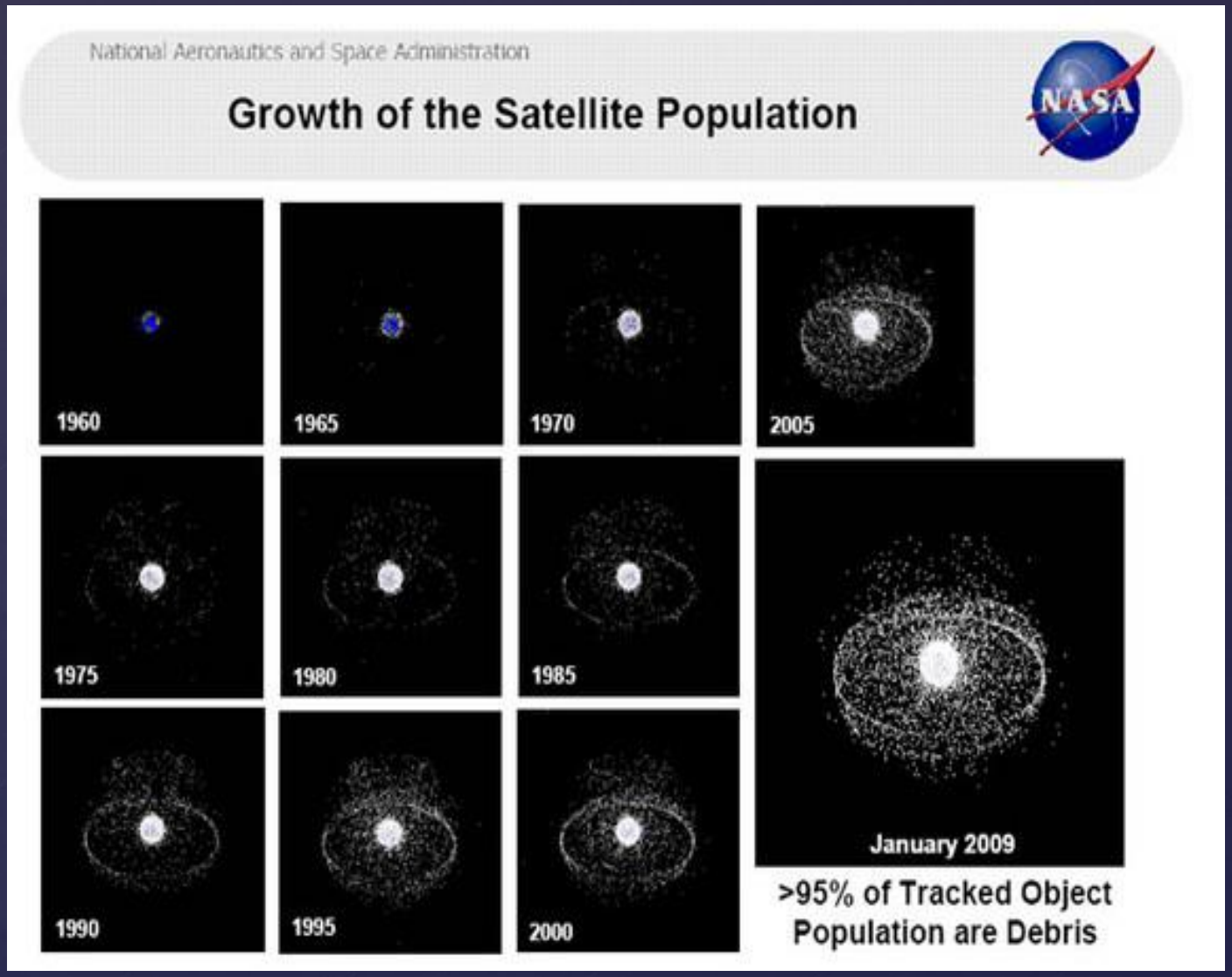
A Path Forward to Improved Space Security:

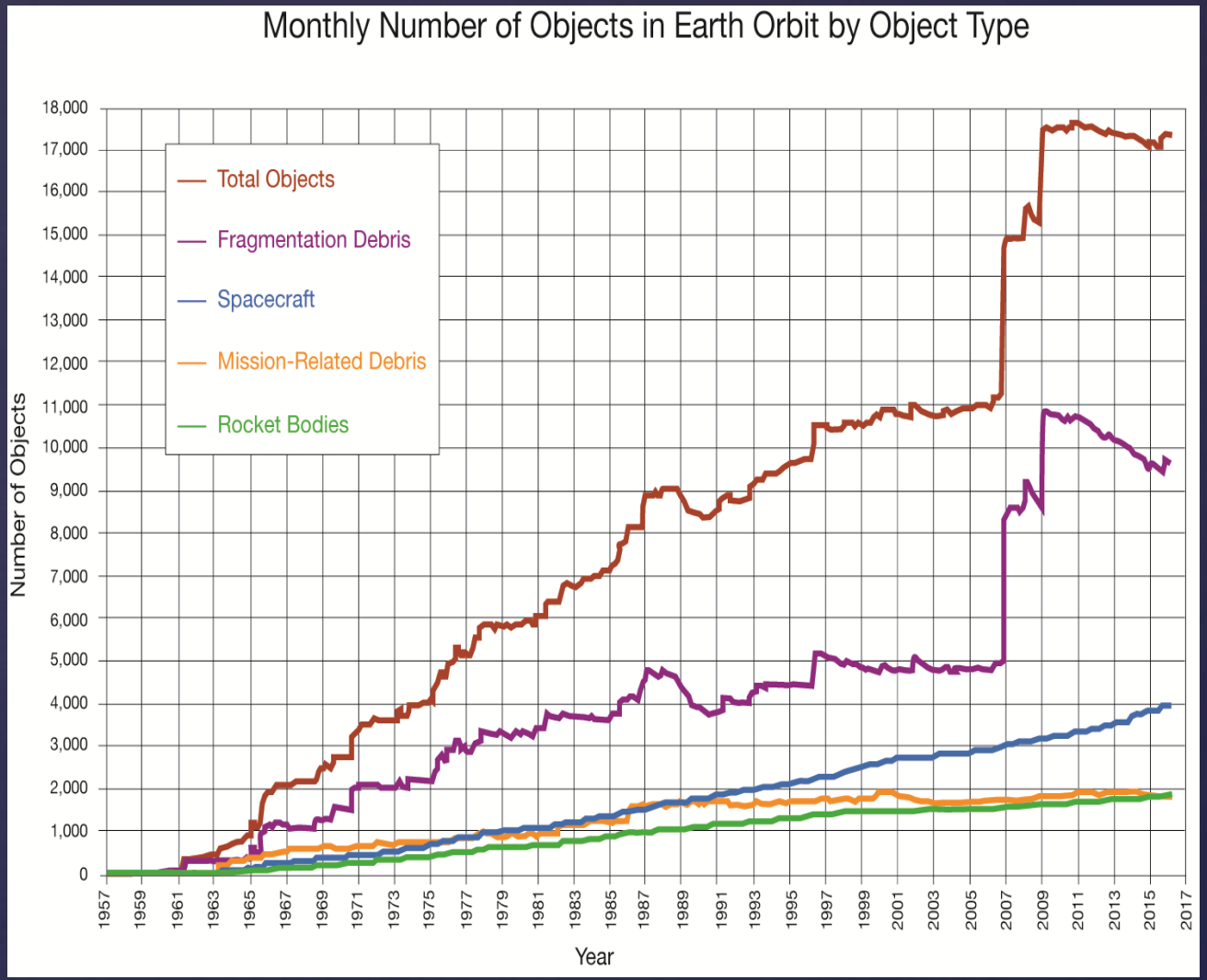
Better Information Sharing, Space Situational Awareness, Space Traffic Management, and More

European Space Policy Institute Autumn Conference
Vienna , Austria
September 27-28, 2018

Joseph N. Pelton, Executive Board
International Association for the Advancement of Space Safety (IAASS) and Former Dean, International Space University



95% of Tracked Objects Are Now Debris



Increase in Space Debris

State	Constellation	# of Sats	Radio Frequency Bands
Canada	CANPOL-2	72	LEO and highly elliptical Earth orbit in VHF-, UHF-, X-, and Ka-bands
Canada	Telesat Constellation	117 satellites plus spares	LEO in Ka-band
Canada	COMSTELLATION	Nearly 800 Satellites	LEO in Ka-band
France	Thales Group's MCSat	between 800 and 4000	LEO, MEO, and highly elliptical Earth orbit in Ku- and Ka-bands
Liechtenstein	3ECOM-1	264	Ku- and Ka-bands
Norway	ASK-1	10	Highly elliptical Earth orbit in X-, Ku-, and Ka-bands
Norway	STEAM	4257	Ku- and Ka-bands
U.K.	L5 (OneWeb)	650-750	Ku- and Ka-bands
US	Boeing	1396-2956	V-band in 1200 km orbit
US	SpaceX	Up to 4000	Ku-Ka band
US	SpaceX	7500 plus	V-band
US	LeoSat	Initially about 80	Ka-band

Problem of Leo Constellations

More Actors More Space Assets/

The Path for Is Daunting

Possible new guideline 1

- Develop a new guideline that all small satellites without active de-orbit thrusters must have a passive system that can deploy at end of life to aid deorbit and also develop improved procedures to facilitate ease of registration.

Possible New Guideline 2

- Develop a new guideline for the deorbit at end of life. One possibility would be that beginning in 2020. Thus there would be a decrease from the 25year to deorbit at end of life to one year less every two years. Thus in 2022 the requirement would be 24 years, in 2024 it would be 23 years, in 2026 it would move to 22 years, in 2028 it would move to 21 years, and in 2030 it move to 20 years, and so on until in 2040 it would be in 15 years and in 2050 it would be ten years.

Possible New Guideline 3

- Develop a new guideline that a small satellite deployed at a specified altitude such as 500km or above must have an active de-orbit capability and possibly that there be a reserved tank for deorbit use only.

Possible New Guideline 4

- Develop a new guideline that within 3 months of the specified end of life date for a licensed operation satellite there must be consultation with the “launching state’ licensing agency. This consultation would be to discuss plans for de-orbit of a satellite or to place it into a parking orbit above GEO orbit. Thus there would be a mandatory consultation every six months until the satellite is de-orbited.

- As an addendum to the above guideline, there might be an ‘ultimate date’ specified for de-orbit that is agreed that is a date certain such as up to 3 years beyond the specified end of life date. A variation on this is that every six months beyond the end of life date there is an ‘automatic command’ to deorbit programmed into the satellite, but that this command can be cancelled by mutually agreed commands of the satellite operator and the registered ‘launching state’ officials.

Possible New Guideline 5

- Develop a new recommended standard for a ground-based command system for an “autonomous kill and deorbit switch” for satellites that have become so-called “zombie satellites” and that are sending interfering transmissions impeding the operation of other satellites. This has been a limited case condition in the past, but the impending increase in the number of operational satellites by perhaps as much as an order of magnitude might see more of these conditions occurring in the future.

Possible New Guideline 6

- New experiments might be set up via the Space Data Association, JSpOC, ESA, NASA or other entities to create expanded networks to exchange improved SSA data from optical, S-band radar, and/or commercial sources. Another experiment would be to change the orbits of space debris to avoid potential conjunctions where different country representatives would be trained to send the needed commands or initiate the laser or directed energy transmission from the ground.

Possible New Guideline 7

Sharing Information for SSA

- National mechanisms for information exchange as to orbital collision risk and space situational awareness will continue as the prime method of risk avoidance until other mechanisms are developed. Technical capabilities, national security concerns, and cost sharing arrangements for both SSA activities and risk warning exchanges remain key issues to be addressed. The International Asteroid Warning Network (IAWN) that has been established in response to the actions of the U.N. General Assembly might provide some useful precedence with regard to sharing of SSA information for due consideration

Key Concerns re Space Traffic Management

- Currently there is an absence of any globally agreed mechanism or process for space traffic management and control or for Active Debris Removal from Earth Orbit. For that matter even national or regional air traffic control systems such as the FAA, EASA, etc. have not formally addressed the issue of safety and control for by the stratosphere (sub-space, near-space or the Protozone. This should be a part of the overall discussion re the implementation of Space Traffic Management (STM)

- U.S. Space directive 3 sets new U.S. objectives for “space situational awareness, the need for an improved registry of space objects in Earth orbit, the need for better sharing of information with regard to operational spacecraft and space debris, the need for an improved space traffic management system and support for collision avoidance services” If other space-faring nations were to do the same then a cooperative framework to cooperate in all these areas might be agreed. This could lead to improved “security of space operations” or “space infrastructure security”.

Cooperative Action for “Security of Space Operations”

Conclusions

- We need improved international cooperation with regard to “Space Security for Space Operations” or what is also sometimes called “Space Infrastructure Security”. This is difficult because this has many dimensions in terms whether one looks to commercial space operations, military or defense related uses of outer space. The steps outline above represents possible ways forward.