



***ACTIVITY OF RUSSIAN FEDERATION  
ON SPACE DEBRIS PROBLEM***

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(UN COPOUS)***

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## ***GENERAL REMARKS***

- **Since the early 1990s Russia continues consecutive participation in all actions concerning space debris. The official activity of the IADC was started in Moscow in 1993 when the IADC Terms of Reference had been adopted and today the IADC is the leading international technical expert on space debris.**
- **The Russian Federal Space Agency (Roscosmos) carries out the coordinated branch policy on space debris mitigation and takes part in all sessions of the IADC and of the ISO space debris working group.**
- **Every year Roscosmos presents a comprehensive report about its activity on debris mitigation to the Scientific and Technical Subcommittee (STSC) of the UN COPUOS.**
- **The activity on debris mitigation is being carried out within the framework of Russian National Legislation, taking into account the dynamics of similar measures and practices of other space-faring nations and also the international initiatives on space debris mitigation, especially the UN Space Debris Mitigation Guidelines.**



# RUSSIAN FEDERAL SPACE AGENCY

## *THE 26-th IADC MEETING, MOSCOW - 2008*



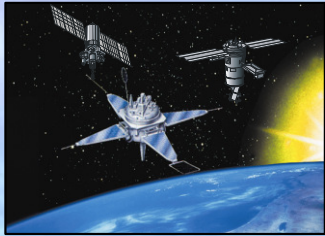


# RUSSIAN FEDERAL SPACE AGENCY

## **THE KEYSTONES OF THE RUSSIAN FEDERATION SPACE POLICY UP TO 2020 AND BEYOND**

(approved by PRESIDENT of RUSSIAN FEDERATION, April, 2008)

### **THE TOP PRIORITIES**



Deployment of orbital satellite groupings for supporting communications, TV and radio broadcasting, navigation, ERS, hydrometeorology, basic space research, defense, thus satisfying the national security, social, economic and science sectors requirements as a result of the space activity implemented at the target level.



Assured space access and autonomy of the Russian Federation space activity within the whole range of the missions to be realized owing to construction of a launch site on the country's territory for operating science- and economy-oriented SC



Fulfillment of international obligations including the ISS commitments, completion of the ISS Russian Segment buildup and enhancement of its scientific application payoff



Exploration of Solar system planets and celestial bodies focused on obtaining profound knowledge about the surrounding world, utilizing extraterrestrial resources, studying the Earth climate evolution mechanisms, searching for exobiota

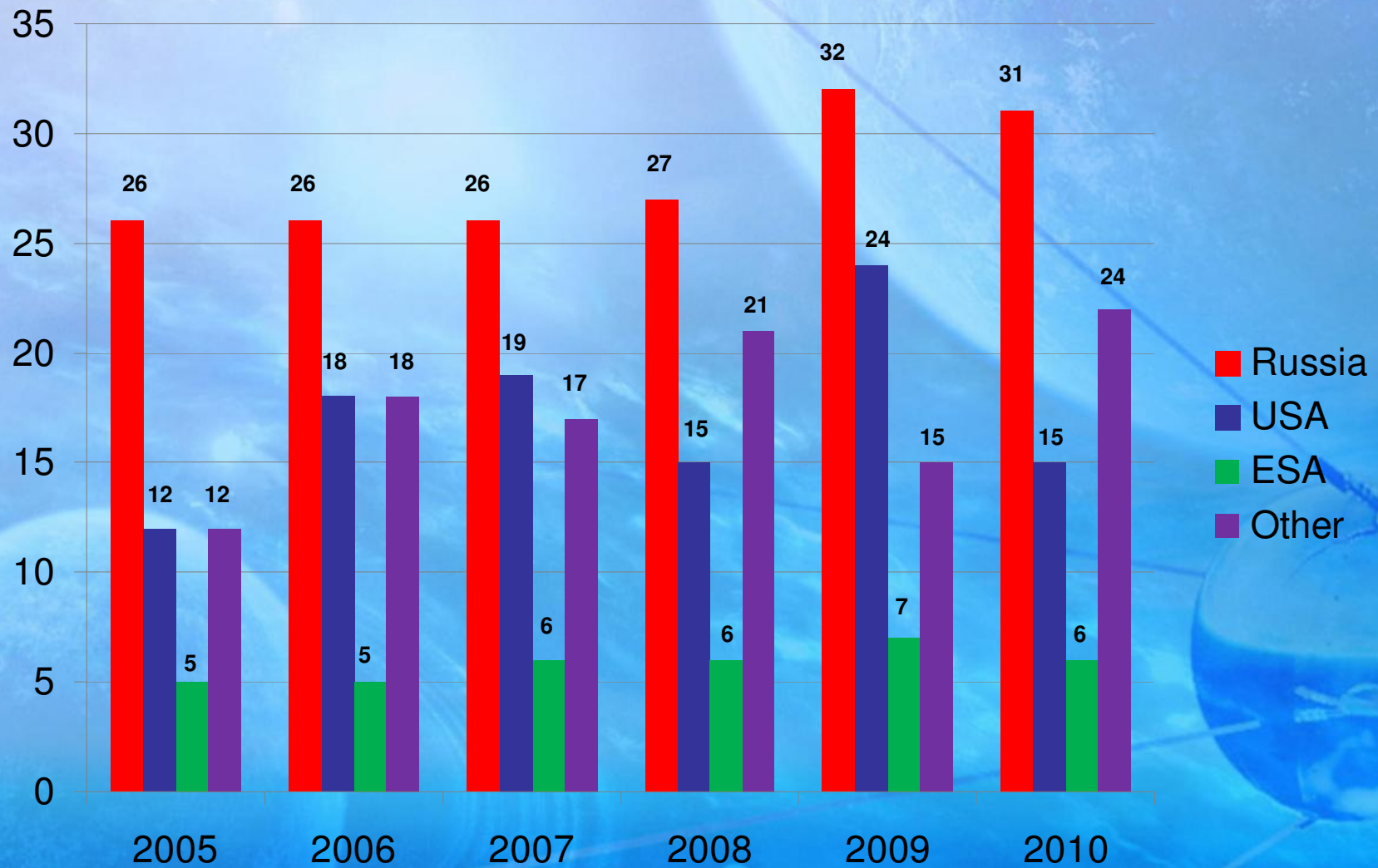
**Safety control  
of  
space activity**



**Assurance of ecological safety of space activity, implementation of technologies and the designs minimizing production of space debris at launch and operation of spacecraft and orbital stations**



## ***DYNAMICS OF LAUNCHES IN RUSSIA AND IN OTHER STATES AND ORGANIZATIONS***





# RUSSIAN FEDERAL SPACE AGENCY



**LV**  
**«Kosmos»**



**LV**  
**«Rokot»**



**LV**  
**«Soyuz»**



**LV**  
**«Proton»**



***DEVELOPMENT OF RUSSIAN STANDARDS  
ON SPACE DEBRIS MITIGATION***

**NATIONAL STANDARD OF THE RUSSIAN FEDERATION**

**“General Requirements to Design and Operation of Spacecraft and Orbital Stages  
on Space Debris Mitigation”**

**(The Standard had come into force since 2009/01/01)**

- **The requirements of the NATIONAL STANDARD OF THE RUSSIAN FEDERATION were harmonized with the UN Mitigation Guidelines**
- **The requirements should be applied to new designed and updated space vehicles of different type: civil, science (including deep space investigations), commercial, military and manned missions.**
- **Application of the requirements of the standard must be putted into practice during the all stages of the life of space means: designing, manufacturing, launch, operation and utilization.**



## **COMPLIANCE OF ROSCOSMOS ACTIVITY IN SPACE DEBRIS MITIGATION WITH THE UN SPACE DEBRIS MITIGATION GUIDELINES**

№/№	The UN Principle of Space Debris Mitigation	The measures undertaken in the space vehicles design and operation
1	<b>Limit debris released during normal operations</b>	<ul style="list-style-type: none"><li>• “Fregat”, “Briz-M”, “DM-3” orbital stages , 3-rd stage of “Soyuz-2” launcher don’t release space debris during normal operations</li><li>• In designs of developed Spacecrafts don’t release space debris during normal operations</li></ul>
2	<b>Minimize during operational phases</b>	<ul style="list-style-type: none"><li>• Strengthening of constructive materials of space vehicles and using of shields around fuel tanks, high pressure vessels not to admit accidental break-ups and to protect against impact of meteors and space debris fragments (“Monitor-E”, “Electro-L”, “Meteor-M”, orbital stages “Briz-M”, “Fregat”)</li><li>• At spacecraft of “Gonets” type to prevent explosions of the detonating gas that is being produced by the silver-cadmium batteries, the said batteries were changed to the nickel-hydrogen ones</li><li>• In case of orbital stages of “DM” type the minimizing of the potential for break-ups is provided due to presence of relief dampers on fuel tanks and gas cylinders</li></ul>



## **COMPLIANCE OF ROSCOSMOS ACTIVITY IN SPACE DEBRIS MITIGATION WITH THE UN SPACE DEBRIS MITIGATION GUIDELINES**

№/№	The UN Principle of Space Debris Mitigation	The measures undertaken in the space vehicles design and operation
3	<b>Limit the probability of accidental collision in orbit</b>	<ul style="list-style-type: none"><li>• Guaranteed withdrawal of orbital stages from the launched spacecraft is being undertaken thus decreasing the probability of dangerous collisions</li><li>• In case of the ISS the estimation of probability of collisions with large debris fragments is being carried out on a regular basis. Maneuvers of the ISS for leaving from dangerous fragments are envisioned thus decreasing the probability of collisions</li><li>• Since June, 2007 the coordinated exchange in orbital data Mission Control Centers, which operate deduction in an orbital position 140° E two geostationary SC Russian «Express-AM3» and Japanese MTSAT</li></ul>
4	<b>Avoid intentional destruction and other harmful activities</b>	<ul style="list-style-type: none"><li>• Intentional destructions are not applied at all launchers, apogee motors and spacecraft developed by Roscosmos</li></ul>
5	<b>Minimize potential for post-mission break-ups resulting from stored energy</b>	<ul style="list-style-type: none"><li>• The pressure release from fuel tanks is made in case of orbital stages after their withdrawal from the launched spacecraft</li><li>• In case of orbital stages of “DM”, “Fregat” and “Briz” type the following procedures are implemented: the removal of the remainders of fuel of the sustainer, a burning out of the remainders of fuel from SOZ engine after separation of spacecraft, a discharge of onboard storage batteries</li><li>• In case of spacecraft of “Express” and “Gonets” types the following procedures are implemented: termination of rotation of handwheels, gyros and other mechanical devices, removal of the remainders of fuel under large pressure, a discharge of chemical sources of a current</li></ul>

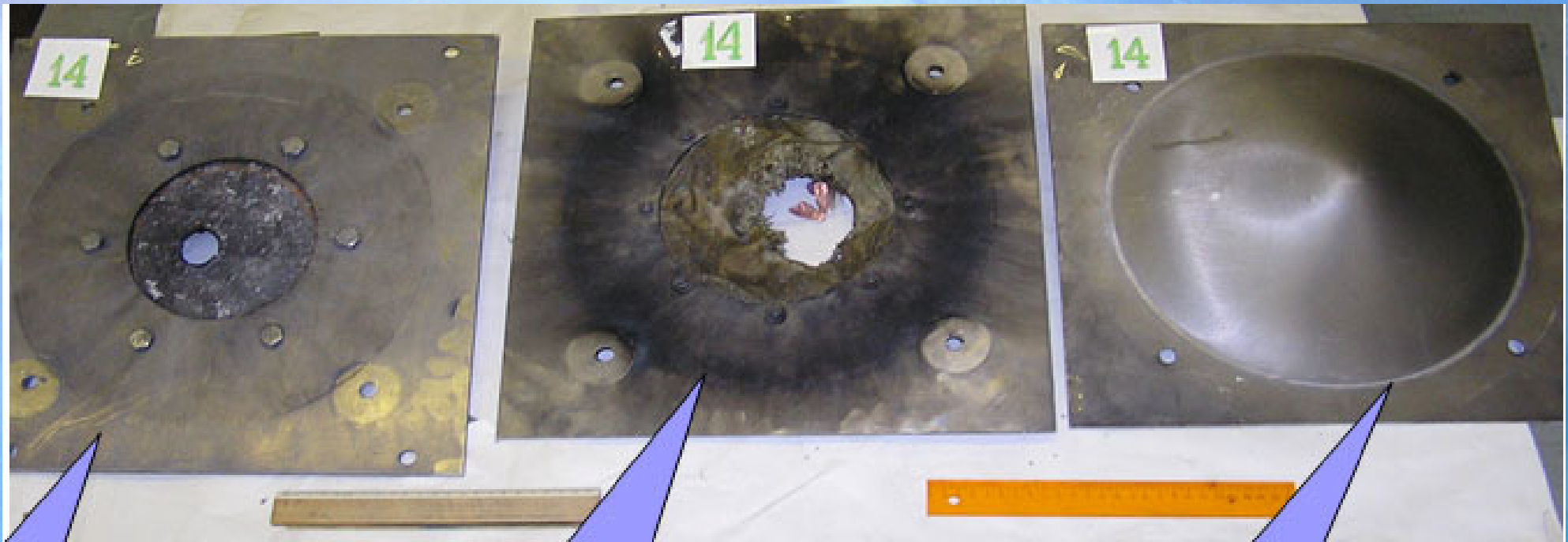


## **COMPLIANCE OF ROSCOSMOS ACTIVITY IN SPACE DEBRIS MITIGATION WITH THE UN SPACE DEBRIS MITIGATION GUIDELINES**

<b>No/№</b>	<b>The UN Principle of Space Debris Mitigation</b>	<b>The measures undertaken in the space vehicles design and operation</b>
6	<b>Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit (LEO) region after the end of their mission</b>	<ul style="list-style-type: none"><li>• At the end of mission at presence of a fuel reserve the orbital stage "Fregat" is disposed with the subsequent splashing down</li><li>• In case of orbital stages of "DM" type after separation of spacecraft it is flooded by the last momentum pulse of the sustainer.</li><li>• In case of spacecraft "Monitor" type its disposal is envisioned from to lower orbit, providing braking of space vehicle and combustion in an atmosphere.</li><li>• SC "Resurs DK1" should be submerge in non-navigable area of the Ocean</li></ul>
7	<b>Limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous Earth orbit (GEO) region after the end of their mission</b>	<ul style="list-style-type: none"><li>• The newly designed geostationary spacecraft disposal to a burial zone (the IADC formula and eccentricity less than 0.003) is envisioned after the end of their mission</li></ul>



**TYPICAL VIEW OF PROTECTED STRUCTURE (NO PENETRATION)**



**Face protection  
screen**

**Second protection  
screen**

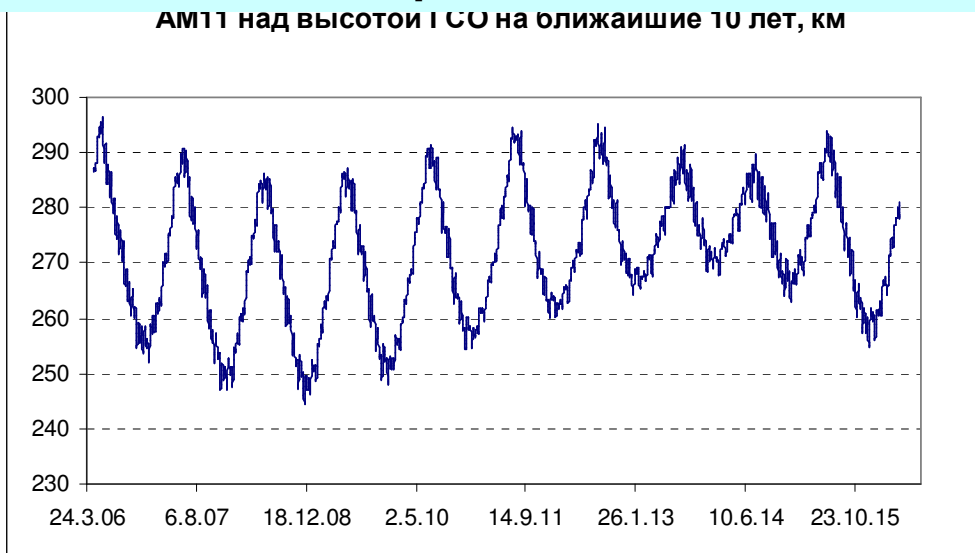
**Protected  
wall**



## **DISPOSAL OF THE EMERGENCY S/C "EXPRESS AM-11" FROM GEO**

### Long term perigee evolution of the disposed "Express AM-11"

AM11 над высотой ГСО на ближайшие 10 лет, км

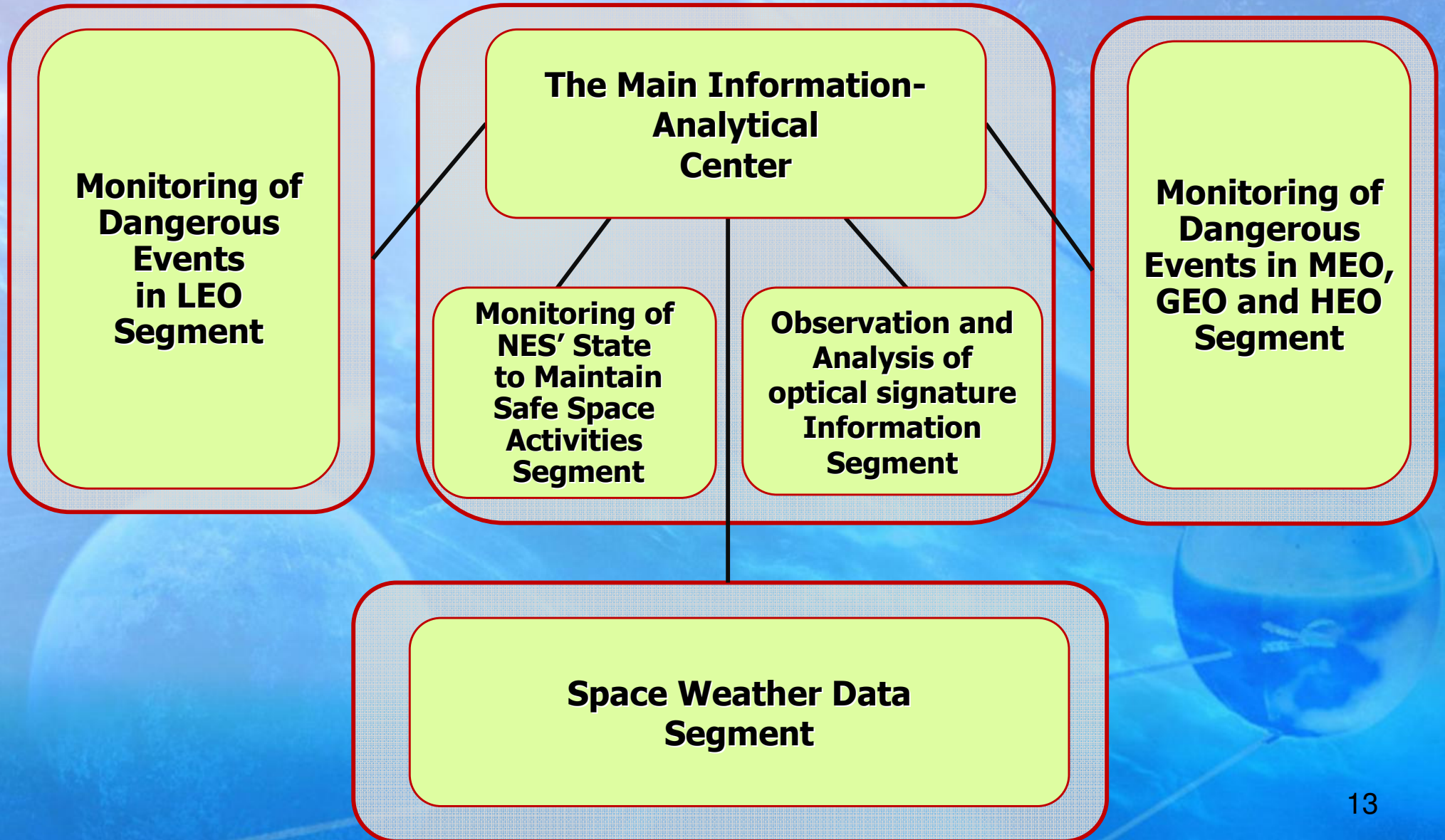


- The emergency of "Express AM-11" took place on 29.03.2006.
- The prospective reason was a depressurization of a contour of the heat-carrier as a result of impact with mechanical object.
- Disposal of the emergency S/C from the protected GEO region was performed since 30.03.2006 till 7.04.2006.

- 10 disposal burns was done totally. The first one was done by the correction engine. Another 9 burns were done by using of orientation engines.
- Orbital parameters of the S/C "Express AM-11" after disposal:
  - apogee - GEO + 324 km,
  - perigee - GEO + 266 km,
  - eccentricity = 0,00026.



***RUSSIAN AUTOMATIC SYSTEM  
ON NEAR-EARTH SPACE HAZARD WARNING (ASSHW)***





**SCHEME OF THE INFORMATIONAL EXCHANGE**

**Information Sources**

Ministry of Defense Sensors

RAS Sensors

Roscosmos Sensors

Foreign Sensors

IZMIRAN



**ASSHW  
(MCC TsNIImash)**

**Roscosmos**

**Internet**

**Information Users**

ISS Operators

Russian SC Operators

Roscosmos' Information Point

Ministry of Emergency

Ministry of Defense

Ministry for Foreign Affairs

Foreign mission control centers



## ***FUTURE DEVELOPMENT OF THE ASSHW***

- **Expansion of international cooperation on control of spacecraft safety flights**
- **Information-ballistic support to operators (governmental, commercial or private):**
  - **Messages on predicted conjunctions of controlled spacecraft with uncontrolled space debris**
  - **Recommendations on avoidance maneuvering**
- **Development of the space surveillance network possessing sensors both in Russia and in other countries**
- **Situation analysis, coordination and scheduling of the Russian and foreign observation sensors**
- **Development of the proposals by principles and organizational procedures of interaction of the ASSHW with the international organizations**



## ***SUMMARY***

- **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.**
- **The Russian NATIONAL STANDARD “General Requirements on Space Systems for the Mitigation of Human-Produced near-Earth Space Pollution” came into force in 2009.**
- **The Russian Federation believes that the UN Space Debris Mitigation Guidelines would increase mutual understanding on acceptable activities in space and thus enhance stability in space-related matters and decrease the likelihood of friction and conflict.**



**Thank you for your attention!**