European Cooperation
in Science and Technology
- COST -

Secretariat

Brussels, 4 July 2012

COST 4145/12

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action TD1201: Colour and Space in Cultural Heritage (COSCH)

Delegations will find attached the Memorandum of Understanding for COST Action as approved by the COST Committee of Senior Officials (CSO) at its 185th meeting on 6 June 2012.

MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as

COST Action TD1201
COSCH - COLOUR AND SPACE IN CULTURAL HERITAGE

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 4154/11 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to realize an interdisciplinary cooperation, on a concerted European level, to prepare a novel, reliable, independent and global knowledge base facilitating the use of today's and future optical measuring techniques for the documentation of European heritage.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 64 million in 2012 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter V of the document referred to in Point 1 above.

———————————

A. ABSTRACT AND KEYWORDS

True, precise and complete documentation of artefacts is essential for conservation and preservation of our cultural heritage (CH). By ensuring access to the best possible documentation of artefacts this Action is contributing to the enhanced understanding of material CH and helps its long-term preservation. Europe is responsible for ensuring that his heritage is passed on to future generations.

Documentation of CH involves researchers, scientists and professionals from multiple disciplines and industries. There is a need to promote research, development and application of non-contact optical measurement techniques (spectral and spatial) – adapted to the needs of heritage documentation – on a concerted European level, in order to protect, preserve, analyse understand, model, virtually reproduce, document and publish important CH in Europe and beyond.

Research in this field typically relies on nationally-funded projects with little interaction between stakeholders. This Action will provide a stimulating framework for articulating and clarifying problems, sharing solutions and skills, standardising methodologies and protocols, encouraging a common understanding, widening applications and dissemination. The Action will foster open standards for state-of-the-art documentation of CH. It will simplify the usage of high-resolution optical techniques in CH and define good practice and stimulate research.

Keywords: Cultural Heritage documentation, optical technologies, 3D scanning, multispectral imaging, colour.

B. BACKGROUND

B.1 General background

"The European Union Treaty (Article 167) specifies that safeguarding moveable and immoveable cultural heritage of European significance must be treated as a priority for the EU and is the legal basis for protection initiatives including research on cultural heritage" (source: http://ec.europa.eu/research/environment/index_en.cfm?pg=ltural). UNESCO defines the protection of CH as "an expression of living culture" that contributes to the peaceful development of societies (source: http://www.unesco.org/en/cultural-diversity/heritage/).

While there are many different expressions of CH, including natural and intangible heritage, in the context of this Action the term 'cultural heritage' encompasses two main categories: movable (paintings, sculptures, coins, etc.) and immovable CH (buildings, monuments, archaeological sites, etc.).

Considering the importance of effective protection and preservation of CH it is paramount to scan, document, analyse, understand, model, virtually reconstruct and visualise/publish CH objects, in particular to

- accurately record artefacts at both micro and nano scales – to include material properties such as form, colour and texture – for today's use and future generations;
- make the resulting e-documentation accessible globally to specialists and the general public;
- monitor the condition of objects for enhanced preventive conservation;
- enhance the knowledge base for art-historical analysis and other scholarly activities;
- support routine applications with specialist know-how and state-of-the-art equipment.

While the level of European technical competence in the precise documentation of spatial or spectral characteristics of surfaces is high – mainly driven by industrial interests – no common standards concerning three-dimensional (3D) shape and colour exist for precise documentation of CH objects. Despite a general understanding of spatial resolution and accuracy of such documentation, and its potential, within the CH community, there is limited awareness that standards could be improved by direct cooperation within the technical sector. It is, therefore, difficult for CH professionals to use these technologies efficiently or even to define requirements. This COST Action will bridge the gap between the CH community and computer scientists and computer engineers by fostering information exchange and providing guidelines for using optical technologies for CH documentation.

Studying and researching CH is mainly achieved through nationally-funded projects. Such projects are usually object-dependent and application-driven, leading to unshared and non-standardised results. This COST Action will constitute an optimal framework to overcome those limitations by providing an interdisciplinary forum for scientists and technicians (developers of measurement systems, software and technologies for a wide range of applications, as well as material scientists, physicists and chemists) and the heritage specialists (art historians, conservators, archaeologists, curators, etc.), to facilitate the exchange of interests, needs, capabilities, constraints, limits and perspectives.

B.2 Current state of knowledge

CH studies employ many techniques. Some of them, like RAMAN and chemical analysis, are destructive because of sample extraction that is needed from the object of study. Such techniques provide valuable information about material composition, but the analysis results are local and often invasive. In opposite to that are the advantages of non-destructive techniques (typically non-contact and imaging-based) that are becoming ever faster, precise, affordable and wide ranging.

The main state-of-the art techniques available for non-contact CH documentation can be summarised as follows:

Digital photography provides valuable visible information, but is subjective and cannot be directly used in context of other acquisitions owing to the lack of unique and known scale.

Infrared reflectography based on a higher transmission of infrared light is useful for detecting the underdrawing in paintings. Carbon black pigments used by the artist absorb infrared light, whereas opaque pigments such as lead white are transparent with infrared light.

Traditional colorimetry and spectrophotometry provide accurate information on the optical properties (such as the reflectance) and colour coordinates of the samples analysed.

Imaging systems for specialist analyses, such as computer tomography, allow making use of various non-optical parts of the electromagnetic spectrum. Depending on design and structure of such systems, they enable examination below the surface and through the object.

Colour, multi- and hyperspectral imaging usually relies on three or more acquisition channels. Images are captured with spectral (or at least colour) information pixel by pixel, and relatively high precision

Structured-light-based techniques for 3D visualisation of artefacts rely on the projection of highly contrasted patterns in order to map the 3D profile of the object. The resulting spatial models may be easily combined with colour images of the object to give a 3D rendering of real appearance of the object.

Passive 3D imaging techniques are complementary techniques to structured light. They use the existing light to collect spatial and visual data which leads to lower quality of the spatial model.

3D laser scanning techniques use the triangulation principle and are able to scan the object of interest using different strategies. Outcome is generally a vast point cloud allowing accurate 3D rendering.

Integrated multi-imaging systems are complex instruments and often a technological compromise. They need to support different technological concepts in order to responds to various wavelengths and to perform dimensional imaging.

However, there are still no well-established and commonly accepted standards for precise, non-contact documentation of CH objects that would implement and combine the above-mentioned techniques. Therefore the Action will address these challenges and will propose general recommendations and provide the CH community with guidelines for the most common applications. The CH partners will ensure the format of proposed guidelines suits the needs of their community.

There are still very few integrated **hardware solutions** for measurement of shape and multispectral colour in a single process. Present standard is to use independent hardware solutions from the above list and to integrate the data collected. There is a lack of automated **software solutions** for analysis of large data sets or integrated solutions for monitoring the condition of CH through virtual models. Both these aspects will be addressed in this Action.

As a result of the 3D and/or spectral acquisition processes, large amounts of data are collected. Such data need to be efficiently stored and made rapidly and adaptively retrievable. All data should be optimally processed, preserved, and made available to heritage researchers.

In conclusion, the design of adapted systems must address many issues including functionality, quality control and preservation of information, semantic multilingual indexing and access, and heterogeneity at various levels. The majority of data are visual and three-dimensional.

Consequently, the limitations imposed by the nature of two-dimensional formats put significant constraints to our perception of geographical space and context. There is always a problem of effectively presenting spatial and other 3D data to scholars and the general public.

B.3 Reasons for the Action

Material heritage of Europe consists of countless and diverse objects. Some artefacts are exposed to negative influences both natural and artificial and are therefore under threat. Proper documentation and conservation of such objects is the responsibility of society; its aim is to protect and preserve them for future generations.

The major benefit of this Action will be its work on technical standard for precise (in terms of spatial resolution and accuracy) documentation of cultural heritage objects. Such standards concerning 3D shape and colour are hitherto missing. Furthermore there is no common standard for art conservators and other users, how to make use of such data. The Action aims at the foundation of a structure that will become a reference for technical questions related to cultural heritage studies and 3D reproduction.

Technological advancements are needed in order to account, as fully as possible, for special characteristics of artefacts in terms of materials, ageing processes, sensitivity to physical, chemical or electromagnetic influences. Optical documentation technologies need to be adapted to those characteristics, which is only possible through interdisciplinary exchange of information, expertise and technology, which will be provided by the COST framework. Therefore this Action does not only address societal needs, but also it aims at technological advance in terms of three-dimensional and (multi) spectral documentation of CH objects. Within this COST Action, experts in information systems and databases will be important partners responsible for the efficiency of the processes of data storage and restitution.

Through this coordinated Action scientific progress will be made, in particular concerning spatio-spectral acquisition, processing, rendering and quality evaluation for heritage documentation. Arts and Humanities researchers, museum professionals and educators will benefit from accurate records of artefacts, once access to these is made available to them, while scientists developing optical recording techniques will benefit from the guidance of standards and principles widely applied in the cultural sector, such as the UNESCO and ICOMOS charters on documentation and preservation of heritage and digital heritage, and the London Charter for 3D Visualisation of Cultural Heritage. By this Action the general public will benefit from access to virtual artefacts of high specification, based on optimal usage of combined spectral and spatial documentation.

This interdisciplinary Action will bridge the humanities with the optical and information sciences. Material sciences are also involved owing to a strong connection between the surface material of heritage objects, their visual appearance and techniques suitable for optical documentation. Also the involvement of chemists will be needed owing to the dependence of spectral reflectance on the chemical composition of an object; this will be of great interest when investigating ageing processes. Therefore the relevant COST domains are

- Individuals, Societies, Culture and Health (ISCH)
- Information and Communication Technologies (ICT)
- Materials, Physics and Nanosciences (MPNS) and
- Chemistry and Molecular Sciences and Technologies (CMST).

Collaboration between the cultural sector and scientists is paramount to ensure mutual understanding of the requirements of CH documentation and how technology should develop to meet these requirements. Humanities specialists will benefit from learning about the state-of-the-art techniques for precision spectral and spatial documentation in order to explore the huge potential of non-contact methods in their fields. Scientists need to learn about the requirements for documentation and analysis of valuable heritage objects, such as paintings, sculptures, buildings, etc. in order to optimise current methods and ensure that future developments go in the right direction. Material scientists, physicists and chemists will provide the theoretical, scientific background in order to link optical data with material properties. This requires effective exchange of information and mutual understanding, which can only be achieved through exposure to and discussion of interdisciplinary research.

B.4 Complementarity with other research programmes

There are a number of current research activities in the European research framework that are relevant to COSCH. This Action will draw on their findings, complement them and, at the same time, avoid duplication of research activities.

EPOCH (www.epoch-net.org) is a network of about a hundred European cultural institutions joining their efforts to improve the quality and effectiveness of the use of ICT for CH. An EPOCH representative offered to participate in COSCH.

Activities of COSCH are complimentary to some of EPOCH's interests by offering a much deeper level of specialist investigation.

CHARISMA (www.charismaproject.eu) is an EU-funded integrating activity project carried out in the FP7 Capacities Specific Programme "Research Infrastructures". The project provides transnational access to scientific instrumentations, knowledge and sites allowing scientists, conservators, restorers and curators to enhance their research at the field forefront.

It completes COSCH activities as it might react on results and recommendations from this Action regarding the proposition of adequate instrumentation.

3D-COFORM (www.3d-coform.eu) is an EU FP7 project that seeks to advance the state-of-the-art 3D digitisation and make 3D documentation an everyday practical choice for digital documentation within the cultural heritage sector. A 3D-COFORM participant is included in the COSCH Action.

However, 3D-Coform limits itself to 3D modelling and does not address colorimetry or spectral acquisition, making the activities of the COST Action highly complementary.

AUTHENTICO (www.authentico.org) focuses on the establishment of scientifically and technically-based international standards in the application field of the research in the innovative integration of non-invasive techniques for objective authentication of metal artefacts (utilitarian and ornamental), based on material composition and description of manufacturing techniques.

It therefore addresses a small part of COSCH Action. Nevertheless information exchange would be useful to support some analytical aspects within COSCH.

Relevant **COST Actions**, that will be reviewed in the course of the Action COSCH, include „WoodCultHer“ (IE0601), „Non-destructive analysis and testing of museum objects“ (MPNS G8) and „EnviArt“ (CMST D42).

C. OBJECTIVES AND BENEFITS

C.1 Aim

The main objective of this COST Action will be to promote research, development and application of optical measurement techniques - adapted to the needs of heritage documentation - based on an interdisciplinary cooperation, on a concerted European level and to offer a novel and reliable, independent and global knowledge base facilitating the use of today's and future optical measuring techniques to support the documentation of European heritage.

C.2 Objectives

The secondary objectives of this Action are:

1. The development of guidelines for CH authorities concerning the specification of minimal spatial resolution/uncertainty values for a selected set of materials (including its finishing techniques) depending on goal of documentation, e.g. visualisation and condition assessment.
2. (a) To deepen knowledge of the potential, output, constraints, preconditions and practical aspects of precise spectral and spatial instruments;
   (b) To research and publish case-studies in the application of the newest spectral and spatial technologies;
   (c) To offer a critical review of current integration of state-of-the-art spectral and spatial optical technologies into documentation of CH objects;
   (d) To lay a foundation for an optimised and adapted use of spectral and spatial techniques by CH authorities.
3. Analysis of mutual benefits from spectral or spatial sensing techniques and the added value of combined usages.
4. (a) Formation of a sustainable European network of researchers, solution providers, end-users and industrial partners in the field of optical measurement techniques for CH documentation, preservation and reconstruction;
   (b) The stimulation of interdisciplinary research projects on a national, bilateral and European level;
   (c) Identification and further development of knowledge centres within the partner network hosting educational services and research support;
   (d) The promotion of mobility among early-stage researchers.

C.3 How networking within the Action will yield the objectives?

The Action will provide the preconditions that stimulate close cooperation, information exchange, as well as a stable base for a fruitful knowledge exchange and coordination of research activities. The networking aspect of COST Actions is an important precondition for progress and success in such an interdisciplinary field with actors from the Arts and Humanities and technologically oriented scientists, with users and developers, with public institutions and profit-oriented enterprises.

Institutions with specialist expertise and instruments for certain types of spatial and/or spectral object documentation will share their knowledge by hosting Training Schools (TSs) and Short-Term Scientific Mission (STSMs) for museums and other institutions dedicated to preservation of CH objects.

C.4 Potential impact of the Action

Actively participating institutions will immediately benefit scientifically and academically, as well as financially due to the access to published results. Access to this new knowledge will also benefit the interdisciplinary community of researchers, users and manufacturers at large. The impact is anticipated from

- (a) an enhanced understanding of the benefits of optical documentation systems in CH;
  (b) a wider adoption of optical technology customised to suit the needs of conservators and scientists in CH;
  (c) a standardisation of methodologies resulting in simplification and enhanced spatio-spectral documentation;

- (a) the enhancement of the quality of research and its publications;
  (b) the dissemination efforts, which will result in enhanced communication between CH and engineering communities;

- (a) the interdisciplinary nature of the programme, which will give the end-user access to expensive instrumentation and bench tests, deepening the understanding of user requirements amongst technology providers;
  (b) knowledge exchange, which should result in a more cost-effective use of individual national funds supporting the research activities of this Action;

- (a) newly established collaborations, which will promote joint submissions of innovative topics to future EU calls;
  (b) promotion of new interdisciplinary careers for Early Stage Researchers (ESRs), and training opportunities offered through their integration into the activities of Working Groups (WGs).

A considerable impact of COSCH Activities is expected on an intensified usage and integration of multisensory optical acquisition techniques. This would greatly enhance the documentation and condition monitoring of heritage objects and is likely to reveal qualities that were not accessible to earlier techniques.

C.5 Target groups/end users

This Action aims at three target groups:

1. Specialists in the fields of Heritage Science and the Arts: museum curators and conservators, private collectors, tourism, governmental heritage agencies, etc.
2. Industrial players: commercial developers and integrators of measurement systems and software.
3. Research and education stakeholders: universities, R&D labs which develop methods and technologies for spatial and spectral object documentation and work in the fields of material science and chemistry.

More than 50 European groups are already involved in the preparation of this Action. They are distributed between technology developers, CH specialists and material science/chemistry specialists, involving both public institutions and industrial stakeholders.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

The technical program of COSCH will focus on the development, adaptation and standardised usage of optical non-contact technologies, suitable for recording the surfaces of heritage objects with high spatial and spectral precision and resolution. Especially, it is anticipated that the combined use of spatial and spectral data of the highest precision may open new possibilities for the documentation, presentation and analysis of heritage objects.

Multispectral imaging opens new doors to objective spectral documentation of objects. Observed data depend on geometrical relationships between sensor, surface and light source. There is a need for connecting spatial and spectral data collection, which has not yet been fully explored. The interaction of surfaces and sensing techniques will be studied in order to derive defined criteria for an optimal usage of documentation techniques depending on object characteristics.

Important innovative aspects of this COST Action, with the strong input from CH specialists, include knowledge exchange in:

- **Acquisition**: Combination and exact matching of 3D and spectral information, development of multi-sensor systems, methods for high-precision surface measurements of large objects without use of reference points or calibration patterns.
- **Processing** (deblurring, enhancing, etc.): For a precise visualisation of CH objects, data (images and 3D) should be of high quality. This process needs establishing physical (spatial and spectral) models of the entire acquisition chain (light propagation, light integration, etc.).
- **Analysis** (feature extraction, fusion, etc.) is the process by which some features (measures, thematic maps, key points, pattern, regions, etc.) are extracted from images or 3D data with analysis algorithms. The challenge here is the integration and adaptation of such analyses within complex data (e.g. 3D+spectral).
- **Standardised characterisation** (optical, spatial description): Digital devices are involved in all stages of the acquisition (display, LCD-Projector, cameras, etc). Their correct calibration, characterisation and management provide faithful and repeatable measurements.

- **Definition of knowledge base related to object characterisation**: All the stages (acquisition, analysis, etc.) use and generate knowledge that needs to be managed in order to support objects description and characterisation.
- **Visualisation and reproduction** (incl. object and colour rendering, Human-Computer interaction): The spectral data are not readily presented on standard monitors. Usually a dimensionality reduction is required. But the latter should balance informative content and Human Visual System properties while rendering these data. These processes should be integrated within the human - machine interaction.
- **Data content:** Improved use as such will add value to the content of acquired data and the potential for their further utilisation. Especially an integration of different data sources should considerably extend the content and value of the data possibly to their full potential.
- **Data storage, transmission and retrieval** (incl. compression and annotation): Optical instruments generate a large amount of data that require appropriate encoding and compression techniques. Furthermore, shared databases should be created and the access to the objects must be facilitated by some annotations and additional semantic information.
- **Quality evaluation** (relevant to all previous steps): The quality of the process should be evaluated and validated by means of protocols and metrics (objective and subjective). This needs to be defined according to the goal of the process, the subsequent stages and user expectations.
- **Dissemination** (dependent on end-users) is the ultimate goal. How to make the acquired data available and in what form? This obviously depends on the nature of the object, the dissemination format (e.g. print, display, database) and on the needs of the end-user (scientist, researcher, curator, industrial, arbitrary user, etc.).

These aspects will be addressed by COSCH participants coming from the involved interdisciplinary fields. It is therefore important to identify and define the following primary tasks (PT1-PT6):

1. Theoretical identification and practical exploration of important characteristics of instruments and their potential impact on data quality, usability and information content with respect to typical surfaces (PT1).

2. Identification and definition of typical application/object requirements and their impact on the characteristics of data to be able to support these applications (PT2).
3. Theoretical analysis and practical investigation of typical and necessary processing tasks and their potential or real impact on quality and information content of results (PT3).
4. Selection of typical applications and/or objects to be subject of implementation of optimal processing chains, from data capture up to the final results, guided by all the interdisciplinary expertise available to COSCH (PT4).
5. Establishment of the conceptual and practical frameworks for multisensory data acquisition, its implementation and evaluation (PT5).
6. Development of recommendations for solution providers as well as end users. These recommendations would facilitate a deeper integration of optical technology into CH applications through an improved correlation between optical means and requirements (PT6).

D.2 Scientific work plan methods and means

As participants in this Action come from many different subject areas there are many possible ways for structuring the work, eventually producing strongly varying concepts based on the selection of priorities. Nevertheless it should be clear, that the success of this Action strongly depends on the interdisciplinary commitment and actual contribution to activities. Which is why the work plan can be separated into two main phases: a first phase dedicated to laying the scientific foundation in each individual WG, and a second phase of interdisciplinary work encouraging all participants to arrive to a common understanding. Within the second phase scientist from each WG contribute to other

WG in a way, that there is a mutual exchange of knowledge and ideas among all groups. This should be possible through the articulation of needs and exchange of views, and through practical exploration of various optical processing chains dedicated to solving the addressed problems in the field of CH in the course of performing the primary and interdisciplinary tasks (PT1-PT6).

From the viewpoint of involved disciplines, the Action identifies 5 working packages, which will be undertaken by the Working Groups:

WG 1: Spectral object documentation
WG 2: Spatial object documentation
WG 3: Algorithms and procedures
WG 4: Analysis and restoration of CH surfaces and objects
WG 5: Visualisation of CH objects and its dissemination

Within these WGs several individual sub tasks (st1.x - st5.x) have to be undertaken in the first phase of the activities. These shall give the base for the interdisciplinary work in the second phase (PT1-PT6 described in D1).

WG 1: spectral object documentation
1st WG task st1.1 Identification, characterisation and testing of spectral imaging techniques in the visible and near IR field

Spectral imaging techniques undergo a comparable change in technology as do spatial imaging techniques. New developments in optical techniques lead to new means of splitting light resulting in new characteristics for instruments dedicated to monitor the optical spectrum for imaged surfaces. It is therefore necessary to explore the limits and advantages of the actual instruments in this waveband

2nd WG task st1.2 Identification, characterisation and testing of imaging techniques beyond the visible and short wave radiation

The physical and chemical composition of surfaces is an important factor determining the interaction with light and reflection behaviour. As not all of these factors have an impact in the visible spectrum, instruments exist which are able to measure beyond this radiation. It is necessary to exploit and qualify also these type of instruments because they are often essential for the analysis of the surface composition.

WG 2: spatial object documentation

1st WG task st2.1 Identification of the main 3D scanning techniques suitable for use in CH objects

The most common 3D scanning techniques in CH digitisation are structured light, stereoscopic imaging and laser scanning, although also a number of other metrology techniques, such as time-of-flight and interferometry, provide useful information in certain environmental conditions. In this task a classification of different techniques applied to 3D scanning of CH will be given, showing conditions of its applicability, and limitations.

2nd WG task st2.2 Analysis and comparison of the different 3D scanning techniques

The actual performance of the techniques identified for different types of CH objects will be analysed in great depth based on the identified setups and available expertise. The goal is to analyse the advantages and limitations of these techniques depending on the deciding characteristics, and to stimulate new developments to address the identified drawbacks.

WG 3: algorithms and procedures

1st WG task st3.1.Registration processes (acquisition, filtering and view integration)

Optical systems provide data for one field of view. As objects in general have to be monitored using many views, techniques are needed to merge individual views. Traditional techniques have physical impact on the surface, which is unacceptable for most CH objects. It is therefore necessary to identify, evaluate and classify available techniques for fusion of views.

2nd WG task st3.2 Integration of multi-sensor data

Optical techniques for CH applications are contactless and carry certain information content, based on the interaction between light and surface. This interaction depends on the wavelength and the sensor used. Thus, information content can be extended by use of different instruments with varying spectral characteristics. A number of integrating steps are required, which have to be categorised and classified.

3rd WG task st3.3 data access and formats

Measured data provide valuable content which should be stored and made available to anyone using it for CH applications. However, due to characteristics introduced by the vendors of instruments or software there exist huge barriers to easy access. This situation has to be addressed and remedied, especially in interdisciplinary and multi-sensoral working fields.

WG 4: analysis and restoration of CH surfaces

1st WG task st4.1 Identification, structuring and implementation of typical use cases

Surface analyses based on various optical, physical or chemical characteristics may serve diverse purposes. Surface characteristics are subject to the interaction with the optical radiation and the process of data capture. It is therefore important for COSH to identify crucial factors affecting these processes and to establish a reliable knowledge base.

2nd WG task s4.2 Development of guidelines

Similarly, it is important to identify and define the impact of the instrumentation on the quality of results. Critical steps in the analytical process should be identified depending on the purpose of the undertaken analysis.

WG 5: Visualisation of CH objects and its dissemination

1st WG task st5.1 Identification, planning, implementation and testing of typical applications of visualisation within CH domains

CH objects can be visualised in many different ways and for different purposes. Applications range from edutainment and relatively simple presentation to the general public to accurate 3D records surveyed for specialist professional research and conservation. Each purpose bears on the quality expected from visualisation. Characteristics of the data have to be identified and the visualisation processes structured and implemented accordingly.

2nd WG task st5.2 Further development of visualisation techniques

Development of innovative visualisation techniques including integration of multi-sensor data as base for enhanced exploitation of information pertaining to shape and colour, as well as other object data and metadata.

E. ORGANISATION

E.1 Coordination and organisation

The duration of this COST Action is four years. It will be a framework open to organisations, institutions and enterprises interested in collaboration within the emerging field of precise spectral and spatial imaging techniques, in physical and chemical sciences applied to CH objects, as well as in research and application of conservation and art-historical analysis of CH objects.

The networking, information exchange and capacity building measures among researchers in this Action will be coordinated through COST and will be implemented by Training Schools (TS), Short-Term Scientific Missions (STSMs) and Plenary Workshops, a dedicated website, conferences, publications and new project proposals.

The Action will be coordinated by the Management Committee (MC). The MC will be responsible for strategic planning, supervision of ongoing work, dissemination activities, contacting external interested parties, setting up the work schedule and logistics for events and schools. The MC will decide on and evaluate the specific activities of the WGs, STSMs, Workshops and Training Schools. The MC will meet once a year and will communicate regularly by email.

Each WG will have a WG Leader. A Steering Committee (SC) made up by the 5 WG Leaders and the MC Chair and Vice-Chair will be established to report research results and critical issues to the MC. The Young Researchers Coordinator (YRC) will protect and integrate the interest of these participants. Each WG elects 4 participants as responsible person for the information exchange to the other WGs, in order to assure an optimal information exchange across the WG borders. The MC in collaboration with the SC will be responsible for monitoring the achievement of the organisational and scientific milestones (M1-8):

M1: First Plenary Workshop completed
M2: First project phase completed and all important characteristics of instruments, algorithms and applications collected and transferred into a knowledge base
M3: Website set-up and functioning
M4: Training School completed
M5: Selected user case studies successfully completed, analysed and evaluated
M6: Final Conference held
M7: A new collaborative project prepared to be submitted to an identified call
M8: Publication of a Special Issue journal about COSCH

Other administrative elements will be necessary to coordinate the work, to streamline communication and to guide the Action. Those will be:

- STSM Coordinator: selected among the MC members tracking the mobility and exchange within the network;
- Training School Coordinator (TSC): selected among the SC members to track the TS activities;
- Young Researchers Coordinator (YRC): selected among the SC members to evaluate the interest of young researchers;
- Website Group (WSG): setting-up COSCH website;
- Editorial Group (EG): tracking all publications by the COSCH network;
- Interface Group (IG): selected out of MC members, looking for new COST Actions and other European and national networks;

The MC Chairperson, MC Vice-Chairperson, Working Group Coordinators and all other functions will be elected by the MC members at the Kick-off meeting of the Action.

The website will highlight the activities and research outcomes of the Action including the Conference and Workshop proceedings. It will also publish best-practice guidelines and other papers for the benefit of the wider community of users.

E.2 Working Groups

The five WGs will organise annual meetings. During the second project phase, these meetings will be interdisciplinary in order to maximise the knowledge exchange between all researchers involved in the Action. The SC will coordinate the scientific programme of the interdisciplinary WGs. WG Leaders will organise the research tasks, including STSMs, workshops and publications, in close contact with the other coordinators (STSM, Young Researcher, Training Schools). Therefore one or two conferences and/or meetings per year will be organised. Each Leader and each Management or Working Group will prepare and present progress reports to the meetings of MC on a regular basis. Each partner may be active in more than one WG.

E.3 Liaison and interaction with other research programmes

Some members proposed for this Action have been involved in European research projects such as 3D -COFORM and EPOCH. So there is considerable scope for liaison and interaction. As well as the exchange of information, joint seminars or workshops will be held.

E.4 Gender balance and involvement of early-stage researchers

With an initial participation of 25% female researchers, this COST Action already demonstrates a commitment towards the gender balance. COSCH aims to achieve gender balance in all official bodies, in particular early-stage female researchers will be encouraged to participate. The Action will be committed to deliver most benefits to early-stage researchers through STSMs and Training Schools. Also, young scientists will be motivated to take up responsibility as WG Coordinator and to present at conferences. They will be encouraged to ask for support by the YR coordinator helping to build partnerships to senior scientists and to get prioritised access to available elements of this Action.

F. TIMETABLE

The duration of the Action is four years, with continued activity beyond that period through collaborations, website and networking activities.

activity	year 1	year 2	year 3	year 4
MC	M1	M2	X	X
WG 1	st1.1	st1.2, PT1	PT1, PT5	PT6, M5
WG 2	st2.1	st2.2, PT1	PT1, PT5	PT6, M5
WG 3	st3.1	st3.2, PT3	st3.3, PT3, PT5	PT6, M5
WG 4	st4.1	st4.2, PT4	PT2, PT5	PT6, M5
WG 5	st5.1	st5.2, PT4	PT2, PT5	PT6, M5
Website	M3	X	X	X
STSM	X	X	X	M7
Training school	X	X	X	M4
Workshop		X	X	
Final conference				M6
Publications		X	X	M8

The filled cells represent time of activities, M characterises milestones, while st*x.x*, PT*x* show ongoing tasks and the deadlines for their deliverable outcomes.

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: CH, CZ, DE, DK, EL, ES, FI, FR, IT, NL, NO, PL, PT, SI, SK, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 64 Million € for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

H.1 Who?

The results of the COST Action COSCH will be disseminated to the following target audiences:

- The members participating in this Action.
- The end-users of the technologies investigated in the course of COSCH: museum curators and conservators, higher education teachers and students, private collectors, governmental heritage agencies.
- Research institutions not involved in the Action: universities and labs developing spatial and spectral technologies.
- Industrial players as potential hardware and software producers.
- International Council on Monuments and Sites (ICOMOS) and its International Scientific Committee for Documentation of Cultural Heritage (CIPA) as an independent top-level organisation for conservation and protection of cultural heritage.
- Other important international societies relevant to COSCH activities such as the *International Society for Photogrammetry and Remote Sensing* (ISPRS).
- International Council of Museums - Conservation Committee (ICOM-CC).
- Students and Early-Stage Researchers. The highly interdisciplinary field represented by COSCH Action requires more young scientists.

H.2 What?

The results of the COST Action will be disseminated to the respective target groups in the following way:

Action Members

- password protected website
- Meetings, workshops, conferences, STSMs, Training Schools

Heritage specialists

- Training Schools
- Workshops
- Public website
- Best-practice guidelines and papers

Research institutions

- Public website
- Scientific publications
- Action Workshops
- Presentations at national or international Conferences

Spatial and optical technology industries

- Direct communication
- Public website
- Public website
- Trade fairs

ICOMOS, CIPA and other societies and organisations

- Presentations at ICOMOS and CIPA conferences
- Direct communication

Students, ESRs

- STSMs
- Training Schools
- Workshops
- Public website
- Scientific publications
- Teaching activities by Action members

H.3 How?

The dissemination of the Action outcomes will be critical for the success of the Action. Therefore a website group as well as an editorial board will be elected during the Kick-Off Meeting, which will be responsible for communication and publication of the Action through the above mentioned means. The Editorial Coordinator will be responsible for keeping in contact with all Action members and gather the information for publication. The Website Coordinator will set up and maintain the website, select and post the information online, and assist Action members in uploading their content.

The Action will also make use of one or more social networking services, to reach a maximum of the target audiences, make them aware of the Action, attract new members and disseminate the results. The type of online dissemination, the choice of social networking sites and the information to be published will be on the agenda for Kick-off Meeting and the MC meetings. Online publications will include the documents produced in the course of the theoretical and practical work, and tutorials or demos focused on systems, methodologies and protocols used for non-contact acquisition of materials

New dissemination opportunities, for example through new conferences, workshops, journals, trade fairs as well as new potential target audiences, will be constantly reviewed by the Editorial Manager. The dissemination plan will be modified accordingly, if necessary, during the course of the Action.