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 rapture 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