

COMPENDIUM

**SPACE DEBRIS MITIGATION STANDARDS
ADOPTED BY STATES AND INTERNATIONAL ORGANIZATIONS**

19 JANUARY 2021

TABLE OF CONTENTS

Introduction	4
Part 1: National mechanisms	
Algeria	5
Argentina.....	6
Australia	7
Austria (Updated on 21 March 2016)	9
Azerbaijan (Added on 6 February 2019)	12
Belgium	13
Canada.....	15
Chile.....	19
Czech Republic	20
Denmark (Added on 14 June 2018).....	21
Finland (Added on 26 January 2018).....	23
France.....	25
Germany.....	29
Greece (Updated on 19 January 2021)	33
Indonesia (Added on 6 April 2017).....	35
Italy.....	36
Japan	38
Mexico.....	40
Myanmar (Updated on 18 January 2021)	41
The Netherlands (Updated on 8 September 2015)	42
Nigeria	43
Poland	44
Russian Federation (Added on 18 February 2019).....	45
Slovak Republic	51
Spain.....	52
Switzerland.....	53

Thailand (Added on 10 February 2016).....54

Ukraine (Updated on 10 January 2017)55

United Kingdom of Great Britain and Northern Ireland.....57

United States of America59

Part 2: International mechanisms

Committee on the Peaceful Uses of Outer Space (COPUOS): Space Debris Mitigation Guidelines.....67

European Space Agency (ESA): Space Debris Mitigation Policy for Agency Projects68

Inter-Agency Space Debris Coordination Committee (IADC): Space Debris Mitigation Guidelines 70

International Organization for Standardization (ISO): Standards and technical reports (Added on 5 September 2018)71

International Telecommunications Union (ITU): Recommendation ITU-R S.1003.2.....77

Italian Space Agency (ASI), British National Space Centre (BNSC), French Space Agency (CNES), German Aerospace Agency (DLR) and European Space Agency (ESA): European Code of Conduct for Space Debris Mitigation79

INTRODUCTION

As a contribution of Canada, the Czech Republic and Germany to the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), and in reference to the agenda item on “General exchange of information and views on legal mechanisms relating to space debris mitigation measures, taking into account the work of the Scientific and Technical Subcommittee” of the Legal Subcommittee (LSC) of the Committee, this report provides a compendium of standards adopted by States and international organizations to mitigate space debris. The aim of this Compendium is to inform States of the current instruments and measures that have been implemented by States and international organizations, and to assist those who wish to enact or develop similar standards in relation to this important topic.

This document is organized in the following manner: Part 1 contains an alphabetical list of States’ profiles, followed by Part 2 which contains a list of international mechanisms. Each profile focuses on debris mitigation mechanisms developed and implemented by the respective State and / or international organization.

The present edition of the Compendium is considered to be a first step of an evolving process. It does therefore not represent an exhaustive source of information on this topic. States and international organizations are invited to provide information on their mechanism they have adopted, based on the template developed, or to update their profile if necessary. Ultimately, it is hoped that this document will provide a comprehensive reference to support members of the Committee on the Peaceful Uses of Outer Space in their coordinated efforts towards space debris mitigation.

Acknowledgment

The initiators of this Compendium on Space Debris Mitigation Standards would like to thank the Legal Services Department of the European Space Agency (ESA) for their editorial support in the frame of compiling and finalizing this documentation.

ALGERIA**National mechanism:**

Throughout its recent activity in the space field and the number of national satellites in orbit (there are two as of June 2014), the People's Democratic Republic of Algeria has not adopted at present a national mechanism for the reduction of space debris. However, reflections are initiated aiming at the implementation of appropriate national solutions to this issue as well as the choice of a site that can accommodate a space debris observatory.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a permanent member of the Committee on the Peaceful Uses of Outer Space, Algeria attaches a big importance to the issue of space debris and is pleased about the work carried out during several years within the Committee, and resulting in the adoption by consensus of the "space debris mitigation guidelines." In this respect, Algeria fully supports the principle of voluntary use of such guidelines.

Furthermore, as a member of the International Telecommunication Union, Algeria considers that the ITU (ITU-R S.1003-1) recommendations on "the protection of environment of the geostationary satellites orbit" are appropriate measures to reduce space debris.

Link to other national mechanisms:

None.

References:

None.

ARGENTINA**National mechanism:**

Argentine Republic has not adopted yet any national mechanism on space debris mitigation. Low profile discussions are in progress with a view to develop national space-related legislation in the near future.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, the Argentine Republic fully adheres to the Space Debris Mitigation Guidelines of the Committee. Furthermore it supports IADC Space Debris Mitigation Guidelines.

Link to other national mechanisms:

None.

References:

None.

AUSTRALIA

National mechanisms:

As of November 2013, Australia has not adopted yet any national mechanism to fully implement the Space Debris Mitigation Guidelines of the Committee or IADC Space Debris Mitigation Guidelines into binding legislation. Space debris mitigation policy is confirmed in:

1. Australia's Satellite Utilisation Policy – 2013
2. Guidelines for Applicants seeking to apply for an Overseas Launch Certificate

Legal Framework: *Space Activities Act*, 1998

1. Australia's Satellite Utilisation Policy

Description:

In April 2013, the (then) Australian Government released its new space policy, formally known as *Australia's Satellite Utilisation Policy*, principle four of which confirms that, in contributing to a stable space environment, the Australian Government will *inter alia*:

“Adhere to the UN Space Debris Mitigation Guidelines in undertaking its space activities.”

and

“Actively participate in the negotiation of an International Code of Conduct for Outer Space Activities, as an important and necessary step in the development of international norms for good behaviour in space.”

Australia's Satellite Utilisation Policy, which closely follows, but replaces, the previously released (September 2011) *Principles for a National Space Policy*, is a statement of Australia's objectives and direction for civilian space activities.

Applicability:

Australia's Satellite Utilisation Policy, which closely follows, but replaces, the previously released (September 2011) *Principles for a National Space Policy*, is a statement of Australia's objectives and direction for civilian space activities. It is not a legal document.

2. Guidelines for Applicants seeking to apply for an Overseas Launch Certificate

Description:

The Guidelines for Applicants seeking to apply for an Overseas Launch Certificate pursuant to the Space Activities Act 1998 specify that an applicant for an overseas launch certificate should provide *inter alia* the following:

“a debris mitigation strategy that addresses the Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS).”

The launch from outside Australia of a payload or launch vehicle in which an Australian national has an ownership interest, including an ownership interest in any part of the payload or launch vehicle, requires an overseas launch certificate. An Australian national must also obtain an overseas launch certificate to carry out a launch overseas. The Guidelines for Applicants seeking to apply for an Overseas Launch Certificate is issued by the relevant Government regulatory authority, the Space Licensing and Safety Office (SLASO), to advise potential applicants of the administrative requirements for the issue of this certificate.

Applicability:

The *Space Activities Act 1998* is binding Australian legislation. The requirements under the Act and the *Space Activities Regulations 2001* for applicants seeking an overseas launch certificate, as they are reflected in the Guidelines for Applicants seeking to apply for an Overseas Launch Certificate, are binding on all Australian nationals, with certain exemptions for Commonwealth entities.

Relation to international mechanisms:

The *Space Activities Act 1998* reflects obligations set out under the Outer Space Treaty, the Rescue Agreement, the Liability Convention, the Registration Convention and the Moon Agreement. These treaties are incorporated as schedules to the Act.

Link to other national mechanisms:

None.

References:

- Satellite Utilisation Policy
<http://www.space.gov.au/Documents/Australia's%20satellite%20utilisation%20policy%20-%20version%201.1p%20-%2016%20April%202013.pdf>
- Space Activities Act 1998 (Cth)
<http://www.comlaw.gov.au/Details/C2004C01013>
- Space Activities Regulations 2001
<http://www.comlaw.gov.au/Details/F2004C00906>
- Guidelines for Applicants seeking to apply for an Overseas Launch Certificate
http://www.space.gov.au/SpaceLicensingSafetyOffice/Documents/OLC_Guidelines_08_05_2013.pdf

AUSTRIA

National mechanisms:

1. Austrian Outer Space Act of 2011 (Bundesgesetz über die Genehmigung von Weltraumaktivitäten und die Einrichtung eines Weltraumregisters - Weltraumgesetz) entered into force on 28 December 2011 (Bundesgesetzblatt I Nr. 132/2011 of 27 December 2011).
2. Austrian Outer Space Regulation of 2015 (Verordnung der Bundesministerin/des Bundesministers für Verkehr, Innovation und Technologie zur Durchführung des Bundesgesetzes über die Genehmigung von Weltraumaktivitäten und die Einrichtung eines Weltraumregisters - Weltraumverordnung) entered into force on 27 February 2015 (Bundesgesetzblatt II Nr. 36/2015 of 26 February 2015).

Description:

The Austrian Outer Space Act is the legal basis for Austrian space activities. In its § 4, subparagraph 1, letter 4, the Act provides that one of the conditions for authorisation of a space activity is that “appropriate provision has been made for the mitigation of space debris according to § 5”.

§ 5 of the Austrian Outer Space Act is entitled “Mitigation of Space Debris” and provides that “the operator has to make provision for the mitigation of space debris in accordance with the state of the art and in due consideration of the internationally recognised guidelines for the mitigation of space debris. Especially measures limiting debris released during normal operations have to be taken.”

The Explanatory Report to the Austrian Outer Space Act explains the meaning and scope of § 4, subparagraph 1, letter 4 and § 5 as follows:

As to § 4, subparagraph 1, letter 4:

“The avoidance of space debris is an important concern of all States and all operators of space activities. Therefore, a separate paragraph, § 5 (see below), has been formulated on the mitigation of space debris which emphasises this particular importance. The condition for authorisation under letter 4 has therefore to be read and applied in combination with § 5.”

As to § 5 (Mitigation of Space Debris):

“The mitigation of space debris is an important concern of all States and operators of space activities. Therefore, the obligation to mitigate space debris plays an important role already in the conditions for authorisation in conjunction with § 4, subparagraph 1, letter 4. In this sense, § 5 and § 4, subparagraph 1, letter 4 have to be read and applied in conjunction. Furthermore, the obligation to mitigate space debris represents an ongoing obligation of the operator also after the authorisation.”

Furthermore, the Explanatory Report specifies that the “internationally recognised guidelines for the mitigation of space debris” referred to in § 5 are first and foremost the 2002 Space Debris Mitigation Guidelines of the Inter-Agency Space Debris Mitigation Committee (IADC). Moreover, it is noted that the European Space Agency (ESA) has aligned its “Requirements on Space Debris Mitigation for ESA Projects” of 2008 with the IADC guidelines and that the Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space of 2007 are also oriented towards them.

The Austrian Outer Space Regulation contains several details in implementation of the Austrian Outer Space Act. As condition for authorisation of a space activity the Regulation provides in § 2, subparagraph 4 that the operator must submit evidence that appropriate provisions have been made for the mitigation of space debris according to § 5 of the Austrian Outer Space Act. To this end, the operator must submit a report on the measures adopted according to the state of the art and in consideration of the internationally accepted guidelines, in particular for the avoidance of space debris and mission residue released during normal operations, for the prevention of on-orbit collisions with other space objects, for the avoidance of on-orbit break-ups of the space object as well as for the removal of the space object from orbit at the end of mission, either by controlled re-entry or by moving the space object to a sufficiently high orbit (“graveyard orbit”). For non-manoeuverable space objects an orbit has to be chosen where their post-mission lifetime does not exceed 25 years.

Applicability:

The scope of application of the Austrian Outer Space Act is regulated in its § 1:

“(1) This Federal Law is applicable to space activities carried out

1. on Austrian territory,
2. on board of vessels or airplanes, registered in Austria or
3. by a natural person with Austrian citizenship or legal persons seated in Austria.

(2) Entitlements under private law are covered by this Federal Law only if Austrian law is applicable according to the rules of private international law.”

Relation to international mechanisms:

The IADC Space Debris Mitigation Guidelines, the ESA Requirements on Space Debris Mitigation and the Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space are explicitly referred to in the Explanatory Report to the Austrian Outer Space Act in order to specify what is meant by “internationally recognised guidelines for the mitigation of space debris” in § 5. This means that, during the authorisation process, particular attention will be paid to these guidelines by the authorising body. Operators not complying with these guidelines risk not obtaining an authorisation for their planned space activity.

ITU Recommendations are only mentioned with respect to frequency allocation (see § 4, subparagraph 1, letter 6, according to which the authorising body has to verify whether the operator fulfils the requirements of the ITU concerning orbital positions and frequency assignments).

The European Code of Conduct for Space Debris Mitigation and the ISO Standards on space debris (e.g.: ISO 24113:2011 Space Systems – Space Debris Mitigation Requirements) are not explicitly mentioned but may nevertheless be taken into consideration as “internationally recognised guidelines for the mitigation of space debris” in the application of § 5.

Link to other national mechanisms:

None.

References:

- The Austrian Outer Space Act (English translation):
<http://www.unoosa.org/documents/pdf/spacelaw/national/austria/austrian-outer-space-actE.pdf>
<http://www.spacelaw.at/services/united-nations-treaties-and-austrian-space-legislation/>
- German original of the Austrian Outer Space Act as published in the official gazette of 27 December 2011: Bundesgesetz über die Genehmigung von Weltraumaktivitäten und die Einrichtung eines Weltraumregisters (Weltraumgesetz)
<http://www.ris.bka.gv.at/Dokument.wxe?Abfrage=BgblAuth&Dokumentnummer=BGB LA 2011 I 132>
- The Austrian Outer Space Regulation (English translation):
<http://www.spacelaw.at/services/united-nations-treaties-and-austrian-space-legislation/>
- German original of the Austrian Outer Space Regulation as published in the official law gazette of 26 February 2015: Verordnung der Bundesministerin/des Bundesministers für Verkehr, Innovation und Technologie zur Durchführung des Bundesgesetzes über die Genehmigung von Weltraumaktivitäten und die Einrichtung eines Weltraumregisters (Weltraumverordnung)
<http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20009102>
- Explanatory Report (English translation):
<http://www.spacelaw.at/services/united-nations-treaties-and-austrian-space-legislation/>

AZERBAIJAN

National mechanisms:

No special national mechanism related to space debris has been adopted.

However, a procedural requirement was established in accordance with Presidential Orders ref. 3303 dated 10 October 2017 and ref. 3738 dated 1 March 2018, which entrusts “Azercosmos” OJSCo to carry out activities to implement the launch, operation and exploitation of the satellites of the Republic of Azerbaijan with telecommunication, Earth observation and other missions. Furthermore, this procedural requirement inter alia applies to space debris mitigation (if any) in relation to the satellites that fall under jurisdiction and responsibility of the Republic of Azerbaijan.

Description:

“Azercosmos” OJSCo is state-owned entity established to carry out activities to implement the launch, operation and exploitation of the satellites of the Republic of Azerbaijan with telecommunication, Earth observation and other missions.

Applicability:

Presidential orders on “Azercosmos” OJSCo are applicable to all satellite related activities of the Republic of Azerbaijan within and outside the country.

Relation to international mechanisms:

General compliance and support to the following international mechanisms:

- ITU Recommendation ITU-R S.1003;
- Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space.

The following standards and guidelines are also taken into account:

- ISO Standards (24113: Space Systems — Space Debris Mitigation Requirements; and others);
- European Code of Conduct for Space Debris Mitigation;
- IADC Space Debris Mitigation Guidelines.

References:

- <http://azercosmos.az/about-us-legal-documents>

BELGIUM

National mechanisms:

1. Law of 17 September 2005 on Activities of Launching, Flight Operation or Guidance of Space Objects (revised by the Belgian Parliament on 1 December 2013)
2. Royal Decree of 19 March 2008

Description:

In Belgian Law, Space Debris issue is addressed under the provisions of the Law of 17 September 2005 on Activities of Launching, Flight Operation or Guidance of Space Objects (cf. article 4, §3, article 5, §1, and article 8, in particular §2, of the Law), as well as under the provisions of the Royal Decree of 19 March 2008 implementing some provisions of the Law (cf. article 7, §1, 3° and 4°, §2 and §4 on Nuclear Power Sources, of the Decree).

Neither the Law nor the Decree actually provides for technical space debris mitigation standards or norms to be complied with by the Operator, but it leaves to the Minister the possibility to impose to the Operator the compliance with standards and norms adopted by intergovernmental bodies and/or relevant non-governmental organizations. Such standards and norms are for instance the Space Debris Mitigation Guidelines adopted by the Committee on the Peaceful Uses of Outer Space, technical standards adopted by IADC, ESA norms & standards, ISO norms, national space agencies' norms, etc. (see below).

Technical compliance with those standards and norms may, if applicable, be supervised and checked by a technical expert designated by the Minister. For that purpose, a specific agreement has been concluded between the national authority (BELSPO) and ESA.

Applicability:

The Law applies to any activity which is carried on by an Operator from the Belgian territorial jurisdiction. The Operator is now defined (in the revised text) as he who exercises the ultimate authority over the activity (that is, the maneuvering of the space object). In the case of non-maneuverable space objects, the Operator is identified by the Law as he who orders the launch of the object according to specific parameters.

The Law doesn't make any distinction in its application whether the Operator is of Belgian nationality or foreign nationality.

Relation to international mechanisms:

Without prejudice to the Minister's decision on a case by case basis, it is likely that the conditions imposed to the Operator will refer to all the following instruments, standards and norms, provided that this doesn't result in any contradiction or redundancy: Space Debris Mitigation Guidelines of the Committee, IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003, European Code of Conduct for Space Debris Mitigation, and ISO Standards (24113: Space Systems – Space Debris Mitigation Requirements. Priority should

be given to Space Debris Mitigation Guidelines of the Committee complemented by IADC Space Debris Mitigation Guidelines.

The possibility also exists for the King to impose compliance with those instruments, standards and norms to all Operators. This is likely to happen once the first implementing cases of the Law will be reviewed. For the moment, the Law has not yet been implemented and the impact of the application of those instruments, standards and norms on the Belgian space operations sector has still to be assessed. This is why a case by case approach has been adopted so far.

Link to other national mechanisms:

So far, there is none. Although, it is explicitly provided by the Law and the Royal Decree that the Minister may call upon the expertise of foreign organisations before taking his/her decision on the application for authorisation.

References:

- http://www.belspo.be/belspo/space/beLaw_en.stm

CANADA

National mechanisms:

1. Canadian Remote Sensing Space Systems Regulations – 2007

Legal Framework:

- *Canadian Remote Sensing Space Systems Act, 2005 (amended 2007)*
2. Canadian Space Agency adoption of the IADC Space Debris Mitigation Guidelines – 2012
 3. Canadian Client Procedures Circular (CPC) for Licensing of Space Stations – 2014

1. Canadian Remote Sensing Space Systems Regulations

Description:

The Canadian Remote Sensing Space Systems Act is a national law adopted by Parliament. The Canadian Remote Sensing Space Systems Regulations are made by the Governor-in-Council upon the recommendation of the Minister of Department of Foreign Affairs, Trade and Development.

A remote sensing satellite disposal plan must be provided in order to obtain a Remote Sensing Satellite License in Canada. Under the Canadian Remote Sensing Space Systems Act, no person in Canada shall operate a remote sensing space system in any manner, directly or indirectly, except under the authority of a License. The Act mentions that a License may not be issued without a “system disposal plan” that, among other things, provides for the protection of the environment, public health, and the safety of persons and property. The Acts also sets out licensees’ requirements and obligations in regard to the disposal plan.

The Canadian Remote Sensing Space Systems Regulations provides information on the implementation of the Act. Under the section *Remote Sensing Satellite Disposal* in Schedule 1, the Regulations set out the requirements to be identified in the Disposal Plan, including the space debris mitigation standards. Those requirements are:

- a) method of disposal that is proposed for each satellite and the reliability of that method;
- b) estimated duration of the satellite disposal operation;
- c) probability of loss of human life and how it was calculated;
- d) amount of debris expected to reach the surface of the Earth, the size of the impact area expressed in square metres, and how they were calculated;
- e) confidence level of the determination of the boundaries and how the boundaries and confidence level were calculated;
- f) identity and quantity of hazardous material and dangerous goods contained in each satellite at the end of its mission life, the quantity expected to reach the surface of the Earth on re-entry and how the quantities were calculated;
- g) orbital elements and epochs of the proposed disposal orbits for each satellite;

- h) an assessment of space debris expected to be released from each satellite during normal operations by explosions, by intentional break-ups and by on-orbit collisions, and the measures proposed to mitigate the production of space debris.

Applicability:

The Act and its regulations are mandatory in Canada, and also apply to the following persons with respect to their activities outside Canada:

- (A) Canadian citizens;
- (B) permanent residents;
- (C) corporations that are incorporated or continued under the laws of Canada or a province;
- (D) members of any prescribed class of persons having a substantial connection to Canada related to remote sensing space systems.

2. Canadian Space Agency adoption of the IADC Space Debris Mitigation Guidelines**Description:**

The Canadian Space Agency (CSA) adopted the Inter-Agency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines in 2012 to mitigate the potential creation of space debris generated from its projects, missions and activities. It is intended to apply the IADC guidelines in the planning, design, construction, operation and end of life of CSA projects, missions and activities for which a Space Debris Mitigation Plan will be established as required in the guidelines.

Applicability:

The IADC Space Debris Mitigation Guidelines will apply to all CSA projects, missions and activities.

3. Canadian Client Procedures Circular (CPC) for Licensing of Space Stations**Description:**

Industry Canada, a Department of the Government of Canada, implemented a licensing regime for space stations (satellites) in 2014. The document *Client Procedures Circular (CPC) 2-6-02 – Licensing of Space Stations* sets out general licensing procedures for all Canadian space stations

(satellites), including application requirements and post-authorization procedures related to licenses that use radio spectrum.

Section 3.3.3 Space Debris Mitigation Plan of CPC-2-6-02 requires that applicants for space station spectrum and radio licences submit a Space Debris Mitigation Plan as part of their applications.

Industry Canada distinguishes between geostationary satellites and non-geostationary satellites. The following is an excerpt from section 3.3.3 of the CPC 2-6-02 describing the policy requirement:

- For geostationary satellites, the applicant must submit a plan for de-orbiting their satellite(s) in compliance with Recommendation ITU–R S.1003-2, *Environmental Protection of the Geostationary Satellite Orbit*.
- For non-geostationary satellites, the applicant must submit a plan for de-orbiting their satellite(s) in accordance with best industry practices.

Applicability:

Use of radio frequencies in Canada requires the regulatory approval that is provided through a Radio Licence issued by Industry Canada. The space debris mitigation requirement is applicable to all space stations (satellites) licensed in Canada. The licensee must agree to comply with all the conditions of licence prior to being granted the licence.

Relation to international mechanisms:

Canada contributed to and supported the development of the Space Debris Mitigation Guidelines of the Committee.

The space debris mitigation requirements of the Canadian Remote Sensing Space Systems Regulations are consistent with the Space Debris Mitigation Guidelines of the Committee and the IADC Space Debris Mitigation Guidelines.

The IADC Space Debris Mitigation Guidelines adopted by the CSA are consistent with the Space Debris Mitigation Guidelines of the Committee. They are also in compliance with the ISO 24113: Space Systems – Space Debris Mitigation Requirements, and the ITU recommendations ITU-R S.1003.

The Canadian Client Procedures Circular (CPC) for Licensing of Space Stations is in compliance with the ITU Recommendation ITU-R S.1003 and the Space Debris Mitigation Guidelines of the Committee.

Link to other national mechanisms:

None.

References:

- Canadian Remote Sensing Space Systems Act:
<http://laws-lois.justice.gc.ca/eng/acts/R-5.4/index.html>
- Remote Sensing Space Systems Regulations:
<http://laws-lois.justice.gc.ca/PDF/SOR-2007-66.pdf>
- CPC-2-6-02-Licensing of Space Stations:
<https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01385.html#s3.3>

CHILE**National mechanism:**

Chile has not adopted yet any national mechanism on space debris mitigation.

Low profile discussions are in progress with a view to develop national space-related legislation in the near future.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, Chile fully adheres to the Space Debris Mitigation Guidelines of the Committee. Furthermore it supports IADC Space Debris Mitigation Guidelines, ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011) and ITU Recommendation ITU-R S.1003.

Link to other national mechanisms:

None.

References:

None.

CZECH REPUBLIC**National mechanism:**

The Czech Republic has not adopted yet any national mechanism on space debris mitigation. Low profile discussions are in progress with a view to develop national space-related legislation in the near future.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, the Czech Republic fully adheres to the Space Debris Mitigation Guidelines of the Committee. Furthermore, it supports IADC Space Debris Mitigation Guidelines, European Code of Conduct for Space Debris Mitigation, ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011) and ITU Recommendation ITU-R S.1003.

Link to other national mechanisms:

None.

References:

None.

DENMARK

National mechanism:

The Danish Outer Space Act of 2016 (lov om aktiviteter i det ydre rum) entered into force on 1 July 2016 (Act no. 409 of 11 May 2016).

The Danish Executive Order on requirements in connection with approval of activities in outer space, etc. (bekendtgørelse om krav ved godkendelse af aktiviteter i det ydre rum m.v.) entered into force on 1 July 2016 (Executive Order no. 552 of 31 May 2016).

Description:

The Danish Outer Space Act and Executive Order on requirements in connection with approval of activities in outer space, etc. is the legal basis for Danish space activities.

Pursuant to section 6(1) no. 4 of the Act, approval of space activities requires that the operator has taken appropriate measures with regard to space debris management. Pursuant to section 6 of the Executive Order, the Danish Agency for Science, Technology and Innovation (now the Danish Agency for Science and Higher Education) may stipulate requirements that space activities which involve the launch of space objects into earth orbit meet relevant standards and guidelines for space debris management, such as standards published by the European Cooperation for Space Standardization (ECSS) or the International Organization for Standardization (ISO). As a general rule, within 25 years of the end date of the functional operating period of the space object, the space object must either safely leave its earth orbit again or safely be placed into an orbit where it is deemed not to constitute a danger to other space activities.

Applicability:

The Danish Outer Space Act and Executive Order apply to space activities carried out within the Danish State. Furthermore, the Act and Executive Order apply to space activities carried out outside the Danish State on Danish craft or facilities or by Danish operators.

Relation to international mechanisms:

The European Cooperation for Space Standardization (ECSS) and the International Organization for Standardization (ISO) are explicitly referred to in the Danish Executive Order on requirements in connection with approval of activities in outer space, etc. Other relevant standards and guidelines such as The Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, the IADC Space Debris Mitigation Guidelines, the ITU Recommendation ITU-R S.1003 and European Code of Conduct for Space Debris Mitigation can also be taken into consideration.

Link to other national mechanisms:

None.

References:

- The Danish Outer Space Act (English translation):
<https://ufm.dk/en/legislation/prevailing-laws-and-regulations/outer-space/outer-space-act.pdf>
- The Danish Executive Order on requirements in connection with approval of activities in outer space, etc. (English translation):
<https://ufm.dk/en/legislation/prevailing-laws-and-regulations/outer-space/executive-order-on-requirements-in-connection-with-approval-of-activities-in-outer-space-etc-final.pdfm>
- Application form and guidelines:
<https://ufm.dk/forskning-og-innovation/indsatsomrader/rummet-og-danmark/rumloven/ansogning-om-rumaktivitet>

FINLAND

National mechanism:

Act on Space Activities, adopted in January 2018, enters into force 23rd January 2018.

Decree of the Ministry of Economic Affairs and Employment on Space Activities, to be adopted and entering into force 23rd January 2018.

Description:

(i) Finland has just enacted a national Act on Space Activities. The act was proposed by the Government to the Parliament in the end of October, accepted by the Parliament in the end of December 2017 and enforced by the President in the beginning of January 2018. The act entered into force 23rd of January 2018. The act is complemented by a decree by the Ministry of Economic Affairs and Employment.

The scope of the Finnish act on space activities is space activities on the territory of Finland or on vessels or airplanes registered in Finland. The act applies both to governmental and non-governmental space activities. However, provisions on authorization, insurance and supervision are not applied to space activities by the national defence forces.

According to the act, space activities means launching space objects into outer space, operation and control of space objects in outer space and returning space objects to the Earth. Space object means any object launched or intended to be launched into outer space, including the component parts of such an object, and any device and its component parts used or intended to be used for launching an object into outer space. Operator means a natural or legal person who is responsible for the carrying out of space activities.

(ii) According to Section 5 of the act on space activities, space activities may only be carried on subject to prior authorization by the Ministry of Economic Affairs and Employment. The Ministry may authorize space activities if the conditions specified in the section are met. One of the conditions is that the operator strives to prevent the generation of space debris and adverse environmental impacts on the Earth, in the atmosphere and in outer space in accordance with section 10. Furthermore, it is provided that the operator has to have a plan for terminating the activities in outer space and for the related measures.

Section 10 of the act contains provisions for environmental protection and space debris. According to the first paragraph, space activities shall be carried out in a manner that is environmentally sustainable and promotes the sustainable use of outer space. In its application for authorization, the operator shall assess the environmental impacts of the activity on the Earth, in the airspace and in outer space and present a plan for measures to counter or reduce any possible adverse environmental impacts. Any nuclear materials used in the space object shall be specified in the application for authorization.

The second paragraph of the section applies to space debris. According to it, the operator shall, in accordance with the recognised international guidelines, ensure that the activities in outer space do not generate space debris. It is further specified in the paragraph, that the operator shall in particular restrict the generation of space debris during the normal function of the space object, reduce the risks of breakage and collision of the space object in outer space and strive to remove the space object from its orbit to a less crowded orbit or to atmosphere after it has completed its mission.

Space debris is not defined in the act. In the explanatory memorandum for the Government proposal it is explained that space debris means, in accordance with general international definition, any non-functional space object and its parts, including non-functional satellites, upper-stages of launch vehicles and other loose particles in outer space.

Recognised international guidelines refer to COPUOS and IADC guidelines, European Code of Conduct for Space Debris Mitigation as well as ISO standards.

Further provisions on the environmental impact assessment and the measures necessary to avoid the generation of space debris may be given by decree of the Ministry of Economic Affairs and Employment. In its current form the decree states only that a space object must be replaced to a non-crowded orbit or to atmosphere in 25 years after the end of its operational time.

Applicability:

The scope of the Finnish act as well as decree on space activities is space activities on the territory of Finland or on vessels or airplanes registered in Finland.

Relation to international mechanisms:

According to the act, the operator shall, in accordance with the recognised international guidelines, ensure that the activities in outer space do not generate space debris. The recognised international guidelines are not defined in the act. In the explanatory memorandum for the Government proposal it is explained that the recognised international guidelines refer to COPUOS and IADC guidelines, European Code of Conduct for Space Debris Mitigation as well as ISO standards.

Link to other national mechanisms:

None.

References:

See www.tem.fi/en/space. The English translation of the act will be published by the end of January 2018.

FRANCE

National mechanism:

Decree on Technical Regulation issued pursuant to Act n°2008-518 of 3rd June 2008, 31 March 2011

Legal framework:

- *French Space Operations Act n°2008-518 of 3rd June 2008*

Description:

1. French Space Operations Act n°2008-518 of 3rd June 2008

The French Space Operations Act (FSOA) was adopted in 2008. It has established a national regime of authorization and supervision of national space activities.

Systems and procedures implemented by the operator in the frame of the operation shall be compliant with the national technical regulation. Authorizations are issued by the Minister in charge of space affairs, on the basis of a technical assessment carried out by the French space agency, CNES.

It is foreseen by the FSOA that the authorizations granted may include specific requirements set forth for the safety of persons and property, protection of public health and the environment, in particular in order to limit risks related to space debris (art. 5 FSOA).

2. Decree on Technical Regulation issued pursuant to Act n°2008-518 of 3rd June 2008, 31 March 2011

The Technical Regulation issued in 2011 pursuant to the FSOA contains the technical requirements that any operator shall comply with. The Technical Regulation is composed of a first part dedicated to launch systems and of a second part dedicated to orbital systems. Both parts contain provisions related to the mitigation of space debris.

- For launch systems, article 21 ('Space Debris limitation'):

The launch system implemented by the launch operator must be designed, produced and implemented such as to comply with the following requirements for the elements operating in outer space:

1. The launcher must be designed, produced and implemented in such a way as to minimise the production of debris during nominal operations, including after the end-of-life of the launcher and its component parts. The launch operator in particular takes the following measures in this respect:

for launch of a single space object, a single launcher element (for example a stage) may be placed in orbit;

for launch of several space objects, a maximum of two launcher elements (for example a stage or the adapter structure) may be placed in orbit.

The above requirements do not apply:

to pyrotechnic systems. The largest dimension of any products generated must be less than 1 mm;

to solid propellant boosters. The size of any combustion debris generated in protected region B must be less than 1 mm. With regard to the design and operation of solid propellant boosters, the launch operator takes steps to avoid placing solid combustion products in long term orbit which could contaminate protected region A.

2. *The launcher must be designed, produced and implemented so that the debris produced in compliance with the requirements of the first paragraph above and which do manage to reach the surface of the Earth, constitute no excessive risk for individuals, property, public health or the environment, in particular as a result of environmental pollution by hazardous substances.*

3. *The probability of occurrence of accidental break-up must be less than 10^{-3} until the end-of-life of the space object. This calculation must include failure modes of propulsion and power systems, mechanisms and structures but does not take account of any external impacts.*

Intentional fragmentations of launcher elements are prohibited.

4. *The launcher must be designed, produced and implemented so that, following the disposal phase:*

all the on-board energy reserves are permanently depleted or placed in a state such that depletion of the on-board energy reserves is inevitable, or in such a condition that they entail no risk of generating debris;

all the means for producing energy production means are permanently deactivated.

5. *The launcher must be designed, produced and implemented so that, after the end of the launch phase, its components placed in orbits passing through protected region A are de-orbited by controlled atmospheric re-entry.*

If the impossibility of meeting this requirement can be duly proven, the launcher must be designed, produced and implemented so that its components are no longer present in protected region A twenty-five years after the end of the launch phase. This result is preferably achieved by uncontrolled atmospheric re-entry or, failing that by placing them to an orbit for which the perigee remains above protected region A for one hundred years following the end of the operation.

6. *The launcher must be designed, produced and implemented so that, after the end of the launch phase, its components stationed in an orbit in or passing through protected region B, are placed in an orbit which does not interfere with this region for more than one year. This orbit must be such that, under the effect of natural disturbances, the launcher or its components do not return to protected region B within one hundred years following the end of the operation.*

7. *The probability of successfully completing the disposal manoeuvres mentioned in paragraphs 4, 5 and 6 above must be at least 0.9. This probability is evaluated for the total duration of the operation. Its calculation, carried out before the beginning of the space operation, must take account of all the systems, subsystems and equipment usable for these manoeuvres, their redundancy levels as applicable and their reliability, taking account of the effects of the ageing reached at the time for which their use is scheduled, along with the availability of the means and energy resources necessary for these manoeuvres.*

- For orbital systems, article 40:

The systems implemented by the operator must be designed, produced and implemented such as to comply with the following requirements:

1. *The systems must be designed, produced and implemented so as to avoid generating debris during nominal operations of the space object.*

The above requirement does not apply:

to pyrotechnic systems. The largest dimension of any products they generate must however be less than 1 mm;

to solid propellant boosters. The size of any combustion debris they generate in protected region B must however be less than 1 mm. With regard to the design and operation of solid propellant boosters, the operator implements measures allowing to avoid placing durably in orbit solid combustion products which could contaminate protected region A.

2. *The probability of occurrence of accidental break-up must be less than 10^{-3} until the end of life of the space object. This calculation must include failure modes of propulsion and power systems, mechanisms and structures, but does not take into account external impacts.*

If a situation leading to such a failure is detected, the operator must be able to schedule and implement corrective measures to prevent any break-up.

3. *The systems must be designed, produced and implemented so that, following the disposal phase:*

all the on-board energy reserves are permanently depleted or placed in such a condition that they entail no risk of generating debris,

all the means for producing energy on-board are permanently deactivated.

4. *The systems must be designed, produced and implemented so that, once the space object has completed its operational phase in an orbit passing through protected region A, the space object is deorbited with controlled atmospheric re-entry.*

If the impossibility of meeting this requirement can be duly proven, it must be designed, produced and implemented so that it is no longer present in protected region A twenty-five years after the end of the operational phase. This result is preferably achieved by uncontrolled atmospheric re-entry or, failing that, by placing in a stable orbit for which the perigee remains above protected region A for one hundred years following the end of the operation.

5. *The space object must be designed, produced and implemented so that, once it has completed its operational phase in an orbit in or passing through protected region B, it is placed in an orbit which does not interfere with this region. This orbit must be such that, under the effect of natural disturbances, the object does not return to protected region B within one hundred years following the end of the operation.*

6. *The probability of having sufficient energy resources to successfully carry out the disposal manoeuvres mentioned in paragraphs 3, 4 and 5 above must be at least 0.9.*

7. *The operator must evaluate the probability of being able to successfully carry out the disposal manoeuvres mentioned in paragraphs 3, 4 and 5 above. This evaluation, which does not include the availability of energy resources, must be made by the operator for the total duration of the operation and take account of all systems, subsystems and equipment usable for these manoeuvres, their level of redundancy, if any, and their reliability, taking account of the effects of the ageing reached at the time they are scheduled to be carried out.*

It has to be mentioned that interim provisions are foreseen by the Technical Regulation, in order to adapt the application of the provisions related to space debris for existing space systems (art. 55 of the Technical Regulation).

Applicability:**French Space Operations Act n°2008-518 of 3rd June 2008**

The scope of the FSOA covers:

- Launch and return operations carried out from the French territory
- Launch and return operations carried out by a French operator from a foreign country
- Procurement of a launch by a French entity
- Control of space objects in outer space by a French operator

As a law, it is mandatory for concerned space operators.

Decree on Technical Regulation issued pursuant to Act n°2008-518 of 3 June 2008, 31 March 2011

As a decree, the Technical Regulation is mandatory for concerned space operators.

Relation to international mechanisms:

France has contributed to the development of Space Debris Mitigation Guidelines of the Committee, the European Code of Conduct for Space Debris Mitigation and, through CNES, to the IADC Space Debris Mitigation Guidelines. The French Technical Regulation is consistent with these guidelines, as well as with the ISO 24113 standard.

Link to other national mechanisms:

None.

References:

- French Space Operations Act n°2008-518 of 3rd June 2008
<http://legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000018931380&fastPos=9&fastReqId=1846263462&categorieLien=cid&oldAction=rechTexte>
- Decree on Technical Regulation issued pursuant to Act n°2008-518 of 3rd June 2008, 31 March 2011
<http://legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000024095828&fastPos=5&fastReqId=289170871&categorieLien=cid&oldAction=rechTexte>

GERMANY

National mechanism:

Product Assurance and Safety Requirements for DLR Space Projects: April 2012 (Issue 7.0)

Legal framework:

- *Raumfahrtaufgabenübertragungsgesetz*, 22 August 1998, BGBl. I, 2510 (Delegation of Space Activities Act)
- *Telekommunikationsgesetz*, 22 June 2004, BGBl. I, 1190 (Telecommunications Act), as amended 7 August 2013, BGBl. I, 3154

Description:

The Space Administration of the German Aerospace Centre (DLR) implements the German national space program. It is the policy of DLR that each contractor involved in the implementation of a particular space mission applies product assurance and safety requirements, including space debris mitigation, throughout all project phases.

For space projects of the Space Administration of DLR, space debris mitigation requirements are mandatory as part of the *Product Assurance and Safety Requirements for DLR Space Projects (DLR Requirements)*. This catalogue provides the core from which project-specific product assurance and safety requirements are prepared and tailored. The document includes space debris mitigation measures and specifies these requirements.

In implementing a particular space mission, the requirements contained in the *DLR Requirements* are tailored to the respective project according to the mission characteristics. The aim is to ensure the application of the relevant requirements, their verifiability and their practicability during the development, production and operation phases of a space project. The tailored requirements form part of the project requirements in the invitation of tenders as well as of the contractual agreements with the respective contractors. In the course of the implementation of the space mission, non-compliance with any of the tailored requirements may be possible on the basis of a waiver. The waiver shall provide the rationale and justification for the deviation and requires formal approval by DLR.

The *DLR Requirements* comprise various requirements that aim to implement a comprehensive system of space debris mitigation. Their general objective is to limit the creation of new space debris and thus to limit the risk to other current and future space missions and the risk to human life. The measures to be adopted in order to achieve this objective include the following categories of requirements:

5.7.7 Space Debris Mitigation Assessments

5.7.10 Space Debris Mitigation Assessment Reports

in respect to: the release mission-related objects, accidental breakups and potential explosions, potential for on-orbit collisions, post-mission disposal plans and procedures and re-entry hazards

5.7. 11 Design Measures

in respect to: prevention of mission-related objects, solid propellants and pyrotechnics, materials and technologies, fragmentation prevention, malfunctioning prevention, on-orbit collisions prevention, limitation of consequences from impact of existing debris/meteorites

5.7.12 Passivation

5.7.13 Disposal Maneuvers

in respect to: LEO and GEO protected regions as well as MEO

5.7.14 Re-entry Safety Measures

in respect to: type of re-entry, methods of compliance assessment, notification

5.7.15 Project Reviews

Applicability:

The *Product Assurance and Safety Requirements for DLR Space Projects* are mandatory throughout all phases of all space missions of the DLR Space Administration.

Relation to international mechanisms:

The space debris mitigation requirements of the *Product Assurance and Safety Requirements for DLR Space Projects* are consistent with the Space Debris Mitigation Guidelines of the Committee, the IADC Space Debris Mitigation Guidelines and the European Code of Conduct for Space Debris Mitigation. They furthermore refer to relevant ISO standards, including ISO 24113, and standards adopted by the European Cooperation for Space Standardization ECSS. The recommendations of the ITU Radiocommunication Assembly in respect to space debris mitigation (ITU-R S.1003-2, Environmental protection of the geostationary-satellite orbit) are among the conditions which the users of German orbit and frequency rights have to fulfill (on the basis of § 56 *Telekommunikationsgesetz*).

Germany has contributed to the development of the IADC Space Debris Mitigation Guidelines in the scope of the IADC and participated in the elaboration of the European Code of Conduct for Space Debris Mitigation in the European Network of Competencies. Germany regards the Space Debris Mitigation Guidelines of the Committee as providing generally accepted guidance for the adoption of national mechanisms governing space debris mitigation.¹

¹ German Statement under Agenda Item 11 of the 49th session of the Legal Subcommittee (22 March-1 April 2010).

Link to other national mechanisms:

The mechanisms NASA STD 8719.14 “Process for Limiting Orbital Debris” and NASA-NPR-8715.6A “Procedural Requirements for Limiting Orbital Debris” represent informative references for the *DLR Requirements*.

References:

- http://www.gesetze-im-internet.de/ra_g/BJNR010140990.html
- http://www.gesetze-im-internet.de/tkg_2004/BJNR119000004.html

GREECE

National mechanism:

Law 4508/2017 (Government Gazette 200/A'/ 22-12-2017) on "Authorization of space activities -Registration in the National Register of Space Objects- Establishment of a Greek Space Organization and other provisions," as amended by Law 4712/2020/146/A'/29-07-2020.

Description:

The above-mentioned law establishes, inter alia, as necessary conditions for the licensing of space activities: (a) adequate provision for the mitigation and management of space waste or residues according to technological developments and international practices (b) the non contamination of space or celestial bodies or adverse changes in the environment.

In addition, the law provides for the reporting entity to report on the impact of the space object on the environment for each space activity. Reports are submitted before the object launches, after its launch, and at the end of its operational life.

Further, it is possible to issue a joint ministerial decision of the Ministers of Digital Policy, Telecommunications and Media and Environment and Energy, which will define the content of the reports, the requirements and the technical standards, which the activity of the organization must comply with. Until this decision is adopted, relevant national, European and international standards, as well as relevant good practices, are applied.

Applicability:

In the case of space activities, they should be: (a) carried out within the Greek territory, (b) exercised outside the Greek territory, if premises, personnel, movable or immovable property belonging to the Greek State or under its jurisdiction are used, (c) exercised, irrespective of location, by individuals of Greek nationality or legal entities based in Greece and only if provided for in an international agreement or treaty, (d) carried out by individuals or legal entities, national and foreign, within the Hellenic Republic territory or for which facilities are used, personal, movable and immovable property of the Greek State or within the jurisdiction and under the responsibility of the Greek State as the "Launching State" under International Law.

Relation to international mechanisms:

Greece participates as a member at the European Space Agency (ESA) and, in this context, it applies and actively participates in the formulation of legal texts, standards, guidelines and good practices in the area of space activities.

In addition, national law provides for:

- (a) the implementation of existing national, European and international standards, as well as the relevant existing good practices, until the adoption of the Joint Ministerial Decision on the definition of the content of environmental impact reporting by space activities.
- (b) that for the issue of any decision to authorize space activities, the Minister of Digital Governance may request technical assistance from third parties, such as Greek, European and International Organizations and agencies, experts, specialists and scientists in order to lay down conditions as to the location of the space activities or the site of the main establishment of the operator or the provision of insurance for space and space objects.

Link to other national mechanisms:

None.

References:

None.

INDONESIA

National mechanism:

Indonesia has not adopted yet any national mechanism to implement Space Debris Mitigation Guidelines of the Committee or IADC Space Debris Mitigation Guidelines.

However, in the Law of the Republic of Indonesia Number 21 of 2013 on Space Activities, all space activities must take into consideration, among others, the protection of space environment.

Through LAPAN, Indonesia has a space debris automatic monitoring system to mitigate the impacts of re-entry of space objects within the Indonesia's territory. This system utilizes data acquired from the Space Track to detect space debris a few hours before its (their) re-entry and its (their) last track including the type of debris and the launching state of the debris.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, Indonesia supports the initiatives aimed at mitigating the impact of space debris, and in accordance with the Space Debris Mitigation Guidelines of the Committee. Moreover, Indonesia supports the IADC Space Debris Mitigation Guidelines and the ITU Recommendation ITU-R.S.1003.2 on the environmental protection of the geostationary satellite orbit. Furthermore, Indonesia puts emphasis on the importance of sharing information for monitoring space debris.

Link to other national mechanisms:

None.

References:

None.

ITALY

National mechanism:

Discussions are in progress with a view to develop national space-related legislation in the near future including provisions covering space debris mitigation measures. Pending the approval of a national space law, implementation of measures relevant to space debris mitigation are currently limited to the Italian Space Agency's (ASI) standard contracts provisions. ASI has the institutional task of defining, coordinating and managing national space programs.

Description:

None.

Applicability:

ASI applies the European Code of Conduct for Space Debris Mitigation, which it has signed on 14 February 2005, through its standard contract provisions, by making the the European Code of Conduct an ASI standard contracts applicable mandatory document.

Relation to international mechanisms:

The primary objectives of the European Code of Conduct for Space Debris Mitigation is to implement the following measures:

- prevention of on-orbit break-ups and collisions,
- removal and subsequent disposal of spacecraft and orbital stages that have reached the end of mission operations from the useful densely populated orbit regions,
- limitation of objects released during normal operations.

The above measures are applicable to the Italian Space Agency projects as follows: for space missions developed before 2005 or already in orbit, ASI has tried to implement the provisions of the European Code to the maximum possible extent, mainly in terms of end of life space debris mitigation procedures, in particular, the disposal phase of the satellites. After 2005, the Space Debris Mitigation European Code of Conduct is an applicable document to ASI space programs and projects, that is from the design, the development and the operational phase of satellites.

The European Code of Conduct for ASI Space Projects is mandatory throughout all phases of all space missions.

Through the application of the European Code of Conduct for Space Debris Mitigation, ASI is also consistent with a number of international mechanisms such as: Space Debris Mitigation Guidelines of the Committee, IADC Space Debris Mitigation Guidelines; ITU Recommendation ITU-R S.1003 relevant to Environmental Protection of Geostationary satellite orbit; ISO Standards (24113 and following deriving standards), that have been developed afterwards. In

this framework, ASI is going to update its current contractual provisions in line with the above updated space debris mitigation measures.

ASI is a member of the IADC and contributed to the IADC drafting and relevant updating of the IADC Space Debris Mitigation Guidelines; at the Committee on the Peaceful Uses of Outer Space Italy fully contributed to the developing of the Space Debris Mitigation Guidelines of the Committee.

Link to other national mechanisms:

None.

References:

None.

JAPAN

National mechanism:

JAXA-Management Requirements (JMR-003B), revised in 2011

The NASDA “Space Debris Mitigation Standard” (NASDA-STD-18)² was adopted in 1996. In view of the integration of NASDA with other space related organizations and its transformation to JAXA in 2003, NASDA-STD-18 was changed to the “JAXA-Management Requirements 003 (JMR-003)”. It was revised to version B in 2011 to be equivalent to ISO-24113 “Space Debris Mitigation Requirements”.

Description:

JMR-003B includes the following requirements:

- Preventing the on-orbit break-up of a space system after the end of its mission, which could generate a large amount of debris
- Transferring a spacecraft that has completed its mission in the Geostationary Earth Orbit (GEO) into a higher orbit in order to preserve the GEO environment
- Reducing the orbital lifetime during which the orbital stage left in the Geostationary Transfer Orbit (GTO) can interfere with the GEO region, in order to preserve the GEO environment
- Minimizing the number of objects released in orbit during the operation of a space system
- Reducing the orbital lifetime during which a space system that had completed operation can interfere with the useful Low Earth Orbit (LEO) region.
- Preventing human casualties on the ground caused by impact of space systems removed from the orbit as well as in the orbit caused by collision with a manned system during space systems launch.
- Minimizing damage caused by on-orbit collision

JMR-003B is an internal document of JAXA, but other Japanese government administrations respect it and apply it in procurement of their spacecraft. This standard is available only in Japanese language.

JAXA standard was among the world first space debris mitigation guidelines developed. It provides in-depth technical procedures for multiple debris mitigation areas involving re-entry risks and specifies detailed requirements to be met by contractors. The technical requirements of Standard 18 are similar to those of NASA Safety Standard 1740.14 “Guidelines and Assessment Procedures for Limiting Orbital Debris” but different points are it includes management requirements including the assignment of responsible manager and its organization, documentation of the debris mitigation plan, and technical review during lifecycle

² Also referred to as Standard 18.

to ensure the compliance. However it doesn't mention complex requirements as NASA standard, such as guidelines limiting released objects with the product of cross sectional area and orbital lifetime, or that of number of objects and orbital lifetime, which would not be easy to verify the compliances.

Supporting documents: To support the project teams following document and analysis tools are being provided:

- i) JERG-2-144-HB001: Space Debris Protection Design Manual
- j) JERG-0-002: Handbook for Space Debris Mitigation Standard
- k) Debris mitigation assessment tool,
- l) Re-entry survivability analysis tool,
- m) Orbital lifetime estimation tool,
- n) Debris impact damage assessment tool

Applicability:

JAXA applies the standard to all of its space projects. JAXA requires the compliance with the standard to the contractors who design its spacecraft and launch vehicles, and recommend other users who apply to launch their spacecraft with the launch vehicles that JAXA has responsibility for their launch and flight safety. To show the compliance, contractors are requested to develop a "Space Debris Mitigation Management Plan" to be authorized by JAXA.

Relation to international mechanisms:

JMR-003B makes no reference to other international guidelines, but its requirements are well consistent with ITU-R S.1003, Guidelines of the Committee on the Peaceful Uses of Outer Space and ISO standards (ISO-24113 and other debris related standards).

Link to other national mechanisms:

None.

References:

None.

MEXICO

National mechanism:

Mexico has not yet adopted a national regulatory framework on space debris mitigation. However, high level discussions within the competent bodies are taking place to develop mechanisms arising in a national legislation in the short term.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

Mexico, as one of the 18 founding members of the Committee on the Peaceful Uses of Outer Space and having signed and ratified the five United Nations Treaties on outer space is aligned with the Space Debris Mitigation Guidelines of the Committee. Moreover, Mexico supports the IADC Guidelines on Space Debris Mitigation and agrees with the ITU Recommendations ITU-R.S 1003 on the environmental protection of the geostationary satellite orbit, the standards of the European Code of Conduct for Space Debris Mitigation as well as the ISO 24113 for space systems: Space Debris Mitigation Requirements.

Link to other national mechanisms:

None.

References:

None.

MYANMAR

National mechanism:

Since the national satellite project is still in the planning stage, the Republic of the Union of Myanmar has not yet adopted the space debris mitigation standards. However, after completing the process of launching the national satellite, the cooperation with the international space community will be done to reduce the space debris as the important issue for building secure and peaceful use of outer space.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a nation which is formulating a space program to launch National Satellite in the near future, Myanmar is always pleased to carry out the affairs of the development of space debris mitigation and the safety and peaceful use of outer space, cooperating with the international communities as under the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space. Also, Myanmar totally supports such guidelines and we will apply those as national practices and principles in our space activities.

Moreover, as Myanmar is one of the members in ITU, International Telecommunications Union, the Recommendation of ITU on Environmental protection of the geostationary-satellite orbit provides us in the procedures of launching and operating the satellite system associated with the used technologies.

Link to other national mechanisms:

None.

References:

None.

THE NETHERLANDS

National mechanism:

The Space Activities Act 2007 regulates space activities under Dutch jurisdiction. The most important provisions of the Space Activities Act concern the establishment of a mandatory licensing system for the performance of space activities, a registry for space objects and the inclusion of a redress provision in the events of State liability.

Space policy in the Netherlands is primarily focused on international cooperation in European contexts within ESA, the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and the EU. This means that the Netherlands has no national space debris mitigation mechanism.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, 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.

Link to other national mechanisms:

None.

References:

None.

NIGERIA

National mechanism:

National Space Research and Development Agency Act 2010 No.9 A 1255

Description:

The National Space Research and Development Agency Act 2010 (NASRDA ACT) established formally the National Space Research and Development Agency, empowering the National Space Council as the regulating and supervisory entity for space activities in Nigeria.

By virtue of the Act, the National Space Council authorizes licences for all space activities in Nigeria. License condition under this Act includes permitting inspection and testing of the licensee's facilities and equipment. License may also be issued on the condition that the licensee provides information to the Council concerning the nature, conduct, location and results of the licensee's activities.

An advance approval of the Council must be obtained for any intended deviation from orbital parameters and it is obligatory to inform the Council immediately of any unintended deviation.

In the Act, particular emphasis is placed on the mitigation of space debris, a licensee is required to conduct its operations in such a way as to prevent the contamination of outer space or cause any adverse changes in the environment of the Earth, to avoid interference with the activities of others states involved in the peaceful exploration of outer space and, to govern the disposal of the pay load in outer space on the termination of operations.

A comprehensive amendment of the Act is planned.

Applicability:

The National Space Research and Development Agency Act 2010, is applicable to all space activities within Nigeria by both citizens and non-citizens.

Relation to international mechanisms:

Nigeria is an active member of the Committee on the Peaceful Uses of Outer Space, with participation in Legal and Scientific and Technical Subcommittees. It supports in totality the Space Debris Mitigation Guidelines of the Committee and the IADC Space Debris Mitigation Guidelines.

Disposal of payload as a condition to obtain a licence as contained in the NASRDA Act is in compliance with Space Debris Mitigation Guidelines of the Committee.

Link to other national mechanisms:

None.

References:

None.

POLAND**National mechanism:**

The Republic of Poland has not yet adopted any national legally binding mechanism on space debris mitigation, but it aligns itself with the guidelines of the United Nations.

Since the process of preparing a national space-related law has been started, an ongoing discussion is taking place regarding potential inclusion of specific requirements of debris mitigation standards in the basic act.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

The Republic of Poland fully adheres to such mechanisms as Space Debris Mitigation Guidelines of the Committee, IADC Space Debris Mitigation Guidelines, ITU Recommendation ITU-R S.1003, European Code of Conduct for Space Debris Mitigation, ISO Standards (24113: Space Systems – Space Debris Mitigation Requirements; and others).

Link to other national mechanisms:

None.

References:

None.

RUSSIAN FEDERATION

National mechanism:

Federal legislation

The Russian Federation Law "On space activity" dated August 20, 1993 N 5363-1 (revised 07.03.2018.);

The Russian Federation Federal Law "On the State Corporation for Space Activities ROSCOSMOS" dated July 13, 2015 N 215-FZ;

The Russian Federation Federal Law "On Standardization in the Russian Federation" dated June 29, 2015 N 162-FZ.

Documents on strategic planning of space activities

Federal Space Program of Russia for 2016-2025 (approved by the Russian Federation Government Decree of March 23, 2016 N 230);

Fundamentals of the Russian Federation's State Policy in the Field of Space Activities for the Period up to 2030 and beyond (approved by the President of the Russian Federation on April 19, 2013 N Pr-906)

Standard technical documentation

GOST R 52925-2018 "Space Technology Items. General Requirements for Space Vehicles for Near-Earth Space Debris Mitigation" (developed by the Federal State Unitary Enterprise Central Research Institute for Machine Building, approved by Order of the Federal Agency for Technical Regulation and Metrology on September 21, 2018 N 632-st) effective date January 1, 2019, substitute GOST R 52925-2008.

Description:

The Russian Federation, along with other States supports the development of international reference document "Compendium of Standards for Space Debris Adopted by States and International Organizations" and provides information on preventive measure for space debris generation.

The Law of the Russian Federation "On Space Activity" dated August 20, 1993 N 5363-1 in Article 22, paragraph 1 states that "space activities are carried out with a view to ensuring the level of permissible anthropogenic burden on the environment and the near-Earth space."

According to subparagraph 16 of Article 14 of the Russian Federation Federal Law "On the State Corporation for Space Activities ROSCOSMOS" dated July 13, 2015 N 215-FZ one of the activities of the State Corporation ROSCOSMOS is the management of activities to reduce the debris in near-Earth space. In accordance with paragraph 1 of Article 11 of this law state corporation "ROSCOSMOS " carries out measures to ensure the safety of space activities, including design,

manufacture, testing, use (operation), and utilization of rocket and space equipment, strategic military rocketry, space objects and space infrastructure.

The Russian Federation Federal Law "On Standardization in the Russian Federation" dated June 29, 2015 N 162-FZ prescribes rules for the use of the Russian Federation national standards and shapes basic goals, principles of standardization, including in defense and state security, establishes the legal status of a national system of standardization and its members, determines the standardization documents, the authority of the Russian Federation national standards body and other matters concerning maintenance of standardization activities in the framework of the national standardization system that meets best international practice and international agreements in this domain. The law is aimed at consolidation the role of standardization for the technical re-equipment and manufacturing improvements, introduction of innovative solutions and bringing national legislation into line with the World Trade Organization Agreement on technical barriers to trade based on the application of the Code of Good Practice for the development, adoption and application of standards.

In the Russian Federation works to limit technogenic pollution in near-Earth space are carried out in accordance with the Federal Space Program of Russia for 2016-2025 years, programmer purpose is to provide the state policy regarding space activities on the basis of the deployment and maintenance of the required constellation of spacecraft to provide socio-economic services, science and international cooperation, including protection of the population and territories from natural and man-made emergencies, as well as implementation of a manned program, construction of launch vehicles and facilities, research and technological groundwork future-oriented space complexes and systems.

In accordance with subparagraph e) of paragraph 18 of section VII "Fundamentals of the Russian Federation's State Policy in the Field of Space Activities for the Period up to 2030 and beyond" one of the objectives of international cooperation in space activities is active participation of Russia in investigations and solution at international level of problems associated with the technogenic pollution of near-Earth space, including the prevention of the formation and disposal of debris from the area of spacecraft operational orbits.

In subparagraph d) of paragraph 19 of Section VIII of the foregoing Fundamentals one of the tasks on the provision of safe space activities is to ensure the environmental safety of space activities, the adoption of technologies and designs that reduce space debris at launches and operation of rocket and space equipment.

GOST R 52925-2018 "Space Technology Items. General Requirements for Space Vehicles for Near-Space Debris Mitigation."

General requirements for the prevention of space debris in the performance of full-time operations should be:

- elimination of space debris particles generation produced by the separation devices of upper stages and spacecraft payload that are performed based on pyro-, pilot-operated check valves, pushers of various types of safety caps and springs of spacecraft devices, as well as fragments ejection equipment based separation explosive bolts, elongated shaped charges, pyro-cutter and pyro-guillotine;

- elimination of particles ejection nozzle plugs, nozzle caps and other elements of the engine units;
- retracting cable inside the spacecraft after the use of cable systems;
- elimination of solid debris emission in the near-Earth space by using the manned space vehicles;
- elimination of propulsion system separation from orbital assets intended to operate in the protected low earth orbit's (LEO) and geostationary orbit (GEO). If the separation of propulsion system is inevitable, it should be performed on such an orbit, while passing it propulsion system will always be outside the protected areas of LEO and GEO;
- elimination of solid-solid products of combustion engines emission in the protected areas of LEO and GEO.

Scheduled operations are possible for separation of orbiters with nuclear power sources on board and launch vehicles if they meet radiation safety requirements.

Prevention of unintended brake-up of spacecraft during operation

Design and development of space equipment must include analysis of the possible effects and failures that could lead to accidental break-up of this equipment.

In operation, one should periodically check the space equipment to identify and predict events that may lead to their break-up or loss of control. The design documentation for the development of space assets should allow for activities to be carried out in case of such events, including activities to de-orbit space vehicles and their passivation, in the case of impossibility to prevent these events.

Prevention of intentional destruction of spacecraft

Spacecraft should be designed and developed so that to avoid the intentional destruction (self-destruction, intentional collision and etc.), as well as other actions that may result in generation of debris and significant increase the risk of collision with space objects were excluded.

Self-destruction of space equipment is considered acceptable immediately before their re-entry to reduce the risk of large space objects impact. Self-destruction is not permitted on regular orbits of space vehicles (including special spacecrafts).

Preventing the break-ups of space equipment at the end of their mission

To prevent (minimizing the likelihood of occurrence) of accidental explosions of spacecraft after their active operation the following is necessary:

a) Execute passivation:

- 1) Removing the residual propellant from the fuel tanks of spacecraft, as well as residues of propellant and gas pressurization of all cavities of propulsion systems by afterburning or

drainage to prevent accidental damage due to pressurization or chemical reactions under the influence of space factors;

2) Discharging the batteries and breaking charging lines;

3) Blowing gas from the high pressure cylinders to a pressure level guaranteeing the absence of possibility of any rupture and break-up, leading to the formation of space debris;

4) Discharging (de-spin) of momentum wheels, gyroscopes and other similar mechanical devices;

b) Designing of space equipment pyrotechnic elements so that to exclude their operation under the action of impact effect of space debris particles.

Preventing spacecraft collisions with space objects

Collision risk with cataloged space objects assessment should be executed for launched space vehicles when planning their launch and the appropriate selection of time slots should be performed in order to minimize the risk of collisions if possible.

In the programs of long-term orbital manned flight one must provide measures to reduce the probability of collision with cataloged space objects.

The spacecraft design should provide maximum protection against the destruction of critical components and systems (failure which could result in loss of space equipment) in a collision with the space debris.

The unmanned orbital flight programs (if technically possible) should also be provided for activities to reduce the probability of collision with cataloged space objects.

Deorbiting of spacecraft, upper stages and orbital rockets stages upon completion of their functioning to disposal zone or on orbits with a limited term of ballistic existence.

The deorbiting success rate for spacecraft, booster and the orbital stages of launch vehicle should be at least 0.8.

This probability is calculated based on the reliability of subsystems used for disposal. At the end of the operation of spacecraft, booster and launch vehicle orbital stages must have all sufficient resources to carry out the disposal.

Spacecraft and launch vehicle orbital stages, operating in geostationary orbit, at the end of the operation shall be deorbited above the geostationary orbit so as to avoid collision with the space objects which continue to be in geostationary orbit. Excess of the perigee height of the disposal orbit over the geostationary orbit (in kilometers) calculated using the formula:

$$235 + (1000 C_R A/m),$$

wherein 235 - the sum of the upper limit of the protected area of its altitude GEO (200 km) and maximum deviations spacecraft orbit due to luni-solar and geopotential perturbations (35 km);

C_R - Solar radiation pressure coefficient (usually within 1-2) kg/m;

A/m - the ratio of the spacecraft cross-sectional area to its mass after the end of normal operation and passivation, m^2/kg .

After deorbiting the spacecraft and launch vehicle orbital stages must have a perigee altitude above GEO enough so that destabilizing forces were not the cause of the return of spacecraft and launch vehicle orbital stages in the protected area of the geostationary orbit for 100 years.

The eccentricity of the disposal orbit should not exceed 0.003 for spent spacecraft and launch vehicle orbital stages in GEO.

All spacecraft and launch vehicle orbital stages that remain in the area of LEO or passing it through (including space objects at high elliptical orbits), or may be there during subsequent motion, must pass to the orbit, which suits one of the following conditions:

- the estimated duration of passive ballistic existence should not exceed 25 years resulted by the forces arise;
- to exclude the possibility of entering into the protected area of LEO the perigee of disposal orbit should be sufficient for destabilizing forces not to cause its return to the protected area of the LEO for 100 years.

Orbiters which construction does not provide for the possibility of changing orbit parameters and maneuvering after the end of their operation, should be passed into orbit in LEO region with estimated time of passive ballistic existence of no more than 25 years.

For orbiters with on-board radioactive, toxic or other harmful substances, de-orbiting should be carried out so as to prevent unacceptable contamination by these substances of the atmosphere or the Earth's surface.

Applicability:

National procedures of the Russian Federation (federal legislation and documents of strategic planning of space activities) are legally binding and provide legal regulation of industrial enterprises of the rocket and space industry and research organizations involved in space activities.

GOST R 52925-2018 "Space Technology Items. General Requirements for Space Vehicles for Near-Earth Space Debris Mitigation" is not legally binding, but its requirements apply to newly created and modernized spacecraft scientific, socio-economic (including exploring deep space), commercial and special (defense) purpose in accordance with the technical specifications.

The standard requirements apply at all stages of the space equipment life-cycle specification development, design, construction, production, operation and disposal.

Relation to international mechanisms:

The Russian Federation supported the application of space debris mitigation measures and relied on agreed international mechanisms to prevent the generation of space debris.

GOST R 52925-2018 "Space Technology Items. General Requirements for Space Vehicles for Near-Earth Space Debris Mitigation" contains the requirements for space systems and is consistent with the provisions of the IADC Space Debris Mitigation Guidelines (document A/AC.105/C.2/L.260), Space Debris Mitigation Guidelines, adopted by the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) (resolution A/RES/62/217 dated 10 January 2008); as well as the international standard ISO 24113: 2011 "Space systems - Space Debris Mitigation Requirements".

The Russian Federation takes an active part in the work of the IADC, STSC, LSC and ISO for limiting debris in near-Earth space.

Link to other national mechanisms:

None.

References:

<https://www.gost.ru/portal/gost/>

<http://nd.gostinfo.ru/document/6431006.aspx>

SLOVAK REPUBLIC**National mechanism:**

The Slovak Republic didn't implement into its legislation any restrictions or rules concerning space debris mitigation policy. The Slovak Republic is currently negotiating its membership into the European Space Agency. This attempt can later lead to the adoption of national mechanism on space debris mitigation.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

Slovak Republic is a member of the Committee on the Peaceful Uses of Outer Space, that is why it fully supports the Space Debris Mitigation Guidelines of the Committee. Furthermore it supports IADC Space Debris Mitigation Guidelines, European Code of Conduct for Space Debris Mitigation, ISO Space Systems – Space Debris Mitigation Requirements (ISO 24113:2011) and ITU Recommendation ITU-R S.1003.

Link to other national mechanisms:

None.

References:

None.

SPAIN**National mechanism:**

Spain has not yet adopted a specific legal mechanism on space debris mitigation.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

Spain, being a member of the Committee on the Peaceful Uses of Outer Space, supports the initiatives aimed at mitigating the impact of space debris, and in particular adheres to the Space Debris Mitigation Guidelines of the Committee. Similarly it supports the guidelines already developed in other international fora, such as the European Code of Conduct for Space Debris Mitigation, the IADC Space Debris Mitigation Guidelines, the ISO Space Debris Mitigation Requirements ISO 24113:2011 and the ITU Recommendation ITU-R S.1003. In addition, Spain supports the adoption of the International Code of Conduct for Outer Space Activities, whose draft is currently under discussion.

Link to other national mechanisms:

None.

References:

None.

SWITZERLAND

National mechanism:

Switzerland has for now no national mechanism on space debris mitigation.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, Switzerland fully adheres to the Space Debris Mitigation Guidelines of the Committee. Furthermore, it actively participates in the work of the Working Group on Long Term Sustainability for Space Activities (LTSSA) in the framework of the United Nations Committee on the Peaceful Uses of Outer Space. Alongside the Space Debris Mitigation Guidelines of the Committee, Switzerland shares the view that the IADC Space Debris Mitigation Guidelines, the European Code of Conduct for Space Debris Mitigation, the ISO Space Systems - Space Debris Mitigation Requirements (ISO 24113:2011) and the ITU Recommendation ITU-R S.1003 should achieve the best possible acceptance within the international space community.

Moreover, Switzerland is conducting the majority of its space activities through the European Space Agency (ESA).³

Link to other national mechanisms:

None.

References:

None.

³ Please refer to the ESA profile (p.45) for a comprehensive description of the relevant space debris mitigation mechanisms and policy applicable to the Agency's missions and activities.

THAILAND

National mechanism:

The Kingdom of Thailand has not adopted yet any national mechanism to fully implement the IADC Space Debris Mitigation Guidelines into binding legislation. However, Thailand, who oversees and regulates the operation of THAICHOTE satellite (THEOS-33396), has a system of the risk assessment of the satellite collision avoidance that can operate the avoidance manoeuvres, if necessary.

Description:

None.

Applicability:

None.

Relation to international mechanisms:

As a member State of the Committee on the Peaceful Uses of Outer Space, Thailand, who oversees and regulates the operation of THAICHOTE satellite (THEOS-33396), adheres to the Space Debris Mitigation Guidelines of the Committee. Furthermore, Thailand supports 2 mitigation measures of the IADC Space Debris Mitigation Guidelines:

1. Post Mission Disposal: A spacecraft or orbital stage should be left in an orbit in which, using an accepted nominal projection for solar activity, atmospheric drag will limit the orbital lifetime after completion of operations. The IADC and some other studies and a number of existing national guidelines have found 25 years to be a reasonable and appropriate life time limit. In this regard, Thailand has studied the possibility of THAICHOTE satellite re-entry into the atmosphere. The outcome of this study was the operating procedure for the THAICHOTE de-orbit and re-entry. This would be the guidelines for mitigating the number of non-operating satellite in low Earth orbit.
2. Prevention of On-Orbit Collisions: In developing the design and mission profile of a spacecraft or orbital stage, a program or project should estimate and limit the probability of accidental collision with known objects during the spacecraft or orbital stage's orbital lifetime. In this regard, Thailand has determined the acceptable risk level of the space object close approaches and readily operates the avoidance manoeuvres, if necessary.

Link to other national mechanisms:

None.

References:

None.

UKRAINE

National mechanisms:

1. Law of Ukraine on Space Activity of 15 November 1996.
2. Industrial standard URKT-11.03 “Limitation of the Near-Earth Orbital Debris Making at Operation of Space Technical Equipment”, entered into force in on 19 July 2006.

Description:

The Law of Ukraine on Space Activity is the legal basis for Ukrainian space activities. Article 9 of the Law is entitled “Prohibitions on and restrictions of space activity” and provides that the infringement of international norms and standards concerning to outer space pollution are forbidden at carrying out space activity in Ukraine.

The main technical activities on limitation of space debris generation stated in the industrial standard URKT-11.03 are as follows:

1. Elimination or minimization of space debris generation during standard operations.
2. Minimization of the possibility of space objects breaking in orbit (including their passivation after mission’s completion or in case of failure).
3. Removal of spacecraft and launch vehicles from orbit after mission’s completion.
4. Prevention of space objects collisions in near-Earth space.

Applicability:

The scope of application of the Law of Ukraine on Space Activity is regulated in its preamble:

“This Law defines general legal principles of carrying out of space activity in Ukraine and, under jurisdiction of Ukraine, abroad.

Provisions of this Law are distributed to all kinds of activity connected with research and use of outer space”.

The requirements of the standard URKT-11.03 are compulsory for all subjects of space activity. They extend to launch vehicles and spacecraft, including the ones that are developed for foreign organizations, if the contract does not specify other space debris limitation activity.

Relation to international mechanisms:

The industrial standard URKT-11.03 is consistent with the Space Debris Mitigation Guidelines of the Committee and IADC Space Debris Mitigation Guidelines.

Link to other national mechanisms:

None.

References:

The Law of Ukraine on Space Activity (unofficial English translation):

<http://www.nkau.gov.ua/nsau/pravonsau.nsf/8EE0562C6B91F547C3256A8F00362010/785F24D0FD8DF9CFC22573D3004E6717?OpenDocument&lang=E>

UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND**National mechanism:**

Outer Space Act 1986 (OSA)

Description:

The Outer Space Act is the legal basis for the regulation of activities in outer space (including the launch and operation of space objects) carried out by persons connected with the United Kingdom. The Act confers licensing and other powers on the Secretary of State acting through the UK Space Agency. The Act ensures compliance with UK obligations under the international conventions covering the use of outer space to which the UK is a signatory.

Under the legislation of the OSA, the Secretary of State shall not grant a licence unless he is satisfied that the activities authorised by the licence will not jeopardise public health or the safety of persons or property, will be consistent with the international obligations of the United Kingdom, and will not impair the national security of the United Kingdom. Further the Secretary of State requires the licensee to conduct his operations in such a way as to prevent the contamination of outer space or adverse changes in the environment of the Earth, and to avoid interference with activities of others in the peaceful exploration and use of outer space.

The Secretary of State requires the licensee to insure himself against liability incurred in respect of damage or loss suffered by third parties, in the United Kingdom or elsewhere, as a result of the activities authorised by the licence. Further the licensee shall indemnify Her Majesty's government in the United Kingdom against any claims brought against the government in respect of damage or loss arising out of activities carried on by him to which this Act applies.

The OSA provides the necessary regulatory oversight to: consider public health and safety, and the safety of property; to evaluate the environmental impact of proposed activities; to assess the implications for national security and foreign policy interests; and to determine financial responsibilities and international obligations.

Within the OSA framework, safety evaluation aims to determine whether an applicant can safely conduct the launch of the proposed launch vehicle(s) and any payload. Because the licensee is responsible for public safety, it is important that the applicant demonstrate an understanding of the hazards involved and discuss how the operations will be performed safely. There are a number of technical analyses, some quantitative and some qualitative, that the applicant must perform in order to demonstrate that their commercial launch operations will pose no unacceptable threat to the public. The quantitative analyses tend to focus on the reliability and functions of critical safety systems, and the hazards associated with the hardware, and the risk those hazards pose to public property and individuals near the launch site and along the flight path, to satellites and other on-orbit spacecraft. The qualitative analyses focus on the organisational attributes of the applicant such as launch safety policies and procedures, communications, qualifications of key individuals, and critical internal and external interfaces.

Under the legislation of the OSA, the Secretary of State shall not grant a licence unless he is satisfied that the activities authorised by the licence will not jeopardise public health or the safety of persons or property, will be consistent with the international obligations of the United

Kingdom, and will not impair the national security of the United Kingdom. Further the Secretary of State requires the licensee to conduct his operations in such a way as to prevent the contamination of outer space or adverse changes in the environment of the Earth, and to avoid interference with activities of others in the peaceful exploration and use of outer space.

The OSA provides the necessary regulatory oversight to: consider public health and safety, and the safety of property; to evaluate the environmental impact of proposed activities; to assess the implications for national security and foreign policy interests; and to determine financial responsibilities and international obligations.

In assessing a mission proposed by a licence applicant, UK Space Agency assessors exploit references to the protection of public health or the safety of persons or property, the prevention of the contamination of outer space or adverse changes to the environment of the Earth, and the avoidance of interference with activities of others in order to reflect current best practices relating to space debris mitigation. Accordingly, during the safety review, applicants will be obliged to demonstrate compliance/conformance with existing norms/best practices in relation to measures such as the IADC Space Debris Mitigation Guidelines, Space Debris Mitigation Guidelines of the Committee, and the growing body of international standards relating to debris.

Applicability:

OSA is a mandatory, statutory instrument applying to UK nationals (i.e. personal rather than territorial).

Relation to international mechanisms:

In performing analysis of licence applications, compliance with the requirements identified in the following documents are evaluated and will determine whether a licence will be issued or otherwise:

- Space Debris Mitigation Guidelines of the Committee
- IADC Space Debris Mitigation Guidelines
- ITU Recommendation ITU-R S.1003
- ISO Standards (24113: Space Systems – Space Debris Mitigation Requirements; and others)

Link to other national mechanisms:

None.

References:

- <http://www.bis.gov.uk/ukspaceagency/what-we-do/space-and-the-growth-agenda/uk-capabilities-for-overseas-markets/the-outer-space-act-1986>

UNITED STATES OF AMERICA

National mechanisms:

- Federal Aviation Administration Authorities:
 - Space Launch Act of 1984, as codified and amended, Title 51 United States Code (U.S.C.), Commercial Space Transportation, chapter 509; Title 51 U.S.C., Commercial Space Launch Activities, Sections 50901-50923
 - National and Commercial Space Programs Act (NCSPA) of 2010, Title 51 U.S.C., Subtitle VI
 - Federal Aviation Administration (FAA) Regulations, Title 14, Code of Federal Regulations (CFR), Parts 415.39, 417.129, 431.43

- National Oceanic and Atmospheric Administration Authorities:
 - Title 51, U.S.C., National and Commercial Space Programs, Subtitle VI, Earth Observations, Section 60122
 - National Oceanic and Atmospheric Administration, Department of Commerce Regulations, Title 15, CFR, Part 960, Licensing of Private Land Remote-Sensing Space Systems; Final Rule
 - NOAA Satellites: Per National Environmental Satellite, Data, and Information Service (NESDIS) Policy NQP-0304, NOAA follows NASA policy and best practices for decommissioning and disposal for the fleet of U.S. meteorological satellites NOAA operates.

- National Aeronautics and Space Administration Authorities:
 - National Aeronautics and Space Act, Title 51 United States Code Sec. 10101, *et seq.*
 - NASA Procedural Requirements for Limiting Orbital Debris, NPR 8715.6A, 2007; revised 2009
 - NASA Process for Limiting Orbital Debris, NS 8719.14A, 2007; revised 2011

- Federal Communications Commission Authorities:
 - Communications Act of 1934, as amended, Title 47 U.S.C., Section 301 *et. seq.*
 - Federal Communications Commission (FCC) Regulations, Title 47, CFR, Parts 5, 25, and 97; initial publication at 69 Federal Register 54586 (September 9, 2004)

- Department of Defense Authorities:
 - Title 10 United States Code
 - DoD Directive 3100.10 (Space Policy), 2012; DoD Instruction 3100.12 (Space Support), 2000

- U.S. Geological Survey:
 - The U.S. Geological Survey follows the U.S. best practices for operations and end of life disposal for the Landsat land remote sensing satellites.

- National Policies:
 - U.S. National Space Policy, Presidential Policy Directive 4 (PPD-4), 2010
 - U.S. Government Orbital Debris Mitigation Standard Practices, 2001

Description:

- **National Space Policy**

Presidential Policy Directive 4 (PPD-4), the National Space Policy of 2010, directs the United States to continue to follow the United States Government Orbital Debris Mitigation Standard Practices, consistent with mission requirements and cost effectiveness, in the procurement and operation of spacecraft, launch services, and the conduct of test and experiments in space. Additionally, PPD-4 requires the head of the sponsoring department or agency to approve exceptions to the Standard Practices and notify the Secretary of State.

- **United States Government Orbital Debris Mitigation Standard Practices**

The United States Government Orbital Debris Mitigation Standard Practices were drafted in 1997 and presented to U.S. industry in 1998. After further consultation with industry, the standard practices were adopted in February 2001. The standard practices encompass all program phases, from initial concept development to space hardware disposal, focusing on: the minimization of intentional debris releases and the occurrence of accidental explosions; the avoidance of hazardous collisions; and, responsible disposal of space hardware. The U.S. Government Orbital Debris Mitigation Standard Practices serve as the overall U.S. Government space debris mitigation technical guidance and as the foundation for specific orbital debris mitigation requirements issued by individual U.S. Government departments and agencies.

- **NASA Procedural Requirements (NPR) for Limiting Orbital Debris**

The current NPR 8715.6A represents the culmination of more than 20 years of orbital debris mitigation policy at NASA, which originated with NASA Management Instruction 1700.8 (1993) and NASA Policy Directive 8710.3 (1997). The NPR establishes (1) the organizations and personnel responsible for orbital debris mitigation within NASA, (2) specific program and project responsibilities from development through end-of-operations, and (3) the report structure necessary to document compliance with the NPR.

- **NASA Process for Limiting Orbital Debris**

NASA Standard 8719.14A sets forth the specific orbital debris mitigation technical requirements for all NASA space programs and projects. These requirements cover the basic four elements of the U.S. Government Orbital Debris Mitigation Standard Practices, as well as other specific areas, such as the use of space tethers. The standard also defines the structure and content of related documentation, as well as their required milestone submittal dates. The predecessor

to NS 8719.14A was NSS 1740.14 (1995), which served as the baseline for the development of the U.S. Government Orbital Debris Mitigation Standard Practices.

- **DoD Directive 3100.10 (Space Policy) and DoD Instruction 3100.12 (Space Support)**

The DoD Space Policy directs all DoD components to promote the responsible, peaceful, and safe use of space, including following the U.S. Government Orbital Debris Mitigation Standard Practices, in accordance with direction in the U.S. National Space Policy. The implementing Space Support Instruction contains procedures DoD will follow to limit debris and responsibilities for implementing these guidelines.

- **Regulation of United States Commercial Space Transportation**

The Federal Aviation Administration (FAA), under the purview of the U.S. Department of Transportation, regulates U.S. commercial space transportation. All U.S. persons launching from U.S. launch sites, reentering to U.S. sites, or conducting launch or reentry operations outside the United States, must adhere to these requirements for commercial launch and reentry vehicles. The FAA does not issue licenses for activities the U.S. Government carries out for the U.S. Government.

The FAA issues licenses to commercial launch vehicles after a rigorous evaluation of the safety of the launch system. If at any time the license holder does not comply with the regulations, the FAA may revoke the license or impose a fine.

The current FAA orbital debris mitigation regulations focus on safety at the end of launch. End of launch is defined by the FAA as the last exercise of control over the launch vehicle. The relevant regulations are as follows:

- §415.39 Safety at end of launch -- To obtain safety approval, an applicant must demonstrate compliance with §417.129 of this chapter, for any proposed launch of a launch vehicle with a stage or component that will reach Earth orbit.
- §417.129 Safety at end of launch -- A launch operator must ensure for any proposed launch that for all launch vehicle stages or components that reach Earth orbit—
 - a) There is no unplanned physical contact between the vehicle or any of its components and the payload after payload separation;
 - b) Debris generation does not result from the conversion of energy sources into energy that fragments the vehicle or its components. Energy sources include chemical, pressure, and kinetic energy; and
 - c) Stored energy is removed by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy.
- §431.43(c)(3) Reusable launch vehicle (RLV) mission operational requirements and restrictions for an RLV mission -- There will be no unplanned physical contact between the vehicle or its components and payload after payload separation and debris generation will not result from conversion of energy sources into energy that fragments the vehicle or its payload. Energy sources include, but are not limited to, chemical, pneumatic, and kinetic energy.

- **Federal Communications Commission (FCC) Regulations**

The FCC regulations apply to radiofrequency licensing of satellite communications, other than communications using U.S. Federal Government stations. (47 U.S.C. 301, 305). The regulations require applicants to provide information concerning use of orbits and plans for mitigation of orbital debris (47 C.F.R. 5.64, 25.114, 97.207). The information is analyzed to determine whether a grant serves the public interest. The FCC must find that the “public interest, convenience, and necessity” will be served in order to grant a license. (47 U.S.C. 308).

FCC regulations also require that geostationary satellites be relocated at end-of-mission in accordance with the IADC guideline, and all satellites must discharge stored energy sources at end-of-mission. 47 CFR 25.283.

An FCC Order (FCC 04-130) articulates additional policies and practices.

- **National Oceanic and Atmospheric Administration (NOAA): Regulation of Private Remote Sensing**

- **Title 51, U.S.C., National and Commercial Space Programs, Subtitle VI, Earth Observations, Section 60122, Conditions for Operations:**

Defines specific guidelines and policy for private remote sensing spacecraft. This statute contains a specific requirement that operators shall, upon termination of operations under the license, make disposition of any satellites in space in a manner satisfactory to the President.

- **National and Commercial Space Programs Act (NCSPA) of 2010 (Title 51 U.S.C., Subtitle VI):**

This Act applies to all U.S. operators of commercial remote sensing satellites. Written compliance with U.S. orbital debris and disposal policies and best practices is a prerequisite for obtaining a license.

- **15 CFR Part 960 Licensing of Private Land Remote-Sensing Space Systems; Final Rule**

The National Oceanic and Atmospheric Administration (NOAA) issues regulations establishing the agency’s requirements for the licensing, monitoring and compliance of operators of private Earth remote sensing space systems under Title 51, U.S.C., National and Commercial Space Programs, Subtitle VI, Earth Observations (the Act) (formerly Title II of the Land Remote Sensing Policy Act of 1992, 15 U.S.C. § 5601, *et seq.*). These regulations implement the provisions of the Act and the 2003 U.S. Commercial Remote Sensing Policy. They are also derived from experience gained with respect to the licensing of private remote sensing space systems. They are intended to facilitate the development of the U.S. commercial remote sensing industry and promote the collection and widespread availability of Earth remote sensing data, while preserving essential U.S. national security interests, meeting foreign policy objectives and complying with international obligations. The regulations contain a specific requirement that operators shall, upon termination of operations under the license, make disposition of any satellites in space in a manner satisfactory to the President. The measures required to meet this requirement are specified in each license issued by NOAA.

NOAA: Operation of U.S. Meteorological Satellites

NOAA NESDIS directs and manages the operations of the U.S. fleet of meteorological satellites, including command and control activities, health and safety monitoring, anomaly investigation and corrective actions. The fleet is comprised of three major systems: the Geostationary Operational Environmental Satellite System (GOES), the Polar-orbiting Operational Environmental Satellite (POES), and the Suomi National Polar-orbiting Partnership. In addition to being responsible for the health and safety of the spacecraft, NOAA NESDIS is also responsible for their decommissioning and disposal.

Applicability:

- **National Space Policy**

The National Space Policy provides guidance to all U.S. Government Departments and Agencies.

- **U.S. Government Orbital Debris Mitigation Standard Practices**

These government orbital debris mitigation standard practices apply to all U.S. Government Departments and Agencies involved in space operations, including regulatory authorities. The implementation of these standard practices is executed through Department/Agency specific requirements or regulations, as applicable. The National Space Policy requires the head of the department or agency sponsoring a launch to approve exceptions to the Standard Practices and notify the Secretary of State.

- **NASA Procedural Requirements for Limiting Orbital Debris**

The processes defined within NPR 8715.6A are mandatory without exception.

- **NASA Process for Limiting Orbital Debris**

NASA orbital debris mitigation requirements are mandatory for each NASA space program and project, although individual requirements can be waived by senior NASA management on a case-by-case basis with justification.

- **DoD Directive 3100.10 (Space Policy) and DoD Instruction 3100.12 (Space Support)**

All DoD components are required to follow DoDD 3100.10 and DoDI 3100.12.

- **Regulations for Commercial Launch Vehicles**

The 14 CFR part 400 regulations are applicable to commercial launch vehicles launched in the United States and to commercial launch vehicles launched by United States citizens or companies.

- **FCC Regulations**

FCC regulations and radio station licensing provisions apply to operations of earth stations in the United States and mobile stations (including space stations) under the jurisdiction of the United States, except for U.S. Federal Government stations. (47 U.S.C. 301, 305). Compliance with regulations is mandatory.

- **NOAA Regulations: Licensing of Private Land Remote-Sensing Space Systems, 15 CFR Part 960**

These Regulations apply to all U.S. operators of commercial remote sensing satellites. Written compliance with U.S. orbital debris and disposal policies and best practices is a prerequisite for obtaining a license.

Relation to other international mechanism(s):

The U.S. Government Orbital Debris Mitigation Standard Practices served as one of the primary sources for the development of the IADC Space Debris Mitigation Guidelines and the later Space Debris Mitigation Guidelines of the Committee. NASA is a founding member of the IADC and has played a leading role in discussions of space debris mitigation in the IADC, and in the Scientific and Technical Subcommittee (STSC) of the Committee on the Peaceful Uses of Outer Space since the topic became a standing agenda item in 1994. In the IADC, NASA continues to play a lead role in researching and developing relevant technical standards; this work will continue to inform the STSC so that the Space Debris Mitigation Guidelines of the Committee can be updated as appropriate.

Link to other national mechanisms:

The FCC regulations apply to a request for a license for an earth station to communicate with a satellite licensed by another country. (47 C.F.R. 25.137(b)). The applicant must provide information concerning the debris mitigation plans for the satellite. Alternatively, the applicant can seek a determination that the satellite operations will be subject to “direct and effective” regulation by another country. The FCC determined in several specific cases that satellites are subject to direct and effective regulation. The cases involved satellites that operate under launch and space operations authorizations issued under national mechanisms by the United Kingdom or France.

References:

- **National Space Policy**
http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf
- **United States Government Orbital Debris Mitigation**
http://orbitaldebris.jsc.nasa.gov/library/USG_OD_Standard_Practices.pdf
http://orbitaldebris.jsc.nasa.gov/library/NPR_8715_006A.pdf
http://orbitaldebris.jsc.nasa.gov/library/NPR_8715_006A.pdf
<http://www.hq.nasa.gov/office/codeq/doctree/871914.pdf>
- **DoD Materials**
 - DoD Directive 3100.10 (Space Policy):
<http://www.dtic.mil/whs/directives/corres/pdf/310010p.pdf>

- DoD Instruction 3100.12 (Space Support):
<http://www.dtic.mil/whs/directives/corres/pdf/310012p.pdf>
- **FCC Materials**
 - Communications Act of 1934, as amended:
http://www.house.gov/legcoun/Comps/FCC_CMD.PDF
 - Code of Federal Regulations (Link for General Browsing of Title 47):
http://www.ecfr.gov/cgi-bin/text-idx?SID=685669905c05d232fc85ebb36583d4d5&tpl=/ecfrbrowse/Title47/47tab_02.tpl
 - Code of Federal Regulations (Links for Specific Provisions Related to Debris Mitigation):
 - Part 5 (Experimental Licensing):
<http://www.ecfr.gov/cgi-bin/text-idx?SID=685669905c05d232fc85ebb36583d4d5&node=47:1.0.1.1.6.2.233.9&rgn=div8>
 - Part 25 (Most Satellite Communications):
 - 47 C.F.R. 25.114 (d)
<http://www.ecfr.gov/cgi-bin/text-idx?SID=685669905c05d232fc85ebb36583d4d5&node=47:2.0.1.1.4.2.36.5&rgn=div8>
 - 47 C.F.R. 25.283
<http://www.ecfr.gov/cgi-bin/text-idx?SID=f4d4bb0aa0761d43a831765407965cd7&node=47:2.0.1.1.4.4.41.13&rgn=div8>
 - Part 97 (Amateur Satellite):
<http://www.ecfr.gov/cgi-bin/text-idx?SID=9c5e6e34eb0f19a977ff59724fd441b2&node=47:5.0.1.1.6&rgn=div5#47:5.0.1.1.6.3.159.4>
 - Order, FCC 04-130, and Explanatory Materials:
<http://transition.fcc.gov/ib/sd/ssr/mod.html>
Federal Register publication of rules adopted in FCC 04-130:
<http://www.gpo.gov/fdsys/pkg/FR-2004-09-09/html/04-20362.htm>
 - Other Explanatory Materials:
 - Licensing Guidance for Small Satellites:
http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-445A1.pdf
 - Licensing Guidance for Commercial Space Launches:
http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-446A1.pdf
- **NOAA Materials:**
 - National and Commercial Space Programs Act (NCSPA) of 2010 (Title 51 U.S.C., Subtitle VI) (Commercial Remote Sensing Satellites):

<http://www.gpo.gov/fdsys/pkg/USCODE-2011-title51/pdf/USCODE-2011-title51-subtitleVI.pdf>

- Licensing of Private Land Remote-Sensing Space Systems, 15 CFR Part 960 (Commercial Remote Sensing Satellites):

<http://www.nesdis.noaa.gov/CRSRA/files/15%20CFR%20Part%20960%20Regs%202006.pdf>

COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE (COPUOS): SPACE DEBRIS MITIGATION GUIDELINES

International mechanism:

Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space, endorsed by the United Nations General Assembly in its Resolution 62/217 of 22 December 2007.

Description:

The Space Debris Mitigation Guidelines of the Committee are the result of more than a decade of work undertaken by the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee (STSC). After extensive preparatory work by the STSC Working Group on Space Debris, the Guidelines were adopted by the STSC at its 44th session in 2007 (A/AC.105/890, para.99), endorsed by the Committee at its 50th session in 2007 (A/62/20, paras. 118 and 119) and subsequently submitted to the General Assembly at its session in 2007.

As agreed by the United Nations General Assembly through resolution 62/217 of 22 December 2007, the Guidelines reflect the existing practices as developed by a number of national and international organizations. From a technical point of view, the guidelines are applicable to mission planning and the operation of newly designed spacecraft and orbital stages and, if possible, to existing ones. There is a total of seven guidelines: a) to limit debris released during nominal [spacecraft / orbital stages] operations, b) to minimize the potential for break-ups during operational phases, c) to limit the probability of accidental collision in orbit, d) to avoid intentional destruction and other harmful activities, e) to minimize the potential for post-mission break-ups resulting from stored energy, and f) / g) to limit the long-term presence of spacecraft and launch vehicle orbital stages in the low-Earth orbit (LEO) region / geosynchronous Earth orbit (GEO) region after the end of their mission.

The Guidelines are meant to be reviewed and revised in the future as necessary.

Applicability:

The Guidelines are not legally binding under public international law. Through resolution 62/217, the United Nations General Assembly invited Member States of the United Nations to implement those voluntary guidelines through relevant national mechanisms “to the greatest extent feasible”, through space debris mitigation practices and procedures.

Relation to international mechanisms:

The Guidelines are based on the technical content and the basic definitions of the IADC Space Debris Mitigation Guidelines, and taking into consideration the United Nations treaties and principles on outer space.

References:

- www.unoosa.org

EUROPEAN SPACE AGENCY (ESA): SPACE DEBRIS MITIGATION POLICY FOR AGENCY PROJECTS

International mechanism:

“Space Debris Mitigation Policy for Agency Projects”, administrative instruction of the European Space Agency (ESA) Director General, entered into force on 28 March 2014.

Note: This administrative instruction replaces ESA’s previous instruction of 2008, fully aligning ESA’s space debris mitigation policy to ISO Standard 24113 "Space Systems – Space Debris Mitigation Requirements" issued in May 2011 and adopted by the European Coordination on Space Standardisation (ECSS) as the ECSS-U-AS-10C standard in 2012.

Description:

The administrative instruction “Space Debris Mitigation for Agency Projects” of the ESA Director General establishes ECSS-U-AS-10C as the ESA standard for the technical requirements on space debris mitigation for Agency projects, sets out the principles governing its implementation and defines the associated internal responsibilities. It applies to a) the procurement of ESA space systems (e.g.: launchers, satellites, inhabited or robotic vehicles) and b) operations, under the responsibility of ESA, of any given space system. For the procurement of launch services for ESA space systems, all reasonable efforts shall be made to ensure the use of launchers which are compliant with ECSS-U-AS-10C. The instruction contains two annexes listing a) implementation requirements (see below) and b) terms and definitions.

The “Implementation Requirements”, annexed to the administrative instruction “Space Debris Mitigation Policy for Agency Projects” of the ESA Director General, define a set of requirements for the limitation of space debris and a set of risk reduction measures in the case of re-entries of space systems (or their components) into the Earth’s atmosphere, including the definition of a maximum acceptable casualty risk for ESA space systems.

Applicability:

The European Space Agency is an international intergovernmental organisation with international legal personality (Art. 15 ESA Convention) and thus a subject of public international law. The ESA Director General is its executive organ (Art. 10, 12 ESA Convention). Within the ESA legal system, the Director General’s administrative instructions and policies are binding for all ESA staff, who, in applicable cases, have to ensure the correct implementation of such acts in ESA’s relation with third parties.

Relation to international mechanisms:

The European Code of Conduct for Space Debris Mitigation, the Inter-Agency Space Debris Coordination Committee (IADC) Guidelines for Space Debris Mitigation, the Space Debris Mitigation Guidelines of the Committee and the United Nations Treaties and Principles on Outer Space are referenced in the administrative instruction “Space Debris Mitigation for Agency Projects” of the ESA Director General; the technical requirements in the administrative

instruction are similar, yet more specific, and meet the same intent of the requirements that are listed in the ISO Standard 24113 of 2011. Therefore, ESA's space debris mitigation policy is fully in line with the non-binding guidelines listed above. It shall be reminded that ESA has taken an active role in the elaboration of some of these instruments, in particular through its involvement in the IADC and through its endorsement of the European Code of Conduct for Space Debris Mitigation of 2004.

Link to national mechanisms:

There is no legal relation between the administrative instruction "Space Debris Mitigation for Agency Projects" of the ESA Director General and national space debris mitigation mechanisms of ESA Member States or non-Member States. However, the administrative instruction specifies that all reasonable efforts shall be made to ensure that, whenever relevant, ESA programmes comply with re-entry regulations and procedures of launching states [cf. Art.VII Outer Space Treaty].

References:

- ESA's space debris mitigation mechanisms and ESA activities regarding space debris mitigation are described on the website of ESA under http://www.esa.int/Our_Activities/Operations/Space_Debris

INTER-AGENCY SPACE DEBRIS COORDINATION COMMITTEE (IADC): SPACE DEBRIS MITIGATION GUIDELINES

International mechanism:

Inter-Agency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines, 2002; revised 2007

Description:

At the 17th meeting of the IADC in Darmstadt, Germany, during 11-13 October 1999, Working Group 4 undertook the challenge to develop the first set of consensus international space debris mitigation guidelines. This effort was designated IADC Action Item 17.2. Together, Working Group 4 and the Steering Group during 2001-2002 developed and refined a draft set of mitigation guidelines. The IADC Space Debris Mitigation Guidelines were adopted by consensus of the Steering Group in October 2002 and were presented to the Scientific and Technical Committee of the United Nations' Committee on the Peaceful Uses of Outer Space in February, 2003. A minor revision to the guidelines was accepted by the Steering Group in September, 2007.

The IADC Space Debris Mitigation Guidelines describe existing practices which have been identified and evaluated for limiting the generation of space debris in the environment. The guidelines cover the overall environmental impact of space missions with a focus on (1) limitation of debris released during normal operations, (2) minimisation of the potential for on-orbit break-ups, (3) post-mission disposal, and (4) prevention of on-orbit collisions.

Applicability:

The IADC Space Debris Mitigation Guidelines are non-binding and as such applicable to mission planning and the design and operation of spacecraft and orbital stages that will be injected into Earth orbit. Organizations are encouraged to use these guidelines in identifying the standard that they will apply when establishing the mission requirements for planned spacecraft and orbital stages. Operators of existing spacecraft and orbital stages are encouraged to apply these guidelines to the greatest extent possible.

Relation to international mechanisms:

The IADC Space Debris Mitigation Guidelines were used as a foundation for the development of the Space Debris Mitigation Guidelines of the Committee, which were adopted by the Committee on the Peaceful Uses of Outer Space and later endorsed by the UN General Assembly in 2007, as well as the basis of the ISO standard 24113 "space systems – space debris mitigation".

References:

http://www.iadc-online.org/index.cgi?item=docs_pub

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO): STANDARDS AND TECHNICAL REPORTS

International mechanisms:

The following is a list of the standards and technical reports developed by the International Organization for Standardization (ISO) for mitigating space debris:

1. ISO 24113, Space systems — Space debris mitigation requirements. Publication date: 1st edition - 2010; 2nd edition - 2011; 3rd edition - in preparation.
2. ISO 23312, Space systems — Detailed space debris mitigation requirements for spacecraft. Publication date: 1st edition - in preparation.
3. ISO 20893, Space systems — Detailed space debris mitigation requirements for launch vehicle orbital stages. Publication date: 1st edition - in preparation.
4. ISO 11227, Space systems — Test procedures to evaluate spacecraft material ejecta upon hypervelocity impact. Publication date: 1st edition - 2012; Amendment 1 - in preparation.
5. ISO 14200, Space environment (natural and artificial) — Guide to process-based implementation of meteoroid and debris environmental models (orbital altitudes below GEO+2000km). Publication date: 1st edition - 2012.
6. ISO 16126, Space systems — Assessment of survivability of unmanned spacecraft against space debris and meteoroid impacts to ensure successful post-mission disposal. Publication date: 1st edition - 2014.
7. ISO 27852, Space systems — Estimation of orbit lifetime. Publication date: 1st edition - 2011; 2nd edition - 2016.
8. ISO 27875, Space systems — Re-entry risk management for unmanned spacecraft and launch vehicle orbital stages. Publication date: 1st edition - 2010; Amendment 1 - 2016; 2nd edition - in preparation.
9. ISO/TR 16158, Space systems — Avoiding collisions among orbiting objects: Best practices, data requirements, and operational concepts. Publication date: 1st edition - 2013; 2nd edition - in preparation.
10. ISO/TR 18146, Space systems — Space debris mitigation design and operation guidelines for spacecraft. Publication date: 1st edition - 2015.
11. ISO/TR 20590, Space systems — Space debris mitigation design and operation guidelines for launch vehicle orbital stages. Publication date: 1st edition - 2017.
12. ISO 13541, Space data and information transfer systems — Attitude data messages. Publication date: 1st edition - 2010; 2nd edition - in preparation.
13. ISO 26900, Space data and information transfer systems — Orbit data messages. Publication date: 1st edition - 2012; 2nd edition - in preparation.
14. ISO 13526, Space data and information transfer systems — Tracking data message. Publication date: 1st edition - 2010; 2nd edition - in preparation.

15. ISO 19389, Space data and information transfer systems — Conjunction data message.
Publication date: 1st edition - 2014.

Description:

ISO 24113 (Document type: international standard) defines the primary space debris mitigation requirements applicable to all elements of unmanned systems launched into, or passing through, near-Earth space, including launch vehicle orbital stages, operating spacecraft and any objects released as part of normal operations. The requirements contained in ISO 24113 are intended to reduce the growth of space debris by ensuring that spacecraft and launch vehicle orbital stages are designed, operated and disposed of in a manner that prevents them from generating debris throughout their orbit lifetime. The requirements are also intended to reduce the casualty risk on ground associated with atmospheric re-entry of space objects. ISO 24113 is the top-level standard in a family of ISO standards addressing space debris mitigation.

ISO 23312 (Document type: international standard) will support compliance with those clauses in ISO 24113 that are relevant to spacecraft. ISO 23312 will define detailed space debris mitigation requirements for the design and operation of spacecraft.

ISO 20893 (Document type: international standard) will support compliance with those clauses in ISO 24113 that are relevant to launch vehicle orbital stages. ISO 20893 will define detailed space debris mitigation requirements for the design and operation of launch vehicle orbital stages.

ISO 11227 (Document type: international standard) supports compliance with those clauses in ISO 24113 that are relevant to space debris impact risk assessment. ISO 11227 describes an experimental procedure for acquiring data to characterize the ejecta released when spacecraft materials are impacted by hypervelocity projectiles representative of space debris and meteoroids. Such data contribute to informed decisions being made with regard to the selection of suitable materials for external surfaces on spacecraft.

ISO 14200 (Document type: international standard) supports compliance with those clauses in ISO 24113 that are relevant to space debris impact risk assessment. ISO 14200 specifies a process for implementing meteoroid and debris environment models in the impact risk assessment of spacecraft and launch vehicle orbital stages. Guidance is provided for selecting and using the models and ensuring their traceability throughout the design phase of a spacecraft or launch vehicle orbital stage.

ISO 16126 (Document type: international standard) supports compliance with those clauses in ISO 24113 that are relevant to space debris impact risk assessment. ISO 16126 defines requirements and a procedure for assessing the survivability of an unmanned spacecraft against space debris and meteoroid impacts to ensure the survival of critical components required to perform post-mission disposal. ISO 16126 also describes two impact risk analysis procedures that can be used to satisfy the requirements.

ISO 27852 (Document type: international standard) supports compliance with those clauses in ISO 24113 that are relevant to post-mission disposal in the LEO protected region. ISO 27852 describes a process for the estimation of orbit lifetime for spacecraft, launch vehicles, upper stages and associated debris in LEO-crossing orbits. ISO 27852 also clarifies the following: a)

modelling approaches and resources for solar and geomagnetic activity modelling; b) resources for atmosphere model selection; c) approaches for spacecraft ballistic coefficient estimation.

ISO 27875 (Document type: international standard) supports compliance with those clauses in ISO 24113 that are relevant to the re-entry of space objects. ISO 27875 provides a framework with which to assess, reduce and control the potential risks that spacecraft and launch vehicle orbital stages pose to people and the environment when those space vehicles re-enter the Earth's atmosphere and impact the Earth's surface. ISO 27875 is intended to be applied to the planning, design and review of space vehicle missions for which controlled or uncontrolled re-entry is possible.

ISO/TR 16158 (Document type: technical report) supports compliance with those clauses in ISO 24113 that are relevant to collision avoidance. ISO/TR 16158 describes some widely used techniques for perceiving close approaches, estimating collision probability, estimating the cumulative probability of survival, and manoeuvring to avoid collisions.

ISO/TR 18146 (Document type: technical report) can be used to guide engineers in the application of those ISO space debris mitigation standards that are relevant to spacecraft. ISO/TR 18146 contains non-normative information on spacecraft design and operational practices for mitigating space debris.

ISO/TR 20590 (Document type: technical report) can be used to guide engineers in the application of those ISO space debris mitigation standards that are relevant to launch vehicle orbital stages. ISO/TR 20590 contains non-normative information on launch vehicle orbital stage design and operational practices for mitigating space debris.

ISO 13541 (Document type: international standard) specifies two standard message formats for use in transferring spacecraft attitude information between space agencies/operators. Such exchanges are used in many ways, including: a) pre-flight planning and scheduling for tracking or attitude estimation support; b) carrying out attitude operations; c) performing attitude comparisons; d) carrying out attitude propagations and/or sensor predictions. These data exchanges can also be important in the assessment of collision probability.

ISO 26900 (Document type: international standard) specifies three standard message formats for use in transferring spacecraft orbit information between space agencies/operators. Such exchanges are used in many ways, including: a) pre-flight planning and scheduling for tracking or navigation support; b) carrying out tracking operations; c) performing orbit comparisons and orbit conjunction analyses; d) performing orbit propagation and orbit reconstruction; and e) designing collaborative manoeuvres. These data exchanges are the foundation of comprehensive, timely, accurate conjunction assessment, collision avoidance, SSA and Space Traffic Management.

ISO 13526 (Document type: international standard) specifies a standard message format for use in exchanging spacecraft tracking data used in orbit determination between space agencies/operators. Such exchanges are used for distributing tracking data output from routine interagency cross-supports where spacecraft missions managed by one agency are tracked from a ground station managed by a second agency. These data exchanges are critical to the development of comprehensive, timely, accurate space catalogues that are foundational to actionable SSA.

ISO 19389 (Document type: international standard) specifies a standard message format for use in exchanging spacecraft conjunction information between originators of conjunction assessments and satellite owner/operators and other authorized parties. Such exchanges provide critical information to satellite owner/operators to enable timely collision avoidance decisions. ISO 19389 is applicable to satellite operations in all environments in which close approaches and collisions among satellites are concerns.

Applicability:

Voluntary

Relation to international mechanisms:

	Measures	ISO Standards (or Technical Reports)	UN Guidelines	IADC Guidelines	
Limiting debris generation	Released objects	General measures for avoiding the release of objects	ISO 24113, 6.1.1	Recommendation 1	5.1
		Slag from solid motors	ISO 24113, 6.1.2.2, 6.1.2.3	--	--
		Combustion products from pyrotechnics	ISO 24113, 6.1.2.1 (Combustion Products < 1 mm)	--	--
	On-orbital break-ups	Intentional destruction	ISO 24113, 6.2.1	Recommendation 4	5.2.3
		Accidental break-ups during operation	ISO 24113, 6.2.2 (Probability < 10 ⁻³)	Recommendation 2	5.2.2 (Monitoring)
		Post-mission break-up (Passivation, etc.)	ISO 24113, 6.2.2.3 (Detailed in ISO 20893, 23312)	Recommendation 5	5.2.1
Disposal at end-of-operations	GEO	Re-orbit at end of operation ISO 24113, 6.3.2 (Detailed in ISO 20893, 23312) 6.3.2.1: General Requirement 6.3.2.2: 235 km+ + (1 000•Cr•A/m), e < 0,003 6.3.1: Success Probability > 0,9	Recommendation 7 (No quantitative requirements) Note: ITU-R S.1003-1 recommends:235 km + 1,000 Cr*A/M Here, A[m ²], M[kg], Cr[-]	5.3.1 235 km+ (1 000•Cr•A/m), e < 0,003	
	LEO	Reduction of orbital lifetime ISO 24113, 6.3.3 (Detailed in ISO 20893, 23312) 6.3.3.1: Orbital lifetime after end of operation < 25 years 6.3.1: Success Probability > 0,9	Recommendation 6 (No quantitative requirements)	5.3.2 (Recommend 25 years)	

	Measures	ISO Standards (or Technical Reports)	UN Guidelines	IADC Guidelines
	Options for removal from the protected region	ISO 24113, 6.3.3.2 (a) ~ (f) (Detailed in ISO 20893, 23312)	Mentioned in Recommendation 6	5.3.2
Re-entry	Avoidance of ground casualties	ISO 24113, 6.3.4 (Detailed in ISO 27875)	Included in Recommendation 6	5.3.2
	Collision avoidance for large debris	ISO/TR-16158 (for assessment only) ISO/19389	Recommendation 3	5.4
	Protection from the impact of micro-debris	ISO 16126 (for assessment only)	--	5.4
	Exchange or pooling of space data for the purpose of safety-of-flight and mitigation of Radio Frequency Interference	ISO 13541, Attitude ISO 26900, Orbit ISO 13526, Tracking ISO 19389, Conjunction	Consensus LTS Guideline 11 (Share space object and orbital event information), Guideline 12 (Orbital information sharing), Guideline 13 (sharing of space debris information), Guideline 14 (Conjunction Assessment), Guideline 31 (Reentry)	5.4 "Reliable orbital information"

References:

1. <https://www.iso.org/standard/57239.html>
2. <https://www.iso.org/standard/75221.html>
3. <https://www.iso.org/standard/73023.html>
4. <https://www.iso.org/standard/57535.html>
5. <https://www.iso.org/standard/54506.html>
6. <https://www.iso.org/standard/55720.html>
7. <https://www.iso.org/standard/68572.html>
8. <https://www.iso.org/standard/44393.html>
9. <https://www.iso.org/standard/55739.html>
10. <https://www.iso.org/standard/61602.html>

11. <https://www.iso.org/standard/68467.html>
12. <https://www.iso.org/standard/53987.html>
13. <https://www.iso.org/standard/46135.html>
14. <https://www.iso.org/standard/53984.html>
15. <https://www.iso.org/standard/64784.html>

INTERNATIONAL TELECOMMUNICATIONS UNION (ITU): RECOMMENDATION ITU-R S.1003.2

International mechanism:

International Telecommunications Union (ITU) Recommendation ITU-R S.1003.2 (12/2010)
Environmental protection of the geostationary-satellite orbit

Description:

ITU-R S.1003.2 provides guidance about disposal orbits for satellites in the geostationary-satellite orbit (GSO). In this orbit, there is an increase in debris due to fragments resulting from increased numbers of satellites and their associated launches.

Given the current limitations (primarily specific impulse) of space propulsion systems, it is impractical to retrieve objects from GSO altitudes or to return them to Earth at the end of their operational life. A protected region must therefore be established above, below and around the GSO which defines the nominal orbital regime within which operational satellites will reside and manoeuvre. To avoid an accumulation of non-functional objects in this region, and the associated increase in population density and potential collision risk that this would lead to, satellites should be manoeuvred out of this region at the end of their operational life. In order to ensure that these objects do not present a collision hazard to satellites being injected into GSO, they should be manoeuvred to altitudes higher than the GSO region, rather than lower.

The recommendations embodied in ITU-R S.1003.2 are:

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

Applicability:

ITU-R S.1003.2 is addressed to member states of the ITU and applies to the operation of satellites in the GSO. Due to its character as a recommendation of the ITU Radiocommunication Assembly, it is not legally binding.

Relation to international mechanisms:

None.

References:

- http://www.itu.int/rec/R-REC-S.1003/_page.print

ITALIAN SPACE AGENCY (ASI), BRITISH NATIONAL SPACE CENTRE (BNSC⁴), FRENCH SPACE AGENCY (CNES), GERMAN AEROSPACE AGENCY (DLR) AND EUROPEAN SPACE AGENCY (ESA): EUROPEAN CODE OF CONDUCT FOR SPACE DEBRIS MITIGATION**International mechanism:**

European Code of Conduct for Space Debris Mitigation, Issue 1.0, 28 June 2004

Description:

The European Code of Conduct for Space Debris Mitigation (in the following: the Code) has been developed and formally adopted, upon signature by their Directors General, by the Italian Space Agency (ASI), the British National Space Centre (BNSC), the French Space Agency (CNES), the German Aerospace Agency (DLR) and the European Space Agency (ESA).

The primary objectives of the Code are a) to help preventing on-orbit break-ups and collisions of spacecraft, b) to facilitate the removal from useful densely populated orbit regions and subsequent disposal of spacecraft and orbital stages that have reached the end of mission operations and c) to help limiting objects released during normal spacecraft operations. To reach these goals, the Code presents fundamental mitigation, safety and protection measures for the design and operation of space systems. These measures are grouped into 1) management measures, 2) design measures including end-of-life measures, 3) operational measures including end-of-life measures, 4) impact protection measures and 5) re-entry safety measures. It does not cover the launch phase safety.

The Code is accompanied by a “Support to Implementation” document aiming at providing appropriate sources of information and tools to individuals involved in the management, design, operation and mission control of spacecraft.

Applicability:

The application of the Code is on voluntary basis. The agencies having adopted it recommend its application “by any other space project conducted in Europe, or by a European entity acting outside Europe, including operators” (Article 2.2 of the Code). The Code contains provisions that “may be given binding effect by means of legal instruments between contracting parties”.

Relation to international mechanisms:

The Code is consistent with the IADC Space Debris Mitigation Guidelines (which, in turn, were used as a foundation for the development of the Space Debris Mitigation Guidelines of the Committee), while providing greater (technical) detail and explanations. The Code, in its

⁴ now UK Space Agency

introduction, furthermore makes reference to Articles I and IX of the Outer Space Treaty of 1967 and to the Liability Convention of 1972.

References:

None.