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Recent Developments in the Implementation of European Space Surveillance & Tracking (EU SST) – Security and Data Policy

Marc Becker[a]*, Pascal Faucher[b]

[a] *DLR Space Administration, Department of Space Situational Awareness, Königswinterer Str. 522-524, 53227Bonn, Germany*, marc.becker@dlr.de
[b] *CNES, Defence and Security Office, 2 place Maurice Quentin, 75039 Paris, France,* pascal.faucher@cnes.fr
* Corresponding Author

Abstract

The European Space Surveillance & Tracking (EU SST) Consortium is the European Union's operational capability for safeguarding space infrastructure and contributing to global burden-sharing in the domain of Space Situational Awareness (SSA). Today, the Consortium of EU member states in cooperation with the EU Satellite Centre serves over 90 user organizations with free services, such as Collision Avoidance for over 140 satellites. The Consortium operates a growing sensor network of radars, telescopes and lasers, which remain under the authority of the member states, reflecting the dual dimension of the SSA domain. Measurements and orbit data from the contributing sensors are shared through a dedicated platform, the EU SST Database.

As the Consortium increasingly shares data through the Database on a daily basis and will be processing that data into a European catalogue precursor, the Consortium's internal Security Committee is responsible for further developing the EU SST data policy that must balance the requirements for transparency and safety of flight with security constraints linked to precise and timely information on the nature, specifications and location of certain space objects.

This paper reports on recent developments in the implementation of EU SST with regard to security and data policy. It highlights the unique governance and data sharing model of EU SST, the diverse architecture of existing SSA sharing agreements, and data security considerations.

Keywords: Space Situational Awareness, Space Surveillance & Tracking, Space Security, European Cooperation, Data Policy

Acronyms/Abbreviations

CDM	Conjunction Data Message
EU	European Union
MFF	Multiannual Financial Framework
SSA	Space Situational Awareness
SST	Space Surveillance & Tracking
STM	Space Traffic Management
TDM	Tracking Data Message
US	United States

1. Introduction

Space Situational Awareness (SSA) is inherently a dual-use mission. As space is becoming increasingly busy, precise knowledge of the domain is crucially important for all satellite operators, regardless of whether they are military, civil, or commercial. In order to protect space-based infrastructure, facilities and services, it is necessary to survey and track as many objects in orbit as possible, including space debris and active satellites. Much of the technology used for surveying and tracking objects in space originates from missile defence systems, and military actors continue to operate space surveillance sensors around the world. This dual dimension of SSA is reflected in the European Space Surveillance & Tracking (EU SST) support framework.

EU SST is the European Union's (EU) operational capability for safeguarding space infrastructure and contributing to global burden-sharing in the SSA domain. While EU SST is a civilian framework, it systematically integrates and leverages military, civil and civil-military contributions from the participating member states, including sensors, operations centres and personnel. As a multilateral collaboration between civilian, military and security actors at the intersection of space safety and space security, EU SST is set up in a way that allows all partners to bring their respective strengths and capabilities into the system while ensuring that national and EU security interests are adequately preserved.

The EU SST framework is built on a unique, member state-led governance model. The participating EU member states (since 2015 France, Germany, Italy,

Spain and the United Kingdom, and since 2019 also Poland, Portugal and Romania), in cooperation with the EU Satellite Centre, have gradually networked their capabilities across sensor, data processing, and service functions to support the operations and decision-making of owners/operators of space assets, civil protection authorities and other European entities.

Today, more than 140 spacecraft of the European Union, its member states and European owners/operators are protected from risk of collision in all orbit regimes. EU SST is also providing more than 100 users with free, added-value services in re-entry and fragmentation analysis [1].

This paper describes recent developments in the implementation of EU SST with a special emphasis on security and data policy aspects. It highlights the unique governance and data sharing model of EU SST, the diverse architecture of existing SSA sharing agreements, and data security considerations. The paper concludes with a perspective on how these aspects will remain relevant as EU SST matures into a fully-fledged programme as part of the European Union's upcoming Space Programme.

2. Legal Basis, Objectives and Governance Model

While a small number of European countries had been active in the space domain for a number of years and operated space surveillance sensors, discussions on a European SSA capability gathered momentum around 2010 in light of Europe's growing dependencies on space-based infrastructure and a changing security environment following the end of the Cold War [2].

By 2013, the European Commission prepared a proposal for a Space Surveillance & Tracking (SST) framework aimed at the provision of European SST services based on the networking of existing SSA capabilities of the member states.

From the outset, the European Council and the Commission had highlighted in their communications the dual use nature of such a system that would make 'the widest possible use of assets, competences and skills that are already existing or being developed in Member States' – including security aspects linked to the 'high sensitivity of SSA data' and 'civil and military SSA user requirements' [3].

2.1 Decision 541/2014/EU

These preparations led to the decision of the European Parliament and the European Council of 16 April 2014 to establish a 'Framework for Space Surveillance and Tracking Support' (Decision No 541/2014/EU, [4]). The decision serves as the legal basis for EU SST and outlines its objectives, the SST services to be provided through the framework, governance principles, and the security dimension.

The objectives of EU SST as laid out in the Decision include safeguarding European space infrastructure – national satellites of the member states and the EU flagship programmes Galileo and Copernicus – and ensuring the long-term resilience of space assets through the provision of free services – collision avoidance, re-entry analysis and fragmentation analysis – to public and private owners and operators of satellites, EU member states, EU institutions, and national authorities in Europe.

The proliferation of space debris was identified as a key challenge to safe and sustainable space operations. While the detection and characterization of military space activities and intentional threats to space infrastructure remain outside of the mandate of a civilian framework, EU SST was from the beginning seen as complementary to other initiatives aimed at ensuring the safety, security and sustainability of space activities, such as the United Nations guidelines for space debris mitigation or the EU's then proposal for an international Code of Conduct [4]. This foreseen complementarity reflected the understanding that a multilateral European SSA capability can contribute to understanding the evolution of the space environment and to providing awareness and transparency of space operations, and therefore is relevant for verification and diplomatic efforts.

Decision No 541/2014/EU also emphasizes the importance of contributing to global burden-sharing and international cooperation in the SSA domain, in particular with the United States. Through fusing existing capabilities of the participating member states, a main objective of EU SST is to attain a higher level of strategic autonomy for Europe, a goal that was reinforced by the 2016 EU Global Strategy, which underlined the need for an autonomous access to space and continuous monitoring of security-relevant developments [5].

2.2 Governance Model

EU SST's unique governance model is a function of the described objectives and the security dimension. The framework is implemented by a Consortium of member states who are represented by their so-called national designated entities, in most cases their respective space agencies or equivalent entities. The member states retain full sovereign control over the participating sensors and operations centres, as some of the infrastructure is operated by militaries and serves national security purposes. The member states are also in charge of defining a joint data policy and requirements for the secure exchange of sensitive information, since '[p]recise information on the nature, specifications and location of certain space objects may affect the security of the Union or its Member States and third countries' [4]. The partners of the Consortium have therefore

created a governance structure that on the decision-making level consists of a Steering, Technical and Security Committee, with the latter being in charge of all matters relating to data security and operational risk.

3. Data Sharing and Data Policy

EU SST's service provision model and operations (Fig. 1) are based on a division of labour and specialisation of the contributing member states across three functions: sensor network, data processing, and service provision. Operations are led by the member states' national operations centres, which are civilian, military, or civilian-military and may integrate additional industrial or scientific stakeholders. Via the operations centres, the member states contribute SST data from a growing sensor network that today comprises a total of 50 assets for surveillance and tracking (12 radars, 34 telescopes and 4 lasers) [1].

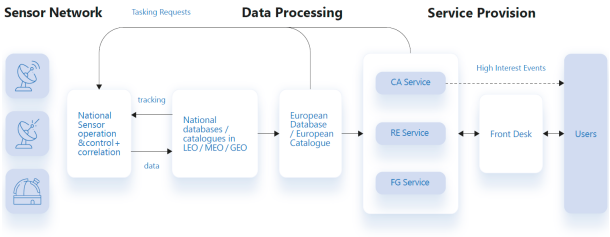

Fig. 1. Service Provision Model

Unclassified SST data is pooled and shared through a central data-sharing platform, the EU SST Database, and is used by the operations centres to generate autonomous EU SST conjunction data messages (CDM) or to refine the CDM received from the 18th Space Control Squadron in the United States. In addition to its added-value collision avoidance service, EU SST has been providing re-entry analysis and fragmentation analysis services to its users since 2016. After being generated by the operations centres, the services are passed on to the users via a front desk that is located at and staffed by the EU Satellite Centre.

3.1 Evolution of Data Sharing

While the physical security of the contributing sensors and national operations centres is the primary responsibility of the member states and their respective national security stakeholders, data sharing and data policy are common priorities that are addressed at the multilateral level. Data sharing in EU SST has significantly evolved and expanded in recent years. Every day, for all orbit regimes, thousands of measurements are fed into, stored in, and shared via the EU SST Database, which is operational since April 2019. Data from the contributing sensors is shared routinely in quasi real time or on request, depending on the type of sensor. For the most part, the shared data consists of tracks and observations of space objects in a tracking data message (TDM) format, which allows efficient data fusion. The EU SST Consortium is conducting dedicated calibration campaigns to validate the performance and data quality of the contributing sensors.

The EU SST Database also serves as the platform for managing sensor tasking requests and hosts additional information, such as on the current status of the sensor network. Given these advanced functionalities, the Database constitutes the basis for building and maintaining a European precursor Catalogue that is currently under development.

3.2 Data Policy and Security Considerations

As the Consortium is setting up an evolved processing chain, an effective data policy is a key priority – aside from technical considerations related to data curation and validation. An initial data policy was developed in 2016 prior to initial operations, and then adjusted and refined multiple times as the Consortium got enlarged, improved its service provision model, operates a joint Database and progresses towards a European Catalogue. Since 2019, the EU SST Security Committee is leading a fresh review to revise the documents in view of the needs and requirements posed by enhanced data sharing and the security interests of the respective partners.

The Security Committee is the body of the Consortium in charge of developing provisions on the use and secure exchange of SST data and information. The Committee is staffed by two representatives per member state, in most cases a representative from the participating space agency and a representative from the armed forces, ministries of defence or national security agencies. The participation of these national security stakeholders is crucial for ensuring that EU SST does not infringe on any sovereign security concerns.

Overall, the joint data policy of the Consortium needs to reconcile operational needs and security interests of the individual partners. A comprehensive policy will allow effective data sharing and processing, catalogue building and maintenance, and service provision while preventing unauthorized disclosure of data and information and adequately protecting data ownership and property rights. Since the data policy is relevant for all functional elements and operations of EU SST, it is being developed in close cooperation with the Technical Committee and working groups. Main aspects to be addressed include data flows between the operations centres and between the processing and service provision functions – along with aspects related to data acquisition and access, data storage and handling, as well as distribution and dissemination.

In order to provide the best possible services to its users in the interest of space flight safety, the Consortium seeks to share as much data as possible, including on objects that are not yet catalogued and newly detected objects. Given that precise tracking data for certain space objects may be considered sensitive or classified, the EU SST Security Committee is working on classification guidance and security requirements that cover for instance how EU SST treats uncorrelated measurement data and unknown objects, and how it protects potentially sensitive information such as data on allied space objects. In view of expanded data sharing, this includes compilations of data items that are individually unclassified but combined may constitute information whose distribution shall be limited due to its sensitivity or due to applicable laws and regulations.

In the current absence of a multilateral SSA data sharing agreement, EU SST's data policy must finally consider a complex architecture of bilateral SSA data sharing agreements within Europe and with the United States. These agreements are typically concluded at the level of the ministries of defence and are therefore not within the remit of the Consortium but the prerogative of the individual partners' national security stakeholders [2].

4. Perspective

Data policy and security aspects will remain relevant as EU SST evolves from a framework into a fully-fledged programme as part of the SSA component of the upcoming EU Space Regulation [6], foreseen to enter into force as the EU transitions to its new long-term budget, the 2021-2027 Multiannual Financial Framework (MFF).

While the successor of the current EU SST initiative will expand the existing baseline SST capability with proposed new services and likely additional participating member states, the general governance and security principles will remain in place [7]. In particular, this includes a responsibility of the participating member states for security accreditation and provisions on the use and secure exchange of SST data and information.

Explicitly understood as the 'precursor of a European Space Traffic Management system' [8], EU SST provides operational capabilities and services that will be needed to underpin future Space Traffic Management (STM) efforts – for instance for monitoring the increased traffic in space, avoiding collisions, and verifying compliance with norms and regulations.

The continued governance model and security configuration also resonate with the current approach to STM in the United States, which foresees a hand-over of the provision of basic STM services (such as collision avoidance) from the US Department of Defense to the Department of Commerce [9]. In view of global burden-sharing and fresh approaches to data sharing and service provision, EU SST maintains a regular working level exchange with the relevant civil and military US stakeholders.

5. Conclusion

As Europe's primary operational SSA capability, EU SST is a working example of a multilateral collaboration between civilian, military, and security actors. The unique governance model allows for addressing and preserving sovereign security interests of the participating member states within a civilian framework. Security and data policy aspects that are for instance linked to critical sensor capabilities and sensitive SST data are handled by a dedicated body of the Consortium, the EU SST Security Committee.

As the framework matures into a fully-fledged programme as part of the European Union's upcoming Space Programme, the configuration of EU SST has proven well equipped for the complex interactions between a diverse set of actors at the intersection of space safety and space security that will be key to the success of any future multilateral SSA or STM initiative.

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