The European Space Surveillance and Tracking Service at the crossroad

In April 2014, the European Parliament and the Council adopted a decision proposed by the European Commission (EC) concerning the development of Space Surveillance and Tracking (SST) Services[1]. To this end, five countries have set up a Consortium in charge of the project: the agreement among the National Space Agencies and offices of France, Germany, Italy, Spain, the United Kingdom and the Commission was signed in June of this year[2].

As space infrastructures are increasingly threatened by the risk of collisions among satellites and especially between satellites and debris[3], the objective of the SST services' development is to provide European space actors with awareness of the space environment and with alerts on collisions, fragmentations and uncontrolled reentries in the atmosphere. Space infrastructures' vulnerability is today well known and seriously considered by public and private actors who are taking different and at times parallel initiatives. By means of sensors (radars and telescopes) based mostly on Earth, it is possible – to a certain extent - to survey, track and identify space objects in some crowded orbits (like low or geostationary ones), in order to create and feed a catalogue and issue alerts. So far, this function has been performed by few countries in Europe, in a limited manner, in punctual rather than systematic way and with the key contribution of US sensors and catalogue[4].

The EU is not engaged in developing an SST *program* as such, rather in supporting the development of *services* exploiting existing national programs. Ideally, pulling existing capabilities to feed the same catalogue and in a systematic way, should decrease in the long term the level of dependence from the US and increase the performance of a "European system".

The undeniable sensitive nature of SST services and the unheeded SST military goals

Space surveillance and tracking of space objects are functions of military relevance. First, such a system can allow the localization and identification of foreign secret satellites, transforming them from previously "undercover" satellites into potential targets. The issue of space security in terms of aggressions by means of antisatellite weapons (ASATs) - beyond accidental collision - is considered by some actors a relevant national-security topic, according to their level of dependence on space assets and the parallel development and test of ASATs [5]. As such, SST services may provide information of particular interest for the military intelligence community as well as necessary information for preparing any aggression to foreign space infrastructures. Secondly, assets required to execute functions of surveillance, identification and tracking may be optic or radar kind of. In relation to the last – particularly complex and expensive infrastructures –, their first mission may be different than SST, like for instance anti-missiles defense: indeed, most of the existing radar-type-of sensors in Europe belong to the militaries[6].

Despite the (potential) final user and the (potential) owner of the sensor providing the data, European institutions have made clear that services will not aim at serving purely military goals[7], as they are intended to be civil in nature and for dual use purposes. "Unheeded" purely-military goals may be among those already identified in the frame of EDA's studies on a Space Situational Awareness (SSA) system[8], including, for instance, identify intentional threats and hostile acts in space, or military intelligence. This can be explained by two main reasons. Beyond the fact that the Commission has no competence in military matters (first reason), national actors are extremely cautious and even sceptic when it comes to handling the development and exploitation of a sensitive system to a supranational entity, be it communitarian or even intergovernmental (second reason). Indeed, despite its intergovernmental nature, in 2012[9], Member States seemed to retrieve from the decision of entrusting to the European Space Agency the development of a SST service, focusing financial support to the two "less sensitive" segments of the SSA program, notably SW (space weather) and NEO (near earth objects[10]. The partial vacuum left by the ESA in the SST field is being filled in by the EU.

Why the EC decided to get involved in such a complex and sensitive program and why MS have accepted this?

Increasing the Union's political ambition and weight

There has been a relatively recent European institutional demand for an independent tool to survey and protect European space assets from risks[11]: essentially debris, but also near Earth objects, and space weather[12]. Motivations expressed by the EU to justify its role are mainly "soft-security"-kind of motivations (avoid collisions or dangerous reentries on Earth, decreasing dependence in services and key technologies); and "economic-industrial"-kind of motivations (protection of the under-deployment space flagship programs and EU relative investments). Another – and much less claimed – reason behind EC's initiative could be essentially political. In fact, since the end of the 80s the EU has shown growing ambitions in the space domain, engaging in an increasing number of fields: from Earth Observation and Navigation/ Positioning, to governmental telecommunications, launchers (see H2020 program and Mr. Brunet discourse[13]) and, recently, security *in* space. By adding SST to its list of high-technology projects, the EU consolidates its image and political weight on the international scene but also internally, in relation to capitals and to the public opinion (even though through different "frame sets"[14]). Moreover, many factors contributed to offer a window of opportunity: the current concern of the international community on the issue of space security and the post-Lisbon EU's direct competence in space affairs. Also, the dual-use approach often invoked by national and European institutions, the incapacity for national Member States to develop such a system alone, scarce results in terms of intergovernmental cooperation and the vacuum left by the ESA in relation to SST, have pushed the EC to find its place in this "new" field.

It is also interesting to wonder which motivations pushed national administrations to accept the Commission's

initiative. Looking at what exactly remains in EU or national hands helps to understand. On the one hand, getting involved in the SST consortium allows Member States to benefit from the European financial resources (around 10 million per year for 7 years) made available to set up and exploit a network of assets (including theirs), likely upgrade them in the future, as well as set up and exploit process and analysis capabilities. Secondly, being part of the process is also necessary to better control it and not to be excluded from European advancements. Aware of this, it is precisely through such incentives that the EU may have succeeded in involving MS and their assets in its new space related initiative.

Sustaining national technological development and capabilities

The SST decision's features reflect each actors' interests as well as their conditions and concerns. The EU is keen in raising a European flag on the service that will go to the final user. Countries are keen in exploiting and likely upgrading sensors, which will be put at contribution, as well as in improving collected data's process and analysis. In order to form a consortium, the EC requires States to be the owners or operators of relevant sensors, to have tasking responsibilities and a minimum level of sensor's availability to feed EU services. Assets being made available are yet unknown to the public, but looking at existing European radars and telescopes which could perform SST functions (surveillance, tracking and characterization), it is possible to identify potential contributors. Thus, France may contribute with its radars *Graves*, *Satam* and those on the *Monge* ship, and also with some optical capabilities like *Oscegeane* or *Tarot*. The first four assets belong to the Ministry of Defense, and most of them perform different missions in origin[15]. Germany may have proposed to exploit *TIRA* sensor, which is an adapted radar to track objects in LEO[16]. Italy may have put at contribution some astronomic and scientific optic and radar sensors belonging to national research centers and Universities, like *Croce del Nord*[17] or the *Multistatic radar system*[18]. Spain may contribute with its Telescope *Fabra-ROA* in Montsec[19] or the *La Sagra Sky Survey Telescope*[20] to survey and track debris in all orbits. Last but not least, the United Kingdom may contribute with the *Ballistic Missile Early Warning System* (BMEWS) although it belongs to the US and is operated by Royal Air Force Air Base in Fylingdales essentially for antimissile defense functions. Being part of the *American Space Surveillance Network* (SSN), it is legitimate to wonder if and to which extent this system will be made available to nourish an "independent" European catalogue. *CAMRa* (*Advanced Meteorological Radar*)[21] and *Starbrook*[22] are radar and optic sensors belonging to UK civil and private entities and may be able to contribute to SST functions. Consortium's absents, for the time being, are EU countries like Sweden or Austria, and non-EU well-equipped countries like Norway and Switzerland[23]. Including these last two in the SST project will certainly raise other membership and security issues. The same goes if ESA's sensors will be included in the network (like the *Optical Ground Station* (OGS) – *Space Debris Telescope* (SDT) in Tenerife; or the two experimental radars based in France and Spain).

Questions on the future of the SST initiative

Through H2020 resources, national actors are called to exploit those sensors, and military ones do not seem to be excluded. In other words, the EC is going to finance know-how and operations at national level to be exploited for European services. National applications may benefit indirectly too. This deal seems to be convenient to all actors.

With such an arrangement, questions arise concerning the effectiveness of the service, and in particular to which extent Member States will accept to pool and share SST data, especially – for example - when a military spacecraft (be it an own space asset, allied or not) is observed and tracked. Also, to which extent military sensors will be made available to SST kind of tasking, being distracted from their original missions. National control and military concerns will affect also the organization of the operational phase, in particular the governance of the whole service-chain as well as the data policy, to be established by the concerned Member States.

As for other European space programs (namely, Copernicus), SST services are placed at the crossroads between national military concerns and European "dual use" ambitions. The difference with them, is that this time the EU does not have control over any asset. The future will tell about the efficiency of such approach, which relies on capital's will and capacity to share limited sensors' tasking and sensitive data.

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Notes

1. European Parliament and the Council (2014) decision N° 541/2014/EU establishing a Framework for Space Surveillance and Tracking Support.
2. ASI, press release, 16 June 2015, "SST Consortium agreement signed", http://www.asi.it/en/news/sst-consortium-agreement-signed.
3. Examples of occurred collisions: American and Russia communication satellites (Iridium and Cosmos), 11 February 2009, "Debris Spews Into Space After Satellites Collide" http://www.nytimes.com/2009/02/12/science/space/12satellite.html?_r=0 . Example of anticollision manouvres: « A peine arrivé sur orbite, Sentinel 1A évite une collision », Air&Cosmos, 14 April 2014.
4. Bilateral agreements between the US and some countries have allowed European assets to avoid high risks of collisions in orbit. See for instance "USSTRATCOM, Germany make arrangement to share space services, data". 28 January 2015 https://www.stratcom.mil/news/2015/534/USSTRATCOM_Germany_make_arrangement_to_share_space_services_data/.
5. The US discourse (and 2006 national space policy) about the need to protect their free access to and use of space, and Chinese and American ASATs tests in 2007 and 2008.
6. Like for instance the French radar Graves and the 4 radars on the Monge ship; as well as the UK Ballistic Missile Early Warning System (BMEWS) operated by Royal Air Force Air Base in Fylingdales.
7. European Parliament and the Council (2014) decision N° 541/2014/EU establishing a Framework for Space Surveillance and Tracking Support.
8. SSA stands for Space Situational Awareness and SST is one of the SSA segments, the other two are Near Earth Objects and Space Weather. « Summary of European SSA civil and military user requirements » jointly elaborated by ESA and EDA, 2011.
9. ESA Ministerial Council 2012.
10. See Conclusions of the ESA Ministerial Council 2012, countries involved in SSA

segments and related budget allocation. ESA website and ESA interview, 2015.

11. European Parliament, 2008, "Resolution on space and security » (INI/2008/2030); Council of the EU, 2006, "Generic Space Systems Needs for Military Operations"; Council of the EU and the ESA, 2008, 5th Space Council "Résolution du Conseil – Faire progresser la politique spatiale européenne".

12. Few instances (Council, WEO) have clearly expressed concern on the arms race issue, while the Commission and the Parliament have rather spoken in terms of natural risks and debris.

13. M. Philippe Brunet Director, Directorate -General for Enterprise and Industry - at the conference organized by the OPECST (Office Parlamentaire d'évaluation des choix scientifiques et technologiques), July 2015.

14. About the role of "frames" in the EC space activities, see Marta L., Stephenson P.: 'The role of the European Commission in framing the European space policy', in: Hoerber T., Stephenson P. (eds.), European Space Policy, Routledge, London, 2015.

15. *GRAVES* (Grand Réseau adapté à la Veille Spatiale) managed by the MoD (Commandement de la défense aérienne et des opérations aériennes (CDAOA)), used to survey and feed a catalogue; *SATAM* (3 radars) belong to the Air Force for air-defense missions; they can perform some tracking in LEO. *Monge* ship belongs to DGA (Armaments General Directorate) and is used to collect parameters "in air" on missiles and launchers and could partially be used for SST functions like acquisition of orbital parameters in LEO. *Oscegeane* is an experimental project (Observatoire Cote d'Azur) to determine spectral signature of GEO objects, therefore it could contribute to determine orbits and identify objects. *TAROT* (Télescope à Action Rapide pour les Objets Transitoires) belongs to national space agency and national research center, CNES-CNRS, and as a secondary mission it could contribute to track debris in GEO.

16. *Tira* belongs to a civil entity, the Fraunhofer Institut, and is used to characterize and localize objects in LEO. This radar is performant in the "characterize and track" phase but needs input from another kind of radar (like *GRAVES*) to, as a first step, survey the space zone and identify the object to be observed and tracked.

17. It belongs to ASI (*Italian Space Agency*) and INAF (*Istituto Nazionale di Astro Fisica*) for the observation of debris and NEOs (Near Earth Objects: asteroids for instance).

18. It belongs to INAF.

19. It belongs to the *Montsec Astronomical Observatory* in Catalonia.

20. *Observatorio Astronomico de Mallorca*.

21. Radar belonging to *Chilbolton Observatory – Science and Techno facilities Council and Rutherford Appleton Laboratory*.

22. *BN Space Center*, *Space Insight Limited* – in Chypres.

23. Nordic countries (Sweden, Finland and Norway) operate radars (*EISCAT*) particularly adapted to surveil polar orbits. Switzerland operates two potentially relevant telescopes: *ZIMLAT* and *ZIMSMART*. Globus II radar in Norway, also, could likely contribute (although today it belongs to the SSN).