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REGULATORY ASPECTS FOR LAUNCH ACTIVITIES IN A FUTURE SPACE TRAFFIC MANAGEMENT REGIME

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Space traffic already takes place. It seems, however, minuscule with regard to the dimension of near-Earth outer space. Around 13.000 man-made objects larger than about 10 cm are currently tracked out of which only 650 are operational spacecraft. On the surface, the management of space traffic does not appear to be a pressing problem. Investigated further, this judgement has to be challenged. A high level or even growing number of launches from more and more launch sites and space ports, the entering of non-governmental entities, the positioning of satellite constellations, an increase in space debris and the advent of reusable launch vehicles supports this judgement.

Considering this scenario, conceptualizing space traffic management will turn out to become a relevant task during the next two decades. Space traffic management will, however, limit the freedom of use of outer space. Therefore an international consensus on internationally binding regulations will only be achieved, if States identify a certain urgency and expect a specific as well as collective benefit from this.

I. Definition of Space Traffic Management

The dimension of this task can be assessed, when the following definition of space traffic

management is taken as a starting point:

> Space traffic management means 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.

Since an authoritative definition of space traffic management does not yet exist, this definition has been set up for the purpose of this study. Through this definition, the purpose of space traffic management becomes clear: it is to provide appropriate means so that space activities can be conducted without harmful interference. By that it supports the universal freedom to use outer space as laid down in the Outer Space Treaty of 1967. It should also be clear that for this purpose of achieving a common good, actors have to follow specific rules, which is also in their self-interest.

II. Dimensions and Phases of Space Traffic

Space traffic touches two dimensions: the scientific and technical area, and the regulatory field that are analyzed in this study. Then, those two dimensions of space traffic are applied to analyzing the three phases of space traffic: the launch phase, the in-orbit operation phase, and the re-entry phase. Below are the findings.

III. Findings

The Current Legal and Regulatory Framework

- The general principles of space law provide for a basis and rationale to establish a space traffic management regime.
- There exist some singular rules in international space law as well as in international telecommunication law, which constitute elements for a space traffic management system (especially for the GEO through the ITU). They are, however neither complete nor are they harmonized. ITU rules, aiming at the avoidance of radio-frequency interference are far more advanced than rules, aiming at the avoidance of physical interference.
- In this context, the IADC space debris mitigation guidelines of 2002 (non-binding soft law) encompass elements of space traffic management (use of disposal orbits, notification in case of controlled re-entry; but so far no provisions on the environment, i.e. avoidance of polluting the atmosphere/troposphere).

- Space law is, however, lacking numerous provisions, which are essential for a comprehensive traffic management regime (i.e. pre-launch notification). Of particular importance is a legal recognition of a difference between space objects considered as valuable assets by their owners, and space debris which have no value at all.
- A space traffic management regime has to touch also the question of harmonizing national space legislation (mostly to be established) and its consequential licensing standards and procedures, since they provide the building blocks for assuring technical safety.
- In the context of arms control/disarmament negotiations notification practices (prior to launch) are currently discussed, thus surpassing the status of civilian space law and negotiations in UNCOPUOS.
- The implementation of a comprehensive space traffic management regime would require additional regulation (with regard to information and the execution of space missions), which would further limit the freedom of use of outer space; in order to achieve a consensus on this, States have to perceive a certain urgency and have to expect a specific as well as collective benefit (as they receive from existing regulation).
- There are interfering factors, in particular military doctrines, which might hinder the establishment and working of a space traffic management regime.

The Launch Phase

- There is a rise in the number of launch vehicles (today 18).
- There is also a rise in the number of launch centers (today 11).
- The prospects for the inauguration of full/partly RLV are still open. In any case, by 2020 they would still be limited to supporting missions below 1000 km.
- Human space flight might only change dramatically beyond 2020.
- Safety certifications should be introduced.
- A clarification of the term "space object" is needed.
- The question of delimitation of air space and outer space should be revisited.
- The concept of the "launching State" has to be clarified.
- A pre-launch notification is necessary.
- Obligatory information in cases of damage is relevant.
- An international level playing field for transport services should be aimed for with a balance of public and private/economic interest.

The In-Orbit Operation Phase

- Maneuvering and in-orbit collision avoidance (with regard to other operational space objects

as well as with regard to space debris) is growing in number and importance.
- Maneuvering in the GEO is intensely applied but with little consideration of possible collisions.
- Reliable collision probabilities can be estimated only when reliable information exists, which currently is not guaranteed.
- There is no prioritization with regard to maneuvers.
- There is no prioritization of certain space activities, no "right-of-way-rules", nor is any kind of utilization of space ruled out (except it is against the peaceful uses).
- There is no traffic separation ("one-way-traffic").
- There are no "zoning" rules (restriction of certain activities in certain areas).
- There are no communication rules (advance notification and communication if orbits of other operators are passed).
- The ITU system of nominal orbital positions finds application only to satellites in the GEO.
- Private/commercial actors have started (i.e. through SUIRG and ITU) coordinating against radio-frequency interference.

<u>The Re-Entry Phase</u>

- Intentional (RLVs as well as active debris mitigation) and un-intentional de-orbiting (natural debris mitigation through decay) is now more frequent but care should be taken that large debris structures will be de-orbited in fragments.
- Responsibilities and liabilities for damages caused by space objects or its components ensue not only from international space law but also from the general provisions of national (tort) civil and administrative law.
- The generally shared wish to reduce space debris raises the question, whether regulation should also set a standard under which conditions a re-entry activity is in general legitimate and under which conditions it is not.
- Notification of, and coordination with, local and downrange air traffic, maritime authorities, and local government officials are already considered a best practice in coordinating launch activities.
- Space Law and Air Law have to solve the open issue of passage of space objects through airspace (the Chicago Convention does not apply to space objects in air space).
- The question is posed to introduce certain internationally recognized descent corridors and possibly even impact areas which are not frequently used by other traffic and which might be dedicated to space traffic.

IV. Conclusion

In the following, a model is provided on how a comprehensive space traffic management regime for 2020 could look like. There could be drafting of an international inter-governmental agreement building on and not replacing the existing treaties. It would include provisions for liability and the basic principle that States are the primary actors but that provisions of the agreement are applicable for private activities as well through national licensing regimes (certain issues will be clarified in the agreement).

This international inter-governmental agreement would comprise a legal text, which cannot be changed easily and technical annexes, which can be adapted more easily (modeled from ICAO or IMO) and contain three parts: the first one would relate to securing the information needs, the second one would focus on the notification system and the third part would concentrate on traffic management. Regarding traffic management, the agreement would:

- Clarify "space objects", including legal distinction between valuable objects and valueless space debris
- Clarify "fault" in case of damage caused in outer space
- Set delimitation for the launch phase and clarifying the concept of the "launching State"
- Provide traffic management rules based on the use of the database for the purpose of collision avoidance, including:
  - Safety provisions for launches
  - Zoning (selection of orbits)
  - Right of way rules for in-orbit phase
  - Prioritization with regard to maneuver
  - Specific provisions for GEO (in harmonization with ITU rules)
  - Specific rules for LEO satellite constellations
  - Debris mitigation mechanisms
  - Safety provisions for re-entries
  - Environment provisions (pollution of the atmosphere/troposphere, etc.)
- Clarify "space objects", including legal distinction between valuable objects and valueless space debris
- Give a framework and main features for national licensing regimes, which implement the provisions of the agreement
- Set out an enforcement mechanism (e.g. renouncement of access to information) and dispute settlement
- Clarify institutionalized interlinks with ICAO and ITU