

Perspectives on future space traffic management

The background of the slide is a composite image of space. It shows the Earth's horizon from space, with a bright sun or star rising over the horizon, creating a lens flare effect. The sky is dark with numerous stars.

Alexander Soucek

Legal Officer, International Law Division, European Space Agency

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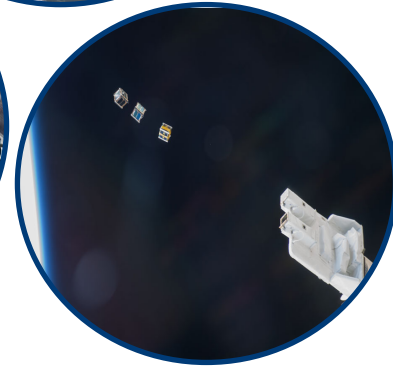
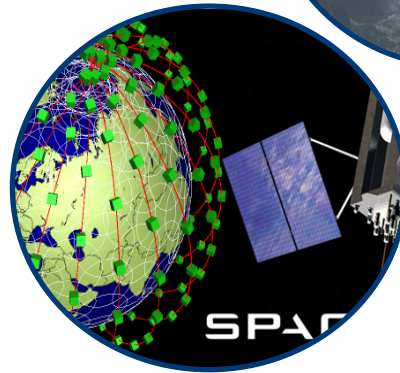
5 September 2016, Vienna, Austria

Space Traffic Management: the concept

- Conceptualized in the 1980s
- **“Space Traffic Management is the set of regulatory rules to ensure safe access to outer space, safe operations in outer space and safe return from outer space.” (IAA, 2006)**
- Basis: to view space activities as a comprehensive traffic regime and regulate them accordingly.

Evolution of spaceflight

- New ways of using outer space: e.g. **mega-constellations, on-orbit servicing missions, space tourism**
- New actors (privatization, “space democratization”)
- New technical challenges (amount of space objects, maneuverability, etc.)
- => new regulatory requirements



Today: “status management”

- The basis of international space law is embodied in five multilateral treaties without a “normative hierarchy”.
- The Outer Space Treaty sets forth some fundamental, commonly recognized principles pertaining to the status of outer space and the conduct of space activities.
- Primary purpose: to regulate inter-state relations (in times of the Cold War).

The example of the “space object”

- The term is not defined beyond that it includes “component parts (...) as well as its launch vehicle and parts thereof”.
- No normative distinction is made between different object categories, their function or their purposes.
- No technical or safety requirements a space object would have to meet are defined; nor are physical object parameters or rules pertaining to space object operations.

STM elements in int. space law

- The space treaties do not provide for technical requirements but are interstratified with STM elements, e.g.:
 - Specific kinds of payloads are forbidden in certain orbits;
 - Registration and notification requirements;
 - appropriate consultations to avoid harmful interference.
- However, most of these elements are not developed in detail.
- STM is not *conceptually* established in the treaties, and, as a result, they are of limited practicability for STM.

STM elements in national space legislation

- NSL partially fills regulatory gaps or may serve as source of inspiration for STM, e.g. making distinctions between:
 - airspace and outer space
 - operation / control / guidance / command;
 - spaceflight phases: launch / operations / disposal / re-entry;
 - orbital and sub-orbital spaceflight;
 - crew (astronauts) and spaceflight participants;
 - environmental and public safety, etc.

STM elements in UN Resolutions (1)

- **Principles Relevant to the Use of Nuclear Power Sources in Outer Space:**
 - object- and traffic-related provisions regarding nuclear reactors and radioisotope generators;
 - early example of comparatively detailed technical instructions for a specific class of space objects and its use: risk mitigation, orbital locations for operation, re-entry.
- Different in concept, scope and language from foregoing space law instruments.

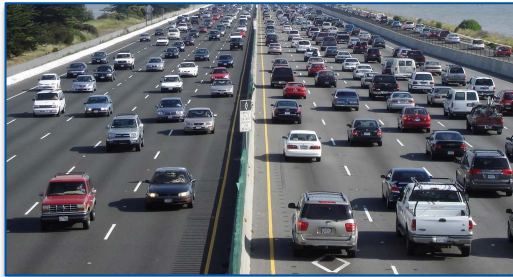
STM elements in UN Resolutions (2)

- **Space Debris Mitigation Guidelines (UNCOPUOS):**
 - safe conduct of space activities free from interference by non-functional space objects or their remnants.
 - requirements for S/C operations incl. EOL; collision prevention; spacecraft removal; ‘zoning’ of near-Earth outer space through ‘protected orbital regions’.
- summary of technical instruments of similar purpose and extent which were established earlier or later in time.

Technical coordination bodies

- Example: **Inter-Agency Space Debris Coordination Committee (IADC)**
- Technical experts discuss technical problems
- Consensus-based establishment of technical requirements, standards => *authoritative character*
- Subsequent practice (custom?), adoption / application through political or legal instruments (e.g. NSL)

Spaceflight as comprehensive traffic regime



Possible phases and elements of STM

- Phases: **launch phase** (e.g. pre-launch notification, launcher upper stages), **in-orbit phase** (operations until EOL; e.g. information duties, CAM), **post-mission and re-entry phase** (debris mitigation, ADR)
- Elements: space-related norms (e.g. orbit zoning), object-related norms and traffic-related norms
- **Builds upon existing space law (c.f. custom)**

Conceptual options for STM

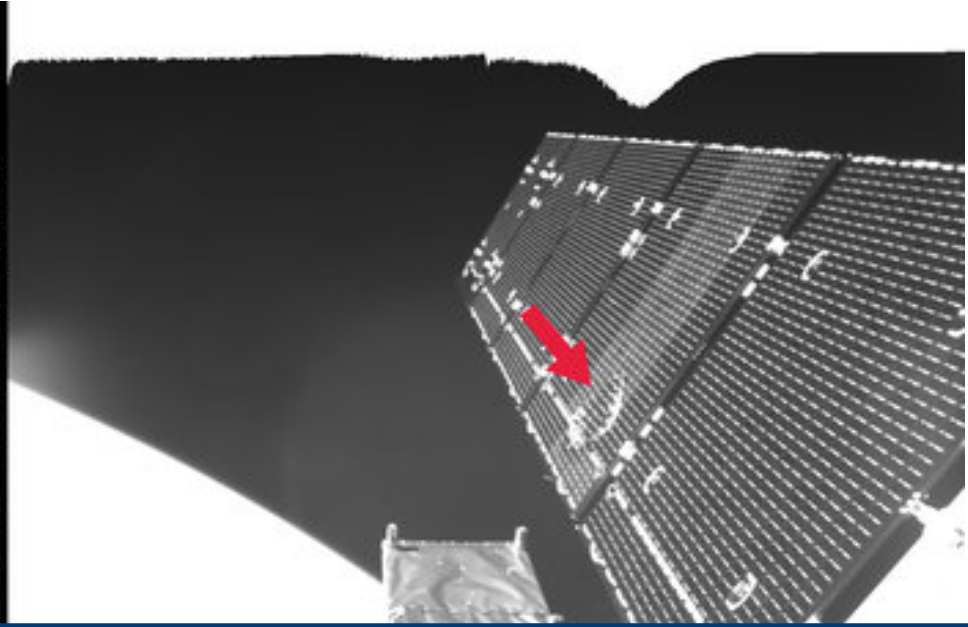
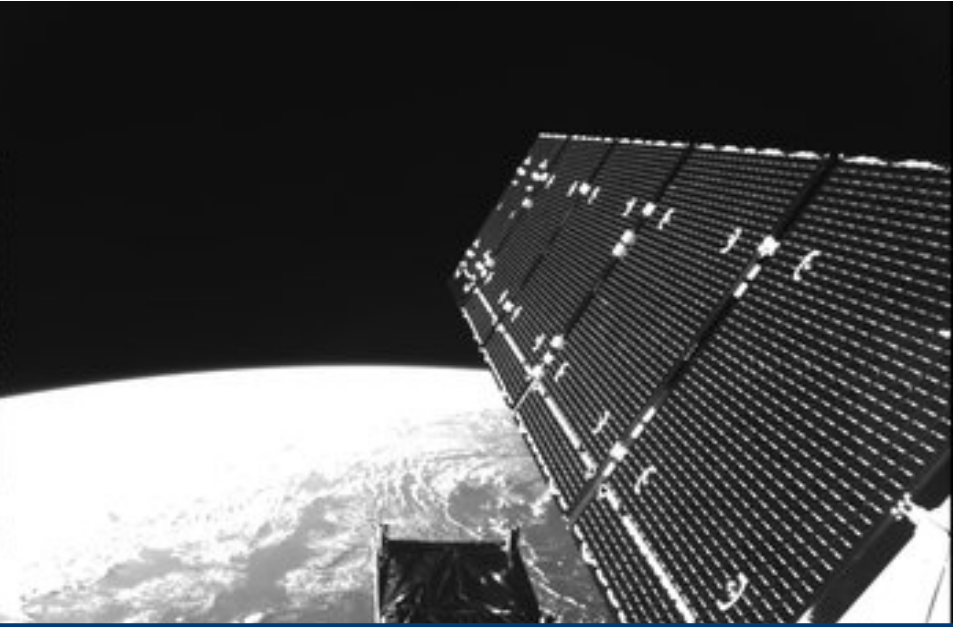
- Various approaches towards one or more STM regimes are conceivable, e.g.: *“ICAO concept”* or *“ITU concept”*:
- a legal framework of permanent character rooted in public international law; derived provisions for space traffic for regular revision; derived technical standards; an overarching institutional frame.
- Alternatives?

Outer space: a realm of a different kind

- Caution to resort to simple analogies with air traffic:
- Outer space as extra-territorial regime.
- Different physical realities; different object types; motion of objects / orbital mechanics; limited maneuvering capabilities; different traffic infrastructure and limited knowledge of objects (-> SSA); high velocities; remote operations, objects remain after EOL; etc.

Space Traffic Management: the future

- The discussion of STM at intergovernmental level has begun: single issue / item at UNCOPUOS Legal Subcommittee 2016.
- STM Study of the International Academy of Astronautics (IAA) to be published in 2016.
- ESA STM approach is in preparation.
- The key question: **an evolution or a revolution?**



Thank you.

Alexander Soucek

European Space Agency