



**International  
Academy of  
Astronautics**

# **Space Traffic Management Towards a roadmap for implementation**

## **The 2018 IAA study on STM**

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**European STM Conference  
Hearing, 24 March 2021**



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# 2016:

## Agenda item in the Legal Subcommittee of UNCOPUOS on Space Traffic Management

A/AC.105/C.2/2015/CRP.13

14 April 2015

English only

**Committee on the Peaceful**

**Uses of Outer Space**

**Legal Subcommittee**

**Fifty-fourth session**

Vienna, 13-24 April 2015

**Item 13: Proposals to the Committee on the Peaceful Uses  
of Outer Space for new items to be considered by the  
Legal Subcommittee at its fifty-fifth session\***

**Proposal for a Single Issue/Item for discussion at the  
fifty-fifth session of the Legal Subcommittee in 2016 on:  
“Exchange of views on the concept of Space Traffic  
Management”**

**Submission by Germany**

At the current session of Legal Subcommittee, the issue of Space Traffic Management (STM) was the theme of the IISL/ECSL Symposium, which took place on 13 April 2015. The presentations provided an excellent overview on the current state of academic research as well as elements of STM already implemented. It also highlighted various aspects of legal concern and provided ideas for further investigations on this issue.


Following this, the German delegation suggests to provide another opportunity for the delegations to exchange their views on the issue of STM and its potential relevance for the work of the Legal Subcommittee. It therefore proposes to inscribe a single issue item on “Exchange of views on the concept of Space Traffic Management” at the 2016 session of the Legal Subcommittee.

The purpose of such a single issue item would be to reflect on the concept of STM, on what it entails and on what consequences it would have for the organization and governance of space activities. In particular the contribution of STM to the safety of space operations benefiting all users of outer space (whether they are established users or recent and future users) could be investigated. The item would also provide the opportunity to discuss the status of academic research in that field and to

\* A/AC.105/C.2/L.295.

V.15-02249 (E)



Please recycle 



## **Global trends 2030 and the role of space**

- Continued global change: Global warming through the carbon society with climate wars, conflicts about water, energy crisis
  - Space as instrument for information and assessment of global change, resources management and energy supply; space as support to climate/geo-engineering
- Information/internet society; linking and vulnerability
  - Satellites as elements of the information infrastructure
- Growing threats of military conflicts
  - Space as enabler for security and defense-related missions; space infrastructure vulnerable
- Decline of the West: growing/rising BRICS and others
  - More different space actors; competition about orbits/frequencies/resources; different political/legal/distributive models of governance



## ► Definition of “Space Traffic Management”

„...the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference.”

(following the study by the International Academy of Astronautics, IAA Paris 2006, eds. Contant-Jorgenson/Lala/Schrogl)





## ▶ **Background of the 2018 STM Study**

- First ideas i.a. by Lubos Perek (IISL paper of 1982 using the term)
- AIAA Workshops in 1999 and 2001
- IISL/ECSL Symposium 2002 at the UNCOPUOS Legal Subcommittee
- 2001-2006 IAA Study Group with 20 contributors of 8 countries resulting in the **IAA Cosmic Study on STM published in 2006**
- Following this publication: numerous other academic products as well as a slowly emerging policy debate
- The present study will be prepared by another international team (joint text without personal attribution); it will advance the 2006 study containing proposals for the implementation of STM
- The **new study published in 2018** (around ten years after the first study)



## ► Academic research since 2006 (I)

More and more public and private institutions work on the concept of Space Traffic Management:

- International Association for the Advancement of Space Safety (IAASS) with the publication of comprehensive report in 2007...
- ... followed by a book publication „The Need for an Integrated Regulatory Regime for Aviation and Space – ICAO for Space?“ in 2011.
- The International Space University has conducted a team project on STM in 2007.
- Dedicated session on STM at the European CEAS Conference 2007.





## ▶ Academic research since 2006 (II)

- Workshop on “The Fair and Responsible Use of Space: An International Perspective” (Co-organized by ESPI with IAA and SWF on 20/21 November 2008 at ESPI in Vienna: Result: “10 Steps to Achieve Fair and Responsible Use of Outer Space” and book publication).
- U.S. House of Representatives Hearing: Space Subcommittee hearing - Space Traffic Management: How to Prevent a Real Life “Gravity”, | 2318 Rayburn HOB Washington, D.C. 20515 | May 9, 2014 10:00am
- Conference on STM at Embry-Riddle Aeronautical University, November 2014.
- STM as the topic of the IISL/ECSL Symposium at the UNCOPUOS Legal Subcommittee 2015 (again after 2002).
- Dedicated session on STM at the IISL Colloquium at IAC 2015.





## ▶ Further activities / initiatives related to STM

- **ICAO**, through the President of its Council in 2005, showed interest but has not taken further steps. Only in 2015, ICAO set up a „learning group“ on civil space. ICAO/UNOOSA AeroSPACE Symposium „Making civil space travel a reality“ March 2015.
- STM has been mentioned in various **NASA** Authorization Acts (for 2010: PUBLIC LAW 111–267—OCT. 11, 2010 124 STAT. 2805) even using the STM definition of the 2006 IAA Study (in 2008: PUBLIC LAW 110-422-OCT. 15, 2008 STAT. 4779; SEC.1102 (a)).
- **Commercial operators** do now coordinate in the Space Data Association since 2009.
- Further development of **Space Situational Awareness** programmes (in Europe by ESA and EU; in the US through bilateral agreements with partners).
- **Space Debris Mitigation** Guidelines of UNCOPIOS of 2008; ISO 24113: Space Systems - Space Debris Mitigation.
- Regulations on **suborbital flights** by FAA and EASA.
- Numerous programmes on **Space Weather**
- **2018 U.S. policy on STM** as third output of newly established National Space Council





## ▶ Recent diplomatic initiatives ...

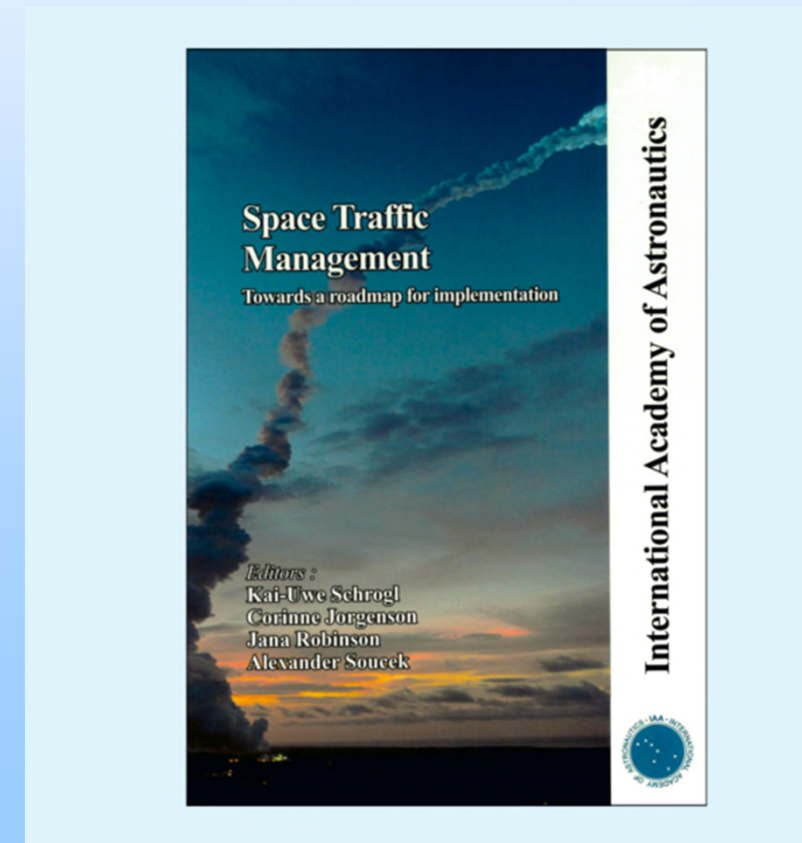
... which could be precursors, or which contain elements of STM:

- Three initiatives on the governmental level relevant for STM:
    - The [Long-Term Sustainability of Outer Space Activities](#) Working Group in the Scientific and Technical Subcommittee of the UNCOPUOS, set up in 2010, which presented its results in 2019.
    - The Governmental Group of Experts (GGE) on [Outer Space Transparency and Confidence Building Measures \(TCBM\)](#) established by the Secretary general of the UN in 2010, which presented its results in 2013.
    - The Draft [International Code of Conduct for Outer Space Activities](#) tabled by the EU in 2007, now suspended.
- ⇒ **How to deal with/possibly merge these activities?**
- ⇒ **STM can provide a perspective.**



## ▶ What does the new study bring?

- **Multidisciplinary** approach
- **Global** participation through contributors and advisers
- **Update** of space activities 2030
- **Detailed** set-out of potential traffic rules
- **Structure for a STM regime** outlining legal instruments down to the level of articles
- **Concrete roadmap** for implementation with timeline





## ▶ **Pre-conditions for negotiating/implementing Space Traffic Management**

- Large increase of transfer into outer space, activities in outer space and return from outer space to Earth.
- Accidents (involving active objects as well as space debris) when launching into outer space, when operating in outer space and when re-entering to Earth (also involving humans in outer space or airplanes in flight).
- Larger variety of activities, which are otherwise uncoordinated (platforms in between airspace and outer space, space tourism, assembly in outer space for example for energy).
- Large increase in active manoeuvring in orbit.
- If issues of of sovereignty arise (e.g. if property rights on orbit slots or frequencies are requested/established).



## ▶ **Current space law is characterized by:**

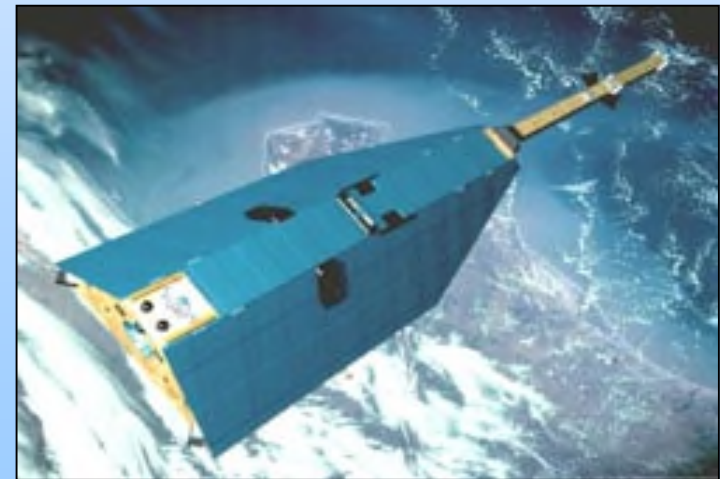
- Primary focus on States as actors in outer space.
- No sufficient and effective mechanisms for non-governmental, private actors.
- Extremely slow development of law-making in UNCOPUOS.
- Law-making competition by other international organizations (ITU,WTO).
- Soft law instead of binding international law (space debris through IADC, Earth observation through CEOS).





## ▶ **Space Traffic Management (STM) is characterized through a new conceptual approach**

- Not a „piecemeal engineering“ of existing space law but „big bang“ as in the law of the sea (includes the transfer of all current legal provisions/treaties and regulations into one coherent and comprehensive text).
- Completely new approach based on functionality.
- New interacting levels and forms of regulation.
- New organizations for implementation.





## ► **Elements of a STM regime**

### **- Two dimensions of space traffic:**

- Scientific-technical area
- Regulatory field

### **- Three phases of space traffic:**

- Launch phase
- In-orbit operation phase
- Re-entry phase





## Securing the information needs (Space Situational Awareness)

- Definition of the necessary data
- Rules for the data provision
- Rules for the data management
- Rules for an information service on space weather

## Notification system

- Parameters for the notification of launches and the operation of space objects
- Rules for the notification of orbital manoeuvres
- Rules for possible encounters
- Rules for the notification of re-entry
- Provisions for the end-of-lifetime of space objects

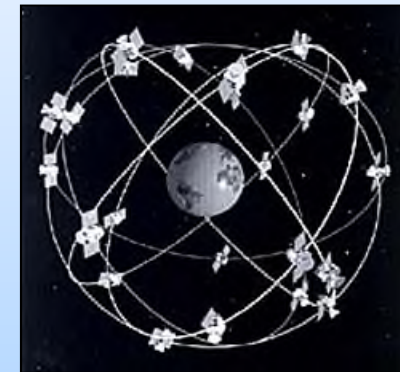
## Space object properties

- Design characteristics (materials, design-for-demise, avoidance of electromagnetic interference, green technologies)



## Traffic rules

- Safety provisions for launches
- Specific regime for space between airspace and outer space
- Zoning (selection of orbits)
- Right of way rules for in-orbit phases
- Priorization with regard to manoeuvres
- Security rules for human spaceflight
- Specific rules for GSO, LG Points, Polar Orbits
- Specific rules for LEO satellite constellations
- Debris mitigation regulations
- Safety rules for re-entry (i.a. descent corridors)
- Environmental provisions (e.g. pollution of the atmosphere/troposphere)
- Radiofrequency use and avoidance of interference







## **Mechanisms for implementation and control**

- Harmonized national licensing mechanisms.
- Enforcement and arbitration mechanisms (i.a. policing in outer space; e.g. renouncement of access to information or frequencies).
- Operative oversight.
- Clearly defined civilian-military coordination and cooperation.





## ▶ **STM: incremental bottom-up approach**

- **co-existence of regulatory instruments** of different nature and purpose may constitute the **building-blocks** of STM emerging from single fields of regulation
- allows **individual solutions** at domestic level
- flexibility to tackle key issues in a comparatively timely manner, but at the **risk of fragmentation**

### **Topics identified in the study:**

- 5.3.1.1 SSA
- 5.3.1.2 Private human spaceflight
- 5.3.1.3 Debris mitigation and remediation
- 5.3.1.4 Development of standards for space safety
- 5.3.1.5 Traffic rules
- 5.3.1.6 Practices for the management of space resources
- 5.3.1.7 National space legislation
- 5.3.1.8 Organisational aspects



## ▶ STM: top-down approach

- creating a **comprehensive and inclusive STM regime**: legal norms (evolvment of existing space law) + institutional management

“ITU approach” as a possible model:

Level 1: **Outer Space Convention (OSC)** ... *comparable to the ITU Constitution and Convention... rarely updated*

Level 2: **Outer Space Traffic Rules (OSTR)** ... *comparable to the ITU Administrative Regulations... reviewed and updated regularly*

Level 3: **Outer Space Traffic Technical Standards (OSTTS)** ... *comparable to the ITU Standards... reviewed and updated regularly with the involvement of also non-governmental stakeholders*

Step	Activity	Years	Date
1	Multi-year Workplan on STM in UNCOUOS LSC to prepare mandate for a State conference open to all States Parties to the five treaties plus all other MS of the UN to negotiate an STM regime	4 (2019 plus 4)	2023
2	Plenipotentiary conference	7 (2019 plus 11)	2030
3	Open for signature	1 (2019 plus 12)	2031
4	Ratifications/Entry into force	3 (2019 plus 15)	2034



## ▶ **From the foreword by Peter Tomka (Judge and former President of the International Court of Justice)**

“By analysing the underlying developments in the space environment, the technical prerequisites for the implementation of the legal regime, and its key regulatory elements, the present study can be considered as a leading work for reference purposes, as well as a good basis for further discussion.

(...)

Realizing the potential of this timely and ambitious study could be a significant step forward. Its authors are to be congratulated on providing a number of suggestions and alternative approaches on how to tackle the challenges of the future for the benefit of all.”



# Content of the 2018 study

**Foreword by Judge Peter Tomka**

**Executive Summary**

**Chapter One. Introduction and scope of the study**

Background

Scope and structure

Definition of STM

**Chapter Two. Academic Research Update since 2006**

**Chapter Three. The Space Environment until 2030**

3.1 Overview of current of space programs

3.2 Global trends and their impact on space traffic

3.3 Trends in space activities

3.4 Projecting the space debris environment

3.5 Other aspects to be considered

**Chapter Four. Traffic Management in Law: Status of Regulation**

4.1 The current regulatory regime for space activities

4.2 Regulatory regimes of comparable traffic systems

**Chapter Five. Establishing STM**

5.1 Introduction

5.2 Towards an international STM system: technical aspects and system elements

5.3 Towards an international STM regime: legal aspects and regulatory elements

5.4 Lessons learned en route to a comprehensive STM regime

5.5 Concluding remarks: a window of opportunity for STM

**Chapter Six. Lines of Action**

Selected Bibliography

List of abbreviations

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