

**Ten Projects
Horizon 2020 for Cultural Heritage
Pre-Kick Off Meeting**



FANTOM X

Project

Second draft, March, 2015

A.I.C. – Associazione Investire in Cultura

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B - TECHNICAL ANNEX

COVER PAGE

Title of Proposal: Tomography Scanner for Cultural Heritage

Acronym: FANTOM X

List of Participants:

Participant No *	Participant organisation name	Country
1	X	X
2	Y	Y
3	Z	Z
4	W	W
5	K	K
6	K	K
7	K	K
8	K	K
9	K	K
10	S	S
11	L	L
12	A	A
13	O	O.

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Fantom X

“Portable Tomography Scanner for Cultural Heritage

1 – Excellence

1.1 – Objectives

Before undertaking any kind of restoration of Cultural Heritage, it is important to deal with non-invasive and non-destructive diagnostic analyses. An important role is played by the radiographic and tomographic X Imaging. Both methodologies allow to study the internal structure of the artefacts; however tomography has the advantage of being able to develop three-dimensional models.

The experimental results of these methodologies are digital radiographic images, that are an easy-to-access digital documentation, archiving and sharing.

In addition, X-ray images can often allow virtual restorations and replicate the objects with 3D printers that are becoming very performing.

The equipment for X-ray imaging, with fixed and portable solutions, has been widely developed in industry, quality control and maintenance of pipelines, as well as for the human medical diagnostics. In recent years, some of these devices have been adapted to diagnostics for Cultural Heritage. However their use in this field has always resulted in restrictions with the consequence that their potentialities have not been fully exploited.

Over the last decade, non-industrial equipment have been developed in research centers.

Our aim is to provide a mobile tool to be placed on the market at an affordable price.

1.2 – Relation to the Work programme

The work programme topic to which Fantom X relates has to be decided

Code 1 (to be written once all Work packages are ready)

1.3 – Concept and approach

Code 2 (to be written once all Work packages are ready)

(Describe the overall project starting from the activities of WP2, WP3, and WP4: their approach, methodology, etc. and any national or international research linked to this project).

1.4 Ambition

Code 3 (to be written once all Work packages are ready)

(Describe for the overall Project, i.e. for the activities reported in WP2, WP3, and WP4:

1 - the state-of-the-art

2 – the progress beyond the state-of-the-art

3 – the literature concerning the previous points)

2 – Impact

2.1 –Expected impacts

Code 4 (to be written once all Work packages are ready)

(Describe how a lasting impact of the Project will be ensured by the following strategic Project choices):

.....

(In particular, describe the following Project outcomes that will become available in a practical use):

.....

2.2 –Measures to maximize impact

Code 5 (to be written once all Work packages are ready)

a) Dissemination and exploitation of results

Preparation of a draft plan for dissemination of project results

All Partners will prepare items for publication (scientific papers, conference abstracts, website updates, etc.). Full details about how to publish Project results are outlined into the Consortium agreement.

b) Communication activities

All partners will describe, according to their opinion:

- Market impacts of the project*
- Market size and potential*
- Steps towards commercialization*
- Necessity of a European approach*

3 – IMPLEMENTATION

3.1 Work plan - work packages, deliverables and milestones

Code 6 (to be written once all Work packages are ready)

(Describe the overall Work Plan based on the activities of the five Work packages.)

Timing of the Work plan (Gantt chart)

Inter-relation of the components (Pert chart)

The following five Work Packages: WP1, WP2, WP3, WP4 and WP5 represent the structure of this Work plan

Table 3.1a: Work package WP1 description

Work package number 1	Start Date or Starting Event						
Work package title	Coordination						
Participant number	X	Y	Z	W			
Short name of participant	X	Y	Z	W			
Person/months per participant:	X	Y	Z	W			

Objectives

This WP guarantees that:

- an effective coordinating structure is created
- the research project is carried out according to the time schedule and budget established,
- meetings are organized to enable collaboration and management of consortium partners,
- the project progress of the WPs is managed and monitored against contractual deliverables,
- the WPs objectives are achieved efficiently,
- a system is created to provide a continuous evaluation feedback and a constant project monitoring.
- the project is managed according to the contract between the FANTOM X consortium partners and the EC, maintaining a continuous link with the EC, and the overall legal, contractual, ethical, financial and administrative management activities are performed ensuring accurate and timely distribution of funds, reporting on activities, etc.).

Description of work

WP 1 is the Coordination Work Package, which will last for the whole duration of the project.

1 - Coordinator

The responsibility of the project coordination will be taken by who will supply the Project Coordinator. The project coordinator is responsible for all deliverables.

The coordinator's main activities concern the monitoring and management of the agreed deliverables and milestones in the contract between the consortium and the EC, and the smooth running of the project as a whole. The coordinator will maintain continuous relationships with the General Assembly including the

Work Package leaders and will report to the EU. For the day-to-day project management, the Project Officer (PO) supports the coordinator. She/he will focus on the daily management, coordination and administrative and financial aspects of the project.

Coordinator activities:

a) Kick Off meeting.

Upon signature of the contract with the European Commission, the project coordinator will organize an initial kick-off meeting for all personnel involved in the project. This kick-off meeting will enable the participants to obtain a better perspective of their role in the FANTOM X project. Prior to concluding the contract with the EC, a Consortium Agreement will be signed between the project partners

b) Process Management tasks.

The Project Coordinator will conduct the overall project management, as specified in the contract between the consortium and the EC, i.e.:

- Organize the project meetings, workshops, and receive reports;
- Oversee the drawing up and timely signing of the Consortium Agreement;
- Ensure that all parties will sign the contract with the EC on time;
- Initiate, prepare and preside over regular project progress meetings and the dissemination of information to all partners pertaining to these meetings;
- Act as liaison to the European Commission on behalf of the group in all verbal and written communication;
- Inform the Commission properly about the situation and progress of the work;
- Inform the Commission in advance of the date and subject of the meetings;
- Coordinate the overall financial, administrative and contractual activities of the project, including monitoring and maintaining the overall adherence to the financial budgets;
- Report the overall budgetary situation of the project to the EC, based on the cost declarations from the individual partners;
- Coordinate the dissemination of knowledge and deliverables.

3 - Operational project management

The consortium agreement and contract conditions with the EC will be monitored by the General Assembly to ensure compliance by all participating parties.

For each work package, a WP leader has been appointed to take primary technical control of and responsibility for the proper management and execution of the tasks related to the particular WP. He/she establishes (in co-ordination with the Project Coordinator) the detailed schedule of his/her WP. He/she is also responsible for the quality of, and the correct and timely submission of deliverables relating to his/her WP. Each WP leader is also appointed to chair the meetings among the partners participating to his/her WP and will communicate frequently both formally and informally with the workers in the WP.

4- Monitoring:

a) Internal reporting

In order to monitor and guide the consortium, each individual partner will regularly (after the first four months and thereafter at four-monthly intervals) submit a progress report to the respective Work Package leaders. On the basis of these reports, the WP leaders will monitor progress and take any necessary action to ensure the work package remains on schedule.

Each WP leader is required to provide the PC regularly (after four months and thereafter at four monthly intervals) with a progress report concerning his/her WP and containing sufficient technical information to enable the PC to be assured that work is progressing according to plan.

The status of the project will be updated by the PC in a Project Dashboard that will highlight all key progress indicators of the project and areas at risk.

b) External reporting

The combined WP reports (task of the PC) will be discussed and evaluated during meetings of the General Assembly and will constitute the interim reports and form the basis for the annual and final reports that will be submitted to the European Commission by the PC.

Based on the EU model format the coordinator will ensure that all partners provide a consistent flow of information containing key points on the financial progress in the form of a financial report and associated financial plan, as well as an activity report and updated implementation plan.

c) Internal communication

A communication plan will be agreed upon by the General Assembly at the kick-off meeting and will define means and methodology of communication among the project partners.

5- Financial / administrative management

The Project Officer of will ensure that all budgetary actions are performed according to the rules and regulations of the EC and the consortium agreement. This includes amongst others establishing a good operating practice for financial management adapted to the financial system of each participating party, to ensure that the received funds are correctly distributed, accounted for, cost statements are received.

Deliverables

- *Consortium Agreement.* A Consortium Agreement will be concluded among the project partners.
- *Kick-Off meeting minutes.*
- *Meeting/workshop minutes.*
- *General Assembly meeting minutes.*
- *Internal website with public areas for communication and data sharing*
- *Partners progress report.* Each individual partner will regularly submit a progress report to the respective Work Package leaders in order to monitor progress and to ensure the work package remains on schedule.
- *Work Package progress report.* Each WP leader is required to provide the PC regularly with a WP progress report concerning his/her WP to enable the PC to be assured that work is progressing according to plan.
- *Interim reports.* The PC will combine the WP progress reports and will constitute the interim reports.
- *Progress reports to the EC.* Annually the PC will submit progress reports to the EC.
- *Final report (technical, financial, deliverables).* The PC will submit the final report to EC.

Table 3.1a: Work package WP2 description

Work package number 2	Start Date or Starting Event						
Work package title	Tomographic X imaging apparatus (Ceccarelli) robotic system development (Ceccarelli)						
Participant number	X	Y	Z	W			
Short name of participant	X	Y	Z	W			
Person/months per participant:	X	Y	Z	W			

Objectives

(Batenburg) The main objective of this workpackage is to develop a complete package of tomography reconstruction software that is specifically designed for the portable scanner developed in WP2. The software will consist of two key components:

- (i) A module for rapid on-site data processing and coarse tomographic reconstruction, allowing immediate assessment of the datasets that have been recorded at the location of the scanner. This module will provide the following features:
 - (a) *Real-time guidance on the optimal positioning of the scanner with respect to the object, based on an optical photographic scan of the exterior of the object, allowing to adjust the*

- settings to both the shape and positioning of the object.*
- (b) Basic preprocessing operations for correcting scanning artefacts, including flat-field correction, beam hardening correction, ring artefact correction, and truncation correction.*
 - (c) Real-time reconstruction of 2-dimensional cross-sections of the object by Filtered Backprojection type reconstruction methods.*
 - (d) A robust and highly automated user interface to operate the features (a)-(c)*
- (ii) A module for highly accurate processing and reconstruction of the tomography datasets, intended for use in a facility with availability of cluster computing facilities. This module will have the following features:
- (a) More sophisticated, computationally intensive methods for correcting acquisition artefacts*
 - (b) Incorporation of prior knowledge in the reconstruction to provide more accurate reconstruction from a limited number of projection images. In particular, discrete tomography methods will be incorporated that can produce accurate images if the object consists of only a few different materials.*
 - (c) Fully 3D reconstruction that utilizes a computational cluster equipped with Graphics Processing Units (GPUs).*

A robust and highly automated user interface to operate the features (a)-(c) (Batenburg)

(Ceccarelli)

This workpackage aims to design and build a robotic mobile platform that can be able to carry a tomography or a radiography source to specific operation sites (such as museums, art galleries) through the following objectives:

- Definition of architecture of the robotic mobile platform
- CAD design of robotic mobile platform
- Simulation of the operation of robotic mobile platform
- Optimization of the design of robotic mobile platform
- Construction and lab testing of the robotic mobile platform

(Ceccarelli)

(Colapietro)

Within the project *Fantom X* we candidate ourselves as scientific coordinators. The main objective of this WP is the study and the design of an X-ray portable scanner to execute radiographies, and collect X-ray images for tomographic reconstruction of archaeological finds. The instrumentation to be achieved should fully adapt to the characteristics of the object to be analyzed and allow the acquisition of the radiographic images in two ways:

1. rotating the object maintaining source and detector steady
2. rotating source and detector, maintaining the object fixed

The instrument will be a "TRANSFORMER" type, i.e. consisting of two or three robots which in turn can be configured to meet the needs of the measurement, whether a radiography that a tomography. A robot will be dedicated to the movement in space of the X-ray source, a second one to the detector movement and a third one to the rotation of the object when possible. The alignment and displacement of the two/three robots along well-defined paths will be secured by a sophisticated software that will make use of an automatic laser telemetry system and electronic multi-axis gyroscopes to maintain the source-detector alignment within the necessary precision.

The instrument will use the fan beam geometry with X-Ray linear detector.

(Colapietro)

Description of work

(Batenburg) The software and algorithms developed in this workpackage will be based on the ASTRA toolbox, a highly flexible software toolbox for tomography algorithm development, jointly developed by CWI Amsterdam and the iMinds Visionlab at the University of Antwerp, Belgium. The ASTRA toolbox, available as open-source software with a GPLv3 license, provides an implementation of 2D fanbeam reconstruction and allows to adjust the parameters of the acquisition geometry in highly flexible ways, adapting to the actual geometry of the scanning device, providing a foundation for the following research and development tasks:

Task 3.1 *On-site guidance for scanner deployment based on a preliminary optical (photographic) scan*

An algorithm will be selected and implemented to determine the size, shape and orientation of the object based on a series of digital photographs. This coarse-grained shape model will form the input of a new algorithm that determines the optimal scanner positioning and acquisition scheme. Elongated objects will require a different acquisition protocol compared to round objects and the new algorithm will automatically provide on-site guidance on how to choose the optimal settings.

Task 3.2 *Pre-processing of projection images to correct for acquisition-related artefacts and incompleteness of the measured data*

The raw data acquired by the scanner will have to be processed to correct for a range of acquisition-related artefacts, including flat-field correction, beam-hardening correction, ring artefact correction, and handling of truncated projection data (for region-of-interest imaging). In this task, a series of correction algorithms will be developed by combining proven existing methods with new approaches that are specific to the mobile scanning setup.

Task 3.3 *Robust and automated user interface for on-site guidance, processing, and reconstruction*

When performing image acquisition on-site, it is crucial to be able to operate the scanner and its software in an automated and intuitive way. In this task, a user interface will be developed that makes the results of Tasks 3.1 and 3.2, combined with 2D fan-beam reconstruction, available in a robust, automated and intuitive manner.

Task 3.4 *Advanced prior-based reconstruction from limited projection data*

Due to time constraints, the amount of data collected by our mobile scanner will always be limited in both the available dose and the number of projection images that can be collected. In recent years, a range of advanced tomography reconstruction algorithms have been developed that can yield accurate images from limited data by incorporating certain prior knowledge about the object. We will develop variants of Discrete Tomography and Compressive Sensing algorithms that are specifically designed for our mobile scanning device and the intended use for scanning cultural heritage objects. These algorithms are intended for off-site processing, as they have high computational demands.

Task 3.5 *Full 3D prior-based reconstruction using a computing cluster setup*

In this task, the reconstruction methods from task 3.4 will be made suitable for rapid processing of large amounts of scanning data in a fully 3D framework, assuming the availability of a computing cluster equipped with GPUs. As a result, large 3D reconstructions using advanced prior-based methods can be performed within 1 hour.

Task 3.6 *Robust and automated user interface for advanced reconstruction in a cluster environment.*

Similar to task 3.3, the various options in choosing parameters for the advanced reconstruction methods, such as setting the specific prior-knowledge model, will be captured in an accessible user interface that can be operated by scientists with expertise on the scanned object, but limited background in the underlying algorithms. **(Batenburg)**

(Ceccarelli)

A suitable design solution will be identified also as based on significant previous experiences by the Mechanimata team that has designed and built several robotic systems including legged-wheeled robots that can remotely controlled or teleoperated. The design developments will be defined in cooperation with other partners of the consortium in taking into account the requirements and functionalities that are expected for the success of the overall system.

the work will be planned with the following phases:

- Definition of design requirements and operation features
- Selection of structure architecture
- Determination of sensor and control equipment

- Design of the robotic system
- CAD modelling of the robotic systems also for simulation purposes
- Simulation for checking design feasibility and operation efficiency
- Optimization of design solutions and robot components
- Construction of the robotic system platform
- Testing of the prototype

(Ceccarelli)

(Colapietro)

The project will develop along the following phases:

1. study and definition of the characteristics of the X-ray source and detector
 - a. acquisition and/or adaptation of commercial devices
 - b. testing and fine tuning of x-ray optics
2. definition of the scanner's mechanical characteristics
3. assembly and fine tuning of the entire instrumentation
4. application on ad hoc phantom specifically made in order to verify characteristics and limitations of the instrumentation
5. engineering of the instrument

(Colapietro)

Deliverables

(Batenburg)

D3.0 (M6) Modelling the acquisition geometry of the mobile scanner within the framework of the ASTRA toolbox.

Deliverable: Demonstrator that can perform a 2D fan-beam reconstruction from simulated data.

D3.1 (M12) Shape reconstruction and algorithm for guiding the choice of the scanner acquisition setup.

Deliverable: Demonstrator and report

D3.2 (M18) Toolbox of pre-processing routines for correcting the raw data

Deliverable: Demonstrator and report

D3.3 (M24) User interface for on-site processing and 2D reconstruction

Deliverable: Demonstrator and report

D3.4 (M24) Set of tailored algorithms for the mobile scanning device that allow accurate image reconstruction from limited data.

Deliverable: Demonstrator and report

D 3.5 (M30) Optimized parallel cluster implementation of advanced image reconstruction techniques.

Deliverable: Demonstrator and report

D3.6 (M24-M36, two major versions) User interface for off-site advanced processing and fully 3D reconstruction

Deliverable: Demonstrator and report

(Batenburg)

(Ceccarelli)

D 1 Design solution of the proposed robotic system

This deliverable will provide a detailed report on a design solution of the proposed robotic system architecture as well as a list and description of its main components

D 2 Optimized design solution of the proposed robotic system

This deliverable will provide a detailed report on the optimized design solution of the proposed robotic system architecture as well as a detailed list and description of its main components. CAD drawings will be included and customized components will be fully detailed for manufacturing.

D 3 A built prototype

A built prototype will be built and preliminary tests will be carried out and analyzed.

(Ceccarelli)

(Colapietro)

1.a Demonstrator and report of the detector and X-ray source chosen

2.b Demonstrator and report of the system source-detector

3. Demonstrator and report of the mechanical project

4. Demonstrator and report of the results of the test

5.Final commercial instrument

(Colapietro)

Table 3.1a: Work package WP3 description

Work package number 3	Start Date or Starting Event						
Work package title	Software for tomographic imaging apparatus						
Participant number	X	Y	Z	W			
Short name of participant	X	Y	Z	W			
Person/months per participant:	X	Y	Z	W			

Objectives

Description of work

Deliverables

Table 3.1a: Work package WP4 description

Work package number 4	Start Date or Starting Event						
Work package title	Assembled mobile equipment						
Participant number	X	Y	Z	W			
Short name of participant	X	Y	Z	W			
Person/months per participant:	X	Y	Z	W			

Objectives

Description of work

Deliverables

Code 7 (All Partners received empty templates for Work packages WP2, WP3, and WP4; please, any Partner should return these templates to each2014@gmail.com compiled as a first draft).

Table 3.1a: Work package WP5 description

Work package number five		Start Date						
Work package title	Project results diffusion							
Participants number								
Short name								
Pearson/months per Participant:								

Objectives

Objectives if this Work package are

1 - Dissemination and exploitation of results

Definition of a work plan for dissemination and exploitation of the project results;
implementation of a social platform

2- Communication activities

Organization of events concerning the partners of the Consortium; preparation of a website;
organization of mid term workshops and final conference open to EU Commission experts

Description of work

This Work package aim is to improve the dissemination of information about the project results and deliverables: it is a core measure of the project's success. According to this preliminary consideration, different promotion and dissemination actions are foreseen and addressed to both experts in the field and any other Stakeholders.

1 - Dissemination of project results through scientific journals and through participation in Congresses, conferences and workshops

All project results will be shared and disseminated among the project Partners. In order to ensure high visibility of the project within the scientific community, publication in high impact factor scientific journals will be encouraged, as will be presentation at relevant workshops and conferences. Each research institution in this proposal will contribute to this dissemination as participants in WP 5.

2 - Organization of a workshop and a conference

In particular, within six months from the starting of the project a workshop will be held open to specific stakeholders.

3 - Demonstration event. In close collaboration with the WP2, WP3 and WP4 teams a demonstration event will be arranged in order to show how the newly developed techniques work.

This will exhibit the validity and usefulness of the new tools to a competent audience, able to comment and discuss the results obtained.

4 - FANTOM X Website. Promotion of the demonstration event will be made through this website.

Other activities:

1 – Organization of the partners consortium meeting before and throughout the project activity according to the Coordinator suggestions (for 24 months); application of tools and methodologies of risk management to the governance of single parts of the project according to the suggestions of the project coordinator.

2 - Dissemination and exploitation of results deliverables, elaboration of a website concerning the activities of the project; maintenance and adjournments of the website during and after the project preparation; organization of events.

3– Project internal communication of documents and deliverables among the project partners

Deliverables

- ~ *Workshop and conference in and related information & dissemination material*
- ~ *Papers in scientific journals*
- ~ *Launch of fully functional Knowledge Base*
- ~ *Demonstration even*
- *Commercial service development*
- *Business Plan for exploitation of products and services*

Next Table 3.1b shows the list of work packages:

Code 8 (to be written once Work packages are ready)

TABLE 3.1b – List of Work packages

Work Package No	Work Package Title	Lead Participant No	Lead Participant Short Name	Person-Months	Start Month	End Month
One						
Two						
Three						
Four						
Five						
				Total months		

Next Table 3.1c shows the list of Deliverables for each Work package:

Code 9 (to be written once Work packages are ready)

TABLE 3.1c – List of Deliverables

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date
		One				
		Two				
		Three				
		Four				
		Five				

3.2–Management structure and procedures

In order to efficiently manage the project, a specific WP dedicated to coordination and management has been foreseen in the project work plan, to ensure that suitable priority and attention will be given to project management. Within this WP 1 all the aspects related to administrative and quality management of the project will be included. The responsibility of the project coordination will be taken by XXX that will supply the Project Coordinator (PC) and a Project Officer (PO).

The project partners are fully committed and agree to work together with the utmost cooperation for the timely fulfilment of their responsibilities. Previous experiences and participations in European framework programs have led to the decision to keep this management structure as simple as possible. The **overall organizational structure** proposed for the FANTOM X project is presented in Figure 1. It is aimed at ensuring the fulfilment of the project objectives, by allowing clear and continuous communication among the project partners.

a) Project Coordinator

The overall management of the project will be the responsibility of XXX as coordinating partner. Key to this is the role of the Project Coordinator, which will be carried out by

The **Project Coordinator** (PC) will be responsible for the **overall coordination** of the **technical and scientific activities, and all other aspects of the project** including **management of potential conflicts** and compromise negotiation in the unlikely event of conflict and will also be the primary contact person for the European Commission. Hence he/she will be responsible for all communication with - and reporting to - the EC.

The **Project Officer** (PO) will be responsible for day-to-day **legal and contractual management** of the project and **administrative and financial activities**. The PO will report to the PC.

In particular, according to the Consortium Agreement, the Coordinator shall be responsible for:

- Monitoring compliance by the Parties with their obligations
- Keeping the address list of Members and other contact persons updated and available
- Collecting, reviewing and submitting information on the progress of the project and reports and other deliverables (including financial statements and related certification) to the Funding

Authority

- Preparing the meetings, proposing decisions and preparing the agenda of General Assembly meetings, chairing the meetings, preparing the minutes of the meetings and monitoring the implementation of decisions taken at meetings
- Transmitting promptly documents and information connected with the project
- Administering the financial contribution of the Funding Authority and fulfilling the financial tasks
- Providing, upon request, the Parties with official copies or originals of documents which are in the sole possession of the Coordinator when such copies or originals are necessary for the Parties to present claims.

The following Table 3.2a gives a list of milestones.

Code 10 (to be written once Work packages are ready)

TABLE 3.2a – List of milestones

Milestone number	Milestone name	Related work package(s)	Estimated date	Mean of verification

The following Table 3.2b gives the critical risks identified and the possible mitigating actions.

Code 11 (to be written once Work packages are ready)

TABLE 3.2b – Critical risks for implementation

Description of risk	Work package(s) involved	Proposed risk-mitigation measures

b) The General Assembly

The General Assembly is the decision making body of the Consortium.

The General Assembly shall consist of one representative of each Party (hereinafter referred to as “Member”).

Each Member shall be duly authorised to deliberate, negotiate and decide on all matters listed in the Consortium Agreement.

The Coordinator shall chair all meetings of the General Assembly, unless decided otherwise by the General Assembly.

The Parties agree to abide by all decisions of the General Assembly.

This does not prevent the Parties from submitting a dispute for resolution in accordance with the provisions of settlement of disputes.

Operational procedures for the General Assembly representation in meetings

Any Member:

- should be present or represented at any meeting;
- may appoint a substitute or a proxy to attend and vote at any meeting;
- shall participate in a cooperative manner in the meetings.

c) The Work Package leaders

All technical and scientific issues of the project, in particular relating to the interdependence between and coherence of the different WPs - will be managed and consolidated by **the Work Package leaders** who will **report to the PC directly**. To achieve the R&D objectives of the project, the experimental, scientific and technical work has been organized into 3 R&D WPs (WP2, WP3, and WP4).

For each of them, a WP leader will be appointed to take primary technical control of and responsibility for the proper management and execution of the tasks related to the particular WP. In particular, he/she establishes (in coordination with the PC) the detailed schedule of his/her WP and the work in progress. Each WP leader is also responsible for identification of risks and for proposing solutions to the PC in respect of his/her WP. Taking into account that any of these R&D WPs will be the responsibility of three/four partners, WP leaders will be rotated among partners any four months.

Each WP leader is required to provide the PC at four monthly intervals with a progress report concerning his/her WP and containing sufficient technical information to enable the PC to be assured that work is progressing according to plan.

d) Means for governance and control

The means for governance and control (quality assurance, consortium agreement and communication plan) will be tailored to the scale of the FANTOM X project. A correctly empowered governance and control for the overall project management will be guaranteed by following means:

The Consortium Agreement: All the FANTOM X rules will be included and described in detail in the **Consortium Agreement**.

This document will define:

- ~ the responsibilities, mutual obligations and roles of the partners;
- ~ the division of the budget;
- ~ the strategy for the exploitation of results;
- ~ the rules for the settlement of disputes

The Consortium Agreement will be signed within the first month of the project and will define in a very clear and detailed way: roles of each partner, formal rules of participation, voting mechanisms, criteria for evaluation of activities realized by each partner, rules for budget re-allocation, etc.

The Quality Plan: A **quality plan** will be agreed by the General Assembly at the Kick-off meeting, and will ensure that appropriate quality assurance is undertaken. It will include:

- ~ persons responsible for quality assurance, quality standards, methodologies and procedures;
- ~ procedures for identification, distribution, collection, filing, maintenance and disposal of quality records

Quality control will represent a key issue in the overall management of the project, since it plays a critical role in keeping the action aligned towards its final objectives.

d) Project Meetings

An initial „launch/kick-off“ meeting will be organized at the start of the FANTOM X project for all the personnel involved in the project. The purpose of the kick-off meeting is to:

- ~ Present to all involved an overview of the project;
- ~ Enable each participant to obtain a better perspective of his/her role in the FANTOM X project and set this in context with the roles and skills of other project members;
- ~ Define the main outline of the Consortium Agreement;
- ~ Establish procedures for Quality Assurance and formalize policies for publication, intellectual property rights and any arbitration procedures.

3.3 – Consortium as a whole

Partners of the Consortium will be all the partners working on the five Work packages. Each partner will designate a member to participate to the meetings of the Consortium.

All the rules reported in the EU suggested Consortium Agreement must be followed.

The Consortium partners belong to very different scientific disciplines, from IT engineers to archaeologists, from robotics and mechanical experts and they have to complement one another in order to create a Robotic System suitable for this project.

Analogously, the presence inside the Consortium of Enterprises is fundamental for building and experimenting the products of project.

The FANTOM X project is proposed by a consortium of xx **partners** from **X EU Member States** and comprises all the appropriate key players to ensure the availability of resources, capacities, technologies, capabilities, technical and operational knowledge required for the timely achievement of the goal of the project.

The consortium will bring together European efforts and methodological/technological developments and has therefore a high potential for developing and validation of innovative non-destructive diagnosis techniques to assess and monitor the state of preservation of the European heritage.

The partners to the FANTOM X project have the following areas of interest and activity, Table 3.3.

Code 12 Any Partner should send these data by mail to each2014@gmail.com; please only one sentence!

Table 3.3 Areas of interest/activity for Fantom X project partners

P	Area of interest / activity
	Conservation and restoration of Cultural property (Kamenova)

3.4 – Resources to be committed

Code 13 (Section 3.4 to be written only after all other points and sections are ready)

According to costs as stated in the budget table in Part A of the Proposal, the following Table 3.4.1 shows the costs distribution.

Table 3.4.1 Total Costs

	WP 1	WP 2	WP 3	WP 4	WP 5	Total
Personnel costs						
Other costs						
Total direct costs						
Indirect costs						
Subcontracting						
Total costs						
Requested subsidy	2					

In order to achieve the objectives of FANTOM X, duration of 24 months has been foreseen for the project. The overall project cost is € xxx.xxxx and **the overall EU contribution requested is € xxxx.xxx**, both reasonable and necessary considering the number of partners, the ambitious objectives and the duration of the project.

In the following, more details are provided about the costs in the main cost categories of the project.

3.4.1 - Personnel Costs

Personnel costs represent a significant part of the project budget, in total € xxxx.xxx. For each work package, the personnel costs have been calculated considering the appropriate man-power (see Table 3.4 a – Summary of staff effort) needed to complete the proposed activities.

TABLE 3.4a – Summary of staff effort

	W P n	W Pn +1	WPn+2	Total Pearson/ Months per Participant
Participant Number/Short Name				
Participant Number/Short Name				
Participant Number/Short Name				
Total Person/Months				

The weighted average monthly rate costs of the personnel that will be working in the work package are provided in Table 3.4.2

Dissemination meetings: participation to international conferences/workshops to present the FANTOM X results, and for attendance to the FANTOM X workshop. Each participant involved in WP5, will receive travel costs.

3.4.3 - Consumables (other direct costs)

The total costs for consumables amount to € xxxxx.

The consumables with FANTOM X are mostly related to preparation, analysis, characterisation, validation, process optimisation, pre-prototype development and tests and are summarized in table 3.4.3

Table 3.4.3.a – Consumables per work package

	Consumables description

A total of € xxx has been included for the purchase of durable equipment by the project partners. The equipment costs were calculated on depreciation basis, considering the duration of usage of the equipment within the project. The table 3.4.3.b provides an overview of the planned equipment purchases

Table 3.4.3.b – Equipment purchase per participant

Partner short name	V a l u e	E l i g i b i l i t y	Description	W P

3.4.4 - Other costs (other direct costs)

The other remaining costs amount to € xxxx. These are listed in Table 3.4.4

Table 3.4.4 – Other direct costs per Work package

	Other costs

4 – Members of the Consortium

Code 14 (All Partners, starting from now, should write at least about three pages plus the relevant publications lists, concerning both the Organizations they belong to and the persons who will carry out the proposed activities)

4.1 – Participants

- A description of the legal entity and its main tasks, with an explanation of how its profile matches the tasks in the proposal;
- a curriculum vitae or description of the profile of the persons, including their gender, who will be primarily responsible for carrying out the proposed research and/or innovation activities;
- a list of up to 5 relevant publications, and/or products, services (including widely-used datasets or software), or other achievements relevant to the call content;
- a list of up to 5 relevant previous projects or activities, connected to the subject of this proposal;
- a description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work;
- any other supporting documents specified in the work programme for this call.

(Kamenova)

Section 4: Members of the consortium

4.1. Participants (applicants)

Please provide, for each participant, the following (if available):

a description of the legal entity and its main tasks, with an explanation of how its profile matches the tasks in the proposal;

The Centre for Restoration of Artworks Ltd. (CRA) is a SME specialised in the conservation and restoration of cultural property. Since its establishment in 2002, CRA has carried out restoration works in numerous cultural heritage sites around Bulgaria, more than 20 of which of national importance.

CRA's main activity comprises the conservation and restoration of mural paintings, stone and stucco plastics, antique and early Christian mosaics, easel paintings, wooden plastics, metal work and metal plastics from different ages, from Antiquity to Modernity. Parallel to the practical conservation tasks, CRA drafts projects, proposing techniques and technologies for the conservation of architectural and archaeological cultural heritage sites after thorough research and experimenting of different materials and techniques.

CRA's team is composed of both, qualified young restorers and professionals with more than 30 years of experience in the restoration field. The company collaborates closely with experts from other related fields, such as chemists, geologists, archaeologists, climatologists, architects, and art historians.

CRA will contribute to the FANTOM X project with its expertise as end user and with its experience in the testing and evaluation of novel techniques and technologies for restoration of cultural property.

CRA will take an active part in the dissemination of the project's results as a demonstrator. CRA will organize and participate to restorer's conferences and workshops.

The company's good connections with policy makers and institutions in the cultural heritage field and media representatives in Bulgaria will benefit the successful dissemination of the project's results.

a curriculum vitae or description of the profile of the persons, including their gender, who will be primarily responsible for carrying out the proposed research and/or innovation activities;

Assoc. Prof. Angel Pavlov Ph.D., (male), chemist. In charge of the research activity – supervises and participates in the experimental process and the validation of conservation protocols; experience in the evaluation and comparison of different products for stone, plasters and mural paintings conservation, in the analysis of pigments, and in the analytical methods; has published more than 45 scientific papers in national and international journals.

Aglika Ikonomova, (female), restorer. A. Ikonomova has more than 30 years of experience in the conservation and restoration field; specialized in the conservation and restoration of wall paintings, mosaics, icons and polychrome wood; specialised in wall paintings' conservation and restoration at the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) in Rome, Italy; worked as a restorer and team leader at the National Institute for Monuments of Culture (NIMC) and was manager in-chief of the Centre for Conservation and Restoration of Works of Art at the Ministry of Culture of Bulgaria; led and participated in the restoration of many cultural heritage sites such as the Notre-Dame d'Abondance abbey in Haute-Savoie, France, the Bachkovo cluster in Bulgaria, and the ancient villa Armira near Ivaylovgrad, Bulgaria; has (co-) authored numerous scientific papers and has taken part in exhibitions in Paris, Sofia, and Plovdiv; member of the Union of the Artists in Bulgaria (UBA) and the and Association of Conservator-Restorers in Bulgaria.

Ablena Mazakova, (female), restorer. A. Mazakova has more than 30 years of experience in the conservation and restoration of works of art; worked at the National Institute for Monuments of Culture (NIMC) as an expert and chief inspector; led and actively participated in the execution of conservation works in cultural heritage sites of national and world significance, such as the Rock-hewn Churches of Ivanovo (UNESCO World Heritage List); author of numerous scientific papers in conservation and restoration; member of scientific organisations such as the Union of the Artists in Bulgaria (UBA), the French section of the International Institute of Conservation (SFIIC), the Bulgarian National Committee of the International Council on Monuments and Sites (ICOMOS), and the Association of Conservator-Restorers in Bulgaria; Bulgarian representative in the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), Italy (1992).

Prof. Diana Gergova Ph. D., (female), archaeologist. Prof. Gergova is one of the leading European archaeologists in the field of late Antiquity; author of more than 200 articles and books about Thracian culture and religion, cultural heritage, comparative studies, etc., published in Bulgaria and abroad; an active researcher and lecturer in archaeology in several Bulgarian and foreign universities; regularly participates in many international scientific forums on Thracian Studies, Sepulchral Architecture, and Archaeometry; member of numerous scientific organizations, such as the Managing Board of the National Committee of the International Council of Monuments and Sites (ICOMOS-UNESCO), the Bulgarian Scientists' Union, the International Shinto Foundation – UN, National Council for Cultural Monuments Protection at the Ministry of Culture, and the Cultural Heritage Council at the Managing Board of the Bulgarian Academy of Sciences.

a list of up to 5 relevant publications, and/or products, services (including widely-used datasets or software), or other achievements relevant to the call content;

E. Tarassova, M. Tarassov, A. Pavlov, P. Ivanova, E. Tacheva

Ancient plasters from the Thracian tomb Shushmanets, town of Shipka, Bulgaria: mineralogical and chemical characteristics. BULGARIAN GEOLOGICAL SOCIETY, *National conference with international participation "Geosciences 2012"*, Sofia, Bulgaria, 13 – 14 Dec 2012, Proceedings, pp 157-158

Patelli, M. Favaro, S. Simon, P. Storme, P. Scopece, V. Kamenova, Z. Kamenarov, A. Lorenzon, F. De Voeght. PANNA Project – Plasma and Nano for New Age Soft Conservation. Development of a Full-Life Protocol for the Conservation of Cultural Heritage . *In proceedings of the 4th International Conference, EuroMed 2012*, Limassol, Cyprus, Oct 29 – Nov 3, 2012. Volume 7616, pp 793-800

Stefano Voltolina , Cristina Aibéo , Tommaso Cavallin , Ellen Egel , Monica Favaro , Veska Kamenova , Luca Nodari , Angel Pavlov , Ivelina Pavlova , Stefan Simon , Paolo Scopece , Emanuele Verga Falzacappa , Alessandro Patelli. Assessment of atmospheric plasma torches for cleaning of architectural surfaces. *Built Heritage 2013 Monitoring Conservation Management*, pp 1051-1057

Mazakova, V. Kamenova, M. Hristova. Restoration and Exhibition of Wall Paintings of the Early Christian Basilica "The Red Church"

6th International Congress "Science and Technology for the Safeguard of Cultural Heritage in the Mediterranean Basin", Proceedings VOL. II, Session B, Diagnostics, Restoration and Conservation, Athens, Greece, 22 – 25 October 2013

Eugenia Tarassova, Mihail Tarassov, Angel Pavlov. Phase and chemical composition of ancient pigments used in decoration of the Thracian tomb-temple Shushmanets, Shipka town, Bulgaria: mineralogical and chemical characteristics. *In proceedings of the National Conference with International Participation "Geosciences 2014"*, Sofia, Bulgaria, pp 121-122.

a list of up to 5 relevant previous projects or activities, connected to the subject of this proposal;

Research and Development:

EU FP7 "PANNA" (2011-2014); FP7 Theme: ENV-NMP.2011.3.2.1-1.

Plasma And Nano for New Age "soft" conservation (acronym: PANNA) is an FP7 European collaborative project focused on the development of new techniques and technologies for cleaning and protection of cultural heritage assets. Within the PANNA project, CRA is responsible for the testing and characterizing of the newly developed tools and products on wall paintings.

Conservation and Restoration (investment projects):

Operational Programme "Regional Development" (2007-2013) – BG 161PO001/3.1-01/2008/001 – „Restoration, conservation, and socialization of the Thracian tomb under the Shushmanets tumulus"

Operational Programme "Regional Development" (2007-2013) – BG 161PO001/3.1-01/2008/001004 – „Restoration, exhibition and construction of tourism infrastructure of the early Christian basilica „the Red church" near Perushtitsa"

Operational Programme "Regional Development" (2007-2013) – BG 161PO001/3.1-01/2008/001/1 – „Restoration and conservation of the St. George church in the village of Arbanasi"

Cross-Border Cooperation Programme "Greece - Bulgaria" – BG2004/016-782.01.06.03.02-13 – "The magnificence of Armira", Ivaylovgrad, Bulgaria

a description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work;

CRA has an atelier equipped with the necessary standard restorer's tools and materials, including optical microscope, and colour spectrophotometer. Additionally, the company has an atmospheric gas plasma system for surface treatment and modification.

[any other supporting documents specified in the work programme for this call.]

(Kamenova)

(Ceccarelli)

1. Poiché il progetto si focalizza sull'uso di un "Portable Tomography Scanner for Cultural Heritage", le esperienze maturate da Mechanimata nel campo del rilievo architettonico strumentale potranno essere tradotte e declinate in questa ulteriore applicazione. Da tempo Mechanimata sta sperimentando una forte interrelazione tra le discipline della robotica con quelle del rilevamento architettonico, attraverso un progetto finalizzato all'attuazione di soluzioni tecniche rivolte all'analisi e conservazione del patrimonio architettonico. La ricerca in corso, parzialmente innovativa nel campo della robotica, prevede la messa a punto di una procedura operativa consistente nella definizione delle specifiche manovre -caratteristiche delle operazioni del rilevamento architettonico- da affidare ai movimenti automatizzati di un robot. I risultati attesi sono essenzialmente di due ordini distinti ma intimamente collegati. Il primo ordine riguarda in dettaglio l'adeguamento del dispositivo robotico, in fase di sperimentazione, alle operazioni inerenti il rilevamento dell'architettura e di siti storici. Il secondo, mira invece a consolidare il processo di collaborazione ed integrazione dei gruppi multidisciplinari interessati al progetto e a formare una nuova coscienza dell'operare sul patrimonio storico architettonico. Sostanzialmente Mechanimata sta studiando un progetto di robot esapodo che possa essere utilizzato come "treppiedi" semovente" su cui applicare le apparecchiature più proprie del rilievo architettonico e cioè Laser scanner e /o apparecchi per termografia".

Tale esperienze potrebbero essere utilmente applicate anche ad altre apparecchiature, ed anche quindi nel caso della ricerca in oggetto.

2. Il secondo contributo che Mechanimata potrebbe apportare alla ricerca in oggetto è l'esperienza pluridecennale nel campo dell'analisi, documentazione, conservazione, rilievo e restauro dei Beni Culturali in generale ed in particolare dei beni architettonici che hanno alcuni dei suoi soci.

Tale esperienza è certificata da varie esperienze sul campo ma anche da molte esperienze nel campo della valutazione di progetti di ricerca italiani ed internazionali nel campo dei Beni Culturali.

(Ceccarelli)

4.2 – Third parties involved in the Project

Kamenova

Please complete, for each participant, the following table (or simply state "No third parties involved", if applicable):

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
<i>If yes, please describe and justify the tasks to be subcontracted</i>	
Does the participant envisage that part of its work is performed by linked third parties ¹	N
<i>If yes, please describe the third party, the link of the participant to the third party, and describe and justify the foreseen tasks to be performed by the third party</i>	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
<i>If yes, please describe the third party and their contributions</i>	

Kamenova

5 – Ethics and Security

5.1 – Ethics

There is no ethics issue in the ethical issue table in the Administrative Proposal Form of FANTOM X, Part A.

5.2 – Security

The activities or results of this project do not raise security issues.

¹ A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

