Supporting Standardisation in the field of Space Traffic Management (STM)

EU Space Label

Final Report

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Acronyms

AIAA	American Institute of Aeronautics and Astronautics
ASI	Agenzia Spaziale Italiana
BNSC	British National Space Centre
CNES	Centre National d'Etudes Spatiales
CONFERS	Consortium for Execution of Rendezvous and Servicing Operations
COPUOS	United Nations Committee on the Peaceful Uses of Outer Space
COSPAR	Committee on Space Research
CPOWG	Close Proximity Operations Working Group
CSOSTF	Commercial Space Operations Safety Task Force
DARPA	Defense Advanced Research Projects Agency
DLR	Deutsches Zentrum für Luft- und Raumfahrt
EIB	European Investment Bank
ENs	European standards
EO	Earth Observation
EPFL	Swiss Federal Institute of Technology - Lausanne
ESA	European Space Agency
EU	European Union
EUSST	European Union Space Surveillance and Tracking
FAA	Federal Aviation Administration
GEO	Geosynchronous Orbit
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IADC	Inter-Agency Space Debris Coordination Committee
IAF	International Astronautical Federation

ICT	Information and communications technology (or technologies)
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
ITU	International Telecommunication Union
LEO	Low Earth Orbit
M/OD or MMOD	(Micro)Meteorites Orbital Debris
MEO	Medium Earth Orbit
MIT	Massachusetts Institute of Technology
NASA	National Aeronautics and Space Administration
OECD	Organisation for Economic Co-operation and Development
RFI	Radio frequency interference
RPO/OOS	Rendezvous and Proximity Operations / On-Orbit Servicing
SBSS	Space-Based Space Surveillance
SDA	Space Data Association
SDC	Space Data Center
SMEs	Small and medium-sized enterprises
SSA/SST	Space Situational Awareness / Space Surveillance and Tracking
SSC	Space Safety Coalition
SSR	Space Sustainability Rating
STM	Space Traffic Management
UK	United Kingdom
UKSA	UK Space Agency
UN	United Nations
UNGA	United Nations General Assembly
US	United States
WEF	World Economic Forum

Abstract

The significant increase in space activities, resulting congestion and associated risks combined with the absence of one common mechanism motivating actors to go the extra mile hamper progress towards a common approach for (EU) Space Traffic Management.

To address this problem, policy objectives focus on promoting a set of common standards, guidelines and best practices and developing incentives for adhering actors under a voluntary mechanism, the EU Space Label. This label could offer guidance on and confirm adherence to clearly defined criteria, help to raise awareness of interconnecting domains, and offer benefits to adhering actors.

The label framework would define general requirements, objectives, governance, and procedures applicable to all space labelling schemes. Within that framework, each space labelling scheme would further specify its specific objectives, scope, assessment criteria and methods, etc.

Possible EU space labelling schemes identified so far include: (1) a Space Label on Safety and Sustainability in Space to minimise the risk of collisions and generation of debris; (2) a Space Label on the Environment to assess and reduce the impacts of space activities on the environment, and (3) a Space Label on Preserving Dark and Quiet Skies to mitigate adverse effects of space activities on astronomical observations.

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Ces dernières années, les activités spatiales ont augmenté de manières exponentielles. La congestion qui en résulte, et les risques qui y sont associés, combinés à l'absence d'un mécanisme commun incitant les acteurs spatiaux à aller au-delà de leurs obligations existantes limitent le développement d’une protection effective des activités spatiales.

Afin de résoudre ces problèmes, la Commission a pour objectif de promouvoir un ensemble de normes techniques, de lignes directrices et de bonnes pratiques communes, ainsi que de développer des mesures incitatives pour les acteurs qui y adhèreraient dans le cadre d'un mécanisme volontaire, le label spatial de l’UE. Tout d’abord, ce label offrirait des lignes directrices sur les mesures supplémentaires à prendre afin de protéger les orbites terrestres. Ensuite, il permettrait de s’assurer que les acteurs du secteur spatial les appliquent au travers de critères précisément définis. De plus, il contribuerait à les sensibiliser à ces problématiques. Enfin, le label spatial de l’UE prévoit de proposer des avantages à ceux qui décident d’y adhérer.

Le cadre du label définirait, par exemple, les exigences générales, les objectifs principaux, la gouvernance et les procédures applicables à tous les labels spatiaux. Dans ce cadre, chaque label spatial préciserait par la suite, de manière plus détaillée ses objectifs spécifiques, sa portée, ses critères et méthodes d'évaluation, etc.

À ce jour, trois labels potentiels ont été identifiés : (1) un label sur la sécurité et la viabilité des activités spatiales visant à minimiser les risques de collision et la création de débris spatiaux ; (2) un label sur l’environnement visant à évaluer et réduire l’impact environnemental des activités spatiales ; et (3) un label sur la préservation du ciel visant à minimiser les effets négatifs des activités spatiales sur les observations faites par les astronomes.

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Die starke Zunahme von Aktivitäten im Weltraum, die daraus resultierende Überlastung des Weltraums und die damit verbundenen Risiken behindern die Entwicklung eines gemeinsamen (EU-)Managements des Weltraumverkehrs. Dieser Trend wird durch die Abwesenheit eines gemeinsamen Mechanismus, der Akteuren Anreize bieten könnte die „Extrameile“ zu gehen, noch verstärkt.

Um diese Probleme anzugehen, konzentrieren sich politische Ziele der Kommission daher auf die Förderung einer Reihe gemeinsamer Standards, Leitlinien und bewährter Verfahren sowie auf die Entwicklung von Anreizen für teilnehmende Akteure im Rahmen eines freiwilligen Instrumentariums, dem EU-Weltraumlabel. Ein solches Label könnte als Orientierungshilfe zur Erfüllung klar definierter Kriterien dienen und deren Einhaltung bestätigen, zur Sensibilisierung verwandter Bereiche beitragen, und teilnehmenden Akteuren Vorteile bieten.

Ein übergeordneter Rahmen würde allgemeine Anforderungen, Ziele, Führung und Verfahren festlegen, die für alle spezifischen Weltraumlabels gelten. Innerhalb dieses Rahmens würde jedes Weltraumlabel dann konkrete Ziele, Anwendungsbereiche, Bewertungskriterien und -methoden usw. definieren.

Folgende EU-Weltraumlabels sind bisher angedacht: (1) ein Weltraumlabel für Sicherheit und Nachhaltigkeit im Weltraum um das Risiko von Kollisionen und das Entstehen von Trümmerteilen zu reduzieren; (2) ein Weltraumlabel für die Umwelt um Auswirkungen von Aktivitäten im Weltraum auf die Umwelt zu bewerten und zu verringern; und (3) ein Weltraumlabel für den Erhalt eines dunklen und ruhigen Nachthimmels um negative Auswirkungen von Aktivitäten im Weltraum auf astronomische Beobachtungen zu verringern.

1 About the Final Report

This chapter serves as introduction to the Final Report and summarises its purpose and structure.

1.1 Purpose of the document

This deliverable constitutes the Final Report of the "Support to Space Traffic Management (STM) standardisation" project carried out by Deloitte, KU Leuven, and GMV (hereinafter "the study team") for the European Commission, Directorate-General for Defence Industry and Space (DG DEFIS).

It presents the wider context in which an EU-wide mechanism is proposed as a voluntary instrument to promote adherence to a set of criteria for the safety and sustainability of space activities and to go the extra mile in tackling the problem of increasing space activities. It sets the scene by briefly describing the current STM stakeholder landscape and political context followed by an overview of existing STM standards and guidelines on EU, national and international level as well as voluntarily compliance mechanisms implemented by industry (sections 2 and 3). It then assesses the extent to which existing voluntary instruments contribute to a common approach for STM, the rationale for intervention at EU level and the feasibility of an EU-wide mechanism for STM standardisation (sections 4 and 5). It then looks into existing high-level systems which could serve as inspiration for the design of an EU-wide mechanism (section 6) followed by a blueprint and roadmap for implementing such a mechanism (sections 7 and 8). It concludes by putting forward the most suitable setup for such a mechanism based on the research, analyses and recommendations undertaken throughout this report (section 9).

This report is based on desk research, literature review findings, inputs from strategic interviews with sector-specific experts, and discussions with high-level experts during Advisory Board workshops.

1.2 Structure of the document

This document is structured as follows:

- **Chapter 1** outlines the purpose and structure of the Final Report;
- **Chapter 2** presents the current state of play in Space Traffic Management;
- **Chapter 3** provides an overview of existing standards, guidelines and other relevant initiatives to ensure sustainable and safe space activities;
- **Chapter 4** assesses the suitability of the existing framework of standards, guidelines and best practices for achieving sustainable and safe space activities incl. problem assessment;
- **Chapter 5** presents the rationale for EU action and EU policy objectives;
- **Chapter 6** presents a selection of existing high-level systems that may serve as a basis for setting up a voluntary mechanism to promote the use of standards, guidelines, and best practices in the field of space traffic management;
- **Chapter 7** details a blueprint for an EU-wide voluntary mechanism;
- **Chapter 8** proposes a roadmap for developing and implementing a voluntary EU-wide mechanism; and,
- **Chapter 9** formulates conclusions and a way forward.

2 Current state of play in Space Traffic Management

This chapter summarises the **current STM landscape[1] with a view to standards, guidelines, and best practices**. It first identifies the major actors active and/or involved in STM and then outlines relevant existing legislative and regulatory frameworks at the EU level. It concludes with an overview of currently existing self-regulatory mechanisms developed and/or used by the space industry itself.

2.1 Stakeholders active in STM-related matters

With the growth of commercial spaceflight and space-related activities, the number of missions, satellites, launchers, and debris in space has expanded dramatically, thus increasing the chance of collisions between these objects. This presents a threat to human spaceflight, operational satellites, and the services they provide to Earth-based users, affecting not only spacefaring nations, but also other countries and stakeholders who rely on these services. Effective and efficient administration becomes imperative for the safety and long-term viability of Earth- and space-based services due to the increasing volume of space traffic.

The space traffic management ecosystem encompasses a wide range of stakeholders, including **intergovernmental organisations, national governments, non-governmental organisations, space industries, individual consumers, and citizens**. Also **commercial and private entities** are involved, as they frequently engage with governmental and public entities that use commercial technologies to achieve their space-related objectives.

It is noteworthy that the **definition of where space begins** is still a subject of ongoing debate, making it **difficult to fully define the scope of STM**. This study acknowledges the potential overlap between Air Traffic Management (ATM), Unmanned Aerial Vehicle Traffic Management (UTM), and STM, as well as the challenges resulting from this overlap and lack of a clear definition. The main focus of this study is, however, the establishment of a mechanism to motivate actors to adhere to a set of common rules, standards, guidelines, best practices, etc. to support a comprehensive STM regime rather than the definition of the limits between ATM, UTM and STM.

To ensure safe and sustainable space operations, STM relies on **Space Situational Awareness (SSA)** and **Space Surveillance and Tracking (SST) technologies**. Ground-based radars and telescopes, space-based sensors such as electro-optical satellites and space-based radars, automated data processing and analysis algorithms, communication networks for data transfer and sharing between organizations and countries, machine learning and artificial intelligence techniques for data analysis and pattern recognition, and collaborative data sharing systems and platforms for international collaboration are provided by various SSA/SST service providers, who are mainly **governmental actors**. Several EU Member States as well as other countries such as the U.K., the U.S., Russia, China and Japan have Space Surveillance and Tracking capabilities.

With this context in mind, the following section presents a non-exhaustive mapping of actors in the field of STM and concludes with a diagram indicating the interplay between STM actors and a table categorising the described STM actors.

[1] Detailed in the Inception Report of the study (D1).

2.1.1 STM Regulatory Landscape

In this subsection, we introduce the actors involved in space traffic management on regulatory level focusing on **EU, intergovernmental and governmental actors**. By examining their roles and responsibilities, we aim to gain a better understanding of the current regulatory state of STM and the efforts being made to ensure safe and sustainable space operations.

2.1.1.1 EU actors

The **European Union Space Surveillance and Tracking (EU SST) Partnership** is composed of 15 EU Member States.[2] Through its sensor, processing, and service provisioning functions, it currently monitors more than 400 satellites and provides Collision Avoidance (CA), Re-entry Analysis (RE), and Fragmentation Analysis (FG) services to almost all EU space operators and an increasing number of non-EU space operators. Additionally, the EU SST Partnership set up a Research and Development Plan to facilitate a sustained long-term evolution and enhancement of EU SST by innovating in the field of sensor function, processing function, and service function activities with a view to achieving an appropriate level of autonomy in space surveillance and tracking and to consolidating EU SST as the European capability for space traffic coordination.[3]

The European Union Agency for the Space Programme (EUSPA) acts on behalf of the Commission in the management of the EU Space Programme. It specifically implements the following components which are affected by space traffic: *Galileo*, Europe's global navigation satellite system, the *European Geostationary Navigation Overlay Service (EGNOS),* a civil regional satellite navigation system, *Copernicus*, the European Union's Earth Observation Programme, the *GOVSATCOM* initiative, a satellite communications service enabling the provision of satellite communication capacities and services to Union and Member State authorities, and certain elements of *Space Situational Awareness* (SSA). SSA provides comprehensive knowledge and understanding of the location and function of natural and man-made space objects and space weather phenomena, and as such plays an active role in space traffic management. Since July 2023, EUSPA manages the EU SST Front Desk which provides registered SST users access to the EU SST Service Provision Portal and is responsible for defining KPIs, coordinating the EU SST Taskforce, and handling communication and user engagement for EU SST.[4]

The European Union Satellite Centre (SatCen) is an agency of the European Union (EU) that provides geospatial intelligence and other related services to support EU policies and operations. It is involved in SSA activities by providing the EU with critical information and data on the location, movement, and potential threat of man-made objects in space. Its contribution is crucial for the protection of space infrastructure and the security of citizens.

A number of **Commission** Directorates-General (DGs), **EU agencies,** and other **EU bodies** rely significantly on space-based data to deliver on public policy domains.[5] These include the Commission Directorates-General for Defence Industry and Space (DG DEFIS), for European Civil Protection and Humanitarian Aid Operations (DG ECHO), and the Joint Research Centre (JRC) as well as the European Border and Coast Guard Agency (FRONTEX), the European Union Aviation Safety Agency (EASA), the European Maritime Safety Agency (EMSA), the European Defence Agency (EDA), and the European Environment Agency (EEA). Other EU actors include the **Council of the EU** through its Competitiveness Council (COMPET), the **European Parliament** with dedicated working groups and committees such as the Industry, Research, and Energy Committee (ITRE) and the Sky & Space

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[2] France, Germany, Italy, Poland, Portugal, Romania, Spain, Austria, Czech Republic, Denmark, Finland, Greece, Latvia, the Netherlands, Sweden.

[3] In the context of EU SST, defence or dual-use technologies linked to collision avoidance are relevant and therefore will be analysed as part of this study; however, missile and other specific military technologies fall outside of the scope of this study.

[4] See: https://www.euspa.europa.eu/newsroom/news/euspa-grows-further-support-eu-space-traffic-management

[5] European Commission, Press release (26 October 2016): New Commission space policy puts focus on improving people's daily lives and boosting Europe's competitiveness. See: https://ec.europa.eu/commission/presscorner/detail/en/IP_16_3530

Intergroup, the **European External Action Service (EEAS)** which promotes the EU space policy to external stakeholders and contributes to its shaping through tools such as the Strategic Compass, and the **European Investment Bank (EIB)** which invests in various projects related to the space industry such as satellite-based navigation and earth observation, satellite communications, and space-enabled services which would all benefit from better space traffic management.

2.1.1.2 Intergovernmental actors

At **intergovernmental level**, many organisations have been involved in activities aiming to better manage space traffic.

Despite having no direct regulatory powers, the **European Space Agency (ESA)** contributes to space traffic management efforts through its participation in the Inter-Agency Space Debris Coordination Committee (IADC), United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) and the main international standardisation bodies. Its Research and Technology Centre, ESTEC, is also engaged in the development of new technologies to mitigate the risk of collision and debris-related damage. The **European Centre for Medium-Range Weather Forecasts (ECMWF),** and the **European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)** which employ meteorological data provided by meteorological satellites for atmospheric science purposes and a range of other applications also contribute to a better management of space traffic.

Numerous committees and agencies of the **United Nations (UN)** play a significant role in STM. For instance:

- The **United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS)** governs the exploration and use of space for the benefit of all humanity, encourages space research programmes, and studies legal problems arising from the exploration of outer space.
- The **United Nations Office for Outer Space Affairs (UNOOSA)** assists States and organisations in implementing the decisions of UN COPUOS and the UN General Assembly (UNGA). Its main aim is to promote international cooperation for the peaceful use and exploration of space.
- The **International Telecommunication Union (ITU)** is responsible for managing radio frequencies and associated orbital positions of satellites and aims to ensure the rational, equitable, efficient, and economical use of the radio-frequency spectrum.
- The **International Civil Aviation Organisation (ICAO),** through its Space Programme, aims to ensure the safe integration of air and space traffic.
- The **World Meteorological Organisation (WMO),** which relies on earth observation satellites, benefits from STM to be able to fulfil its mission of promoting international cooperation and coordination in weather, climate, and water-related matters.

The **Inter-Agency Space Debris Coordination Committee (IADC)** brings together national space agencies and ESA, and studies developments and trends concerning space debris and space object populations. It aims to pool resources, share and review findings, and identify potential preventive and remedial measures, including space debris mitigation and active debris removal.[6] Participation in the IADC is voluntary. It cannot promulgate binding decisions, but IADC recommendations are highly authoritative and taken based on consensus between most of the world's predominant space agencies.

2.1.1.3 Governmental actors

Governments play a crucial role in space technology and applications as they ensure public interests are protected through services such as safety, communication, and weather forecasting. In the EU, many Member States have established national space agencies, such as the **German Aerospace**

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[6] See: https://www.iadc-home.org/what_iadc

Centre (DLR), the **French National Centre for Space Studies (CNES),** the **Italian Space Agency (ASI),** the **Netherlands Space Office (NSO),** the **Spanish Space Agency (AEE),** and the **Luxembourg Space Agency (LSA)**. Nevertheless, licensing and authorisation regulations differ across EU countries, with France, Luxembourg, and Finland regulating through their **space legislation** while others, such as Germany, Italy, and Spain, regulate through their **telecommunications acts**. Moreover, EU Member States also have military forces involved in space operations, such as the **French Air and Space Force**, the **German Air and Space Operations Centre**, and the **Italian Space Operations Command**, with responsibilities including satellite operation, space activity monitoring, and safeguarding national security interests.

The space ecosystem outside of the EU is dominated by several entities, including the **National Aeronautics and Space Administration (NASA)**, the **National Oceanic and Atmospheric Administration (NOAA)** and the **Department of Commerce (DoC) in the U.S.**, **China's National Space Administration (CNSA)**, **Russia's State Corporation for Space Activities (Roscosmos)**, **India's Space Research Organisation (ISRO)**, **Japan's Aerospace Exploration Agency (JAXA)**, and the **United Kingdom Space Agency (UKSA)**.

When it comes to licensing and regulation of space activities, the **Federal Aviation Administration (FAA)**, the **Federal Communications Commission (FCC)**, and **NOAA** oversee these activities in the U.S. In China, the **Commission for Science, Technology, and Industry for National Defence (COSTIND)** and the **State Administration of Science, Technology and Industry for National Defence (STATIND)** are responsible for licensing. **Roscosmos** is the primary licensing agency in Russia while licensing in India is provided by the **Indian National Space Promotion and Authorisation Centre (IN-SPACe)**. In Japan, licensing is issued by the **Office of the Prime Minister**, and in the **UK**, **the Civil Aviation Authority (CAA)** handles licensing.

These countries also have military forces responsible for space operations, including the **U.S. Space Force**, **China's People's Liberation Army Strategic Support Force**, **Russia's Space Force**, **India's Defence Space Agency**, **Japan's Defence Operations Squadron**, and the **UK Space Command**. Regarding specific SSA and SST services, in the U.S., these capabilities are provided by the **Space Surveillance Network**, **the Air Force Space Surveillance System**, and the **Ground-based Electro-Optical Deep Space Surveillance System**. China's SSA/SST capabilities have been rapidly developed in recent years and include the Five-hundred-meter **Aperture Spherical radio Telescope (FAST)**. In Japan, a number of optical systems for SSA/SST are operated by **JAXA's SSA System**, which combines observation and analysis capacities. The UK's Royal Air Force provides SSA/SST services on behalf of the Ministry of Defence and the UK Space Agency by operating sensors, including the **UKSST radar network**.

2.1.2 STM Implementation Landscape

In this subsection, we introduce the implementation level of STM initiatives established by the actors described above as well as commercial and private actors impacted by these initiatives.

The **International Organisation for Standardisation (ISO)** plays a role in STM by developing standards related to space systems and services, thereby supporting the efforts of organisations in regulating and managing space traffic. These standards help to ensure the safety, reliability, and efficiency of space activities and operations. Also **European standardisation organisations** play a key role in shaping space traffic management and the associated technological requirements for space operators. This includes the **European Committee for Standardisation (CEN)**, the **European Committee for Electrotechnical Standardisation (CENELEC)**, and the **European Cooperation for Space Standardisation (ECSS)**.

The increasing number of **commercial and private actors** in the space industry has made their role in the STM domain essential. These commercial and private actors are responsible for a significant proportion of the objects in orbit, and thus drive the need for effective STM systems and regulations. In the EU, we can identify a strong and competitive industrial base in the field of space technology, research, and development. The **European Union Industry and Start-ups Forum on STM (EISF)** launched in April 2022 brings together key players of the EU space industry to further strengthen the EU industrial base and enhance the EU operational capacities in the field of STM. Networks, fora, and associations such as **ASD-Eurospace**, **SME4SPACE**, #**YEESS**, the **Global Satellite Operators' Association (GSOA)**, or **CONFERS** aim to represent the means and interests of the space industry including on topics relating to the management of space traffic. **Commercial stakeholders such as space industrial actors and satellite operators** aim for stability, predictability, and transparency in space. Foremost, satellite operators need to safeguard their investments, and, as such, their assets. These include companies such as **Airbus Defence and Space**, **SES**, **GMV**, **Eutelsat**, **Intelsat**, **Inmarsat**, **SpaceX**, and many others.

Further downstream, also customers of these companies have a stake in sound space traffic management.[7] They are, in essence, users of satellite communication and remote-sensing services and play a role in **processing space-based data** to provide a vast range of downstream services. They are defined as **intermediate customers** as they are able to process raw data received into tools usable for end-users. These include providers of goods and services, ranging from telecommunications companies, the use of multi-sensor images with specialised algorithms for agricultural purposes (**FARMSTAR**), applications that enable the creation and sharing of pictures of the earth from space (**SnapPlanet**) to tools that forecast air quality and weather (**AirText UK**, **Earth.Null**, **Plume Labs**, **Weather4D**, etc.). These actors would be negatively impacted if a satellite service on which they depend was interrupted by an incident in space due to the absence of a comprehensive STM regime.

Lastly, **end-users or consumers of goods and services** that rely on space-based data have an interest in effective STM; these range from **civil protection authorities** who rely on Earth observation for rescuing missions, to **NGOs** and **research centres** monitoring climate change. Also **citizens** have a stake in safe and sustainable space traffic management as goods and services their respective governments and companies deliver are based on space-data such as weather forecasting, disaster response, telecommunications, or navigation positioning, all of which can be impacted in the event of collisions in space.

The figure below visually summarises the previous subsections by providing an overview of key stakeholders in the STM ecosystem.

[7] European Commission, Copernicus (July 2017): Fostering the uptake of Copernicus and Space applications, p. 4. See: https://www.copernicus.eu/sites/default/files/Fostering_the_uptake_of_Copernicus_and_Space_applications_July2017.pdf

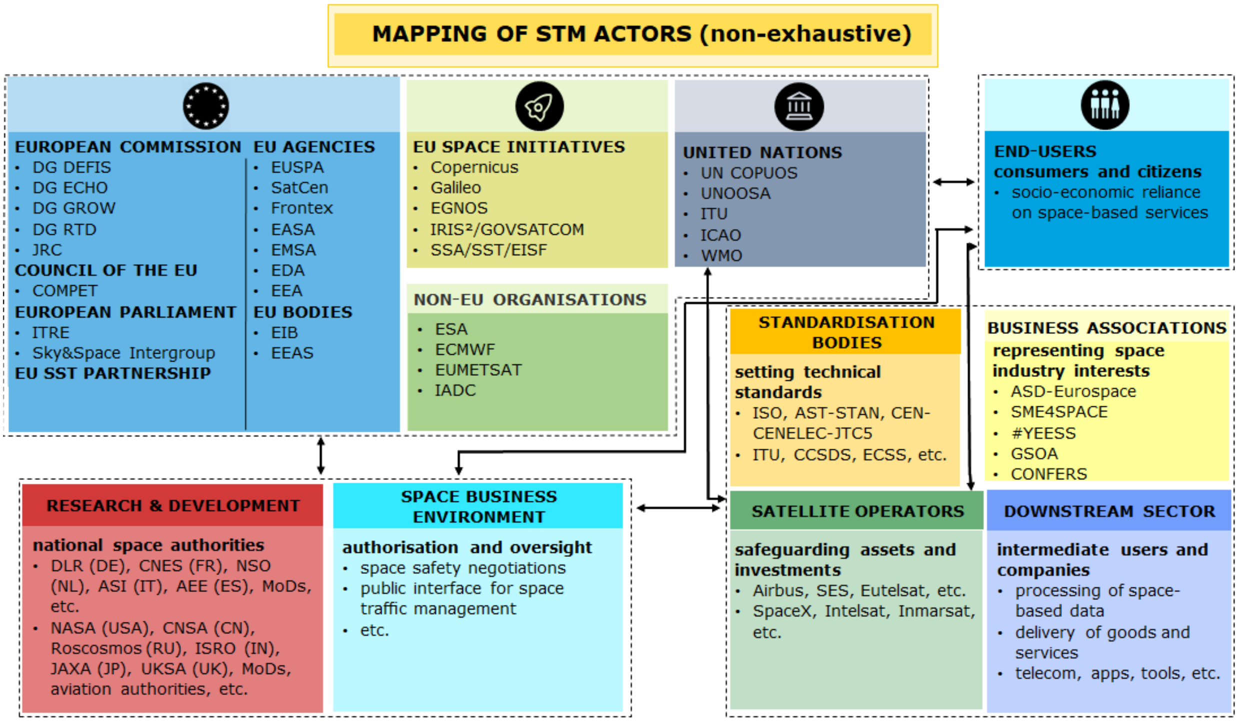

Figure 1 – non-exhaustive mapping of STM actors (Source: Deloitte, KUL compilation)

The table below differentiates STM stakeholders into implementation and regulatory levels and indicates whether stakeholders are directly impacted by an EU approach on STM.

Actors	Implementation	Regulatory	Directly impacted by EU approach on STM
EU SST Partnership	X		X
EUSPA	X		X
SatCen	X		X
European Commission		X	X
Council of the EU		X	X
European Parliament		X	X
Other EU Agencies and Bodies	X		X
ESA	X		X
ECMWF	X		X
EUMETSAT	X		X
IADC		X	
UN COPUOS		X	
UNOOSA		X	
ITU		X	
ICAO		X	
WMO	X		

Actors	Implementation	Regulatory	Directly impacted by EU approach on STM
National Space Agencies	X	X	X (EU Member States)
National Defence Actors	X	X	X (EU Member States)
Standardisation Organisations		X	
Space Business Associations	X		X (if active in EU)
Space Operators	X		X (if active in EU)
Downstream Actors	X		X (if active in EU)
End-users			X (if active in EU)

Table 1 – non-exhaustive mapping of STM actors by category

2.2 Existing legislative and regulatory frameworks on EU level

This section provides an overview of relevant EU legislative and regulatory frameworks including non-binding agreements and guidelines supporting sustainable and safe space operations.

2.2.1 Legal framework and competences of the EU in space

The Lisbon Treaty which became effective in December 2009 brought significant changes to the institutional architecture of the EU. **Article 189 TFEU** marked a turning point in the legal competence of the EU in the space domain.[8]

The Treaty granted the EU an international legal personality and changed the legal context for security and defence-related matters. Article 189 TFEU granted the EU explicit competence in space.[9] Art. 189(1) TFEU empowers the EU by creating a specific **legal basis for the action of the EU in space matters** and reinforcing the EU's legitimacy and political leadership in space policymaking to promote scientific and technical progress, industrial competitiveness, and the implementation of other EU policies. This Article allowed the EU to go beyond the position expressed in the 2007 joint paper with the ESA and marked the understanding of space as a key area for security and defence-related matters and not only as an "area of interest" serving other EU policies where the EU had exclusive competence. This makes the Article very relevant as it allows the EU to make use of its competence in space in the service of its policies, such as defence. It also strengthens the political visibility of the EU space sector which appears for the first time in a specific article.[10]

The Treaty of Lisbon also shed some light on **"shared competence"**: Article 2 TFEU provides different types of competences: exclusive, shared, and those labelled as "supporting competencies". Article 3 TFEU lists those areas in which the EU would have exclusive competencies. Article 4 TFEU provides shared competencies. Space is included in Article 4(3) TFEU stating that in the area of space, the Union

[8] Article 189 TFEU:
1. To promote scientific and technical progress, industrial competitiveness and the implementation of its policies, the Union shall draw up a European space policy. To this end, it may promote joint initiatives, support research and technological development and coordinate the efforts needed for the exploration and exploitation of space.
2. To contribute to attaining the objectives referred to in paragraph 1, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall establish the necessary measures, which may take the form of a European space programme, excluding any harmonisation of the laws and regulations of the Member States.
3. The Union shall establish any appropriate relations with the European Space Agency.
4. This Article shall be without prejudice to the other provisions of this Title.
[9] Naja, G. (2012). L'espace Européen après Lisbonne. DOI 10.3917/geoec.061.0107
[10] Ibid.

shall have the competence to carry out activities, in particular, to define and implement programmes without preventing the Member States from exercising their own competence.[11]

In this sense and according to the European Space Policy Institute (ESPI), a shared competence in the space field implies that "*space agencies consider programme matters under the aegis of the EU, but without prejudice to purely national and bilateral activities that did not form part of the EU space policy*".[12] Member States retain control of their national space policies while remaining under the umbrella of the applicable EU law and initiatives (e.g. communications, policies, etc.).

As such, Article 189 TFEU **formalises the space domain as a shared competence, paving the way for an EU Space Policy** which was until then only present in soft-law instruments.[13]

Besides Art. 189 TFEU, other provisions may provide legal bases for EU action in this area. By adopting legislative acts legally based on other Articles of the Treaty (for instance, transport, trans-European networks, industrial policy, etc.), a policy initiative in the space domain is not limited by the "shared competence". Such subtility is what paved the way e.g., for the Galileo and Copernicus programmes.

Though the powers of the EU in the field of space may appear limited due to the exclusion of harmonisation and Art. 4 (3) TFEU, they allow the EU to take regulatory action in several areas in the space domain such as space debris issues. The formulation of Article 189 TFEU excludes the harmonisation of Member State laws (i.e., binding norms). However, the EU can take action in the form of non-binding initiatives such as best practices which may then be taken up in national legislation.

A more detailed overview of legal references supporting EU competences in space is available at Annex A – Overview of legal references supporting EU competences in the space domain.

2.2.2 Current EU regulatory framework: EU Space Regulation

A new **Regulation establishing the EU Space Programme** for the years 2021 to 2027 was adopted by the Council and European Parliament in April 2021.[14]

The **overall purpose of this Regulation** is twofold:[15] It establishes the Union Space Programme ('the Programme') for the duration of the Multiannual Financing Framework (MFF) 2021-2027, lays down its objectives, the budget for the same period, the forms of Union funding, and the rules for providing such funding, as well as the rules for the implementation of the Programme. It also establishes the European Union Agency for the Space Programme (EUSPA) which replaces and succeeds the European GNSS Agency and lays down the rules of its operation.

In relation to Space Traffic Management (STM) and in support of sustainable and safe space operations, the Regulation introduces new components, such as the **Space and Situational Awareness (SSA)** component to monitor space hazards, and the new Governmental Satellite Communication (GOVSATCOM) component to provide national authorities with access to secure satellite communications.

One of the general objectives of the EU Space Programme (Article 4) is to *"enhance the **safety, security and sustainability** of all outer space activities pertaining to space objects and debris proliferation, as well as space environment, by implementing appropriate measures, including development and deployment of technologies for spacecraft disposal at the end of operational lifetime*

[11] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12008E004&from=EN
[12] Jamschon, L. (2017). Art. 189 TFEU: Much ado about nothing?. University of Vienna. http://othes.univie.ac.at/48483/1/51118.pdf
[13] Munari F., EU Competences in Space http://www.eu-space.eu/images/2017/document/Slides/Slides-Francesco-Munari.pdf
[14] EU space programme 2021-2027, https://www.consilium.europa.eu/en/policies/eu-space-programme/
[15] Regulation (EU) 2021/696 of the European Parliament and of the Council of 28 April 2021 establishing the Union Space Programme and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013 and (EU) No 377/2014 and Decision No 541/2014/EU, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2021.170.01.0069.01.ENG&toc=OJ%3AL%3A2021%3A170%3ATOC

and for space debris disposal." The specific objective of the **SSA component** of the Programme is to "*enhance capabilities to monitor, track and identify space objects and space debris with the aim of further increasing the performance and autonomy of capabilities under the SST sub-component at Union level, to provide SWE services and to map and network Member States' capacities under the NEO sub-component*". Furthermore, according to Article 54, the **Space Surveillance and Tracking (SST) sub-component** of SSA shall support, *inter alia*, *"monitoring and seeking synergies with initiatives promoting development and deployment of technologies for spacecraft disposal at the end of operational lifetime and of technological systems for the **prevention and elimination of space debris**, as well as with the **international initiatives** in the area of the **space traffic management**".*

These provisions on the SSA component and SST sub-component of the EU Space Programme establish the basis for the development of the technical capabilities needed for STM. According to interviewed stakeholders[16], this is of particular importance as the current priority at the European level should be the strengthening of the EU Space Programme and associated technical capabilities. Interviewees further explained that once the technical capabilities are developed, a relevant strategy or legislation should naturally follow.

2.2.3 Political environment for Space Traffic Management

In general terms, non-legal acts are defined as rules of conduct that are laid down in instruments that have not been attributed legally binding force. As such, they may have certain legal effects indirectly.

2.2.3.1 Article 288 TFEU

Non-binding norms form an important part of the EU governance machinery. Whereas regulations, directives and decisions are all binding mechanisms, Article 288 TFEU presents **recommendations** and **opinions** as having a non-binding force that helps to exercise Union competencies. Beyond these two non-binding instruments mentioned in Article 288, there are other measures which are generically referred to as non-binding; these include European Council Conclusions, **Council Conclusions**, **Commission Communications**, **Joint Communications**, Green Papers, White Papers, Non-Papers, Joint Papers, Joint Letters, Resolutions, Strategies, Arrangements, Working Arrangements, Inter-Institutional Arrangements, Guidelines, Declarations, **Resolutions**, Action Plans, Reports, Interim Reports, Progress Reports, Programmes, Memoranda. Moreover, for the conclusion of non-binding arrangements with third countries, the Union enters into international soft legal commitments such as Codes of Conduct, Declarations or Joint Statements.[17]

2.2.3.2 Commission Communications

In space policy, the EU has taken diverse non-binding measures such as the Communication from the Commission COM/2016/0705 on a Space Strategy for Europe; Communication from the Commission COM/2007/0212 on a European Space Policy, and Communication from the Commission COM/2021/70 on an **Action Plan on synergies between civil, defence and space industries** published in February 2021.[18]

This Action Plan on synergies launches eleven actions to further enhance the EU technological edge and support its industrial base, notably the EU strategy for Space Traffic Management. According to the Commission Communication, this STM strategy is a flagship project which should develop STM standards and rules to avoid collision events which may result from the proliferation of satellites and

[16] During the inception phase of this study, 14 strategic interviews were carried out to understand the current EU legal, political and economic landscape for a potential creations and establishment of EU-wide voluntary mechanism.

[17] Ibid.

[18] EU industry: Commission takes action to improve synergies between civil, defence and space industries, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_651. For more information, please refer to https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:70:FIN

space debris with potentially catastrophic consequences for EU assets in space. The STM strategy should also address the risk of non-EU standards becoming the norm, as this dependence would harm EU efforts to achieve technological sovereignty. This strategy is of particular importance, as it shows that the EU recognises the importance of STM and paves the way for the consolidation of an EU position on STM and should therefore contribute to building an international approach to STM.

In this context, the **Joint Communication on Space Traffic Management** JOIN(2022) 4[19] by the Commission and the High Representative adopted in February 2022 outlines the EU vision and strategy for Space Traffic Management and highlights the importance of addressing the increasing complexity of space operations. It outlines EU plans to develop a comprehensive and cooperative approach to STM that takes into account the interests of all stakeholders.

The Joint Communication is relevant for the development of STM standards as it sets the framework for EU policy in this area and provides guidance on the key objectives that standards should aim to achieve. It emphasises the need for internationally recognised standards to ensure the safe and secure use of outer space and to promote the long-term sustainability of space activities. It describes furthermore the need for **STM obligations** including short-term limited obligations with limited costs for the industry involved. In the medium term, a more comprehensive regulatory approach to STM would be the objective, in consultation with the Member States to identify relevant areas mature for legislation while preserving the competitiveness of the industry and respecting the competences of the EU and Member States.

In response to the Joint Communication, the **Council of the EU** highlighted in its **Conclusions**[20] the challenges of an increasingly congested orbital space and the need for a common approach to ensure a safe and sustainable European space policy, emphasized the urgency of developing an EU STM approach taking into account both civil and military STM needs, and stressed the importance of the EU SST system for enhancing Europe's strategic autonomy and the competitiveness of its space industry on a worldwide scale. These notions were further iterated and reinforced in a **Resolution**[21] of the **European Parliament**.

The Joint Communication is also in line with the **vision** and wishes expressed by the **space industry** itself. ASD-Eurospace, the trade association of the European Space Industry, stated in its position paper on STM: *"The European Union has an opportunity to seize to be at the forefront of the discussions on the topic of Space Traffic Management and provide the grounds to protect key European space infrastructures and their associated services. By being proactive, the European Union will allow the European space sector to use agreed rules and procedures to its advantage. Furthermore, the European approach may be seen as more neutral in the worldwide community than the US approach."*[22]

2.2.3.3 Joint Statements

In the field of space, the Commission and the ESA signed a Joint Statement in October 2016 on a shared vision and goals for the future of Europe in space. As part of this statement, and of particular importance for STM, the two organisations envisaged to "ensure **European autonomy in accessing and using space in a safe and secure environment** and in particular consolidate and protect its infrastructures"[23].

[19] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022JC0004
[20] https://data.consilium.europa.eu/doc/document/ST-10071-2022-INIT/en/pdf
[21] https://www.europarl.europa.eu/doceo/document/TA-9-2022-0355_EN.pdf#:~:text=European%20Parliament%20resolution%20of%206%20October%202022%20on,an%20EU%20contribution%20addressing%20a%20global%20challenge%20%282022%2F2641%28RSP%29%29
[22] ASD-Eurospace Position Paper: "Space Traffic Management (STM): An opportunity to seize for the European space sector" - Eurospace
[23] https://www.esa.int/ESA_Multimedia/Images/2016/10/Signature_of_ESA_EU_Joint_Statement_on_Shared_Vision_and_Goals

2.3 State of Play in STM standardisation

The section below provides an overview of the most relevant Standards Development Organisations (SDOs) in the field of STM and outlines their key working principles and collaboration processes from the inception of a standard until its adoption. In the area of STM standardisation, we highlight the policy ambitions of the EU as well as published and planned standards contributing to global and EU-level ambitions.

2.3.1 Standards Development Organisations in the field of STM

Standard Development Organisations (SDOs) develop and publish a range of (international) standards.

2.3.1.1 Overview of main SDOs

There are two major types of SDOs. The first type of SDO work on international standards via respective national standardisation bodies[24] with representatives coming from industry, academia, and the public sector. Examples include the **International Organisation for Standardisation (ISO)** and the **European Committee for Standardisation (CEN)**.

The second type of SDO are initiatives from specific communities without any formal link to national standardisation bodies. These bring together experts from industry, the public sector, academia, etc. and form a 'consortium', often globally. Examples in the geospatial, ICT and space sector are the **Open Geospatial Consortium (OGC)**, **W3C**[25] and the **Consultative Committee for Space Data Systems (CCSDS)**.

Although not an SDO *per se*, the **European Cooperation for Space Standardisation (ECSS)** regularly monitors the efforts of standardisation organisations in space standards. An **ECSS Space Traffic Management Mirror Working Group (ECSS STMWG)** was created in 2020 to coordinate positions and interests of European space industries and space agencies to be considered in new ISO standards and concomitant developments. In particular, the WG is envisaged to:

- facilitate the planning, development and review of specific standards, and harmonising inputs and contributions of ECSS STMWG members on STM issues;
- provide technical recommendations and input to ECSS TA (ECSS Technical Authority) to develop a European position on standards within ISO;[26]
- contribute to providing standards to help increase the accuracy of SSA.

The purpose of the ECSS STMWG is therefore to provide ECSS contributions to the development of worldwide STM implementation standards in the framework of ISO TC20/SC25 WG 3 (Operations & Support Systems).

Other organisations are not SDOs *per se*; they do not develop standards themselves but promote standards in a particular field and support the standardisation process. Examples in the space sector include **ASD-Eurospace** and **CONFERS**.

Lastly, the **European Space Agency (ESA)** has been publishing **Space Environment Reports**[27] since 2017 offering an overview of ongoing global debris mitigation efforts and raising awareness of space activities in general. The reports are updated yearly, are publicly available, and support the awareness-raising guideline laid out in the UN COPUOS Guidelines for the Long-Term Sustainability of

[24] Examples of national standardisation (or normalisation) bodies are: AFNOR (FR), DIN (DE), NBN (BE), ANSI (US), etc.
[25] Developing standards for the web.
[26] ASD-EUROSPACE (January 2021) – Eurospace Position Paper: STM, an opportunity to seize for the European space sector, Annex 3 – ECSS Action Towards ISO, 13.
[27] Latest edition: https://www.sdo.esoc.esa.int/environment_report/Space_Environment_Report_latest.pdf.

Outer Space Activities. The reports show trends and deorbiting measures being performed and contain recommendations that have been often transposed into standards.

SDOs do not develop full STM regulatory frameworks but specific **standards that can support regulatory frameworks**. Before diving deeper into the standards at stake for STM, it is important to explain how SDOs operate and how they link to existing initiatives, regulations and guidelines from the UN, the EU, and Member States.

2.3.1.2 Key working principles of SDOs

SDOs work according to five key principles:

1) **International Standards** and other SDO documents **are voluntary**. They do not include contractual, legal, or statutory requirements. Voluntary standards do not replace national laws. This means that although legislation can refer to standards to be followed and implemented, International Standards themselves are not legally binding.

2) Standards and SDO work should **respect the rules** and principles defined by the World Trade Organisation (WTO). The **Agreement on Technical Barriers to Trade** (TBT) is one of the legal texts of the WTO Agreement and obliges WTO Members to ensure that, *inter alia*, **voluntary standards do not create unnecessary obstacles to trade**. Six principles defined by the WTO are followed by SDOs: transparency, openness, impartiality, and consensus (see further), relevance and effectiveness, coherence, and development dimension.

3) SDOs might refer in their documents to elements that might be the subject of **patent rights**. SDOs do not take responsibility for identifying any or all such patent rights. Details of any patent rights identified during the development of a document will be in the Introduction of relevant SDO documents and/or, e.g., for ISO, in a database of patent declarations.

4) SDO work is **consensus-based**. This means that there are no mechanisms in SDOs to decide on the adoption of standards based on voting by one or another 'majority' nor by a supreme body. SDOs and their Working Groups work with the stakeholders involved until they reach an agreement[28]. This makes **standards, once published, quite solid and applied broadly in practice**.

5) Within standards, **clear expressions** are used that indicate how to understand and implement a standard. There are four key expressions: "shall" (or "must") indicates a requirement; "should" indicates a recommendation; "may" indicates that something is permitted and "can" indicates that something is possible, for example, that an organisation or individual can do something. **Requirements** can be **verified through so-called conformity assessments** for which conformity classes are defined.

SDOs have developed clear procedures and guidelines on how standards must be developed, adopted, and published. The International Organisation for Standardisation (ISO) and International Electrotechnical Commission (IEC) have developed joint directives and policies that describe those procedures[29]. Similar procedures exist for other SDOs.

2.3.1.3 Collaboration between SDOs

Rules exist for collaboration between SDOs. There are several SDOs active in the field of space; the figure below provides a visual overview thereof:

[28] "A general agreement, characterised by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments. Consensus need not imply unanimity" (ISO/IEC Guide 59:2019)
[29] See https://www.iso.org/directives-and-policies.html

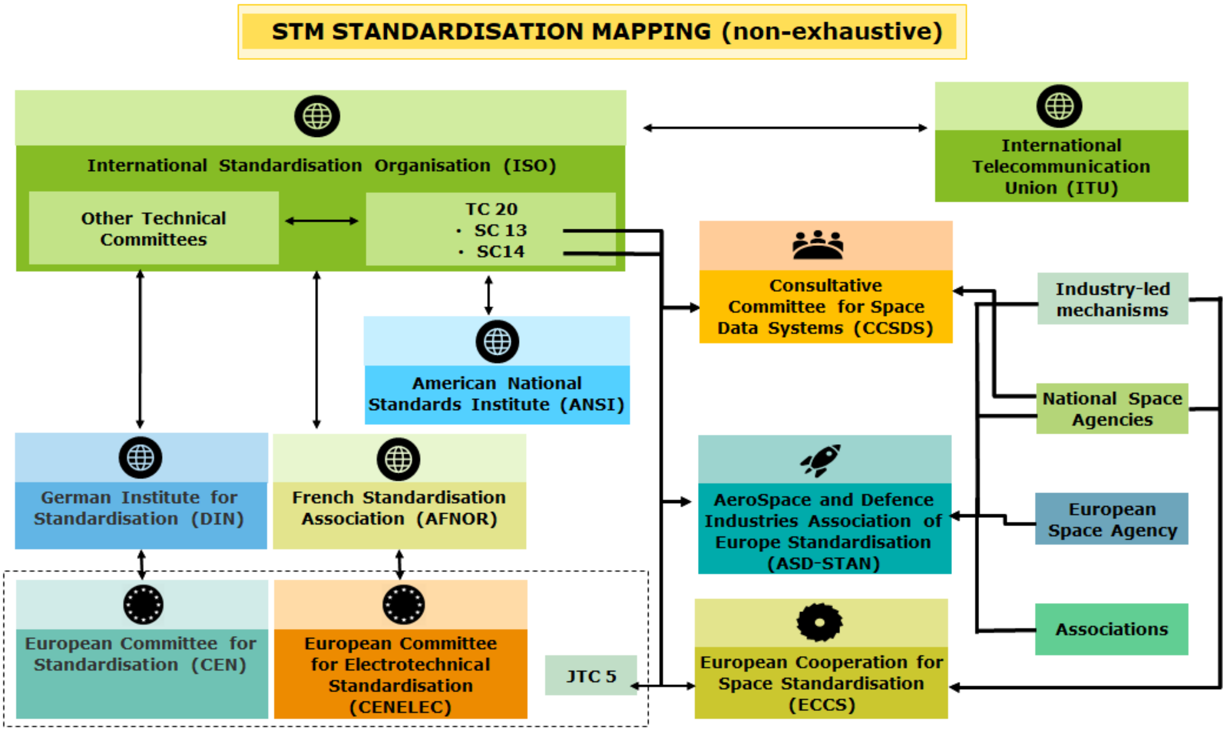

Figure 2 – non-exhaustive STM Standardisation Mapping (Source: Deloitte, KUL compilation)

In the context of the collaboration between ISO and CEN, the **Vienna Agreement** should be mentioned as a key agreement regulating their technical cooperation. Formally approved on 27 June 1991 in Vienna by the CEN Administrative Board following its approval by the ISO Executive Board at its meeting on 16 and 17 May 1991 in Geneva, it replaced the Agreement on the exchange of technical information between ISO and CEN (Lisbon Agreement) concluded in 1989. The 'codified' Vienna Agreement was approved by the ISO Council and the CEN Administrative Board in 2001. In practical terms, it foresees, among others, a mechanism to make some of the ISO standards European Norms (EN) published by CEN/CLC.

This **mechanism** can and is also **applied in the space sector**[30]. For example, *ISO 26900 - Space data and information transfer systems — Orbit data messages*[31] was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 502.0-B-2, November 2009) and was adopted (without modifications except those stated in Clause 2 of this International Standard) by Technical Committee ISO/TC 20 ‘Aircraft and space vehicles’ and Subcommittee SC 14 ‘Space systems and operations’ in collaboration with SC 13 ‘Space data and information transfer systems’. Based on the Vienna Agreement, this standard became a pre-European Norm: prEN ISO 26900 (see figure below).

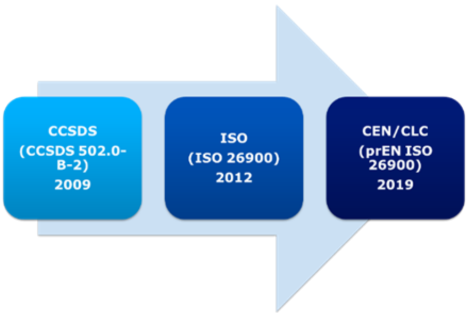

Figure 3 - Standard on Orbit Data Messages: from CCSDS over ISO to a European Norm (Source: Deloitte, KUL compilation)

[30] Similar mechanisms exist between other SDOs.
[31] This standard has been withdrawn and revised by ISO 26900:2024 (publication 02/2024)

The most important effect of **ISO standards becoming CEN standards** is that they are **applicable in all EU Member States**. So, while an EU Member State does not need to adopt an ISO standard (not all EU Member States are a member of e.g., ISO/TC 20 SC 14), they must implement/apply CEN standards. If a conflicting national standard is in existence, this standard must be withdrawn.

The CEN/CLC JTC 5 has taken over a series of ISO standards such as prEN ISO 13526 - Space data and information transfer systems — Tracking data message; prEN ISO 13541 - Space data and information transfer systems — Attitude data messages; prEN ISO 17107 - Space data and information transfer systems — XML specification for navigation data messages; prEN ISO 19389 -Space data and information transfer systems — Conjunction data message and prEN ISO 26900 - Space data and information transfer systems — Orbit data messages. Besides this, CEN/CLC focuses on other STM aspects, mainly on terminology related to SSA.

Within **ISO**, ISO/TC 20 is the Technical Committee (TC) focusing on aircraft and space vehicles and has published over 600 standards since its setup in 1947. There are currently 11 active sub-committees (SC) of which at least two are or might be potentially relevant: SC 13 on space data and information transfer systems, and SC 14 on space systems and operations.[32]

TC 20 SC 14 has 16 participating members and 14 observing members. From Europe, participating members are Finland, France, Germany, Greece, Italy, Romania and Spain; observing members are the Commission (liaison B[33]), Cyprus, Ireland, Luxembourg, the Netherlands, Poland, Slovakia, and Sweden. This poses a challenge for the EU in uniformly implementing these standards, although not all EU Member States are active in the space domain. In addition, space stakeholders (from e.g., industry, academia, and the public sector) in these countries can take the initiative to set up a national mirror committee. This mirror committee must be endorsed by the national standardisation body (e.g., AFNOR in France) and can appoint a delegation to go to international meetings (which should also be endorsed by the national standardisation body).

Two other ISO committees can access SC 14 documents[34]: IEC/TC 207 - Process management for avionics and ISO/TC 211 - Geographic Information/Geomatics. Those two committees have activities and standards that are relevant for the work of SC 14. They might provide comments and input during the development of one or more standards. In that sense, they help align standards from different TC/SCs. SC 14 has access to documents of these two committees as well as to those from ISO/IEC JTC 1/SC 7 - Software and systems engineering, ISO/TC 20/SC 13 - Space data and information transfer systems, ISO/TC 20/SC 18 - Materials, ISO/TC 197 - Hydrogen technologies and ISO/TC 204 - Intelligent Transport Systems.

ISO/TC 20/SC 14 further has 'category A'-liaisons[35] with other organisations:

- ASD-STAN AeroSpace and Defence Industries Association of Europe – Standardisation
- CCSDS Consultative Committee for Space Data Systems
- COSPAR Committee on Space Research
- ECSS European Cooperation for Space Standardisation
- ESA European Space Agency
- IAA International Academy of Astronautics
- ITU International Telecommunication Union

[32] https://www.iso.org/committee/46484.html and https://www.iso.org/committee/46614.html
[33] B-liaisons are unique to governmental organisations wishing to be kept informed of the work of a technical committee or subcommittee.
[34] Normally documents are not public until they have been adopted (voted) and published.
[35] A-liaison organisations make an effective contribution to the committee's work and may propose new work items for the committee to develop. A-liaisons may also nominate experts to working groups (WGs) and hold Convenor or Project Leader roles within these WGs. A-liaisons do not have voting rights. However, they can submit comments during the voting process and are strongly encouraged to do so. Comments received from liaison organisations are given the same treatment as comments from member bodies. Liaison organisations can also propose new work items. Individuals nominated to represent their organisation under Category A at the TC or SC level are expected to present the views and share the expertise of their organisation.

Other relevant standardisation bodies or associations not mentioned by ISO/TC 20/SC 14 include IDC-A (International Data Centre Association), CPO Working Group (Close Proximity Operations Working Group on cybersecurity and related matters) and the project PER ASPERA: Space Robotic Technologies, led by ESA[36]. They are rather indirectly involved in the standardisation process as they cover topics relevant to or having a potential influence on that standardisation work.

2.3.2 EU policy ambitions for STM standardisation

The EU has an active standardisation policy[37] - e.g., see the *"EU Strategy on Standardisation Setting global standards in support of a resilient, green and digital EU single market"* - which promotes standards to achieve better regulation and enhance the competitiveness of the European industry.

In 2011, the Commission proposed a series of measures to **strengthen the system of standard-setting**. These measures included enhancing the EU cooperation with leading standardisation organisations in Europe; drafting European standards (ENs) with the support of other organisations representing groups such as consumers, SMEs, and environmental and social organisations; recognising the importance of the Global Information and Communication Technologies standards which play a prominent role in the EU; and increasing the number of European standards for services if there is a demand from the industry.

In its **Communication on a strategic vision for European standards** released in 2011, European standards and standardisation were recognised as effective policy tools for the EU since these ensure "*the interoperability of networks and systems, a proper functioning of the Single Market, a high level of consumer and environmental protection, and more innovation and social inclusion".*[38] The strategic objectives to be supported by the European standardisation system included the following considerations:

- Standards need to be quickly available to ensure interoperability between services and applications in the field of information and communication technologies;
- Standardisation within the EU will continue to make a significant contribution to the European economy since standards are powerful tools for businesses to increase their competitiveness;
- European standards will need to respond to increasing demand for European policies and legislation;
- European standards will affect businesses of all sorts and individuals;
- Standards have an important role to play in supporting the competitiveness of European businesses in the global market, allowing them to access foreign markets and establish business partnerships around the globe.

This Communication is further supported by the **Standardisation package and Joint Initiative on Standardisation** adopted in June 2016 as well as the **EU Strategy on Standardisation** adopted in February 2022.

The **Standardisation package** on "European Standards for the 21st Century" sets out its vision for a single and efficient standardisation policy that adapts to the changing environment, supports multiple policies, and brings benefits to companies, consumers, and workers. Within the **Standardisation package**, concretely in the **Communication on "European Standards for the 21st Century"**, the **Joint Initiative on Standardisation** is mentioned which aims to modernise the way standards are produced in Europe by promoting faster standards development, closing the gap between research

[36] See https://www.esa.int/Enabling_Support/Space_Engineering_Technology/PERASPERA_Space_Robotic_Technologies.
[37] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0031
[38] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee: A strategic vision for European standards: Moving forward to enhance and accelerate the sustainable growth of the European economy by 2020. See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0311

priorities and European standardisation, clearer prioritisation, and stronger international presence.[39] The participants of this Joint Initiative on Standardisation are the European Commission, EU Member States, EFTA Member States, the three European standardisation organisations, national standardisation bodies, and European industry, also represented by several associations including Small and Medium Enterprises (SMEs), and societal stakeholders representing environmental interests, trade unions and consumers.[40]

The EU has the ambition to be at the forefront of the **development and promotion of the use of STM-related standards and guidelines**. The promotion of the implementation of STM-related standards should be based on an assessment of which standards have the biggest impact. The promotion should take the form of a supporting toolbox and a series of recommendations. European agencies could use the toolbox e.g., in procurement processes while Member States could use it when satellite operators wish to operate services over their territory. It should be stressed that the selection of STM-related standards to be promoted as a priority should be done in collaboration with Member States and the EU space industry.[41]

In its position paper on STM, ASD-Eurospace stresses that the EU should promote the collaboration with and active role of ECSS and embraces the idea that the ECSS is the main SDO to *"provide technical inputs and recommendation to develop a European position on standards within the ISO forum"*.[42] ECSS could thus provide valuable assistance in the identification of relevant standards, ongoing and planned work, etc.

Finally, the EU recognises that it is not enough to identify, develop and promote the **application of the standards and guidelines**, but also to **create incentives and implement a certification mechanism** for the application of the standards and guidelines. As part of the Joint Communication JOIN(2022)4 "An EU approach to Space Traffic Management"[43], the EU considers, 1) the use of an 'EU Safe Space Label' as a visual recognition that space operators carrying that label abide by an agreed set of standards, guidelines and/or best practices which aim at fostering safe, sustainable and secure use of space; 2) the modifications of award criteria in tenders, grants or other financial instruments to stimulate (not oblige) the use of STM-related standards and guidelines, and 3) to compile a list of companies and operators that implement STM-related standards and guidelines.

[39] Communication on "European Standards for the 21st Century". See: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016DC0358
[40] Joint Initiative on Standardisation. See: https://single-market-economy.ec.europa.eu/news/joint-initiative-standardisation-responding-changing-marketplace-2016-06-13_en
[41] JOIN(2022) 4 final of 15.2.2022 to the European Parliament and the Council "An EU Approach for Space Traffic Management. An EU contribution addressing a global challenge."
[42] ASD-Eurospace (2021). Space Traffic Management: An opportunity to seize for the European space sector. https://eurospace.org/eurospace-position-paper-space-traffic-management-stm-an-opportunity-to-seize-for-the-european-space-sector/.
[43] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022JC0004

3 Outlining existing standards, guidelines and best practices supporting space traffic management

This section presents an overview of the existing international guidelines and best practices, international standards and other initiatives supporting space traffic management zooming in on the domains of space safety and sustainability, the environment, and the preservation of dark and quiet skies. These guidelines, standards and best practices serve different purposes and have been categorised according to their scope i.e., focus on sustainability on Earth or in space; corporate- or product-focussed; on a mandatory or voluntary basis; focused on space safety or space sustainability. These initiatives are linked to and build upon space-related international treaties, conventions, and agreements such as the Outer Space Treaty (1966)[44], the Rescue Agreement (1967)[45], the Liability Convention (1971)[46] and the Registration Convention (1974)[47].

First, we discuss, where applicable, the most relevant international guidelines and best practices supporting space safety, the environment, and dark and quiet skies. Then, we introduce the key international standards designed to assist actors engaged in space activities with the goal of ensuring the long-term preservation of space. Finally, we introduce relevant initiatives that aim to promote adherence to the afore-mentioned standards and guidelines and/or that propose related best practices.

3.1 International guidelines and best practices supporting space traffic management

This section investigates relevant international guidelines and best practices supporting space traffic management.

As will be outlined in more detail in the following subsections, **guidelines and best practices** in the field of **space safety and sustainability are comprehensive and provide an overall framework** for the international community to conduct safe space activities and tackle the rising issue of space debris.

While the European Space Agency (ESA) attempts in its Life Cycle Assessment (LCA) Handbook[48] to offer a first methodology for quantifying and addressing environmental impacts unique to space missions, there are **currently no globally recognised standards or established best practices** specifically **addressing the impact of space activities on the environment**.

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[44] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (resolution 2222 (XXI)). https://www.unoosa.org/pdf/gares/ARES_21_2222E.pdf.
[45] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (resolution 2345 (XXII)). https://www.unoosa.org/pdf/gares/ARES_22_2345E.pdf.
[46] Convention on International Liability for Damage Caused by Space Objects (resolution 2777 (XXVI)). https://www.unoosa.org/pdf/gares/ARES_26_2777E.pdf.
[47] Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX)). https://www.unoosa.org/pdf/gares/ARES_29_3235E.pdf.
[48] https://sdg.esa.int/activity/esa-lca-database-and-handbook-framework-life-cycle-assessment-space-4854

Furthermore, current research indicates that there are **no equivalent international guidelines or best practices specifically addressing the preservation of dark and quiet skies**.

Since international space treaties are not directly binding on private operators, suitable national procedures and norms requiring prior authorisation for national space activities – e.g., in the form of detailed pre-launch licensing requirements – are vital to ensure the safety and sustainability of outer space. It is crucial to ensure that space actors who intend to introduce objects into space from an assorted national jurisdiction and undertake related activities in orbit possess the capabilities and protocols deemed necessary to adaptively contend with the interference risks posed by and to space objects under their ownership and/or control. This includes due regard for internationally constructed normative horizons of space safety and sustainability.

Considering the broad and general nature of international space law, various initiatives for more detailed standards and guidelines have been developed. These are designed to enhance the safety and sustainability of space activities across national jurisdictions, providing more detailed and specific guidance that complements the high-level principles set out in international treaties. In the next sub-sections, the most important non-binding guidelines and best practice documents are discussed followed by an overview of the most relevant international standards.

3.1.1 UNGA Resolution 68/74

The **UNGA Resolution 68/74** (2013) guides nations in developing national space legislation aligned with international space law. It emphasises national responsibility for space debris mitigation and safe space operations and urges States to establish regulatory frameworks, particularly for private sector space activities. The resolution offers recommendations on authorisation, supervision, and registry of space activities, and addresses liability and insurance aspects. It highlights the importance of national laws in overseeing non-governmental entities in space and ensuring adherence to international obligations.[49]

3.1.2 UN COPUOS Guidelines

The United Nations Office for Outer Space Affairs (UNOOSA) has published the United Nations Treaties and Principles on Outer Space (2007), the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space (UN COPUOS, 2010), recommendations on national legislation relevant to the peaceful exploration and use of outer space (2013), and the Guidelines for the Long-term Sustainability of Outer Space Activities (2018).

The first document provides an **overview of all the United Nations treaties and principles** adopted by the UN General Assembly (UNGA) that are relevant for conducting space activities safely and sustainably. This document serves as a starting point for all States and third parties involved in space activities to understand the principles for conducting safe and sustainable outer space activities.

The **UN COPUOS Space Debris Mitigation (SDM) Guidelines**, endorsed by the UNGA in 2007 and published by UNOOSA in 2010, are non-binding guidelines distilled through a process of political deliberation in the UN COPUOS Scientific and Technical Subcommittee based on the technical content and basic definitions of the SDM guidelines of the IADC[50]. The UN COPUOS SDM Guidelines put forth the following recommended guidelines for the mission planning, design, manufacture and operational (launch, mission and disposal) phases of spacecraft and launch vehicle orbital stages:

- Guideline 1: Limit debris released during normal operations;

[49] United Nations General Assembly. (2013). Recommendations on national legislation relevant to the peaceful exploration and use of outer space (Resolution 68/74) https://www.unoosa.org/pdf/gares/A_RES_68_074E.pdf
[50] Ibid., 4.

- Guideline 2: Minimise the potential for break-ups during operational phases;
- Guideline 3: Limit the probability of accidental collision in orbit;
- Guideline 4: Avoid intentional destruction and other harmful activities;
- Guideline 5: Minimise potential for post-mission break-ups resulting from stored energy;
- Guideline 6: Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low-Earth orbit (LEO) region after the end of their mission;
- Guideline 7: Limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous Earth orbit (GEO) region after the end of their mission.

Due to several developments since the adoption of the UN COPUOS SDM Guidelines and the then IADC Guidelines by which they were inspired (see section 3.1.3), such as the accelerating emergence of large constellations and small satellites, some of the assumptions regarding the evolution of the orbital environment and space object population, which underlie the initial Guidelines, might no longer correlate with the present situation and evolving safety and sustainability requirements in orbit.

The UN COPUOS SDM Guidelines do not contain detailed or elaborated *quantitative* guidelines but are instead *qualitative* in nature. They aim to **promote the achievement of qualitative, textually defined objectives or goals**. The document is conceived as **a 'living', flexible document** that was adopted by consensus by the Member States and endorsed by UNGA.[51]

The more recent **UN COPUOS Guidelines for the Long-Term Sustainability (LTS) of Outer Space Activities** (2018)[52] aim to support the development of national frameworks, including national procedures for the authorisation and supervision of space activities. The guidelines address the policy, operational, safety, scientific, technical, international cooperation, and capacity-building aspects of space activities. The table below provides an overview of the 21 LTS Guidelines:

A.	**Policy and regulatory framework for space activities**
A.1	Adopt, revise, and amend national regulatory frameworks
A.2	Elements to consider when developing such frameworks (e.g., weighting costs and benefits of certain measures)
A.3	Supervise national space activities
A.4	Ensure the equitable, rational, and efficient use of the radio frequency spectrum and the orbital regions
A.5	Enhance the practice of registering space objects
B.	**Safety of space operations**
B.1	Provide contact information and share information on space objects and orbital events
B.2	Improve the accuracy of orbital data on space objects
B.3	Promote the collection, sharing and dissemination of space debris monitoring information
B.4	Perform conjunction assessment during all orbital phases
B.5	Develop practical approaches for pre-launch conjunction assessment
B.6	Share operational space weather data and forecasts

[51] See W. Munters, 'Small satellites, large constellations and space debris: in dubio pro LEO?' in J. Wouters, P. De Man and R. Hansen (eds.), Commercial Uses of Space and Space Tourism – Legal and Policy Aspects, Edward Elgar Publishing (2017) 79-81. (Discussing particularly the qualitative nature and teleological interpretation of UN COPUOS SDM Guidelines; generally the risks and related legal status of large constellations and the OneWeb constellation.)

[52] Guidelines for the Long-term Sustainability of Outer Space Activities. https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf

B.7	Develop space weather models and tools, collect practices on the mitigation of space weather effects
B.8	Design and operate space objects regardless of their characteristics
B.9	Take measures to address risks associated with the uncontrolled re-entry of space objects
B.10	Observe measures of precaution when using sources of laser beams
C.	**International cooperation, capacity-building, and awareness**
C.1	Promote and facilitate international cooperation in support of long-term sustainability
C.2	Share experience related to long-term sustainability of outer space activities
C.3	Support capacity building
C.4	Raise awareness of space activities
D.	**Scientific and technical research and development**
D.1	Promote and support research into sustainable exploration and use of outer space
D.2	Investigate and consider new measures to manage space debris in the long term

Table 2 - Overview of the 21 UN COPUOS Guidelines for the Long-Term Sustainability (LTS) of Outer Space

It follows from the UN COPUOS LTS Guidelines that States should adopt national frameworks that ensure the long-term sustainability of space activities, including by reflecting international norms, standards, guidelines, and best practices on the safe conduct of space activities (Guideline A.1). When adopting national frameworks, States should also ensure the implementation of space debris mitigation measures, such as the UN COPUOS Space Debris Mitigation Guidelines. States should also consider using international technical standards, such as those published by ISO, CCSDS and national standardisation bodies, as well as recommended practices and voluntary guidelines proposed by IADC and COSPAR (Guideline A.2).

The politically sensitive nature of the guidelines is reflected in the strong emphasis placed on their non-binding character, which may hamper their widespread implementation. As such, the Guidelines note that they are "formulated in the spirit of enhancing the practice of States and international organisations in applying the relevant principles and norms of international law" (para. 15). Specifically, the guidelines do not constitute "a revision, qualification, or reinterpretation of the principles and norms of international law, and nothing in the guidelines should be interpreted as giving rise to any new legal obligation for States". Nevertheless, as an umbrella initiative incorporating a variety of international initiatives to increase the safety and sustainability of space activities, the UN COPUOS LTS Guidelines are a particularly important instrument.

The UN COPUOS LTS Guidelines stress their applicability to the space environment and the importance of addressing risks to people, property, and the **environment** associated with the launch, in-orbit operation, and re-entry of space objects. Guideline A.2[53] encourages the development of national regulatory frameworks that minimise human impacts on Earth and in outer space, aligning with Sustainable Development Goals. Guideline D.1[54] urges consideration of social, economic, and

[53] "Promote regulations and policies that support the idea of minimising the impacts of human activities on Earth as well as on the outer space environment. They are encouraged to plan their activities based on the Sustainable Development Goals, their main national requirements and international considerations for the sustainability of space and the Earth."

[54] "Take into account, with reference to the outcome document of the United Nations Conference on Sustainable Development (General Assembly resolution 66/288, annex), the social, economic and environmental dimensions of sustainable development on Earth. States and international intergovernmental organisations should promote the development of technologies that minimise the environmental impact of manufacturing and launching space assets and that maximise the use of renewable resources and the reusability or repurposing of space assets to enhance the long-term sustainability of those activities. States and international

environmental dimensions in space activities, promoting technology for minimal environmental impact and resource maximisation. Lastly, Guideline D.2[55] emphasizes that new measures for sustainability, particularly in re-entries, should avoid undue risks to people, property, and the environment.

3.1.3 IADC Space Debris Mitigation (SDM) and other Guidelines

The Inter-Agency Space Debris Coordination Committee (IADC) is a forum for cooperation between the national space agencies of 12 countries including Italy (ASI), France (CNES) and Germany (DLR) but also e.g., India (ISRO), Japan (JAXA), USA (NASA), Russia (ROSCOSMOS) and Ukraine (SSAU), as well as the European Space Agency (ESA). Initially published in 2002 and updated in 2007 and 2020, the latest revision of the IADC Space Debris Mitigation Guidelines, Revision 3, dates from June 2021.[56] Due to its technical, transnational, and inter-agency nature, the **IADC Guidelines reflect a broad range of relatively apolitical international inputs**. They are **based on agreement by consensus** among the IADC member agencies and on several agreed-upon **fundamental principles** which are directly relevant to the safety and sustainability of space activities: "(1) Preventing explosive and collisional on-orbit break-ups; (2) Removing spacecraft and orbital stages that have reached the end of their mission operations from the useful densely populated orbit regions; and (3) Limiting the objects released during normal operations."[57]

The Guidelines "describe existing practices that have been identified and evaluated for limiting the generation of space debris in the environment", and organisations and operators are recommended to apply the Guidelines to the greatest extent possible to "mission planning and the design and operation of spacecraft and orbital stages that will be injected into Earth orbit."[58] They offer organisations and operators comprehensive best practices throughout the lifecycle of a space object and emphasise "the overall environmental impact of missions".[59]

More concretely, the IADC recommends certain space debris mitigation measures. All IADC Guidelines are immediately relevant in the context of STM as they concern vital aspects of physical space object behaviour and attributes. However, the final Guideline on the **prevention of on-orbit collisions** appears especially salient:[60]

1. **Limit Debris Released during Normal Operations**
2. **Minimise the Potential for On-Orbit Break-ups**
    - 2.1 Minimise the potential for post-mission break-ups resulting from stored energy;
    - 2.2 Minimise the potential for break-ups during operational phases;
    - 2.3 Avoidance of intentional destruction and other harmful activities;
3. **Post Mission Disposal**
    - 3.1 Geosynchronous Region;
    - 3.2 Objects Passing Through the LEO Region;
    - 3.3 Other Orbits;
4. **Prevention of On-Orbit Collisions**

According to the IADC Space Debris Mitigation Guidelines, "In developing the design and mission profile of a spacecraft or orbital stage, a program or project should **estimate and limit the probability of accidental collision with known objects during the spacecraft or orbital stage's orbital**

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intergovernmental organisations should consider appropriate safety measures to protect the Earth and the space environment from harmful contamination, taking advantage of existing measures, practices and guidelines that may apply to those activities, and developing new measures as appropriate."

[55] "New measures aimed at ensuring the sustainability of space activities and involving either controlled or uncontrolled re-entries should not pose an undue risk to people or property, including through environmental pollution caused by hazardous substances."

[56] IADC, IADC Space Debris Mitigation Guidelines (Rev. 3), IADC-02-01 (June 2021), see https://www.iadc-home.org/documents_public (last accessed 29 April 2024).

[57] Ibid., 5.

[58] Ibid., 6.

[59] https://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space_Debris-Guidelines-Revision1.pdf

[60] Ibid., 9-12.

lifetime. If reliable orbital data is available, avoidance manoeuvres for spacecraft and coordination of launch windows may be considered if the collision risk is not considered negligible. **Spacecraft design should limit the probability of collision with small debris which could cause a loss of control, thus preventing post-mission disposal**."[61]

In addition, the IADC publishes the '**Support to the IADC Space Debris Mitigation Guidelines**' which elaborates on the IADC SDM Guidelines.[62] The first release was published in 2004, the latest revision was concluded in 2021. This document provides additional guidance on the purpose of each mitigation measure, considerations regarding its feasibility, examples of existing practices and how the guide can be tailored to specific needs.

Various other publications by the IADC are pertinent in the context of STM. For instance, the IADC publishes a regularly updated comprehensive and highly technical '**Protection Manual**'[63] dedicated to measures protecting and shielding spacecraft from (micro)meteorites or orbital debris (M/OD or MMOD) impacts. **MMOD protection is important in an STM context** since even small debris (in the >1cm size range) may incapacitate or otherwise damage a spacecraft or other space objects in a collision. In turn, a damaged space object may release additional fragments, or **an incapacitated spacecraft may lose control capacity** and so become unable to enact collision avoidance manoeuvres or controlled re-entry, thus **imposing additional risks or costs on other orbital users or potentially affected parties on Earth**.

The aim of the **Protection Manual** (PM) is to "provide a synthesis of the knowledge and experience available among the contributors" and **"provide the framework that allows comparable meteoroid/orbital debris (M/OD) risk assessments across the spectrum of member agencies"** [64].

Furthermore, the IADC issued the '**IADC Statement on Large Constellations in Low Earth Orbit**.'[65] In this Statement, the IADC clearly explains its rationale:

> "*At its 33rd meeting in Houston in March 2015, the IADC noted the emerging plans for large constellations of satellites in Low Earth Orbit (LEO) and* ***recognised the potential for such systems to have an important influence on the evolution of the space debris environment and the consequent impact on the population of man-made satellites orbiting the Earth****. Accordingly, in March 2015, the IADC committed to conducting a series of investigations and analyses to investigate the* ***potential risk posed by such constellation systems and*** *consider* ***potential mitigation actions*** *which could help inform the design and operation of such distributed architectures to ensure that they are developed predictably and sustainably.*"[66]

Through this statement, the IADC seeks to reinforce the relevance of its existing SDM guidelines to constellation architectures with due regard to the added and unique risks posed by constellations to the orbital environment. The statement also includes several **considerations that apply space debris mitigation measures and objectives to the superlative case of large constellations**. Constellation design typically involves highly 'synchronised' geometries and coordinated operations between constellation satellites. The IADC's statement includes considerations concerning the **entire constellation and constellation object lifecycle**, including:[67]

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[61] Ibid., 12.
[62] IADC, Support to the IADC Space Debris Mitigation Guidelines (Rev. 5.8), IADC-04-06 (June 2021), 8, see https://www.iadc-home.org/documents_public (last accessed 29 April 2024).
[63] IADC, Protection Manual (v.7.2), IADC-04-03 (September 2021), see https://www.iadc-home.org/documents_public (last accessed 29 April 2024).
[64] Ibid., xi.
[65] IADC, IADC Statement on Large Constellations of Satellites in Low Earth Orbit (Rev. 1.1), IADC-15-03 (July 2021), see https://www.iadc-home.org/documents_public (last accessed 29 April 2024).
[66] Ibid., 4.
[67] Ibid., 7-10.

1. **Constellation Design**
    1.1 Altitude Separation
    1.2 Number of Spacecraft
    1.3 Altitude Separation at Orbital Plane Intersection
2. **Spacecraft Design**
    2.1 Reliability of the Post-Mission Disposal (PMD) Function
    2.2 Design Measures to Minimise Consequences of Break-ups
    2.3 On-ground Risk
    2.4 Structural Integrity
    2.5 Trackability
3. **Operations**
    3.1 Launcher Stages
    3.2 Collision Avoidance
    3.3 Disposal Strategy
    3.4 Launch and Early Operations

The Space Debris Mitigation Guidelines (2021), while mostly focused on space environment, also refer to the environment on Earth. According to the guidelines, debris surviving re-entry into the Earth's atmosphere should not pose undue risk to people or property while ensuring the prevention or minimisation of ground environmental pollution from radioactive, toxic, or other pollutants.

3.1.4 International Telecommunication Union (ITU) regulations and guidelines

The avoidance of radiofrequency interference (RFI), together with preventing physical interference (collisions), has been deemed an important requirement of a comprehensive STM system. Most notably, the International Academy of Astronautics (IAA) includes RFI within the scope of its STM concept.[68] The coordination, allocation and registration of radiofrequency spectrum use is governed at the global level by the ITU and its Radio Sector communication (ITU-R). Overall, the ITU regulatory and coordinative regime to avoid RFI is considered necessary and highly effective as supported by the ITU's near-universal, global membership.[69]

Due to its near-universal level of ratification, the ITU norms are widely applicable and may offer a strong additional basis if the EU desires to promote the establishment of **equitable international frameworks for STM and orbital use that consider a wide variety of global interests**. In addition, the ITU welcomes the space and telecommunication industry as sector members. Although they ultimately lack the voting powers that only Member States have, the close involvement of the space industry in the work of the ITU ensures that the rules adopted by the latter are workable and that non-binding rules promoted by the ITU enjoy broad support among operators. Two documents of the ITU are particularly relevant: the ITU regulations on spectrum use and the environmental protection of the geostationary satellite orbit.

3.1.4.1 ITU Regulations on spectrum use (radio regulations)[70]

The ITU Radio Regulations contain detailed technical rules and procedures aimed at avoiding or otherwise minimising harmful interference between radio stations of different administrations. The

[68] "If a spacecraft or orbital stage is to be disposed of by re-entry into the atmosphere, debris that survives to reach the surface of the Earth should not pose an undue risk to people or property. (…) Also, ground environmental pollution, caused by radioactive substances, toxic substances or any other environmental pollutants resulting from on-board articles, should be prevented or minimised in order to be accepted as permissible." https://www.unoosa.org/documents/pdf/copuos/lsc/2017/tech-10.pdf
[69] In terms of membership, ITU has 193 Member States and over 900 companies, universities, research institutes and international and regional organizations.
[70] ITU-R: Managing the radio-frequency spectrum for the world. https://www.itu.int/en/mediacentre/backgrounders/Pages/itu-r-managing-the-radio-frequency-spectrum-for-the-world.aspx

Regulations facilitate equitable access to and rational use of the natural resources of the radio-frequency spectrum and associated satellite orbits. They also ensure the availability of the frequencies used for distress and safety purposes and assist in the prevention and resolution of cases of harmful interference between the radio services of different administrations. Furthermore, the Regulations facilitate the efficient and effective operation of all radio communication services and, where necessary, regulate new applications of radio communication technology. Despite their name, these Regulations are legally binding for ITU Member States.

3.1.4.2 Recommendation ITU-R S.1003.2. - Environmental protection of the geostationary-satellite orbit[71]

In addition to the binding norms contained in its Constitution, Convention and Radio Regulations, the ITU also adopts Recommendations constituting a set of international technical guidelines and standards. Although they are approved by ITU Member States, their implementation is not mandatory; yet the close involvement of Member State experts, industry and operators in their formulation does facilitate their implementation. One particularly relevant ITU-R Recommendation, addressed to Member States of the ITU, is Recommendation ITU-R S.1003.2 (12/2010) which provides guidance on disposal orbits for satellites in the geostationary-satellite orbit (GSO). The recommendations embodied in ITU-R S.1003.2 are:

- Recommendation 1: As little debris as possible should be released into the GSO region during the placement of a satellite in orbit.
- Recommendation 2: Every reasonable effort should be made to shorten the lifetime of debris in elliptical transfer orbits with the apogees at or near GSO altitude.
- Recommendation 3: Before complete exhaustion of its propellant, a geostationary satellite at the end of its life should be removed from the GSO region such that under the influence of perturbing forces on its trajectory, it would subsequently remain in an orbit with a perigee no less than 200 km above the geostationary altitude.
- Recommendation 4: The transfer to the graveyard orbit removal should be carried out with particular caution to avoid radio frequency interference with active satellites.

3.1.5 Codes of Conduct

3.1.5.1 European Code of Conduct for Space Debris Mitigation

The **European Code of Conduct for Space Debris Mitigation**[72] was signed in 2004 by the Italian Space Agency (ASI), the then British National Space Centre (BNSC), the French Space Agency (CNES), the German Aerospace Agency (DLR) and the European Space Agency (ESA). The EU was not involved in its formulation or adoption. The Code of Conduct aims to support the prevention of on-orbit break-ups and collisions of spacecraft, facilitate the removal from useful densely populated orbit regions and subsequent disposal of spacecraft and orbital stages that have reached the end of mission operations, and limit objects released during normal spacecraft operations. The Code of Conduct includes mitigation, safety and protection measures for the design and operation of space systems. These measures are grouped into five categories: management measures, design measures (including end-of-life measures), operational measures (including end-of-life measures), impact protection measures, and re-entry safety measures. The Code does not cover launch phase safety.

[71] Environmental protection of the geostationary-satellite orbit. https://www.itu.int/rec/R-REC-S.1003/en
[72] See: https://www.unoosa.org/documents/pdf/spacelaw/sd/2004-B5-10.pdf

The Code is accompanied by a Support to Implementation document which aims to direct those involved in the management, design, operation, and mission control to appropriate sources of information and tools to assist in implementing the Code of Conduct.

3.1.5.2 Draft International Code of Conduct for Outer Space Activities

The **Draft International Code of Conduct for Outer Space Activities**[73] is the result of an initiative to develop a voluntary non-binding code which enhances the safety, security, and sustainability of space activities initiated by the EU[74] and presented for discussion and wider adoption to other Member States of the UN on various occasions. According to Article 2, States should conduct space activities safely per "internationally accepted practices, operating procedures, technical standards and policies associated with the long-term sustainability of outer space activities". Moreover, States should establish and implement national frameworks that ensure the safety, security, and sustainability of space activities including space debris mitigation measures per the UN COPUOS Space Debris Mitigation Guidelines (Article 4).

The latest version of the Draft was presented in March 2014, and it has so far failed to gather sufficient support for adoption. The process revealed the limits of the EU's political sway in pushing international space law initiatives with both traditional allies and adversaries in the space diplomacy arena raising objections to the content and process of the Code. The Code is nevertheless relevant for revealing a certain level of consensus among EU Member States on transparency and confidence-building measures in space and best practices in terms of increasing space safety and sustainability as it was approved by all EU Member States before being submitted to the UN for wider discussion and adoption.

3.2 Existing standards related to space traffic management

This section describes international standards that are relevant for STM. They are grouped according to their content into three main categories: procedural standards – usually high-level –, data-related standards, and detailed technical standards. These standards cover space safety and sustainability while other standards, only briefly mentioned here, cover the environment.

For the desk research, the websites of ISO, CEN/CENELEC, ECSS, CCSDS, and other Standards Development Organisations have been screened. The most relevant ISO and CEN standards were purchased to analyse their content based on their description using keywords such as risk of collision, debris mitigation, safe space, risk assessment, etc. The abstract descriptions of each standard can be found in Annex B – Description of relevant standards.

3.2.1 Relevant standards for space safety and sustainability

This section lists standards relevant to space safety and sustainability. These standards form a family of standards that are interrelated and build upon each other from high-level standards to more detailed technical standards. Moreover, the standards take stock of the international treaties and conventions and develop UN COPUOS and IADC Guidelines and best practices further. This logic and interconnection are illustrated in the figure below[75]:

[73] See: https://data.consilium.europa.eu/doc/document/ST-17175-2008-INIT/en/pdf
[74] The Code was picked up under the French presidency in the second half of 2008 and a first draft text was agreed upon in the EU Council in December 2008.
[75] For reasons of clarity not all standards are mentioned in the figure.

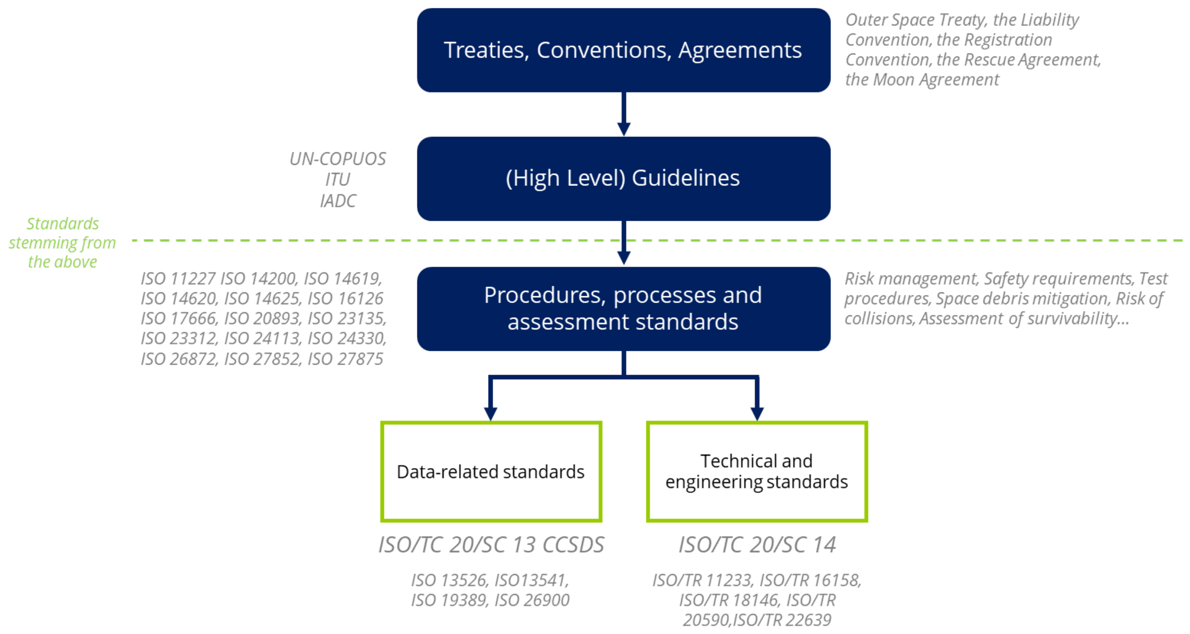

Figure 4 - Relationship between international guidelines and standards

3.2.1.1 Procedural standards (procedures, processes, and assessment)

This group includes standards that describe procedures, management processes and assessment approaches for avoiding collisions and debris, minimising risks, and assessing those risks and the survivability of satellites. The standards are developed under ISO/TC 20/SC 14 "Space systems and operations" and CEN-CENELEC/JTC 5.

- ISO 24113:2019 - Space systems — Space debris mitigation requirements
- ISO 20893:2021 - Space systems — Detailed space debris mitigation requirements for launch vehicle orbital stages
- ISO 23312:2022 - Space systems — Detailed space debris mitigation requirements for spacecraft
- ISO 23135:2022 - Space systems — Verification programme and management process
- ISO 14200:2021 - Space environment (natural and artificial) — Guide to the process-based implementation of meteoroid and debris environmental models (orbital altitudes below GEO + 2 000 km)
- ISO 17666:2016 - Space systems — Risk management
- ISO 16126:2014 - Space systems — Assessment of survivability of unmanned spacecraft against space debris and meteoroid impacts to ensure successful post-mission disposal
- ISO 11227:2012 (reviewed and confirmed in 2017) - Space systems — Test procedure to evaluate spacecraft material ejecta upon hypervelocity impact[76]
- ISO 14620-3:2021 - Space systems — Safety requirements — Part 3: Flight safety systems
- ISO 24330:2022 - Space systems — Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS) — Programmatic principles and practices.
- ISO 26872:2019 - Space systems — Disposal of satellites operating at geosynchronous altitude
- ISO 27852:2024 - Space systems — Estimation of orbit lifetime
- ISO 27875:2019 - Space systems — Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages[77]

[76] This standard will be replaced in due course by ISO/AWI 11227 - Space systems - Test procedure to evaluate spacecraft material ejecta upon hypervelocity impact (under development).
[77] This standard will be replaced by ISO/WD 27875 - Space systems - Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages (under development).

- ISO/CD 9490 – Space Traffic Coordination[78]
- ISO/TS 6434 - Space systems — Design, testing and operation of a large constellation of spacecraft
- ISO 14619:2023 – Space experiments – General requirements
- ISO 14625:2023 - Space systems — Ground support equipment for use at launch, landing or retrieval sites - General requirements
- EN 16604-10:2019 - Space sustainability — Space debris mitigation requirements (ISO 24113:2011, modified)

3.2.1.2 Data-related standards

To be able to track spacecraft, space actors need to collect and exchange data about them, and store and manage related information. The CCSDS (Consultative Committee for Space Data Systems) which is a space data-dedicated international standardisation body, develops these data-related standards. The ISO/TC 20/SC 13 "Space data and information transfer systems" also focuses on data while some data standards have also been developed in ISO/TC 20/ SC 14.

- ISO 26900:2012 - Space data and information transfer systems — Orbit data messages (is the same as CCSDS 502.0-B-2)[79]
- ISO 19389:2014 - Space data and information transfer systems — Conjunction data message (is the same as CCSDS 508.0-B-1)
- ISO 13526:2010 - Space data and information transfer systems — Tracking data message (is the same as CCSDS 503.0-B-1)
- ISO 13541:2021 - Space data and information transfer systems — Attitude data messages (is the same as CCSDS 504.0-B-1)
- EN 16604-30-03:2020 - Space Situational Awareness Monitoring — Part 30-03: Observation System Data Message (OSDM)

3.2.1.3 Technical and engineering standards

The following standards focus on testing guidelines before launch, space debris mitigation requirements and recommendations for the design and operation of spacecraft and launch vehicle orbital stages, as well as orbit determination and estimation techniques for operation planning. The standards are more detailed and focus often on operational aspects. These standards have been developed in ISO/TC 20/ SC 14 and CEN-CENELEC/JTC 5.

- ISO/TR 16158:2021 - Space systems — Avoiding collisions with orbiting objects
- ISO/TR[80] 18146:2020 - Space systems — Space debris mitigation design and operation manual for spacecraft[81]
- ISO/TR 20590:2021 - Space systems — Space debris mitigation design and operation manual for launch vehicle orbital stages
- ISO/TR 11233:2014 - Space systems — Orbit determination and estimation — Process for describing techniques
- ISO/TR 22639:2021 - Space systems – Design guidelines for multi-geo spacecraft collocation
- EN 16603-10-03:2022 - Space engineering – Testing
- CEN/CLC/TR 17603-10-03:2022 - Space engineering – Testing guidelines
- EN 16602-40:2018 - Space product assurance – Safety
- EN 16603-10-04:2021 - Space engineering – Space environment

[78] At the time of finalising this report, this Committee Draft was at the level of a New Work Item Proposal.
[79] This standard has been withdrawn and revised by ISO 26900:2024 (publication 02/2024)
[80] ISO Technical Report (TR) is an informative document containing data obtained from e.g., a survey, from an informative report, or information of the perceived "state of the art".
[81] This standard will be replaced by ISO/AWI TR 18146 - Space systems - Space debris mitigation design and operation manual for spacecraft (under development).

3.2.2 Relevant standards for environmental management

In 1996, ISO launched its environmental management system standard ISO 14001. The standard aims to provide tools for companies and organisations to help them identify and control their corporate environmental impact. In that sense, it is also applicable to organisations active in the space sector.

ISO 14001 and ISO 14040 are part of the ISO 14000 family of standards. ISO 14001 provides requirements related to environmental systems and includes some guidance. ISO 14040 provides a generic framework for life cycle assessment (LCA). Other standards in the family focus on specific approaches such as audits, communications, labelling and life cycle analysis, as well as environmental challenges such as Green House Gas Emissions. The ISO 14000 family of standards are developed by ISO Technical Committee ISO/TC 207 (68 published standards and 21 under development) and its various subcommittees (there are currently 6, SC 6 itself does not exist):

- SC 1 - Environmental management systems (12 standards)
- SC 2 - Environmental auditing and related environmental investigations (3 standards)
- SC 3 - Environmental labelling (8 standards)
- SC 4 - Environmental performance evaluation (9 standards)
- SC 5 - Life cycle assessment (16 standards)
- SC 7 - Greenhouse gas and climate change management and related activities (17 standards)

Examples of relevant standards are:

- ISO 14001:2015 - Environmental management systems — Requirements with guidance for use
- ISO 14040:2006 - Environmental management – Life cycle assessment Principles and framework
- ISO 14068-1:2023 - Climate change management — Transition to net zero — Part 1: Carbon neutrality

3.2.3 Relevant standards for the preservation of dark and quiet skies

Research undertaken as part of this study revealed that no international standards addressing challenges related to the preservation of dark and quiet skies currently exist.

3.3 Industry-led initiatives promoting the use of standards, guidelines and best practices that support space traffic management

Space traffic management is gaining importance and urgency as it is a crucial aspect to ensure the continued safety and sustainability of increasing space activities. Over the years, various industry-led initiatives have been developed to foster good behaviour when it comes to space traffic management. These include guidelines, best practices, lessons learnt, de facto standards from the industry, public-private partnerships, and international bilateral/multilateral regulations and agreements.

At a high level, these initiatives address:

- conducting regular space situational awareness (SSA) and orbital debris mitigation activities to reduce the risk of collisions between objects in space;
- developing and implementing communication protocols to ensure safe and efficient coordination of space activities;
- establishing guidelines and best practices for satellite launch and re-entry operations to minimise the impact on the environment and surrounding communities;

- collaborating with other industry stakeholders and regulatory bodies to develop international standards and best practices for space traffic management;
- establishing clear lines of communication and coordination both between private space actors and public agencies with STM-related responsibilities;
- developing contingency plans and response protocols to address potential space debris collisions or other emergencies; and
- developing standards for sustainable propulsion systems and technologies to reduce environmental impacts.

The sections below intend to showcase some of the most relevant examples of industry-led initiatives compiling guidelines, best practices, lessons learned, de facto standards from the industry, public-private partnerships, and international bilateral/multilateral regulations and agreements.

3.3.1 Space Data Association

The **Space Data Association (SDA)**[82], established in 2009, is an international association that includes both public and private civil, commercial, and military spacecraft operators collaborating to ensure a controlled, reliable, and efficient **space environment**, playing a significant role in promoting space traffic management and improving space situational awareness.

With over 40 satellite operators as members, accounting for more than 60% of GEO satellites (i.e., satellites in orbit at 35 785 km above the Earth), the SDA has developed a set of best practices for space traffic management that its members are expected to follow. These best practices include sharing data on satellite orbits, providing advanced warning of potential collisions, and deorbiting satellites at the end of their life.

Furthermore, the SDA **encourages its members to adopt international STM standards** and collaborate with other satellite operators and STM providers. This encourages satellite-to-satellite communication to improve the accuracy and timeliness of collision warnings, contributing to the mitigation of risks associated with space operations and promoting the long-term viability of commercial satellite services.

Additionally, the SDA promotes the disposal of satellites at the end of their operational lives, minimising the risk of collision and growth of space debris. Guidelines for deorbiting satellites in a controlled manner and minimising the potential for fragmentation are part of the SDA best practices.

3.3.2 Space Safety Coalition Handbook on "Best Practices for the Sustainability of Space Operations"

The Space Safety Coalition (SSC) is an industry-led consortium comprising organisations and companies committed to promoting the safety and sustainability of space operations. Established in 2019, the SSC has gained the endorsement of over 60 international industry players, including satellite operators, spacecraft manufacturers, and launch providers.

The primary objective of the SSC is to develop a set of best practices and guidelines for space traffic management. It addresses gaps in current space governance by publishing, coordinating, and updating a **"Best Practices for the Sustainability of Space Operations" handbook**[83]. This living document promotes better spacecraft design, operations, and disposal practices to ensure the long-term sustainability of space operations. It refers explicitly to the UN COPUOS and IADC Guidelines and the application of ISO 24113:2019 "Space Systems — Space Debris Mitigation" standard.

[82] Welcome to the Space Data Association - Space Data Association (space-data.org)
[83] Endorsement-of-Best-Practices-for-Sustainability_v10-002.pdf (spacesafety.org)

A key aspect of the handbook is risk management in space activities, from risk identification and analysis to risk mitigation. This focus helps to ensure that space activities are conducted safely and responsibly. The document also offers case studies and examples, facilitating the understanding and effective implementation of the guidelines and best practices. Endorsing companies have expressed their support for SSC efforts to promote space safety and sustainability, committing to implementing the guidelines and best practices in their space operations.

3.3.3 Net Zero Space initiative

Net Zero Space is an industry-led initiative[84] launched in 2020 which aims to promote sustainability in the space sector. It is a global, multi-stakeholder platform that gathers actors from across the space value chain[85] to raise awareness of the need to protect the Earth's orbital environment. **A key goal of the initiative is to develop standards for sustainable space operations**, including standards for reducing space debris and sustainable propulsion systems. In practice, it rather promotes the use of guidelines (UN COPUOS, IADC, ITU) and international standards (ISO). It also encourages the development of new technologies to reduce the environmental impact of space activities.

The **Net Zero Space Declaration**[86] is a call for action endorsed by 59 actors from 24 countries urging a global commitment to achieving sustainable outer space use for the benefit of all humankind by 2030. Endorsing stakeholders commit to taking tangible actions according to their operational scale and means to contribute to the "Net Zero Space" goal. In 2022, two working groups developed action-oriented policy recommendations[87] [88] presented at the fifth edition of the Paris Peace Forum. These recommendations focus on enhancing regulations and public policy regarding space debris mitigation and remediation, as well as on developing reference modelling to assess the risks of collision in orbit.

3.3.4 Space Sustainability Rating

The **Space Sustainability Rating (SSR)**[89] is a rating system developed by the World Economic Forum (WEF), the European Space Agency (ESA), the Massachusetts Institute of Technology (MIT), and other organisations. It is led and operated by the École Polytechnique Fédérale de Lausanne (EFPL) Space Center (eSpace). The SSR aims to provide a framework for assessing and improving the in-orbit sustainability of space activities, considering factors such as orbital debris mitigation, collision avoidance, and end-of-life disposal.

The SSR evaluates space missions based on compliance with sustainability criteria and assigns ratings from A (highest) to E (lowest). The rating methodology involves a composite indicator approach that considers both short-term and long-term effects on operators and the environment. Satellite operators can subscribe to receive up to 10 ratings annually for their missions. The SSR team also provides support to improve an operator's mission sustainability. While the SSR can be used to assess any stage of a space mission, its ratings are specific to the assessed phase only as different mission phases may have varying impacts and requirements.

The **SSR is based on principles outlined in the UN Guidelines** and examines specific decisions about design, operations, and post-mission disposal. Organisations can join the SSR as association members to contribute to the rating system and support communication and policy efforts. By participating in the rating system, spacecraft operators, launch service providers, and satellite

[84] FAQs | Net Zero Space (netzerospaceinitiative.org)
[85] The entire sequence of activities and processes involved in the space industry, from the conception and design of space missions and spacecraft to their launch, operation, and utilisation in space. It encompasses the different stages and components necessary to make space missions and operations possible.
[86] Net Zero Space Initiative Calls for Protecting Earth Orbit's Environment – SpacePolicyOnline.com
[87] 2022 Working Group 1 - Fostering Better and More Interoperable Norms: Comparing Existing Binding National Requirements Relating to Space Debris
[88] 2022 Working Group 2 - Developing a Reference Modelling to Assess Risks of Collision in Orbit
[89] Space Sustainability Rating – Promoting Sustainable Behavior of Space Actors

manufacturers can showcase the sustainability levels of their mission. The SSR has been endorsed by UNOOSA and the IAF (International Astronautical Federation). Several companies actively support the SSR concept and express interest in participating.

3.3.5 ESA Close Proximity Operations Working Group

Since December 2019, the **Close Proximity Operations Working Group** (CPOWG) is a collaborative effort between the European Space Agency (ESA) and European industry (space system integrators, space equipment suppliers, operators, insurers, national agencies, and Universities) to **develop guidelines, best practices, and standards** for safe and efficient close proximity operations[90] in space. It focuses on operations in space that involve spacecraft manoeuvring in close proximity to each other or to space debris. This includes topics such as rendezvous, docking, debris proximity, and in-orbit servicing. Its objectives are to[91]:

- exchange information at the European level to ensure a level playing field for all stakeholders (e.g., national space agencies, system integrators and suppliers, operators, insurers, and universities);
- define a CPO glossary/boundary of applicability;
- **prepare safety/sustainability guidelines** (e.g., technical, operational, verification and validation) for non-human related missions involving rendezvous up to capture;
- provide visibility on the results of CPOWG activities to the European space community and industry;
- **contribute to the development** of worldwide Rendezvous and Proximity Operations and On-Orbit Services implementation standards **in the framework of ISO 24330**.

3.3.6 ESA Space Debris Mitigation Policy for Agency Projects

The Space Debris Mitigation Policy for Agency Projects which entered into force in March 2014 **aligned ESA's space debris policy to ISO standard 24113** adopted by the ECSS as **ECSS-U-AS-10C**. The document establishes ECSS-U-AS-10C as the standard for the technical requirements on space debris mitigation for ESA projects, lays out the principles governing its implementation, and defines the associated international responsibilities. The policy is applicable to the procurement of all ESA space systems as well as to the operations of any space system under ESA's responsibility. The policy contains an annex on Implementation Requirements which define a set of requirements for the limitation of space debris and a set of risk reduction measures in case of re-entries of space systems or their components into the Earth's atmosphere including the definition of a maximum acceptable casualty risk for ESA systems.

The European Code of Conduct for Space Debris Mitigation, the IADC Space Debris Mitigation Guidelines, and the UN COPUOS Space Debris Mitigation Guidelines are referenced in this Policy. The technical requirements set out in the policy are aligned with ISO standard 24113.

ESA updated its Space Debris Mitigation Policy for Agency Projects in 2022 applying the latest ISO standard on space debris mitigation requirements (ISO 24113:2019)[92] as contained in ECSS-U-AS-10C, Rev.1.

[90] Close proximity operations refer to any activities between two spacecraft in relatively close area.
[91] ESA publishes Guidelines for Safe Close-Proximity Operations – The Clean Space blog
[92] In the meantime, there is a new version of this standard (2023)

3.3.7 ESA Life Cycle Assessment Handbook

Efforts to evaluate the environmental impact of the space sector have been sparse, with ESA taking a lead role in developing Life Cycle Assessment (LCA) tools specific to space activities.[93] In addition to dedicated studies addressing the unique space-related aspects, ESA published the first worldwide guidelines on how to perform LCA of space systems. These guidelines were tailored to fit the unique challenges of space activities, requiring special adjustments to standard LCA methods outlined in ISO 14040 and ISO 14044. ESA's pioneering efforts in analysing and quantifying environmental impacts in the space sector led to the publication of an **ESA LCA Handbook** in 2017 which explains how to use this adapted approach.

The Handbook aligns with UN Sustainable Development Goals addressing targets like achieving sustainable resource management, reducing waste generation, and promoting sustainable business practices.[94] However, it is important to note that while the ESA LCA Handbook represents a pioneering effort in applying LCA to space missions, it does have certain **limitations**. Most notably, it requires **infrastructure impacts to be evaluated separately from main operations** but divided per life cycle stage which aligns with PEF standards. However, most LCA studies combine infrastructure impacts with related processes, diverging from ESA's approach. Additionally, many LCA software programs do not support separate evaluations of infrastructure impacts making compliance with the ESA Handbook challenging or impossible in practice[95]. There are also challenges related to data availability and uncertainties, difficulties in defining scope and boundaries, the potential for outdated information over time, and the need for careful interpretation of results.

3.3.8 CONFERS "Guiding Principles for Commercial Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS)"

Established in 2016, the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS) is a public-private partnership comprising industry partners such as Airbus, Astroscale, AGI, Lockheed Martin, OneWeb, and TAS. Led by the U.S. Defence Advanced Research Projects Agency (DARPA), CONFERS focuses on **developing guidelines and best practices** for on-orbit satellite servicing, debris removal, and space-based rendezvous and proximity operations (OOS&R activities) to promote responsible space operations and space traffic management.

CONFERS has produced several key documents, including the "**Guiding Principles for Commercial Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS)**"[96] and the "**CONFERS Recommended Design and Operational Practices**". These documents outline responsible norms of behaviour, recommended practices, and mission phases for OOS&R activities, aiming to minimise the risk of generating space debris. By engaging stakeholders from across the industry, these documents aim to develop consensus on OOS&R activities, including common terminology, recommended practices, and a certification process for OOS&R missions. This collaboration helps to ensure that OOS&R activities are conducted safely and in compliance with existing STM guidelines and standards, contributing to the long-term sustainability of space activities.

CONFERS was actively involved in the development of ISO 24330 – Space Systems – Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS) – Programmatic principles and practices.

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[93] Ariaudo, P., Analysis of the consequences of the EU's environmental framework on space activities and options toward promoting greener space activities in Europe: Green Space, 2014
[94] See: https://sdg.esa.int/activity/esa-lca-database-and-handbook-framework-life-cycle-assessment-space-4854
[95] De Schryver, A. et al., "Supporting the Green Deal ambitions applied to EU space activities". European Commission.
[96] CONFERS-briefing-to-STSC_FINAL_5Feb2020.pdf (satelliteconfers.org)

3.3.9 Commercial Space Operations Safety Task Force

The **Commercial Space Operations Safety Task Force (CSOSTF)**[97] was established in 2010 by the U.S. Federal Aviation Administration (FAA) to support the safe and sustainable growth of the commercial space industry. It is composed of a group of experts from the commercial space industry, academia, and government agencies who work together to **develop safety standards and best practices** for commercial space operations.

The CSOSTF is made up of several working groups, each focused on a specific area of space operations. These working groups include the Launch Safety Working Group, the Vehicle Safety Working Group, the Ground Safety Working Group, and the Re-entry Safety Working Group. Each working group is led by a team of industry experts who work together to develop safety guidelines and best practices for their respective areas of focus. These **guidelines** cover a wide range of topics, including launch safety, space vehicle design, orbital safety, and re-entry safety. The CSOSTF also works to develop safety standards for ground operations including manufacturing, testing, and servicing of space vehicles. These standards establish safety rules and other safety processes, analyses and products which must comply with FAA regulations.

It is ambiguous whether the CSOSTF's safety standards are entirely new creations or if they primarily contribute to and endorse existing ISO standards in compliance with FAA regulations.

3.3.10 Bilateral and multilateral agreements

While several countries with space capabilities have signed bilateral agreements to promote cooperation and coordination on space traffic management, also **several private entities operating in space have started drafting and committing to bilateral or even multilateral agreements**.

One key bilateral agreement is the **SpaceX and NASA Joint Spaceflight Safety Agreement**[98] signed in 2015 which established guidelines for the safe and responsible use of space. The Agreement includes requirements for pre-launch planning and analysis, real-time monitoring of space operations, and post-flight reporting and analysis. It also includes provisions for the exchange of data and cooperation between SpaceX and NASA to ensure the safety and sustainability of space operations. The Agreement has been updated several times since its initial signing to reflect changes in the space industry and new developments in space sustainability.

The U.S. also has commercial and country/intergovernmental agreements regarding Space Situational Awareness data-sharing. **USSPACECOM's Space Situational Awareness sharing programme** enhances the safety, stability, security, and sustainability of spaceflight for all by allowing for a more transparent window into the orbits. USSPACECOM holds more than 170 Space Situational Awareness sharing agreements with partners from the commercial sector, academia, and foreign and intergovernmental agencies.[99]

One of the most prominent multilateral and multinational agreements between satellite operators is the **Satellite Orbital Safety Best Practices Guide**[100] developed by Iridium, OneWeb, SpaceX, and the American Institute of Aeronautics and Astronautics (AIAA) to promote the safety and sustainability of space operations. The guide includes best practices for satellite design, launch, and operation, as well as for collision avoidance and debris mitigation. It also includes recommendations for sharing orbital data and for cooperating with other space actors to ensure safe and responsible use of space.

[97] https://www.faa.gov/space
[98] https://www.nasa.gov/news-release/nasa-spacex-sign-joint-spaceflight-safety-agreement/
[99] https://www.unoosa.org/pdf/pres/stsc2012/tech-40E.pdf and https://www.dvidshub.net/news/443933/usspacecom-polish-ministry-national-defence-and-polish-space-agency-sign-space-situational-awareness-sharing-agreement
[100] https://www.aiaa.org/news/news/2022/09/08/aiaa-iridium-oneweb-spacex-release-satellite-orbital-safety-best-practices-reference-guide

3.4 Other initiatives for the promotion of standards, guidelines and best practices supporting space traffic management

In this section, we will explore additional initiatives that play a significant role in promoting standards, guidelines, and best practices supporting space traffic management. These initiatives, developed by various organisations and associations, complement existing frameworks and further support the global effort to conduct safe and sustainable space activities.

3.4.1 International Association for the Advancement of Space Safety

Founded in 2004 in Noordwijk, Netherlands, the **International Association for the Advancement of Space Safety (IAASS)**[101] is a non-profit professional organisation that promotes space safety through research, education, and advocacy. The IAASS brings together more than 200 experts from 25 countries with 55% of the members coming from industry and the remaining 45% from academia, space agencies and government institutions intending to share knowledge and develop a set of **guidelines and best practices** for space traffic management including the use of space situational awareness (SSA) data, orbital debris mitigation, and collision avoidance strategies.

One of the primary goals of the IAASS is to contribute to standards development, reports and position papers for space safety covering a wide range of topics, including launch safety, spacecraft design and operation, and space debris mitigation. They are intended to provide a framework for ensuring the safety of space operations and promoting the responsible use of space. The IAASS is promoting the establishment of a commercial Space Safety Institute to offer safety certification services on a commercial basis.

The applicable safety requirements are defined in **IAASS-SSI-1700 Space Safety Standard**: "Commercial Human-Rated Systems Certification"[102]. These requirements are intended to protect flight personnel (i.e., crew and flight participants), the vehicle and relevant launcher, carrier or other interfacing systems from spaceflight hazards. The IAASS standard, drawing on over 60 years of government space programs experience, encompasses both technical and programmatic requirements. These requirements are designed to be used in tandem as demonstrated in previous space programs including the Commercial Crew Program[103]. The programmatic requirements include design process requirements and requirements for independent verification of compliance.

The IAASS works closely with other industry groups, government agencies, and international organisations to promote the safety and sustainability of space operations.

3.4.2 Secure World Foundation Handbook for New Actors in Space

The **Secure World Foundation (SWF)**[104] is a non-profit organisation dedicated to promoting the peaceful and sustainable use of space for the benefit of humanity. The organisation was founded in 2002 and is based in Broomfield, Colorado, USA. It has collaborated with a wide range of stakeholders including governments, international organisations and industry leaders in the space sector to develop and promote best practices for space governance and to ensure that space activities are conducted in a safe, sustainable, and responsible manner.

[101] HOME | IAASS
[102] STANDARDS | IAASS
[103] The Commercial Crew Program (CCP) provides commercially operated crew transportation service to and from the International Space Station (ISS) under contract to NASA, conducting crew rotations between the expeditions of the International Space Station program. See: https://www.nasa.gov/exploration/commercial/crew/index.html
[104] Promoting Cooperative Solutions for Space Sustainability | Secure World (swfound.org)

The SWF has developed several **guidelines and best practices** related to space traffic management, an area in which it is particularly active, including guidelines for safe and sustainable activities in space, best practices for satellite operations and recommendations for improving space situational awareness.

The **SWF Handbook for New Actors in Space**[105] is a comprehensive guide for countries and organisations that are new to the field of space activities. It provides practical guidance on a wide range of topics related to space activities including space law, policy, and governance. It is designed to help new actors understand the complex regulatory and legal environment of space activities and to provide them with the tools and resources they need to navigate this environment effectively. One of the key features of the handbook is its focus on sustainable and responsible space activities. The handbook emphasises the importance of safe and sustainable activities in space including the need to mitigate space debris and avoid collisions with other space objects. It also includes guidance on fundamental principles, laws, norms, and best practices for peaceful, safe, and responsible activities in space. The handbook is available online and is regularly updated to reflect new developments and changes in the industry. It includes a range of resources, including case studies, best practices, and checklists, that are designed to help new actors implement the guidance effectively.

3.4.3 Space Safety Institute Compendium

The **Space Safety Institute (SSI)**[106] is a non-profit organisation that focuses on promoting the safe and responsible use of space. The institute was established in 2017 and is based in Colorado, USA. It conducts research, provides education and training, and develops **guidelines and best practices** related to space safety and space traffic management including space situational awareness, collision avoidance, satellite tracking, and debris mitigation. It also collaborates with other organisations including NASA and the U.S. Department of Defence on space safety initiatives.

The **Space Safety Institute Compendium**[107] is a collection of resources and guidelines related to space safety that has been developed by the SSI. It is a comprehensive resource that offers guidelines on a wide range of space safety issues including space debris, human factors in space operations, and the use of space for scientific and commercial purposes. It also includes best practices and **guidelines based on the latest research and industry standards** that are regularly updated to reflect new developments and changes in the industry. One of the key features of the Compendium is its focus on interdisciplinary collaboration: The guidelines and best practices included in the Compendium are developed through a collaborative process that involves experts from different fields including engineering, physics, psychology, and law. This interdisciplinary approach helps to ensure that the guidelines and best practices are comprehensive and effective. The Compendium is also designed to be accessible and user-friendly. It includes a range of resources including checklists, templates, and case studies designed to help individuals and organisations implement the guidelines and best practices effectively. The Compendium is also available online, making it easy to access and use.

3.4.4 EU Industry and Start-ups Forum on Space Traffic Management

The **European Union Industry and Start-ups Forum on Space Traffic Management (EISF)**[108] is an initiative of the European Commission launched in 2022 that brings together representatives from the EU space industry and start-up community to discuss and develop solutions for the challenges of STM. It is a platform for the exchange of ideas and best practices and provides opportunities for networking and collaboration among industry stakeholders. The EISF covers a wide range of topics

[105] Handbook for New Actors in Space | Secure World (swfound.org)
[106] Space Safety Institute | The Aerospace Corporation
[107] 2022 Space Safety Compendium | The Aerospace Corporation
[108] https://defence-industry-space.ec.europa.eu/eu-space-policy/space-traffic-management/space-traffic-management-stakeholder-mechanism_en

related to STM including space situational awareness, collision avoidance, and debris mitigation. It also focuses on emerging trends and technologies in the field of STM such as the use of artificial intelligence and machine learning to enhance space situational awareness. One of the key EISF goals is to foster innovation and entrepreneurship in the field of STM. It provides start-ups with opportunities to showcase their innovative ideas and technologies and to connect with potential investors and customers. The EISF is an important initiative for promoting the development of STM solutions in the EU. By bringing together industry and start-up stakeholders, it helps to promote collaboration and innovation in the field of STM and to ensure that the EU remains at the forefront of developments in this important area.

3.4.5 European Commission Recommendation on Product Environmental Footprint methods

In December 2021, the Commission adopted the Recommendation on Product Environmental Footprint and Organisation Environmental Footprint methods as a common way to measure environmental impacts of products and organisations, respectively. The recommendation states that "the Environmental Footprint methods measure and communicate about the environmental performance of products (both goods and services) and organisations across their whole lifecycle, relying on scientifically sound assessment methods agreed at international level. The use of the Environmental Footprint methods is already established in the context of EU policies and legislation."[109]

However, the **distinctive activities** and **limited production quantities** within the space industry present several challenges for assessing environmental impact. Processes like launching, stage disposal, and spacecraft decommissioning do not neatly fit into any of the existing standardised methods for measuring environmental footprint. Much of the sector's activities fall outside the scope of existing methodologies, and there is currently insufficient empirical data, particularly at the component level, to support the modelling and generalization required by these methodologies. Consequently, the European Commission's Product Environmental Footprint (PEF) and Organization Environmental Footprint (OEF) methodologies are, at first sight, deemed unsuitable as such for the space sector.[110] However, the refinement of the PEF method over the years and the possibility to develop a sector-specific method based on PEF – a Product Environmental Footprint Categories Rules (PEFCR) – may allow to address the specificities of the space sector. This opens the possibility for having a method that encapsulates the challenges of space activities on what concerns LCA.

3.4.6 International Astronomical Union

Established in 1919, the **International Astronomical Union (IAU)**'s mission encompasses promoting and safeguarding astronomy through international collaboration. Its membership consists of professional astronomers from 92 countries engaged in research, education, and outreach. Its responsibilities include defining astronomical and physical constants and establishing clear astronomical nomenclature. Additionally, it plays a role in discussing future international astronomical facilities. The United Nations, in its 1982 UN Resolution 13, recognised the IAU's authority to assign designations to celestial bodies and surface features[111].

The IAU actively promotes best practices for maintaining dark and quiet skies. Its **Global Outreach Project**[112] specifically focused on Dark and Quiet Skies aims to raise awareness about the significance of preserving night skies for cultural, heritage, health, ecological, and astronomical research purposes.

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[109] European Commission. Environmental footprint methods. See: https://environment.ec.europa.eu/news/environmental-footprint-methods-2021-12-16_en

[110] Ariaudo, P., Analysis of the consequences of the EU's environmental framework on space activities and options toward promoting greener space activities in Europe: Green Space, 2014, p.

[111] https://unstats.un.org/unsd/geoinfo/ungegn/docs/4th-uncsgn-docs/4-uncsgn-rpt-en.pdf

[112] https://www.iau.org/public/darkskiesawareness/

Furthermore, the IAU, along with other organisations, has made efforts to involve the UN in the protection of dark and quiet skies. They submitted a working paper to UN COPUOS emphasising the need for international cooperation to address growing threats to the night sky from human activities[113].

The IAU's **Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference** (IAU CPS) is a global entity co-hosted by the NSF's NOIRLab[114] (USA) and the SKA Observatory (SKAO)[115]. The Centre coordinates international efforts to mitigate the impact of satellite constellations on astronomy[116]. Within the IAU, the **Executive Committee Working Group on Dark and Quiet Sky Protection**[117] focuses on reducing and preventing artificial sky glow and radio-frequency interference. It collaborates with the IAU-UNESCO initiative for World Heritage astronomical sites emphasising the protection of skies for astronomical observations across all wavelengths.

3.4.7 American Astronomical Society

The **American Astronomical Society (AAS)** founded in 1899 and headquartered in Washington, DC is an influential international body in astronomy. It brings together around 8,200 members encompassing professional astronomers, educators in astronomy, and enthusiastic amateur astronomers. With a mission centred on advancing and disseminating humanity's scientific understanding of the universe, it is committed to fostering a diverse and inclusive community within the field of astronomy. A key focus of the AAS is the promotion and protection of dark and quiet skies. The AAS issues general recommendations and organises events to propagate best practices in this area, engages in discussions and initiatives that highlight the importance of preserving the natural night sky. The AAS, in partnership with the National Science Foundation's NOIRLab[118], has been proactive in addressing the challenges posed by satellite constellations. It hosted the **Satellite Constellations 1** (SATCON1[119]) workshop in 2020, a virtual gathering of diverse stakeholders including astronomers, satellite operators, and policymakers. This workshop aimed to understand and quantify the impacts of large satellite constellations on astronomy and the night sky experience. Building on this, the **Satellite Constellations 2** (SATCON2) workshop in 2021 focused on implementing strategies to mitigate these impacts[120]. Throughout these workshops, the AAS led discussions on various threats to dark and quiet skies such as the reflection of sunlight from satellites and debris, the overcrowding of space orbits, radiofrequency interferences, and challenges arising from the (limited) radiofrequency spectrum for astronomers.

The table below offers a categorisation matrix of various instruments pertinent to space traffic management discussed in the preceding subsections. This categorisation matrix differentiates between instruments focused on safety and/or sustainability underlining their respective areas of impact. Additionally, these instruments are classified based on their relevance to either the Earth's environment or the space environment, a key distinction in the context of sustainable efforts. Another aspect of this analysis is the identification of the primary targets of these guidelines, be they countries, companies or products, helping to elucidate their scope and specificity. Finally, the matrix distinguishes these instruments by their binding nature, separating those that mandate compulsory actions from those suggesting voluntary practices.

[113] https://www.iau.org/news/announcements/detail/ann22010/
[114] https://noirlab.edu/public/about/light-pollution/work-with-the-iau/
[115] https://cps.iau.org/about/
[116] https://cps.iau.org/news/new-radio-astronomical-observations-confirm-unintended-electromagnetic-radiation-emanating-from-large-satellite-constellations/
[117] https://www.iau.org/science/scientific_bodies/working_groups/286/
[118] https://noirlab.edu/public/
[119] https://aas.org/satellite-constellations-1-workshop
[120] https://aas.org/sites/default/files/2022-06/Satcon%20Leave-Behind%20Final.pdf

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
International guidelines and best practices to ensure sustainable and safe space activities				
UNGA Resolution 68/74	Sustainability Safety	Space environment	Countries	Non-binding
UN COPUOS Space Debris Mitigation Guidelines	Sustainability Safety	Space environment	Countries	Non-binding
UN COPUOS Guidelines for the Long-Term Sustainability of Outer Space Activities	Sustainability Safety	Space environment	Countries	Non-binding
IADC Space Debris Mitigation (SDM) Guidelines	Sustainability Safety	Space environment	Countries	Non-binding
IADC Protection Manual	Sustainability Safety	Space environment	Countries	Non-binding
Support to the IADC Space Debris Mitigation Guidelines	Sustainability Safety	Space environment	Countries	Non-binding
IADC Statement on Large Constellations in Low Earth Orbit	Sustainability Safety	Space environment	Countries	Non-binding
ITU regulations on spectrum use (radio regulations)	Safety	Space environment	Countries	Binding for acceding countries
Recommendation ITU-R S.1003.2. - Environmental protection of the geostationary-satellite orbit	Sustainability Safety	Space environment	Countries	Non-binding
European Code of Conduct for Space Debris Mitigation	Sustainability Safety	Space environment	Countries	Non-binding

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
Draft International Code of Conduct for Outer Space Activities	Sustainability Safety	Space environment	Countries	Non-binding
Existing standards related to space safety, environmental sustainability, and dark and quiet skies				
ISO 24113:2019 - Space systems — Space debris mitigation requirements	Sustainability Safety	Space environment	Products	Non-binding
ISO 20893:2021 - Space systems — Detailed space debris mitigation requirements for launch vehicle orbital stages	Sustainability Safety	Space environment	Products	Non-binding
ISO 23312:2022 - Space systems — Detailed space debris mitigation requirements for spacecraft	Sustainability Safety	Space environment	Products	Non-binding
ISO 23135:2022 - Space systems — Verification programme and management process	Sustainability Safety	Space environment	Products	Non-binding
ISO 14200:2021 - Space environment (natural and artificial) — Guide to the process-based implementation of meteoroid and debris environmental models (orbital altitudes below GEO + 2 000 km)	Sustainability Safety	Space environment	Products	Non-binding
ISO 17666:2016 - Space systems — Risk management	Sustainability Safety	Space environment	Products	Non-binding
ISO 16126:2014 - Space systems — Assessment of survivability of unmanned spacecraft against space debris and meteoroid impacts to ensure successful post-mission disposal	Sustainability Safety	Space environment	Products	Non-binding
ISO 11227:2012 (reviewed and confirmed in 2017) - Space systems — Test procedure to evaluate spacecraft material ejecta upon hypervelocity impact[121]	Safety	Space environment	Products	Non-binding

[121] This standard will be replaced in due course by ISO/AWI 11227 - Space systems - Test procedure to evaluate spacecraft material ejecta upon hypervelocity impact (under development).

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
ISO 14620-3:2021 - Space systems — Safety requirements — Part 3: Flight safety systems	Safety	Space environment	Products	Non-binding
ISO 24330:2022 - Space systems — Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS) — Programmatic principles and practices.	Sustainability Safety	Space environment	Products	Non-binding
ISO 26872:2019 - Space systems — Disposal of satellites operating at geosynchronous altitude	Sustainability Safety	Space environment	Products	Non-binding
ISO 27852:2024 - Space systems — Estimation of orbit lifetime	Sustainability Safety	Space environment	Products	Non-binding
ISO 27875:2019 - Space systems — Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages[122]	Sustainability Safety	Space environment	Products	Non-binding
ISO/CD 9490 – Space Traffic Coordination[123]	Sustainability Safety	Space environment	Products	Non-binding
ISO/TS 6434 - Space systems — Design, testing and operation of a large constellation of spacecraft	Sustainability Safety	Space environment	Products	Non-binding
ISO 14619:2023 – Space experiments – General requirements	Sustainability Safety	Space environment	Products	Non-binding
ISO 14625:2023 - Space systems — Ground support equipment for use at launch, landing or retrieval sites - General requirements	Sustainability Safety	Space environment	Products	Non-binding
EN 16604-10:2019 - Space sustainability — Space debris mitigation requirements (ISO 24113:2011, modified)	Sustainability Safety	Space environment	Products	Non-binding

[122] This standard will be replaced by ISO/WD 27875 - Space systems - Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages (under development).
[123] At the time of finalising this report, this Committee Draft was at the level of a New Work Item Proposal.

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
ISO 26900:2012 - Space data and information transfer systems — Orbit data messages (is the same as CCSDS 502.0-B-2)[124]	Sustainability Safety	Space environment	Products	Non-binding
ISO 19389:2014 - Space data and information transfer systems — Conjunction data message (is the same as CCSDS 508.0-B-1)	Sustainability Safety	Space environment	Products	Non-binding
ISO 13526:2010 - Space data and information transfer systems — Tracking data message (is the same as CCSDS 503.0-B-1)	Sustainability Safety	Space environment	Products	Non-binding
ISO 13541:2021 - Space data and information transfer systems — Attitude data messages (is the same as CCSDS 504.0-B-1)	Sustainability Safety	Space environment	Products	Non-binding
EN 16604-30-03:2020 - Space Situational Awareness Monitoring — Part 30-03: Observation System Data Message (OSDM)	Sustainability Safety	Space environment	Products	Non-binding
ISO/TR 16158:2021 - Space systems — Avoiding collisions with orbiting objects	Sustainability Safety	Space environment	Products	Non-binding
ISO/TR[125] 18146:2020 - Space systems — Space debris mitigation design and operation manual for spacecraft[126]	Sustainability Safety	Space environment	Products	Non-binding
ISO/TR 20590:2021 - Space systems — Space debris mitigation design and operation manual for launch vehicle orbital stages	Sustainability Safety	Space environment	Products	Non-binding
ISO/TR 11233:2014 - Space systems — Orbit determination and estimation — Process for describing techniques	Sustainability Safety	Space environment	Products	Non-binding
ISO/TR 22639:2021 - Space systems – Design guidelines for multi-geo spacecraft collocation	Sustainability Safety	Space environment	Products	Non-binding

[124] This standard has been withdrawn and revised by ISO 26900:2024 (publication 02/2024)
[125] ISO Technical Report (TR) is an informative document containing data obtained from e.g., a survey, from an informative report, or information of the perceived “state of the art”.
[126] This standard will be replaced by ISO/AWI TR 18146 - Space systems - Space debris mitigation design and operation manual for spacecraft (under development).

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
EN 16603-10-03:2022 - Space engineering – Testing	Sustainability Safety	Space environment	Products	Non-binding
CEN/CLC/TR 17603-10-03:2022 - Space engineering – Testing guidelines	Sustainability Safety	Space environment	Products	Non-binding
EN 16602-40:2018 - Space product assurance – Safety	Sustainability Safety	Space environment	Products	Non-binding
EN 16603-10-04:2021 - Space engineering – Space environment	Sustainability Safety	Space environment	Products	Non-binding
ISO 14001:2015 - Environmental management systems — Requirements with guidance for use	Sustainability	Earth environment	Companies	Non-binding
ISO 14040: 006 - Environmental management – Life cycle assessment	Sustainability	Earth environment	Products	Non-binding
ISO 14068-1:2023 - Climate change management — Transition to net zero — Part 1: Carbon neutrality	Sustainability	Earth environment	Companies[127] and products	Non-binding
Industry-led initiatives for the promotion of standards, guidelines and best practices				
Space Data Association (SDA)	Sustainability Safety	Space environment	Companies or products	Non-binding
Space Safety Coalition (SSC) Handbook “Best Practices for the Sustainability of Space Operations”	Sustainability Safety	Space environment	Companies or products	Non-binding
Net Zero Space initiative	Sustainability	Space environment	Companies or products	Non-binding

[127] And other types of organisations.

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
Space Sustainability Rating (SSR)	Sustainability	Space environment	Companies or products	Non-binding
ESA Close Proximity Operations Working Group (CPOWG)	Sustainability Safety	Space environment	Companies or products	Non-binding
ESA Space Debris Mitigation Policy for Agency Projects	Safety	Space environment	Companies or products	Non-binding
ESA LCA Handbook	Sustainability	Earth environment Space environment	Companies or products	Non-binding
CONFERS "Guiding Principles for Commercial Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS)"	Sustainability Safety	Space environment	Companies or products	Non-binding
Commercial Space Operations Safety Task Force (CSOSTF)	Sustainability Safety	Space environment	Companies or products	Non-binding
SpaceX and NASA Joint Spaceflight Safety Agreement	Sustainability Safety	Space environment	Companies	Non-binding
USSPACECOM's Space Situational Awareness sharing programme	Safety Sustainability	Space environment	Companies or products	Non-binding
Satellite Orbital Safety Best Practices Guide	Sustainability Safety	Space environment		
Other initiatives for the promotion of standards, guidelines and best practices				
International Association for the Advancement of Space Safety (IAASS)	Sustainability Safety	Space environment	Companies or products	Non-binding

Instrument	Scope: safety and/or sustainability	Scope: Earth environment and/or space environment	Addresses: countries, companies, or products	Binding force: mandatory or voluntary actions
Secure World Foundation (SWE) Handbook for New Actors in Space	Safety Sustainability	Space environment	Companies or Products	Non-binding
Space Safety Institute (SSI) Compendium	Safety	Space environment	Countries Companies or Products	Non-binding
EU Industry and Start-ups Forum (EISF) on Space Traffic Management	Safety	Space environment	Companies or products Countries	Non-binding
European Commission Recommendation on Product Environmental Footprint methods (PEF)	Sustainability	Earth environment	Companies or products	Non-binding
International Astronomical Union (IAU)	Sustainability	Space environment	Companies or products Countries	Non-binding
American Astronomical Society (AAS)	Sustainability	Space environment	Companies or products Countries	Non-binding

Table 3 - Categorisation matrix of guidelines, best practices, standards, industry-led initiatives and other initiatives

3.5 Observations on examined initiatives and their complementarities

The initiatives described in the previous sub-sections reflect the complexity and uneven availability of instruments aiming to make space activities safer and more sustainable.

As regards the domain of **space safety and sustainability**, all assessed initiatives strive to improve and align existing standards, and to update them regularly rather than developing new standards. Almost all initiatives assessed refer explicitly to the international guidelines of UN COPUOS and IADC, several also to those of the ITU; also international standards are often referenced. In some cases, industry-led initiatives contribute to the development of standards, but in most cases they promote the use or application of mostly ISO or ECSS standards. The most cited standard is ISO 24113 but also CCSDS data standards and standards such as ISO 24330 are referenced regularly.

As regards the **impact of space activities on the environment**, no sector-specific guidelines nor best practices currently exist at international level to measure the environmental performance of space activities and their impact on the environment. While the LCA handbook developed by ESA is a first attempt to measure the environmental performance of space activities and their impact on the environment, it is not considered sufficiently mature for application across the space sector[128]. The ISO standards for environmental management (ISO 14001) and the European Commission's Product Environmental Footprint (PEF) provide preliminary starting points to assess the impact of space activities on the environment, but further developments are required before their systematic application across the space industry can be envisaged.[129]

As regards the **preservation of dark and quiet skies**, while several organisations and initiatives are actively working towards this goal, no unified guidelines, standards, or best practices currently exist at international level.

Annex C - Evaluation matrix for existing standards, guidelines, and best practices to ensure sustainable and safe space activities outlines the effectiveness, level of adherence, future-orientation, and coherence of the examined initiatives with the EU objectives of supporting space traffic management.

[128] European Commission, Analysis of the consequences of the EU's environmental framework on space activities and options toward promoting greener space activities in Europe, 2015.
[129] European Commission, *Supporting the Green Deal ambitions applied to EU space activities*, 2022.

4 Assessing the suitability of the overall set of existing standards, guidelines, and best practices supporting space traffic management

This section assesses the extent to which the existing set of international guidelines, best practices and standards is suitable for an effective common approach to space traffic management. We then continue with an overview of the main problem identified based on our analysis as well as potential consequences. This paves the way for explaining why action at the EU level is needed and, in the following section, which subsidiarity and proportionality considerations are to be considered.

4.1 Problem assessment

This sub-section identifies the main challenges that impact the implementation of voluntary instruments by space operators.

4.1.1 Causes

No common mechanism exists that could motivate space actors towards applying additional voluntary instruments

As outlined in section 3, in the field of **space safety**, various standards, guidelines and best practices exist, and some of these voluntary instruments, e.g., the IADC Space Debris Mitigation Guidelines, are widely adhered to by a large number of space actors. However, space operators are not obliged to adhere to even the most widely used of such instruments, except for those made mandatory through e.g. national legislation or licensing processes (for more details, see Annex D – National space legislation instruments: Examples of making standards, guidelines and best practices binding, and Annex E – National space legislation per country). Similarly, although some initiatives exist that try to tackle space safety issues through e.g., labelling schemes, **no common mechanism currently exists** that would **put forward or recommend a set of instruments** or **offer incentives to space actors for adhering to those voluntary instruments**. Consequently, adhering to voluntary instruments remains a discretionary decision by each space actor depending on their corporate values, business model or financial capacity.

When looking at the **impact of space activities on the environment**, the existing set of international guidelines, standards and best practices is quite limited, and there is a **lack of standardised methodology** to comprehensively evaluate the environmental footprint of space activities. Various methodologies exist, albeit not specifically tailored to the space sector, and are commonly employed to assess and communicate environmental footprints across products and organisations. **Further cooperation** on developing a common and comprehensive methodology as well as international standards, guidelines and/or best practices focusing specifically on the impact of space activities on the environment **is therefore needed**. In the absence of a common and comprehensive methodology, no common mechanism is currently in place that aims to incentivise space actors to adhere to the few instruments that currently do exist.

Unlike the more developed area of space safety, the field of **preserving dark and quiet skies** is still relatively nascent. There are currently no comprehensive voluntary instruments specifically dedicated to the preservation of dark and quiet skies. **Further cooperation** on developing international standards, guidelines and/or best practices focusing on the preservation of dark and quiet skies **is therefore needed**. In the absence of such voluntary instruments, no common mechanism is currently in place that aims to incentivise space actors to adhere to those instruments.

Increasing space activities lead to increasing congestion in space

The increasing number of new satellite launches greatly contributes to an increase in space traffic and therefore in **space congestion**. The growing number of space objects especially in the LEO orbit regime increases the risk of collisions in space and therefore of **space debris**. Collisions with debris can damage or destroy active satellites in orbit which can lead to a disruption of services that society relies on.[130] Even if collision avoidance manoeuvres help to prevent damage to spacecraft, the increasing congestion in space leads to a growing need to carry out such manoeuvres which strains operator resources and further increases interruption of services during such manoeuvres.

Space congestion also poses challenges to the preservation of dark and quiet skies due to increased light and noise pollution impacting scientific research and endangering potential astronomical observations-based forecasts.

Many voluntary instruments in some domains and only few or none in others make it difficult for motivated space actors to choose those that are most suitable

As outlined section 3, **numerous voluntary instruments** in the field of **safety and sustainability in space** are already in place. Many of them aim to tackle similar challenges, but they **may diverge** in e.g., scope and applicability as well as in requirements and criteria. This may make it **difficult** for motivated space actors **to choose** those instruments that are **most suitable.**

Addressing the impact of space activities on the **environment** involves navigating a currently still **limited framework** for assessing and communicating environmental footprints across products and organisations that is **not specifically designed for** the unique challenges of the **space sector**. This makes it **challenging** for space actors **to reduce** or even just **assess** the **impact** of their space activities on the environment.

As regards the **preservation of dark and quiet skies, no international standards and only few guidelines** currently exist given the relative newness of this area. This makes it **challenging** for stakeholders **to determine** the **best way to act** to ensure consistency across the industry and with other existing instruments e.g., in the domain of space safety and sustainability.

4.1.2 Problem statement

The absence of motivational drivers to implement voluntary instruments leads to a lack of incentives for space operators to go the extra mile in tackling the problem of increasing

[130] Some areas of application of space-based services include: precision agriculture and integrated farming solutions, which help farmers increase yields by 10% and save more than 20% on fertiliser and pesticides; rescue operations during floods, fires, earthquakes and hurricanes; urban mapping, planning and infrastructure monitoring, enabling better transport and smart waste management; siting of renewable energy facilities, assessing potential energy generation and environmental impacts; air quality forecasting and UV radiation which impact our health; to mention some. Available at: https://defence-industry-space.ec.europa.eu/document/download/5d810d48-2316-42e9-a92c-f5323a7326b4_en?filename=EUSpace%20Factsheet%20EN.pdf

space activities. This, in turn, hampers progress towards a common approach for (EU) Space Traffic Management.

The number, scope and level of maturity of voluntary instruments in the fields of space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies vary to a large degree, making it difficult for space actors to decide which instruments are suitable to follow. No common mechanism currently exists that would guide or motivate space actors to implement voluntary instruments.

In the absence of a mechanism offering tangible incentives, space actors may decide to take a 'business as usual' approach implementing no or only few voluntary instruments, thereby deciding not to go the extra mile. This choice could be due to e.g., costs of implementation or administrative burden. While mandatory rules may help to set a baseline level for ensuring safety and sustainability in space, the absence of incentives to go the extra mile may slow down innovation, technological developments, and innovative solutions for such common problems.

This leads to a situation in which space activities and associated risks of e.g., collisions and space debris, increase unabated, leading to growing congestion in space. This has an impact on the conduct of space operations, making the management of space traffic more challenging. In the absence of a mechanism and incentives for space actors to change the way they conduct their space activities, it may be challenging to develop a common (EU) space traffic management approach aiming to ensure access to, activities in and return from outer space for generations to come.

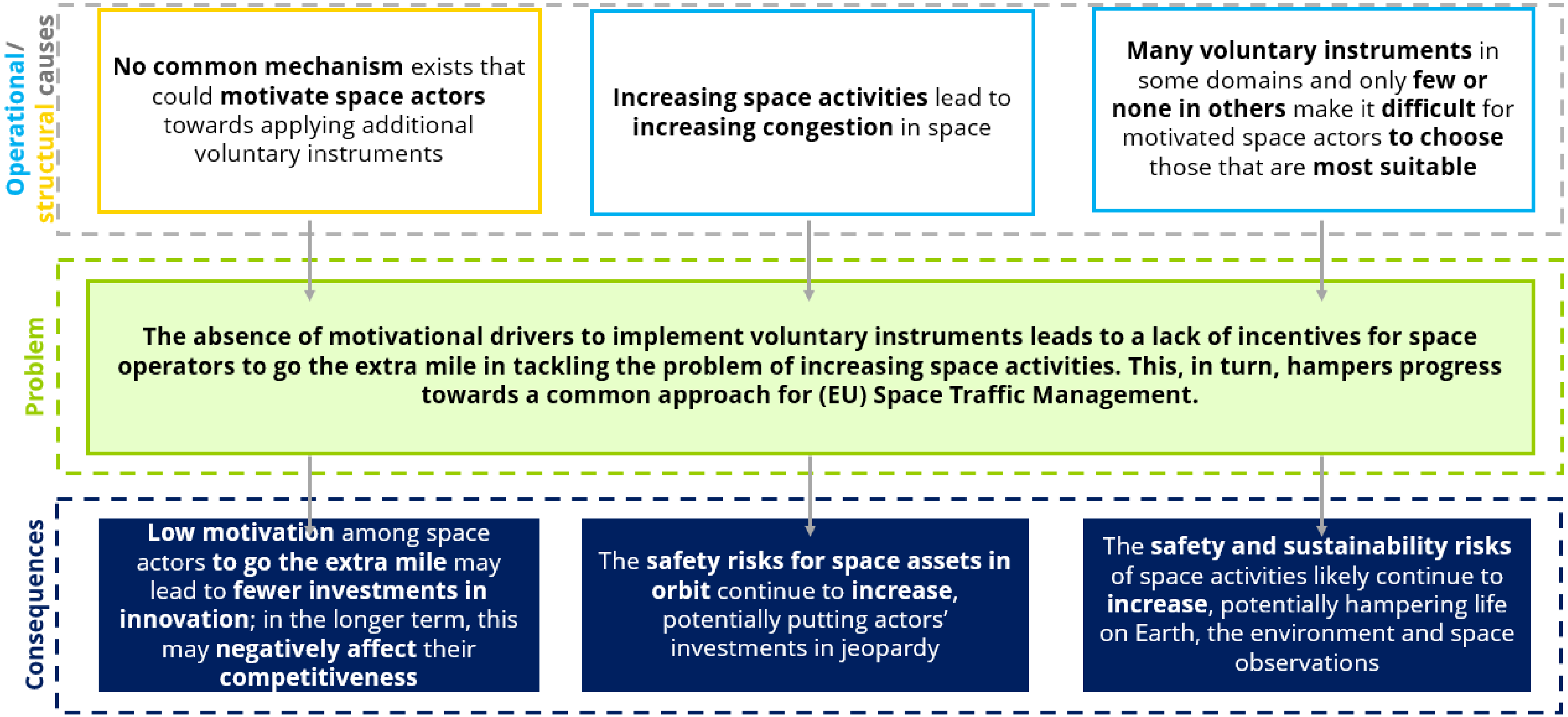

Figure 5 - Problem tree outlining the causes, problem statement and consequences of the absence of incentives for EU space actors to go the extra mile

4.1.3 Consequences

The consequences of the structural and operational causes outlined in the sections above in the current space traffic management framework are **multifaceted** covering *inter alia* competitiveness, innovation[131], and safety and sustainability risks for assets in space and on Earth.

Low motivation among space actors to go the extra mile may lead to fewer investments in innovation; in the longer term, this may negatively affect their competitiveness

In the field of **space safety and sustainability**, low motivation of space actors to adhere to voluntary instruments may hamper a coordinated and common approach to managing traffic in space. The absence of such a coordinated approach combined with increasing space activities obliges space actors to increase their resources dedicated to reducing the risks from collisions and to managing collision avoidance manoeuvres. As a result, space actors may therefore prioritise the safeguarding of their space assets over costly and less essential research, innovation, and technological developments. Discoveries that might help to mitigate the risks to space assets or otherwise offer space actors a competitive edge might be made very late or not at all, impeding on their competitiveness in a context in which the risks from collisions continue to grow. In addition, in the absence of incentives, space actors may choose to invest in solutions that may not be state-of-the-art while accepting residual safety risks to keep costs low, or to favour speed of innovation over safety to remain competitive, leaving some safety risks unaddressed. This is particularly relevant as not adhering to safety standards may have longer-term sustainability consequences and pose a threat for future spacecraft in orbit, but may not necessarily pose a high, direct, or immediate risk to an individual actor.

As an OECD study on the economics of space debris mentioned,[132] while data are limited, some operators (in the geostationary orbit) have indicated that the full range of protective and debris mitigation measures (e.g., shielding, collision avoidance manoeuvres) may amount to some 5-10% of total mission costs which often range in the hundreds of millions of USD. Furthermore, in March 2023 alone, Starlink satellites likely conducted more collision avoidance manoeuvres than in the entire first 2.5 years of their deployment.[133] Furthermore, disruption of space-based services such as telecommunications, navigation, and Earth observation impact activities on Earth affecting vital areas such as emergency communication during disasters.

As regards the impact of space activities on the **environment**, the current absence of a universally agreed-upon methodology and obligation requirements to provide information on environmental impacts of space activities leads to a lack of motivation among space actors to invest in research and innovation looking into ways to make space activities more environmentally friendly.

Also in the field of **preserving dark and quiet skies**, the absence of common voluntary instruments leads to a lack of motivation among space actors to engage in research to explore ways to reduce the impact of their space activities on light pollution and radiofrequency interferences.

The safety risks for space assets in orbit continue to increase, potentially putting actors' investments in jeopardy[134]

The **loss of or damage to spacecraft** can lead to an economic loss of the resources that a space actor invested in an asset as well as expensive recovery efforts, delays in the deployment of new

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[131] For example, autonomous driving, navigation programmes, internet of things, disaster response, to mention some.
[132] Undseth, M., C. Jolly and M. Olivari (2020), "Space sustainability: The economics of space debris in perspective", OECD Science, Technology and Industry Policy Papers, No. 87, OECD Publishing, Paris, https://doi.org/10.1787/a339de43-en.
[133] Lewis, H. [@ProfHughLewis]. (2023, April 4). "In March 2023 alone, #Starlink satellites likely performed more conjunction risk mitigation manoeuvres ('collision avoidance manoeuvres') than they did in the entire first 2.5 years of #Starlink deployment". https://twitter.com/ProfHughLewis/status/1643173774718631936
[134] The consequences and figures presented in this sub-section are applicable to LEO. In the Geostationary Earth Orbit (GEO), the situation is different. As of 2021, there were about 560 operational satellites in GEO. Once they reach the end of their operational

technologies, and a loss in revenue due to the disruption of the services that those assets provide. The above-mentioned OECD study[135] confirms that, on any orbit, the most direct consequences of a fatal collision with space debris are spacecraft replacement costs and related delays and data loss.

The **ESA Space Environmental Reports** show that actions to limit space debris released during normal operations remain below a level that would allow a reduction in the amount of space debris, and therefore hinder the long-term sustainability of space operations.[136] More importantly, the **IADC Report on the Status of the Space Debris Environment** states that a potential doubling of the space debris population may occur within 25 years. In the longer term, this space debris population is expected to be 10 times larger due to the increasing rate of catastrophic collisions.[137]

The **2022 ESA Space Environmental Report** shows that the rate of successful post-mission disposal attempts has improved significantly, reaching 70% in LEO. However, many defunct space objects are left drifting in important orbits with no attempt made to remove them, further contributing to the growing risks of collisions in space and the resulting damage or loss of space assets. This apparent high post-mission disposal rate of 70% in absolute numbers is mainly due to the disposal adherence of spacecraft operating in GEO and MEO orbits. If those objects are discarded in the analysis, one can observe that less than 10% of the objects launched to LEO in the last 15 years[138] have been successfully removed from their orbital regime after reaching end-of-life. **This rate of 10% is not sufficient to ensure a sustainable and safe space environment**.[139]

The extrapolation of this current behaviour into the future shows how the number of catastrophic in-orbit collisions could rise. Critically, even in the case of no further launches into orbit, it is expected that collisions among existing space debris objects will lead to further growth in the space debris population. The deployment of large constellations has further exacerbated this trend which leads to increasing rates of collision avoidance operations. Consequently, the risks to space assets become increasingly challenging to manage in light of current trends in space activities, space debris and resulting space congestion.

lives, GEO satellites are generally moved to a graveyard orbit 300 km above the GEO region for disposal. While only two thirds of operational GEO satellites successfully reach a graveyard orbit at the end of their lives, this strategy slows the developing problem of debris. The general consensus is that the risk of collisions occurring in GEO is less than that in LEO. Unlike LEO, objects in GEO are concentrated within a relatively narrow band of specific altitude and inclinations. However, the overall volume of this band is relatively large given its greater distance from Earth. In addition, GEO satellites orbit in the same direction, at the same speed and inclinations, and so the probability of a high-speed collision is reduced. Nonetheless, the geopotential wells (applicable to GEO), which are concentrations of debris found at two specific longitudes in the region represent a significant increase of the risk of collision at and near these locations. In comparison, Medium Earth Orbit (MEO) is considerably less congested than LEO and GEO due to its large volume and relatively low number of satellites. The low density of objects results in a low risk of collision with space debris in the MEO region, at least one order of magnitude less than that in GEO. Nonetheless, there are additional risks inherent to the MEO region, for instance, satellites in MEO do not always have a clear method of disposal. For more information, see: https://www.hdi.global/globalassets/_local/international/newsroom/hdi_global_specialty_study_space_debris_2023_corpv5.pdf

[135] Undseth, M., C. Jolly and M. Olivari (2020), "Space sustainability: The economics of space debris in perspective", OECD Science, Technology and Industry Policy Papers, No. 87, OECD Publishing, Paris, https://doi.org/10.1787/a339de43-en.

[136] https://www.esa.int/Space_Safety/Space_Debris/ESA_s_Space_Environment_Report_2022

[137] IADC, Report on the Status of the Space Debris Environment, 2023.

[138] S. Frey, S. Lemmens, Status of the space environment: current level of adherence to the space debris mitigation policy. Accessible at: SDC7-paper483.pdf (esa.int)

[139] GMV. Existing STM guidelines and best practices.

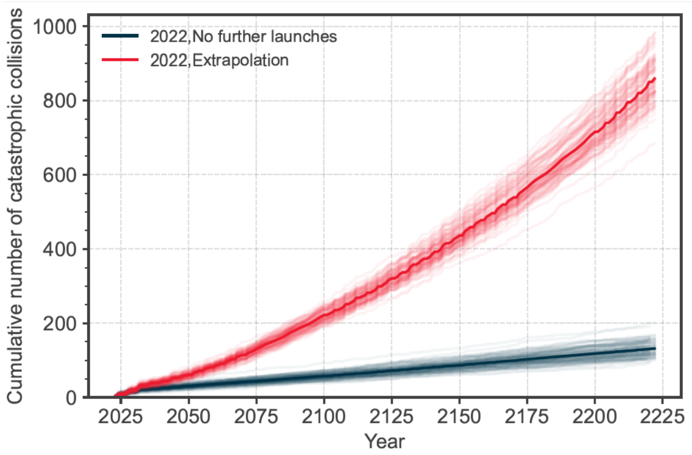

Figure 6 - Extrapolation of the cumulative number of catastrophic collisions (Source: ESA Space Environment Report (2022))

The safety and sustainability risks of space activities likely continue to increase, potentially hampering life on Earth, the environment and space observations

As regards **life on Earth** and **the environment**, space activities pose potential impacts due to the utilisation of both renewable and non-renewable resources and the atmospheric consequences of rocket launches and satellite de-orbiting.[140] Firstly, satellite construction heavily relies on materials like aluminium, titanium, and lithium. During operation, satellites gather Earth observation data which is stored in data centres characterised by high water and energy consumption rates, significant carbon emissions from computer component manufacture, and challenges related to recycling said components.[141] Besides, rocket launches inject pollutants such as black carbon, aluminium, CO_2, and reactive gases into the atmosphere. These emissions can have adverse climate impacts, contribute to ozone depletion, and disrupt upper atmospheric dynamics. Lastly, at the end of their operational life, satellites are de-orbited, often resulting in the burning up of components and the release of pollutants into the atmosphere.[142] If the challenges of the space sector in reliably assessing its effects and meeting EU Green Deal targets are not addressed and space operators not incentivised to implement (future) voluntary instruments, space activities will continue to have a devastating impact on the environment.

As regards the **preservation of dark and quiet skies**, light pollution and radio frequency interferences directly affect the quality and accuracy of observational data. Astronomers already note challenges regarding astronomical via radio waves and optical wavelengths, due to an increased number of satellites. This impedes space observations that are essential for space situational awareness (e.g., hazardous near-Earth object surveys) and space exploration. Consequently, space observations will be increasingly hampered which will negatively impact our understanding of space. For example, current predictions for the Vera C Rubin Telescope indicate that there will be a significant damage for approx. 30-40% of the images[143]. In addition, Earth observations often rely on radiometers which are affected by radio interference from nearby satellites. It is thus important not only to limit but to prevent challenges caused by all types of interferences e.g., jamming, spoofing or interception.

[140] Gaston, K.J., Anderson, K, Shutler, J.D., Brewin, R.J.W., Yan X. (2023). "Environmental impacts of increasing numbers of artificial space objects". ESA Journals. See: https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/fee.2624
[141] Wilkinson, R., Mleczko, M.M., Brewin, R.J.W., Gaston, K.J., Mueller, M., Shutler, J.D., Yan, X., Anderson, K. Environmental impacts of earth observation data in the constellation and cloud computing era. Science of The Total Environment. See: https://www.sciencedirect.com/science/article/pii/S0048969723072121
[142] Gaston, K.J., Anderson, K, Shutler, J.D., Brewin, R.J.W., Yan X. (2023). "Environmental impacts of increasing numbers of artificial space objects". ESA Journals. See: https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/fee.2624
[143] IAU. 2020. The impact of mega-constellations of communication satellites on Astronomy". Available at: https://www.unoosa.org/documents/pdf/copuos/stsc/2020/tech-35E.pdf

5 Assessing the appropriate level of action and outlining suitable policy objectives

Even with a widespread implementation of guidelines and standards described in section 3, additional steps are needed to ensure a safe and sustainable use of space long term.

As already outlined the Joint Communication on STM[144], one solution for enhancing space traffic management could be for the EU to establish an EU-wide mechanism to incentivise the implementation of standards, guidelines and best practices. Such an initiative may create important benefits for space activities in general and, in turn, real operational and economic benefits for individual space actors. Arguably, such a mechanism should stimulate the implementation of standards, best practices, and guidelines potentially increasing the effectiveness of these instruments with a view to supporting space traffic management.[145]

5.1 Subsidiarity and proportionality: necessity and added value of EU action

This section focuses on assessing the appropriate level of action based on subsidiarity and proportionality assessments.

5.1.1 Subsidiarity assessment

EU measures taken on the basis of a non-exclusive competence, such as the parallel competence set forth in Article 189 TFEU, must respect the **principle of subsidiarity**, according to which the EU shall act "only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States […], but can rather, because of the scale or effects of the proposed action, be better achieved at Union level".[146]

Individual actions by Member States can contribute towards a more suitable management of space traffic, including in domains such as space safety and sustainability, the preservation of dark and quiet skies and a reduced impact of space activities on the environment. However, taking into account the transnational nature of the identified problem as well as the international nature of space, actions taken at Member State level may be insufficient to enhance space traffic management long-term.

For these reasons, action at EU level can better achieve the policy objectives of promoting standards, guidelines, and best practices currently guiding space activities along the value chain as well as of incentivising implementation of these instruments by space actors from the EU and third countries. In particular, EU action may be better placed to raise awareness for space safety and sustainability, efforts to reduce the impact of space activities on the environment and the preservation of dark and quiet skies among space operators, to monitor the relevance and applicability of relevant instruments, to develop and promote EU instruments whenever appropriate, to outline the capability to reward

[144] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=JOIN:2022:4:FIN
[145] Doucet, 147–49.
[146] Article 5 (3) TEU

companies who adopt international or EU instruments, and to establish a mechanism to label products or missions that adhere to relevant instruments.

Moreover, action at EU level provides added value by avoiding duplication of efforts across the EU and Member States to promote a proper management of space traffic, and by increasing synergies between actors involved in space activities.

5.1.2 Proportionality assessment

The proposed EU measures must also satisfy the **principle of proportionality**, in the sense that they must be appropriate to achieve the objectives pursued and their content and form may not go beyond what is necessary to achieve these objectives.[147]

In determining the proportionality of measures, the CJEU assumes that the EU legislator has a broad measure of **discretion**, which not only applies to the nature and scope of the acts but in some cases also extends to the finding of the basic facts that underlie the proposal of the measure.[148] The legislator has a particularly high level of discretion when acting in areas that entail "political, economic and social choices […] and in which it is called upon to undertake complex assessments".[149] In those cases, "the criterion to be applied is not whether a measure adopted in such an area was the only or the best possible measure since its legality can be affected only if the measure is manifestly inappropriate having regard to the objective which the competent institution is seeking to pursue".[150] The CJEU does not make explicit when an act is manifestly inappropriate, but considerations to be taken into account include whether the legislator did not omit certain basic facts from its assessment underlying the choice of the proposed measure.[151] Moreover, it also means that, for matters where the legislator has broad discretion, "it is irrelevant whether the measure adopted in the legislative act is the only conceivable measure or even only the most appropriate".[152]

As explored earlier in the study, space traffic management, including domains such as space safety and sustainability, the preservation of dark and quiet skies and efforts to reduce the impact of space activities on the environment, are dependent upon a number of legal, regulatory and technical matters which influence how space actors conduct their activities in space. As a result, measures aimed to support this require complex assessments regarding the legal, regulatory, and technical factors at play, the design of measures suitable to incentivise space actors to adopt best practices, as well as other impacts of said measures.

Therefore, these measures must be subject to broad discretion on the part of the EU legislator. This means that the proportionality of its actions will only be checked against the test of manifest inappropriateness compared to the objective that is pursued, that the legislator is granted a certain level of discretion with respect to the assessment of the impacts, circumstances and effects of the

[147] Article 5(4) TEU; CJEU, C-611/17, Italy v Council, 2019, para. 55; CJEU, C-482/17, Czech Republic v European Parliament and Council, 2019, para. 77.
[148] S. Weatherill, 'The Limits of Legislative Harmonization Ten Years after Tobacco Advertising: How the Court's Case Law has become a "Drafting Guide"', 2011 German Law Review, p. 827.
[149] C-482/17, Czech Republic v European Parliament and Council, 2019, para. 77. Also in CJEU, C-5/16, Poland v European Parliament and Council, 2018, para. 151; CJEU, C-62/ 14, Gauweiler and Others, 2015, paras 68–70.
[150] CJEU, C-482/17, Czech Republic v European Parliament and Council, 2019, para. 77. AG Kokott has clarified this minimal test as meaning that "an infringement of the principle of proportionality by the Union legislature can be taken to exist only where the EU measure concerned is manifestly disproportionate, that is to say, where it is manifestly inappropriate for attaining the legitimate objectives pursued, goes manifestly beyond what is necessary to achieve those objectives or entails disadvantages which are manifestly disproportionate to its objectives": opinion of AG Kokott in case C-477/14, Pillbox 38 (UK) Limited, trading as Totally Wicked v. Secretary of State for Health, 2016, para. 58.
[151] CJEU, C-310/04, Spain v. Council, 2006, para. 123: "It follows that the institutions must at the very least be able to produce and set out clearly and unequivocally the basic facts which had to be taken into account as the basis of the contested measures of the act and on which the exercise of their discretion depended". See also D. Harvey, 'Towards Process-Oriented Proportionality Review In The European Union', 23 (1) European Public Law 2017, pp. 93–122.
[152] Opinion of AG Kokott in case C-477/14, Pillbox 38 (UK) Limited, trading as Totally Wicked v. Secretary of State for Health, 2016, para. 58.

proposed measures, and that the proposed measures will be found proportionate even if they may not be the most appropriate to attain the objectives that are pursued.

Considering the aforementioned level of discretion, the proposed measure – the creation of a non-binding mechanism to promote the use of relevant standards and guidelines – is appropriate to achieve the objective pursued, in the sense that the measure is capable of increasing the level of safety and sustainability of space activities. The principle of proportionality is therefore respected.

5.2 Policy objectives of the EU for safe and sustainable space activities

This section presents the policy objectives derived from the problem assessment outlined in section 4. The policy objectives set out the political priorities of the EU and aim for action in the relevant field. They are an essential step of the study as they help to create a logical link between the identified problems and an EU-wide voluntary mechanism to support safe and sustainable space activities.

These policy objectives are visualised through an objective tree as presented in Figure 7. In line with the Better Regulation Guidelines[153], we have defined **policy objectives at three levels** in close collaboration with DG DEFIS:

(i) **General objectives** refer to Treaty-based goals and constitute a link to the existing policy-setting.

(ii) **Specific objectives** relate to the concrete aims to achieve safe and sustainable space activities.

(iii) **Operational objectives** relate to actual deliverables and/or actions related to the specific objectives.

5.2.1 General objectives

The general objective is identified in the Request for Services for this study on 'Support to Space Traffic Management (STM) Standardisation', the Joint Communication to the European Parliament and the Council on An EU Approach for Space Traffic Management[154] and Regulation (EU) 2021/696 of the European Parliament and of the Council of 28 April 2021 establishing the Union Space Programme and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013 and (EU) No 377/2014 and Decision No 541/2014/EU[155].

The **general objective** of this initiative is to **support a common approach to Space Traffic Management while fostering EU space industrial competitiveness in full compliance with the respective competences of the EU and its Member States.**

5.2.2 Specific objectives

Over the years, various instruments compiling standards, guidelines, best practices, lessons learnt, etc. have been developed by industry, national actors, and international organisations. These aim at supporting efforts of space operators to act responsibly in space and adhere to relevant standards.

While space safety and sustainability is the most advanced of the three domains explored in this study, discussions are ongoing regarding international standards, guidelines and best practices aiming to assess the impact of space activities on the environment and to ensure the preservation of dark and quiet skies.

153 https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation/better-regulation-guidelines-and-toolbox_en
154 https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52022JC0004
155 https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32021R0696&from=EN#d1e1315-69-1

The above general objective is therefore further specified through two **specific objectives** that define the nature of the resulting initiative. Concretely, this initiative aims to:

- **Promote a set of common standards, guidelines, and best practices** to guide space actors towards safer and more sustainable space activities.
- **Incentivise adherence** by space actors **to these common standards, guidelines, and best practices**, thereby fostering their competitiveness.

5.2.3 Operational objectives

The gradual but relentless increase of satellites in orbit forces space operators to react more frequently to avoid collisions which may otherwise lead to damaged or destroyed space assets and a further increase in space debris. In this regard, better managing space traffic is considered essential for reducing the risks of collision and space debris generation, and for enhancing the overall **safety and sustainability of space activities**.

The EU's commitment to achieving climate neutrality by 2050 as outlined in the European Green Deal[156] includes a comprehensive strategy for curbing greenhouse gas (GHG) emissions and for ensuring economic growth decoupled from resource use across all sectors, including the space industry. Effectively **greening the European space sector** requires transformative changes throughout the entire life cycle of space missions spanning design and manufacturing (encompassing spacecraft and launchers) and operational phases (including spacecraft control, data acquisition, processing, storage, and distribution).

The increasing number of space objects launched by public and private entities, coupled with rapid advancements in technology, leads to challenges in **preserving dark and quiet skies**. The presence of light pollution from artificial sources and sunlight reflections off satellites obscures the view of celestial objects, while radio frequency interference disrupts the delicate instruments used for detecting and analysing signals from space. These factors significantly hinder astronomers' efforts to observe and understand the universe which underlines the need to establish mechanisms to safeguard dark and quiet skies.

However, as outlined in section 4, the current level of implementation of existing standards, guidelines and best practices indicates 1) a low motivation among space actors to go the extra mile leading to potentially fewer investments in innovation with consequences for their competitiveness, 2) increasing safety risks for space assets in orbit potentially putting actors' investments in jeopardy, and 3) increasing safety and sustainability risks, potentially hampering life on Earth, the environment and space observations. As a result, an **EU initiative should aim to encourage the implementation of existing standards, guidelines and best practices on space safety and sustainability** while **emphasising the protection of the environment and the preservation of dark and quiet skies,** thereby **supporting safe and sustainable space activities and a common approach for space traffic management**.

With the problems identified and the general and specific objectives in mind, the **operational objectives** that this initiative seeks to achieve are therefore to:

- **Establish an EU Space Label** that offers guidance on and **confirms adherence** to **clearly defined criteria** based on common standards, guidelines and best practices.
- **Raise awareness** of the **importance and interconnectedness** of various domains, e.g. space safety, the environment, and dark and quiet skies.

[156] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

- **Offer benefits to actors who adhere** to common standards, guidelines and best practices, thereby **fostering innovation** and **technological development**.

These objectives are summarised in the figure below:

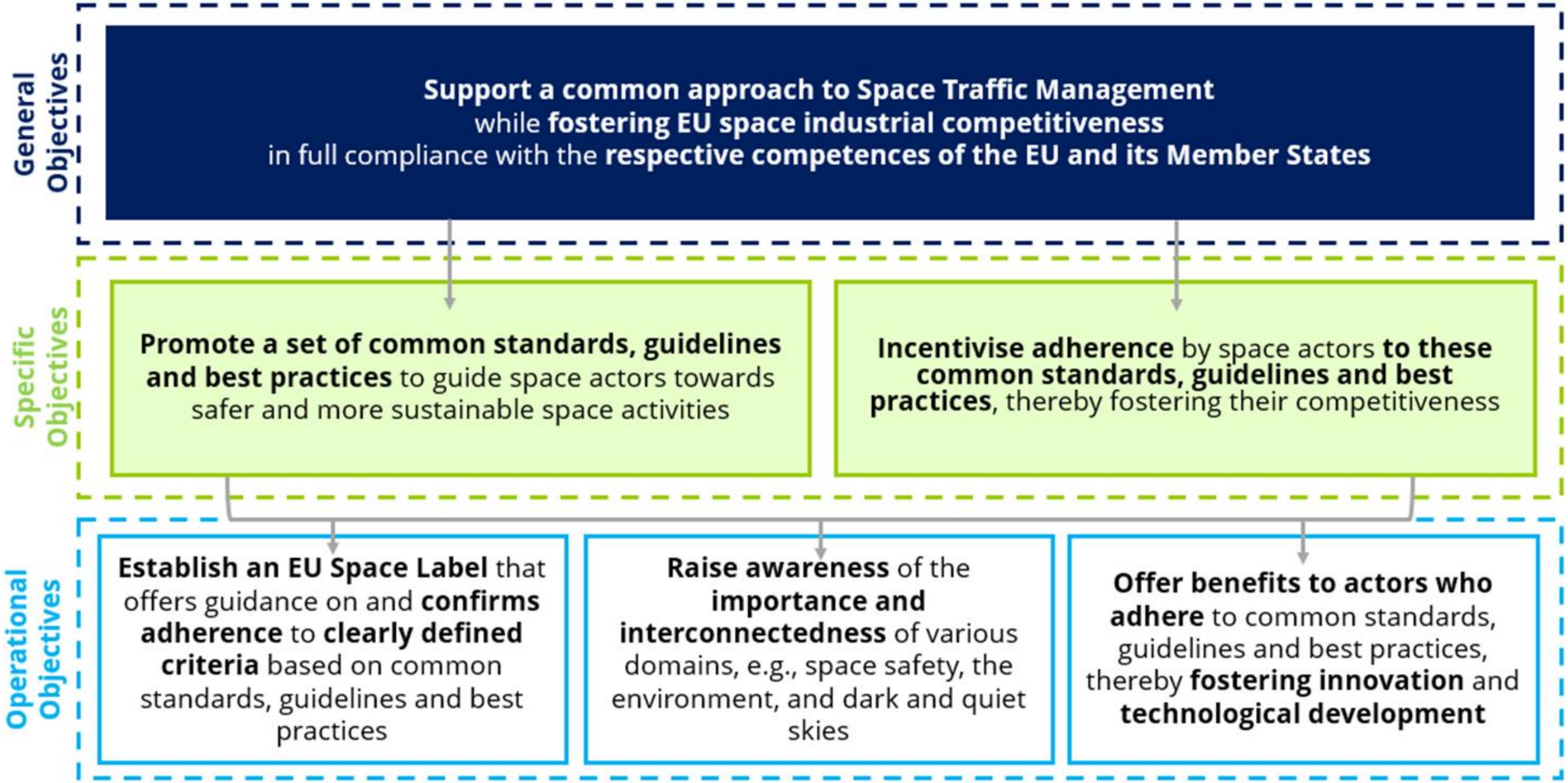

Figure 7 - Policy objectives of the EU initiative

6 Examples of high-level systems to support the use of standards, guidelines, and best practices in space traffic management

In this section, we assess five existing non-binding high-level systems. These high-level systems have been selected to inspire and shape the setup of an EU-wide mechanism to address the problems identified in section 4 and achieve the objectives developed in section 5. They are examples of best practices that have been established at EU and international levels to promote better conduct in various areas.

The selected high-level systems have been categorised as:

1. Public (intergovernmental) mechanism based on broad principles (based on the example of the United Nations Global Compact);
2. Public (intergovernmental) mechanism based on detailed guidelines (based on the example of the OECD Guidelines for MNEs);
3. Public (intergovernmental) mechanism based on labelling (based on the example of the EU Ecolabel);
4. Private-sector-led mechanism based on labelling (based on the example of the Voluntary Sustainability Standards);
5. Private-sector-led mechanism based on expert rating (based on the example of the Space Sustainability Rating).

Important to note: *the United Nations Global Compact, the OECD Guidelines for MNEs, and the Voluntary Sustainability Standards (VSS), further detailed below, have been translated into European Law as mandatory reporting requirements for companies and organisations. Hence, in this section, the UN Global Compact, the OECD Guidelines and the Voluntary Sustainability Standards are used as an example of a setup of a potential EU mechanism which could be similar to these existing mechanisms, rather than implying the adherence to or integration into these mechanisms.*

Should a similar system or elements thereof be established by the EU in the domain of space traffic management, it is important to take into account several factors. This section therefore contains:

1. Short presentation of each high-level system;
2. Assessment of the strengths and weaknesses of each presented system;
3. Identification of a potential role for the Commission in each presented system.

6.1 High-level system 1: Public (intergovernmental) mechanism based on broad principles (United Nations Global Compact)

6.1.1 Introduction and type of model

High-Level System	Level of Application		Bindingness for Companies	
	Company Level	*Product Level*	*Voluntary*	*Mandatory*
UN Global Compact	X		X	

The United Nations Global Compact[157] is a voluntary, principles-based corporate sustainability and corporate social responsibility initiative. It encourages companies to align their strategies and operations with ten universal principles in the areas of human rights, labour, environment, and anti-corruption.

Signing up to these principles implies that companies strive to comply with these broad principles. Companies uphold the same principles regardless of their location and understand that positive practices in one area do not compensate for the harm caused in another.[158]

The UN Global Compact was announced by the UN Secretary-General Kofi Annan in an address to the World Economic Forum in 1999 and was launched in 2000.[159] As of November 2023, there are 18 000 companies and more than 3 800 non-business participants which represent businesses, civil society organisations, business associations, labour organisations, academic institutions, and cities.[160]

6.1.2 Functioning logic

As a voluntary initiative, the UN Global Compact aims to engage a diverse group of businesses and stakeholders. Companies wishing to participate in the UN Global Compact must fulfil two main requirements:

- Submit a Letter of Commitment: Applicants must provide a letter from their highest-level executive (or equivalent), endorsed by the Board, committing the organisation to meet fundamental responsibilities in the areas related to the principles[161] i.e. human rights, labour, environment, and anti-corruption. This letter, no longer than two pages, should express the company's commitment to the UN Global Compact, the Ten Principles, and the Sustainable Development Goals[162].
- Produce an annual Communication on Progress (COP): Participants must create a yearly COP outlining their efforts to operate responsibly, support society, and integrate the UN Global Compact and its principles into their strategy, day-to-day operations, organisational culture, and decision-making processes. The COP consists of a renewed expression of support for the UN Global Compact and an online questionnaire designed to assist participating companies in

[157] https://unglobalcompact.org/
[158] Idem.
[159] SECRETARY-GENERAL PROPOSES GLOBAL COMPACT ON HUMAN RIGHTS, LABOUR, ENVIRONMENT, IN ADDRESS TO WORLD ECONOMIC FORUM IN DAVOS. See: https://press.un.org/en/1999/19990201.sgsm6881.html
[160] UN Global Compact. Who should join? See: https://unglobalcompact.org/participation/join
[161] Examples of principles under the UN Global Compact include: "Businesses should support a precautionary approach to environmental challenges" (principle 7); "Undertake initiatives to promote greater environmental responsibility" (principle 8); "Encourage the development and diffusion of environmentally friendly technologies" (principle 9).
[162] The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. See: https://sdgs.un.org/goals

tracking their performance on the Ten Principles. It details the work of the companies in embedding the Ten Principles into their strategies and operations and their efforts to support societal priorities.

Companies that fail to deliver the COP or to meet the criteria over time will be downgraded from active to non-communication participants. Participants who do not communicate progress for two years in a row will be expelled, and the UN Global Compact will publish their names. The UN Global Compact only has a mandatory disclosure framework, but no performance or assessment framework. It does not provide a seal of approval, nor does it make judgments on performance. It has an open and transparent approach in which the aim is to improve best practices of participants.

Non-business organisations (e.g., academic institutions, business associations, cities and municipalities, civil society organisations, foundations, labour organisations, public sector organisations, corporate social responsibility organisations) can participate in the UN Global Compact. They have to follow a similar procedure, i.e., submit a letter of interest and submit an annual 'Communication on Engagement' (COE) presenting how the organisation has supported the UN Global Compact.

6.1.3 Scope of the commitments

The Ten Principles of the UN Global Compact are derived from the Universal Declaration of Human Rights, the International Labour Organisation's Declaration on Fundamental Principles and Rights at Work, the Rio Declaration on Environment and Development, and the United Nations Convention Against Corruption. As mentioned before, the main four areas on which the ten principles focus are human rights, labour standards, environment, and anti-corruption. Important to note is that the EU created binding rules based on the UN Global Compact, i.e., the EU Corporate Sustainability Reporting Directive[163] and the EU Corporate Sustainability Due Diligence Directive[164].

6.1.4 Cost implications for companies

When joining, larger companies are required to make an annual contribution to support their engagement in the UN Global Compact. These contributions are used to support global and country-level operations and are split between the global secretariat and Local Networks. The contributions range from 30,000 USD for companies with a >30 billion USD annual gross revenue to much smaller fees for SMEs and small organisations.[165]

6.1.5 Potential incentives for adherence by companies

The main incentives of the UN Global Compact are related to learning, setting up partnerships and fostering dialogue. Participants will be able to network (e.g., through seminars, training, networking events organised by local networks, etc.) and share best practices and solutions with companies and organisations from all over the world while being perceived as human rights champions. They will receive best practice guidance and access to tools, resources and training, and particular support from their Local Network. In addition, the link with the UN is seen as an incentive for participating in the Global Compact due to being an organisation with "moral authority, knowledge and experience".

[163] See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464
[164] See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0071
[165] https://unglobalcompact.org/about/finances

6.1.6 Overall strengths and weaknesses

The following table provides an overview of the strengths and weaknesses of this high-level system.

Category	Strengths	Weaknesses
Applicability	The principles included in the UN Global Compact are broad in scope, covering several dimensions e.g., human rights, environment, anti-corruption. The principles are derived from existing international commitments avoiding duplication or inconsistencies with already existing frameworks. Any company or organisation can join this initiative (globally), incl. MNEs and SMEs.	The commitments are very soft, and thus likely to be less impactful in trying to change corporate behaviour than other high-level systems.
Governance (incl. costs)	The setup of this mechanism is relatively easy in comparison to other systems here assessed. The costs involved in the setup and governance are unknown.	N/A
Costs for companies for adherence and membership	The entry threshold is low: companies can apply through a simple registration procedure i.e., a commitment letter and an online application tool. The costs for companies to join are relatively low and proportional to their revenues. The fee of 30 000 USD applies only to larger companies.	N/A
Incentives for companies	Networking access through e.g., seminars, trainings, etc. organised by the local networks with a wide range of stakeholders; this allows better knowledge-sharing and best practice exchanges among participants. Learning opportunities for companies through unlimited access to learning experiences on key topics to help implement the Ten Principles and achieve global goals such as the Sustainable Development Goals.	No tangible economic benefits for companies
Monitoring and enforcement	Companies must renew their commitment annually and report on their actions in implementing the Ten Principles; this offers	There are no performance or assessment frameworks, no seal of approval or judgments

Category	Strengths	Weaknesses
	transparency in terms of performance and flexibility for companies to adapt their commitments. Companies are expelled if they do not renew their commitment for two consecutive years. Their names will be made public on the UN Global Compact website.	on companies' performance, and no tangible consequences in case of non-compliance
Awareness-raising	The UN Global Compact is the world's largest corporate sustainability initiative as it has more than 12 000 participants in over 160 countries. It is aligned also with the UN Sustainable Development Goals which makes the Global Compact widely known by businesses across the world.[166]	N/A

Table 4 - Overall strengths and weaknesses of High-level system #1

6.1.7 Potential role of the Commission in a similar high-level system for space traffic management

As mentioned, the UN Global Compact has already been adopted under EU law. However, the aim of this section is to understand what the potential role of the Commission could be in case a similar system were to be adopted – not related to the UN Global Compact but rather focused on the promotion of guidelines and standards specific to space traffic management.

If the Commission were to set up a high-level system similar to the UN Global Compact, it could fulfil a role similar to the UN in governing and operating such a system. It would then develop guiding principles on space traffic management, e.g., in the domains of safety and sustainability in space, the impact of space activities on the environment, and the preservation of dark and quiet skies. It could establish a Board that provides ongoing strategic and policy advice and makes recommendations. In addition, the Commission could form an Office responsible for the overall management and coordination of the mechanism including communication and promotion activities. The Commission could also call on Member States to set up local networks in charge of supporting adhering organisations in the implementation of relevant principles and reporting requirements.

6.1.8 Suitability of the high-level system to support the achievement of identified policy objectives in space traffic management

The table below provides an overview of the extent to which the policy objectives (see section 5) could be achieved if a similar system were established in the domain of space traffic management.

[166] https://unglobalcompact.org/what-is-gc

	Policy objectives	Suitability of the high-level system to help achieve identified STM policy objectives
Specific objectives	**Promote a set of common standards, guidelines, and best practices** to guide space actors towards safer and more sustainable space activities.	This specific objective is **likely to be achieved** as such a system could put forward a set of guidelines, standards and best practices to which companies would pledge to adhere. While the UN Global Compact principles are more general and high-level, more targeted principles based on specific standards/guidelines could be developed for the EU-wide mechanism.
	Incentivise adherence by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness.	This specific objective **may be achieved** as such a system could offer interesting incentives such as access to training and seminars, access to networking through e.g. events to exchange best practices, etc. However, such a system does not offer any tangible economic benefits to adhering actors.
Operational objectives	**Raise awareness** of the importance and interconnectedness of various domains, e.g., space safety, the environment, and dark and quiet skies.	This operational objective is **likely to be achieved** if such a system is built on standards, guidelines and best practices focusing specifically on space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies, and if these are incorporated into the same overarching system. Training and networking mechanisms can contribute to raising awareness, and annual reporting mechanisms may help to monitor the relevance and applicability of these areas.
	Offer benefits to actors who adhere to common standards, guidelines, and best practices, thereby fostering innovation and technological development.	This operational objective **may be achieved** as such a system offers reputational benefits to adhering companies by promotional means, e.g. websites and other materials; similarly, the names of companies that no longer adhere will be published as non-adherent on a public website which discourages non-adherence.However, However, such a system does not offer any tangible economic benefits to adhering actors.
	Establish an EU Space Label that offers guidance on and confirms adherence to clearly defined criteria based on common standards, guidelines, and best practices.	This operational objective is **unlikely to be achieved** as this system does not foresee the establishment or award of a label.

Table 5 - Link of High-level system #1 to the policy objectives of the EU initiative

6.2 High-level system 2: Public (intergovernmental) mechanism based on detailed guidelines (OECD Guidelines for MNEs)

6.2.1 Introduction and type of model

High-Level System	Level of Application		Bindingness for Companies	
	Company Level	Product Level	Voluntary	Mandatory
OECD Guidelines	X			X

The Guidelines for Multinational Enterprises (Guidelines) of the Organisation for Economic Co-operation and Development (OECD) is a set of recommendations of participating States applicable to multinational enterprises (MNEs) operating in or from their territory on e.g., labour rights, environmental protection, human rights, consumer protection, information disclosure and fight against corruption (infra). Once a State has declared its adherence to these Guidelines, they become mandatory for all companies operating in or from that State's territory.

The Guidelines set out principles and standards of good practice for Responsible Business Conduct in a global context consistent with applicable laws and internationally recognised standards. Responsible Business Conduct is defined by the OECD in terms of an expectation "that all companies – regardless of their legal status, size, ownership or sector – should 1) make a positive contribution to the economic, environmental and social progress of the countries in which they operate, and 2) avoid and address negative impacts of their activities, including in the supply chain"[167]. For each of these areas, the Guidelines refer to relevant international conventions and treaties. However, they do not further operationalise these principles in more precise commitments/standards.

The Guidelines were originally adopted by the OECD Ministerial Council in 1976 as part of the Declaration on International Investment and Multinational Enterprises (MNEs) which aimed to encourage positive contributions by MNEs to economic, environmental, and social goals. The Guidelines have been revised several times (1979, 1984, 1991, 2000 and 2011) and are currently again under revision (public consultation ended in February 2023). As of March 2023, the Guidelines are endorsed by 51 governments (all 38 OECD member states and 13 non-OECD members). Observance of the Guidelines by enterprises is mandatory once the country has adhered to the Guidelines.

6.2.2 Functioning logic

The Guidelines are developed by the OECD in collaboration with adhering States, in line with adhering States' laws (to avoid conflicting approaches) and internationally recognised standards[168], and apply to companies in adhering States. States establish a National Contact Point[169] (NCPs) in charge of

[167] OECD, RBC and Sustainable Development Goals, https://mneguidelines.oecd.org/RBC-and-the-sustainable-development-goals.pdf
[168] In the case of the OECD Guidelines for MNEs, some of the standards include the ISO Standard on Environmental Management Systems, the International Finance Corporation's Environmental and Social Performance Standards, and Strategic Approach to International Chemicals Management (SAICM), reporting standards such as the Global Reporting Initiative, among others. See: https://www.oecd-ilibrary.org/docserver/81f92357-en.pdf?expires=1690213539&id=id&accname=guest&checksum=8754F624EA42A6FD33927B3807347D28
[169] NCPs have a politicised nature. Most NCPs are based in business-related departments of governments, which makes these departments less willing to intervene in ways that would be challenging for corporate actors. NCPs are often not neutral platforms for the mediation process to happen. This lack of neutrality can lead to a number of practical problems, for instance, NGOs and unions are asked to always substantiate their claims with a lot of effort, while corporations' claims are accepted at face value. See: https://www.researchgate.net/publication/348994318_The_UN_Global_Compact_and_the_OECD_Guidelines_for_Multinational_Enterprises_and_Their_Enforcement_Mechanisms

awareness-raising, promoting the Guidelines and handling potential violations through a non-judicial complaint mechanism (i.e., 'specific instance procedure').

States sign up to the Guidelines which apply[170] to MNEs operating in or from their territory. As companies do not sign up to the Guidelines, there is no formal certification of companies.

6.2.3 Scope of the commitments

The scope of the commitments is broad and covers all dimensions of sustainability and responsible business conduct i.e., general policies of companies; disclosure; human rights; employment and industrial relations; environment; combating bribery, bribe solicitation and extortion; consumer interests; science and technology; competition and taxation.

6.2.4 Cost implications for companies

There are no direct cost implications for companies as they do not sign up directly to this mechanism.

6.2.5 Potential incentives for adherence by companies

MNEs must follow the Guidelines once these are adopted by the State in or from which they operate. The main incentive is therefore avoiding specific instance procedures for violating the Guidelines which may result in damages to the companies' reputation.

6.2.6 Overall strengths and weaknesses

The following table provides an overview of the strengths and weaknesses of this high-level system.

Category	Strengths	Weaknesses
Applicability	The Guidelines are broad in scope covering sustainability and other issues, thus allowing to cover various subject-matters. The Guidelines provide details and support to companies on how to improve responsible business conduct consistent with applicable laws and internationally recognised commitments, encouraging and facilitating adherence by companies.	States need to sign up to the Guidelines, and only then do they apply to MNEs. Buy-in from States is necessary before they apply to companies. The Guidelines only apply to MNEs.
Governance (incl. costs)	The governance mechanism is rather easy in comparison to other mechanisms since the adhering States must 'only' establish an NCP.	Public authorities may accrue significant costs for setting up such a guidelines-based system

[170] The OECD Guidelines for MNEs "provide principles and standards of good practice consistent with applicable laws and internationally recognised standards. Observance of the Guidelines by enterprises is voluntary and not legally enforceable. Some matters covered by the Guidelines may also be regulated by national law or international commitments. Obeying domestic laws is the first obligation of enterprises. The Guidelines are not a substitute for, nor should they be considered to, override domestic law and regulation. In countries where domestic laws and regulations conflict with the principles and standards of the Guidelines, enterprises should seek ways to honour such principles and standards to the fullest extent which does not place them in violation of domestic law."

Category	Strengths	Weaknesses
		due to negotiating processes, establishment of a body overseeing the mechanism, and NCPs.
Costs for companies for adherence and membership	No data is available on costs for MNEs to comply with the Guidelines. Costs will depend on the degree to which MNEs are already compliant with commitments included in the Guidelines, and if there is a specific instance procedure filed against them in case of violation.	
Incentives for companies	N/A	One of the main incentives of this mechanism is to avoid specific instances of procedures for violating the Guidelines which may otherwise result in damages to the company's reputation. This incentive is much weaker than those in other mechanisms.
Monitoring and enforcement	A grievance mechanism (specific instance procedure) allows to hold MNEs to account over alleged violations of the Guidelines.	There are no specific reporting requirements for MNEs; the only enforcement mechanism to verify compliance with the Guidelines is the specific instance procedure which is not often used in some States; this may not be sufficient to ensure full compliance with the Guidelines. NCPs may perform unevenly across signatory countries due to their different levels of institutionalisation, political will by national governments to strengthen the work of NCPs, and available resources for the work of NCPs.
Awareness-raising	This system is a strong instrument for awareness-raising due to the role of NCPs whose main tasks include raising awareness for the Guidelines and supporting companies in implementing the recommendations.	Awareness-raising depends on the capacity of each NCP which may vary from country to country.

Table 6 - Overall strengths and weaknesses of High-level system #2

6.2.7 Potential role of the Commission in a similar high-level system for space traffic management

As mentioned, the OECD Guidelines for Multinational Enterprises have already been adopted under EU law. However, the aim of this section is to understand what the potential role of the Commission could be in case a similar system were to be adopted – not related to the OECD Guidelines but rather focused on the promotion of other guidelines and standards specific to space traffic management.

If the Commission were to set up a high-level system similar to this example but specific to space traffic management, it could refer to existing standards and guidelines on e.g., space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies. It would set up procedures for National Contact Points to encourage adherence to these standards and guidelines.

6.2.8 Suitability of the high-level system to support the achievement of identified policy objectives in space traffic management

The table below provides an overview of the extent to which the policy objectives (see section 5) could be achieved if a high-level system were established in the domain of space traffic management.

	Policy objectives	Suitability of the high-level system to help achieve identified STM policy objectives
Specific objectives	**Promote a set of common standards, guidelines, and best practices** to guide space actors towards safer and more sustainable space activities.	This specific objective is **likely to be achieved** as such Guidelines could integrate and refer to relevant standards, guidelines and best practices in the fields of space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies.
	Incentivise adherence by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness.	This specific objective is **unlikely to be achieved** as this system does not foresee to provide any incentives to companies or organisations.
Operational objectives	**Raise awareness** of the importance and interconnectedness of various domains, e.g., space safety, the environment, and dark and quiet skies.	This operational objective is **unlikely to be achieved**; motivated and well-resourced NCPs may be effective in raising awareness among their national space actors of the importance and interconnectedness of various domains whereas lesser-motivated and lesser-equipped NCPs may be less effective, leading to potentially fragmented awareness-raising efforts.
	Offer benefits to actors who adhere to common standards, guidelines, and best practices, thereby fostering innovation and technological development.	This operational objective is **unlikely to be achieved** as this system does not foresee to offer any benefits to adhering actors.
	Establish an EU Space Label that offers guidance on and confirms adherence to clearly defined criteria based on common standards, guidelines, and best practices.	This operational objective is **unlikely to be achieved** as this system does not foresee the establishment or award of a label.

Table 7 - Link of High-level system #2 with the policy objectives of the EU initiative

6.3 High-level system 3: Public (intergovernmental) mechanism based on labelling (EU Ecolabel)

6.3.1 Introduction and type of model

High-Level System	Level of Application		Bindingness for Companies	
	Company Level	Product Level	Voluntary	Mandatory
EU-Ecolabel		X	X	

The EU Ecolabel is a voluntary label at product level for environmental excellence. It was established in 1992 and is currently implemented under Regulation (EC) No. 66/2010. It certifies products with a guaranteed low environmental impact. Since it is a voluntary award scheme, producers, importers and retailers can choose to apply for the label for their goods and services. In addition, the EU Ecolabel is an EN ISO 14024 type I ecolabelling scheme.[171] It is "third party verified" meaning that independent accredited third parties are responsible for assessing the conformity of products with EU Ecolabel criteria.

6.3.2 Functioning logic

An independent third party (accreditation body) awards the EU Ecolabel based on multiple criteria that indicate the overall environmental preferability of a product category which is determined through a life-cycle assessment. The EU Ecolabel is voluntary for companies.[172]

The EU Ecolabel is awarded to products that meet specific environmental performance criteria based on the latest strategic objectives of the EU Ecolabel community. These criteria are determined through a scientific analysis of the entire life cycle of products and set out the environmental requirements that must be met for a product to bear the EU Ecolabel. The criteria are based on the top-performing products available on the EEA market in terms of environmental performance and generally represent the top 10-20% of products available at the time they are adopted. In developing the criteria, various factors are taken into consideration, including environmental impacts, social and ethical aspects, etc.

For the award of the EU Ecolabel, any company that wishes to use it can apply to the competent bodies[173] designated by each Member State (e.g., government ministries or others). To use the EU Ecolabel, a product must be in line with the EU Ecolabel criteria for that product category and must have been awarded the label. The application process consists of four main steps: contacting the Competent Body to apply; registering in the Ecolabel catalogue (ECAT); providing information needed for testing and carrying out the verification of the product/service; submitting all documents required for application; and carrying out the assessment by the Competent Body, which will lead to the decision on eligibility.

Once the application process is completed and the EU Ecolabel is awarded, **control of the use of the EU Ecolabel is crucial to ensure correct implementation.** As mentioned in Article 10 of Regulation

[171] ISO 14024 Type 1 Ecolabel schemes cover the whole life cycle and all relevant environmental aspects and has absolute requirements. All stages from raw materials to production, use, disposal and recycling are included in the assessment when the requirements are established. The objective of this type of environmental labelling programme is to contribute to a reduction in the environmental impacts associated with products, through the identification of products that meet the specific criteria of a Type I programme for overall environmental preferability. See: https://www.iso.org/news/ref2273.html

[172] See: https://environment.ec.europa.eu/topics/circular-economy/eu-Ecolabel-home/about-eu-Ecolabel_en

[173] To see the competent bodies of the Member States, see: https://ec.europa.eu/environment/archives/Ecolabel/tools/competentbodies_en.htm#:~:text=The%20Competent%20Bodies&text=They%20are%20independent%20and%20neutral,label%20to%20companies%20that%20apply.

(EC) No 66/2010[174] on EU Ecolabel, the Competent Body which awarded the EU Ecolabel must verify regularly that the product is in line with the EU Ecolabel criteria and relevant assessment requirements. It can also undertake verifications based on a complaint or through random spot-checks. If a Competent Body finds that a product displaying the EU Ecolabel does not meet the relevant criteria for the product group or the label is being used incorrectly, they can prohibit the use of the EU Ecolabel on that product. Once prohibited, the Competent Body must inform all other Competent Bodies and the Commission.

6.3.3 Scope of the requirements

The overall scope of the requirements of the EU Ecolabel concerning sustainability is limited and specifically focused on environmental impact. The criteria and requirements differ depending on the type of product. Some product categories have fewer criteria/requirements than others.

When the requirements for a specific product category or service are revised, each product or service is re-assessed to check whether the product or service conforms with the new requirements.[175]

6.3.4 Cost implications for companies

The applicant company is responsible for compiling the application and obtaining all necessary supporting evidence which includes conformity assessment by an independent third party. The applicant must also pay an application fee[176] and an annual license fee requested by the Competent Body. In some cases, applicants may be charged for an on-site verification. After the award of the EU Ecolabel licence, Competent Bodies may also charge for extension/modification fees and on-site inspections. Reductions are available for micro-enterprises and SMEs, companies from developing countries and companies registered under EMAS or certified under ISO 14001.

6.3.5 Potential incentives for adherence by companies

The following main incentives have been identified as relevant by previous studies[177]:

- Corporate Social Responsibility: Consumers' increased awareness of environmental issues motivates companies to satisfy customers' specific requests for products and services of high environmental quality;
- Increased business opportunities: One of the most powerful drivers for companies to choose the EU Ecolabel is the need to respond to external pressures coming from the "demand side". The decision to use ecolabels by the business sector is driven by the aspiration to extract a premium price on ecolabelled products/services and to gain access to other markets and opportunities offered by green public procurement policies;
- Recognition of the label in all EU countries:[178] This ensures consistency and a common understanding of environmental standards across the EU. It makes it easier for consumers and

[174] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32010R0066
[175] Ecolabelling Denmark. 10 strengths: How the Nordic Swan Ecolabel and the EU Ecolabel promote circular economy See: https://www.Ecolabel.dk/en/why-choose-Ecolabelling/circular-economy/10-strengths
[176] For fees in each Member State see: https://environment.ec.europa.eu/system/files/2023-02/EU_Ecolabel_fees_table_2023_02.pdf
[177] Iraldo, F.; Barberio, M. Drivers, Barriers and Benefits of the EU Ecolabel in European Companies' Perception. Sustainability 2017, 9, 751. https://doi.org/10.3390/su9050751
[178] A survey conducted by Eurobarometer between September and October 2017 showed that more than a quarter of European respondents (27 %) are aware of the EU Ecolabel. Around one third of respondents (32 %) said that ecolabels play an important role in their purchasing decisions. Among those who were aware of any ecolabels, 30 % said that they have bought a product carrying the EU ecolabel and more than three-quarters (78%) of respondents agreed that they 'trust that products carrying the EU Ecolabel are environmentally friendly'. In a more recent survey conducted by Eurobarometer between February to March 2021, around a fifth of

companies to identify environmentally friendly products and services regardless of where they are in the EU;

- Green public procurement: The EU Ecolabel is highly regarded for green public procurement purposes and is featured prominently in the Buying Green! Handbook[179] which outlines how the label can be used at various stages of the procurement process. This allows companies whose products/services are awarded the EU Ecolabel to access new markets and green financing i.e., through public procurement;
- Economic opportunities in the field of circular economy: The EU Ecolabel promotes sustainable consumption and production which are drivers towards a circular economy. Recognising these opportunities, many companies have begun to explore and integrate its principles by analysing their suppliers and improving product design.[180]

6.3.6 Overall strengths and weaknesses

The following table provides an overview of the strengths and weaknesses of the high-level system.

Category	Strengths	Weaknesses
Applicability	This mechanism covers a wide range of product categories with the possibility of adding more product categories if deemed relevant.	The scope is limited, and the label only applies to products rather than companies. A label such as the EU Ecolabel is focused on e.g., the environmental dimension only. A label such as the EU Ecolabel is defined in such a way that only 10-20% of products on the market can be labelled. If more products comply, the criteria become more stringent. This may result in companies losing or no longer being able to obtain the label.
Governance (incl. costs)	The governance mechanism structure is well designed and provides clarity to companies regarding the steps to follow to obtain the label and the bodies in charge of each step from application to label award. Such a label is based on a solid legal basis, i.e., a Regulation, which defines the roles and responsibilities of each body in charge of the labelling process.	The system is quite complex due to the diverse actors involved and the procedure to ensure the award of the label from requirements and criteria development to monitoring and verification after the label is awarded. The costs to set up a label are high as it requires significant efforts to develop the mechanism in terms of methodology development, establishment of a legal basis (potentially a

European respondents (22%) declared to have bought products marked with an environmental label. This shows that labels play an important role in the purchasing behaviour of European consumers. For additional information see also: https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home/faq_en

[179] The handbook provides detailed guidance on incorporating the EU Ecolabel into procurement procedures to promote environmentally friendly purchasing practices. See: https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

[180] See: https://www.sustaineurope.com/the-eu-ecolabel-as-a-driver-to-circular-economy.html

Category	Strengths	Weaknesses
	There is strong stakeholder engagement for the development of the requirements and criteria to be used for each specific product category; this ensures representation, buy-in, and a strong knowledge basis.	Regulation), a governance mechanism, national competent bodies, etc. The governance system for monitoring and enforcement requires significant efforts in terms of verification/conformity assessment, checks following complaints, actors involved, and time needed to carry out the verifications.
Costs for companies for adherence and membership	Application fees are relatively low and proportional to the size of the company. In addition, reductions are available for micro-enterprises and SMEs, companies from developing countries and companies registered under EMAS or certified under ISO 14001.[181]	While the fees for the acquisition and use of the label are not high, the conformity assessment of the products to be labelled may be costly for applicants depending on the type of product being tested. Regular verifications and ad-hoc checks also create costs.
Incentives for companies	Companies whose products/services have been awarded such a label can access green public procurement and so reduce their costs. Reporting obligations on the sustainability of products may be easier in terms of efforts and time needed for companies that have such a label since they can reuse indicators already provided as part of having obtained the label. Such a label may serve as an effective tool for businesses to demonstrate their environmental efforts and provide visible proof of their sustainability practices; they can demonstrate their corporate social responsibility using such a label which allows them to attract environmentally conscious customers and partners. Such a label may bring economic opportunities for companies interested in circular economy, as the label recognises efforts in terms of sustainable production.	N/A

[181] A one-off application fee and an annual fee are payable to the Competent Body that processes the application. Application for the EU Ecolabel varies depending on the type of companies (ranging from 200-350 EUR for micro-enterprises; 200-600 for SMES; 2000-2000 for all other companies. 30% reduction for companies registered under EMAS or 15% reduction for companies certified under ISO 14001.There is a maximum annual fee for the use of the Ecolabel: EUR 18 750 for micro-enterprises, SMEs and businesses; EUR 25 000 for all other companies. See: https://europa.eu/youreurope/business/product-requirements/labels-markings/ecolabel/index_en.htm#:~:text=Application%20for%20the%20EU%20Ecolabel,2000%20for%20all%20other%20companies.

Category	Strengths	Weaknesses
	Requirements for such a label are transparent and publicly available which offers transparency about the application and awarding processes.	
Monitoring and enforcement	This mechanism has a strong verification procedure which ensures that such a label is correctly used.	N/A
Awareness-raising	The label is widely known by consumers and public and private sectors which allows for the promotion of better corporate behaviour by companies who are awarded the label. It also offers awareness-raising activities such as a website advising companies on how to market the logo, etc.[182]	N/A

Table 8 - Overall strengths and weaknesses of High-level system #3

6.3.7 Potential role of the Commission in a similar high-level system for space traffic management

If the Commission were to set up a high-level system similar to the EU Ecolabel, it would need to put in place a Regulation establishing the roles and responsibilities of the bodies responsible for such a label. The Commission would be responsible for similar tasks as those under the EU Ecolabel, such as coordinating the process for the development of requirements and criteria; establishing the Labelling Board and ensuring it represents the interests of relevant parties such as public (EU and national authorities) and private sectors (incl. SMEs) during the creation and revision of requirements and criteria; promoting the label through awareness-raising actions and information and public education campaigns to targeted stakeholders; and providing a platform for exchange of information and experiences to foster consistent implementation of the label.

6.3.8 Suitability of the high-level system to support the achievement of identified policy objectives in space traffic management

The table below provides an overview of the extent to which the policy objectives (see section 5) could be achieved if a similar system were established in the domain of space traffic management.

Policy objectives		Suitability of the high-level system to help achieve identified STM policy objectives
Specific objectiv	**Promote a set of common standards, guidelines, and best practices** to guide space actors	This specific objective is **likely to be achieved** as adherence to specific standards and guidelines is required to obtain such a label.

[182] See: https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home/eu-ecolabel-branding_en

Policy objectives		Suitability of the high-level system to help achieve identified STM policy objectives
	towards safer and more sustainable space activities.	
	Incentivise adherence by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness.	This specific objective is **likely to be achieved** if appealing incentives are available and accessible to space actors who adhere to relevant standards, guidelines and best practices.
Operational objectives	**Raise awareness** of the importance and interconnectedness of various domains, e.g., space safety, the environment, and dark and quiet skies.	This operational objective is **likely to be achieved** if the label is built on standards, guidelines and best practices focusing specifically on space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies, and if these are incorporated into the same overarching labelling framework.
	Offer benefits to actors who adhere to common standards, guidelines, and best practices, thereby fostering innovation and technological development.	This operational objective is **likely to be achieved** if space actors adhering to relevant standards, guidelines and best practices can reap benefits in terms of e.g., easier access to financial and/or reputational benefits, outreach to additional customer groups, etc.
	Establish an EU Space Label that offers guidance on and confirms adherence to clearly defined criteria based on common standards, guidelines, and best practices.	This operational objective is **likely to be achieved** for **space missions** or components as the main focus of this system is to establish and award a label for products. This operational objective is **unlikely to be achieved** for standards, guidelines and best practices that address **companies**.

Table 9 - Link of High-level system #3 with the policy objectives of the EU initiative

6.4 High-level system 4: Private-sector-led mechanism based on labelling (Voluntary Sustainability Standards)

6.4.1 Introduction and type of model

High-Level System	Level of Application		Bindingness for Companies	
	Company Level	Product Level	Voluntary	Mandatory
Voluntary Standards	X	X	X	

Many private organisations develop labels or certificates based on standards to regulate business conduct and behaviour on sustainability challenges. More recently, these initiatives have been captured under the name of Voluntary Sustainability Standards (VSS). The United Nations Forum on Sustainability Standards (UNFSS, 2013: 3) defines VSS as "Standards specifying requirements that producers, traders, manufacturers, retailers or service providers may be asked to meet, relating to a wide range of sustainability metrics, including respect for basic human rights, worker health and safety, the environmental impacts of production, community relations, land use planning and others." These VSS have been translated into EU Law as mandatory.

Currently, there are more than 300 product- or sector-specific VSS operational worldwide. Some label a limited number of products, producers, or companies, while others label many products, producers or companies all over the world. VSS may therefore apply both at corporate and product level.

6.4.2 Functioning logic

A VSS works via a certification logic. An organisation (private sector) defines general objectives or theories of change that it wants to achieve in the behaviour of companies, and operationalises them into specific requirements, standards and indicators which can be monitored and assessed. The development of guidelines and best practices is made through an inclusive consensus-based and multi-stakeholder process and represents all affected stakeholders. If companies conform to these standards, they can obtain a VSS label which they can then use in commercial transactions. Granting a label is based on a set of procedures including a conformity assessment performed by an independent third party.

6.4.3 Scope of the commitments

Depending on the VSS, the scope of the commitments can be narrow or broad. It can, for example, include many different sustainability-related aspects such as the principles[183] formulated by the Forest Stewardship Council (FSC)[184], one of the oldest and most widely used VSS labels.

6.4.4 Cost implications for companies

Costs for being awarded a VSS vary widely depending on the investments a company needs to make to be able to adhere to the standards on which a VSS label is based, or on the scope of the VSS itself. Typically, a pre-audit will determine which corrective actions a company needs to take to adhere to the VSS requirements. If there are many corrective actions to take, the costs of getting awarded the VSS label will be higher. Typically, companies that are not already at least to a certain degree aligned with the requirements will not apply for a VSS label.

In addition, the costs of a company for operating under certified conditions tend to be higher than for operating under non-certified conditions, likely due to the stringency of the labelling requirements.

6.4.5 Potential incentives for adherence by companies

A VSS can provide several benefits offering incentives to companies: A VSS can (1) provide access to markets where consumers require labels for purchase/procurement processes; for instance,

[183] 1) comply with all applicable laws; 2) maintain or improve the social and economic well-being of workers; 3) uphold the rights of Indigenous Peoples; 4) maintain or improve the social and economic well-being of local communities; 5) manage their products and services in a way that maintains or improves their long-term economic viability, social benefits, and environmental benefits; 6) maintain, conserve, and/or restore the ecosystem services and environmental values of managed forests; and also avoid, repair, or mitigate negative environmental impacts; 7) establish a management plan that outlines their economic, environmental, and social policies and objectives; 8) demonstrate progress toward meeting these objectives; 9) maintain or improve high conservation values; 10) ensure that all management activities comply with FSC principles and criteria.

[184] See: https://fsc.org/en/fsc-standards

sustainability labels cater, at least to a certain degree, to specific consumer demands and niches, and offer market incentives in the demand for sustainable products; (2) provide quality assurance and sustainability signals to investors; (3) assure compliance with criteria in procurement tenders; and (4) display a visual sign of commitment to corporate social responsibility/responsible business conduct.

6.4.6 Overall strengths and weaknesses

The following table provides an overview of the strengths and weaknesses of the high-level system.

Category	Strengths	Weaknesses
Applicability	Such a system can be broad in scope, so it can cover aspects of e.g., space safety and sustainability, impact of space activities on the environment, and preservation of dark and quiet skies. Such a system could allow for the development of several labels for which companies could apply.	N/A
Governance (incl. costs)	A VSS organisation develops guidelines and best practices through an inclusive consensus-based and multi-stakeholder process and aims to represent all affected stakeholders. For public authorities, the costs for setting up such a system are low as it is led by the private sector.	A public authority wishing to shape the scope, requirements, or governance of a VSS may have no or very little influence as VSS are led by the private sector. For the private sector, the costs of setting up and managing a VSS label might be high depending on the applicability in terms of companies, requirements, labelling process, etc.
Costs for companies for adherence and membership	Depending on the nature and requirements of the label, the costs may be low for companies that are already compliant with some, most or all applicable requirements.	Depending on the nature and requirements of the label, the costs may be high for companies that are not compliant with the requirements. In the immediate future, obtaining a VSS label might be challenging for smaller companies who do not (yet) adhere to relevant standards, and may not have the required resources to upgrade their processes quickly to comply with VSS label requirements.
Incentives for companies	Incentives for companies to obtain a VSS label include access to green public procurement and reputational benefits.	N/A

Category	Strengths	Weaknesses
	Sustainability reporting obligations may be easier in terms of efforts and time needed for VSS-labelled companies thanks to the use of indicators already provided to obtain the label.	
Monitoring and enforcement	Labelling systems such as the VSS label have well-developed procedures to assess conformity with predefined standards. Due to strong mechanisms to monitor compliance and correct use of the label by the awarded company, their effectiveness in terms of changing corporate behaviour and operations is significant.	N/A
Awareness-raising	While not all labels enjoy the same level of global recognition, some are currently known worldwide and are therefore used by companies inside and outside the EU. Depending on the label, organisations who obtained it may opt to carry out awareness-raising activities, e.g., Rainforest Alliance.[185]	N/A

Table 10 - Overall strengths and weaknesses of High-level system #4

6.4.7 Potential role of the Commission in a similar high-level system for space traffic management

If the Commission were to set up a high-level system similar to a VSS, its role in setting up or initiating such a system is limited since such a system is mostly driven by private actors. However, the Commission could provide incentives to private actors to set up a labelling system. For example, several VSS emerged out of grants from donors which facilitated the creation of a label.

In the context of private labels, it is not uncommon for several competing labels to emerge. In this context, the Commission could be involved in defining the EU's objectives and targets in the short-, medium-, and long-term. It could also observe the development of the standards by the industry in collaboration with European Standardisation Organisations.

6.4.8 Suitability of the high-level system to support the achievement of identified policy objectives in space traffic management

The table below provides an overview of the extent to which the policy objectives (see section 5) could be achieved if a similar system were established in the domain of space traffic management.

[185] See: https://www.rainforest-alliance.org/business/marketing-sustainability/the-ultimate-guide-to-marketing-your-rainforest-alliance-certified-product/

Policy objectives		Suitability of the high-level system to help achieve identified STM policy objectives
Specific objectives	**Promote a set of common standards, guidelines, and best practices** to guide space actors towards safer and more sustainable space activities.	This specific objective is **likely to be achieved only to a limited extent** as the promotion of standards, guidelines, and best practices depends on the level of engagement by the industry and the type of label developed by the private sector.
	Incentivise adherence by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness.	This specific objective is **likely to be achieved only to a limited extent** as the incentivisation is highly dependent on the setup of the VSS and the level of engagement by the private sector.
Operational objectives	**Raise awareness** of the importance and interconnectedness of various domains, e.g., space safety, the environment, and dark and quiet skies.	This operational objective **may be achieved** if the system is built on standards, guidelines and best practices focusing specifically on space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies, and if these are incorporated into one overarching framework.
	Offer benefits to actors who adhere to common standards, guidelines, and best practices, thereby fostering innovation and technological development.	This operational objective **may be achieved** in case the Commission decides to engage with such a system through a rewarding capability in the form of funding opportunities and showcasing companies that have successfully adopted and implemented applicable standards and guidelines.
	Establish an EU Space Label that offers guidance on and confirms adherence to clearly defined criteria based on common standards, guidelines, and best practices.	This operational objective is **likely to be achieved** as such a system foresees the establishment and award of a label.

Table 11 - Link of High-level system #4 with the policy objectives of the EU initiative

6.5 High-level system 5: Private-sector-led mechanism based on expert rating (Space Sustainability Rating)

6.5.1 Introduction and type of model

High-Level System	Level of Application		Bindingness for Companies	
	Company Level	Product Level	Voluntary	Mandatory
Space Sustainability Rating	X		X	

The Space Sustainability Rating (SSR) is a voluntary framework developed by the World Economic Forum (WEF), ESA and a joint team led by the Space Enabled Research Group at the MIT Media Lab in collaboration with BryceTech and the University of Texas in Austin. The framework convenes experts providing technical expertise and guidance on space sustainability issues (provided by ESA among other organisations with specific technical knowledge) to assess the sustainability of space missions[186]. The level of applicability of the SSR is at corporate level.

6.5.2 Functioning logic

The SSR offers a framework for space operators to evaluate the sustainability level of their missions. Space operators, including government agencies, private companies, and other organisations involved in space activities can request a rating. The assessment process for the SSR involves collecting data sent by space operators and other stakeholders and using this data to evaluate the sustainability of their space activities based on the criteria and indicators outlined in the framework.

The SSR is based on a set of modules developed by the Global Future Council on Space Technologies of the WEF which include e.g., orbital debris mitigation, collision avoidance, radio-frequency interference, space environmental management, and corporate behaviour. Each of these pillars is further broken down into specific criteria and indicators which are used to evaluate the sustainability of space activities.

After receiving the information from the requesting entity, the SSR team evaluates the requesting entity's mission based on several indicators and provides a mark or evaluation result. The results are then weighted based on the relative importance of each indicator to the overall sustainability of space activities, resulting in an overall score. The results of the assessment (score) are then used to assign a sustainability rating to the requesting entity. Depending on the result of the assessment, the rating ranges from basic to platinum.

A second score is aggregated enabling the possibility to earn additional credits towards a bonus "Step" indicator which highlights certain steps a mission can take to 'go above and beyond' the baseline rating; this includes, for example, adding optional elements such as active debris removal or de-orbiting fixtures. Bonuses are reported separately and do not contribute to the baseline rating of a requesting entity. It is however reported as an honourable mention represented by stars on the side of the SSR label.

Ratings remain valid during the mission phase and as long as the parameters remain unchanged.

6.5.3 Scope of the commitments

The scope of the commitments is narrow and established in the framework. It includes the general commitments (modules) related to space sustainability as well as specific indicators and parameters. Specifically, it focuses on orbital debris mitigation, radio-frequency interference, space environmental management, and corporate behaviour.

6.5.4 Cost implications for companies

Overall, the cost implications for companies are substantial. Spacecraft operators and satellite manufacturers are to subscribe to the SSR through a yearly subscription for a flat-rate fee of CHF 10,000[187]. This includes the fee associated with up to 10 ratings incl. reviewing, processing, and evaluation as well as tailored and continuous support from the SSR team.

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[186] https://www.esa.int/Space_Safety/Space_Debris/Space_sustainability_rating_to_shine_light_on_debris_problem

[187] 10.199,20 EUR as of 20/06/2023. In order to enable academic projects and start-ups with limited financial resources to apply for a rating, a special discount on the subscription fee is offered to these entities. See: https://spacesustainabilityrating.org/#homefaq

6.5.5 Potential incentives for adherence by companies

The SSR makes the aggregate score of rated companies publicly available. This offers increased transparency for rated companies whose missions, thanks to their SSR rating, are considered more sustainable without disclosing any mission-sensitive or proprietary information.

Such a mechanism could potentially also offer other incentives such as improved funding conditions from financial backers interested in supporting and furthering the sustainability ambitions in the field of space.

6.5.6 Overall strengths and weaknesses

The following table provides an overview of the strengths and weaknesses of the high-level system.

Category	Strengths	Weaknesses
Applicability	The scope of the countries and companies is broad. Any company or organisation involved in space-related activities, as well as any country actively engaged in space activities, can apply to obtain an SSR. The system is applicable to a wide range of actors and lifecycle stages before and after the space mission[188] as muti-stakeholder-led ratings offer flexibility and inclusivity to consider a broad spectrum of companies with varying levels of access to information. In the case of the SSR, the variability of space industry actors is considered to ensure a level-playing field for all actors, considering if a mission has single or multiple assets, the operator's capabilities, and the temporal aspects of a mission's lifetime.	The number of companies that have been tested and given a rating is still relatively low. Therefore, it is still too early to determine the overall applicability.
Governance (incl. costs)	This is a multi-stakeholder system which allows for the involvement of, and therefore likely buy-in by, a diverse range of actors.	The overall governance of the SSR is complex as a higher number of diverse actors is involved which implies substantial coordination and alignment costs. Moreover, in terms of management, the WEF stated that the SSR was developed in collaboration with a group of leading space experts and stakeholders and that it represents a significant investment in terms of resources and expertise.

[188] In-orbit operations is not as covered by the SSR due to the difficulties to monitor what space operators do once their spacecraft is in orbit.

Category	Strengths	Weaknesses
Costs for companies for adherence and membership	Discounts are provided for companies that have limited financial resources to apply for a rating.	Applying to get a rating is costly for companies as the fees are very high.
Incentives for companies	Ratings can provide incentives related to reputation. Since this system offers transparency on a company's rating and level of sustainability of its missions, it is likely to incentivise desired behaviour. A favourable score for a particular rated operator might result in improved funding conditions for potential investors.[189] Along with the rating itself, the SSR also provides a detailed report about steps that operators could take to increase their ratings, such as changes to their spacecraft design or further information that they could share.[190] This guidance and exchange of knowledge may help actors to improve the rating of their operations.	At least in the near future, this system does not seem to offer insurance benefits or easier access to public procurement or green financing, which could all be relevant and offer real incentives for companies to adhere to this system.
Monitoring and enforcement	Monitoring and enforcement are strong in the lifecycle stages before and after the space mission, as this initiative evaluates the implementation and efficiency of collision avoidance and post-mission disposal strategies. It also assesses the ability to detect and track a spacecraft and promotes compliance with existing space debris mitigation guidelines.	Enforcement is weak during mission implementation as it is difficult to monitor and control what space operators do once their spacecraft is in orbit.
Awareness-raising	The SSR offers a common definition regarding the sustainability of space missions. This is relevant as it offers companies a common framework by which they are measured in their level of sustainability, which may further motivate them to improve the sustainability of their operations. This makes it possible to define a certain level of sustainability which all space operators should aim to achieve.	N/A

[189] https://www.esa.int/Space_Safety/Space_Debris/Space_sustainability_rating_to_shine_light_on_debris_problem
[190] https://www.wevolver.com/article/a-new-rating-for-space-sustainability

Category	Strengths	Weaknesses
	The SSR carries out marketing activities to raise awareness about the system through e.g., events or press promotion.[191]	

Table 12 - Overall strengths and weaknesses of High-level system #5

6.5.7 Potential role of the Commission to achieve the policy objectives in a similar high-level system for space traffic management

If the Commission were to set up a high-level system similar to the SSR, its role could be to bring together a consortium that develops a rating focused on a specific area e.g., space safety and sustainability or the preservation of dark and quiet skies. The requirements, type of rating, applicability of companies and overall methodological procedure to award the rating would be created by this consortium. The Commission could also support the selection of existing standards to be included in such a mechanism.

Additionally, the Commission could play a role in promoting the adoption of such a mechanism by engaging with stakeholders in the space domain through its various industry groups. It could also provide incentives such as access to green public procurement or other funding opportunities to those space operators who have obtained a rating.

Alternatively, to avoid duplicating the efforts of the SSR, the Commission could decide to join the existing SSR as a member and support the promotion of the rating at EU level.

6.5.8 Suitability of the high-level system to support the achievement of identified policy objectives in space traffic management

The table below provides an overview of the extent to which the policy objectives (see section 5) could be achieved if a similar system were established in the domain of space traffic management.

Policy objectives		Suitability of the high-level system to help achieve identified STM policy objectives
Specific objectives	**Promote a set of common standards, guidelines, and best practices** to guide space actors towards safer and more sustainable space activities.	This specific objective is **likely to be achieved** as adherence to specific standards, guidelines and best practices is required to obtain such a rating.
	Incentivise adherence by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness.	This specific objective is **likely to be achieved** as such a scaled system allows companies on different levels of capabilities and preparedness to apply as different targets exist for different rating levels, thereby reducing barriers to apply.

[191] See: https://spacesustainabilityrating.org/ssr-in-the-press/

Policy objectives		Suitability of the high-level system to help achieve identified STM policy objectives
		In addition, incentives such as guidance and advice or access to finance are available to rated companies independently of their levels of capabilities and preparedness.
Operational objectives	**Raise awareness** of the importance and interconnectedness of various domains, e.g., space safety, the environment, and dark and quiet skies.	This operational objective **may be achieved** if the system is built on standards, guidelines and best practices focusing specifically on space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies, and if these are incorporated into one overarching framework. In a scaled system such as a rating, it would be possible to assign different rating levels in different domains, thereby allowing space actors to choose in which domain they wish to invest efforts.
	Offer benefits to actors who adhere to common standards, guidelines, and best practices, thereby fostering innovation and technological development.	This operational objective is **likely to be achieved** if space actors adhering to relevant standards, guidelines and best practices can reap benefits in terms of e.g., easier access to financial and/or reputational benefits, outreach to additional customer groups, etc.
	Establish an EU Space Label that offers guidance on and confirms adherence to clearly defined criteria based on common standards, guidelines, and best practices.	This operational objective is **likely to be achieved** as the system foresees the establishment and award of a label in the form of a scaled rating.

Table 13 - Link of High-level system #5 with the policy objectives of the EU initiative

6.6 Conclusions and recommendations for an EU-wide mechanism

6.6.1 Conclusions drawn from the assessment of the high-level systems

The previous sub-sections presented five existing voluntary high-level systems outlining their strengths and weaknesses and assessing in how far each system would be able to support the EU in achieving its policy objectives in the domain of space traffic management.

Based on this assessment, the **most suitable high-level system** on which to build an EU-wide mechanism for space would be **high-level system 3 "public (intergovernmental) mechanism based on labelling"**. The assessment confirms that **both specific objectives** and **all three operational objectives** are **likely to be achieved** under a public mechanism based on labelling.

Considering the varied landscape of space actors and the **general policy objective** of the EU to foster the **competitiveness of the EU space industrial sector**, it is important to design a voluntary mechanism that also considers the **varying resources and capabilities** available to e.g., global players, SMEs, and start-ups. Any voluntary EU-wide mechanism should therefore offer all space actors,

independently of their level of resources or capabilities, the possibility to reap the benefits offered by such a mechanism. Based on the assessment above, this is **most likely to be achieved** through a rating system such as **high-level system 5 "private-sector-led mechanism based on expert rating"**. Such an expert rating could be designed in such a way as to allow space actors to be rated based on their performance not in absolute terms but considering also their available resources or capabilities, thereby strengthening their competitiveness.

6.6.2 Recommendations for establishing an EU-wide mechanism

Based on the above assessment and conclusions, we **recommend building the voluntary EU-wide mechanism on high-level system 3 "public (intergovernmental) mechanism based on labelling" complemented by elements of high-level system 5 "private-sector-led mechanism based on expert rating"**.

While duplications of existing systems should be avoided to reduce administrative burden and any risk of confusion among users, it is important to highlight that the **examples put forward** in this section – the EU Ecolabel for labelling and the Space Sustainability Rating for expert rating – **cover some**, **but not all, aspects** that are **essential for supporting space traffic management**.

The **EU Ecolabel**, a voluntary certification scheme renowned for endorsing environmentally friendly products and services, finds its domain primarily within the confines of **Earth-based industries and consumer goods**. Its criteria and standards, meticulously crafted to **address terrestrial environmental concerns**, may not seamlessly translate to the reality of space activities. **Space activities** present a myriad of **unique challenges** including microgravity, vacuum conditions, and the ever-looming threat of space debris which demand specialised considerations **beyond the scope of the EU Ecolabel**. Moreover, the regulatory framework governing space activities extends far beyond the EU, falling under the purview of **international space law and collaboration** among various global stakeholders. While sustainability principles are increasingly pertinent to space activities, developing a tailored eco-label for space activities would necessitate **extensive collaboration** and the formulation of **new, specialised standards attuned to the singular challenges of outer space**.

The **Space Sustainability Rating**, a voluntary rating scheme known for its detailed technical assessment of space actors' performance in the field of **collision avoidance and post-mission disposal**, has done tremendous work in raising awareness for the need to increase space sustainability efforts. However, as mentioned in section 3, the domain of **space traffic management extends beyond space safety and sustainability** as it encompasses the already identified areas of environmental impacts of space activities and the preservation of dark and quiet skies, but may include also other domains in the future. For this reason, it would be **more suitable** to foresee a **mechanism** that offers the **flexibility** to **assess the performance** of space actors **in any domain** that is, or will be, deemed **relevant for supporting space traffic management**. In addition, were the Commission to **join the existing SSR**, e.g., to avoid duplicating existing initiatives, its **role and possible influence** in shaping an EU approach to Space Traffic Management through the SSR would likely be **rather limited** as **other international organisations** are **in charge** of managing this mechanism. To **foster the competitiveness of the EU space industry**, part of the **EU's general objective** of this initiative, it seems **more suitable** to develop a **mechanism at EU level** that the **EU**, through the Commission and while respecting the competences of the EU Member States, **can shape in line with its wider strategic priorities** and policy objectives in the field of Space Traffic Management.

7 Blueprint for an EU Space Label

The previous section recommended building a voluntary EU-wide system for space traffic management on a public mechanism based on labelling complemented by elements of expert rating. Based on this recommendation, this section therefore presents a blueprint for a voluntary EU-wide mechanism in the form of an EU Space Label. It identifies key requirements for an effective voluntary labelling mechanism and encompasses all applicable core components.

7.1 Key principles and concepts of effective labelling

The development of this blueprint for an EU Space Label starts from the basic assumption that the newly created label will operate as a **voluntary, multi-criteria and third-party verified labelling framework**. This implies that:

- labels are awarded on a voluntary basis (*voluntary*);
- labels relate to products, services, organisations and/or processes if and when they fulfil a pre-defined set of criteria (*multi-criteria*);
- an independent person or organisation is responsible for verifying if the defined criteria are fulfilled (*third-party verification*).

A review of the literature and existing studies on such labels and their adoption in different domains highlight key factors that contribute to effective labelling[192]. There is a general consensus that the success of voluntary labels is determined not only by the **characteristics of the label itself** but also by the **approach taken for its development and introduction** to stakeholders. A solid understanding of the context in which the label will be introduced and a **strong engagement of and endorsement by all relevant stakeholders are widely recognised as key success factors**. Other factors that determine the success of a label include the selection of products or processes that could receive the label, the quality of the criteria, the quality of the assessment process, and the visibility of the label.

This section attempts to address these success factors in the context of space activities for the introduction of a label aimed at supporting a common (EU) Space Traffic Management approach. The proposed blueprint is structured along **three main stages for the design** of a label: the development of the label, the assessment and certification process, and ensuring the use and maintenance of the label. For each of these stages, we identify and propose key requirements that should be met as well as other options to consider for their implementation. The identification of these requirements and options relies on five main sources of evidence:

- relevant standards on conformity assessment and labelling, such as ISO/IEC 17000:2020(E) - Conformity assessment - Vocabulary and general principles; ISO/IEC 17065:2012(E) - Conformity assessment - Requirements for bodies certifying products, processes and services;

[192] See e.g., Winters et al, 2015; Tröster & Hiete, 2018.

and ISO 14024:2018 - Environmental labels and declarations - Type I environmental labelling- Principles and procedures;

- the ISEAL Codes of Good Practice[193] which provide a globally recognised framework defining practices for effective and credible sustainability systems and focusing on three core elements of a sustainability system: Standard-Setting, Assurance and Impacts;
- relevant EU legislation establishing rules on conformity assessment, certification, and accreditation[194], the internal market, competition, and state involvement[195];
- existing EU labelling and certification practices[196] such as the EU Ecolabel[197] and the EU Cybersecurity Certification Framework[198];
- expert/stakeholder input.

Concerning existing EU labelling and certification practices, the EU Ecolabel and the EU Cybersecurity Certification Framework can be considered as examples of EU voluntary labelling programmes for offering insight and inspiration on how a labelling framework could be set up. They both consist of a general labelling framework under which various specific labelling schemes can be developed. The labelling framework establishes general rules and procedures for creating specific labelling schemes, each of which focuses on its category of products or processes.

This approach of working with different schemes is suitable to the EU Space Label which could be considered as an EU space labelling framework under which different space labelling schemes could be developed that would cover different aspects related to space traffic management.

Three potential EU space labelling schemes have been identified so far:

1. A Space Label on Safety and Sustainability in space
2. A Space Label on Environmental Aspects
3. A Space Label on Preserving Dark and Quiet Skies

It is important to note that while we propose specific labelling schemes for these topics as part of this study, the current level of maturity of those topics varies widely. This is why it is important to continue discussions at both international and EU levels, particularly on environmental aspects of space activities and the preservation of dark and quiet skies, to develop mechanisms such as standards or guidelines that allow for their inclusion in potential specific labelling schemes.

[193] https://www.isealalliance.org/get-involved/resources/iseal-codes-good-practice
[194] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008R0765
[195] e.g., Articles 49, 65 and 107 of the Treaty on the Functioning of the European Union (TFEU)
[196] As presented in the Interim Report, and discussed during three workshops (July, September and October 2023) and stakeholder interviews dedicated to the space label.
[197] http://data.europa.eu/eli/reg/2010/66/oj
[198] http://data.europa.eu/eli/reg/2019/881/oj

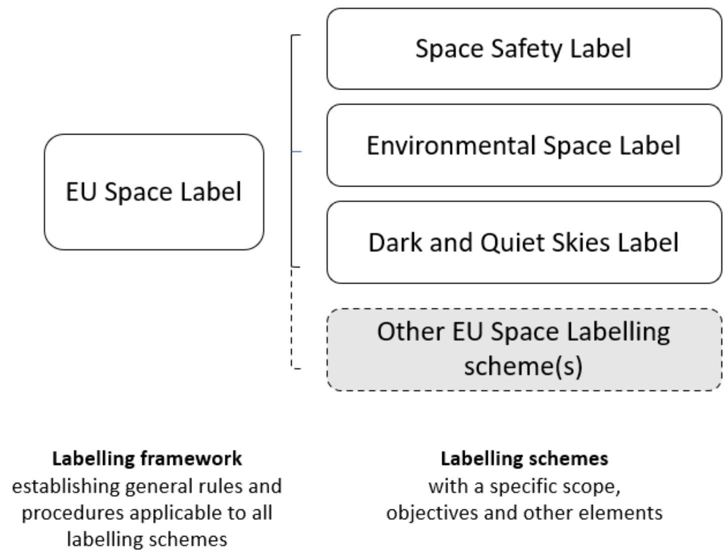

Figure 8 - Relationship between labelling framework and labelling schemes

Throughout this chapter, the various relevant elements of the EU Space Label are introduced and discussed. Recommendations are provided on whether these elements should be developed at the level of the overarching labelling framework and/or at the level of a specific labelling scheme. Moreover, specificities related to each of the three potential labelling schemes are detailed where applicable.

For a clear understanding of the meaning of the main concepts, this chapter follows the terms and definitions specified in ISO/IEC 17000 Conformity assessment — Vocabulary and general principles and ISO 14024:2018 - Environmental labels and declarations. The following definitions are therefore applied:

- **labelling programme**: a voluntary, multiple-criteria-based third-party programme that authorises the use of labels[199];
- **attestation**: after successful completion of the certification procedure, issue of a statement, based on a decision, that fulfilment of specified requirements has been demonstrated;
- **certification**: procedure by which a third party gives written assurance that a product or process conforms to specified requirements (also called third-party attestation[200]);
- **conformity assessment**: demonstration that specified requirements are fulfilled;
- **conformity assessment body**: the body that performs conformity assessment activities, excluding accreditation;
- **accreditation**: third-party attestation related to a conformity assessment body conveying formal demonstration of the competence, impartiality and consistent operation of the conformity assessment body in performing specific conformity assessment activities;
- **surveillance**: systematic iteration of conformity assessment activities as a basis for maintaining the validity of the statement of conformity.

[199] Definition based on the ISO 14024:2018 definition of a 'Type I environmental labelling programme'.
[200] First-party attestation, which is performed by the person or organisation that provides or that is the object of conformity assessment, is called 'a declaration'.

7.2 Development of the label

This sub-section discusses the **requirements[201] and approaches for the effective development of an EU Space Label** consisting of a wider EU space labelling framework under which different space labelling schemes could be developed and implemented. It starts with the scope and objectives of the label before proposing criteria for awarding the label, providing an overview of a proposed governance structure, and detailing the overall process of developing and adopting the label.

7.2.1 Scope and objectives of the label

Design question: What would be the scope and the objectives of the EU Space Label?

7.2.1.1 Requirements

The **first step in the design and development** of a label consists of determining the objective(s) and scope of the labelling framework (general objectives and scope) and, if already known, of each envisaged labelling scheme (specific objectives and scope). In both cases, the objectives should be driven by a clear vision of its desired outcomes and impacts.

In defining the **objectives of the labelling frameworks and schemes**, their necessity should be justified. The framework and labelling schemes should be **positioned relative to existing practices and initiatives** such as existing labelling schemes (e.g., at the national level), but also relevant standards, and regulatory and legislative initiatives with potentially similar or overlapping scopes. Complementarity and coherence between the new labelling framework or schemes and existing initiatives should be examined and justified. There should be an added value in developing and implementing a new label.

In defining the **scope of a label**, clarity should, at minimum, be provided on what will be assessed and certified (i.e., products, processes, systems, organisations, or a combination of these). In case of a wider labelling framework under which different schemes are developed, each of these schemes could have a different scope. It is important to be very clear about the scope at the level of both the overall labelling framework – i.e., what is the common scope of all underlying schemes –, and at the level of the specific labelling scheme – i.e., what is the exact scope of each scheme.

7.2.1.1.1 Existing EU labelling frameworks

Using the **EU Ecolabel** as a good practice to illustrate the above, **Regulation (EC) No 66/2010**[202] already states that Ecolabel criteria should “take into account the latest strategic objectives of the Community in the field of the environment”. These criteria are established for a wide range of so-called product groups, which means that the scope of each of these product groups is different. The overall objective is to minimise the environmental impacts of these products over their entire lifecycle while guaranteeing their high quality.

Because each product category is different, criteria are tailored to address the unique characteristics of each product category. In the development of the criteria for a product group, a reasoning should be provided for the choice and scope of the product group. In addition to this, an analysis should be provided

[201] Requirements in this context (also in subsequent sections) are those defined in the relevant international standards for developing labels. They are different from the requirements defined in other International Standards, e.g., those on space safety, which cover the safety aspects themselves and might be the basis for defining the criteria for the label (schema).
[202] Regulation (EC) No 66/2010 of the European Parliament and of the Council

of existing laws and ongoing legislative initiatives related to the product group sector. With regard to the expected impact of introducing an ecolabel for this new product group, a quantitative indication should be given on the potential environmental benefits, and the added value of developing EU ecolabel criteria for the chosen product group should be demonstrated.

Likewise, **EU Regulation No 2019/88 on ENISA and ICT cybersecurity certification**[203] includes a list of ten security objectives of European cybersecurity certification schemes that must be achieved by the certification schemes designed under the Cybersecurity Certification Framework. The specific elements of European cybersecurity certification schemes laid down in Article 54 of the Regulation include elements dealing with the objectives and scope of the certification schemes. The first **three elements of each cybersecurity certification scheme** are:

- the subject-matter and scope of the certification scheme including the type or categories of ICT products, ICT services and ICT processes covered;
- a clear description of the objectives of the scheme and of how the selected standards, evaluation methods and assurance levels correspond to the needs of the intended users of the scheme;
- references to international, European, or national standards applied in the evaluation or, where such standards are not available or appropriate, to technical specifications or other cybersecurity requirements defined in the European cybersecurity certification scheme which may serve as inspiration (e.g., good practices) and help to achieve the objectives set out in the labelling framework.

While other labelling and certification schemes exist and provide valuable inspiration, their specific objectives and intended use are not sufficient to address the identified challenges in the area of space traffic management. The subsequent sections therefore focus on the EU Ecolabel and the European Cybersecurity Certification Framework as benchmarks for a possible EU Space Label.

7.2.1.2 Design of the EU Space Label

Based on the elements outlined above, the objectives and scope of the EU Space Label could be defined:

- at the **level of the EU Space Label framework** with a set of common objectives and a wider scope applying to all specific labelling schemes;
- at the **level of specific labelling schemes** with additional objectives and a specific scope on the specificities sought by each of the labelling schemes.

Specific labelling schemes should therefore address both general objectives and comply with the scope of the broader framework, and provide clarity on their specific objectives and scope.

In this section, we first discuss the objectives and scope of the EU Space Label framework before focusing on the specific objectives and scope of each of the three proposed EU space labelling schemes.

7.2.1.2.1 EU Space Label framework

As outlined in section 5.2, the **overall objective** of the EU Space Label framework is to support a **common approach to Space Traffic Management** while **fostering EU space industrial competitiveness** in full compliance with the respective competences of the EU and its Member States. To this end, the **specific objectives** of the EU Space Label framework are to 1) **promote a set of**

203 http://data.europa.eu/eli/reg/2019/881/oj

common standards, guidelines, and best practices to guide space actors towards safer and more sustainable space activities, and 2) **incentivise adherence** by space actors **to these common standards, guidelines, and best practices**, thereby fostering their competitiveness.

The EU Space Label framework therefore provides a **mechanism to establish EU space labelling schemes** and to attest that all aspects evaluated in accordance with such schemes comply with specified requirements.

The **principles** of the EU Space Label framework include:

- **scalability** i.e., it allows taking into account different domains, stakeholders, labelled elements, etc. allowing for flexibility and adaptability depending on e.g., stakeholder needs and challenges in the design and management of the EU Space Label and labelling schemes;
- **transparency** i.e., it allows involving a vast array of stakeholders from an early stage on and allowing them to share their advice and to shape relevant labelling developments and processes, and defining criteria that are clear and easy to understand for all stakeholders involved.

The **scope** of the EU Space Label framework covers **all aspects related to a space mission** and **may include any relevant aspects contributing to the proper functioning of Space Traffic Management**.

The ISO 24113 standard defines a (space) mission in a narrow way: "set of tasks or functions to be accomplished by a spacecraft (3.25) or launch vehicle orbital stage (3.13), other than its disposal". In the context of this blueprint, a **space mission** is therefore considered to **cover all its phases** including definition, from design, manufacturing, testing, to launch, early operations, in orbit validation, commissioning, in-orbit (routine, non-routine and contingency) operations, in orbit, to end of life and disposal. Although the **label** would **apply to all these phases**, the focus is on the design phase as many elements are decided at the time of the design of a space mission. However, compliance with label criteria should also be monitored throughout the other phases, such as criteria on e.g., in-orbit operations. This means that a label could be suspended or withdrawn based on subsequent assessments and data obtained or observed on a space mission during in-orbit operations or end-of-life.

Other characteristics include:

- the label is attributed for a **limited amount of time**;
- the label is attributed **based on compliance checks** against labelling criteria (transparency);
- the label is not linked to single products or services but covers those products, processes and services that are part of a space mission; in this sense, one could consider a **main label** for the overall **space mission** and **sub-labels** for e.g. particular **elements that are part of that space mission**; this, in turn, would also influence how the label could be used and by whom (scalability, transparency).
- the label **affects organisations involved in the different stages of a space mission** (manufacturers, operators, etc.) as particular requirements might be related to particular components or products for which these organisations are responsible; one way to bring these multi-phase, multi-stakeholder and multi-product challenges together is to use the approach of

product life-cycle management in which certain **tier levels** are defined[204]; the label would then cover the relevant tier levels (e.g. up to tier 2) as defined in the future PEFCR for space activities (scalability, transparency);

- the label will be open to both **EU and non-EU organisations** (transparency);
- finally, the label will **build upon mandatory rules** defined in legislation and on requirements defined in existing (international) standards but will **go further by setting more ambitious targets beyond existing mandatory rules** and, where possible, requirements outlined in (international) standards; the aim of the label is therefore to **motivate space actors to reach those more ambitious targets**; the label could offer **different target levels for each criterion** to take into account the specificities of various actors along the value chain, allowing all interested actors – e.g. global players as well as start-ups – to go the extra mile while taking into account their varying levels of available resources and capacities (transparency, scalability).

It is to be noted that the **above details**, in particular the notions of main label and sublabels, and different target levels and tier levels, and the questions of if, how and to which extent they will feature in the final label framework will **require close consultations with relevant stakeholders.** Such consultation will take place during the actual development of the EU Space Label to ensure that the EU Space Label framework is designed in a way that is useful and advantageous for relevant space actors.

7.2.1.2.2 Space Label on Safety and Sustainability in Space

The **general objective** of the Space Label on Safety and Sustainability in space ('Space Safety Label') is **to minimise the risk of collisions and the generation of debris** in all activities carried out throughout the lifecycle of a space mission.

In all lifecycle phases, particular attention should be paid to the following **specific objectives**:

- **Reduce the risk of collisions during launch, in-orbit, and re-entry through appropriate mission design, development, and operations**. This includes the possibility to carry out manoeuvres, to quickly communicate with different operators and service providers, and to intervene, when necessary, on time (ISO/TR 16158, 2013).
- **Reduce the risk of creating debris**. This relates to the way the launch vehicles and spacecraft are designed, manufactured, and operated. Different aspects are relevant such as the intentional release of space debris into Earth orbit, the occurrence of break-ups in Earth orbit, and the disposal of a spacecraft or launch vehicle at the end of its mission (ISO 24113, 2023).

As outlined in section 4, the application of non-binding international standards and guidelines by space operators should not be understood as a given[205]. Using them as a basis for granting a Space Safety Label could therefore help to stimulate their application by space actors. The Space Safety Label should therefore, as an absolute minimum, encourage designers, developers, manufacturers and operators of launch vehicles and spacecraft to **apply the requirements (and recommendations) defined in international standards and guidelines** (see section 3).

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[204] Supply chains consist of "Tiers" based on their closeness to you or your final product (Sustain Life - https://www.sustain.life/blog/tier-suppliers). Tier 1 are typically organisations that you directly conduct business with. Tier 2 is where your Tier 1 suppliers get their materials and Tier 3 is one step further removed from a final product and typically work in raw materials (sievo.com).

[205] The Revolutionary Design of Spacecraft through Holistic Integration of Future Technologies – ReDSHIFT. Proposal for improved mitigation procedures and guidelines. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c2c577c5&appId=PPGMS

In addition, the label should stimulate motivated label users to **go beyond these requirements by setting more ambitious targets** for the Space Safety Label than those outlined in international standards and guidelines. To reach these ambitious targets (and benefit from incentives linked to the label), motivated actors may decide to implement innovative solutions and new techniques, thereby generating a competitive advantage and attracting more business.

Both approaches will help to **further reduce the risk of collisions** and **the generation of debris**, and therefore **further improve** the **safety and sustainability of space activities** in the long term.

Regarding the **scope**, the Space Safety Label relates to both the **space mission as a whole ('main label')** as well as to **products, services and other elements ('sub-labels'** to allow for scalability) that form part of the mission. For example, the use of more robust materials can limit the generation of debris during the launch and operation phases, while having in place reliable and efficient communication and coordination processes for collision avoidance scenarios (allowing for smooth exchanges with other space actors and dedicated services such as EU SST) can lower the risk of collisions.

7.2.1.2.3 Space Label on Environmental Aspects

The **general objective** of the Space Label on Environmental Aspects ('Environmental Space Label') is to ensure that the **impacts of space activities on the environment are reduced** in line with the European Green Deal targets [206].

Particular attention should be paid to the following **specific objectives**:

- **Mitigate GHG emissions originating from space activities**. The EU has established ambitious targets for reducing greenhouse gas emissions, emphasising the urgency of **achieving carbon neutrality** (net-zero greenhouse gas emissions) by **2050**. This entails for example a substantial reduction in greenhouse gas emissions and an enhancement in removal efforts, aiming to achieve a minimum **55% reduction in net greenhouse gas emissions** by **2030** compared to 1990 levels emissions.[207]
- Contribute to the promotion of a **circular economy** where the **design and production of products for space missions prioritise durability, repairability, recyclability, and ease of re-manufacturing**. This entails for example the **sustainable use of resources** and the **reduction of waste** in space activities.[208]

The **scope** of the Environmental Space Label encompasses **the impact of space missions throughout their lifecycle on the environment**. It is important to note that while the scope of the label relates to a **space mission as a whole ('main label')**, it could also include **parts of the supply chain** such as products (**'sub-labels'** to allow for scalability) contributing to the mission.

Labelling each individual product or component of a space mission (e.g., avionics, thermal control systems, power systems, propellants, radiation shields, integration services, etc.) would present practical challenges: Assigning labels to each product and/or components of a space mission would result in a **burdensome and complex categorisation process** both in terms of time and costs. Given the highly specialised and customised nature of space mission components, this approach may not be

[206] European Commission, The European Green Deal. Available at https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[207] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law')
[208] When referring to circular economy, we mean its applicability for the Earth environment. However, it is important to note that the principles of a circular economy are at a very early stage and further efforts are needed in the space sector in order for the sector to be able to apply these principles.

feasible in the space industry. Conversely, in assessing and **labelling organisations**, difficulties might arise when evaluating **companies** that are **not exclusively dedicated to a space mission**. This approach should therefore be discarded as well.

A **mandatory assessment based on PEFCR** (see section 3.4.5) for space would **assess** the **environmental performance of a space mission** in its entirety **and its impact on the environment**. Based on that assessment, the Environmental Space Label would then **define criteria aiming to improve the performance and reduce the impact** of a space mission on the environment. By considering all phases of a space mission from conception to disposal, the Environmental Space Label could therefore enable the creation of environmental performance classes based on the collective and holistic assessment of environmental impacts of space activities under PEFCR.

7.2.1.2.4 Space Label on Dark and Quiet Skies

Given the increasing number of space objects launched by states and private entities, there is a need to establish mechanisms to preserve dark and quiet skies to avoid jeopardising astronomy research from Earth and in space. The increased number of satellites in orbit creates light pollution due to sunlight reflecting off them, which can obscure the optical observation of celestial objects with telescopes. Radio frequency interference (radio pollution) can disrupt the sensitive instruments (radio-telescopes) designed to detect faint signals. Both of these aspects pose challenges for astronomers trying to observe and understand the universe. As a result, astronomers may face difficulties in e.g., detecting asteroids and other celestial bodies, thus limiting our planetary defence capabilities and our knowledge of the universe, and obtaining high-quality data, which can hinder their ability to make precise observations, making space exploration more challenging. Significant disruptions and issues have already been reported by the astronomy community.[209] For instance, for modern fast wide-field surveys, such as those conducted by the Vera C. Rubin Telescope, current predictions indicate that approx. 30% to 40% of captured images are expected to suffer significant damage.[210]

In the absence of mitigating measures taken by e.g., satellite operators or manufacturers, the onus is on astronomers and observatories to adapt their observations and equipment to account for the interferences caused by satellites. This may translate into increased costs as they may need to implement new procedures or acquire additional equipment to adapt their observations. Furthermore, it may require sophisticated filtering systems to counteract light pollution or advanced scheduling algorithms to avoid observing at times when satellites pass—measures that can be costly and complex to implement.

The **general objective** of the Space Label on the Preservation of Dark and Quiet Skies ('Dark and Quiet Skies Label') is therefore to **mitigate the adverse effects of space activities on astronomical observations**.

This is further specified by the **specific objective** to **minimise the negative impacts of space activities on astronomical observations** throughout the design and operational phases of space missions which could be achieved **through e.g., assessing and implementing measures to**:

[209] IAU. 2020. "The impact of mega-constellations of communication satellites on Astronomy". Available at: https://www.unoosa.org/documents/pdf/copuos/stsc/2020/tech-35E.pdf; ESO. 2023. "ESO and astronomy groups petition the UN to address the impact of satellites on dark and quiet skies". Available at https://www.eso.org/public/announcements/ann23001/
[210] see https://www.space.com/light-pollution-serious-threat-astronomy-skywatching

- **reduce the brightness of spacecraft** by e.g., employing materials with low albedo[211] and avoiding the deployment of unnecessarily large structures in space while still ensuring the trackability of objects by space surveillance and tracking sensors;
- **reduce the transmission of satellite radio frequency signals** by e.g., minimising the frequencies used within the authorised spectrum and the power emitted while still enabling required communication or alternative use of such transmission (e.g., navigation signals or Synthetic Aperture Radar for Earth Observation).

To implement these measures, the Dark and Quiet Skies Label would for example:

- assess the **use of specific materials** during the design stage of a spacecraft; and
- encourage **sharing information**[212] and improving communication between spacecraft operators and observatories on e.g., spacecraft ephemerides, materials used, or operational strategies (e.g., flying closer to Earth's atmosphere to reduce exposure times).

This could help mitigate the impact on astronomical observations. To do so, a balanced coordination between the needs of the spacecraft operators and manufacturers on the one hand and the astronomical community on the other will be needed.

The **scope** of the Dark and Quiet Skies Label would therefore encompass a **space mission as a whole ('main label')** in terms of its overall impact on astronomical observations while **products, services and other elements ('sub-labels'** to allow for scalability) that form part of the mission (e.g., selected materials) would relate to their contribution to the impact of the overall mission.

7.2.2 Criteria

Design question: What criteria will apply to the EU Space Label?

7.2.2.1 Requirements

The quality of the criteria is generally considered as one of the key success factors of effective labelling schemes: Labels are awarded based on fulfilling these criteria which means that compliance with these criteria needs to be assessed[213]. When determining the quality of label criteria, several elements are considered including:

- **Clarity:** criteria should be clear and easily understandable. The criteria should be freely available and easy to consult for all stakeholders.
- **Relevance:** the criteria should address all objectives of the labelling scheme. Only criteria that are relevant to meeting these objectives should be included.
- **Stringency:** criteria should at least be equivalent to existing regulatory requirements, and preferably go beyond existing requirements. In the labelling scheme, it should be clearly indicated where and to what extent the criteria go beyond the relevant legal requirements.

[211] Albedo refers to the "fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow covered surfaces have a high albedo; the albedo of soils ranges from high to low; vegetation covered surfaces and oceans have a low albedo. The Earth's albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes". Source: European Commission, Knowledge4Policy Glossary, available at: https://knowledge4policy.ec.europa.eu/glossary-item/albedo_en
[212] Shared information includes up-to-date information about the position and velocity of spacecraft when conducting observations.
[213] Criteria are different from the rules defined in legislation but can be based on them. They can be based on the requirements defined in the standards but might also go beyond them (additional requirements) or define a more ambitious target or higher threshold.

- **Measurability:** the included criteria should be auditable, verifiable, or measurable.

7.2.2.1.1 Existing EU labelling frameworks

Both the EU Ecolabel and the EU Cybersecurity Certification Framework contain general rules on the requirements for the criteria.

For **the EU Ecolabel**, the Regulation states that the criteria "shall take into account the views of all interested parties involved in the consultation process", "shall take into account relevant Community policies and work done on related product groups" and "shall be based on sound data and information which are representative as far as possible of the entire Community market". It is also important to note that the criteria "shall be based on the best products available on the Community market in terms of environmental performance throughout the life cycle, and "shall correspond indicatively to the best 10-20 % of the products available on the Community market in terms of environmental performance at the moment of their adoption". The Regulation also states that "in order to allow for the necessary flexibility the exact percentage shall be defined on a case-by-case basis and in each case with the aim of promoting the most environmentally friendly products and ensuring that consumers are provided with sufficient choice".

Regarding the **EU Cybersecurity Certification Framework**, the Regulation specifically emphasises that the criteria should allow to demonstrate that the general security objectives put forward in the Regulation are achieved.

7.2.2.2 Design of the EU Space Label

7.2.2.2.1 EU Space Label framework

At the level of the overall **EU space labelling framework**, a set of **general requirements for all EU Space Label criteria** should be determined which apply to all criteria developed and defined under each EU space labelling scheme (transparency).

The **definition and selection of criteria** would then be done at the level of the **specific space labelling schemes**. The importance of clear, relevant, ambitious, feasible, measurable, and scientifically solid criteria should be emphasised. The criteria used for the specific space labelling schemes should be more ambitious and far-reaching than related criteria (and targets) adopted through e.g., mandatory rules, international standards or other similar instruments, while still being feasible to comply with (e.g., technical feasibility).

7.2.2.2.2 Space Label on Safety and Sustainability in Space

The Space Safety Label would, as a starting point, be built on **existing international standards and guidelines**. A family of relevant ISO standards exists of which many have become European Standards (see section 3.1 and Annex B – Description of relevant standards). The most prominent international standards (which are further elaborated in more detailed technical standards)[214] are ISO 24113 Space Systems — Space debris mitigation requirements; and ISO/TR 16158 – Space systems — Avoiding collisions with orbiting objects. ISO 24113 is further detailed in two other standards: ISO 20893 – Space systems – Detailed space debris mitigation requirements for launch vehicle orbital stages; and ISO 23312 – Space systems — Detailed space debris mitigation requirements for spacecraft. It should be noted that

[214] In addition to guidelines developed by different organisations and associations active in the space sector (e.g., ESA, projects such as ReDSHIFT).

for several ISO standards, a European counterpart exists, e.g., ISO 24113 (2019) is also available as ECSS-U-AS-10C Rev. 1. A new version of ISO 24113 exists (2023) for which its European counterpart is currently under review by ECSS members and will be adopted as ECSS-U-AS-10C Rev. 2. Another standard that is relevant in the context of collision avoidance and debris mitigation is ISO 24330 – Space Systems – Rendezvous and Proximity Operations (RPO) and On Orbit Servicing (OOS) – Programmatic principles and practices.

The **requirements defined in those standards are a good starting point** for developing the Space Safety Label. They **allow for the definition of criteria related to collision avoidance and space debris mitigation**, and more specifically to the development and implementation of Space Debris Mitigation Plans. However, as mentioned in section 7.2.1, the Space Safety Label would **foresee more ambitious targets going beyond the requirements outlined in existing standards**. As mentioned, those more ambitious targets could also be defined as a target range to take into account different capabilities and resources of space actors, setting higher targets for well-resourced actors (e.g., major players) and more attainable target for less-resourced actors (e.g., start-ups).

7.2.2.2.2.1 Collision Avoidance

Collision avoidance is detailed in **ISO/TR 16158**. The technical report "describes the workflow for perceiving and avoiding collisions among orbiting objects, data requirements for these tasks, techniques that can be used to estimate the probability of collision and guidance for executing avoidance manoeuvres" (ISO/TR 16158, 2013). The technical report describes **how close approaches can be perceived** and the data needed to do this (e.g., orbit data), **how to determine potential collisions**, **how to estimate the probability of survival**, which information is needed for taking further actions (e.g., manoeuvre capabilities), assessments of potential consequences, and information requirements for warnings.

The **Space Safety Label could therefore add the precision with which spacecraft should manoeuvre as well as the timeframe within which manoeuvres should be performed**.

Collision avoidance is based on identifying positions and tracking of spacecraft which requires information related to so-called ephemerides (position and velocity), but also on uncertainties related to such information. The **requirements as defined in ISO 24113 do not contain specific targets** e.g., defining requirements on manoeuvring.

The **Space Safety Label could therefore include different targets** e.g., defining the precision for manoeuvring in meters, or the maximum reaction time to decide whether a manoeuvre will be performed. The label could award a better score for spacecraft that can manoeuvre with a precision of meters or even centimetres within e.g., minutes rather than hours.[215]

It is also worth noting that several **standards** exist and should be used **for information exchange** in this context: orbit data messages (ISO 26900, 2012[216]), tracking data messages (ISO 13526, 2015), conjunction data messages (ISO 19389, 2014) and attitude data message (ISO 14541, 2021).

[215] Manoeuvring distance and speed may depend on the size of a spacecraft; labelling criteria will therefore need to take such specificities into account to avoid disadvantaging e.g., smaller spacecraft which may not be able to manoeuvre as fast as bigger spacecraft due to the use of e.g., a different propellant.
[216] This standard has been withdrawn and revised by ISO 26900:2024 (publication 02/2024)

The **Space Safety Label** could therefore entail **criteria** related to the **degree to which the required information exchange is implemented**, which could include **adherence to defined data schemes** as outlined in e.g. ISO 26900, 13526, 19389 and/or 14541.

7.2.2.2.2.2 Space Debris Mitigation

Space debris mitigation requirements are defined in a series of standards at different levels of detail. In ISO 24113, the **requirements are often (but not always) quantified**.

The **Space Safety Label** could **take these requirements as a baseline** and **set higher targets** for obtaining the label, such as:

- *Restricting intentional release of debris into Earth orbit (under normal operations)*

  "Spacecraft shall be designed so as not to release space debris into Earth orbit during normal operations, other than space debris from pyrotechnics and solid rocket motors" (clause 7.1.1.1) and "Space debris left in Earth orbit by a launch vehicle after normal operations, …, shall satisfy the following conditions:

  a) remain outside the GEO-protected region for at least 100 years;

  b) have an orbit lifetime of fewer than 25 years if released into an orbit that lies within or crosses the LEO-protected region within 100 years." (clause 7.1.1.3)

  The **Space Safety Label** could **add more ambitious requirements** as even the standard itself mentions that the **aim is to achieve an orbit lifetime of much less than 25 years**.

  Another requirement states that "Pyrotechnic devices and solid rocket motors shall be designed so as **not to release space debris larger than 1 mm** in their largest dimension into Earth orbit" (clause 7.1.2.1).

  The **Space Safety Label** could further strengthen these targets.

- *Avoiding break-ups in Earth orbit*

  This **requirement** as defined in ISO 24113 focuses on accidental break-ups, usually caused by an on-board source of energy; intentional break-ups shall be avoided in any case. The requirement is that "[t]he probability of accidental break-up of a spacecraft or launch vehicle orbital stage in Earth orbit shall be less than 10^{-3} until its end of life" (clause 7.2.2.1).

  The **Space Safety Label** could **make the target more ambitious** with potentially different levels, keeping in mind that those targets should remain technically feasible.

- *Disposal of a spacecraft after the end of the mission*

  Under the provisions for successful disposal, the **requirement** is formulated as "the probability of successful disposal of a spacecraft or launch vehicle orbital stage shall be at least 0,9 through to the end of life." (clause 7.3.1.1)

  It is stressed that **90% is a minimum**, so the **Space Safety Label** could **define a higher percentage**. For example, the World Economic Forum refers to a target of 99% for Post Mission Disposal (PMD) for spacecraft in the LEO regime[217].

[217] See: https://www3.weforum.org/docs/WEF_Space_Industry_Debris_Mitigation_Recommendations_2023.pdf

Other **requirements** are also defined, e.g. to **minimise interference with the GEO-protected region**: "A spacecraft operating in the GEO-protected region with a continuous presence shall be disposed of in such a way that its orbital state, after disposal manoeuvres, satisfies at least one of the following conditions: a) the orbit has an initial eccentricity less than 0,003 and a minimum perigee altitude ΔH (in km) above the geostationary altitude, in accordance with (a well-defined) formula, and b) the orbit has a perigee altitude sufficiently above the geostationary altitude that long-term perturbation forces do not cause the spacecraft to enter the GEO protected region within 100 years after its end of life." (clause 7.3.2.2).

The **Space Safety Label** could therefore **define a minimum threshold** for ΔH (in km) considering that the further away a spacecraft is from the GEO-protected region, the lower is its risk of interfering with that region (and thus a better scoring in the assessment for the label).

Disposal to **minimise interference with the LEO-protected region** is also defined as a **requirement**: "The orbit lifetime of a spacecraft or launch vehicle orbital stage shall be less than 25 years" after the end of its mission (clause 7.3.3.1). This is a similar requirement as related to the intentional release of debris above.

The **Space Safety Label** could set a more ambitious target of e.g., 20 years or even a (much) shorter time. In the U.S., discussions are ongoing to reduce the orbital lifetime of space objects operating at an altitude of 2 000 km or less to five years after the end of their mission[218].

Finally, specific **requirements for re-entry** are also defined including one related to the expected number of casualties: "The expected number of casualties per re-entry of a spacecraft or launch vehicle orbital stage shall be less than 10^{-4}" (clause 7.3.4.3).

The **Space Safety Label** could enhance this target, e.g., by further reducing the risk of casualties.

According to ISO 24113, a **Space Debris Mitigation Plan (SDMP)** should have specific **planning requirements**. Every mission is planned carefully at all its stages, and space debris mitigation actions are included in this process. Those actions might differ for different players, e.g., for launch and spacecraft operators. **ISO 24113 provides only a very high-level overview** of what should be part of the SDMP such as a compliance matrix, applicable requirements, justification for non-compliance, etc. However, **two more detailed standards** contain a lot **more details** on the SDMP and are different for spacecraft (ISO 23312) and launch vehicles (ISO 20893).

As an example, for launch vehicles "the SDMP shall include detailed break-up prevention, disposal, re-entry requirements and plans, including verification either by analysis, simulation, demonstration and, where possible, ground testing to comply with the requirements defined by the approving agent (e.g., see ISO 15864)" (clause 8.1.2). For launch vehicles, ISO 20893 defines the following requirements:

- Break-up prevention plan – including probabilities of accidental break-ups (and confidentiality levels); critical pressures of pressure vessels; timeline for passivating; justification of the design of the passivation; use of structural materials to avoid debris.
- End of mission disposal plan – including probabilities of accidental disposal (and confidentiality levels); nominal orbit where launch vehicle is separated from the payload; the disposal method; details of the orbital domain aimed for disposal; systems and capabilities; estimates of propellant, power, controllability, and communication; the rationale for the plan.

[218] https://docs.fcc.gov/public/attachments/DOC-387024A1.txt

- Re-entry plan – including the re-entry casualty risks (and confidentiality levels); the geographic area and related casualty risks; a timeline for disposal and re-entry and a list of persons/entities that must be notified (including NOTAM[219] and AVURNAV[220]).

The minimum requirements are clearly set in the standard(s), but the **Space Safety Label could** 1) **add more requirements/targets** for the respective plans themselves (e.g., include more aspects to be covered), and/or 2) **specify concrete targets** for the aspects covered by the plans (e.g., probability levels for accidental break-ups).

7.2.2.2.2.3 Rendezvous and Proximity Operations (RPO) and On Orbit Servicing (OOS)

Closely related to collision avoidance and debris mitigation are particular requirements for a spacecraft that is having 'rendezvous' with another spacecraft, e.g. to transfer fluids, to replace devices, to collect debris, etc. While useful in prolonging a mission through e.g., refuelling or repairs, these close encounters increase the risks of collisions and the generation of new debris. **ISO 24330 – Space Systems – Rendezvous and Proximity Operations (RPO) and On Orbit Servicing (OOS) – Programmatic principles and practices** describes relevant requirements and recommendations.

The standard stresses the importance of **responsible design and operations** (including effective communications, liability for damage and insurance) and of **transparent operations** with a focus on **notifying states involved/impacted, communicating with entities involved, using relevant protocols, registering the orbit used, etc.** The standard also lists the programmatic practices for such operations, such as communication discipline; collision avoidance in proximity; anomaly resolution; on-orbit checkout; how to avoid physical and electromagnetic interference, etc.

Some of the requirements are very explicit, such as the need to verify hardware and software design of systems; the availability of approved and proven safety procedures; the need for trained and qualified operators; etc. **Examples of such precise requirements** are:

- "Except while in or establishing a proximity operations control volume (see B.7), passively safe trajectories shall be used" (clause 5.2.3);
- "Servicers and/or clients shall notify and exchange information with affected third parties in advance of close approaches to support safety of spaceflight (e.g., operator points-of-contact, ephemerides, ability to manoeuvre, and manoeuvre plans) while respecting owner/operator intellectual property and proprietary information" (clause 5.2.4).

The **Space Safety Label could therefore add clear thresholds** which are **not defined in the current version of the standard**. For example, notification or communication could stress timeframes e.g., notification of a close approach X time before the encounter.

It must be noted that there are **additional (technical) standards** that might provide further input for defining additional OOS criteria for the Space Safety Label.

To summarise this section, the **table below** provides an **overview of possible criteria to consider for the Space Safety Label**, including the associated requirements laid down in international standards and proposed thresholds and targets.

[219] Notice to Airmen which follow a pre-defined schema (information to be provided) and is shared with relevant aviation authorities.
[220] Avis Urgent aux Navigateurs: this is a messaging system from France for all types of navigation activities, but with focus on the maritime sector. It is mentioned explicitly in the standard though.

Criteria	Requirements in international standards	Possible thresholds and targets in the label
	Collision avoidance	
Having manoeuvre capabilities	***ISO/TR 16158 / ISO 24113***	
	"Spacecraft shall have recurrent manoeuvre capabilities"	Threshold: not defined Target: manoeuvre capabilities in meters or centimetres Target: manoeuvre capabilities in hours or minutes
Data message exchange	***ISO 26900 / ISO 13526 / ISO 19389 / ISO 14541***	
	Different data messages are the basis for collision avoidance e.g., orbit data messages (ISO 26900, 2012[221]), tracking data messages (ISO 13526, 2015), conjunction data messages (ISO 19389, 2014) and attitude data message (ISO 14541, 2021). The schema and way of sharing data messages is defined in those standards.	Threshold: schema and ways of sharing data to be followed Target: all information for the different elements of the schema must be filled in/completed
	Debris mitigation	
Restricting intentional release of debris into Earth orbit (under normal operations)	***ISO 24113 (clause 7.1)***	
	"Spacecraft shall be designed so as not to release space debris into Earth orbit during normal operations, other than space debris from pyrotechnics and solid rocket motors" (clause 7.1.1.1); and "Space debris left in Earth orbit by a launch vehicle after normal operations, …, shall satisfy the following conditions: a) remain outside the GEO-protected region for at least 100 years; b) have an orbit lifetime of fewer than 25 years if released into an orbit that lies within or crosses the LEO-protected region within 100 years." (clause 7.1.1.3)	Thresholds: a) remain outside the GEO-protected region for more than 100 years; b) have an orbit lifetime of fewer than 25 years if released into an orbit that lies within or crosses the LEO-protected region within 100 years Targets: a) e.g., 150, 200 years b) e.g., 20, 10 or even 5 years
	"Pyrotechnic devices and solid rocket motors shall be designed so as not to release space debris larger than	Threshold: maximum 1mm Target: e.g., 0.5mm, 0.1mm

[221] This standard has been withdrawn and revised by ISO 26900:2024 (publication 02/2024)

Criteria	Requirements in international standards	Possible thresholds and targets in the label
	1 mm in their largest dimension into Earth orbit" (clause 7.1.2.1)	
Avoiding break-ups in Earth orbit	***ISO 24113 (clause 7.2)***	
	"The probability of accidental break-up of a spacecraft or launch vehicle orbital stage in Earth orbit shall be less than 10^{-3} until its end of life" (clause 7.2.2.1)	Threshold: maximum 10^{-3} Target: e.g., 10^{-4} or smaller
Disposal of spacecraft after the end of mission	***ISO 24113 (clause 7.3)***	
	"The probability of successful disposal of a spacecraft or launch vehicle orbital stage shall be at least 0,9 through to the end of life." (clause 7.3.1.1)	Threshold: minimum 90% Target: e.g., 95 or even 99%
	"A spacecraft operating in the GEO-protected region with a continuous presence shall be disposed of in such a way that its orbital state, after disposal manoeuvres, satisfies at least one of the following conditions: a) the orbit has an initial eccentricity less than 0,003 and a minimum perigee altitude ΔH (in km) above the geostationary altitude, in accordance with (a well-defined) formula, and b) the orbit has a perigee altitude sufficiently above the geostationary altitude that long-term perturbation forces do not cause the spacecraft to enter the GEO protected region within 100 years after its end of life." (clause 7.3.2.2).	Thresholds: • maximum eccentricity of 0,003 • no minimum perigee altitude Targets: • eccentricity lower than threshold • the higher the perigee altitude (in km), the higher the score
	"The orbit lifetime of a spacecraft or launch vehicle orbital stage shall be less than 25 years after the end of its mission" (clause 7.3.3.1)	Threshold: maximum 25 years Target: e.g., 20, 10, 5 years or less
	"The expected number of casualties per re-entry of a spacecraft or launch vehicle orbital stage shall be less than 10^{-4}"	Threshold: 10^{-4} casualties Target: lower than threshold
Space Debris Mitigation	***ISO 24113 / ISO 20893 (as an example, SDMP for launch vehicles)***	

Criteria	Requirements in international standards	Possible thresholds and targets in the label
Plan (SDMP) and detailed plans for spacecraft and launch vehicle	"The SDMP shall include detailed break-up prevention, disposal, re-entry requirements and plans, including verification either by analysis, simulation, demonstration and, where possible, ground testing to comply with the requirements defined by the approving agent (e.g. see ISO 15864)" (ISO 20893, clause 8.1.2)	Threshold: minimum elements referred to in requirements Targets: • adding more elements into the plan; • adding targets for e.g., probability levels for accidental break-ups
Rendezvous and Proximity Operations (RPO) and On Orbit Servicing (OOS)		
Responsible design and operations	***ISO 24330***	
	"Except while in or establishing a proximity operations control volume (see B.7), passively safe trajectories shall be used" (clause 5.2.3)	Threshold: use safe trajectories except during proximity operations Target: specify delimitations between safe trajectories and proximity operations control volumes
	"Servicers and/or clients shall notify and exchange information with affected third parties in advance of close approaches to support safety of spaceflight (e.g., operator points-of-contact, ephemerides, ability to manoeuvre, and manoeuvre plans) while respecting owner/operator intellectual property and proprietary information" (clause 5.2.4).	Threshold: notify and exchange information Target: specify what kind of information and communication timeframes and protocols to use

Table 14 - Potential criteria for Space Safety Label

7.2.2.2.3 Space Label on Environmental Aspects

The criteria for the **Environmental Space Label** will be developed based on the framework of the **Product Environmental Footprint Categories Rules for the space sector (PEFCR)** which will be based on the PEF method (see 3.4.5).

The **PEF method is the EU-recommended Life Cycle Assessment (LCA)-based method to quantify the environmental impacts of products (goods or services)**.[222] The PEF Category Rule (PEFCR) serves as a detailed manual for conducting a thorough study on the Environmental Footprint of a specific product. **PEF** specifically focuses on a distinct set of **impact categories** directly associated with the analysed product or service.

The PEFCR for space will, once developed, address the unique challenges of space missions at every stage from launch preparation to the launch itself and post-launch activities, such as re-entry and high-

[222] European Platform on LCA | EPLCA. Environmental Footprint. See: https://eplca.jrc.ec.europa.eu/EnvironmentalFootprint.html

altitude emissions[223]. For example, PEFCR for space will allow to consider high-altitude emissions during re-entry of a spacecraft and the impact of such events on various impact categories, such as water (groundwater, rivers, lakes, and seas), air, and land.

Impact category	**Description**	**Measure**
Climate change	Increase in global temperatures due to GHG emissions, mainly due to the combustion of fossil fuels	kg CO_2 eq
Ozone depletion	Depletion of the stratospheric ozone layer, deriving an increase in skin cancer cases in humans and damage to plant	kg CFC-11 eq
Human toxicity, cancer effects	Impact on human health via absorbed substances from the air, water, and soil	CTUh
Human Toxicity, non-cancer Effects	Impact on human health via absorbed substances	CTUh
Particulate Matter	Adverse health impacts from particulate matter emissions and its precursors	Disease incidence per kg of $PM_{2.5}$ emitted
Ionising Radiation	Impact on human health from ionising radiation	kg U^{235} eq
Photochemical Ozone Formation	Harmful effects of ground-level ozone on organic compounds in animals and plants	kg NMVOC eq
Acidification	Contribution to a decline of coniferous forests and fish mortality	mol H+ eq
Eutrophication, terrestrial	Nutrient release causing algae/plant growth in ecosystems	mol N eq
Eutrophication, freshwater	Nutrient release causing algae/plant growth in freshwater	kg P eq
Eutrophication, marine	Nutrient release causing algae/plant growth in marine ecosystems	kg N eq
Ecotoxicity, freshwater	Potential toxic impacts on freshwater ecosystems	CTUe
Land Use	Use and transformation of land for various purposes	Pts
Water Use	Abstraction of water impacting water availability	m3 of water use related to local water scarcity
Resource Use, fossils	Impact of extracting fossil fuels on future generations	MJ
Resource Use, minerals, and metals	Impact of extracting minerals/metals on future generations	kg Sb eq

Table 15 - Impact categories considered in the Environmental Footprint method

[223] Mejía-Kaiser, M. (2020). Space Law and Hazardous Space Debris. Oxford Research Encyclopedia of Planetary Science. Available at: http://dx.doi.org/10.1093/acrefore/9780190647926.013.70

Under **PEFCR for space**, the **environmental performance** of space activities and their **impact** on the environment will be **calculated** for each **impact category**. Based on these **quantifications under PEFCR for space**, the **Environmental Space Label** could therefore:

- **define specific performance thresholds** and **grade the environmental performance** of a space mission based on its environmental footprint;
- **set specific criteria to reduce** and **mitigate the environmental impacts** of a space mission **on the environment**.

For example, looking at the **impact category on Climate Change** which allows to assess **greenhouse gas (GHG) emissions**, the **Environmental Space Label criteria** could **consider** the **amount of emissions emitted as a baseline**, and then evaluate the amount of **emissions reduced** and the amount of **emissions mitigated**.

There are also **other impact categories** that should be taken into consideration for the definition of criteria and associated thresholds, **such as 'Land use', 'Water use' and 'Resource Use'**. These criteria would be related to the amount of land, water and resources used for space activities. Moreover, also other important aspects related to e.g., **ecodesign and circular economy** could drive the design of criteria for the Environmental Space Label.

7.2.2.2.3.1 Greenhouse gas emissions

7.2.2.2.3.1.1 Amount of emissions emitted

Under the **PEFCR for space**, the **amount of emissions emitted** throughout the lifecycle of a space mission will be **measured**. The **Environmental Space Label** could therefore **define performance levels** based on the emissions emitted (and calculated under PEFCR for space) and **assign a performance class** to a space mission.

7.2.2.2.3.1.2 Amount of emissions reduced

Based on the calculations under PEFCR for space (baseline), it is possible to quantify the **amount of emissions reduced through sustainable practices** such as (1) energy efficiency, (2) water efficiency, (3) renewable energy sources, (4) ecodesign, and (5) use of alternative raw materials.

Practices to reduce emissions	Description	Practical Industry Examples	PEFCR Impact category(ies)
Energy efficiency	Evaluates the efficiency of energy usage throughout the lifecycle of a mission. It considers the reduction of energy consumption and its impact on emissions	• Monitor and control energy use in real-time with Energy Management Systems (EMS); • Optimise manufacturing processes to reduce energy-intensive steps; • Implement lean principles to reduce energy use in production processes; • Capture and reuse waste heat generated during manufacturing	Climate change

Practices to reduce emissions	Description	Practical Industry Examples	PEFCR Impact category(ies)
		processes; Upgrade fleets with energy-efficient vehicles.	
Water Efficiency	Assesses the efficient use of water resources, especially in space missions that may require water for cooling and other purposes	• Implement water recycling systems to treat and reuse process water; • Optimise cooling tower operations to minimise water consumption; or • Improve industrial processes to reduce water-intensive steps.	Climate change; Water use
Renewable energy sources	Assesses the adoption of renewable energy sources during mission operations to reduce carbon emissions.	• Sign wind PPAs with wind energy providers to purchase wind-generated electricity; • Implement large-scale solar installations to power industrial facilities; • Use biogas from organic waste or biomass for on-site energy production; • Install hydropower systems for on-site energy generation; • Transition to electric vehicles which can be charged using renewable energy sources; or • Use biofuels from organic materials to power vehicles.	Climate change
Ecodesign	Evaluates the extent to which ecodesign principles are integrated into the development of a mission. Ecodesign focuses on designing products or systems with minimal environmental impact, optimising materials, and reducing waste	• Design products with interchangeable parts to extend their lifespan; • Create products with modular components that can be easily repaired or upgraded; or • Design products for easier disassembly and recycling of components.	Climate change; Resource Use
Use of alternative raw materials	Assesses the use of sustainable materials and their impact on reducing the environmental footprint.	• Use bio-based materials; • Use recycled materials in product manufacturing; or	Climate change; Resource Use

Practices to reduce emissions	Description	Practical Industry Examples	PEFCR Impact category(ies)
		• Investigate business models to reuse products.	

Table 16 - Examples of how to reduce emissions through sustainable practices

The **Environmental Space Label** could therefore **define specific criteria and thresholds** linked to **the amount of emissions reduced** in space activities. These could be for example

- a threshold based on the **percentage of emissions reduced** as a minimum requirement; or
- **different reduction performance levels** based on relative reduction of emissions compared with the baseline measurement of the status quo of the emissions activity at licensing moment.

Practice	Indicator	Threshold
Energy efficiency	Reduction in energy consumption by 2030 compared to 1990	30%
Renewable energy sources	Reliance on renewable energy sources in spacecraft manufacturing process by 2030	30%
Water efficiency	Reduction in water consumption by 2030 compared to 1990	30%
Ecodesign	Ratio of space actors participating in a mission adopting ecodesign principles by 2040	80%
Alternative raw materials	Ratio of mission components integrating alternative materials to replace raw materials (whenever feasible)	60%

Table 17 - Illustrative example of indicators and thresholds to measure the amount of emissions reduced

7.2.2.2.3.1.3 Amount of emissions compensated via offsetting and/or carbon removals

While the mitigation **of EU GHG emissions** is an urgent priority to achieve carbon neutrality by 2050, the EU also needs to **compensate for residual emissions** that cannot be eliminated by compensating or scaling up carbon removals e.g., by removing carbon dioxide (CO_2) from the atmosphere[224]. The Commission proposed in 2022 a voluntary framework to certify carbon removals, setting out criteria to define high-quality carbon removals, which is still under discussion. Under this framework, solutions and technologies considered as high quality to remove and store carbon would include nature-based solutions (e.g., restoring forests and/or soils, innovative farming practices), technology (e.g., bioenergy with carbon capture and storage, direct air carbon capture and storage), and long-lasting products and materials (e.g., wood-based construction).[225]

Solution		Cost range ***(USD per ton of CO_2)***
	Afforestation & reforestation	5-240

[224] EU Monitor. Questions and Answers on EU Certification of Carbon Removals. Available at https://www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vlyhl8dwtdtp?ctx=vg9pjk198axu&start_tab0=85
[225] European Commission. Carbon Removal Certification. Available at https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification_en

Solution		Cost range *(USD per ton of CO_2)*
Nature-based solutions	Enhanced weathering	50-200
	Soil carbon sequestration	45-100
Technology	Bioenergy combined with carbon capture & storage	15-400
	Direct air carbon capture & storage	100-345

Table 18 - Estimated cost ranges for carbon capture and storage (CSS) and carbon dioxide removal (CDR) solutions as of 2023 worldwide[226]

Based on the calculations of emissions emitted under PEFCR (baseline), it is possible to quantify the **amount of emissions reduced or compensated.** The **Environmental Space Label** could therefore **define specific criteria and thresholds** linked to **these amounts of emissions**. For example, a threshold of **max 5% of the total carbon footprint** of a mission **for compensating or removing emissions** via removals could be applied to obtain the Environmental Space Label. This measure would **encourage organisations** to **first look at sustainable practices** to reduce the generation of their greenhouse gas emissions along their value chain, and **only mitigate residual emissions** that cannot be eliminated by other means.

7.2.2.2.3.2 Land use, water use and resource use

Based on the PEFCR for space, the **Environmental Space Label** could **define specific criteria and thresholds** linked to **the amount of land, water and resources used** for space activities. These could be for example:

- a threshold based on the **percentage of land, water and resources** used as a minimum requirement; or
- **different performance reduction levels** based on a relative reduction compared with the baseline measurement of the status quo of the activity at licensing moment.

To determine quantitative thresholds or performance reduction levels, it is necessary to gather environmental impact data across different space systems. The environmental footprint of a representative product (or product category) is measured at the moment of developing the space PEFCR, which can then be used to set standard thresholds. These standard thresholds will then allow to compare the environmental impact of a comparable product under PEFCR (e.g., the amount of land, water, and resources it uses) and its environmental performance under the Environmental Space Label (e.g., in how far it manages to reduce its use of land, water, or resources) with the baseline data collected for that representative product.

Practice	Indicator	Threshold
Land use	Reduction of negative changes in soil quality (%) due to e.g., ground based infrastructure This is typically only of relevance for bio-sourced products, for example biomethane as propellants	TBD based on PEFCR

[226] Statista. Estimated cost ranges for carbon capture and storage (CSS) and carbon dioxide removal (CDR) solutions as of 2023, by approach or technology. Available at https://www.statista.com/statistics/1304575/global-carbon-capture-cost-by-technology/#:~:text=It%20is%20estimated%20that%20CCS,345%20U.S.%20dollars%20per%20tCO%E2%82%82.

Practice	Indicator	Threshold
Land use, emissions	GHG emissions arising from direct land use change	TBD based on PEFCR
Water use	Reduction in water consumption (%) linked to e.g., manufacturing of components Freshwater eutrophication	TBD based on PEFCR
Resource use, fossil	Primary energy consumption Reduction of use of non-renewable fossil natural resources (e.g., natural gas, coal, oil) (%) linked to e.g., manufacturing of components	TBD based on PEFCR
Resource use, minerals, and metals	Reduction of use of non-renewable natural resources such as minerals and metals (%) linked to e.g., manufacturing of components	TBD based on PEFCR

Table 19 - Illustrative example of indicators to measure the land, water and resources used

Based on the standard thresholds calculated under PEFCR (baseline), the **Environmental Space Label** will be able to **determine the environmental performance of a space mission** (or parts thereof) **in reducing the land, water, and resources it uses**. Depending on the standard thresholds defined under the PEFCR for space, the **Environmental Space Label** could therefore **define specific thresholds** linked to **the reduction of land, water, and resource uses**. For example, a **reduction of min. 10% of land, water, and resources used** by a mission across all predefined indicators could be applied to obtain the Environmental Space Label. This measure would **encourage organisations** to **first look at sustainable practices** that are **easy to implement** ('low-hanging fruits') and likely to **generate a high impact** in the calculation of the **environmental footprint of their mission**.

7.2.2.2.3.3 Circular economy: obsolete equipment in the ground segment

Considering the **circular economy principles**, criteria could focus on efficient resource use and waste management. For example, criteria could include **reusing products and components without additional processing**, and putting in place **recycling practices** where possible. So, rather than discarding malfunctioning or obsolete equipment, a space actor could employ **remanufacturing and repair techniques** more intensively to extend the operational lifespan of its components; this involves e.g., refurbishing and upgrading components to meet current needs, reducing the need for new manufacturing, and minimising waste. Other possible criteria could look at how a space actor implements a procedure ensuring that waste not suitable for re-use is recycled.

Therefore, the **Environmental Space Label** could **define specific criteria and thresholds** linked to **circular economy practices** for space activities. These could be for example:

- a threshold based on the **percentage of equipment a) reused, b) recycled, or c) repaired**;
- different **performance reduction levels** based on e.g., **waste reduction** or **use of circular materials during manufacturing**; and/or
- **using tools and equipment** that are **suitable for more than one purpose**, e.g., deploying tools and equipment used for discarded end-of-life products also in other processes or products.

Practice	Indicator	Threshold
Reuse of e.g., electrical equipment	Percentage of objects (e.g., electrical equipment such as computers, monitors, keyboards, etc.) which are collected and diverted for reuse	80%
Recycling of e.g., electrical equipment	Percentage of objects (e.g., electrical equipment such as computers, monitors, keyboards, etc.) which are collected and diverted for recycling	50%
Repair of e.g., electrical equipment	Percentage of objects (e.g., electrical equipment such as computers, monitors, keyboards, etc.) which are collected and diverted for repair Percentage of e.g., reconditioned electrical equipment which has been bought	50%
Waste management	Reduction of the waste generated within a building	65%
Circular material use during manufacturing	Percentage of circular material used during e.g., the manufacturing phase of a satellite	TBD[227]

Table 20 - Illustrative example of indicators and thresholds to measure circular economy

Based on the thresholds, performance reduction levels, and tools and equipment used, the **Environmental Space Label** will be able to **determine the environmental performance of a space mission** (or parts thereof) linked to **circular economy practices**. The **Environmental Space Label** could therefore **define thresholds, reduction levels or target levels in the efficient use of resources and waste management**. For example, an **increase of min. 10% of circular economy practices implemented** by a mission across all predefined indicators could be applied to obtain the Environmental Space Label. This measure would **encourage organisations** to **first look at circular economy practices** that are **easy to implement** ('low-hanging fruits') and likely to **generate a high impact** in the calculation of the **contribution of their mission to the circular economy**.

7.2.2.2.4 Space Label on Dark and Quiet Skies

The Dark and Quiet Skies Label draws from existing recommendations and requirements outlined by the **Dark & Quiet Skies Scientific Organising Committee & Working Groups of the International Astronomical Union (IAU)**[228] complemented by insights shared by informed stakeholders during bilateral interviews conducted as part of this study.

As **no standards adopted by international standardisation bodies currently exist** in this field (see section 3.2.3), the **recommendations of the IAU** serve as a **basis for shaping the Dark and Quiet Skies Label**. As such, the recommendations **provide guidelines** specifically related to **minimising light pollution from satellites** and **ensuring limited radiofrequency interference with astronomical observations**, and emphasise the need to:

- **design missions to minimise negative impacts on astronomical observations[229] by**

[227] This percentage would inherently need to be lower as generally high quality/purity materials are required for a satellites and space systems in general, and these high quality/purity levels are difficult to obtain with recycled materials.
[228] Recommendations to Keep Dark and Quiet Skies for Science and Society." International Astronomical Union, Jan. 2021, https://www.iau.org/static/publications/uncopuos-stsc-crp-8jan2021.pdf
[229] Williams, A., Rotola, G. Bringing Policy Coherence to Satellite Constellation Mitigations for Space Debris and Astronomy. See: https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/208/SDC8-paper208.pdf

- conducting operations from the lowest possible orbits, resulting in increased speed as satellites move across the sky, and so, a decreased impact on astronomical observations[230];
- limiting the time of satellites in orbit to what is necessary for the completion of a mission and minimise its time in orbit after the completion of its mission.

- **design satellites to minimise negative impacts on astronomical observations[231] by**
  - minimising the brightness of a satellite once in orbit during all orbital phases and preventing specular flares when observed from the ground; minimising the average brightness to a visual magnitude of 7 at least, ideally even lower;
  - minimising the reflectance of satellite surfaces; in-depth analyses of material configurations encompassing flat and dispersive surfaces should be part of the design process;
  - minimising the satellite components that directly face the Earth; satellites inherently possess temperatures, leading them to emit thermal radiation; such radiation, specifically in the infrared spectrum, can interfere with astronomical observations; conducting radiance analyses on satellites help to determine acceptable limits for thermal emissions;
  - curbing visible light emissions rather than thermal radiation; achieving a complete dark sky temperature of 2.7 Kelvin is unfeasible, but thermal radiation is deemed less consequential for infrared observations as the latter do not typically require extended exposure periods;
  - reducing the use of materials that may contribute to increased sky brightness in the future; materials used in satellite construction, e.g., aluminium, can pose unexpected challenges for astronomers; when re-entering the atmosphere of the Earth, apart from very high brightness created during ablation, might decompose into microscopic particles floating in the upper layers of the Earth atmosphere;
  - carrying out reflectance simulation analyses to better understand reflective properties of satellites; Bi-directional Reflectance Distribution Function (BRDF) measurements on satellites should be integrated into developmental phases; a nuanced approach could entail creating a reflectance model that centres on BRDF measurements of the constituent materials of a satellite rather than the entire satellite;
  - reducing sidelobe levels during satellite design; for radio frequency emissions, providing more detailed information on antenna power density fluxes, beam patterns, and out-of-band sidelobes spanning the full spectrum of operating frequencies is essential and should surpass what is typically provided for ITU filings and regulatory submissions; this helps to ensure that radio telescopes and designated radio quiet zones remain free from interference from individual satellites and satellite constellations;

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[230] One interviewed expert mentioned that lower orbits result in higher brightness levels of the satellites

[231] Williams, A., Rotola, G. Bringing Policy Coherence to Satellite Constellation Mitigations for Space Debris and Astronomy. See: https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/208/SDC8-paper208.pdf

  - equipping satellites with beam control capabilities to avoid specific regions of the Earth, granting an added layer of flexibility in diminishing potential negative impacts on observations;

- **conduct satellite operations in a way that minimises negative impacts on astronomical observation[232] by**
  - supplying observatories before the launch of a satellite with projections of its initial deployment orbit; as observatories often earmark their observation slots well in advance, having this information early is essential to prevent observational disruptions;
  - encouraging coordination between astronomers and satellite operators as synchronised operations ensure that satellite trajectories do not intrude the purview of observatories; this minimises potential clashes and allows for smoother observation sessions;
  - sharing up-to-the-minute information such as ephemeris predictions detailing satellite locations with an accuracy of arcseconds and time precision down to a tenth of a second; these predictions, made available 12 hours beforehand, are integral for observatories to plan their activities effectively;
  - supporting the development of specialised software applications for astronomical observation planning to bridge informational gaps and harness data provided by satellite operators to generate observational plans that factor in satellite trajectories, ensuring minimal disruptions;
  - employing active measures to minimise specular reflections and flares from satellites that impede observatory functions, e.g. through operational methods such as adjusting components and managing orientation; where flares are inevitable, satellite operators should collaborate with affected observatories to foresee these events, enabling observatories to take precautions;
  - providing satellite models predicting satellite brightness as a function of its orbit to aid in understanding potential satellite brightness.

For these requirements and recommendations that might serve as a basis for defining criteria for the **Dark and Quiet Skies Label**, two main data sources could be used for defining the criteria and associated targets: **(1)** design, manufacturing and after-deployment data: **publicly available and timely industry data during the design and manufacturing process and after deployment**, and **(2)** operational data: **engineering and operational constraints on individual satellite units and overall mission design**.

Possible requirements	Recommendations	Technical details
Provide publicly	share with astronomers and observatories	

[232] Williams, A., Rotola, G. Bringing Policy Coherence to Satellite Constellation Mitigations for Space Debris and Astronomy. See: https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/208/SDC8-paper208.pdf

Possible requirements	Recommendations	Technical details
available and timely industry data during design and manufacturing process and after deployment	• operational data	→ e.g., satellite location, timings, manoeuvres, rotations, and attitude adjustments, some of which is already existing data that would need to be shared
	• spacecraft system data	→ e.g., dimensions, profile, albedo, and reflectance
	• radio emission data	→ e.g., antenna specifications, equivalent power flux density calculations for sidelobes and main beams, and electronic system noise emissions
Engineering and operational constraints on individual satellite units and overall mission design	• minimise and control satellite reflectance to below visual magnitude	→ minimise average satellite brightness to visual magnitude of 7 at least, and prevent specular flares when observed from the ground → provide real-time data on satellite attitude and spatial orientation (8-hourly updates after manoeuvres) to astronomy community
	• minimise radio transmissions over Radio Quiet Zones and observatories	→ minimise antenna side-lobe levels to avoid spillover transmissions that could interfere with radio telescopes and radio astronomy observatories → temporarily halt satellite transmissions over radio-quiet zones
	• minimise Unintended Electromagnetic Radiation (UEMR)	→ avoid radio noise that a satellite might emit outside its designated frequencies, or when the size of a satellite fleet increases
	• minimise and control intentional optical transmission	→ provide real-time data on intentional optical transmissions from satellites (8-hourly updates) to astronomy community
	• minimise satellite operational altitude	→ minimise operational altitudes; orbits of 600 km or lower offer a compromise between brightness and length of time that satellites are illuminated
	• minimise number of satellite unit numbers	→ reduce number of satellites in orbit
	• minimise number of satellite units as a second priority to altitude	→ minimise time spent in orbit when not in service
	• ensure sufficient orbital control of satellites to reduce reflected sunlight and radio	→ improve satellite body orientation

Possible requirements	Recommendations	Technical details
	emissions on astronomy facilities	

Table 21 - Possible requirements that might serve as a basis for defining criteria for the Dark and Quiet Skies Label

Given that currently no international standards exist in this domain, the **Dark and Quiet Skies Label** would put forward a **first set of clear guidelines**, for example as outlined above, **aiming to reduce the impact of space activities on astronomical observations**. **Close cooperation** between astronomers on the one hand and space operators and manufacturers on the other will be essential in this process.

7.2.3 Governance structure

Design question: What will be the governance structure for the EU Space Label development and maintenance?

7.2.3.1 Requirements

Voluntary labelling schemes will only be effective if they are endorsed by all relevant stakeholders. Engagement of these stakeholders is thus crucial in the development and implementation of the label. This can be achieved through an effective governance structure promoting both stakeholder participation and oversight.

7.2.3.1.1 Relevant standards

In the ISO 14024:2018 standards on the principles and procedures for so-called type I environmental labelling programs, consultation is put forward as a key principle, stating that "*a process of formal open participation among interested parties shall be established at the outset for the purpose of selecting and reviewing product categories, product environmental criteria and product function characteristics*."

7.2.3.1.2 Existing EU labelling frameworks

Both the EU Ecolabel and the European Cybersecurity Certification Framework rely on tailored governance structures as foreseen in relevant Regulations:

- Article 5 of **Regulation (EC) No 66/2010 on the EU Ecolabel** introduces the European Union Ecolabelling Board (EUEB) to be established by the Commission and consisting of representatives of the so-called competent bodies of all Member States and other interested parties. The EUEB contributes to the development and revision of EU Ecolabel criteria and reviews of the implementation of the EU Ecolabel scheme. It also provides the Commission with advice and assistance on these areas, in particular on recommendations on minimum performance requirements. Balanced participation of all relevant interested parties, i.e., competent bodies, producers, importers, consumer organisations, etc., is foreseen.
- Two governance structures are established under the **European Cybersecurity Certification Framework**: The European Cybersecurity Certification Group (ECCG) and the Stakeholder Cybersecurity Certification Group (SCCG). The ECCG is composed of representatives of the

national cybersecurity certification authorities or representatives of other relevant national authorities. The ECCG should help ensure the consistent implementation and application of the Cybersecurity Act, and the cybersecurity certification programme and associated schemes in particular. The SCCG is composed of members selected from among recognised experts representing the relevant stakeholders. SCCG members are selected by the Commission through an open call ensuring a balance between different stakeholder groups as well as an appropriate gender and geographical balance.

The EU Ecolabel and the European Cybersecurity Certification Framework both clearly define the **role and contribution of the relevant national authorities:**

- In the **EU Ecolabel Regulation**, several tasks are assigned to the competent bodies which should be assigned and put into operation in each Member State. These can be bodies within or outside government ministries, and Member States can decide to assign multiple bodies. As per EU Ecolabel Regulation, the composition of these competent bodies should guarantee their independence and neutrality while their rules of procedure should ensure transparency of their activities and the involvement of all interested parties (e.g., relevant stakeholders with technical knowledge for the development of the criteria such as competent bodies, producers, importers, consumer organisations, etc.). The main task of these competent bodies is to ensure that the verification process is carried out in a consistent, neutral, and reliable manner. The verification means "a procedure to certify that a product complies with specified EU Ecolabel criteria".[233] In addition to their participation in the EUEB, they should also participate in a working group of competent bodies to exchange information and experiences on awarding the Ecolabel and controlling its use.
- The **European Cybersecurity Certification Framework** requires the designation of one or more national cybersecurity certification authorities in each Member State. Besides their participation in the ECCG, these national cybersecurity certification authorities have several key tasks in the conformity assessment and certification processes (see section 7.3). An important role is assigned to ENISA, the EU Agency dedicated to achieving a high common level of cybersecurity across Europe: The Cybersecurity Act grants a strong mandate to ENISA with a key role in setting up and maintaining the European Cybersecurity Certification Framework[234].

7.2.3.2 Design of the EU Space Label

For the EU Space Label, we recommend an approach similar to the European Cybersecurity Certification Framework with the establishment of two different governance bodies. This allows for the **participation of national space authorities and other relevant stakeholders** in different roles (transparency):

- The **EU Space Labelling Group (ESLG)** should be composed of representatives of **national space authorities (e.g., space agencies)** or other relevant national authorities. The ESLG is a pool of experts from space agencies and other relevant national authorities who advise and

[233] Regulation (EC) No 66/2010 on the EU Ecolabel. See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010R0066
[234] According to article 8 of the Cybersecurity Act, "ENISA shall support and promote the development and implementation of Union policy on cybersecurity certification of ICT products, ICT services and ICT processes, as established in Title III of this Regulation, by (a) monitoring developments, on an ongoing basis, in related areas of standardisation and recommending appropriate technical specifications for use in the development of European cybersecurity certification schemes (b) preparing candidate European cybersecurity certification schemes ('candidate schemes') for ICT products, ICT services and ICT processes (c) evaluating adopted European cybersecurity certification schemes in accordance with Article 49(8); (d) participating in peer reviews and (e) assisting the Commission in providing the secretariat of the ECCG.ENISA shall also provide the secretariat of the Stakeholder Cybersecurity Certification Group".

assist the designated governing body in the implementation of the EU Space Label and who contribute to the selection, preparation, adoption, and review of specific space labelling schemes.

- The **Stakeholder Space Labelling Group (SSLG)** should be composed of members selected from among **recognised experts representing relevant stakeholders such as industry, academia, etc.** These experts will be invited by the designated governing body through an open call and will support it in the development of specific space labelling schemes, in particular as regards criteria definition, assessment methods and compliance check procedures.

A **governing body for the EU Space Label** will be in charge of managing the EU Space Label and specific labelling schemes. More specifically, this governing body would 1) take the lead in preparing candidate labelling schemes and steer the debate with experts from the ESLG and SSLG; 2) provide the secretariat for the ESLG and SSLG; and, 3) complementary to these two tasks, monitor relevant developments in the area of space standardisation and recommend, together with the ESLG and SSLG, appropriate technical specifications in the development of specific labelling schemes.

Options for allocating the **role of the governing body** could be:

- **European Union Agency for the Space Programme (EUSPA)**. EUSPA is the operational Agency for the EU Space Programme, contributing to sustainable growth, security, and safety of the EU in the space domain. EUSPA's tasks currently include the security accreditation of the EU Space Programme components, communication, user uptake and market development, and operating the Space Surveillance and Tracking (SST) Front Desk. This Agency therefore seems adequate for managing the EU Space Label.
- **Joint Research Centre (JRC)**. The JRC is the Commission's science and knowledge service which provides independent scientific advice supporting EU policies. A designation would depend on an assessment of the legal feasibility as well as JRC's statute and legal capacity to carry out this task.

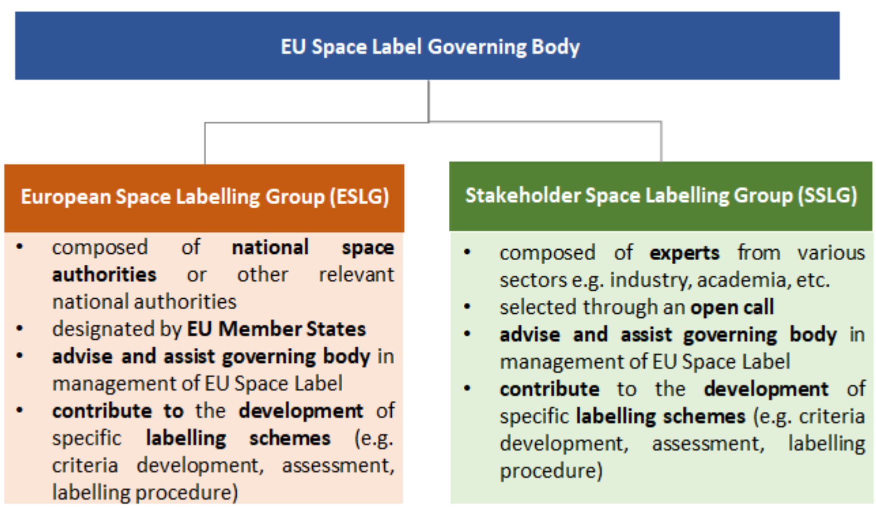

Figure 9 - Proposed governance structure of the EU Space Label

7.2.4 Label development and adoption process

Design question: What will be the process for developing and adopting the EU Space Label?

7.2.4.1 Requirements

Participation of stakeholders in the development of voluntary labels is generally considered one of the key factors contributing to the success of such labels. Through their participation in established governance bodies, but also public consultation initiatives, relevant stakeholders should be able to contribute to different stages in the process of developing and adopting labels and specific labelling schemes. The development and adoption process therefore needs to be well-designed, transparent, and systematised so that it can function efficiently. For stakeholders, it is important to be familiar with the different steps in the process, and how, when and where they can intervene.

7.2.4.1.1 Existing EU labelling frameworks

When looking at the **EU Ecolabel** and the **European Cybersecurity Certification Framework**, there is a high degree of similarity in the overall process of proposing, selecting, preparing, and adopting labelling schemes. Both EU labelling schemes are **driven by an EU Regulation** that lays down the **general rules** related to the establishment of specific labelling schemes under a wider labelling framework outlined in that same Regulation.

To **identify strategic priorities** for future labelling schemes, they both rely on specific programming tools. For the

- **EU Ecolabel**, the Strategic EU Ecolabel Work Plan serves as the operational tool for the planning and management of activities. The Work Plan is a non-binding rolling document for Commission services, national Competent Bodies and stakeholders involved in the implementation of the label.
- **European Cybersecurity Certification Framework**, a similar tool is the Union rolling work programme for European cybersecurity certification in which strategic priorities for future European cybersecurity certification schemes are identified. The rolling work programme is updated at least once every three years and includes a list of ICT products, ICT services and ICT processes or categories thereof that could benefit from being included in the scope of a European cybersecurity certification scheme.

For both EU labelling frameworks, these programming tools serve as the basis for **requesting the preparation of new labelling schemes**:

- In the **European Cybersecurity Certification Framework**, it is the Commission that requests ENISA to prepare a candidate scheme that meets all relevant requirements.
- This procedure is a bit different for the **EU Ecolabel**, where "*following consultation of the EUEB, the Commission, Member States, Competent Bodies and other stakeholders may initiate and lead the development or revision of EU Ecolabel criteria*".[235] It is important to note that, considering the priorities identified in the EU Ecolabel Work Plan 2020–2024, no requests for developing EU Ecolabel criteria for new product groups are currently being considered.

[235] Regulation (EC) No 66/2010 on the EU Ecolabel. See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010R0066

Finally, there is the process for **preparing and adopting specific labelling schemes**[236]:

- When preparing a candidate scheme under the **European Cybersecurity Certification Framework**, **ENISA consults all relevant stakeholders** using a formal, open, transparent, and inclusive consultation process, and closely cooperates with the ECCG (representatives of national cybersecurity certification authorities or other relevant national authorities). The ECCG provides ENISA with assistance and expert advice concerning the preparation of, and adopts an opinion on, the candidate scheme. Considering the opinion of the ECCG, **ENISA transmits the candidate scheme to the Commission**, which, based on the candidate scheme prepared by ENISA, **adopts an Implementing Act** to establish a new European cybersecurity certification scheme.
- The procedure for preparing new **EU Ecolabel** criteria, i.e., criteria for a new product group, is structured around **three main documents prepared and submitted by the party initiating and leading the development** of the EU Ecolabel criteria (i.e., Commission, Member States, competent bodies, other stakeholders) to the Commission and the EU Ecolabelling Board (EUEB):
    - a **preliminary report** contains a quantitative indication of the potential environmental benefits related to the product group, a reasoning for choice and scope of the product group, an analysis of other environmental labelling criteria, an overview of current laws and ongoing legislative initiatives related to the product group sector, and an analysis of the current and future potential for market penetration of relevant future products bearing the EU Ecolabel;
    - following the publication of the preliminary report, a **proposal for draft criteria and a technical report in support of the proposal** provide justification for, and explain the environmental benefits related to, each criterion; both are made available for public consultation on the EU Ecolabel website for comment. The party leading the development of the product criteria distributes both documents to all interested parties. At least two open working group meetings are held on the draft criteria to which all interested parties, such as competent bodies, industry (including SMEs), trade unions, retailers, importers, and environmental and consumer organisations, should be invited. The Commission also participates in these meetings.
    - the **final report** contains answers to all comments and proposals received during the public consultation indicating whether they are accepted or rejected and why. Together with the final report, which should also include a proposal for a marketing and communication strategy, two manuals will be prepared: one manual to assist potential users of the EU Ecolabel and competent bodies in assessing the compliance of products with the criteria, and one manual guiding the use of EU Ecolabel criteria by authorities awarding public contracts. The Commission should consult the EUEB on the content of the final report including proposed criteria. After consulting the EUEB, the Commission adopts a **Commission Decision** to establish the specific EU Ecolabel criteria for the product group.

[236] There is also a process for a revising existing scheme, which we discuss in section 7.4.3.

7.2.4.2 Design of the EU Space Label

For the EU Space Label, we recommend structuring the **process and procedures for preparing and establishing new labelling schemes** around the following main steps:

1. The Commission establishes and adopts a multi-annual (e.g., 3 years) **Work Programme** which contains an overview of possible labelling schemes to be developed and/or reviewed. It also contains the strategic priorities for, scope of, need for and objectives of each possible scheme. The governing body supports the Commission in preparing the Work Programme based on its own expertise as well as by collecting the views and expert advice of the ESLG and SSLG;
2. Based on the Work Programme, the Commission **requests** the governing body to develop a specific labelling scheme;
3. The governing body **prepares** a candidate scheme in collaboration with the ESLG. This preparation is done through means of a draft proposal which should contain e.g.:
    - the subject-matter and scope of the labelling scheme;
    - a clear description of the objectives of the specific labelling scheme;
    - references to relevant international, European and national standards and technical specifications that will be used during the compliance check;
    - specific criteria and assessment methods to be used during the compliance check;
    - maximum period of validity of the label awarded under the labelling scheme;
    - a clear description of incentives for potential label users;
    - applicable rules in case of misuse of the labelling scheme.

    These details should be

    - complemented by the reasoning of choice for the scheme based on e.g., priorities or developments;
    - based on an assessment of existing standards, guidelines and best practices as well as regulatory and legislative initiatives at EU and Member State levels;
    - based on a complementarity and coherence analysis between the specific labelling scheme and existing initiatives to ensure that the new labelling scheme will generate an added value and avoid overlaps and incoherences.
4. The governing body **consults** the **SSLG** on the candidate scheme; based on feedback received, it further **revises** the draft proposal together with the ESLG;
5. The governing body conducts a **public consultation** on the draft proposal; based on feedback received, it further **revises** the draft proposal together with the ESLG;
6. The governing body **finalises** the proposal based on feedback received in cooperation with the ESLG and **consults** the **SSLG** for final feedback. The proposal also contains comments received during the stakeholder consultation process as well as details on how these were addressed as well as reasons why comments are not addressed.
7. The governing body **presents** the scheme proposal to the Commission **for adoption**;

8. The Commission **adopts** the specific labelling scheme e.g., by means of a Commission Decision;
9. The governing body develops **supporting guidelines, materials, and tools** to assist potential candidates in the application process for the new labelling scheme. For example,
    a. supporting guidelines and a website to allow candidates to obtain more information on how to compile and submit their application file;
    b. a helpdesk acts as a contact point for candidates in case of questions and/or complaints.

These steps are further detailed in sections 8.2 and 8.3.

7.3 Assessment and certification

This section discusses requirements and approaches related to the conformity assessment/compliance check and certification/award stage (e.g., assessment methods, bodies, requirements, and procedures) and how they could be applied to the design of the EU Space Label. This stage is therefore about assessing whether the criteria for the EU Space Label are met before awarding a label to a space actor.

As can be seen in the following sections, relevant standards for voluntary labelling mechanisms put forward **comprehensive conformity assessment methods, bodies, requirements, and procedures**. Conformity assessments are often used in EU legislation to prove that certain products sold within the EU provide a high level of protection to public interests such as safety and the environment. When applied in full, the EU conformity assessment requires the development of a complex assessment structure, which is especially suitable in case of products that are mass distributed across the single market. Compliant products are labelled with e.g., a CE marking making them easily recognisable.

The ecosystems and areas of application of e.g., the EU Ecolabel of European Cybersecurity Certification Framework are rather broad, and the number of label applicants and users are therefore high. **Assessments** under both these mechanisms are carried out in a **decentralised manner on EU Member State level**. To ensure **proper and uniform assessments**, **fair and equal treatment** of label applicants and users, and **reliability and trust** in the overall labelling process, comprehensive and harmonised assessment methods, bodies, requirements, and procedures across all EU Member States are therefore adequate for these two mechanisms.

The **space ecosystem** is comparatively small, even including various value chain levels, and the expected **numbers of label applicants and users** are therefore **lower**. To assess whether EU Space Label criteria are fulfilled, this section therefore **proposes to organise assessments more centrally**, to **channel required and highly specialised knowledge and expertise into simpler structures**, and to **explore options for putting in place comprehensive compliance checks** instead of full-fledged conformity assessments as per e.g., ISO/IEC 17000:2020 or EC Regulation No 765/2008.

While relevant standards on conformity assessment such as ISO/IEC 17000:2020 may guide and shape comprehensive compliance checks for the EU Space Label, **further legal and operational assessments, and stakeholder consultations, are needed to strike the right balance between efficiency and low administrative burden** on the one hand, and **transparency and impartiality** of, **and trust** in the EU Space Label, on the other.

For clarity, this section will therefore refer to **'conformity assessment'** in the context of relevant standards on labelling mechanisms, the EU Ecolabel, and the European Cybersecurity Certification

Framework, to **'compliance check'** in the context of the EU Space Label, and to both in, e.g., section headings, to indicate that they cover both.

7.3.1 Assessment methods

Design question: Which compliance checking methods will be applied to assess whether the criteria for the EU Space Label are met?

7.3.1.1 Requirements

7.3.1.1.1 Relevant standards

ISO/IEC 17000:2020 on 'Conformity Assessment' defines conformity assessment as "*demonstration that specified requirements are fulfilled*". In EC Regulation No 765/2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products, conformity assessment is defined as "*the process demonstrating whether specified requirements relating to a product, process, service, system, person or body have been fulfilled*". In ISO/IEC 17000:2020(E), different conformity assessment activities and procedures are discussed including testing, inspection, audits, validation, verification, and peer assessment.

In ISO/IEC 17000:2020(E), the basic principle of procedures for assessing and demonstrating compliance is described as follows: "*The methodology for assessing whether a product complies with the product environmental criteria and product function characteristics, and for verifying on-going compliance, shall be documented and shall have sufficient rigour to maintain confidence in the programme. There may be many factors influencing the choice of compliance procedures and the methodologies may vary from one programme to another".*

While different assessment methods, e.g., technical tests, audits, inspections, verifications, peer assessment, etc., could be considered, it is important to select a methodology that is adequately rigorous to assess compliance with each of the criteria and to properly document the selected methodology. Following ISO 14024:2018(E), methods for assessing compliance should first and primarily make use of standards i.e., ISO, IEC, and other international standards, which, if needed, could be complemented with other repeatable and reproducible methods and evidence provided by the manufacturer.

7.3.1.1.2 Existing EU labelling frameworks

Regulation (EC) No 66/2010 on the EU Ecolabel emphasises the importance of streamlined assessment and verification procedures across Member States which should simplify the EU Ecolabel scheme and reduce the administrative burden associated with the use of the label. Once the Ecolabel criteria for a new product group are established, specific assessment and verification requirements are indicated for each criterion. The selection and definition of the assessment methods is part of the technical report (one of the three reports to be prepared in the process of preparing new EU Ecolabel criteria). The technical report presents the relevant test methods for assessing the criteria, provides an estimation of the testing costs and, for each criterion, the information that needs to be provided by the applicant[237] about all tests, reports, and documentation.

[237] In defining the rules on the application procedure, the EU Ecolabel Regulation states that "applications shall include all relevant documentation, as specified in the relevant Commission measure establishing EU Ecolabel criteria for the product group in question".

In the **European Cybersecurity Certification Framework**, specific evaluation criteria and methods to be used are required for each scheme. Hence, each cybersecurity certification scheme contains a chapter indicating the specific evaluation criteria and methods to be applied to evaluate the conformity of an applicant with those criteria. The Cybersecurity Act also states that the "*person who submits ICT products, ICT services or ICT processes for certification shall make available all information necessary to conduct the certification".*

7.3.1.2 Design of the EU Space Label

As mentioned above, due to the **smaller ecosystem** and consequently **lower number of labelling applications expected** for the EU Space Label compared to e.g. the EU Ecolabel domain, it seems reasonable to **organise assessments more centrally**, e.g. on EU level.

However, it is **vital** for the credibility of the label to ensure that **selected assessment methods are suitable** for checking – and confirming – whether an **applicant complies with relevant labelling criteria**, and that they are **carried out in an impartial, transparent, and streamlined way**. This will help to ensure that label applicants, label users, and other stakeholders can rely on the fact that space missions or parts thereof carrying the EU Space Label have undergone **comprehensive and suitable assessment methods to prove their compliance** with relevant labelling criteria.

Therefore, for each of the criteria defined under a specific space labelling scheme, **specific methods for checking compliance with each criterion should be determined**. Concretely, this means that for all criteria proposed in section 3, the labelling scheme should detail how compliance with the criteria will be checked. For example, in case the labelling scheme on space safety and sustainability contains ten criteria, the methods for checking compliance should be determined for each of these ten criteria.

This also includes the **information that needs to be produced by the applicant and assessed by the compliance checking body** during compliance checks. The general rules on the EU space labelling framework dealing with compliance checking methods should therefore lay down that **space actors who apply for the label should make available all information needed to enable compliance checking bodies to carry out the check**. The assessment methods defined for a particular criterion will determine what kind of information the applicant will need to provide. In each specific space labelling scheme, it **should therefore be determined for each criterion what kind of information is needed to assess compliance against the criteria based on the defined assessment method for each criterion**. So, in case the labelling scheme on space safety and sustainability contains ten criteria, it should be clearly defined what information is needed to assess each criterion based on the assessment method defined for each criterion.

The methods for checking compliance **should primarily rely on standards, ideally international standards, otherwise regional and national standards**. Section 3 refers to many existing standards which will likely be central for compliance checks. If no standards exist, **other repeatable and reproducible methods** such as technical tests should be used. In the absence of all the above, **evidence provided by the applicant organisation** should be used.

7.3.2 Conformity assessment/compliance checking procedures

Design question: Who could be in charge of checking compliance with the criteria of the EU Space Label?

7.3.2.1 Requirements

7.3.2.1.1 Relevant standards

Depending on the entity performing the assessment, three types of conformity assessment procedures can be distinguished (ISO/IEC 17000:2020(E)):

- **First-party conformity assessment activities** are performed by the person or organisation that provides the object (product, process, or service) of the assessment (self-assessment).
- **Second-party conformity assessment activities** are performed by a person or organisation that has a user interest in the object (product, process, or service) of the conformity assessment. Examples given in ISO/IEC 17000:2020(E) include (potential) purchasers or users of products, or organisations representing user interests.
- **Third-party conformity assessment activities** are performed by a person or organisation that is *independent* of the provider of the object (product, process, or service) of the conformity assessment and has no user interest in the object.

The difference between these three procedures is in the relationship between the person or organisation performing the assessment, and the organisation providing the object that is assessed. In the case of first-party conformity assessment, the organisation that provides the object of assessment also assesses its product or process. In a second-party conformity assessment, assessments are performed by an organisation that uses, or has a user interest in, the object of assessment. In a third-party conformity assessment, there is full independence between the organisation providing the object to be assessed and the organisation that performs the assessment.

7.3.2.1.2 Existing EU labelling frameworks

The **EU Ecolabel** fully relies on third-party conformity assessment. It is the task of the competent bodies at Member State level to ensure that the verification process is carried out in a consistent, neutral, and reliable manner by a party independent from the operator being verified. There are two stages of verification:

1. As part of their application, an **applicant compiles and submits an application file** containing all relevant information that is needed to demonstrate that the product meets each criterion. For each criterion, there are specific assessment and verification requirements which could include product tests, declarations of compliance, or independent verifications. It is important to note that all test and independent verification costs are borne by the applicant.
2. After receiving the application, the **National Competent Body examines the application**. If needed, it can ask for further information within two months of receipt of an application. It may also make a list of additional documentation required for the assessed product to comply with the product group criteria. This list will be submitted to the applicant who must ensure that the relevant documentation is provided.

In the **EU Cybersecurity Certification Framework**, both first-party and third-party conformity assessments are considered. It is important to note that the EU Cybersecurity Certification Framework foresees **three different assurance levels** for ICT products, ICT services and ICT processes: **'basic', 'substantial' or 'high'**. These assurance levels refer to the level of risk associated with the intended use of the ICT product, ICT service or ICT process in terms of the probability and impact of an incident.

For ICT products, services and processes that present a low risk corresponding to assurance level 'basic', a European cybersecurity scheme may allow for conformity self-assessment (or first-party assessment).

For **third-party assessments**, the European Cybersecurity Certification Framework foresees **three different mechanisms**:

- Conformity assessment by **accredited *conformity assessment bodies***, but only for certificates referring to assurance level **'basic' or 'substantial'**;
- Conformity assessment only by a ***public body* that meets the requirements of an accredited conformity assessment body**, and only in **duly justified cases** for certificates referring to assurance **level 'basic' or 'substantial'**;
- Conformity assessment by the ***national cybersecurity certification authority*** for certificates referring to assurance level **'high'**.

The **definition of the possible conformity assessment procedure is one of the required elements in each cybersecurity certification scheme**. For each scheme, it should be determined 1) which assurance level(s) are applicable, and 2) whether conformity self-assessment is permitted.

7.3.2.2 Design of the EU Space Label

For the compliance checking procedures of the EU Space Label, we recommend to not allow for any type of first-party assessment but to **rely on third-party compliance checks**. Furthermore, in light of the **lower number of applications expected**, we recommend that these **third-party checks be carried out more centrally, e.g., on EU level, under the responsibility of the governing body supported by a group of independent experts**. The governing body as a more central entity **streamlining space domain expertise, resources, and capabilities**, combined with **highly specialised knowledge and expertise** as well as **independence** provided by a **pool of independent experts** may **strike the right balance** between required resources, expertise, and impartiality.

Third-party compliance checks could also be carried out:

- under the **responsibility of another EC/EU institution**, such as DG DEFIS or JRC;
- by **national space authorities**. As explained in section 7.2.3, EU Member States should designate one or more national space authorities who will participate in the ESLG. These authorities are experts in their country in the fields related to the specific labelling schemes, and so could be engaged as compliance checking bodies;
- by **body/bodies that meet the requirements that compliance checking bodies** need to fulfil; these requirements would be defined in the EU Space Label framework and specific labelling schemes. In this case, any organisation that meets the requirements for compliance checking bodies could carry out compliance checks; this could be a public body, a company, a research institute, or any other type of organisation.

7.3.3 Requirements for conformity assessment/compliance checking bodies

Design question: What are the requirements to be met by organisations operating as conformity assessment/compliance checking bodies?

7.3.3.1 Requirements

7.3.3.1.1 Relevant standards

ISO/IEC 17065:2012(E) contains requirements for bodies that certify products, processes and/or services. These requirements are categorised into five groups:

- **General requirements:** requirements on legal and contractual matters, the management of impartiality, liability and financing, non-discriminatory conditions, confidentiality and publicly available information;
- **Structural requirements:** requirements on the organisational structure and top management and on mechanisms for safeguarding impartiality;
- **Resource requirements:** requirements on the certification body personnel and the resources for evaluation;
- **Process requirements:** requirements on the certification process and its various steps, such as application (review), evaluation, review, certification decision, certification documentation, surveillance, suspensions or withdrawal and complaints and appeals;
- **Management system requirements:** requirements on establishing and maintaining a management system.

Some of these requirements should be highlighted as they deal with key principles of the conformity assessment process, such as:

- **Impartiality:** Certification activities should be undertaken impartially. Conformity assessment bodies should be responsible for the impartiality of their certification activities and should not allow commercial, financial, or other pressures to compromise impartiality.
- **Confidentiality:** Except for information that the client makes publicly available, or when agreed between the certification body and the client, all other information is considered proprietary information and should be regarded as confidential.
- **Competence:** The personnel should be competent in the conformity assessment functions they perform, including making required technical judgments.

It is important to mention that **Regulation (EC) No 765/2008** sets out the requirements for accreditation at EU level. The main principles of accreditation in the EU are that there is one accreditation body per EU country and no competition between national accreditation bodies. Accreditation is seen as the preferred means of demonstrating the technical capacity of conformity assessment bodies. When requested by a conformity assessment body, a national accreditation body evaluates whether that conformity assessment body is competent to carry out a specific conformity assessment activity. Where it is found to be competent, the national accreditation body should issue an accreditation certificate to that effect.

7.3.3.1.2 Existing EU labelling frameworks

In **Regulation (EC) No 66/2010 on the EU Ecolabel,** the requirements relating to competent bodies are included in a separate Annex and are strongly in line with the requirements put forward in ISO/IEC 17065:2012(E): Competent bodies should be independent of the organisation or the product they assess, carry out their conformity assessment activities with the highest degree of professional integrity and the requisite technical competence in the specific field, and should be free from all pressures and inducements, particularly financial, which might influence their judgment or the results of their conformity assessment activities. They should be capable of carrying out all the conformity assessment tasks assigned to them by the Regulation, whether those tasks are carried out by the competent bodies themselves or on their behalf and under their responsibility. The impartiality of the competent bodies, their top-level management and assessment personnel must be guaranteed.

Also, the **EU Regulation No 2019/88 on ENISA and ICT cybersecurity certification** contains an Annex that details the requirements to be met by the conformity assessment bodies. Again, the requirements included here – 20 requirements in total – are in line with the requirements of ISO/IEC 17065:2012(E). It is important to note that under the EU Cybersecurity Certification Framework, conformity assessment bodies should be accredited by national accreditation bodies appointed according to Regulation (EC) No 765/2008. Such accreditation should be issued only where the conformity assessment body meets the requirements for conformity assessment bodies as set out in the Annex to the Regulation. The accreditation is issued to the conformity assessment bodies for a maximum of five years and may be renewed on the same conditions, provided that the conformity assessment body still meets the requirements. Additionally, the EU Cybersecurity Certification Framework has put in place a peer review mechanism in which the national cybersecurity certification authorities are subject to a peer review by at least two national cybersecurity certification authorities of other Member States and the Commission. This peer review also assesses the procedures for monitoring, authorising, and supervising the activities of the conformity assessment bodies.

While the requirements mentioned in the Annex to the Regulation apply to all certification schemes, the EU Cybersecurity Certification Framework also allows the definition of specific or additional requirements at the level of specific certification schemes. The list of elements required for all certification schemes includes the following element: *"where applicable, specific or additional requirements to which conformity assessment bodies are subject to guarantee their technical competence to evaluate the cybersecurity requirements"*. The requirements defined at the level of a specific certification scheme are complementary to the general requirements included in the EU Regulation No 2019/88 on ENISA and ICT cybersecurity certification.

7.3.3.2 Design of the EU Space Label

While conformity assessment bodies have their justified place in many domains, e.g., the EU Ecolabel or European Cybersecurity Certification Framework, and their competence and independence are beyond doubt, the comparatively **lower number of applications** expected for the **EU Space Label does not seem to justify** setting up a **complex structure** and **time-consuming procedure** of full-fledged national conformity assessment bodies. We therefore **recommend attaching compliance checks to a more central, possibly EU-level entity** which may also generate cost-saving capacities. As mentioned, the **governing body**, familiar with the EU Space Label due to its work in preparing and **managing specific space labelling scheme**, appears to be a **fitting candidate**. This body could be complemented in its compliance checking tasks by the **EU SST Partnership** providing insights and expertise from a **national perspective**, and **independent experts** offering insights and expertise from an **external perspective**.

However, it is **vital** to ensure that the **compliance checking body of the EU Space Label fulfils certain requirements to ensure that compliance checks can be carried out appropriately.** While requirements such as **impartiality, confidentiality and transparency** put forward by the ISO standard ISO/IEC 17065:2012(E) certainly seem suitable, a **more profound legal assessment** will be required to determine which other requirements should be fulfilled by the compliance checking body of the EU Space Label. This will help to ensure that, although the compliance checking body may not be accredited by a national accreditation body, it does comply with similar requirements of conformity assessment bodies, thereby **offering credibility and authority**.

Similarly, if the governing body is **supported** in this task **by a pool of independent experts**, **requirements should also be defined at the level of those experts** responsible for carrying out compliance checking activities; this should include e.g. competence and familiarity in the requirements of the compliance checks they carry out, appropriate knowledge and understanding of the applicable requirements and standards; and the ability to draw up documents, records and reports demonstrating that compliance checks have been carried out. At the level of the **specific space labelling schemes**, **additional requirements** for experts responsible for carrying out the checks **could be defined**, mainly on **technical competencies** to apply relevant compliance checking methods. Considering the compliance checking methods specified for each criterion, each space labelling scheme should define the additional technical requirements to be met by the experts in charge of checking compliance under each labelling scheme.

Lastly, to avoid any conflicts of interest, it is important to ensure that **any organisation or person involved in compliance checks is independent from the organisation which applies for the label**. Relevant procedures and mechanisms should therefore be put in place.

7.3.4 Procedure for conformity assessment/compliance checks and award of the label

Design question: What will be the process for the compliance checks and award of the EU Space Label?

7.3.4.1 Requirements

7.3.4.1.1 Relevant standards

In the ISO/IEC 17065:2012(E) standard, the different steps of the conformity assessment and certification process are specified as part of the process requirements[238]. These steps entail:

- **Application:** the certification body (also referred to as 'conformity assessment body') should obtain all necessary information from the applicant to complete the certification process in accordance with the relevant certification scheme;
- **Application review:** the certification body should conduct a review of the information obtained;
- **Evaluation:** e.g., design and documentation review, sampling, testing, inspection and audit;
- **Review:** all information and results related to the evaluation are reviewed by a person not involved in the evaluation process;

[238] It is important to note that these steps also apply to the process of assessing if organisations that wish to operate as a conformity assessment body are conformant with the requirements for such bodies (see section 7.3.3).

- **Certification decision:** it is decided to grant certification based on all information related to the evaluation, its review, and any other relevant information;
- **Certification documentation:** formal certification documentation is provided to the applicant.

7.3.4.1.2 Existing EU labelling frameworks

The figure below shows the **typical process of a label conformity assessment**, including different mechanisms for top-down (blue lines) and bottom-up (orange lines, see section 7.4.2 for more details) conformity assessments. Concerning top-down conformity assessment, it is the label organisation (or label owner) that sets out requirements to the certification bodies (or conformity assessment bodies) in charge of checking conformity of the label adopters (or label applicants) to the criteria. If the label applicants demonstrate conformity to the criteria, a label is awarded to them. The accreditation bodies check whether the conformity assessment bodies meet the requirements for such bodies.

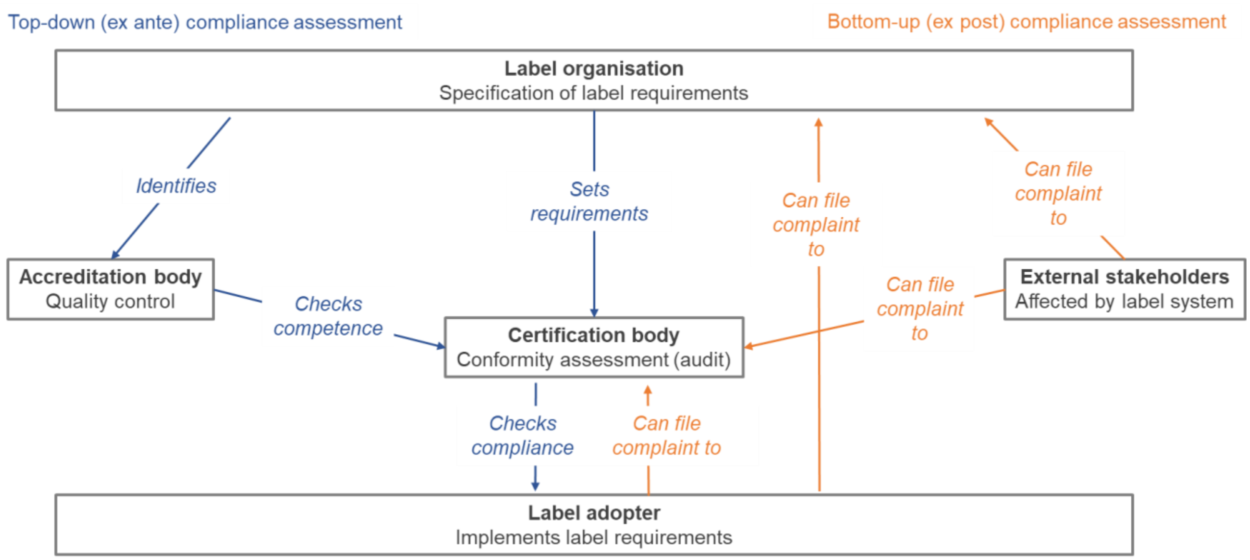

Figure 10 - Conformity assessment – general

When comparing the EU Ecolabel and the EU Cybersecurity Certification Framework, several important differences can be seen regarding the organisations involved in the conformity assessment.

The figure below shows the process for conformity assessments for the **EU Ecolabel**. It can be seen that the conformity assessment for the **overall label** (i.e., covering all relevant criteria) is in the hands of the **national competent bodies** assigned by the Member States. These competent bodies receive and assess applications and award the EU Ecolabel to products that meet the criteria set for them. This assessment is mainly based on a dossier prepared and submitted by the applicant, containing all information and test results needed to show that the product meets each criterion. Some assessments and verifications of EU Ecolabel criteria require **product tests**. In this case, the conformity assessment is done by **independent verifiers or test facilities** in charge of carrying out product tests and/or issuing declarations of compliance required for proving compliance with **specific criteria**. It is important to mention that whenever the assessment and verification of EU Ecolabel criteria require product tests, those tests should be preferably performed by laboratories that meet the general requirements of EN ISO 17025 or equivalent. In addition to the review and approval of all the documentation provided in the application (or sometimes directly by suppliers), the **competent bodies** may also carry out on-site visits to the applicant and/or its suppliers on a case-by-case basis.

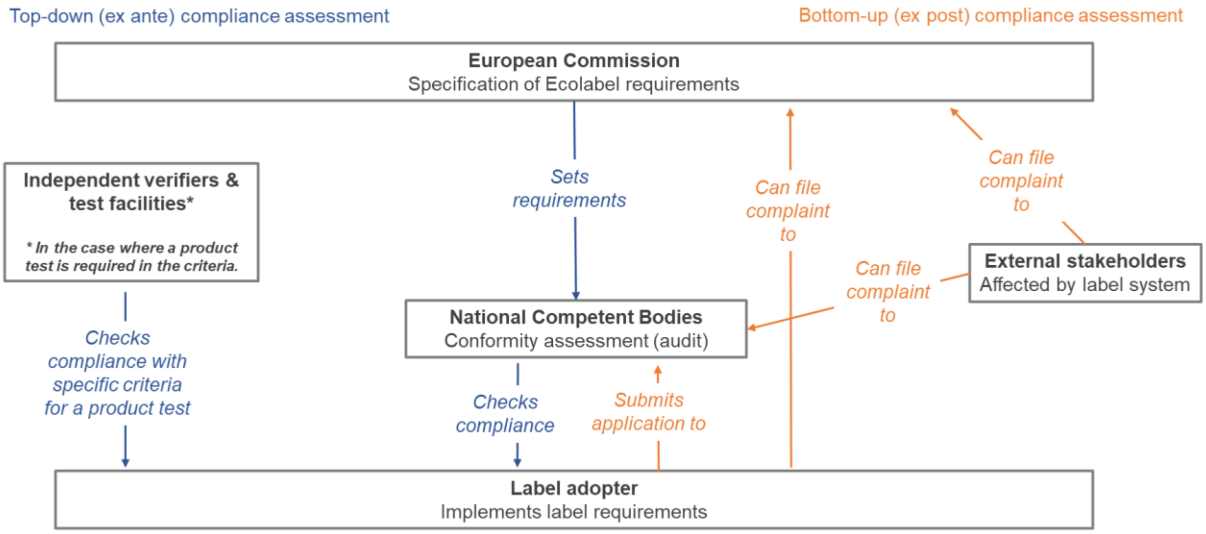

Figure 11 - Conformity assessment – EU Ecolabel

The conformity assessment of the **EU Cybersecurity Certification Framework** contains some specific elements. It is important to note that it relies on national accreditation bodies to assess if conformity assessment bodies meet the requirements defined for such bodies. For this accreditation of conformity assessment bodies, they can rely on the support of national cybersecurity certification authorities. The actual **conformity assessment** is done by accredited conformity assessment bodies for certificates referring to assurance level 'basic' or 'substantial', or by national cybersecurity certification authorities for certificates referring to assurance level 'basic' or 'high'.

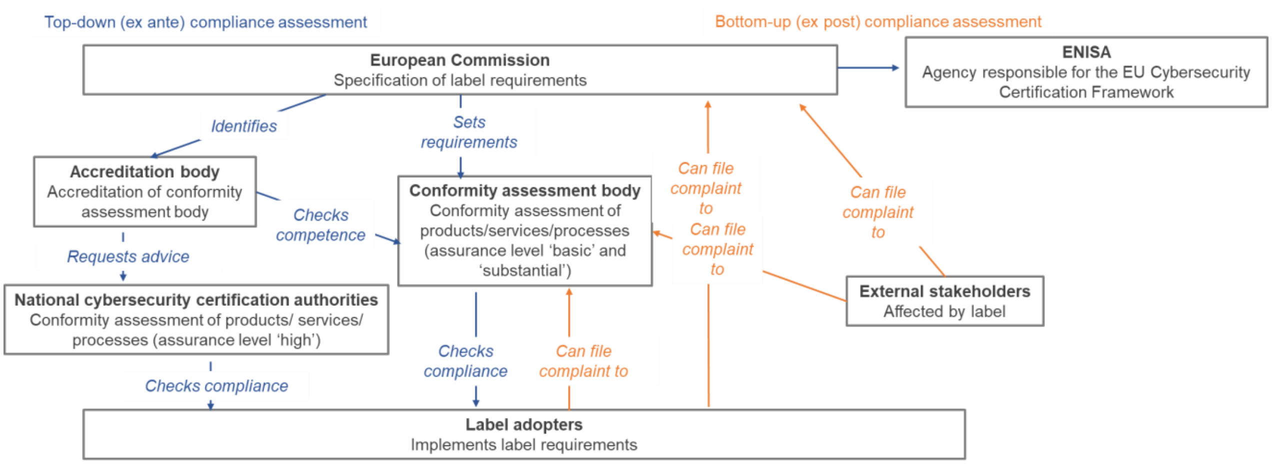

Figure 12 - Conformity assessment – EU Cybersecurity Certification Framework

7.3.4.2 Design of the EU Space Label

For the overall compliance checking process of the EU Space Label, we recommend assigning the **coordinating role to the governing body**. Designating one body at EU level as being in charge of compliance checking processes would allow to **create cost-saving capacities** by **avoiding** the need to create a **complex structure of conformity assessment bodies on national level** for a comparatively low number of expected applications.

The compliance assessments could be done, or supported, by e.g., the EU SST Partnership together with an independent pool of experts. The **EU SST Partnership** and the Commission already work together in developing the EU SST capability incl. capabilities providing data, information, and services on space objects. Since these data, information and services could be suitable for the assessment of certain criteria, EU SST could be engaged in checking compliance with such criteria. The **independent pool of experts**, selected through an open call, could come from various sectors such as academic institutions, and could contribute with their expertise in compliance checks in subject-matters related to specific labelling schemes.

Once the compliance check is carried out and the results indicate that a space mission or part thereof (see section 7.2.1) complies with the criteria of the labelling scheme in question, the governing body would be responsible for **awarding the label** to that mission or part of the mission.

An additional aspect to consider is that if the governing body (e.g., EUSPA) and the compliance checking body (e.g., EU SST Partnership) take on these roles, it is crucial to **invest in capacity-building** to make sure that both entities are able to carry out their tasks effectively.

Furthermore, it is important to define the **application process and award of the label**. These processes should be closely calibrated to the criteria, assessment methods, and compliance check processes defined for each scheme, and should be easy to implement to **keep costs** (e.g., independent tests) **and administrative burden for applicants to a minimum**. During the definition of this procedure, it is therefore important to define:

- the **type of information** to be provided by the applicant as part of the application process, e.g., types of documentation, supporting evidence, etc.;
- the **measures to support the applicant** during the application process, e.g., establishment of a helpdesk or website, development of supporting guidelines, etc.;
- the **overview of the application process** incl. main bodies involved and their tasks from application until award of the label;
- the **conditions for the award of the label** e.g., having met all the criteria and having successfully passed the conformity assessment.

The **procedure for compliance checks would be identical for all space labelling schemes**: An application is reviewed by the governing body and then evaluated technically by the EU SST Partnership and/or independent experts. The governing body reviews the evaluation, decides whether the label is granted and issues the label to the applicant based on an Implementing Decision from the Commission. The figure below provides an overview of how the compliance checking process could look like in the context of the EU Space Label:

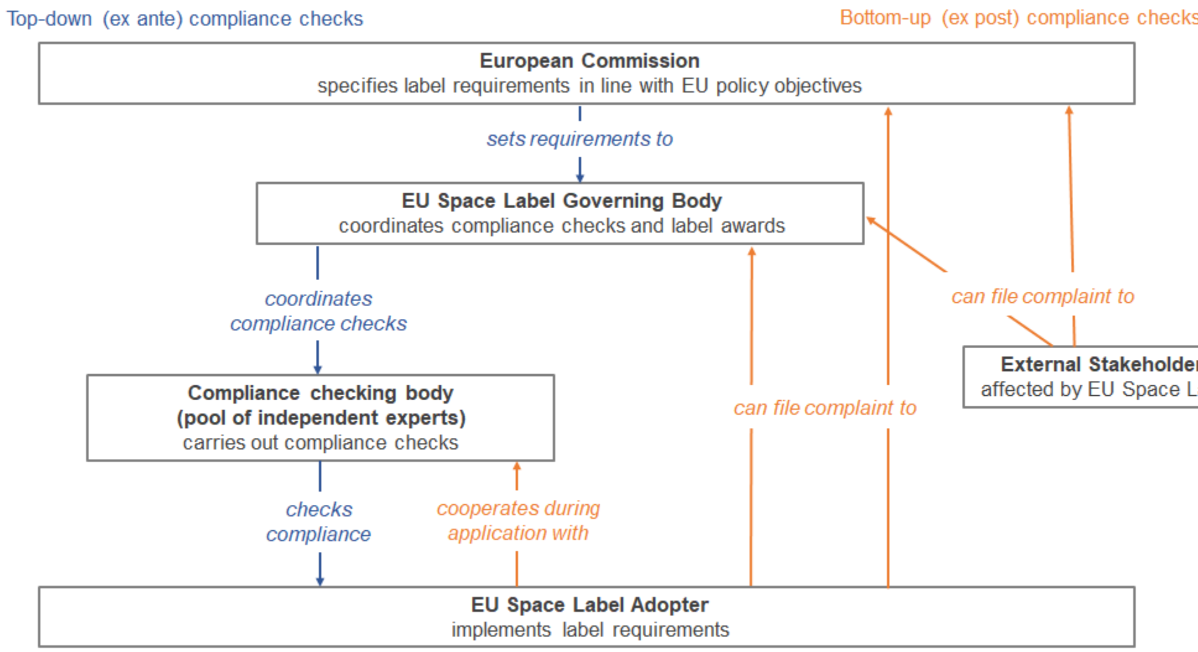

Figure 13 - Compliance checks – EU Space Label

7.4 Use and maintenance of the label

This sub-section discusses the **requirements and approaches related to the use and maintenance of the label** including promoting the use of the label, monitoring, and preventing misuse of the label, and reviewing and revising the label.

7.4.1 Promoting and incentivising the use of the label

Design question: How will the use of the label be promoted?

7.4.1.1 Requirements

Voluntary labels and other certification mechanisms should be effectively **promoted**, and interesting **incentives** offered, to ensure that they are adopted and used by the target community. Typically, **five categories of incentives** can be considered for **promoting the use of voluntary labels**[239]:

- **legal instruments** to apply legislative, executive and judicial powers that put in place policy support and advantages to organisations which have been awarded the label; examples include laws, directives, and regulations but also regulatory relief and public procurement/purchasing initiatives;
- **operational instruments** to provide additional operational support to organisations which have been awarded the label;

[239] These four types are also used in the Compendium of EMAS Promotion and policy support in the Member States: https://green-business.ec.europa.eu/document/download/80ef3d7e-c2f5-465b-a454-8cedfa8a8f55_en?filename=EMAS_Compendium_2015.pdf

- **economic and financial instruments** to deploy financial incentives for organisations which have been awarded the label; this includes e.g., subsidies and awards as long as it is done in compliance with EU competition rules;
- **learning and capacity-building instruments** to increase knowledge about the label and its criteria, and to build up skills and competences to meet the criteria; this can be done via different instruments, such as learning materials, trainings, workshops, targeted assistance, etc.;
- **marketing and promotional instruments** to increase awareness of the label and promote label users to other stakeholders; these take the form of e.g., publications, conferences, workshops, and other events.

7.4.1.1.1 Existing EU labelling frameworks

The regulatory frameworks of both the EU Ecolabel and the EU Cybersecurity Certification Framework contain **provisions dealing with promoting the use of their respective labels and certificates**.

In Regulation (EC) No 66/2010 on the **EU Ecolabel**, Article 12 on the promotion of the label states that "Member States and the Commission shall, in cooperation with the EU Ecolabel Board, agree on a specific action plan to promote the use of the EU Ecolabel by awareness-raising actions and information and public education campaigns and by encouraging the uptake of the scheme, especially for SMEs". Awareness-raising actions and information campaigns target consumers, producers, manufacturers, wholesalers, service providers, public purchasers, traders, retailers, and the general public. Important elements in the promotion of the EU Ecolabel are 1) the EU Ecolabel website which provides information and promotional materials on the EU Ecolabel as well as information on EU Ecolabel products, and 2) the 'Manual for authorities awarding public contracts' which is part of the procedure for the development and revision of EU Ecolabel Criteria and which provides guidance for the use of EU Ecolabel criteria to authorities awarding public contracts.

According to Art. 4 of the **EU Cybersecurity Certification Framework**, ENISA is required to promote the use of European Cybersecurity Certifications to avoid the fragmentation of the EU internal market. Art. 8 of the Regulation, which specifically deals with cybersecurity certification and standardisation, lays down some specific **tasks for ENISA related to promoting and supporting the use of cybersecurity certificates**: Besides supporting and promoting the development of an EU policy on cybersecurity certification, ENISA should "contribute to capacity-building related to the evaluation and certification processes by compiling and issuing guidelines as well as by providing support to Member States upon request."[240]

7.4.1.1.2 Public procurement as an example of incentives in existing EU labelling frameworks

Public procurement is an important incentive to motivate companies to apply for a specific label, e.g., the **EU Ecolabel**.

As Article 43 of Directive 2014/24/EU on public procurement states, contracting authorities aiming to purchase works, supplies or services with specific environmental social or other characteristics may in the **technical specifications, award criteria or contract performance conditions require a specific label as means of proof.** The following conditions must be met:

[240] European Commission, Regulation (EU) 2019/881 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification. See: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0881&rid=6

- "the label requirements only concern criteria which are linked to the subject-matter of the contract and are appropriate to define characteristics of the works, supplies or services that are the subject-matter of the contract;
- the label requirements are based on objectively verifiable and non-discriminatory criteria;
- the labels are established in an open and transparent procedure in which all relevant stakeholders, including government bodies, consumers, social partners, manufacturers, distributors and non-governmental organisations, may participate;
- the labels are accessible to all interested parties;
- the label requirements are set by a third party over which the economic operator applying for the label cannot exercise a decisive influence."

Article 43 also establishes that if the contracting authorities do not require that the works, supplies or services meet all of the label requirements, it must be indicated which label requirements are asked. Moreover, **all labels that confirm that the works, supplies, or services meet equivalent label requirements must be accepted** by the contracting authorities. Lastly, if an economic operator has no possibility of obtaining the specific label indicated by the contracting authorities or an equivalent one within the relevant time limits for reasons not attributable to the economic operator, the **contracting authority must accept other appropriate means of proof** such as a technical dossier from the manufacturer, as long as the works, supplies or services to be provided **fulfil the requirements of the specific label or the specific requirements** indicated by the contracting authority.[241]

Similarly, the use of **EU Green Public Procurement** (EU GPP)[242] has the objective of minimising the environmental impact of purchase by incorporating environmental criteria in public procurement procedures for goods, services or works. These voluntary criteria[243] cover diverse product groups including electronics, energy, and transportation. The **criteria of the EU GPP are strongly linked to EU Ecolabel criteria**. This means that contracting authorities can rely on the EU Ecolabel when drafting the technical specifications of goods and services to be purchased, or when a compliance assessment is carried out. This also means that no additional verification or sustainability assessments are needed to prove compliance with the technical specifications.[244] For companies having been awarded a relevant label, e.g., the EU Ecolabel, it is easier to demonstrate compliance with EU GPP criteria when participating in GPP procedures, as the EU Ecolabel criteria are the same as the GPP criteria.

7.4.1.1.3 Business advantages as a result from using a specific label

Schemes such as **labels serve as communication tools** as they convey information to consumers about a company's products or services.

[241] Directive 2014/24/EU on public procurement, Article 43. See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024
[242] Green Public Procurement (GPP) is defined in Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Public procurement for a better environment (COM/2008/0400 final) as a voluntary instrument to stimulate the use of green standards in private procurement. See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0400
[243] A preliminary set of common GPP criteria has been established in the framework of a recently developed Training Toolkit on Green public procurement. See: https://green-business.ec.europa.eu/green-public-procurement/gpp-training-toolkit_en
[244] Global Ecolabelling Network. See: https://globalecolabelling.net/2023/08/12/shining-a-light-on-green-public-procurement-with-eu-ecolabel/#:~:text=2%2Din%2D1%3A%20The,complies%20with%20EU%20GPP%20criteria&text=products%20automatically%20comply%20with%20EU,the%20compliance%20with%20these%20specifications.

For instance, ecolabels in general, such as the **EU Ecolabel**, contribute to the overall awareness of the environmental impacts of products and services. The 2006 Evaluation of the EU Ecolabel[245] found that one of the main incentives for applying for the EU Ecolabel is business advantages offered by **consumers' increased awareness of environmental issues** leading to customer's specific requests for products and services with high environmental quality being satisfied by a company offering such a product or service carrying the EU Ecolabel. In general, ecolabels play a significant role of "guarantee" for consumers. "One of the most powerful drivers for companies to choose the EU Ecolabel is the need to **respond to external pressures coming from the 'demand side'**, i.e., final consumers and intermediate customers, who ask for reliable and clear information on the products and services that are presented as 'green'."[246]

Similarly, the **ENISA Cybersecurity Certification framework** has as goals to provide **transparency** to consumers regarding the level of cybersecurity of ICT products, services, and processes, and raise the level of security of these products, services, and processes. Having a certification, for example the European Cybersecurity Scheme on Common Criteria (EUCC), allows ICT suppliers to **showcase proof of assurance** throughout commonly understood assessment processes widely recognised at EU level.[247]

7.4.1.2 Design of the EU Space Label

7.4.1.2.1 Instruments to consider for incentivising the use of the EU Space Label

To support and promote the use of the EU Space Label, we recommend exploring, preparing, and implementing five types of incentivising instruments: legal instruments, operational instruments, economic and financial instruments, learning and capacity-building instruments, and marketing and promotional instruments. The table below provides an overview of these instruments with examples on how they could be applied to the EU Space Label:

legal instruments (at EU level)	
regulatory relief	• **fast-track permits/simplified application procedures**: procedures for obtaining certain authorisations or permits are simplified for organisations with an EU Space Label in a relevant domain; • **extended validity of permits/authorisation:** the validity of certain permits or authorisations are extended for organisations with an EU Space Label in a relevant domain, e.g., in line with the validity of the EU Space Label; • **reduced reporting and monitoring requirements**: organisations with an EU Space Label are eligible for reduced and/or simplified reporting and monitoring requirements in relevant domains.
public procurement	• **using EU Space Label criteria in public procurement**: EU Space Label criteria are used to draw up sections of technical specifications in public tenders as e.g., technical and/or award criteria;

[245] European Commission. EVER: Evaluation of EMAS and Eco-label for their Revision. See: https://ec.europa.eu/environment/ecolabel/documents/EU-Ecolabel-revision.pdf
[246] Irando, F. and Barberio, M. Drivers, barriers and benefits of the EU Ecolabel in European Companies' Perception. See: https://www.mdpi.com/2071-1050/9/5/751
[247] ENISA. See: https://www.enisa.europa.eu/news/an-eu-prime-eu-adopts-first-cybersecurity-certification-scheme

	• **using EU Space Label criteria as proof of compliance with technical specifications**[248]: EU Space Label is accepted as one means of proof of compliance with technical specifications.
integration in government strategies and (legal) frameworks	• **references to EU Space Label in national government strategies or plans**: Member States recognise the importance of the EU Space Label in national strategies and/or policy plans, and actively promote its use e.g., by offering further benefits. There may also be a possibility to link the EU Space Label to the licensing system of national authorities.
operational instruments	
EU SST support	• **support to organisations**: organisations**,** especially SMEs, with an EU Space Label in a relevant domain could be eligible for priority support from EU SST, e.g., in case of conflicts, issues or risk of collision.
economic and financial instruments	
fee reductions	• **reduction of administrative fees**: lower fees, e.g., for other applications or registration procedures, are made available to organisations with an EU Space Label; • **reduction of financial warranties**: financial warranties are reduced for organisations with an EU Space Label.
funding support	• **access to EU/national grants**: grants are offered to companies that aim to implement measures to become compliant with EU Space Label criteria; • **increased funding**: an increased funding rate (e.g., +5%) in research, development, and/or innovation programmes is made available to organisations with an EU Space Label; • the use of the EU Space Label could be **linked to criteria relating to space sector activities under the EU Taxonomy Regulation**, helping to access e.g., sustainable financing frameworks (in collaboration with DG FISMA).
learning and capacity-building instruments	
assessment	• **self-assessment**: an online tool and/or reference framework is made available to organisations, e.g., SMEs and start-ups, to self-assess their compliance with EU Space Label criteria, giving them an indication on where they stand, together with guidance on how to improve compliance; • **assistance and guidance**: as part of the application process, organisations receive guidance and advice on what is needed to ensure they comply with the EU Space Label criteria with which they may not (yet) be compliant.
capacity-building and support	• **access to knowledge resources**: guidelines, manuals, training materials, etc. on how to comply with EU Space Label criteria;

[248] In certain cases, it is possible to require a label as part of technical specifications, provided that the conditions laid down in Article 43 of Directive 2014/24/EU are met. One of these conditions is that the label only concerns criteria which are linked to the subject matter of the contract. It is often recommended as a 'good practice' to always refer to the criteria underlying a label, to ensure that they are all relevant and clear to all tenderers. In that case, the EU Space Label can still be accepted as a proof of compliance with the technical specifications.

	• **workshops and trainings**: workshops and training programmes on how to become compliant with EU Space Label criteria; • **EU Space Label helpdesk**: a helpdesk offers guidance and advice on specific questions or issues related to obtaining the EU Space Label; • **implementation assistance**: targeted guidance and assistance to companies that have been awarded an EU Space Label.
assistance in other domains	• **access to other types of support and assistance**: offer priority or fast-track access for organisations with an EU Space Label when they apply for support instruments in other domains, e.g., support for SME Internationalisation, InvestEU financial instruments, Intellectual Property, etc.
marketing and promotional instruments	
EU Space Label platform	• **EU Space Label website**: website containing all relevant information on the EU Space Label and how to obtain it; • **EU Space Label list of organisations**: publicly available list/database naming all organisations that have been awarded an EU Space Label.
prizes and awards	• **EU Space Label Award**: acknowledgement of organisations that demonstrate compliance and best use of the EU Space Label incl. official recognition; • **EU Space Label Prize**: financial contributions through e.g., innovation funds or prize competitions as a reward to organisations with an outstanding performance in complying with EU Space Label criteria; • **EU Space Label Ambassadors**: recognition of persons, organisations, or initiatives that demonstrate the benefits of adopting and using the EU Space Label beyond their own organisation, e.g., referral scheme.
governance forum	• **Chairpersonship in working groups**: rotating chairpersonship in a potential industry working group on the EU Space Label and other dialogues; organisations with an EU Space Label could be (co-)chairs or part of the board for e.g., for 6 months, allowing for enhanced visibility and exposure.
promotional instruments	• **promotion campaigns**: organisations with an EU Space Label are highlighted as leading examples in campaigns promoting the EU Space Label and its benefits; • **participation in trade missions**: organisations with an EU Space Label are invited to participate in national or EU trade missions in non-EU countries; • **public and/or exclusive events**: organisations with an EU Space Label can participate in public or exclusive events, e.g., EU Space Conference, industry roundtables, or other major events.

Table 22 - Overview of instruments and how these can be used for the purposes of the EU Space Label

The above incentives are **non-exhaustive** and will need to be further explored. Indeed, it is important for the Commission to conduct a **legal and economic feasibility assessment** and to **measure the appetite for and interest of the industry in these incentives**.

7.4.1.2.2 Other elements to consider to further enhance the attractiveness of the EU Space Label

As outlined throughout this blueprint, important factors determining the adoption of the EU Space Label are related to its **design and development**. It is important to **engage all relevant stakeholders** in the development process to ensure that their needs and interests are taken into consideration. Similarly, it is important to **meet all requirements of an effective labelling programme** as outlined throughout this blueprint. Aspects such as the scope, criteria, compliance checking methods, etc., will strongly determine if, and to which extent, stakeholders will be motivated to apply for the EU Space Label.

Of particular importance is the **application process**. **Costs and administrative burden** of applying for the EU Space Label should be kept reasonable, and the process should be streamlined with other related processes as much as possible. For example, according to the **"collect once, use many times" principle**, applicants should ideally be able to reuse the data and information provided under national rules or other reporting obligations when they compile their application file for the EU Space Label.

A broad spectrum of **incentives** can be used to encourage organisations to apply for the EU Space Label. Considering the competences of the Commission, a distinction could be made between **direct incentives provided by the Commission** and **indirect incentives offered by other stakeholders**. As for indirect incentives, the Commission could proactively engage with other stakeholders (e.g., Member States public administrations[249], investors, insurance companies, etc.). Engaging these stakeholders in the label development and maintenance processes is an important mechanism to explore opportunities for collaboration and ensure buy-in from the wider ecosystem. For what concerns incentives provided by the Commission, engaging other Commission services in the label development and maintenance processes may allow to identify and raise awareness for incentives available in other policy domains. For example, Commission services likely offering incentives of interest to space actors may include e.g., other services of the Directorate-General for Defence Industry and Space (DEFIS), the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (GROW), or the European Health and Digital Executive Agency (HaDEA).

As mentioned in section 7.4.1.2.1, the **promotion** of the EU Space Label could be done via **different mechanisms** to raise awareness for the EU Space Label and its potential benefits. Legal, financial, and operational incentives could motivate organisations to apply for the label while support and capacity-building initiatives may equip organisations, especially SMEs and start-ups, with the necessary resources and knowledge to access the benefits offered by the EU Space Label. These strategies, when **implemented in conjunction**, could significantly promote the widespread use of the EU Space Label.

In this context, EU space labelling schemes assigning a **rating** (i.e. a target range rather than an absolute target) could take into account e.g., applicants' varying resources and capabilities (see section 6.6). In this case, some more **"premium" benefits** could be reserved for applicants achieving the **highest rating** while more **administrative, funding and barrier-removing initiatives** could be offered also to applicants achieving a **lower rating**. This would allow for a more flexible model that **likely encourages organisations to apply for the label to obtain more easily accessible benefits even with a lower rating score**, and **likely motivates them to improve their rating score to unlock premium benefits**.

That being said, it is important to avoid any potential discrimination in the customisation, proportionality, and design of available incentives. **Access to incentives must be equal and fair** to all eligible label

[249] To illustrate this in another field, the 'Compendium of incentives offered by the Member States to EMAS users' provides an overview of incentives provided in the Member States to users of the European Eco-Management and Audit Scheme: https://green-business.ec.europa.eu/publications/compendium-emas-incentives-june-2023_en

applicants and should therefore take into account e.g., the size and type of applying organisations. It is therefore recommended to consider a "proportionality" factor to ensure fairness in applying for and using the EU Space Label by all relevant organisations including e.g., global players, SMEs and start-ups.

Finally, it is important to consider whether **some benefits** could be **obtained only at certain lifecycles of a mission**. For example, more interesting incentives could be made available to label holders when their mission changes from one phase to the next, thereby functioning as a milestone. Similarly, particularly appealing incentives could be reserved for the end-of-life stage to ensure that label holders remain motivated to comply with relevant labelling criteria until the end of their mission.

7.4.2 Misuse of the label

Design question: How will misuse of the EU Space Label be monitored and addressed?

7.4.2.1 Requirements

7.4.2.1.1 Relevant standards

To ensure confidence in a labelling scheme or initiative, any unauthorised or incorrect use of the label should be prevented. In this context, ISO 14024:2018 on 'Environmental labels and declarations — Type I environmental labelling — Principles and procedures' demands the establishment of a clear and explicit policy regarding the proper use of the label, and any deviation from this policy should result in appropriate corrective action and possible withdrawal of the label. Through a legally enforceable labelling agreement, holders of the label can be obliged to follow some key rules regarding the use of the label.

7.4.2.1.2 Existing EU labelling frameworks

For the **EU Ecolabel**, several mechanisms are put in place to prevent misuse of the label:

- Article 9 of Regulation (EC) No 66/2010 includes some basic rules about the **terms and conditions of use of the EU Ecolabel**. According to this Article, the EU Ecolabel may only be used in connection with products complying with the EU Ecolabel criteria applicable to the products concerned and for which the EU Ecolabel has been awarded. Moreover, the EU Ecolabel should always have the form as depicted in the Annexes to the Regulation.
- Article 9 also demands the **conclusion of a contract** between the competent body and the operator covering the terms of use of the EU Ecolabel. Only after the conclusion of this contract, the operator is allowed to place the EU Ecolabel on the product. A standard contract is included in the Annex to the Regulation.
- Article 10 deals with market surveillance and control of the use of the EU Ecolabel and lays down the **procedures for monitoring the use of the label**. This also entails the establishment of a procedure for stakeholders to formally complain about products awarded the EU Ecolabel that do not comply with applicable criteria.
- Article 17 deals with **penalties** applicable to the infringements of the provision of the Regulation. It states that "Member States shall lay down the rules on penalties applicable to infringements" and "shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate, and dissuasive. The Member States shall notify

those provisions to the Commission without delay and shall notify it without delay of any subsequent amendment affecting them".

With regards to the procedures for **monitoring the use of the EU Ecolabel**, **verifications of products** to which an EU Ecolabel was awarded can take place 1) on a **regular basis**, and 2) in case of a **complaint**. The complainant needs to fill in the "Non-compliance with EU Ecolabel criteria complaint form" and attach relevant photographs and/or supporting documents. The Commission reviews the complaint and assesses whether the evidence provided is sufficient to start an investigation. The complaint can be rejected on the grounds of insufficient supporting evidence. In this case, a rejection letter including the reasons for rejection is sent to the complainant. If the complaint is approved, the Commission liaises with the national Competent Body that issued the EU Ecolabel to the label holder in question and launches an investigation. If the **outcome of this investigation** demonstrates that the **product is not compliant**, the Competent Body informs the label holder that the EU Ecolabel for their product is **suspended**. The holder has three months to demonstrate that its product is compliant with the EU Ecolabel criteria; during this period, the use of the EU Ecolabel logo is not allowed for this product. **If compliance cannot be proven**, the Competent Body **withdraws the label**. Regardless of the outcome, the complainant is notified whether an investigation has been opened.

Also EU Regulation No 2019/881 on the **EU Cybersecurity Certification Framework** states that "*natural and legal persons shall have the right to lodge a complaint with the issuer of a European cybersecurity certificate or with the relevant national cybersecurity certification authority".* The **Implementing Act of the European Common Criteria-based cybersecurity certification scheme (EUCC)**[250] establishes several measures to prevent misuse of the certification by certified organisations:

- Articles 25-27 refer to **monitoring activities** to check the compliance of an EUCC certificate holder with their obligations according to Cybersecurity Certification Regulation. The certificate holder should execute several monitoring activities to monitor the conformity of the certified ICT product with its security requirements. In particular, the EUCC certificate holder must monitor vulnerability information regarding the certified ICT product, and the assurance expressed in the EUCC certificate.
- Article 28 mentions that in case there is no conformity with the EUCC certification, the certificate holder must propose to the certification body the remedial action necessary to address the non-conformity. Whenever deemed necessary (e.g., no cooperation from the holder) by the certification body, the latter might suspend the EUCC certificate.
- Article 29 establishes that if the EUCC certificate holder does not comply with its commitments and there is continued or recurring infringement by the holder, without an appropriate remedial action proposed by the holder, the certificate will be withdrawn.
- Article 30 establishes the conditions for suspension of the EUCC certificate.

In addition to these Articles, Article 63 deals with the right to lodge a **complaint**. According to this Article, natural and legal persons can issue a complaint with the issuer of a European cybersecurity certificate or with the national cybersecurity certification authority, the latter if the complaint relates to a European cybersecurity certificate issued by a conformity assessment body. The authority or body to

250 Commission Implementing Regulation (EU) 2024/482 of 31 January 2024 laying down rules for the application of Regulation (EU) 2019/881 of the European Parliament and of the Council as regards the adoption of the European Common Criteria-based cybersecurity certification scheme (EUCC). See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R0482

which the complaint has been issued needs to inform the complainant of the progress of the complaint and the decisions taken, as well as whether the complainant has the right to an effective judicial remedy.

7.4.2.2 Design of the EU Space Label

It is important to have mechanisms and procedures in place to avoid any misuse of the EU Space Label. Key mechanisms and procedures include, e.g., the conclusion of a labelling agreement when awarding the label, procedures for continuously monitoring compliance with labelling criteria, and procedures for dealing with identified cases of misuse.

When awarding an EU Space Label to an organisation, a **legally enforceable labelling agreement** should be concluded between the organisation awarding the label and the label holder. Only after the conclusion of this agreement, the label holder is allowed to 'use' the label, i.e., to communicate to, e.g., external partners, stakeholders, and the public that the label has been awarded to its space mission or to a part of a space mission for which the label holder is responsible.

Also after awarding the label to an organisation, it is important to monitor and ensure compliance with label criteria. This could be done in different ways: First, label holders could be requested to **regularly report** on the status of their mission (or parts thereof) and their compliance with relevant criteria. It could be determined that an awarded label remains valid during a particular mission phase and as long as the parameters remain unchanged; reporting and re-assessment would then, for example, be required when the mission phase changes.

Another important mechanism for monitoring and detecting misuse of the label is the establishment of a **stakeholder reporting mechanism**. Similar to the EU Ecolabel, a formal complaint procedure should be put in place through which a stakeholder can report that a space mission (or part thereof) awarded with an EU Space Label does not comply with the applicable criteria. This complaint procedure could be managed by a helpdesk established within the governing body.

Third, the **governing body** accompanied by independent experts and, when relevant, the EU SST Partnership in their role as **compliance checking body** and/or competent **independent experts** should **regularly check** if a mission or part thereof that has been awarded the label still meets the criteria of that label, even beyond or in addition to the regular reporting obligations by the label holder. The label holder should allow the governing body, compliance checking body, and independent experts to undertake all necessary investigations to monitor compliance with applicable criteria.

Finally, also the procedure for dealing with identified cases of misuse should be designed and established. This could entail the **suspension and/or withdrawal** of the permission to use the label. When determining the consequences of a misuse of the label, it is important to distinguish between different types of misuse, e.g., 1) using the EU Space Label without permission, 2) using the label inappropriately, 3) omitting to report a change in parameters, or 4) providing incorrect information during, e.g., the application process, regular reports during label implementation, regular checks by the governing body, compliance checking body and/or independent experts, an investigation following a complaint by a stakeholder, etc.

7.4.3 Revision of the label

Design question: How will the revision and update of the EU Space Label take place?

7.4.3.1 Requirements

7.4.3.1.1 Relevant standards

To ensure the effectiveness and impact of a voluntary labelling scheme, it is important to regularly review and revise it. **Reviewing** a labelling scheme is about evaluating if all its elements, especially the criteria, are still applicable and suitable[251]. **Revising** a labelling scheme is about implementing changes, e.g., new or modified criteria. Even before the actual review and revision of a labelling scheme, it is important to clearly determine and communicate the validity period of the criteria. Label criteria should always be set for a predefined period, and a formal decision should be made whether these criteria will remain in place or be modified. This requirement is included in ISO 14024:2018 on 'Environmental labels and declarations — Type I environmental labelling — Principles and procedures'. In ISO 14024:2018, it is also stated that product criteria should be reviewed within a predefined period considering factors such as new technologies, new products, new environmental information, and market changes.

7.4.3.1.2 ISEAL Codes of Good Practice

According to the ISEAL Codes of Good Practice, reviews should be conducted at least every five years and should draw on implementation experience, stakeholder feedback, and findings and learnings generated through monitoring, evaluation and learning activities.

7.4.3.1.3 Existing EU labelling frameworks

For the **EU Ecolabel**, the validity period of the criteria for each product group is determined by the Commission as part of the procedure for establishing the EU Ecolabel criteria. Usually, EU Ecolabel criteria are valid for a period of three to five years depending on the Commission Decision on establishing criteria for each product group. For the revision of EU ecolabels, a distinction is made between a full revision and a non-substantial revision of the criteria. While the procedure for a full revision is similar to the standard procedure for developing criteria, a shortened procedure has been put in place for a non-substantial revision of the criteria. In case of a non-substantial revision, the Commission shall produce a report containing a justification explaining why there is no need for a full revision and why a simple updating of the criteria and their stringency levels is sufficient[252]. Although not explicitly determined by the EU Ecolabel Regulation, ecolabel criteria are reviewed before their expiration after which their validity is prolonged, or they are revised. If the criteria are revised, label holders need to renew their contract which is linked to a reassessment of their compliance with the revised criteria. In case the criteria validity is prolonged, the contract is automatically renewed for as long as the criteria remain valid.

In the **European Cybersecurity Certification Framework**, the maximum validity period of European cybersecurity certificates is determined for each cybersecurity certification scheme. EU Regulation No 2019/88 on ENISA and ICT cybersecurity certification states that at least every five years, ENISA should evaluate each adopted European cybersecurity certification scheme considering the feedback received from all interested parties. Also, the procedure for revising cybersecurity certification schemes is determined: The Commission or the ECCG can request ENISA to start the process of developing a revised candidate scheme in case the review of the existing scheme concluded that this is necessary. There is no shortened procedure for revising certification schemes which means that the process of revising a scheme is similar to the process of developing a scheme.

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[251] Review and revision of a label refer to reviewing and possibly revising the overall labelling framework and/or specific labelling schemes. It does not entail checking if an awarded label is still valid.
[252] Stringency levels refers to the 'threshold' or 'target values' used, i.e., the level of ambition of the criteria.

7.4.3.2 Design of the EU Space Label

Based on relevant standards and existing practices on reviewing and revising voluntary labelling schemes, we recommend the following elements for the review and revision of the EU Space Label:

- A **maximum validity period** of the specific labelling schemes should be determined per scheme, e.g., 5 years. The validity period refers to the period during which the criteria remain valid. Before the end of this period, a review of the criteria should take place. This review could result in a prolongation of their validity or a revision of the criteria.
- In case the validity of the criteria is prolonged, labelling agreements with companies that have received the label for their mission or parts thereof remain valid. In case the criteria are revised, a compliance check based on the new or modified criteria will be needed. In case companies are no longer compliant with the new or modified criteria, they should be given the opportunity to adapt to the new criteria. It could also be decided that label holders may continue using the label based on their compliance with an older version of the criteria; this would, for example, be particularly relevant for label holders whose mission or parts thereof are already in orbit, and who therefore can no longer adapt to any updated criteria linked to e.g., mission design.
- A **procedure** and a **schedule** for reviewing and revising all space labelling schemes should be determined at the level of the framework to ensure coherence across revisions of all specific labelling schemes. We recommend:
    - using the **same or a very similar procedure** for reviewing and potentially revising a scheme as the one established for developing a scheme: The governing body coordinates the review and revision in cooperation with the ESLG obtaining feedback from the SSLG and through a public consultation, and then presents it to the Commission for approval;
    - scheduling and carrying out the review of schemes at an **interval of max. 5 years**, preferably before their scheduled expiry to ensure that, if a revision is needed, a new scheme is in place before the current scheme expires.
- Within the procedure, **two types of revisions** could be envisioned:
    - a **full revision** of the criteria when e.g., criteria or standards that serve as a basis for compliance with the specific labelling scheme are superseded;
    - a **non-substantial revision** in case of an update of existing criteria when an update of relevant criteria is needed while relevant standards are still applicable.
- It is also relevant to define how the **outcomes** of the revision should be presented to stakeholders and the Commission, and which **key actions** need to be taken to make the necessary adjustments to the specific labelling scheme.
- In case no revision of the scheme is needed, the Commission should decide to **prolong the validity** of the existing scheme including its criteria with a justification provided by the governing body as to why a revision is not necessary.

It is important to note that label review and revision procedures should consider the fact that **space missions** that were awarded the label in the past (or companies contributing to a labelled space mission) **should not be punished for not being able to demonstrate compliance with certain of the updated labelling criteria**. A typical example would be that of a space mission whose design was compliant at the moment it obtained the label but was already operational in orbit when relevant criteria affecting mission design were updated.

7.5 Synthetic Overview of EU Space Label components

To conclude this section, we briefly **summarise the main components and characteristics** of the EU Space Label following the different stages and requirements discussed in this section. We make a clear distinction between what should be **established at the level of the overall EU Space Label framework** and **at the level of specific labelling schemes**.

	EU Space Label framework	EU space labelling schemes
	Development of the label	
Scope and objectives of the label	A set of common objectives and a wide scope applicable to all specific labelling schemes should be defined at the level of the EU Space Label framework. Regarding the scope, the EU Space Label framework applies to all aspects related to a space mission. As for objectives, the EU Space Label is defined as a framework for the creation of EU space labelling schemes to support a common approach to Space Traffic Management while fostering EU space industrial competitiveness in full compliance with the respective competences of the EU and its Member States.	Specific objectives and a specific scope should be defined for each space labelling scheme in line with the overall objectives and scope of the EU Space Label framework. This means that specific labelling schemes should address both general objectives and comply with the scope of the broader framework, but also provide clarity about their own specific objectives and scope.
Criteria	A set of general requirements should be determined which apply to all criteria developed and defined for each specific space labelling scheme. Such criteria should be clear, relevant, measurable, and scientifically solid.	The definition and selection of the criteria is done at the level of each specific space labelling scheme.
Governance structure	It is recommended to establish two governance bodies to allow for the participation of national space authorities (ESLG) and other relevant stakeholders (SSLG).	The development of specific space labelling schemes relies on the overall governance structure of the EU Space Label framework.
Label development and adoption process	A process for preparing and establishing new labelling schemes is defined at the level of the EU Space Label framework and consists of the following steps:	All space labelling schemes should follow the same process for their development and adoption.

	EU Space Label framework	EU space labelling schemes
	1. establish a Work Programme containing labelling schemes to be developed and reviewed/revised; 2. request the development of a specific labelling scheme; 3. develop a draft proposal for the candidate scheme together with ESLG and gathering SSLG views; 4. carry out a public consultation on the candidate scheme; 5. finalise the draft proposal together with ESLG and gathering SSLG views; 6. present the proposal for the new scheme to the Commission; 7. adopt new space labelling scheme; 8. develop supporting guidelines and tools for the new labelling scheme.	
Assessment and certification		
Assessment methods	The EU Space Label framework establishes the rules and approach for determining assessment methods. The main rule is that for each criterion defined under a specific labelling scheme, the associated method(s) for checking compliance with that criterion should be determined. The general rules should also lay down that organisations who apply for the label should make available all information needed to enable compliance checking bodies to carry out the check. The method for checking compliance should primarily rely on standards, ideally international standards, otherwise regional and national standards.	The definition of the compliance checking methods is done at the level of a specific labelling scheme. For each criterion proposed, the specific labelling scheme should detail how compliance with each criterion should be checked. This also entails the definition of the information that needs to be produced and used for the compliance check. In each specific space labelling scheme, it should be determined what kind of information is needed for each criterion.

	EU Space Label framework	EU space labelling schemes
Compliance checking procedures	The EU Space Label should fully rely on third-party compliance checks carried out by a group of independent experts under the responsibility of the governing body.	Compliance checks for all space labelling schemes should be carried out by a pool of independent experts under the responsibility of the governing body.
Requirements for compliance checking bodies	It should be guaranteed that the governing body meets a set requirements for coordinating compliance checks. In addition, the EU Space Label framework should specify that all experts engaged in compliance checking activities should be competent and familiar with the requirements of the compliance checks they carry out, have appropriate knowledge and understanding of relevant requirements and testing standards, and are able to draw up documents, reports, etc. demonstrating that compliance checks have been carried out.	Requirements for independent experts engaged in compliance checks should be determined for each specific labelling scheme; these should be related to the technical competencies required to apply the compliance checking methods defined for each specific labelling scheme. In addition, experts should be selected in a way that ensures the absence of any conflicts of interests.
Compliance checks and award of the label	The procedure for carrying out compliance checks should be determined at the level of the EU Space Label framework and should be the same for all space labelling schemes. It should entail an application for a label which is reviewed by the governing body and evaluated by independent experts. The governing body reviews the evaluation and decides whether to award the label.	All space labelling schemes should follow the same compliance checking and labelling award procedure.
Use and maintenance of the label		
Promoting the use of the label	The use of the EU Space Label should be promoted and supported through different types of incentives e.g., legal instruments, operational instruments, economic and financial instruments, learning and capacity-building instruments, and/or marketing and promotional instruments.	Incentives should be tailored to the criteria defined for each specific labelling scheme and should also consider the scope and objectives of each scheme. Particular attention should be attributed to developing incentives that are useful and attractive to potential label users to stimulate adoption while ensuring fairness and fostering competitiveness.
Misuse of the label	Mechanisms for avoiding and detecting misuse of the label should be implemented at the level of the EU Space Label framework, such as:	Specific labelling schemes should adhere to the mechanisms for avoiding misuse determined at the level of the overall framework.

	EU Space Label framework	EU space labelling schemes
	• a legally enforceable labelling agreement should be concluded when a label is awarded to an organisation; • label holders should regularly report on their compliance with the criteria and on any changes that might affect their compliance, e.g., a new mission phase; • the governing body should coordinate regular checks to verify if a labelled mission (or parts thereof) still meets applicable criteria; • a stakeholder reporting mechanism should be put in place through which stakeholders can report that a labelled mission (or parts thereof) does not comply with applicable criteria; • a procedure should be put in place for dealing with identified cases of misuse which could result in suspension/withdrawal of the label.	
Review and revision of the label	The EU Space Label framework should lay down general rules related to the review and revision of labelling schemes. For instance, a procedure should be defined for the review and revision of labelling schemes: At least every x years, a specific labelling scheme should be reviewed; based on the results of the review, a revision of a specific labelling scheme could take place.	For each specific labelling scheme, the maximum period of validity should be determined. In line with the general rules, a review of each labelling scheme should take place at least every five years; if the review determined that the criteria or other elements are no longer suitable, a revision of the specific labelling scheme should take place.

Table 23 - Overview of EU Space Label components

8 Roadmap for developing and implementing the EU Space Label

This section aims to present the key steps to **develop and implement the EU Space Label**. This entails setting up a **labelling framework** under which **specific labelling schemes** can be developed to address specific domains, such as space safety and sustainability, environmental aspects, and the preservation of dark and quiet skies.

Section 8.1 presents a concrete roadmap for the development and implementation of the **labelling framework** from a governance perspective. Section 8.2 specifies **relevant intermediary steps** allowing to prepare specific labelling schemes based on the labelling framework. This is followed by section 8.3 where we present a roadmap for the development and implementation of **specific labelling schemes** from a governance perspective. Lastly, section 8.4 illustrates the **application process** for obtaining a specific label from a user perspective.

The figure below presents the complete process to develop and establish the EU Space Label framework and subsequent specific labelling schemes.

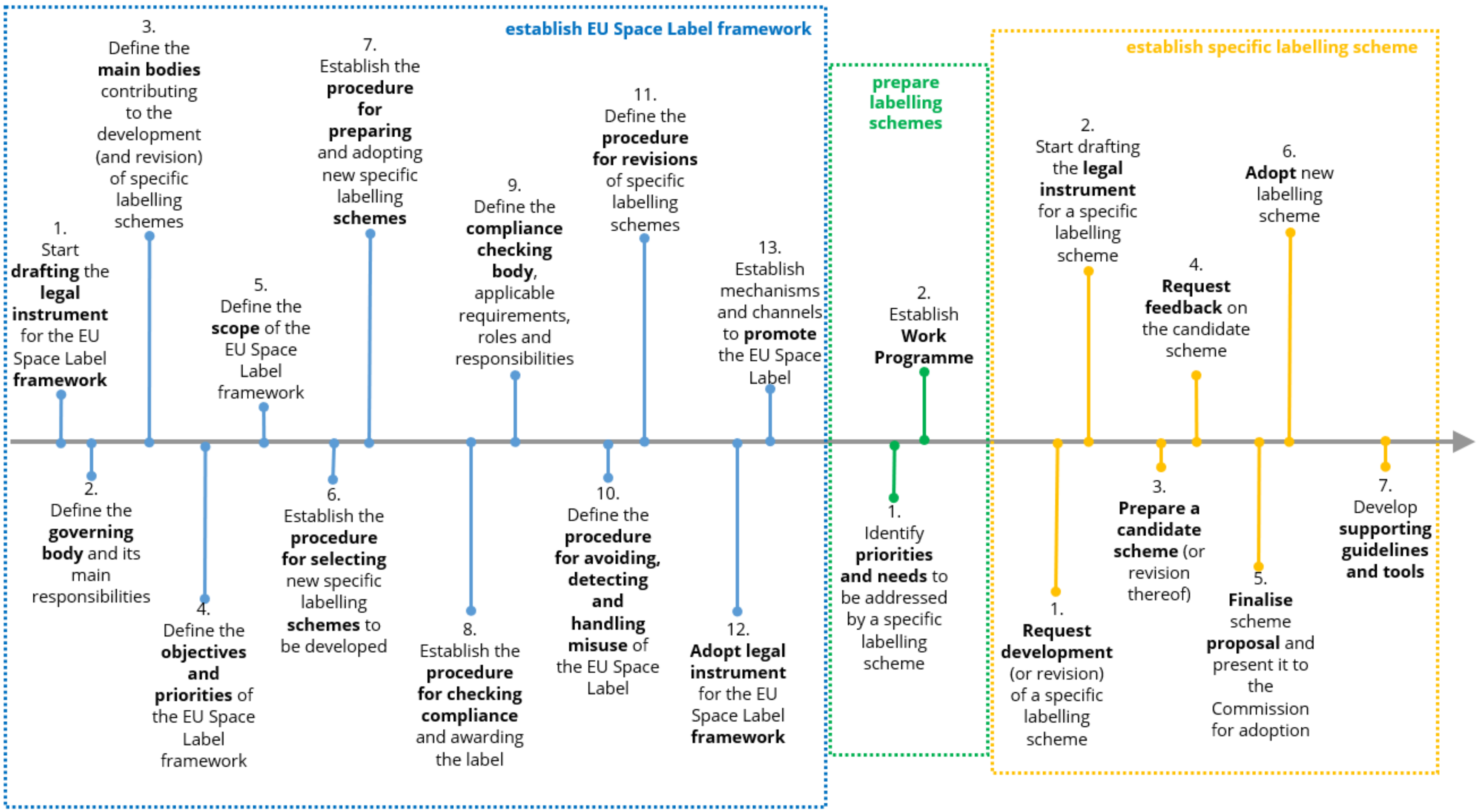

Figure 14 - Visual of a Roadmap for setting up the EU Space Label framework, preparing the establishment of future labelling schemes, and establishing specific labelling schemes

8.1 Key steps to develop and implement the EU Space Label framework (governance perspective)

The figure and table below aim to present the key steps to develop and implement the EU Space Label framework from the governance perspective. Most of the described steps can be taken in parallel and are part of the drafting and adoption process for the legal instrument of the EU Space Label. This process depends on a range of factors which may have an impact on the timeline to complete the below steps. It is assumed that completion of steps 1 to 12 below could be achieved within 24 to 42 months.

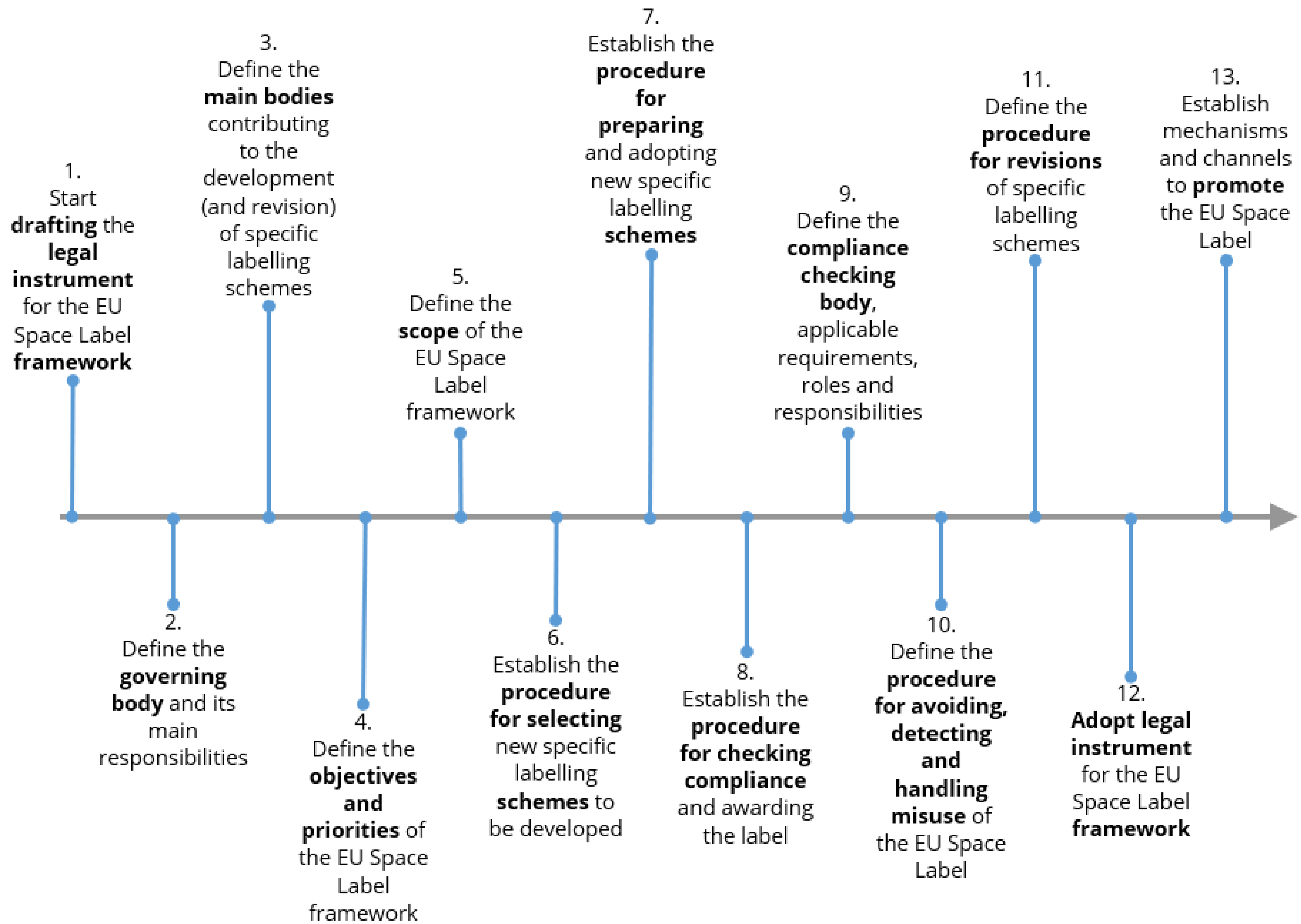

Figure 15 - Visual of a Roadmap for setting up the EU Space Label framework

Steps	Actor in charge	Description
1. Start drafting the legal instrument for the EU Space Label framework	European Commission	Start drafting the **legal instrument for the EU Space Label framework**. The legal instrument should include the elements outlined in steps 2 to 11 below.
2. Define the governing body and its main responsibilities	European Commission	Define the **body responsible for implementing the EU Space Label framework** ('governing body'). This body can be designated through the legal instrument; this also offers the possibility to give the legal mandate to that body, define the objectives it should achieve, the tasks it should carry out, etc. *The **governing body** will be **responsible for*** • *taking the lead in preparing candidate schemes and steering the debate with experts from national space authorities of EU Member States and other sectors such as industry, academia, etc.;* • *providing the secretariat for the ESLG and the SSLG (see step 3); and* • *complementary to these two tasks, monitoring relevant developments in space standardisation, and recommending appropriate technical specifications for use in specific labelling schemes.*
3. Define the main bodies contributing to the development (and revision) of specific labelling schemes	European Commission	Define the bodies responsible for **assisting the governing body** in the development and subsequent revisions of specific labelling schemes. *We recommend establishing **two bodies** to allow for the participation of relevant stakeholders:* • *the **EU Space Labelling Group (ESLG)** brings together representatives of national space authorities or other relevant national authorities (e.g., labelling or standardisation) designated by EU Member States; it will contribute to the selection, preparation, adoption, and review of specific space labelling schemes;* • *the **Stakeholder Space Labelling Group (SSLG)** brings together, following an open call, recognised experts from diverse sectors such as industry, academia, etc.; it will support the governing body in the development of specific space labelling schemes, in particular as regards criteria definition, assessment methods, and compliance check procedures.*
4. Define the objectives and	European Commission	Define the **overall objectives** that the framework should achieve; these should be aligned with wider EU policy objectives and priorities in the space field.

Steps	Actor in charge	Description
priorities of the EU Space Label framework		*The **objective** of the EU Space Label framework is to support a common approach to STM while fostering EU space industrial competitiveness in full compliance with the respective competences of the EU and its Member States. To this end, the **specific objectives** of the EU Space Label framework are to* • *promote a set of common standards, guidelines, and best practices to guide space actors towards safer and more sustainable space activities; and* • *incentivise adherence by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness.* *The EU Space Label **framework** should provide a **mechanism to establish EU space labelling schemes** and to attest that all aspects evaluated in accordance with such schemes comply with specified requirements.* *In addition, the EU Space Label should consider **key principles** such as:* • ***scalability** i.e., it allows taking into account different domains, stakeholders, labelled elements, etc. allowing for flexibility and adaptability depending on e.g., stakeholder needs and challenges in the design and management of the EU Space Label and labelling schemes;* • ***transparency** i.e., it allows involving a vast array of stakeholders from an early stage on and allowing them to share their advice and to shape relevant labelling developments and processes, and defining criteria that are clear and easy to understand for all stakeholders involved.*
5. Define the scope of the EU Space Label framework	European Commission	Define the **scope** of the EU Space Label framework; this should be high-level and set the basis for the specific labelling schemes. *The scope of the EU Space Label framework covers **all aspects related to a space mission** and may include any relevant aspects contributing to the proper functioning of STM.* *Further **characteristics to consider** are:* • *the label is attributed for a limited amount of time;* • *the label is attributed based on compliance checks against relevant labelling criteria;* • *the label covers those products, processes and services that are part of a space mission;*

Steps	Actor in charge	Description
		• *the label affects organisations involved in the different stages of a space mission;* • *the label is open to EU and non-EU organisations;* • *the label builds on mandatory rules defined in legislation and on requirements defined in existing (international) standards but will go further by setting more ambitious targets beyond existing mandatory rules and, where possible, requirements outlined in standards.*
6. Establish the procedure for selecting new specific labelling schemes to be developed	European Commission	Establish the **procedure for selecting new specific labelling schemes** to be developed. The specific labelling schemes should be aligned with the objectives of the EU Space Label framework. *The Commission establishes and adopts a multi-annual (e.g., 3 years)* ***Work Programme*** *which contains an overview of possible labelling schemes to be developed and/or reviewed as well as strategic priorities for, scope of, need for, and objectives of each possible scheme.* *The governing body supports the Commission in preparing the Work Programme based on its own expertise as well as by collecting the views and expert advice of the ESLG and SSLG.*
7. Establish the procedure for preparing and adopting new specific labelling schemes	European Commission	Establish the **procedure for preparing and adopting a new specific labelling scheme**; this should be the same for all specific labelling schemes to ensure coherence across the labels. *The main steps (see section 8.3 for details) are:* • *the Commission* ***requests*** *the governing body to develop a specific labelling scheme based on the Work Programme;* • *the governing body* ***prepares*** *a candidate scheme in collaboration with the ESLG;* • *the governing body* ***consults*** *the* ***SSLG*** *on the candidate scheme; based on feedback received, it further* ***revises*** *the draft proposal together with the ESLG;* • *the governing body conducts a* ***public consultation*** *on the draft proposal; based on feedback received, it further* ***revises*** *the draft proposal together with the ESLG;* • *the governing body* ***finalises*** *the proposal based on feedback received in cooperation with the ESLG and* ***consults*** *the* ***SSLG*** *for final feedback;*

Steps	Actor in charge	Description
		• *the governing body* ***presents*** *the scheme proposal to the Commission* ***for adoption****;* • *the Commission* ***adopts*** *the specific labelling scheme e.g. by means of a Commission Decision.*
8. Establish the procedure for checking compliance and awarding the label	European Commission	Establish the **procedure for checking compliance and awarding the label**. Based on this procedure, specific elements will then be further clarified for each specific labelling scheme. *The main elements to be defined are, e.g.:* • ***rules on compliance checking methods****, i.e.,* ○ *for each criterion of a specific labelling scheme, specific compliance checking methods are determined, and related documentation required from the applicant;* ○ *compliance checking methods should rely on international standards, otherwise regional or national standards; if none exist, other repeatable and reproducible methods should be used;* ○ *if relevant, a list of potential compliance checking methods that could be used for criteria under specific labelling scheme;* • ***rules on compliance checking procedures****, i.e.:* ○ *compliance checks should be carried out through third-party assessments;* ○ *details on procedural steps e.g., application, application review, evaluation, evaluation review, award decision, and award of the label;* ○ *a clear statement that applicants should make available all required information to enable compliance checks e.g., types of documentation, supporting evidence, etc.;* • ***overview of the application process****, i.e.:* ○ *main bodies involved and their tasks from application until award of the label;* ○ *information to be provided by the applicant e.g., types of documentation, supporting evidence, etc.;* ○ *measures to support applicants e.g., establishment of a helpdesk, website, supporting guidelines, etc.*

Steps	Actor in charge	Description
		○ *conditions for award of the label e.g., having met all the criteria and having successfully completed the compliance check.*
9. Define the compliance checking body, appliable requirements, roles and responsibilities	European Commission	Define the **compliance checking body** based on capabilities and expertise to carry out compliance checks. *We recommend, e.g.:* • *defining the main body responsible for carrying out compliance checks; this can be under the umbrella of the governing body;* • *setting up a pool of independent experts supporting the main compliance checking body in carrying out compliance checks;* It is also important to clarify the **requirements** that the compliance checking body should fulfil. *The main elements to be defined are, e.g.:* • *requirements that the compliance checking body must fulfil e.g., impartiality, confidentiality, and competence (e.g., technical expertise to carry out the assessment);* • *requirements that independent experts should fulfil, e.g., expertise in compliance checks and subject-matter expertise related to a specific scheme;* • *mechanisms ensuring an absence of any possible conflict of interest for any person involved in compliance checking activities.* Lastly, the main **roles and responsibilities** of the compliance checking body should be defined. *The main elements to be defined are, e.g.,* • *role and responsibilities of the compliance checking body incl. independent experts e.g.,* ○ *carrying out compliance checks as per defined procedure and methods;* ○ *evaluating compliance with relevant criteria based on information provided by the applicant.*
10. Define the procedure for	European Commission	Establish the **procedure for avoiding, detecting, and handling misuse** of the label.

Steps	Actor in charge	Description
avoiding, detecting and handling misuse of the EU Space Label		*Some elements to be considered include, e.g.:* • *defining a **body responsible** for ensuring correct use of the label, e.g., governing body;* • *putting in place a legally enforceable **labelling agreement** with the applicant prior to awarding the label;* • *defining rules and procedures for label holders to **regularly report** on the status of their missions and their compliance with relevant criteria;* • *establishing a **stakeholder reporting mechanism** allowing stakeholders to report perceived misuse and submit a complaint; this includes, e.g., **investigations** into an alleged misuse following a complaint;* • *defining rules and procedures for the compliance checking body to carry out **regular checks** to ensure continued compliance with relevant criteria also after the award of the label;* • *defining **consequences** in case a misuse is confirmed, e.g., withdrawal of the permission to use the label.*

11. Define the procedure for revisions of specific labelling schemes	European Commission	Define the **procedure for revising specific labelling schemes**. The governing body may be tasked with leading the revision as stated in the Work Programme.
		Some elements to consider include e.g.:
		• *specifying that the **validity** of a **scheme** and its **criteria** is determined at the level of the specific scheme;*
		  ○ *if the validity of the criteria is prolonged, label agreements with companies having the label remain valid;*
		  ○ *if the criteria are revised, a compliance check will be needed against the new or modified criteria.*
		• *define **preconditions** for when*
		  ○ *a full revision should take place e.g., criteria or standards that serve as a basis for compliance with the specific labelling scheme are superseded;*
		  ○ *a non-substantial revision should take place e.g., an update of relevant criteria is needed while relevant standards are still applicable;*
		  ○ *no revision is needed e.g., all relevant criteria and standards remain up to date.*

Steps	Actor in charge	Description
		• *set up a **consultation mechanism** through which stakeholders can provide input and feedback to revisions, similar to procedure for scheme development;* • *define how the **outcomes** of the revision should be presented to key stakeholders and the Commission, similar to procedure for scheme development;* • *define key actions to take **after the revision** to make necessary adjustments to specific labelling schemes;* • *foresee **specificities**, such as derogations from compliance obligations with certain criteria, e.g., compliance with revised design criteria for missions that are already in orbit.*
12. Adopt legal instrument for the EU Space Label framework	European Parliament and Council of the EU	The **legal instrument** for the EU Space Label framework is **adopted** by the European Parliament and the Council of the EU based on a proposal by the Commission.

13. Establish mechanisms and channels to promote the EU Space Label	Governing body, ESLG and SSLG	Prepare and implement **actions to promote** the EU Space Label and incentivise its use (see section 7.4.1 for further details).
		We recommend considering and further assessing the feasibility of, e.g.:
		• *<u>legal instruments</u>, e.g.:*
		  ○ *regulatory relief, such as fast-track permits/simplified application procedures, extended validity of permits/authorisations, reduced reporting and monitoring requirements;*
		  ○ *public procurement, such as using EU Space Label criteria in public procurement or as proof of compliance with technical specifications;*
		  ○ *integration in government strategies, such as encouraging EU Member States to include references to EU Space Label in national government strategies or plans;*
		• *<u>operational instruments</u>, e.g.:*
		  ○ *EU SST support, such as priority support to labelled missions, e.g., during conjunctions in space;*

Steps	Actor in charge	Description
		• *<u>economic and financial instruments</u>, e.g.:* ○ *fee reductions, such as reduction of administrative fees or financial warranties;* ○ *funding support, such as access to EU/national grants, increased funding, use of label linked to criteria relating to space sector activities under EU Taxonomy Regulation;* • *<u>learning and capacity-building instruments</u>, e.g.:* ○ *assessment, such as self-assessment or assistance and guidance;* ○ *capacity-building and support, such as access to knowledge resources, workshops and trainings, EU Space Label helpdesk, implementation assistance;* ○ *assistance in other domains, such as access to other types of support and assistance;* • *<u>marketing and promotional instruments</u>, e.g.:* ○ *EU Space Label platform, such as website and/or list of missions/contributing organisations;* ○ *prizes and awards, such as EU Space Label Award, Prize, or Ambassadors;* ○ *governance forum, such as chairpersonship in working groups;* ○ *promotional instruments, such as promotion campaigns, participation in trade missions, public and/or exclusive events.*

Table 24 - Roadmap for the development and establishment of the EU Space Label framework

8.2 Key steps to prepare the establishment of future EU Space Labelling schemes (governance perspective)

The figure and table below present the key steps from a governance perspective to prepare the establishment of future space labelling schemes once the EU Space Label framework as outlined in section 8.1 is set up. While the duration of such preparatory work cannot be determined with certainty, it can be assumed that these steps, depending on their complexity, could be completed within 12 to 18 months.

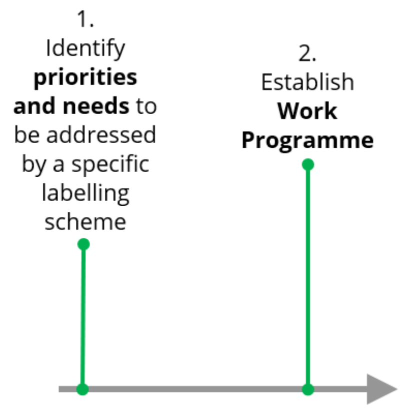

Figure 16 - Visual of the Roadmap for preparing the establishment of future space labelling schemes

Steps	Actor in charge	Description
1. Identify priorities and needs to be addressed by a specific labelling scheme	European Commission, Governing body	In line with the Commission's space policy objectives and EU strategic priorities, the Commission and the governing body **outline the priorities and needs to be addressed by future labelling schemes**.
2. Establish Work Programme	European Commission	Based on identified priorities and needs, the **Commission establishes a Work Programme** containing possible space labelling schemes to be developed and reviewed/revised as well as the strategic priorities for, scope of, need for, and objectives of each possible scheme. The governing body supports the Commission in preparing the Work Programme based on its own expertise as well as by collecting the views and expert advice of the ESLG and SSLG.

Table 25 - Roadmap for preparing the establishment of future space labelling schemes

8.3 Key steps to develop and implement specific EU Space Labelling schemes (governance perspective)

The figure and table below present the key steps from a governance perspective to develop and implement a specific labelling scheme once the EU Space Label framework as outlined in section 8.1 is set up and preparatory work as outlined in section 8.2 is completed. While the duration for the development of a new specific labelling scheme cannot be determined with certainty, it is assumed that the development and adoption of a specific labelling scheme, depending on its complexity, could take between 12 and 24 months.

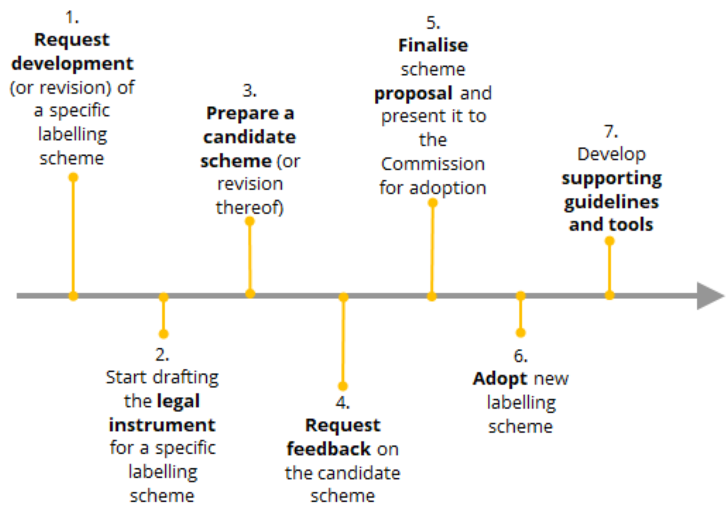

Figure 17 - Visual of the Roadmap for developing and establishing a specific labelling scheme

Steps	Actor in charge	Description
1. Request development (or revision) of a specific labelling scheme	European Commission	Based on the Work Programme, the **Commission requests the governing body** to develop (or revise) a specific labelling scheme.
2. Start drafting the legal instrument for a specific labelling scheme	European Commission	The Commission needs to adopt a **legal instrument** for each specific labelling scheme.

Steps	Actor in charge	Description
3. Prepare a candidate scheme (or revision thereof)	Governing body, ESLG	Based on the formal request, the governing body **prepares** a candidate scheme in collaboration with the ESLG. This is done through means of a draft proposal which should contain e.g. • the subject-matter and scope of the labelling scheme; • a clear description of the objectives of the specific labelling scheme; • references to relevant international, European and national standards and technical specifications that will be used during the compliance check; • specific criteria and assessment methods to be used during the compliance checks; • maximum validity period of the label awarded under the labelling scheme; • a clear description of incentives for potential label users; • applicable rules in case of misuse of the labelling scheme. These details should be • complemented by the reasoning of choice for the scheme based on e.g., priorities or developments; • based on an assessment of existing standards, guidelines and best practices as well as regulatory and legislative initiatives at EU and Member State levels; • based on a complementarity and coherence analysis between the specific labelling scheme and existing initiatives to ensure that the new scheme will generate an added value and avoid overlaps and incoherences.
4. Request feedback on the candidate scheme	Governing body	The **governing body gathers feedback** on the candidate scheme by **consulting** the **SSLG**. Based on feedback received, it further **revises** the draft proposal together with the ESLG. The governing body then carries out a **public consultation** on the draft proposal. Based on feedback received, it further revises the draft proposal together with the ESLG.

Steps	Actor in charge	Description
5. Finalise scheme proposal and present it to the Commission for adoption	Governing body	Based on the feedback received during the previous step, the governing body finalises the scheme proposal in cooperation with the ESLG and consults the SSLG for final feedback. The **governing body presents the final proposal to the Commission**.
6. Adopt new labelling scheme	European Commission	The **Commission adopts** the **specific labelling scheme**, e.g., by means of a Commission Decision.
7. Develop supporting guidelines and tools	Governing body	The **governing body develops supporting guidelines, materials and tools** to assist potential candidates in the application process for the new labelling scheme, for example: • supporting guidelines and a website allowing candidates to obtain more information on how to compile and submit their application file; • a helpdesk acts as a contact point for candidates in case of questions and/or complaints.

Table 26 - Roadmap for the development and establishment of a specific labelling scheme

8.4 Key steps to apply and use a specific labelling scheme (user perspective)

The figure and table below present the key steps to apply and use a specific labelling scheme from the perspective of a label candidate/user. While the duration for the label application process cannot be determined with certainty at this point, it is assumed that, assuming reactivity and cooperation by the label applicant, steps 2 to 6 could be completed within 12 months.

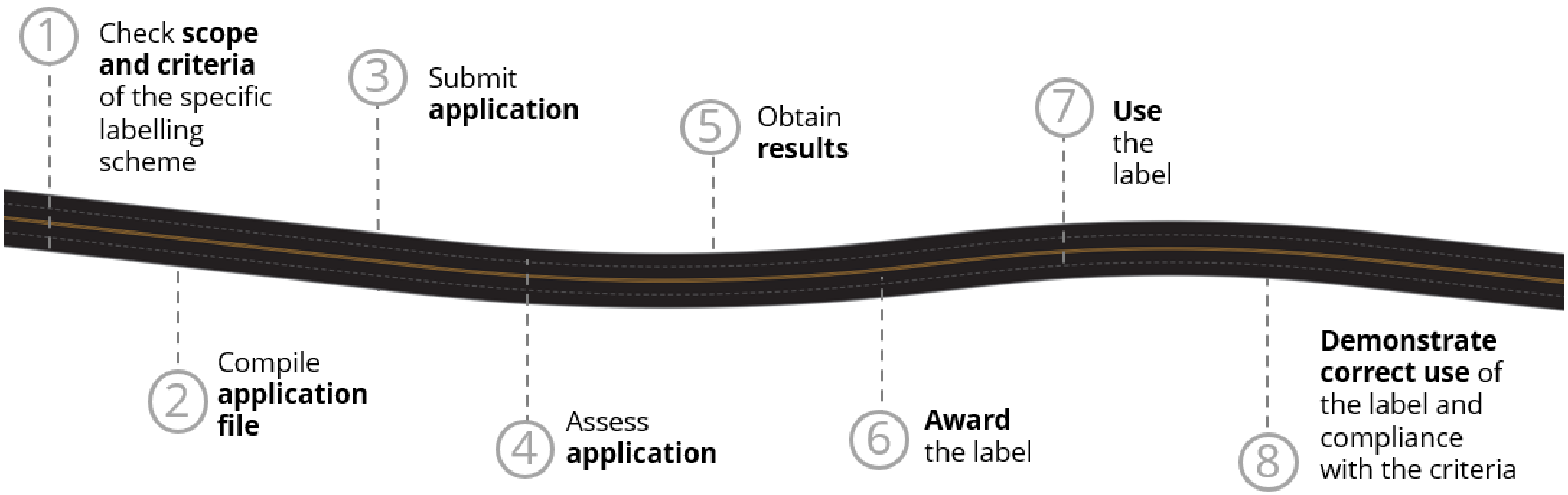

Figure 18 – Visual of the Roadmap describing the application for and use of a specific label

Steps	Description
1. Check scope and criteria of the specific labelling scheme	The candidate checks whether it complies with the scope of the specific labelling scheme and consults the criteria to be fulfilled. The candidate can obtain more information through the governing body's website; by contacting the governing body's helpdesk; or by referring to the supporting guidelines.
2. Compile application file	The candidate compiles its application file describing its mission, components, etc., and provides all declarations / licenses / technical documentation etc. required to demonstrate compliance with relevant criteria.

Steps	Description
	The supporting guidelines provide the candidate with relevant information on how to compile its application file.
3. Submit application	The candidate submits its application to the governing body.
4. Assess application	The candidate waits for the outcome of the compliance check and provides additional evidence if requested by the compliance checking body.
5. Obtain results	The candidate receives the results of the compliance check of its application from the governing body.
6. Award the label	The candidate signs the labelling agreement with the governing body and is awarded the specific label.
7. Use the label	The candidate is allowed to display the label logo and communicate about it for promotional purposes. The candidate can use the label e.g., as proof of compliance in procurements or to attract new business.
8. Demonstrate correct use of the label and compliance with the criteria	Whenever requested by the governing body, the candidate must be able to provide all required information and documentation to demonstrate that it uses the label correctly, e.g., in case of regular reports on compliance by the label user, regular checks by the governing body, or in case of an investigation following a complaint on possible misuse.

Table 27 - Roadmap for the application for and use of a specific label

9 Conclusions and way forward

Based on the analysis above, conclusions and a potential way forward are formulated in this section.

9.1 Conclusions

In recent years, the **number of satellites launched into orbit has increased at an exponential rate**. The exponential growth of commercial spaceflight and space-related activities have increased the number of objects in space leading to a **higher risk of collisions**. This does not only present a threat to human spaceflight, operational satellites, Earth- and space-based services but also affects the numerous stakeholders who rely on these services. As regards life on Earth and the environment, space activities pose challenges which, if not addressed, will continue to have a **devastating impact on the environment.** At the same time, **light pollution and radio frequency interferences** directly affect the quality and accuracy of observational data which impedes on space observations that are essential for space situational awareness (e.g., hazardous near-Earth object surveys) and space exploration. All these challenges, i.e. space safety and sustainability, environmental aspects, and the preservation of dark and quiet skies, are relevant and should be addressed in the context of **Space Traffic Management** so that EU and other space actors can continue to access, conduct activities in, and return from outer space safely, sustainably, and securely.

As we have reflected in this report, the **existing set of standards, guidelines and best practices** provide a starting point to address some of the issues related to space traffic management. Regarding **space safety and sustainability**, the **most developed** pillar of the three, all assessed initiatives strive to improve and align existing standards, and almost all of them refer explicitly to international guidelines of UN COPUOS and IADC, as well as ITU. As regards the impact of space activities on the **environment**, **no sector-specific guidelines or best practices currently exist** at international level to measure the environmental performance of space activities and their impact on the environment. Lastly, for the **preservation of dark and quiet skies**, while several organisations and initiatives are actively working towards this goal, **no unified guidelines or best practices currently exist** at international level.

The **number, scope, and level of maturity of voluntary instruments** in the fields of space safety and sustainability, the impact of space activities on the environment, and the preservation of dark and quiet skies **vary to a large degree**, making it difficult for space actors to decide which instruments are suitable to implement. In the absence of a common mechanism, space actors may decide to take a 'business as usual' approach implementing no or only few voluntary instruments. This leads to **consequences** such as low motivation among space actors to go the extra mile, ultimately affecting their competitiveness; safety risks for space assets in orbit potentially jeopardising actor's investments; and continuously increasing safety and sustainability risks of space activities potentially hampering life on Earth, the environment and space observations.

Against this background, the **aim of the Commission's initiative** in the context of this study was to look for ways to **support a common approach to Space Traffic Management** while **fostering EU space industrial competitiveness** in full compliance with the respective competences of the EU and its Member States. It intends to do so by **promoting a set of common standards, guidelines, and best practices** to guide space actors towards safer and more sustainable space activities, and by **incentivising adherence** by space actors to these common standards, guidelines, and best practices, thereby fostering their competitiveness. This follows up on the **Joint Communication** on Space Traffic Management[253] which, as a possible incentive measure to **"foster the use by EU operators of the guidelines and standards recommended at the EU level"**, puts forward the **"use of a 'safe space' label similar to the concept of the eco-label"**.

This report therefore looked at options to **establish an EU Space Label that offers guidance** on and **confirms adherence** to clearly defined criteria based on common standards, guidelines, and best practices, to **raise awareness** for the importance and interconnectedness of various space domains, and to **offer benefits** to actors who adhere to common standards, guidelines, and best practices, thereby fostering innovation and technological development.

We therefore assessed **existing initiatives** which served as inspiration for the further development of the blueprint for a possible EU Space Label. These **high-level systems** were selected due to their **relevance at EU and international levels** for the purposes for which they were originally created: We looked at the United Nations Global Compact as an example of a public (intergovernmental) mechanism based on broad principles; at the OECD Guidelines for MNEs as an example of a (intergovernmental) mechanism based on detailed guidelines; at the EU Ecolabel as an example of a public (intergovernmental) mechanism based on labelling; at the Voluntary Sustainability Standards as an example of a private-sector-led mechanism based on labelling; and at the Space Sustainability Rating as an example of a private-sector-led mechanism based on expert rating.

Based on these examples and assessment of the high-level systems, we could see that the **most fit for purpose** would be **high-level system 3**, i.e., a public intergovernmental mechanism based on **labelling in combination with high level-system 5**, i.e., a private-sector-led mechanism based on **expert rating**. We assessed that a combination of these two high-level systems align with the **political context and ambitions of the EU** and are likely to **offer a common approach at the EU level** to address the issues of space safety and sustainability, environmental aspects, and preservation of dark and quiet skies while **fostering** the **competitiveness** of the **EU space industry** in full compliance with the **respective competences of the EU and its Member States**. In this context, we also concluded that the unique specificities of the space domain do not fit the rather narrow framework of the existing EU Ecolabel (focused on environmental aspects on Earth), and that the Commission would have limited capabilities within the existing Space Sustainability Rating (managed by international organisations) to achieve its overarching objective of supporting an EU approach for Space Traffic Management.

Once we understood the functioning of these high-level systems, we developed a blueprint for the EU Space Label.

9.2 Way forward

The **blueprint** and **roadmap** offer a way forward for the **establishment of an EU Space Label** that would guide and incentivise space actors towards adherence to clear and common standards, guidelines, and best practices for safer and more sustainable space activities. Given the wide domain and diverse challenges of Space Traffic Management, the blueprint proposes an **overarching space labelling framework** under which **specific labelling schemes** could be further developed to address specific domains of interest, such as safety and sustainability in space; environmental aspects; and preserving dark and quiet skies.

[253] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022JC0004

Furthermore, the blueprint identifies **key requirements for an effective voluntary labelling mechanism** and encompasses all applicable core components: from defining the **scope and objectives** of the label framework and individual labelling schemes, defining **criteria**, a **governance** structure, methods of **assessment**, and **measures to promote and incentivise** the use of the label, while also touching upon the topics of **misuse** and **revision** of the label.

On **objectives** and **scope**, the EU Space Label considers two levels:

- **level of the EU Space Label framework** with a set of common objectives and a wider scope applying to all specific labelling schemes;
- **level of specific labelling schemes** with additional objectives and a specific scope on the specificities sought by each of the labelling schemes.

Specific labelling schemes should therefore address both general objectives and comply with the scope of the broader framework, but also provide clarity about their specific objectives and scope.

Three **labelling schemes** are proposed to address known challenges of increased space activities:

- a **Space Label on Safety and Sustainability in space** ('Space Safety Label') aiming to **minimise the risk of collisions and the generation of debris** in all activities carried out throughout the lifecycle of a space mission;
- a **Space Label on Environmental Aspects** ('Environmental Space Label') aiming to ensure that the **impacts of space activities on the environment are reduced** in line with the European Green Deal targets[254]; and
- a **Space Label on the Preservation of Dark and Quiet Skies** ('Dark and Quiet Skies Label') aiming to **mitigate the adverse effects of space activities on astronomical observations**.

The definition and selection of the **criteria to adhere to** would be done at the level of the specific space labelling schemes. The importance of clear, relevant, ambitious, feasible, measurable, and scientifically solid criteria should be emphasised. The criteria used for the space labelling schemes should be **more ambitious and far-reaching** than related criteria and targets adopted through e.g., mandatory rules, international standards, or other similar instruments while still being feasible to comply with (e.g., technical feasibility), thereby **promoting 'going the extra mile'** in addressing challenges related to increased space activities.

Adoption of the label **by space actors** is key to its success, and incentive measures are seen as an essential tool to promote its use. Five types of **incentivising measures** are considered: legal instruments, operational instruments, economic and financial instruments, learning and capacity-building instruments, and marketing and promotional instruments. These range from regulatory relief and efficiency in public procurement procedures to funding support, self-assessment tools and guidance, as well as enhanced showcasing and visibility.

The **roadmap** proposes key steps to **develop and implement the EU Space Label framework** from a governance perspective. These steps are then further detailed for the **development and implementation of specific labelling schemes**. Additionally, we present a roadmap illustrating the **application for and use of the label** from a user perspective.

Upon agreement of the final concept for the EU Space Label, **next steps** would include starting to draft the **legal instrument** for the EU Space Label framework. The legal instrument would define e.g., the

[254] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

governing bodies and their main responsibilities, the objectives, priorities, and scope, as well as the requirements for the EU Space Label framework and specific labelling schemes. Its **adoption** through **relevant EU decision-making procedures** ensures **full compliance** with **respective competences** of the EU and its Member States.

9.3 Potential and outlook

To conclude, the EU Space Label concept proposed in this study allows the EU to demonstrate **transparency** as it foresees for relevant stakeholders and actors to actively shape the EU Space Label and its specific labelling schemes, **scalability** as, in proposing a combination of labelling and expert rating, it offers ways forward to make the EU Space Label attractive to space actors with varying resources and capabilities while sticking to its ambitious objectives, and **flexibility** as it allows for additional schemes to be developed in case other domains require action at EU level in the future.

In particular, the **Space Safety Label**, designed and implemented with a high degree of scalability and transparency, would allow numerous actors in the space ecosystem to unlock possible benefits. By addressing **various mission phases** and **supply chain levels**, **providing assessments** based on **actors'** varying degrees of **resources and capacities**, and **offering benefits** taking into account **actors' ambitions and capabilities,** the Space Safety Label has the potential to encourage space actors and the wider space ecosystem to go the extra mile and address the issues of increasing space activities in ways that are comprehensive and long-term, thereby contributing to keeping space accessible, safe and sustainable.

Similarly, the **Environmental Space Label** would be a pioneering label aimed to **address the environmental impacts of space activities**. Like the EU Ecolabel for activities on Earth, this initiative would promote **sustainability and responsible practices in space activities** as it would signify a **commitment from space actors to minimise their ecological footprint**. By encouraging adherence to strict environmental standards and fostering collaboration in space traffic management, the Environmental Space Label would thus aim to ensure sustainable space activities, thereby playing their part in the European Green Deal, a major EU policy priority.

Lastly, the **Dark and Quiet Skies Label** would address pertinent challenges in a field that only recently has been gaining traction in the space ecosystem. In the absence of international standards, this label would do **pioneering work in promoting a set of best practices and recommendations** which, combined with attractive incentives and benefits, would highlight **the needs of both space operators and manufacturers as well as astronomers and observatories**, thereby striving for a **collaborative approach** in ensuring the long-term use and observation of space for all actors involved.

Consequently, and finally, the proposed EU Space Label concept, once implemented, will offer the EU a comprehensive mechanism to **support a common approach to Space Traffic Management** and **foster EU space industrial competitiveness** in full compliance with the **respective competences of the EU and its Member States** for years to come.

Annex A – Overview of legal references supporting EU competences in the space domain

In the table below, we provide an overview of some of the most relevant Articles and legal bases establishing the competences of the EU in space matters.

Legal Basis	Space-related Legal act(s)	Relevance for EU space policy
TFEU Article 189	N/A	Art. 189(1) TFEU empowers the EU by creating a specific legal basis for the action of the EU in space matters and reinforcing the EU's legitimacy and political leadership in space policymaking to promote scientific and technical progress, industrial competitiveness, and the implementation of other EU policies.
TFEU Article 4(3)	N/A	This Article provides the legal basis for the area of space and gives the competence to the Union to carry out activities, in particular to define and implement programmes without preventing the Member States from exercising their own competence.
TEU Article 21	N/A	Article 21(1) TEU mentions that the Union shall seek to develop relations and build partnerships with international organisations and promote multilateral solutions to common problems, and it shall define and pursue common policies and actions. In this sense, cooperation with ESA on space policy programmes and actions is necessary to achieve common objectives.
TFEU Article 187	Council Regulation (EC) 876/2002 setting up the Galileo Joint Undertaking – repealed	This Article gives the competence to the Union to set up joint undertakings or any other structure necessary for the efficient execution of Union research, technological development and demonstration programmes.
TFEU Article 114	Decision 676/2002/EC on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) – in force	This Article allows the EU to adopt measures for the approximation (also known as harmonisation) of laws in the Member States which have as their objective the establishment and functioning of the Single Market. Approximation aims to ensure harmonised legislation across the EU and limit regulatory differences between Member States to achieve the objective of Article 26 TFEU i.e. to establish or ensure the functioning of the Single Market. Therefore, Article 114 TFEU constitutes an appropriate legal basis when the following conditions are met:

Legal Basis	Space-related Legal act(s)	Relevance for EU space policy
		• there are significant disparities between national laws; • these disparities obstruct fundamental freedoms and thus harm the Single Market; • there is a genuine link between the adopted regulatory measure and the removal of existing obstacles in the internal market.
TEU Article 14	Council Joint Action 2004/552/CFSP of 12 July 2004 on aspects of the operation of the European satellite radio-navigation system affecting the security of the European Union – repealed	This Article focuses on the competences, composition and procedures to elect Members of the European Parliament. Paragraph 1 of this Article establishes that the European Parliament shall, jointly with the Council, exercise legislative and budgetary functions and that it shall exercise functions of political control and consultation as laid down in the Treaties. Taking into account the role of the European Parliament in the ordinary legislative procedure under Article 14 TEU, any part of the proposed action for implementing the recommendations of any assignment related to space that would require a legislative act to be passed under this procedure would find its basis in this provision.
TFEU Article 352	Council Regulation (EC) 1321/2004 on the establishment of structures for the management of the European satellite radio-navigation programmes – repealed	Also called the *flexibility clause*, this Article forms an important addition to the entire system of EU competences. It provides a residual competence where the Treaties provide an objective but where, even under the expansive interpretation of the CJEU, no competence can be found in any provisions of the legal basis. Under Article 352 TFEU, to trigger the flexibility clause, the following requirements must be fulfilled: • action by the EU must be necessary; • the measure must be within the framework of the policies defined in the Treaties; • the necessary powers for the EU are not provided by the Treaties.
TEU Article 26(2)	Council Decision 2012/281/CFSP in the framework of the European Security Strategy in support of the Union proposal for an international Code of Conduct on outer-space activities – in force	This Article mentions that the European Council will identify the Union's strategic interests, determine the objectives of and define general guidelines for the common foreign and security policy, including for matters with defence implications. It will therefore adopt the necessary decisions. Paragraph 2 of this Article mentions that the Council shall frame the Common

Legal Basis	Space-related Legal act(s)	Relevance for EU space policy
		Foreign and Security Policy and will take the decisions that are necessary for defining and implementing it.
TFEU Articles 170 and 172	Regulation (EC) 683/2008 on the further implementation of the European satellite navigation programmes (EGNOS and Galileo) – repealed Regulation (EU) 912/2010 setting up the European GNSS Agency – repealed Regulation (EU) 1285/2013 on the implementation and exploitation of European satellite navigation systems – repealed	These Articles on Trans-European Networks (TEN) state that to achieve the objectives of Articles 26 and 174 TFEU, the EU will contribute to the establishment and development of trans-European networks in the areas of transport, telecommunications and energy infrastructures. Moreover, the guidelines and projects of common interest which relate to the territory of a Member State will require the approval of the Member State concerned.
TEU Article 28	Council Decision 2014/496/CFSP of 22 July 2014 on aspects of the deployment, operation, and use of the European Global Navigation Satellite System affecting the security of the European Union – repealed Council Decision (CFSP) 2021/698 on the security of systems and services deployed, operated and used under the Union Space Programme which may affect the security of the Union – in force	This Article states that where the international situation requires operational action by the Union, the Council can adopt the necessary decisions. These decisions shall commit the Member States in the positions they adopt and in the conduct of their activity.
TFEU Article 192	N/A	Article 192 TFEU refers to the ordinary legislative procedure for passing measures in the field of environment, also regarding the measures to achieve the mentioned objectives. Article 192(1) TFEU is the basis of numerous Directives and Regulations harmonising matters ranging from water and air quality to chemicals and waste. More than thirty international agreements have been concluded based on Article 192 TFEU. Hence, Article 192 TFEU provides a sound legal basis for an environmental policy which could be relevant for EU space policy.

Table 28 - Overview of legal bases used for EU space-related legal acts

Annex B – Description of relevant standards

In this section, the relevant standards listed in section 2 are further described according to their definition in the ISO website.

Standards related to space safety and sustainability

Procedures, processes, and assessment standards

- **ISO 24113:2019 - Space systems — Space debris mitigation requirements**

ISO 24113:2019 defines the primary space debris mitigation requirements applicable to all elements of unmanned systems launched into or passing through near-Earth space including launch vehicle orbital stages, operating spacecraft and any objects released as part of normal operations. The requirements contained in this document are **intended to reduce the growth of space debris by ensuring that spacecraft and launch vehicle orbital stages are designed, operated and disposed of in a manner that prevents them from generating debris throughout their orbital lifetime**. The requirements are also intended to reduce the casualty risk on the ground associated with atmospheric re-entry of space objects. The lower-level documents contain detailed requirements and implementation measures associated with the high-level requirements described in ISO 24113.

In early 2023, this version of the standard was replaced by a new version with the following changes:

- the addition of a term and definition for "expected number of casualties per re-entry" to replace the term "casualty risk";
- the modification of definitions for the terms "disposal phase", "Earth orbit", "end of life", "end of mission", "passivate" and "probability of successful disposal";
- the applicability of requirements in this document concerning a space object that enters an unbound Keplerian orbit or leaves Earth orbit;
- the modification of a requirement relating to space debris left in Earth orbit by a launch vehicle after normal operations;
- minor changes to two of the requirements relating to accidental break-up caused by an on-board source of energy;
- changes to a requirement and NOTE concerning the assessment of the probability of impact-induced break-up of a spacecraft;
- the modification of a requirement and addition of a NOTE relating to the assessment of the probability that an impact will prevent the successful disposal of a spacecraft;
- the modification of a requirement and addition of a NOTE relating to the need for disposal capability/probability reassessment before extending the mission lifetime of a spacecraft;
- the addition of NOTEs pointing out the need for and potential benefit of reducing orbital lifetime significantly below 25 years in the LEO-protected region;
- the addition of a NOTE concerning the collision probability associated with a deployable device that augments the orbital decay of a spacecraft or launches vehicle orbital stage in the LEO-protected region;
- the modification of a requirement relating to the assessment of the hazard caused by the ground impact of any objects that are expected to survive re-entry;

- the specification of a threshold for the expected number of casualties during the re-entry of a spacecraft or launch vehicle orbital stage, and the addition of supplementary NOTEs;
- the addition of a NOTE concerning the listed contents of the space debris mitigation plan;
- minor modifications to the two figures in Annex B;
- updates to the Bibliography.

- **ISO 20893:2021 – Space systems — Detailed space debris mitigation requirements for launch vehicle orbital stages**

ISO 20893:2021 was developed to support the implementation of the high-level space debris mitigation requirements in ISO 24113. It contains a detailed and practical **set of requirements and recommendations to assist the space industry in conforming to the requirements of ISO 24113 which relate to launch vehicle orbital stages.**

This document establishes a **set of requirements for planning and executing verification programmes for commercial/non-commercial manned and unmanned space systems.** It defines a distributed verification programme for each contractor that engages in the development of any element of a space system, starting from the lowest level (i.e. unit/piece part level) and the earliest phase (i.e. requirement phase) to the acceptance and the delivery review of a system's development as well as the launch site activities. It primarily addresses **verification associated with space, launch, and ground segment acquisitions**. Space support segments including range safety, ground support equipment, and launch operation facilities, which are not otherwise addressed in this document, can also benefit from the described verification programme and management processes.

- **ISO 23312:2022 - Space systems — Detailed space debris mitigation requirements for spacecraft**

ISO 23312:2022 defines **detailed space debris mitigation requirements and recommendations for the design and operation of unmanned spacecraft in Earth orbit**. This document defines detailed requirements that apply to:

- avoiding the intentional release of space debris into Earth's orbit during normal operations;
- avoiding break-ups in Earth orbit;
- disposal of a spacecraft after the end of the mission;
- estimating the mass of the remaining usable propellant;
- developing and maintaining the space debris mitigation plan.

This standard has been developed upon the standard ISO 23339:2010 - Space systems — Unmanned spacecraft — Estimating the mass of remaining usable propellant[255].

- **ISO 23135:2022 - Space systems — Verification programme and management process**

ISO 23135:2022 establishes a set of requirements for planning and executing verification programmes for commercial/non-commercial manned and unmanned space systems.

The standard defines a distributed verification programme for contractors that engage in the development of any element of a space system, starting from the lowest level (i.e. unit/piece part level) and the earliest phase (i.e. requirement phase) to the acceptance and the delivery review of a system's development as well as the launch site activities.

- **ISO 14200:2021 Space environment (natural and artificial) — Guide to process-based implementation of meteoroid and debris environmental models (orbital altitudes below GEO + 2 000 km)**

[255] ISO 23339 gives requirements for estimating the mass of the remaining usable propellant of an unmanned spacecraft in low Earth orbit (LEO) or geostationary Earth orbit (GEO), and for designing propellant measurement systems.

ISO 14200:2021 specifies a **common process for selecting and implementing meteoroid and space debris environment models** used in the impact flux assessment for design and operation of spacecraft and other purposes. This document provides guidelines and requirements for the process.

- **ISO 17666:2016 – Space systems — Risk management**

ISO 17666:2016 defines the **principles and requirements for integrated risk management on a space project**. It explains what is needed to implement a project-integrated risk management policy by any project actor, at any level (i.e. customer, first-level supplier, or lower-level suppliers). It contains a summary of the general risk management process, which is subdivided into four (4) basic steps and nine (9) tasks. The implementation can be tailored to project-specific conditions.

- **ISO 16126:2014 – Space systems — Assessment of survivability of unmanned spacecraft against space debris and meteoroid impacts to ensure successful post-mission disposal**

ISO 16126:2014 defines **requirements and a procedure for assessing the survivability of an unmanned spacecraft against space debris and meteoroid impacts, intending to ensure the survival of critical components** required to perform post-mission disposal. ISO 16126:2014 also describes two impact risk analysis procedures that can be used to satisfy the requirements. It is part of a set of International Standards that collectively aim to reduce the growth of space debris by ensuring that spacecraft are designed, operated, and disposed of in a manner that prevents them from generating debris throughout their orbital lifetime.

- **ISO 11227:2012 – Space systems — Test procedure to evaluate spacecraft material ejecta upon hypervelocity impact**[256]

ISO 11227:2012 describes an experimental procedure for **assessing the behaviour, under orbital debris or meteoroid impacts, of materials** that are intended to be used on the external surfaces of spacecraft and launch vehicle orbital stages. It provides a unified method by which to rank such materials. The ejecta production characteristics of different materials are compared under standardised conditions in which test parameters are fixed to one number. Optional tests with different parameters are also useful for the proper selection of materials in other conditions, and they could be performed as research items. ISO 11227:2012 establishes the requirements to be satisfied for the test methods to characterise the amount of ejecta produced when a surface material is impacted by a hypervelocity projectile. Its purpose is to evaluate the ratio of ejecta total mass to projectile mass, and the size distribution of the fragments. **These are the necessary inputs for modelling the amount of impact ejecta that a surface material might release during its orbital lifetime, thereby helping to assess its suitability for space use while mitigating the production of small space debris.** The purpose of ISO 11227:2012 is to provide data that need to be considered in the selection of outer spacecraft materials, though the selection is not based on these criteria alone.

- **ISO 14620-3:2021 - Space systems — Safety requirements — Part 3: Flight safety systems**

ISO 14620-3:2021 sets out the **minimum requirements for flight safety systems (FSSs), including flight termination systems (FTSs, externally controlled systems or on-board automatic systems), tracking systems, and telemetry data transmitting systems (TDTSs) for commercial or non-commercial launch activities of orbital or suborbital, unmanned space vehicles**. The intent is to minimise the risk of injury or damage to persons, property or the environment resulting from the launching of space vehicles. This standard is intended to be applied by any person, organisation, entity, operator or launch authority participating in commercial or non-

[256] This standard will be replaced in due course by ISO/AWI 11227 - Space systems - Test procedure to evaluate spacecraft material ejecta upon hypervelocity impact (under development).

commercial launch activities of orbital, or suborbital, unmanned space vehicles unless more restrictive requirements are imposed by the launch site country.

- **ISO 24330:2022 - Space systems — Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS) — Programmatic principles and practices**

ISO 24330:2022 establishes **guiding principles and best practices at the programmatic level for all participants in the rendezvous and proximity operations (RPO) and on-orbit servicing (OOS) industry**. These principles and practices establish the broadest boundaries for the behaviour of participants in the RPO/OOS industry and precede more detailed standards. In principle, ISO 24330:2022 also covers both robotic and Human Space Flight missions, but requirements are derived from robotic missions. This standard applies to a broad array of RPO/OOS industry participants from spacecraft equipment manufacturers, spacecraft operators, service providers, developers of RPO/OOS simulation, planning and safety tools, and insurers. It helps to establish responsible norms of behaviour for RPO and OOS that industry participants are supposed to achieve and promote throughout the global industry.

- **ISO 26872:2019 - Space systems — Disposal of satellites operating at geosynchronous altitude**

ISO 26872:2019 provides **techniques for planning and executing the disposal of space hardware that reflect current internationally accepted guidelines and consider current operational procedures and best practice**s. ISO 26872:2019 specifies requirements for the following:

- planning for disposal of a spacecraft operating at geosynchronous altitude to ensure that final disposal is sufficiently characterised and that adequate propellant will be reserved for the manoeuvre;
- selecting final disposal orbits where the spacecraft will not re-enter the operational region within the next 100 years;
- executing the disposal manoeuvre successfully;
- depleting all energy sources on board the vehicle before the end of its life to minimise the possibility of an event that can produce debris.

This standard has been revised by ISO 23312:2022.

- **ISO 27852:2024 - Space systems — Estimation of orbit lifetime**

ISO 27852:2024 describes a process for the **long-duration orbit lifetime prediction of orbit lifetime for spacecraft, launch vehicles, upper stages and associated debris in LEO-crossing orbits after mission phase** (including any mission lifetime extensions). It also clarifies: (a) modelling approaches and resources for solar and geomagnetic activity modelling; (b) resources for atmosphere model selection; and (c) approaches for spacecraft ballistic coefficient estimation.

- **ISO 27875:2019 - Space systems — Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages**[257]

ISO 27875:2019 supports compliance with those clauses in ISO 24113 that are relevant to the **re-entry of space objects**. ISO 27875:2019 provides a framework with which to assess, reduce and control the potential risks that spacecraft and launch vehicle orbital stages pose to people and the environment when those space vehicles re-enter the Earth's atmosphere and impact the Earth's surface. It is intended to be applied to the planning, design and review of space vehicle missions for which controlled or uncontrolled re-entry is possible.

[257] This standard will be replaced by ISO/WD 27875 - Space systems - Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages (under development).

- **ISO/CD[258] 9490 - Space systems — Space Traffic Coordination**[259]

ISO/CD 9490 establishes **requirements for protocols and operations on Space Traffic Coordination critical to ensure flight safety and mitigate collision risk, from pre-launch safety assessment through manoeuvre plans, on-orbit collision avoidance support services, and end-of-mission disposal**. ISO/CD 9490 levies requirements of an STC system that will facilitate the provision of high-availability, timely, comprehensive and sufficiently accurate services to support the safe, efficient, and sustainable use of space. This standard is under development by ISO/TC 20/SC 14.

- **ISO/TS[260] 6434 - Space systems — Design, testing and operation of a large constellation of spacecraft**

ISO/TS 6434 provides requirements that are relevant to **large constellations of spacecraft throughout their life cycle**, including planning, designing, testing, operating and disposal activities. ISO/TS 6434 is currently under publication process.

- **ISO 14619:2023 – Space experiments – General requirements**

ISO 14619:2023 addresses **experimental add-on components to a space system under development** and specifies the **procedures for preparing and carrying out space experiments (SEs),** and analysis and processing of the findings. It is applicable to both manned and unmanned space systems. It can be tailored to the specific needs of different kinds of SEs.

- **ISO 14625:2023 - Space systems — Ground support equipment for use at launch, landing or retrieval sites - General requirements**

ISO 14625:2023 specifies the **general characteristics, performance, design, test, checkout, maintenance, safety, reliability, maintainability and quality requirements for ground support equipment (GSE) and systems** intended for use at launch, landing or retrieval-site installations, or other locations that are the responsibility of the launch, landing and retrieval site. It applies to the design, check out and maintenance of non-flight hardware and software used to support the operations of transporting, receiving, handling, assembly, inspection, test, checkout, service, launch and recovery of space vehicles and payloads at the launch, landing or retrieval sites.

- **EN 16604-10:2019 - Space sustainability — Space debris mitigation requirements (ISO 24113:2011, modified)**

EN 16604-10:2019 defines the primary **space debris mitigation requirements** applicable to all elements of systems launched into, or passing through, near-Earth space, including launch vehicle orbital stages, operating spacecraft and any objects released as part of normal operations or disposal actions. The requirements contained in this document are intended to reduce the growth of space debris by ensuring that spacecraft and launch vehicle orbital stages are designed, operated and disposed of in a manner that prevents them from generating debris throughout their orbital lifetime. It identifies the clauses and requirements modified concerning ISO 24113, Space systems - Space debris mitigation requirements.

Data-related standards

- **ISO 26900:2024 - Space data and information transfer systems — Orbit data messages**

ISO 26900:2024 specifies **four standard message formats for use in transferring spacecraft orbit information between space agencies and commercial or governmental spacecraft operators: The Orbit Parameter Message (OPM), the Orbit Mean-Elements Message (OMM), the Orbit Ephemeris Message (OEM), and the Orbit Comprehensive Message (OCM)**. This

[258] ISO CD stands for Committee Draft.
[259] At the time of finalising this report, this Committee Draft was at the level of a New Work Item Proposal.
[260] TS refers to Technical Specification.

document includes sets of requirements and criteria that the message formats have been designed to meet. For exchanges in which these requirements do not capture the needs of the participating agencies and satellite operators, another mechanism may be selected.

- **ISO 19389:2014 - Space data and information transfer systems — Conjunction data message**

ISO 19389:2014 specifies a **standard message format for use in exchanging spacecraft conjunction information** between originators of Conjunction Assessments (CAs) and satellite owners/operators and other authorised parties. Such exchanges are used to inform satellite owners/operators of conjunctions between objects in space to enable consistent warnings by different organisations employing diverse CA techniques.

- **ISO 13526:2010 - Space data and information transfer systems — Tracking data message**

ISO 13526:2010 was last reviewed and confirmed in 2015. It specifies **a standard message format for use in exchanging spacecraft tracking data between space agencies**. Such exchanges are used for distributing tracking data output from routine interagency cross-supports, in which spacecraft missions managed by one agency are tracked from a ground station managed by a second agency. The standardisation of tracking data formats facilitates space agency allocation of tracking sessions to alternate tracking resources.

- **ISO 13541:2021 - Space data and information transfer systems — Attitude data messages**

ISO 13541:2021 specifies two standard **message formats** for use in transferring **spacecraft attitude information** between space agencies/operators. Such exchanges are used in many ways, including a) pre-flight planning and scheduling for tracking or attitude estimation support; b) carrying out attitude operations; c) performing attitude comparisons; d) carrying out attitude propagations and/or sensor predictions. These data exchanges can also be important in the **assessment of collision probability**.

- **CCSDS 508.0-B-1 on Conjunction Data Message (became ISO 19389)**

The following two CCSDS standards correspond to ISO 19389 and ISO 26900 respectively.

CCSDS 508.0-B-1 on Conjunction Data Message **specifies a standard message format for use in exchanging spacecraft conjunction information between originators of CAs and satellite owners/operators and other authorised parties**. Such exchanges are used to inform satellite owners/operators of conjunctions between objects in space to enable consistent warnings by different organisations employing diverse CA techniques. The standard applies to satellite operations in all environments where there is concern about close approaches and collisions among satellites. It aims at:

- avoiding the intentional release of space debris into Earth's orbit during normal operations;
- avoiding break-ups in Earth orbit;
- disposal of a spacecraft after the end of the mission;
- estimating the mass of the remaining usable propellant;
- developing and maintaining the space debris mitigation plan.

- **CCSDS 502.0-B-2 on Orbit Data Message (became ISO 26900)**

CCSDS 502.0-B-2 on Orbit Data Message **specifies three standard message formats for use in transferring spacecraft orbit information between space agencies and commercial or governmental spacecraft operators**: the Orbit Parameter Message (OPM), the Orbit Mean-Elements Message (OMM), and the Orbit Ephemeris Message (OEM). Such exchanges are used for:

- pre-flight planning for tracking or navigation support;
- scheduling tracking support;
- carrying out tracking operations (sometimes called metric predicts);
- performing orbit comparisons;
- carrying out navigation operations such as orbit propagation and orbit reconstruction;
- assessing mutual physical and electromagnetic interference among satellites orbiting the same celestial body (currently primarily Earth, Moon, and Mars);
- performing orbit conjunction (collision avoidance) studies; and
- developing and executing collaborative manoeuvres to mitigate interference or enhance mutual operations.

This Recommended Standard includes sets of requirements and criteria that message formats should be designed to meet. For exchanges where these requirements do not capture the needs of the participating agencies and satellite operators, another mechanism may be selected.

- **EN 16604-30-03:2020 - Space Situational Awareness Monitoring — Part 30-03: Observation System Data Message (OSDM)**

EN 16604-30-03:2020 aims to: a) enable consistent **data exchange between observation data providers and SSA systems**; b) facilitate data exchange automation and ingestion of observation data from different providers; c) facilitate SSA system architecture performance simulations; and d) provide a quick way to estimate the expected performance from one observing system.

Technical and engineering standards

- **ISO/TR 16158:2021 - Space systems — Avoiding collisions with orbiting objects**

ISO/TR 16158:2021 is a guide for establishing **essential collaborative enterprises to sustain the space environment and employ it effectively**. **This requires diligent collaboration among all who operate satellites**. ISO/TR 16158:2013 describes some widely used techniques for perceiving close approaches, estimating collision probability and the cumulative probability of survival, and manoeuvring to avoid collisions.

- **ISO/TR[261] 18146:2020 - Space systems — Space debris mitigation design and operation manual for spacecraft**[262]

ISO/TR 18146:2020 contains information on the **design and operational practices for spacecraft for mitigating space debris**. It provides information to engineers on what is required or recommended in the family of space debris mitigation standards to reduce the growth of space debris by ensuring that spacecraft are designed, operated, and disposed of in a manner that prevents them from generating debris throughout their orbital lifetime.

- **ISO/TR 20590:2021 - Space systems — Space debris mitigation design and operation manual for launch vehicle orbital stages**

ISO/TR 20590:2021 contains information on the **design and operational practices for launch vehicle orbital stages for mitigating space debris.** It provides information to engineers on the requirements and recommendations in the space debris mitigation standards to reduce the growth of space debris by ensuring that launch vehicle orbital stages are designed, operated, and disposed of in a manner that prevents them from generating debris throughout their orbital lifetime.

[261] ISO Technical Report (TR) is an informative document containing data obtained from e.g., a survey, from an informative report, or information of the perceived "state of the art".
[262] This standard will be replaced by ISO/AWI TR 18146 - Space systems - Space debris mitigation design and operation manual for spacecraft (under development).

- **ISO/TR 11233:2014 - Space systems — Orbit determination and estimation — Process for describing techniques**

ISO/TR 11233:2014 prescribes how **orbit determination and estimation techniques** are to be described so that parties can plan operations with sufficient margins to accommodate different individual approaches to orbit determination and estimation. ISO/TR 11233:2014 does not require the exchange of orbit data nor does it prescribe a method of performing orbit determination. It only prescribes the information that shall accompany such data so that collaborating satellite owners/operators understand the similarities and differences between their independent orbit determination processes.

- **ISO/TR 22639:2021 - Space systems – Design guidelines for multi-geo spacecraft collocation**

ISO/TR 22639:2021 addressed the **design process of collocation** and the basic contents of the collocation design process which include considerations, initial collocation strategy design, simulation evaluation of collocation strategy, optimal collocation strategy selection and collocation agreement. ISO/TR 22639:2021 gives guidelines for multi-geo spacecraft collocation and applies to multi-geo constellations.

- **EN 16603-10-03:2022 - Space engineering – Testing**

EN 16603-10-03:2022 addresses the requirements for **performing verification by testing space segment elements and space segment equipment** on the ground before launch. The document is applicable for tests performed on qualification models, flight models (tested at acceptance level) and proto-flight models.

- **CEN/CLC/TR 17603-10-03:2022 - Space engineering – Testing guidelines**

CEN/CLC/TR 17603-10-03:2022 provides a**dditional information for the application of the Testing standard EN 16603-10-03** mentioned above. This handbook will be the guideline for all space projects, related equipment and complete systems, by providing background information that aids the reader to better understand and meet the requirements of the standard EN 16603-10-03.

- **EN 16602-40:2018 - Space product assurance – Safety**

EN 16602-40:2018 defines the **safety programme and the safety technical requirements** aiming to protect flight and ground personnel, the launch vehicle, associated payloads, ground support equipment, the general public, public and private property, the space system and associated segments and the environment from hazards associated with European space systems. This Standard applies to all European space projects.

- **EN 16603-10-04:2021 - Space engineering – Space environment**

EN 16603-10-04:2021 applies to all product types which exist or operate in space and **defines the natural environment for all space regimes**. It also defines general models and rules for determining the locally induced environment. The natural space environment of a given item is that set of environmental conditions defined by the external physical world for the given mission (e.g. atmosphere, meteoroids and energetic particle radiation).

The induced space environment is that set of environmental conditions created or modified by the presence or operation of the item and its mission (e.g. contamination, secondary radiations and spacecraft charging). The space environment also contains elements which are induced by the execution of other space activities (e.g. debris and contamination).

Standards on environmental management

- **ISO 14001**

This is a family of standards that provides requirements related to environmental systems as well as some guidance. Other standards in the family focus on specific approaches such as audits, communications, labelling and life cycle analysis, as well as environmental challenges such as climate change. The ISO 14000 family of standards are developed by ISO Technical Committee ISO/TC 207 and its various subcommittees.

- **ISO 14001:2015 - Environmental management systems — Requirements with guidance for use**

The standard specifies the requirements for an environmental management system that an organisation can use to enhance its environmental performance. ISO 14001:2015 is intended for use by an organisation seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability. The intended outcomes of an environmental management system include enhancement of environmental performance; fulfilment of compliance obligations; achievement of environmental objectives. ISO 14001:2015 applies to any organisation, regardless of size, type and nature, and applies to the environmental aspects of its activities, products and services that the organisation determines it can either control or influence considering a life cycle perspective. ISO 14001:2015 does not state specific environmental performance criteria. Claims of conformity to ISO 14001:2015, however, are not acceptable unless all its requirements are incorporated into an organisation's environmental management system and fulfilled without exclusion. Organisations can get certified for ISO 14001.

- **ISO 14040:2006 - Environmental management – Life cycle assessment**

The standard describes the principles and provides a framework for life cycle assessment (LCA) including the objective and scope of the LCA, the life cycle inventory analysis (LCI), the life cycle impact assessment (LCIA), life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA. This standard covers the LCA and LCI studies.

- **ISO 14068-1:2023 - Climate change management — Transition to net zero — Part 1: Carbon neutrality**

The standard supports transition to low greenhouse gas emission activities across value chains and life cycles by providing principles, requirements, and guidance for achieving and demonstrating carbon neutrality (e.g., reducing and offsetting carbon footprints, prioritizing direct and indirect GHG emission reductions).

Standards on dark and quiet skies

As outlined in section 2.2.3, no specific standards from standardisation organisations (e.g., ISO) have been found on the topic of dark and quiet skies.

Annex C - Evaluation matrix for existing standards, guidelines, and best practices to ensure sustainable and safe space activities

The table below provides an overview of existing initiatives to promote adherence to standards, guidelines and best practices aimed at ensuring sustainable and safe space activities. During the analysis of these initiatives, a lack of data regarding their use and adherence appears. Therefore, this overview presents a summary of the available information analysed by the study team and had to be based on expert assumptions. We also analyse the extent to which the initiatives achieve their objectives, as well as their relevance in achieving a high level of adherence by space actors and their coherence with EU policy objectives. The aim is to understand whether the existing standards, guidelines and best practices are fit for the purpose of achieving sustainable and safe space operations at the EU level.

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
International guidelines and best practices to ensure sustainable and safe space activities				
UNGA Resolution 68/74	- design - manufacture - launch - in-orbit operations - end-of-life disposal	Unknown - This Resolution emphasises the peaceful use of space, urging nations to collaborate for mutual benefits, particularly in helping developing countries harness the benefits of space technology. It also stresses the importance of space debris mitigation and reiterates established space principles such as non-appropriation and the responsibility of nations for their space activities. The extent to which this instrument is effective is unknown.	Unknown - The level of adherence to the resolution is unknown. UNGA consists of 193 Member States. However, the extent to which all of these States adhere to the UNGA Resolution is unknown.	High – The Resolution provides guidelines for national authorisation procedures and safety and technical standards.
UN COPUOS Space Debris Mitigation (SDM) Guidelines	- design - manufacture - launch - in-orbit operations	Medium – The Guidelines are an instrument of soft law; UN COPUOS is currently the main place for discussions on space debris.	Unknown – As per its 2021 annual report, there are 100 members in UN COPUOS.[263] It is unclear to which	High – The Guidelines are highly coherent with long-term EU policy objectives of space safety and sustainability, more concretely of

[263] See: https://www.unoosa.org/res/oosadoc/data/documents/2022/stspace/stspace80_0_html/UNOOSA_Annual_Report_2021.pdf

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
	- end-of-life disposal		extent the Guidelines are adopted by all members.	debris mitigation, as they complement and complete the general obligations contained in the Outer Space Treaty.[264]
UN COPUOS Guidelines for the Long-Term Sustainability (LTS) of Outer Space Activities	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High - There are currently 100 members in UN COPUOS, which demonstrates a great interest and engagement in UN COPUOS.	Unknown – As per its 2021 annual report, there are 100 members in UN COPUOS.[265] It is unclear to which extent the Guidelines are followed by all members.	High – The Guidelines are coherent with existing long-term EU policy objectives, practices, operating procedures and technical standards relevant to space sustainability and safety.[266]
IADC Space Debris Mitigation (SDM) Guidelines	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High –Nations (exact number unknown) around the world have developed safety standards and specific guidelines building on the IADC SDM Guidelines.[267]	Medium –The IADC in its status report of the space debris environment[268] recognises that adoption of the IADC SDM guidelines is not yet at a level where they would induce substantial benefits or a slowdown of debris population growth.	High – The Guidelines describe existing practices for limiting space debris and include proposals on debris mitigation. They are therefore coherent with the EU policy objectives on debris mitigation.
IADC Protection Manual	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High – The Protection Manual is deemed effective in providing knowledge on spacecraft protection from hypervelocity impacts and assessing meteoroid and orbital debris risk to spacecraft.[269]	Low – the level of adherence is deemed not yet sufficient enough to induce substantial benefits.[270]	High – The Protection Manual is highly coherent with the long-term EU policy objectives of space debris mitigation[271] as they underscore the importance of shielding spacecraft from micro-meteorite and orbital debris, thereby aiming at reducing the generation of more space debris.

[264] See: https://www.cambridge.org/core/journals/leiden-journal-of-international-law/article/abs/out-of-sight-out-of-mind-the-proliferation-of-space-debris-and-international-law/4F36705744F7F104911F2C5CF4C20781
[265] https://www.unoosa.org/res/oosadoc/data/documents/2022/stspace/stspace80_0_html/UNOOSA_Annual_Report_2021.pdf
[266] https://swfound.org/media/206891/swf_un_copuos_lts_guidelines_fact_sheet_november-2019-1.pdf
[267] See: https://www.sdo.esoc.esa.int/environment_report/Space_Environment_Report_latest.pdf
[268] See: https://www.iadc-home.org/documents_public/file_down/id/5432
[269] See: https://www.iadc-home.org/documents_public/file_down/id/5432
[270] Ibid.
[271] See: https://www.iso.org/obp/ui#iso:std:iso:16126:dis:ed-2:v1:en:ref:2

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
IADC Statement on Large Constellations in Low Earth Orbit	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High – The Statement is considered to be the most effective method to reduce the long-term environmental impacts of global space activity by slowing the rate of growth of the space debris population.[272]	Low – The level of adherence is not yet sufficient enough to induce substantial benefits.[273]	High – The Statement is coherent with long-term EU policy objectives related to space debris mitigation efforts and overall safety and sustainability of space as it aims to address the impact of large constellations in LEO.
ITU Regulations on spectrum use (radio regulations)	- in-orbit operations	High - The Regulations have been deemed highly effective in facilitating fair access to the radiofrequency spectrum and associated satellite orbits, ensuring the availability of frequencies for safety purposes and for handling harmful interference between administrations' radio services.	High - The Regulations are globally recognised and have near-universal membership, indicating a high degree of adherence by industry and governmental actors.	High - The Regulations are coherent with high-level and long-term EU policy objectives on sustainable and safe space operations, as they promote the rational use of limited natural resources including radio frequencies and associated orbits, in a manner that is equitable, efficient, and economically sound.
Recommendation ITU-R S.1003.2. - Environmental protection of the geostationary-satellite orbit	- in-orbit operations - end-of-life disposal	Unknown - The Recommendations aim at reducing the amount of debris in GEO and provide guidance for satellite operators on how to dispose of their satellites safely and sustainably. The extent to which the Recommendation has achieved its objectives is unknown.	Unknown – The Recommendations set out clear standards and guidelines for the disposal of satellites in GEO, but the level of adherence is voluntary and non-binding, which brings uncertainty about the extent to which the Recommendations are implemented.	High – The Recommendations show coherence with high-level and long-term EU policy objectives on sustainable and safe space operations by guiding the disposal of satellites in GEO. The Recommendations align with international efforts to mitigate space debris and ensure the long-term sustainability of space activities.
European Code of Conduct for Space Debris Mitigation	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High – The Code is deemed to be effective in being able to prevent on-orbit break-ups and collisions of spacecraft by promoting carbon batteries and new technologies, and by facilitating the removal and	Low - The Code was signed by only a few European national space agencies which suggests a low level of adherence.	High - The Code is consistent with high-level and long-term EU policy objectives on sustainable and safe space operations. The objectives of the Code align with ESA space debris policy. Additionally, the focus of the

[272] See: https://www.iadc-home.org/documents_public/file_down/id/5432
[273] Ibid.

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
		disposal of spacecraft and orbital stages that have reached the end of mission operations.		Code on space debris mitigation and space safety is consistent with international efforts to promote the sustainable use of space.
Draft International Code of Conduct for Outer Space Activities	- design - manufacture - launch - in-orbit operations - end-of-life disposal	Low - The Draft Code has so far failed to gather sufficient support for its international adoption.	Low – The Draft Code failed to gather sufficient support from the industry for its international adoption.	High - The Draft Code is in line with EU policy objectives on the safety, security, and sustainability of space activities as it aimed to promote better behaviour when conducting space activities.
Industry-led initiatives for the promotion of standards, guidelines and best practices				
The Space Data Association (SDA)	- in-orbit operations - end-of-life disposal	Unknown – Effective and secure mechanism for the sharing of operational data using a machine-to-machine interface. The extent to which this instrument changes companies' behaviour is unknown. SDA supports safer and more sustainable space operations to some extent as it collates independently pooled data from operators to prevent collisions. Participants receive secure, reliable and immediate access to this accurate information and analysis that greatly improves operations for conjunction assessment and authoritative contact information for a given space object.	High – currently 40 members share ephemerides of their spacecraft. These members are some of the most important space operators e.g. DLR, Boeing, NASA, Eutselsat, SES, etc.	High – The Space Data Association aims to strengthen SSA capabilities of space actors. This is in line with EU objectives.
The Space Safety Coalition (SSC) Handbook "Best Practices for the Sustainability of Space Operations"	- launch - in-orbit operations - end-of-life disposal	Unknown - its effectiveness ultimately depends on the commitment of	Unknown - The level of adherence may vary depending on the	High - The Handbook provides guidance and best practices for improving space safety, risk

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
		organisations and individuals to follow its recommendations and guidelines.	organisation and the specific space mission or operation involved.	mitigation of debris (i.e. space debris management), cooperation and coordination among different stakeholders in the space industry, which is in line with EU objectives.
The Net Zero Space Initiative (NZSI)	- design - manufacture - launch - in-orbit operations - end-of-life disposal	Medium – aimed at addressing the environmental impacts of space activities, it helps to promote a more sustainable and environmentally responsible approach to space activities. Upon expressing their endorsement, all stakeholders will pledge to provide specific, actionable examples of measures they have implemented, or plan to implement.	High – Despite its relatively short time of existence, NZSI is collaborating with a significant number of industry partners and governments (including China). This suggests a high degree of adherence to NZSI best practices and guidelines.	High - By promoting sustainable space activities, the NZSI aims to reduce the environmental impact of space activities, which supports the broader environmental and climate policy objectives of the EU.
The Space Sustainability Rating (SSR)	- launch - in-orbit operations - end-of-life disposal	Unknown - The SSR appears to be an effective tool for assessing and improving the sustainability of space activities. It provides a common language and framework for assessing space sustainability issues, which can help establish best practices for the space sector.	Unknown – The SSR consistently enhances its collaborations within the space industry. In 2022, nine additional organisations applied for the SSR. The extent to which the SSR is relevant is unknown, mainly because the rating is rather new in comparison to other mechanisms. In addition, the number of members and ratings provided to date are not available.	High – The SSR is highly coherent with EU policy objectives as it aims at reducing the risk of space debris, on-orbit collisions, and unsustainable space operations.
ESA Close Proximity Operations Working Group (CPOWG)	- in-orbit operations	High - Since December 2019, the CPOWG has drafted design guidelines and best practices for safe and responsible proximity operations. The group establishes a current technical understanding and agreement of	Unknown – As the group brings together experts from across the industry to develop practical solutions to CPO challenges, it is assumed that it has the potential to gain widespread support within the industry.	High - CPOWG provides guidance and best practices for improving space safety, and collision avoidance, which is in line with EU objectives.

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
		European stakeholders on CPO, serving as a baseline for future technical discussions.		
ESA Space Debris Mitigation (SDM) Policy for Agency Projects	- launch	Unknown – The extent to which the objectives have been achieved is not clear.	High – All industry actors involved in ESA projects or developing ESA systems must abide by this Policy.	High – The Policy is highly coherent with the long-term EU policy objectives on space safety and sustainability, concretely related to the aspect of space debris reduction and mitigation. The European Code of Conduct for Space Debris Mitigation, the IADC Space Debris Mitigation Guidelines, and the UN COPUOS Space Debris Mitigation Guidelines are referenced in the policy.
ESA LCA Handbook	- design - manufacture - launch - in-orbit operations - end-of-life disposal	Unknown – The extent to which all the objectives have been achieved is not clear.	Unknown – The extent to which this instrument is widely being used by the industry is unknown.	High – This instrument aims to identify and measure potential environmental impacts of space activities on the environment. This is in line with EU objectives.
CONFERS "Guiding Principles for Commercial Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS)"	- in-orbit operations	High – The CONFERS Guiding Principles are effective in achieving their primary goal of creating a framework of best practices, standards, and norms for safe and responsible on-orbit satellite servicing, debris removal, and space-based rendezvous and proximity operations. It has brought together stakeholders from across the industry and developed a consensus on how best to approach OOS activities.	Unknown - As a voluntary instrument, adherence to the CONFERS Guiding Principles is not mandatory. However, the involvement of major satellite operators, manufacturers, and service providers as CONFERS members suggests a high level of buy-in and potential adherence from the industry**.**	High – The focus of the CONFERS Guiding Principles is aligned with long-term EU policy objectives of space debris mitigation and removal as they contribute to improving safety and sustainability of space servicing.

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
Commercial Space Operations Safety Task Force (CSOSTF)	- in-orbit operations	Unknown - The CSOSTF appears to be an effective instrument for promoting safety in commercial space operations, as it establishes standards for commercial space operations and removes duplicative processes and approvals for the U.S. commercial space sector.	High – U.S. commercial space sector actors must abide by the standards established by the CSOSTF. Additionally, a high number of European actors adhere to these standards.	High - The CSOSTF aims at protecting public safety and sustainability during commercial space activities which is aligned with EU policy objectives.
SpaceX and NASA Joint Spaceflight Safety Agreement	- design - manufacture - launch	High – the Agreement establishes safety requirements and compulsory processes for joint spaceflight missions between NASA and SpaceX to mitigate potential safety risks.	High - Joint spaceflight missions between SpaceX and NASA must abide by the safety requirements established in the agreement.	High - The agreement establishes safety requirements and processes that are critical for ensuring the safety of astronauts and the long-term sustainability of space activities. SpaceX and NASA's joint spaceflight missions are high-profile and high-risk, and the safety requirements established in the agreement are designed to minimise the risk of accidents or other safety hazards. By requiring hazard analysis and regular safety reviews, the agreement helps to identify and mitigate potential safety risks, which in turn helps to reduce the creation of space debris and to minimise the risk of collisions between objects in space. It is therefore aligned with EU policy objectives.
USSPACECOM's Space Situational Awareness (SSA) sharing programme	- in-orbit operations	High – This is a U.S. Programme that aims at promoting bilateral data sharing with countries to strengthen SSA capabilities. It is highly effective as countries share their data with the	High - This Programme is highly relevant, as USSPACECOM holds more than 170 SSA sharing agreements with partners from the commercial sector, academia, and foreign and	High – This Programme supports the policy objective of strengthening SSA capabilities for space safety and sustainability, which is an objective of the EU.

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
		U.S. which allows the latter to benefit from increased knowledge. The U.S. also shares data with those signatories, which makes the initiative a win-win solution in terms of strengthening both parties' SSA capabilities.	intergovernmental agencies that share views about safe and sustainable activities in space.	
Satellite Orbital Safety Best Practices Guide	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High – The Guide includes best practices for satellite design, launch, and operation, as well as for collision avoidance and debris mitigation, and recommendations for sharing orbital data and cooperating with other space actors to ensure safe and responsible use of space. It has proven effective for new satellite operators and constitutes the most complete list of best practices according to a wide number of industry players.	High - Many satellite operators have voluntarily adopted the best practices in the Guide, particularly those related to end-of-life disposal, to help minimise the creation of space debris and reduce the risk of collisions in space.	High - The Guide aligns with many of the long-term EU policy objectives on the safety of space activities by providing guidance on collision avoidance, debris mitigation, and end-of-life disposal. Moreover, the Guide is consistent with the growing awareness of the need for sustainable and responsible space activities in both the public and private sectors.
Other initiatives for the promotion of standards, guidelines and best practices				
International Association for the Advancement of Space Safety (IAASS)	- design - manufacture - launch - in-orbit operations - end-of-life disposal	Medium - The IAASS develops standards, reports, and position papers for space safety covering a wide range of topics with highly technical standards. It has been effective in promoting the establishment of a commercial Space Safety Institute to offer safety certification services on a commercial basis.	Unknown - The degree of adherence to IAASS standards, guidelines, and best practices by industry actors may vary. The impact and influence of IAASS collaborations with other industry groups, government agencies, and international organisations on this adherence remain undetermined.	High - The IAASS is highly coherent with the long-term EU policy objectives of space safety and sustainability, concretely on the use of space situational awareness (SSA) data, orbital debris mitigation, and collision avoidance strategies.

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
The Secure World Foundation (SWE) Handbook for New Actors in Space	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High – The Handbook has been widely praised for its clarity, comprehensiveness, and practical guidance. It has been used by a wide range of stakeholders, including governments, industry, academia, and civil society organisations, to inform their space policies and practices.	Unknown – The Handbook does not have members in the traditional sense, but rather partnerships worldwide with main industry players and governments to promote the use of the handbook through outreach activities and training sessions. It is often cited as a key resource in these efforts.	Medium - While the Handbook is not specifically focused on high-level and long-term policy objectives, it emphasises the importance of sustainability, and international cooperation in space activities with guidance on space governance and sustainability.
The Space Safety Institute (SSI) Compendium	- design - manufacture - launch - in-orbit operations - end-of-life disposal	High – the Compendium is widely regarded as comprehensive covering the entire lifecycle of space risks, with practical guidance and real-world experiences, effective for a wide range of stakeholders, and credible as it is based on sound science.	High - Many space agencies, industry organisations, and other stakeholders around the world have referenced the Compendium in their safety policies and procedures and have adopted its guidance in their space activities. This demonstrates a high level of adherence and indicates that it is widely recognised as a valuable resource for promoting safety and sustainability in the space domain.	Medium - While the Compendium is not specifically tailored to any high-level and long-term policy objective, it guides risk management throughout the lifecycle of a spacecraft, guidance on space debris mitigation, and guidance on managing the end-of-life disposal of spacecraft.
EU Industry and Startups Forum (EISF) on Space Traffic Management	- design - manufacture - launch - in-orbit operations - end-of-life disposal	This instrument is quite new (first edition occurred in April 2022), hence it is not possible to determine at this stage the extent to which it is effective, relevant or coherent.		
European Commission Recommendation on Product Environmental Footprint methods (PEF)	- not yet applicable to space. However, the traditional PEF method is applicable to all lifecycle stages.	The PEF method is not yet applicable to the space sector. It is not possible to determine the extent to which it is effective, relevant or coherent.		
International Astronomical Union (IAU)	- design - manufacture - in orbit operations	Unknown – the IAU's effectiveness in reaching its awareness-raising objectives for the importance of dark	Unknown – the IAU has 12 400 individual members from 92 countries across all continents. The level of	High – the IAU's objective in this initiative is to consider the

Instrument	Lifecycle stage (design, manufacturing, launch, in-orbit operations, end-of-life disposal)	Effectiveness (extent to which the instrument achieves its objectives)	Relevance (level of adherence)	Coherence with EU policy objectives
		and quiet skies is high, as is evident from their activities such as the Global Outreach Project. The extent to which companies have implemented the recommendations is unknown.	adherence by companies and countries to IAU recommendations is unknown.	preservation of dark and quiet skies, which is in line with that of the EU.
American Astronomical Society (AAS)	- design - manufacture - in orbit operations - in orbit operations	Unknown – the AAS' effectiveness in reaching its awareness-raising objectives for the importance of dark and quiet skies is high, as is evident from their activities such as SatCon2. The extent to which companies have implemented the recommendations is unknown.	Unknown – the AAS has approx. 8 200 individual members. The level of adherence by companies and countries to AAS recommendations is unknown.	High – the AAS's objective in this initiative is to consider the preservation of dark and quiet skies, which is in line with that of the EU.

Table 29 - Evaluation matrix for existing standards, guidelines and best practices to ensure sustainable and safe space activities

Annex D – National space legislation instruments: Examples of making standards, guidelines and best practices binding

This section examines national space legislation related to safety and sustainability, the incorporation of international standards and guidelines into national legislation, and the enforcement of national space legislation. Additionally, a comprehensive table is included in Annex D, detailing national instruments relevant to space safety and sustainability in over fifty countries and their links to international standards and guidelines.

National space legislation and policies of selected countries

This section provides a comprehensive overview of relevant national instruments tied to space safety and sustainability in selected countries, underscoring their links to international standards and guidelines.

United States

This section provides an overview of the United States' space policy and the main instruments focused on ensuring the safety and sustainability of space activities.

National Space Policy

Approved in 2020, the National Space Policy[274] establishes a set of principles, objectives, cross-sector guidelines and sector guidelines for space operations. The need to ensure the safety and sustainability of space activities, as well as the promotion of the commercial space sector, feature prominently in the document. Of particular relevance is the provision mandating all U.S. executive departments and agencies to ensure the preservation of the space environment, especially the minimisation of space debris, through the following actions:

- Lead the development and adoption of international and industry standards and policies;
- Make available basic space situational awareness data and provide for basic space traffic coordination;
- Use space situational awareness data from commercial, civil and national security sources to detect actions in space that are inconsistent with the safety and long-term sustainability of space activities;
- Develop space flight safety standards and best practices to coordinate space traffic;
- Keep the domestic space object registry up to date;
- Limit the creation of space debris per the U.S. Government Orbital Debris Mitigation Standard Practices;
- Ensure that the regulatory framework applicable to non-government activities is regularly assessed;
- Promote research and technological development to understand and mitigate space debris risks;
- Promote active debris removal in coordination with allies and partners;
- Notify the Secretary of State of any exceptions to the application of the U.S. Government Orbital Debris Mitigation Standard Practices; and

[274] https://www.space.commerce.gov/policy/national-space-policy/

- Collaborate with the commercial space sector and foreign nations to foster the development of best practices to prevent on-orbit collisions.

The National Space Policy further addresses the need to ensure the cybersecurity of space systems, including by leveraging "widely adopted best practices and standards in the creation of rules and regulations". Additionally, the document sets forth guidelines for commercial space activities, including the objective to foster the development of space collision warning measures by collaborating with industry and foreign nations to:

- "Maintain and improve space object identification databases;
- Pursue common international data standards and data integrity measures;
- Disseminate orbital tracking information to commercial and international entities, including predictions of space object conjunctions;
- Enhance the common understanding of resident space objects;
- Develop and implement standard practices for conjunction assessment operations to ensure the safety of flight of all space operations, across all orbital regimes; and
- Develop common commercial operating guidelines and propose licensing requirements […] for large constellations, rendezvous and proximity operations, satellite servicing, small satellites, end-of-mission planning, and other classes of space operations."

U.S. Space Priorities Framework

In 2021, the White House set forth the United States Space Priorities Framework[275]. The policy document establishes two priorities for U.S. space policy: (1) "maintain a vibrant space enterprise across the civil, commercial, and national security sectors", and (2) "lead in the responsible, peaceful, and sustainable exploration and use of outer space". The second priority includes strengthening global governance of space activities, boosting space situational awareness sharing and space traffic coordination, and prioritising space sustainability and planetary protection.

Space Policy Directive 2 (SPD-2)276 – Streamlining Regulations on Commercial Use of Space

In 2018, the President of the United States mandated competent public servants to review and simplify existing regulations on the commercial use of space. In particular, the Secretary of Defense, the Secretary of Transportation and the Administrator of NASA were instructed to examine and minimise existing U.S. Government requirements, standards, and policies associated with commercial space flight launch and re-entry operations from Federal launch ranges, except for requirements necessary to protect public safety and national security.

Space Policy Directive 3 (SPD-3)277 – National Space Traffic Management Policy

Established in 2018, the Space Policy Directive 3 (SPD-3) espouses a national STM policy and is undoubtedly one of the most important developments in the domain and likely responsible for a significant degree of the remarkable urgency concerning the topic evident in the international plan.

Through SPD-3, and thus revealing the US' understanding of the issues involved in STM, the U.S. also recognises several principles and encourages other nations to do the same:

"(a) Safety, stability, and operational sustainability are foundational to space activities, including commercial, civil, and national security activities. It is a shared interest and responsibility of all spacefaring nations to create the conditions for a safe, stable, and operationally sustainable space environment.

[275] United States Space Priorities Framework (whitehouse.gov)
[276] President Signs Directive on Space Regulatory Reform – Office of Space Commerce
[277] President Signs Space Traffic Management Policy – Office of Space Commerce

(b) Timely and actionable SSA data and STM services are essential to space activities. Consistent with national security constraints, basic U.S. Government-derived SSA data, and basic STM services should be available free of direct user fees.

(c) Orbital debris presents a growing threat to space operations. Debris mitigation guidelines, standards, and policies should be revised periodically, enforced domestically, and adopted internationally to mitigate the operational effects of orbital debris.

(d) An STM framework consisting of best practices, technical guidelines, safety standards, behavioural norms, pre-launch risk assessments, and on-orbit collision avoidance services is essential to preserve the space operational environment."

Space Policy Directive 5 (SPD-5)278 - Cybersecurity Principles for Space Systems

Established in 2020, the Space Policy Directive 5 (SPD-5) recognises that cybersecurity principles and practices that apply to terrestrial systems also apply to space systems. The document sets out the following cybersecurity principles for space systems:

- Space systems and their supporting infrastructure including software should be developed and operated using risk-based, cybersecurity-informed engineering.
- Space system owners and operators should develop and implement cybersecurity plans for their space systems that incorporate capabilities to protect against unauthorised access, reduce vulnerabilities of command, control and telemetry systems, protect against communications jamming and spoofing, protect ground systems from cyber threats, promote adoption of appropriate cybersecurity hygiene practices, and manage supply chain risks.
- Space system cybersecurity requirements and regulations should leverage widely-adopted best practices and norms of behaviour.
- Space system owners and operators should collaborate to promote the development of best practices and mitigations.
- Space system operators should make appropriate risk trades when implementing cybersecurity requirements specific to their system.

Executive Order 13744 - Coordinating Efforts To Prepare the Nation for Space Weather Events

Approved in 2016, Executive Order 13744[279] sets forth the policy of the United States to prepare for space weather events to minimise economic loss and human hardship. In particular, it determines that the U.S. Government must have: "(1) the capability to predict and detect a space weather event, (2) the plans and programs necessary to alert the public and private sectors to enable mitigating actions for an impending space weather event, (3) the protection and mitigation plans, protocols, and standards required to reduce risks to critical infrastructure before and during a credible threat, and (4) the ability to respond to and recover from the effects of space weather". Concurrently, executive departments and agencies are to prepare for the effects of space weather events coordinatively.

U.S. Government Orbital Debris Mitigation Standard Practices

The U.S. Government Orbital Debris Mitigation Standard Practices[280] were established in 2001 by the U.S. Government "to limit the generation of new, long-lived debris by the control of debris released during normal operations, minimising debris generated by accidental explosions, the selection of safe flight profile and operational configuration to minimise accidental collisions and post-mission disposal of space structures". The Standard Practices, which were updated and refined in 2019, apply to the procurement and operation of spacecraft, launch services and the conduct of tests and experiments in

[278] President Signs Space Cybersecurity Policy Directive – Office of Space Commerce
[279] Federal Operating Concept for Impending Space Weather Events (fema.gov)
[280] Complying With OD Mitigation Requirements (nasa.gov)

space by U.S. Government agencies. The document covers (1) control of debris released during normal operations, (2) minimising debris generated by accidental explosions, (3) selection of safe flight profile and operational configuration, (4) post-mission disposal of space structures, and (5) additional standard practices for certain classes of space ports. The Standard Practices are aligned with the IADC Space Debris Mitigation Guidelines and the UN COPUOS Space Debris Mitigation Guidelines.

National Orbital Debris Implementation Plan

Adopted in 2022, the National Orbital Debris Implementation Plan[281] sets forth an implementation plan to guide the actions of the U.S. Government in addressing orbital debris challenges. It was developed by the Orbital Debris Interagency Working Group, which coordinates science and technology policy, strategy, and federal research and development about orbital debris hazards. The Implementation Plan identifies 44 specific actions for U.S. Government departments and agencies to develop across three pillars: debris mitigation, tracking and characterisation of debris, and remediation of debris.

U.S. Federal Communications Commission (FCC)282

The U.S. Federal Communications Commission employs a strategy of leveraging the necessity to access radio spectrum within the U.S. domestic sphere to impose orbital debris mitigation and collision avoidance capability requirements to virtually all U.S. satellites, as well as non-U.S.-licensed satellites seeking access to the U.S. market and applicants seeking to conduct experimental or amateur satellite operations. In 2020, the FCC amended Title 47 of the Code of Federal Regulations, stipulating that all satellites must be equipped with manoeuvrability sufficient to perform collision avoidance manoeuvres during any period when the satellite is in an orbit that is above the International Space Station (approximately 400 kilometres altitude).[283] In 2022, the FCC further amended Title 47 to shorten the 25-year timeframe for post-mission disposal of space stations in LEO to 5 years.[284] The change was justified by the need to reduce the probability of collisions and service outages, as well as the need to reduce the frequency of collision avoidance manoeuvres.

U.S. Department of Defense (DoD)

Recognising space as a priority domain for the Department of Defence, DoD Directive 3100.10[285] provides that the Department will "[s]trengthen the safety, security, stability, sustainability, and accessibility of the space domain", as well as "[p]romote long-term sustainability of the space environment; cooperate with like-minded international partners to establish, demonstrate, and uphold norms of safe and sustainable activities; and cooperate with other U.S. Government departments and agencies to act as a good steward of the domain". DoD Instruction 3100.12 sets forth guidelines and procedures on space support. The document contains several relevant provisions, including the requirement that satellite operations "ensure the preservation of space-based missions, mitigate the threat of in-space collisions, minimise orbital debris generation, and be conducted safely and responsibly consistent with national security requirements". Regarding debris mitigation, the following practices must be considered in the acquisition and operation of space systems: (1) release of debris during normal operations shall be controlled in all operational orbit regimes; (2) generation of debris by accidental explosions during and after completion of mission operations shall be minimised; and (3) the probability of collision with known objects during launch and orbital lifetime shall be estimated and limited in the development of the design and mission profile for spacecraft or upper stages. Moreover, spacecraft disposal at the end of mission life must be planned for programmes involving on-orbit operations, through atmospheric re-entry, manoeuvering to a storage orbit, or direct retrieval.

[281] 07-2022-NATIONAL-ORBITAL-DEBRIS-IMPLEMENTATION-PLAN.pdf (whitehouse.gov)
[282] Federal Communications Commission | The United States of America (fcc.gov)
[283] FCC Mitigation of Orbital Debris in the New Space Age, Federal Register Vol. 85 No. 165, 25 August 2020.
[284] FCC Mitigation of Orbital Debris in the New Space Age Second Order and Report, FCC 22-74, 29 September 2022.
[285] DoDD 3100.10, "Space Policy," August 30, 2022 (whs.mil)

Another measure is the standard 321-20[286] – Common risk criteria standards for national test ranges, which sets forth a common set of range safety policies, risk criteria and guidelines for managing risk to people and property during manned and unmanned space flight operations. In particular, the document establishes:

- "Acceptable risk criteria for both the general public […] and mission-essential personnel […], excluding people in the launch or re-entry vehicle;
- Debris injury thresholds for unprotected people;
- Debris hazard thresholds for aircraft and ships;
- Vulnerability models for large commercial transport aircraft and business-class jets;
- Approach for evaluating flight hazards to critical assets;
- Provisional acceptable risk criteria for unoccupied or largely unoccupied public infrastructure."

NASA

The **NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteoroid and Orbital Debris Environments (NPR 8715.6)[287]** specify NASA requirements and guidelines to limit the generation of orbital debris and implement the U.S. Government Orbital Debris Mitigation Standard Practices. The document aims at defining responsibilities and requirements that ensure that NASA and its partners, providers and contractors consider the preservation of the near-Earth space environment and the space environment beyond Earth's orbit, as well as the mitigation of the risk to human life and space missions due to orbital debris and meteoroids. To limit future debris generation, NPR 8715.6 requires each NASA program and project to conduct a formal assessment of the potential to generate orbital debris during deployment, mission operations, and after the mission has been terminated.

NPR 8715.6 is complemented by the **NASA Technical Standard Process for Limiting Orbital Debris (NASA-STD-8719.14B)[288]** and the Handbook for Limiting Orbital Debris (NASA-HDBK-8719.14). NASA-STD-8719.14B provides specific technical requirements for limiting orbital debris and methods to comply with the NASA requirements for limiting orbital debris generation as set out in NPR 8715.6. It includes requirements to (1) limit the generation of orbital debris, (2) assess the risk of collision with existing space debris, (3) assess the potential of space structures to impact the surface of the Earth, and (4) assess and limit the risk associated with the end of the mission of a space object. The Standard is consistent with the U.S. Government Orbital Debris Mitigation Standard Practices, the IADC Space Debris Mitigation Guidelines and the UN COPUOS Space Debris Mitigation Guidelines.

France

Adopted in 2008, the Space Operations Act[289] established a regulatory regime for the authorisation and supervision of space activities. The Act applies to the launching of space objects from French territory and the return of space objects to French territory, as well as the launching of space objects from foreign territory and the return of space objects to foreign territory conducted by French nationals.

According to the Space Operations Act, space activities are subject to prior authorisation by the Minister in charge of space affairs. An authorisation is granted for 10 years following an assessment of the moral, financial and professional guarantees of the applicant, as well as a technical assessment of the systems and procedures involved in the intended activity, including concerning the safety of persons and property, public health and environmental protection.

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[286] https://www.trmc.osd.mil/wiki/download/attachments/113019901/321-20_Common_Risk_Criteria_Test_Ranges.pdf?version=1&modificationDate=1623181167532&api=v2
[287] NASA Procedural Requirements for Limiting Orbital Debris
[288] Process for Limiting Orbital Debris | Standards (nasa.gov)
[289] LOI n° 2008-518 du 3 juin 2008 relative aux opérations spatiales (1) - Légifrance (legifrance.gouv.fr)

The technical assessment is carried out by Centre National d'Etudes Spatiales (CNES) and checks whether the space operator complies with the requirements set out in the Regulation. In particular, applicants must demonstrate that the intended activity complies with the technical requirements regarding the safety of persons and environmental protection, including by providing hazard studies, risk assessments, environmental impact assessments, and risk management plans. The environmental impact assessment must include an assessment of the production of space debris and lead to the planning of measures to prevent the identified environmental impacts and minimise space debris. Additionally, launch systems, the control of space objects and the return of space objects must adhere to several technical requirements aimed at mitigating space debris.

Operators intending to conduct a mission to another celestial body must also comply with the COSPAR Planetary Protection Policy[290]. On top of the aforementioned requirements, the Space Operations Act stipulates that authorisations may impose further requirements for the intended space activities, including regarding the safety of persons and property, public health, environmental protection, and space debris mitigation.

Operators must adhere to COSPAR standards. The obligations set out in the Technical Regulation are consistent with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, COSPAR standards, ISO standards such as 24113:2010, CCSDS standards and the European Code of Conduct for Space Debris Mitigation.

United Kingdom

The Outer Space Act of 1986[291] applies to the launch or procurement of a space object and the operation of a space object outside the United Kingdom by UK nationals and companies. The Space Industry Act[292] regulates spaceflight and associated activities conducted in the UK. According to the Space Industry Act, the Space Industry Regulations[293] detail the licensing and regulation of spaceflight activities, spaceports, and range control services in the UK. Under the same Act, the Spaceflight Activities (Investigation of Spaceflight Accidents) Regulations[294] establish a spaceflight accident investigation body and set forth the rules governing the conduct of accident investigations. According to the Space Industry Act, the carrying out of space and sub-orbital activities and the operation of a spaceport in the UK are subject to the issuance of a licence.

The Act gives the regulator, the Civil Aviation Authority, discretion[295] in respect of the grant of licenses. However, the regulator is under a duty to exercise its functions, including the licensing of space activities, to ensure public safety and take into account any international space debris mitigation guidelines issued by international organisations (e.g., IADC, UN COPUOS) where the UK is represented. To obtain a licence, applicants must assess health and safety risks to persons taking part in spaceflight activities and take all reasonable steps to reduce risks to the health, safety, and property of other persons to as low as reasonably practicable. Applicants must also submit an assessment of foreseen environmental impacts.

The Space Industry Regulations further detail the requirements for the granting of a license, including the requirement to describe the engineering practices, design and operational measures that will be used to prevent or mitigate the creation of space debris during the proposed spaceflight activities.

According to the Space Industry Act, the regulator may attach conditions to a licence, including:

[290] PPPolicyDecember-2017.pdf (cnes.fr)
[291] Outer Space Act 1986 (legislation.gov.uk)
[292] Space Industry Act 2018 (legislation.gov.uk)
[293] The Space Industry Regulations 2021 (legislation.gov.uk)
[294] The Spaceflight Activities (Investigation of Spaceflight Accidents) Regulations 2021 (legislation.gov.uk)
[295] According to the Space Industry Act, the regulator may grant a licence under this Act if the regulator thinks fit. The Act itself provides a list of requirements to guide the regulator in the license granting.

“(a) safety requirements regarding the design and operation of spacecraft, carrier aircraft and payloads;

(b) requirements regarding the assembling, integration and fuelling of spacecraft or carrier aircraft, a mating of spacecraft or carrier aircraft to their payloads and fuelling of payloads;

(c) requirements for handling strategies relating to the security and integrity of payloads;

(d) requirements relating to the range, tracking, surveillance, risk management, weather measurement and meteorological forecasting;

(e) requirements for the protection of persons whose health or safety could be put at risk by spaceflight activities carried out by the licensee, or at or from a spaceport operated by the licensee;

(f) requirements for the protection of sensitive or restricted information, technology or items;

(g) space debris mitigation guidelines.”

Important to note is that the analysis of licence applications includes an evaluation of the operator's compliance with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003 and ISO 24113:2011 Space systems - Space Debris Mitigation Requirements. According to the Space Industry Regulations, operators must conform to the technical requirements contained in Chapter 6 of ECSS-E-ST-10-06C or with substantially equivalent requirements.

Australia

The Space (Launches and Returns) Act of 2018[296] establishes a regulatory regime for space activities conducted in Australia or by Australian nationals outside Australia. According to the legislation, the following activities are subject to prior authorisation: the launch of a space object from Australia, the return of a space object to Australia, the launch of a space object from outside Australia by Australian nationals, the return of a space object to outside Australia by Australian nationals, the operation of a launch facility in Australia, and the launch of a high-power rocket from Australia.

The Space (Launches and Returns) (General) Rules[297] detail the application requirements for the launch facility licence, the Australian launch permit, the overseas payload permit, the return authorisation, and the authorisation certificate. The aforementioned legislation is complemented by the Flight Safety Code[298], which details the requirements for applicants to demonstrate that activities will be conducted safely.

The Space (Launches and Returns) Act requires applications for the grant of a launch permit, or an overseas payload permit to include a plan addressing the environmental impacts of the launch and connected return, as well as a strategy for debris mitigation. According to the Space (Launches and Returns) (General) Rules, the strategy must be based on an internationally recognised guideline or standard for debris mitigation and include an orbital debris assessment based on an internationally recognised model. The General Rules specifically mention that debris mitigation measures may address:

“(a) how debris may be limited during normal operations;

(b) how the potential for break-ups during operational phases will be minimised;

(c) how the probability of accidental collision in orbit will be limited;

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[296] Space (Launches and Returns) Act 2018 (legislation.gov.au)
[297] Space (Launches and Returns) (General) Rules 2019 (legislation.gov.au)
[298] Microsoft Word - Flight Safety Code - Refreshed - 2019-08-28 - accessible (industry.gov.au)

(d) how the potential for post-mission break-ups as a result of stored energy will be minimised;

(e) how the long-term presence of payloads and launch vehicle orbital stages in the low-earth orbit region or geosynchronous earth orbit will be limited after the end of the mission."

To ensure that operations carry as low of a risk as reasonably practicable, applications must include a risk hazard analysis and a flight safety plan. For this purpose, applications must conform to the launch safety standards and the risk hazard analysis methodology outlined in the Flight Safety Code. Applicants must also provide a technology security plan, which aims to prevent unauthorised access to the technology involved in the operation of the launch facility.

Operators must present a debris mitigation strategy based on an internationally recognised guidelines or standards such as the UN COPUOS Space Debris Mitigation Guidelines or the IADC Space Debris Mitigation Guidelines.

Japan

Per the principles of the Space Basic Act, Act No. 76 of 2016[299] establishes a system for the licensing of the launching and control of spacecraft in Japan, as well as a system for compensation for damage caused by a fall of a spacecraft in Japan. The launching of spacecraft using a launch site located in Japan or onboard a Japanese ship or aircraft requires prior authorisation from the Prime Minister, which is only granted if the following conditions are met:

(1) the design of the launch vehicle complies with the launch vehicle safety standard specified by the Cabinet Office Order, or the design of the launch vehicle has obtained foreign certification, and

(2) the launch site complies with the type-specific launch site safety standard specified by the Cabinet Office Order for ensuring the safety of the vicinity of the trajectory and launch site of the launch vehicle.

The launch vehicle safety standard contains provisions on flight capability, safety requirements for ignition devices, functions for flight safety operation and termination, reliability and redundancy of safety-critical systems, prevention of the occurrence of orbital debris relating to the separation of spacecraft, and restriction of the occurrence of orbital debris relating to the orbital stage.

The Review Standards under the Space Basic Act require the implementation of space debris mitigation measures for satellites. The Review Standards also require the risks to people, property, public health, and the environment associated with the launch, on-orbit operation, and re-entry of space objects to be equal to or less than the level of generally accepted international standards.

The Japan Aerospace Exploration Agency (JAXA) developed its space debris mitigation standard, JAXA Management Requirements 003D (JMR-003D)[300]. The standard sets forth the mitigation measures which are taken during the planning, design and operational phases of launch vehicles and spacecraft to minimise the generation of space debris during launch, orbital injection, on-orbit operation, and after the end of the mission. The standard essentially contains six measures:

"(1) Preventing the on-orbit break-up of a space system after the end of its mission which could generate a large amount of debris. […]

(2) Re-orbiting a spacecraft operated in geostationary earth orbit (GEO) upon completion of its mission to preserve the GEO environment.

(3) Reducing interference of the orbital stage left in geostationary transfer orbit (GTO) with the GEO-protected region to preserve the GEO environment.

[299] Act on Launching of Spacecraft, etc. and Control of Spacecraft (Act No. 76 of 2016) (cao.go.jp)
[300] JAXA安全・信頼性推進部

(4) Minimising the number of objects released in orbit during the operation of a space system.

(5) Reducing interference of disposed space systems with LEO-protected regions and orbit for global navigation systems with an orbital period of 12 hours.

(6) Avoiding human casualties made by survived space systems which re-entered to the Earth."

The Japan Aerospace Exploration Agency (JAXA) developed its space debris mitigation standard, JAXA Management Requirements 003D (JMR-003D), which is consistent with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003-2 and ISO standards (ISO-24113 and other debris related standards).

The Review Standards under the Space Activities Act require the implementation of space debris mitigation measures for satellites and requires that the risks to people, property, public health, and the environment associated with the launch, on-orbit operation, and re-entry of space objects be equal to or less than the level of generally accepted international standards.

Russia

The basis for national space legislation in the Russian Federation is provided by the Space Activity Law, originally adopted in 1993 and subsequently updated on various occasions, most recently in 2018.[301] The law provides that all space technology, including space objects and objects of space infrastructure that are created for scientific and socio-economic purposes, is subject to verification for compliance with the requirements established by the legislation of the Russian Federation (Art. 10).

Additionally, any space activity authorised by the Russian Federation must be carried out in compliance with the safety requirements established by laws and other regulatory legal acts of the Russian Federation (Art. 22). The Law does not determine specific standards but rather imposes an obligation on Roscosmos and the Ministry of Defence to "inform relevant governing institutions as well as citizens about any threats to security caused by space activities".[302] The relevant national legislation on the topic of space safety standards for space technology and space activities is comprehensive and has been developed over multiple decades by national standardisation authorities as well as through the incorporation of accepted standards of international bodies, with or without further modification to the domestic regulatory context. National standards follow a strict categorisation that differentiates between Russian National Standards that are mandatory in Russian territory, standards adopted during the time of the former USSR that have since the dissolution of the Soviet Union been applied as regional standards in the countries of the Commonwealth of Independent States as maintained by the Euro-Asian Council for Standardisation, Metrology and Certification, standards for branches of the Russian national economy that are mandatory for use by Roscosmos, and standards mandatory for application by specific companies.[303]

International standards that are implemented in Russian law (e.g. ISO 24113:2011 Space Systems - Space Debris Mitigation Requirements and ISO 15859-12:2004 - Space systems - fluid characteristics, sampling and methods of analysis) are typically categorised as mandatory Russian National Standards.[304] The basic rules, principles and goals of the Russian standardisation system are laid down in Federal Law No. 162-FZ of June 29, 2015 'On Standardisation in the Russian Federation'.[305] While

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[301] Federal Law 5663-1. Original Russian version can be found at https://fzrf.su/zakon/o-kosmicheskoj-deyatelnosti-n-5663-1/ (last accessed on 13 March 2023).

[302] S.P. Malkov and C. Doldirina, 'Regulation of space activities in the Russian Federation', at https://aerohelp.com/sites/default/files/sergey_p._malkov_catherine_doldirina_space_activities.pdf (last accessed on 13 March 2023).

[303] See O. Zhdanovich, 'Russian national space safety standards and related laws', in R. Jakhu and J. Pelton (eds.), Space Safety Regulations and Standards, 2010, p. 55.

[304] See e.g. GOST R ISO 15859-10-2010 on Space systems - fluid characteristics, sampling and methods of analysis. Part 10 Water, available at https://www.russiangost.com/p-60841-gost-r-iso-15859-10-2010.aspx (last accessed on 13 March 2023).

[305] As amended on 30 December 2020. Original version available at https://base.garant.ru/71108018/ (last accessed on 13 March 2023).

specific regulations regulate standards governing aspects of Russian space activities, key provisions on the safety of space operations in Russia are laid down by the general law 184-FZ 'On Technical Regulation', first adopted in 2008 and whose most recent revisions went into effect on 23 December 2021.[306]

Though labelled a technical regulation, the instrument has the status of federal law and places a mandatory requirement on aspects of operation, production, service, and processes, establishing minimal necessary requirements for space activities on the following specific safety issues: radiation safety, biological safety, explosion safety, mechanical safety, fire safety, product safety, thermal safety, chemical safety, electrical safety, radiation safety of the population, electromagnetic compatibility and unit of measurements (Art. 7, para. 1). The law confirms that the basis for draft technical regulations may be provided in whole or in part by either national or international standards, with the exception for the latter in cases where international standards or sections thereof would be "ineffective or unsuitable for achieving the goals established by […] this Federal Law, including due to climatic and geographical features of the Russian Federation, technical and (or) technological features" (Art. 7, para. 8). Federal Law No. 99-FZ of May 4, 2011 (as amended on December 29, 2022) 'On Licensing Certain Types of Activities' includes space activities within its scope of application, and obliges authorised officials of the licensing authorities in the course of licensing to assess compliance by the license applicant or licensee with all relevant license requirements.[307]

Rules on standards for space activities by Roscosmos are included in the Federal Law 'On the State Corporation for Space Activities Roscosmos' of July 2015.[308] Further provisions can be found in the Federal Space Program of Russia for 2016-2025 and the Fundamentals of the Russian Federation's State Policy in the Field of Space Activities for the Period up to 2030 and beyond.[309] Requirements for ensuring the safety of space operations are included in all of the above documents, while specific instruments have been adopted that further outline standards for the mitigation of space debris. Management of activities to reduce 'man-made contamination' in near-Earth outer space is a key responsibility of Roscosmos. To this end, the space agency develops and submits to the Russian government, per domestic legislation and together with interested federal executive bodies, proposals to ensure the safety of space activities concerning the design, manufacture, testing, use (operation), and disposal of rocket and space technology, military missile technology for strategic purposes, space objects and space infrastructure (Art. 11, para. 1 and Art. 14, para. 16). Non-binding recommendations further specify guidelines for the reduction of space debris, such as GOST R 52925-2018.[310]

While not legally binding, the requirements contained in the latter instrument apply to newly created and modernised spacecraft used for either scientific, socio-economic, commercial and defence purposes.[311] They are consistent with the provisions of the IADC Space Debris Mitigation Guidelines, the UN COPUOS Space Debris Mitigation Guidelines and ISO 24113: 2011.[312]

[306] See the original Russian version at https://www.consultant.ru/document/cons_doc_LAW_40241/ (last accessed on 13 March 2023).
[307] Original version available at https://www.consultant.ru/document/cons_doc_LAW_113658/ (last accessed on 13 March 2023). For more on these licensing requirements, see the Decree of the Government of the Russian Federation of February 14, 2022 N 168 'On approval of the Regulations on licensing space activities and the invalidation of certain acts and certain provisions of certain acts of the Government of the Russian Federation', referring to Federal Law of May 4, 2011 N 99-FZ (as amended on December 29, 2022) 'On licensing of separate types of activity'.
[308] N 162-FZ and N 215-FZ, last amended in December 2020 and 1 April 2022, respectively.
[309] Approved by the Russian Federation Government Decree of March 23, 2016 N 230 and by the President of the Russian Federation on April 19, 2013 N Pr-906, respectively.
[310] GOST R 52925-2018 "Space Technology Items. General Requirements for Space Vehicles for Near-Earth Space Debris Mitigation" (developed by the Federal State Unitary Enterprise Central Research Institute for Machine Building, approved by Order of the Federal Agency for Technical Regulation and Metrology on September 21, 2018 N 632-st) effective date January 1, 2019, substitute GOST R 52925-2008.
[311] See https://www.russiangost.com/p-353993-gost-r-52925-2018.aspx (last accessed on 13 March 2023).
[312] Submission by the Russian Federation to UNOOSA on space debris mitigation standards, at https://www.unoosa.org/documents/pdf/spacelaw/sd/RF.pdf (last accessed on 13 March 2023).

Annex E – National space legislation per country

The table below provides an overview of national space legislations per country. We aim to analyse the scope of applications in the life-cycle of space operations and whether they focus on safety and sustainability topics. We also assess whether they establish a compliance mechanism and whether they include any international standards for the space actors to conform with.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
Algeria	Presidential Decree No. 02-48 Creation, organisation and functioning of the Algerian Space Agency (ASAL) of 16 January 2002 Law No. 19 -06 of 17 July 2019 on Space Activities Draft Decree on the procedures for registration in the national registry of objects launched into outer space Draft Decree on a system for space risk prevention and mechanisms for intervention in the event of a disaster	Algerian Space Agency (ASAL)	The purpose of Law No. 19 -06 is to lay down general rules for the conduct of space activities, defined as activities for the study, design, manufacture, development, launch, flight, guidance, control and return of space objects.	Environmental protection, public safety, public health		Algeria expresses its adherence to the following rules in performing/authorising its space activities: UN COPUOS Space Debris Mitigation Guidelines and ITU Recommendation ITU-R S.1003-1.
Argentina	National Decree No. 995/91 Creation of the National Commission on Space Activities 1991 National Decree No. 125/95 Establishment of the National Registry of Space Objects Launched into Outer Space 1995 Law No. 26.306 Regime of the Registry of Cultural Heritage on Meteorites and other celestial bodies that are on or enter in the future the Argentine territory, its	National Commission of Space Activities (CONAE) National Communications Entity (ENACOM)		Environmental protection		Argentina expresses its adherence to the following rules in performing/authorising its space activities: UN COPUOS Space Debris Mitigation Guidelines and IADC Space Debris Mitigation Guidelines.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	airspace and jurisdictional waters 2007 Law No. 26.092 Creating the Argentine Company of Satellite Solutions Sociedad Anonima (AR-SAT) Law No. 27.208 Declaring the development of the satellite industry as a state policy and a national priority regarding geostationary telecommunications satellites and approving the Argentine Geostationary Satellite Plan 2015-2035 to be executed by the company AR-SAT National Communications Authority Decree No. 267/2015 Creating the National Communications Entity (ENACOM), the authority on communications that grants the radiofrequency licences					
Armenia	Law No. HO-152-N on Space-related Activities of the Republic of Armenia Decree of the Government of the Republic of Armenia On the Rules and Conditions of Licensing of Space Activities and the Approval of the License Form Decree of the Government of the Republic of Armenia On Defining the Rules for Registration of Space Technology and Objects Decree of the Government of the Republic of Armenia On Establishing the Rules of Obtaining Agreement from	Public administration body authorised by the government		Environmental protection, public safety		

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	the Authorised Body for the Alienation by the Operator of the Space Objects and (or) Equipment in favour of Another Operator Decree of the Government of the Republic of Armenia On Defining the Rules for the Use of Decommissioned State-Owned Space Technology and Objects					
Australia	Space Activities Act 1998 (amended in 2010) Space (Launches and Returns) Act 2018 Space (Launches and Returns) (General) Rules 2019 Space (Launches and Returns) (High Power Rocket) Rules Space (Launches and Returns) (Insurance) Rules 2019 Flight Safety Code 2019 Maximum Probable Loss Methodology Australian Civil Space Strategy 2019–2028	Ministry for Industry, Science and Technology Australian Space Agency	The objects of the Space Activities Act are: (a) to establish a system for the regulation of space activities carried on either from Australia or by Australian nationals outside Australia; and (b) to provide for the payment of adequate compensation for damage caused to persons or property as a result of space activities regulated by this Act; and (c) to implement certain of Australia's obligations under the UN Space Treaties; and (d) to implement certain of Australia's obligations under specified space cooperation agreements.	Environmental protection, space debris mitigation, public safety, public health	Revocation of the authorisation, imposition of fines	Operators must present a debris mitigation strategy based on an internationally recognised guideline or standard such as the UN COPUOS Space Debris Mitigation Guidelines or the IADC Space Debris Mitigation Guidelines.
Austria	Federal Law on the Authorisation of Space Activities and the Establishment of a National Registry 2011 (Outer Space Act) Explanatory Report to the Outer Space Act 2016 Regulation No. 36/2015 of the Federal Minister for	Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology	The Outer Space Act applies to space activities carried out: 1. on Austrian territory, 2. on board vessels or aeroplanes, registered in Austria or	Public safety, public health, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	Operators must mitigate space debris in due consideration of internationally recognised guidelines. The Explanatory Report Accompanying the Austrian Outer Space Act of 2011 explicitly mentions the IADC Space Debris Mitigation Guidelines, the ESA Requirements on Space Debris

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	Transport, Innovation and Technology in Implementation of the Federal Law on the Authorisation of Space Activities and the Establishment of a National Space Registry 2015 (Outer Space Regulation) Telecommunications Act Frequency Use Regulation		3. by a natural person with Austrian citizenship or legal persons seated in Austria.			Mitigation for ESA Projects, and the UN COPUOS Space Debris Mitigation Guidelines. The Explanatory Report also mentions that operators must fulfil the requirements of ITU Recommendations concerning the orbital position and frequency allocation. Operators may also consider international standards and guidelines not explicitly mentioned in the Explanatory Report which could, for example, be the European Code of Conduct for Space Debris Mitigation and the ISO standards on space debris (e.g.: ISO 24113:2011 Space Systems – Space Debris Mitigation Requirements).
Azerbaijan						Azerbaijan expresses its adherence to the following rules in performing/authorising their space activities: ITU Recommendation ITU-R S.1003, UN COPUOS Space Debris Mitigation Guidelines, ISO Standards (24113: Space Systems — Space Debris Mitigation Requirements; and others), European Code of Conduct for Space Debris Mitigation and IADC Space Debris Mitigation Guidelines.
Belarus	Decree 609 of the President of the Republic of Belarus of 22 December 2004	National Academy of Sciences	The National Academy of Sciences was assigned the task of conducting a unified State policy and coordinating and assuring State regulation of the activities of organisations engaged in the exploration and use of outer space for peaceful purposes, except as regards the planning, allocation, and			

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
			the effective use of the radio frequency spectrum.			
Belgium	Law of 17 September 2005 on Activities of Launching, Flight Operation or Guidance of Space Objects (revised in 2013) Royal Decree Implementing Certain Provisions of the Law of 17 September 2005 on Activities of Launching, Flight Operations and Guidance of Space Objects Operator Handbook	King of Belgium Ministry with responsibility for space research Belgian Science Policy Office (BELSPO)	The Law on the Activities of Launching applies to activities of launching, flight operations and guidance of space objects carried out by natural or legal persons in the zones placed under the jurisdiction or control of the Belgian State or using installations, personal or real property, owned by the Belgian State or under its jurisdiction or its control. When provided for under an international agreement, the law may apply the activities of launching, flight operations and guidance of space objects carried out by natural or legal persons of Belgian nationality, irrespective of the location where such activities are carried out.	Environmental protection, public safety	Revocation of the authorisation	The Minister with responsibility for space research can oblige operators to conform to international standards and rules, such as the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003, European Code of Conduct for Space Debris Mitigation, and ISO standards (24113: Space Systems – Space Debris Mitigation Requirements. Such a decision is taken on a case-by-case basis. However, the King may impose compliance with those standards on all operators.
Brazil	Law 8.854 of 10 February 1994 Law Establishing the Brazilian Space Agency Law 9.112 of 10 October 1995 Law on sensitive goods Decree 1.953 of 10 July 1996 Creating the National System for the Development of Space Agencies Law No. 9994 of 24 July 2000 Resolution No. 51 of 26 January 2001 on Commercial Launch Activities from the Brazilian Territory Administrative Edict No. 27 of 20 June 2001 Administrative Edict No. 5 of 21 February 2002 Administrative Edict No. 96 of 30 November 2011	Brazilian Space Agency (AEB)	Resolution No. 51 on the Licensing of space launches from Brazilian territory regulates the authorisation of space launches from the Brazilian Territory. Personal Jurisdiction (Art 2): A license will only be granted to legal persons, associated or affiliated with business or legal representation in the country, with express powers to respond administratively or judicially and considered technically and administratively qualified to perform launching activities.		Revocation of the authorisation	

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	Administrative Edict No. 182 of 28 May 2020					
Canada	Radiocommunication Act, R.S.C. 1985 (amended 2017) Aeronautics Act Canada Transportation Act Canadian Aviation Regulations Canadian Space Agency Act 1990 Remote Sensing Space Systems Act 2005 (amended 2007) Remote Sensing Space Systems Regulations 2007 Canadian Space Agency (CSA) adoption of the IADC Space Debris Mitigation Guidelines 2012 Client Procedures Circular (CPC) Licensing of Space Stations 2017	Ministry of Transport Ministry of Foreign Affairs, Trade and Development Canadian Space Agency (CSA) Industry Canada	Under the Canadian Aviation Regulations, the authorisation for a launch from Canadian territory is granted by the Minister of Transport made according to the Canadian Transportation Act. The licensing and supervision of Canadian Telecommunications Satellites is the responsibility of the Ministry of Industry.	Environmental protection, public safety, public health, space debris mitigation	Revocation of the authorisation, imposition of fines	The space debris mitigation requirements of the Remote Sensing Space Systems Regulations are consistent with the UN COPUOS Space Debris Mitigation Guidelines and IADC Space Debris Mitigation Guidelines. The CSA adopted the IADC Space Debris Mitigation Guidelines to mitigate the potential creation of space debris generated from its projects, missions and activities. The adopted Guidelines are consistent with the UN COPUOS Space Debris Mitigation Guidelines, ISO 24113: Space Systems – Space Debris Mitigation Requirements, and the ITU Recommendation ITU-R S.1003. The CPC for Licensing of Space Stations is consistent with ITU Recommendation ITU-R S.1003 and the UN COPUOS Space Debris Mitigation Guidelines. Moreover, operators must submit a plan for de-orbiting their geostationary satellite(s) in compliance with Recommendation ITU-R S.1003-2 on Environmental Protection of the Geostationary Satellite Orbit.
Chile	Supreme Decree No. 338 Establishment of a Presidential Advisory Committee known as the Chilean Space Agency	Chilean Space Agency	The Chilean Space Agency provides advice in all matters concerning the identification, formulation and implementation of policies, plans, programmes, measures and other			Chile expresses its adherence to the following rules in performing/authorising its space activities: IADC Space Debris Mitigation Guidelines, UN

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	(amended by Supreme Decree No. 0144 of December 29, 2008)		activities relating to space, and serves as coordinating centre government organisations involved in this field.			COPUOS Space Debris Mitigation Guidelines, ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011) and ITU Recommendation ITU-R S.1003.
China	Measures for the Administration of Registration of Objects Launched into Outer Space 2001 Interim Measures on the Administration of Licensing the Project of Launching Civil Space Objects 2002 Measures on Space Debris Mitigation and Protection 2015 Measures for the Registration of Space Objects Hong Kong Outer Space Ordinance 1997 National Industry standard QJ3221-2005 – Requirements for Orbital Debris 2005 (revised in 2015) Office of Telecommunications Authority, Guidelines for De-commissioning of Satellite and Mitigation of Space Debris 2007 Regulation on the Promotion of Orderly Development and Safety Management of Microsatellites 2021 Standardisation Administration, Space Debris Mitigation Requirements – GB/T 34513-2017	Commission of Science, Technology and Industry for National Defence (COSTIND) Department of International Cooperation Ministry of Foreign Affairs Standardisation Administration Office of Telecommunications Authority	The Measures for the Administration of Registration of Objects Launched into Outer Space apply to all the space objects launched in the territory of China, and the space objects jointly launched abroad by China and other States. The Interim Measures on the Administration of Licensing the Project of Launching Civil Space Objects regulate the administration of the project of launching civil space objects.	Public safety, public health, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	The Measures on Space Debris Mitigation and Management and Protective Management and the National Industry standard QJ3221-2005 mirror the IADC Space Debris Mitigation Guidelines. The Guidelines for De-commissioning of Satellite and Mitigation of Space Debris explicitly reference the IADC Space Debris Mitigation Guidelines and ITU Recommendation S.1003-1.

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Colombia	Decree 2442 of 18 July 2006 on the Creation of the Colombian Commission of Space (CCE)	Colombian Commission of Space (CCE)	The Colombian Commission of Space (CCE) was established to deal with consultation, coordination, orientation and planning to guide the execution of a national policy for the development and application of space technologies and to coordinate plans, programs and projects in the field.			
Czech Republic						The Czech Republic expresses its adherence to the following rules in performing/authorising its space activities: UN COPUOS Space Debris Mitigation Guidelines, IADC Space Debris Mitigation Guidelines, European Code of Conduct for Space Debris Mitigation, ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011) and ITU Recommendation ITU-R S.1003.
Denmark	Outer Space Act (Act No. 409 of 11 May 2016) Executive Order on requirements in connection with the approval of activities in outer space, etc. (Executive Order No. 552 of 31 May 2016) National Space Strategy	Ministry for Higher Education and Science Agency for Science and Higher Education	The Outer Space Act applies to space activities carried out within the Danish State and space activities carried out outside the Danish State on Danish craft or facilities or by Danish operators.	Public safety, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	The Agency for Science and Higher Education may stipulate that space activities meet relevant standards and guidelines for space debris management. The Executive Order explicitly refers to standards published by ECSS or ISO. Although not explicitly mentioned in the Executive Order, other standards and guidelines may also be considered such as the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, the ITU Recommendation ITU-R S.1003 and the European Code of

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
						Conduct for Space Debris Mitigation. The Outer Space Act stipulates that operators document the fulfilment of the Radio Regulations of the ITU.
Ecuador	Executive Decree No. 1246 on the Creation of the Ecuadorian Space Institute	Ecuadorian Space Institute	The Ecuadorian Space Institute was created as a public law entity under the Ministry of National Defense. For its operation, the Center for Integrated Surveys of Natural Resources by Remote Sensing (CLIRSEN) became part of the Ecuadorian Space Institute. Amongst others, the purposes of the Ecuadorian Space Institute are a scientific investigation of near-Earth outer space and outer space; coordination of programs and projects in the spatial area per the National Development Objectives; the development of space technology; applied research for Earth observation, remote sensing and geographic information systems; and the promotion of the peaceful uses of outer space and other peaceful purposes.			
Finland	Act 63/2018 on Space Activities 2018 Decree 74/2018 of the Ministry of Economic Affairs and Employment on Space Activities 2018 Government Decree 739/2019 on the Finnish Space Committee National Space Strategy National Strategy for Space Situational Awareness	Ministry of Economic Affairs and Employment	The Act on Space Activities applies to space activities carried on within the territory of the State of Finland and to space activities outside the territory of the State of Finland if they are carried on (i) on board a vessel or aircraft registered in Finland, or (ii) by a Finnish citizen or a legal person incorporated in Finland.	Public safety, environmental protection, space debris mitigation	Revocation of the authorisation	Operators must ensure that space activities do not generate space debris per recognised international guidelines. Although the legislation does not explicitly mention any standards or guidelines, the Government proposal for the Act on Space Activities lists the following instruments: UN COPUOS Space Debris Mitigation Guidelines, IADC Space Debris Mitigation

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
						Guidelines, European Code of Conduct for Space Debris Mitigation and ISO Standards on space debris mitigation.
France	Law No. 61-1382, 20 December 1961 Statute of the Centre National d'Etudes Spatiales (CNES) Decree 62-153 Regulations Relating to the CNES Law No. 2008-518 of 3 June 2008 (Space Operations Act) Decree No. 2009-640 of 9 June 2009, implementing the provisions provided for in Title VII of the Space Operations Act Decree No. 2009-643 of 9 June 2009 relating to the authorisation granted according to the Space Operations Act Decree No. 2009-644 of 9 June 2009, modifying Decree No. 84-510 of 28 June 1984 relating to CNES Decree of 31 March 2011 on Technical Regulation issued according to the Space Operations Act Decree No. 2009-1657 of 24 December 2009 relating to the Defence and National Security Council and the General Secretariat for Defence and National Security Order of 3 September 2019 on the creation and organisation of the space command Space Defence Strategy of	Ministry in charge of space affairs National Centre for Space Studies (CNES) French Space Command (CDE)	Space Operations Act: - Material scope: any activity consisting in launching, attempting to launch or intending to procure the launch of an object into outer space, or of ensuring the commanding of a space object during its journey in outer space, including the Moon and other celestial bodies, and, if necessary, during its return to Earth and; transfer of a space object which has been authorised under the Space Operations Act; transfer of control of a space object whose launching has not been authorised under the Space Operations Act. - (Quasi) territorial jurisdiction: activity from national territory or means or facilities falling under French jurisdiction. - Personal jurisdiction: French natural or juridical person, juridical persons whose headquarters is located in France.	Public safety, public health, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	Operators must adhere to COSPAR standards. The obligations set out in the Technical Regulation are consistent with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, COSPAR standards, ISO standards such as 24113:2010, CCSDS standards and the European Code of Conduct for Space Debris Mitigation.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	the Ministry of the Armed Forces 2019					
Germany	Delegation of Space Activities Act 1998 Satellite Data Security Act 2007 Product Assurance and Safety Requirements for DLR Space Projects 2019 (Issue 8.2) Telecommunications Act 2004 (amended 2022) Administrative Provision for the Registration, Coordination and Notification of Satellite Systems in the German Name and for the Transfer of Rights to Use Orbits and Frequencies 2018	Federal Ministry of Economics German Aerospace Centre (DLR) Federal Network Agency	Satellite Data Security Act: - Material scope: operation of high-grade Earth remote sensing systems, handling of data generated by such high-grade earth remote sensing systems until the moment of their dissemination. - Territorial jurisdiction: foreign legal persons or foreign associations of persons with their head office within the territory of the Federal Republic of Germany; if inalterable sequences of instructions to command the orbital system are transmitted from within the territory of the Federal Republic of Germany; where the data of high-grade earth remote sensing systems are disseminated from within the territory of the Federal Republic of Germany. - Personal jurisdiction: German nationals or legal persons or associations of persons under German law.	Public safety, space debris mitigation		The space debris mitigation requirements of the Product Assurance and Safety Requirements for DLR Space Projects are consistent with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines and the European Code of Conduct for Space Debris Mitigation. The Product Assurance and Safety Requirements for DLR Space Projects specifically refer to relevant ISO standards, such as ISO 24113:2011, and standards adopted by the ECSS. The mechanisms NASA STD 8719.14 “Process for Limiting Orbital Debris” and NASA-NPR8715.6A “Procedural Requirements for Limiting Orbital Debris” represent informative references for the Product Assurance and Safety Requirements for DLR Space Projects. According to the Telecommunications Act, users of orbit and frequency rights must respect the recommendations of the ITU Radiocommunication Assembly concerning space debris mitigation (ITU-R S.1003-2, Environmental protection of the geostationary-satellite orbit).
Ind	ISRO System for Safe and Sustainable Space	The Department of Space		Space debris mitigation		The Indian Space Research Organisation (ISRO) follows the UN COPUOS Space Debris

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	Operations Management (IS4OM)	(DOS) of the Government of India is currently developing a national regulatory framework, following the decision to open the space sector to private participation. In the meantime, the Indian National Space Promotion and Authorisation Centre (IN-SPACe) under the DOS is the authority mandated to authorise and supervise all space activities of private actors.				Mitigation Guidelines and the IADC Space Debris Mitigation Guidelines. In several past missions, ISRO implemented ISO and CCSDS standards in the design and development of space-based systems and operations. Such standards are being increasingly adopted in ongoing ISRO missions.
Indonesia	Law of the Republic of Indonesia No. 21 of 2013 on Space Activities Presidential Regulation No. 45 of 2017 on National Plan on Space Activities year 2016 – 2040	National Institute of Aeronautics and Space (LAPAN) Ministry of Communication and	Law No. 21 applies to: (i) all space activities which are carried out in and/or from the territory and the jurisdiction of Indonesia;	Environmental protection, public safety, public health	Revocation of the authorisation, imposition of fines	Indonesia expresses its adherence to the following rules in performing/authorising its space activities: UN COPUOS Space Debris Mitigation Guidelines, IADC Space Debris Mitigation Guidelines and ITU

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	Government Regulation No. 11 on Remote Sensing 2018	Informatics Ministry of Research and Technology	(ii) all space activities which are carried out for and/or on behalf of the Unitary State of the Republic of Indonesia; (iii) Indonesian citizens or Indonesian legal entities which are involved and/or participated in space activities; and (iv) foreigners with a license to carry out space activities. Law No. 21 regulates, inter alia, space activities; space-related activities; management and supervision; spaceport; safety and security; mitigation of re-entry space objects and search and rescue of astronauts; registration; international cooperation; responsibility and liability; insurance, security interest, and facilities; and environmental preservation. Commercial Space Activities may be conducted by legal entities established under Indonesian Law and foreign enterprises. Government Regulation No. 11 applies to remote sensing.			Recommendation ITU-R S.1003-2.
Italy	Law Decree No. 128 of 4 June 2003 Reorganisation of the Italian Space Agency Law No. 7 of 11 January 2018 Measures for the coordination of space and aerospace policy and provisions concerning the organisation and operation of the Italian Space Agency Code for Electronic Communications 2003	Italian Space Agency (ASI) National Authority for Telecommunications (NAC)				The Italian Space Agency (ASI) applies the European Code of Conduct for Space Debris Mitigation. ASI follows the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, the ITU Recommendation ITU-R S.1003 and the relevant ISO Standards (24113 and following deriving standards).

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
Japan	Law No. 161 of 2002 concerning Japan Aerospace Exploration Agency, National Research and Development Agency Act No. 43 of 2008 (Basic Space Act) Basic Plan for Space Policy (updated in 2020) Act No. 76 of 2016 on Launching of Spacecraft, etc. and Control of Spacecraft (Space Activities Act) Act No. 77 of 2016 on Ensuring Appropriate Handling of Satellite Remote Sensing Data (Remote Sensing Data Act) Act No. 83 of 2021 on the Promotion of Business Activities Related to the Exploration and Development of Space Resources (Space Resources Act) Cabinet Office Order No. 50 of 2017 Regulation for Enforcement of the Space Activities Act Cabinet Order No. 280 of 2017 for Enforcement of the Space Activities Act Review Standards and Standard Period of Time for Process to Procedures under the Space Activities Act 2017 Guidelines on Permission Related to Launching of Spacecraft, etc. 2018 Guidelines on Type Certification for Launch Vehicles 2018 Guidelines on Compliance	Prime Minister Cabinet Office National Space Policy Secretariat	The Space Activities Act establishes a system for permission and license related to the launching of spacecraft, etc. and the control of spacecraft in Japan, as well as a system for compensation for damage caused by a fall, etc. of a spacecraft, etc. in Japan, per the basic principles of the Basic Space Act. A person who intends to implement the launching of spacecraft, etc. using a launch site located in Japan or onboard a ship or aircraft with Japanese nationality must obtain permission from the Prime Minister for each instance of launching.	Public safety, public health, environmental protection, space debris mitigation	Revocation of the authorisation	The Japan Aerospace Exploration Agency (JAXA) developed its space debris mitigation standard, JAXA Management Requirements 003D (JMR-003D), which is consistent with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003-2 and ISO standards (ISO-24113 and other debris related standards). The Review Standards under the Space Activities Act require the implementation of space debris mitigation measures for satellites and requires that the risks to people, property, public health, and the environment associated with the launch, on-orbit operation, and re-entry of space objects be equal to or less than the level of generally accepted international standards.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	Certification for Launch Site 2018 Guidelines on License Related to Control of Spacecraft 2018 Guidelines on a License to Operate a Spacecraft Performing On-Orbit Servicing 2021 Application Manual for the Space Activities Act 2018 Cabinet Office Order No. 41 of 2017 Regulation for Enforcement of the Remote Sensing Data Act Cabinet Office Order No. 282 of 2017 for Enforcement of the Remote Sensing Data Act Guidelines on Measures, etc. Under the Remote Sensing Data Act 2017 Application Manuals for the Remote Sensing Data Act 2017 Cabinet Office Order No. 73 of 2021 Regulation for Enforcement of the Space Resources Act					
Kazakhstan	Law of the Republic of Kazakhstan on Space Activities 6 January 2012 No. 528-IV	Government		Environmental protection, public safety, public health		Operators must respect international norms and standards, including pollution of outer space.
Laos						Lao People's Democratic Republic expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ISO Space Systems — Space Debris Mitigation Requirements (ISO 24113:2011) and ITU

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
						Recommendation ITU-R S.1003.
Luxembourg	Law on the Exploration and Use of Space Resources 2017 Law on Space Activities 2020	Ministry/Ministries in charge of space affairs and the economy	The Law on Space Activities applies to space activities carried out: (1) by an operator, whatever the nationality thereof, from the territory of the Grand Duchy of Luxembourg or through installations, whether movable or immovable, under the control and jurisdiction of the Grand Duchy of Luxembourg; or (2) in the territory of a foreign State or an area not subject to the sovereignty of a State by natural persons of Luxembourg nationality or by legal persons established under Luxembourg law. The Law on Space Activities does not apply to missions involving the exploration and use of space resources, which are governed by the Law on the Exploration and Use of Space Resources.	Management of risks related to space activities	Revocation of the authorisation	
Mexico						Mexico expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ISO Space Systems — Space Debris Mitigation Requirements (ISO 24113:2011), ITU Recommendation ITU-R S.1003 and the standards of the European Code of Conduct for Space Debris Mitigation.
Myanmar						Myanmar expresses its adherence to the following rules in performing/authorising their space activities: UN COPUOS

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
						Space Debris Mitigation Guidelines and ITU-R S.1003-2 on Environmental protection of the geostationary-satellite orbit
Netherlands	Space Activities Act 2007 Decree of 13 November 2007, containing rules concerning a registry of information concerning space objects (Space Objects Registry Decree) Order of the Minister of Economic Affairs dated 7 February 2008, No. WJZ 7119929, containing rules governing licence applications for the performance of space activities and the registration of space objects Order of the Minister of Economic Affairs dated 16 April 2010, No. WJZ/10020347, containing amendments to rules governing licence applications for the performance of space activities and the registration of space objects Decree of 19 January 2015 expanding the scope of the Space Activities Act to include the control of unguided satellites (Unguided Satellites Decree) Order by the Minister of Economic Affairs of 26 June 2015, No. WJZ/15055654, amending the Space Activities Licence Application and Registration Order, in	Ministry of Economic Affairs Netherlands Space Agency Telecommunications Agency	The Space Activities Act applies to space activities that are performed in or from within the Netherlands or else on or from a Dutch ship or Dutch aircraft. By Order in Council, the Act can also be declared wholly or partly applicable to: (i) designated space activities that are performed by a Dutch natural or juridical person on or from the territory of a State that is not a party to the Outer Space Treaty or on or from a ship or aircraft that falls under the jurisdiction of a State that is not a party to the Outer Space Treaty; (ii) the organisation of outer space activities by a natural or juridical person from within the Netherlands.	Public safety, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	The Netherlands expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003, the European Code of Conduct for Space Debris Mitigation and relevant ISO Standards. The Netherlands supports ESA and EU initiatives.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	connection with changes to the application form					
New Zealand	Outer Space and High-altitude Activities Act 2017 Outer Space and High-altitude Activities (Licenses and Permits) Regulations 2017 Outer Space and High-Altitude Activities (Definition of High-Altitude Vehicle) Regulations 2017	Minister of the Crown New Zealand Space Agency	According to the Outer Space and High-altitude Activities Act, a person must not launch a launch vehicle from a launch facility in New Zealand, or from a vehicle in the air that was launched from New Zealand, unless the person has a launch licence for the launch of the launch vehicle from the launch facility or the vehicle. A New Zealand national must not launch a launch vehicle from a launch facility outside New Zealand, or from a vehicle in the air that was launched from outside New Zealand unless the New Zealand national has an overseas launch licence for the launch of the launch vehicle.	Environmental protection, space debris mitigation, public safety	Revocation of the authorisation, imposition of fines	Operators must provide a space debris mitigation plan and a safety plan. Both can be based on international standards or guidelines.
Nigeria	National Space Research and Development Agency Act No. 9 A 1255 2010	National Space Research and Development Agency National Space Council	The National Space Research and Development Agency (NASRDA) was established for, among other things, the encouragement of capacity building in space science and technology development and management, and develop satellite technology for various applications and related matters.	Space debris mitigation, environmental protection		Nigeria expresses its adherence to the following rules in performing/authorising its space activities: UN COPUOS Space Debris Mitigation Guidelines and IADC Space Debris Mitigation Guidelines.
Norway	Act No. 38 of 13 June 1969 on launching objects from Norwegian territory into outer space	Ministry of Industry, Trade and Fishery Norwegian Space Agency (NOSA) Norwegian Communication Authority	The Act requires that permission be obtained from the competent Ministry to launch objects into outer space from: a) Norwegian territory, also including Svalbard, Jan Mayen and the Norwegian external territories. b) Norwegian vessels, aircraft etc. c) Areas that are not subject to the sovereignty of any state, when the			

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
		Norway is currently in the process of revising the national regulatory framework and setting up a new authority at the Civil Aviation Authority to oversee space activities from 2023.	launching is undertaken by a Norwegian citizen or person with habitual residence in Norway.			
Philippines	Republic Act No. 11363 An Act Establishing the Philippine Space Development and Utilisation Policy and Creating the Philippine Space Agency, and for Other Purposes 2019 (Space Act)	Department of Information and Communications Technology National Telecommunications Commission Philippine Space Agency (PhilSA)				The Philippines expresses its adherence to the following rules in performing/authorising its space activities: UN COPUOS Space Debris Mitigation Guidelines.
Poland						Poland expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003, the European Code of Conduct for Space Debris Mitigation and ISO Standards

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
						(24113: Space Systems – Space Debris Mitigation Requirements; and others).
Portugal	Decree-Law No. 16/2019, of 22 January, Laying down the regime of access to and exercise of space activities ANACOM Regulation No. 697/2019, of 5 September, Regulation on access to and exercise of space activities	The authority currently responsible for the implementation of Decree-Law No. 16/2019 is the National Authority for Communications (ANACOM). However, the legislation foresees the creation of the Space Authority. Once such authority is created, it will be responsible for the implementation of Decree-Law No. 16/2019.	The Decree-Law applies to space activities, considered to be space operations or launch centre operations: a) Carried out on national territory, including sea space and airspace under Portuguese sovereignty or jurisdiction, on-board Portuguese vessels and aircraft or from facilities under Portuguese jurisdiction or sovereignty, regardless of the operator's nationality; or b) Carried out outside the national territory by Portuguese operators or operators established on national territory.	Public safety, public health, space debris mitigation, environmental protection	Revocation of the authorisation, imposition of fines, prohibition of space activities for a period of up to 2 years	Operators must provide a space debris mitigation plan, which can be based on international standards and guidelines. The Regulation explicitly lists the ISO 24113:2011 standard, the IADC Space Debris Mitigation Guidelines and the UN COPUOS Space Debris Mitigation Guidelines. Operators must provide a public safety plan in line with the standards issued by the US Federal Aviation Administration (FAA).
Russia	Federal Law No. 5663-1 of 20 August 1993 on Space Activity (revised in 2018) Government Resolution No. 536 of 31 May 1995 On the procedure and conditions of	Roscosmos State Corporation Communications Administrati	Law on Space Activity: - Material scope: any activities directly connected with operations to explore and use outer space, including the Moon and other celestial bodies. Explicitly mentioned are, inter	Public safety, public health, environmental protection, space debris mitigation		GOST R 52925-2018 is consistent with the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines and ISO 24113:2011 Space

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	episodic use of drop zones of separating rocket parts Federal Government Decree No. 104 Statute on Licensing Space Operations 1996 Federal law No. 7-FZ of 10 January 2002 On Environment Protection Federal Law No. 184-FZ of 27 December 2002 on Technical Regulation Federal Law No. 126-FZ of 7 July 2003 On Communications Government Resolution No. 336 of 2 July 2004 Regulations of the State Commission for Radio Frequencies Order No. 44 of the Federal Space Agency of 22 March 2010 (Administrative Regulations) Federal Law No. 99-FZ of 4 May 2011 On Licensing Certain Types of Activities Federal Law No. 215-FZ of 13 July 2015 on the State Corporation for Space Activities ROSCOSMOS Federal Law No. 162-FZ of 29 June 2015 on Standardisation in the Russian Federation Order of the Ministry of Communications of Russia No. 419 of 22 October 2015 Regulation on the organisation of work on the international legal protection of the assignment (destination) of radio frequencies and radio	on State Commission for Radio Frequencies Ministry of Defence	alia, scientific space research, use of space technology for communications, manufacturing of materials and products in outer space, preparation for launch or launch of space objects etc. - (Quasi-)territorial jurisdiction: activities pursued or undertaken by foreign organisations and citizens under the jurisdiction of the Russian Federation. - Personal jurisdiction: activities pursued or undertaken by organisations and citizens of the Russian Federation.			Systems - Space Debris Mitigation Requirements. GOST R 52925-2018 is not legally binding.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	frequency channels Presidential Decree No. 64 of 27 January 2020 Fundamentals of State Policy of the Russian Federation in the field of space activities for the period up to 2030 and beyond Government Resolution No. 298 of 18 March 2020 On Licensing of Space Activities GOST R 52925-2018 - Space Technology Items. General Requirements for Space Vehicles for Near-Earth Space Debris Mitigation (developed by the Federal State Unitary Enterprise Central Research Institute for Machine Building, approved by Order of the Federal Agency for Technical Regulation and Metrology on 21 September 2018 N 632-st) Draft Federal Law On Amending Certain Legislative Acts of the Russian Federation to Improve Legal Regulation of Issues Related to the Use of Drop Zones of Separating Parts of Space Rockets Draft Federal Law On Amending Certain Legislative Acts of the Russian Federation Concerning Conformity Assessment of Space Equipment Draft Government Resolution On Accreditation in the Field of Space Activities					

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
Slovakia						Slovakia expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, the European Code of Conduct for Space Debris Mitigation, ITU Recommendation ITU-R S.1003 and the ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011).
Slovenia	Telecommunications Act Space Activities Act 2022	Ministry responsible for technology	The Space Activities Act applies to space activities taking place in the territory of the Republic of Slovenia and to space objects entered into the Republic of Slovenia's register of objects launched into outer space (hereinafter: the register). The Act also applies to space activities taking place outside the territory of the Republic of Slovenia on a vessel or aircraft registered in the Republic of Slovenia and concerning space activities carried out by citizens of the Republic of Slovenia and legal persons established in the Republic of Slovenia.	Public safety, public health, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	Space activities must be conducted per the international standards and guidelines of internationally recognised standardisation organisations on the safety and technology of space activities. Space activities must limit the generation of space debris per the UN COPUOS Space Debris Mitigation Guidelines.
South Africa	Act No. 84 of 1993 (Space Affairs Act) (amended in 1995) Act 36 of 2008 (National Space Agency Act)	Council for Space Affairs South African National Space Agency	Space Affairs Act: - Material scope: launching, operation of a launch facility, participation in space activities entailing obligations to the State in terms of international conventions, treaties or agreements ratified by South Africa or affecting national interest and any other space activity prescribed by the Minister. - Territorial jurisdiction: launching from South African territory.	Public safety	Revocation of the authorisation, imposition of fines	

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
			- Personal jurisdiction: legal persons incorporated or registered in South Africa that launch from the territory of another State or that participate in space activities entailing international obligations for South Africa or affecting South Africa's national interests.			
Spain	Royal Decree 278/1995 of 24th February 1995, establishing in the Kingdom of Spain the Registry foreseen in the Convention adopted by the United Nations General Assembly on 2 November 1974	Spanish Space Agency Ministry of Science and Innovation Ministry of Defence	Royal Decree 278/1995: - Material scope: launching of a space object. - (Quasi) territorial jurisdiction: launches from Spain or Spanish facilities. - Personal jurisdiction: launches carried on by the Spanish State or launches that have been procured by the Spanish State or by Spanish entities.			Spain expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, the European Code of Conduct for Space Debris Mitigation, ITU Recommendation ITU-R S.1003 and the ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011). Spain also supports the adoption of the Draft International Code of Conduct for Outer Space Activities.
Sweden	Act on Space Activities (1982:963) Decree on Space Activities (1982:1069)	Government Swedish National Space Board	The Act applies to activities in outer space (space activities). In addition to activities carried on entirely in outer space, also included in space activities is the launching of objects into outer space and all measures to manoeuvre or in any other way affect objects launched into outer space. Merely receiving signals or information in some other form from objects in outer space is not designated as space activities according to this Act. Nor is the launching of sounding rockets designated as space activity. Space activities may not be carried on from Swedish territory by any party other than the Swedish State without		Revocation of the authorisation, imposition of fines	

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
			a licence. Nor may a Swedish natural or juridical person carry on space activities anywhere else without a licence.			
Switzerland						Switzerland expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines, the IADC Space Debris Mitigation Guidelines, the European Code of Conduct for Space Debris Mitigation, ITU Recommendation ITU-R S.1003 and the ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011).
Thailand						Thailand expresses its adherence to the UN COPUOS Space Debris Mitigation Guidelines and the mitigation measures of the IADC Space Debris Mitigation Guidelines on post-mission disposal and prevention of on-orbit collisions.
Tunisia	Decree No. 84-1125 of 24 September 1984 (modified by decree No. 931642 of 9 August 1993) on the creation of the National Commission of the Outer space	National Commission of the Outer space	The National Commission for Outer Space has the task to propose, within the framework of the country's development plans, in collaboration with the relevant departments and agencies, a national policy for the peaceful use of outer space.			
Turkey	Presidential Decree on the Establishment of the Turkish Space Agency	Turkish Space Agency	The purpose of the Presidential Decree is to regulate the procedures and principles regarding its establishment, duties and authorities. The Presidential Decree covers the Turkish Space Agency organisation and personnel.			

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
Ukraine	Law of Ukraine No. 503/96-VR of 15 November 1996 on Space Activity Decree of the President of Ukraine No. 117 of 29 February 1992 on the establishment of the National Space Agency of Ukraine Law of Ukraine of 15 November 1996 Ordinance of the Supreme Soviet of Ukraine on Space Activity Decree of the President of Ukraine No. 665/97 of 22 July 1997 on Regulations for the National Space Agency of Ukraine Industrial standard URKT-11.03 - Limitation of the Near-Earth Orbital Debris Making at Operation of Space Technical Equipment 2006	Ukrainian National Space Agency Ministry of Defence	Law of Ukraine on Space Activity: - Material scope: space activities that are defined as scientific space research, the design and application of space technology and the use of outer space. - (Quasi) territorial jurisdiction: in Ukraine or under the jurisdiction of Ukraine outside its borders.	Public safety, public health, environmental protection, space debris mitigation		The Law of Ukraine on Space Activity forbids the infringement of international norms and standards concerning outer space pollution. The industrial standard URKT-11.03 is consistent with the UN COPUOS Space Debris Mitigation Guidelines and the IADC Space Debris Mitigation Guidelines.
United Arab Emirates	Federal Law No. 12 of 2019 on the Regulation of the Space Sector	Emirates Space Agency	The Law applies to Space Activities and other Space Sector-related activities that are carried out: 1- In the State's Territory or the State's establishments outside the State's Territory. 2- From ships or aircraft registered with the State or Space Objects registered by the State. 3- By persons who hold the nationality of the State or companies that have headquarters in the State.	Public safety, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	
United Kingdom	Outer Space Act 1986 Communications Act 2003 Wireless Telegraphy Act 2006 Space Industry Act 2018 Explanatory Notes Relating	UK Spaceflight Regulator cited within the Civil Aviation	The Outer Space Act applies to the launch or procurement a launch of a space object and the operation of a space object outside the UK by UK nationals and companies. The Space Industry Act regulates spaceflight and	Environmental protection, space debris mitigation, public safety, public health	Revocation of the authorisation, imposition of fines	The analysis of licence applications includes an evaluation of the operator's compliance with the UN COPUOS Space Debris Mitigation Guidelines, the IADC

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	to the Space Industry Act 2018 Space Industry Regulations 2021 Spaceflight Activities (Investigation of Spaceflight Accidents) Regulations 2021 The Regulator's Licensing Rules 2021	Authority Ofcom	associated activities conducted in the UK.			Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003 and ISO 24113:2011 Space systems - Space Debris Mitigation Requirements. According to the Space Industry Regulations, operators must conform to the technical requirements contained in Chapter 6 of ECSS-E-ST-10-06C or with substantially equivalent requirements.
United States	US Code Title 42 - Public Health and Welfare US Code Title 47 - Telecommunications US Code Title 51 - National and Commercial Space Programs Code of Federal Regulations Title 14 - Aeronautics and Space Code of Federal Regulations Title 15 - Commerce and Foreign Trade Code of Federal Regulations Title 47 – Telecommunication US Government Orbital Debris Mitigation Standard Practices 2001 (updated 2019) FCC Orbital Debris in the New Space Age, Report and Order and Further Notice of Proposed Rulemaking 2020 FCC Allocation of Spectrum for Non-Federal Space Launch Operations, Report and Order and Further Notice of Proposed Rulemaking	Secretary of Transportation Secretary of Commerce Federal Communications Commission (FCC) National Telecommunications and Information Administration (NTIA) Federal Aviation Administration (FAA) National Oceanic and Atmospheric Administration (NOAA) Department of Defense	US Code Title 51: - Material scope: launch of a launch vehicle, operation of a launch or reentry site, re-entry of a re-entry vehicle. - Territorial jurisdiction: all activities carried out in the USA. - Personal jurisdiction: a citizen of or entity organised under the laws of the USA, an entity organised under the laws of a foreign country in which a controlling interest is held by a US citizen or legal entity unless a foreign country has jurisdiction over the activity carried out by that entity because of territoriality or agreement with the US Government. US Code Title 47: - Material scope: Construction, launch and operation of a satellite. - Territorial jurisdiction: all communications to or from the United States, or by a mobile station under the jurisdiction of the United States, except for U.S. Federal government stations. - Personal jurisdiction: No limits specified.	Public safety, public health, environmental protection, space debris mitigation	Revocation of the authorisation, imposition of fines	The FCC Regulations (Streamlining Licensing Procedures for Small Satellites, Report and Order), contained in Title 47 of the Code of Federal Regulations, require that geostationary satellites are relocated at end-of-mission per the IADC Space Debris Mitigation Guidelines. The U.S. Government Orbital Debris Mitigation Practices are aligned with the IADC Space Debris Mitigation Guidelines and the UN COPUOS Space Debris Mitigation Guidelines. The FCC Orbital Debris in the New Space Age Orders implements space debris mitigation measures informed by both domestic and international debris mitigation measures, including the NASA Standard and U.S. Government Orbital Debris Mitigation Practices, as well as IADC and UN COPUOS guidance.

	National instrument(s)	Competent authority	Scope of application	Safety and sustainability topics	Compliance mechanisms	Link with international standards
	2021 FCC Orbital Debris in the New Space Age, Second Report and Order 2022 National Orbital Debris Implementation Plan 2022 NASA Procedural Requirements (NPR) for Limiting Orbital Debris (NPR 8715.6A) NASA Process for Limiting Orbital Debris (NASA Standard 8719.14A) Presidential Space Policy Directives 2, 3, 4 and 5 Department of Defense (DoD) Directive 3100.10 (Space Policy) DoD Instruction 3100.12 (Space Support)					

Table 30 - National space legislation per country

Main sources: UN Compendium on Space Debris Mitigation Standards Adopted by States and International Organisations, documents submitted to the UN UN COPUOS WG on the Long-Term Sustainability of Outer Space Activities, UNOOSA Collection of National Space Law, own research by the authors of this study.

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