

Date of Submission	
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## **IPL Project (IPL - 217) Annual Report Form 2017**

**1 January 2016 to 31 December 2016**

1. Project Number (approved year) and Title

**IPL-217 (2016) PROTHEGO – PROTection of European Cultural HEritage from GeO – Hazards**

2. Main Project Fields

(1) Technology Development

**A. Satellite and in situ monitoring tools. Hazard Mapping**

(2) Targeted Landslides: Mechanism, evolution and impact

**B. Landslide Threatening European Cultural Heritage Sites**

(3) Capacity Building

**C. Enhancing Institutional Capacities and strengthening conservation policy maker**

3. Name of Project leader

**Dr. Daniele Spizzichino (ISPRA project manager)**

Affiliation: (office and position)

**ISPRA - The Italian National Institute for Environmental Protection and Research –  
Researcher (Rome office)**

and Contact: (postal address and email)

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**Dr. Geol. Claudio Margottini (scientific coordinator)**

Affiliation: (office and position)

**Scientific and Technological Attaché, Embassy of Italy in Egypt**

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Core members of the Project: Names/Affiliations: (4 individuals maximum)

- **Dr. Francesca Cigna - Natural Environment Research Council British Geological Survey. NERC Principal investigator. (WP2: harmonization of PS data and creation of digital factsheets, and WP7: dissemination and communication).**
- **Dr. Kyriacos Themistocleous - Cyprus University of Technology, Cyprus Remote Sensing and Geo-Environment Research Lab. CUT Principal investigator. Participate in PROTHEGO by leading WP5: local scale monitoring**
- **Prof Giovanni B Crosta – University of Milano Bicocca. Department of Earth and Environmental Sciences. UNIMIB Principal Investigator. participates in PROTHEGO by leading WP3: integration of persistent scatterers (PS) and geohazard products and implementation of multi-criteria methodology, and WP4: identification of most endangered sites.**
- **Dr José Antonio Fernández Merodo - Geological Survey of Spain IGME Geohazards InSAR Modelling. IGME principal investigator. WP6: local scale investigation and advanced modelling.**

4. Objectives: (5 lines maximum)

**Develop and validate a multi-scale methodology for the detection and monitoring of European Cultural Heritages exposed to natural hazards. PROTHEGO applies novel space technology based on radar interferometry (InSAR) to monitor monuments and sites potentially unstable due to geo-hazards. Remotely sensed information on ground stability are combined with geo-hazard datasets available to identify the most endangered sites.**

5. Study Area: (2 lines maximum)

**The project approach will be applied to all European UNESCO sites (more than 400) and calibrated through some test pilot at local scale (e.g. Rome, Cyprus, Alhambra, Pompei).**

6. Project Duration (1 line maximum)

**September 2015 – February 2018 (30 Months)**

7. Report

1) Progress in the project: (30 lines maximum)

**The aim of the project PROTHEGO is to develop and validate an innovative multi-scale methodology for the detection and monitoring of European Cultural Heritages exposed to geo-hazards (e.g. landslides, subsidence, earthquake). However, this procedure, that includes field surveying, ground-based data collection, periodical observations, is time consuming and**

expensive. Moreover, the installation of monitoring devices, such as optical targets, GPS stations, or inclinometers, on the heritage sites and monuments can lead to aesthetic and functional impacts that can affect the integrity and availability of the heritage. Satellite remote sensing and Geographical Information Systems (GIS) can successfully resolve these problems by providing the scientists and the heritage preservation and conservation practitioners with integrated remote monitoring of the study areas and the unique advantage to store and manipulate a large amount of spatial and attribute data simultaneously. In particular, new space technology based on radar interferometry, is now capable of monitoring surface deformation, since 1992, with mm precision. During the first twelve months of the project, a number of activities have started and developed, with a view to achieving key targets and goals of the project. Specifically, the objectives achieved in this period are:

- 1) Collection and validation of data on the UNESCO cultural heritage in Europe and on presence, distribution and availability of databases on geo-hazards at European scale; contact with national UNESCO focal points have been made for all the EU Countries;
- 2) Analysis of satellite InSAR and PS datasets available at European scale. A methodology has been designed to harmonise ground stability and motion information from satellite-derived data, and will be used to extract information about observed ground movement within the core areas and buffer zones of the UNESCO sites of Europe;
- 3) Structuring and management of the teamwork within the Project Partners of PROTHEGO, including preparation and signing of the Consortium Agreement and business meetings;
- 4) Dissemination and awareness of the project at national and international level;
- 5) Specific and targeted involvement of Associate Partners of PROTHEGO and definition of their roles in the project.

2) Planned future activities or Statement of completion of the Project (15 lines maximum)

It is currently in progress the activity of creating a GIS platform of the final distribution of the UNESCO European Cultural Heritage and its interaction (overlapping) with geo-hazards. This step will lead primarily to define what assets in terms of mapping are subject to which hazard and secondarily to define eventual lack of information and future needs. The research activities concerning the analysis of satellite InSAR and PS datasets available at European scale is still in progress at the moment. A GIS-based catalogue will be implemented. For each WHL site already covered by satellite ground motion information, geospatial information and metadata (e.g. type of data, areal coverage, monitoring period, processing method, accessibility and other resources) will be produced. A digital Factsheet is still under construction, showing overview of observed ground motion velocities, and full deformation histories. The Integration of PS and geo-hazard products started during this first year of activities. A GIS-based multi-criteria analysis (AHP) to identify and, when it is possible, to rank the most critical UNESCO Cultural

**Heritage sites at the European scale is in progress. The output of the analysis will be used as input for the following research activities.**

3) Beneficiaries of Project for Science, Education and/or Society (15 lines maximum)

**PROTHEGO was funded in the framework of the Joint Programming Initiative on Cultural Heritage and Global Change (JPICH) – HERITAGE PLUS, under ERA-NET Plus and the Seventh Framework Programme (FP7) of the European Commission. The project is involving different kind of beneficiaries, stakeholders and Associated Partners, at European/National level as well as at very local detail scale. The firsts will implement National and/or European policies (e.g. European Commission, UNESCO, ESA, EuroGeoSurveys, MIBACT); the latter will transfer the scientific approach and main outcome to practical conservation works, involving large companies, SME, consultants, then generating real new job opportunities within this new segment.**

4) Results: (15 line maximum, e.g. publications)

**List of 2016 publication and links**

<http://www.prothego.eu/dissemination.html>

[https://link.springer.com/chapter/10.1007%2F978-3-319-48974-2\\_11](https://link.springer.com/chapter/10.1007%2F978-3-319-48974-2_11)

<http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=2545459>

<http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=2571428>

<http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=2545494>

[http://www.35igc.org/Uploads/Conference/IGC\\_PROGRAMME\\_MONDAY\\_2016\\_WEB.pdf](http://www.35igc.org/Uploads/Conference/IGC_PROGRAMME_MONDAY_2016_WEB.pdf)