

**HII ACTIVE:  
Advanced ConnecTivity platform for VERTical  
segments (ACTIVE)  
(EIT 15502).**

**Politecnico di Milano**

**Call for Sub-granting on task A1607:**

**Vertical Application in a second area – Contribution  
on transport segment**

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## 1 Introduction and General Context

This document describes a sub-granting proposal offered to eligible contractors by Politecnico di Milano, in the context of the High Impact Initiative named “Advanced ConnecTivity platform for VERTical segments (ACTIVE)”, supported by EIT Digital in its Digital Infrastructure (former Future Cloud) action line.

The goal of Politecnico di Milano inside the HII ACTIVE project is that of developing a gateway for intra-avionic communications. In the avionic field, the concept of the future “more electric aircraft (MEA)” will lead to a decrease of the number of cables and connectors, impacting on the aircraft's weight, reliability and maintenance. In line with Recommendation ITU-R M.2318-0, the International Civil Aviation Organization (ICAO) is fostering the use of wireless technologies for transmitting safety-related communications, assumed to be part of an exclusive network, the aircraft itself.

The main characteristic of the data collection gateway is that of coping with specific sensors used in the avionics industry. The data collection gateway must realize acquisition, analysis, aggregation and pre-processing of the domain specific signals produced by the sensors used in avionic. The aim is the extraction of safety-related features and their transmission to end users through the middleware platform developed in the HII ACTIVE Project. The developed prototype will be built using commercial off-the-shelf hardware, *i.e.*, Arduino, Raspberry Pi, etc. Considered transmission technologies will be based on existing wireless and wired systems (e.g. Wi-Fi, ZigBee, Power Line Communications). In order to provide the prototype with the advanced functionalities that are required by the avionic gateway, the development will be done by Politecnico di Milano with the support of a sub-grantee experienced in the development of the required functionalities.

**Contractors are requested to provide evidence of expertise with the activities that are subject of this sub-grant, in particular the development of digital data communications systems, including high data rate systems, based on wireless technologies.**

Chapter 2 of this document will describe in more details the non-technical aspect of the sub-grant, reporting also the amounts, the evaluation criteria, the expected timeline and IPR issues.

Chapter 3, instead, reports the technical aspects, including a description of the context of the work and main requirements for the application that will be developed.

## 2 Non-Technical Aspects

### 2.1 Conventions

In the rest of the document the following convention is adopted to differentiate between mandatory and preferred requirements:

- shall** A key word indicating a mandatory requirement. Solutions are *required* to meet all such mandatory requirements.
- should** A key word indicating flexibility of choice with a strongly preferred alternative. Equivalent to the phrase *is recommended*.

### 2.2 Sub-granted Activities and Budget

The Health and Usage Monitoring System (HUMS) is an integrated recording and monitoring system that includes sensors, data acquisition technology and software algorithms (both onboard and ground-based) that are provided as a unit with the goals of reducing maintenance costs and improving safety and availability. HUMS are designed to monitor the health of mechanical components in a helicopter as well as the usage of the airframe and its dynamic components. The intelligence gained from the use of HUMS allows to improve aircraft airworthiness in terms of safety, readiness, and costs.

The goal of Politecnico di Milano activity in the ACTIVE project is to develop a data collection gateway, installed in the Helicopter, which provides wireless connectivity between Wireless Sensor Nodes (WSNs) and end users. The data collection gateway must be able to support and enhance the capabilities of the current HUMS systems. The main goal is to extract and provide information about parameters for safety issues, during flight, and maintenance, during ground-based operations in park. The data collection gateway must be able to transmit data both to local users, using short range wireless technologies, and to remote users through a telecommunication network. Cloud storage of collected data must be provided for remote processing and analysis.

In details, the offered sub-grant is part of the catalyst 15502-A1607 contributing to Task 7 “Vertical Application in a second area – Contribution on segment, e.g. transport” of the HII ACTIVE project. It consists in the development of services according to the two following scenarios:

- 1) Interfacing of the data collection gateway with the on-board terminal. The goal is to extract and provide information about parameters for safety issues, during flight, and maintenance, during ground-based operations in park. The topology of the sensor network must be able to guarantee redundancy of the data sent from the WSNA to the on-board terminal. This redundancy must be provided by using wireless and PLC transmission technologies. As a consequence, redundant copies of the same measures have to be provided to the on-board system.
- 2) Interfacing of the data collection gateway with cloud. Helicopter airlines and manufacturers have the interest in supervising the health and usage status of their fleet to schedule maintenance. The ability to monitor the health of an entire fleet, regardless the physical location of each aircraft, can be realized by transmitting data acquired from the data collection gateway through existing

telecommunication networks. Data transmitted through the telecommunication network can be stored in the cloud and then analyzed by means of a centralized middleware platform. This capability must be available both during park and during flight. The set of parameters to be monitored during the flight phase can be configured by an external entity.

The sub-granted activity will consist in the development of a hardware prototype that, with reference to the two scenarios described above, implements the advanced functionalities that have been object of study and investigation by Politecnico di Milano for the vertical avionic wireless sensor network application within the Task 7 of the ACTIVE project.

The amount granted by the sub-grant will be € 40,000.00 (EUR forty thousand);

## 2.3 Evaluation Criteria

The grant will be awarded to a company with an expertise in the development of functionalities for wireless transmission technology and in the implementation of digital signal processing algorithms for communication systems. The company receiving the grant will be selected, according to the selection rules of grantor, on the basis of its proven experience and portfolio of previous works, and on the basis of the further candidatures' information/detail provided.

Other preferential criteria are related to the proven ability and portfolio of previous works and to the proven capability to ensure the delivery on time or, even to shorten the expected timeline (e.g. providing Gantt charts or the evidence of the usual deployment cycle and timing).

A preferential criterion is the availability to meet the sub-granter (Politecnico di Milano) frequenting the EIT Digital Milano Satellite, for alignments. The EIT Digital KIC Partner (Politecnico di Milano) shall give financial support for the KIC added value Activity carried out by the Sub-grantee, within the limits specified by the Annual Grant Agreement.

The maximum amount of sub-grant under this Agreement is € 40,000.00.

Candidate contractors are welcome to apply for the maximum granted amounts. In case of equitable portfolio and proven expertise, the preference will be given to the candidates guaranteeing more features and meeting the preferential criteria above exposed (including delivery time).

## 2.4 Timeline

The sub-granting procedure and activities will take place on the basis of the following timeline:

- September 19<sup>th</sup>, 2016: publication of the present sub-grant call;
- September 27<sup>th</sup>, 2016: deadline for candidate contractors to apply;
- September 29<sup>th</sup>, 2016: contractor selection and engagement;
- October 3<sup>rd</sup>, 2016: start of the activities (T0 below);
- November 30<sup>th</sup>, 2016: end of the main development activities;
- December 16<sup>th</sup>, 2016: end of documenting and reporting activities.

Selected contractor shall comply with the following timeline:

- T0 + 20 days: a document defining requirements and specifications based on a block diagram of the system with a description of the hardware and software components;
- T0 + 60 days: release of the prototype;
- December 16<sup>th</sup>, 2016: at this time all documentation and software have to be released, tested and approved.

## 2.5 Budget and Cost Reporting

The funding is 100% on a cost basis, and the budget of the sub-grant is:

- Up to maximum € 40,000.00 (EUR forty thousand);

The contractor will be allowed to claim this funding up to the maximum of € 40,000, on basis of cost claim. Within one week from the conclusion of the development activities (i.e. within December 9<sup>th</sup>, 2016) the contractor is requested to present a Cost Report consistent with the rules of EU H2020 cost reporting and with the guidelines provided by Politecnico di Milano. The report will be verified and approved by Politecnico di Milano; eventual iterations between the contractor and Politecnico di Milano may occur to refine the report within the above established end of reporting activities (December 16<sup>th</sup>).

## 2.6 Traveling and logistics

Most of the sub-granted activities are expected to be performed by contractors in their offices, while most of the interactions with the sub-granter will occur by audio/video conference or electronic means (e.g. e-mail, shared folders, etc.). Nevertheless, face to face meetings are expected to take place in Milano (Italy), at the co-location center of EIT Digital, for the kick-off of the activities and the following discussion of the requirements and app details. The contractor will be also required to travel to Milano for the activity alignments at least once every 2 weeks of activity (at least 6 times during the period of the sub-granted activities). All travel expenses are considered already included into the budget and extra travelling costs will not give right to additional funding/reimbursements.

## 2.7 Interactions with the KIC partners and Management of the Service

The contractor is requested to ensure the continuous interaction with the involved partners of the activities in order to discuss the requirements, contribute in the service design and approve/check the choices. Some features and technical aspects of the application will be discussed in the first phase of the activities. The contractor is also requested to ensure the maintenance and the management/administration of the service till the end of the sub-granted activities.

## 2.8 IPR issues

All the IPR of the implemented software shall be owned exclusively by the KIC Partner contributing to the activity, that is Politecnico di Milano. The contractor shall provide warranty that the implemented software is free of constraints and/or property rights of third parties not previously agreed upon Politecnico di Milano.

## 2.9 How to Apply?

Responses to this call shall be sent to [responsabilegestionale-deib@polimi.it](mailto:responsabilegestionale-deib@polimi.it)

Responses shall include the following information:

- Description of the company, relevant competences and experiences
- Link to portfolio of previous projects and contracts about development of modem and products for wireless communication systems
- CV of the persons that will be involved in the project
- Contact person
- Requested budget and motivation
- Agreement to move to the appointed EIT Digital satellite, to have meetings with the sub-granter, as stated in 2.6
- Agreement to respect the proposed project timeline (see 2.4)
  - Award criteria: ability to shorten the fixed deadline (providing Gantt charts or the evidence of the usual deployment cycle and timing)

Candidates will be evaluated with respect to their competences/experiences and their ability to complete the task according to the tight timeline of the project.

## **2.10 Information and Contacts**

For more information on this call, please contact Maurizio Magarini, Politecnico di Milano ([maurizio.magarini@polimi.it](mailto:maurizio.magarini@polimi.it)).

## 3 Technical Aspects

### 3.1 Technical Context

The activity supported by this sub-grant are finalized to the development a Helicopter sensor network hardware prototype. The function of the Helicopter sensor network is to provide an integrated recording and monitoring system that includes sensors, data acquisition technology and software algorithms (both onboard and ground-based). The goal is to reduce maintenance costs and to improve safety and availability.

The work to be done consists in the development of software e firmware parts of a prototype that implements an Avionics IoT (Internet of Things) system. Sensors send measures to the gateway using wireless links and wired links as well. The link between gateway ad un local terminal, i.e., the on-board terminal, is based on the use of dissimilar technologies WiFi and Ethernet.

Hardware components will be chosen among those available in the consumer market that are of common use for prototyping. The prototype will be used to verify the performance that can be achieved with reference to the following functionalities.

Single gateway working in isolation. WiFi and ZigBee wireless communication between sensors and gateway. Alarm generation in case of failures. Reconstruction of the temporal sequence and order of measures taken by the sensor nodes by implementation of a network synchronization protocol.

### 3.2 REQUIREMENTS: Avionics IoT (Internet of Things)

Sub-granting activity's first objective is the development of a prototype of a gateway for an avionic sensor network which follows an already existing concept developed by activity done by Politecnico di Milano in Task 7 "Vertical Application in a second area – Contribution on segment, e.g. transport" of the HII ACTIVE project.

Main requirements for the prototype to be developed are listed as follows:

- [R1] Capability of managing acquisition from a number of five sensors: two high data-rate wireless sensors, *e.g.*, accelerometers, connected to the GW through Wi-Fi, two low data-rate wireless sensors, *e.g.*, temperature, connected to the gateway through ZigBee, and one wired sensor, connected to the gateway through bus I2C/SPI/UART (InterIntegrated Circuit/Serial Peripheral Interface/ Universal Asynchronous Receiver Transmitter);
- [R2] Connectivity from the GW to a local terminal based on the use of dissimilar technologies (WiFi + Ethernet);
- [R3] Distribution of synchronization signals from the GW to the sensors for reconstruction of the temporal sequence and order of measures taken by the nodes;
- [R4] Availability of APIs for local and cloud data retrieval;
- [R5] Check of consistency on data sent by redundant sensors to detect the possible fault of a sensor or outage of the link between sensor and GW;
- [R6] The link between digital sensors and TDC is realized by using commercial off-the shelf (COTS) wired (SPI, I2C, UART) and wireless technologies (ZigBee and Wi-Fi);

[R7] Core components of the prototype are realized by COTS hardware boards, *i.e.*, Raspberry and Arduino.