



REQUEST FOR INFORMATION (IN PREPARATION FOR THE PROCUREMENT OF EGNOS GEOSTATIONARY NAVIGATION PAYLOAD SERVICES: "GEO-4" and "GEO-5")

Reference: GSA-EGN-ESP-RFI-240203

Issue/Version: 1.1

Date: 25/05/2018

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1 Introduction

The European Geostationary Navigation Overlay Service (EGNOS) is providing services since 2009 and its exploitation is under the responsibility of the European GNSS Agency (GSA). EGNOS is a satellite based augmentation (SBAS) system providing correction data and integrity information for improving positioning, navigation and timing services over Europe.. Today, EGNOS augments GPS using the L1 (1575.42 MHz) Coarse/Acquisition (C/A) civilian signal. EGNOS will augment both GPS and Galileo in the future, using L1 and L5 (1176.45 MHz) frequencies.

EGNOS is providing 3 services, free of charge to users:

- Open Service (OS), which improves the achievable positioning accuracy by correcting to a large extend errors affecting the GPS signals. OS is intended for high-volume satellite navigation applications. It is subject to the service limitations described in the EGNOS OS SDD [2] ;
- Safety of Life (SoL) Service, that provides the most stringent level of signal-in-space performance to all Safety of Life user communities. The service fulfils in particular civil aviation requirements (EGNOS Signal-In-Space is compliant to the ICAO SARPs for SBAS [4]) and supports operations down to Localiser Performance with Vertical Guidance (LPV) minima as low as 200 ft. It is subject to the service limitations described in the EGNOS SoL Service Definition Document (SDD) [1] ;
- EGNOS Data Access Service (EDAS) is the EGNOS terrestrial data service which offers ground-based access to EGNOS data in real time to authorised users (e.g. added-value application providers). It aims at offering commercial data dissemination for professional or commercial use by means of improved performance and data with greater added value than those obtained through its open service. It is subject to the service limitations described in the EGNOS EDAS SDD [3]

At the moment, version 2 of the system (EGNOS V2) is in operations however the development of the version 3 (EGNOS V3) has been started.

EGNOS messages are broadcast to users simultaneously from navigation payloads on board at least two GEO satellites. Nominally, two payloads are used operationally while a third GEO payload remains in backup; this redundant configuration of the space segment has been designed to ensure continuous availability of the signal to end users and needs to be replenished over time.

EGNOS space segment is provided by commercial satellite operators on the basis of service contracts, covering provision of access to SBAS payloads on-board GEO satellites. The so-called GEO-1, GEO-2 and GEO-3 service contracts cover the space segment needs for a number of years, GEO-1 and GEO-2 services being the first to

end. Considering that the replacement satellites will need to be available for EGNOS system qualification well before they can be used in the operational system, and in view of the fact that satellite procurement may last a number of years, the GSA is already planning how to replace the services currently delivered by GEO-1 and GEO-2. The latest deadlines for the start of the provision of the new services are 2024 and 2027 respectively. These services will be called GEO-4 and GEO-5 throughout this RFI.

In view of this procurement, GSA is conducting a preliminary market analysis and issuing the present Request For Information (RFI) to collect information about opportunities to embark navigation payloads on-board GEO satellites launched in a suitable timeframe. The outcomes of this RFI will be used to decide on the best approach for the procurement of the payload services, which may be either procured at the same time or separately. The outcomes of this RFI will also help the GSA define the tender specifications and the most appropriate time to launch the Invitation(s) To Tender.

Please note that:

- i. **the GSA reserves at its sole discretion the right to decide whether and when it will launch the actual procurement for the replenishment of the EGNOS space segment.**
- ii. **the descriptive part of the present RFI is intended solely for the purpose of providing context information.**
- iii. **neither the present RFI nor the answers to it are in any way binding on the GSA in its preparation of procurement documentation.**
- iv. **the GSA will ensure that the opinions expressed in the replies will not unduly bias its procurement and the resulting tender specifications will ensure as wide a competition as possible.**
- v. **Any information included in the replies specifically marked as confidential will be treated by the GSA accordingly.**

2 Acronyms and Abbreviations

Table 1 – Abbreviations

Abbreviation	Definition
CPF	Central Processing Facility
C/A	Coarse/Acquisition
DFMC	Dual Frequency Multi-Constellation
ECAC	European Civil Aviation Conference
EDAS	EGNOS Data Access Service
EGNOS	European Geostationary Overlay Service
ENP	European Neighbouring Policy
EU	European Union
FIR	Flight Information Region
GEO	Geostationary Orbit
GEO-1	Geo transponder service provided from the SES-5 satellite at 5°E with uplink stations in Belgium and Luxembourg
GEO-2	Geo transponder service provided from Astra-5B satellite at 31.5°E with uplink stations in Belgium and Luxembourg
GEO-3	Geo transponder service provided from Q2 2019 from E5WB satellite at 5°W, currently under development, with uplink stations in France and Italy.
GEO-4	Geo satellite transponder service to be procured by the GSA with the latest expected operational start date in 2024
GEO-5	Geo satellite transponder service to be procured by the GSA with the latest expected operational start date in 2027
GNSS	Global Navigation Satellite System (e.g. GPS, Galileo, GLONASS etc.)

Abbreviation	Definition
GPS	Global Positioning System
GSA	European GNSS Agency
ICAO	International Civil Aviation Organisation
IOT	In Orbit Test
MCC	Mission Control Centre
NLES	Navigation Land Earth Station
OS	Open Service
OSD	Operational Start Date
PRN	Pseudo-Random Noise sequence
RF	Radio-frequency
RFI	Request for Information
RIMS	Ranging and Integrity Monitoring Station
SARPS	Standards and Recommended Practices
SBAS	Satellite Based Augmentation System
SDD	Service definition Document
SoL	Safety of Life
SPS	Standard Positioning Service

3 Reference Documents

- [1] EGNOS Safety of Life Service Definition Document (SoL SDD), issue 3.1, 26/09/2016

- [2] EGNOS Open Service Service Definition Document (OS SDD), issue 2.3, 03/10/2017
- [3] EGNOS Data Access Service Service Definition Document (EDAS SDD), issue 2.1, 19/12/2014
- [4] ICAO SARPS Annex 10, including up to Amendment 91 of 07/03/2018
- [5] DFMC SBAS SARPS (under finalisation, it will be provided at the time of the procurement).

4 Purpose of the RFI

The purpose of this RFI is to obtain information from owners of geostationary satellites planned to be available for operational service from 2021 to 2027 and able to embark a navigation payload. The GSA is asking for information on the points listed in 6.4 below, to understand what parameters influence the service provided and accordingly shape the potential procurement of EGNOS navigation payload services.

5 EGNOS System Presentation

5.1 Overall EGNOS System Architecture

The purpose of EGNOS is to provide an overlay augmentation to GPS and to Galileo (EGNOS V3), through the broadcast by GEO satellites of GPS-like navigation signals containing integrity and differential corrections information applicable to the navigation signals of the GPS and Galileo satellites. As a result, the EGNOS system provides integrity positioning meeting requirements for aviation Safety-of-Life (SoL) services that allows it to address needs of various modes of transport.

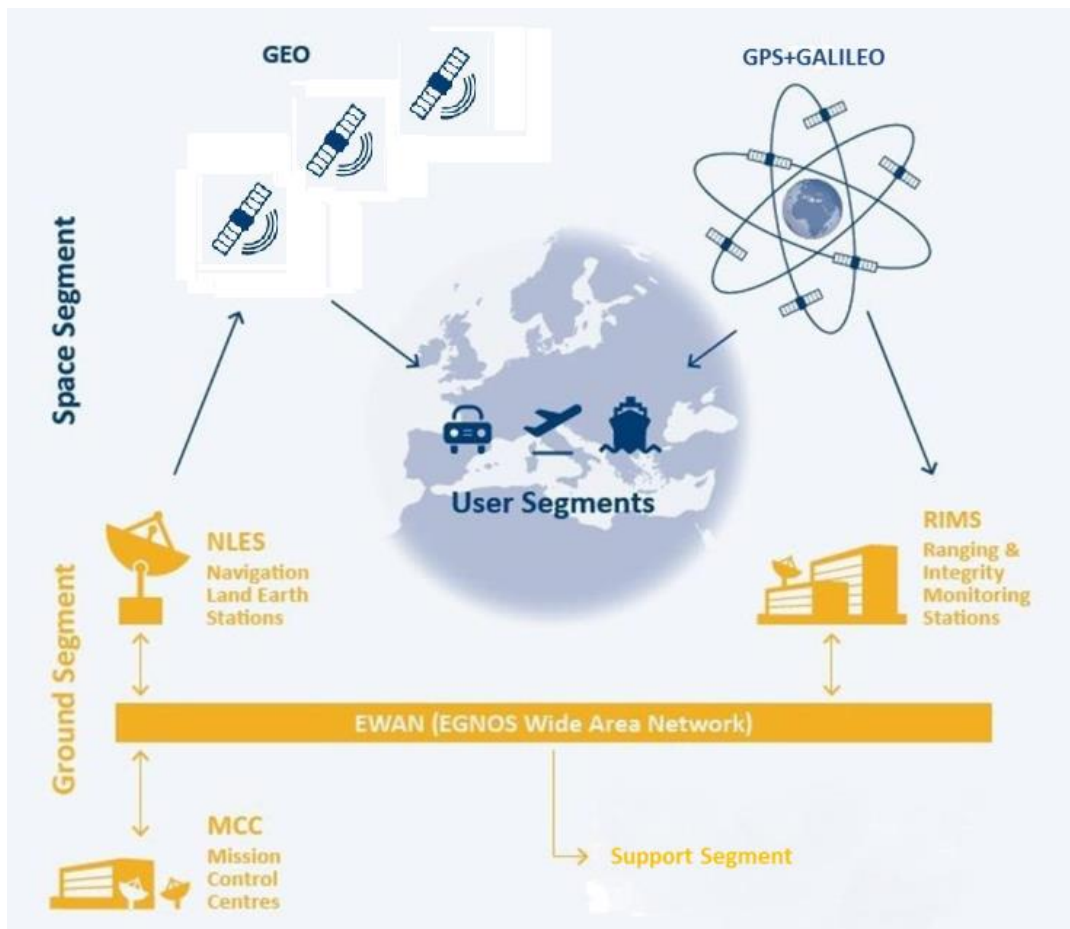


Figure 1: EGNOS Functional Architecture

EGNOS services are delivered to the ECAC Flight Information Region (FIR). Extensions are being investigated to cover other adjacent regions. An example of the coverage extension for the ECAC FIR and countries of the European Neighbouring Policy is given in Figure 2.

The EGNOS ground segment is responsible for the computation of the corrections and integrity data. To this purpose, Ranging and Integrity Monitoring Stations (RIMS) are distributed mainly over Europe and North Africa; they collect GPS (and Galileo in the future) measurements. The network of RIMS is connected to 2 Mission Control Centres (MCCs) where the integrity, differential corrections, ionospheric delays are computed by the Central Processing Facility (CPF). This information is sent via the EGNOS Wide Area Network to the Navigation Land Earth Station (NLES), where messages are coded and modulated in a GPS-like signal, according

to the SBAS signal specification defined in [4] (and soon to be also in accordance with [4] for messages in L5). The NLES uplinks the messages to the space segment (2 GEO satellites broadcasting simultaneously while a 3rd GEO satellite remains in back-up), where transparent bent-pipe payloads broadcast the GPS-like signals on the GPS L1 (1575.42 MHz) frequency (and soon on the L5 (1176.45 MHz) frequency in addition). The EGNOS system design requires two NLES per GEO satellites (an active one whose message is uplinked and a back-up one).

Further information on the EGNOS system architecture can be found in [1] .

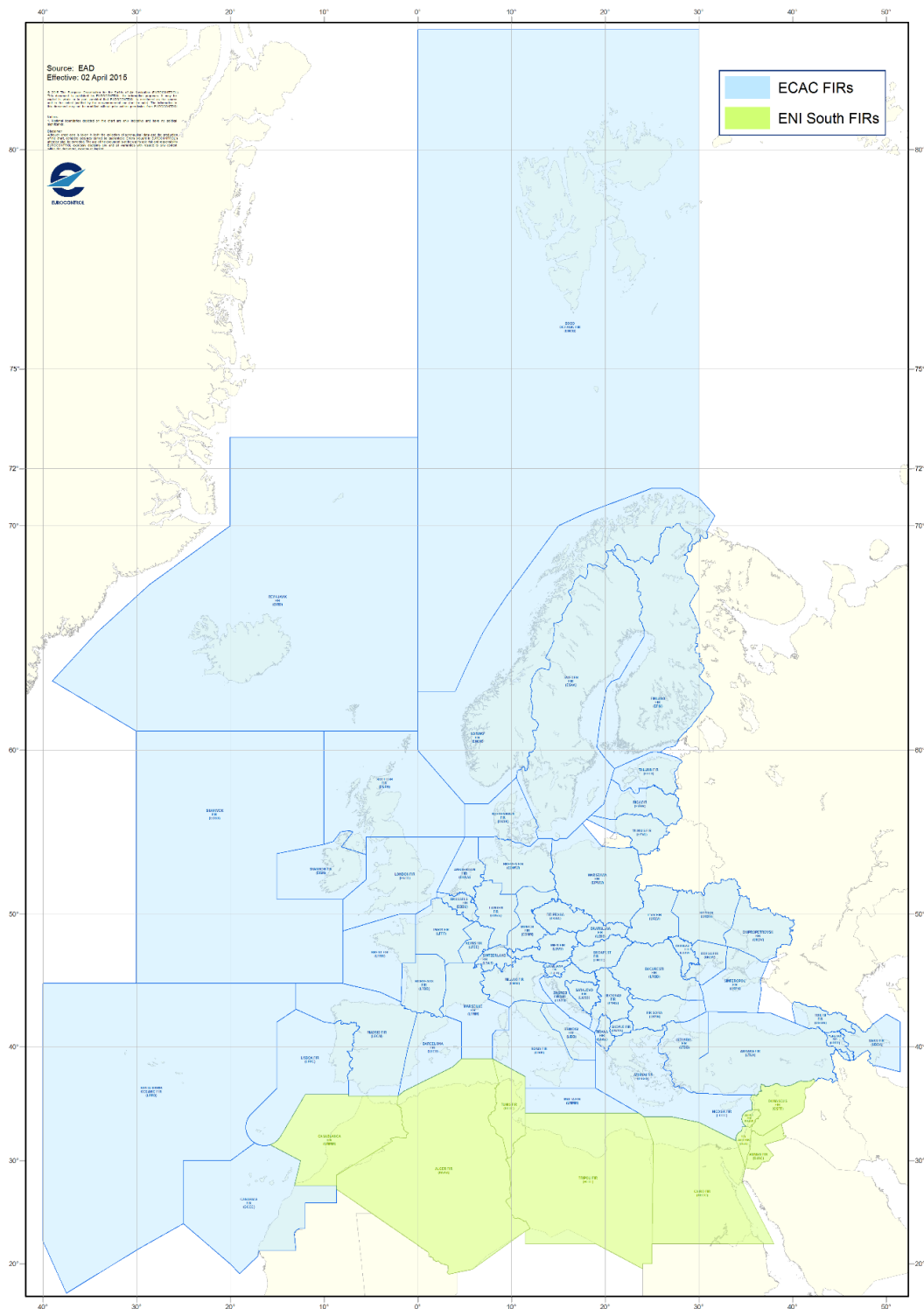


Figure 2: ECAC and ENI South Region Coverage FIR

5.2 EGNOS Space Segment

The SoL service requirements defined in the EGNOS mission requirements in terms of continuity and availability require that the service area is continuously covered. Considering availability of individual payloads and of the hosting satellite platform during the satellite's lifetime, this requirement translates in the need for at least 2 independent SBAS payloads broadcasting simultaneously (i.e. hosted on-board different GEO satellites), with a third payload as back-up. This third GEO is required to ensure availability of the service, in case of failure of one of the two operational GEOs. The backup payload can be also used either by the Design Authority for the technical qualification of new EGNOS system releases or by the EGNOS Service Provider for operational qualification of a new release under deployment.

The current EGNOS Space segment is composed of payloads embarked on the following satellites:

- Inmarsat 3F2 (15.5° W) until end 2018 with uplink stations in France and The Netherlands
- Inmarsat-4F2 (63.9° E) with uplink stations in The Netherlands and Italy
- GEO-1 (SES-5 at 5°E) with uplink stations in Belgium and Luxembourg
- GEO-2 (Astra-5B at 31.5°E) with uplink stations in Belgium and Luxembourg
- GEO-3 (E5WB, at 5°W), currently under development, to be available from Q2 2019 onwards with uplink stations in France and Italy.

EGNOS space segment will change in the short term due to decommissioning of Inmarsat3F2 and GEO-3 entry in operational service; from 2022 onwards, three GEO payloads will remain. This RFI targets new GEO transponder services (GEO-4 and GEO-5), with an availability date in the time period from 2021 to 2027. GEO-4 and GEO-5 are to be exclusively used by the EGNOS V3 system.

The following chart shows the indicative timelines of the payload services used by EGNOS V3. The figure assumes a period of 2 years between the transponder operational qualification (OSD = Operation Start Date) and its effective use by the EGNOS operational system. With this constraint, the latest possible OSD for GEO-4 and GEO-5 to replace GEO-1 and GEO-2 respectively, will be 2024 and 2027. However, the GSA is also considering to advance GEO-4 procurement and request an OSD earlier than 2024. The EGNOS transponders service provision phase are expected to last for about 15 years; this duration depends on the foreseen reliability of the payload in-orbit and is defined by the payload owner.

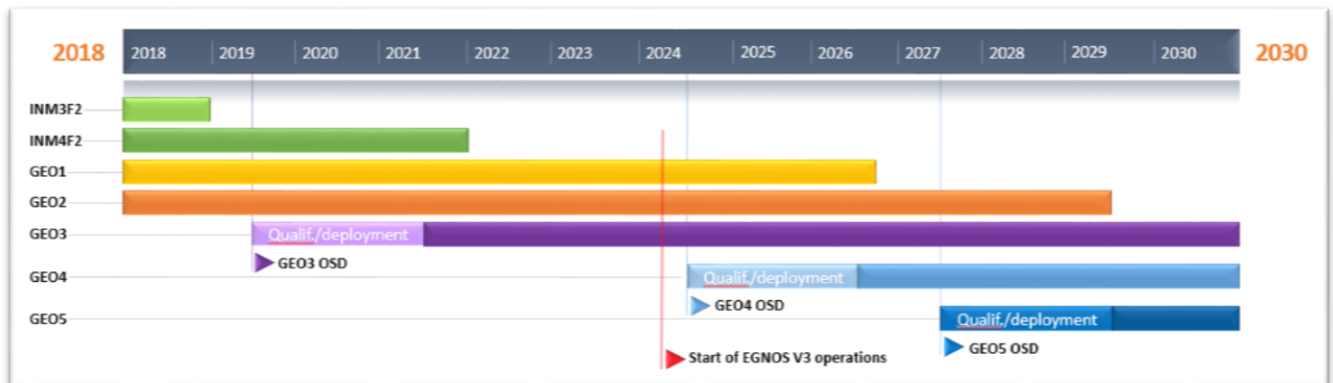


Figure 3: GEO Roadmap

6 Information requested

6.1 Scope of the request

The main purpose of the Request for Information is to obtain information on opportunities for GEO satellites to embark a navigation payload in the coming years, to enable the GSA take into account the market situation when defining the procurement of transponder services. It shall be noted that no decision has been taken on whether GEO-4 and GEO-5 services will be procured jointly or separately nor on the date to issue a tender.

In preparing their answers, participants are invited to take into account that the scope of the service will comprise:

- Provision of the EGNOS GEO-4 and/or GEO-5 payload service compliant to requirements expressed in SBAS specifications [4] , [5] .
- Provision of two independent uplink stations connected to each SBAS payload for the transmission of the SBAS signals generated by the NLES equipment. This includes hosting and maintenance services for the NLES equipment at each uplink station during the period of the service provision phase. The uplink stations shall be located in European Union territories.
- A target service provision phase of 15 years starting from the operational qualification or Operational Start Date (OSD). Other options are possible based on the answers to this RFI.

6.2 Main transponder service characteristics

This section presents a preliminary set of requirements for the EGNOS GEO-3 Service with the scope of helping the participants to better assess the possibility to procure a piggy-back payload on one of their future GEO satellites.

The basic requirements of the GEO-4 and GEO-5 transponders to support EGNOS mission are:

- Orbital positions between 16° W and 32° E to cover the entire ECAC area with a minimum of 5 degrees elevation avoiding orbital slots already hosting SBAS GEOs.
- Transparent bent-pipe navigation payload.
- Two channels for L-band downlink. The payload shall provide 2 channels to support the independent transmission of SBAS signals in L1 and L5 bands. The RF characteristics shall comply with [4] ,[5] .

Some major characteristics are:

- L1 channel:
 - Carrier frequency 1575.42 MHz,
 - Bandwidth (3 dB) 24 MHz,
 - Received power on ground: from –164 dBW (at the output of the antenna specified in [4] table B-88, for all locations where satellite is observed with an elevation of 5 degrees or higher) to –152.5 dBW (at the output of a 0 dBic antenna).
- L5 channel :
 - Carrier frequency 1176.45 MHz,
 - Bandwidth (3 dB) 24MHz,
 - Received power on ground: from –158 dBW (at the output of a 3 dBi linearly polarised antenna, for all locations where satellite is observed with an elevation of 5 degrees or higher) to –150.5 dBW (at the output of a 0 dBic RHCP antenna).

At the time of the procurement a larger band might be requested for the second channel: E5 with a bandwidth of approximately 55 MHz. In this case, two downlink carriers will be required: SBAS L5 signal specified above plus an additional carrier for E5b signal at the center frequency 1207.14 MHz

The two channels shall allow separate command and configuration: turn on/off of each channel independently, channel gain and level control setting, etc.

- Service availability (transponder + RF uplink stations): the outage rates shall not exceed

	Mean Time between Outages	Mean Duration
Outage Mode 1	1 year	10 minutes
Outage Mode 2	10 years	36 hours

Note: An outage is defined as a period of time during which the service is not provided according to the requirements (e.g. performance is not compliant to the specifications). This includes also unavailabilities caused by manoeuvres, software upgrades, preventive maintenances, RF station problems, etc.

6.3 Main uplink RF stations and hosting sites needs

Detailed hosting site requirements will be issued at the time of the procurement. At this stage, GSA wants to inform the participants of some high level needs:

- Two independent RF uplink stations per satellite where EGNOS NLES equipment will be collocated. The uplink station will also need to accommodate network equipment and have space for operations as well as an storage room.
- Specific RF environment requirements to be respected: interference free, antenna clear horizon, low multipath, etc. Besides the payload uplink antenna, an L-band downlink antenna will also be installed.
- On-site support for maintenance activities which should follow the procedures defined by the EGNOS operator.
- The sites, service and satellite operator will be subject to GNSS Programme security rules and constraints.

6.4 Expected feedback from the participants

The following information is expected from the participants in their answers to the present RFI:

1. Future satellite plans and possibility to embark SBAS payload(s) in due time to ensure an OSD from 2021 to 2027

A short description of launch plans of future satellites, indicating which satellites could embark SBAS payload(s), having regards to the main transponder characteristics listed in section 6.2 above.

The following information is expected:

- Orbital location of the satellites;
- Mass/Power/Physical accommodation constraints to embark an EGNOS payload as a piggy-back mission on the satellite;

- technical impact of the third carrier in E5b frequency band
- Timing constraints to embark the EGNOS payload on the future satellites and deadlines to sign a contract in order to fit into the satellite development schedule.

2. Service availability and long-term payload reliability

The participants are invited to elaborate on:

- Expected availability of the payload, considering the satellite manoeuvres plans including assessment of the impact of the chosen propulsion sub-system.
- Mitigation measures proposed against the risk that the payload becomes unavailable, notably mitigation proposed against a critical failure to ensure service restoration, either by using a spare satellite or launch of a new satellite, etc.
- Reliability of the service, as a function of time since OSD, and its impact on the possible service duration. The participants are invited to share their trade-off between the duration of the service provision phase versus risks of underperformance, as well as their assessment of the conditions that would increase service reliability.

3. EGNOS Payload Procurement, In Orbit Test, Commissioning

Information on the way to procure the payload, explaining the intended supply process and information on the schedule and set-up to conduct in-orbit testing and to commission the EGNOS payload explaining the role of the entities involved.

NOTE: GSA and ESA will request the right to participate to the payload development reviews/IOT/commissioning activities (reviews, test campaigns...).

4. EGNOS RF Uplink Stations and Hosting Sites

Information regarding the potential Hosting Sites locations for the two RF Uplink Stations and respective NLES and the security protections in place. Please note that Hosting Sites shall be located in European Union territories.

5. Contractual arrangements, payment scheme, cost estimate

Currently the availability of the geo transponders for EGNOS is ensured as a service paid for with a monthly fee starting at the operational start date, a portion of this fee is paid as an advance payment (pre-financing of the service).

The participants are invited to suggest if clear benefits could be expected by the GSA if other contractual arrangements or payment modalities would be chosen and elaborate on those.

The participants are also requested to explain:

- which benefits they foresee if the GSA were procuring GEO-4 and GEO-5 services together (although payloads would reach Operation Start Dates a few years apart) and the synergies of sharing ground sites or, more generally, a common operator.
- how the service price depends from the contracted service duration and what impact possible contract extensions would have on the service price and whether longer service could be procured via options (i.e. decision on execution is taken later in lifetime of contract or possibly not executed at all).
- the impact of the third carrier in E5b frequency band in terms of additional cost.

A rough estimate of EGNOS GEO-4 and/or GEO-5 payload services cost shall be provided for each proposed contractual approach, explaining under what conditions this price is provided.

The participants should note that the cost range information will be used solely to decide which terms and conditions the GSA could envisage for the procurement and these data will not be used for other purposes.

7 RFI Validity

Answers to the RFI shall be sent electronically to tenders@gsa.europa.eu by 31 August 2018 (at the latest).

Information received will be used only for the purposes stated in this RFI.

The GSA reserves the right to share the information received from the participants with other public sector entities – European Space Agency and the European Commission – within the framework of existing confidentiality obligations between the GSA and such parties.

End of Document