The Definition and Delimitation of Outer Space and the Safety of Aerospace Operations

Prepared in collaboration with a Research Team at the McGill University Institute of Air and Space Law

Presented by Andrea J. Harrington

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Operational boundaries between airspace and outerspace

The **Fédération Aéronautique Internationale** (FAI) of Lausanne (CH), the world air sports federation governing aeronautics world records, as recognized the 100 km separation line proposed by Theodore von Karman between the fields of aeronautics and astronautics. As a matter of fact no airplane can be designed for sustained flight anywhere close to 100 km, and because of decompression risk commercial airliner are constrained to fly well below: not higher than 18 km. On the other hand no satellite can sustain orbital flight anywhere close to 100 km.

The following operational boundaries exist between aviation and space:

- **18 km, upper limit of civil aviation traffic**
- 50 Km, upper limit of atmospheric buoyancy (balloons);
- 120 Km, re-entry threshold for space systems;
- **160 Km, lowest practical operating orbit for satellites.**

The emerging “Near-Space” (18-160 km)

Suborbital rockets, trans-atmospheric rockets (also called point-to-point suborbital rockets) and orbital rockets all transit through near-space.

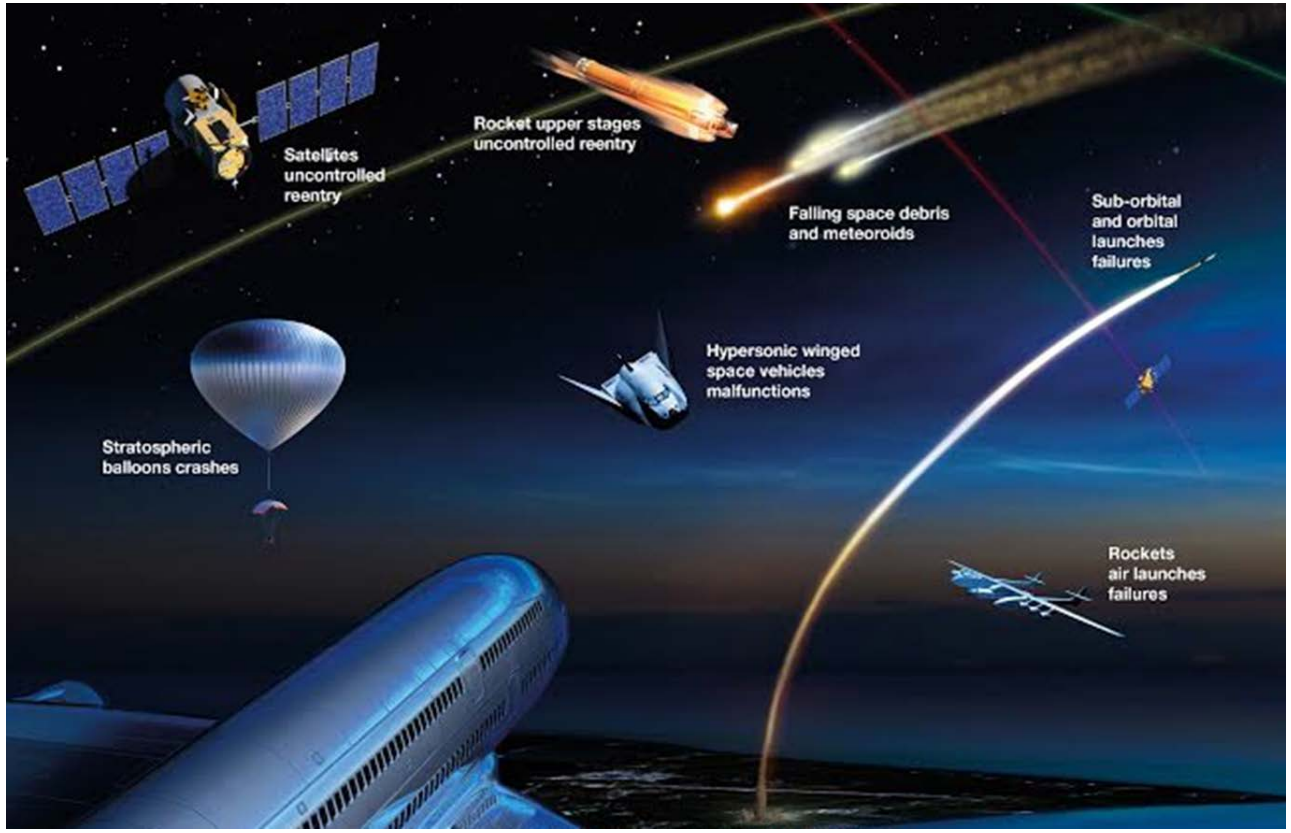
While suborbital rockets fly almost vertically from the point of launch, trans-atmospheric rockets and orbital rockets will overfly foreign countries en route. Furthermore it is in near-space that critical phases of space systems re-entry take place (e.g. fragmentation/explosion during uncontrolled re-entry).

The core of the search for a delimitation between airspace and outerspace is about defining were national sovereignty with reference to overflight ends. Each space faring country has a potential conflict of interests w.r.t. overflight rights.

The emerging “Near-Space” (18-160 km) cont’d

Commercial (and military) interests have begun to develop for operating systems in near-space. Such systems (suborbital vehicles, stratospheric balloons, pseudo-satellites and high-altitude drones) are meant to fly from few minutes or hours, to weeks, months or even years

Operations in near-space are a potential threat for air traffic beneath and for the public on ground, in case of failures or malfunctions. They are also a threat for space bound and returning traffic.



Questions Presented

- Is there a relationship between suborbital flights for scientific missions and/or for human transportation and the definition and delimitation of outer space?
- Will the legal definition of suborbital flights for scientific missions and/or for human transportation be practically useful for States and other actors with regard to space activities?
- How could suborbital flights for scientific missions and/or human transportation be defined?
- Which legislation applies or could be applied to suborbital flights for scientific missions and/or for human transportation?
- How will the legal definition of suborbital flights for scientific missions and/or for human transportation impact the progressive development of space law?
- Other questions to be considered in the framework for the legal definition of suborbital flights for scientific missions and/or for human transportation?

Is there a relationship between suborbital flights for scientific missions and/or for human transportation and the definition and delimitation of outer space?

- Suborbital flights are generally characterized as those flights that achieve what would be considered an outer space altitude without sufficient speed to achieve orbit around Earth
- These flights flag questions about the applicability of the air law or space law regimes, given the uncertainty as to whether they are aircraft operating as spacecraft or spacecraft operating as aircraft
- Including other critical differences (such as liability differences):
  - The air law regime provides for territorial sovereignty over airspace
  - The space law regime prohibits the exercise of territorial sovereignty over any part of outer space

Will the legal definition of suborbital flights for scientific missions and/or for human transportation be practically useful for States and other actors with regard to space activities?

- Solely creating a definition will not answer the question of applicable law
- Definition and establishment of legal regime will create legal certainty
  - Benefits to States include: better ability to control responsibility/liability through appropriate legislation/regulation
  - Benefits to private actors include: regulatory certainty, cost effective investment
- Obligations drastically change based on applicable regime

How could suborbital flights for scientific missions and/or human transportation be defined?

- Spatialist approaches (physical boundary)
  - Von Karman line (100 km)
  - Buffer zone
  - Effective control
  - Aerodynamic lift
  - Lowest point of orbital flight
- Functionalist approaches (based on activities)
  - Mission purpose
  - Design and licensing
  - Impact on air/space traffic control

Which legislation applies or could be applied to suborbital flights for scientific missions and/or for human transportation?

Space Law

- 1967 Outer Space Treaty
- 1968 Rescue Agreement
- 1972 Liability Convention
- 1976 Registration Convention
- 1979 Moon Treaty
- Customary international law
- National laws and regulations

Air Law

- 1944 Chicago Convention
- Warsaw or Montreal Convention (for private liability)
- Other aviation multilateral & bilateral treaties
- Customary international law
- National laws and regulations

How will the legal definition of suborbital flights for scientific missions and/or for human transportation impact the progressive development of space law?

- A decision relation only specifically to orbital flights would likely create a push for general demarcation or classification of other activities
- It would encourage individual States to promulgate appropriate legislation and/or administrative regulations for their activities
- Classification as aviation would narrow the scope of space law/broaden the scope of air law, while classification as space activities would have the opposite effect
- It would imply the need for revisiting the concept of innocent passage
- A more urgent need would be created to deal with space traffic management and integration into airspace
- There would be increased likelihood of bilateral agreements between States
- Attention to environmental protection would need to increase with increased activity
- The principles of non-discrimination and cooperation would be solidified

Other questions to be considered in the framework for the legal definition of suborbital flights for scientific missions and/or for human transportation?

- How can a regime for the definition and delimitation of outer space adapt to, or be sufficiently flexible to accommodate, consistently changing technological realities?
- What impact would the adoption of a rule for the definition and delimitation of outer space have on national security concerns?
- How will a rule of definition and delimitation of outer space effect existing and targeted levels of aerospace safety?
  - How will a rule of definition and delimitation of outer space effect existing air traffic control mechanisms?
  - How will a rule of definition and delimitation of outer space contribute positively to or detract from the development of a space traffic control regime?
- How can varying national legal regimes be harmonized at this stage to ensure regulatory certainty?
- Will any new regime have an impact on the equitable and rational use of increasingly congested low Earth orbits?

Questions or comments?

- Andrea Harrington: andrea.harrington@mail.mcgill.ca
- Ram Jakhu: ram.jaku@mcgill.ca