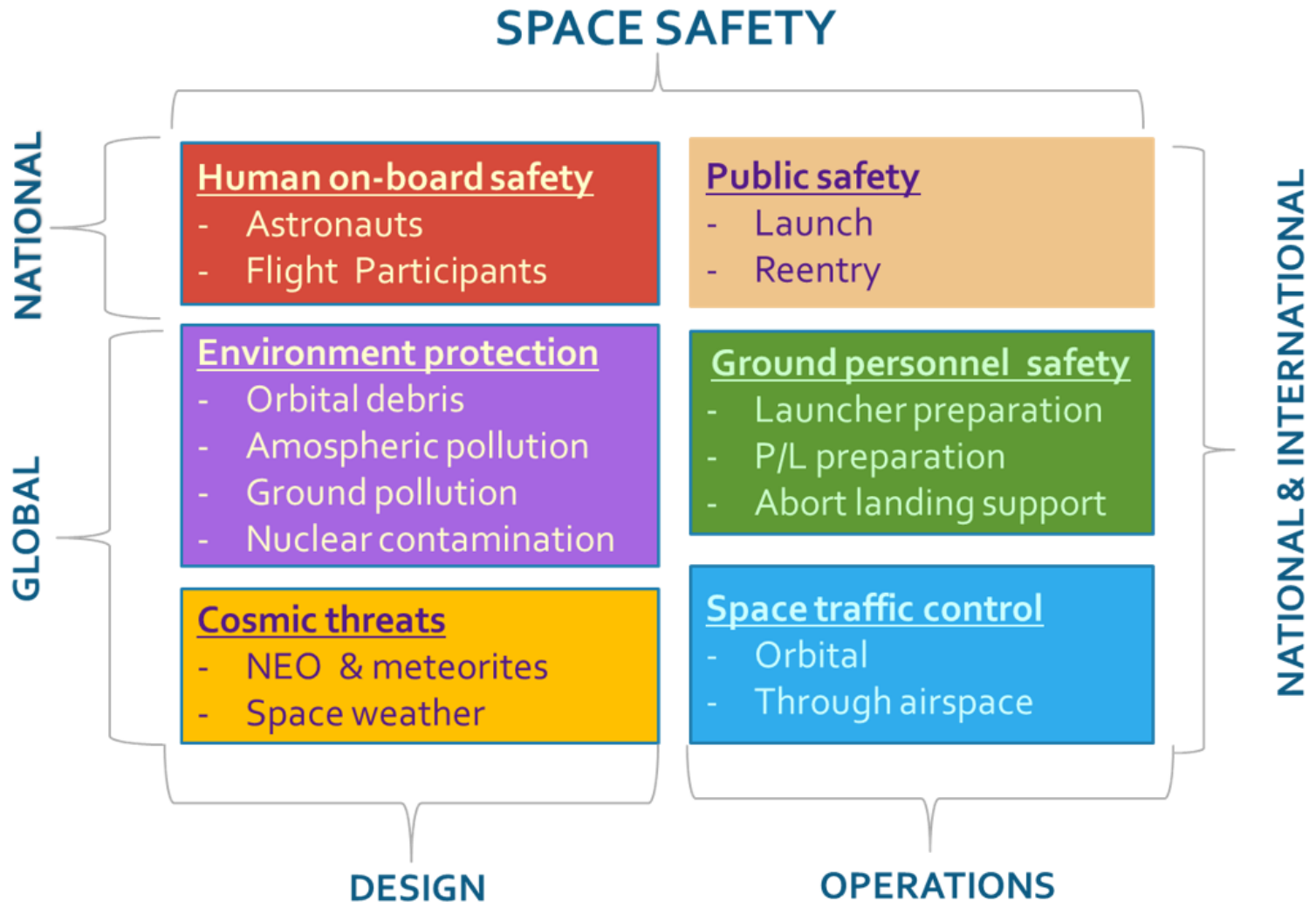
# SPACE SAFETY AND THE IAASS MANIFESTO

by

IAASS

57th session of the UN COPUOS Scientific and Technical Subcommittee


SPACE SAFETY
NATIONAL
GLOBAL
Human on-board safety
- Astronauts
- Flight Participants
Environment protection
- Orbital debris
- Amospheric pollution
- Ground pollution
- Nuclear contamination
Cosmic threats
- NEO & meteorites
- Space weather
Public safety
- Launch
- Reentry
Ground personnel safety
- Launcher preparation
- P/L preparation
- Abort landing support
Space traffic control
- Orbital
- Through airspace
NATIONAL & INTERNATIONAL
DESIGN
OPERATIONS

# IAASS Manifesto
# for a Safe and Sustainable Space

1. ***Ensure that citizens of all nations are equally protected from the risks posed by over-flying space systems and objects during launch and re-entry operations;***
2. ***Ensure that space systems are developed, built and operated according to common minimum ground and flight safety rules which reflect the status of knowledge and the accumulated experience of all space-faring nations;***
3. ***Seek to prevent collisions or interference with other aerospace systems during launch, on-orbit operation, and re-entry;***
4. ***Ensure the protection of the ground, air and on-orbit environments from chemical, radioactive and debris contamination related to space operations;***
5. ***Ensure that mutual aid provisions for space mission safety emergencies are progressively agreed, developed and made accessible without restriction anywhere on the Earth and in Outer Space.***

## *#1*
## *Ensure that citizens of all nations are equally protected from the risks posed by over-flying space systems and objects during launch and re-entry operations*

Related issues:

a. Legal regime uncertainty due to lack of internationally agreed delimitation between airspace and outerspace.
b. Acceptable risk levels (if any) defined on event basis, and unilaterally established by the country performing launch and re-entry operations.
c. Lack of internationally agreed standard methods for launch and re-entry risk assessment.
d. Overflown countries often unaware of event risk, and unable to control the cumulative annual risk in case of multiple overflying rockets.
e. Launch and re-entry risk assessments usually not including risk for public traveling by air.
f. Re-entry alert services available only in some countries (e.g. EU Re-entry Analysis Service), and covering only risk on ground.
g. Quantitative vs. qualitative (i.e. FT) performance requirements for system safety functions (e.g. FTS, re-entry functions).

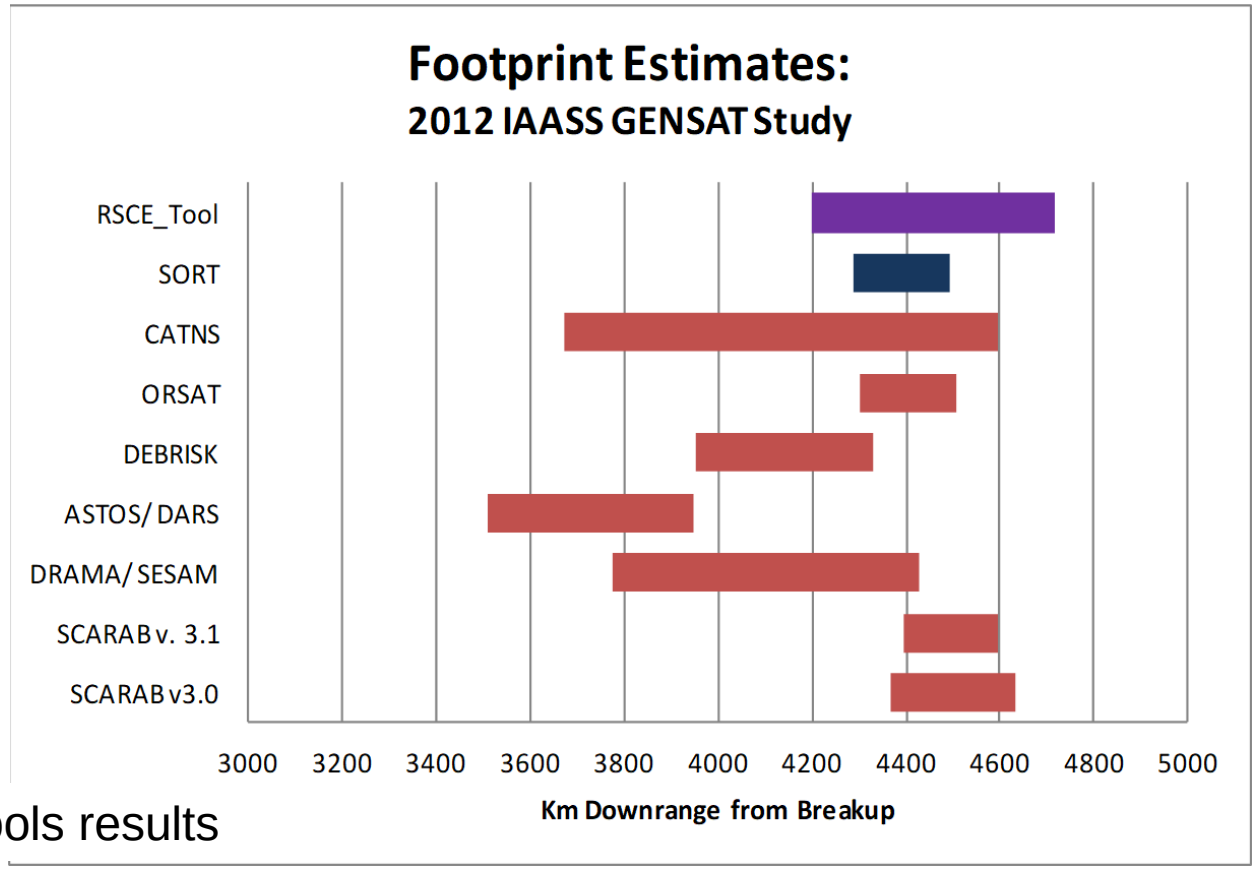
## *#1.a*
## *Legal regime uncertainty due to lack of internationally agreed delimitation of airspace/outerspace*

A study of IAASS and McGill University IASL has proposed the insertion of an intermediate space region, called Near-Space, between 18 km and 160 km with a mixed legal regime. The proposed legal regime would be as follows:

a) innocent passage (civil/commercial space activities) would be freely allowed, but the safety risk for overflown population should comply with international norms TBD.
b) The economic exploitation of Near-Space (e.g. operation of pseudo-satellites) should be the exclusive prerogative of the country underneath.
c) Overflights for non-civil/commercial purposes (e.g. ICBM tests) would require authorization by overflown countries.

## #1.c
## Lack of internationally agreed standard methods for launch and re-entry risk assessment

| | SCARAB v3.0 | SCARAB v. 3.1 | DRAMA/ SESAM | ASTOS/ DARS | DEBRISK | ORSAT | CATNS |
|---|---|---|---|---|---|---|---|
| Fragmentation altitude | 77.2 | 74.8 | 78 | 78 | 78 | 78 | ~74 |
| Number of fragments | 6 | 5 | 30 | 15 | 23 | 21 | 26 |
| Surviving mass | 41 | 124.5 | 71.4 | 73 | 58.7 | 47.2 | 159.7 |
| Surviving mass (%) | 10 | 30 | 18.2 | 18.7 | 14.5 | 12 | 37.7 |
| Casualty area ($m^2$) | 5.3 | 5.28 | 33.4 | 14.1 | 18.2 | 15.3 | 29.4 |
| Range (min-heel) (km) | 4368 | 4395 | 3777 | 3510 | 3955 | 4301 | 3985 |
| Range (max-toe) (km) | 4631 | 4597 | 4430 | 4411 | 4332 | 4509 | 4604 |
| Footprint length (km) | 263 | 202 | 652 | 438 | 377 | 208 | 619 |



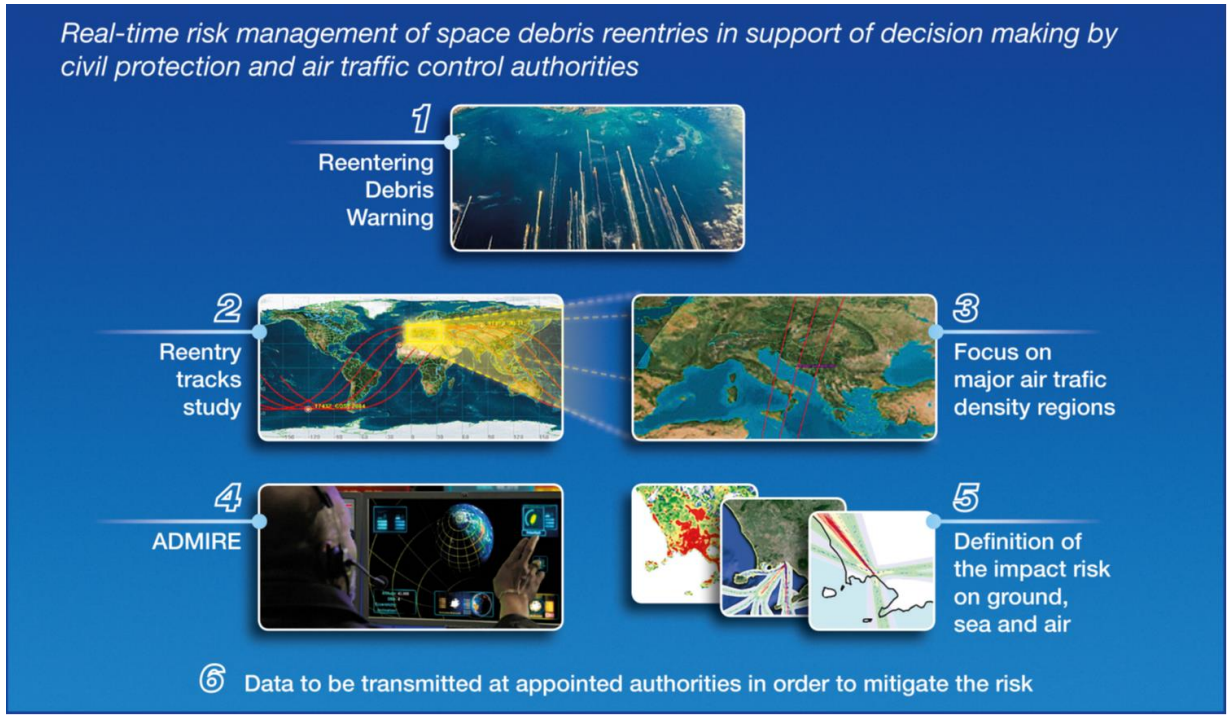

IAASS L&R Committee study comparing re-entry tools results

***#1.e***
***Risk assessments usually not including risk for public traveling by air.***
***# 1.f***
***Re-entry alert services available only in some countries (e.g. EU Re-entry Analysis Service), and covering only risk on ground.***

Currently, approximately 70% of re-entries of intact objects are uncontrolled, ±50% of the returning mass, (i.e. 100 tons/year). On average, there is one spacecraft or rocket body uncontrolled re-entry every week.

Small fragments are not modeled and many may survive. A fragment with mass > 300gm is catastrophic for an airliner.

With the introduction of space-based internet services the LEO population may increase up to 40 times! within a decade.




**The IAASS "ADMIRE" Project for Aviation Space Debris Safety**

## #2
## *Ensure that space systems are developed, built and operated according to common minimum ground and flight safety rules which reflect the status of knowledge and the accumulated experience of all space-faring nations*

IAASS promotes the development of international performance-based space safety standards for the design and operations of space systems (e.g. human-rating standard IAASS-SSI-1700)

International consensus space safety safety standards should be mandatory whenever there are risk for foreign people, either on ground (e.g. at spaceport), or on board (foreign flight participants).

## #3
## *Seek to prevent collisions or interference with other aerospace systems during launch, on-orbit operation, and re-entry;*

The IAASS promotes the principles of:

- Separating military Space Situational Awareness (SSA) from civil Space Traffic Management (STM).
- Enlarging national launch authority mandates (e.g. FAA-AST) to include commercial on-orbit and beyond-earth-orbit space operations licensing, and civil/commercial STM services.
- ICAO to Integrate Air Traffic Management and Space Traffic Management in a single international system, also in consideration of growing air-launches from the international airspace)

The IAASS promotes international research and professional exchange in the field of STM:

- Membership of the Advisory Board of the IAA Study Group 5.15 on "*Space Traffic Management - Towards a Roadmap for Implementation*", 2018
- Started an IAASS Space Traffic Management Working Group.

## #4
## *Ensure the protection of the ground, air and on-orbit environments from chemical, radioactive and debris contamination related to space operations*

For the effective protection of the orbital environment, tree main actions are needed:

- Ban ASAT tests
- Enforce prevention of space debris creation
- Enforce removal of space debris

- Confrontation vs. cooperation: China seems to have developed full ASAT capabilities up to MEO, HEO and GEO. Confrontation may lead to irreversible degradation of the orbital environment. A minimum of cooperation is beneficial and truly necessary. IAASS supports the *International Code of Conduct for Outer Space Activities,* a non-legally binding, voluntary international instrument aimed at building norms of responsible behavior in space activities.
- Institute for Prevention and Control of Space Debris (IPCSD). The IAASS has proposed at UN COPUOS the establishment (on commercial basis) of an IPCSD to certify compliance with ISO 24113 “Space debris mitigation requirements” and to provide support to commercial entities during development and operations.

## #4
## *Ensure the protection of the ground, air and on-orbit environments from chemical, radioactive and debris contamination related to space operations – CONT'D*

The IAASS has developed a proposal, in cooperation with McGill University IASL, for an international regulatory framework for:

1) Ensuring that future satellites and rocket stages are no longer abandoned, voluntarily or accidentally, on-orbit at the end of their mission;

2) Facilitating active debris removal by establishing an international/intergovernmental organization to conducting Active Debris Removal (ADR) on the model of INTELSAT and INMARSAT.

On one hand the launching state of a space object that later becomes a debris must have the primary responsibility for its removal, and on the other hand removal systems development and operational costs can be minimized through international cooperation, thus also avoiding liability issues, and defeating, by international dissemination of technologies, the concern about acquisition of military advantage due development and deployment of new potential dual systems.

*"I believe it is an interesting framework that may get around many of the policy and legal issues that any single government agency or private company would encounter"* – Don Kessler

## #5
## *Ensure that mutual aid provisions for space mission safety emergencies are progressively agreed, developed and made accessible without restriction anywhere on the Earth and in Outer Space*.

- Although the US Congress is very much wary about China intention in space, it has always encouraged NASA for the last 30 years to seek cooperation in space rescue matters.
- Also the perspective of separated national and international Moon bases/missions goes in the direction of promoting cooperation on rescue and interoperability standards, otherwise even direct communication between Moon bases and/or with EVA suited astronauts of different countries would be impossible in case of emergency.
- The IAASS is promoting the development of International Search & Rescue capabilities in space similar to those existing in civil fields (ICAO, IMO) and also in the military community (International Submarine Escape and Rescue Liaison Office - ISMERLO).

Congested
Contested
Competitive

***TODAY***


***TOMORROW***

Safe
Sustainable
Shared