SPACEWAYS

# 2nd STM Brief

# Approaches to STM across the world

***The Current State of Play in Space Traffic Management***

***May 2022***

*This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208.

www.spaceways-h2020.eu

Spaceways will establish an assessment of technical and policy-related issues associated with Space Traffic Management (STM) and propose a set of recommendations and guidelines to the European Commission. A main goal will be to **characterise and understand the context of STM**, especially its international and domestic dimensions. The project focuses on an analysis of European capabilities and technology gaps and on a policy, legal and economic assessment of this domain, leading to recommendations and guidelines. This **second Brief** provides an overview of the initiatives in the field of STM at global level.

## WHAT IS THE CURRENT STATE OF PLAY IN ADDRESSING STM?

The issues and challenges regarding STM are multi-layered, involving various actors and approaches. As recalled in the 1st STM Brief, space is a shared environment and requires shared solutions.[1] An isolated STM strategy cannot fulfil the goals of safety and security of space operations. National governments and space agencies are essential in the efforts to establish Space Traffic Management measures and mitigate space debris. Yet at the moment no common approach exists between spacefaring nations.

### International approaches to STM

**The United States** plays a central role in the development of policies related to STM. With the **Space Policy Directive 3** (SPD-3) adopted in June 2018[2], the U.S. declared STM a top space policy priority and brought renewed attention to the topic, highlighting also the commercial and industrial elements that drive Washington. SPD-3 called for the creation of the **Open Architecture Data Repository** (OADR) within the Department of Commerce to unburden the Pentagon from civil STM activities and it ignited the revision of the Orbital Debris Mitigation Standards Practices.

From a technical point of view, the U.S. relies on the vast and geographically dispersed **Space Surveillance Network** (SSN), composed of ground and space based SSA sensors (radars, telescopes, satellites), with the recent addition of the cutting-edge radar system Space Fence. The US space surveillance capabilities are currently considered the most complete in the world. These technical assets belong to the US military, which operates them (including the Space Object Catalogue) and provides space surveillance data to other countries arounds the world. To this end, the US has signed more than a hundred SSA

[1] Spaceways (May 2022) A Congested Space and its Safety. The importance of space traffic management. https://spaceways-h2020.eu/publications-spaceways/spaceways-1st-stm-brief-may-2022/
[2] Space Policy Directive-3, National Space Traffic Management Policy, White House, June 2018. https://trumpwhitehouse.archives.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208. This document reflects only the view of the author(s) and the European Commission is not responsible for any use that may be made of the information it contains.

sharing agreements with foreign entities, public and private. The US also provides some SSA data openly on the space-track.org website, and benefits from american private companies providing SSA-as-a-service.[3]

**China** lacks a comprehensive space legislation, in turn based on White Papers and separate regulations with very limited influence on STM. In the latest White Paper, the China National Space Administration focuses on "space environment governance" and states that Bejing "will actively participate in discussions on international issues and the development of relevant mechanisms" including STM.[4] Recently, Beijing protested about an alleged close encounter with a SpaceX satellite and affirmed the opennes to establish formal lines of communication to avoid such events in futureRegarding capabilities, China operates a growing network of ground-based radars and optical telescopes to monitor the space environment. These are operated by the Chinese Academy of Science, with a central role of the People's Liberation Army Strategic Support Force. Beijing has supported some international efforts on space sustainability, but its 2007 destructive ASAT test[5] has had a negative impact on space sustainability.

**Russia** is a major space power which owns important capabilities to monitor traffic across all orbits. Moscow runs a Space Surveillance System, under the responsibility of the armed forces, as well as the civil International Scientific Optical Network. This makes it a relevant actor in any STM-related debate, however no national regulation dedicated to space sustainability has been elaborated yet and the war in Ukraine may be critical in contributing to further distanciate Russia from the international space community.

**Japan** has a regulatory framework for space activities composed of the 2008 Basic Space Law, further developed in the 2016 Law on Space Activities.[6] The country openly refers to STM and is developing "action programmes"[7] related to the formulation of shared orbital flight rules. The country also has an interest in the field of Active Debris Removal and has ongoing developments related to the regulations of these orbital activities. In terms of SSA, Japanese capabilities are very limited today. The Japanese space agency manages two

3 Further developments concern the role of large private satellite operators, such as SpaceX, which in March 2021 signed an agreement with the National Aeronautics and Space Administration (NASA) to avoid collisions between their respective assets, committing to manoeuvre its satellites in case of close approaches with NASA spacecrafts. An isolated move that will not put a solution into orbit per sé, but could be seen as an example of a first bottom-up approach.

[4] China's Space Program: A 2021 Perspective. http://www.cnsa.gov.cn/english/n6465652/n6465653/c6813088/content.html

[5] B. Weeden, 2007 Chinese Anti-Satellite Test Fact Sheet, Secure World Foundation. https://swfound.org/media/9550/chinese_asat_fact_sheet_updated_2012.pdf

[6] H. Yotsumoto et al., The Space Law Review: Japan, December 2021, The Law Reviews. https://thelawreviews.co.uk/title/the-space-law-review/japan#:~:text=The%20Space%20Activities%20Act%20was,for%20damages%20arising%20from%20them

[7] https://www8.cao.go.jp/space/english/stm/coa2020.pdf

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208. This document reflects only the view of the author(s) and the European Commission is not responsible for any use that may be made of the information it contains.

facilities, but there are plans to further develop capabilities with a larger role for the Defence Ministry.[8]

**India** has not yet formalised a national space policy or a specific STM policy. It maintains limited SSA capabilities, mostly civilian and managed by the Indian Space Research Organisation (ISRO). The ISRO Space Situational Awareness and Management Directorate looks to reinforce the SSA network; this change is also driven by military interests.[9]

The **United Kingdom** benefits from the integration of its modest radar capabilities with the American SSN. In recent years, the UK has conducted a thorough overhaul of its domestic space regulatory framework and it has promoted discussion on international norms for space security, safety, and sustainability.[10]

### International organisations: privileged venues for multilateral dialogue on STM

Although states remain central, existing international organisations are recognised as relevant *fora* and would be the **appropriate platforms** to discuss STM multilaterally and discuss concrete solutions (see also box on ITU). **The United Nations Committee for the Peaceful Uses of Outer Space (UNCOPUOS)** is the UN space law-making body relevant to address STM. COPUOS gathers a hundred countries to discuss legal and technological aspects. It provides a forum for dialogue to find common ground and coordinated approaches at international level, and it makes continuous progresses on **soft law** and **non-binding instruments**. The EU participates to COPUOS meetings with a status of observer and often uses this forum to convey a broader "European" position. Since a position needs to be negotiated in advance, COPUOS indirectly encourages intra-EU dialogue on space matters. Two sets of UN guidelines are relevant in the context of STM: the 2007 **Debris mitigation guidelines** and the 2019 **Long-term Sustainability (LTS) guidelines**, which may eventually evolve into international customary law, becoming binding for all states, or be converted by states and agencies in their national legal and licensing system.[11]

**International Telecommunication Union**

The **ITU** is the oldest UN specialised agency, having dealt with communication affairs since the telegraphy. It is responsible for the allocation of radio spectrum and satellite orbits in accordance with principles of equitable access, rational use, and protection from technical harmful interference. The ITU could be considered as an **interesting example** of an **adaptable and inclusive** framework, as it maintains its layered binding nature and, since its inception, gathers public and private actors, from states to companies and organisations.

[8] Spaceways project deliverables.
[9] https://www.orfonline.org/research/india-and-the-us-are-expanding-their-space-cooperation/
[10] United Nations, Report of the Secretary-General on reducing space threats through norms, rules and principles of responsible behaviours (2021). https://www.un.org/disarmament/topics/outerspace-sg-report-outer-space-2021/
[11] Spaceways deliverables WP3.1 and 3.2

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208. This document reflects only the view of the author(s) and the European Commission is not responsible for any use that may be made of the information it contains.

## What are the implications for Europe and its Member States?

Member States of the European Union have various involvement on the STM topic.[12] **France** has adopted in 2008 the Space Operations Act which has partial implications for STM. **Italy** has declared STM a priority in Prime Minister's strategic documents on space policy, emphasising the need to aggregate political support on STM. Besides, references to STM and to the general framework of SSA/SST are included in the French Space Defence Strategy[13] and in the Italian National Security Strategy for Space.[14] **Germany** provided important impulses to discuss the topic at EU level during Berlin's European semester, efforts then continued by **Slovenia** in 2021 and **France** in 2022 during their respective presidency of the European Union.

**EU SST**

Established in 2014 and operative since 2016, the EU SST Consortium puts together **seven members**, France, Germany, Italy, Poland, Portugal, Romania, Spain, and the **EU Satellite Centre** – with a front desk role. Soon to evolve into a Partnership, the EU SST Consortium capability consists of three main functions: sensor, processing, and service provision. Sensors from Member States contribute with data that are analysed in the processing function and feed a joint database and ultimately a catalogue. Three services are provided: Collision Avoidance, Re-entry Analysis, and Fragmentation Analysis.

Europe is a space power and the implications of a crowded space environment **directly regard the strategic assets** of European companies, institutions, and national governments. In 2016 the Copernicus Sentinel 1-A satellite was hit by a "millimetre-size" debris on a solar panel, causing a power loss, and recently had to manouvre to avoid a 30-year old debris.[15] In September 2019, the ESA Aeolus satellite had to perform an urgent manoeuvre to decrease a high collision risk with a satellite of the Starlink constellation, an event that emphasised the need to better communicate and coordinate between operators.[16] In March 2021, a Galileo satellite had to perform a collision avoidance manoeuvre, the first ever for the MEO constellation.[17] Focusing on STM would be even more significant in the near future, considering the expansion of the **Galileo and**

[12] The European states selected and reported in this Brief are those with a more structured and documented approach to SSA and STM and are included in Spaceways deliverable WP3.2

[13] Ministère des Armées (2019). Space Defence Strategy. https://www.defense.gouv.fr/english/layout/set/print/content/download/574375/9839912/version/5/file/Space+Defence+Strategy+2019_France.pdf

[14] Presidency of the Council of Ministers (2019). National security strategy for space. http://presidenza.governo.it/AmministrazioneTrasparente/Organizzazione/ArticolazioneUffici/UfficiDirettaPresidente/UfficiDiretta_CONTE/COMINT/NationalSecurityStrategySpace.pdf

[15] Copernicus Sentinel-1A satellite hit by space particle. https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-1/Copernicus_Sentinel-1A_satellite_hit_by_space_particle

[16] ESA spacecraft dodges large constellation https://www.esa.int/Safety_Security/ESA_spacecraft_dodges_large_constellation; J. Foust, How to better manage space traffic: Aeolus/Starlink encounter shows emails and late-night phone calls no longer cut it, November 2019, Space News. https://spacenews.com/how-to-better-manage-space-traffic-aeolus-starlink-encounter-shows-emails-and-late-night-phone-calls-no-longer-cut-it/

[17] EUSPA, Galileo satellite performs collision avoidance manœuvre. https://www.euspa.europa.eu/newsroom/news/galileo-satellite-performs-collision-avoidance-manoeuvre

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208. This document reflects only the view of the author(s) and the European Commission is not responsible for any use that may be made of the information it contains.

**Copernicus** programmes and the launch of the **Secure Connectivity system**.[18] European satellites are particularly valuable asset: **10% of the EU's total Gross Domestic Product is enabled by satellite navigation**. **Copernicus** is the world's **first provider of space data** and information, supporting the economy and society in the occurrence of emergencies and crisis.[19] The **European Union owns more than 30 satellites in orbit**, with investments in space programmes beyond **€14 billion** in the Multiannual Financial Framework 2021-2027. Furthermore, the EU SST Consortium (soon to evolve into a Partnership) provides services to over 250 satellites (see box on EU SST).[20] These assets now evolve in a congested environment: it is therefore important that Europe finds a cohesive voice and contributes to shaping the global debate around STM, building on the European Commission Joint Communication **"An EU Approach for Space Traffic Management"** of February 2022.[21]

[18] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_921
[19] EU SPACE Programme Overview. https://ec.europa.eu/defence-industry-space/eu-space-programme-overview_en
[20] 3rd EU SST Webinar: Building the future of SST, October 2021. https://www.eusst.eu/newsroom/3rd-eu-sst-webinar/
[21] https://ec.europa.eu/info/files/joint-communication-eu-approach-space-traffic-management-eu-contribution-addressing-global-challenge_en

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208. This document reflects only the view of the author(s) and the European Commission is not responsible for any use that may be made of the information it contains.


The strength of Spaceways lies in the partnership **between major European research institutes and European Space Industry players**, used to working together and capable of providing an end-to-end analysis of Space Traffic Management (STM) issues and the most appropriate answers and solutions.

Spaceways brings these key actors together to develop a collaborative European vision of STM. This consortium, coordinated by the Fondation pour la Recherche Stratégique, is able to provide a complete review of STM stakes at each stage of the analysis, from concepts to industrialization, taking into account the evolution of legislation, and its impacts on technologies, space infrastructure and satellite operations.

To ensure the study outputs are embraced by the whole European space community, external stakeholders are actively involved within a **Stakeholder Engagement Programme**, gathered in a series of six workshops with more than 100 participants from 24 European entities - including institutional actors (national agencies, Ministries of Defence, intergovernmental organisations, and EU institutions), public and private satellites operators, Space Surveillance and Tracking (SST) service providers, and R&D related entities (SME, start-ups, and a non-profit organisation).

The STM Briefs series is led by **Istituto Affari Internazionali (IAI).**

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004208. This document reflects only the view of the author(s) and the European Commission is not responsible for any use that may be made of the information it contains.