## EUSPA ROLE IN EU SST: SERVICE PROVISION, USER UPTAKE AND SECURITY

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# ABSTRACT

In order to safeguard space infrastructure, the European Union has a dedicated capability for Space Surveillance and Tracking (EU SST) that provides space safety services to a growing community of users. EU SST is based on a cooperation between the SST Partnership, composed of 15 Member States, and the European Union Agency for the Space Programme (EUSPA). While Member States are responsible for their sensors, processing activities and services generation, EUSPA is responsible for the SST Front Desk – the user interface of EU SST - and supports security related activities. EUSPA's Front Desk responsibility officially started in July 2023, following a European Commission's Decision to transfer this function from the previous operator, the EU Satellite Centre (SatCen). The current premises of the SST Front Desk are located at EUSPA's Galileo Security Monitoring Centre (GSMC) in Madrid, Spain.

The SST Front Desk manages the SST Service Provision Portal, which is the platform used for the provision of EU SST services i.e. collision avoidance, re-entry, and fragmentation analysis, facilitating the communication with users. It also supports the coordination of space traffic, with different web and programmatic interfaces for accessing the services information, and many other user-oriented features, including service configuration, visualisation and statistical reporting.

Moreover, the Front Desk has a helpdesk team that supports users of these services, including spacecraft owners and operators, EU institutions and EU Member States, among others. To date, approximately 200 organisations are registered for the services, with roughly 500 satellites registered for the collision avoidance service – which has been available since 2023 to the international community.

The Front Desk operational team also coordinates the EU SST taskforce for handling critical SST events, e.g. major re-entries or anti-satellite weapons (ASATs), which in close cooperation with the Member States experts deals with scenarios of high public interest, among others. The Front Desk is also responsible for KPIs activities, which monitor all EU SST functions i.e. sensor, processing, and services, through a dedicated reporting platform, that underpins the management of the Programme by the European Commission.

In terms of user coordination and engagement, EUSPA has numerous activities to collect feedback and user needs, to align and evolve SST services accordingly. EU SST is already part of EUSPA's User Consultation Platform and will also have new devoted modules in the EU Space Academy. The Agency is also responsible for communication and outreach activities.

In addition to its responsibility for service provision and user uptake, EUSPA oversees the EU Space Programme security – taking the necessary steps required to ensure the confidentiality, integrity and availability of the Programme data and services. For SST, EUSPA will also support the definition of the security requirements needed to shape the SST network, and contribute to its development as well as its security monitoring.

#### 1. EU SPACE PROGRAMME AND EU SST

Space Surveillance and Tracking (SST) is part of the Space Situational Awareness (SSA) component of the EU Space Programme, adopted by the European Union in 2021 with the Regulation (EU) 2021/696 of the European Parliament and of the Council [1].

For the implementation of the EU Space Surveillance and Tracking (SST) [2], established in 2021, the SST Partnership of 15 EU Member States (Austria, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Latvia, the Netherlands, Poland, Portugal, Romania, Spain and Sweden) together with the European Union Agency for the Space Programme (EUSPA) acting as the EU SST Front Desk form the SST Cooperation.

The SST Cooperation and its services are based on three main functions: sensor, processing and service provision. Sensors from Member States (and soon from commercial providers) contribute with data that is analysed in the processing function, feeding a joint database and ultimately a catalogue of space objects; from this, SST information is produced for three services, generated by the Operations Centres (OCs) and delivered to users via the SST Front Desk.



Figure 1. EU SST service provision chain

The Sensor function consists of a network of sensors to survey and track space objects in all orbital regimes (LEO, MEO, HEO and GEO). The network currently comprises approximately 40 sensors of the member states (incl. surveillance and tracking radars, and telescopes), and soon should have commercial sensors contributing as well.

The Processing function aims to coordinate the datasharing between the different OCs via a common database and to process thousands of daily measurements from the sensors contributing to EU SST. Such data is the basis of the future EU SST Catalogue that will be used for the SST services. Germany is responsible for hosting the EU SST Database and generating the future EU SST Catalogue.

The Service Provision function is in charge of providing three SST services – Collision Avoidance (CA), Re-entry Analysis (RE) and Fragmentation Analysis (FG) – to entitled users through a secure portal, the SST Service Provision Portal, managed by EUSPA, which acts as Front Desk, as already mentioned. Currently, the French (COO) and Spanish OCs (S3TOC) are responsible for the CA service, while the Italian OC (C-SSA) is in charge of the RE and FG services.

More than 200 organisations (e.g. satellite owners/operators, civil protection, aviation authorities, industry, Member States, EU entities) are receiving these services, with approximately 500 satellites safeguarded from the risk of collision. Such numbers have increased since 2023, with the opening of the CA service to the international community of satellite owners/operators.

## 2. THE EU SPACE PROGRAMME AGENCY

EUSPA is the operational European Union Agency for the Space Programme [3]. It adopts a user-oriented approach to promote sustainable growth and to improve the security and safety of the EU. In the execution of its mission, EUSPA counts on several partnerships with the European Commission, European Parliament, Member States, European Space Agency, and private actors across the EU. For SST, as aforementioned, it strongly cooperates with the SST Partnership and its Member States for the provision of SST services. Such cooperation is regulated by an Implementing Arrangement, defining the roles and responsibilities of each party and constituting entities.

For supporting the implementation of the Space Programme, the Agency has its activities structured in three main areas, service provision, security and user and market uptake:

## 2.1 Service Provision

On Service Provision, EUSPA operates Galileo and EGNOS, offering tailored navigation services like the Galileo High Accuracy Service and life-saving Galileo Search and Rescue Service. EUSPA also maintains, monitors and provides operational adjustments and updates for EGNSS ground and space infrastructure. The Agency also coordinates the implementation of GOVSATCOM including the development of the services hub and the user market. With EU SST, as the Front Desk, the Agency supports the protection of Europe's space assets – including Galileo, EGNOS, Copernicus and GOVSATCOM satellites – along with those of its Member States and other space operators.

## 2.2 User and market uptake

EUSPA drives Copernicus, EGNOS, Galileo, SST and upcoming GOVSATCOM/IRIS2 adoption in diverse sectors such as environmental protection, transportation, maritime, consumer solutions, emergency management, digitalisation, and more. The Agency fosters the development of EU industry and entrepreneurship by providing market intelligence (e.g.: EO & GNSS Market Report), technical know-how to innovators, academia, start-ups, and SMEs and funding.

#### 2.3 Security

EUSPA's security mission includes both operational matters and accreditation as well. EUSPA is ensuring the safety and security of EU Space Programme components in space and on the ground. It operates the GSMC and is also working on the development of secure governmental services to enhance security measures. Furthermore, within EUSPA, the independent Security Accreditation Board (SAB) holds authority over security accreditation for EU Space Programme components, making autonomous decisions such as granting satellite launch approvals or authorizing system operations.

Besides these 3 main areas, the Agency also supports the implementation of the EU priorities and strategies. To highlight the EU Space Strategy for Security and Defence

(EUSSD [4]), which was adopted in March 2023, and is a direct implementation of the EU Strategic Compass, in which space, together with cyber and maritime, are identified as contested strategic domains, the security of which must be ensured.

The Agency is located in different EU Member States, such as the Czech Republic where it has its HQ, in France with the GSMC-FR, in the Netherlands with the Galileo Reference Centre, and in Spain with the Galileo Service Centre and the GSMC-ES, where the SST Front Desk is located.

# **3** EUSPA - THE INTERFACE OF EU SPACE SAFETY SERVICES

As the SST Front Desk, the Agency cooperates with the SST Partnership on a number of activities to provide space safety services to a community of users.

#### 3.1 SST Portal

The SST Service Provision Portal [5] is the web-based interface to centralise, store and make available SST services (CA, RE and FG) and their information to SST users, ensuring their adequate handling and traceability. It includes different programmatic (REST API) and web interfaces for users e.g. satellite operators; to access, analyse and visualise the services information.



Figure 2. EUSPA SST Portal https://portal.eusst.eu/

For the CA service, it includes several specific features to support managing conjunction events. For instance, it includes the visualization of the evolution of conjunctions defining parameters (e.g. probability of collision, miss distances, collision plane); complemented with a dynamic timeline that shows the upload of products and user ephemerides and manoeuvres information if available. It allows information to be exchanged through programmatic means, both from the service perspective e.g. with conjunction data messages; and from the user perspective, acting in EU SST as the central point for satellite operators ephemerides uploads, including operational and ad-hoc ephemerides for special screenings.



Figure 3. SST Portal and the management of conjunction events

The provision of the CA service is based on what is known as the Service Configuration Documentation (SCD), which is used to agree on the CA service tailoring between satellite operators and EU SST. This SCD is also defined and available in the SST Portal.

The SST Portal also includes a communications and coordination platform, that enables communication with users, with devoted communication channels for events for two active spacecraft; and with additional coordination features being developed, as to:

- standardize such exchanges and traffic coordination, as to have prompt feedback on the course of action (e.g., take/decline responsibility to mitigate risk, the status of mitigation/stand-down action implementation).
- and to allow the mediation, through a coordination facilitator i.e. EU SST (CA NOCs), with proposed recommendations; considering agreed international guidelines and/or future standards on risk mitigation, rules of the road, etc.
- and an API supporting all the above-mentioned features for machine-2-machine/automated processes.



Figure 4. SST Portal Communication and Coordination Platform

Last but not least, the SST Portal also offers many other features for the RE and FG services. For the re-entry

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service it is possible to have a 30 days re-entry list, to visualize the re-entry window and corridor, the object ground track and overflights over areas of interest i.e. EU Member States, and a risk index to aid in identifying major events. For FG, the Portal will notify users as soon as an event has been detected by the IT OC, and when available, will provide information on the fragments distribution delivered as visual information (e.g. Gabbard diagram, cloud evolutions). More details in the EU SST Service Portfolio [6].

Long-term Charts
 Fragments Viewer
 Early Impact Risk Analysis
 Products



Figure 5. SST Portal FG 3D visualization

#### 3.2 SST Helpdesk

The SST Helpdesk is the main support channel for SST users, from inquiries from potential users, to managing new registrations, usage of the services and needs collection. It also supports CA service establishment with devoted meetings with users, for the service presentation and tailoring.



Figure 6. EUSPA SST Helpdesk

## 3.3 SST Taskforce

EUSPA also coordinates a taskforce activated during critical events to coordinate the EU SST response and produce specific outputs to be delivered to key stakeholders, and potentially to the public.

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Among other events, to highlight the recent re-entry of a battery pallet ejected from the International Space Station (ISS) [7], which had a mass of more than 2 tons and contained a considerable number of battery cells of nickel-chrome alloy steel with nickel oxide cathodes. These materials most likely did not burn completely when re-entering the Earth's atmosphere and the object's fragments could disperse, which made it deserve careful monitoring. EU SST contributing sensors observed the object and OCs performed analyses to produce the best possible estimation for the expected re-entry location and time.



Figure 7. ISS DEB (EP BATTERY) -Map of the object ground track (last prediction).

Such taskforce coordinates closely also with a number of actors for operational purposes: for aviation for instance with EUROCONTROL and the European Aviation Crisis Coordination Cell (EACCC); and as well with DG ECHO for civil protection matters. Activities are being prepared to tailor the service to such entities.

## 3.4 SST Performance Reporting

The Agency also conducts a transversal activity in the frame of EU SST that provides monitoring and reporting on the performance of the programme in all functions i.e. sensors, processing, services; through the provision of a set of KPIs and additional indicators, through a reporting platform, which is a devoted system for statistics provision.



Figure 8 EUSPA SST Reporting Platform

This platform also allows real-time monitoring at the Front Desk level, of operational activities (i.e. users' activity, OCs' activity, service compliance with portfolio, SCD); and plays an important role in sensors performance monitoring: calibration, integration of sensors, assessment campaigns.

In addition, this reporting function also pays close attention to the operational activity in EU SST. Below, is an evolution since 2021 of the number of CA High Interest Events (HIEs), which are conjunction events with the highest level of risk, where potentially a mitigation action e.g. collision avoidance manoeuvre. Particular events have been highlighted (incl. ones known to have generated a considerable number of debris, and the ones involving Starlink satellites in red, which have seen a significantly increased number).



Figure 9. Reporting on number of CA HIE (Hight Interest Events) against different secondaries

## 3.5 Uptake of services and users

EUSPA also develops strategies and implements a set of activities that promote the SST services among existing and potential users, and contribute to the continuous improvement of EU SST, while supporting the SST market development.

Such activities include a number of events and training sessions, with workshops, and webinars on specific topics; incl. the usage of the EU Space Academy, with lectures on SST services foreseen for Q3 2024. There is also a regular collection of user needs, and new service requirements; and a frquent collection of user feedback - also supported by the Agency User Consultation Platform.

Specific activities are also carried out in terms of market development, as to assess needs from users for commercial services, interest on a potential marketplace, support the industry through potentially some Programme tools e.g. CASSINI.

#### 3.6 Communication and dissemination

There are also a number of activities, aiming to maximise the impact of EU SST and its outreach, through different means. For instance, the EU SST website contains information of general interest on EU SST, news, articles, procurement opportunities, and services information, among others. In social media, different networks are managed. To complement, several materials are also produced e.g. Service Portfolio, leaflet, factsheet, and promotional videos.

## 3.7 Security

EUSPA is as well supporting the security activities of EU SST. It started already contributing with its experience and expertise to define the systems security requirements, needed to shape the SST network and its different assets.

The Agency will also operate the security monitoring of the SST network, alongside what is being done at the Galileo Security and Monitoring Centre, which is an integral part of the Galileo infrastructure. It monitors and takes action regarding security threats, security alerts and the operational status of systems components. The GSMC is organised as a Security Operations Centre (SOC) that monitors and takes action regarding security and cyber-security threats and alerts

The threat response mechanisms envisaged for EU SST, are similar to the ones foreseen for the Programme, as per Council Decision 698 [8], where in the event of a threat to the security of the Union or one or more of its Member States1 or to mitigate serious harm to the essential interests of the Union or of one or more of its Member States arising from the deployment, operation or use of the systems set up and services provided under the components of the Union Space Programme; or in the event of a threat to the operation of any of those systems or the provision of those services, the Council shall issue instructions to the EUSPA, and the GSMC is responsible for implementing these instructions.

# **4 FUTURE PERSPECTIVES**

In terms of future activities, the SST Front Desk will continue to evolve its different functions as to cope with new user needs and evolved services. Moreover, in the short-term efforts will be oriented to keep developing the SST Portal as a services platform in support of space traffic coordination, considering standardization, mediation, and automation, considering the number of events against large constellations. Specifically on users, it is foreseen to have devoted exchanges with the aviation community as to gather their needs and tailor the RE service accordingly.

Furthermore, the protection of the Programme assets is a priority for the Agency, and a number of synergies have already occurred between SST and Galileo, such as for the decommissioning of GSAT0104 or more recently for supporting and closely monitoring the launch L12 of 2 Galileo satellites. The next flagship system, IRI2, will require as well devoted support from SST.

Last, on Space Traffic Management the Agency will support the European Commission as per its communication on the EU Approach to STM [9], highlighting the gathering of user requirements, to develop STM capabilities alongside the SST Partnership, and support regulatory efforts as required.

# **5 REFERENCES**

[1] – Regulation (EU) 2021/696 of the European Parliament and of the Council of 28 April 2021 establishing the Union Space Programme and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013 and (EU) No 377/2014 and Decision No 541/2014/EU: <u>Regulation - 2021/696 - EN - EUR-Lex</u> (europa.eu)

[2] – European Union Space Surveillance and Tracking webiste: <u>https://www.eusst.eu/about-us/</u>

[3] – European Union Space Programme Agency website: <u>https://www.euspa.europa.eu/about/about-</u> <u>euspa</u>

[4] – EU Space Strategy for Security and Defence -JOINT COMMUNICATION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL European Union Space Strategy for Security and Defence. 10/03/2023: <u>Register of Commission Documents - JOIN(2023)9</u> (europa.eu)

[5] – European Union Space Surveillance and Tracking Portal: <u>https://portal.eusst.eu/portalng</u>

[6] – European Union Space Surveillance and Tracking Service Portfolio: <u>https://portal.eusst.eu/portalng/public-download/ServicePortfolio</u>

[7] – European Union Space Surveillance and Tracking Taskforce article on <u>EU SST monitors re-entry of space</u> <u>object ISS DEB – EU SST</u> [8] – Council Decision (CFSP) 2021/698 of 30 April 2021 on the security of systems and services deployed, operated and used under the Union Space Programme which may affect the security of the Union, and repealing Decision 2014/496/CFSP - Publications Office of the EU: Decision - 2021/698 - EN - EUR-Lex (europa.eu)

[9] – JOINT COMMUNICATION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL An EU Approach for Space Traffic Management An EU contribution addressing a global challenge: <u>EUR-Lex</u> -<u>52022JC0004 - EN - EUR-Lex (europa.eu)</u>