International Institute of Space Law (IISL) and
European Centre for Space Law (ECSL)

SPACE LAW SYMPOSIUM 2021
"Space Law for the Global Space Economy"

Economic aspects of long-term sustainability of outer space activities and space traffic management

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On the occasion of the 60th Session of the Legal Subcommittee
of the United Nations Committee on the Peaceful Uses of Outer Space

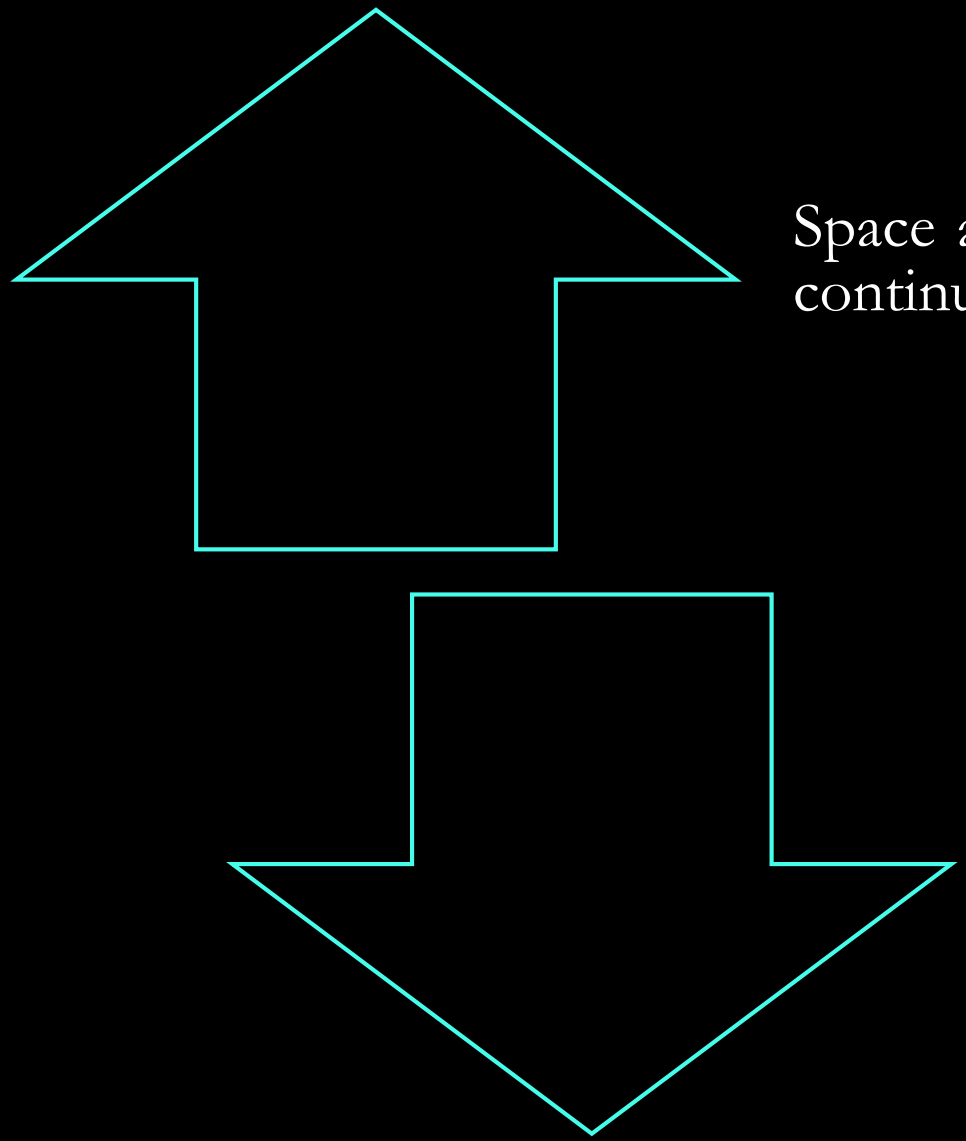
WHY?

Why is the issue of
long-term sustainability of outer space activities and
space traffic management
worth your attention and require ACTION?!

Ethical and environmental concerns translated through economic reasoning

- Space environment could be compared to a basket where numerous objects are thrown by different players in an uncoordinated way.
- Every space actor is governed by its own interests.
- At a certain point the basket will be full and therefore unable to further accommodate the objects.
- Same as a basket limited in its size, the most economically attractive space resources are similarly rare and limited.
- Another comparison could be made to space highways that require clear rules and coordinated efforts/responsible behaviors of all stakeholders in order to be effectively driven.

DISCREPANCY PROBLEM



Space actors keep launching and their numbers continue to grow

Not many care about and / or undertake efforts to:

- Limit space debris released during their normal operations;
- Minimize potential for on-orbit break-ups;
- Ensure post mission disposal;
- Prevent on-orbit collisions.

Unsustainable space environment

STATUS QUO

- Growing number of space actors
- More affordable launch opportunities and more frequent launches
- Growing number of space objects launched and released, same for space debris
- More frequent occurrence of situations requiring collision-avoidance and maneuvering
- Improved space surveillance technologies
- More institutions advocating for space sustainability and STM, and having them on their agenda
- Emerging experimental technologies and pilot projects for on-orbit satellite servicing and active debris removal
- Sensitivity of such operations due to security concerns and economic viability of their performance
- Bigger geopolitical tensions between space powers
- Lack of transparency in conducting space activities and confidence-building measures

UNSUSTAINABLE SPACE ENVIRONMENT

Problem from environmental perspective

- Debris risks to generate more debris
- Debris could constitute a hazard for operational satellites and activities in space

Problem from ethical perspective

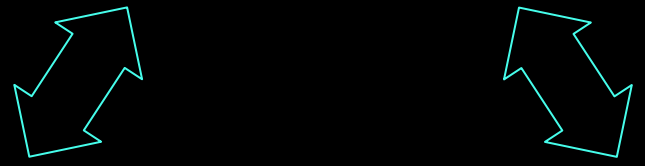
Accessibility of space for future generations and a safe operational environment for space activities

Problem from economic perspective

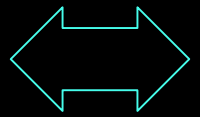
- Resiliency of space infrastructure / assets is questioned
- Sustainable and continued provision of space-based services could be compromised
- Might render a satellite non-functional which would require its replacement

KEY INCENTIVES TO A "VOLUNTARY" IMPLEMENTATION OF SPACE SUSTAINABILITY MEASURES

Image / Reputation



Competitive Advantage
(I 'do' whereas others 'don't do')



Acknowledgment of their Importance for Economic Interests

KEY STAKEHOLDERS
in the realm of Space Sustainability / STM advocacy

- UNOOSA
- UNIDIR
- ITU
- FAA
- ICAO
- Secure World Foundation (SWF)
- Institute for Defense Analysis (IDA)
- AIAA
- IAASS
- The Aerospace Corporation
- WEF Global Future Council on Space
- STM EU Consortia

LEGAL GROUNDS FOR LONG-TERM SUSTAINABILITY OF OUTER SPACE ACTIVITIES

- Outer Space Treaty
- Liability Convention
- Registration Convention
- Principles Relevant to the Use of Nuclear Power Sources in Outer Space
- Safety Framework for Nuclear Power Source Applications in Outer Space
- Space Debris Mitigation Guidelines
- Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects
- Recommendation ITU-R S.1003-2 'Environmental protection of the geostationary-satellite orbit'
- Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities
- COSPAR Planetary Protection Policy
- Guidelines for the **Long-term Sustainability of Outer Space Activities** of the Committee on the Peaceful Uses of Outer Space (2018, 2019)

LTS GUIDELINES

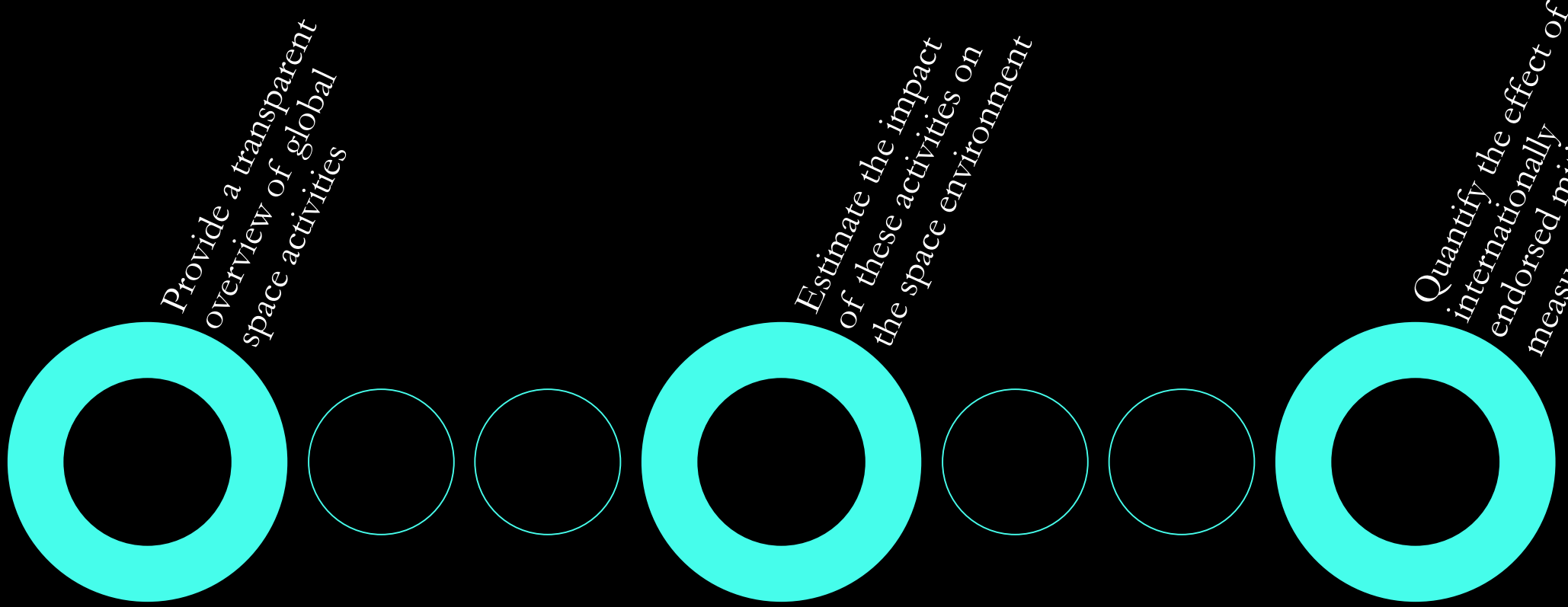
A. Policy and regulatory framework for space activities	B. Safety of space operations
A1. Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities A2. Consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities A3. Supervise national space activities A4. Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites A5. Enhance the practice of registering space objects	B1. Provide updated contact information and share information on space objects and orbital events B2. Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects B3. Promote the collection, sharing and dissemination of space debris monitoring information B4. Perform conjunction assessment during all orbital phases of controlled flight B5.Develop practical approaches for pre-launch conjunction assessment B6. Share operational space weather data and forecasts B7. Develop space weather models and tools and collect established practices on the mitigation of space weather effects B8. Design and operation of space objects regardless of their physical and operational characteristics B9. Take measures to address risks associated with the uncontrolled re-entry of space objects B10. Observe measures of precaution when using sources of laser beams passing through outer space
C. International cooperation, capacity-building and awareness	**D. Scientific and technical research and development**
C1. Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities C2. Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange C3. Promote and support capacity-building C4. Raise awareness of space activities	D1. Promote and support research into and the development of ways to support sustainable exploration and use of outer space D2. Investigate and consider new measures to manage the space debris population in the long term

SPACE SUSTAINABILITY AND SDGS

- We talk about the **UN Sustainable Development Goals (SDGs)** and how 'space' can help achieving them

- ...we should also start talking about the need to define the **Space Sustainability Goals**, and in addition, add 'Space' as the 18th SDG

ESA ANNUAL SPACE ENVIRONMENTAL REPORT



ESA ANNUAL SPACE ENVIRONMENTAL REPORT

2. Space Environmental History in Numbers	3. Environmental Status	4. Intentional Object Release
• Overall Space Environment • Evolution of Environment in LEO • Evolution of Environment in GEO • Usage of the Protected Regions • Constellations in the LEO protected region • Active payloads in the LEO protected region • New Catalogued Objects in the Space Environment • Objects Removed from the Space Environment • Nuclear Power Sources	• Status of the Environment in LEO • Status of the Environment in GEO • Fragmentations in 2020 • Changes to the Environment • Conjunction statistics in LEO	• Mission Related Objects • Solid Rocket Motor Firings
5. Fragmentation History	6. End-Of-Life Operations History	**7. Environment Metrics**
• All fragmentation events • Non-system related fragmentation events	• End-Of-Life Operations in Low Earth Orbit • End-Of-Life Operations in Geostationary Orbit	• Environmental Index • Environment Evolution

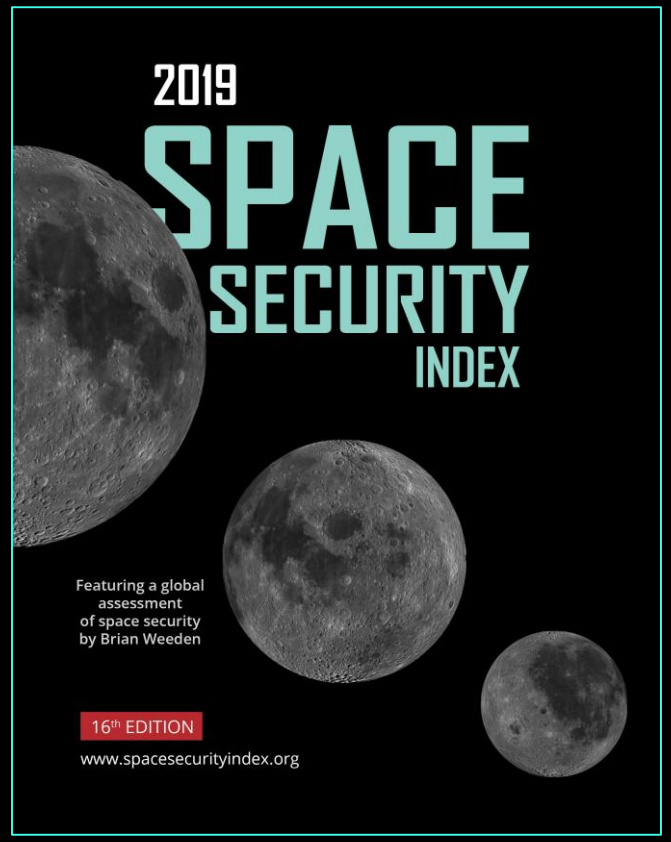
SPACE SECURITY INDEX

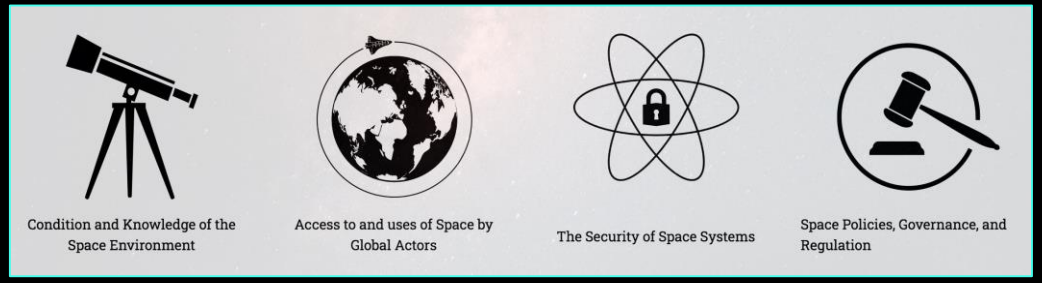
PURPOSE

- **to** improve trust and transparency related to space activities
- to provide a common, comprehensive, objective knowledge base to enhance capacity for dialogue and policies that contribute to the governance of outer space as a shared global commons

HOW

- in the past - a single, annual report
- today - a collection of fact-based guides and assessments of interrelated trends and developments in space





Assure the future viability of Earth orbit as a global commons to advance human welfare

SPACE SUSTAINABILITY RATING (SSR)

WHAT	Conceptualized within the WEF Global Future Council on Space Technologies, the SSR is designed to support long-term sustainability of the space environment by increasing transparency of actors' debris mitigation efforts
HOW	Actors self-apply to undergo an evaluation of their mission through a questionnaire to establish a rating
	An alignment of all the measurements will feed into the SSR to provide a comprehensive assessment of sustainability of space events / missions
IMPACT	Provides a comprehensive rating for sustainability of space missions bringing more transparency to the sector and highlighting and rewarding responsible actors

TAKE ACTION

Become a *CHAMPION*

Third parties in a position to and willing to trial SSR and support its development

Become an *ADVOCATE*

Organizations not in a position to trial SSR based on nature of their business, but support the initiative

SPACE SITUATIONAL AWARENESS

as a tool to know what to coordinate, manage and control

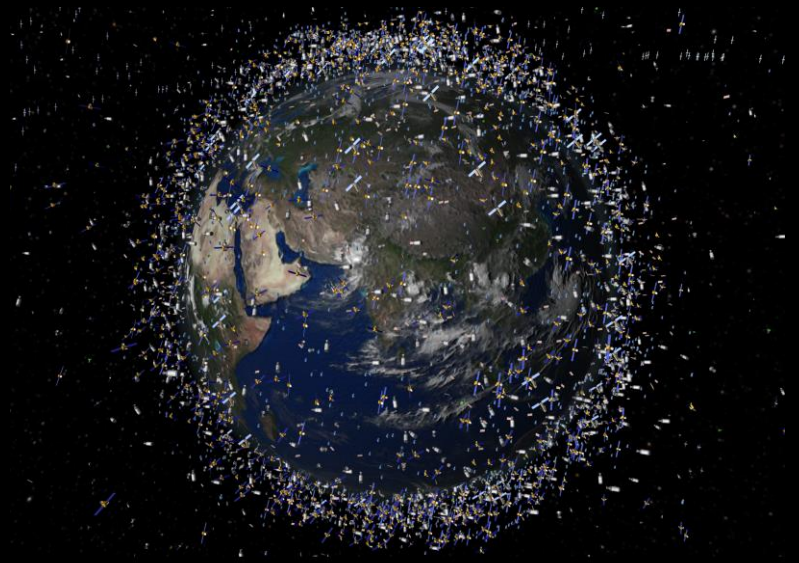
Who has the SSA data and where do they get them from?

Which data and information are shared?

With whom are those SSA data shared? Based on which legal grounds?

Under which terms?

How to efficiently bridge SSA capabilities with STM mandate?



Note: Artist's impression; size of debris exaggerated as compared to the Earth

Knowledge (SSA) without action (STM) has little value, however action (STM) without generally accepted, transparent, certain and thus predictable rules fail to be an efficient solution for SUSTAINABLE SPACE ENVIRONMENT.

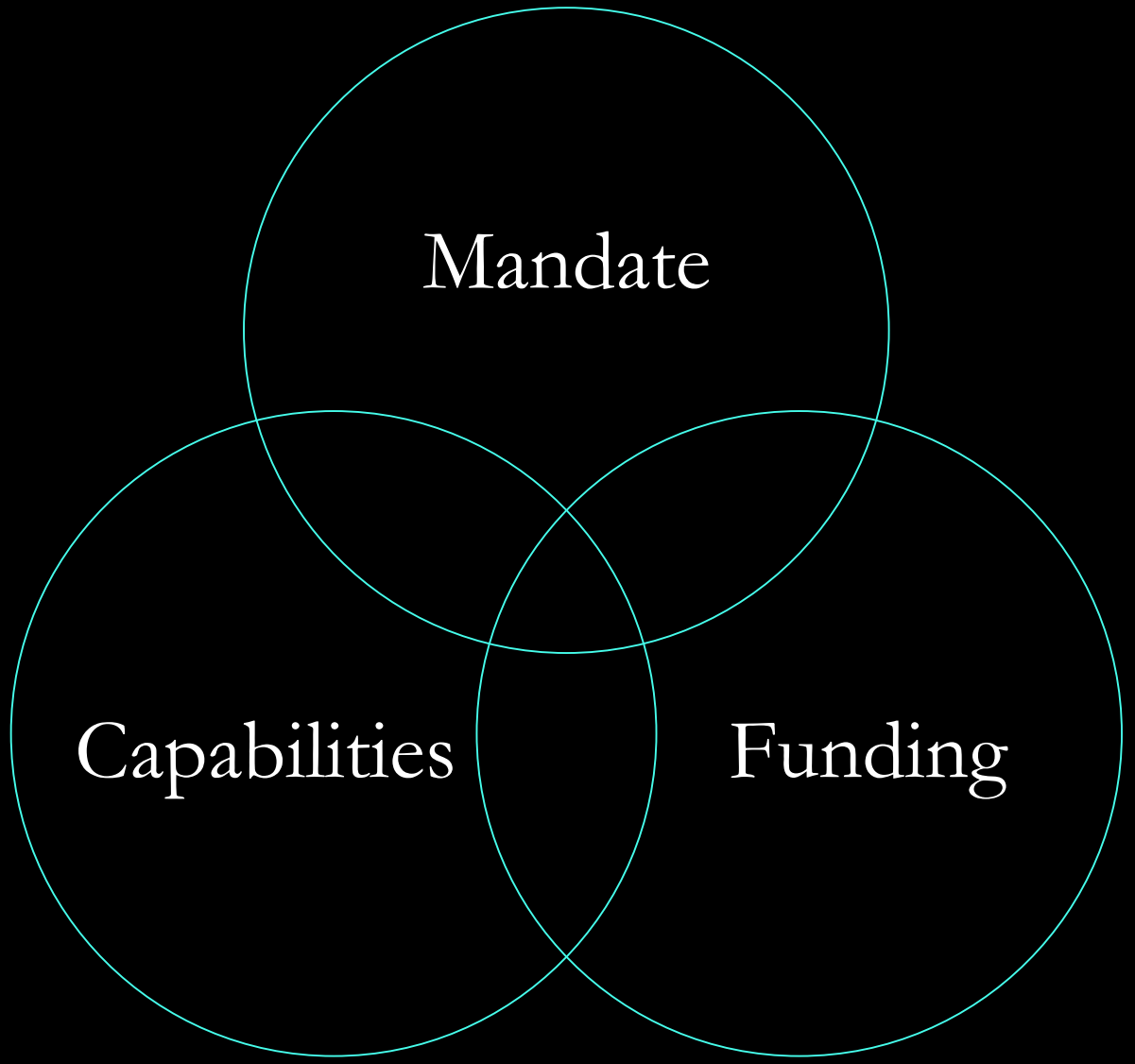
There are rules for all other types of traffic

but not for SPACE TRAFFIC

WHY?

SPACE TRAFFIC MANAGEMENT

- WHAT activities do we exactly intend to manage?
- HOW do we intend to execute this function? Is it about managing, coordinating, regulating, controlling …?
- WHO does define the authority and grant the (global) mandate for it to be recognized by all space actors? WHO does have such capabilities?
- WHERE is the limit of the mandate? STM might need to imply coordination with other related types of traffic, e.g. maritime and air.
- WHO will fund it?



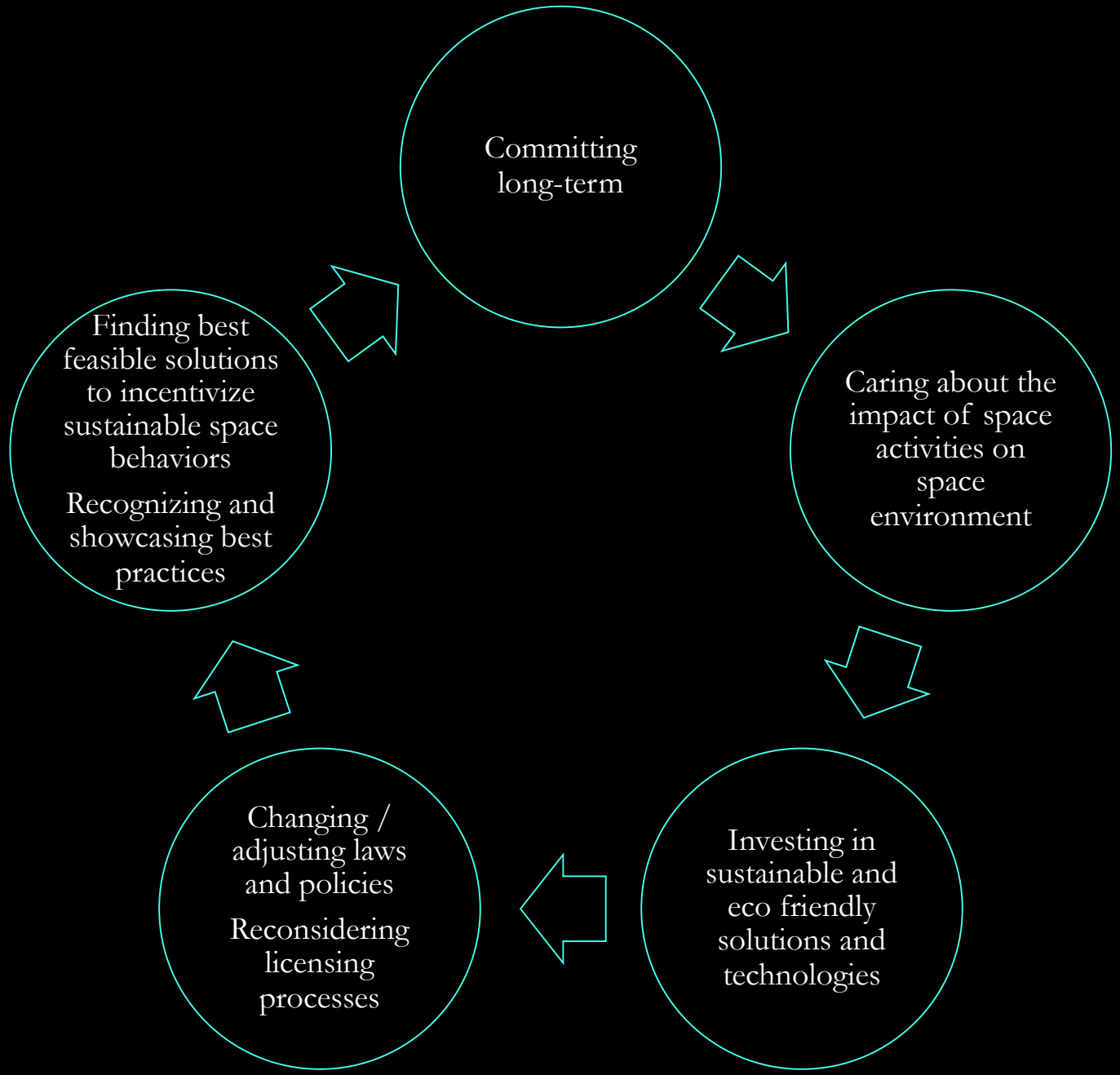
ACTIONS TO BE TAKEN TODAY FOR SUSTAINABLE SPACE

THE FUTURE IS NOW

TO DO LIST

- ✓To promote environmental consciousness and responsible behaviors in space
- ✓To showcase best practices and assist stakeholders wishing to align their activities with space sustainability guidelines
- ✓To focus on implementation and enforcement mechanisms
- ✓To incentivize responsible and environmentally sustainable behaviors
- ✓To promote the platforms for inclusive and interdisciplinary dialogue on space sustainability and STM
- ✓To make the dialogue uninterrupted by fostering a continuous engagement and participation of all key actors at all stages of the dialogue
- ✓To coordinate the parallel ongoing initiatives on the same subject

INVESTING AND COMMITTING TO SUSTAINABLE SPACE



SPACE requires

‘SUSTAINABLE DEVELOPMENT that meets the needs of the present without compromising the ability of future generations to meet their own needs’.

“Our Common Future”,
known as the Brundtland Report

Thank you for your attention!

Coordinated action. That's what we need.

Respectfully yours,

Dr. Olga Stelmakh-Drescher

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#SpaceWatchGL Opinion: Space Sustainability Trends 2020/2021 and Beyond

#SpaceWatchGL Opinion: Space Traffic Management: Trends 2020/2021 and Beyond