



*Promoting Cooperative Solutions for Space Sustainability*

# **A Broader View of Space Security**

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- Space security in a geopolitical context
  - Traditional “national security” lens and driver for space activities
  - Space support for military and intelligence activities on Earth
- Space security in an environmental context
  - Emergence of environmental threats as potentially more of an issue than intentional threats
  - Many new actors in space doing many different things
- Space security in a human context
  - Human and environmental security challenges on Earth
  - Role of space in tackling global challenges

# What is security?

**security** (noun): the state of being free from danger or threat

Could actually mean:

- An actual measure of danger
- Set of procedures followed
- Feeling/perception of safety (or danger)

*To whom does it apply to?*



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# **SPACE SECURITY IN A GEOPOLITICAL CONTEXT**

a. Now Planned or in Immediate Prospect

(1) Ballistic Missiles. A family of IRBM's and ICBM's is now in the latter stages of development. Components of these missiles can be used to develop other space vehicles, for both military and scientific use.

(2) Anti-ICBM's which are now being developed.

(3) Military Reconnaissance. (see "Reconnaissance Satellites" section, paragraphs 20-23)

b. Feasible in the Near Future

(1) Satellites for Weather Observation.

(2) Military Communications Satellites.

(3) Satellites for Electronic Countermeasures (Jamming).

(4) Satellites as Aids for Navigation, tracked from the earth's surface visually or by radio.

c. Future Possibilities.

(1) Manned Maintenance and Resupply Outer Space Vehicles.

(2) Manned Defensive Outer Space Vehicles, which might capture, destroy or neutralize an enemy outer space vehicle.

(3) Bombardment Satellites (Manned or Unmanned). It is conceivable that, in the future, satellites carrying weapons ready for firing on signal might be used for attacking targets on the earth.

(4) Manned Lunar Stations, such as military communications relay sites or reconnaissance stations. Conceivably, launching of missiles to the earth from lunar sites would be possible.

"Draft Preliminary Statement of U.S. Policy on Outer Space," U.S. National Security Council Planning Board, 20 June 1958

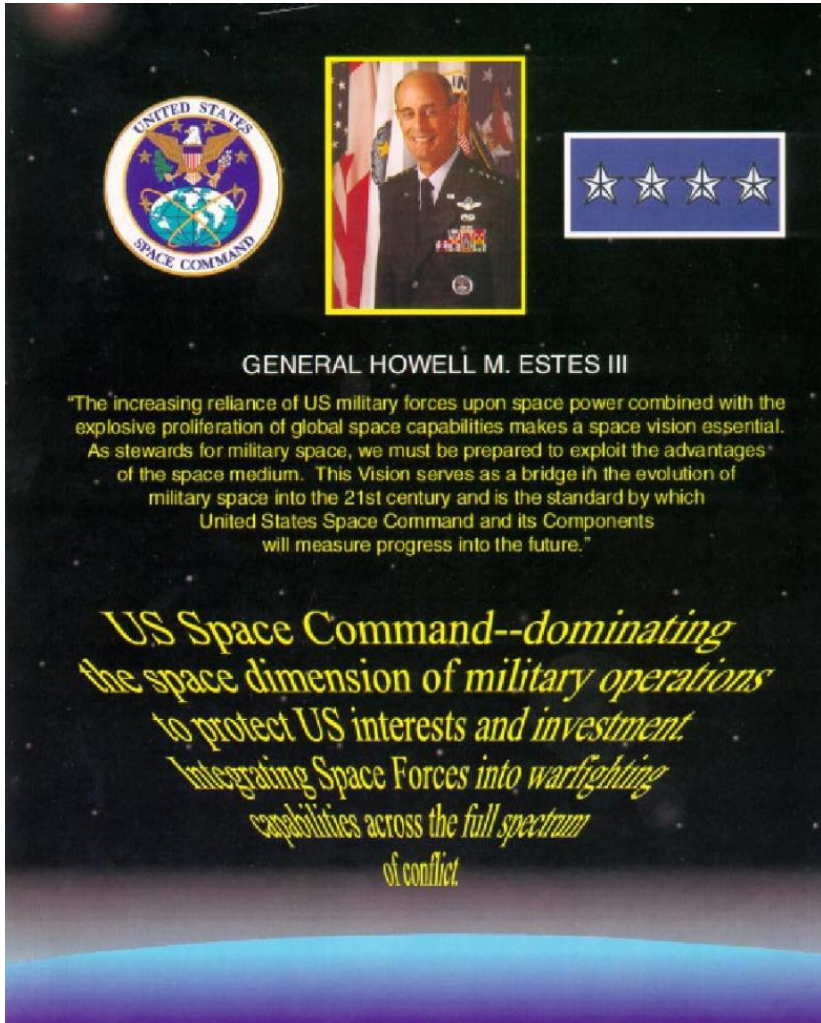
<http://marshall.wpengine.com/wp-content/uploads/2013/09/NSC-5814-Preliminary-U.S.-Policy-on-Outer-Space-18-Aug-1958.pdf>

# A sanctuary, of sorts

Name	Type	Method	Target Orbit	Began	First Tested	Operational
IS/IS-M/IS-MU	co-orbital	single kinetic interceptor	LEO (<1600 km)	1961	1963-1982	1973
Skif	co-orbital	destructive laser	LEO (?)	1976	1987 (did not reach orbit)	-
Kaskade	co-orbital	multiple separate "missiles" w/ "space tugs"	MEO, GEO	1976	-	-
A-60	airborne	laser dazzler mounted on converted transport aircraft	LEO?	1981	-	-
Kontakt	direct ascent (air launch)	single kinetic interceptor	LEO (< 600 km)	1983	1995?	-
Naryad-V	co-orbital	multiple separate "missiles" w/ "space tugs"	MEO, GEO	1985	1990 (partial failure)	-
Kamin	co-orbital	multiple individual small satellite "space mines"	LEO, MEO, GEO	1985	-	-
Lider	co-orbital	particle beams	LEO	1985	-	-
Amulet	direct ascent	single nuclear interceptor	LEO	1985	-	-

\* Only includes dedicated ASAT systems, and not dual-use systems with ASAT capability, such as the A-135 missile defense system

Source: Hendrickx (2016) "Naryad-V and the Soviet anti-satellite fleet," [Space Chronicle](#), Vol 69 Sup 1; Podvig (2011), [Russianforces.org](#)



"Vision for 2020," United States  
Space Command, February 1997

<https://www.scribd.com/doc/94609208/United-States-Space-Command-Vision-for-2020>

# Rising China, resurgent Russia

- China is on a deliberate path to develop the full-spectrum of space capabilities as the US and Russia
  - Space for prestige
  - Space for industrial/technological development
  - Space for human and environmental security
  - Space for military purposes
- Evidence suggests Russia may have restarted some of its ASAT programs
- Rumors that Russian electronic warfare, cyber, and jamming capabilities have been on display in Ukraine and Syria



# China's recent ASAT testing activities

Date of Test	Target Object	Interceptor Object	Interceptor Type	Amount of Trackable Debris Created	Notes
7/5/2005	None known	SC-19	direct ascent	0	Likely rocket test
2/6/2006	None known	SC-19	direct ascent	0	Likely flyby of an unknown orbital target
1/11/2007	FengYun 1C	SC-19	direct ascent	3,280	Successful intercept and destruction of an orbital target
1/11/2010	CSS-X-11 (ballistic)	SC-19	direct ascent	0	Successful intercept and destruction of a suborbital target
1/27/2013	Unknown (ballistic)	SC-19	direct ascent	0	Successful intercept and destruction of a suborbital target
5/13/2013	None known	?	direct ascent	0	Likely rocket test of a new system capable of reaching GEO
7/23/2014	None known	SC-19	direct ascent	0	Non-destructive test
10/30/2015	None known	Possible upgraded SC-19	direct ascent	0	Non-destructive test
<b>Total Amount of Trackable Debris</b>				<b>3,280</b>	



*TEL on launch pad in May 2013.  
Image © DigitalGlobe.*



*Korla Missile Test Complex Jan 2013  
Image © DigitalGlobe.*

# Russian space EW in Ukraine

At 13.01hrs and again at 13.19hrs the SMM UAV was subjected to serious electronic jamming while flying over “DPR”-controlled Chermalyk (40km NE of Mariupol). Initial analysis of the SMM UAV flight log data indicated that the SMM UAV was subjected to military-grade GPS jamming. The Ukrainian Air Operations Liaison Officer to the “Anti-Terrorism Operation” (“ATO”) headquarters in Sector 'M', who was immediately contacted by the SMM UAV Team, told the SMM at 13.24hrs that there was no jamming by the Ukrainian forces. The SMM UAV left the area and landed safely. This is the third serious interference with the movement of the SMM UAV and is an impediment to the fulfilment of the Mission's mandate.

Source: [Organization for Security and Cooperation in Europe](#)

## Russian R-330ZH Zhitel



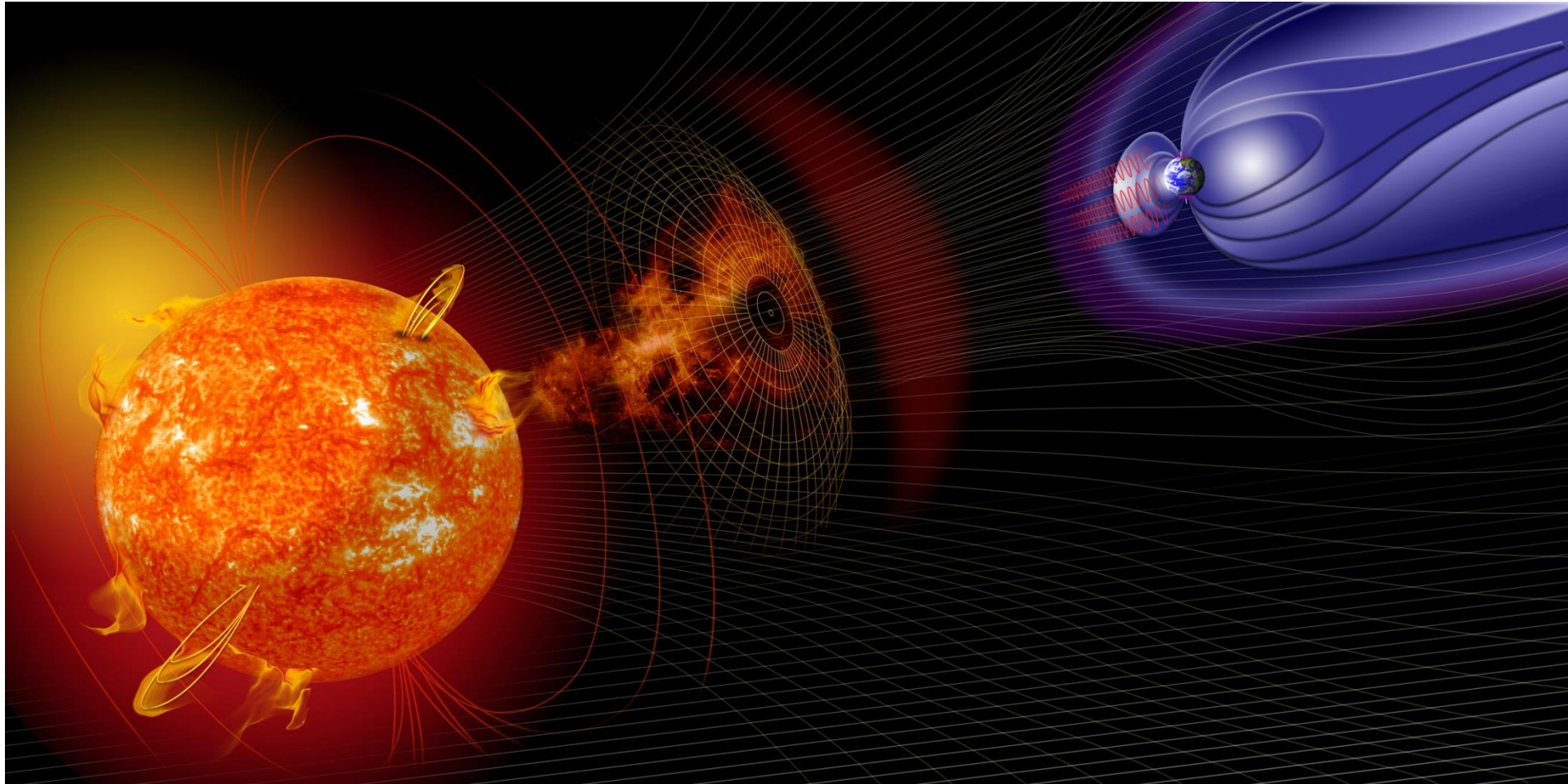
Source: Ukrainian journalist [Yaroslav Krechko](#)



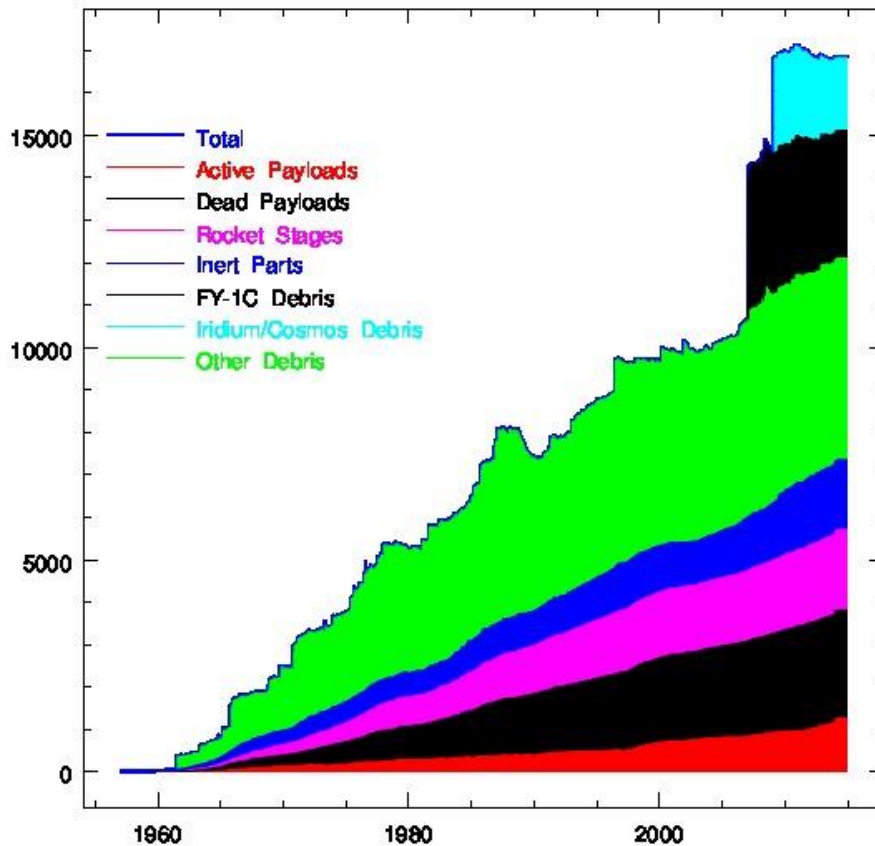
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# **SPACE SECURITY IN AN ENVIRONMENTAL CONTEXT**

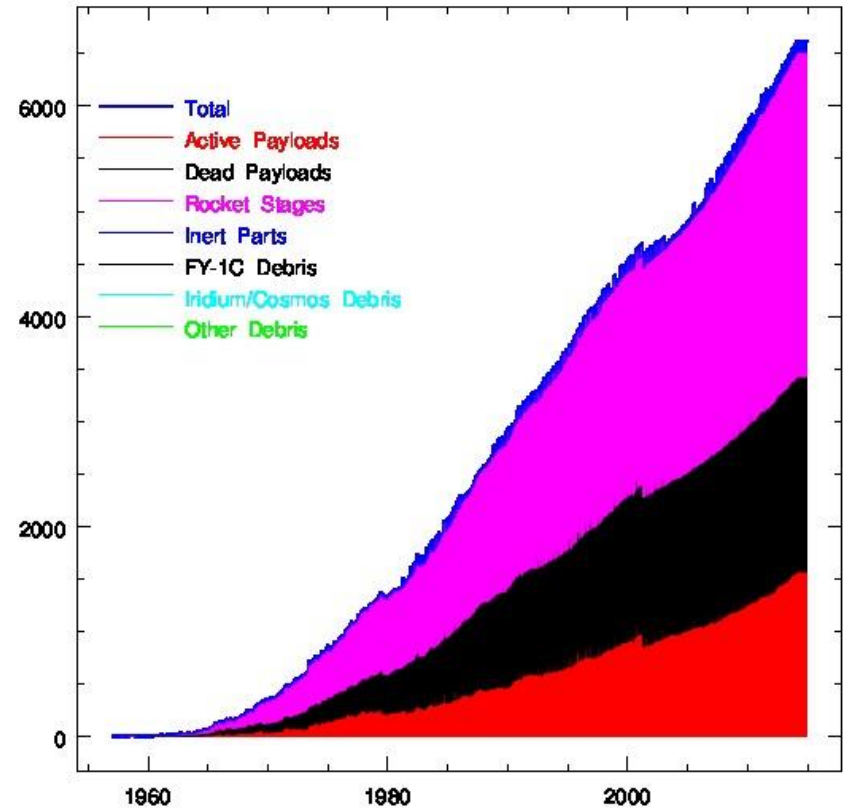
# Space weather



# Long-term growth in space objects



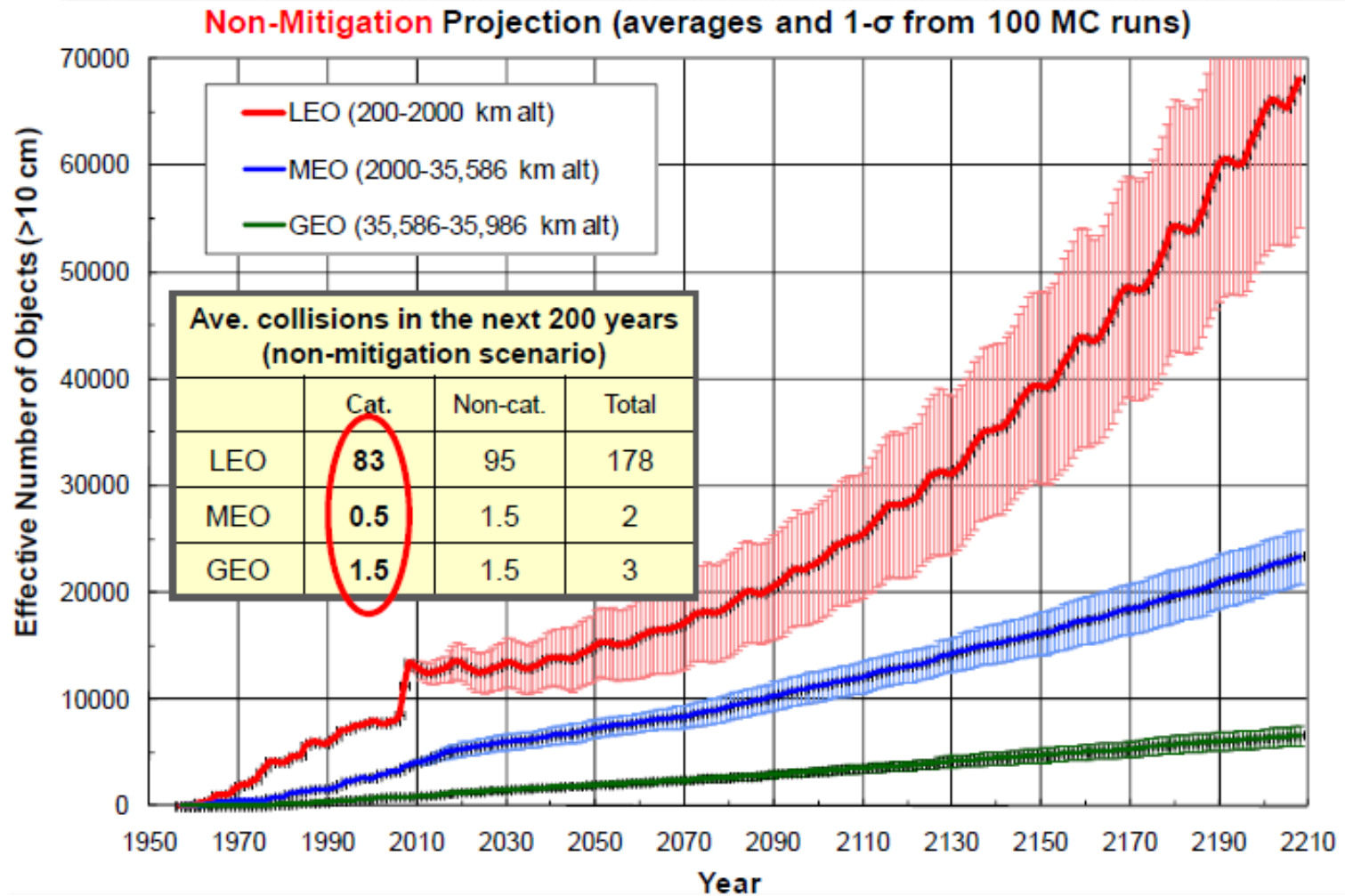
Number of objects



Mass of objects

Graphs from Jonathan's Space Page <http://planet4589.org/>

# The next 200 years, if things stay the same



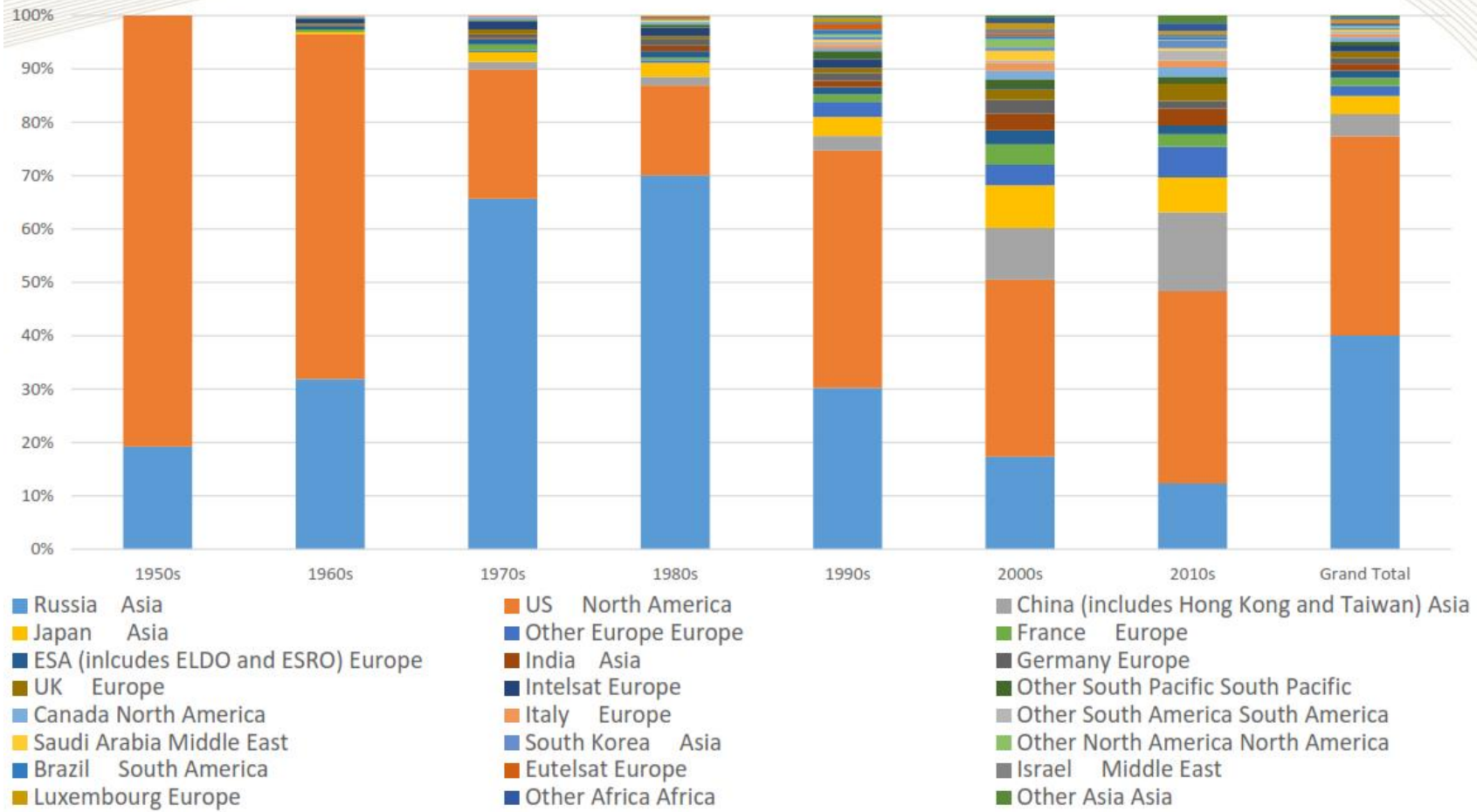
*J-C Liou, NASA Orbital Debris Program Office (2009)*



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# Space is becoming more international

Satellites by Owner Country -1950s-today



Adapted from [IDA Global Trends in Civil and Commercial Space Study](#)



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# Some of the 16,000+ planned new satellites

Company	# of sats	Altitude	Earth-Space	Space-Earth	Space-Space
Boeing	2956	1200 km	27.6-29.1 GHz 29.5-30.0 GHz	17.8-20.2 GHz	
Kepler	140	500-650 km	12.75-13.25 GHz 14.0-14.5 GHz	10.7-12.7 GHz	25.25-27.5 GHz
OneWeb	720	1200 km	14.0-14.5 GHz 27.6-29.1 GHz 29.5-30.0 GHz	10.7-12.7 GHz 17.8-18.6 GHz 18.8-19.3 GHz	
OneWeb	1280	8500 km	42.5-43.5 GHz 47.2-50.2 GHz 50.4-51.4 GHz	37.5-42.5 GHz	
SpaceX	4425	1110-1325 km	14.0-14.5 GHz 13.85-14.0 GHz 27.5-29.1 GHz 29.5-30.0 GHz 47.2-52.4 GHz	10.7-12.7 GHz 12.15-12.25 GHz 17.8-18.6 GHz 18.8-19.3 GHz 37.5-42.5 GHz	
SpaceX	7518	335-346 km	47.2-52.4 GHz	37.5-42.5 GHz	
Telesat	117	1000 km 1248 km	27.5-29.1 GHz 29.5-30.0 GHz	37.5-42.4 GHz	





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# SPACE SECURITY IN A HUMAN CONTEXT

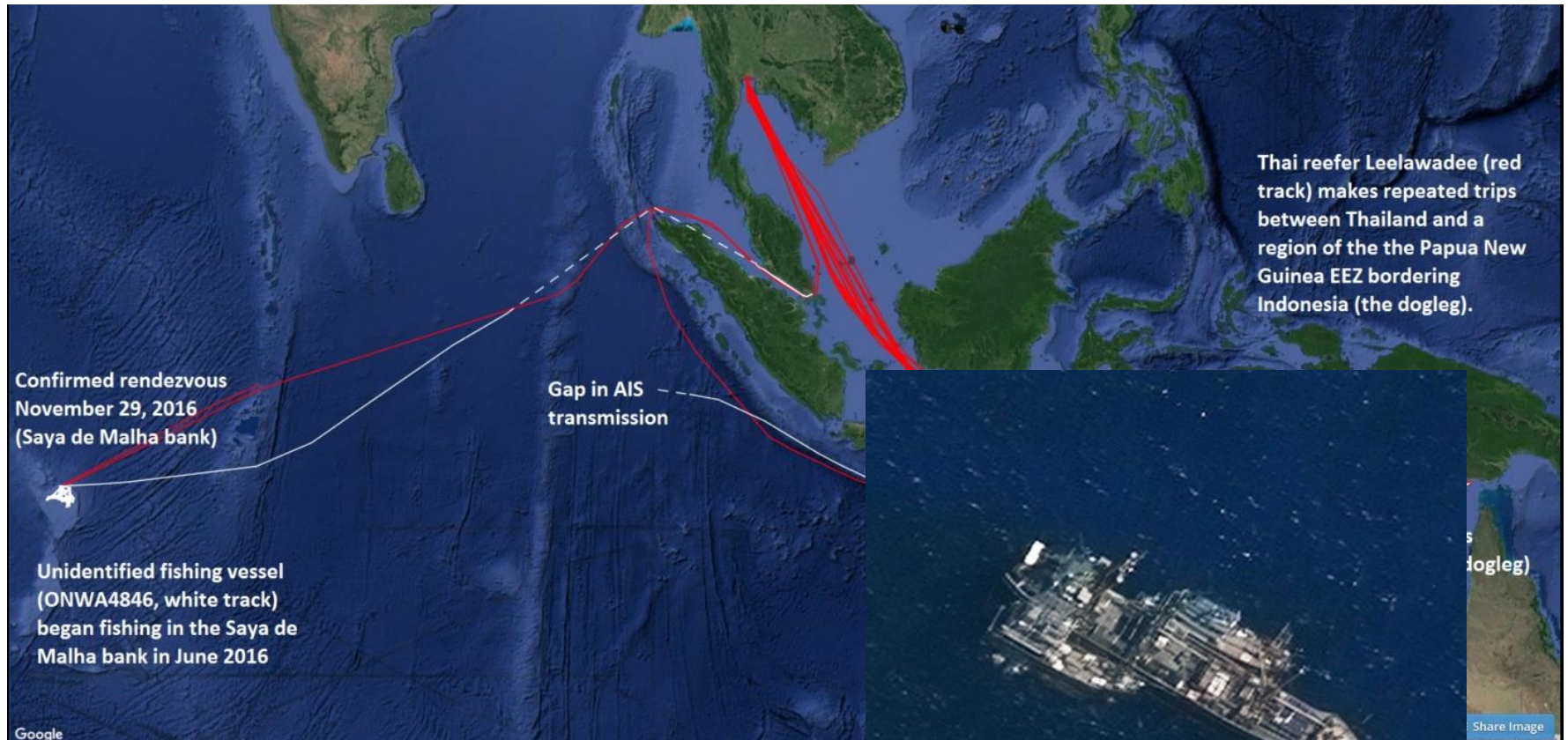
# Space can help tackle global challenges

- Broadband communications
- Access to education and healthcare
- Food security
- Human rights
- Climate change
- Disaster management
- Arctic governance
- Management of fisheries, forests, and water



[http://www3.weforum.org/docs/WEF\\_Bringing\\_Space\\_Down\\_to\\_Earth.pdf](http://www3.weforum.org/docs/WEF_Bringing_Space_Down_to_Earth.pdf)

# Catching illegal fishing (and slavers)



<https://arstechnica.com/tech-policy/2017/02/to-catch-a-thief-with-satellite-data/>

# Possible evidence of war crimes



[http://satsentinel.org/sites/default/files/reports/Satellite\\_Snapshot\\_SouthSudan.pdf](http://satsentinel.org/sites/default/files/reports/Satellite_Snapshot_SouthSudan.pdf)

# Election fraud in Afghanistan



<http://afghanistandataproject.org/projects/2014-audit-sat/>



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# SUMMARY

- All three of these contexts are operating simultaneously
  - No one is more right (or wrong) than the others
  - Interrelated and cross-linked
- Understanding the problem(s) in one context requires understanding problems in all three
- Solving the problem(s) in one context means crafting solutions that can resolve problem(s) in all three
- Example: space debris



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**THANKS. QUESTIONS?**

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