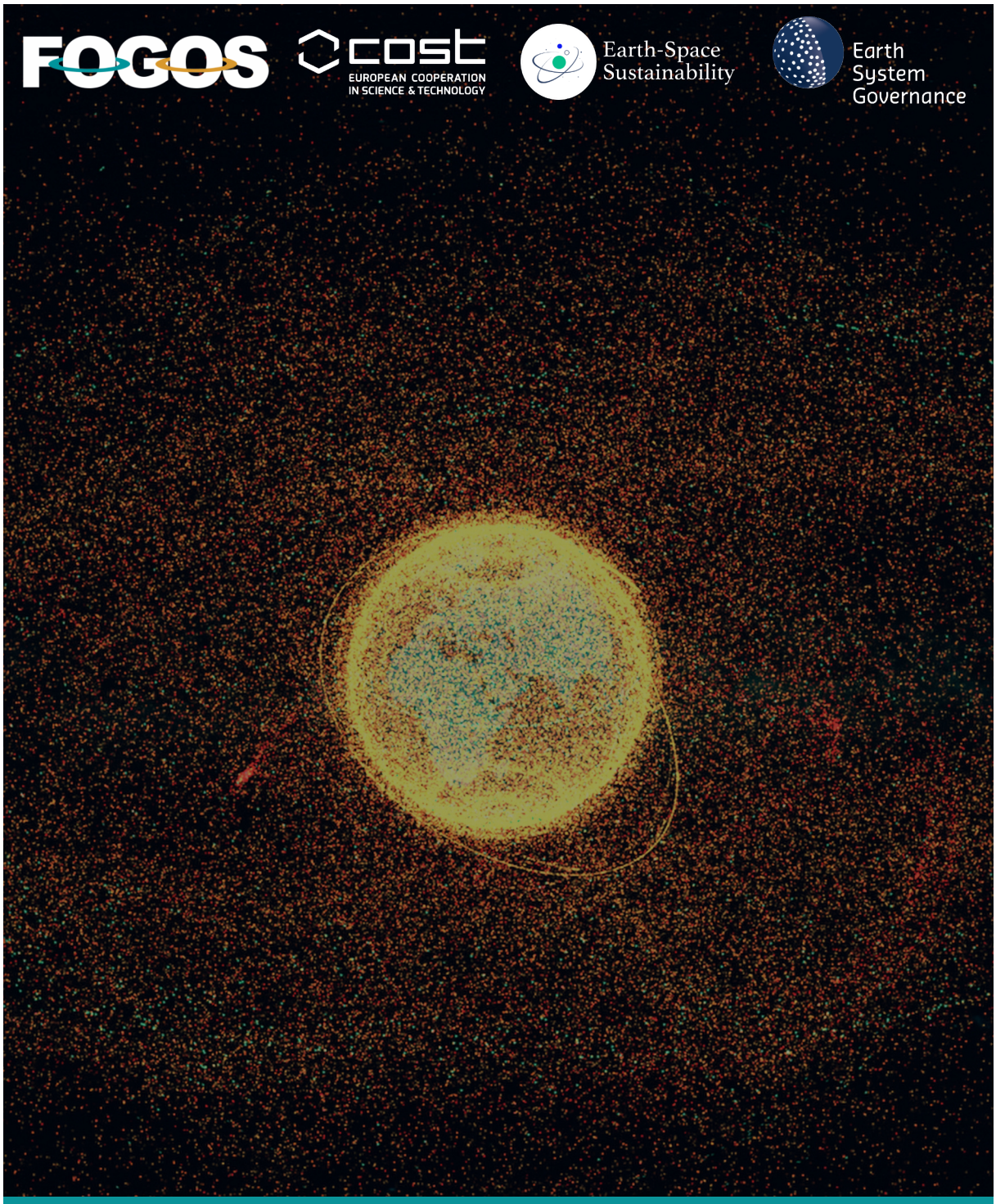
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Space Traffic Management: The Cologne Manual

Policy Brief: 1
February 2026

Executive Summary

The space environment is highly congested. Increasing satellites and space debris make in-orbit collisions more likely, threatening vital space services like communication and navigation.

As space traffic intensifies, exclusive discussions between national or regional entities fragment attempts to finding safe and sustainable solutions. **An international space traffic management framework is urgently needed to avert a space traffic crisis.**

This policy brief outlines the Cologne Manual on Space Traffic Management (CM-STM).[1]

The manual proposes an operational blueprint in the form of 11 guidelines to ensure the safe use of outer space. The CM-STM covers technical and legal aspects and is informed by academic research and international stakeholders from industry and government. The manual has been designed to reassure sceptical space players and promote a positive rhetoric to encourage its direct implementation by national and international legislators and the operators responsible for the safety and sustainability of objects in space.

Space Traffic Management

Space traffic management (STM) refers to the coordinated international efforts, policies, legal rules, norms, technologies and strategies designed to ensure the safe, sustainable and efficient operation of objects into, in and out of outer space. STM is an interdisciplinary concept driven by space object operators who recognise that the coordination of space traffic is more cost-effective than repair or replacement and compensating for losses in services.

A sustainable solution to space traffic can only be reached through the effective coordination of international actors and operators.

It is incumbent on all stakeholders to recognise that an international STM is in the interest of all space actors. This includes launch operators, commercial and governmental operators of space objects in orbit, and the clients of space services, including governments. This will ensure the most cost-effective option for continued space activity. Yet, the creation of a systematic synchronised international STM framework remains elusive due to four main reasons:

1. **Space traffic is growing exponentially.** There are now over 11,000 active satellites. This includes hundreds or thousands of satellite constellations, like OneWeb and Starlink, respectively, with further constellations planned for the near future (e.g., the Chinese Guowang and Qianfan). It is difficult for operators to coordinate and manage space objects in a highly congested orbital and launch environment.
2. **The operational landscape is diverse and complex.** There are over 80 State actors and thousands of additional non-State actors working in the space arena.[2] These actors have varying degrees of experience and technology access. They often operate in environments where information about other operators and knowledge of orbital threats and collision avoidance options are limited.
3. **Collision avoidance approaches are fragmented, uncoordinated, and insufficient.** States are developing STM on national and regional levels in isolation (see e.g., US or EU approaches) and poor knowledge and communication create delays in determining necessary action.
4. **Governments view STM with scepticism.** Some States view STM as a potential hindrance to space activity, fearing it will obstruct their freedom of exploration and use.

The Institute of Air Law, Space Law and Cyber Law at the University of Cologne has developed a practical manual on STM which ascertains its central components and informs States and operators on the required steps for efficient space traffic coordination (STC).[a] The project, funded by the German Aerospace Centre (DLR), brought together over 40 international technical and legal experts from organisations including DLR, the European Space Agency (ESA), the Japanese Aerospace Exploration Agency (JAXA), the Kenya Space Agency (KSA), and the Brazilian Space Agency (AEB). Their expertise informed the development of 11 timeless guidelines that are ready to be directly implemented by national and international legislators, space object operators, and other relevant stakeholders. The guidelines are formulated in such a way that they allow for national deviations and appropriations, while assuring the minimal level of synchronisation required for implementing effective safety measures in an international landscape.

a. STC refers to the technical means and operative procedures to ensure safe and stable operations through e.g. the use and exchange of surveillance and tracking information and collision avoidance measures.

STM and the Outer Space Treaty

The Cologne Manual draws upon the Outer Space Treaty of 1967 (OST, see Table 1).[3] The CM-STM paves a path to establish a safe operational environment in outer space.

We argue that this can only be achieved through effective Space Traffic Management, which includes Space Traffic Coordination, space debris mitigation, and remediation measures.

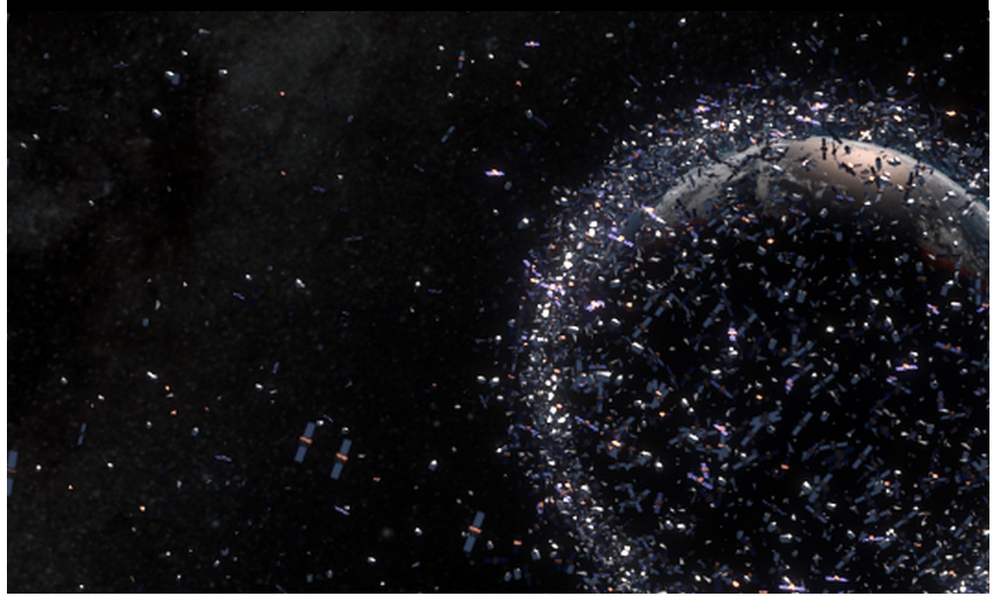
Article No.	Relevance	Quote
I	Indirectly requires the sustainable management of outer space.[4]	"Outer space … shall be free for exploration and use by all States without discrimination of any kind" "States shall facilitate and encourage international co-operation"
II	Outer space cannot be appropriated and cannot serve the interest of only one entity, reinforcing the sustainability of space operations.[5]	"Outer space … is not subject to national appropriation"
III	International environmental law and human rights are applicable to space operations.[6]	States "shall carry on activities … in accordance with international law"
IX	Requires: (1) respect for the environmental integrity of Earth and outer space and (2) the prevention of harm.	States "shall … avoid [the harmful contamination of outer space] and also adverse changes in the environment of the Earth"

Table 1.

At the same time, the OST creates several unresolved contradictions which makes progress difficult:

- Article VIII determines that States "retain jurisdiction and control" over nationally registered space objects which implies they have quasi-territorial sovereignty of space objects, including space debris.[7] This prevents unauthorised interference of a space object, such as removal or change of trajectory.[8]
- States must therefore freely accept limitations to their sovereignty of space objects.[9] In practice, States are reluctant to accept restrictions and instead favour permissive frameworks, soft law and measures that will permit them to grow their respective national space sectors and explore and use outer space as freely as possible.[10]
- States have a wide range of interpretation of sustainability, adapting it for their own geopolitical purposes.
- Subtle differences in the official translations of the space treaties, especially the OST, can lead to further misunderstandings.[11]

It is crucial to utilise an effective rhetoric to reassure States that they will not be disadvantaged by participating in STM. Through clear guidelines and STC, an international STM framework will facilitate, and not obstruct, States from retaining their sovereignty over nationally registered space objects, and their freedom to explore and use outer space.



STM Guidelines

The Cologne Manual proposes 11 guidelines on STM which are practically-oriented and appropriate for direct implementation. To read the guidelines in full, refer to the CM-STM.

1. Operators should acquire space surveillance and tracking information before operations begin and should assure appropriate mission planning and object design. Operators should issue detailed notifications of space activities in advance of all operational stages that might impact other relevant stakeholders (pre-launch, launch, in-orbit, and end-of-life phases).
2. In accordance with Article VI of the OST, States should enact national legislation to translate international STM obligations into national law thus ensuring compliance of non-governmental space activity with an international STM.
3. All space objects should be registered in national space object registries, which should be publicly accessible and maintained.
4. States and operators should communicate, liaise, consult and coordinate with each other, including the air traffic management systems and International Telecommunication Union.
5. Space object operators should openly publish a point of contact and establish in-house procedures and communication channels to ensure timely responses to avert collisions. Providers of space surveillance and tracking information should share relevant information with operators. States should agree on a set of priorities to establish international standards to minimise collisions and enter into agreements with operators.
6. Actors should cooperate to acquire, collect, improve, validate, and share space situational awareness (SSA) information to ensure safe operations.
7. Operators should acquire and share SSA and object information at all operational stages and report any unexpected events in a timely manner.
8. Space object operators should develop cyber security strategies and report and respond to incidents promptly.
9. Military space object operators should adhere as far as possible to the STM measures. When complete adherence is not possible, they should assure the same standard of safety through other measures.
10. Operators should connect and communicate through a single universal and dedicated channel chain supported by interoperable IT systems to facilitate easy and quick identification and communication. Stakeholders should endeavour to develop a standardised message format, and information sharing parameters. Actors could establish an international technical advisory body to develop protocols and standards and to advise operators on a voluntary basis.
11. Actors should implement space debris mitigation and remediation measures and respect and observe international environmental standards.

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Acknowledgements

We thank Jacqueline Reichhold, Konstantinos Andritsos, Martin Schwamborn, Niklas Kaupert, the experts that contributed to the CM-STM, and our Advisory Board (listed here). We are grateful to the DLR for their continued support of the Institute. We also thank Ian Christensen (Secure World Foundation) for their insightful review of this policy brief.

This policy brief is based upon work from COST Action FOGOS CA23118, supported by COST (European Cooperation in Science and Technology). COST is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

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Funded by the European Union

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