Innovative Commercial Sensors

Statement of works

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Applicable and Reference Documents

Table 1: Applicable documents

|  |  |
| --- | --- |
| Reference | Document title |
|  | *CCSDS 503.0-B-2 : Tracking Data Message* |
|  | *CCSDS 502.0-B-2 : Orbit Data Message* |
|  | *EU SST\_ICD\_0001\_2-3SST2018-20 : D4.3 – Coordinated Scheduling Interface Definitions* |
|  | *EU SST Database Interface Control Document (ICD)* |
|  | *Passive Ranging ICD* |
|  | *CALL FOR PROPOSALS* |

Abbreviations and Acronyms

Table 2: List of used abbreviations

|  |  |
| --- | --- |
| Acronym | Description |
| AP | Autonomous Products |
| CAT | Sensor Category |
| CC | Calibration Campaign |
| COM | (European) Commission |
| COOC | Coordination Committee |
| EC | European Commission |
| ECSS | European Cooperation for Space Standardisation |
| KPI | Key Performance Indicators |
| [MR] | Measurements Rate |
| MS | Milestone |
| [N] | Noise |
| [O2] | Objects observed per hour |
| [O3] | Objects uniquely observed by a sensor per hour in a 48h period |
| Op | Operational assessment |
| REA | Research Executive Agency |
| [RN1] | Responsiveness |
| SEC | Security Committee |
| SST | Space Surveillance and Tracking |
| STC | Steering Committee |
| TBC | To be confirmed |
| TBD | To be discussed |
| TN | Technical Note |
| [TL] | Timeliness |
| YOR | Yearly Operations Review |

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# Introduction

## Context

For the last decades, the number of objects in orbit has highly increased, encouraging the provision of services related to achieving space surveillance and tracking (SST) activities such as, conjunctions and re-entry, analysis and fragmentation detections.

The “Decision of the European Parliament and the Council Establishing a Space Surveillance and Tracking Support Framework” n°541/2014/EU [RD-2] (“SST Decision” hereinafter) was adopted on April 16th, 2014, establishing the SST Support Framework 'to contribute to ensuring the long-term availability of the European and national space infrastructure, facilities and services which are essential for the safety and security of the economies, societies and citizens in Europe’

After an initial phase of EU SST activities carried out in 2016 and 2017 by the SST Cooperation within the frame of the SST2015 projects (1SST2015, 2SST2015 and 3SST2015), a second phase of EU SST activities was performed from the second half of 2017 to the end of 2020 under the SST16-17 projects (1SST16-17 and 2-3SST16-17). The last EU SST activities in the frame of the SST Decision are being carried out within the frame of:

* The 1SST2018-20 project “First funding line in Working Programme 2018, 2019 and 2020 for the further development of a European SST Service provision function” under the Copernicus and Galileo funding scheme. Operational activities are within the scope of 1SST2018-20. The project has started on the 30th of March 2019 and is planned to end on the 30th of June 2023 for an overall duration of 51 months
* The 2-3SST2018-20 project “Second funding line in Work Programme 2018 - 2020 for the further development of a European SST Service provision function” under the H2020 funding scheme. The project has started on the 1st of January 2020 and will end on the 30th of June 2023

This consortium were using a sensors network (composed of on-ground optical sensors, tracking and surveillance radars and laser stations) to locate space objects (spacecraft or debris), in order to determine latest orbits first, predict future trajectories then, and finally, assess consequences and risks on environment (in orbit by means of a conjunction analysis, on earth using a re-entry analysis).

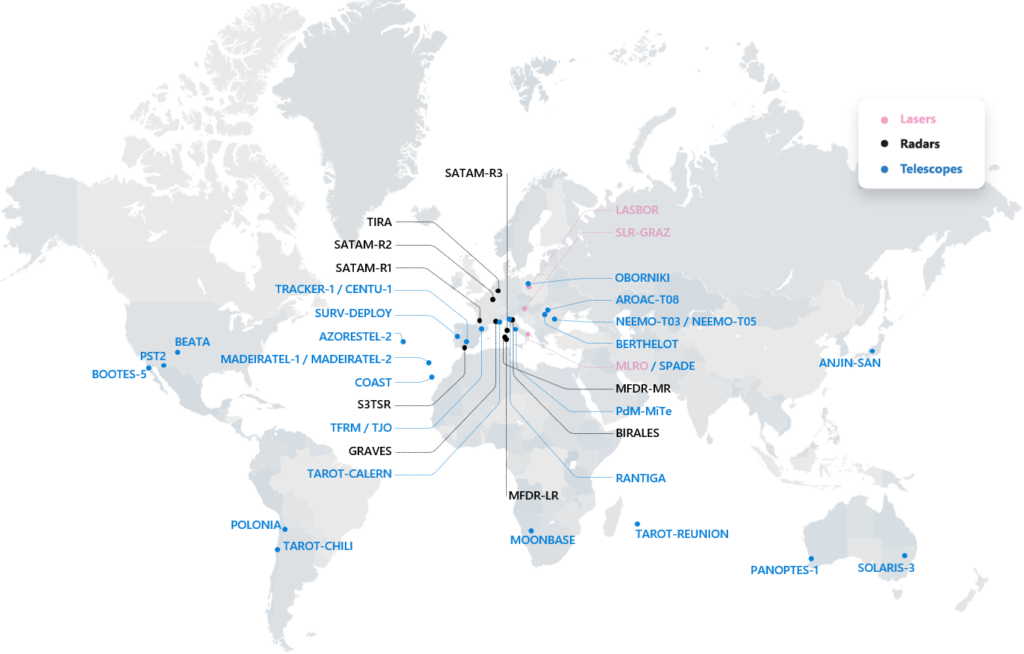


Figure 1: EU SST Sensors Network (July 2022)

Thanks to the good operating results, since 11th November 2022, this consortium has been turned to a 15 delegations Partnership (Austria, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Spain and Sweden) working together in order to improve EU SST operating results and science around space situational awareness.

An operative side on one hand, and a R&D side on the other hand, which are working both in a strong cooperation, as R&D activities are performed as long-term development strategy, comprise this partnership.

## Scope of the call

This note aims to define the eligible criteria and rules related to the EU SST investment in innovative commercial data solutions.

## Outline of the activity

### Activity informative details

As proposed in the partnership, a part of the operating activities for the next three years will be dedicated to promote and support commercial data providers (radars, optical sensors and passive ranging sensors, laser ranging and other suitable sensor types) either on-ground or space based located. The main objective is to increase the proportion of commercial data from current 5% up to 50%, provided there is added value, by the end of the partnership (30th June 2026). Setting up the conditions for commercial support is supported by an exchange with the European Union Industry and Start-up Forum (EISF).

The aim of this document is to describe the activities related to the 4 Meuros Cascading Grant assigned to the Italian Space Agency, dedicated to co-fund the development of new optical solutions implemented by the European industry by supporting:

* Already existing and operational sensor / network of sensors upgrades intending to improve performances (accuracy, detection capabilities, timeliness, …)
* Development of a new cross-technology based sensor
* Improving an already existing and operational sensor / network of sensors, thanks to cross-technology features
* Deployment of sensors outside European VLA
* Development of solutions to decrease the price of data

This contract will be divided in two different phases:

* **Phase 1: Working period**

This stage starts once the application is granted and the contract is signed. During this step, the activities described in the Work Breakdown Structure (See 2.1) are performed.

This phase shall not begin after 1st of June 2025 and ends automatically 1 month prior the end of the contract.

* **Phase 2: Validation period**

This stage starts after the end of the Phase 1, once the sensor(s) is(are) upgraded and ready to provide data to EU SST, for 1 month.

During this step, the Contractor will provide data to EU SST in order to assess the quality and viability of the co-funded sensor, to be qualified TRL-8/9.

*Note: All data exchanged during this period are free of any charges.*

### Main objectives

The overall main objectives are described below.

* It is not mandatory for a single project to cover all main objectives
* a single project must cover at least one of the main objectives

1. LEO Detection capabilities

the effort shall be focused on project offering to detect and catalogue objects smaller than 10cm (high priority), and between 10-50cm (medium priority) in LEO.

1. MEO Detection capabilities

the effort shall be focused on project offering to detect and catalogue objects smaller than 35cm in MEO

1. GEO Detection capabilities

the effort shall be focused on project offering to detect and catalogue objects smaller than 35cm in GEO

1. Transversal technology

the effort shall be focused on project offering transverse solution for all far VLAs (such as optical + radar combination).

1. Location Diversification

the effort shall be focused on project offering deployment of sensor in the following VLA:

1. Asia;
2. Pacific Ocean;

### Sensor lifecycle

According to the current procedures, the lifecycle for sensors in EU SST networks once operational is composed by three different stages:

* **Integration stage:** During this stage, the provider is implementing EU SST ICD to connect, declare the operational parameters and observation strategy. A pre-operational campaign assessment is performed, confirming:
  + The communication is established
  + The measurement files are provided correctly
  + The general statistics meet the declared ones.

Once successful, the sensor is officially integrated and allowed to provide “Operational” data used internally to EU SST.

* **Operational stage:** During this stage, the sensor is providing measurements according to a routine data provision way (for surveillance) or answering to specific and punctual needs (for observation requests, namely tasking requests).

In order to ensure high quality of data, the sensor is periodically (every 6 months) assessed in line with an assessment campaign composed by the technical assessment on one hand, and the operational assessment on the other hand. Since the technical assessment is focused on the quality of the data thanks to well-tracked objects data comparison process (see 8.4), the operational assessment campaign is focused on operational metrics such (delay to provide measures to EU SST – namely timeliness; number of measurements shared, number of tracks shared, number of objects covered, answers to tasking requests, etc).

* **Maintenance stage:** As a cyber-physical device, in order to address any failures or upgrades, a sensor can be declared in maintenance. EU SST shall be warned a couple of months prior (in case of scheduled maintenance), or as soon as an issue is raised. In case of the maintenance has an impact in performances of the sensor, in order to be Operational again, once the maintenance is complete, the provider requests for an extra technical assessment (namely *Flash Calibration*).

Note that this technical assessment is mandatory to be allowed to provide operational data to EU SST.

# Work Packages

## Overview

As described in the Figure 2, the project is conducted following six already identified tasks:

* Task 1: Design
* Task 2: Manufacturing and Purchase
* Task 3: Transport
* Task 4: Construction, installation and integration
* Task 5: Commissioning and validation
* Task 6: Management

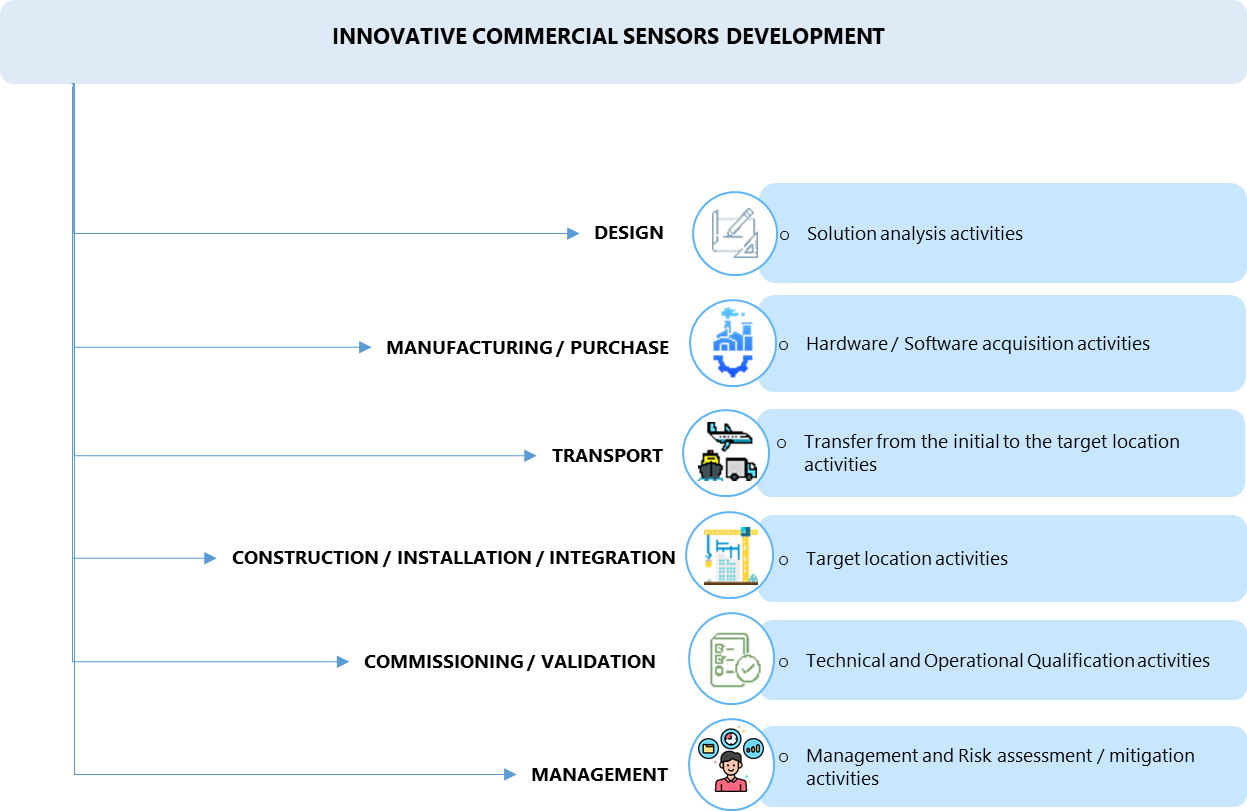


Figure 2 : Work Breakdown structure

Meanwhile the Management is obvious and described above, find details about the five other tasks below.

## Task 1: Design

### Outline

This task includes all activities related to define the target solution, meaning:

* Providing technical details and report describing the solution (including hardware and software performance analysis)
* Hardware benchmark and tests
* Algorithms definition

### Input

N/A

### Output

The output of the activity is at least:

* The list of required devices with technical justifications
* The algorithms design at top level
* The acquisition method for each device or software involved (Manufactured or Purchased)
* The design documents

## Task 2: Manufacturing / Purchase

### Outline

This task includes all activities related to build or buy (when it is needed) hardware and software identified in 2.2.

This task does not include additional analysis which would be purchased to refine the design or analysis performed in the task 2.2.

During this task, the contractor is expected to report to the Contractor Authority:

* An up-to-date acquisition schedule;
* An up-to-date Risk register regarding the timeline;
* Mitigation strategy in case of risk once identified.

### Input

At least, the output listed in 2.2.3 are considered.

### Output

At least:

* The required devices and software
* The acquisition schedule

## Task 3: Transport

### Outline

This task includes all activities related to transfer each part of the solution, from the manufacturing to the target facility. It includes also trip achieved by the experts.

The schedule is expected to be defined by the contractor and maintained up-to-date overall the duration of the contract.

### Input

N/A

### Output

At least:

* An up-to-date transport schedule
* An up-to-date Risk register regarding the timeline;
* Mitigation strategy in case of risk once identified.

## Task 4: Construction / Installation / Integration

### Outline

This task includes all activities related to host the sensor into its final location, meaning:

* Terrain acquisition
* Facility building (e.g. shelter)
* Deployment of the sensor

### Input

N/A

### Output

At least:

* An up-to-date construction schedule;
* A weekly progress report
* An up-to-date Risk register regarding the timeline;
* Mitigation strategy in case of risk once identified.

## Task 5: Commissioning / Validation

### Outline

This task includes all activities related to evaluate the sensor meaning:

* Tests performed in test environment;
* Tests performed in real conditions;
* Tests performed in the final location once the sensor is deployed;
* Assessment Campaign participation and supervised by EU SST.

### Input

N/A

### Output

At least:

* Tests report
* Calibration campaign status
* Mitigation strategy in case of risk once identified.

# Specifications

1. Objectives compliancy

The Contractor shall be compliant with at least, one of the objectives detailed in 0.

1. Output TRL

The output TRL shall be higher or equal to 8 at the end of the contract.

## Phase 0: Selection period

1. Project details for technical evaluation

The Contractor shall provide in the application form an exhaustive description of the project, detailing the expected benefits and outputs at the end of the working period.

1. System details for technical evaluation

The Contractor shall provide in the application form the technical characteristics of the system in use as described in 8.3.

1. Expected quality of the data

The Contractor shall provide in the application form the expected quality of the data once the project is achieved.

1. Thresholds inheritance

The details expressed in both DATA-REQ-5 shall be compliant with the related thresholds covered by DATA-REQ-56.

1. Work package content description

The Contractor shall detail each activity expected to be achieved within the work packages detailed in 2.

1. Work package calendar

The Contractor shall detail, for each work package, a tentative calendar for each activities, and potential connection between some activities (if any).

1. Subcontractors list

The Contractor shall detail, for each work package:

* The list of subcontractors involved
* The perimeter related to each subcontractor involved
* The budget related to each subcontractor involved

1. Initial Risk register

The Contractor shall detail in the application form, the risks register related to each activity, work package, and the overall packages.

## Phase 1: Working period

1. Termination date

The Contractor shall end the working period by 30th May 2026 at the latest.

1. Duration

The Contractor shall take at least 12 months.

1. Process implementation

The Contractor shall implement the process detailed in 2.

1. Reporting implementation

In addition to DATA-REQ-13, the Contractor shall implement to reporting process as described in 5.

## Phase 2: Validation period

### Integration process

1. Connectivity implementation duration

The Contractor shall implement the adaptation to be integrated to the EU SST within 2 weeks at maximum posterior to the start of Phase 2.

1. Pre-operational campaign

Once connected, the Contractor shall answer to the observation requests within the 2 weeks, in order to:

* Be calibrated according to the Technical Performance Assessment Process (See 8.4).
* Check the connection is working properly.

EU SST will send the final answer within 2 weeks from the last measurement epoch.

1. Pre-operational failure

In case of failure, the Contractor shall perform improvement and send the data within 2 weeks since the rejection by the EU SST. In case of 2-times in a row failure, the contract will be interrupted.

*Note: In case of weather event, a waiver can be requested to extend once the weather conditions are good to operate the sensor.*

### Operational phase

1. Duration

Once integrated, the Contractor shall provide overall data acquired during 1 month posterior to the integration without any restrictions.

### Eligible data

1. Eligible data

Once completed, the contractor shall be able to provide at least, one of the following data to EU SST:

1. Tracks (See DATA-REQ-21) related to non-natural objects orbiting the Earth;
2. Physical data (e.g. resolute images of the target) of non-natural objects orbiting the Earth.
3. Correlation process

If applicable, the Contractor shall explain, at the high-level, the correlation process and sources within the application form.

1. Track definition

The Contractor shall consider a track as a set of measurements, associated to a same object, and delimited by the “mean track duration” parameter defined in 8.3.

#### Common requirements

1. Measurements definition

The measurement shall comply with the following table:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Nature | Type of parameter | Radar | | Optical | | Passive Ranging | Space based |
| Data | **Epoch** | MANDATORY | | | | | |
| **Celestial coordinates** | MANDATORY | | | | OPTIONAL\*\*\* | MANDATORY\*\* |
| **Range** | MANDATORY\* | | N/A | | OPTIONAL\*\*\* | MANDATORY\*\* |
| **Range rate** | MANDATORY\* | | N/A | | OPTIONAL\*\*\* | MANDATORY\*\* |
| **TDOA / FDOA value** | N/A | | N/A | | MANDATORY\*\* | MANDATORY\*\* |
| Meta data | **Participants** | MANDATORY | | | | | |
| **Corrections applied** | MANDATORY | | | | | |
| **Biases** | MANDATORY | | | | | |
| **Frequency** | MANDATORY | | N/A | | MANDATORY | MANDATORY\*\* |
| **Wavelength** | N/A | | MANDATORY | | N/A | MANDATORY\*\* |
| **Frame** | MANDATORY | | | | | |
| **Timescale** | MANDATORY | | | | | |
| Meteorological information | **Pressure in hPa** | REQUESTED | | | | | N/A |
| **Humidity in %** | REQUESTED | | | | | N/A |
| **Temperature in K** | REQUESTED | | | | | N/A |
| **Slant Total Electron Count in TECU** | REQUESTED | | | | | N/A |
| **TROPO\_DRY in m** | REQUESTED | | | | | N/A |
| **TROPO\_WET in m** | REQUESTED | | | | | N/A |
| Additional information | **RCS** | OPTIONAL | | | | | OPTIONAL\*\* |
| **Power Received / Power Emitted ratio** | OPTIONAL | N/A | | OPTIONAL | | OPTIONAL\*\* |
| **Signal to noise ratio** | OPTIONAL | N/A | | MANDATORY | | OPTIONAL\*\* |
| **Magnitude** | N/A | OPTIONAL | | N/A | | OPTIONAL\*\* |
| **Sensor ephemeris** | N/A | | | | | MANDATORY |

\* *Range is mandatory for Ranging radars meanwhile Range Rate is mandatory for Doppler radars*

*\*\* For space based solutions, the nature of the expectation (mandatory or not) depends on the technology behind. The inheritance rule is applied.*

*For Passive Ranging solutions, the nature of the expectation (mandatory or not) depends on the technology behind.*

*\*\*\* If available due to cross-technology solutions or obtained thanks to an internal process*

1. Other measurements definition

If DATA-REQ-22 is not applicable, the Contractor shall detail the content of the data.

1. Media corrections

The measurements shall be provided without media corrections (see [AD-1]).

1. Additional corrections

In case other data corrections than media corrections (See DATA-REQ-24) are involved (such as time bias, …):

1. Applied corrections shall be explicitly mentioned in the file according to the related format;
2. Nature of corrections shall be frozen at the beginning of the activity;
3. Any changes shall be reported to EU SST and approved thanks to the evaluation process before being used.
4. Environment data

The Contractor shall provide the following environment data for each measurement:

1. Pressure in hPa
2. Humidity in %
3. Temperature in K
4. Slant Total Electron Count in TECU
5. TROPO\_DRY in m
6. TROPO\_WET in m

#### Space based additional data

1. Sensor ephemeris

In case of space-based data, the ephemeris of the sensor shall be provided with each set of measurements and containing:

* The frame used to express state vectors;
* The epoch (and the time scale) of state vectors;
* The state vectors;
* The frame used to express the covariance;
* The covariance for each state vector.

1. Ephemeris interval

The ephemeris shall cover the complete interval of the measurements.

1. Ephemeris time step

The ephemeris shall contain for each measurement epoch, the information described by DATA-REQ-27.

1. Ephemeris format

The ephemeris shall be compliant with the CCSDS-OEM standard (See [AD-2]).

### Measurement Exchange protocol

1. Data format

The data shall be compliant with either:

1. CCSDS-TDM format for radars and optical data (See [AD-1]);
2. Specific format defined by an ICD for others. Any change in the ICD during the period of work shall be firstly approved by EU SST.
3. TDM metadata constraints

The TDM shall be structured as follow:

* Sensor identification : Station ID as declared in the EU SST Database meaning <MS>\_<NAME>\_<CONFIG>
* Target identification : NORAD ID or International Designator only

#### Nominal Operating procedure

*This procedure is the main way to exchange data between the Contractor and EU SST.*

*Note the EU SST Database interface will change in 2024. The EU SST will be provided early during the contract to let the Contractor anticipate the transition, to be fully operational once the upgrade is expected.*

1. Data sharing

The Contractor shall share data to the EU SST according to the applicable ICDs (0 and 0).

1. EU SST database ICD implementation

The Contractor shall implement the ICDs related to the EU SST database (See [AD-4]).

1. EU SST request ICD implementation

The Contractor shall implement the ICDs related to the EU SST On-demand Requests system (COPLA – Coordinated Scheduler) (See [AD-4]).

1. EU SST ICDs upgrade

The Contractor shall implement modifications in its system once new EU SST ICD is released, accordingly to the schedule communicated by EU SST.

1. EU SST Procedure upgrade

The Contractor shall implement modifications in its system once new EU SST Procedure is released.

#### Safe Operating procedure

*This mode is defined for redundancy, in case of the provider is unable to join the EU SST interface.*

*In that case, the [TL] threshold won’t be used to assess the data is valid or not.*

1. Backup solution

The Contractor shall provide an online solution to host data in case of failure within the Operating mode.

1. API

The Contractor shall develop an API related to the backup solution.

1. ICD related to the Backup API

The Contractor shall provide and maintain the documentation related to the API involved.

### Performance assessment

#### Description

The EU SST will assess the performances of the Contractor during the validation phase, in order to ensure a high level of quality, thanks to the established procedure (See 8.4).

This evaluation will be performed either:

1. According to a calibration procedure involving specific objects;
2. By comparing residuals observed regarding the final products.

See DATA-REQ-42 for thresholds.

Besides, effective added value of the Contractor to the EU SST shall be assessed by the EU SST, in order to compare performance of the Contractor regarding all the other sensors / candidates.

#### Requirements

1. Calibration campaign participation

The Contractor shall participate to a calibration campaign at the end of the working period, according to the established procedure (See 8.4.1).

1. Technical Reference thresholds

The Contractor shall be compliant to the technical thresholds defined in 8.4.1.

*Note: For your perfect information, please find here under a recap of the technical thresholds*

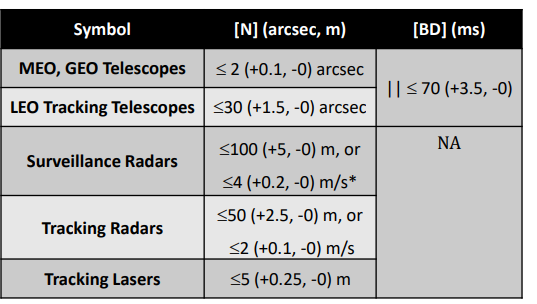


Table 3 : Noise thresholds per type of sensor

1. Noise thresholds inheritance

In case the measurement type is not explicitly mentioned in the table defined by DATA-REQ-42, the thresholds defined for the subjacent technology are used.

*For example:*

* *Passive Ranging measurement refers to “ Tracking radar threshold”;*
* *SBSS optical measurement refers to “Surveillance telescope threshold”*

1. Thresholds update

The thresholds defined in DATA-REQ-42 and can be revaluated overall the contract by EU SST solely.

1. Procedure upgrade

The procedure described in 8.4 can be revaluated by EU SST throughout the contract.

1. Data exchange protocol

The procedure described in 8.4 can be revaluated by EU SST throughout the contract.

# Eligible criteria

### Legal governance

1. Eligible structure

The nature of the Contractor shall be either:

1. A Start-Up;
2. A Small and Medium Enterprise (SME);
3. A Large Enterprise (LE)
4. A consortium
5. Origin

The Contractor shall be a European company located in a European country, accordingly to the ownership form.

1. Consortium composition

In case that the Contractor is a consortium, all members shall be compliant DATA-REQ-47 and DATA-REQ-48.

1. Consortium legal representative

In case that the Contractor is a consortium, a unique legal representative shall be identified, speaking in the name of all the members.

### Technology maturity

1. Input Technical Readiness Level related to Hardware development

The Technical Readiness Level (TRL) related to the hardware to be developed at the time the application is submitted shall be higher or equal to 6 (See 8.1 for more details).

1. Input Technical Readiness Level related to Software development

The Technical Readiness Level (TRL) related software to be developed at the time the application is submitted shall be higher or equal to 4 (See 8.1 for more details).

1. Technical Readiness level evaluation

The Technical Readiness Level (TRL) shall be evaluated according to ISO-1290:2013.

### Sensor(s)

1. Sensor ownership

The Contractor shall be the owner of its sensor(s).

1. Sensor ownership in case of consortium

For Consortium only, the primary legal representative shall own the sensor(s) related to this contract.

1. Location restriction

For optical sensors in European VLA, the Contractor shall provide additional details contributing to demonstrate the added value of the sensor such as (non-exhaustive list):

* LEO capabilities;
* High dedication leading to high contribution;
* High reactivity;
* Large field of view;
* Number of observable objects in same slot

## Quality / Assurance

1. Risk Management Document

The Risk Management Strategy (RMS) shall be detailed in a document.

*Note: ISO-31000 compliancy would be better.*

1. Risk Management Document Upgrade

The Contractor shall maintain the Risk Management Strategy (RMS) document during the period of work, and submit it at each evolution.

1. Quality and Assurance Plan Definition

The Quality and Assurance Plan (QAP) shall be provided at the time the application is submitted.

*Note: ISO-90001 compliancy would be better.*

1. Quality And Assurance Plan Upgrade

The Contractor shall maintain the Quality and Assurance Plan (QAP) during the period of work and submitted at each evolution.

1. Maintenance reporting

All maintenance (scheduled or not) shall be reported by the Contractor to the EU SST. Impact of this maintenance (such as potential risk on the quality) shall be mentioned.

1. End of maintenance calibration

At the end of the maintenance, the Contractor shall schedule a calibration campaign accordingly to the procedure (See 8.4).

# Reporting

## Kick-Off Meeting (KOM)

1. Meeting content

Once the contract is signed, the Contractor shall schedule a Kick-Off meeting within 15 days posterior to the signature, presenting:

* The work packages content (including activities)
* The work packages calendar
* The risk related to each work package (including risks related to each activity)
* The budget repartition
* The overall calendar

1. Organization

The Contractor shall organize the meeting by proposing both In-person and Remote solutions.

1. Deliverables

The Contractor shall provide the following deliverables within 1 week posterior to the meeting:

* A minute of meeting (MoM).
* The presentations shall be provided at the end of the meeting.

1. Attendees

The attendees will be (at least):

* The Contractor
* EU SST (both Technical and Contractual delegates)
* The European Commission delegates

## Intermediate Review Meeting (IR)

1. Meeting content

Every 3 months, the Contractor shall schedule an Intermediate Review Meeting presenting:

* The status of activities currently in progress
* The risks related to activities currently in progress
* The up-to-date roadmap of the activated work packages
* The up-to-date roadmap of the overall project until termination

1. Organization

The Contractor is free to organize this meeting with either:

1. In-person solution
2. Remote solution
3. Both
4. Deliverables

The Contractor shall provide the following deliverables within 1 week posterior to the meeting:

* A minute of meeting (MoM).
* The presentations shall be provided at the end of the meeting.

1. Attendees

The attendees will be (at least):

* The Contractor
* The EU SST technical delegates

## Critical Intermediate Review Meeting (CIR)

1. Meeting content

Every 6 months, the Contractor shall schedule a Critical Review Meeting presenting:

* The status of activities currently in progress
* The risks related to activities currently in progress
* The up-to-date overall risks register
* The up-to-date roadmap of the activated work packages
* The up-to-date roadmap of the overall project until termination
* The up-to-date financial monitoring report

1. Organization

The Contractor is free to organize this meeting with either:

1. In-person solution
2. Remote solution
3. Both
4. Deliverables

The Contractor shall provide the following deliverables within 1 week posterior to the meeting:

* A minute of meeting (MoM).
* The presentations shall be provided at the end of the meeting.
* The Step-by-step report containing:
  + Details related to the achieved works
  + The remaining works
  + Un up-to-date roadmap for the activities, work packages and overall project
  + Un up-to-date risks register
  + Un up-to-date financial monitoring report.

1. Attendees

The attendees will be (at least):

* The Contractor
* The EU SST (both Technical and Contractual parts)
* The European Commission delegates

## Pre Final Acceptance Review Meeting (PreFAR)

1. Meeting content

At the end of the Phase 1, the Contractor shall schedule the Pre Acceptance Review Meeting presenting:

* The works achieved
* The remaining works
* The up-to-date overall risks register
* The up-to-date roadmap of the activated work packages
* The up-to-date roadmap of the overall project until termination
* The up-to-date financial monitoring report
* The overall status of the project

1. Organization

The Contractor shall organize the meeting by proposing both In-person and Remote solutions.

1. Deliverables

The Contractor shall promie the following deliverables within 30 days prior to the meeting:

* The presentations shall be provided at the end of the meeting.
* The Step-by-step report containing:
  + Details related to the achieved works
  + The remaining works
  + Un up-to-date roadmap for the activities, work packages and overall project
  + Un up-to-date risks register
  + Un up-to-date financial monitoring report.

1. Attendees

The attendees will be (at least):

* The Contractor
* EU SST (both Technical and Contractual delegates)
* The European Commission delegates

1. Closure milestone for Phase 1

The acceptance of the PreAR’s conclusions by EU SST and the European Commission is leading to close the Phase 1 of the contract.

## Final Acceptance Review Meeting (FAR)

1. Meeting content

At the end of the Phase 2, the Contractor shall schedule the Final Acceptance Review Meeting presenting:

* The works achieved
* The remaining works
* The up-to-date overall risks register
* The up-to-date roadmap of the activated work packages
* The up-to-date roadmap of the overall project until termination
* The up-to-date financial monitoring report
* The overall status of the project

1. Organization

The Contractor shall organize the meeting by proposing both In-person and Remote solutions.

1. Deliverables

The Contractor shall provide the following deliverables within 30 days prior to the meeting:

* The presentations shall be provided at the end of the meeting.
* The Step-by-step report containing:
  + Details related to the achieved works
  + The remaining works
  + Un up-to-date roadmap for the activities, work packages and overall project
  + Un up-to-date risks register
  + Un up-to-date financial monitoring report.

1. Attendees

The attendees will be (at least):

* The Contractor
* EU SST (both Technical and Contractual delegates)
* The European Commission delegates

1. Closure milestone for Phase 2

The acceptance of the FAR’s conclusions is leading to close the Phase 2 of the contract.

# Financial terms

## Main requirements

1. Co-funded rate

The Contractor shall provide at least 55% of the total cost of the project (thanks to own funds), meaning EU SST will contribute up to 45% of the total cost at maximum.

1. Eligible activities

The eligible activities are defined in the main body of the attached ASI Call for Proposal [AD-6].

1. Eligible costs

The eligible costs are defined in the main body of the attached ASI Call for Proposal [AD-6].

1. SBSS restrictions

For SBSS projects, the following costs are not eligible:

* Cost related to the satellite launch
* Cost related to the Ground Segment developments

## Payment milestones

### Phase 1: Working Period

1. Frequency

The reimbursement of the eligible costs, not already claimed by the Contractor, is achieved by EU SST every 6 months.

1. Payment acceptance conditions

The payment is granted only if:

* The last CIR (or PreAR) has been scheduled and achieved properly.
* EU SST (both Technical and Contractual delegates) has approved the results of the last CIR (or PreAR).
* The European Commission delegates have approved the results of the last CIR (or PreAR).

### Phase 2: Validation Period

1. Frequency

The reimbursement of the last eligible costs, not already claimed by the Contractor and honoured by EU SST are made at the end of the closure of the Phase 2.

1. Payment acceptance conditions

The last payment is unlocked after a formal approval of the FAR conclusion (See 5.3), meaning:

* The data have been received and assessed by EU SST.
* The FAR has been scheduled and achieved properly.
* The EU SST (both Technical and Contractual delegates) has approved the results of the FAR.
* The European Commission delegates have approved the results of the FAR.

## Contract interruption conditions

1. Critical Intermediate Review GO/NOGO

In case of internal failure, or risks continuously growing leading to compromise the achievement of the project, the NOGO status can be requested at the end of the CIR either by EU SST or European Commission. In such case, the contract is broken.

1. Pre Acceptance Review GO/NOGO

In case of internal failure, or risks continuously growing leading to compromise the achievement of the project, the NOGO status can be requested at the end of the PreAR either by EU SST or European Commission. In such case, the contract is broken.

1. Final Acceptance Review GO/NOGO

In case of internal failure, or risks continuously growing leading to compromise the achievement of the project, the NOGO status can be requested at the end of the FAR either by EU SST or European Commission. In such case, the contract is broken.

# Communications

## Technical discussions

The communication between the Contractor and the Contractor Authority regarding the technical aspects detailed into this document shall be monitored by the following EU SST technical expert:

Elena Vellutini

[Elena.vellutini@asi.it](mailto:Elena.vellutini@asi.it)

## Contractual discussions

The communication between the Contractor and the Contractor Authority regarding the administrative aspects detailed into this document shall be monitored by the following Contractor Authority team leader:

Elena Vellutini

[Elena.vellutini@asi.it](mailto:Elena.vellutini@asi.it)

## Procurement discussions

The communication between the Contractor and the Contractor Authority regarding the procurement aspects shall be monitored by the following purchasing department officer:

Vanessa Viti

[Vanessa.viti@asi.it](mailto:Vanessa.viti@asi.it)

# Appendices

## Technical Readiness Level definition

|  |  |
| --- | --- |
| TRL | Definition |
| TRL9 | Actual system “flight proven” though successful mission operations. |
| TRL8 | Actual system completed and “flight qualified” through test and demonstration. |
| TRL7 | System prototype demonstration in a space environment. |
| TRL6 | System/Subsystem model or prototype demonstration in a relevant environment (ground or space). |
| TRL5 | Component and/or breadboard validation in relevant environment. |
| TRL4 | Component and/or breadboard validation in laboratory environment. |
| TRL3 | Analysis and experimental critical function and/or characteristic proof-of-concept. |
| TRL2 | Technology concept and/or application formulated. |
| TRL1 | Basic principles observed and reported. |

## 

## List of KPIs monitored to assess the quality and the contribution of sensors to EU SST

| **Type** | **ID** | **Names** | **Definition** | **Thresholds** | **Metrics** | **Inputs data Source** | **Applicability** | **Considerations** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **QUALTY MEASUR.** | [N] | Noise | Measurement noise is defined as the root mean square (RMS) observation residuals.  Measurement noise is generally assimilated to a Gaussian (normal) distribution. In this way, the interval centred on the mean with semi-amplitude of 1- σ comprises 68.27% of residuals data | 2.0 arcsec telescopes  30 arcsec telescopes tracking exclusively LEO objects   50m tracking range radars   2m/s tracking range rate radars   100m survey range radars   4m/s survey range rate radars   50 tracking lasers | *Angular*:  as angular measurements are defined in spherical coordinates, the standard deviation will be computed to:   * ra ∙cos(dec), or equivalently az ∙cos(el), where ra=right ascension, dec=declination, az=azimuth and el=elevation, * dec or equivalently el   *Range and Range rate*:  Obtained as direct results from measurements  Results expressed as Half round-trip light time or 1-way equivalent | Calibration Campaign | All sensors | The lower the noise the shorter difference between precise value and observation. RMS of the observation residuals, for every component. Angular components are compressed into a single value ( total astrometric error) Thresholds mainly inspired on the implementing decision |
| [B] | Bias | For telescopes difference in time between sensor measurements respect a well-known precise orbit | No Threshold | Telescopes: [B] is computed with an OD approach minimizing the residuals (ms) | Calibration Campaign | Telescopes | Specific calibration campaign or equivalent data  Telescopes every four months since 2020 |
| [BD] | Bias Drift | The time drift of the telescopes | |[BD]| 70 | Difference between [B] (Time Bias) associated to the current calibration campaign and the [B] Time Bias) associated to the currently declared in operations. In case no [B] declared in operations the value 0.0 ms will be taken as a reference | Calibration Campaign | Telescopes | Time Bias [B]has to be stable along the time so [BD] should tend to zero |
| [OR] | Outilisers Rejected | Percentage of measurements rejected by assessment teams due to lack of consistency with the rest of measurements shared |  10%  If 5% [OR ]  10% & [N] < Threshold. Special analysis will be carried out to assess the impact of the outliers. In case that the assessment with the outliers has a result [N] > Threshold, the outliers will be included in the computation | Number of measurements rejected/Number of measurements fulfilling the CC requirements  Rejection criteria:  Average Mean of the residuals ± 5Sample SD | Calibration Campaign | Al sensor | The lower the number the value, the more consistent the data. |
| **DATA SHARING** | [TN] | Track Noise | Noise of the compressed track, computed from the noise of the individual measurements and the number of measurements contained in the track | No Threshold | TN=[N]/√([M]/[T]) [  N] Noise of the individual measurement y  [M] number measurements.  [T] number of tracks | EUSST DB Data shared and Calibration Campaign | All sensors | The lower the noise, the better the track. Exclusive for telescopes (it is also used in the architecture studies as telescopes added value for Tracklet accuracy). |
| [TD] | Track Duration | Mean track duration. Average duration of all shared tracks | No Threshold | Sum for all tracks (Track last observation epoch- Track first observation epoch)/ [T] | EUSST DB Data shared | All sensors | Interdependent, they can be seen as the inverse of each other. Both are strongly dependent on the definition of the track  Longer track duration could mean less time for other tracks, and so fewer tracks, and similarly vice versa. |
| [T] | Number of tracks | Tracks as defined in Definitions section corresponding to a sensor | No Threshold | Straightforward recount from TDMs | EUSST DB Data shared | All sensors |
| [M] | Number of measurements | Measurements as defined in Definitions section corresponding to a sensor | No Threshold | Straightforward recount from TDMs | EUSST DB Data shared | All sensors | Both parameters are positively influenced by the frequency of observations and the FoV.  Other factor is surveillance strategy.  [MR] same as before per unit of time |
| [MR] | Measurements rate | Number of measurements as defined in Definitions section per operational time | ≥21 telescopes performing tracking  ≥24 telescopes performing only survey  ≥ 12 tracking radars  ≥ 250 survey radars  ≥ 19 tracking lasers | Straightforward recount from TDMs measurements / Effective dedication declared time (h) | EUSST DB Data shared | All sensors |
| [TL] | Timeliness | Delay of provision of measurements | 48 h >90% data shared | Time between the end of the tracks shared and sharing.  In the EUSST DB, this is “Inserted time” – “End time” | EUSST DB Data shared | All sensors | It is computed as the time by which 90% of the data has been shared.  To give a statistically complete picture, it is complemented with the % of data shared in 48h/24h |
| [O1] | Different Objects observed | Number of different Objects observed by a sensor | No Threshold | Total number of different objects observed | EUSST DB Data shared | Surveillance Sensors | Value is very dependent on the observation strategy. Only observed objects correlated against a public source |
| [UT] | Useful Time Percentage | Time actually dedicated to EUSST with respect to that declared | No Threshold | Ratio from Sum (direct) for all tracks (Track last observation epoch- Track first observation epoch)/ originally foreseen to EU SST eventually allocated in actual operations | EUSST DB Data shared | All sensors | Actual availability used by sensor with respect to the commitment.  Statistic does not account for the time while sensors are operating but not obtaining results: 1)repositioning time is not considered. 2)Setting for first observation is not considered 3) for tracks overlapped in the time, the operational time is not aggregated |
|  | [RO1] | Un Robustness to operate | Time actually dedicated to maintenance-repairs with respect to that declared to EUSST | No Threshold | Time operational maintenance or technical shutdown (only declarative) with respect to the time committed in the grant | EUSST DB Data shared | All sensors | Time a sensor has been off operations due to a shutdown.  This parameter cannot be obtained from the operational data and it is declarative (consistent to KPI ) |
| [RN1] | Responsiveness capability | Capability to react positively to request in monitored TR | ≥7.0%telescopes performing tracking,  ≥4.0%tracking radars and tracking lasers | Number of times that measurements are provided to a TR, divided by the number of HIE.  For sensors declared as a contributors to the Mission Support TR, it will be taken into account for the computation of the parameter. | EUSST DB Data shared | Sensors that perform tracking | Dependent on the TR features. Some events are not observable from some locations. The overlap of TR impact on the availability  The more TR covered, more meaningful the statistics is. |
| [O2] | Different Objects observed every hour | Average number of different objects observed by a sensor per hour | ≥7 objects/hour survey telescopes    ≥65objects/hour for surveillance radars | Average of number of different objects observed per interval of 1 hour. The whole operational period is divided in N intervals of 1 hour. For each interval i, the number of different objects observed by the sensor is computed | EUSST DB Data shared | Surveillance Sensors | Rapidity of the sensor for acquiring different objects. A measurement of the sensor rapidity : FoV and Repositioning |
| [O3] | Unique objects observed every hour | Average number of different objects observed exclusively by a sensor per hour | ≥0.1 objects/hour surveillance telescopes  ≥11 objects/hour for surveillance radars | Average of number of objects uniquely observed by a sensor per interval of 48 hours. The whole operational period is divided in N intervals of 48 hours. For each interval i, the number of different objects observed exclusively by the sensor is computed: eoi | EUSST DB Data shared | Surveillance Sensors | When this parameter value is high, it means that the sensor observes objects that would not be observed by the network without it. A low value means that the sensor observes objects redundantly (because of a close location, for example). **This parameter cannot be computed for each sensor independently**. We need the information of all the sensors at the same time to be able to determine the exclusive observations: one object observed by only one sensor within the interval. |

## Parameter description details

### Sensor description form

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Explanation |
| MS | - | Member State. Please use ISO 3166-1 |
| Name | - | Name of the sensor with respect to naming convention:  <MS ISO 3166-1>\_<Sensor name>\_<configuration> (e.g. PL\_BEATA, FR\_TAROT-CALERN, ES\_TFRM-PB, IT\_SPADE). |
| Declared dedication |  | Percent of time contributed to EU SST. |
| Operational experience | - | Description of operational experience on SST (including references) |
| Constrains in data policy | - | Possible exclusions of the sensor work (e.g., data restrictions, object restrictions) - description about exclusion |
| Use | - | Surveillance, Tracking, Both (for sensors that can do surveillance and tracking) |
| Location | degree / meter | Longitude, Latitude, Altitude above MSL; ECEF coordinates  (min precision: at least 7 digits for Lat./Lon. and 3 digits for altitude) |
| VLA | - | Groups sensors in similar geographical areas that would potentially see similar region of the GEO belt. To be consistent with the architecture, and facilitate the simulation assessments |
| Potential dedication | - | Maximum time hypothetically a sensor could be working for EUSST |
| Mount | - | Type: <AzEl | Eq | X-Y> |
| [deg/s] | Max angular Vel angle 1 |
| [deg/s] | Max angular Vel angle 2 |
| [deg/s2] | Max angular Acc angle 1 |
| [deg/s2] | Max angular Acc angle 2 |
| Responsiveness | [h] | Preparation hours - Time elapsed from the reception of a request and the sensor being ready to perform the measurement |
| - | Processing - Time elapsed from the observation to the availability of the processed data |
| Format data sharing | - | User input (EU SST requires: CCDS TDM, CRD) |
| Point of contact | - | Point of contact for the sensor to clarify information |
| Comments | - | To clarify the data introduced in the Almanac fields, to add information (expected upgrades), etc. |
| Owner | - | Entity that has ownership of the SST sensor |

### Observation process description form

* **For optical based sensors:**

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Explanation |
| MS | - | Member State. Please use ISO 3166-1 |
| Name | - | Name of the sensor with respect to naming convention:  <MS ISO 3166-1>\_<Sensor name>\_<configuration> (e.g. PL\_BEATA, FR\_TAROT-CALERN, ES\_TFRM-PB, IT\_SPADE). |
| Mode | - | The mode ID of the configuration |
| FOV |  | The field of view dimensions. |
| Wavelength | meter | The mean wavelenght of the signal |
| Limiting magnitude | - | The highest observable magnitude\*. |
| Exposure Time | Second | The exposure time per image |
| Image per area | - | The number of image per shot |
| Pointing duration | Second | The time between two shots (for surveillance) |
| Measure accuracy | deg | The estimated accuracy for measurements |
| Mean track duration | Second | The mean duration of a track |

*\* In case of magnitude is function as Elevation, please fill the following table instead.*

*The elevation step used is up to the Contractor.*

|  |  |
| --- | --- |
| Elevation (°) | Limiting magnitude |
| 0 | 12 |
| … | 13 |
| 90 | 14 |

* **For radar based sensors:**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | | Explanation |
| MS | - | | Member State. Please use ISO 3166-1 |
| Name | - | | Name of the sensor with respect to naming convention:  <MS ISO 3166-1>\_<Sensor name>\_<configuration> (e.g. PL\_BEATA, FR\_TAROT-CALERN, ES\_TFRM-PB, IT\_SPADE). |
| Mode | - | | The mode ID of the configuration |
| FOV |  | | The field of view dimensions. |
| Frequency | Hz | | The frequency of the signal |
| RCS@1000km |  | | The minimum radar cross section of a target observed at 1000km range. |
| Measure Per Track | - | | The minimum number of measurement per track |
| Measurement period | s | | The duration between two measures in a track |
| Measure accuracy | meter / meter/second / second / Hz | | The estimated accuracy for measurements, depending on the case :   * Range value : precision expressed in meter * Radial velocity : Precision expressed in meter/second * TDOA : Precision expressed in second * FDOA : Precision expressed in Hz. |
| Mean track duration | Second | The mean duration of a track | |

* **Contribution to services:**

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Explanation |
| MS | - | Member State. Please use ISO 3166-1 |
| Name | - | Name of the sensor with respect to naming convention:  <MS ISO 3166-1>\_<Sensor name>\_<configuration> (e.g. PL\_BEATA, FR\_TAROT-CALERN, ES\_TFRM-PB, IT\_SPADE). |
| Mode | - | The mode ID of the configuration |
| Services contribution | - | Select which case are compliant with your system.   * **CA** : YES/NO * **RE** : YES/NO * **FG** : YES/NO |

## Sensor Assessment Process

The following procedure aims to define the manner to evaluate the operational performance of a sensor. As an output, the status of the sensor (meaning “Operational” or “Not-Operational”) will be determined.

This categorization procedure is based on both subjacent assessment process:

* A technical assessment aiming to estimate the measurement accuracy (See 8.4.1)
* An operational results based assessment process aiming to evaluate the reactivity of the sensor and the contribution to EU SST (See 8.4.2)

### Technical Assessment process

#### Eligible calibration data

In order to calibrate, EU SST is requesting for well-known objects observation campaigns. These objects are selected thanks to different criteria such as:

* Their location
* Their observability
* The accuracy of ephemeris available

In addition, in order to make the assessment relevant and representative, EU SST has been established some rules driving observation campaigns as described below.

For each sensor, the observation campaign shall be performed considering the following rules:

* Telescopes:
  + Maximum duration (between the first and last measurements): 14 days
  + Minimum number of objects with at least 50 measurements (35 for LEO): 3
  + Minimum number of total measurements: 130 (LEO) 200 (MEO/GEO)
* Radars:
  + Maximum duration (between the first and last measurements): 14 days
  + Number of tracks belonging to different passes: 5
  + Minimum total tracks duration: 6 minutes

#### Eligible targets

##### LEO Targets

| **Object Name** | **SP3c Code** | **ILRS ID** | **NORAD ID** | **Altitude [km]** | **Inclination °** |
| --- | --- | --- | --- | --- | --- |
| **Larets** | L59 | 304206 | 27944 | 691,00 | 98,20 |
| **CryoSat-2** | L12 | 1001301 | 36508 | 720,00 | 92,00 |
| **SARAL** | L46 | 1300901 | 39086 | 814,00 | 98,55 |
| **Sentinel-3A** | L74 | 1601101 | 41335 | 814,50 | 98,18 |
| **Sentinel-3B** | L75 | 1803901 | 43437 | 814,50 | 98,65 |
| **Stella** | L56 | 9306102 | 22824 | 815,00 | 99,00 |
| **HY-2C** | L69 | 2006601 | 46469 | 957,00 | 66,00 |
| **HY-2D** | L78 | 2104301 | 48621 | 971,00 | 66,00 |
| **Starlette** | L55 | 7501001 | 7646 | 1000,00 | 50,00 |
| **Jason-3** | L39 | 1600201 | 41240 | 1336,00 | 66,00 |
| **Sentinel-6A** | L40 | 2008601 | 46984 | 1355,90 | 66,04 |
| **LARES** | L60 | 1200601 | 38077 | 1450,00 | 69,50 |

##### MEO /GEO Targets

| Object Name | SP3c Code | ILRS ID | Norad ID | Altitude [km] | Inclination ° |
| --- | --- | --- | --- | --- | --- |
| Galileo-210 | E01 | 1603002 | 41550 | 23220 | 56 |
| Galileo-211 | E02 | 1603001 | 41549 | 23220 | 56 |
| Galileo-212 | E03 | 1606902 | 41860 | 23220 | 56 |
| Galileo-213 | E04 | 1606903 | 41861 | 23220 | 56 |
| Galileo-214 | E05 | 1606904 | 41862 | 23220 | 56 |
| Galileo-207 | E07 | 1606901 | 41859 | 23220 | 56 |
| Galileo-208 | E08 | 1507902 | 41174 | 23220 | 56 |
| Galileo-209 | E09 | 1507901 | 41175 | 23220 | 56 |
| Galileo-101 | E11 | 1106001 | 37846 | 23220 | 56 |
| Galileo-102 | E12 | 1106002 | 37847 | 23220 | 56 |
| Galileo-202 | E14 | 1405002 | 40129 | 23220 | 56 |
| Galileo-201 | E18 | 1405001 | 40128 | 23220 | 56 |
| Galileo-103 | E19 | 1205501 | 38857 | 23220 | 56 |
| Galileo-104 | E20 | 1205502 | 38858 | 23220 | 56 |
| Galileo-215 | E21 | 1707901 | 43055 | 23220 | 56 |
| Galileo-204 | E22 | 1501702 | 40545 | 23220 | 56 |
| Galileo-205 | E24 | 1504501 | 40889 | 23220 | 56 |
| Galileo-216 | E25 | 1707902 | 43056 | 23220 | 56 |
| Galileo-203 | E26 | 1501701 | 40544 | 23220 | 56 |
| Galileo-217 | E27 | 1707903 | 43057 | 23220 | 56 |
| Galileo-206 | E30 | 1504502 | 40890 | 23220 | 56 |

#### Procedure

| Step | Action |
| --- | --- |
| #1 | The Contractor shall schedule acquisition campaign within the 6 months period it has been notified by the EU SST considering the constraints described in 0 |
| #2 | Once data are available, the Contractor shall push them to the EU SST database (See DATA-REQ-33) with the “Calibration” flag |
| #3 | The EU SST calibrate the sensor according to bias / noise internal estimation procedure to provide the final report |
| #4 | In case the calibration fails, the sensor is turning to Non-Operational.  The Contractor shall request for flash calibration to the EU SST. |

### Contribution to EU SST Assessment process

#### Description

The assessment is made thanks to the overall data received during the computation period by computing, among the list of KPIs detailed in 8.2, a restricted list of KPIs.

The computation period is covering the 6 past months to the final evaluation.

#### Evaluation criteria

In order to assess the contribution of sensors to EU SST, the following KPIs are considered.

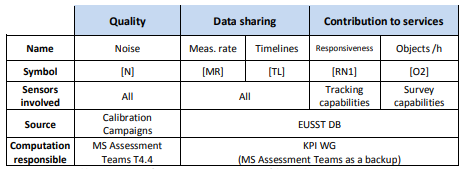
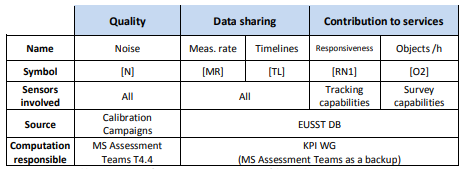


Table 4 : Contribution to EU SST assessment parameters

### Exhaustive list of KPIs and thresholds

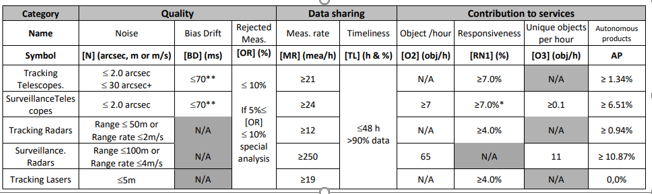


Table 5 : Exhaustive list of KPIs and thresholds used to determine the category of the sensor

## On-operation data quality process

In addition to the calibration campaign, in order to support sensors and ensuring a high level of quality, a continuous or regular update of the noise parameter is defined.

To do so, the process will request (thanks to COPLA) in a monthly basis, measurements of reference objects to assess the noise of the measures coming from the sensors. At the end of the month, the evaluation leads to the following conclusion:

* If the measurement noise is compliant with threshold, all data received are considered valid (and paid).
* All received data are rejected (and not paid) otherwise.

| Step | Action |
| --- | --- |
| #1 | During the first part of the month (15days maximum), COPLA is requesting for measurements of reference objects (in addition to operational requests). |
| #2 | During the second part of the month (15days maximum), the assessment team is evaluating the noise thanks to 8.4.1. |
| #3 | The assessment is then assessing the operational KPIs of the sensors to consider valid data. |
| #4 | At the end of the month, a report is written and shared to both EU SST and related commercial data providers to summarize the amount of valid data |

*Note: In order to ensure an unbiased evaluation, the measurements are rescaled to 1Hz.*