electron transmission microscopy;</li> <li>• laser cleaning of stone, ceramics and other artefacts;</li> <li>• quantitative and morphological characterisation of microbial communities in biofilms.</li> </ul>
<b>Innovative aspects</b>	<p>The research laboratory continuously improves and implements diagnostic methodologies:</p> <ul style="list-style-type: none"> <li>• Development of diagnostic methodologies for the chemical characterisation of works of art;</li> <li>• Study of conservation treatments;</li> <li>• Development of statistic models for data treatment for attribution and provenance studies;</li> <li>• Development of chemical and physical methodologies of dating;</li> <li>• Study of deterioration layers on various substrates of mobile artefacts and monuments;</li> <li>• Study of phenomena and processes of biodeterioration;</li> <li>• Development of methodologies for laser cleaning of stone, ceramics, wood and metallic objects for conservation treatments or industrial applications.</li> </ul>
<b>Main advantages</b>	<p>The main advantage of this research centre is related to the interdisciplinary and complementary approach adopted for diagnostic investigation of Cultural Heritage. This approach allows a complete characterisation of various materials and artefacts based on the synergic collaboration between chemists, physicists, biologists, geologists, art historians and archaeologists.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	The expected partners are identified as private and public owners of works of art, restorers and research organisations willing to carry out diagnostic investigations and/or laser cleaning.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22306

[ ITALY ]

Università degli studi di Brescia, Dipartimento di Ingegneria Civile, Architettura, Territorio (DICATA)

www.unibs.it - <http://dicata.ing.unibs.it/tecnicacostruzioni>

<b>Sector</b>	Research on construction technologies.
<b>Activities</b>	Mechanical tests on lime mortars with natural pozzolana.
<b>Contact</b>	

<b>Title</b>	EXPERIMENTAL INVESTIGATION ON MECHANICAL BEHAVIOUR OF NATURAL POZZOLANA LIME MORTARS AS A FUNDAMENTAL STEP FOR THE DESIGN OF STRUCTURAL REPAIR OF HISTORICAL BUILDINGS
<b>Abstract</b>	<p>The proposed technology deals with the investigation of the mechanical behaviour (EN 1015-11) of lime mortars (NHL, EN 459) enriched with natural pozzolana. In the first part of this experimental research, a set of different mortars were reproduced in laboratory according to traditional methods, and tested after 28, 60 and 90 days of curing. An innovative penetration test, not included in European Standards but very suitable for obtaining experimental data on compressive strength in situ, was studied and adopted as well.</p> <p>Mechanical tests on plastering mortar are also planned.</p>
<b>Detailed description</b>	<ul style="list-style-type: none"> <li>• Determination of flexural and compressive strength (EN 1015-11: 1999);</li> <li>• Determination of static modulus of elasticity in compression (UNI 6556: 1976);</li> <li>• Determination of adhesive strength of hardened rendering and plastering mortars on substrates (EN 1015-12: 2000);</li> <li>• Determination of cylinder splitting tensile strength (UNI EN 12390: 2002);</li> <li>• Penetrations test, non-destructive test not include in European Standards. The method is based on the measurement of the penetration depth increment of a steel probe by means of repeated blows of a Schmidt rebound hammer.</li> </ul>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Using mortar with natural lime and pozzolana in conservative interventions, taking into account the necessary compatibility between the original materials and the new ones;</li> <li>• The mortar mix designs selected and reproduced in laboratory clearly show that the compressive mechanical strength increases in time because of the natural pozzolana addition;</li> <li>• Penetration tests can be successfully adopted as reliable non-destructive tests on historical masonry and it can be easily used as in situ tests;</li> <li>• It's the first time that historic mix designs are reproduced in a laboratory following the indications</li> </ul>

	traced in the architectural treaties (printed documentary sources).
<b>Main advantages</b>	<p>From a technological point of view, mortar identification is a fundamental step in the design of the repair materials, taking into account the necessary compatibility between the original materials and the new ones.</p> <p>From an historical point of view, the study of mortars manufacture provides useful information on the building culture and the use of building materials, helping in indicating the different construction phases and in planning conservative interventions.</p> <p>The comparison between the results given by the penetration tests and the compressive tests confirmed that exists a correlation between them. The simple, practical method used to study the mechanical response of mortar joints shows important relapses upon restoration and maintenance of historical heritage.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industrial partners.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

Technology Offer TO\_PL\_22249

[ POLAND ]

Wojskowa Akademia Techniczna

www.wat.edu.pl - http://www.pollasnet.org.pl

<b>Sector</b>	Optoelectronics, laser applications.
<b>Activities</b>	Laser cleaning of monuments and works of art.
<b>Contact</b>	

<b>Title</b>	LASER CLEANING OF MONUMENTS AND WORKS OF ART
<b>Abstract</b>	The Institute of Optoelectronics of Warsaw Military University of Technology developed technology of laser cleaning of monuments and works of art, that has been proven in many conservation works. Technology of laser cleaning is a non-contact technique avoiding any chemical contamination and mechanical destruction of the precious objects. The Institute is looking for partners interested in joint conservation projects as well as in technical co-operation.
<b>Detailed description</b>	<p>Method utilizes laser ablation process, in which a matter transfers from solid state into gaseous phase. Laser pulse incident on the object is absorbed by dirt layers, heating it to the evaporation temperature and removing from original object substrate. Polluted surfaces could be cleaned with a surgical precision with only minimal material losses, which in turn could be easily intercepted by sucking-filtrating system. Technology offers utilization of set of own ReNOVALaser Nd:YAG and Er:YAG systems for different cleaning applications as well as diode pumped picosecond Nd:YAG laser with computer controlled x-y table designed for cleaning of paintings, paper and parchment. Nd:YAG laser systems are equipped with harmonic generators (UV, VIS and NIR wavelengths), pantographs and optical fibers. Several diagnostic methods, based on arrangements ready to use, are proposed to study different aspects of laser-matter interaction during laser renovation of different substrate materials, among them:</p> <ul style="list-style-type: none"> <li>• reflectometry, acoustics, LIBS and Raman spectrometry to estimate the progress of the process "in situ" and control it in the real-time to stop cleaning process before interference of laser beam with the original substrate of object;</li> <li>• photo-acoustic spectrometry for the sensitive detection of gas concentrations generated during laser ablation.</li> </ul>
<b>Innovative aspects</b>	Cultural Heritage objects (buildings, monuments, statues, cloths etc.) are cleaned conventionally by mechanical and/or chemical means providing only a limited control of the cleaning process. This may lead to the destruction of the surface layer and substrate as well as create environmental

hazards. Laser cleaning, in contrast, is a non-contact technique avoiding any chemical contamination and mechanical destruction of the objects.

### Main advantages

- non-contact – energy is delivered in the form of an electromagnetic wave.
- directly controlled – possibility of selection of suitable laser wavelength, energy density in the laser beam as well as pulse repetition frequency. Cleaning can be immediately (also automatically) stopped by switching off a laser.
- selective – laser radiation is highly monochromatic. Selection of wavelength, which is strongly absorbed in a given encrustation but weakly in underlying substrate provides removal of dirt layers without infringement of a substrate material. Due to difference in reflection coefficient, laser beam itself can select between dirt and original object.
- local – laser cleans only the place to which a laser beam is directed. Conservator can change the beam diameter from hundredth parts of millimeter to several centimeters, changing simultaneously energy density – laser fluence. Using optical fiber, laser radiation can be directed to areas difficult to reach or to the object's hollows while laser unit can be placed even a few dozen meters away from the cleaned object.
- environmentally friendly – laser cleaning does not produce huge quantities of wastes in contrast with abrasive methods, where a lot of waste material and liquids are present. Dust and gases connected with removed materials are the only substances accompanying laser renovation. Laser method does not employ dangerous chemicals and solvents so, it is easy to ensure safety and working comfort.
- complementary – many complicated objects with especially complex technological structure and different water and chemical resistance can be met in the conservation practice. Thus, traditional techniques for encrustation removal cannot be used. Laser technology is a supplement to conventional procedures which offers selective and precise operation.

### Current state of development

#### Intellectual Property Rights

Secret know-how. Each utilized laser arrangement is characterized by slightly different output parameters and each individual object in turn creates its own and unique, different conservation problems. Hence, there is no possibility to establish standards, copyrights, specific action procedures. Parameters, desired for specific encrustation removal and expected cleaning level are established during preliminary investigations.

#### Application domains

Construction technology; Materials technology. Developed ReNOVALaser systems have been utilized for cleaning of more than hundred of diverse objects with various substrate materials. It includes removal of black hard encrustations from marble, sandstone, limestone, terracotta, plaster and alabaster; overpaintings from monochrome decorative fabrics and black silver sulfates from gilded silver threads; mold and fungus from fabrics, leather, parchment and paper; calcinations from clay and leaden goods; corrosion from bronze, aluminium, iron and numerous metal alloys; varnish, binders and overpaintings from painting layers as well as polluted layers from ivory and bones. Especially important, from the point of view of research and development program, was conservation work in Sigismund Chapel, at King's Cathedral, Wawel Castle in Cracow (cleaning of more than 800 m<sup>2</sup> of walls and interior).

#### Collaboration details

#### Type of partner sought

Industry, research, services.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC Central Poland

## Know-how/expertise KHE\_FR\_22253

[ FRANCE ]

## A-Corros

<b>Sector</b>	Diagnostics and conservation of metals.
<b>Activities</b>	Diagnostics and conservation of metallic artworks either terrestrial or submarine.
<b>Contact</b>	

<b>Title</b>	EXPERTISE AND DIAGNOSIS IN CORROSION AND CONSERVATION OF METALLIC CULTURAL HERITAGE, EITHER TERRESTRIAL OR SUBMARINE
<b>Abstract</b>	<p>A french company offers expertise and diagnosis in corrosion problems of the metallic Cultural Heritage, either terrestrial or submarine.</p> <p>The company is looking for industrial or research partners to collaborate in a Mediterranean centre for conservation and restoration of underwater artefacts.</p>
<b>Detailed description</b>	<p>A-Corros is a company specialized in the expertise and diagnosis in corrosion problems of the metallic Cultural Heritage, either terrestrial or submarine. The working fields are mostly harbour infrastructures, industrial heritage (metallic monuments) and submarine archaeology.</p> <p>On the industrial heritage point of view, A-Corros deals with on site corrosion measurements, laboratory experiments and provides some conservation recommendations. A-Corros is specialized either in the on site diagnosis or the laboratory experiments (in collaboration with LERM society) and especially on non-destructive testing.</p> <p>The next axis of development will deal with the creation, in Arles, of a Mediterranean centre for conservation and restoration of underwater artefacts. This laboratory will work with European and moreover Euromediterranean partners in order to develop some collaboration in the fields of:</p> <ul style="list-style-type: none"> <li>• corrosion expertise: optimizing on site diagnosis tools and protocols;</li> <li>• conservation: developing on site conservation treatments and optimizing treatment times;</li> <li>• education: training archaeologist and young conservators.</li> </ul>
<b>Innovative aspects</b>	<p>The innovative aspects of this project lay on research projects:</p> <ul style="list-style-type: none"> <li>• development of tools able to ameliorate the on site diagnosis by means of non-destructive testing (acoustic emission, lamb waves, etc.);</li> <li>• development of a really innovative method to dechlorinate underwater archaeological artefacts: use of subcritical fluids.</li> </ul>



<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights. In link with Clemson University, South Carolina, U.S.A
<b>Application domains</b>	Construction technology; Materials technology; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Research organisation and industries.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	MedIN (French Mediterranean)

Know-how/expertise KHE\_IT\_22482

[ ITALY ]

CNR, Istituto di Biologia e Patologia Molecolari (IBPM)

www.ibpm.cnr.it

<b>Sector</b>	Research and studies in the biotechnology sector.
<b>Activities</b>	Production of enzymes for wood, paper and frescos restoration.
<b>Contact</b>	

<b>Title</b>	BIOTECH PRODUCTION OF ENZYMES IN MICROORGANISMS
<b>Abstract</b>	<p>Enzymes are bioreactive molecules able to catalyze chemical reaction such as degradation of specific substrates. Biotech technology is able to produce in the laboratory simple microorganisms as optimal producers of bioactive enzymes.</p> <p>Enzymes have been successfully applied at restoration of wood, paper and fresco. We propose a novel approach for production of friendly useful bioactive molecules in simple microorganisms.</p>
<b>Detailed description</b>	<p>Barley alpha amylase has been produced in an engineered strain of brewery yeast. The enzyme produced has been applied for dissolving starch glues used in old paper and ancient books.</p> <p>A pilot study carried out in our laboratory has obtained a good protocol for the utilization of bioengineered yeast strains as enzyme producers.</p>
<b>Innovative aspects</b>	<p>Although enzymes have been proposed as useful molecules their high cost of commercially available enzymes and storage as active molecules made their use difficult and expensive. By applying novel biotech approaches we are able to offer novel protocols and strategies for the production and the utilization of freshly produced enzymes in microorganisms.</p> <p>This approach is innovative, not very expensive and is able to produce cell free medium containing the enzymatic activity of interest.</p>
<b>Main advantages</b>	<p>Enzymes like amylases, lipases and proteases are used to dissolve glues and other substrates. In particular in ancient book and paper restoration amylases are used for dissolving glues.</p> <p>Our aim is to use biotechnology in order to produce a miscellanea of specific microorganisms as novel generation biofactories able to produce and secrete in the growth medium active enzymes that can be easily applied in restoration.</p> <p>The easy and low cost growth procedures, the possibility to produce freshly active molecules and the versatility of the approach make our experimental strategy innovative in the field of Cultural</p>

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	Heritage restoration.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc) We are interested in set up collaboration with small medium enterprises able to support with a small budget further application and production of biotech enzymes.
<b>Application domains</b>	Materials technology. Restoration, cultural heritage, ancient paper, industrial application.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry small medium enterprise.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_22316

[ ITALY ]

## CNR, Istituto per la Conservazione e la Valorizzazione dei Beni Culturali (ICVBC)

www.icvbc.cnr.it

<b>Sector</b>	Research and studies in the field of conservation of cultural heritage.
<b>Activities</b>	Development of innovative technologies and methodologies for restoration, conservation, monitoring and promotion of cultural heritage.
<b>Contact</b>	

<b>Title</b>	FLUORINATED POLYMERS FOR CONSERVATION AND RESTORATION OF STONE ARTIFACTS
<b>Abstract</b>	An Italian research centre developed and studied different fluorinated and perfluorinated polymers to be used for the consolidation and protection of stone works of art. Thanks to the high energy of the C-F bond, these compounds show high chemical stability that, associated with their high hydrophobic properties, makes them eligible products for the conservation and restoration of Cultural Heritage objects exposed to aggressive environment. The proponents look for the technical collaboration with companies able to develop the synthesis to an industrial level..
<b>Detailed description</b>	The development of fluorinated polymers concerns the synthesis of different classes of compounds: perfluoropolyetheric amides and partially fluorinated (metha)acrylic polymers. Perfluoropolyetheric amides are viscous liquid materials having high chemical stability and bearing polar groups capable of "fixing" them to polar substrate such as stone. Their properties make them eligible as protective agents for stone objects of relevant historical and artistic importance, in particular for those exposed to an aggressive environment. Partially fluorinated (metha)acrylic polymers, on the other hand, in consequence of their suitable glass transition temperature, solubility in many organic solvents, water repellence, adhesive and cohesive properties, may be considered good consolidants for porous decayed materials such as stone or wood artefacts. Among the different partially fluorinated (metha)acrylic polymers, the poly 2-fluoroacrylate show the higher chemical stability and may be also proposed as protective agents for stone works of art.
<b>Innovative aspects</b>	The conservation and restoration of works of art is usually performed with polymers or pre-polymers, supplied from the market for other uses and adapted for this specific application. The main characteristics of the involved products are water repellence capacity, and adhesive and cohesive properties which make them appreciated products for the consolidation and protection of indoor as well as outdoor stone artifacts.

One of the more important drawbacks of the currently traditional compounds is their moderate or low chemical stability that reduces the lifetime of the conservation treatments and, often, produces undesirable by-products. The low chemical stability is usually due to the low energy of the C-H bond.

It is known that perfluorinated compounds, thanks to the high energy of the C-F bond, show high stability. However they are not suitable for stone treatments because of their low affinity with these polar materials. Introduction of polar groups in the perfluorinated chain, or the substitution of specific hydrogen with fluorine in the molecule of traditional polymers, greatly improves the performances of the final products.

In the case of the perfluorinated compounds the presence of polar groups, such as the amidic ones, gives affinity with stones without losing the chemical stability of the original compounds. In the case of traditional polymers (acrylic polymers) the partial fluorination in the main chain improves the chemical stability maintaining the appreciated properties of the not fluorinated polymers.

#### Main advantages

The synthesis of specific compounds for the conservation and restoration of works of art puts at disposal of restorers and institution devoted to conservation of Cultural Heritage products with well known and tested characteristics, and in particular with defined and desired properties. Moreover, the knowledge of the characteristics of the treatment products allows choosing the better solution for any case, avoiding undesirable or irreparable final results.

#### Current state of development

#### Intellectual Property Rights

Others (registered design, plant variety right, etc).

#### Application domains

Materials technology.

#### Collaboration details

#### Type of partner sought

Industry, in particular chemical companies specialized in polymers and/or fluoropolymers.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC RECITAL

Know-how/expertise KHE\_IT\_22567

[ ITALY ]

Politecnico di Torino, Dipartimento di Scienza dei Materiali e  
Ingegneria Chimica (DISMIC)

www.dismic.polito.it

<b>Sector</b>	Research on materials science and electronics.
<b>Activities</b>	Innovative materials for corrosion and protection of metallic artefacts, low pressure plasma coatings for protection of cultural heritage.
<b>Contact</b>	

<b>Title</b>	PECVD COATINGS FOR PROTECTION OF METALLIC ARTEFACTS
<b>Abstract</b>	Tackling the conservation problem of bronze archaeological artefacts, the plasma enhanced chemical vapour deposition technique of organosilicon thin films for protecting the artifacts for long-term exhibition may be proposed.
<b>Detailed description</b>	<p>The plasma enhanced chemical vapour deposition (PECVD) technique was adopted in the frame of different INCMED projects for producing new corrosion resistant organosilicon thin films with protective barrier effects against aggressive agents on bronze archaeological artefacts. This eco-friendly, reliable and effective method was implemented in a home-made reactor. It started from such organosilicon precursors, as hexamethyldisiloxane (HMDSO), tetraethoxysilane-(TEOS), tetramethoxysilane-(TMOS), and with different oxygen-argon mixtures and different input power values. The innovative coatings similar to <math>\text{SiO}_2</math>, were tested and optimised on copper-based reference alloys. This was done in the conditions in which they were received and aged in different soils. The reference alloys possessing micro-chemical and micro-structural characteristics similar to the ancient alloys, allow a reliable optimisation of the PECVD coatings proposed for the later stage of restoration and protection of bronze archaeological artefacts.</p> <p>Extensive testing of the used parameters resulted in the optimisation of the PECVD treatment technique. Moreover, the plasma phase, the characteristics of the obtained deposits and all possible operative scenarios were extensively explored. This information was significant for successive process scale-up and for the in situ process control.</p> <p>Research work showed that variations in the process conditions are highly related to the chemical composition and the properties of the deposit.</p> <p>In summary the corrosion protection properties similar to <math>\text{SiO}_2</math> thin films are strongly affected by the variation of the plasma process parameters. There is a marked increase in the protective effectiveness of the coatings obtained with the increase of the discharge input power. This leads to the formation of more inorganic films. Plasma pre-treatment processes play an important role in</p>

	determining the inhibiting properties of the deposited film. The pre-treatment removes the surface contamination, thereby reducing the defectiveness degree of the coating and enhancing its adhesion to the substrate. By performing the deposition process in oxygen-rich plasma, a further increase of the protective properties of the layers is achieved.
<b>Innovative aspects</b>	With respect to the commonly used inhibitors PECVD is a non-toxic technique furnishing a long-lasting result.
<b>Main advantages</b>	The versatility of the PECVD may be exploited in numerous coatings' applications with various substrates ranging from metals and paper to textiles and polymers. This is due to the low pressure and low temperature operative conditions employed. The analysis of the environmental impact justifies the great interest of performing PECVD treatments on metallic substrates also from an industrial point of view.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, research organizations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	ALPS IRC

Know-how/expertise KHE\_IT\_22281

[ ITALY ]

Università degli studi di Bari, Centro interdipartimentale  
laboratorio di ricerca per la diagnostica dei beni culturali

www.uniba.it

<b>Sector</b>	Research for new tools and methodologies for cultural heritage diagnostics.
<b>Activities</b>	Archaeometrics investigation, dating, laser cleaning.
<b>Contact</b>	

<b>Title</b>	BIOACTIVE NANOPARTICLES TO FIGHT MICROBIAL COMMUNITIES ON STONE ARTWORKS
<b>Abstract</b>	An Italian university interdisciplinary research group is developing a both remedial and preventive approach to decrease microorganisms proliferation on stone artworks. The method is based on the use of bioactive copper nanoparticles as antimicrobial agents capable to exert a marked biological activity over a long period of time. Researchers are looking for a partner for technical cooperation and/or financial support.
<b>Detailed description</b>	<p>The copper nanoparticles (NPs) have a core-shell structure in which a metallic core is surrounded by a shell composed of the surfactant molecules. The colloidal dispersions are morphologically stable and can be easily exploited thanks to their composition.</p> <p>Due to their core-shell structure, when exposed to an aqueous solution, the NPs exert a controlled release of metal ions. Preliminary experiments performed on exponential cultures have shown a reduced or complete inhibition of bacteria in generating colonies on appropriate media. The activity of NPs was tested on different concentrations, ranging from <math>1 \times 10^5</math> to <math>1 \times 10^9</math> colony forming units (CFU) /ml, of a number of Gram-positive bacteria (namely, <i>Bacillus Pumilus</i> ATCC 7061, <i>Bacillus megaterium</i> ATCC 14581, and <i>Arthrobacter histinolovorans</i> ATCC 11442). No significant difference in activity of NPs was detected.</p> <p>Studies are presently underway to determine the effectiveness of NPs on spore germination and to establish the minimal inhibitory concentration of NPs for complete bacterial-growth inhibition. The activity of NPs will be further investigated through molecular methodologies for selective amplification, by real-time PCR (RT-PCR) amplification, of targeted DNA sequence from only viable cells in the presence of dead cells.</p>
<b>Innovative aspects</b>	The innovative aspect of the use of copper NPs in the field of biodeterioration of Cultural Heritage is both related to the enhanced bioactivity of the metal when applied in the form of nanoparticles and to the structure of the NPs themselves. The core-shell structure provides a control over the



	releasing properties of the metal ions and a proper tuning of their bioactivity. Thanks to the nanometer size, a low concentration of biocide is sufficient for remedial and preventive bioactivity. The NPs can be incorporated in polymer systems, as used in consolidation and protection treatments, in order to create nanocomposites gradually releasing bioactive copper ions.
<b>Main advantages</b>	The main advantage of our method relies in the combined use of consolidant/protective polymer systems and bioactive material to be applied on out-door stone monuments.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

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# 3 Information and communication technologies for cultural heritage



2008

## Technology Offer TO\_IT\_22331

[ ITALY ]

## Alpha Consult Srl

www.alphaconsult.it

<b>Sector</b>	WEBGIS.
<b>Activities</b>	Consultancy and technical assistance in GIS, georeferenced cartographic data, thematic maps and in setting up data modelling for environmental risk analysis.
<b>Contact</b>	

<b>Title</b>	WEBGIS APPLICATIONS FOR CULTURAL HERITAGE MAPPING AND ADVANCEMENT
<b>Abstract</b>	Preparation of web Gis portals for central, regional and local authorities, including applications development for the Ministero per i Beni e le Attività Culturali (Italian Ministry of Cultural Heritage and Activities), geo-referencing tools for archeological sites, architectural places, materials according to the guidelines of ICCD, Ministry's Institute for the Central Catalogue and Documentation.
<b>Detailed description</b>	Alpha Consult is made up of an independent group of highly qualified, skilled and experienced professionals, providing consultancy and technical assistance in GIS to both the public and the private sectors. A technology centre for the development of customised solutions using commercial and in house GIS products and facilities to set up webGIS sites are installed in the firm's premises. L'Alpha Consult Srl has a technical data entry service centre, equipped with high resolution scanners, automatic vectorization programs, and staff specialised in georeferencing cartographic data, preparing thematic maps and setting up data modelling for environmental analysis.
<b>Innovative aspects</b>	Technology integrator: using off the shelf products such as Map Guide, Autocad, Map 3D of AutoDesk Inc. ArcMap 9.2 and SDE of ESRI Inc. SQL and Microsoft Office products, providing a shell both on the server side and on the client side to integrate and automate all the products, by means of Alpha Consult developed applications such as GDL (Graphic Data Link) and Info Map and Medatata Server respectively Map 3D and Map Guide application. GPS integration with webGIS tools is also provided, including applications complying with Open Geospatial Consortium (OGC) web specifications such as Web Map Service (WMS), client and server.
<b>Main advantages</b>	Turnkey solutions: Alpha Consult srl develops turnkey solutions including data preparation, application development and web provider, that became a map proving services when geographic

data are involved. Web hosting and database transactions application are provided such as in the webGIS portal of the Viterbo Province or the Lazio Region applications.

**Current state of development**

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**Intellectual Property Rights**

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**Application domains**

Information processing, information systems.

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**Collaboration details**

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**Type of partner sought**

Accademy and research organisation.

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**Tasks to be performed  
by the partner sought**

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**IRC Partner**

IRC CIRCE

Technology Offer TO\_IT\_22387

[ ITALY ]

Applidea Editrice Srl

www.applidea.it

<b>Sector</b>	Web, publishing, communication.
<b>Activities</b>	Activities: Website, database and 3D development for cultural heritage.
<b>Contact</b>	

<b>Title</b>	WEB-BASED ARCHIVES ON HUMAN SKELETAL MATERIAL WITH TRIDIMENSIONAL REPRESENTATIONS
<b>Abstract</b>	The Anthroponet project is a comprehensive archive of the skeletal material from Sardinia, based on a digital database that can be accessed on the web. The period considered stretches from the Lower Paleolithic to the end of the Roman Empire articulated in the following phases: definition of the data dictionary and cataloging criteria of skeletal materials; recording; compilation of information units and glossary; digitalisation of data; 3-dimensional reconstructions; creation of the web interface.
<b>Detailed description</b>	<p>The projected database is composed by seven major groups of information: geography, general information, excavation and burial type, archaeological and anthropological information, relative and absolute dates, bibliography. Some items will be complemented by graphics, photographs, tridimensional representations (skeletal elements and artifacts). These will enable the retrieval of dimensions (length, angles, perimeters, areas, volumes). The database is susceptible to be updated as new skeletal collections become known or are recovered.</p> <p>In order to allow the use of the resulting website for touristic and educational purposes, informative pages concerning the scientific contents, and a glossary of technical terminology will be published. The end result will be a useful instrument for scholars of prehistory and ancient history, who will be able to retrieve specific information and perform comparative analyses. The produced synthesis of information truly represents a necessary condition for the study of the evolution of the bio-demographic features of Sardinia in the period covered.</p>
<b>Innovative aspects</b>	<p>Anthroponet project is the first experiment on Italian territory and one of the first, at the international level, about census of skeletal material on a geographical basis and on-line spread of results. It uses Google API (Application Programming Interface) map technology: archaeological sites are located on maps according to coordinates inserted during census.</p> <p>Three-dimensional reproductions allow prolonged and non-invasive use of special finds, which can be</p>

examined and measured accurately without being touched, thus remaining preserved from the risks of wear. It's possible to get measuring linear, angular and more.

<b>Main advantages</b>	<p>The census of skeletal material of prehistoric Sardinia will enable the anthropology community to find specific information on sites of interest and carry out general statistical analyses. The information collected may be shared among scholars of different scientific disciplines at regional, national and international levels. They can also provide a valuable material to be used for educational purposes, cultural and tourism, to promote and enhance the heritage of Sardinia. Such knowledge is extremely useful for the study of specific anthropological problems, such as the origin of particular diseases (thalassemia), the health and lifestyle, and the mode of peopling Sardinia.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Archaeological superintendencies, anthropology and archaeology departments of universities, museums.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22492

[ ITALY ]

BCAA Srl

www.bcaa.it

<b>Sector</b>	Creative design and technical solutions for graphic and digital media.
<b>Activities</b>	Video and animation 2D/3D, audio production, live interactive, web and multimedia creation.
<b>Contact</b>	

<b>Title</b>	KIS (KILYKÄ INTERACTIVE SYSTEM) – THE NAKED WAY FOR MULTIMEDIA APPLICATIONS
<b>Abstract</b>	<p>KIS stems from the experience gained in the field of multimedia communications and of research in integrating different languages and expressive codes such as gestural, visual and music-instrumental. KIS is an immersive installation with a high experiential impact for the delivery of multimedia content. It is a technology that allows the user to create experiential moments of great impact. Users live their “experience” inside an empty box (greater than 5 x 5 meters). This box virtually recreates around the user the world to be experienced by combining:</p> <ul style="list-style-type: none"> <li>• video;</li> <li>• three-dimensional resources, for example 3D tours;</li> <li>• sounds and music;</li> <li>• images and animations.</li> </ul>
<b>Detailed description</b>	<p>KIS is based on a “markers less” motion-capture system. The great innovation of KIS is that the user moving inside the box interacts with all these resources without the need of any device (mouse, keyboards, gloves, sensors, etc.). User can drag images, activate sounds and movies simply by moving hands in the air, so actively exploring, investigating, and selecting the virtual contents recreated around him. This is done just with the movement of the body, which is interpreted by the system and translated into display instructions. KIS is an installation utility to repeated. Once the hardware is installed, you can modify and customize the setting simply by varying the conveyed content. This means that the customer can reuse the system for immersive experiences on various themes, just creating new multimedia content. KIS has competitive costs The installation of KIS has significantly lower costs than other motion capture devices.</p>
<b>Innovative aspects</b>	The KIS system is based on:



- Motion capture. These systems are able to encode the movement of user hand into binary information. Thanks to the simplicity of the mechanism, from their very beginning these systems have worked in “real time”, allowing the emergence of human-machine interaction methods now well consolidated. The motion capture applied to the human body today is feasible following different methods and tools. The fundamental difference lies whether markers (reflective or bright points) are placed on the body joints. Marker-based systems are highly accurate in identifying the parts of the body associated with markers themselves. The image sequence is captured by cameras connected to the computer. This elaborates the images and identifies the movements by tracking the markers. The installation of such motion capture systems is however significantly complex and requires a long preparation phase for both the stage and the performer(s). These features make marker-based systems suitable for the realization of videogames, movies and whenever the time required by the preparation is not an issue. The great innovation of KIS is it operates without markers. A powerful system of marker-less motion capture analyses the video stream acquired by a camera and transforms it into dynamic variables (absolute and relative coordinates of the body in space, the quantity and quality of movement, etc.). Such variables describe in real time the observed scene, i.e., the background environment and the subject who moves inside (who has not the need to dress any motion sensor).
- Rendering engine that receives the input from the “motion/expression capture” module and virtually transforms it in any possible type of output (video, audio, interactivity, management of 3D virtual environments).

<b>Main advantages</b>	The installation of KIS has significantly lower costs than other motion capture devices. The motion capture system is completely markerless, with consequent speed up of the installation and the calibration process.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected we are just working on patents.
<b>Application domains</b>	Information processing, information systems KIS is ideal for making installations, even permanent, within fair stands, playgrounds, museums or art galleries, corporate presentations and tourism promotion, and whenever it is necessary to engage and amaze.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy, digital entertainment, research organisation, public administration.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22515

[ ITALY ]

## Boviar Srl

www.boviar.com

<b>Sector</b>	Monitoring and diagnostics of architectural structures.
<b>Activities</b>	Studying, designing, manufacturing and supplying of instruments and systems for monitoring and diagnostic of architectural structures.
<b>Contact</b>	

<b>Title</b>	SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEMS FOR MONITORING AND DIAGNOSIS OF STRUCTURES AND TERRITORY
<b>Abstract</b>	Systems for monitoring and diagnosis of structures and territory, made up of a multi-level network (data acquisition, transmission and processing) and a centralized support system for the decision-making.
<b>Detailed description</b>	<p>The system is made up of a multi-level network (data acquisition, transmission and processing) and a centralized support system for the decision-making.</p> <p>For each structural tipology there are specific monitoring parameters which are deemed typical of that structure's response and functional to the assessment of its actual status in relation to some limit conditions purposely defined.</p> <p>The data logging system integrates all the sensors and transducers suitable to read the engineering units which the preliminary scientific analysis will have identified (accelerometers, wind-speed sensors, displacement transducers, load cells, etc.).</p> <p>Each of the handiwork under control is fitted with a local slave, which is linked to a data collection and transmission terminal unit, capable to communicate with a local centralizer (local master) situated within a distance of 2 km, which is able to store data, to carry out a first-level processing in order to validate the measurements taken by the sensors and finally transmit all readings from the monitored sites.</p> <p>Transmission at all levels of the network is made by means of highly-reliable technologies (e.g. satellite network) with internet-based standard protocols. The possibility to extend the system to an undefined number of structures at no further costs than those of the local acquisition and trasmission apparatuses is given by the particular architecture network which is of a wireless and distributed type.</p>
<b>Innovative aspects</b>	The system, through a control panel with a user-friendly interface, allows the operator, for each structure, to:

- receive and store incoming data
- identify the structure and integrate the acquisition data with details of the material, structural diagrams and site effects
- analyse static and dynamic conditions and provide on request a “picture” of the internal strain status of the structure
- determine the degradation status and evaluate the hazard degree as well
- signal alarm conditions and suggest a number of options for decision making.

Main advantages

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Current state of development

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Intellectual Property Rights

Secret know-how.

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Application domains

Construction technology; Information processing, information systems; Measurement methods.

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Collaboration details

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Type of partner sought

Light industry, university, high school, research organisation.

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Tasks to be performed  
by the partner sought

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IRC Partner

IRC IRIDE

## Technology Offer TO\_IT\_22098

[ ITALY ]

## Carlo Gavazzi Space Spa

www.cgspace.it

<b>Sector</b>	Information processing, information systems.
<b>Activities</b>	Earth observation, satellite manufacturing, data collection, processing and distribution from ground terminal, environment monitoring, in situ instruments, security systems, robotics.
<b>Contact</b>	

<b>Title</b>	TRACEABILITY OF MOVEABLE CULTURAL ASSETS
<b>Abstract</b>	The presented technology aims at developing a geo-location system able to track moveable cultural assets during the transportation on their way to/from exhibitions. By application of a geo-location system a full nail-to-nail traceability of each asset is provided to the operator in real time.
<b>Detailed description</b>	<p>This is a space based technology allowing the geo-location and control of moveable cultural assets (e.g. art objects, paintings, sculptures) on their way to exhibitions and museums. The system allows a complete nail-to-nail control on the whole transportation, deposit, watching operations on the object and its way back.</p> <p>The system, wholly based on internet/intranet technology and extranet, allows any operator to access all logistic information on the collection or the specimen in real time during its transportation. Also e-mail and sms gateway services are integrated in the system. Wireless palm devices, RFID (Radio Frequency Identification) new technologies and other devices can be integrated.</p>
<b>Innovative aspects</b>	Innovative projects already implemented in this field are CUSPIS, coordinated by NEXT Spa ( <a href="http://www.cuspis-project.info/demonstrations.htm">www.cuspis-project.info/demonstrations.htm</a> ) and PILOT/SMART.
<b>Main advantages</b>	Full control and traceability of the assets on their way to and from the destination place.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information system.

Collaboration details

Type of partner sought

Transportation company, art museums.

Tasks to be performed  
by the partner sought

IRC Partner

IRC Lombardia

## Technology Offer TO\_IT\_22100

[ ITALY ]

## Carlo Gavazzi Space Spa

www.cgspace.it

<b>Sector</b>	Information processing, information systems.
<b>Activities</b>	Earth observation, satellite manufacturing, data collection, processing and distribution from ground terminal, environment monitoring, in situ instruments, security systems, robotics.
<b>Contact</b>	

<b>Title</b>	EARTH OBSERVATION TECHNOLOGIES APPLIED TO CARTOGRAPHY AND TOURIST GUIDANCE
<b>Abstract</b>	This project presents the development of a hand portable tool for tourist purposes. The tool is user friendly palm device capable of displaying ad hoc cartography in the town of interest, providing vocal comments comment to the highlights in the historical town, displaying 3D models of remains and old buildings in their original reconstruction.
<b>Detailed description</b>	<p>This project considers the development of a user friendly tool at the service of the tourist during his excursions for sight seeing. The tool is composed of a GIS based portable palm device that is capable of the following functions:</p> <ul style="list-style-type: none"> <li>• generating customized cartography and tour proposals in the town of interest</li> <li>• highlights in the historical town</li> <li>• displaying 3D models of remains and old buildings in their original reconstruction</li> <li>• providing vocal comments on each art object under consideration.</li> </ul> <p>The technical principle of this system is similar to that of satellite navigators. However, the system integrates extremely different kinds of information in a very flexible way. The database is composed not only of road cartography but acts as a prototype of a digital library where all information about the history, geography and cultural items are stored. Vocal comments, pictures, 3D models are included and georeferenced. The system constitutes a digital tour guide in the hands of the tourist. Local useful addresses (hotels, restaurants, info contacts, etc.) and information (open times, prices, etc.) are also stored and highlighted in the cartography.</p>
<b>Innovative aspects</b>	Use of innovative space technologies for tourist services and cultural applications.
<b>Main advantages</b>	In a one-touch tool thousands of information are immediately available at a glance.

<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Public institutes (e.g., public institutes for conservation of historic and artistic works, local administration, township, etc.). Tour magazines, art magazines, IT companies.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

## Technology Offer TO\_IT\_22146

[ ITALY ]

## Carlo Gavazzi Space Spa

www.cgspace.it

<b>Sector</b>	Information processing, information systems.
<b>Activities</b>	Activities: Earth observation, satellite manufacturing, data collection, processing and distribution from ground terminal, environment monitoring, in situ instruments, security systems, robotics.
<b>Contact</b>	

<b>Title</b>	CULTURAL HERITAGE SURVEILLANCE
<b>Abstract</b>	A high-tech video system for security control and surveillance is offered to museum halls, art galleries, cathedrals, etc.
<b>Detailed description</b>	<p>The system is a centralized system fully equipped with multiple “always-on” video cameras, surveillance monitors and sensors. Museum halls, art galleries, cathedrals, etc. are monitored by an on-site security equipment. Upon an intrusion event security professionals are immediately alerted and the exact location of the endangered site is identified by live video feed. The system provides security over the investigated areas and on the same system itself. Past events are recorded and archived for further analysis.</p> <p>The system ISS-VS, provided by Telematic Solutions Spa is an example of this technology which has been already successfully applied to urban areas, airports, road networks and endangered areas.</p>
<b>Innovative aspects</b>	Use of innovative technologies for monitoring the security of museum halls, collections and paintings also in ancient buildings like churches and cathedrals.
<b>Main advantages</b>	If centralized for many areas of interest, this technology has low maintenance costs and allows immediate decision and intervention.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems.



Collaboration details

Type of partner sought

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Public sector in the field of cultural heritage, churches.

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Tasks to be performed  
by the partner sought

IRC Partner

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IRC Lombardia

## Technology Offer TO\_IT\_22105

[ ITALY ]

## Centrica Srl

www.centrica.it

<b>Sector</b>	Services and products focused on the Web, imaging and multimedia areas.
<b>Activities</b>	Product provider of innovative technologies in digital and internet imaging.
<b>Contact</b>	

<b>Title</b>	AN INNOVATIVE TOOL TO DELIVER HIGH QUALITY IMAGES IN THE WORLD WIDE WEB
<b>Abstract</b>	An Italian ICT company has developed a software that allows Internet users to view images in a web browser, at any resolution, with high chromatic fidelity and Intellectual Property Rights (IPR) protection capabilities through digital watermarking, dynamic download. The interface can be designed through a Flash component and/or in HTML/Javascript. The company is looking for licence and joint venture agreements.
<b>Detailed description</b>	<p>This software enables internet users to view images of high resolution quickly and interactively. It is ideal for all providers of visually rich content: merchandise catalogues, cultural heritage images, digital archives-image banks, territory, industrial imaging, medical imaging. It enables providers to distribute high quality image content to the largest possible audiences, immediately increasing site traffic, brand recognition, and orders. Once the tool is installed on an Internet server, images are uploaded to it. Source images can be in the entire common graphics file format: TIFF, JPEG. Image size is open ended, the software commonly handling any image quantity. Of course adequate storage space has to be made available on the server to host the image files. The images are then automatically converted into a particular kind of pyramidal format and are ready to be served. Once the server receives a query from a client, for example a request to zoom in, the server will retrieve and serve only the required portion of the image, which has a size to fill the viewing window, typically only a few Kilobytes and therefore fast to transmit even if uncompressed.</p>

## HIGHLIGHT FEATURES

*Client side*

No plug-in is required, user is given a choice of an HTML viewer enabling basic functions such as zooming and panning, or a Flash viewer with advanced functionality and completely customisable (60 API). All existing Internet browsers in the standard configuration support both viewers. The

user can choose the size of the viewing window according to the speed of the available Internet connection, the image in a larger viewing window requiring longer time to load.

No special hardware requirements. The tool viewers are compatible with most installed hardware and operative systems, including older browser versions and slower CPUs.

No special Internet connection necessary. No specific platform necessary, viewer will work on all Windows, Macintosh, Unix and Linux platforms running either Microsoft Internet Explorer or Netscape Navigator Internet browsers. The image is inherently protected from copy because only the content of the viewing window can be copied (and this only by printing the computer screen).

#### *Server side*

Easy to download and install, the software can be easily downloaded and installed within minutes. The software is accompanied by simple, easy to follow instructions, allowing putting high resolution images online in a matter of minutes. It fits easily in existing website architecture (Apache, IIS) no re-designing is necessary, all that is needed is to provide new hyperlinks from the existing website to the high-resolution images. The software is already available for Windows 2000/2003 Server; Linux server platforms. Multiformat design allows to readily upload most common source image file formats, such as TIFF and JPEG. The server aspect is fully customisable according to particular needs such as special functions, integration with existing databases, watermarking procedures etc.

<b>Innovative aspects</b>	The innovative aspect is the ability for Internet users to view very high resolution images over the internet with integrated colour serving and copyright protection (the images can be watermarked for the protection of copyright rights of the owners).
<b>Main advantages</b>	High speed even with narrow band connections, such as modem, GPRS (General Packet Radio Service), etc. Visualisation through standard Internet browsers (Microsoft Internet Explorer, Mozilla) without plugins and/or with Flash. Colour management system for high colour fidelity. Integrated image watermarking technology for copyright protection. Digital watermarks are embedded both on source images resident on the server as well as on each image served to clients. Dynamic download: images can be served at desired resolution to authenticated users. Available for the Windows (2000/2003) and Linux platforms. Access to the server can be direct, through PHP templates or with Flash interface.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems. The product can be useful in the following fields: cultural Heritage, photographic archives, mapping-GIS, medicine, pre-press, industry, e-commerce, tourism.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Original Equipment Manufacturing (OEM) agreements, value added resellers, public administration, regional government, universities, galleries
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22108

[ ITALY ]

## Centrica Srl

www.centrica.it

<b>Sector</b>	Services and products focused on the Web, imaging and multimedia areas.
<b>Activities</b>	Product provider of innovative technologies in digital and internet imaging.
<b>Contact</b>	

<b>Title</b>	A STATE OF THE ART DAM/DAR (DIGITAL ASSET MANAGEMENT/DIGITAL RIGHTS MANAGEMENT) WEB-BASED SOFTWARE DESIGNED FOR DIGITAL IMAGE COLLECTIONS
<b>Abstract</b>	An Italian ICT company has developed a web based platform for Digital Asset Management/Digital Rights Management (DAM/DRM) of digital image collections. The company is looking for licence and joint venture agreements.
<b>Detailed description</b>	<p>The platform is a web-based DAM/DRM software designed for fully automated access – viewing in multiple resolutions, on-demand distribution, pricing and invoicing – of digital image collections. The platform is composed of three main layers:</p> <ul style="list-style-type: none"> <li>• a platform independent XHTML user interface</li> <li>• a platform independent Web renderer (written in PHP4)</li> <li>• a platform-dependent multi-resolution image server and modules</li> </ul> <p>It is a unique solution for DAM serving as a single access point for all digital image files and their metadata, thus enabling users to find, access, share, distribute and track image files within or outside an organisation more efficiently, saving time and money.</p> <p>All image archives can be easily published on the web, allowing customers to search, resize and download hi-resolution images in real time according to customizable licensing and pricing policies.</p> <p>Main features:</p> <ul style="list-style-type: none"> <li>• automates the process of uploading, viewing, publishing, maintaining, marketing, and distributing web-based image banks or stores</li> <li>• enables customers to zoom images to examine the finer details</li> <li>• integrates a sophisticated DRM system</li> <li>• centrally stores images and metadata and customizes downloads encoding image information and unique transaction identification</li> <li>• allows scalable and secure deployment of large collections at any resolution</li> </ul>

- integrates spidering to automatically search the web and reports when it finds watermarked images
- allows the personalization of image licensing and pricing policies for all variables
- embeds a sophisticated extendable event driven messaging system
- user interface embeds a Content Management System (CMS) module leveraging the XML language capabilities, which enables system administrators or/and collection administrators to edit all the static content of the site without any need of programming
- automatic content validation and multilingual capabilities
- Color Management Module (CMM) for generation of images in a customizable color space.

The platform has been designed as a web tool: its web interface doesn't need any plug-in and it is compliant with IE 6+ and Mozilla 7+, on Windows, MAC and Linux/Unix operating systems. The server side is available for both Windows 2000/2003 server and Linux platform.

#### Innovative aspects

The platform has been developed from the beginning to fill up a market segment that is forecasted in rapid growth and still not crowded and the system has specific exclusive Digital Rights Management (DRM) capabilities. This architecture allows easy customization and extendibility without need of specialized programming skills, at the same time ensuring top performance, flexibility and scalability. The system is designed to work with the open source MySQL server but can be integrated with other databases.

The platform ability to make high-resolution images available to Internet customers drastically reduces asset search and delivery time. It also enables the implementation of a multi-tiered pricing structure thus granting the system administrator to efficiently service market segments with different needs. DAM/DRM solutions considerably reduce administration expenses – asset (digital file) management and distribution.

The exceptional integration of image watermarking, asset management, search capabilities, dynamic distribution and spidering for IPR protection are but a few of the features that make this platform an exceptional product in a new market segment (DAM/DRM).

Reuse and differentiated use, the success key for asset management: the product ensures the capability to reuse the asset in a variety of ways and enables the implementation of different business models.

Dynamic license generation: the system automatically generates licenses of use of the images with a user-defined template and according to image utilisation (country, circulation, type of publication, web site, book, advertise, etc..) and pricing structure. Licenses (HTML files) are archived and delivered to the customer as well.

The administrator can access to specific functions to modify in real time the pricing structure of the archive.

CMS capabilities: the administrator of the system can access and modify in a web environment all the static content of the application: help pages, FAQ, delivery notes templates, license templates, invoices templates, e-mails.

Crawler: full or semi-automated search of digitally watermarked images on the world wide web. Digitally watermarked images are searched by the tool's software agent.

In the event that suspicious images are detected, a report is generated and automatically sent by

e-mail to the image collection administrator. The technology automatically reports potentially unauthorized usages of the images.

### Main advantages

From an end user point of view, either a customer willing to purchase an image and/or a graphic designer inside an organisation, the system has some unique features:

- zooming capabilities
- download the image at any resolution in real time (dynamic distribution)
- organize search results in an unlimited number of personal collections (light boxes), the customer can use the system environment as working space
- share light boxes with co-workers to accelerate the process of decision making
- availability of multiple search criteria.

The image archive administrator has the possibility to:

- create/modify and manage multiple image archives with different data structures
- access advanced users management capabilities
- watermark in a visible manner the images in the previews and in the comp (low resolution) delivery
- invisible watermark the delivered images through system dynamic distribution technology applying different watermarking strategies (unique ID, Photo ID, transaction ID etc..)
- activate the spidering module to search watermarked images over the internet to enforce IPR
- embed Metadata extracted from the database in IPTC of the delivered images in a personalized way and at delivery time
- modify in real time the licensing pricing structure
- modify, without the need of any programming, the static content of all the web environment through the CMS capabilities of the platform
- localize the platform in any language without the need of any programming through the platform translation engine
- configure the system to generate, send and archive invoices and images licenses of use.

### Current state of development

### Intellectual Property Rights

Secret know-how.

### Application domains

Information processing, information systems. The product can be useful in the following fields: cultural heritage, image banks, medicine, pre-press, industry, e-commerce, tourism, mapping/GIS.

### Collaboration details

### Type of partner sought

Value added reseller, public administration, regional government, universities, galleries.

### Tasks to be performed

by the partner sought

IRC Partner

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IRC RECITAL

Technology Offer TO\_IT\_22290

[ ITALY ]

## CNR, Istituto di Studi sui Sistemi Intelligenti per l'Automazione (ISSIA)

www.issia.cnr.it

<b>Sector</b>	Research and studies on computer vision, robotics and multimodal human-machine interfaces.
<b>Activities</b>	Activities: Development of hardware and software systems to signals and images process.
<b>Contact</b>	

<b>Title</b>	A GEOGRAPHICALLY DISTRIBUTED SYSTEM FOR THE AIDED RECOMPOSITION OF FRAGMENTS
<b>Abstract</b>	The geographically distributed system (developed to recombine the 140.000 fragments of the <i>S. Mathew</i> fresco painted by Cimabue in the Upper Church of S. Francis in Assisi and broken during the earthquake on the 1997) allows several people, spread around the world, to cooperate to the same recombination through properly designed digital tools (enhanced man-machine interface, content-based image retrieval, ...). It can be applied to every recombination of fragments (paper, tissues, stones, ...).
<b>Detailed description</b>	<p>The aim of the system is to realize a "aided virtual recombination" of fragments. Virtual because the work is done on digital images of fragments. Aided because it tries to exploit the contribution of both digital tools and of restorers. The operators can provide to the recombination process their knowledge and experience and can extract from fragments semantic information beyond the capabilities of image analysis algorithms; on the other side they are slow and not consistent in evaluating, classifying and describing the pictorial content of a huge number of images. Digital algorithms can instead extract only syntactical information from images (color, texture, drawings, contours, ...) but they can measure these characteristics very quickly and consistently.</p> <p>The automatic placement of fragments has been discarded also because it involves their direct comparison with a reference image that need to be available at a satisfactory level of quality (color, scale, ...). Unfortunately quite often these requirements are not fulfilled (sometimes even the simple knowledge of the subject represented in the picture is not available).</p> <p>The system has been designed with two main objectives in mind: to transpose, as much as possible and in a natural and effective way, the traditional recombination process in a digital way; to exploit the available images of the picture before the fragmentation, if available, while being able to provide a significant help even without it.</p> <p>Transposing the traditional process in a digital form strongly reduces the training phase: restorers do not need to change their habitual organization neither need to become expert in image</p>



processing or digital tools. Nonetheless they can work on digital objects (preventing any damage to the real fragments) and fully exploit their knowledge and experience while being supported by the digital tools provided by the system.

The ability to apply the tools also without a reference image allows the system to be broadly used in all the recomposition problems, regardless the available pictorial documentation about the painting before fragmentation.

The main components of the user interface have been inspired by their counterparts in the physical laboratory. The fragments, the table covered by the image of the fresco (if available) at a real-scale size, several boxes used to organize fragments logically related to each other: all these elements have a digital version inside the system that behaves mostly in the same way, apart from all the improvements made possible by their digital nature. Real fragments are represented by their two-dimensional picture: some information is missed (restorers cannot anymore manipulate physical fragments to measure things such as roughness, weight, characteristics of the back of fragments). A few advantages can compensate for this loss: fragments can be manipulated without any fear of damaging their sensitive pictorial film; fragments can have multiple instances, therefore they can be classified into several boxes (each referring to a different visual property) and used by multiple restorers at the same time, increasing the efficiency of the work; using image processing techniques several characteristics (color, contrast, lightness, scale, ...) can be manipulated to enhance the perception of visual details.

Several advantages are added by the containers, that are the virtual boxes used to classify the fragments. They collect objects that share some property, such as colors, texture, shape, dimension. The fragments in each digital container can be dynamically ordered on the basis of each of their properties. Moreover, they can be shared by several restorers.

A workspace, the virtual counterpart of the physical table, is available. The restorers can bring fragments in the workspace and move them around (using a special mouse allowing simultaneous rotation and translation) to find their correct place. The image of the fresco, if available, can be superimposed to the workspace to reproduce the condition of the physical laboratory. The digital environment allows several features impossible in reality: the visual characteristics of the reference image can be changed dynamically, if needed; fragments can be shown in half-transparency to better appreciate their position with respect to the background; the already placed fragments can be shown or removed to improve the visual perception of the space; the scale of the display can be decreased to evaluate larger parts of the fresco (up to the whole picture if needed) or increased to enhance visual details. A miniature image, showing the whole fresco at low resolution, enables an easy navigation through the picture by naturally selecting the region of interest.

The system offers a fundamental improvement to the whole process by supporting the retrieval of fragments of interest (digital images of each single fragment) from the database using a query-by-example modality that is incremental and iterative.

A set of images, fragments or details of the image of the whole fresco, are used as examples to index the database. The system returns the fragments most similar to the examples on the basis of the selected characteristics. If the results are not satisfying, the set can be modified by adding, removing or changing the examples: the process can be repeated until the operator's needs are fulfilled.

The system is designed around a client-server architecture. The client application runs on a workstation with a Windows environment: it includes the user interface and all the local processing involved in the activities related to the recomposition. The server application runs on a multi-processor system with a Unix environment: it manages the database and executes all the processing required to extract meta-data from the huge amount of fragments and to execute the queries on the basis of the examples provided by the users.

The client part handles the interaction with the restorers: it is responsible for the presentation layer as well as for handling user requests. Due to the need of a large visualization space to show the different components required by the recomposition process, the workstation is configured to support multiple monitors. The current version of the workstation uses three 17" monitors, although the hardware configuration can handle up to five monitors. Two graphics cards are installed on the workstation: an OpenGL compliant accelerated graphics card (used to manage the workspace where fragments need to be rendered at very high speed) and a second PCI graphics card that can connect up to four monitors.

A special input device (a mouse with 6 degrees of freedom) is used to allow the restorers to move the fragments in the working area using simultaneous translations and rotations. Only three degrees of freedom are currently used (two for translation and one for rotation). Several buttons on the mouse allow the restorer to access the most frequent fragment-related operations in a direct way. The workstation is equipped with a suitable amount of core memory to handle the huge number of fragments involved in the recomposition and with a significant amount of disk memory: in fact, to reduce the bandwidth of the connection between the clients and the server all the images of fragments are locally stored. The computational power required to the workstation is instead quite low: the most demanding processing is done by the OpenGL accelerated graphics card or by the application running on the server.

This client-server architecture spreads the physical laboratory for traditional recomposition used in the past over a geographical network: the operators can be everywhere a low-speed internet connection is available (starting from 33K modem) and do not need anymore to be where the physical fragments are stored.

The system has been developed in cooperation with the Central Institute for Restoration (Istituto Centrale del Restauro) that was in charge of the whole restoration of the St. Francis church in Assisi. Restorers are very interested in this strongly innovative approach to the recomposition of fragments, a problem that occurs frequently and always presents different and difficult challenges: apart from the number and characteristics of fragments, further problems often arise from the lack of a picture of the whole fresco before fragmentation and even of any information about the subject represented in the paint.

The restorers have worked with the system on the St. Matthew's fresco during its development to test its functionalities. They have pointed out several improvements that the system can bring into their work: it allows an integrated and quick access to the huge amount of available information; moreover the measures provided by the image processing algorithms provide an objective base to compare sets of fragments with the whole database and to organize in a very short time homogeneous groups of fragments useful for work; several facilities (zooming, half-transparency, colour correction, contrast, luminance, ...) make easier to find the right location for a fragment; the

digital environment, in spite of its lower information content, allows a stronger concentration with respect to the physical laboratory and a richer and more flexible interaction between restorers working on the same project.

#### Innovative aspects

There are not commercial solutions to the problem of digitally recomposing fragments. This system is NOT automatic: it aims to realize a synergy between the expertise and knowledge of operators and the efficiency and effectiveness of digital tools. It makes easier and faster the recombination but the operator is still the main responsible of the process.

The characterization of fragments is made by suitably designed image processing algorithms, in order to reach a consistent and fast evaluation and organization of the database.

Its geographically spread architecture saves time and money (the operators do not need to move where physical fragments are) and enhance the inter-operators communication required by the task.

#### Main advantages

- The fragments need not to be touched (they cannot be damaged). Even heavy fragments can be easily moved and assembled;
- The operators do not need to be in the same place (where the physical fragments are): they can work from virtually anywhere in the world because only a very slow communication channel is needed between the workstation and the server;
- The operator can benefit from many digital tools (colour correction, image enhancement, support to organization of fragments,...) that improve his/her efficiency;
- The operator can be helped by a suitable designed search engine based on the image contents.

#### Current state of development

#### Intellectual Property Rights

Others (registered design, plant variety right, etc).

#### Application domains

Information processing, information systems.

#### Collaboration details

#### Type of partner sought

Industry.  
Research organization.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC IRIDE

Technology Offer TO\_IT\_22291

[ ITALY ]

CNR, Istituto di Studi sui Sistemi Intelligenti  
per l'Automazione (ISSIA)

www.issia.cnr.it

<b>Sector</b>	Research and studies on computer vision, robotics and multimodal human-machine interfaces.
<b>Activities</b>	Activities: Development of hardware and software systems to signals and images process.
<b>Contact</b>	

<b>Title</b>	OMERO: A SYSTEM TO ALLOW BLIND PEOPLE TO TOUCH VIRTUAL REALITY
<b>Abstract</b>	OMERO is a multi-modal system. It uses haptic interfaces to enable the tactile interaction with virtual models, besides vision and hearing, to allow a better interaction with virtual reality (involving a richer use of human senses). Moreover, the use of touch allows visually impaired people to interact with the virtual models. Special care is paid to preparing virtual models and to render them in a polymorphous and redundant way to significantly improve the perception and understanding process.
<b>Detailed description</b>	<p>The multimodal system OMEMO is based on a workstation composed by a suitably configured personal computer equipped with a haptic interface. The latter is needed to provide on the user's hand the force-feedback required to activate the sense of touch. The system is able to use the sensory channel of vision (by images on the screen), of hearing (by sound and synthesized vocal messages) and of touch (by haptic rendering through the special interface). The information content of the model is rendered in a polymorphous and redundant way using all the available communication channels: each user, depending on his characteristics or limitations, can choose the most appropriate sensorial modality to enhance his experience.</p> <p>The system has been intensively tested has a tool to allow visually impaired people to interact with virtual reality. Virtual models are properly designed to help blind people to overcome some problems they encounter while interacting with the real world:</p> <ul style="list-style-type: none"> <li>• the sense of touch is serial (and not parallel as vision). That means that a scene is perceived as a sequence of details, all at a fixed scale, that must be integrated by the brain into a global and meaningful mental schema</li> <li>• touch does not allow any process of hiding/enhancing details (vision can emphasize the global perception by increasing the distance to the scene or focus on details by a closer look or by the use of special lenses)</li> <li>• touch does not allow the perception of details that are too small with respect to the size of</li> </ul>

fingertips

To help with this problem the system offers the following functionalities:

- the virtual model is organized so that the user can start his exploration with a very coarse description of the scene. The blind can more easily identify objects and evaluate their shape and size. After this first exploration a rough mental schema of the scene is already made and the user is presented with progressively more detailed views whose information content can more easily be arranged inside the well-understood global idea of the world
- different parts of the virtual model can be explored one at a time. Specific regions of the scene can be enlarged and touched separately: that simplifies the exploration and increases the scale of details
- details of the model can be divided into layers, depending of their semantic meaning. The haptic rendering of each layer can be turned on or off, so the user is further assisted in the organisation of the mental schema of the scene
- the haptic interface (beside the rendering of virtual objects) can apply forces to guide the user's hand along suitable paths through the scene, to ensure that all its principal regions are visited and a complete and correct understanding is reached

Two main sets of experiments have been made. In the first one a model of an historical site (the svevian castle in Bari) has been reproduced. Two different versions (a very simple one and another with a larger number of details) have been realized. Moreover, the models of a few rooms of the castle have been realized at a larger scale to facilitate the appreciation of fine details that would be too small in the general model. Several sound effects have been used to help blind to acquire information about the environment. A text-to-speech tool has been used to identify the rooms to the user as long as to provide structural and historical information about the different parts of the castle.

After the virtual visit, blind have been able to move inside the castle for a real visit, using the cane or the dog to avoid personal injuries. They have been able to organize the visit in a mostly autonomous way and have experienced an enhanced consciousness of the spatial map of the site. The second test has been done on a virtual model of the Apulia region. The virtual model has been organized into several semantic layers. The first one was made by the shape of the region and of its provinces: it has been used to provide the global basic schema to the users. A second layer provided information about rivers and lakes, represented as depressions that allow the user to understand the shape and dimension of lakes and the path of rivers. Two further layers have been realized to represent the main cities and the principal roads of the region respectively. The users have been able to learn the position of the cities and also to know how it is possible to plan a travel between them by car.

This model has validated the system as a tool for teaching any concept involving the knowledge of a territory (history, geography, archaeology, art, biology, etc.) but also to communicate to blind all the touristic information increasingly available on the net that is currently reserved to sighted people.

The system has been verified with a large number of visually impaired people, ranging from people with low vision to totally blind (also born blind). Different performances have been observed, depending on the dexterity in motion control, on the confidence with spatial representations, on

the general familiarity with digital systems. In general users has been able to acquire useful spatial information from the virtual models, to identify some objects inside the scene and to learn new data from the experience.

The results point out that the major benefit come if the power and flexibility of virtual reality are fully exploited: that means that the experts in the topic at hand must properly focus the information content provided by the model and the engineers must code these data in the best form to help final users to overcome their sensorial limitations.

The Regional Council of the Unione Italiana Ciechi (Italian Union of Blind) have cooperated in defining the requirements for the system, in testing its performances during all the phases of development and in suggesting further improvements of its functionalities. The blind have found it very useful and believe it can further improve in the future and be applied in many other fields of interest.

#### **Innovative aspects**

The use of haptic interfaces allows blind people to explore the virtual models using touch, sound and vocal messages. This is the normal way they interact with the world, so no particular training is necessary, apart a normal familiarization with the interface.

The use of virtual reality allows the realization of models that can improve the experience of the blind, especially with respect to the problems arising from this sensorial limitation. The model can be built with different scales, with several levels of details, with the information divided into layers on the base of its semantic content: such capabilities can significantly increase the comprehension by visually impaired users.

Moreover, the haptic interface can apply forces to the hand of the user to guide its path along the scene, granting a complete and meaningful exploration of its relevant regions.

#### **Main advantages**

The system is able to acquire data in the most common format (VRML) for 3D data, being able to exploit the huge amount of digital information available in several fields (school, cultural heritage, science, earth, tourism, etc.).

Suitably prepared models can be used as laboratory for didactical purposes, can improve the knowledge of art and cultural heritage, can enable the knowledge of geographical regions even by a touristic point of view.

#### **Current state of development**

#### **Intellectual Property Rights**

Information processing, information systems.

#### **Application domains**

#### **Collaboration details**

#### **Type of partner sought**

Industry, academy, research organisation.

Tasks to be performed  
by the partner sought

IRC Partner

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IRC IRIDE

## Technology Offer TO\_IT\_22315

[ ITALY ]

## CNR, Istituto per i Beni Archeologici e Monumentali (IBAM)

www.ibam.cnr.it

<b>Sector</b>	Research and studies on technologies applied to the cultural heritage.
<b>Activities</b>	Activities: Archaeology, virtual heritage, conservation and valorisation of historical buildings, remote sensing, non-destructive analysis for cultural heritage.
<b>Contact</b>	

<b>Title</b>	REAL TIME 3D PLATFORM FOR REMOTE VISITING OF CULTURAL HERITAGE
<b>Abstract</b>	An Italian research institute has developed an advanced information platform, able to represent the architectural morphology of the buildings under study with great accuracy at various scales, including both detailed elements and the monument as a whole, as well as the textural features of the internal and external surfaces. Every available information is accessible in Real time 3D. The institute is interested in technical cooperation with companies or research organisations.
<b>Detailed description</b>	An Italian research institute has developed an advanced navigation platform, for the “virtual visit” of monuments. The main aim is to enable the public to enjoy the results of archaeological and archaeometric research, via the web or stand-alone products, and to “virtually visit” monuments using real time 3D visiting systems. The navigation platform allows the user to visualise complex scenes and DVR-based knowledge models in “full-screen mode” even on desktop computers. The current state of the monument is shown along with the previous phases in its history. All the textures have been obtained by processes of photomodelling and have been applied to the geometrical forms in accordance with the radiosity algorithm, with lights and shadows of the ‘area’ type. The result is extremely life-like, almost indistinguishable from the reality. The 3D platform use integrated methods for the creation of three-dimensional models through laser scanning techniques, digital photogrammetry, 3D photomodelling and direct surveying. It has been tested on Byzantine sites in the province of Lecce and in Basilicata, in the South of Italy.
<b>Innovative aspects</b>	The platform allows: <ul style="list-style-type: none"> <li>• fruition of cultural heritage through an immersive system of visit</li> <li>• remote visiting</li> <li>• result extremely life-like.</li> </ul>



<b>Main advantages</b>	The platform allows to increase tourist flows.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Research organisations, companies.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_21727

[ ITALY ]

## Crealab Srl

www.crealabnet.it

<b>Sector</b>	Information and communication technologies.
<b>Activities</b>	Implementation and deployment of technological solutions for communication.
<b>Contact</b>	

<b>Title</b>	CREA-RE A FLEXIBLE REMOTE MANAGEMENT PLATFORM APPLICABLE TO ALL DOMAIN
<b>Abstract</b>	An Italian ICT company has developed an innovative system for the management of mobile smart phone devices. The system operates the device setting management to simplify the use of mobile services. It can be used both by the customer care department of a mobile telecom operator and by the device's owner in web self service version. The company is looking for license and joint venture agreement.
<b>Detailed description</b>	The device management platform proposed here can be used to shape the device settings, using a friendly web graphical interface. The system provides access profiles and hierarchy restrictions so that it can be used by expert operators and less skilled ones not having access to all platform functionalities. The system platform is made of a server (communication and application server) and a client (application to be installed on the mobile smart phone device). It is already integrated with fundamental mobile telecom systems (MMS-C, SMS-C, etc.) and covers the device setting, software distribution, application management and content management area of device management environment. The system presents an innovative technology since it is a client/server platform, which enables the management of mobile remote setting. This innovative technology addresses the needs of both business and private user sector in order to exploit at maximum the available resources and technologies on the mobile market. The system is able to have real-time interaction between the mobile customer care and the client. For this reason this platform is unique and offers faster assistance, enabling the resolution of all the configuration problems related to a mobile (e.g. email, SMS, MMS, virus problems, etc.).
<b>Innovative aspects</b>	<p>The device management platform is able to:</p> <ul style="list-style-type: none"> <li>• control and modify configuration parameters</li> <li>• manage application and install software</li> <li>• manage the device content</li> <li>• carry out many other supporting operations and remote assistance.</li> </ul>

## Functionalities:

- device information
- management of connection and messaging settings
- auto-diagnostic
- management of applications and tasks
- file management (reading and sending files)
- software distribution
- protection, block and mobile security (Wipe and Lock)
- parental control
- backup and restore
- off-line functionalities
- integration with con GPS device
- integration with external device (server, internet and bluetooth)
- integration with Java device application
- machine to machine (M2M)
- management utility and platform support.

This system is the first platform able to provide those services. For the communication between mobile phone and communication server a proprietary protocol is used, and this makes the platform and the system much more reliable and efficient of all the current device management systems that adopt the standard protocol Open Mobile Alliance for Device Management (OMA-DM).

Moreover this management platform enables a secure and flexible communication to address the different market needs and maximum control on technological innovation.

**Main advantages**

The management platform developed provides all that modern technologies currently offer, by using a dedicated protocol for the communication between client and server. This choice enables the platform to be sure, personalised and fast in the communication between client and server. Thanks to its flexibility CREA-RE can be easily customised for a wide range of market application, starting from Mobile Bussiness to Cultural Heritage domain. The benefits: reduces both timing needed for calling the call centre and general management; reduces training timing for both operators and users; provides real evidence of problem resolution; enables GPS service; improves software distribution for mobile application; improves web self service solution; facilitates the use of smart phone; protects and improves the use of Mobile Services; protects and improves the management of personal data and/or company data; reduces timing and cost for restoring in case of theft, loss and device substitution.

**Current state of development****Intellectual Property Rights**

Patent(s) applied for, but not yet granted.

**Application domains**

Information processing, information systems. Thanks to its flexibility CREA-RE can be easily customised for a wide range of market application, starting from mobile bussiness to cultural heritage domain.

**Collaboration details****Type of partner sought**

SME, research organisation.

**Tasks to be performed by the partner sought****IRC Partner**

IRC CIRCE

## Technology Offer TO\_IT\_22104

[ ITALY ]

## Demetra Scs Onlus

www.demetra.net

<b>Sector</b>	Information and communication technologies for environment and cultural heritage.
<b>Activities</b>	Survey, maintenance, conservation and valorisation of landscape.
<b>Contact</b>	

<b>Title</b>	DIDÀ, GPS GUIDE AND WALKIE POD: THE MULTIMEDIA VIDEO-GUIDE SYSTEMS FOR TOURS IN PARKS AND CITIES.
<b>Abstract</b>	<p>Didà is a personal digital assistant (PDA), thin film transistor (TFT) touch screen and 400MHz processor, integrated with an radio frequency identification (RFID) active controller, running Microsoft Windows CE.NET with Microsoft SQL server database. The RFID active reader has an integrated antenna that can communicate to the tags, active ultra high frequency (UHF) tags, settled along the path-tour near the points of interest at a distance of up to 300 feet (100 meters). Tags can be buried in the ground or put on the trees, monuments and other points of interest in a non direct visible way. The signal propagation characteristics of the UHF radio band used by intelligent long range RFID technology provides long-range communication and high-speed transmission rates for reliable data exchange. A unique feature of the active UHF tags is the highly sophisticated anti-collision handling algorithm that allows simultaneous communication with thousands of tags within the interrogator's reading zone. GPS Guide is a PDA of last generation, TFT display, touch screen, Wi-Fi technology and bluetooth, GPS receiver SiRFIII, running under Window Mobile 5.0. Walkie Pod is an iPod video integrated with a software for the development od the multimedia contents.</p>
<b>Detailed description</b>	<p>Following its successes in the environmental sector in Italy, the company wanted to respond to the increasing demand for multimedia systems in parks and cities around the world. Starting from this Demetra developed Didà, GPS Guide and Walkie Pod in order to:</p> <ul style="list-style-type: none"> <li>• develop an innovative video-guide system for tours in cities, parks, botanical gardens, archaeological sites etc, suitable for tours on foot or by mountain bike</li> <li>• improve visits to tourist locations for blind and deaf people in a safe way</li> <li>• give visitors more information keeping the freedom of the naturalistic experience.</li> </ul> <p>Didà is an innovative RFID multimedia guide that responds to its location and surroundings. It accompanies visitors everywhere and provides them with complete freedom. The visitor receives a palmtop Didà system loaded with maps and information covering all aspects of the route. He then selects the appropriate language (English, German, French, Italian and Spanish) and the</p>

preferred profile of the tour (i.e. botanical, natural, historical, architectural, geological, archaeological etc) and he is ready to start. When he gets close to a point of interest (i.e. a tree) the antenna receives the radio signals by the corresponding tag and the audio and video information about the point of interest starts automatically. There is the possibility to see and hear again the same video by touching a little icon on the PDA screen. In this way it is possible to see and hear also the video corresponding to the points of interest that were not activated by the visitor (because the visitor did not walk through). Didà is suitable for tours on foot or by mountain bike. In every moment of the tour the visitor can indicate the exact point where he is, he can see on the palmtop a map of the area and calculate how long the tour will last. After the tour, the visitor can download and print the route he has followed. The difference with Didà and GPS Guide is that walkie Pod works on demand: when the visitor comes near a point of interest he has to select on walkie Pod the number corresponding to the point of interest. Didà, GPS Guide and Walkie Pod do not need diggings and other invasive operations on the landscape.

<b>Innovative aspects</b>	With Didà innovation lies on the new application of RFID technology in the education/entertainment sector (this sector is also called with the new name of "edutainment"). The RFID technology used by Demetra has been already established, but the sector where this technology is applied is new. With GPS Guide innovation lies on the use GPS technology to a new activity which is the discovery of the landscape and the city. With walkie Pod innovation lies on the use of iPod video to a new activity which is the discovery of the landscape and the city.
<b>Main advantages</b>	<p>Didà, GPS Guide and walkie Pod:</p> <ul style="list-style-type: none"> <li>• answer to the increasing demand for multimedia systems in parks and cities</li> <li>• discover and valorise the landscape from different perspectives (environmental, historical and cultural) through an innovative and user-friendly system</li> <li>• make leisure time fun and educational</li> <li>• improve the cognitive and emotional experience of a visit in a naturalistic area, in a park and in a city</li> <li>• take actively part to the environment where the use of traditional signals is not allowed or it would not be in harmony with the landscape. In other terms Didà, GPS Guide and Walkie Pod allow to enjoy and to live the real environment</li> <li>• improve visits to tourist locations for blind and deaf people, also ensuring safety at all time. Indeed it makes it possible to avoid unsafe and dangerous parts of the tour explaining how to continue and where to be careful.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	City councils, tourist agencies, parks, botanical gardens.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

## Technology Offer TO\_IT\_22303

[ ITALY ]

## Demetra Scs Onlus

www.demetra.net

<b>Sector</b>	Information and communication technologies for environment and cultural heritage.
<b>Activities</b>	Survey, maintenance, conservation and valorisation of landscape.
<b>Contact</b>	

**Title**

SMART BOTANICAL GARDEN SYSTEM

**Abstract**

Following its successes in the environmental sector in Italy, the company wanted to respond to the increasing demand for multimedia systems in parks and cities.

Starting from this, this company has developed a smart botanical garden system, based on radio frequency identification technology, for:

- an efficient and cost saving management of the data flow and information for the maintenance of the botanical garden (this use is for people who works inside the botanical garden and maintain it)
- a multimedia and interactive visit to the botanical garden (this use is for visitors who wants to have information about trees, plants and all the object there are in the botanical garden).

The system is composed by a palmtop, a reader which is installed on the wall of the botanical garden, microchips (based on passive radio frequency identification technology), a PC desktop that works as a server and a wireless connection. It is possible to do a different login depending if the person is a worker of the botanical barden or is a visitor.

In the first case the smart botanical garden system can:

- make an inventory of the botanical material, starting from the seeds boxes to the adult plants, using unique codes that identify all the objects of the botanical garden and store all the related information
- create a central data base which is the historic memory of the botanical garden. This data base contains all the information related to the flowers, trees, etc and can be updated in real time, with the possibility to insert the last maintenance works
- georefer on the position of the maintainer of the botanical garden during the visit in the botanical garden and have information related to the object the visitor is seeing.

In the second case the system can:

- give the visitors of the botanical garden all the information related to the points of interest (flowers, trees, etc.).

<b>Detailed description</b>	<p>The company has developed a technical solution based on passive radio frequency identification technology in order to identify and track all the objects of the botanical garden. The system is composed by a palmtop, a reader which is installed on the wall of the botanical garden, microchips (based on passive radio frequency identification technology), a PC desktop that works as a server and a wireless connection. It is possible to do a different login depending on if the person is a worker of the botanical garden or is a visitor.</p> <p>Data and information are spread through a wireless connection and through a reader installed on a wall of the botanical garden.</p> <p>Every object to identify (for example a flower or a tree or another object of interest) has a microchip that is read by a palmtop. The Identification code of the object (point of interest) is sent to the PC desktop that sends back to the palmtop all the information related to the point of interest. These information can be:</p> <ul style="list-style-type: none"> <li>• localization of the position in which the person is, with the possibility to see on the screen of the palmtop the position inside the paths map</li> <li>• botanical files with audio, text and video files related to the point of interest</li> <li>• suggestions how to reach the next point of interest.</li> </ul>
<b>Innovative aspects</b>	Efficient and cost saving management of the data flow and information for the maintenance of the botanical garden and a multimedia instrument for the improving of the visit to the botanical garden.
<b>Main advantages</b>	<p>Smart botanical garden system:</p> <ul style="list-style-type: none"> <li>• answers to the increasing demand for multimedia systems in parks and cities</li> <li>• discovers and valorise the botanical garden from different perspectives through an innovative and user-friendly system</li> <li>• make leisure time fun and educational</li> <li>• improves the cognitive and emotional experience of a visit in a botanical garden</li> <li>• improves visits to a botanical garden for blind and deaf people, also ensuring safety at all time</li> </ul> <p>Indeed it makes it possible to avoid unsafe and dangerous parts of the tour explaining how to continue and where to be careful.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Botanical gardens.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

## Technology Offer TO\_IT\_22172

[ ITALY ]

## Ecomedia Scarl

www.ecomedia.it

<b>Sector</b>	Information and communication technologies.
<b>Activities</b>	GIS and LBS (Location Based Services) applications, cartography, multimedia, energy and mobility management.
<b>Contact</b>	

<b>Title</b>	MUST SYSTEM: MULTILINGUAL SIMULTANEOUS TRANSMISSION FOR AUTOMATIC COMMENTARIES (GPS/RFID)
<b>Abstract</b>	MUST system offers solutions for automatic commentaries with audioguides within tourist circuits, dedicated to groups that need simultaneous multilingual transmission, or to single users. Suitable both in open space and indoor with Location Based System (LBS) and free patterns. Central unit integrates with audio guides cabled system on board (coach, buses, train, boat,...) or with radio receivers for users within 200 meters. Advanced versions offers multimedia contents or predefined context-aware contents.
<b>Detailed description</b>	MUST-mobilis is dedicated to: <ul style="list-style-type: none"> <li>• large multilingual groups visiting several resources</li> <li>• fixed positions, halls, or stands for simultaneous multilingual commentaries or instructions</li> <li>• info points offering audio and printing services on demand and FM/Wi-Fi broadcasting nodes.</li> </ul> MUST-comodum is embedded in backpack for bike tours, hiking, families with initial language choice and automatic resource recognition
<b>Innovative aspects</b>	Mobile location based services and multilingual simultaneous commentaries finally integrated in one customizable system.
<b>Main advantages</b>	MUST different solutions, with mobile or fixed devices, radio or cable transmission, cover many application domains and offer easy-to-use advanced technologies for tourist fruition. ECOmedia also offers GIS applications, surveying services, commentaries production (text and audio) to support and complete all needs related to sites fruition.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.



<b>Application domains</b>	Information processing, information systems. Other application domains are: <ul style="list-style-type: none"> <li>• Touristical site fruition, open space and indoor, integrated in transport vectors (buses, train, boat, etc.) or single user portable or totem located</li> <li>• Specific LBS mobile solutions are dedicated to technical maintenance, monitoring and GIS surveying of archaeological areas.</li> </ul>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Public and/or private end-users of the MUST system as site managers or tour operators; partners for further development or marketing activities.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC-CIRCE

## Technology Offer TO\_IT\_22574

[ ITALY ]

ENEA

www.enea.it

**Sector** Research and study in the field of cultural heritage.

**Activities** Research and Innovation in the field of ICT.

**Contact**

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**Title**

MULTIPURPOSE DIGITAL ARCHIVE

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**Abstract**

An Italian research institute has developed a digital archive system, allowing for not just archiving multimedia representations of objects, but also inserting them in the context in which they are used through integration with web, e-mail, enterprise information systems, desktop publishing systems. The system was commissioned by an important private foundation of the Italian visual, decorative and advertising art of the twentieth-century.

The proposer is looking for end-user or technological partners

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**Detailed description**

In the recent years, digital archives are replacing gradually those on paper and Internet is becoming the main access channel to the digital material contained in them.

The core of the technology is a system for digital archiving. It allows for the storage of the digital representations of different types of objects (for example, painting, photography, cinema film, sculpture, advertising object, etc.). Such objects are represented digitally by images, multimedia, text documents, structured information.

In addition, the system allows for integration of the digital archive within the context of activities in which it is used. In particular, it allows to associate business and other information to the entities stored in the archive. The system has standard modules which allow for storing data about clients, suppliers or business activities. In alternative, it can be easily integrated with other information systems already used in an organisation. In this way the user can find not only digital representations of objects, but also all related information regarding their life cycle (examples, exhibitions in which an object was shown, clients which bought it, maintenance information, additional information found on the web, etc.).

The system has been used in the cultural heritage sector for:

- activation of big collections containing multiple types of objects
- planning and management of exhibitions

- creation of personalized catalogues for exclusive client
- creation of art books
- restoration planning and management
- e-commerce application.

The technology on which the system is based is FileMaker Pro. It can be integrated with database management systems, such as MySQL, MS SQL Server, Oracle. The input to the system can come from (remote) data bases, scanners, digital camera(s), Videotape, Web, web-GIS, etc. The system has an integrated web browser and e-mail client.

The image files can be of any type (TIFF for the high resolution images, JPEG, PNG, etc.). The system allows for the storage, creation and manipulation of images of different resolution within the digital archive. Depending on his requirements, the user can store several images of the same object, with different resolutions, different scale, with or without watermarks, or other merged objects, etc.

In output the system can be connected to various devices (mobile telephones, PDAs, MP3/MP4, DVD, etc). It is integrated with desktop publishing systems (e.g., Adobe InDesign). It is also possible to create PDF files (for example for the purpose of an electronic newsletter) within the system itself, through the use of document layouts created by the user.

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#### Innovative aspects

- Scalable distributed architecture
- Manipulation of high resolution images within the system
- Integration of the digital archive with company information systems
- Deployment of the digital archive within the organisational structure and not simply as a stand-alone application (obtained through extended functionalities, and integration with other systems)
- Seamless web and e-mail integration

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#### Main advantages

- Flexible structuring of archive and business information
- Friendly-user interface, easy to learn
- Multi-language platform
- Single point of access to all information regarding an object (from object digital representation, to traceability information, regarding business activities, clients, suppliers, etc. related to the object under consideration)
- Advanced internal data structures based on international standards and data models, allowing for representations of multiple types of objects, entities, activities, etc. in a single system

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#### Current state of development

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#### Intellectual Property Rights

Secret know-how.

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#### Application domains

Information processing, information systems.

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#### Collaboration details

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#### Type of partner sought

Museums, art galleries, art trading organisations, editors, services, industry, technological partners.

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#### Tasks to be performed by the partner sought

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#### IRC Partner

IRC IRENE

## Technology Offer TO\_IT\_22404

[ ITALY ]

## Georender Srl

www.georender.it

<b>Sector</b>	Geophysics and topographical surveys.
<b>Activities</b>	Services on 3D laser scanner surveying and modelling, georadar, geoseismic, geoelectric investigation for applications to civil and urban planning.
<b>Contact</b>	

<b>Title</b>	3D LASER SCANNER SURVEYING AND MODELLING
<b>Abstract</b>	An Italian SME based in Turin has developed the surveying services that combine traditional techniques (GPS, total station, photogrammetry...) with 3D laser scanners (LIDAR technology). Laser scanning has highly effective applications in many fields, such as engineering, geology, architecture, cultural heritage. Laser scanning can be appreciably cheaper than traditional surveying techniques and much faster. The company is looking for technical co-operation as for project research partners.
<b>Detailed description</b>	An Italian SME has developed the surveying services that combine traditional techniques (GPS, total station, photogrammetry...) with 3D laser scanners (LIDAR technology). Laser scanning has highly effective applications in many fields, such as engineering, geology, architecture, cultural heritage. The company provides a valuable support to studies and investigations designed to ascertain, modelling and document the geometric, morphological and dimensional characteristics of portions of the territory, objects, buildings, industrial plants, civil works.
<b>Innovative aspects</b>	Laser scanners are used as surveying tools to produce detailed 3D renderings of complex morphological and topological realities. The technology provides us with the ability to obtain accurate as-built information on almost any surface or structure. The company uses data processing techniques to create 2D e 3D models by combining high-resolution digital images with the spatial data supplied by laser scanners.
<b>Main advantages</b>	The surveying service offered by the company can be appreciably cheaper than traditional surveying techniques, in that it is much faster. The high rate of acquisition and the accuracy of the data, in fact, ensure considerable time savings even when dealing with highly complex geometries. Moreover, once the data has been acquired, each new elaboration and each new measuring process can be performed on the data without having to return to the place.

The survey can be performed from a considerable distance, of up to 2000 m (as a function of specific conditions). In this manner, objects or areas situated in places that are hazardous or hard to reach can be surveyed in full safety (es roads, rock slope, quarries, industrial plants...).

The laser system uses an active sensor and hence its operation does not depend on external lighting conditions; accordingly, this technique proves highly effective in the analysis of underground cavities.

The possibility of repeating the measuring process makes this technique ideally suitable for monitoring evolving situations and documenting temporary situations, to obtain detailed and quantitative assessments of geometric and morphological modifications

<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Construction technology; Information processing, information systems; Measurement methods.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	University, Research Centres, Industry.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	ALPS IRC

## Technology Offer TO\_IT\_22411

[ ITALY ]

## Hyperborea Srl

www.hyperborea.com

<b>Sector</b>	Information and communication technologies.
<b>Activities</b>	Development of dedicated software of data management and integration.
<b>Contact</b>	

**Title** ARIANNA3 - SOFTWARE FOR HISTORICAL ARCHIVES DESCRIPTION. INTERNATIONAL STANDARD ARCHIVAL DESCRIPTION (ISAD) COMPLIANT

**Abstract** Arianna3 is a software, distributed in standalone and client server version, which helps archivists describe, index and, at the same time, reorder documentary material of historical interest with full International Standard Archival Description (ISAD) and International Standard Archival Authority Record (ISAAR) standards compliance. Arianna3 is an open system: XML/EAD standard use for electronic coding of archival finding aids ensure communication and exchange with other information systems or softwares and preservation in time of the archival description, in a format absolutely independent from specific software or hardware platforms used to produce it.

**Detailed description** Arianna3 is a software tool thought for historical archives: it allows to describe, index and reorder any kind of documentation with full international ISAD and ISAAR standard compliance. Arianna3 is distributed both in standalone and client-server version, allowing same database increase from different work stations and managing access privileges in order to distinguish management and supervisor roles from compiler and indexer ones. Arianna3 uses a totally original data model, fitting to different archival realities, remote and recent, public or private, so that user can establish multiple access ways to the same document and deal specifically with data concerning families, corporate bodies and places referred in the description. Arianna3 is fully compliant to the most recent standards as ISAD(G) and ISAAR(CPF) and uses an analytical yet flexible data model: strictly guiding the compiler but allowing him to fit to the most different contexts. Arianna3 allows to perform every kind of intervention on the documentary material, from the most generic, such as the realization of simple consistency finding aid, to the most sophisticated, such as the analytical inventory or the integral transcription of each document. Finding aids made with Arianna3 can be published on print, thanks to particularly accurate RTF formats, and on Internet using HTML format.

Arianna3 uses powerful tools for rearranging and renumbering of fonds, series and archival units; it has extremely versatile print formats for provisory and definitive labels production. Arianna3 is an open

system: XML/EAD standard use for electronic coding of archival finding aids ensure communication and exchange with other information systems or softwares and preservation in time of the archival description, in a format absolutely independent from specific software or hardware platforms used to produce it. Arianna3 is compliant with all the most popular database server: MySQL, PostgreSQL, Oracle and SQLServer, and it can handle at the same time multiple data bases for the most different archivist works. Arianna3 is a multilingual software: using UNICODE standard is able to manage descriptions using characters of all languages (Spaniard, German, Greek, Korean, etc.). The application interface then is available in many other languages too and it can be workstation specific, so that different native language users can utilize it easily. Arianna3 uses a powerful full-text engine, so that user can make Google like searches inside the archival databases made, being fully compliant with standards for acquisition, management and exchange of digital resources metadata. Arianna3 allows a flexible yet complete management of high resolution images linked to documentary material, being fully compliant with standards for acquisition, management and exchange of digital resources metadata.

<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Use of XML/EAD for electronic coding of archival finding aids ensuring communication and exchange with other information systems and preservation in time of the archival description</li> <li>• Adaptable and customizable interface, fitting to every screen resolution</li> <li>• Customizable data model rendering allowing different depth level of interventions</li> <li>• Customizable level of compilation check to ensure uniformity between compilers</li> <li>• Use of UNICODE standard for multilingual data capability together with multilingual interface rendering for different native language users</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Client server version for multi-user contexts and load balancing</li> <li>• Integrated database appending capabilities via import for standalone uses in geographical distributed contexts or network unavailability</li> <li>• Minimum hardware and software requirements, scalable and modular architecture</li> <li>• Multilingual interface and data management and fully customizable vocabularies</li> <li>• Customizable and adaptable user interface</li> <li>• Almost every DBMS compliance, so that you can use what you already have or the free one distributed in the package</li> <li>• An all-in-one tool for every kind of archivist work covering every step of the process, from Integrated image management and link with documentary material</li> <li>• Full text and contextual searches</li> <li>• Contextual help on line</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Any partner involved in the market where we distribute our product.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22414

[ ITALY ]

## Hyperborea Srl

www.hyperborea.com

<b>Sector</b>	Information and communication technologies.
<b>Activities</b>	Development of dedicated software of data management and integration.
<b>Contact</b>	

<b>Title</b>	ARIANNAWEB - SOLUTION FOR HISTORICAL ARCHIVES ONLINE PUBLISHING. ENCODED ARCHIVAL DESCRIPTION (EAD) COMPLIANT
<b>Abstract</b>	<p>AriannaWeb is a tool for integrated consulting of archival finding aids in XML-EAD format with the purpose of:</p> <ul style="list-style-type: none"> <li>• online publishing of historical archives description and documentation</li> <li>• allowing google like full text searches</li> <li>• ensuring availability in long time perspective of archival descriptions made with software applications</li> <li>• efficiently visualizing high resolution digital reproductions</li> <li>• managing virtual reading room for historical archives.</li> </ul>
<b>Detailed description</b>	<p>AriannaWeb is an information system developed with the purpose of:</p> <ul style="list-style-type: none"> <li>• online publishing of historical archives description and documentation</li> <li>• allowing google like full text searches</li> <li>• ensuring availability in long time perspective of archival descriptions made with software applications</li> <li>• efficiently visualizing high resolution digital reproductions</li> <li>• managing virtual reading room for historical archives.</li> </ul> <p>AriannaWeb is a tool for integrated consulting of archival finding aids in XML-EAD format. AriannaWeb is able to import and convert archival data bases using specific mappings between different descriptive models and XML-EAD standard. AriannaWeb allow to easily integrate an archivist presentation inside a portal or a web site, with full respect both of layout peculiarities and informative decisions.</p> <p>AriannaWeb is a real application server managing an XML-EAD documents repository and exposing an access interface to their informations. The interface is user friendly with powerful functionalities and "ISAD-oriented" APIs. AriannaWeb requests can be done both via direct Java</p>



API calls and via Web Services (using standard SOAP protocol). AriannaWeb software architecture pursue to unbind the system from a prefixed presentation model, allowing users to integrate archival descriptions inside service oriented portals and web sites.

AriannaWeb uses a full-text search engine allowing both generic and contextual searches (dates, titles, indexes, etc.) . AriannaWeb moreover is able to manage high resolution images associations with archival units (using links to XML-MAG documents), and let the user easily manage his visualization needs with standard zoom, pan, selections tools.

EAD is a specific XML schema for archival finding aids tagging, developed mainly from Berkeley University and compliant with international ISAD standard for archival descriptions.

Such a standard has been chosen because:

- it allows the maximum interoperability between AriannaWeb and other archival description softwares or information systems
- it guarantees preservation over time of managed finding aids, in a self consistent format which is not dependent from any specific software or hardware platform.

<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• IIPIImage based image browsing system for high resolution digital reproductions</li> <li>• Web services architecture with standard SOAP protocol</li> <li>• Use of XML-EAD standard</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Flexible and customizable data rendering</li> <li>• Image management with links between documentary material and its digital reproductions</li> <li>• Based on standard XML-EAD</li> <li>• Full text and contextualized searches</li> <li>• Archives and fonds georeferencing</li> <li>• Services for reading rooms management</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Any partner involved in the market where we distribute our product.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22272

[ ITALY ]

## ID Technology Srl

www.idtech.it

<b>Sector</b>	Consulting services, software customisation, technical support and training.
<b>Activities</b>	Cultural heritage archiving and management solutions, digital libraries, Service Oriented Architecture (SOA), Open Archives Initiative (OAI).
<b>Contact</b>	

<b>Title</b>	OLTREWEB: INTEGRATED ACCESS METAWEB TO HETEROGENEOUS CULTURAL HERITAGE ASSET
<b>Abstract</b>	<p>The system consists of a J2EE application. A number OAI-PMH distributed wrappers insists over cultural object digital asset (photos, postcards, pictures, monuments, books, etc.) and extract Dublin Core metadata.</p> <p>All metadata are captured from different protocols (JDBC, Z39.50, etc) and encodings (standard ICCD inventories, SBN Libraries catalogues, other OAI-PMH applications) into Dublin Core XML encoding, and stored into a central OAI Repository. A web site allows users to query metadata and retrieve remote object detailed description.</p>
<b>Detailed description</b>	<p>The system consists of a 3-tiers J2EE application. A number OAI-PMH distributed wrappers insists over Cultural Object Digital Inventory Description of Art Masterpieces, such as Photos, Postcards, Pictures, Monuments, Books, etcetera. National standards are captured from different protocols (JDBC, Z39.50, etc) and encodings (ICCD inventories, SBN Libraries catalogues, other OAI-PMH applications) into Dublin Core XML encoding, and stored into a central OAI Repository. A web site allows users to query metadata and retrieve remote object detailed description. The system can transform the queried metadata into IMS standard Learning Object Model XML encoding. Multilanguage is supported.</p> <p>The system is a full Java implementation on top of the Open Source OAI Provider solution. ID Technology is an italian software&amp;services IT consultancy SME oriented to medium and large enterprises/public institutions. ID Technology solutions are innovation-oriented and have a significative added value as a result of its R&amp;D activities. The company have a Vision 2000 Quality Certification, and can count on italian and global customers portfolio.</p>
<b>Innovative aspects</b>	<p>Interoperability is the keyword of Oltreweb solution.</p> <p>Information is shared over an Open Standard OAI-PMH approach based on widely used HTTP protocol.</p>

Information can be annotated with multiple metadata formats. Default metadata are Dublin Core, i.e. interoperable online metadata standards that support a broad range of purposes and business models. Custom metadata formats are modeled through XML schemas, and can cover a wide range of use cases.

Metadata can be used to drive information integration through interoperability by modeling Application Profile metadata. Application Profile is a declaration specifying which metadata terms an organisation, information provider, or user community uses in its metadata and how those terms have been customized or adapted to a particular application.

<b>Main advantages</b>	<p>Information is structured and can be “plugged” into knowledge management, digital libraries systems, search engines.</p> <p>Information delivery can be profiled or can be open-accessed.</p> <p>Semantic Interoperability can drive [open access] integrated systems. Oltreweb metadata harvesting becomes a way to enable semantic coreography among information systems.</p> <p>Oltreweb based solutions have been succesfully used in real cases. ID Technology can count 20 installations for Italian Ministry of Cultural Heritage customers, among public historical archives and libraries.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>The software is distributed by Ministero per i Beni e le Attività Culturali (Ministry of Cultural Heritage and Activities).</p>
<b>Application domains</b>	<p>Information processing, information systems.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Content publishers, content provider (cultural heritage foundations, museums, archives, art galleries); public administrations.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>IRC MEDIA</p>

## Technology Offer TO\_IT\_22284

[ ITALY ]

## ID Technology Srl

www.idtech.it

<b>Sector</b>	Consulting services, software customisation, technical support and training.
<b>Activities</b>	Cultural heritage archiving and management solutions, digital libraries, Service Oriented Architecture (SOA), Open Archives Initiative (OAI).
<b>Contact</b>	

<b>Title</b>	A SCALABLE DISTRIBUTED OPEN ARCHIVAL INFORMATION SYSTEM (OAIS)
<b>Abstract</b>	The technology implements the standard OAIS reference model under a distributed platform to manage digital lifecycle . The solution is an archive to preserve information and make it available for a wide community. The OAIS framework is modeled as a process distributed over a Service Oriented Architecture (SOA) platform. The solution interoperates with a Wiki, a digital Library, a ontology based classifying modul.The integration among partners and organisations who are not federated on the ESB is driven by OAI-PMH.
<b>Detailed description</b>	<p>The technology implements the standard OAIS reference model under a distributed platform in order to manage digital content lifecycle (JHOVE/STORE Capture, METS/OAI-ORE based Manage/Preserve, OAI/SOAdeliver). The solution is an archive to preserve information and make it available for a wide community. The OAIS framework is modeled as a process distributed over a Service Oriented Architecture (SOA) platform.</p> <p>The SOA platform is an Enterprise Service Bus. Services are controlled by a management portal. The solution interoperates with:</p> <ul style="list-style-type: none"> <li>• Wiki to deliver WEB2.0 annotation features</li> <li>• DL to manage digital content</li> <li>• an Ontology based classifying module, generating metadata automatically</li> <li>• thesauri in order to control metadata vocabularies</li> <li>• OAI repository for Open Archive Initiative based integration among partners and organisations who are not federated on the ESB.</li> </ul> <p>ID Technology Srl, is an Italian SME of Milano and provides ISO 9001:2000 Certified IT consultancy services. IDTECH dedicates a business unit for cultural heritage archiving and management solutions for private historical companies, and for public administration institutions. R&amp;D centre staff is involved in R&amp;D projects funded by the Italian government, in the application fields of knowledge based learning, open standards for cultural heritage archiving solutions (SOA),</p>

	interoperability standard compliance.
<b>Innovative aspects</b>	<p>The solution is based on latest IDABC european interoperability initiative issues for the integration of Public Administration organisations systems.</p> <p>The platform allows to plug in OAIS a number of features to interoperate, classify and deliver content without the need to maintain a costly architecture, since modules are disjointed and can work together as web services.</p> <p>New classification methods can be enabled without changing the existing environment.</p> <p>New modules are provided through standard Web Services interfaces.</p> <p>A Java based ISO standard thesauri management API.</p>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Ready to use systems for public administration archives and content repositories</li> <li>• DL module is ready to use also for private customers who want to manage their digital content through a OAIS cost effective solution</li> <li>• Covers international archive management standards</li> <li>• Covers international interoperability open standards</li> <li>• Covers italian cultural heritage catalogation standards for documents, images and digital content</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	IT Company (content management, R&D, intelligent classification), content publishers, content provider (cultural heritage foundations, museums, archives, art galleries), public administration (departments of ministry of cultural heritage).
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC MEDIA

## Technology Offer TO\_IT\_22538

[ ITALY ]

## In Target Consulting Services Srl

www.intarget.it

<b>Sector</b>	Traceability and management of cultural assets.
<b>Activities</b>	Information system for the management and the valorisation of archaeological finds.
<b>Contact</b>	

<b>Title</b>	AN INFORMATION SYSTEM FOR THE MANAGEMENT AND THE VALORIZATION OF CULTURAL ASSETS
<b>Abstract</b>	It enables to track all information associated to cultural assets and manage its full lifecycle. Has the capability to analyze and exploit the full potential of the managed cultural assets. It is also able to manage all associated documentation and other digital attachments.
<b>Detailed description</b>	<p>We have developed an information system which permits the management of all cultural assets and related documents.</p> <p>It can be applied to museums, archeological sites, exhibitions, etc.</p> <p>It can be accessed from different perspectives, depending on the knowledge and the interest of the users.</p> <p>It promotes a methodology for managing cultural assets, and can be adapted to the workflows, the protocols and the peculiarities of organisation.</p> <p>It enables the company to keep control of all the cultural assets and to analyze and exploit the full informative potentiality of them.</p> <p>All the activities and the events related to the cultural assets can be recorded, when they are available, even acting in the past: the system is able to reorganize the full history of the assets, including all their transformation and relationships, even if the events and the activities are not recorded in a chronological sequence.</p>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Promotes a methodology</li> <li>• Uses innovative technology (RFID, and barcode readers) to track all the aspects</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Promotes a Methodology</li> <li>• Workflow based</li> <li>• Technology aware</li> <li>• Different perspective of usage</li> </ul>

	<ul style="list-style-type: none"> <li>• Tracks all the history, even based on non chronological input</li> <li>• Multiuser environment</li> <li>• Enables to exploit the informative potentiality of cultural assets</li> </ul>
Current state of development	
Intellectual Property Rights	
Application domains	Information processing, information systems.
Collaboration details	
Type of partner sought	Industry, academy, cultural organisation.
Tasks to be performed by the partner sought	
IRC Partner	IRC CIRCE

Technology Offer TO\_PL\_22407

[ POLAND ]

**Institute for Mechanised Construction and Rock Mining (IMBIGS)**

www.imbigs.org.pl

<b>Sector</b>	Research and development in the field of mechanical engineering and safety.
<b>Activities</b>	Development and validation of engineering equipments.
<b>Contact</b>	

<b>Title</b>	ALARM SENDER USING LAN/VAN NETWORKS WHICH CAN BE USED IN MUSEUMS ETC.
<b>Abstract</b>	<p>A Polish SME has developed a technology of signal transmission from local alarm systems through LAN/VAN (local area network, virtual area network) networks. It is an advantageous alternative for radio monitoring systems.</p> <p>The partners for technical cooperation, joint venture or manufacturing agreement are sought and also partners for further product development or commercial agreement with technical assistance.</p>
<b>Detailed description</b>	<p>A Polish SME active in information and communication technologies has developed a technology of signal transmission from local alarm systems through LAN/VAN (local area network, virtual area network) networks. This new kind of alarm sender can displace radio monitoring systems. It provides transmission to monitoring stations with confirmation of signal reception, global range thanks to utilization of Internet technology, easy installation and collaboration with most networks based on Ethernet architecture. The sender works using protocol TCP/IP (Transmission Control Protocol, Internetwork Protocol), with both static and dynamic IP addressing. The device can be plug in to programmable output of alarm switchboard.</p> <p>The device, designed for assembling in housing of alarm switchboard is a two-sided printed-circuit board with dimensions of 68 mm x 110 mm with about 50 elements mounted on it. The device encloses an input signal strip and RJ45 input, serving for connection to local computer network. The alarm sender controls input lines state and in case of any change reports it to monitoring station via local LAN network or, using LAN network, via Internet.</p>



<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Frequent tests transfer providing very high level of sabotage security</li> <li>• The fastest signal transfer to monitoring station (about 5 sec. after the incident)</li> <li>• Notice of signal receipt from monitoring station</li> <li>• Possibility of battery voltage value transfer when working without current supply</li> <li>• Possibility of feeding directly through alarm switchboard feeder</li> <li>• Testing of feeding and battery charge state.</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Fast signal transfer – about 1 sec.</li> <li>• Very frequent test signal transfer along with automatic control in RCVR</li> <li>• No additional costs for the user – uses existing Internet connection</li> <li>• Global range without any costs thank to global Internet network.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy or research organisation
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

## Technology Offer TO\_IT\_22415

[ ITALY ]

## Interagens Srl

www.interagens.com

<b>Sector</b>	Software and multimedia technologies.
<b>Activities</b>	Interactive animated characters for communication, education, entertainment.
<b>Contact</b>	

<b>Title</b>	INTERACTIVE ANIMATED CHARACTERS FOR CULTURAL HERITAGE
<b>Abstract</b>	Interagens (www.interagens.com) realizes Interactive Animated Characters (IACs) that guide, help, teach and entertain users of cultural heritage in museums, galleries, historical and archeological sites. IACs can be deployed both on desktop and mobile devices, including phones.
<b>Detailed description</b>	<p>Interagens Srl creates solutions for communication, training and entertainment based on interactive animated characters: digitally animated characters that interact with the users and are controlled in real time by a software system.</p> <p>For example IACs assist and entertain visitors to websites, giving them personalised information, helping them to make purchases and carry out online operations and promoting the services offered. Furthermore, IACs help users of e-learning courses, playing a motivational role, explaining the subjects to be learned and personalising them to suit the students' needs.</p> <p>IACs are developed using Macromediae Flashe, which ensures very wide diffusion, great portability, even on palmtops and mobile phones, and extreme lightness; they are compliant with the accessibility standards ("Stanca" law, W3C requirements).</p> <p>Interagens offers the following services:</p> <ul style="list-style-type: none"> <li>• thorough analysis of the client's communications, training or entertainment needs</li> <li>• creating tailor-made products</li> <li>• integrating products in the client's applications</li> <li>• creating ad hoc IACs</li> <li>• personalising the look of the IACs</li> <li>• analysing the effect of the IACs on users</li> <li>• giving advice on communications and training projects</li> <li>• maintaining and updating the IACs.</li> </ul>
<b>Innovative aspects</b>	IACs are controlled in real-time by a patent-pending software system that makes them able to

interact with users in a number of ways; the software system also enables developers to create and update IACs in a fast and cost-effective way.

### Main advantages

IACS offer significant advantages with respect to traditional multimedia products, because they provide effective communication, are easy to use, and can adapt themselves to the context. Here are their main applications.

Virtual presenters for websites:

- museums, exhibitions, events
- libraries and records
- multimedia kiosks for tourists and citizens.

Virtual tutors for:

- answering frequently asked questions
- assisting with the use of the e-learning platform
- supervising and stimulating the students
- providing personalised feedback.

Entertainers in the guise of:

- playmates
- smart adversaries
- interactive avatars
- virtual actors.

Virtual teachers for teaching:

- problem-solving abilities
- diagnostic abilities
- interacting abilities (selling, leadership, negotiation)
- carrying out procedures
- using complex tools.

### Current state of development

### Intellectual Property Rights

Patent(s) applied for.

### Application domains

### Collaboration details

### Type of partner sought

Public administrations, universities, research organisations.

### Tasks to be performed by the partner sought

### IRC Partner

IRC CIRCE

## Technology Offer TO\_IT\_22561

[ ITALY ]

## IPT Srl

www.iptsat.com

<b>Sector</b>	Territorial information systems.
<b>Activities</b>	Supply of integrated services about analysis and interpretation of images obtained through remote sensing technology, application of geometric and radiometric corrections, production of specific thematic characters, integration of satellite data in the overall context of territorial informational systems.
<b>Contact</b>	

<b>Title</b>	WEBGIS FOR CULTURAL HERITAGE
<b>Abstract</b>	The exploitation and management of cultural heritage through the Geographic Information System (GIS) technology and web applications is a valuable tool to for conservation and maintenance, and to involve the largest number of people potentially interested in their use.
<b>Detailed description</b>	<p>Each user has its access level:</p> <ul style="list-style-type: none"> <li>• User "citizen" - for the purposes of general knowledge of the area, identification of routes or thematic information on services</li> <li>• User "expert" - for decision-making purposes, tourists and environmental exploitation, study.</li> </ul> <p>The information extracted from archives alphanumeric and mapping (GeoDataBase) can be processed and presented in text form and in georeference maps. This gives the advantage of being able to:</p> <ul style="list-style-type: none"> <li>• see the exact location of artefacts</li> <li>• observe them in 2D and 3D</li> <li>• exceed all the information related to them (location, hours of open and close, conservation status, progress work, photographs, etc.)</li> <li>• create themes of all kinds</li> <li>• define a tourist route</li> <li>• print maps and other forms of territorial representation.</li> </ul> <p>These services may also provide the ability to create, for example, a tourist route to get on a PDA and/or cell phone that will guide us in all steps.</p>
<b>Innovative aspects</b>	WebGIS: territorial, geographic and thematic system information accessible through the Internet with a Web browser (Internet Explorer, Netscape, etc.). You can access the service to manipulate, process and analyze georeferenced-data directly from the your PC connected to the internet, exploiting the potential of GIS software Desktop without having installed on your computer. These

applications don't require specific skills by the user. The best known examples of WebGIS are web applications for the location map, or the street atlases on-line (tuttocittà, Google Earth, Virtual Earth, etc).

**Main advantages**

Great dissemination of information via Internet. Easy access through a standard web browser. Creating thematic maps. Space analysis. No cost for the desktop GIS software by the user. Interactivity.

**Current state of development**

**Intellectual Property Rights**

**Application domains**

Information processing, information systems.

**Collaboration details**

**Type of partner sought**

**Tasks to be performed  
by the partner sought**

**IRC Partner**

IRC CIRCE

Technology Offer TO\_ES\_22278

[ SPAIN ]

**Labein-Tecnalia**

www.labein.es

<b>Sector</b>	Research and development in the field of Automotive industry; Construction and territorial development, Energy; Environment; Iron and steel; Innovation systems.
<b>Activities</b>	Services related to assessment of conformity, diagnosis, maintenance, new products or processes.
<b>Contact</b>	

<b>Title</b>	AUGMENTED REALITY FOR THE DIFFUSION, PROMOTION AND LEARNING OF CULTURAL HERITAGE
<b>Abstract</b>	LABEIN, a Spanish Technological centre, offers know-how and expertise in the use of augmented reality for cultural heritage applications. The technology provides a high degree of realism, due to the combination between reality and virtual information, and information that can not be caught by the senses. Hence, augmented reality make cultural heritage more appealing for visitors. A company or institution is sought for technical cooperation and commercial agreement with technical assistance.
<b>Detailed description</b>	<p>In order to reach the cultural heritage as a resource, whose maintenance is sustainable, arises the necessity to put in value of the cultural resources. With this objective, arises the necessity to develop methods, products, systems and tools that allow to approach the cultural heritage to the citizen and the visitors with the purpose of knowing it, to understand it and, thus, to value it. The use of new technologies in general and augmented reality in particular, for the diffusion and conservation of the cultural heritage opens a great number of possibilities to this sector.</p> <p>The augmented reality is a novel technology, a variation of the virtual reality whose main difference is that while in the virtual reality the user submerges in a completely virtual world, the augmented reality allows that the user to see the real world augmented with virtual information. Real and virtual information coexists in the same space allowing the interaction with the environment, increasing the perception of the real world and providing information that the user can not perceive by his senses.</p> <p>Some of the potential applications of this technology applied to the diffusion of the cultural heritage are: Recreation of historical elements disappeared partially; presentation of evolution of aspect and uses of a building/environment during other phases of history; simulation of the restoration in situ of historical buildings; virtual guidance; new exhibitions for interpretation centres; games, etc.</p> <p>LABEIN has deep knowledge and a very long experience in the augmented reality technologies, and the application to different areas and specially in the scopes of the construction and the cultural</p>

heritage. It has participated in projects of european, national and local scope, for the application of these technologies during the past few years.

<b>Innovative aspects</b>	<p>Some of the main innovating aspects of this technology for the creation of applications or tools for the diffusion of the cultural heritage are the following ones:</p> <ul style="list-style-type: none"> <li>• dynamic and attractive presentation of the information, as a tool for the improvement of the understanding of the information</li> <li>• a high degree of realism, due to the combination between reality and virtual information</li> <li>• help for the interpretation of the environment, including information that cannot be caught by the senses</li> <li>• approach to the patrimony to groups that traditionally are not interested in the cultural heritage (children, adolescent, etc.), facilitating its approach of an interactive and fascinating way</li> <li>• to eliminate barriers, like the language, that traditionally finds the tourist when it arrives to a foreign country.</li> </ul>
<b>Main advantages</b>	<p>The main advantage of the augmented reality technologies applied to the diffusion and preservation of the cultural heritage is in the capacity of the applications that use these technologies to attract visitors the tourist environment. In this way, an increase of the income generated by the own resource is obtained. At the end the cultural heritage will become an economic resource that acts as a tractor element of this region, instead of an economic load.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems. Main market applications are diffusion, promotion, learning and sensibilization of cultural heritage for institutions, tourism or education.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Companies, institutions.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	BASQUE IRC

Technology Offer TO\_ES\_22279

[ SPAIN ]

**Labein-Tecnalia**

www.labein.es

<b>Sector</b>	Research and development in the field of Automotive industry; Construction and territorial development, Energy; Environment; Iron and steel; Innovation systems.
<b>Activities</b>	Services related to assessment of conformity, diagnosis, maintenance, new products or processes.
<b>Contact</b>	

**Title** INTEGRATION OF INFORMATION TECHNOLOGIES FOR MANAGEMENT AND REVALORISATION OF HISTORICAL SURROUNDINGS

**Abstract** LABEIN, a Spanish technological centre in the Basque country, has a deep know-how on the application of web technologies, database management systems, GIS and virtual reality in the areas of sustainable management of territory and cultural heritage. Information technologies applied to historical heritage offers an integral treatment of the data that favours a greater knowledge of its problematic in order to allow a correct management. Companies and institutions are sought for technical co-operation.

**Detailed description** At present time, it is fundamental to have detailed information that can be used as the basis for a suitable management of the historical heritage. Therefore, it is fundamental to have a deep multidisciplinary knowledge, based on studies and investigations about those cultural, historical, architectonic, archaeological, environmental, social, economic aspects, etc. in order to reflect exactly the richness and complexity of heritage, including its characteristics, location and the potential problems associated to its conservation. Given the important volume of information that is related to the historical heritage, it is important to have solid database management systems where all the data (technical information, studies, basic and derived cartography, models of virtual reality, multimedia material, etc) are integrated. It is also important to consider that the information levels will be different depending on the profile of user and the use that will be made of the data. Geographical information systems (GIS) allows integrating diverse information as the one that arises around the historical heritage in a way that its later use is simpler and, in many cases, accessible, either a simple visualization or recovery of the stored data or even more complex processes, such as those that are carried out when analyzing manifold criteria and variables (nD-modelling). Some of the potential applications are:

- to establish and represent tendencies in the movements of structures throughout time, from measurements coming from sensors
- to generate alarms when certain values are exceeded
- to plan and to prioritize interventions according to the existing economic resources and based on the state and importance of the buildings



- to value the partial cost that supposes throughout the time the restoration and maintenance of each element of the monumental set
- to value possible relations between the environmental degradation of the materials and environmental conditions of the surroundings or to the own building.

Other applications are the promotion and diffusion of the monumental sets; the tours on the land with possibility of interaction on the own virtual surroundings on the part of the user; the bird's-eye views on the cultural landscape; the thematic tourist routes based on personal interests or of the time available for future visits "in situ", etc. LABELIN, the technological centre has experience in the development of research projects using web, GIS and databases technologies for the management and diffusion of the historical patrimony. It has participated in numerous projects of european, national and local scope for the application of these technologies during the past few years.

#### Innovative aspects

Among the main innovative aspects that these technologies have towards the management and diffusion of historical heritage it is possible to emphasize:

- to diagnose and to know the characteristics of a monumental set throughout all its life cycle
- to carry out complex analysis of data sets from an integral point of view
- to operate the information in an effective and suitable way for different users
- to facilitate the decision making process to owners and managers of heritage
- to present the information of interest in a dynamic and attractive way, as a means for improving the vision and personal experience of heritage
- to help the interpretation of the historical surroundings by means of the incorporation of information inside a context
- to rise awareness and appreciation of heritage among the citizens by means of friendlier applications
- to eliminate both linguistic and physical barriers, allowing the experience of heritage for all, including foreign and disables people.

#### Main advantages

The main advantage of these information technologies applied to historical heritage refers to the possibility of offering an integral treatment of the data, that favours a greater knowledge of its problematic in order to allow a correct management. This information can also be used for dissemination activities, so that a better knowledge of the characteristics of the historical heritage can entail a socioeconomic revitalization of these constructed cultural sets.

#### Current state of development

#### Intellectual Property Rights

Secret know-how.

#### Application domains

Information processing, information systems. These technologies can be used to promote and spreading of the monumental sets; the tours on the land with interaction on the own virtual surroundings on the part of the user; the bird's-eye views on the cultural landscape; the thematic tourist routes based on personal interests or of the time available for future visits "in situ", etc.

#### Collaboration details

#### Type of partner sought

Companies or institutions.

#### Tasks to be performed by the partner sought

#### IRC Partner

BASQUE IRC

## Technology Offer TO\_IT\_22302

[ ITALY ]

## Liberologico Srl

www.liberologico.com

<b>Sector</b>	Information and communication technologies, web systems for data storage and digital publishing.
<b>Activities</b>	System integration, development of information tools and systems to data management.
<b>Contact</b>	

<b>Title</b>	A WEBGIS FOR PLANNING, MANAGING AND DOCUMENTING OF RESTORATION WORKS
<b>Abstract</b>	Liberologico is an IT SME which has matured a strong expertise in developing software for cultural heritage. Among its products, the company has developed SICaR w/b, a webGIS for the planning, managing and documenting of restoration works.
<b>Detailed description</b>	<p>SICaR w/b is a webGIS, developed with standard technologies, aimed at planning the feasibility project of a restoration work and geo-referencing all the documentation, both geometric and alphanumeric, related to the work of art:</p> <ul style="list-style-type: none"> <li>• geometric data: vector representation of the work of art and of all the data which can be graphically visualized (such as areas of deterioration and the correspondent restoration works, stratigraphic structure of wall surfaces, etc.)</li> <li>• alphanumeric data:             <ul style="list-style-type: none"> <li>- technical information about the state of conservation and the restoration (chemical, physical, petrographic analyses; methodologies, materials and tools used during the work, etc.)</li> <li>- data contributing to an in-depths knowledge of the work of art (general historical data, bibliography, archive documents, catalogue cards, etc.)</li> </ul> </li> </ul> <p>Thanks to SICaR w/b the restorers and any person concerned with restoration works can map degradation or restoration areas over an exact and measurable model (iconometric model) of the work of art and also geo-reference all the related technical and documentary data.</p> <p>All the various data can be consulted through a transversal access which allows to make cross-referenced queries and statistics. SICaR w/b allows a comprehensive view of the degraded surfaces, of the works carried out and of the related information. It also consent to elaborate statistics and estimates, thus offering a valuable supporting tool for the economical and temporal plan of the works and the subsequent monitoring.</p> <p>The system has a web interface which can be accessed after inserting a user login and password: data entry and consultation take place by connecting to any web browser without installing any</p>

software and can also be made through wireless connection and mobile devices.

SICaR w/b was adopted by the Italian Ministry of Cultural Heritage within the ARTPAST project (2006-2007), intended to the defining of a first experimental data restoration structure for the management of important restoration sites. SICaR w/b's use by twelve Italian heritage superintendencies has resulted in a huge archive, for the first time shared, arranged and consulted through the internet, which enables to make transversal researches and to compare the repairs methodologies employed in each yard. A framework agreement has been signed among the Ministry of Culture, the Centre of Conservation La Venaria Reale (Torino) and Liberologico, concerning the use, implementation and adoption of SICaR w/b.

### Innovative aspects

SICaR w/b has many advanced features.

Administration features:

- working groups and users configuration
- workflow configuration
- dictionary and controlled terminology configuration
- layers and reference systems configuration
- background configuration
- configuration of translation for localization.

Editing features:

- zooming and panning
- multi-user vectorial editing
- design of polygon closed by point and by free-hand
- entry/change of circles and rectangles
- shifting of polygons/circles/rectangles
- adding/removing/shifting of polygons points
- bring to front/send to back polygons/circles/rectangles
- cut and paste polygons/circles/rectangles
- progressive visualization of high resolution background raster
- geo-referencing and consultation of linked-cards
- cataloguing features
- multi-users data-entry
- critical-historical and administrative description of the restoration site
- restoration site diary
- chemical, physical and optical, etc. analysis
- restoration works
- stratigraphic unit of wall surfaces, with prospect cards and activities
- litotype
- photographic/iconographic sources
- bibliographic sources
- archive sources
- national and international standard catalogue cards

- heterogeneous multimedia documentation (doc, xls, pdf, etc.)
- external database links.

Searching features:

- full-text research
- step-by-step advanced research
- visualization on a map of research results.

Import/export features:

- DXF files import that can be used as a background
- DXF files import that can be used as a working layer
- XML import/export of alphanumeric cataloguing cards
- visualization of geo-referenced areas.

Statistics features, identification and mapped surface quantification, in relation to reference systems, layers, selected areas and single mapping.

Future extensions currently under development:

- a specific module for the monitoring and maintenance
- the 3D visualization within LARTEC, a public-private laboratory of Regione Toscana for the technological innovation of conservation and communication of cultural heritage.

### Main advantages

The system is intended to meet one of the major needs of people concerned with restoration activities (curators, restorers, conservators, operators, analysts, consultants, etc.): to have a unique tool to make an estimate of both costs and working time of a restoration work, to collect the historic and artistic data and the technical-scientific ones, to monitor the state of conservation.

Indeed it is a commonplace to remember that any restoration work has to be preceded by the collection, as largest as possible, of historical information, scientific and academic analyses, so that a deep understanding of the artwork may be obtained and the restoration activities correctly planned. Thus conservators are looking for a management tool which enables them to easily find the identification data of the object as well as the ones concerning the object's history, such as the activities which have been performed on it (restorations, restrictions, passing of property, exhibitions, etc.). Moreover what they need is a system which could not only record the materials and substances used and the methodologies adopted for a restoration work, but also allow other restorers and conservation researchers to access them in future, in order to avoid that the documentary archives collected for the restoration of a single work of art are only managed by the restricted group of people who produced them. SICaR w/b was developed in order to meet these needs

### Current state of development

### Intellectual Property Rights

Secret know-how.

	SICaR w/b users are all the people concerne3D with restoration and conservation of cultural heritage: monuments and fine arts office, restoration centers, standardization bodies, faculty of architecture and school of specialization on restorations, building enterprises.
<b>Application domains</b>	Information processing, information systems. SICaR w/b users are all the people concerne3D with restoration and conservation of cultural heritage: monuments and fine arts office, restoration centers, standardization bodies, faculty of architecture and school of specialization on restorations, building enterprises.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy, research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

## Technology Offer TO\_IT\_22304

[ ITALY ]

## Liberologico Srl

www.liberologico.com

<b>Sector</b>	Information and communication technologies, web systems for data storage and digital publishing.
<b>Activities</b>	System integration, development of information tools and systems to data management.
<b>Contact</b>	

<b>Title</b>	GSM AUDIO-GUIDE FOR ARTS, TOURISM AND ENVIRONMENT
<b>Abstract</b>	<p>Liberologico is an IT SME which has matured a strong expertise in developing software for cultural heritage. In the field of cultural tourism marketing, the company has developed AGATA, an IT platform that allows to easily set up mobile based location services for any kind of telephone. The company is searching for:</p> <ul style="list-style-type: none"> <li>• final users, interested in adopting its technologies: public administrations, cultural bodies, etc.</li> <li>• partners to collaborate with in international project: research centers, SME, etc.</li> <li>• software reseller to distribute software in EU market.</li> </ul>
<b>Detailed description</b>	<p>AGATA – GSM audio-guide for arts, tourism and environment is a web-tool for telephone services that allows to set up easily a wide range of interactive vocal applications usable by any kind of telephone, both land and mobile phone:</p> <ul style="list-style-type: none"> <li>• information available to the listeners: dial and vocal access to information and services, available both on internet and intranet network (public utility information, mobile audio-guide, tourist information, events, info-mobility, health, etc; product information, customer care services, help desk, advertisement and vocal banner, post-marketing, etc.)</li> <li>• internal communication: vocal contacts and address book, vocal calendar and agenda, sales force automation, etc.</li> <li>• M-payment: there are three implementations: e-wallet based on pre-paid cards, vocal trolley and SSL transaction based on J2ME – SSL technologies and vocal payment.</li> </ul> <p>Thanks to AGATA it is possible to deliver to tourist's mobile phone both - for instance - cultural information written ex novo and entered in the CMS and pre-existed information stored in the database and published in a web-site.</p> <p>AGATA allows to easily develop an innovative audio-guide service, that does not require to rent a dedicated tool but it can be listened to directly by the mobile phone. With AGATA the information are always and everywhere available and they arrive directly to the tourist mobile phone.</p>

AGATA is the best solution for territorial networks, open spaces and places where is not available a point of access and exit (e.g. open space museums, open air itineraries, museums networks, archaeological areas, historical centres, natural parks, etc.) where to rent a traditional audio-guide could be difficult, and to extend the services over the open-hours of cultural facilities.

AGATA integrates the best technologies for speech processing with technologies for VAS services management, providing the users with an Automated Response System.

Contents are read by a high quality synthetic voice, that might be enrich by jingles and pre-recorded messages.

The user can interact with the application dialling the phone or typing the PC. The system is developed to browse the vocal three by the mobile phone: it allows the user to receive information and to interact with the application both by dialling and by natural voice.

AGATA is available in 4 versions:

#### BASIC

Classic audio-guide service available for any mobile phone.

#### NEWS

It allows to manage and send promotional messages and news both in audio format and as SMS/MMS for fidelity purposes and marketing aims. The operator (i.e. hotel facility manager, vendor, events manager, museum manager, etc) enters in the CMS the promo-message and sets the delivering parameters, for instance as a vocal banner at the beginning or at the end of a story, or an SMS. The tool allows also to deliver the message toward more recipients.

#### COMMUNITY

Tool for community services and social networking management:

- **VOTING:** tool to set opinion-polls to know the level of satisfaction of a service and to get back in real-time the preferences and the public voting. The user calls and interacts with natural voice with the automatic vocal operator, which recognises and records the user vote and answers by the synthetic voice system. Moreover, the tool allows the user to vote by SMS.
- **BLOG:** module to publish user opinions about the visited places. The messages, entered in the system both by the web and by SMS, can be both listened and read.
- **WEB REPOSITORY:** it allows the phone and the web integration: the user finds on the web the itinerary that he listened to by the audio-guide and s/he can download it both in pdf format comprehensive of images – as an easily printing mini-guide – and in mp3 format.

#### TOURIST PASS

It is an alternative system of traditional tourist cards, that implements multi-channel e-booking and e-payment features – web/mobile-phone, to buy cumulative tickets and integrated tourist services (e.g. museums tickets, public transport, shows tickets, etc.).

It does not require POS, and it allows to save installation and maintenance costs. It guarantees the transaction control and it allows real-time statistics processing about the customs and tourists purchasing behaviours.

<b>Innovative aspects</b>	<p>It is made up of the following features:</p> <ul style="list-style-type: none"> <li>• PIN: it allows to record the user data by entering personal data and associating the mobile phone number to a personal ID-code number (PIN) made up of 8 alpha-numeric characters, that can be later used for a service.</li> <li>• J2ME: to make protected transaction toward a bank gateway based on a J2ME standard application.</li> <li>• VOICE: to make protected transaction toward a bank gateway with voice user recognition.</li> </ul>
<b>Main advantages</b>	<p>AGATA is an absolutely innovative product in the software market. Its special features are:</p> <ul style="list-style-type: none"> <li>• design and deploy: the user can develop his/her interactive vocal application by an on-line CMS. This means that you do not need neither to install hardware (i.e. PBX) or a technical help</li> <li>• user friendly: the WYSIWYG editor allows to create the structure, commands, features and contents of a interactive vocal application without writing code</li> <li>• IT-TLC convergence: AGATA can manage database/web/telephonic integrated services, as for instance data writing/reading on a database, action user tracking, etc.</li> <li>• quality: high quality and multi-language (more than 15 languages) vocal synthesizer (TTS – Text To Speech) allows to vocalize both information in real time and database queries results; the ASR (Automatic Speech Recognition) can recognise high definition vocal command</li> <li>• customized and modulated: it is possible to choose among a set of standard tools that correspond to different features and services.</li> </ul>
<b>Current state of development</b>	<p>AGATA is VXML based on, and it is made up of the following elements for the development, the administration and the vocal services monitoring:</p> <ul style="list-style-type: none"> <li>• web editor: it has a content management user-friendly interface, that allows also to edit the vocal three and to easily and autonomously configure the service</li> <li>• TTS gateway: for the TTS technology integration</li> <li>• ASR gateway: for the ASR technology integration</li> <li>• VAS gateway: to set up additional push services by SMS/MMS, emails, automatic contact centre (direct marketing, voting, community)</li> <li>• m-payment gateway: several configurations (vocal electronic trolley, e-wallet, SSL transaction)</li> <li>• web-services gateway: system integration through XML-RPC or SOAP.</li> </ul>
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	<p>Information processing, information systems.</p> <p>Other application domains are:</p> <ul style="list-style-type: none"> <li>• Audioguide for museum and open spaces (city tour, archaeological area, parks, etc.)</li> <li>• Information on current events (art exhibitions, theatre, music, etc.)</li> <li>• Location based tourist information (restaurants, bus stops, infomobility, pharmacies, etc.).</li> </ul>



Collaboration details

Type of partner sought

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Industry, academy, research organisation.

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Tasks to be performed  
by the partner sought

IRC Partner

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IRC RECITAL

## Technology Offer TO\_IT\_22305

[ ITALY ]

## Liberologico Srl

www.liberologico.com

<b>Sector</b>	Information and communication technologies, web systems for data storage and digital publishing.
<b>Activities</b>	System integration, development of information tools and systems to data management.
<b>Contact</b>	

<b>Title</b>	PLATFORM FOR MULTI-SCHEMA CATALOGUING
<b>Abstract</b>	Liberologico, thanks to its deep experience in the development of technological platforms for the cultural heritage, has developed ArtIn-XML, a platform for the multi-standard cataloguing and the organisation of catalogue records, which has been widely tested in important projects both at local and at national level.
<b>Detailed description</b>	<p>ArtIn XML is a flexible multi-standard cataloguing platform, based on XML, whose main features are the independence from any standard guidelines of cataloguing and the ability to self-configure its data-entry interfaces according to the descriptive schema concerned.</p> <p>It is composed of two integrated modules:</p> <ul style="list-style-type: none"> <li>• ArtIn XML desktop: desktop version for the multi-standard cataloguing</li> <li>• ArtIn XML w/b: web based version for multi-standard cataloguing and consulting.</li> </ul> <p>Both modules are independent from the cataloguing standards they are managing. They have been designed so that they can accept an XML description of any possible cataloguing standard (according to the SIGEC standard), and to self-configure accordingly. Thanks to this solution, the system can easily manage custom or future versions of a cataloguing schema, without any direct customization on the relational archive or the user interface.</p> <p>Moreover, ArtIn XML is fully equipped, both in the desktop and in the web-based versions, with import/export features following ICCD (.trc) and XML formats, thus enabling both on-line and off-line cataloguing, in a central, shared, safe archive.</p> <p>ArtIn XML w/b is the web version of the ArtIn XML Desktop software. It is built using Java technology, with the support of GWT (Google Web Toolkit) and Ajax libraries. This approach allows to use the web interface without reloading the page at each insert/modify operation on the data, thus greatly increasing the speed of data entry. The XHTML interface conforms to the W3C and WCAG standards, as well as to the Italian laws (legge Stanca).</p> <p>ArtIn XML Desktop has been adopted by the Italian Ministry of Cultura Heritage in the ARTPAST</p>

project ([www.artpast.org](http://www.artpast.org)) where it has been used to digitally catalogue the archive of approximately 30 Superintendences. The project was about the cataloguing of about 2.000.000 of cataloguing items in different ICCD formats, which had been possible since ArtIn XML is able to deal with any ICCD format and any schema version, thanks to a self-configuring XML based module.

<b>Innovative aspects</b>	ArtIn XML, both desktop and web, are independent from the cataloguing standards they are managing. They have been designed so that they can accept an XML description of any possible cataloguing standard (according to the SIGEC standard), and to self-configure accordingly. Thanks to this solution, the system can easily manage custom or future versions of a cataloguing schema, without any direct customization on the relational archive or the user interface.
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems. ArtIn XML potential final users are all the people concerned with the cataloguing of cultural heritage: monuments and fine arts office; cataloguing and standardization bodies; cultural heritage, art trade and art appraisal organisations; museums and galleries; foundations; public and private collections.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy, research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

Technology Offer TO\_PL\_22224

[ POLAND ]

Magit Sp. z o.o.

www.magit.pl

<b>Sector</b>	Information technology, multimedia, internet, advertisement.
<b>Activities</b>	Information technology devices and software, advertisement services.
<b>Contact</b>	

<b>Title</b>	3D INTERACTIVE VISUALISATIONS OF MUSEUMS, BUILDINGS AND CITIES
<b>Abstract</b>	Magit, a Polish company, offers a wide range of IT solutions to be applied in marketing, education and information services. Its clients list features leading banks, national and international chain stores, public sector institutions and many others. The company offers 3D interactive visualisations that can be applied in promotion of museums, monuments, historical buildings and cities.
<b>Detailed description</b>	In order to fully appreciate the beauty of a historical building or paintings in a museum, one has to see them with one's own eyes. Virtual visualisation can, however, be an interesting complement, which at the same time encourages the viewer to personally visit the place being presented in the future. A virtual tour of a museum that makes it possible to see particular works of art being presented there is also an alternative for those who do not have the opportunity to visit a museum. Thanks to the technology of interactive visualisation, they can broaden their knowledge in the privacy of their own home. Children also find this form of culture and art presentation interesting. Another proposal is a virtual city. 3D technology makes it possible to go for a tour of the city or a chosen area. The user simultaneously receives information about where there are, in front of what monument they are standing and they can become acquainted with its history. This is not all - how about going back in time and seeing what the city used to look like 200 years ago?
<b>Innovative aspects</b>	Interactive visualisation.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Making available information about facilities without the necessity to visit them in person</li> <li>• Ability to present elements that are not visible "live", due to the conditions in which they find themselves (e.g. sunken ships, devices inaccessible because of a lack of space)</li> <li>• Making available written electronic information about the facility being presented</li> </ul>

<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems. Visualisations of buildings, museums, cities, department stores and real estate for sale.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Public and private sector, industry, services, research centres.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

Technology Offer TO\_PL\_22239

[ POLAND ]

Magit Sp. z o.o.

www.magit.pl

<b>Sector</b>	Information technology, multimedia, internet, advertisement.
<b>Activities</b>	Information technology devices and software, advertisement services.
<b>Contact</b>	

<b>Title</b>	THE MULTIMEDIA KIOSKS, INFORMATION POINTS FOR MUSEUMS, GALERIES, MONUMENTS, ETC.
<b>Abstract</b>	Magit, a Polish company, offers a wide range of IT solutions to be applied in marketing, education and information services. The company manufactures advanced info kiosks integrating newest computer and touch screen technology achievements. The kiosks may be used as an advertisement medium or an information point in museums, galleries, monuments, public institutions and other.
<b>Detailed description</b>	<p>The info kiosks arise in result of integration of newest computer and touch screen technology achievements. The touch screen technology plays a key role and it cooperates with specialised software used in info kiosk. The info kiosks are adapted to public usage - fulfil requirements in field of software and equipment safety. The software is prepared exactly for the customer needs and allows the intuitive interaction with random user.</p> <p>The info kiosks can be used as an advertisement medium or an information point in museums, galleries, monuments, public institutions and other. They can be used also for internet access and electronic communication. It is possible to configure additional equipment (connect point, the printer, card or barcode reader, camera and others) which allows achieving personalised functionality like ticket sale. The kiosks work properly outdoors as well as indoors and are prepared for the different and difficult climate and temperature conditions. The info kiosk is specially made to decrease customer service expenses and provide complex information services for customers.</p>
<b>Innovative aspects</b>	Integration of newest computer and touch screen technology achievements.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Safe</li> <li>• User friendly</li> <li>• Tailor-made</li> <li>• Possibility to configure additional equipment</li> <li>• Outdoor and indoor use</li> </ul>

	<ul style="list-style-type: none"><li>• 24 hours work</li></ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems. Advertisement medium or information point in museums, galleries, monuments, public institutions; facilitates wide range of services to the visitors and customers: information, translation, ticketing and other.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, services.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

## Technology Offer TO\_IT\_22341

[ ITALY ]

## META Srl

www.gruppometa.it

<b>Sector</b>	On-line and off-line multimedia communication.
<b>Activities</b>	Consultancy, system integration, development information and multimedia technologies for the valorisation of cultural heritage.
<b>Contact</b>	

<b>Title</b>	META3D: AN ENGINE FOR HIGH QUALITY 3D REAL-TIME RENDERING AND SIMULATION
<b>Abstract</b>	Meta3D is a complete, high performance platform for advanced 3D real-time rendering, simulation and rapid production graphics. It is a 3D rendering and simulation engine with high qualitative and performance standards, ease of use and versatility. It delivers high quality photo-realistic graphics with optimal performance from OpenGL 1.1 to the latest 3D hardware.
<b>Detailed description</b>	The Meta3D engine is feature-rich, supporting a great number of atmospheric and visual effects and animation techniques. Hardware optimal solutions are provided through vertex programs and software assembler fallbacks for non-programmable 3D hardware and a highly modular material system. The physics engine natively supports rigid and articulated bodies, cloth, interactive liquid surfaces, gasses and particle systems and operates on a modular framework that allows the introduction of any new element or behaviour into simulations. The rigid-body simulation system is not subject to the mathematical instabilities of traditional rigid-body simulation techniques, resulting in movements that always appear fluid and natural. Simulation accuracy can be traded for speed with fine grained control. Meta3D has a completely dynamic behaviour allows instant-result content creation and modification and unlimited dynamic and interchangeable content.
<b>Innovative aspects</b>	The main advantages of Meta3D are the high quality of the 3D scenes with minimal hardware requirements and use of resources and the possibility to emulate complex movements and atmospheric agents and to interact in an effective way with the objects in the scene. The Meta3D physics engine delivers complex physics with innovative approaches that give highly realistic results with unprecedented speed and stability. Meta3D is optimized for the web use using innovative optimisation methods that operate with entirely dynamic content, giving unified solutions that allow better accuracy, interactivity and efficiency. It compresses the 3D models preserving the quality of the visual results using advanced techniques and proprietary algorithms and formats working on the reduction of model complexity,



	the repetition of similar features, image compression techniques, the possibility of progressive, downloads, etc.
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Meta3D may be used in a lot of different contexts going from the reconstruction and 3D navigation and exploration (both automatic and user-guided) of sites, rooms and places, e.g. in the Cultural Heritage and architectural fields; the definition of virtual metaphors for the interactive fruition of information, e.g. for exploring complex databases or navigate among semantic query results; the simulation of complex mechanical systems; the interactive and advanced visualization of user manuals and technical documentation; the building of multi-room 3D-chat environments; the creation of 3D last generation games; etc.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Museums, multimedia and web development and commercialization of software products.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_22335

[ ITALY ]

## Metis Systems Srl

www.metis-group.com

<b>Sector</b>	High quality digital reproduction of large size originals and books.
<b>Activities</b>	Production of medium and large format scanners for reproduction of maps, books, drawings, parchments, papyrus, and any other ancient, precious and delicate document.
<b>Contact</b>	

<b>Title</b>	DIGITAL REPRODUCTION SYSTEMS FOR EXTREME HIGH QUALITY REPRODUCTION OF LARGE ORIGINALS AND BOOKS
<b>Abstract</b>	Metis Systems S.r.l., which founders come from an extended experience in satellite imaging, has a deep knowledge in high technology and digital imaging. Metis manufactures medium and large format scanners, which are designed to match the Cultural Heritage demands in terms of extreme high quality reproduction and original care of: maps, books, drawings, parchments, papyrus, and any other ancient, precious and delicate document.
<b>Detailed description</b>	All Metis equipment are the result of a perfect integration between the technology designed by Metis such as: high precision mechanic, an outstanding optical scheme, a very sophisticated electronics, an innovative lighting system "SynchroLight", special devices that guarantee the complete safety of the original during the scanning; and several, top quality, components such as: Professional Trilinear CCD sensors, Lamps IR un UV free, Professional Optics, etc. The key points of Metis's equipment success are the extreme high quality, the resolution and the geometrical precision of any reproduction. The resolution (Resolving Power) in the DRS system is very high and uniformly distributed over the entire scan area due to the perfect integration of all elements into the optical path (including professional Lens and CCD); an extremely accurate kinetics of the DRS system (including motor, electronic, high precision mechanics, rails, etc.) also plays a determining role. The advanced optical and mechanic design of any DRS system allow to achieve extremely high geometric accuracy over the full scan area. The zenithal point of view of the Optic, respect to the original, ensures proper and natural perspective. The DRS systems deliver, by far, the highest quality and the most accurate geometry in respect to any reproduction made by any other worldwide competitor system. All DRS systems integrate the Metis "SynchroLight" lighting system which, by delivering a very powerful and uniform lighting on the original, maximizes image quality even at the highest scan speed. The SynchroLight, that uses lamps IR and UV free, concentrates all the light power into a unique uniform light blade which runs over the originals (in synchronization with the CCD), so that the original is exposed to the light only for the few seconds which are required for the scan time. Furthermore the SinchroLight, thank to its designs, only diffuses a minimal

amount of light in the ambient. The structure of any DRS system has been designed to maximize the integration between the different elements in order to achieve a superior solidity, reliability and time duration. The high precision and robustness of the various components of the DRS structure allows in fact to reach and maintain, by the time, extremely high performances from an optical-mechanical point of view, which is essential for an intensive use of the system. In general the DRS manufacturing materials and components have been oversized in order to guarantee the best reliability, durability and also minimize the maintenance need. For the same reasons most of the components are constituted by high quality aluminum and steel. As a result of all the above matters, the DRS systems deliver, by far, the highest quality and the most accurate geometry in respect to any other reproduction made by using any of the worldwide competitor system.

The DRS product family includes:

- DRS 5070 for documents and books up to 50x70 cm size; it includes a book cradle for books up to a thickness up to 25 cm;
- DRS A1 Plus for documents and books up to 67x103 cm size; it includes a book cradle for books with a thickness up to 25 cm;
- DRS 2xA0 for documents and books up to 120x180 cm size; it includes a reproduction table for originals with a thickness up to 15 cm.

<b>Innovative aspects</b>	The most innovative aspect of these systems, that always deliver superb image quality, high geometric precision and guarantee stability of the performance over the time, is that, thanks to a very user friendly software interface, any system can be easily used by any operator, even the beginner ones; in the mine time, as the DRS software, also offers possibility of high level personalization, will match the expectation of the most demanding and professional users. Furthermore, thanks to an advanced and sophisticated conception, all these systems, guarantee the complete safety of any original, even the most precious and ancient manuscripts, and, in the mine time, also allow high productivity.
<b>Main advantages</b>	The real advantages of any Metis DRS system are: the incomparable quality; color fidelity; geometric precision. Of any reproduction over the time, together with the complete safety of any original and the high productivity. Once again the quality, which is today recognized as the best reproduction quality available on the market, by all the clients that have had the possibility to test it, is the result of the integration of all the various components and the advanced Metis technology, that are assembled in any DRS system.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Construction technology; Materials technology; Measurement methods. Cultural Heritage Institutes (Libraries, Historical Archives, Museums); Government (Geographical Institute, Cadastral Archives); Private (Foundation's archives and libraries). Photolab Digital Service Bureau.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Any partner involved in the market where we distribute our systems.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22129

[ ITALY ]

## P-Culture working group

www.pculture.it

<b>Sector</b>	Tourism.
<b>Activities</b>	Development of touristic paths.
<b>Contact</b>	

<b>Title</b>	ADMIRE: PERSONALIZED CULTURAL TOURISM SYSTEM ON MOBILE DEVICE
<b>Abstract</b>	An Italian SME is developing a personalized cultural tourism system able to provide cultural information and visit paths according to the users' preferences and interests. Technological and cultural partnerships aimed to develop the concerned system and to explore further research areas are sought.
<b>Detailed description</b>	<p>ADMIRE is a personalized cultural tourism system able to provide cultural information and visit paths according to the users' preferences and interests.</p> <p>It is composed by a client/server architecture, where the client side is implemented by pocket Pc or smartphone Windows mobile compatible with a GPS receiver. A main web server is used for the central information management.</p> <p>The users' cultural profile is used by the system to select time by time the best cultural site or commercial service in order to increase the users' satisfaction degree. In this way, the visit time available is optimized too.</p> <p>The main aim of ADMIRE is provide tourist itinerary suitable to the users' interests and preferences, involving and emphasizing all cultural and tourist items (well-known and unknown) of a territory.</p>
<b>Innovative aspects</b>	<p>The innovation side of ADMIRE is represented by a "personalised sub-system". It traces the users' cultural choices (historical and artistic features for each cultural site as well a detailed and in depth description of the cultural information required) and optimises the users' available visit time and satisfaction degree. This sub-system was built using user modelling techniques joined with relationship database and object oriented databases to store the users' cultural profile. Moreover, an algorithm based on genetics algorithms is used to identify the most suited cultural sites for the users, according to their specific cultural profile preferences.</p> <p>ADMIRE will be implemented in Mediterranean cities within the Phoenicians' route European cultural path, in order to demonstrate how the system can increase the cultural and economical</p>

assets of a cultural path.

Research areas to be enhanced: user modelling in order to personalize behaviours and contents; data mining; techniques for accurate GPS localization; context aware and cognitive actions; cultural management for a new ontology aimed to join cultural information and tourist information; user interaction and user interface within e-inclusion policies and users' suitable interact.

<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Public or private research organisations in field of cultural heritage or ICT innovative solution, academies, universities, ICT mobile or embedded industries.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

## Technology Offer TO\_IT\_21658

[ ITALY ]

## Radiolan Srl

www.radiolansrl.it

<b>Sector</b>	Electronic and telecommunication.
<b>Activities</b>	Development of advanced communications systems; supply of innovative telematics solutions based primarily on radio technologies.
<b>Contact</b>	

<b>Title</b>	LOW-COST DEVICE FOR WIRELESS TELEMTRY AND REMOTE CONTROL OF SYSTEMS
<b>Abstract</b>	A small Italian company located in Rome has developed a low-cost wireless transceiver featuring data packets "store and forward" for highly reliable "multi-hop" radio communication such as telemetry applications. The device is equipped with a free-license networking proprietary firmware, and it operates at 868MHz. The SME is looking for commercial agreement and application partners for further development of specific applications.
<b>Detailed description</b>	<p>A transceiver is a device that has both a transmitter and a receiver. It can be used as node in "multi-hop" radio communication networks. The use of the "multi-hop" technique allows creating a very flexible and adaptable wireless network without infrastructures such as antennas or repeaters. A small Italian company located in Rome has developed both the wireless hardware module and the free-license networking firmware.</p> <p>The wireless transceiver operates at 868MHz, and it is suitable for creating a radio communication network on either short or long ranges, either indoor or outdoor, walking around radio propagation obstacles and obstructions of any kind.</p> <p>The firmware allows managing the radio communication between other transceivers, and manages the data packet "store and forward" function.</p> <p>The device can be used in many ways: from telemetry to remote control of systems.</p> <p>A team of electronic engineers with many years experience in the ICT sector proposes this technology all ready for any demonstration of engineering models.</p>
<b>Innovative aspects</b>	<p>Reliable wireless transmission of data packets, using unlicensed frequency band (868 MHz available in Europe), able to walk around any kind of radio propagation obstacle and obstruction, is the most significant benefit gained.</p> <p>Proprietary (totally license-free) networking firmware truly provides "store and forwarding" of data packets through the most suitable path of transceiver modules, qualified as network nodes.</p>

	<p>Just a small technical effort is required for any specific application: temperature and humidity measurement data, collected over wide area indoor environments such as fine arts museums, are sent by wireless "data packets" to a personal computer performing as operation and monitoring centre as well as database.</p>
<b>Main advantages</b>	<p>The small-footprint [4 cm x 3 cm] printed circuit board is very cost-effective, as includes: microstrip integrated antenna, radio transceiver chip and microprocessor chip with its memory and firmware on-board.</p> <p>Power is supplied either by means USB port connecting to any kind of personal computer, or Lithium battery or power adapter (in the range 3.3-5 V DC).</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Patent(s) applied for.</p> <p>An Italian patent request has been already submitted and, depending on further development on going, an European patent may be considered.</p>
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Any kind interested in promoting joint business.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_PL\_22312

[ POLAND ]

## Smarttech Sp. z o.o.

www.smarttech.pl

<b>Sector</b>	Optical measurements.
<b>Activities</b>	Development of macro and micro measuring devices (hardware, software), machine vision systems; services in the field of measurement.
<b>Contact</b>	

<b>Title</b>	SCANBRIGHT – MOBILE SYSTEM FOR 3D MEASUREMENT
<b>Abstract</b>	ScanBright is a mobile integrated system for 3D measurement. The device enables full processing path from the model measurement to its copy generation on any CAD (Computer Aided Design) /CAM (Computer Aided Manufacturing) platform or computer graphics program. The system can be applied for rapid prototyping, modeling and documentation of works of art.
<b>Detailed description</b>	<p>ScanBright – mobile integrated 3D measurement system – allows not only measurement, but also advanced edition of measurement data without the necessity of any additional software or hardware. This is an optimum solution for customers looking for a device that will enable them a full processing path from the model measurement to its copy generation on any CAD (Computer Aided Design) /CAM (Computer Aided Manufacturing) platform or in the computer graphics program.</p> <p>That system consists of three modules, each of which is configured according to the client's individual request:</p> <ul style="list-style-type: none"> <li>• 3D Scanner: use for non-contact measurement of three-dimensional objects' absolute co-ordinates (x,y,z) and for obtaining information on their texture (RGB – Red, Green and Blue);</li> <li>• Mesh3D software controlling the work of 3D Scanner, which enables further data processing and export to other programs;</li> <li>• Workstation enabling fully independent measurements and mobility of the system (portable version available).</li> </ul> <p>The system is sold in two versions:</p> <ul style="list-style-type: none"> <li>• Standard: for computer graphics, industrial design and visualisation;</li> <li>• Professional: for engineering and archival application.</li> </ul>



<b>Innovative aspects</b>	The system offers a 3D measurement with full conversion of results for commercial purposes: CAD/CAM/rapid prototyping, computer graphics and Internet.
<b>Main advantages</b>	<p>Special features:</p> <ul style="list-style-type: none"> <li>• Simple set-up</li> <li>• Fully automated cloud of points merging process to get true three-dimensional (360°) object representation</li> <li>• Combining information about shape and texture (RGB – Red, Green and Blue) of a 3D object</li> <li>• Fully automated cloud of points (x, y, z) conversion into formats: IGES (Initial Graphics Exchange Specification), DXF (Autodesk Drawing eXchange), VRML (Virtual Reality Modelling Language)</li> <li>• Rapid field object measurement (to 5 million points in 10 sec.)</li> <li>• Work reliability</li> <li>• Special construction solutions absorbing the damaging effect of shocks</li> <li>• Integrated emergency power supply</li> <li>• Hardware mobility - single maintenance</li> <li>• Integrated software for data edition</li> <li>• Cost-effective complex hardware/software solution</li> <li>• Exports formats TXT, DXF, IGES, STL (Standard Template Library), VRML + texture</li> <li>• Possibility of changing the device's settings after purchase.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems; Measurement methods. The system can be applied for rapid prototyping, modeling and documentation of works of art, monuments, craft and contemporary art.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, research.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

## Technology Offer TO\_IT\_21700

[ ITALY ]

## Tecnolab Srl

www.tecnolabsrl.it

<b>Sector</b>	Information technology and consultancy for mobile communication and bank software.
<b>Activities</b>	Development of innovative applications and products for industry and commercial companies.
<b>Contact</b>	

<b>Title</b>	HANDHELD INFORMATIONAL PLATFORM FOR MUSEUMS
<b>Abstract</b>	A small Italian company has developed a pocket PC multimedia software tool that can enrich the experience of visiting museums and art exhibitions. The company is searching for partners working in this area in order to provide technical consultancy and training, and cooperate on integration with informational contents.
<b>Detailed description</b>	Using radio frequency technology (RFID) or infrared technology the customer can identify statues and paintings uniquely and have a multimedia description and a customised experience. The multimedia contents can be more than one for each art piece exposed, so the customer interacting with these can choose his favourite, and have his own path in the museum. Also contents can be delivered using 4 different media: video, audio, picture, static or sliding text. The final user can look at details using the zoom function and search for related information on the artist, such as anecdotes or special contents.
<b>Innovative aspects</b>	The most important features are: <ul style="list-style-type: none"> <li>• multilanguage support</li> <li>• the software logs information about its usage for statistical analysis</li> <li>• it provides an easy and quick inventory for assets</li> <li>• it doesn't requires WiFi or other always-on network connections.</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• The software runs on every pocket PC device.</li> <li>• It can be quickly upgraded using Secure Digital (SD) cards</li> <li>• The software brings together its ease of use with the capability of supplying the final user with large quantities of multimedia data</li> </ul>
<b>Current state of development</b>	

<b>Intellectual Property Rights</b>	Patent(s) applied for but not yet granted.
<b>Application domains</b>	Information processing, information systems. Museums and art exhibitions.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Museums, art exhibitions organisers, multimedia content creators.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Technology Offer TO\_IT\_22429

[ ITALY ]

## Togunà Interactive Srl

www.i-musee.info

<b>Sector</b>	Information and Communication Technologies.
<b>Activities</b>	Design and manufacturing of video guide systems for museums and art events.
<b>Contact</b>	

<b>Title</b>	I-MUSEE - INTERACTIVE MUSEUM
<b>Abstract</b>	<p>"i-musee - Interactive Museum" is the first product/service of the startup company Togunà Interactive S.r.l., founded in December 2007 by five young professionals with complementary skills living in Como.</p> <p>i-musee is an innovative videoguide system for museums and art exhibitions, deployable in both outdoor and indoor environments. It's aimed at replacing standard audioguide systems, while retaining the same flexibility and ease of use for end users.</p>
<b>Detailed description</b>	<p>By exploiting the power of the latest mobile devices with location aware capabilities, as well as the expertise of our staff in producing quality multimedia contents, our company is able to offer a turn-key service to cultural and natural heritage sites willing to innovate their communication methods with visitors.</p> <p>The target users are both curators and visitors of cultural and natural heritage sites.</p> <p>Market analysis show a constant increase by cultural heritage site managers of the need to provide visitors with an enriched and involving user experience through the latest ICT technologies.</p> <p>At the same time the demand by visitors for new and effective learning tools is increasing as long as their everyday use of multimedia-capable mobile devices, especially among the young and middle aged people.</p> <p>By deploying the i-musee system at their sites, curators and educators can fully satisfy these needs and use our platform in order to provide visitors with a tool able to deliver the exhibition-related cultural messages in an innovative and effective way.</p>
<b>Innovative aspects</b>	<p>The i-musee systems is a combination of the latest PDA mobile devices, Rfid technology (used for automatic selection of the exhibits and visitor localization), as well as a flexible software architecture proving the end user with a virtual guide able to guide him along the exhibition areas.</p> <p>The software design went through numerous iterations and usability tests in order to produce a</p>

graphical user interface suitable to any visitor typology, especially people without any prior experience with mobile devices.

The software architecture can be expanded and integrated with numerous additional services, both offline and online, such as pre-visit or post-visit selection of the visitor's favorite exhibits, educational mini-games and links to promotions of items available in the local bookshop.

A number of audioguide producers and academic researchers already built similar videoguide prototypes and tested them in cultural heritage sites. Many of them failed in obtaining a positive feedback from visitors due to their approach to the design of the guide, either making it a browser-able archive or just by adding multimedia elements on top of an audioguide-styled content.

By designing the i-musee system we examined and overcome these limitations by adopting an innovative game-like approach for the user interface while balancing the educational requirements during content production.

#### Main advantages

Users can benefit from an enriched experience along their visit to a cultural heritage site by listening to and watching quality audio-visual content produced by our internal staff or by an external partner in collaboration with curators and educators of the site.

Users can choose the best options available on the mobile device that suit their needs. A number of accessibility options has been implemented for deaf and hear-impaired people, sight-impaired and left-handers.

If provided by content producers, users can choose from different kind of tours (themed-tours, best of, or age-specific tours) according to their education level and time available for visiting the site, all from the same mobile device they get at the beginning of the visit from the site's staff.

#### Current state of development

#### Intellectual Property Rights

Copyright protected.

#### Application domains

Information processing, information systems.

#### Collaboration details

#### Type of partner sought

Cultural heritage sites willing to deploy an innovative solution for visitors, partners willing to collaborate in expanding our technological platform.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC Lombardia

## Technology Offer TO\_IT\_22122

[ ITALY ]

## Università degli studi di Milano

www.unimi.it

<b>Sector</b>	Research and higher education.
<b>Activities</b>	Research and development, educational activities in sciences and humanities.
<b>Contact</b>	

<b>Title</b>	NEW ACCESSIBILITY TOWARDS CULTURAL HERITAGE
<b>Abstract</b>	An innovative tool, called T-system, was developed by an integrated multidisciplinary Italian team of archaeologists and computer scientists offering a high level accessibility to the cultural heritage both for education and dissemination. Through T-system different and heterogeneous archives can be integrated without altering their internal structure. The team is looking for partners involved in culture heritage (museums, collections, public and private companies) and computer fields in order to test and disseminate the applications of the system.
<b>Detailed description</b>	<p>The system allows to bring the single document from its original environment to the modern user's environment, filling the gap between the document and its interpretation.</p> <p>The concept idea of T-system moves from the consideration that the study of cultural heritage is not a static subject: in fact researches evolve, through discovery of new documents and development of new theses by scholars. Therefore cultural heritage cannot be perceived anymore as a complex of single objects, storable in museums or collections, without links with the historical and social context. Cultural heritage value widens in space and time: it is under this point of view that it must be disseminated to the great public.</p> <p>Up to now, the interpretation of a document or a collection needed different heuristic passages usually carried out by scholars. Thanks to the T-system methodology, such an opportunity of knowledge dissemination is extended to the great public. The process of research is thus clearly defined, so that the public can assess and interpret a document under different points of view.</p> <p>At the root of this interpretation process a deep knowledge of all cultural aspects is needed. This semantic net relies on the bulk of documents and topics related to every specific cultural environment. These are put in connection through different interpretation tools developed by scholars: in this way users are allowed to disclose information otherwise difficult to assess. Two communication media typologies have been defined: the T-system ontology and narrations.</p> <p>The T-system ontology promotes a common knowledge base which can be used by both</p>

archaeologists and computer scientists, in order to provide a unique access point to heterogeneous data-sources.

Narrations are tools to describe specific aspects of the cultural domain, in order to make information accessible. Items, such as finding and monuments, related to a narration are dynamically connected through the T-system ontology. A narration plays the role of communication medium at different levels, both among archaeologists and towards the large public. Since narrations are retrieved from a scientific background produced by the examination of different scientific interpretations, the large public is able to assess and verify the disseminated contents.

T-system is mostly employed by the great public: through the net of narrations realized by experts, the user can choose his own cultural path, and therefore can approach a great number of objects or monuments scattered in different places of the world and now recorded into different archives.

#### Innovative aspects

Archaeologists and computer science experts have developed an innovative mind orientation, within a proper cultural perspective. The T-system is a conceptual architecture, context oriented, open and participatory where different actors cooperate to create and disseminate knowledge. A team of cultural operators was created as an environment in which every single background was preserved in order to exploit any tacit knowledge as working seed for creativity in cultural heritage handling.

This attitude allows to deal with cultural heritage, dynamically evolving over the time through the discovery of new documents and the development of new theories.

#### Main advantages

T-system offers a set of services for different final users in the field of cultural heritage valorisation, involving dissemination and acquisition of knowledge.

For museums and collections, the following services will be offered in order to facilitate the valorisation of specific cultural compounds:

- data base development, archive integration in order to handle wider information
- collection integration within the semantic net through a narration system
- personalised virtual wings development for data presentation
- new multidisciplinary extraction professional figures creation.

Adopting the system, organisations can insert their own cultural heritage in a semantic net (without modifying their own databases or allowing their access to all levels of users) and make it available for both experts and great public.

#### Current state of development

#### Intellectual Property Rights

Information processing, information systems.

#### Application domains

#### Collaboration details

#### Type of partner sought

Software house, museums, cultural institutions and organisations.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC Lombardia

## Technology Offer TO\_IT\_22220

[ ITALY ]

## Università degli studi di Milano, Dipartimento di Informatica e Comunicazione (DICO)

<http://dico.unimi.it>

<b>Sector</b>	Sectors: research and higher education on computer science and information and communication technologies.
<b>Activities</b>	Activities: Research and development, educational activities in theoretical foundations and practical techniques for implementation of computer systems.
<b>Contact</b>	

<b>Title</b>	MUSIC PROCESSING TECHNOLOGY
<b>Abstract</b>	An Italian university has developed a Music Processing Technology (MPT) consisting of a set of functional units devoted to the analysis/processing/synthesis of music information, and to make music contents interactive. MPT allows the developer/user to work with music information within a multimedia environment in which all the music representation forms are integrated, and semiautomatically synchronous (audio, video, score, lyrics). The offer is looking for partners to develop the technology and find possible applications.
<b>Detailed description</b>	<p>Music processing technology's main applications are:</p> <ul style="list-style-type: none"> <li>• multimedia automatic indexing and retrieval for both audio and music contents</li> <li>• audio recordings and multimedia tracks browsing by means of music contents (themes, notes, rhythms, bars, instruments, etc.)</li> <li>• comparisons between audio and score data</li> <li>• video tracking by audio contents and vice-versa</li> <li>• singers and performers automatic recognition and simulation</li> <li>• automatic music copyright management tools</li> <li>• singing and performing tracking within music education systems.</li> </ul>
<b>Innovative aspects</b>	<p>MPT allows to move easily within music information by means of cross score, audio, video, lyrics relationships.</p> <p>This result has been achieved by enriching any commercially available Multimedia Player with the following additional features:</p> <ul style="list-style-type: none"> <li>• users can click on any point of the score and automatically the Multimedia Player points to the corresponding sound time slice, and video frame</li> <li>• users can select starting and ending words within lyrics and automatically the Multimedia Player plays the corresponding audio and video</li> </ul>



- by entering the music contents' mode, users can browse the score by music "objects" i.e. score themes, by means of special forward and backward commands; pointed music object gets red coloured note heads; then play the currently pointed music object
  - users have all these music sound formats available: PCM .wav, compressed MP3, MIDI; other formats could be easily considered
  - the entire cross score/audio/video/lyrics relationships are obtained automatically by an 'ad hoc' computer processing based on MPT modules.
- MPT can be suitably implemented adopting IEEE MX - the new standard for the multilayer coding of music information (2008) – as the basic coding format.

<b>Main advantages</b>	The relevant advantage of MPT consists of the ease of moving within music information by means of cross score/audio/video/lyrics relationships.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Ministry for cultural heritage, musical institutions, theatres, musical archives.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Lombardia

## Technology Offer TO\_IT\_21649

[ ITALY ]

## Università degli studi di Palermo, Dipartimento di Ingegneria Informatica (DINFO)

www.csai.unipa.it

<b>Sector</b>	Research and higher education on automation and robotics.
<b>Activities</b>	Research on mobile robotics cultural heritage concerns mainly the development of a cognitive architecture for robot vision and action.
<b>Contact</b>	

<b>Title</b>	ROBOT ACTING AS A GUIDE IN CULTURAL AREAS
<b>Abstract</b>	A laboratory for robotics of an Italian university has developed software architecture for autonomous robots able to guide people in public sites like museums and cultural areas. The robot is mobile and autonomous; it recognises the environments in which it is by its own sensors. It can interact with tourists in several ways. The robot moves indoors. The research group is looking for technical collaboration to develop missing software items to solve problems related to the robot outdoor movements.
<b>Detailed description</b>	<p>The proposed technology is the result of research within the Cicerobot project that concerns both the theory and the development of a robot provided with automated reasoning and that is able to perceive and act.</p> <p>At present the robot is able to interact with users via a touchscreen in order to move in its workspace and to visit particular museum sites. The present system, for the development phase, required about a year work for three persons and it is based on researches performed in the Robotics Laboratory in the last 10 years. Such research, developed in collaboration with psychologists, philosophers, knowledge scientists, and engineers of information technologies too, has produced the development of a software architecture in which the robot designs a kind of internal pattern of the surrounding environment. In such an internal pattern the robot can prefigure itself, it can imagine its interactions with the external environment and it can consequently act.</p> <p>The robot is provided with a knowledge basis related to particular museum information at different detail levels. Consequently it is an interactive guide that will let the access to sites by placing historical and architectonic information at user disposal and it can be also remotely controlled through Internet. Both for tele-presence operation and as custom guide for in site visitors the robot needs a high degree of operation autonomy as it operates in a dynamic and unstructured environment. The robot is also equipped with a safe and reliable navigation system, a location system and security systems to avoid collisions with obstacles and person.</p>

For this purpose the robot is equipped with suitable sensors allowing to acquire information about the surrounding environment and to plan needed actions to satisfy user requests.

The research group asks for technical collaboration by either firms or another university to develop new software functions needed to make the robot able to move in an open environment.

Then the collaboration could include also the development of new functions in order to use the robot in sea environments.

<b>Innovative aspects</b>	<p>Innovative features distinguishing the robot:</p> <ul style="list-style-type: none"> <li>• automatic reasoning that makes the robot able to both perceive and act</li> <li>• high-level knowledge functions allowing reasoning about targets, actions, knowledge perception and acquisition, knowledge states of other agents, time, co-ordinate execution, learning and 3-D vision</li> <li>• integration of reasoning, perception, learning and action.</li> </ul>
<b>Main advantages</b>	<p>The robot is able to guide persons in public sites like museums and cultural areas. The robot, due to its mobility and autonomy is able to recognise the environment in which it is by its own sensors (cameras, laser, sonar).</p> <p>The robot is able to interact with tourists in different ways.</p>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry or research institutes, universities.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC MEDIA

## Technology Offer TO\_IT\_22340

[ ITALY ]

## Università degli studi di Siena, Centro di GeoTecnologie (CGT)

www.geotechnology.eu.

<b>Sector</b>	Research and higher education on geophysics, geological and environmental sciences.
<b>Activities</b>	Remote sensing, photogrammetry, GIS, WebGIS, 3D modelling, geological technologies applied to cultural heritage.
<b>Contact</b>	

<b>Title</b>	GEOTECHNOLOGIES FOR CULTURAL HERITAGE: REMOTE SENSING, DIGITAL PHOTOGRAMMETRY, GIS, WEBGIS, 3D MODELLING, LASER SCANNING, GEOPHYSICS
<b>Abstract</b>	The Centre of Geotechnologies (CGT) is involved in applied geotechnologies for the study of the cultural heritage. Our main aims are: archaeological data management, reconstruction of the landscape, 3D modelling for the study of monuments and artefacts, protection of the cultural heritage, dissemination of geographical and archaeological data by means of multimedia and web technologies.
<b>Detailed description</b>	<p>The Centre for Geotechnologies (CGT) is an academic institute of the university of Siena (Italy). The CGT contributes, with Italian and international private and public institutions operating in the field of earth sciences and cultural heritage, concerns:</p> <ul style="list-style-type: none"> <li>• survey, analysis and monitoring of landscape and excavation sites, mainly through remote sensing and digital photogrammetric techniques</li> <li>• data management by means of GIS techniques</li> <li>• goenvironmental data distribution by means of web technologies</li> <li>• 3D modelling and laser scanning reconstruction.</li> </ul>
<b>Innovative aspects</b>	<p>The CGT research activities meet the humanities needs of new technologies applications for the study of cultural heritage. These techniques represent a real innovation absolutely necessary for the knowledge development. Besides, these techniques are a useful tool for the most quick and complete documentation (during the fieldwork, emergency excavations, etc.).</p> <ul style="list-style-type: none"> <li>• Digital photogrammetry: fundamental tool for the acquisition of metric and thematic data of high detail. It represents a procedure of survey, prospecting and documenting the monuments in a not invasive way, to be further utilized for the individuation and the measurement of the accurate morphological characteristics of the selected objects.</li> <li>• Laser scanning and 3D modelling: represent the most faithful and exhaustive documentation, manageable with analysis tools and database systems, at the same time the further processing</li> </ul>

provides the possibility for virtual reality modelling for public presentation, virtual reconstructions and communication of Cultural heritage.

- GIS and webGIS: the GIS allows to organize and to manage archaeological data in geographic databases. The data, organized and classified, allow spatial analysis, information increasing and predictive model creation. The organized and thematized data can be also shared with other scholars world wide by means of web technologies.
- Remote sensing: the high spatial resolution and multispectral information of satellite scenes allows to individualize archaeological signs, sometime hidden to direct observation.
- GPS, survey and archaeological map with accurate georeferenced data.
- Geophysics: geoelectric investigation with the OhmMapper and the georesistivimeter allows not invasive analysis in order to individuate the presence of a supposed site, and its plane.

Most of these application (photointerpretation, geophysics) can be useful in the archaeological risk prevention.

### Main advantages

The availability and the capability to integrate all these methodologies consent to produce complexes works and to achieve complete results. Digital photogrammetry, remote sensing and geophysics, laser scanning represent not-invasive techniques, that allow to execute preliminary investigation at relative low cost and detailed measures. They represent effective tools in surveying, prospecting and documenting the territory, in its urban, environmental and architectural components.

- Digital photogrammetry is a useful instrument in the field of the archaeology, both during the excavation that in the 3D model reconstruction. An excavation surface or section can be quickly relieved and documented. The CGT owns an aerostatic balloon in order to relieve the excavation surface.
- 3D modelling: the computer graphics offer to cultural heritage a powerful instrument for the reconstruction of the geometry and the integration of the lost evidences, in the way to study the monuments. At the same time, is a good way for the presentation and the communication of cultural heritage towards the non-scientific world.
- GIS and WebGIS: different layers containing the information allow to collect data and to conduct analysis in order to reconstruct the landscape, in diacronic and synchronic way and to elaborate predictive models.
- The union between GIS and web technologies represents one of the ultimate steps for the creation of a common dialogue between different branches of learning, giving the chance for sharing the research results among a large number of scientists.
- Geophysics: quickly and not invasive techniques revealing hidden constructions for preliminary and extensive survey

### Current state of development

### Intellectual Property Rights

Secret know-how.

### Application domains

Information processing, information systems; Measurement methods.

### Collaboration details

### Type of partner sought

University, research organisation and public institutes for cooperation in humanities domain.

### Tasks to be performed by the partner sought

### IRC Partner

IRC RECITAL

Technology Offer TO\_IT\_22359

[ ITALY ]

Università degli studi di Siena, Dipartimento Ingegneria dell'Informazione

www.spin.unisi.it

<b>Sector</b>	Information engineering.
<b>Activities</b>	Study, development and validation of wireless sensor network, image processing, assistive technologies, intelligent environments.
<b>Contact</b>	

<b>Title</b>	WIRELESS SENSOR NETWORK FOR REAL-TIME MONITORING OF CULTURAL HERITAGE ASSETS
<b>Abstract</b>	Wireless sensor networks (WSN) and distributed computing applied to the evaluation of surface and subsurface phenomena for cultural heritage real-time assets monitoring.
<b>Detailed description</b>	The main idea is to exploit the possibilities offered by WSN when applied to real-time monitoring of cultural heritage assets. In particular we front the problems of distributed computing for developing networks capable of automatically detecting anomalous events and rise alarms. The problems related to power consumption optimization along with node synchronization are covered along with multimodal sensor exploitation for robust and reliable event detection. The Sensor Network will interact with a real time 3D representation system capable of mapping the detected parameters in real time, while granting the full access to the multimedia documentation and to metric measurements.
<b>Innovative aspects</b>	Development of sensor packs and suitable processing algorithms for the real-time analysis of distributed parameters through the exploitation of distributed computational capabilities of WSNs. Development of 3D virtual assets capable of "living" the life the cultural asset is living (accumulation of real time data, interactive visualization of real-time data, new navigation and presentation metaphors).
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Information processing, information systems; Measurement methods.

Collaboration details

Type of partner sought

Tasks to be performed  
by the partner sought

IRC Partner

IRC RECITAL

## Technology Offer TO\_IT\_22350

[ ITALY ]

## Università degli studi di Trieste, Geonetlab

[www2.units.it/8telegeom](http://www2.units.it/8telegeom)

<b>Sector</b>	Research and higher education on information and communication technologies, satellite positioning, geomatics.
<b>Activities</b>	Information and communication technologies applied to study landscape and archaeological sites.
<b>Contact</b>	

<b>Title</b>	ROAD AND ENVIRONMENT SURVEY BY GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) STATIC AND MOBILE MAPPING SYSTEM. PERSONAL DIGITAL ASSISTANT (PDA) TOURIST GUIDE FOR ARCHAEOLOGICAL AND CULTURAL HERITAGE
<b>Abstract</b>	A laboratory of an Italian university offers a mobile mapping system integrating several cultural tourism guides with a road survey performed with GEONETLAB mobile mapping system. The system offered is also able to measure air pollution due to traffic, thanks to the integration of GALILEO satellite navigation system which offers applications in civil and environmental engineering. The system can be applied also for workers safety in construction yards.
<b>Detailed description</b>	<p>A mobile mapping system is a van equipped by satellite and inertial positioning devices, which are integrated in order to take geo-referenced and geo-oriented digital photos in any environmental condition, tunnel included; pollution sensors can be added, as well as laser scanners. Thanks to these devices, thematic itineraries can be mapped and displayed on PDA, also with cultural and environmental heritages, as Point of Interested (PoI) and their vocal or written description. The same can be done inside the PoI, as in archaeological sites. The road survey allows also to alert the driver about the road accessibility (width, slope, pavement) so to make the trip comfortable and safe. Moreover GPRS links allows both to be tracked for security if required, and to connect to digital libraries if more news are desired.</p> <p>The same methodology has been applied for monitoring the positioning of workers and machines in a construction yard, so to alert dangerous situations.</p> <p>Industrial partner working in the field of tourism, security and safety, infrastructure and construction is sought for technical co-operation, commercial agreement with technical assistance to promote the proposed mobile mapping system.</p>
<b>Innovative aspects</b>	Several ICT tools have been just joined in an innovative way for new applications.



<b>Main advantages</b>	The main advantage is to join technical and human sciences in mass market products as well as in security and safety of people.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Construction technology; Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRENE

Technology Offer TO\_IT\_22211

[ ITALY ]

Università della Calabria, Dipartimento di Meccanica

www.meccanica.unical.it

<b>Sector</b>	Research and higher education on mechanical engineering.
<b>Activities</b>	Research, educational activities and training in augmented reality and virtual reality.
<b>Contact</b>	

<b>Title</b>	LOW-COST SYSTEM FOR THE STEREOSCOPIC VISUALIZATION OF 3D DIGITAL MODEL
<b>Abstract</b>	The department of mechanical engineering of the university of Calabria, skilled in the fields of the augmented reality and virtual reality technologies, has developed a low-cost device for stereoscopic visualization of 3D digital models.
<b>Detailed description</b>	<p>The device allows users to find themselves in a simulated environment in which they can perceive the depth of a scene, giving at the same time the possibility of interacting with the virtual objects in a very natural way.</p> <p>The digital models are reconstructed with a very high degree of precision (80,1 mm), thanks to advanced scanning technologies (3D laser and structured light scanners, high definition cameras), also the surface appearance is very realistic without any trace of aliasing or other visual faults. External and internal textures are extremely faithful to the original object, and the high level of detail allows the user to not perceive any aliasing phenomenon even with the highest zoom factor. The device was designed for the cultural heritage sector, but it can be used in many fields like design, medicine, training, marketing etc. In the cultural heritage field the device allows users to interact with the archaeological finds in a simulated environment, in which they can perceive the depth of the scene observing each find from every point of view. This way to observe and study the finds overcomes the limits usually experienced in the museums, where the objects are protected by glass structures and visible only from few points of view. Furthermore, the researchers can develop, in a very short time, custom software applications that can satisfy the customers' needs. Taking cultural heritage as an example, the researchers could create a replica of the museum halls in order to simulate a realistic visit of the museum, or develop applications in which the artefacts are presented contextually to the site of origin.</p>
<b>Innovative aspects</b>	The device may be sold with custom ready-to-use VR applications where the user can interact with the virtual world in a very natural way. All the physical property of the environment (e.g.: weight,

friction, cinematic joints, etc.) can be simulated. The visual quality is improved by many innovative effects like dynamic shadows and reflections, smoke, and all the most recent CG techniques.

**Main advantages**

Compared to the systems already available on the market, the device has a very competitive price and a higher quality of the visualization. The design is attractive, and colour, look and dimensions are fully customizable by the customer. This reveals to be useful in order to make the device perfectly suited to the place (museum, expo, hall, etc.) that hosts it.

**Current state of development**

**Intellectual Property Rights**

Secret know-how.

**Application domains**

The custom solutions for virtual augmented reality can be employed in many market sectors like: cultural heritage, automotive and industry in general, education, entertainment, etc.

**Collaboration details**

**Type of partner sought**

Organisation involved in the cultural heritage valorisation.

**Tasks to be performed by the partner sought**

**IRC Partner**

IRC MEDIA

## Technology Offer TO\_IT\_22412

[ ITALY ]

## Virtual Italian Parks Srl

www.virtualitalianparks.com

<b>Sector</b>	Information and communication technologies, web 3D, immersive internet and virtual reality.
<b>Activities</b>	Developing services for business customers.
<b>Contact</b>	

<b>Title</b>	VIRTUAL REALITY PLATFORM AND 3D GRAPHICAL ENGINE
<b>Abstract</b>	<p>Virtual Italian Parks is the first company in Italy fully devoted to virtual reality services. We did lot of services in Second Life for Big Brands, such as Accenture, BNL BNP Paribas, Costa Crociere, Ferrarelle, IDC, Fondazione Valore Italia, Nokia, Renault Italia, Sony.</p> <p>We did develop a new virtual reality (VR) platform, named Moondus, that allow customers to build their virtual worlds.</p>
<b>Detailed description</b>	<p>Moondus, the VR platform we are developing, allow customers to build their virtual worlds. We did develop a 3D engine with effects similar to the better known unreal engine and cry engine. We are able to build virtual worlds in Moondus and to allow avatars to access it from a LAN, VPN or internet. We are able to uploaad the content from already existing 3D tools such as Blender, Sketch-up, 3D Studio, Maya, AutoCad. The functions of the virtual world are similar to the functions of Second Life. The difference is that we are adding more security and the look and feel is like a game of last generation. We are currently developing a museum application. We are also one of partners of the European project "Virtual Life".</p>
<b>Innovative aspects</b>	<p>Our field of activity is one of the most advanced technology frontier in this time window. Moondus is innovating in the way people can interact with an environment, an application together with other people. We are innovating:</p> <ul style="list-style-type: none"> <li>• the graphical engine</li> <li>• the social networks</li> <li>• the integration with the 3D tools used by the architects and the designers</li> <li>• the level of security and reciprocal trust in the virtual worlds</li> <li>• the cost/benefit of large environments.</li> </ul>

<b>Main advantages</b>	We have a broad skill in this area and we are ready to develop catalogues, museums, architectural reconstructions, cultural events, educational applications. Main advantages are the quality of the product and the services and the cost/benefit versus competitors.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems. Cultural heritage, museums, archaeology reconstructions, education and training, advertising. Using Moondus, the users have a complete new immersive experience.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industrial, media, financial.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Technology Offer TO\_ES\_22096

[ SPAIN ]

**Virtualware**

www.

**Sector****Activities****Contact****Title**

RECREATION OF HERITAGE SITES USING VIRTUAL REALITY TECHNOLOGY

**Abstract**

Heritage is a very important part of every country. Virtual Reality enables heritage sites to be recreated extremely accurately, so that the recreations can be published in various media. The original sites are often inaccessible to the public, or may even no longer exist. This technology can be used to develop virtual reproductions of caves, natural environment, old towns, monuments, sculptures and archaeological elements.

**Detailed description**

The country, region or town heritage consists of the site that occupies its natural environment, its flora, its fauna and all the creations and expressions of the people who inhabited.

Heritage represents an important value of culture as well as an essential element for fields such as tourism, regional development or education.

From the expertise and professionalism of Virtualware in Virtual Reality technologies, several ways to communicate such heritage are proposed in the least intrusive, more amusing and more advanced way.

The process used for virtual reproduction of a cave is based in the following main steps:

- Data collection in the area through a 3D laser scanning and photogrammetry;
- Data processing in cabinet;
- Virtual model generation;
- Application development;
- Design, installation and setting up of the Virtual Reality system.

This technology combined with advanced viewing devices can make visitors feel as if they were actually inside that prehistoric cave which is no longer open to the public, walking through that Roman settlement whose ruins are all that now remain standing or strolling through the old quarter of the city just as it was centuries ago.

<b>Innovative aspects</b>	<p>The main properties of this solution are as follows:</p> <ul style="list-style-type: none"> <li>• Adaptable everywhere: being a digital solution it may presented in different formats according to the available room. From PCs spread in a lounge to a stereoscopic large screen system;</li> <li>• Scalable: Virtual Reality technology allows a whole scalability in every sense;</li> <li>• Reliable, accurate: Very accurate advanced methods of picking up information are used to develop the environment;</li> <li>• Interaction: It allows the user to make a tour over the cave observing the different details just scrolling over the screen;</li> <li>• Simple servicing: Only computers devices or projectors do need servicing;</li> <li>• Customized: It allows the incorporation of additional multimedia information in the environment according to the specific requirements of every project;</li> <li>• Immersion: The three-dimensionality generated in real-time makes the users like they were actually inside.</li> </ul>
<b>Main advantages</b>	<p>The main advantages of the virtual replica are:</p> <ul style="list-style-type: none"> <li>• Not intrusive methodology for the preservation of the natural heritage;</li> <li>• A reliable data collecting process by a laser scanning which obtain an extremely similarity with the real cave;</li> <li>• Multimedia content to explain more detailed the main characteristics, the cave painting, etc ...;</li> <li>• Portable method to communicate by multiple places of widely diffusion;</li> <li>• Advanced systems of VR at interpretation centres, exhibitions and events: Giant Screens, HMDs, etc.;</li> <li>• Interactive CDROMs;</li> <li>• WEB sites;</li> <li>• Accessible for more users;</li> <li>• Innovative entertaining method to promote the heritage of a country.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	<p>Others (registered design, plant variety right, etc)</p> <p>This technology can contribute to promote heritage sites. Due to the progressing deterioration of the Santimamiñe Cave and its paintings, its virtual reproduction at its maxim quality was proposed. Virtualware has recently developed the first virtual cave ever seen, which is now available at the interpretation centre of the cave's museum. The users can enjoy the final result based on a huge stereoscopic screen.</p> <p>And small sample will be available very soon in our website (<a href="http://www.virtualware.es">www.virtualware.es</a>).</p>
<b>Application domains</b>	<p>Virtual Reality applications can be used as promotion and diffusion tool to make known heritage sites to different audience and even as an innovative element for tourist campaigns.</p>
<b>Collaboration details</b>	
<b>Type of partner sought</b>	<p>Private companies, public administrations.</p>
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	<p>BASQUE IRC</p>

Know-how/expertise KHE\_IT\_22554

[ ITALY ]

**CERERE, Centro regionale per il recupero dei centri storici calabresi**[www.cererecalabria.it](http://www.cererecalabria.it)

<b>Sector</b>	Conservation of cultural heritage.
<b>Activities</b>	Valorisation of architectural heritage and environmental heritage; promotion and development of project dealt with use of cultural heritage; implementation of training courses.
<b>Contact</b>	

<b>Title</b>	SiDi, SYSTEM OF DIAGNOSIS AND INTERVENTION FOR THE RESTORATION OF ARCHITECTONIC HERITAGE
<b>Abstract</b>	CERERE is a consortium constituted by university of study "Mediterranean" of Reggio Calabria and Calabria Region. The SiDi project, system of diagnosis and intervention for the restoration of architectonic heritage, represents a technical and methodology contribution to the field of conservation, requalification and valorisation of existing building stock, of environmental and cultural estate of Calabria Region. The project defines methods for the valorisation of "material culture" of unpopulated depopulating ancient villages raging in Calabrian territory, by giving solutions of restoration and conservation through operations suited to endogenous architectural language.
<b>Detailed description</b>	The SiDi workshop is characterised by a adaptive structural model, for the acquisition and processing of information concerning the cultural estate blight and the opportunities/priorities of possible intervention. The process of intervention promoted by SiDi is made according a vertical process that foresees the accomplishment of purely planning stages and testing as well as indirect stages, one of them regards the managing field and the other the transfer of gained data.
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Acquiring knowledge about methodologies and solutions for tweak of a system suited to a quick and exact gathering about the blight of architectonic heritage.</li> <li>• Correlating information about blight to the heritage databank and to the paper of environmental risk for the belonging territory, with the help of a technologic system just like thematic GIS</li> <li>• Correlating data about heritage to information concerning their social-economic rating got through innovative techniques of restoration of architectonic estate.</li> <li>• Defining a systematic model (such as an oriented gathering classes) of possible diagnosis and restoration interventions, by making in accomplished and coherent manner the concerning whole set of solutions and good available practices and by defining for each abstract object the relative elements and thus costs of application.</li> </ul>



- Defining the specifics and showing a filing system of intervention dossiers about specific estate of architectonic heritage in the form of requires of above defined classes, by assuring in the course of time the availability of all information describing a diagnostic/conservative like intervention.
- Equipping the gathering information about blight, risk and of social-economic rating with intervention choices at estate's disposal through a Decision Support System (DSS) system suited to needs of cultural field, able to set efficient and easy tools for catching present intervention sceneries and the setting of optimized alternative sceneries showing in accomplished manner territory politics of conservation in their synthesis of cultural, managing and social-economic priorities.
- Supplying such system with an easy to read graphic interface based on two-dimensional tools and on new three-D modelling solutions in real time about the landscape, able to well show the relationship among the estate, the territory and the relative anthropic sceneries and on four-D in order to define effecting processes and future life cycle of estate.

### Main advantages

The advantages of project SiDi will be evaluated by distinguishing into direct and indirect benefits: the former are those ones referred to proposer companies, the latter are those ones referred to the accomplishment of project and of which community will enjoy of. Direct benefits will arise form a potential patent coming from the next prototyping of diagnosis and intervention system of the research workshop. The proposer companies will see therefore, regardless of the patent, improving their competitiveness by researching in a field like that of diagnosis and conservation of architectonic heritage characterised by a plurality of solutions never able to face the problem in its complex, where the need of an unambiguous and aimed solution, like that one of Project SiDi, is clear and many times demonstrated. Indirect benefits can be read in social-economic key. On one hand, project results will compete for a rationalization within the intervention of diagnosis and restoration of architectonic heritage, then will produce a reduction of costs afforded by community for these interventions; on the other hand it will be produced high degree working activity in the field of conservation and in indirect manner in the field of tourism which will get indirect benefit from the grown valorisation and promotion of architectonic heritage.

### Current state of development

### Intellectual Property Rights

Secret know-how.

### Application domains

Information processing, information systems.

### Collaboration details

### Type of partner sought

Academy and industry.

### Tasks to be performed by the partner sought

### IRC Partner

IRC IRIDE

Know-how/expertise KHE\_IT\_22175

[ ITALY ]

CNR, Istituto di Ricerche sulle Attività Terziarie (IRAT)

www.irat.cnr.it

<b>Sector</b>	Research and studies in the field of service activities and their interdependences with other sectors of the economy like management of tourism, cultural heritage industries, urban design and planning.
<b>Activities</b>	Research activities and studies on tourism and cultural heritage mainly oriented to improve and develop integrated and sustainable local territorial resources.
<b>Contact</b>	Marichela Sepe (m.sepe@irat.cnr.it)

**Title** PLACEMAKER SOFTWARE: A FLEXIBLE AND INTERACTIVE TOOL FOR COMPLEX ANALYSIS AND SUSTAINABLE PLANNING

**Abstract** PlaceMaker is a complex method for analysing the urban landscape designed to identify elements that do not feature in traditional mapping and which constitute the contemporary identity of the places, meant as fundamental element of cultural heritage, representing them in a map that renders the places intelligible. The software tool, under development, supports PlaceMaker method - carried out in the framework of a research project based on an agreement between the Italian National Research Council and the Urban Design and Planning Department of the University of Naples Federico II- to all its phases. Representation of the places is realized by means of insertion in maps of symbols and elements connected to multimedia schedules that can be continuously updated

**Detailed description** The software tool, under development, supports PlaceMaker method of analysis designed to identify elements that do not feature in traditional mapping and which constitute the contemporary identity of the places, meant as fundamental element of cultural heritage, representing them in a complex map that renders the places intelligible.

The main characteristics of PlaceMaker software under development are: flexibility, facility and rapidity of use, strong graphical impact, indexing of the results.

Flexibility makes it possible to conserve, manage, modify and update in a particular format the multimedia data that are necessary for the creation of the multimedia schedule, connected to the symbols placed on the maps.

Regarding facility and rapidity of use, with simple and fast operations the creation of the maps takes place on the basis of traditional cartography or other kinds of maps. The map is therefore constituted by a cartographic base on which are inserted a series of symbols to which the multimedia database is associated. The multimedia database connected to the symbols contains the data collected in the different phases of PlaceMaker method and in particular written texts, schedules, images, planimetries, maps, audiovisuals. The software possesses a database that allows the creation and modification of the categories of symbols of PlaceMaker, used for the

entire map. Once the database of categories has been constructed, the symbols can be positioned on the base map, making it possible to connect the information referred to the places with the related multimedia schedule.

The partial maps and the created symbols for the final complex map can be overlapped and connected, the final product being characterized by a strong graphical impact.

Different uses of the software devoted to different users are foreseen (planners, citizens, tourist). In order to render the results of the analysis objective and useful to sustainable planning, the software connects the symbols of the complex map to numerical indices that allow the calculation of quality, place-identity sustainability, potentiality and weakness of the places represented in the map.

### Innovative aspects

Unlike other analytical approaches which study only one aspect of the city (perceptive, urban, etc.) or multidisciplinary approaches which collect a lot of data but find difficulty collating it, PlaceMaker method and software consider the places from all points of views and with different but compatible tools of relief. PlaceMaker assembles, elaborates and reconstructs the data deriving from surveys based on physical reconnaissance, sensory perceptions, graphical elaboration, photographic and video records, and sets this data against that provided by an overview of expectations, an analysis based on traditional cartography and a questionnaire given to local inhabitants.

Traditional cartography is still unable to represent the new urban features of the contemporary city which are not easily identifiable and often remaining invisible. The innovative feature is that, far from excluding traditional types of analysis, PlaceMaker method and software integrate them with several approaches serving to understand the city and cultural heritage in all their complexity.

There are three main criteria governing the study of aspects that are not univocally translatable into objective facts: scientificity, meaning the objectivity of the results and the repeatability of the method in different kind of contexts; capability for updating, meaning the possibility to add new data, to modify the existing ones, to obtain other results; timing, meaning the possibility of using the results in a sustainable programming both of guardianship and enhancement of cultural heritage and urban design and planning. Those criteria are satisfied thanks to combined use of PlaceMaker method and software.

Furthermore the software is flexible for several uses and suitable for different kinds of contexts.

### Main advantages

### Current state of development

### Intellectual Property Rights

Secret know-how.

### Application domains

Information processing, information systems.

### Collaboration details

### Type of partner sought

Software house, research organisation, academy.

### Tasks to be performed by the partner sought

### IRC Partner

IRC IRIDE

Know-how/expertise KHE\_IT\_21995

[ ITALY ]

**CNR, Istituto di Studi sui Sistemi Intelligenti per l'Automazione (ISSIA)**

www.issia.cnr.it

<b>Sector</b>	Research and studies on computer vision, robotics and multimodal human-machine interfaces.
<b>Activities</b>	Development of hardware and software systems for signals and images process.
<b>Contact</b>	Marco Leo (leo@ba.issia.cnr.it); Tiziana D'Orazio (dorazio@ba.issia.cnr.it); Paolo Spagnolo (spagnolo@ba.issia.cnr.it) ; Arcangelo Distante (distante@ba.issia.cnr.it).

<b>Title</b>	A SYSTEM TO AUTOMATICALLY MONITOR ARCHAEOLOGICAL SITES AND MUSEUMS
<b>Abstract</b>	<p>An Italian research institute has developed an intelligent visual system able to monitor indoor and outdoor areas in order to prevent dangerous and illegal activities in archaeological sites and museum that could damage cultural heritage.</p> <p>In particular the system is able to automatically:</p> <ul style="list-style-type: none"> <li>• detect, localize and track people in the monitored areas</li> <li>• recognize their activities, detect human intrusion in forbidden areas</li> <li>• send acoustic and visual alarms to catch the attention of the guardians.</li> </ul>
<b>Detailed description</b>	<p>The visual system consists of multiple cameras (also operating in the infrared range) properly placed and connected to hyper-threading processors able to record and process acquired images. On each processor advanced algorithms run continuously in order to:</p> <ul style="list-style-type: none"> <li>• segment moving regions from static ones</li> <li>• classify moving regions in order to recognize the people in the scene</li> <li>• keep track of people movements in the scene even when they pass from the field of view of a camera to that of another one</li> <li>• recover the 3D position of both people and objects in the scene</li> <li>• recognize eventual suspicious human activities</li> <li>• detect human intrusion in forbidden areas.</li> </ul> <p>Image segmentation is performed by an adaptive background subtraction technique; moving regions are classified using appearance based descriptor and supervised neural networks. Tracking of the people in the scene is performed introducing a probabilistic framework able to solve occlusion and camera changes whereas the 3D position of the object in the scene is performed by homographic projection.</p> <p>Human activity recognition is performed by high level reasoning about human motion and interactions with other objects. Finally intrusions in forbidden areas are detected comparing the</p>

	observed scene with a database of allowed positions preliminary built.
<b>Innovative aspects</b>	The system does not require human supervision: after a preliminary calibration phase it is, in fact, able to work autonomously and to immediately send an alarm in case of suspicious behaviours. Moreover, the system is able to simultaneously and continuously monitor different and large areas.
<b>Main advantages</b>	The system allows to prevent illegal activities that otherwise could be only late discovered by observing damages and eventually, scanning CCCT registrations. At the same time it avoids the long and tedious activity of watching at monitors that often is not fruitful due to the impossibility to simultaneously inspect several monitors and to the natural decreases of human attention.
<b>Current state of development</b>	Available for demonstration field tested.
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy, research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

Know-how/expertise KHE\_IT\_22247

[ ITALY ]

CNR, Istituto per i Beni Archeologici e Monumentali (IBAM)

www.ibam.cnr.it

<b>Sector</b>	Research and studies on technologies applied to cultural heritage.
<b>Activities</b>	Archaeology, virtual heritage, conservation and valorisation of historical buildings, remote sensing, non-destructive analysis for cultural heritage.
<b>Contact</b>	

<b>Title</b>	SATELLITE IMAGERY PROCESSING FOR ARCHAEOLOGY
<b>Abstract</b>	The proposed know-how is related to an advanced approach for processing data from multispectral satellite imagery for the identification of buried archaeological structures, the management of archaeological sites and palaeoenvironmental studies.
<b>Detailed description</b>	<p>During the last century, aerial photos have been the most common remote sensing data source used in the field of archaeological investigations. The current availability of Very High Resolution (VHR) satellite images, such as IKONOS (1999) and QuickBird (2001), Worldview (2007), can provide new perspectives in the field of archaeological prospection. The main advantages of VHR satellite images compared to aerial photos, are the synoptic view and a more rich dataset thanks to its wider spectral capability.</p> <p>The integration with other datasets, such as hyperspectral airborne imagery, lidar and SAR airborne and satellite data, allow to achieve significant improvement in the data analysis and interpretation process, especially in complex environmental contexts (such as desert, forest covered areas, etc.) Concerning the VHR satellite, the proposed data processing takes advantage from data fusion, edge enhancement, edge detection and classification techniques.</p> <p>This approach allowed us to discover archaeological remains of different historical periods and site typologies as well (neolithic settlements, etruscan remains, roman centuriations, medieval villages, paleoriverbeds)</p>
<b>Innovative aspects</b>	<p>The main innovative aspects are the following:</p> <ul style="list-style-type: none"> <li>• multi sensor, multi scale, multitemporal data integration for the CHM (Cultural Heritage Management)</li> <li>• development of semi-automatic algorithms for the extraction of archaeological features</li> <li>• validation of classification procedures for the landscape archaeology and palaeoenvironmental applications.</li> </ul>

<b>Main advantages</b>	<p>The main advantages are the following:</p> <ul style="list-style-type: none"> <li>• not invasive technologies</li> <li>• efficient and cost effective techniques</li> <li>• multiscale analysis capability</li> <li>• high exportability to different geographic and environmental contexts.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Research organisations and industry.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_22255

[ ITALY ]

**CNR, Istituto per le Tecnologie Applicate ai Beni Culturali (ITABC)**

www.itabc.cnr.it

<b>Sector</b>	Research and studies in the field of technologies applied to cultural heritage.
<b>Activities</b>	Research, integrated technologies for data acquisition on site, post-processing of topographical data, virtual ecosystems, virtual storytelling, multiuser domain, virtual archaeology.
<b>Contact</b>	Eva Pietroni, Sofia Pescarin, Maurizio Forte, Claudio Rufa, Marco Di Iorio, Nicolò Dell'Unto, Fabrizio Galeazzi, Alessia Moro, Lola Vico Lopez, Valentina Vassallo, Augusto Palombini, Carlo Camporesi, Bartolomeo Trabassi

**Title** VIRTUAL REALITY APPLICATION FOR CULTURAL HERITAGE, OFF AND ON LINE

**Abstract** The research activity of the Virtual Heritage Lab (VHLab) of CNR ITABC is oriented to the development of an integrated methodology for the creation of informative systems in the field of cultural heritage, mainly through virtual reality applications. Three-dimensional and interactive virtual environments can be the best solution to contextualize spatial data, to visualize, simulate relationships among different kinds of contents, referred to the same cultural context. Archaeological and historical research produces, during the phases of acquisition, post-processing and communication, huge quantities of spatial data, disseminated in different archives, with various formats, ontologies and typologies. It is fundamental to integrate all these data in the same spatial domain, to represent and enhance their interrelations, to interact with them, to be "surrounded" by spatial information. From the last two years VHLab has been developing new research projects oriented to the study and communication of cultural heritage through multi-user virtual reality applications, off and on line. The state of the art in this field is still quite pioneering, because there are no Multi-user Domains (MuD) for sharing and exchanging cultural and scientific contents, in the field of virtual heritage.

**Detailed description** Virtual heritage can define all the digital processes connected with a multidisciplinary approach to the interpretation, knowledge and communication of cultural heritage. The interpretation and communication process is created by spatial-temporal coordinates but it depends on the sense of place transmitted through cross-cultural domains. This gap of distance in time, space and place between present and past can be partially filled by a virtual reality environment, where the simulation is able to reproduce a holistic context of the cybernetic information. In network and collaborative environments cyberspaces and information are shared and the experience, subjective and objective, is embodied by avatars, actions, interactions, behaviors, navigations, feelings, storytelling. This embodiment constitutes a new way of learning, communication and cultural transmission; in cybernetic terms it is a "mirror effect", we can display our action and mind in someone's embodiment. Actually it is possible to find virtual communities developed entirely inside three-dimensional environments,



where the users (represented by avatars) can directly contribute to modify the aspect of the virtual world and the social relationships between people. In very few cases virtual reality applications in the field of cultural heritage are oriented to scientific fruition. The project, "Integrated Technologies of robotics and virtual environment in archaeology", financed by the Italian Ministry of the University and Scientific Research, gives us the occasion to experiment a multi-user domain in the web destined to the scientific community: archaeologists, experts in human and social sciences. They have the possibility to share information, ideas, test simulations and exchange data. All the topographical data acquired on the archaeological sites involved in the project, together with all the historical sources collected, converge in a virtual multiuser domain where users can meet, dialog, modify the scene or the map of the relations of cultural contents, according to their own interpretation and personal hypothesis, discussing them with other users. The project has been finished in March 2009, it can be considered as a pilot-study case. Another off line Multiuser VR project has been just concluded by our lab: the Virtual Museum of Via Flaminia Antica, opened to public fruition in the National Roman Museum at Diocletian Thermal Bath, since January 2008. The via Flaminia was a roman consular road, built in 220 B.C. and connected Rome and Rimini, in Northern Italy. The conditions of fruition led us to project this application mainly for communication needs, combining different kinds of media. Four visitors interact in the same virtual environment through their avatars using joysticks and their computer screens. They meet inside the archaeological sites along the first thirteen miles of Via Flaminia: Livia's villa Milvian Bridge, the area of Grottarossa and the ancient arch of Malborghetto. Through their actions they create, in real time, a virtual performance on a large screen for all the audience present in the room. On this large screen discovered contents, like movies, multimedia, 3D reconstructions, can be visualized in stereoscopy. In this way the interaction of each user-avatar inside the virtual world is finalized not only to his own learning but to collective interpretation, collective actions, common storytelling. In the next future we would like to extend the concept of "multiuser domain" to artificial life. We imagine a virtual scenario where artificial creatures, self-organized in the territory, able to develop autonomous behaviours, can relate with human users, in an unpredictable network of possible relationships and events. Artificial life can be very useful to simulate natural and social phenomena on the territory. Territory is perceived, interpreted, occupied, lived according to different meanings or symbolic values that living beings give to places. That is why the "space" become "places" and the territory become a "map" in our mind. "Virtual Rome" is another project that VHLab is developing for Seat Pagine Gialle and Promoroma: the WebGIS VR technology will enable to explore in real time the areas of Appia Antica, via Flaminia and Imperial Forum valley.

<b>Innovative aspects</b>	Virtual ecosystems; Alive virtual environment; Multiuser domain; Artificial life and artificial intelligence; Virtual storytelling; Access and sharing of data; Possibility of editing of virtual scenario; Transparency of data and methodological processes (top-down and bottom up approaches).
<b>Main advantages</b>	Valorization and communication of cultural heritage; Improvement of learning; Cultural impact on research and on general public; New tools of interaction and data sharing; Multidisciplinary approach; Integrated methodologies and technologies; Tools for interpretation of cultural contexts.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected. Property rights of digital contents belong to our Virtual Heritage Lab (CNR ITABC)
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	

Type of partner sought

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Research organisations, local public organisations, museums, academies.

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Tasks to be performed  
by the partner sought

IRC Partner

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IRC CIRCE

2008

## Know-how/expertise KHE\_IT\_22536

[ ITALY ]

## CNR, Istituto per le Tecnologie della Costruzione (ITC)

www.itc.cnr.it

<b>Sector</b>	Research and studies in the field of construction focused on applied research, certification and training.
<b>Activities</b>	Applied research to improve built-up environment, to find new construction methods and technologies, to manage refrigeration aspects, homes comfort, sustainable building, assess performance and quality of construction products and systems.
<b>Contact</b>	

<b>Title</b>	OPEN SOURCE WEBGIS
<b>Abstract</b>	Environment heritage conservation and tourism promotion refer to a complex production chain where private companies and public institutions are involved with specific interests and skills. Existing heterogeneous open source software applications have been extended to increase the functionalities.
<b>Detailed description</b>	We analyzed the work cycle from harvesting, to aggregation, to presentation of geo-referenced information about sites and territories provided by different public local administration departments dealing with cultural and environmental heritage conservation and tourism promotion. During the information aggregation phase, the material collected is acquired by content managers, converted in digital form and manipulated using the QGIS Desktop stand-alone application; then information should be directly published on the web using the webGIS P.mapper.
<b>Innovative aspects</b>	QGIS has been extended to face some major limitations. We developed an add-on to convert DXF to SHP format, in the form of a QGIS plug-in, using GPL libraries through an assisted process the user could specify different parameters used to automatically generate the p.mapper (WEBGIS) configuration files and scripts, avoiding the publisher to edit configuration files of any sort. We extended p.mapper features allowing to visualize images related to specific points of interest described in the current layer's DBF by an URL address.
<b>Main advantages</b>	Open source technology.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	

<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Final users, both private and public, interested in adopting its technologies; partners to collaborate with in international project.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

Know-how/expertise KHE\_IT\_22445

[ ITALY ]

e-voluzione Srl

www.e-voluzione.it

<b>Sector</b>	Information and Communication Technologies, hardware and software solutions for measurement problems.
<b>Activities</b>	Measurement systems, Man Machine Interfaces.
<b>Contact</b>	

<b>Title</b>	TECHNOLOGY FOR MUSEAL EXHIBITS, MAN MACHINE INTERFACES
<b>Abstract</b>	e-voluzione is an SME specialized into man machine interfaces and measurement solutions. Our museal experience starts with the museum "Citta' della Scienza" in which we realized the most part of technological exhibits. Recently we realize the technological stand of "Comune di Napoli" for the International Forum of Culture in Monterrey, Mexico.
<b>Detailed description</b>	Our skill begins from the experience on building four control centers for space shuttle missions with related man machine interfaces one for each type of user. We developed new technologies to interface computers and humans. Our system are using by expert and not-expert people with great satisfaction. We integrate high technology software, with sensors, cameras, all full integrated with multimedia to show the cultural contents.
<b>Innovative aspects</b>	Integration of technology from industrial and research market into museal exhibit will enhance the public feeling and comprehension of contents.
<b>Main advantages</b>	Integration of simple and cheap technology. We develop software, in such a way we are free to personalize everything for the specific customer.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Copyright protected.
<b>Application domains</b>	Information processing, information systems; Measurement methods. Our market is the museums, as the temporary exhibitions, or companies which need multimedia integrated with the real world.

Collaboration details

Type of partner sought

Industry, research organisation.

Tasks to be performed  
by the partner sought

IRC Partner

IRC IRIDE

## Know-how/expertise KHE\_IT\_22264

[ ITALY ]

## Forus Srl

www.forus.it

<b>Sector</b>	Information and Communication Technologies for cultural heritage.
<b>Activities</b>	Design, project and development systems and technologies for the conservation of cultural heritage and tourism.
<b>Contact</b>	

<b>Title</b>	UNDERWATER ARCHAEOLOGY SYSTEM
<b>Abstract</b>	An italian SME offers a system which allows telecontrol of underwater archaeological sites and telemonitoring of underwater heritage. The company is looking for partners interested in supporting the commercialisation of the system and users interested in buying or renting the system to organize tours, organize archaeological excavations underwater etc.
<b>Detailed description</b>	The system, called STARS, was conceived and developed in collaboration with the department of underwater archaeology of the Sicily Region, and installed at Cala Gadir underwater site, on the island of Pantelleria, in Italy. The system allows monitoring and fruition of the submerged vessel, and provides the end-user (technician, student and tourist) with the possibility to view the underwater site from the Internet.
<b>Innovative aspects</b>	Motion detection Endowed with a semi-mobile adjustable camera
<b>Main advantages</b>	Ease-of-use for the end-user Possibility to have an underwater cultural experience for people Possibility to perform underwater
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	The technology is not IPR protected.
<b>Application domains</b>	Information processing, information systems. Application in security industry and in underwater archaeology.



Collaboration details

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Type of partner sought

Government (cultural organisations), mainly underwater archaeological department; also tourism organisations interested in underwater activities.

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Tasks to be performed  
by the partner sought

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IRC Partner

IRC IRIDE

Know-how/expertise KHE\_IT\_22416

[ ITALY ]

**Geographike Srl**

www.geographike.it

<b>Sector</b>	Geographic Information System (GIS), Earth observation and remote sensing to process geographic data.
<b>Activities</b>	Analysis on geographical data based on remote sensing GIS and webGIS techniques.
<b>Contact</b>	

<b>Title</b>	WEBGIS AND DBMS (DATABASE MANAGEMENT SYSTEM) SOLUTIONS FOR CULTURAL HERITAGE ADVANCEMENT
<b>Abstract</b>	The whole set of activities involved in cultural heritage advancement projects can be improved by using webGIS and DBMS solutions. In facts, cultural heritage is strictly related to the territory and the Web-GIS approach is an innovative way to manage and promote this knowledge.
<b>Detailed description</b>	<p>A web-based project focused to the cultural heritage advancement can be summarized by the steps described below:</p> <ul style="list-style-type: none"> <li>• preliminary analysis: specific topic definition, user requirements, etc.</li> <li>• conceptual database modelling</li> <li>• thematic data acquisitions, quality checks, revision activities, normalisation</li> <li>• geographical data acquisition</li> <li>• definition of the relationships between geo-located places and thematic data</li> <li>• geographical DBMS implementation</li> <li>• web application implementation.</li> </ul> <p>A similar application was produced in cooperation with the Milan Province, within the framework of the PTCP ("Piano Territoriale di Coordinamento Provinciale"), by carrying out studies and researches about "Historical Memory Places" and building a geo DBMS and a Web GIS application (see the link below).</p>
<b>Innovative aspects</b>	The very heterogeneous data set and information forming the cultural heritage can be l to places in the territory. These links refer both to physical objects (like buildings, museum, cities, monuments), and more abstract geographical concepts, as generic places, itineraries, etc. Features and landscape richness too can be involved in these processes since their intrinsic geographic meaning. The web based geographic access to territory is a new way to perform management, browsing and researches. The web applications are also featured by special capabilities for users cooperation and documents sharing.

<b>Main advantages</b>	Web GIS and DBMS solutions allow a real cultural knowledge diffusion and a better cultural heritage management.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Information processing, information systems.
<b>Application domains</b>	
<b>Collaboration details</b>	
<b>Type of partner sought</b>	SME, research organisations, public Institutes, local administrations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC RECITAL

Know-how/expertise KHE\_IT\_22332

[ ITALY ]

**Homegate Srl**

www.homegate.it

<b>Sector</b>	Internet service provider.
<b>Activities</b>	Development of tool for digital presentation of cultural heritage, web site, flipping book, QR Code, database, Online Public Access Catalogue (OPAC) web.
<b>Contact</b>	

<b>Title</b>	NEW TECHNOLOGIES AND INNOVATION FOR THE CULTURAL HERITAGE
<b>Abstract</b>	An Italian software and services IT consultancy, specialized on new technologies for cultural heritage. Partner of Microsoft in developing programs in Italy to help the diffusion of Italian culture through the most advanced and innovation-oriented technologies.
<b>Detailed description</b>	<p>The experience gained by HomeGate through its involvement over several years in the realization and management of the added value projects on cultural heritage, has enabled it to develop unique skills to answer the problems of digital web publishing and strong expertise in the creation and implementation of cultural websites.</p> <p>We have worked with tireless enthusiasm to make our software and technological know-how available to cultural entities and at the same time we have extended our skill set, thanks to the continuous dialogue between our developers and the museums, curators, academics, art historians, catalogers, etc.</p> <p>The challenges we've faced are many and varied. Implementation of these projects not only involves technical aspects, it also meant developing an ability to size the project correctly from the beginning, defining the proper parameters, economizing and managing resources, and ensuring the final solution is easy and simple to use for the organisation without the help of outside experts.</p> <p>The software we developed for these projects includes several generic user modules which can easily be adapted for use in completely different circumstances.</p> <p>OPAC (Online Public Access Catalogue) for the online publication of book, catalogues, manuscripts and paintings.</p> <p>With experts from the Biblioteca Ambrosiana and the Biblioteca Lancisiana, we realized a few web modules for the online publication and search of printed books, catalogues, manuscripts and paintings, according to the national standards of the ICCU.</p>

#### OPEN CATALOGUE OF MANUSCRIPTS

The open catalogue implemented for the Lancisian manuscripts was designed and coordinated by Professors Antonio Cartelli and Marco Palma from the University of Cassino, authors of a previous open catalogue for the Biblioteca Malatestiana in Cesena. This module can easily be personalized for use by any library to give scholars a tool for collaborative study, for exchange of information on collections, to design projects and discuss problems of common interest.

#### ONLINE PUBLISHING OF DIGITAL IMAGES

At the Ambrosiana we began the first attempts at online publishing of images of manuscripts, letters, drawings and paintings. Depending on the specific needs, the images were further enriched with transcriptions, search and high resolution zoom features.

#### DIGITAL TURNING PAGES BOOKS

To make manuscripts more palatable to a non-specialist public we designed a system which assembles digital images of individual pages into a virtual book so that the user can turn the pages on internet environment as if it were real. This product is based on external XML description of pages and allow to handle any number and size of pages.

#### VIRTUAL TOURS OF MUSEUMS AND COLLECTIONS

We've worked extensively on creating virtual tours from photographic footage. The system allows us to activate hot spots on the image and link them to other virtual tours, films, audio and catalogue details.

#### NEWSLETTERS, ONLINE QUESTIONNAIRES, EVENTS AND EXHIBITIONS, FORUMS

Interaction with users and visitors is extremely important for libraries and museums and can become a key to the success of their website. We have built standard modules to manage event/exhibition calendars and user communication tools such as newsletters, questionnaires and online surveys and discussion forums.

#### ONLINE COPYRIGHT MANAGEMENT MODULE

With the advice of the Biblioteca Ambrosiana, we realized a sophisticated management module to handle the entire process of selling copyright to images of manuscripts, drawings and paintings online. The software, which can be adapted for any type of copyright or cost, manages the entire process, from the initial request depending on the final use of the image (viewing and study, scientific or commercial publication, etc.), to online payment or billing. In more than 5 years of using the system in Biblioteca Ambrosiana, we have gathered much valuable feedback on the benefits of offering such a service online, with considerable savings in internal costs and clerical staff.

#### WEB-BASED MANAGEMENT OF SITE CREATION AND UPDATES

Over the years we have learned that any software solution designed for use by museums, libraries and cultural entities in general must be easy to use and especially simple to maintain and update. Our content management system (CMS) is entirely web-based, enabling users not only to edit or

create web page content, but also to add new menus and sections to the site. The site is generated automatically from the SQL Server database using style sheets (CSS), in full compliance with web accessibility criteria laid down by the Stanca Law (Law 9 January 2004, no. 4) and the provisions of the "European Cultural Website Quality Principles", developed within the Minervanetwork (Ministry for Arts and Culture) by the Italian WP5 Working Group.

#### QR CODE FOR MOBILE ACCESS TO INFORMATION

The ability to read QR Code (bi-dimensional bar code) with any kind of phone and mobile device provide cultural information and visit paths according to the users' preferences and interests. A pilot project has been developed at the Art Gallery of Ambrosiana and allows visitors to access detailed informations on painting in different digital form (texts, audio, video, animations). Other projects are under development for personalized cultural tourism system in web 2.0 concept.

#### Innovative aspects

#### Main advantages

End to end solutions, consulting and development.  
Turnkey project for cultural institutions.

#### Current state of development

#### Intellectual Property Rights

Copyright protected.

#### Application domains

Information processing, information systems.

#### Collaboration details

#### Type of partner sought

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC CIRCE

2008

Know-how/expertise KHE\_IT\_22502

[ ITALY ]

Meogeo Srl

www.

Sector  
Activities

Contact

**Title**

ADVANCED TECHNOLOGIES FOR RISK ASSESSMENT AND MANAGEMENT OF CULTURAL RESOURCES

**Abstract**

The approach we proposed for risk assessment and management of cultural resources is based on both in-situ and remote sensing technologies. The employment of new technologies allows us to perform risk prediction, prevention and mitigation. Both natural and human induced risks are modelled and evaluated for different types of cultural resources located in different environmental settings characterized by specific natural, socio-economic parameters and risks, among them, environmental impacts, natural deterioration of material, anthropogenic pressure.

**Detailed description**

Cultural heritage is endangered from both human activities and natural disasters, this drives the necessity of finding innovative ways for the improvement of the management planning, protection and conservation of the culture heritage is urgent more than ever.

When considering isolated monuments or sites, the level of intervention is well defined and can be better approached. Whereas, when larger areas (archaeological sites and landscape) are examined and when more cultural and social parameters are taken into account, the management and preservation becomes much more complex to be analysed.

The methodological approach we proposed is specifically developed for the assessment and management of risk at different spatial scales of cultural resources, from single monument to landscape. In particular, the employment of new technologies allows us to predict the risk, reconstruct potential scenarios for prevention and mitigation. Both natural and human induced risks are modelled and evaluated for different types of cultural resources located in different environmental characterized by specific natural, socio-economic parameters and risks, among them: fire, landslide, floods, and hydro-geologic risks, material deterioration, anthropogenic pressure and management of cultural and natural resources.

The system is characterized by a high degree of flexibility and potentiality to be used in various areas providing reliable results that can be used by the responsible local authorities or by other cultural heritage managers.



<b>Innovative aspects</b>	<p>The main innovative aspects are linked with the system capability to:</p> <ul style="list-style-type: none"> <li>• explore the different environmental and social variables that influence the cultural heritage monuments and sites</li> <li>• define the weight of influence of each of the above factors</li> <li>• provide an expert tool which would be used for the risk assessment management of the cultural resources.</li> </ul>
<b>Main advantages</b>	The proposed methodological approach is capable to provide innovative solutions for the preventive conservation of the cultural environment for different geographic areas and type of monuments.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry and research organisations.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

Know-how/expertise KHE\_IT\_22463

[ ITALY ]

## Officina per le Arti Opera Srl

www.officinaopera.it

<b>Sector</b>	ICT and survey for cultural heritage.
<b>Activities</b>	Laser scanning surveying and data processing, 3D digital modelling, texturing and interactive navigation of 3d models as a resource for the visualisation of corrupted sites or monuments and for virtual restoration or for simply communication and support for tourists.
<b>Contact</b>	

<b>Title</b>	3D DIGITAL TEXTURED MODELS -SUITABLE FOR INTERACTIVE NAVIGATION- FROM LASER SCANNING DATA
<b>Abstract</b>	An Italian company that answers the demand for market needs related to the preservation and protection of historical heritage, provides services in the field of multimedia representation using the most recent technologies for metric data acquisition, digital modelling and virtual 3D reconstruction. Partner is sought for technical cooperation and/or manufacturing agreement.
<b>Detailed description</b>	The company is offering its experience in the integration of different approach and devices in metric data collection and in digital modelling referred to historical monuments or artefacts, that is what is usually named "cultural heritage". The company is particularly interested in the processes that allow common people to enjoy digital documentation of cultural heritage. This kind of documents requires the solution of many problems that can be solved thanks to company's experience, such as the visualization of huge photorealistic 3d models on the web (algorithms for progressive visualization of triangles or of textures -jpeg2000 and others). Another interesting feature is linking databases to 3d models, in order to build 3d hypertexts.
<b>Innovative aspects</b>	The experiences in the academic world gives furthermore innovation and scientific rigour to the offered services. 3D hypertexts, for example, are an interesting approach in the fruition of cultural heritage digital documents; they allow people to navigate a 3D textured model exported in a wrml format and click on the model to achieve information on the monument or the artefact.
<b>Main advantages</b>	The company offers a set of services for different final users in the field of cultural heritage. The management staff has a specific education in architecture; that's why the company is effective in documentation phases and in particular in the interpretation of the data, in their structuring and management for the proposition of philological reconstructions or - so called - virtual "anastilosi". This way the team can assure a full compliance of the output with the requirements of the customers

(hypertexts, navigable and measurable models, etc).

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**Current state of development**

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**Intellectual Property Rights**

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**Application domains**

Documentation and fruition of cultural heritage.

The application of the ultimate technologies and specific know-how gathered through a constant activity of experimentation and surveying, allows OPERA to offer a very wide gamma of services to its customers.

The main activities of OPERA are:

- metric data acquisition with traditional and innovative surveying techniques (contact, topographic, photogrammetric and laser scanning)
- processing and restitution of the metric data
- three-dimensional modelling with CAD and NURBS modellers
- post-processing of the 3D models for structural analysis and GIS applications
- texturing and visualization of the virtual models
- videos and animations production
- database processing
- 2D and 3D hypertexts
- video for stereoscopic presentations
- high quality merchandising
- spaces and events for multimedia productions.
- The company deals with:
  - monumental architectures and historical contexts
  - archaeological sites
  - historical villas and gardens
  - art museums and galleries
  - architectonic design.

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**Collaboration details**

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**Type of partner sought**

Museums, art exhibitions, cultural institutions and organisations, academies, research organisations, public administrations.

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**Tasks to be performed by the partner sought**

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**IRC Partner**

IRC MEDIA

Know-how/expertise KHE\_IT\_22455

[ ITALY ]

**Planetek Italia Srl**

www.planetek.it

<b>Sector</b>	Information sciences applied to land management.
<b>Activities</b>	Development of information solutions, consulting services and training about storage, elaboration, distribution of cartographic databases and satellite remotely sensed images, WebGIS and earth observation data integration.
<b>Contact</b>	

<b>Title</b>	WEBGIS 3D AND PERMANENT SCATTERERS TECHNIQUE FOR MONITORING AND MANAGEMENT OF CULTURAL HERITAGE
<b>Abstract</b>	A service based upon the integration of the satellite monitoring with information acquired in situ, and 3D reconstructions models, is designed for the management and promotion activities typical of cultural heritage sites. For example the technique of the Permanent Scatterers is used to evaluate the stability of monuments and buildings. The subsequent integration into a 3D webGIS system comprehensive of the intangible cultural components, makes up a friendly tool to serve several system user segments spanning from academics to decision makers. The partners sought are: industries and academics in order to adopt, develop and/or implement the technologies proposed.
<b>Detailed description</b>	<p>The system aims to offer a cultural heritage mapping and monitoring service based on webGIS and earth observation data integration.</p> <p>Data acquired by satellite-borne Synthetic Aperture Radar (SAR) systems can be profitably used for the detection and quantification of slow movements, provided that the interferometric analysis and data interpretation is guided by field knowledge and comprehension of building/ground deformation mechanisms. The Permanent Scatterers (PS) technique is capable to generate high precision ground and building displacement data that, integrated with ground truth, can potentially represent a valuable quantitative input for warning purposes.</p> <p>The products that are obtained from this kind of study are:</p> <ul style="list-style-type: none"> <li>• motion survey that is a large scale product that identifies the areas affected by displacements</li> <li>• displacement monitoring that allows the monitoring of the areas of interest on a reduced scale basis. The objective is to accurately quantify the deformation velocity of unstable areas through the displacement rate measurement of some points located within identified cultural heritage.</li> </ul> <p>The EO data processing outputs are integrated into a 2D Web Geographic Information System (GIS) application in order to facilitate the process of interpretation and to consult in a dynamic way the maps of the area of interest. Besides the 2D application a 3D application is integrated into the system so to give to the user the ability to navigate in a 3D world.</p>

The final GIS integration platform enables better query and analysis functions to the set of thematic layers. For instance the GIS could contain views customized to the user needs with links to different types of information. The user is also able to submit spatial and temporal queries by activating custom tools.

### Innovative aspects

The innovative aspects are related both to the technique and to the technology used to reach the final service. The Permanent Scatterers technique overcomes several limitations of conventional SAR differential interferometry (DInSAR) applications in instability studies. The basic principle of interferometry relies on the fact that the phase of SAR images is an ambiguous (modulo- $2\pi$ ) measure of the sensor-target distance. Distance variations are determined by computing on a pixel by pixel basis the phase difference (interferometric phase) relative to two SAR images acquired over the same area during successive satellite passes. By compensating for the topographic contribution to the interferometric phase (differential SAR interferometry - DInSAR), ground deformation can be isolated in single or in series of interferograms. These applications are possible as long as the phase contribution introduced by electromagnetic scattering on the various objects within the test area remains nearly constant (coherence condition) between the two acquisitions involved in each interferogram. The loss of coherence, typically related to the presence of vegetation cover and to the presence of atmospheric distortion affecting the interferometric phase, is the major problem for monitoring applications that need to rely on long-term sequential SAR observations. The PS technique relies on the fact that the scattering mechanism of a certain amount of image pixels is dominated by single point-wise elements (i.e. much smaller than the image pixel). As long as these dominant scatterers correspond to objects whose reflectivity does not vary in time (in particular portions of man-made structures and rock exposures not masked by vegetation), all decorrelation effects turn out being negligible. Permanent Scatterers can be thought of as natural (i.e. not deployed ad hoc) benchmarks of a high density geodetic network. The PS technique combines the wide-area coverage typical of satellite imagery with the capability of providing displacement data relative to individual image pixels. The webGIS technology allows different cartographic dataset and Earth Observation (EO) products integration through a friendly graphical user interface. The cartographic navigation is guaranteed through pre-defined maps that allows the user to immediately reach the information of its own interest also inside big-sized files. The user can browse and query different cartographic database via Internet, by searching on graphic and alphanumeric criteria, and view the raster cartography (like aerial photos or satellite imagery) related to the area of interest. The system provides a series of optional tools for the direct access to raster database, for the safety of the datasets, for the management of multiple servers and for the 3D visualization and navigation. Together with the traditional navigation of 2D maps, a new way of viewing the maps is available: the user while displaying the cartography can change over, by clicking on the 3D button, all the 2D scene in a usable 3D web page. It is possible also the punctual interrogation of the cartographic raster data in order to obtain the quota of each single displayed point on the map. Moreover it is possible to realize interactively an elevation diagram of every object on the map.

### Main advantages

The development of an effective WebGIS integration has a great relevance because:

- the possibility to easily visualize, query and make in evidence correlation between the available data with the EO products could foster the integrated use of the SAR technologies application with the traditional techniques
- it facilitates the process of interpretation, the consultation in a dynamic way of the area of interest maps and the exploitation into the user environment
- it enables better query and analysis functions to the entire set of thematic layers

### Current state of development

### Intellectual Property Rights

The same methodology has been used for the landslide monitoring service.

**Application domains**

Information processing, information systems.

**Collaboration details**

Industries and academies

**Type of partner sought**

**Tasks to be performed  
by the partner sought**

**IRC Partner**

IRC IRIDE

da recuperare

TECHA

2008



Know-how/expertise KHE\_IT\_22155

[ ITALY ]

**SRS Engineering Design Srl**

www.srs.it

<b>Sector</b>	Development of software for heating, ventilation and air conditioning manufactures (HVAC).
<b>Activities</b>	Control, supervision and monitoring environmental conditions during transport and exposition of works of art.
<b>Contact</b>	

<b>Title</b>	DEVELOPMENT OF TECHNICAL SOFTWARE FOR ENGINEERING DESIGN AND CONTROL SYSTEMS DES
<b>Abstract</b>	It is presented the expertise of an italian SME specialised in the development of software for heating, ventilation and air conditioning manufactures (HVAC), PLC software development and supervision for HVAC. Furthermore, the company is expert in DB management by mean of SQL (Structured Query Language). The company expertise can be applied in control, supervision and monitoring environmental conditions during transport and exposition of work of arts
<b>Detailed description</b>	<p>The engineering company here presented have some ten years of experience with deep knowledge in development of Technical Software for Engineering Design and Control Systems.</p> <p>The historical competences of this company are on software for automotive design and software for HVAC:</p> <ul style="list-style-type: none"> <li>• AHU selection software for salesmen network;</li> <li>• Manufacturing software for HVAC;</li> <li>• PLC software development;</li> <li>• supervision and monitoring for HVAC with data history, reports and graphycs.</li> </ul>
<b>Innovative aspects</b>	The company expertise can be applied in control, supervision and monitoring environmental conditions during transport and exposition of work of arts.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• the company provide his high quality services supporting own and client design teams and product development platforms;</li> <li>• the company can design an environment control system with remoted supervision, data history and display.</li> </ul>
<b>Current state of development</b>	



<b>Intellectual Property Rights</b>	Others (registered design, plant variety right, etc).
<b>Application domains</b>	Construction technology; Materials technology; Information processing, information systems. The company provides services and expertises and solution applicable in Cultural Heritage field.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Companies, research organisation, academy, industry.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

## Know-how/expertise KHE\_IT\_21729

[ ITALY ]

## TEA Sas

www.teacz.com

<b>Sector</b>	Consulting services on cultural heritage, statistical research.
<b>Activities</b>	Virtual restoration, digital imaging, multi-spectral imaging.
<b>Contact</b>	

<b>Title</b>	TECHNIQUES AND METHODOLOGIES FOR NOT-INVASIVE DIAGNOSTIC OF THE CULTURAL HERITAGE
<b>Abstract</b>	TEA gained considerable skills in the field of not invasive methodologies and techniques for the preservation of the cultural heritage. Specifically, TEA deals with the reflexography and the implementation of image enhancement algorithms.
<b>Detailed description</b>	TEA Sas di E. Console & C. is a services firm, skilled in economical and statistical analysis. Since 2006 it is certified according to UNI EN ISO 9001:2000 standard for the following activities: <ul style="list-style-type: none"> <li>• planning and provision of applied and experimental multi-sectorial statistics consulting services</li> <li>• planning and provision of research and development services for geographical and alphanumeric data processing (GIS, WEBGIS, Geomarketing) and digital images processing (virtual restoration and not-invasive diagnostic).</li> </ul>
<b>Innovative aspects</b>	TEA, thanks to the coordination of the 5FP project ISyReADeT (Integrated System for Recovery and Archiving Degraded Texts, contract n. IST-1999-57462) and thanks to the research expertise of its administrator, Elena Console, gained considerable skills in the field of not invasive methodologies and techniques for the preservation of the Cultural Heritage. Specifically, TEA deals with the reflexography and the implementation of image enhancement algorithms. Reflexography is a non destructive diagnostic optic technique for the analysis of written or painted surfaces. The multispectral/hyperspectral imaging technologies standing at the basis of the reflexography, allows to identify in the texts and in the paintings elements of great utility for the restorers and the historians. In the case of texts, the multi/hyperspectral imaging allows to highlight particular features on paper materials and provides information about the ink used. The further processing of the obtained images allows to enhance the text readability in case of deterioration of the surface or

in case that fragments of word are totally or partially hidden.

As regards to the paintings, the reflexographic analysis can show features that are not visible to the human eye, such as the preparatory drawings, the presence of pictorial drawings up that are hidden by layers of colour done by the artist or due to following restoring interventions, the trend of the brush-strokes, etc.

TEA has a multispectral camera CCD able to acquire in the 3 spectral bands of the visible (RGB, red, green and blue) and in the infrared, for a total spectral range going from 300 to 1.000 nanometers. Moreover TEA uses a liquid crystals tunable filter for hyperspectral acquisition in the visible range.

#### Main advantages

The multi/hyperspectral imaging offers the following advantages:

- high quality of the images
- prompt visualization of the acquired images
- not-invasive acquisitions
- data archiving on digital support
- simplicity of duplication and printing
- possibility of using image processing techniques for the solving of artistic preservation problems.

#### Current state of development

#### Intellectual Property Rights

Information processing, information systems.

Techniques for virtual restorations and for multi/hyperspectral imaging have been often prohibitively expensive. This is instead a technology suitable for use in the routine preservation of cultural objects. Moreover, the image enhancement software is simple to be used also for non expert people: it allows, in fact, the application of very specific algorithms in a "blind" way: there is no need to have mathematical expertise for managing it.

#### Application domains

#### Collaboration details

#### Type of partner sought

The expected partners are identified as private and public owners of works of art or paper materials (museums, libraries, archives) willing to carry out some experiments on the goods (paintings, manuscripts, printed material) or, differently, aim at realizing intervention of not-invasive diagnostic and/or virtual restoration, resarch organisation for improving the image enhnacement software, company of software engineering.

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC MEDIA

Know-how/expertise KHE\_IT\_22319

[ ITALY ]

Università della Calabria, Evolutionary System Group (ESG)

<http://galileo.cincom.unical.it>

<b>Sector</b>	Cultural heritage, digital edutainment, 3D sound, computer graphics.
<b>Activities</b>	Interdisciplinary research, high education, promotion of scientific interchange through networking actions.
<b>Contact</b>	

<b>Title</b>	GRAPHICAL AND VIRTUAL RECONSTRUCTION, GIS EMBEDDED, OF ARCHAEOLOGICAL ENVIRONMENTS
<b>Abstract</b>	The department of mathematics of university of Calabria, specifically the ESG Group, has developed some support tools related to the interactive fruition of the archaeological heritage and for the entertainment. Between the developed technologies, the augmented reality tools of the archaeological site are presented to the user both on classic desktop (remote) and on mobile devices (location based service).
<b>Detailed description</b>	<p>Detailed description or (if technology request) special requirements.</p> <p>Technological levels of interactive fruition are three:</p> <ul style="list-style-type: none"> <li>• Web</li> <li>• Interactive museum</li> <li>• Mobile systems.</li> </ul> <p>Relating to the interactive fruition on the web, ESG developed a plug in for Firefox 2.0 that allows the interactive exploration of the 3D models (virtual reconstruction). The model is based on the open source technology of Irrlicht, an engine that high performs in real-time 3D. This technology allows users to interact live with the environment, moving throughout.</p> <p>The interactive museum is a virtual environment where user can activate exploration mechanism and informative interaction with the objects present in it; the interaction process can be done manipulating, visualizing from different angles and moving them inside the environment; the user can surf within the museum both using a keyboard and even using the mobile device; the input of this technology is represented by the virtual reconstructions, archaeological rests images and info related to the object analysed. All objects have been reconstructed in 3D in order to give user a more immersive experience and a better visualization. The mobile systems allows users to interact with the real world through a GPS System that will identify the real position of the user on the map pre-charged on the device, and will display how the location looked like during its existence. The system architecture works as follows:</p>

- GPS antenna furnishes to the devices the latitude and longitude of customer in order to identify him inside the archaeological site
- inside the device are allocated the reconstructions of the site and are identified by their position through latitude and longitude, geo-referential data, furthermore to this reconstructions are associated all info related (audio, texts)
- because in GPS system there is a compass embedded, when user will be nearby a rest, he/she will see on the device display the 3D model of the object he/she is looking at, according to his own view.
- user will be able to interact with the 3D object, using different options:
- visualizing all texts related to it
- listen to the audio info related to it
- furthermore in the system is embedded a mini map of the archaeological site that shows, in every moment the position of user.

#### Innovative aspects

Main innovative aspects of the developed technologies are related to the entertainment, the interactivity and the customization of the fruition.

The interactive museum is a innovative way to entertain and to enjoy the audience; it could be used for didactical aims, too. The web fruition uses tools open source, easy to use and to access. The possibility to be helped by a mobile device during a visit inside an archaeological site twists the traditional concept of the tourist guide, merging the real with the virtual in a simple and dynamic way.

#### Main advantages

The system added value is the peculiarity to not separate the real from the virtual: the user equipped of PDA (or other mobile devices) when is nearby the place characterized by the presence of an archaeological rest inside the site, will display the virtual reconstruction of the object (3D model) that will be showed as it originally was and the user will be able to listen to the info associated (audio, texture, images and video).

Another important aspect is related to the customization of paths inside the archaeological areas: we developed an optimizing model that represents the problem and that satisfies the customers' specifics.

#### Current state of development

#### Intellectual Property Rights

#### Application domains

Construction technology; Information processing, information systems.

#### Collaboration details

#### Type of partner sought

Academy, research organisation, industry

#### Tasks to be performed by the partner sought

#### IRC Partner

IRC MEDIA

Know-how/expertise KHE\_IT\_22300

[ ITALY ]

**VICOMTech, Visual Communication Technologies**

www.vicomtech.org

<b>Sector</b>	Digital TV and multimedia services; biomedical application; tourism, heritage and creativity; interaction for education, leisure and e-inclusion, industrial applications.
<b>Activities</b>	Applied research on interactive computer graphics and multimedia.
<b>Contact</b>	

<b>Title</b>	VALORISATION OF CULTURAL HERITAGE
<b>Abstract</b>	This research area is in charge of the development of technologies that will allow the dissemination of knowledge related to collective memory, providing leisure experiences to the users
<b>Detailed description</b>	<p>We work in:</p> <ul style="list-style-type: none"> <li>• mixed reality technologies (virtual and augmented reality) for the implementation of experiences based on both currently existing and non-existing historical events and environments</li> <li>• mobile applications based on wireless technologies in order to implement mobile assistants that allow calculating the location of the user and the transmission of multimedia content in real time to mobile devices</li> <li>• storage, management and indexation systems for multimedia cultural contents based on standards and semantic web technologies, as well as intelligent inference engines for browsing and searching contents</li> <li>• new interaction interfaces that will provide an added value when recreating cultural contents, including informal learning applications in cultural scenarios.</li> </ul>
<b>Innovative aspects</b>	This research area is in charge of the development of technologies that will allow the dissemination of knowledge related to collective memory, providing leisure experiences to the users. The use of Virtual and Augmented Reality technologies in the cultural sector allows the real experience of the historical events and environments (existing and non-existing), simplifying their understanding. These technologies are combined with new multimodal user interface, which help user interaction based on several modes (sight, gestures, speech). Finally, wireless technologies are the basis of the implementation of mobile assistants that allow the location of the user in outdoor environment, as well as the transmission of multimedia contents in real time to the devices of the users.
<b>Main advantages</b>	The real validation of the implemented projects within the department has provided us with a wide

	knowledge about the social acceptance of the implemented technologies. All the projects have been conducted by multidisciplinary teams, collaborating with institutions, organisations and enterprises within the sector.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Information processing, information systems. Existing market applications have focused on specific subsectors but do not target the whole value chain.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Libraries, documentation centres and archives; museums, exhibition rooms, interpretation centres, foundations with own cultural archives; cultural enterprises which provide services to public and private institutions, including curators and activities organisers.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	BASQUE IRC

Know-how/expertise KHE\_IT\_22329

[ ITALY ]

CNR, Istituto per le Tecnologie Applicate ai Beni Culturali (ITABC)

www.itabc.cnr.it

<b>Sector</b>	Research and studies in the field of technologies applied to cultural heritage.
<b>Activities</b>	Activities: Development of new technologies for cultural heritage conservation and promotion.
<b>Contact</b>	

<b>Title</b>	ARKIS CuBE: 3D JAVA-BASED WEBGIS AND 3D VIRTUAL MODELLING SYSTEM
<b>Abstract</b>	3D Java-based webGIS application, with database connection (SQL Server 2005) and use of 3D virtual modelling techniques for representing monuments through GIS technologies. The application is intended and developed with the hope of creating a national standard for storing information about evaluation of the monument conservation status by means of a national historical heritage network.
<b>Detailed description</b>	<p>The application consists of two main scenarios: a 3D GIS-like map of Italy where all known monuments are positioned, as much realistically as possible, and a detailed 3D visual environment where each monument (or part of it) is represented through GIS technologies with multiple informative layers.</p> <p>Both scenarios make use of inquiring instruments, in the form of SQL queries that can even be created by the user, that allow to investigate all the available informative layers related to both monuments and territory and their relationships.</p> <p>At the same time it is possible to save each "investigation experience" in order to make it available for further research purposes or archive documentation.</p> <p>This is mostly a web based application as it is intended to be opened to a wide range of users that will hopefully carry their own contribute to grow a national database of very rich and detailed information about the state of conservation of Italian historical heritage and monuments.</p> <p>The concept behind this application involves complete integration of very heterogeneous data type, such as numerical, geometrical and iconographical information over an exact geometrical model. Such integration is aimed to reach a complete management of all the relevant processes: evaluation of the monument conservation status, definition of the necessary restoration project, monitoring over the restoration process and maintenance of the monument afterwards.</p> <p>Information is organized on a multiscalar system, ranging from territory scale, to the monument and its parts local scale.</p>



This application is aimed to private or institutional users who are interested in the cultural and historical heritage, on national scale.

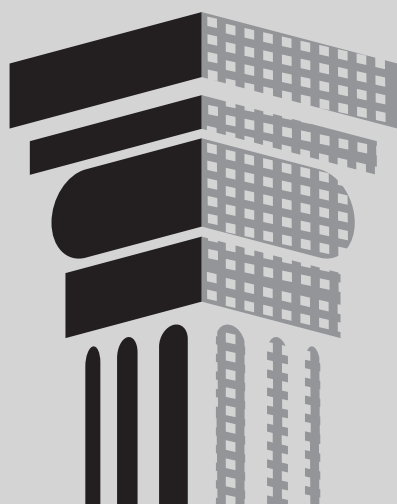
Among the features, there are tools for calculating areas, perimeters and surfaces, data required for technical procedures and documentation.

<b>Innovative aspects</b>	3D modelling techniques applied to GIS technology to increase the ease and deepness of investigation level. Using multilayer GIS-style technology to study 3D objects.
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Web based distribution to maximize the number of possible users</li> <li>• Centralized national database</li> <li>• Java technology to maximize compatibility of the application</li> <li>• Integration among heterogeneous data over an exact geometrical model</li> <li>• Wide range of tools for technical computing</li> <li>• Aimed to a wide range of users both private and institutional</li> </ul>
<b>Current state of development</b>	Development phase laboratory tested. ARKIS CuBe is the further development of ARKIS-Architecture Recovery Knowledge Information System (2D GIS) and of the ARKIS-NET. Both softwares are protected by copyright.
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Information processing, information systems.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry; research organisation; company
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

TECHA

4

## Sustainable technologies for cultural heritage



2008

## Technology Offer TO\_PL\_22360

[ ITALY ]

Institute for Mechanised Construction and Rock Mining  
(IMBIGS)

www.imbigs.org.pl

<b>Sector</b>	Research and development in the field of mechanical engineering and safety.
<b>Activities</b>	Development and validation of engineering equipments.
<b>Contact</b>	

<b>Title</b>	SILICA SOL FROM WASTE CHALCEDONITE USED IN ORDER TO IMPROVE THE CONSTRUCTION PRODUCTS' PROPERTIES
<b>Abstract</b>	A Polish research institute has developed a technology of producing silica sol used to improve the construction products' properties. It can be used for protection of construction natural stone and concrete from degradation during exploitation, improvement of their physicochemical and endurance properties and renovation of already built constructions, especially historic ones. The partners for technical coop., joint venture or manufacturing agreement or further product development are sought.
<b>Detailed description</b>	<p>A Polish research institute working in the field of rock mining and building materials has developed a technology of producing silica sol from waste chalcedonite used in order to improve the construction products' properties. It is in the form of water colloidal silica dispersion. Impregnation process is based on transformation within impregnated part structure - silica sol enters inside the part and transforms itself into silica gel. The gelation is irreversible – creates artificial binding. Results of silica impregnation are filling and sealing of micro-cracks (gaps inside the structure) through constant silica compounds causing:</p> <ul style="list-style-type: none"> <li>• decreasing absorbability,</li> <li>• limiting CO<sub>2</sub> and aggressive gases insertion inside the structure,</li> <li>• increase of mechanical strength of impregnated parts.</li> </ul> <p>Silica compounds, build-in inside the stone structure do not completely plug pores, allowing to remove water excess from the interior part of the stone.</p> <p>Final effects of the impregnant's using are:</p> <ul style="list-style-type: none"> <li>• decreasing absorbability of about 10-20%,</li> <li>• increase of compressive strength of about 70%,</li> <li>• increase of chemical resistance to "acid rains" and CO<sub>2</sub> influence,</li> <li>• limiting capillary water migration and accumulation of salts,</li> <li>• limiting the increase of micro-organisms (fungus, moss, alga, lichens),</li> </ul>

	<ul style="list-style-type: none"> <li>• lack of possibility to rinse out the introduced impregnant from the interior of the material.</li> </ul> <p>Costs of impregnation of 1m<sup>2</sup> of the building element is about 60-90 cents.</p>
<b>Innovative aspects</b>	A distinctive feature of the new method is that a specific type of crystallographic silica is used as a raw material to produce the impregnant- occurring in the natural deposits of chalcedonite - amorphous silica.
<b>Main advantages</b>	<p>Limiting investment, production and exploitation costs:</p> <ul style="list-style-type: none"> <li>• extending life of materials, parts and constructions</li> <li>• limiting the construction costs</li> <li>• simple and cheap technology of impregnant production and usage,</li> <li>• less machines and equipment,</li> <li>• limiting energy consumption for eco-impregnant production,</li> <li>• cheap waste initial raw material,</li> <li>• possibility of common usage, base for „anti-graffiti” preparation.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) granted.
<b>Application domains</b>	Construction technology; Materials technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy or research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC Central Poland

## Technology Offer TO\_PL\_21641

[ ITALY ]

SUPO Cerber Sp. zo.o.

www.supo.com.pl

<b>Sector</b>	Fire fighting security systems.
<b>Activities</b>	Services in the range of complex fire-protections.
<b>Contact</b>	

<b>Title</b>	AUTOMATIC WATER FOG SYSTEM FOR FIRE EXTINGUISHING
<b>Abstract</b>	A Polish medium sized company developed a fully automatic fire protection system especially designated for wooden structures in historical buildings. The company is interested in commercial agreement with technical assistance.
<b>Detailed description</b>	<p>The company developed a fire fighting system designed to extinguish class A fires inside and outside of wooden structures in historical buildings. It works as fully automatic set and is based on the fog effect.</p> <p>In the system wide water dispersion is obtained with relatively low pressures between 4 and 10 bar. Small drops of water can easily evaporate and prevent fire areas being flooded. The evaporating water can enlarge space even 1700 times, enabling quick change into vapor, big heat absorption and large cooling effect. As a result the fragile wooden structures could suffer a minimum of fire and water damage.</p> <p>The system is fully automatic and can work with other fire detecting systems.</p> <p>System is highly composed of four parts:</p> <ul style="list-style-type: none"> <li>• fire detection</li> <li>• control</li> <li>• water supply and pneumatics</li> <li>• pipes and low pressure nozzles.</li> </ul>
<b>Innovative aspects</b>	Fully automated fire protection system that enables both early detection and fast extinguishing of fire (app. 12 seconds).
<b>Main advantages</b>	<p>The low pressure used in the system can lower the cost of installation.</p> <p>The fog system secures the wooden structures that usually suffer damage from the water stream.</p> <p>Fully automatic system enables early detection of fire and as a result minimum damage.</p>

	The system enables the most efficient use of water.
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Patent(s) applied for Patent application pending.
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Owners and administrators of wooden buildings.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC South Poland

## Technology Offer TO\_IT\_21779

[ ITALY ]

## Xewer Srl

www.xewer.com

<b>Sector</b>	Energy.
<b>Activities</b>	Design and project of photovoltaic systems.
<b>Contact</b>	

<b>Title</b>	MICRO PHOTOVOLTAIC SYSTEM FOR SMALL AND MEDIUM ELECTRIC USES (SUN SPARK)
<b>Abstract</b>	Sun Spark is a compact dimensions and easy installation plant for production of electric power from solar energy.
<b>Detailed description</b>	<p>The system consists of two units:</p> <ul style="list-style-type: none"> <li>• external unit composed by: photovoltaic panel, INOX steal structure and a 3D joint for a better guideline of the panel;</li> <li>• indoor unit of compact dimensions to install indoor and composed by storage cells, inverter and panel of control.</li> </ul>
<b>Innovative aspects</b>	<p>The system basic version is able to provide a power of 420/800W which is an optimal measure for small and medium electric uses such as buildings, offices and rooms. Internal 12V accumulators provide a good autonomy even in solar radiation absence.</p> <ul style="list-style-type: none"> <li>• Photovoltaic Panel in Silicon polycrystalline or monocrystalline</li> <li>• Compact dimensions: H 475 x P 185 x L 275 mm for internal furniture</li> <li>• Easy to install</li> <li>• AC output voltage: 225V, 50 Hz</li> <li>• Output power: 420/800W (750/1200W)</li> <li>• Internal accumulators by 12V (Pb/Gel Long Life 5 Year)</li> <li>• Checked autonomy in bad situations: 4h at 100W or 9h at 40W for the system of 800Wp (the system autonomy improves with the use of monitor PC, television set, hi-fi...)</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Sun Spark can be used whenever it is not possible to have electric power from power grid.</li> <li>• Easy to install</li> <li>• Checked autonomy in bad situations.</li> </ul>



Current state of development	
Intellectual Property Rights	Secret know-how.
Application domains	Construction technology.
Collaboration details	
Type of partner sought	Distributors, manufacturers and assemblers interested in all kinds of devices that require an autonomous and clean source of energy. Middle-sized.
Tasks to be performed by the partner sought	
IRC Partner	IRC CIRCE

## Technology Offer TO\_IT\_21781

[ ITALY ]

## Xewer Srl

www.xewer.com

<b>Sector</b>	Energy.
<b>Activities</b>	Design and project of photovoltaic systems.
<b>Contact</b>	

<b>Title</b>	ELECTRIC GENERATION SYSTEMS WITH ACCUMULATION FUELLED BY PHOTOVOLTAIC OR AEOLIAN ENERGY
<b>Abstract</b>	A firm located in Rome specialised in research, planning and implementation of electrical energy generation systems fuelled by a renewable source has created a line of electrical generators with accumulation. These generators are photovoltaic but also aeolian, fixed or portable, highly innovative, adaptable to every use. A commercial agreement with technical assistance is sought.
<b>Detailed description</b>	<p>A firm located in Rome is experienced in the field of energy production with no environmental impact. Through its experience in research, planning and implementation of electrical energy generation systems fuelled by a renewable source, the firm has realised a line of electrical generators, fixed or portable, highly innovative and versatile. Every product can be adapted to specific customers' requirements.</p> <p>The system is mainly constituted by a unit, created with highly innovative configuration and compounds, able to accumulate for successive uses the energy produced by a photovoltaic or aeolian generator.</p> <p>The fields of application (fixed or not) are wide: everywhere an autonomous source of electricity is necessary, even in hostile or closed environments. In particular this system can substitute in every part the traditional gasoline-fuelled electrical generators producing electricity with zero cost and emissions.</p> <p>Main technical features:</p> <ul style="list-style-type: none"> <li>• Power distributed: from few to 3.500 Watts (even more if requested)</li> <li>• Accumulated energy: depends on requirements</li> <li>• Tension: 220/110 V AC; 12/24 V DC (40A)</li> <li>• Possibility of recharge by mains and/or car.</li> </ul>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Electrical energy produced from renewable energy</li> <li>• Zero emissions (for uses in closed environments)</li> </ul>

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	<ul style="list-style-type: none"> <li>• Zero maintenance (particularly expensive for traditional gasoline-fuelled generators)</li> <li>• Long-life system (extendible with substitution of the internal accumulator)</li> <li>• Very easy to use - Electrical energy production with zero costs</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• No maintenance (particularly onerous for traditional gasoline-fuelled generators)</li> <li>• Long-life usage of the system (extendible with substitution of the internal accumulator)</li> <li>• Transportable system</li> <li>• Silent</li> <li>• Very easy to use.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Secret know-how.
<b>Application domains</b>	Construction technology.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Distributors, manufacturers and assemblers interested in all kinds of devices that require an autonomous and clean source of energy. Middle-sized.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_26492

[ ITALY ]

CNR, Istituto per le Tecnologie Applicate ai Beni Culturali (ITABC)

www.itabc.cnr.it

<b>Sector</b>	Research and studies in the field of technologies applied to cultural heritage.
<b>Activities</b>	Development of new technologies for cultural heritage conservation and promotion.
<b>Contact</b>	

**Title** SUSTAINABLE INTEGRATED TECHNOLOGIES FOR DOCUMENTATION AND CONSERVATION OF THE BUILT HERITAGE

**Abstract** Built Heritage Sustainable Technologies Lab (BHeSTLab) is an ITABC laboratory engaged in research, technological advancement and training in the field of the development and application of new diagnostic and surveying techniques as well as of sustainable design solutions and strategies for the restoration and readaptation of historic buildings. BHLab has developed a Protocol of diagnostic design intervention that represents an operating model for conservation designers for Superintendencies, research institutes and architectural restoration designers. This model for the documentation and conservation of the built heritage is the result of an approach involving multidisciplinary analysis and integrated design aimed at the restoration and the energy and functional recovery of (monumental and non monumental) historic buildings with special reference to sustainable solutions respecting landscape, environmental, cultural, economic and social values.

**Detailed description** BHeST Lab promotes the application of innovative methods for conservation interventions and the upgrading of historical buildings and urban centres. This it does by tackling the themes of intended use, energy saving, installed plant and equipment, functional solutions, in a framework of general compatibility with the existing heritage and the surrounding environment. The Laboratory offers its specific multidisciplinary knowhow acquired over a period of 20 years for the management of the diagnostic, fact-finding and design process aimed at conserving the architectural heritage by means of efficient solutions favoring technology transfer and innovative and eco-sustainable methods. In support of this process, the laboratory has developed:

- integrated diagnostic analysis systems having a low impact on the monument and the environment;
- a diagnostic design procedure for the integral coordination of chemical and physical analysis methods and intervention decision-making processes;

TECHA

- experimental procedures to evaluate materials and building techniques as a function of alteration phenomena;
- technologies and tools for technological adaptation, upgrading and energy efficiency and the use of renewable resources for the built heritage
- a multicriteria analysis application tool for selecting technological solutions for the restoration of buildings of substantial historical and artistic importance and for verifying the feasibility and compatibility of new energy saving systems and alternative energy sources in ancient and historical centre buildings.
- specific ICT tool (3DGis ) for the management of all the information regarding the monument or architectural complex, including data referring to the documentation, restoration, maintenance and supervisory interventions;
- guidelines for the integration of innovative energy efficient products and components (solar, insulation, photovoltaic, glass, ventilation) according the rules of building energy efficiency and the prescriptions of the Restoration Charts.

Furthermore, the laboratory is in a position to offer consultancy and to carry out:

- integrated instrumental and direct surveys of complex monumental architectures (geometric, photogrammetric, material surveys, analysis of cracks, subsidence and degradation, survey and analysis of distributive, functional, compositive systems, as well as of building techniques and technological plant)
- solid 3D modeling, photographic rendering and animation of virtual models
- historical research and stratigraphic analysis to document the evolutionary phases of the monument.
- projects of consolidation and antiseismic enhancement, energy rehabilitation, maintenance plans, requalification and functional upgrading of historic monuments and buildings

The Laboratory has several modes of operation: by project, developing the advancement of knowledge by means of multiyear integrated projects focused on individual monuments or groups of buildings representing different architectural types; setting up multidisciplinary groups, also at the international level, in order to implement these projects; seeking financial support in the form of national and international funding.

The most significant projects carried out in recent years include: study and restoration of the Bedestan in Nicosia, the former Church of St Nicholas, on Cyprus (UNDP); Research project Cultural heritage for all, aimed at allowing access to museum structures by disabled persons (MIUR); Project Socrates applied to the re-adaptation of the Zena Castle in Piacenza; Project Securba on the topic of energy saving in historical centres (European Programme IEE, CIP).

#### Innovative aspects

For the first time in the restoration sector attention is focused on all the resources, both cultural and environmental, in a holistic approach that guarantees the respect of the monument's cultural values and the social values of the environment.

Specific innovations include:

- energy saving solutions for a historic building that are satisfactorily integrated with pre-existing ones are significantly beneficial to the environment and the economy of resources, which may not be immediately obvious.

	<ul style="list-style-type: none"> <li>• a tool to assist decision-making, with integrated software, useful for designers, restorers, administrators and heritage safeguarding professionals for evaluating the aesthetic impact and the capacity of integration of renewable energy systems and energy saving on monuments and contexts of value.</li> </ul>
<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• competitive advantage of virtuous restoration processes based on principles that respect also environmental quality and residential well-being by testing solutions and technologies allowing a sustainable use of resources</li> <li>• the added value of energy saved in full respect of the monument's aesthetic appeal and history gives this method the edge over similar more traditional methods</li> <li>• the possibility, also in the restoration sector, of obtaining quality and energy efficiency certification, and thus also tax benefits</li> </ul>
<b>Current state of development</b>	The technology is in an advanced stage of development.
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	Construction technology; Materials technology.
<b>Collaboration details</b>	Technical co-operation; Joint venture agreement, Financial resources.
<b>Type of partner sought</b>	The Laboratory is interested in activating scientific and technical cooperation by means of partnership, consortia and associations, collaboration among institutions, entrepreneurs and local actors in order to boost knowledge, skills and innovative capacities in the processes of conserving and upgrading the built heritage.
<b>Tasks to be performed by the partner sought</b>	Development and enhancement of decision-making support systems Developers of innovative sustainable technologies for energy saving and renewable energy (industry, academic or research organisation) Cooperation for implementation of web based 3D GIS for smart data integration in the 'sustainable restoration' process.
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_22379

[ ITALY ]

Luigi Fioramanti Architettura

www.lfarchitettura.it

<b>Sector</b>	Solar architecture and urban planning.
<b>Activities</b>	Large scale urban planning; Public and private architecture; Internal design and urban retail; conservation and re-use projects for historical buildings; Construction managing and security supervision.
<b>Contact</b>	

<b>Title</b>	PROFESSIONAL SERVICES IN FAVOUR OF SUSTAINABLE ARCHITECTURAL PLANNING
<b>Abstract</b>	Studio's staff is active in the field of architectural planning, including sustainable interventions for the conservation and re-use of historical buildings, by means of bio-climate analysis and innovative environmentally-accepted technologies.
<b>Detailed description</b>	Studio's approach towards architecture aims at giving a full and complex response to the clients' needs, placing at the top of the list the project's sustainability (from local to urban scale), using appropriate technologies and ecological materials, searching for the most accurate and respectful solutions for the environment and its safeguard. Sustainability is therefore a main element in the process of adopting architectural solutions (technological, typological and formal): from building's locating to the use of low pollution materials; from the use of renewable energy sources to the object's formal criteria.
<b>Innovative aspects</b>	Studio's interventions are based on the research for a new mixture between architecture and environmental resources.
<b>Main advantages</b>	
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	
<b>Application domains</b>	
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Industry, academy, research organisation.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC CIRCE

Know-how/expertise KHE\_IT\_22261

[ ITALY ]

Università degli studi di Napoli Federico II,  
Dipartimento di Progettazione Urbana e di Urbanistica

www.dpuu.it

<b>Sector</b>	Research and higher education on urban design and planning.
<b>Activities</b>	Research on new technologies for buildings: life cycle of buildings, impact reduction during the construction phase through the use of dematerialized technologies, light structures and eco-efficient products.
<b>Contact</b>	

<b>Title</b>	DECISION SUPPORT AND TOOLS FOR ECO-EFFICIENCY IN REHABILITATION WORKS USING FIBER REINFORCED MATERIALS TECHNOLOGIES
<b>Abstract</b>	An Italian research group offer its know-how in: decision support in R&D and production activities for eco-efficiency in rehabilitation works using fiber reinforced materials technologies; test/verification finalized to evaluate technological aspects; development of Guidelines for the appropriate integration of fiber reinforced materials in architectural heritage rehabilitation. Technical and manufacturing agreement, as well as financial resources, are sought.
<b>Detailed description</b>	<ul style="list-style-type: none"> <li>• Decision support in R&amp;D and production activities. Such activities are related to the improvement of fiber reinforced materials existing technologies associated to functional, technological and environmental characteristics, like transpirability, reversibility, integrability, aspect and compatibility.</li> <li>• Test on performances of fiber reinforced materials applications. Performances test/verification are finalized to evaluate technological aspects (durability, transpirability, aspect, etc.) showing the added value in terms of eco-efficiency in production, logistic and technical application in buildings.</li> <li>• Guidelines for the appropriate integration of fiber reinforced materials in architectural heritage rehabilitation works. Guidelines are based on indicators systems for an appropriate integration of fiber reinforced materials able to show the aptitude to preserve the identity of cultural and constructive heritage during and after the rehabilitation works.</li> </ul>
<b>Innovative aspects</b>	<ul style="list-style-type: none"> <li>• Decision support in R&amp;D activities can develop lean production lines of innovative technologies.</li> <li>• Test/verification on eco-efficiency and mechanical performances in interventions is part of the supply chain of building operators finalized to assess the application in structural retrofit.</li> <li>• Guidelines can be reproducible and transferable in different contexts for building product companies, designers, contractors or Public Administration.</li> </ul>



<b>Main advantages</b>	<ul style="list-style-type: none"> <li>• Decision support in R&amp;D activities can actuate processes of industrial competitiveness in specific sectors of a growing market, integrating the innovation issues with rehabilitation works finalized to the reduction of resources consumption and low-impact interventions.</li> <li>• Test/verification on eco-efficiency and mechanical performances in interventions – particularly for FRM based on cementitious matrix – improves the market of fibre reinforced materials and supporting the development of national industries.</li> <li>• Guidelines are finalized to control the compatibility and ways of use of fiber reinforced materials in architectural heritage finalized to a correct integration, according to the prescriptions of normative.</li> </ul>
<b>Current state of development</b>	
<b>Intellectual Property Rights</b>	Exclusive rights.
<b>Application domains</b>	Construction technology; Materials technology The use of decision support and tools for eco-efficiency in rehabilitation works develops the market of fiber reinforced materials technologies, improving industries competitiveness.
<b>Collaboration details</b>	
<b>Type of partner sought</b>	Building components industry, Technology departments or Universities.
<b>Tasks to be performed by the partner sought</b>	
<b>IRC Partner</b>	IRC IRIDE

EU RTD Result EURTD\_IT\_22380

[ ITALY ]

**“Sapienza” Università di Roma, Dipartimento di Architettura (DiAR), Osservatorio sul moderno a Roma**

w3.uniroma1.it/osmar

<b>Sector</b>	Research and higher education on architecture.
<b>Activities</b>	Restoration, re-use, modern architecture projects.
<b>Contact</b>	

<b>Title</b>	TERRITORY SUSTAINABLE DEVELOPMENT: URBAN PROJECT FOR AN ENVIRONMENTALLY-ACCEPTED REGENERATION/REUSE OF MODERN AND CONTEMPORARY ARCHITECTURE
<b>Abstract</b>	The Osservatorio promotes a field research based on the use of environmentally-accepted technologies and on the experimentation of innovative strategical approaches in the recuperation/reuse of modern and contemporary architecture.
<b>Detailed description</b>	<p>In particular, the project aims at creating a multidisciplinary network among all those researchers (from both the technical/scientific and humanistic fields) involved in the development and transfer of innovation to a sustainable recuperation of modern architecture. Putting their skills together, researchers can indeed optimise their results.</p> <p>The project also includes the compilation of guidelines preparatory to the formulation of common rules for the environmentally-accepted restoration and recuperation of architecture, with a view to the use of primary sources and to the improvement of buildings' energy efficiency, while promoting initiatives to reduce energy consumption and to enhance the use of renewable sources.</p>
<b>Innovative aspects</b>	Osservatorio's activities are based on an innovative approach to the architecture recuperation; an approach that, starting from the environmental analysis, aims at promoting an environmentally – socially and economically accepted intervention in buildings recuperation.
<b>Main advantages</b>	<p>Thanks to the creation of a multidisciplinary network, all researchers with different skills can work together for a sustainable recuperation of modern architecture, optimizing their results.</p> <p>Skills involved cover manifold fields of intervention:</p> <ul style="list-style-type: none"> <li>• architectural, environmental and territory planning</li> <li>• architecture, arts and language history</li> <li>• restoration</li> </ul>

	<ul style="list-style-type: none"><li>• energy engineering</li><li>• impact assessment on environment and economy</li><li>• materials and intervention techniques</li></ul>
Current state of development	
Intellectual Property Rights	
Application domains	Construction technology.
Collaboration details	
Type of partner sought	Industry, academy, research organisation.
Tasks to be performed by the partner sought	
IRC Partner	IRC CIRCE

