



Promoting Cooperative Solutions for Space Sustainability

Trends and Developments on the Nature of Threats to Space Systems

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Low Earth orbit (LEO): 160-2000 km; Earth observation, telecom, weather, missile warning/ISR satellites

Medium Earth orbit (MEO): 2000-35,786 km; navigation, missile warning/ISR satellites

Geosynchronous Earth orbit (GEO): 35,786 km; telecommunications, weather, missile warning/ISR, Earth observation satellites

High Earth orbit (HEO): >35,786km; communications satellites

Elements of a Space Capability

Space segment



Ground
segment

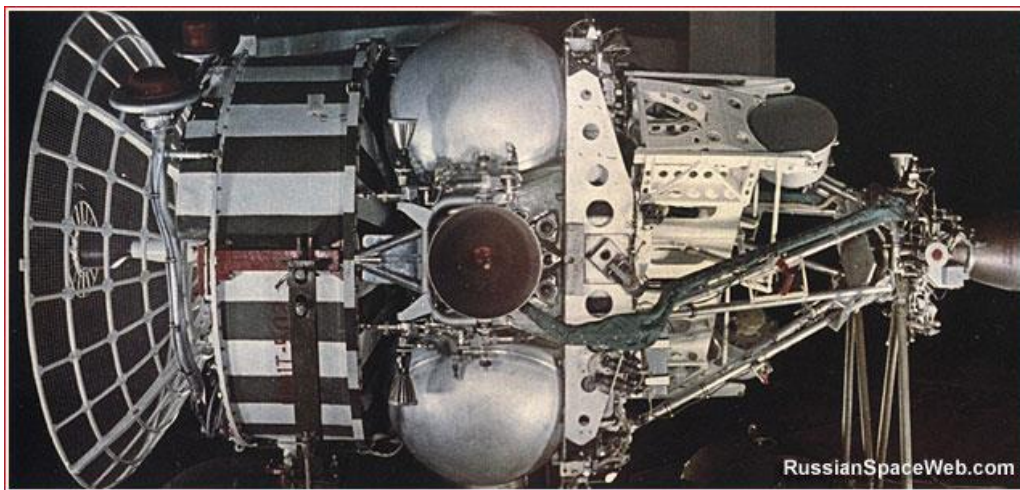


User segment



Internet

Many Ways to Attack Satellites



Soviet IS killer satellite (1960-1987)



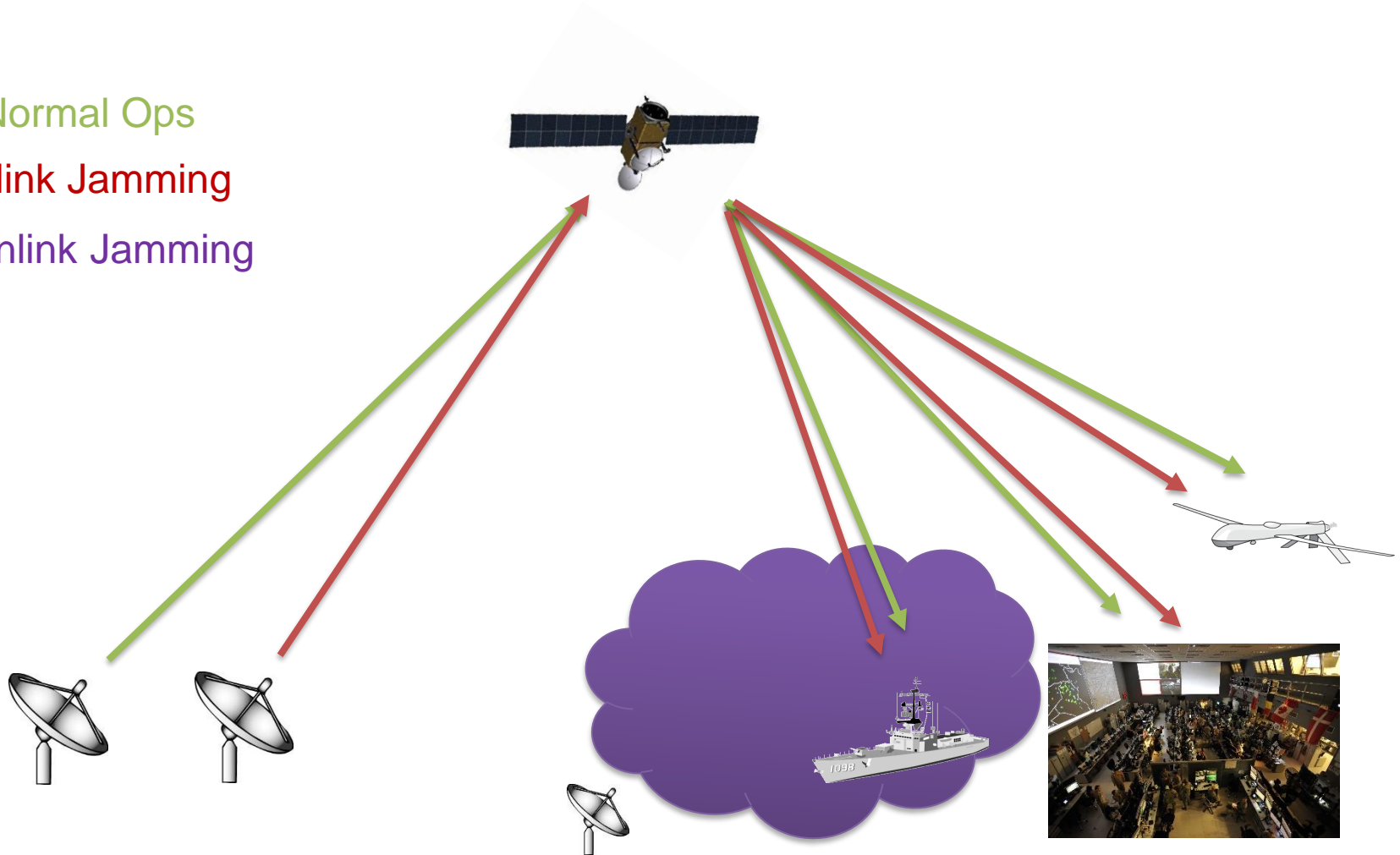
*U.S. Air Force F-15
launching an ASM-135
ASAT missile (1978-1988)*



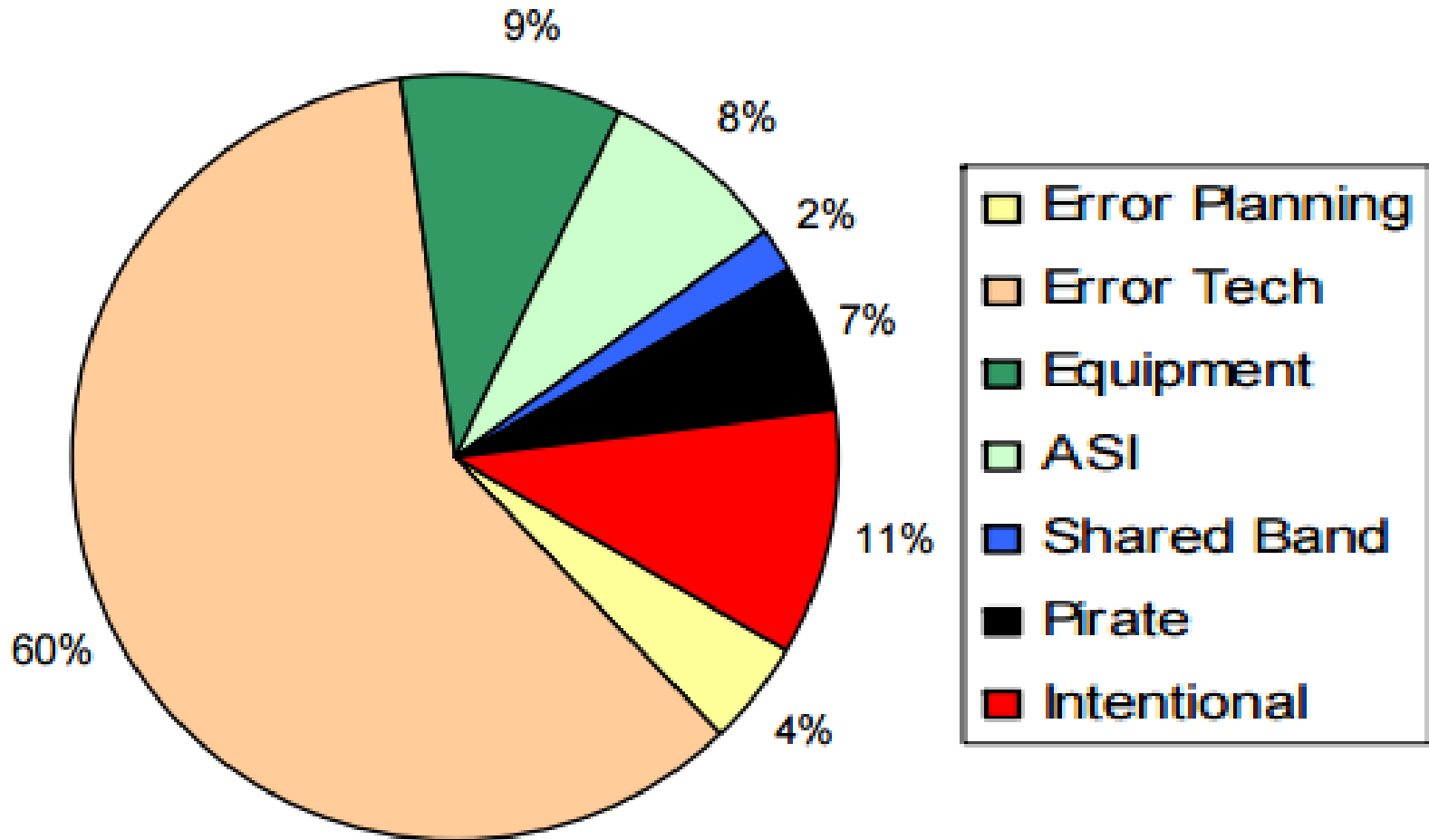
*Commercially-
available GPS
jammer (2014)*

Satellite jamming

Normal Ops
Uplink Jamming
Downlink Jamming



Sources of RFI Interference



Source: [Eutelsat briefing to the ITU](#) (2013)

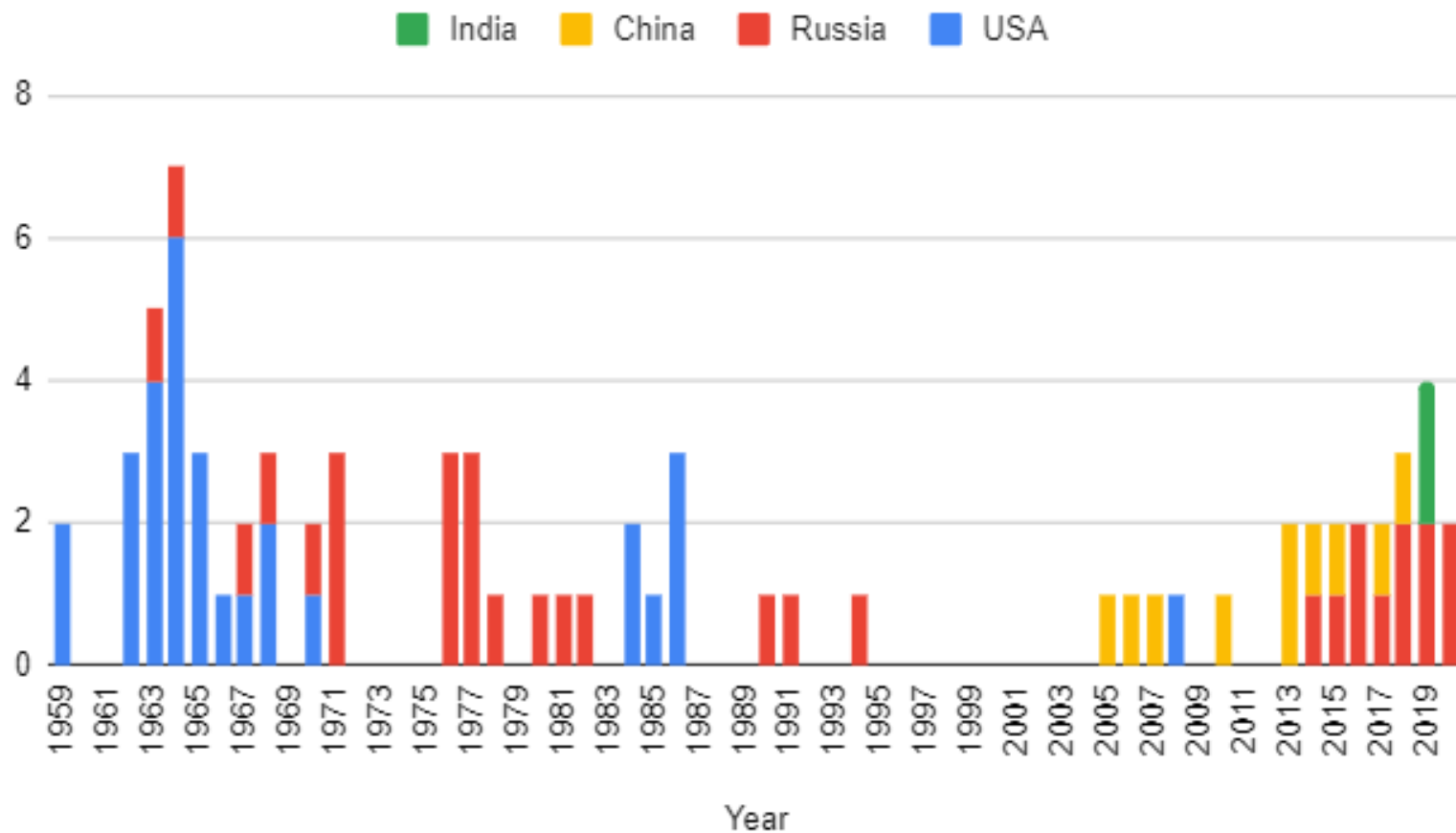
SWF's Counterspace Threat Assessment

- Space domain undergoing significant changes
- Existence of counterspace capabilities is not new, but the circumstances surrounding them are
- Discussions of space capabilities often veer quickly into classified territory
- *Global Counterspace Capabilities: An Open Source Assessment*
 - Significant research and development of a broad range of kinetic (i.e. destructive) and non-destructive counterspace capabilities in multiple countries: direct ascent, co-orbital, electronic warfare, directed energy, cyber
 - US, Russia, China, Iran, North Korea, India, France, and Japan
 - Policy, organizations, military utility, Space Situational Awareness (SSA)
 - ***Only non-destructive capabilities are actively being used in current military operations***
- <https://swfound.org/counterspace>; French-, Spanish-, Mandarin-, and Russian-language versions of the executive summary available

	China	Russia	U.S.	France	India	Iran	Japan	North Korea
LEO Co-Orbital	Y	G	Y	R	R	R	R	R
MEO/GEO Co-Orbital	Y	Y	Y	R	R	R	R	R
LEO Direct Ascent	G	Y	Y	R	Y	R	R	R
MEO/GEO Direct Ascent	Y	Y	Y	R	R	R	R	R
Directed Energy	Y	Y	Y	Y	R	R	R	R
Electronic Warfare	G	G	G	Y	Y	Y	R	Y
Space Situational Awareness	G	G	G	Y	Y	Y	Y	R

Legend: none **R** some **Y** significant **G**

ASAT Tests By Country and Year





Questions?

Thanks.

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