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Long-term sustainability of outer space activities

European Union joint contribution on the implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities

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European Union

EU Joint contribution
on the implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities of the UN Committee on the Peaceful Uses of Outer Space

Introduction

In June 2019, the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space were adopted (A/74/20, para 163 and Annex II). The Committee encouraged States and international intergovernmental organizations to voluntarily take measures to ensure that the guidelines are implemented to the greatest extent feasible and practicable.

In view of this, the EU, together with its Member States, wishes to present the implementation status vis-à-vis some of the guidelines.

Since the EU and its Member States are co-sponsors of the 21 Guidelines for the Long-Term Sustainability of Outer Space Activities and in order to actively contribute to the Working Group on the Long-term Sustainability of Outer Space Activities (WG-LTS), the EU and its Member States prepared a Joint contribution on the implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities structured along the 21 guidelines which are recalled by their title in the order of appearance in A/74/20.

The joint EU contribution consists of the contribution of the EU and of individual contributions of the respective Member States, which provided information on how they have implemented the guidelines or what their intention is to do so, taking into consideration the level of the development of space activities at EU level and at national level.

A. Policy and regulatory framework for space activities

Guideline A.1 — Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities

Member States

Austria

Austria is state party to the UN Outer Space Treaty (1968) and the UN Convention on International Liability for Damage Caused by Space Objects (1972).

Austria developed and adopted a national space act in 2011. The "Bundesgesetz über die Genehmigung von Weltraumaktivitäten und die Einrichtung eines Weltraumregisters (Weltraumgesetz) BGBl. I No. 132 / 2011] has the following elements: Scope of application; definitions; authorisation; conditions for authorisation (liability insurance with minimum insurance sum); mitigation of space debris; modification or termination of the space activity; revocation and modification of the authorisation; transfer, registry; registration and information for the registry; recourse; aspects to be detailed in a regulation; supervision and competent authorities; sanctions; transitional provision; implementation.

Based on this, a regulation was drafted, the Austrian Outer Space Regulation, which enacts more precise implementations.

The Austrian Space Act contains two explicit provisions to strengthen long-term sustainability: 1) space debris prevention [§ 4 Z 4 in conjunction with § 5] and 2) other harmful pollution of the environment and outer space [§ 4 Z 5 in conjunction with Art. 9 of the Outer Space Treaty].

Cyprus

Recognizing the dynamic prospects of the space sector, Cyprus decided to adopt a national regulatory framework for outer space activities, taking into account its obligations under the United Nations treaties on outer space as State responsible for national activities in Outer Space and as a Launching State.

To that effect, Cyprus is currently developing its national Space Law for outer space activities in order to authorize and supervise national space activities and enhance the practice of registering space objects.

Denmark

The space act of Denmark was enacted in 2016 as a framework law with further requirements detailed in an executive order that was adopted in parallel to the space act. The Sofia guidelines were used as an example for the act, and space acts of other countries were used for inspiration. The regulatory framework is updated whenever needed, e.g. if called for by new international standards or guidelines. The space act has not been amended yet, but the executive order was revised once to strengthen space debris requirements, among others.

España

La Ley de Ciencia aprobada el 25 de agosto de 2022 prevé la creación de la Agencia Espacial Española, adscrita a los Ministerios de Ciencia e Innovación y Defensa. Esta Agencia ahondará en la ordenación de las competencias y en el establecimiento de una política nacional que sirva de guía, tanto al sector público como al privado.

Finland

Finland has a national space law, Act on Space Activities (63/2018) and a Decree of the Ministry of Economic Affairs and Employment on Space Activities (74/2018). The Space Act includes provisions on scope of application, licensing and supervision process and its requirements, registry for space objects, liability and insurance, as well as consequences of breach of license. What can be viewed as progressive is its positive approach to environment and space sustainability. The Space Act includes specific references to space debris mitigation and highlights the importance of environmental issues in outer space and on Earth.

Portugal

Portugal's Space Law establishes the first regime on space activities, comprising both the ones of operators located in Portugal and those developed from Portuguese territory. Complemented with the administrative regulation, they address almost all of Part A topics.

Slovakia

The Slovak Republic is currently drafting the "Act on Regulation of Outer Space activities in the Slovak Republic", including registration of the objects launched into outer space. Within this "space law" it is considered to deal with all the relevant regulatory frameworks connected to the launch and execution of space activities.

Slovenia

National Space Activities Act has been adopted by the parliament on 16 March 2022. The Act lays down the conditions and procedure for issuing licences to conduct space activities and governs the registration of launched space objects, the obligations of the operator, liability for any damage caused by space objects and the supervision of the implementation of the Act.

There is no need for any change of legislation. Strategic planning and coordination of radio spectrum policy is regulated in article 25 of Telecommunications Act and in article 26 is stipulated that Radio frequency band allocation plan should be prepared in accordance with acts of international law governing the radio frequency spectrum and applicable in the Republic of Slovenia.

Sweden

In April 2020, the Swedish government initiated an official investigation to review the current legislation regarding space activities, and the report was submitted to the government in November, 2021. The Swedish government's purpose of the official investigation is to achieve a long-term sustainable regulation of space activities in line with international regulations and national security needs while creating predictability and good conditions for companies, universities and colleges as well as authorities in the space area. The report was during spring 2022 referred to relevant government agencies and other relevant stakeholders. The referral statements are currently being processed within the government offices.

The Netherlands

The Netherlands is party to the five UN space treaties. In 2006 the Netherlands adapted its Space Activities Act (the Act) which came into force in January 2008. The Act defines 'space activities' as 'the launch, the flight operation or the guidance of space objects in outer space' and applies to private space activities that are performed 'in or from within the Netherlands or else on or from a Dutch ship or Dutch aircraft'. The Act does not apply to activities of Dutch citizens abroad, nor to space activities that are performed under the responsibility of the government.

The Decree Unguided Satellites of 19 January 2015 extended the scope of the Act to include the control of unguided space objects from the Netherlands in outer space by means of a communications link.

The Radiocommunication Agency, responsible for the implementation of the Act, commissioned an analysis of the LTS Guidelines whereby an indication would be given, for each guideline whether or not it is already covered in the Act and secondary regulations and if not, if it should be implemented and how this could be done. The results of this research will be delivered at the end of 2022 and are input for the intended revision process of the Act, which may start in the second part of 2023 at the earliest.

As a member State of the COPUOS, the Netherlands fully adheres to the Space Debris Mitigation Guidelines of the Committee, IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003, the European Code of Conduct for Space Debris Mitigation and the ISO Standards. The Netherlands supports ESA- and EU-initiatives.

Guideline A.4 — Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites

EU institutions

The EU Space Programme (EUSP) adheres to the relevant rules and procedures laid out in the international Radio Regulations. For space systems, this requires as a first step the submission of a satellite network filing to the ITU to establish the frequency rights of the space system. As EU institutions have only regional organisation observer status at the ITU, all matters concerning frequencies used by the EUSP have to go via a MS as the submitting country (FR, IT, DE in the past). The MS then usually delegates operational matters to the Commission (for example, in the form of a licence for Galileo) but retains overall responsibility for the rights and obligations of the satellite network filing. The filings are coordinated under the ITU rules and procedures, which ensures that the concerned EUSP is used so "as not to cause harmful interference with the reception and transmission of radio signals".

Decisions made by the EU and MS fully take into account the spectrum needs of space-based Earth-observation systems. This entails finding a balance between the economic growth needs of the EU for new radio technologies like 5G, and the need to protect spectrum used by EO systems, which can be degraded very easily by interference. In practice this usually requires emission limits to be placed on the new radio technologies to limit the potential for interference into EO (and other) systems. The Commission in collaboration with MS conducts technical studies to determine the appropriate limits.

The EU and MS actively follow the rules and procedures defined in the Radio Regulations for space systems within their responsibility. The Commission is also actively engaged in promoting appropriate and responsible spectrum management, primarily to protect spectrum used by GNSS.

Member States

Austria

Austria has been a member of the International Telecommunication Union (ITU) and its predecessor since 1866 and has ratified the International Telecommunication Treaty. This also contains the Radio Regulations, which are updated every 3-4 years at the World Radiocommunication Conference.

Austrian frequency management is implemented in accordance with the Telecommunications Act and the Frequency Usage Ordinance in line with the interests of the state. As a member state of the ITU, Austria is obliged to comply with its current regulations, in particular with regard to satellite filing with the Radiocommunication Bureau of the ITU. This ensures frequency coordination, efficient use of frequencies and avoidance of harmful interference.

Denmark

The Danish space act stipulates that operators document the fulfilment of the Radio Regulations of the ITU. Further, space objects in LEO are required to limit the presence in orbit to 25 years after end of functional lifetime.

Germany

Germany is a member state of the International Telecommunications Union (ITU) and manages frequency rights according to their requirements. These requirements are implemented nationally through the national Telecommunications Act (Telekommunikationsgesetz) and subsequent administrative regulations. The Federal Network Agency (Bundesnetzagentur) operates a measuring station in Leeheim to detect and mitigate harmful interference.

Italy

Italy is a member State of the International Telecommunications Union (ITU). The allocation of radio frequencies is internally covered by the regulatory framework on licenses for the operation of telecommunications systems, having administrative nature, and applied under the supervision of the National Authority for Telecommunications (NAC) (2003 Code for electronic communications and relevant decisions of the NAC).

The conditions for the general authorisations on satellite services are oriented to enhance openness and sustainability. Italy shares the requirements indicated by the Resolution on "Sustainability of radio spectrum and associated satellite orbit resources used by space services" adopted by the Conference of Plenipotentiaries of the ITU in 2022.

Portugal

The National Space authority is simultaneously the National Communication Authority, the entity responsible for the allocation of spectrum.

Slovakia

The Slovak Republic follows the rules and procedures of the ITU Radio Regulations. The Intergovernmental Frequency Spectrum Harmonization Committee was established at the Ministry of Transport and Construction. The main task of the commission is the coordination of frequencies in the Slovak Republic. Changes in the allocation of frequencies/frequency bands are incorporated into the National Frequency Allocation Plan, which is updated annually and approved by the Government. The radio frequency spectrum is administered by the Regulatory Authority for Electronic Communications and Postal Services for all services and users.

Slovenia

Slovenia supports and implements all of activities in EU (and ITU) to protect radiocommunications harmonised for equitable, rational and efficient use for the Long-term Sustainability of Outer Space Activities of the UN Committee on the Peaceful Uses of Outer Space.

The Netherlands

The Netherlands Space Activities Act provides a flexible licensing system for private space operators under the authority of the Dutch Government. The Act contains a series of conditions to be complied with by the Dutch satellite operators (the licensees) relating to the safety of persons and property, environmental protection, public order, security, financial security, third party liability as well as compliance with international obligations of the state. The 2008 Order of the Rules Concerning Space Activities and the Establishment of a Registry of Space Objects was amended in 2015 and lists the information to be submitted, divided in five categories:

a) The fullest possible description of the space activities, including a description of the applicant's knowledge and experience of conducting space activities.
b) Relevant technical information about the space activity.
c) Documentary proof of a liability insurance policy.
d) Financial documents consisting of:
    1. A financial statement for the past financial year, including the audit opinion (if issued);
    2. A projected profit and loss account, with explanatory notes;
    3. A liquidity forecast, with explanatory notes;

4. A risk analysis indicating what management measures have been taken to safeguard the continuity of the space activities.

e) Documentary evidence of the authorisation to use frequency space (e.g. ITU filing rights).

As part of the envisaged revision of the Act (see A.1) this list of information will be revised also.

The Netherlands fully adheres to the relevant rules and procedures laid out in the international Radio Regulations. The Radiocommunication Agency is Notifying Administration for the Dutch satellite operators. In cooperation with the Dutch satellite operators the Agency arranges the necessary frequency rights for space system via a submission of a satellite network filing to the ITU in coordination with other member states. Regarding fulfilling these obligations under the Radio Regulations of the ITU, the Netherlands has established a policy for the cooperation between the Dutch government and the Dutch satellite operators containing requirements on how and under what conditions the Agency undertakes the so called "ITU filing activities" for the Dutch satellite operators. Mainly matters concerning satellite services, such as frequency management, the process of the ITU filing application and making the acquired international frequency rights available to operators. To avoid so called "paper satellite networks", the Netherlands will not accept applications for filing for the sole purpose of acquiring satellite (orbit) positions on a speculative basis. Nor does the Netherlands accept excessive filing activities to secure that developing countries and latecomers in this market may have equitable access to valuable and scarce orbital resources.

B. Safety of space operations

EU institutions

As part of the EU Space Programme, a dedicated Space Situational Awareness programme component consists of sub-components addressing Space Surveillance & Tracking (EU SST), Space Weather, and Near Earth Objects.

EU SST is implemented by a consortium of currently 7 (FR, DE, IT, ES, PL, PT, RO), and soon a partnership of 15 EU Member States (AT, CZ, DE, DK, ES, FI, FR, EL, IT, LV, NL, PL, PT, RO, SE), who contribute with existing national assets such as sensors and operational capabilities.

Guideline B.1 — Provide updated contact information and share information on space objects and orbital events

EU institutions

As part of their external engagement efforts, EU SST publicly shares information on orbital events such as fragmentations, re-entries or conjunctions of high interest through various channels.

Member States

Austria

The practical details of this guideline shall be elaborated in the UN Working Group on the Long-Term Sustainability of Outer Space Activities.

Denmark

All Danish space objects have been registered with the UNOOSA register of outer space objects. This includes space objects launched before the space law was enacted. Contact information of operators and status of space objects are surveyed continuously and updated as needed. Currently there is no formal requirement to engage with SST services, but Danish operators use the services on their own initiative. A requirement is intended in the future and the approach is under consideration.

España

España coordina el Consorcio de Estados Miembros EU SST que proporciona los servicios de Vigilancia y Seguimiento Espacial de prevención de colisiones, análisis de fragmentaciones y análisis de re-entradas. España es, junto con Francia, el responsable de proporcionar el servicio de prevención de colisiones y facilita la coordinación y el intercambio de datos en caso de eventos entre dos satélites activos. De hecho, EU SST ha puesto en marcha, a través del portal de provisión de servicios gestionado por el Front Desk de EUSST localizado también en España, una Plataforma de Comunicación y Coordinación para este tipo de eventos disponible para todos los usuarios del servicio de prevención de colisiones.

España comparte a diario medidas en formatos estandarizados, para garantizar la interoperabilidad, en el marco del Consorcio EUSST, a través de su base de datos. Además, desarrolla herramientas específicas para una interacción más eficiente y transparente con los usuarios de prevención de colisiones, permitiendo una toma de decisiones basada en un mejor conocimiento de la situación.

Germany

The civil-military German Space Situational Awareness Centre (GSSAC) is tasked with the creation of operational space situational awareness (SSA) information. It provides SSA information as well as operational services (e.g. collision avoidance, re-entry and fragmentation analysis). SSA data is exchanged bilaterally with individual partners and through the European Space Surveillance and Tracking (EU SST) programme.

The German Space Operations Center (GSOC), a major satellite operator in Germany, shares contact information and satellite ephemeris data with conjunction service providers and actively contacts other satellite operators in order to harmonize collision avoidance (COLA) measures.

There are a number of German academic and commercial satellites whose operators usually use their own infrastructure to operate their satellites. Some of these operators already use the services of the EU SST consortium. Additionally, to the EU SST service, GSSAC voluntarily communicates a proximity warning to these satellite operators on an event-related basis in the case of a critical approach.

Within EU SST, the consortium partners exchange SSA data in standardised formats. At GSOC, all relevant international standards for data exchange are operationally implemented in order to fully support data exchange among operators and conjunction service providers.

Italy

Italy practically implements this Guideline partly through improvement to its access to capabilities for Space Situational Awareness (SSA) and Space Surveillance and Tracking (SST). This includes the development of new tools and capabilities to make better use of the data currently available. The scientific, institutional and industrial national space community has developed important know-how in SSA. Italy carries on an important role also in the European framework of cooperation developing infrastructures and delivering SST services for the EU, while being engaged in ESA towards Near Earth Objects and Space Weather activities.

This capability has been developed thanks to a series of infrastructures made available partly by the Defense (telescopes and radars) and the Italian National Institute for Astrophysics, INAF (Sardinia Radio telescope, Northern Cross), and partly by the ASI (MLRO, SPADE). In the coming years, thanks to the development funded by the ASI of the FlyEye telescope, Italy will equip itself with a dedicated control center and national infrastructures.

Portugal

Part B of the Guidelines: Portugal does not yet have space operation located in its territory. When licensing, structuring and/or support those operations, or even in design the administrative processes and procedures, Portugal intends to use the LTS Guidelines as reference.

Slovakia

Slovakia is actively and timely providing and sharing updated information on space objects and their orbital events to the UNOOSA through its Permanent Mission to the United Nations in Vienna. A position of focal point regarding providing / sharing information has been created and will be maintained and implemented also under the future “Space Law”.

Slovenia

A Decree Implementing Space Activities Act is in a process of adaptation. Once in place, space entities will have obligation to register all space activities and provide with relevant contact information. This contact information will be further sent to the UN register. In the process of requesting for licence to conduct space activities, the operators will have to provide initial information of space object. According to Space Activities Act operators will also be liable to provide the ministry information regarding all the changes during the operation.

Sweden

SE has applied for, and been accepted, as a partner in the EU-SST partnership program. The process of signing has recently commenced.

The Netherlands

The Decree of 13 November 2007, containing rules with regard to the registry of information concerning space objects and the Form for registration space object (annex 1 by article 4 of the before mentioned Decree) provides a consistent manner of providing information about the space objects under Dutch jurisdiction. The Netherlands established also a public national registry for objects launched into outer space containing information about all space objects (satellites) under Dutch jurisdiction and contains the following information:

1. The name of the licensee.

2. The name of the satellite.
3. The UN registration number.
4. The description an function of the satellite.
5. The orbital parameters.
6. The country and location of the launch.
7. Expected and actual decommissioning date.

The licensee (the Dutch Space Operator) must furnish this information for every space object at least six months *before* starting to carry out the space activity and within three weeks *after* the actual launch or decommissioning date, the licensee must furnish the update information. Subsequently, the Netherlands submits this registration information to the UNOOSA under the Registration Convention. When the UNOOSA registration process is finalised the Netherlands updates its national registry for space objects launched into outer space accordingly. If there are any changes to the registration information of the space object, the licensee must notify the Radiocommunication Agency as soon as possible and in any event furnish the new information with within three weeks at the Agency. The Netherlands informs the UNOOSA about the change in the registration information and will update its national registry accordingly.

As part of the envisaged revision of the Act (see A.1) this registration process and information will be evaluated and the Act and regulations may be revised.

Guideline B.2 — Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects

EU institutions

As part of their operation and further enhancement of a sensor network for surveillance and tracking (over 40 radars, telescopes and lasers) and as part of their dedicated Data-Sharing Platform, EU SST routinely shares information on space objects between the participating Member States and with the Owners/ Operators of spacecraft registered for its Collision Avoidance service.

Member States

Austria

In the future, there might be some specific activities of Austrian institutions in this area.

Denmark

As described under guideline B.1, a requirement on mandatory use of a SST service is under consideration. There are currently no detailed plans for promoting techniques or technologies to improve accuracy of orbit data. It will be important to discuss the subject with relevant stakeholders first. It may be a challenge that most Danish space objects are 1U – 3U cubesats on a small budget.

España

España, en el marco del Consorcio EU SST, contribuye en la implementación de esta guideline de la siguiente forma:

- Utilizando estándares comunes reconocidos internacionalmente en el intercambio de datos.
- Mediante la coordinación y el intercambio de datos descrito anteriormente en la Guideline B.1, que permite mejorar la precisión de los datos orbitales.
- Mediante el desarrollo continuo de nuevas herramientas que permitan mejorar la precisión en el procesamiento de los datos.

Además, España, gracias al Programa Nacional de Vigilancia y Seguimiento Espacial S3T, desarrolla nuevos activos nacionales y mejora los existentes con el fin de aumentar la precisión de los datos orbitales.

Germany

The German Experimental Space Surveillance and Tracking Radar (GESTRA) represents an essential element in the area of SSA. In Germany, GESTRA allows monitoring the low earth orbit independently and generating orbital data of space objects in this orbital area at the GSSAC. GESTRA will be integrated into EU SST and will expand its sensor architecture. In addition, the Tracking and Imaging Radar (TIRA) of the Fraunhofer Society is an important instrument for tracking and characterising individual objects with high precision.

For improving the accuracy and precision of orbital data, GSOC is operating two telescope stations located in South Africa and Eastern Australia within the Small Aperture Robotic Telescope Network (SMARTnet). They proved to be a significant improvement of the accuracy of derived orbit information in GEO. A third station is planned to be deployed in South America in 2023.

In addition to these operational capacities, several scientific institutions are conducting research on improved capacity to collect orbital data from space objects. Commercial companies are also developing capacities to collect SST data.

Italy

Italy follows the international consolidated practice recommending States to share orbital information on space objects and notify in a timely manner and to the greatest extent practicable, potentially affected States of scheduled manoeuvres. As a principle, Italy notifies the competent organizations of other States any scheduled manoeuvre in the event of close approach when a modification of trajectory is needed to perform a collision avoidance.

Slovakia

Slovakia invests in the improvement of the ground-based passive sensor infrastructure to acquire data of space objects in all orbital regions. Slovak entities established interfaces for the data exchange for orbit determination purposes with European Space Agency (ESA), and with partners in Germany (space agency), Switzerland (academia), Poland (industry), and the Czech Republic (public entity). Currently, Slovak academia and industry are seeking collaboration for data exchange with France and Spain.

Slovenia

According to the Space Activities Act operators will have the obligation to report the orbital data at the time of entry in the Register of Space Objects and all the changes during the operational phase. The ministry is further responsible to provide this information to the UN.

Sweden

Sweden has applied for, and been accepted, as a partner in the EU-SST partnership program. The process of signing has recently commenced.

The Netherlands

The Netherlands doesn't have any national capacity to track and trace space objects and to detect risks of events occurring in outer space. However, one of the requirements of the space operations license under the Netherlands Space Activities Act is that the licensees needs to know the position of each space object every day and must inform the Radiocommunication Agency as soon as possible about possible collisions with another space object(s).

This situation will be evaluated as part of the envisaged revision of the Act (see A.1). One of the questions hereby is if the licensees should provide on a more regular basis about some information requirements related to the current and predicted location of their space object(s).

Guideline B.3 — Promote the collection, sharing and dissemination of space debris monitoring information

Member States

Austria

The Observatory Lustbühel (belonging to the Austrian Academy of Sciences) has been an internationally well-recognized player for space debris monitoring through satellite laser ranging.

Denmark

Denmark participates in the space debris monitoring information through its membership of ESA.

España

España dispone de una red de sensores, incluyendo radares, telescopios y láseres, cuyas medidas son compartidas a diario en formatos estandarizados, para garantizar la interoperabilidad, a través de la base de datos del Consorcio EU SST. Dichas medidas son tomadas de manera rutinaria, pero en caso de eventos de interés, pueden ser requeridas a través de una solicitud de tarea específica. Entre los múltiples sensores que posee España, destaca uno de los dos únicos radares de vigilancia operativos dentro de EU SST, el S3TSR, radar escalable y de altas prestaciones para la detección de basura espacial en LEO, que se desarrolla gracias al Programa Nacional S3T.

Además, España ha creado y mantiene catálogos nacionales de objetos en los regímenes orbitales de LEO, MEO y GEO.

Germany

A national object and orbit data catalogue is to be set up at the GSSAC. It is intended to serve as a basis for products and services for the GSSAC in order to protect national space systems, for example, from collisions with other space objects.

Within EU SST, Germany will build and maintain the EU SST object and orbital data catalogue under the leadership of the German Space Agency.

At the DLR Institute of Software Technology in close cooperation with the GSOC, the software Backbone Catalogue of Relational Debris Information (BACARDI) is being developed. It is intended to calculate and display orbital data for up to 100,000 objects in space in real time.

Italy

The Italian scientific and technological communities bear a long-standing expertise in the fields of hazards posed by man-made space objects and orbital debris, as shown by the advances in the realization and deployment of the FlyEye telescopes devoted to surveying the space debris population; the participation to the EUSST programme aimed at reaching a high level of autonomy in monitoring the space debris population.

A network of FlyEye telescopes is able to observe an extremely wide field area visible sky every night, thus it can be extremely effective in observing the MEO (Medium Earth Orbit) region, where navigation constellations reside, and the region above 1500 km of altitude. To this purpose, in 2022 ASI has started the procurement of 4 FlyEye telescopes for space debris observations.

Slovakia

Slovak academia and industry are collecting, sharing and disseminating space debris monitoring information.

Sweden

The Swedish Civil Contingency Agency (MSB) works actively to raise awareness of problems relating to space debris and the possible effects and consequences for critical societal functions with dependencies to space services. MSB is also active in the work mentioned in B.1 with aims to develop an operational SST that should be able to measure and track objects in space.

The Netherlands

The Netherlands doesn't have any national capacity regarding space debris monitoring. As ESA member the Netherlands keeps a close eye on the ESA's Space Debris Office work which constantly monitors the debris situation and reports on the current state of the debris environment. This situation will be evaluated as part of the envisaged revision of the Act (see also A.1).

Guideline B.4 — Perform conjunction assessment during all orbital phases of controlled flight

EU institutions

EU SST, with information from various data sources (own sensor network, data from US DoD based on sharing agreements of participating Member States, and owner/operator ephemeris), and through its dedicated operational centres, offers a Collision Avoidance service free of charge, which currently serves 300 registered spacecraft across LEO, MEO and GEO.

Until now the Collision Avoidance service was limited to EU space satellites operators. When established, the EU SST Partnership will offer Collision Avoidance service to non-EU satellites operators, once the detailed provisions concerning the access to SST services and relevant procedures are defined.

Member States

Austria

The efforts of the Observatory Lustbühel also contribute to the improvement of conjunction predictions.

Denmark

To date, Danish space objects have been either uncontrolled or equipped with very low power propulsion units, therefore eliminating the need for conjunction assessments in connection with trajectory changes. This is foreseen to change in the near future. There is a need to investigate the capability of operators to perform the assessments when needed and how to involve conjunction assessment service providers.

España

España, a través del Centro Español de Vigilancia y Seguimiento Espacial S3TOC, analiza el riesgo de colisión de alrededor de 300 satélites europeos (número de usuarios que va creciendo de manera continua) y da soporte a los usuarios proporcionando asesoramiento sobre las maniobras necesarias para evitar dichas colisiones. Dicho soporte, se ha extendido a todas las fases de un vuelo controlado como parte de la mejora continua del servicio de prevención de colisiones.

Germany

Germany is participating in the EU SST programme, which, among other services, carries out conjunction analyses for EU Member States, EU organisations, and European satellite operators. Germany contributes sensor data to the collision avoidance (CA) service of EU SST and operates the EU SST database at GSSAC for the exchange of data within the EU SST consortium.

German academic and commercial small satellite operators are interested in cooperating more closely with bodies such as the GSSAC in the field of conjunction analyses. For this purpose, the German Space Agency and the GSSAC have recently held discussions to improve cooperation with small satellite operators.

The CA service of EU SST comprises clearly defined methods and processes for categorising approaches and dealing with high-risk events. Registered users receive further information in such cases. Individual cases also receive advice on possible actions (e.g. evasive manoeuvres).

Additionally and voluntarily, GSSAC provides proximity warnings to national registered and non-registered satellite operators on an event-related basis, i.e. in the event of critical approaches.

The GSOC started to develop and operate a software system for conjunction assessment in 2009 and, ever since, is continuously developing, maintaining and operating the system. It features conjunction assessment, COLA manoeuvre planning, and generation of COLA products.

Italy

Italy implements this Guideline by exchanging orbital data of national maneuverable satellites with the competent entities of other States in case of an event of close approach. This data exchange practices have been consolidated after the conclusion of specific space situational awareness agreements either at national public bodies level, or at the operator’s level. Italy considers the importance of performing conjunction assessment during all orbital phases of controlled flight to ensure the safety of space operations.

Furthermore, Italy participates in the EUSST Partnership for the delivery of Collision Avoidance (CA), Re-entry Analysis (RE) and Fragmentation Analysis (FG) services. The Italian Operations Centre (OC) provides data and information for the RE and FG services by using national sensors, including MRLO, SPADE, PdM MiTe, Birales, RANTIGA, MFDR-MR, MFDR-LR.

Italy supports ESA efforts to facilitate collaboration among member States by promoting interoperability and standardization with regard to conjunction assessments.

Slovakia

Slovak academia is studying application of machine learning methods on the conjunction analysis between operational spacecraft and space debris.

Slovenia

According to the Space Activities Act, operators will have to demonstrate that space activities envisage measures for limiting the generation of space debris in accordance with the applicable UN Space Debris Mitigation Guidelines.

To perform the conjunction assessment the operators would need an accessible model. So far the operators are using the NASA models because they cannot access the European information on the space objects description of how this guideline has been implemented or, if is in the process, how it will be implemented description of possible barriers, challenges or intentions for the future.

The Netherlands

The Netherlands doesn't have any national capacity regarding conjunction assessment capacity. This situation will be evaluated as part of the envisaged revision of the Act (see also A.1) as part of the envisioned additional licensing requirements concerning safety and the protection of the space environment.

Guideline B.5 — Develop practical approaches for pre-launch conjunction assessment

Member States

España

Como parte de la mejora continua del servicio de prevención de colisiones, dicho servicio se ha extendido a todas las fases de vuelo incluyendo el asesoramiento durante el lanzamiento. En esta línea, ya se están realizando pruebas operacionales dentro del Consorcio EU SST. De hecho, recientemente se proporcionó apoyo en el lanzamiento de 3 cubesats a bordo del lanzador Vega C. España participó a través del S3TOC y proporcionando medidas de uno de sus telescopios (TFRM).

Germany

In Germany there is no governmental development or production of national space launch vehicles. Germany also does not possess any launch sites for launch vehicles. Germany participates in launch vehicle programmes of ESA.

The federal government is currently supporting the commercial development of small launch vehicles ("microlaunchers"). Developments related to the implementation of this guideline can be reported on further in the LTS Working Group.

Italy

Italy considers pre-launch conjunction assessment capability pivotal for avoiding collisions during the high-risk launching phase. In view of contributing to measures concerning the spread of ballistic missiles, Italy has subscribed the Hague Code of Conduct against Ballistic Missile Proliferation (HCoC), whose members voluntarily commit politically to provide pre-launch notifications (PLNs) on ballistic missile and space vehicle launches (SLVs).

Slovenia

According to the Space Activities Act operators will have to demonstrate that space activities envisage measures for limiting the generation of space debris in accordance with the applicable UN Space Debris Mitigation Guidelines.

For small satellite operators it's almost impossible to do the calculation well before the launch. They are provided with the information on the final altitude of the space craft by the launch operators in the final stages of preparation – it is only then that the assessments can be done.

Guideline B.6 — Share operational space weather data and forecasts

EU institutions

The EU work on space weather is two-fold.

The Galileo component of the EU Space Programme Regulation will contribute to space weather information via the European GNSS Service Center (GSC). Building on the prototype "Ionosphere Prediction Service" (IPS) developed in H2020 and currently operated at JRC, Ispra, the service will monitor ionospheric activity, deliver real-time predictions of ionosphere state and of GNSS performance at user level, and will inform GNSS users in good time of an upcoming event that could degrade the nominal performance of GNSS. The service, known as "Contribution to Ionosphere Prediction" (CIP) is currently being procured. It will be free of charge for all users.

Under the SSA component, the EU, with the support of the European Space Agency (ESA), is working towards the provision of one space weather service based on SWE user needs, the technological readiness of the services and the result of a risk assessment.

Member States

Austria

Austria contributes to the improvement of space weather data and forecasts and to the dissemination of space weather data and forecasts through its specific competences.

Denmark

Danish research institutions conduct research and share data through the membership of European Space Agency. The activities are conducted without government involvement.

España

España tiene su propio servicio de predicción de meteorología espacial denominado SenNMEs "Servicio Nacional de Meteorología Espacial", quien coopera con el servicio de meteorología espacial de la ESA.

Este servicio procesa y distribuye datos en los siguientes campos: Sol, medio interplanetario, entornos de radiación y el impacto sobre la Tierra.

Estos datos se distribuyen según las distintas categorías de usuarios (aviación, protección civil, red eléctrica, etc.).

Germany

The scientific community in Germany is strongly involved in space weather activities. There is a diverse group of experts at universities and research institutions, among others, which conduct fundamental and applied research on space weather. The entire spectrum is covered from the sun and heliosphere, via magnetosphere, plasma sphere, ionosphere and thermosphere, to effects on space and terrestrial infrastructure, including among other things, air traffic. The DLR Institute for Solar-Terrestrial Physics, for example, operates the Ionospheric Monitoring and Prediction Center (IMPC). It provides a range of pre-operational services including space weather data.

On the governmental side, various services and capacities are under development, including a Space Weather Advisory Centre at the GSSAC. A national space weather center is in preparation. The protection of the necessary frequency spectrum for monitoring space weather is being actively pursued.

Various facilities in Germany operate ground-based space weather sensors such as the Federal Agency for Cartography and Geodesy's Geodetic Observatory Wettzell and the Low-Frequency Array (LOFAR) for radar interferometry. In addition, Germany obtains data from space-based sensors, including those of NASA and of NOAA.

Italy

The Italian scientific community contributes to the advancement of our knowledge of the properties and evolution of the Space Weather phenomena with observational campaigns from space and from the ground. Furthermore, the Italian Space Agency participated several times in space missions related to Space Weather. The Heliospheric Space Weather Center project, carried on in synergy between the Aerospace Logistics Technology Engineering Company (ALTEC S.p.A.) and the Astrophysical Observatory of Torino of the Italian National Institute for Astrophysics (INAF), is aimed at providing space weather medium and short-term forecast, by combining remote-sensing and in situ open data with novel data analysis technologies.

Regarding the issue of climate change and the environmental challenges of the future, Italy contributes to the Destination Earth (DestinE) initiative, which aims to develop a highly accurate digital model of the Earth to monitor and predict the interaction between natural phenomena and human activities. As part of the Green Deal and the European Commission's Digital Strategy, DestinE will contribute to achieving the objectives of the dual transition, green and digital.

Slovakia

The institutes in Slovakia operates several unique ground-based Space Weather (SWE) observatories. The high-altitude monitoring of secondary cosmic rays, routine observations of the solar atmosphere, measurements of geomagnetic conditions, and detection of ionosphere-thermosphere variations. All the data are freely available on the demand principle. In the following years, the technology readiness level of data acquisition will be increased to fulfill the standards of the ESA Space Weather Services Network and the process of Slovak SWE data flow will be coordinated for straightforward integration into European systems according to international standards.

Detailed information on activities of several institutions performing SWE related observations and/or measurements can be found in biennial reports of the National Committee of COSPAR at https://nccospar.saske.sk/.

Sweden

The Swedish National Authorities, the Swedish Meteorological and Hydrological Institute (SMHI) and the Swedish Civil Contingencies Agency (MSB) has together with the national power grid operator Svenska kraftnät, developed a warning system where space weather data from the UK MetOffice is received, adjusted and shared with relevant actors. The information includes warnings and notices about ongoing and forecasted solar storms of magnitudes with potential to cause damage to technical systems within critical societal functions. The warning system is continuously improved to suit the user needs.

The Netherlands

The Netherlands shares the scintillation data from the Caribbean with the international space weather community (e.g. for ICAO space weather centres). Next to participating in the ICAO/PECASUS consortium the national space weather service is based on collaboration with the Met Office (UK) and, indirectly, with SWPC (USA). The task of The Netherlands is to evaluate the quality of the space weather data and forecasts. The resulting validation and model verification results are shared with the data owner, presented in official reports to ICAO and provide input to the WMO. Most verification and validation work involves navigation and communication (GNSS).

Guideline B.7 — Develop space weather models and tools and collect established practices on the mitigation of space weather effects

EU institutions

The EU has actively contributed to space weather research through funding of projects related to space weather and its impacts. For example, the Horizon 2020 project Space Weather Atmosphere Models and Indices (SWAMI), that worked on reducing the risk of collisions in space through better thermosphere modelling, and the EU 7th Framework Programme project on Modelling space weather events and mitigating their effects on satellites (SPACESTORM). More studies will be funded with the focus on, among other things, enabling further exploitation of space weather data by renewed effort on modelling and forecasting using currently available data and data from new measurement systems.

Member States

Austria

See Guideline B.6.

Denmark

Danish research institutions conduct research in this area. The activities are conducted without government involvement.

España

En España, distintos grupos de investigación contribuyen a los servicios antes descritos, Entre estos grupos está la Universidad de Alcalá de Henares que tiene un grupo de investigación en meteorología espacial y cuyo objetivo principal está en la investigación de la actividad solar y su influencia en el entorno terrestre, así como el desarrollo de productos para la predicción de eventos.

Germany

On behalf of the German Federal Ministry for Economic Affairs and Climate Action, the German Space Agency has developed a concept for the establishment of a national space weather service. Existing infrastructure of the GSSAC and the German Weather Service is taken into account.

The impacts of space weather effects on technological systems have already been investigated in relevant studies at national and international level. Germany is currently participating in further developing scientific models and services for the prediction of space weather, as well as developing payload instruments for the measurement of space weather phenomena in orbit. German scientists contribute with both their expertise and competence to the development and manufacture of measuring instruments and to the further development of prediction models.

Italy

Italy participates in the European Space Weather System development activities carried out in the framework of the ESA Space Safety Programme (S2P).

Italy is also a member State of the World Meteorological Organization.

Slovakia

Slovakia has several research groups that contribute with their expertise to the effort of mitigation of SWE effects. They are active and recognized in domains of solar physics, space radiation, and thermosphere-ionosphere. They were successful in several ESA / PECS calls and are prepared to actively contribute to ESA Space Safety Programme. There is a high potential in Slovakia to provide digital services based on machine learning techniques to assure high-efficient and accurate nowcasting and forecasting of space weather effects.

Sweden

The Swedish national authorities MSB and SNSA participates in ESA's program for space safety, where a large part concerns the development of space weather services. SMHI is following and advising what EUMETSAT is doing in the field of space weather.

The Netherlands

The national space weather centre in The Netherlands has a dialogue with the national vital sectors on mitigation and adaptation to space weather effects and works with the national crisis managers on improving space weather alerts. Lessons-learned and advises on best practices are shared with ICAO/METP, WMO and other national operational space weather service providers in Europe.

Whole Atmospheric Models are used to study the behaviour of the thermosphere/ionosphere in past events to improve validation activities. The Netherlands is developing a tool for combining all types of space weather data (satellite, ground based, etc.) that will improve validation activities. In the near future will make this tool publicly available as open source.

Activities in The Netherlands focus on the R2O transition that is currently ongoing, also in the ESA SWE activities.

Guideline B.8 — Design and operation of space objects regardless of their physical and operational characteristics

Member States

Denmark

Operators are required to demonstrate compliance with current ISO and ECSS standards on space debris mitigation as part of the Danish space regulation.

Germany

All major active and planned governmental German satellites have GNSS receivers on board to enable precise position determination in orbit. In general, most German small satellites are larger than the standard size 1U and can therefore be tracked with modern SST capacities.

Manufacturers and operators of space objects are either encouraged or required to limit the long-term presence of their space objects in the protected orbit regions. The Product Assurance, Safety & Sustainability Requirements for DLR Space Projects set requirements for the disposal of objects in LEO and GEO in accordance with the Space Debris Mitigation Guidelines of COPUOS and the IADC (e.g. maximum stay of 25 years in LEO). These requirements are also applicable to the small satellite promotion programme of the German Space Agency.

Researchers and operators in Germany are also working on satellite technologies to limit the residence time of objects in protected orbital regions.

Italy

The University of Padova is part of the European Consortium aimed at developing a way to deorbit space debris called E.T.PACK, along with Spanish and German Universities.

Slovenia

According to the Space Activity Act and the proposed Decree on Implementation of Space Activity Act, the operators will need to provide evidence that the space object is designed in a way that it will not cause additional space debris.

The Netherlands

To protect the environment in outer space, the licensees under the Dutch Space Activities Act need to ensure that their satellites in the Low Earth Orbit will completely burn up in the atmosphere, 25 years after the launch at the latest. Besides, the licensees (the Dutch space operators) need to know the position of each space object every day (see B.2).

This situation will be evaluated as part of the envisaged revision of the Act (see A.1). It will be examined whether additional measures and new or revised license requirements are necessary regarding the trackability of space objects (including small satellites) to limit the long-term presence of space objects in protected regions of outer space after the end of their mission.

Guideline B.9 — Take measures to address risks associated with the uncontrolled re-entry of space objects

EU institutions

EU SST, with data from its own sensor network and through its dedicated operational centres, offers a Re-entry service free of charge, which currently serves more than 125 registered users, including civil protection authorities from EU Member States. EU SST follow closely each uncontrolled re-entry and produces specific products towards EU civil protection and EU civil aviation. When established, the EU SST Partnership will offer Re-entry to non-EU users, once the detailed provisions concerning the access to SST services and relevant procedures are defined.

Member States

Austria

Austria develops and operates small satellites. Currently, no satellites relevant for risks associated with uncontrolled re-entry are planned.

Denmark

All existing and planned Danish space objects are cubesats of small sizes. Although, re-entries are always un-controlled, they pose no threat to persons or objects on the ground nor in the airspace. Relevant measures will be considered in due time, should the nature of Danish space activities change.

España

El Consorcio EU SST proporciona el servicio de análisis de reentradas, monitorizando la reentrada no controlada de objetos potencialmente peligrosos (masa mayor de 2000 kg, RCS > 1m2 y elementos de cohete). Ante un evento así, España contribuye proporcionando medidas de sus sensores al Consorcio EU SST que permitan una mejor monitorización.

En la actualidad, España ha desarrollado con éxito un Protocolo de Alertas Espaciales en casos de reentradas en la atmósfera terrestre incontroladas.

Germany

In the case of the ROSAT re-entry on 23 October 2011, DLR informed the public about the re-entry ahead of time. The most important partner agencies were informed about the re-entry through the IADC in advance. DLR also coordinated closely with individual international partners, such as the United States.

Germany regularly participates in the “re-entry test campaigns” of the IADC which aim to exchange orbit data, re-entry analyses and other information in the event of the uncontrolled re-entry of a space object.

Germany participates with sensor data in the re-entry analysis service of EU SST. The service provides predictions for the uncontrolled re-entry of objects with a mass of more than 2,000 kg or a radar cross-section of over one meter.

Concerning construction solutions, the concept Design for Demise (D4D) is currently being studied internationally with an increased focus. Research is being carried out in Germany, including through involvement in activities of the CleanSpace programme of ESA. The Product Assurance, Safety & Sustainability Requirements for DLR Space Projects also suggest applying D4D measures.

Italy

Italy considers of paramount importance for the sustainability of outer space activities the development and implementation of measures to exchange information and notification, in a timely manner and to the greatest extent practicable, of predicted high-risk re-entry events in which the re-entry space objects or residual material from the re-entering space object potentially could cause significant damage or radioactive contamination. In that regard, Italy has developed a set of best practice to implement such Guideline.

On the occasion of the uncontrolled re-entry of the Italian BeppoSax spacecraft, occurred on 30 April 2002, a specific national coordination unit was set up, composed of civil and military bodies, coordinated by the Italian Civil Protection Department, to continuously monitor and predict the re-entry event. In particular, Italy provided regularly updated previsions of time passage over the populated territory and related geographical band of fragments falls to the United Nations and, through the local Italian Embassies, to the States potentially affected by the re-entry. Besides, Italy contributes with national sensors to the Re-entry Analysis service provided by the EUSST Partnership. Within the framework of the latter, Italy oversees the provision of re-entry and fragmentation services. In 2022, this operational activity has resulted into closely following the most significant uncontrolled re-entry (in coordination with the Italian Department for Civil Protection) and in-orbit fragmentation events.

Slovakia

Slovak academia and industry are monitoring re-entry events with passive optical systems and also developing tools for analysis of such events, which allow to model the fragmentation of the parent body in the atmosphere, estimation of the dynamics and physics (size, density, luminosity) of the fragments in the atmosphere, which can be used for the estimation of the fragments survivability, which consequently leads to estimation of the risk estimation on the ground population.

Slovenia

According to the Space Activity Act and the proposed Decree on Implementation of Space Activity Act, the operators will need to provide a plan for safe termination of the space object's operation in outer space and/or its return to Earth.

Sweden

The Swedish Civil Contingency Agency (MSB) monitors the space domain and acts in cases where space objects are expected to make an uncontrolled re-entry. In this case, the operational duty officers of MSB are involved and risk analyses are performed together with advisers of the authority.

The Netherlands

The Netherlands has no space object tracking capabilities. In case of a forecasted uncontrolled re-entry of a space object under Dutch jurisdiction and control, the Netherlands will seek support from other States and/or international intergovernmental organisations with such capabilities (e.g. ESA). This situation will be evaluated also as part of the envisaged revision of the Act (see A.1).

C. International cooperation, capacity-building and awareness

Guideline C.1 — Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities

EU institutions

The European External Action Service has launched in September 2019 the 3SOS initiative, standing for Security, Safety and Sustainability in Outer Space in order to build support for a safe, secure and sustainable outer space across the space community and the disarmament community, promoting good behaviour in outer space amid concerns about orbital debris and arms race. Common understanding and common efforts, at worldwide level, are needed to act swiftly (therefore the "thrice SOS") and jointly for a safe, secure and sustainable outer space. The 3SOS campaign aims at building that common understanding by raising the awareness of all potential actors: policy-makers, industry, think-tanks, academia, scientific community or the general public. In this framework, we have organised one workshop in two separate sessions, in July and in October 2021 focusing on a Common Understanding of the risks and threats to safety, Security and sustainability in Outer Space, and a workshop in October this year devoted to presenting the 3SOS public diplomacy campaign, focusing on aspects of space security in addition to space safety and sustainability through Space Traffic Management (STM).

The recent Joint Communication of the Commission and the High Representative on Space Traffic Management outlines the EU's Approach to Space Traffic Management. One of the four pillars includes international cooperation, with multilateral engagement foreseen in the context of the United Nations, and bilaterally with international partners in view of interoperability and data-sharing toward international standards and rules for STM building on regional approaches.

Member States

Austria

Austria has built up specific competencies and technological leadership in the field of space. Austria's space landscape is characterized by dynamic small and medium-sized enterprises, an increasing number of start-ups and established research institutions. Austria's space sector has become a key member of the European and international space community through the participation in EU programs.

The Austrian Space Strategy 2030+: „People, Climate, Economy: Space is for everyone" has a strong focus on sustainability on earth and in space.

Austria has actively supported the work on long-term sustainability and the establishment of a UN working group for further discussion on the implementation of the guidelines and will continue its support.

Denmark

Denmark follows the work of the COPUOS LTS working group and discussions in the EU and ESA relating to LTS. Further, the space regulating authority in Denmark participates in a Nordic network of similar authorities, with the aim to cooperate and share experience on all aspects of approval of national space activities, including LTS.

España

El Consorcio EU SST coordinado por España, es un ejemplo perfecto de cooperación internacional para la sostenibilidad a largo plazo de las actividades del espacio ultraterrestre. El Consorcio EU SST se encuentra formado por 7 EEMM. Sin embargo, de acuerdo con la Regulación EU 2021/696, se está finalizando a día de hoy la formalización del partenariado formado por 15 EEMM que reemplazará a dicho Consorcio, involucrando así a un mayor número de países. Además, dicha Regulación EU 2021/696 admite la inclusión de nuevos usuarios de servicios de SST fuera de la UE. Estos requisitos deben ser formalizados a través de un acto de ejecución de la UE, y se prevé que los servicios sean accesibles para este tipo de usuarios a partir de 2023.

Germany

The orientation towards the principle of sustainability and the intensification of international cooperation are central guidelines of the space strategy of the Federal Government. This LTS guideline therefore touches upon core elements of German space policy.

A large part of German space activities is embedded in international organisations, such as ESA, EU and EUMETSAT.

German experts are involved in a variety of international forums and bodies dealing with various space issues. Germany cooperates with numerous international partners on the basis of bilateral government and agency agreements of the peaceful use of space. Germany is also actively supporting the work of UNCOPUOS and UNOOSA. For example, Germany was closely engaged in the set-up of the Working Group on Space Resources within the COPUOS Legal Subcommittee.

Italy

To implement this guideline, Italy actively participates in various international and national fora performing research on the space environment. Italy recognizes the paramount importance that international cooperation provides as a basis for all States to develop and strengthen their capacity to undertake and/or derive benefits from space activities. Furthermore, international cooperation on scientific and technical projects between both spacefaring and non-spacefaring nations can contribute to capacity and confidence-building.

Italy implements this measure both at governmental and agency level. In particular, the ASI operates in the framework of bilateral and multilateral relations and space cooperation agreements and coordinates the Italian participation in European and international space projects. At bilateral level, Italy is party to several space intergovernmental framework agreements for the exploration and use of outer space activities, while the ASI is currently party to more than sixty bilateral agreements signed with different international partners, that are space faring countries as well as emerging or developing countries.

At multilateral level, Italy implements this Guideline also actively participating in different multilateral intergovernmental regional and international organizations, such as the ESA, EUMETSAT, EUTELSAT, the UNCOPUOS, the Inter-Agency Space Debris Coordination Committee (IADC) and groups such as the Group of Earth Observation (GEO), the Committee on Earth Observation Satellites (CEOS), the International Committee on Global Navigation Satellite Systems (ICG), the International Space Exploration Coordination Group (ISECG) and other technical fora.

Portugal

Portugal participates in the international fora regarding LTS, namely in COPUOS and its working groups, besides bilateral agreements that can also address this topic. The 2022 edition of EuROC, brings together students from 15 European countries, to launch their projects, also focused in sustainability of space activities.

Slovakia

Slovakia is actively developing its international relations in cooperation within the European Union, in the European Space Agency framework and also with the third countries. Within this cooperation and strengthening international ties, Slovakia, promotes sustainable and peaceful use of outer space and stresses the importance of preserving sustainable space environment also for the future generations. Slovakia is one of countries promoting document "Dark and Quiet Skies" presented within the UN COPUOS, which is particularly important in the context of the long-term sustainability of space activities.

Slovakia supports democratisation of space, and pays a special attention to the topic of smaller and emerging spacefaring nations. In this regard, Slovak Space Office lists among the active stakeholders contributing to the international discussion on national capacity and ecosystem building using such platforms as IAC, GLEC, UN COPUOS, or Emerging Space.

Slovakia plays an active role in the international collaboration within the space safety domain. Within several projects conducted as a part of the country's collaboration with ESA (e.g. Slovakia National Space Safety Programme Study, Slovak Automated Space Surveillance and Tracking Optical System), various international experts and institutions were involved.

Slovakia favours a multilateral STM approach in the framework of the United Nations.

The Netherlands

The Netherlands supports ESA and EU policies and participates in the European space programme. One of the four components is space monitoring and surveillance (Space Situational Awareness, SSA). This also includes Space Surveillance and Tracking (SST) and the envisaged EU SST partnership. The Netherlands is currently considering a possible Dutch contribution to this partnership, which will start in the course of 2022. Furthermore, the Netherlands welcomes the EU approach to Space Traffic Management (STM). In line with this EU approach and because it is a global problem, the Netherlands prefers an international regulatory framework in the field of STM to be drawn up in the framework of UNCOPUOS.

Guideline C.2 — Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange

EU institutions

The EU discusses topics related to space safety and Space Traffic Management, including experiences and best practices, in space dialogues with international partners. Based on the recent Joint Communication of the Commission and the High Representative on Space Traffic Management, the EU intends to develop a toolbox aiming to share experience regarding the long-term sustainability of outer space activities.

Member States

Austria

Austria supports the exchange of experience and the development of new ways for the exchange of information. This could be discussed in the UN Working Group on the Long-Term Sustainability of Outer Space Activities.

Denmark

In addition to the text in C.1, relevant work is, or will be, shared with other member states of the European Union, and through UNCOPUOS or other international partners as relevant.

España

Dado que EUSST consiste en un esfuerzo multilateral, la cooperación internacional, el intercambio de experiencias y el intercambio de información es fundamental para el éxito de esta actividad. En este contexto, España ha contribuido a resolver los siguientes desafíos:

- Establecimiento de acuerdos para definiciones comunes de los términos y conceptos más relevantes.
- Definición de nomenclaturas, formatos y metodologías para el intercambio de datos e información.
- Desarrollo de procedimientos para el intercambio de información, solicitud de tareas de sensores, interacciones con los usuarios, condiciones de la prestación de servicios…

Finalmente, debido a la dimensión dual del dominio SST, es necesario prestar especial atención a la seguridad de la información, por lo que hay un Comité de Seguridad específico, del que forma parte España, que se encarga de definir la política de datos e información del Consorcio.

Germany

Germany has many years of experience in exchanging expertise and information on the long-term sustainability of space activities.

Germany is represented by the German Space Agency in the Inter-Agency Space Debris Coordination Committee (IADC), which it chaired from April 2020 to October 2021. During this period, key IADC documents, including the Space Debris Mitigation Guidelines, were updated and adopted.

In standardisation bodies such as the International Organisation for Standardisation (ISO), the European Cooperation for Space Standardisation (ECSS), the Consultative Committee for Space Data Systems (CCSDS), the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC), German representatives are involved in the development of international standards that are relevant for the long-term sustainability of space activities.

Germany also participates in exchanging know-how on specific aspects of long-term sustainability, such as near-earth objects and space weather, through established bodies and forums.

In addition, there are numerous international specialist conferences in which German experts participate and share their expertise, such as the International Astronautical Congress.

An exchange on the topic of sustainability with non-state actors takes place through contracts and grants as well as the Working Group on Product and Quality Assurance of the German Space Agency. In view of the increasing number of small satellites by universities, the German Space Agency initiated a dialogue with German universities in 2021 on the topic of sustainability.

Italy

Italy is deeply engaged in international and regional initiatives, international academic committees and other entities, NGOs and industries, addressing long-term sustainability issues and allowing the exchange of information, expertise and experience relating to the long-term sustainability of outer space activities between the members of these entities. Italy, through ASI, participates to the Inter-Agency Space Debris Coordination Committee (IADC), together with other twelve space agencies, for increasing the knowledge on space debris population and contributing, in particular, to the development of common mitigation guidelines.

It promotes conversations around the sustainability of the space environment and strongly supports this methodology and the maximum use of multistakeholder dialogue for enhancing the exchange of information.

Portugal

Portugal has shared its experience in dealing with the implementation of the LTS guidelines, more specifically addressing regulatory topics, in workshops, conferences, and multilateral and bilateral fora. In 2022, the Agency´s annual conference, an open event, the New Space Atlantic Summit, also looked at the Sustainability of Space Operations.

Slovakia

Slovakia was a part of the project executed within the UN COPUOS presenting the national implementation of the long-term sustainability of outer space activities and is also involved in the work of the UN COPUOS working group on Long-Term sustainability of Outer Space Activities where information is being shared in a wider spacefaring nations community.

The Slovak Space Office is regularly holding an event called “Emerging Space”, where Slovak space activities and sharing experience of other emerging space faring nations take place. This is a great opportunity also to promote importance of the LTS and exchanging best practices among various participants.

The Slovak Space Office consistently includes sharing experience and best practices related to the long-term sustainability of outer space activities in discussions with its international partners. It also supports such dialogues between relevant Slovak companies and researchers and their international counterparts.

Slovenia

We are raising awareness through organization of different space related activities, media channels, direct contacts, etc.

The Netherlands

The Netherlands shares experience, best practices and information related to space objects under Dutch jurisdiction and control with States, international intergovernmental organisations and non-governmental entities/private entities in an open and transparent manner. The Netherlands will continue with this to enhance the long-term sustainability of space activities.

Guideline C. 3 — Promote and support capacity-building

EU institutions

The European Union does not have budget for capacity-building of international partners on space activities, such as training for spacecraft design, flight dynamics and orbits.

The European Union is currently promoting the uptake of space data with dedicated regional outreach, via its international cooperation assistance.

The EU's Earth Observation Programme – Copernicus – has a free, full and open worldwide data policy. The Copernicus Emergency Management Service provides free value-added products to countries affected by disasters on demand.

Member States

Austria

Austria has built up expertise in certain areas addressed here (e.g. small satellite development), in other areas we cooperate with other actors (e.g. orbit tracking).

Austria actively supports capacity-building activities and initiatives of the EU, as part of the EU's position as observer at the UNCOPUOS.

Cyprus

Cyprus is currently promoting the uptake of space data and space technologies with dedicated workshops and with the support of ESA, since Cyprus is an ESA Cooperating state and EUSPA.

Denmark

There are currently no plans for promoting or supporting capacity-building in other states.

España

Con el fin de promover nuevas formas de cooperación, España ha desarrollado una herramienta de planificación de sensores, que será implementado en la parte operacional en los próximos meses. El objetivo de este Planificador Coordinado (COPLA) es coordinar todos los sensores de EUSST para optimizar su uso y mejorar los servicios (análisis de conjunciones, predicciones de reentrada, análisis de fragmentaciones, catalogación…).

Germany

Germany supports a wide range of capacity-building measures, in particular with UNOOSA and its Programme on Space Applications. This includes the Drop Tower Experiment Series (DropTES) which enable research teams from developing countries to carry out microgravity experiments at the drop tower of the Center of Applied Space Technology and Microgravity in Bremen.

Germany is also involved in capacity-building measures in the area of space law. The 'Cologne Commentary on Space Law' (CoCoSL) was set up in cooperation between DLR and the University of Cologne. It has been translated into several languages, including four UN languages. Germany also welcomes the project Space Law for New Space Actors of UNOOSA and participates in related outreach activities. Germany also supports the capacity-building efforts of ESA and the European Centre for Space Law (ECSL).

Germany supports the UN-SPIDER programme of UNOOSA, which promotes the worldwide use of satellite services and data for disaster management. Since 2007, UN-SPIDER maintains an office in Bonn with German funding.

Italy

Italy has been promoting and supporting capacity-building in the space sector for emerging space countries. In the framework of the Italy-Kenya space cooperation, the ASI concluded a Framework Agreement with Sapienza University of Rome following which the former undertakes to engage the latter on issues of common interest, including higher education programmes for Kenyan universities. Since 2019, Sapienza University and Kenya Space Agency (KSA) have been carrying out capacity building activities through the Outer Space Law for International Cooperation and Sustainable Development Project (OSL Project), which focusses on legal and policy instruments, also relating to the sustainability of space activities, including the 21 Guidelines on LTS. Activities include training courses, webinars and joint participation in International conferences, such as IAF's Glec 2022 in Quito, Ecuador.

Malta

The Malta Council for Science and Technology (MCST) in collaboration with the European Space Agency has been running the Space Research Fund (SRF) which has been an active initiative since 2018. This fund is instrumental for the progressive enhancement of the local, space-related knowledge base, laying down the foundations for a sustainable space sector in Malta.

The SRF provides opportunities for Maltese public, private and RPOs to carry out research and development using Earth Observation data, building technical capabilities in various sectors.

The organisations participating in this funding scheme often form Consortia which usually consists of a variety of entities ranging from academia and the public and private sectors. These collaborative partnerships further the transfer of knowledge and the development of expertise in various sectors. These consortia ensure that there is no duplication of efforts and that the best use of limited financial and human resources warrant long-term sustainability.

The satellite data utilised in these projects is customised to suit end user requirements where datasets are adapted to the needs of stakeholders and to ensure that the data is represented in the most effective and efficient way. These projects showcase the potential use of satellite data and thus have encouraged further demand by local stakeholders to seek to address local societal challenges using space data and innovative solutions.

Portugal

Portugal is actively promoting capacity building in space relates topics, both internally as internationally through different initiatives such as hosting de 2022 edition of the International Space University or with the overture of two more space courses in the national universities, including PhDs. The EuROC seeks to stimulate engineering students to design, build and launch their own vehicles. In a broader spectrum the competition aims to encourage students to study science, technology, engineering and math (STEM) and to the development of technological skills.

Slovakia

Slovakia supports democratisation of space, and pays a special attention to the topic of smaller and emerging spacefaring nations. In this regard, the Slovak Space Office lists among the active stakeholders contributing to the international discussion on national capacity and ecosystem building using such platforms as IAC, GLEC, UN COPUOS, or Emerging Space.

Thanks to becoming Slovakia an associate member of the ESA, it will gain new contracts for Slovak entities in the field of space technology and research and will be able to cooperate in space research and participate in ESA programmes. It will also have an opportunity to participate directly in ESA tenders and calls. Furthermore, this kind of cooperation will mean new job opportunities for Slovak experts and support for Slovak start-ups and SME's.

Access for international collaboration of SME's and also research and development in space sector will be raised. It is still to be specified which domains Slovakia will strengthen and prioritize with its potential to expand in the space sector.

Slovakia has been cooperating with the ESA since 2010 and has long demonstrated its interest in space activities and understanding of their significance for the further development of the space ecosystem and building of space infrastructure in Slovakia.
All the industry and researchers, start-ups and private sector are being informed through calls and latest initiatives related to capacity building through (www.eraportal.sk) and the Slovak Space Office (http://slovak.space/spaceoffice.sk).

Education programmes such as EUSPA Academy and ESA RUS trainings are one of the great examples how to support space industry developments and Copernicus Program as source of open data for further developments and applications in Earth Observation domain with its services.

The Slovak Republic intends to join NATO Space Center of Excellence (HQ in Toulouse, France). The CoE's mission will be to support NATO, its sponsoring nations and contributing participants in the field of space development of concept and doctrine, education and training, and lessons learned. For the time being, the Memorandum of Understanding is being drafted by France.

The Ministry of Defence of the Slovak Republic sees the main advantage of joining the NATO Space CoE the possibility to contribute to the development of shared capabilities that will be inevitable for the Slovak Armed Forces' interoperability with their partners in the future (in the spheres of intelligence, navigation, communication systems).

As the CoE membership is conditioned by sending at least one Slovak officer to the Staff Structure of the CoE the Slovak MoD is currently evaluating its personal capacities in this sphere.

Sweden

The Swedish Civil Contingency Agency (MSB) is active in the work with Galileo's publicly regulated service (PRS) and is currently building up the ability to be able to use the service in Sweden.

MSB also participates in other relevant working groups within the EU to monitor and highlight Sweden's needs and requirements related to the development of space services.

The Netherlands

1. Additionally to C.2 the Netherlands supports capacity-building initiatives. For example the Netherlands brings in and shares expertise on space law and data accessibility related matters within ESA, EU and UNCOPUOS programmes and initiatives.

2. Furthermore, the Netherlands supports capacity building in developing countries through the Geodata for agriculture and water programme (G4AW) that is commissioned by the ministry of foreign affairs of the Netherlands. The programme aims at supporting smallholder farmers with information and/or financial services based on satellite data thereby contributing to food security.

3. Through the Satellite Data Portal the Netherlands provides high resolution optical data for the entire Netherlands freely to users from within Europe. This data is often used for training purposes and validation and calibration of services.

Guideline C.4 — Raise awareness of space activities

EU institutions

The European Union has set-up specific outreach instruments managed by the European Commission for promotion and awareness raising activities, both in the EU and in non-EU countries.

The Foreign Partnership Instrument funds the 'Global Action on Space' (2021-24) to enable new opportunities for the EU space ecosystem worldwide. Through this Action, the European Commission deploys a wide number of outreach activities worldwide, including, inter alia: the provision of targeted space market reports on more than 40 countries around the world; 'space diplomacy' activities and training and individualised coaching to both the public and private sectors wishing to engage into cooperation on space with partners from all 5 continents.

The Galileo Information Centres in Latin American countries provide information on European Global Navigation Satellite System, enable local capacities and promote academic and business-to-business cooperation between EU space actors and relevant counterparts in Latin America.

The Copernicus Relays and Academies are two well-established networks. They contribute to create local expertise and boost knowledge sharing on Copernicus both in the EU and in non-EU countries.

Member States

Austria

The Austrian Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology responsible for Space Affairs in Austria and the Austrian Research Promotion Agency responsible for implementing the Austrian Space Strategy develop and implement various awareness raising activities for different user communities.

Cyprus

Cyprus is currently raising awareness of space activities with seminars/conferences and through communications channels of the Deputy Ministry of Research Innovation and Digital Policy.

Denmark

The first Danish national Space strategy from 2016 focused on cooperation between industry, research institutes and authorities to promote the awareness of the possibilities that space can offer a modern society. The strategy was updated in 2021 with a number of themes of which one relates to security and protection of space infrastructures. This include actions to avoid collision of space objects, e.g. use of STM and SST.

España

España contribuye a la divulgación de los eventos críticos y desarrollos tecnológicos más importantes ya sea a través de RRSS propias como las del CDTI y/o las de otros como la Agencia Espacial Europea con el objetivo de aumentar la concienciación del público general sobre la sostenibilidad a largo plazo de las actividades en el espacio ultraterrestre. España promueve además la participación y asistencia de medios de comunicación generalistas en eventos destacados de espacio como los lanzamientos de la Agencia Espacial Europea de satélites con importante participación nacional.

Germany

The potential applications of space-based activities are diverse. German space actors such as DLR and the German space industry are naturally interested in bringing the benefits of German and international space activities into the focus of the public.

The German Space Agency regularly publishes the journal 'Countdown', which is available free of charge in printed form and online. It contains contributions on current topics and space activities. The exhibition INNOspaceEXPO "ALL.TÄGLICH!" informs about the importance of space technologies in everyday life and is also accessible virtually.

At the DLR_School_Labs at various locations in Germany as well as online, researchers at DLR pass on their knowledge of experiments under space conditions or of technical phenomena in space activities to school groups. The student labs are interactive and convey knowledge about space applications and their significance for modern life on earth.

Non-state actors in German space activities are also committed to making the areas of application and advantages of space-based projects more tangible and better known. The German Aerospace Industries Association has launched the campaign Space is #all-embracing (Raumfahrt ist #allumfassend) to show how space applications help shape and simplify our daily lives.

Italy

Italy promotes several initiatives that contribute to raise awareness of space activities and its benefit for the society, as well of the needs to preserve the space environment for future generations.

The ASI/IAF International Space Forum at Ministerial Level initiative aims to encourage a global and local discussion and debate on the necessity of promoting a greater involvement of the Academia and research centres into space activities. It contributes to the flowing of space knowledge also in regions of the world where space activities are not yet developed or its benefits are not yet known enough.

Furthermore, Italy is a strong supporter of the Space Economy Leaders Meeting initiative, launched by the Saudi Space Commission in 2020, in the margins of the G20, which aims to raise the awareness of the importance of the space economy for the global economy and to promote the inclusion of such topic in the agendas of the G20. In 2021, Italy, through ASI, organised the second edition of the initiative, in the margins of the G20 under the Italian Presidency of the G20, and promoted the adoption of a final recommendation dedicated to the promotion of the implementation of the LTS guidelines. The Indonesian space agency has organized the 2022 edition and the Indian space agency is already preparing the next year edition.

Malta

The deliverables of SRF projects include open access to research outputs through the publication of articles in reputable, peer-reviewed journals, local media, participation and dissemination of results in local educational events and international conferences, and the organisation of at least two public dissemination events. These activities help to promote space downstream activities and increase awareness on and uptake of space applications by the public and private sector.

Various outreach activities and dissemination events are organised, providing an avenue for researchers to share their work, discuss ideas concerning developments within the local space sector and promote space-related activities that are taking place locally. These activities encourage dialogue between practitioners, experts, and researchers in different fields of the local Space sector, and provide an avenue for further collaborations between key, local stakeholders.

MCST and Esplora organise various educational and training activities in collaboration with the European Space Agency. A series of different topics are covered through this programme and is targeted towards audiences in different career stages. These activities serve as a tool to further raise awareness and promote the use of space applications by the public and private sector.

The project "Maleth", lead by Prof Joseph Borg (University of Malta), helped in raising awareness in space activities streaming and promoting a space music composition from the International Space Station, created by Dr Leonardo Barilaro from Malta College of Arts, Science and Technology (MCAST).

During the academic year 2021/2022 MCAST, within the framework of its Aerospace Program, organized 4 seminars for dissemination, inviting four world-class researcher and professors in the field of space activities. Erasmus international exchange started with the University of Padova. MSc Students project with ESA are targeted for the new ay 2022/2023.

Portugal

The Portuguese Space Agency has led different activities of awareness to space, such as summer free courses for the young public, a space bus that crossed the country with open content for the general public and a national competition for secondary school students to flight in zero G gravity, besides the CANSAT or the EuROC, the first European rocketry competition.

Slovakia

The Slovak Space Office actively promotes institutional and public awareness of space activities and their applications for sustainable development, environmental monitoring and assessment, disaster management and emergency response (e.g. through outreach events, hackathons, startup incubation programme).

The Slovak Space Office also actively supports activities of non-governmental entities (e.g. R&D projects or events conducted by companies and researchers) enhancing the long-term sustainability of outer space activities.

One of the initial steps towards raising awareness of space activities in Slovakia was the launch of Slovak Space Office and the establishment of a National Contact Point (NCP) for the EU Space Programme. Both of these entities work in close cooperation in order to provide orientation and practical information regarding opportunities for Slovak entities which are interested in participating in space-related programmes of the EU. The underlying objective is to connect Slovak entities (academia, governmental and non-governmental institutions, and private sector) that are present in the space ecosystem more efficiently with one another and with potential international partners.

NCP for the EU Space Programme operates similarly and very closely with Slovak NCPs for Horizon Europe (HE). This entails dissemination of information through common channels (social media, web portals, newsletters etc.), preparation of joint events, participation in HE networking projects, or sharing knowledge and experience in order to increase Slovak participation in EU programmes. Subsequently the goal of these activities is to search for and present success stories in order to encourage new players who will bring innovative solutions and services enhancing the quality of life on Earth to enter European space ecosystem.

Several barriers that are being gradually addressed are:

a) out-reach activities among graduates and young professionals to promote space activities,
b) participation in popularisation events for the general public in order to present the many uses of space technology and data in everyday life,
c) strengthening cooperation and the flow of information between the space actors in Slovakia.

Sweden

The Swedish National Space Agency (SNSA) actively works to raise the awareness of space activities in the community, mainly through programs for students of all ages, including design of material for educational purposes. The Swedish Civil Contingency Agency (MSB) is actively raising awareness of developments in the space domain and what consequences it has for society from safety and security perspectives. This is done by writing reports, giving lectures and appearing in the media. The Swedish Meteorological and Hydrological Institute (SMHI) and the SNSA are participating in Copernicus and its Committees, in boosting the knowledge and use of Copernicus and its services.

The Netherlands

The Netherlands underlines the importance of enhancing the long-term sustainable use of outer space and contributes to this by raising raising-awareness in different ways. For example by statements and participations in WG groups within UNCOPUOS and supporting private entities that will enhance the long term sustainability. On the other hand the Netherlands, in particular the International Institute of Air and Space Law of Leiden and the Radiocommunication Agency, offers regularly support to academies, private entities and universities all over the world in providing education and information about the legal and regulatory aspects of conduction space activities.

D. Scientific and technical research and development

Guideline D.1 — Promote and support research into and the development of ways to support sustainable exploration and use of outer space

EU institutions

The European Union research and Innovation programme Horizon Europe supports research into sustainable exploration and use of outer space through research grants in all three parts of the programme: in Excellent Science, in Global Challenges & European Industrial Competitiveness and in Innovative Europe. Examples are:

- extensive research in the field of Space Surveillance and Tracking (Space Based Surveillance System, Automated Collision Avoidance …);
- innovative instrumentation and technologies enabling space science and exploration missions;
- robotic servicing and exploration technologies;

- technologies for in-situ space resources utilisation;
- technologies for sustainable use of Earth orbit and of resources (e.g. raw material, rare-earth metals), e.g. modularity, standard interfaces, orbital replacement units, serviceability including refuelling, self-removal and decommissioning.

Member States

Austria

Austria supports research into and development of ways to support sustainable exploration and use of outer space.

The development of sustainable space technologies should be included in the EU space programmes.

The environmental footprint of the space engineering sector should be enhanced.

Austria supports efforts of the EU to increase the participation of developing countries in space activities specifically relevant for sustainable development and climate protection.

Denmark

The guideline is partly incorporated in the Danish space law through requirements on safety and environmental impact for new space activities, but the other aspects of the guideline are not yet implemented.

España

España promueve de manera muy activa las actividades de investigación y desarrollo en este ámbito, ya sea a través de las actividades tecnológicas financiadas en el marco de la Agencia Espacial Europea como mediante instrumentos propios de financiación nacional (algunos ejemplos serían el Plan Estatal de Investigación Científica y Técnica y de Innovación (PEICTI), los instrumentos de financiación del CDTI, o más recientemente el Plan de Recuperación, Transformación y Resiliencia financiado por el Mecanismo de Recuperación y Resiliencia).

Germany

Germany aims to support the implementation of this guideline through national programmes, European projects at ESA and EU, as well as internationally.

Through DLR, Germany is involved in the activities of the Committee on Space Research (COSPAR), which develops guidelines for protecting the Earth and space from harmful contamination. The Product Assurance, Safety & Sustainability Requirements for DLR Space Projects contain requirements based on the COSPAR guidelines.

In addition, Germany contributes to the promotion and development of sustainable space technologies through numerous initiatives. With a strong focus on sustainability in the new national space strategy, Germany plans to become even more intensively involved in the matter.

Italy

Italy implements this Guideline through continued support on the development of new technology, both through national programmes and projects overseen by the ESA and the EU. Through both avenues, there are opportunities to fund technology that seek to minimise the environmental impact of space assets throughout their lifecycle. Italy also supports the national scientific community in the development of appropriate metrics to assess the impact of missions on the space environment.

Malta

Although still in its infancy, local research is being conducted on the development of Space Surveillance and Tracking technologies such as fragment impact devices on Satellites and object catalogue registries that are able to quickly update orbit information of surrounding, orbiting objects and their relative positions to each other. Other research is being conducted concerning the development of Pico Satellites.

Research was also conducted to see whether off the shelf components could be used to build space-worthy Satellites that could withstand high levels of radiation without being compromised. The initial testing was successful and further development of these satellites is still ongoing.

Since the beginning of 2021 MCAST started activities for the development of techniques for assessing and reducing the risk posed by space debris related to the following topics:

- Measurement (i.e. monitoring);
- Protection and diagnostic;
- Space Debris mitigation.

These three main topics are functional for the development of Statistic Optimization techniques for Hypervelocity Impacts (HVI) protection systems, to improve the mass distribution efficiency and overall performances of the spacecraft systems.

The new academic year 2022/2023 will see also the start of research related to the development of Ballistic Limit Equations (BLEs) and analysis of their uncertainties.

Portugal

The public funding destined to R&D open competitions includes the thematic area of space to with the I&D Center can apply, preserving the freedom of research. For example, 8 research centers work with space weather, 3 that work with Near Earth Orbits and 4 in precision flying, all areas that contribute to a sustainable exploration and use of outer space.

Slovakia

Slovakia promotes and supports research into and the development of sustainable space technologies, processes and services and other initiatives for the sustainable exploration and use of outer space (e.g. through its collaboration with ESA, Horizon Europe, hackathons, incubation programme).

On August 17, 2022 the Ministry of Defence of the Slovak Republic published a Call for application of request for grants for R&D projects in the sphere of defence. One of the given topics of the projects- to-be is “the domain of space and space technologies”. It is aimed at research study with practical application in the sphere of the Ministry of Defence. The details can be found: https://www.mosr.sk/ucelova-podpora/.

The Netherlands

The Netherlands is supportive of research into and the development of ways to support sustainable exploration and use of outer space. For example, the Netherlands was instrumental in creating The Hague International Space Resources Governance Working Group, established in 2016, supporting research concerning a potential governance framework on space resources.

Guideline D.2 — Investigate and consider new measures to manage the space debris population in the long term

EU institutions

Horizon Europe supports in the Global Challenges & European Industrial Competitiveness pillar research fostering a sustainable, safe and at the same time economical viable use of space. Specifically in the Future Space Ecosystem topic area the research and Innovation actions aim at the paradigm shift to towards a sustainable, highly automated, flexible, maintainable and economically viable space infrastructure in a holistic approach, prepared to minimise environmental impact and maximise commercial opportunities in space and on Earth: the future space ecosystem.

The EU SST Partnership will be in charge of developing activities aiming to space debris mitigation in order to reduce their generation; and space debris remediation by managing the existing space debris. These activities will contribute to the development of new measures to manage the debris population in the long term.

Space robotics, automation and Artificial Intelligence (AI) combined with standardization, modularization and digitalization have been identified as strategic elements for improving aspects such as flexibility, cost-efficiency and protection of the space environment as in their applications in on-orbit satellite services: an enabler for the green deal in space.

The main activity areas:

- Application and service concepts and key technologies for in-space services up to demonstration in orbit, i.e. on-orbit servicing, assembly/disassembly, manufacturing, upgrade, re-use/recycle, relocation, de-orbiting, active debris removal, logistics, etc.
- New system concepts that will enable the evolution from mission individual spacecraft design towards a more long-term vision of an automated, flexible and sustainable space infrastructure, based on modular, adaptable and maintainable space assets composed of functional modules (that are developed independent from an individual mission and that can be attached to a platform to upgrade platforms' functionality).
- Application and service enabling technologies such as electric propulsion, robotics, AI, etc.

The envisaged, modular approach will enable a complete, game-changing paradigm shift in the way space assets are designed, built, integrated, tested, how space is accessed, used and commercially exploited in the coming decades, while offering the opportunity to simplify the disassembly, partially reuse or recycle of future space assets to safe resources (i.e. raw material, rare-earth metals) and reduce costs.

Investigation of new measures could include, inter alia, methods for the extension of operational lifetime or the adaption of the mission objectives, new technologies to allow the use of in-space service capabilities, novel techniques prevent collision with and among debris and objects with no means of changing their trajectory, advanced measures for spacecraft passivation and post-mission disposal and designs to enhance the disintegration of space systems during uncontrolled atmospheric re-entry.

Member States

Austria

Austria supports continued EU engagement in this area.

Overall, the innovative and economic potential in the engagement in space sustainability should be strengthened.

Denmark

Denmark follows international work on guidelines and technical standards with the purpose to implement these into the national space regulation when relevant. Danish industry and academia participate in national and international research on Space debris.

España

España, a través del Consorcio EUSST, contribuye en el desarrollo de nuevos servicios de mitigación y remediación. Hasta la fecha, España ha proporcionado apoyo en varias misiones y pruebas operacionales de este tipo, entre las que destacan:

- Apoyo para el acoplamiento para servicio en órbita de MEV-2.
- Soporte a la misión ELSA-d., experimento enfocado en un potencial nuevo servicio de Active Debris Removal (ADR). España lideró la coordinación de los sensores y contribuyó con datos de sensores españoles.
- El S3TOC lideró el apoyo de EUSST a EUMETSAT en las últimas etapas operacionales de METOP A, el primer satélite meteorológico en órbita polar.

Adicionalmente España es uno de los EEMM miembros más activos en las actividades de "PERASPERA" de la UE que incluye temas relativos a "In Orbit Service", entre otras aplicaciones para retirada de basura espacial.

Germany

At German universities and institutes, numerous research projects are under way on novel technological approaches of dealing with space debris. These projects explore novel engines, mechanisms for enabling space objects' disposal, methods for the active removal of space debris and much more.

The German Space Agency dynamically adapts the Product Assurance, Safety & Sustainability Requirements for DLR Space Projects to swiftly integrate new scientific findings into the requirements. New developments, such as design for demise approaches or specific measures applicable to satellite constellations are also taken into consideration. Space cyber security is also considered in these Requirements.

At ESA level, Germany supports the guidelines of COPUOS by funding programmes to promote the responsible and sustainable use of space, such as the first space debris removal mission (ClearSpace-1) to remove an ESA-owned space debris object from LEO.

Italy

We may refer to the ASI activities in the field of space debris mitigation as falling into three different domains:

a) IADC. ASI has been one of the founding members of the International Space Debris Coordination Committee and as such it actively participates to the definition of guidelines and of the regulatory aspects of the space activities, to the technical working groups devoted to studying the most relevant topics involved into monitoring the space debris and to the sharing of assets and data when joint observational campaigns are organized;

b) EUSST. ASI is the national entity representing the Italian involvement into the EUSST for providing services in the three major domains of space debris monitoring: collision avoidance, re-entry and fragmentation. This implies developing an operational capability at national level and the sharing of data and assets within the consortium;

c) Research. ASI supports research initiatives either directly through the funding of national programs or through fostering the participation of academic or research entities to EU or international cooperative programs on space debris. ASI applies the European Code of Conduct for Space Debris Mitigation, which it has signed on 14 February 2005, through its standard contract provisions, which gives to the European Code of Conduct a mandatory character. After 2005, the European Code of Conduct for Space Debris Mitigation is an applicable document to all phases of all space missions.

Malta

In the framework of the MCAST Aerospace Program, the research focus at MCAST is on the following activities:

- Measurement of the effects of MMOD environment for new Risk Assessment (RA) strategies.
  - Conceptual design of a single-stage Light-Gas Gun (LGG) facility has been performed: To test new aerospace materials, simulate HVI in GEO, structural testing of spacecraft subsystems. Next step is the funds retrieval to build the facility at MCAST.
- Experiment design of a payload for a sub-orbital rocket to study spacecraft repair after space debris impacts.
  - Conceptual design on-going. After successful validation on a sub-orbital rocket the following step will be an improved design to be tested onboard the International Space Station.
- Assessment of optical surfaces deterioration following impacts with space debris.
  - Ongoing definition of the requirements for impact test campaigns to validate and extend the craterisation models available.

These activities are developed in collaboration with CISAS at the University of Padova (Italy), South East Technological University (Ireland) and INAF Bologna (Italy).

Sweden

The Swedish National Space Agency (SNSA) supports industry involvement in ESA programs for in-orbit debris removal.

The Netherlands

The Netherlands participates in the debate in UN COPUOS concerning the need and feasibility of new measures for space debris mitigation. As part of the envisaged revision of the Act (see A.1) the Netherlands will also investigate the necessity for new measures to manage the space debris population in the long term.