European GNSS Supervisory Authority

Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (2007 to 2013)

'Cooperation' Specific Programme

Theme: Transport (including Aeronautics)

Sub-theme: Support to the European Global Navigation Satellite System (Galileo) and EGNOS

Activity: 7.4.3. ADAPTING RECEIVERS TO REQUIREMENTS AND UPGRADING CORE TECHNOLOGIES

Area 7.4.3.1 Receivers

Funding Scheme: Collaborative Project

DESCRIPTION OF TOPIC Galileo.2011.3.1-2:

Technologies for PRS Receivers

GSA

SEVENTH FRAMEWORK PROGRAMME

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Caveat: Final availability of budget for this Call is subject to Commission Decision to delegate the management of the Call to GSA. Whilst this is considered a technical formality, potential applicants are informed that, in the absence of such a Decision, the GSA will not be in a position to award any grant. Therefore, the potential applicants are kindly requested to take this into account in the assessment of their investment in any preparatory work. The GSA expects to get notified of the Commission Decision early next year. As soon as this is the case, a notice of information will be published on the Cordis and Participant Portal websites.

I. INTRODUCTION

I.1. Context

Satellite navigation is a large and growing market. As a key enabler in applications in many transport and other domains, it is benefiting business, governments and citizens. To fully take advantage of these opportunities, Europe has decided to embark on its own satellite navigation programmes. The European Global Navigation Satellite System (GNSS) programmes include Galileo and EGNOS. These programmes are

EGNOS is an SBAS system that is operational for non SOL applications and will be certified for SOL in 2010. EGNOS service is available through geostationary satellites or terrestrial links (EDAS). More information on EGNOS can be found on: http://www.egnos-portal.eu/.

Galileo is a global positioning and timing system, complementing and co-existing with current GNSS like GPS. More information on Galileo can be found on:
http://ec.europa.eu/enterprise/policies/space/galileo/index_en.htm.

In parallel to the development of the GNSS systems, Europe has launched an ambitious R&D programme to stimulate so-called downstream markets. In 2011 the R&D activities related to Galileo will be implemented by both the European Commission and the GNSS Supervisory Authority (GSA, on behalf of the European Commission).

The programme covers GNSS applications development, GNSS receiver's development, international cooperation, education, innovation and enabling activities.

The topic will address the development of technologies useful for PRS receivers, including security modules; ASIC; tri-band RF front end; cryptographic protection technologies; MEMS for low-end receivers; and smart small-size antennas for pedestrian applications.

I.2. Special conditions

Special procedures will apply to this topic, due to the sensitive nature of the subject addressed, and the need of compliance to the European GNSS PSI. These procedures are described in the Guide for Applicants. They will apply to all actions unless it can be demonstrated to be UNCLASSIFIED.

I.3. List of Acronyms

3D-IC	Three-dimensional integrated circuit
ASIC	Application-Specific Integrated Circuit
EC	European Commission
EDAS	EGNOS Data Access System
EGNOS	European Geostationary Navigation Overlay Service
FP6, FP7	6th, 7th Research Framework Programmes
GKMF	Galileo Knowledge Management Facility
GNSS	Global Navigation Satellite System
GSA	European GNSS Supervisory Authority
IC	Integrated circuit
IP	Intellectual property
MEMS	Micro-electromechanical system
PRS	Public Regulated Service
PUF	Physically-Unclonable Functions

PVT	Position Velocity Time
RF	Radio frequency
SM	Security Module
SME	Small or Medium Enterprise[1]
SPOC	Single Point Of Contact

I.4. Note on terms used

The word *shall* is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted *(shall* equals *is required to)*. The word *should* is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited *(should* equals *is recommended that)*. The word *may* is used to indicate a course of action permissible within the limits of the standard *(may* equals *is permitted to)*.

[1] Please note that the new European SME definition (Commission Recommendation 2003/361/EC) is the legal basis for this topic in order to define an eligible SME. The new European definition of an SME came into force on 1 January 2005 raising the financial ceiling above which a company is no longer classified as SME. To qualify as an SME, a company has to meet four requirements: 1. be an organisation or enterprise engaged in economic activity; 2. have fewer than 250 employees, calculated as annual working units (AWU); 3. have an annual turnover of €50 million or less, or have a balance sheet not exceeding €43 million; and 4. be autonomous in terms of managerial independence and the ownership of its equity. This requirement entails several conditions. Full details of the EU definition can be found at: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm.

II. TOPIC DESCRIPTION

II.1. Scope

The aim of this topic is to integrate into receivers new technologies that can contribute to the improvement of performances and the reduction of the cost of low-end PRS receivers. This can be done by improving PRS receiver performances, integrating low-power consumption and miniaturization technologies, exploiting software receiver technology and combining PRS receivers with other functions (e.g., communications). This will also lead to the development of EU competence and innovation in PRS receiver technology.

Projects are expected to develop technologies useful for PRS receivers, including security modules, ASICs, tri-band RF front end, protection of cryptographic assets, integration of MEMS in low-end receivers, and the integration of smart small-size antennas for pedestrian applications.

The scope of this topic is open to any R&D that complies to the above, with particular interest to the ones as follows.

II.1.1. Security modules technologies

Fast-acquisition unit (FAU): This function is considered as a technical challenge to be solved for obtaining the full benefit of the PRS. The expected outcome is to provide PRS users with an optimised and efficient PRS Fast Acquisition Unit. This FAU should be available as an ASIC to be integrated into PRS receivers and as an Intellectual Property (IP) block to be integrated into future Integrated Circuits (IC). Several architectures may be conceived. However, an architecture that would be scalable from low-end to high-end PRS receiver products is preferred.

Jamming supervisor: There exist different kinds of jamming signals, and several kinds of techniques have been developed to counter these interferences. However, these signal processing techniques should not be activated e when they provide no benefits, thereby saving power consumption and not adding any degradation to the incoming signal. Within this context, a jamming supervisor function could be conceived to automate the processing of interferences. This jamming supervisor would perform:

- Detect and characterise interferences in the received signal
- Alert the PRS receiver user of the degradation of signal reception conditions
- Select and activate the appropriate available countermeasure.

II.1.2. Tri-band RF front end

This topic will aim at preparing RF technology for the PRS receivers. The added-value of having a dual-constellation service with the use of a differentiated GNSS RF spectrum should not be detrimental to the power consumption, the size and the cost of medium-end receivers, and possibly low-end receivers. This brings some specific constraints and challenges to the RF Front-end of the receiver, with the need to process GNSS signal carried on two frequencies, i.e. L1 and E6, or even three frequencies, i.e. L1, L2 and E6.

The expected outcome is the design of a high performance RF Front-End chip and possibly external filters, compliant with PRS receiver specifications, and enabling integration of GPS augmentation.

II.1.3. Cryptographic protection technologies

The price of PRS receivers will be a major driver for the adoption by interested User Communities and the production cost of a PRS receiver will depend to a large extent on the cost of the PRS Security Module.

Reducing the cost of securing the PRS SM against potential attacks requires launching R&D for highly innovative technologies. These technologies include three-Dimensional Integrated Circuit (3D-IC), Physically-Unclonable Functions (PUF), tamper-resistant and tamper-respondent technology, chip authentication. Techniques that can be used to help securing a European manufacturing process may be proposed as well. Innovative techniques related to the manufacturing of PRS receivers may also be proposed.

II.1.4. MEMS for low-end receivers

MEMS are currently a major technological breakthrough that will impact GNSS in the next years. As far as security is concerned, MEMS can help to counter some intrinsic vulnerability of GNSS such as its susceptibility to interference.

II.1.5. Smart small-size antennas for pedestrian applications

Countering low-power jammers could become one day a real challenge for GNSS receivers, including PRS receivers. The integration of low-profile antennas within a professional suit is also a specific need for governmental pedestrian users. There is a current trend towards wearable technologies. This is well adapted to Governmental security forces which one day may have their equipment integrated in their professional suit.

Yet, the human body acts as a screen against RF interferences. Embedding GNSS antennas in various locations around its uniform may be a solution to circumvent one interference source.
There is a current trend and technological improvement of wearable technologies. This is well adapted to Governmental security forces which one day may have their equipment integrated in their professional suit.
The PRS receiver could be designed to select among several antennas the one that delivers the best signal-to-noise ratio, thereby improving continuity of service and resistance to jamming sources.

This study should

- Develop low profile antennas
- Explore and demonstrate the concept of wearable technologies when applied to GNSS RF interference mitigation for pedestrian security forces.

II.2. Evaluation criteria

The projects will be evaluated against the standard criteria applicable to Collaborative Projects in FP7. The sections below describe how these criteria should be interpreted given the specific topics and objectives of the GNSS activities in the Transport Work Programme.

II.2.1. S/T QUALITY

“Scientific and/or technological excellence (relevant to the topics addressed by the Call)”

- Soundness of concept, and quality of objectives
- Progress beyond the state-of-the-art
- Quality and effectiveness of the S/T methodology and associated work plan

Within the context of this topic, the proposal should aim to provide direct benefit to low-end and medium end PRS Receiver technology, going beyond the current state of the art in this domain.

II.2.2. IMPLEMENTATION

"Quality and efficiency of the implementation and the management"

- Compliance to PSI rules
- Appropriateness of the management structure and procedures
- Quality and relevant experience of the individual participants
- Quality of the Consortium as a whole (including complementarity, balance)
- Appropriateness of the allocation and justification of the resources to be committed (budget, staff, equipment)

The consortium should aim to gather proven experience and expertise in the conception of PRS receivers or. Ideally, the project coordinator would have a strong background on PRS, PRS Receivers or the conception of low-end Security modules.

II.2.3. IMPACT

"Potential impact through the development, dissemination and use of project results"

- Contribution, at the European level, to the expected impacts listed in the description of topics under the relevant topic/activity
- Appropriateness of measures for the dissemination and/or exploitation of project results, and management of intellectual property.

Impact will be measured mainly by how projects contribute to the widespread adoption of PRS. The generation of Public benefits e.g. increasing the security of the PRS service and / or providing better Information assurance for PRS users are also taken into account.

II.2.4. Additional Recommendations

- The project should take into account, to the extent feasible, relevant standards and regulations on safety, security and other aspects.

- The project should use, to the extent feasible, iterative/incremental development methodologies which enable early demonstration of results.

- The consortium may employ *PhD students* to carry out RTD activities.

II.3. Deliverables

The project shall provide at least the following outputs during its lifetime.

Nr.	Description	Status[2]	Dissemi-nation level[3]
1	Detailed project plan including team organisation, contacts;	M	CO (+ CL)

[2] M: Mandatory, R: Recommended, O: optional

[3] Recommended dissemination level: PU = Public; PP = Restricted to other programme participants (including the GSA); RE = Restricted to a group specified by the Consortium (including the GSA); CO = Confidential, only for members of the Consortium (including the GSA); CL = Classified (see guide for applicants).

Nr.	Description	Status[2]	Dissemi-nation level[3]
2	Quarterly progress reports based on a template to be supplied by the GSA;	M	CO (+ CL)
3	Meeting minutes of all review meetings;	M	CO (+ CL)
4	Technical feasibility study;	R	PU + CO (+CL)
5	Design Justification Files, including production costs tradeoffs	R	CL
6	Final report based on GSA template. It should coverall project activities including R&D and exploitation activities; activities related to dissemination, knowledge contribution. The report should include an executive summary that should be UNCLASSIFIED and a summary that is public.	M	PU + CO (+CL)
7	Source code and related documentation of main developments	R	PU + CO (+CL)

II.4. Schedule and milestones

The total duration of the project shall be less than 24 months. The project shall be split in several phases and several milestones shall be identified.

II.5. Interaction with GSA

The consortium shall appoint one person to be the single point of contact towards the GSA. The consortium should report to GSA whenever requested. The consortium is responsible for organising meetings. Any deviations from the workplan should be communicated to GSA as soon as possible.

The GSA will make expert resources available to the project, which can provide assistance in the following areas:

- € Technical support in e.g. review of project deliverables, provision of Galileo documentation;
- € Access to UNCLASSIFIED GNSS documentation via GSA's GKMF. The GKMF is the Galileo Knowledge Management Facility that is hosted by the GSA. It contains documents and results from the research activities on Galileo, and allows users to search and retrieve public information on GNSS. The GKMF may also serves as documentation management system and dissemination tool for the projects funded under the Galileo FP7
- € Liaison with the WG-PRS forum.

III. RECOMMENDATIONS FOR WRITING THE PROPOSAL

Proposals should follow the guidelines as they are explained in the Guide for Applicants for this topic. There are several guides, for this topic it is the guide that covers the funding scheme collaborative projects and is includes the default single stage evaluation process. Consortia are expected to complete both a part A with administrative and financial information and a part B with the technical proposal. Any classified material should be included in a separate annex that cannot be submitted electronically (see guide for applicants for more details). The guide for applicants has clear instructions on both part A and part B.