



Promoting Cooperative Solutions for Space Sustainability

Potential Adversary Counterspace Capabilities

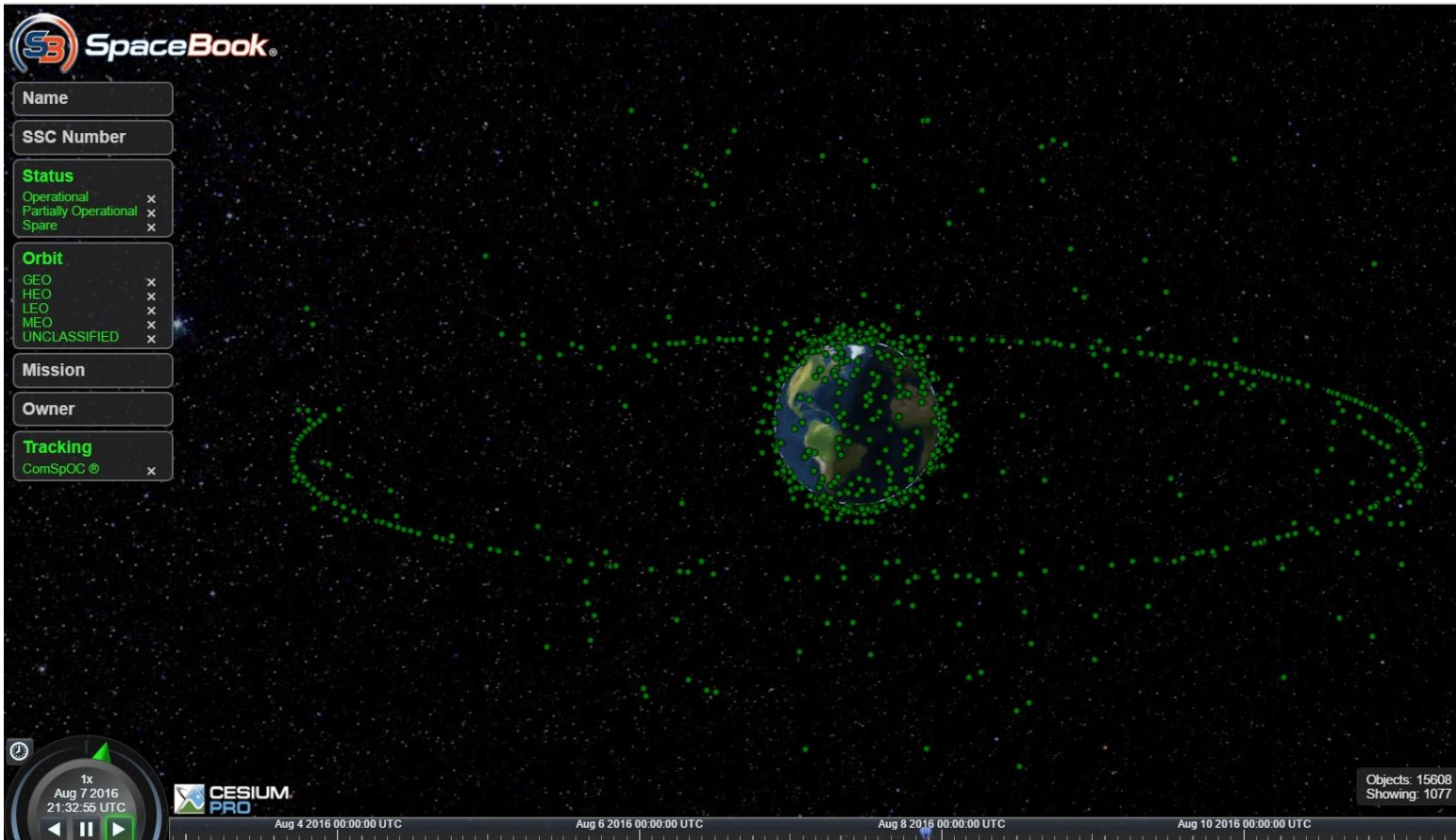
Brian Weeden

Technical Advisor

Secure World Foundation

Note: This briefing is compiled entirely from public, unclassified sources

Orbitology review



LEO
($<2,000$ km)

MEO
($20,000$ km)

HEO
($500-40,000$ km)

GEO
($36,000$ km)

Source: [AGI SpaceBook](http://www.agi.com)

Soviet ASAT Programs 1960-1993*

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](#)



Resurgent Russian counterspace capabilities

- Once a space superpower, Russia appears to be recapitalizing some of its Cold War-era counterspace capabilities
 - Multiple flight tests of “Nudol” BMD/ASAT missile, which appears to replace the 51T6 (SH-11 Gorgon) missile of A-135
 - Multiple tech demos of on-orbit rendezvous and proximity operations (RPO), which have links to Naryad-V co-orbital ASAT program
 - Tests of the tracking component of air-launched ASAT missile (Kontakt)
 - Test of an airborne laser dazzler (Sokol Eshelon, aka A-60) against satellite
- Also indications of operational electronic warfare/cyber capabilities
 - Multiple reports of GPS and mobile communications jamming in eastern Ukraine impacting UAV ops
 - Some additional reports coming from Syria

Sokol Eshelon today



Source: Russianplanes.net (2011)

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](#)



Promoting Cooperative Solutions for Space Sustainability

Rising Chinese space capabilities

- China is on a path to develop a “full spectrum” of space capabilities over next two decades
 - National prestige (human spaceflight, exploration)
 - Support to military ops on Earth (PNT, ISR, satcom)
 - Economic development/industrial base
 - Counterspace/missile defense
- China has been more forceful in asserting its regional power, but has (so far) refrained from outright military aggression

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	DN-2	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
Total Amount of Trackable Debris				3,280	

Source: [“ASAT testing in space: The Case of China”](#),
SWF Fact Sheet

Footage of 2010 and 2013 tests



Source: JS7TV ([Youtube](#))

Vulnerability of U.S. national security space

Estimated Risk Posed to U.S. Space Systems by Chinese Counterspace Capabilities

System Type	1996	2003	2010	2017
Communication	Low risk	Moderate risk	High risk	High risk
Imagery	Low risk	Moderate risk	Moderate risk	High risk
SIGINT	Low risk	Moderate risk	Moderate risk	Moderate risk
Ocean surveillance	Low risk	Low risk	Moderate risk	Moderate risk
Weather	Low risk	Low risk	Moderate risk	Moderate risk
PNT	Low risk	Moderate risk	Moderate risk	Moderate risk
Missile warning	Low risk	Moderate risk	Moderate risk	Moderate risk
Overall	Low risk	Moderate risk	Moderate risk	Moderate risk

	Low risk
	Moderate risk
	High risk

Source: [“The U.S.-China Military Scorecard”](#), RAND, November 2015

\$2,500 Phase-Coherent GPS Signal Synthesizer

*Used to perform cyber attacks on GPS
receivers using manipulated civil signals*



Source: [Nighswander, Ledvina, Diamond, Brumley, and Brumley \(2012\)](#)

\$85 million White Rose of Drachs

*Successfully steered off course by UT grad
students using homemade GPS spoofer*



Source: [UT Austin School of Engineering \(2016\)](#)