The Space Safety Coalition in the context of international space cooperation

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UN COPUOS STSC

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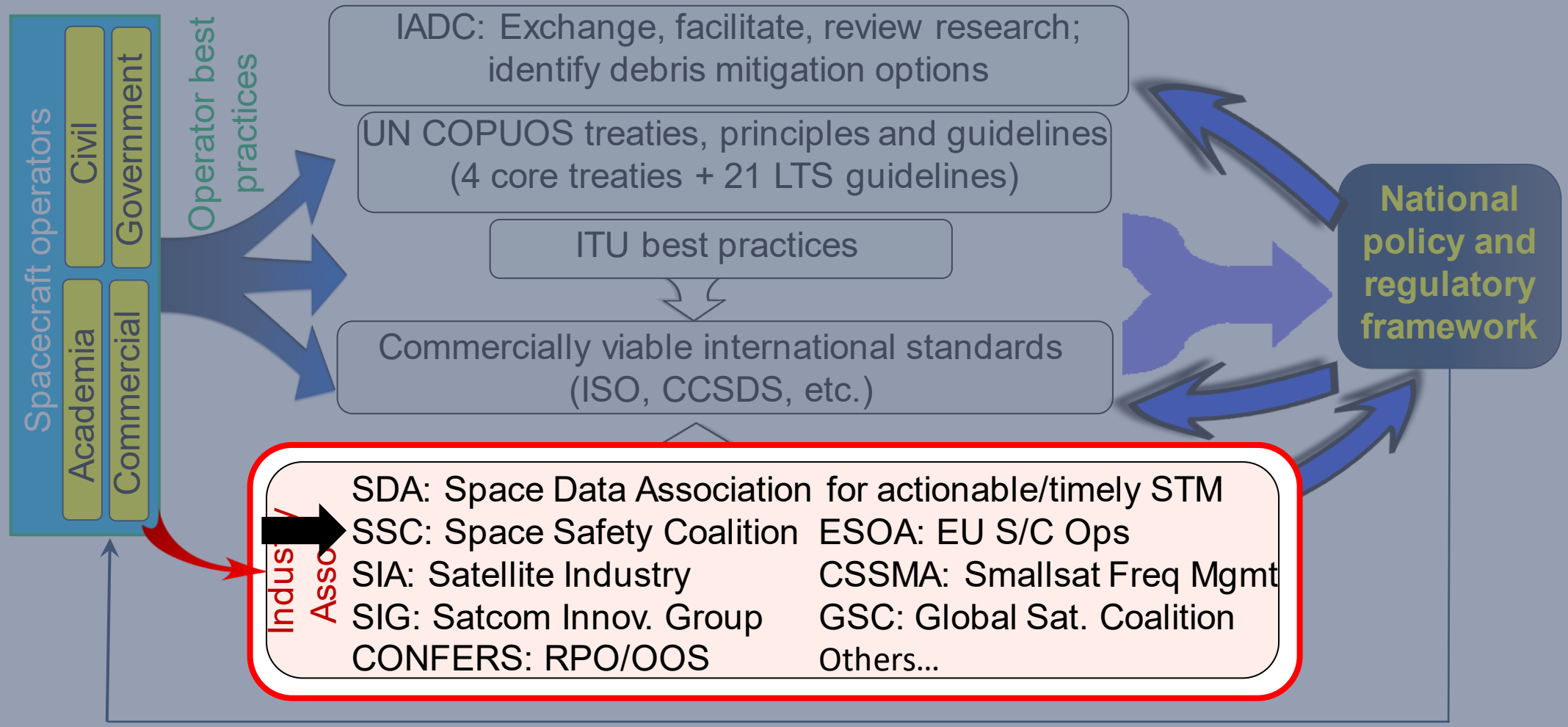
Space policy framework *virtuous cycle*



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Space Safety Coalition (SSC)

- https://spacesafety.org
- Most operators support space sustainability
  - "It's just good business sense"
  - Especially important for new large constellations
- SSC is a new ad hoc coalition of willing space operators and relevant industry stakeholders, formed to assemble a **living set of aspirational best space operations practices**
- Signatories endorse and agree to strive to implement best practices
  - To ensure safety and commercial viability of space activities
- SSC can make a difference, in *advance* of:
  - Space treaties and consensus guidelines
  - Standards
  - National regulations

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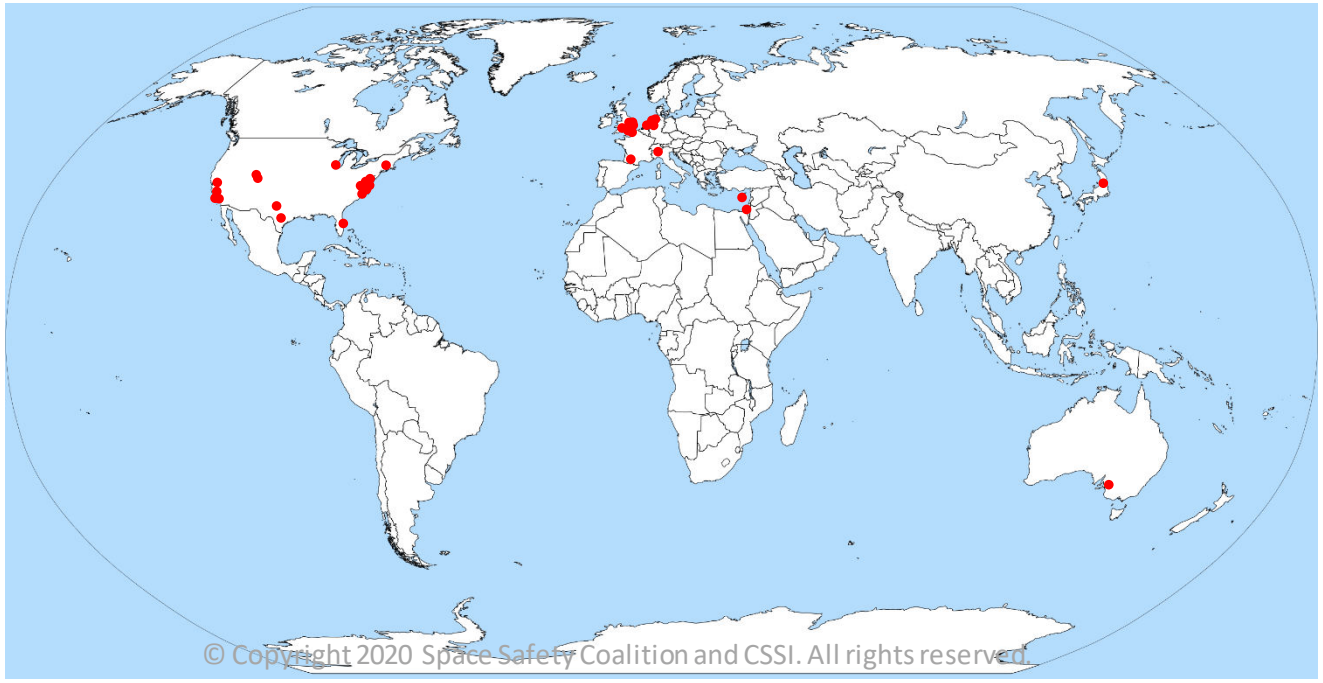
Diverse set of 37 global space organizations have endorsed so far



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SSC's "Best Practices for the Sustainability of Space Operations"

- **A ground-breaking "living" best practices document:**
  - **Part 1: Endorses existing international guidelines and standards (IADC, UN, ISO)**
  - **Part 2: Contains over forty additional specific best practices to further enhance and secure the long-term sustainability of space operations**
    - Spans all phases of design and spaceflight, orbit regimes, spacecraft form factors, life cycle phases, and mission types

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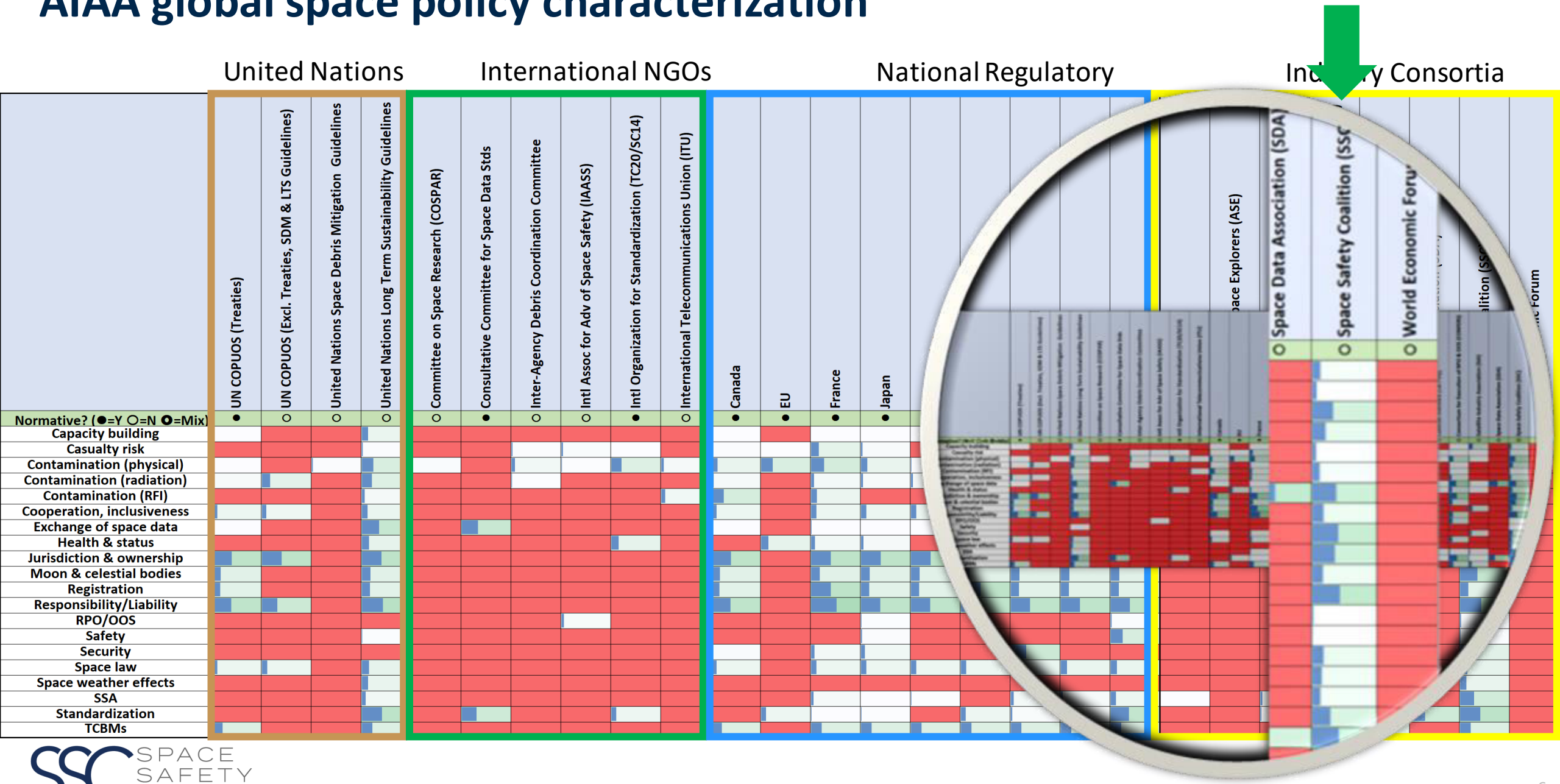
AIAA global space policy characterization



Why is “business as usual” not an option ?

1. **Because today’s flight safety is not sufficient.**
   - Spacecraft operators can’t tell which conjunctions are “too close”
   - Flight safety services missing serious collision risks and are not transparent and timely
   - Spacecraft operators overwhelmed by false alarms and inaccurate SSA*
   - Only 60% of spacecraft and 65% upper stages in LEO are successfully disposed**

2) **Because New Space is a threshold of intense change:**
   - Operational spacecraft may increase tenfold by 2029.
   - Quantity of tracked debris may increase tenfold within two years.
   - Low-thrust propulsion will soon be the rule, rather than exception.
   - High conjunction rates fuel desire for automated collision avoidance decision making.
   - Step change increase in state and commercial actors in space.
     - Highest treaty ratification of 63% omits many countries out.
     - Information pooling, exchange and standardization is critical.

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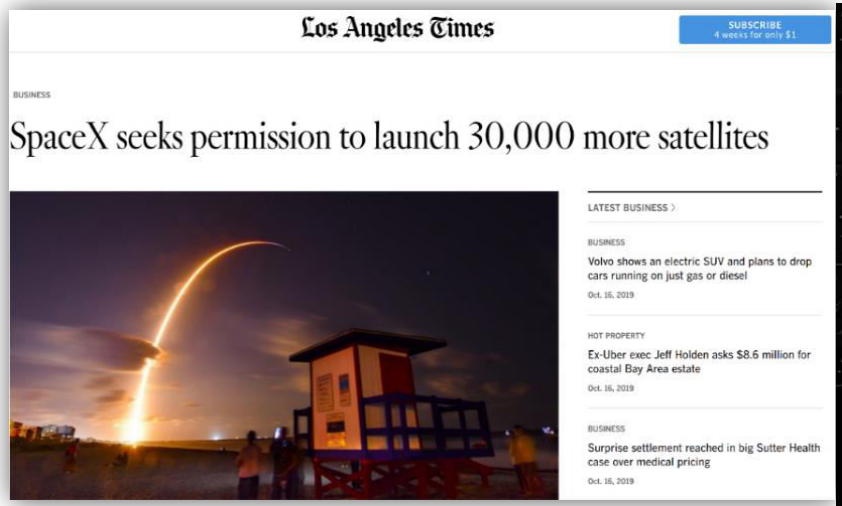
* Oltrogge, D.L. and Alfano, S., “The Technical Challenges to Better Space Situational Awareness and Space Traffic Management,” Journal of Space Safety Engineering, https://doi.org/10.1016/j.jsse.2019.05.004, May 2019

**ESA Space Debris Office, “Space debris mitigation in practice,” Stijn Lemmens, ESA ECSL Workshop – Standards, 20 Mar 2019

Even if only half of New Space applicants actually come to fruition…

- That will be a space population like we've never seen before!
- 58,841 new spacecraft proposed globally in next ten years



Los Angeles Times

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IEEE SPECTRUM

Amazon Reports Collision Risk for Mega-Constellation of Kuiper Internet Satellites

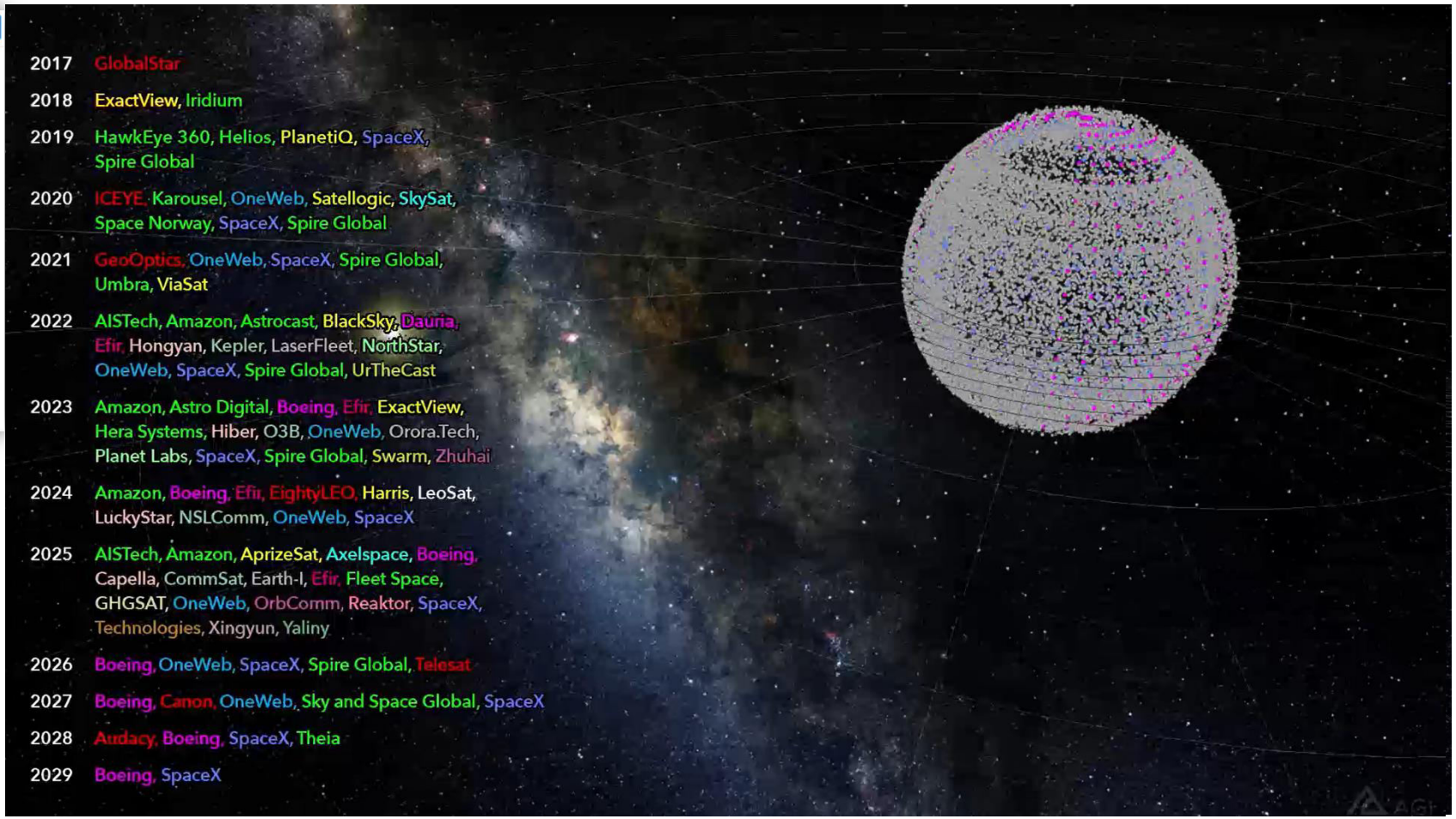
By Mark Harris
Posted 2019-10-16 16:18 GMT

For the first time, we have a complete, representative number for the overall orbital collision risk of a satellite mega-constellation.

Last month, Amazon provided the U.S. Federal Communications Commission (FCC) with data for its planned fleet of 3,236 Kuiper System broadband Internet satellites.

If one in 10 satellites fails while on orbit, and loses its ability to dodge other spacecraft or space junk, Amazon's figures [PDF] show that there is a 12 percent chance that one of those failed satellites will suffer a collision with a piece of space debris measuring 10 centimeters or larger. If one in 20 satellites fails—the same proportion as failed in rival SpaceX's first tranche of Starlink satellites—there is a six percent chance of a collision.

More than a third of all the orbital debris being tracked today came from just two collisions that occurred about a decade ago. Researchers are concerned that more explosions or breakups could accelerate the Kessler Syndrome—a runaway chain reaction of orbital collisions that could render low earth orbit (LEO) hostile to almost any spacecraft.



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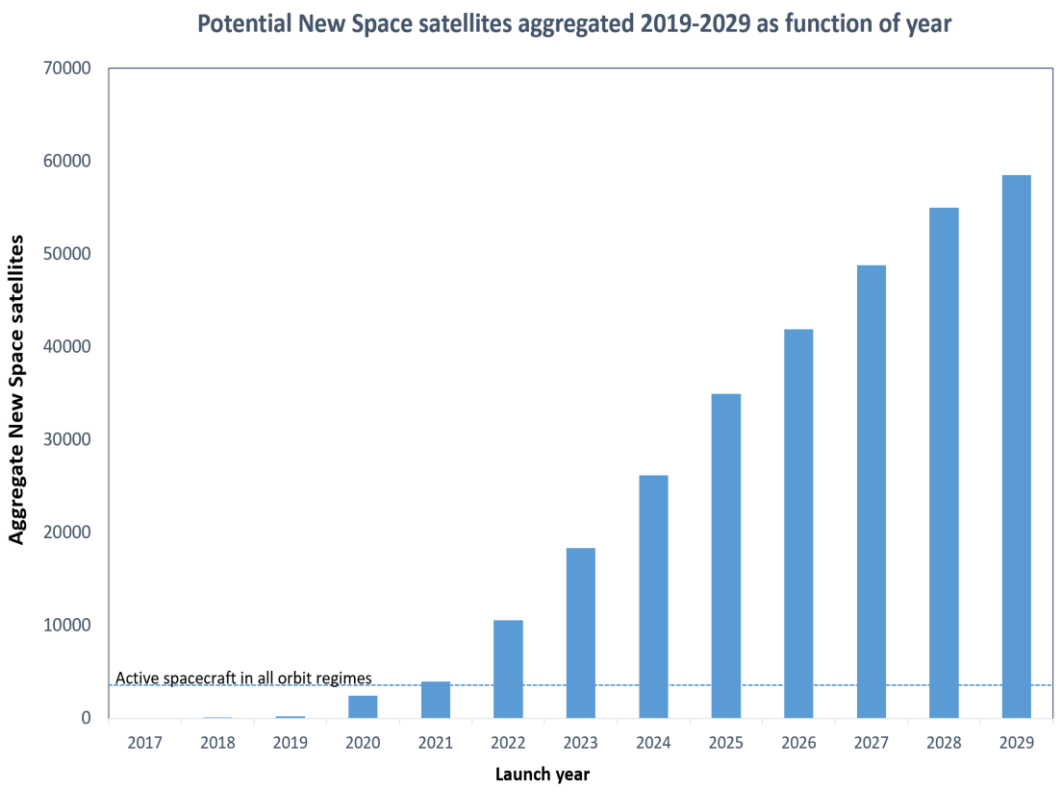
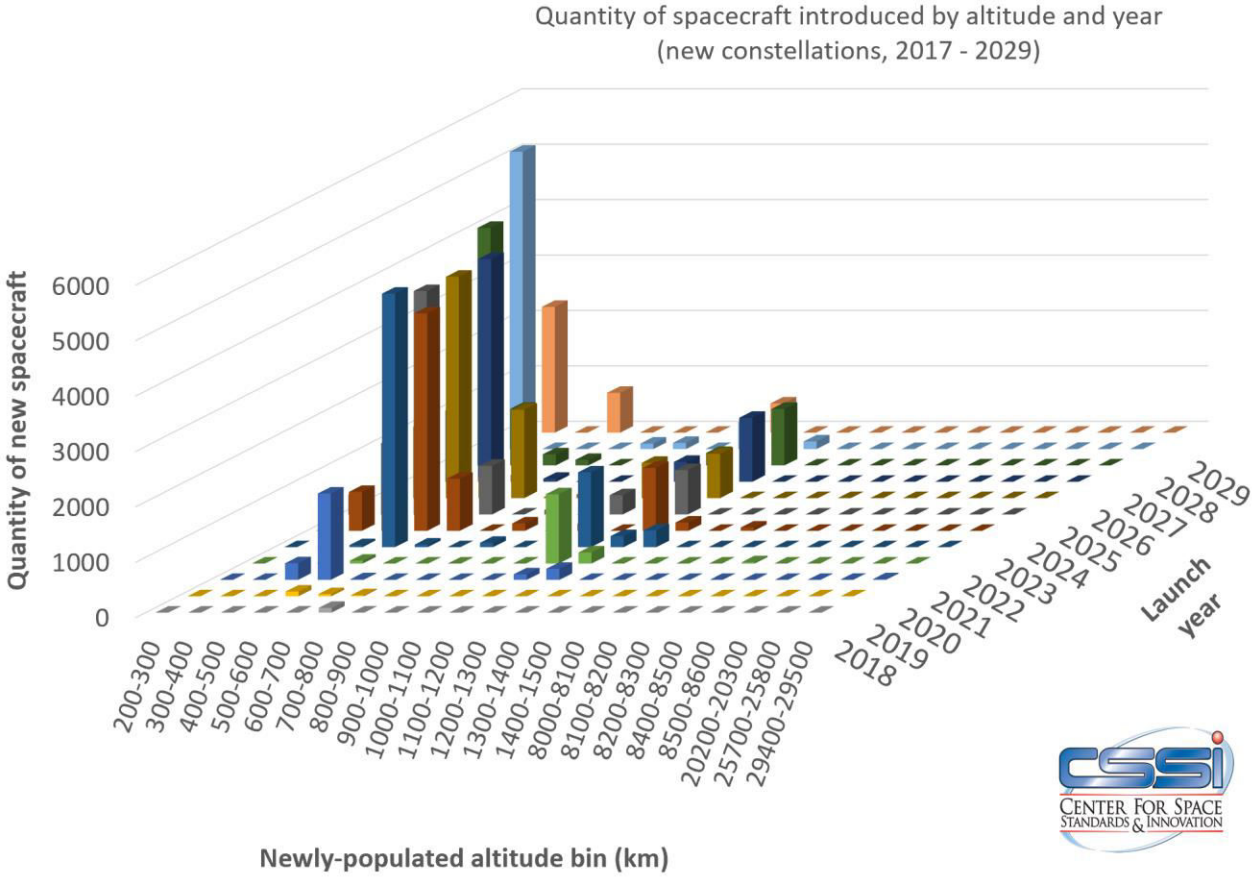
Still have time to prepare for potential large constellations!

- **While SpaceX and OneWeb launching now, onslaught isn't for several years.**
- **Imperative to get our space safety guidelines and processes in order <u>now</u>.**





CSSI Center For Space Standards & Innovation

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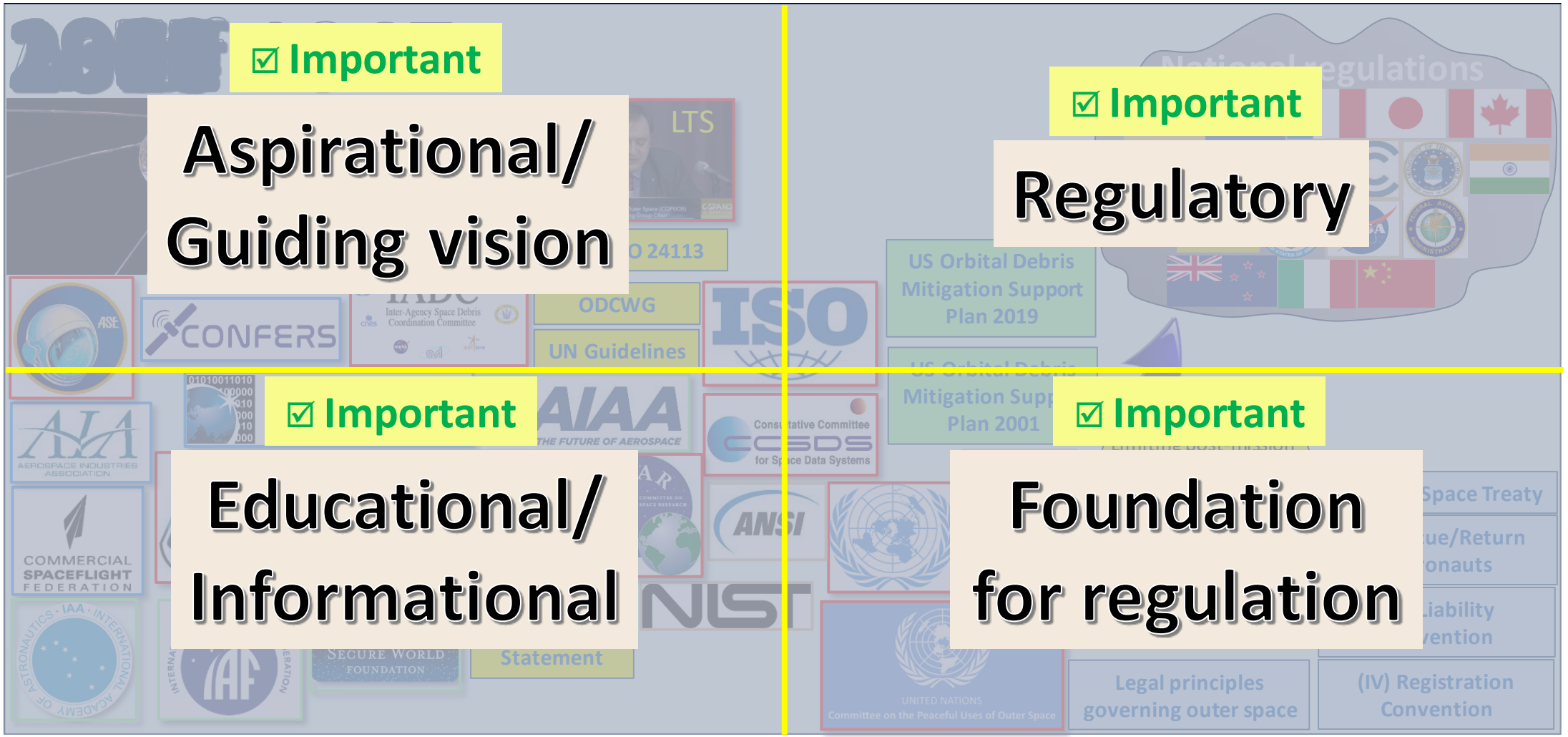
Space safety policy landscape continuum

Color scheme:
Non-Gov't Organizations | National regulations
Industry Associations | International bodies



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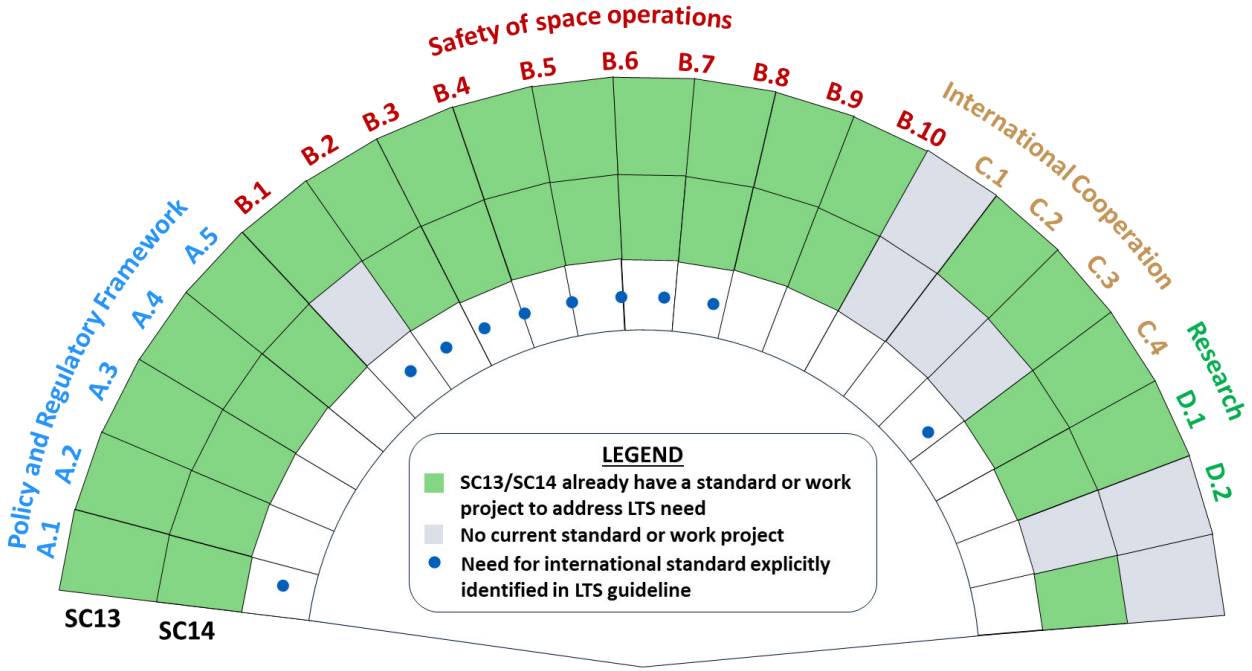
Space Safety Coalition aids implementation of LTS guidelines

SSC incorporates ISO standards that address LTS guidelines



SSC best practices that address LTS guidelines

Guideline	Guideline Title	SSC Endorsement Doc
Safety of space operations		
B.1	Provide updated contact information and share information on space objects and orbital events	Endorses data sharing relevant to orbital debris mitigation and collision avoidance
B.2	Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects	Endorses accurate orbit solutions and data sharing
B.3	Promote the collection, sharing and dissemination of space debris monitoring information	Encourages use of SSA and STM entities to share safety of flight data
B.4	Perform conjunction assessment during all orbital phases of controlled flight	Endorses Active Collision Avoidance when feasible
B.5	Develop practical approaches for pre-launch conjunction assessment	Endorses use of launch providers who take steps to preclude collisions between spacecraft, stages of the launch vehicle, active space and debris throughout deployment phase
B.6	Share operational space weather data and forecasts	
B.7	Develop space weather models and tools and collect established practices on the mitigation of space weather effects	
B.8	Design and operation of space objects regardless of their physical and operational characteristics	Endorsed practices are agnostic of size/form factor/function.
B.9	Take measures to address risks associated with the uncontrolled re-entry of space objects	Advocates for design for demise and 1.e-4 casualty risk per spacecraft
B.10	Observe measures of precaution when using sources of laser beams passing through outer space	

Guideline	Guideline Title	SSC Endorsement Doc
Scientific and technical research and development		
D.1	Promote and support research into and the development of ways to support sustainable exploration and use of outer space	Incorporates by reference and promotes IADC guidelines which are based upon such research
D.2	Investigate and consider new measures to manage the space debris population in the long term	Incorporates by reference and promotes IADC guidelines which are based upon such investigations

Guideline	Guideline Title	SSC Endorsement Doc
Policy and regulatory framework for space activities		
A.1	Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities	
A.2	Consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities	
A.3	Supervise national space activities	
A.4	Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites	
A.5	Enhance the practice of registering space objects	Endorses spacecraft owner, operator and stakeholder exchange of information relevant to safety-of-flight and collision avoidance with other space operators and stakeholders

Guideline	Guideline Title	SSC Endorsement Doc
International cooperation, capacity-building and awareness		
C.1	Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities	Incorporates by reference IADC, UN COPUOS and ISO/CCSDS guidelines and standards which promote international cooperation
C.2	Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange	Spacecraft owners, operators and stakeholders should exchange information relevant to safety-of-flight and collision avoidance via intra-operator coordination and SSA and STM service entities
C.3	Promote and support capacity-building	Incorporates by reference IADC, UN COPUOS and ISO/CCSDS guidelines and standards which promote capacity building
C.4	Raise awareness of space activities	Incorporates by reference IADC, UN COPUOS and ISO/CCSDS guidelines and standards which promote space activities

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Summary

- **The global space policy framework unites the existing legal regime with complementary non-legally binding best practices and confidence-building measures to form in aggregate a comprehensive virtuous cycle.**
- **As a key part of that virtuous cycle, the space industry can embrace existing international space policies while aspiring to achieve an even higher standard, in advance of international consensus.**
- **In so doing, like-minded space industry members can lead the initiative to implement the 21 LTS guidelines in a practical and expeditions manner.**

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Legal entities that have a direct and material interest in space safety and sustainability can learn more about the space safety coalition at: https://spacesafety.org or email us at info@spacesafety.org

Best Practices for the Sustainability of Space Operations