

NATIONAL STANDARD OF THE RUSSIAN FEDERATION FOR SPACE DEBRIS MITIGATION

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Normative and technical document that define requirements for the mitigation of human-produced near-earth space pollution develops in Russian Federation.

NATIONAL STANDARD of the Russian Federation GOST R 52925-2008 «SPACE TECHNOLOGY ITEMS. General Requirements on Space Systems for the Mitigation of Human-Produced near-Earth Space Pollution» was approved in 2008 and entered into force since 1st January of 2009. Requirements of this standard harmonized with requirements of «UN SPACE DEBRIS MITIGATION GUIDELINES»

This standard consists of six parts:

- Scope;
- References to Standards;
- Terms & Definitions;
- Abbreviations;
- General Provisions;
- General Requirements on Space Systems for the Mitigation of Human-Produced near-Earth Space Pollution.

SCOPE

This standard establishes the general requirements on space vehicles for the mitigation of human-produced debris in near-Earth space. The requirements in this standard apply to newly created and updated space systems that are scientific, socio-economic, to include studying deep space, commercial, and special (defense), in nature, including reusable and manned space vehicles. The requirements in this standard must apply at all stages of the space system's life cycle: development of general and design specifications, design, production, placing in operation, operation, and disposal.

GENERAL PROVISION

This standard defines main sources of human-produced near-Earth space pollution.

There are:

- Inadvertent explosions of space systems;
- Self-destruction of spacecrafts (spacecraft systems) when their active operations are complete or as a result of an emergency;
- Release into near-Earth space of operations components (springs, thrusters, parts of pyrobolts, etc.);
- Stages of launch vehicles, boosters, and spacecrafts when their active operations are complete;
- Destruction of space objects as a result of them colliding together on-orbit or with particles of natural origin;
- Emissions of unburned propellant from the propulsion system;
- Inadvertent release of materials from the space vehicle's surface;
- Cable systems released after use;
- Release into near-Earth space of life support products from manned space vehicles.

This standard defines principal measures for mitigating human-produced near-Earth space pollution.

There are:

- Preventing the formation of space debris during the nominal operations of space systems;
- Preventing the possible destruction of space systems, including as a result of an explosion;
- Breakout space systems from operating orbits after active operations are complete;

- Preventing the collision of space systems on orbit;
- Minimizing the ballistic lifetimes of space systems after active operations are complete.

The requirements in this standard on space systems with respect to mitigating the human-produced near-Earth space pollution must be included in a separate section of the general and design specifications for updated and newly developed space systems.

The design and operational documentation of all space systems must include the specific hardware and design and logistics/technical measures for implementing general and design specification requirements on mitigating the human-produced near-Earth space pollution, and the rationale for these measures.

When planning programs, projects, or experiments involving the launch of space systems into orbit, it is mandatory that the trajectories of these objects be determined reliably using existing means of observation.

The cost of work to implement the requirements in this standard must be taken into consideration when planning and fulfilling them.

During the assessment of an item of space technology, certification entities must conduct an analysis on fulfilling the requirements for human-produced pollution mitigation in near-Earth space.

All instances of human-produced near-Earth space pollution, including those not associated with realizing this standard, must be analyzed, the causes must be determined, and recommendations put forward on preventing them.

The fulfillment of these requirements applicable to space technology for mitigating human-produced near-Earth space pollution shall be monitored by the item's owner.

GENERAL REQUIREMENTS ON SPACE SYSTEMS FOR THE MITIGATION OF HUMAN-PRODUCED NEAR-EARTH SPACE POLLUTION

This standard defines several groups of General Requirements on Space Systems for the Mitigation of Human-Produced near-Earth Space Pollution:

Requirements on mitigating human-produced near-Earth space pollution during nominal operations.

Requirements on preventing the destruction of space systems:

- Preventing the inadvertent destruction of orbital systems and insertion systems during operation;
- Preventing the intentional destruction of space systems;
- Preventing the destruction of space systems after active operations are complete.

Requirements on preventing the collision of space systems with space objects:

- When planning the launch of orbital and insertion systems, the risk must be assessed of collision of the orbital/insertion systems to be launched with documented space objects, and appropriate time intervals for launch must be selected to minimize the risk of collision;
- Measures to decrease the likelihood of collision with documented space objects must be included in orbital systems for long-duration manned mission programs;
- The design of orbital systems must involve maximum protection against destruction in a collision with space debris, which can result in the formation of new space debris.

Requirements on breakout of space systems when operations are complete to debris areas or to orbits with limited ballistic lifetimes:

- Orbital and insertion systems operating in the area of geostationary orbit, when operations are complete, must be removed from geostationary orbit in order to prevent collision with a space object that remains in geostationary orbit. The perigee altitude of the debris orbit must exceed the altitude of geostationary orbit by the value calculated according to the equation IADC
- All orbital and insertion systems that have completed operations and are located in or passing through low-Earth orbit area (including space objects in highly elliptical orbit), or could be located there as a result of a subsequent trajectory, must be break out to an orbit in which one of the following conditions are present:
 - The duration of its passive ballistic lifetime under the impact of residual atmosphere does not exceed 25 years;

- Breakout to a debris area is performed to prevent the possibility of entering low-Earth orbit.

Orbital systems not designed with the capability to change orbital parameters or maneuver after operations are complete must be inserted into orbits in low-Earth orbit area with a passive ballistic lifetime not exceeding 25 years.

Breakout of orbital systems containing radioactive, toxic, or other harmful substances from orbit must be performed in such a way as to preclude the inappropriate contamination of the Earth's atmosphere or surface.

The Russian Federation is devoted to the international efforts on space debris problem resolution and is already implementing practical steps on space debris mitigation on a voluntary basis within its own national mechanisms taking into account the UN Space Debris Mitigation Guidelines.