



FEDERAL SPACE AGENCY OF RUSSIAN FEDERATION

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

***48-th session
of the Scientific and Technical Subcommittee
of the UN Committee on the Peaceful Uses of Outer Space (COPUOS)***

7-18 February 2011



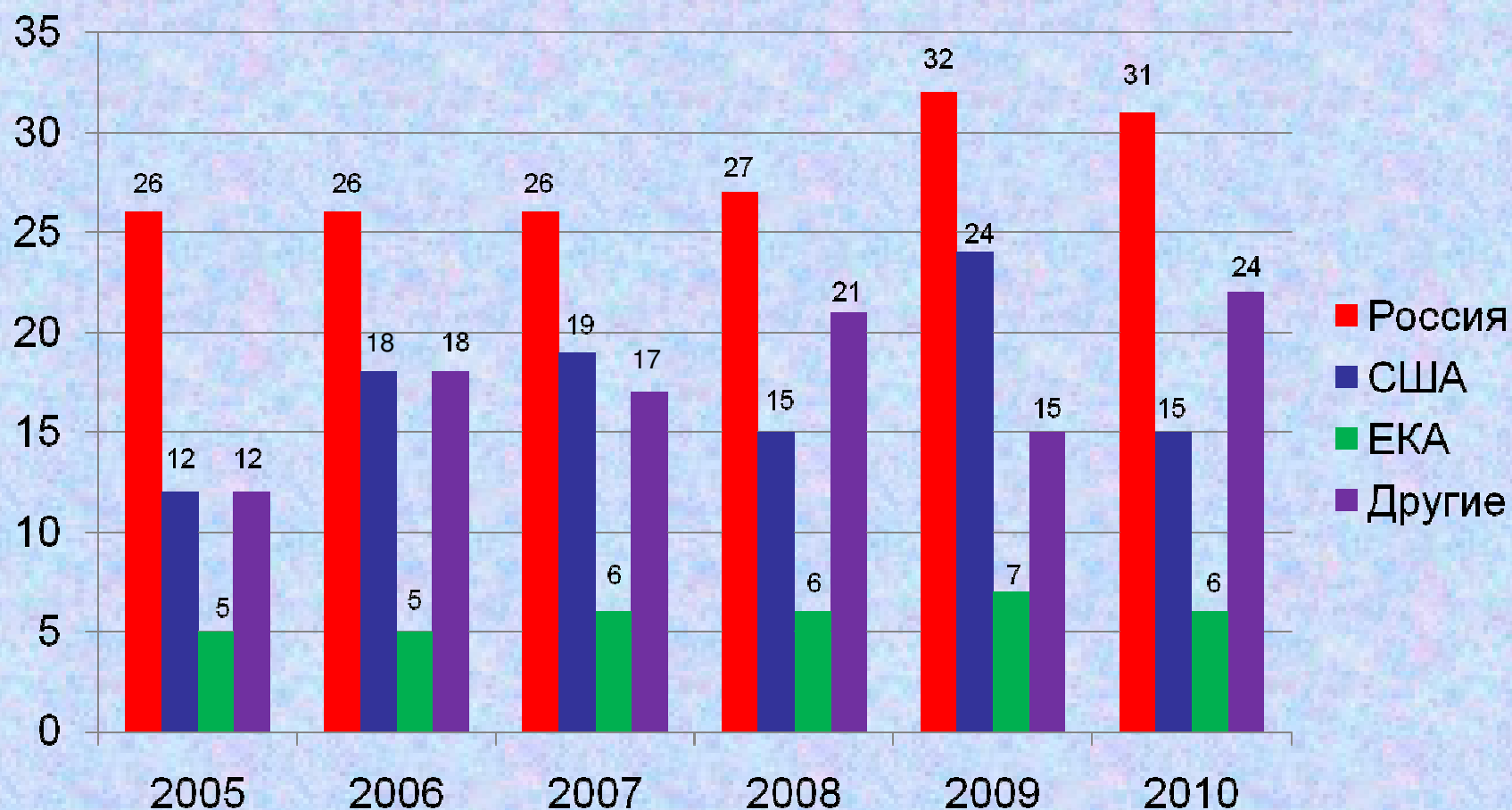
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- **Federal Space Agency of Russia continues consecutive activity in the field of space debris problems. This work concerns the safety of spacecraft and the International Space Station, the latest one in a especial meaning.**
- **The activity on debris 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 (Ref. Doc. is A/RES/62/217 issued 10 January, 2008).**
- **Russian designers and operators of spacecraft and orbital stages are in charge to follow the requirements of National Standard of the Russian Federation "Space Technology Items. General Requirements on Space Systems for the Mitigation of Human-Produced near-Earth Space Population" in all projects of space vehicles being again developed.**



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DYNAMICS OF LAUNCHES IN RUSSIA AND IN OTHER STATES AND ORGANIZATIONS





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RUSSIAN LAUNCHES IN 2010

№/№	Type of Launcher	Accelerating Engine	Number of Launches	Type of Orbit
1	“Proton-M”	“Briz-M	9	Geostationary
2	“Rokot”	“Briz-KM”	1	Circular
3	“Proton-M”	“DM-2”	2	Circular
4	“Proton-M”	“DM-3”	1	<i>Failure Launch</i>
5	“Soyuz-FG”	-	4	Circular
6	“Soyuz-U”	-	6	Circular
7	“Soyuz-2.1”	“Fregat”	2	Circular
8	“Kosmos-3M”	-	1	Circular
9	“Dnepr”	-	3	Circular
10	“Rokot”	-	1	Circular
11	“Molnya-M”	-	1	Circular
Total:			31	



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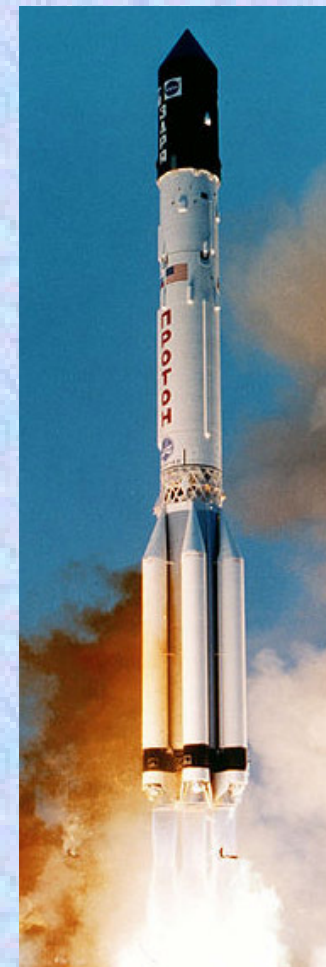
LV
«Kosmos»



LV
«Rokot»



LV
«Soyuz»



LV
«Proton»



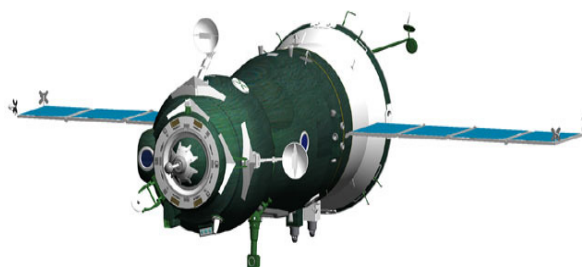
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SC
«Progress»



SC
«Raduga-1»



SC
«Soyuz TMA»



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

No/№	The UN Principle of Space Debris Mitigation	The measures undertaken in the space vehicles design and operation
1	Limit debris released during normal operations	• “Fregat”, “Briz-M”, “DM-3” orbital stages , 3-rd stage (block “I”) of “Soyuz-2” Launcher don’t release space debris during normal operations • In designs of developed Spacecrafts don’t release space debris during normal operations
2	Minimize during operational phases	• 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”) • 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 • 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



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3	Limit the probability of accidental collision in orbit	• Guaranteed withdrawal of orbital stages from the launched spacecraft is being undertaken thus decreasing the probability of dangerous collisions • 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 • 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
4	Avoid intentional destruction and other harmful activities	• Intentional destructions are not applied at all launchers, apogee motors and spacecraft developed by Roscosmos
5	Minimize potential for post-mission break-ups resulting from stored energy	• The pressure release from fuel tanks is made in case of orbital stages after their withdrawal from the launched spacecraft • 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 • 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



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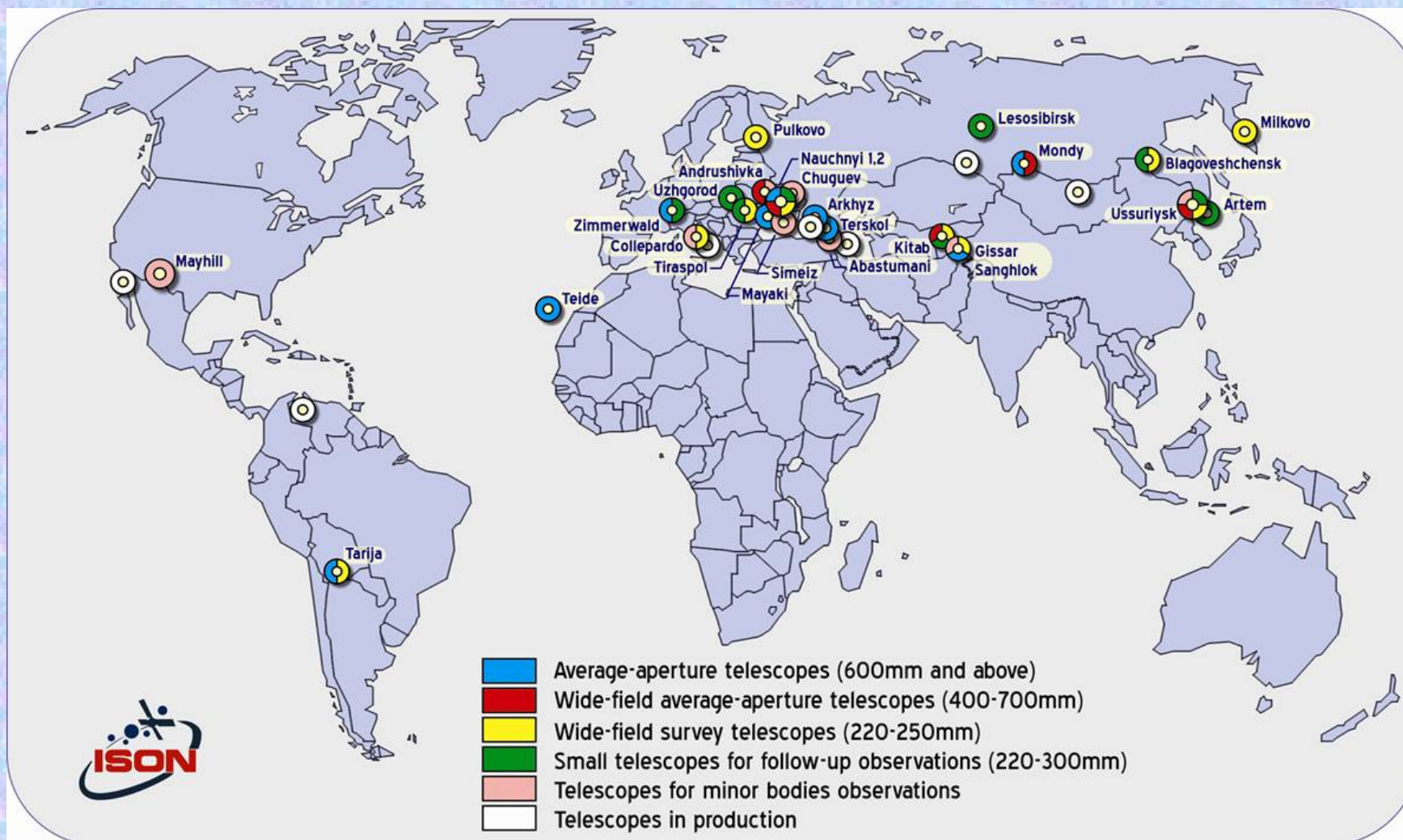
COMPLIANCE OF ROSCOSMOS ACTIVITY IN SPACE DEBRIS MITIGATION WITH THE UN SPACE DEBRIS MITIGATION GUIDELINES

No/№	The UN Principle of Space Debris Mitigation	The measures undertaken in the space vehicles design and operation
6	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	• At the end of mission at presence of a fuel reserve the orbital stage "Fregat" is disposed with the subsequent splashing down • In case of orbital stages of "DM" type after separation of spacecraft it is flooded by the last momentum pulse of the sustainer. • In case of spacecraft "Monitor" type its disposal is envisioned from to lower orbit, providing braking of space vehicle and combustion in an atmosphere. • SC "Resurs DK1" should be submerge in non-navigable area of the Ocean
7	Limit the long-term interference of spacecraft and launch vehicle orbital stages with the	• 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



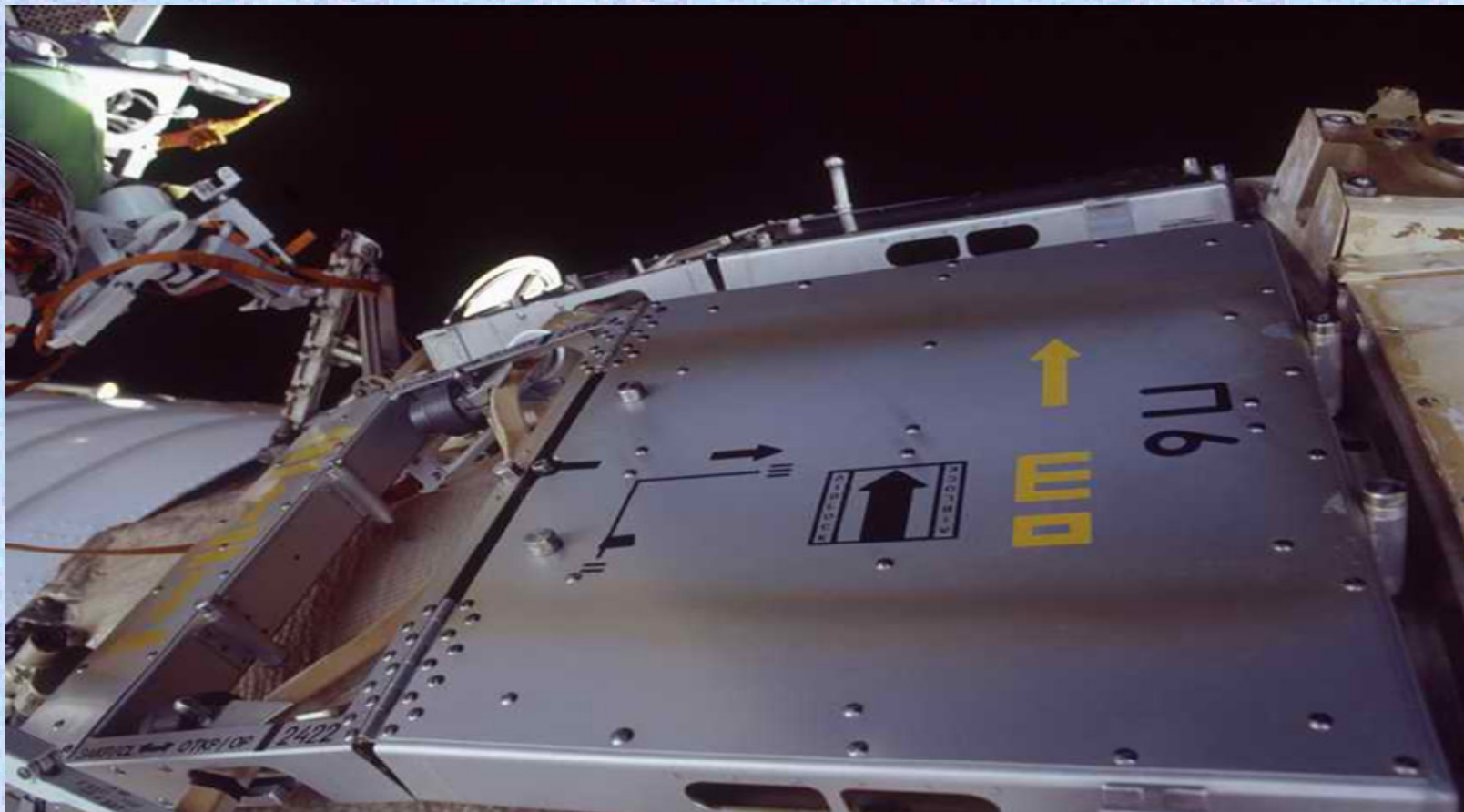
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INTERNATIONAL SCIENTIFIC OPTICAL NETWORK





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A shield section on a conic part of Russian ISS segment "Zaria"



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THE IADC RE-ENTRY CAMPAIGN 2010-1 (LV "Vostok-2m" orbital stage)

	Participant	Quantity of measurements	Quantity of reentry time predictions		Error of the definitive prediction $\Delta t = t_{\text{official}} - t_{\text{prediction}}$
			all	in last day	
1	England / BNSC (Herridge)	-	11	4	+44 min
2	Germany / DLR (Wiedemann)	-	7	4	+11 min
3	ESA (Klinkrad)	4	11	4	+9 min
4	India / ISRO (Ganeshan)	-	17	6	+6 min
5	Italy / ASI (Pardini)	-	22	7	+5 min
6	China / CNSA (Xiong)	-	25	4	-54 min
7	Russia / Roscosmos (ИВАНОВ)	93	22	9	+2 min
8	USA / NASA (Johnson)	117	7	4	+10 min
9	France / CNES (Laporte)	1	7	3	-24 min
10	Japan / JAXA (Hirose)	4	7	1	+37 min



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ISS safety control

Year	Dangerous approaches quantity	Notice quantity	Abnormality of “Red Level” $P_c < 10^{-4}$	Escape maneuver quantity
International Space Station				
2009	58	233	7	2
2010	42	191	2	1
Cargo SC “Progress”				
2009	3	7	-	-
2010	6	15	-	-



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СХЕМА ФУНКЦИОНИРОВАНИЯ АСПОС ОКП

1. Анализ состояния ОКП, планирование и координация работ сегментов
2. Проведение и обработка измерений
3. Выявление, анализ и прогнозирование возможных опасных ситуаций
4. Выдача предупреждений и рекомендаций по парированию опасных ситуаций





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.



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Thanks for your attention!