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NATIONAL SECURITY FORUM

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Welcome to our Fall Series - *Warfare in the Age of AI*

Upcoming Programs

https://nationalsecurityforum.org

- 18 Nov – Space wars and defense
- Jan – Special Program @ new venue
- Feb – (TBD) Rescheduled trip to NNSS

Moving venues starting in January

Q&A

On cards in the room

In Q&A or Chat box on Zoom

The Space Domain

UNITED STATES
SPACE FORCE

Lt Col David “Zes” Zesinger
US Space Force
Army War College
Department of Military, Strategy,
Plans and Operations

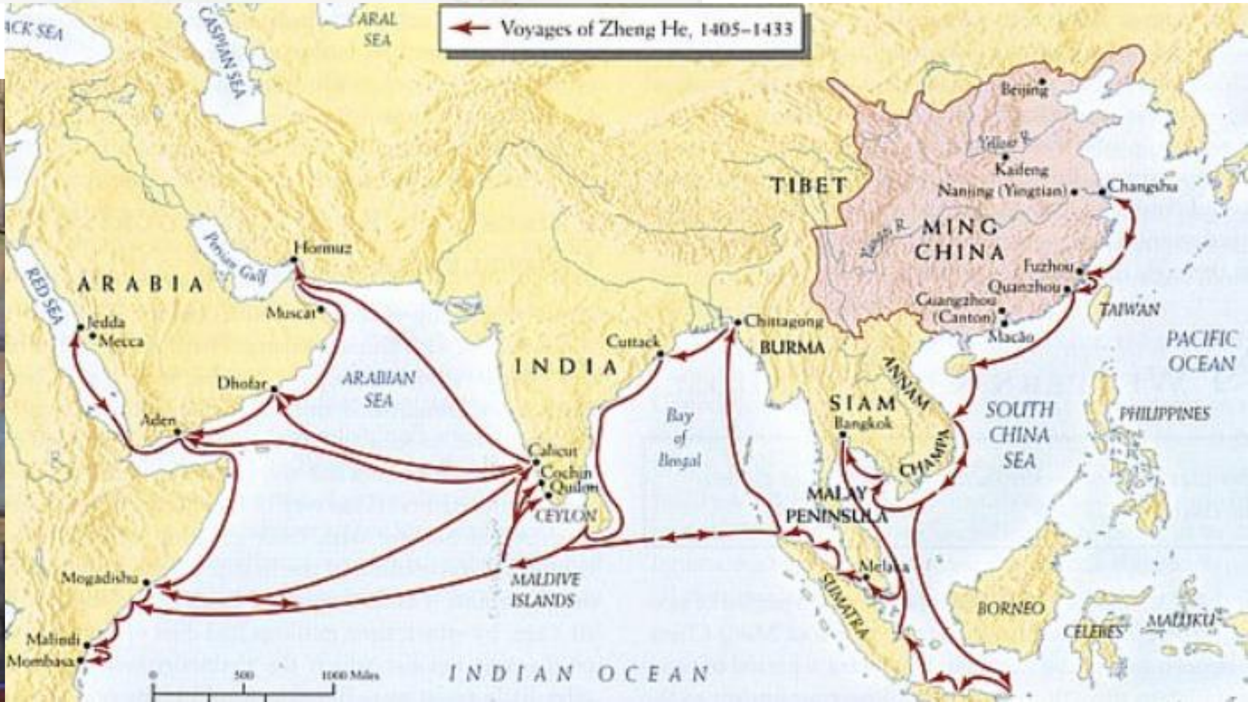
Mission: Secure our Nation’s interests in, from, and to space

Origin: Why a Space Force?

- **Zheng He**, Ming dynasty explorer
- China -> **uncontested dominance** of Sea
- Emperor's death created turning point
- China closed doors to outside
    - **The West took to global exploration & exploitation**
    - Led to "Century of **Humiliation**"
- **Similar cross-roads today**

Zheng He - 1405
62 nine-masted, ~400 ft ships, +200 others
28,000 man crew

Columbus - 1492
3 three-masted, ~80 ft ships
86 man crew



Origin: Why a Space Force?

- Modern world has been greatly enhanced by space effects:
  - Smart Phones
  - Banking
  - Transportation
  - Logistics
  - Navigation
  - Farming
  - Weather
  - Archeology
  - You name it!

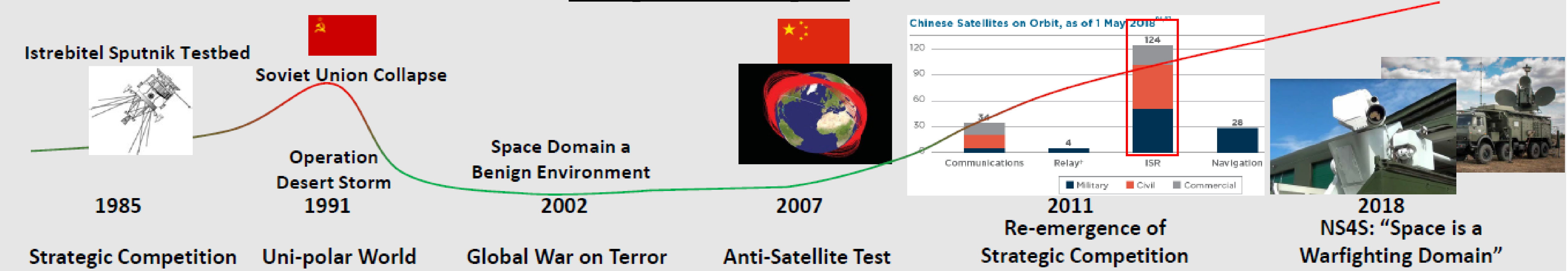
- Modern Warfare has likewise significantly evolved due to space effects

Origin: Why a Space Force?

x 100	x 12	x 1
x 1,000	x 100	x *up to* 80
x 1,000	x 24	x 2
x 10%-50%	x 10%	x 0
x 1	x 1	x **1 per bomb**

Origin: Why a Space Force?

Competition in Space



- After Cold War, space a peaceful sanctuary
- Many of our military & economic advantages depend on space
  - Smart weapons, smart phones, banking, navigation, etc.
- Adversaries view this as a potential Achilles Heel
- Space a warfighting domain, like any other

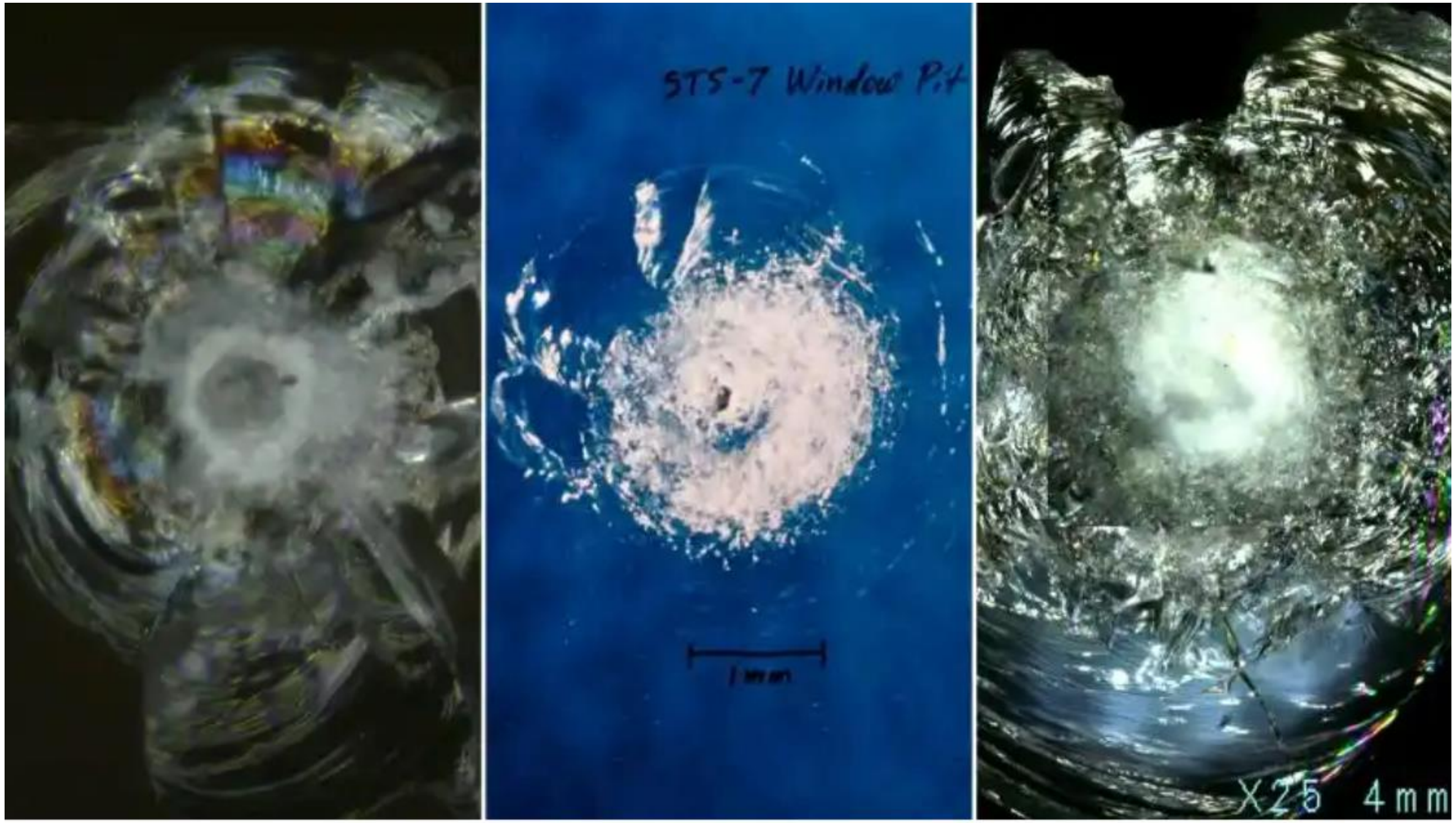
2015 – PLA's Strategic Support Force
2024 – Aerospace Forces

2015 - Russian Space Force, reactivated

ASAT TEST
Xichang Space Center, China

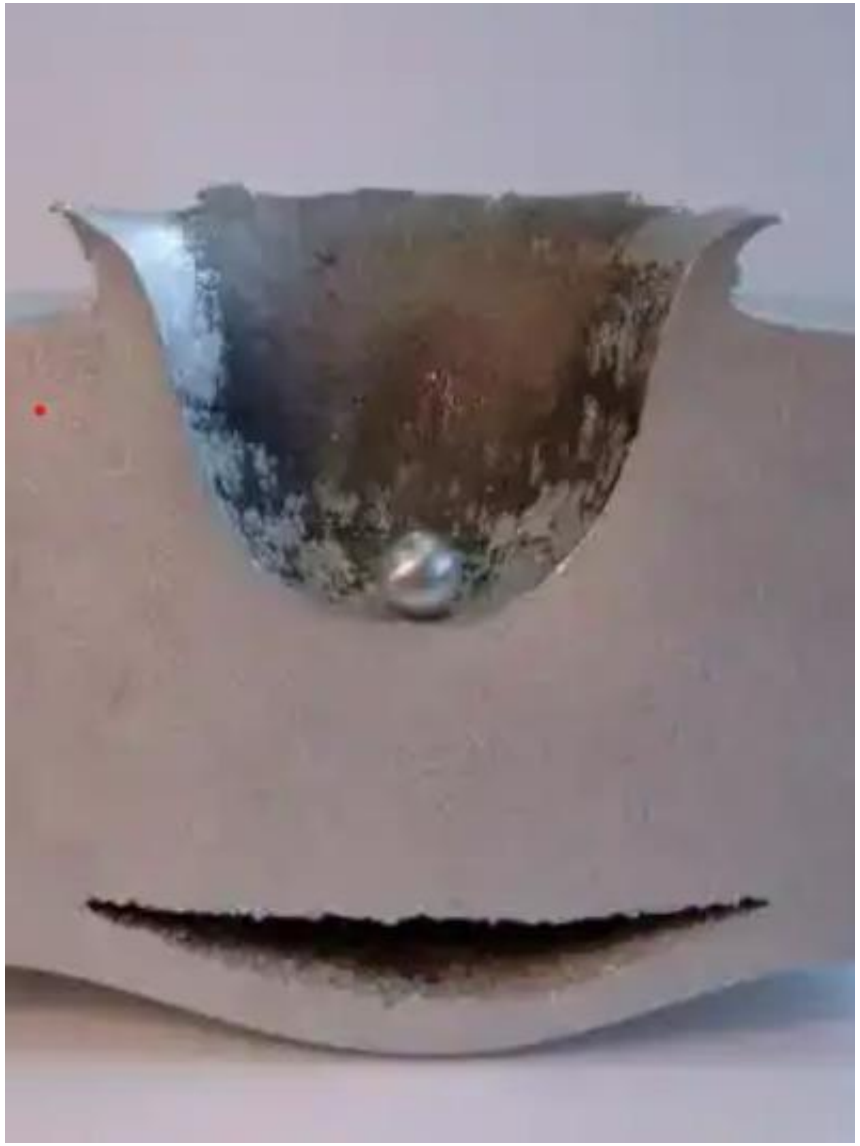
January 11, 2007

Debris Damage

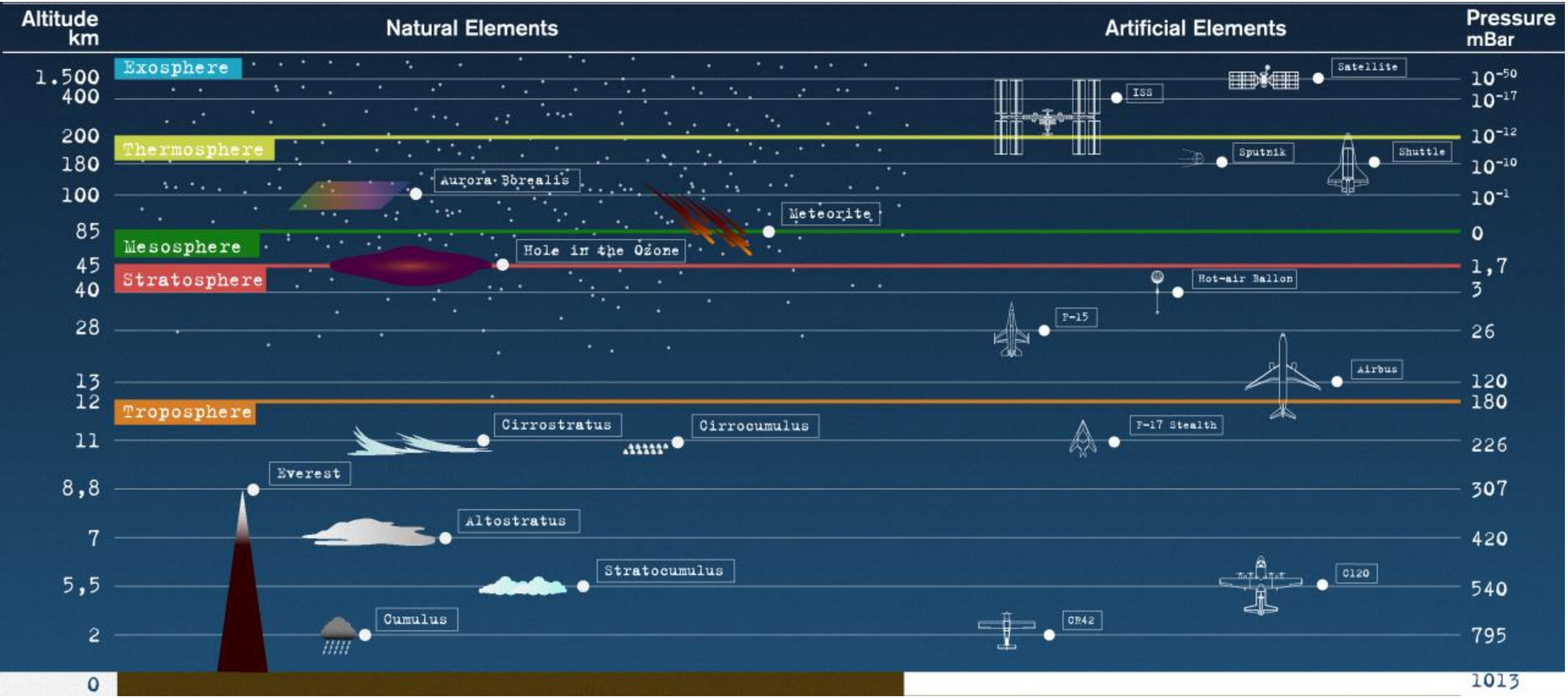


Space Shuttle window damage from paint-fleck sized objects

Aluminum BB at 4.2 miles/second (15,000 miles/hour) vs Aluminum block



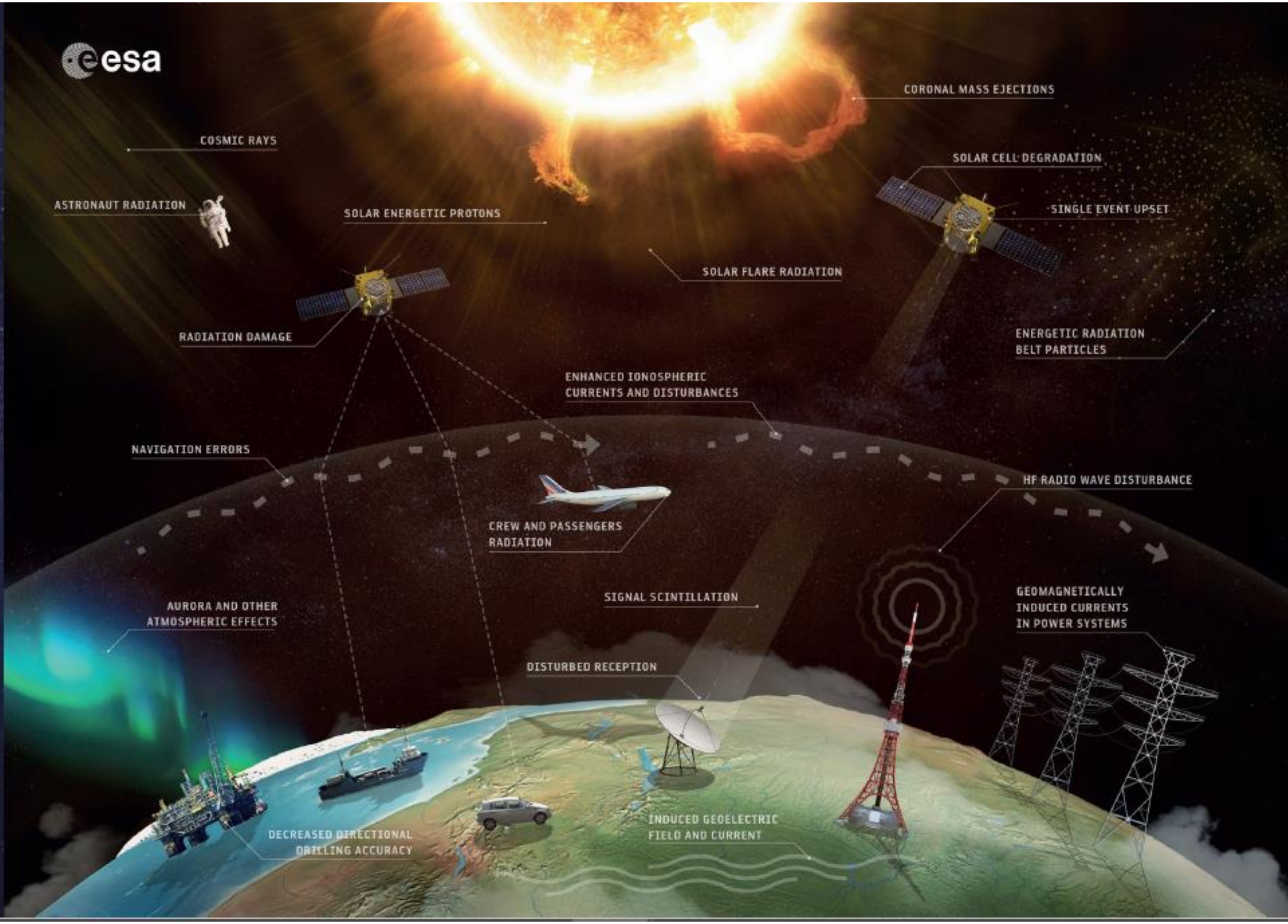
Space Environment: Where is Space?



Space Environment: What is Space?

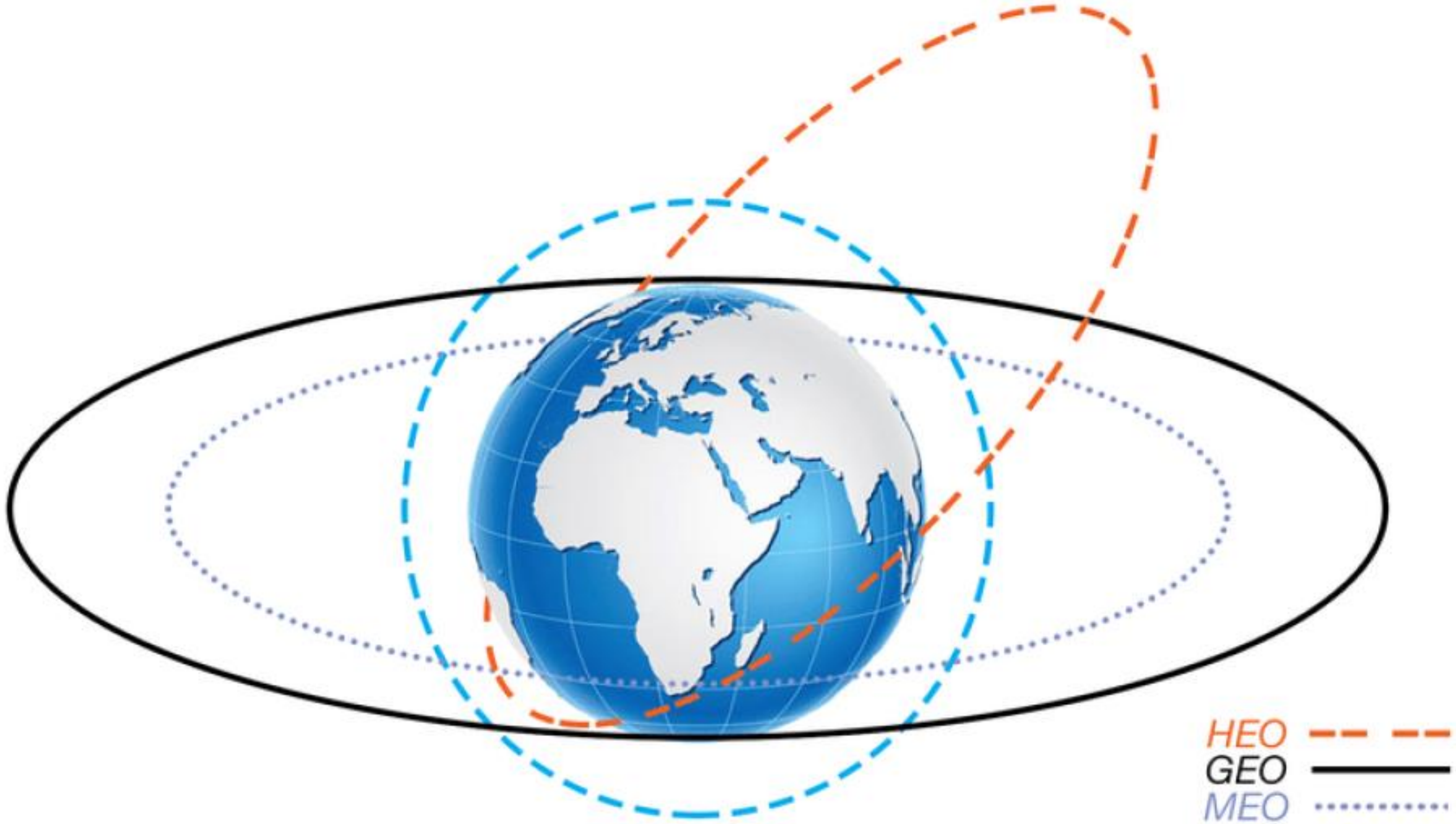
Space Weather

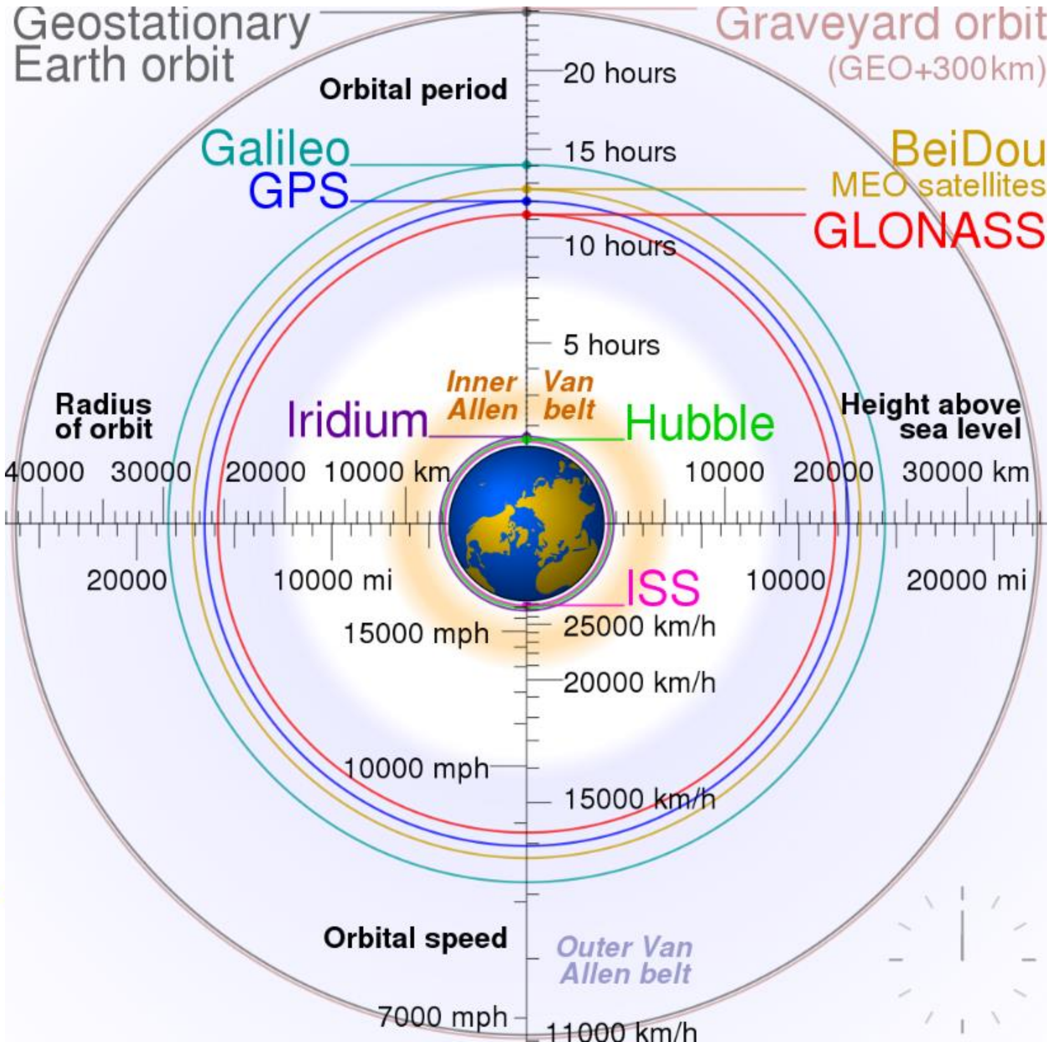
- Magnetic charge
- Plasma Environment
- Radiation
  - Solar Flares
  - Solar Wind
  - Magnetic Storms
  - Ionosphere
  - Solar Proton Events
  - Solar Energetic Particles
  - Galactic Cosmic Rays
- Orbital Debris
- Micro-Atmosphere
- ***Vacuum***
- **Gravity**



Space Environment: Basic Satellite Orbits

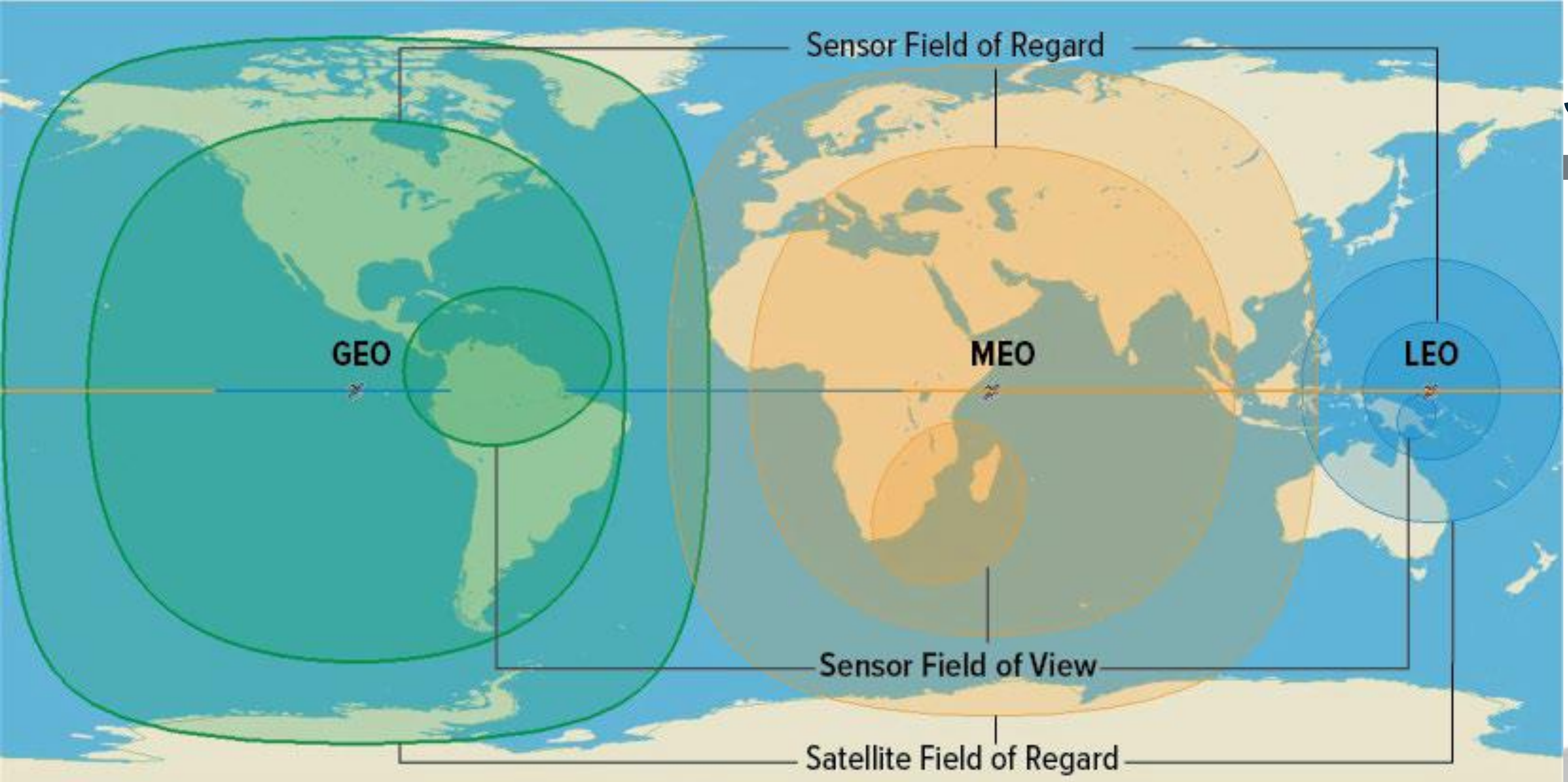
- Low Earth Orbit (LEO)
  - Starlink, Space Station (200-300 miles)
- Medium Earth Orbit (MEO)
  - GPS (12.5K miles)
- Geostationary Orbit (GEO)
  - Comm, DirectTV (22K miles)

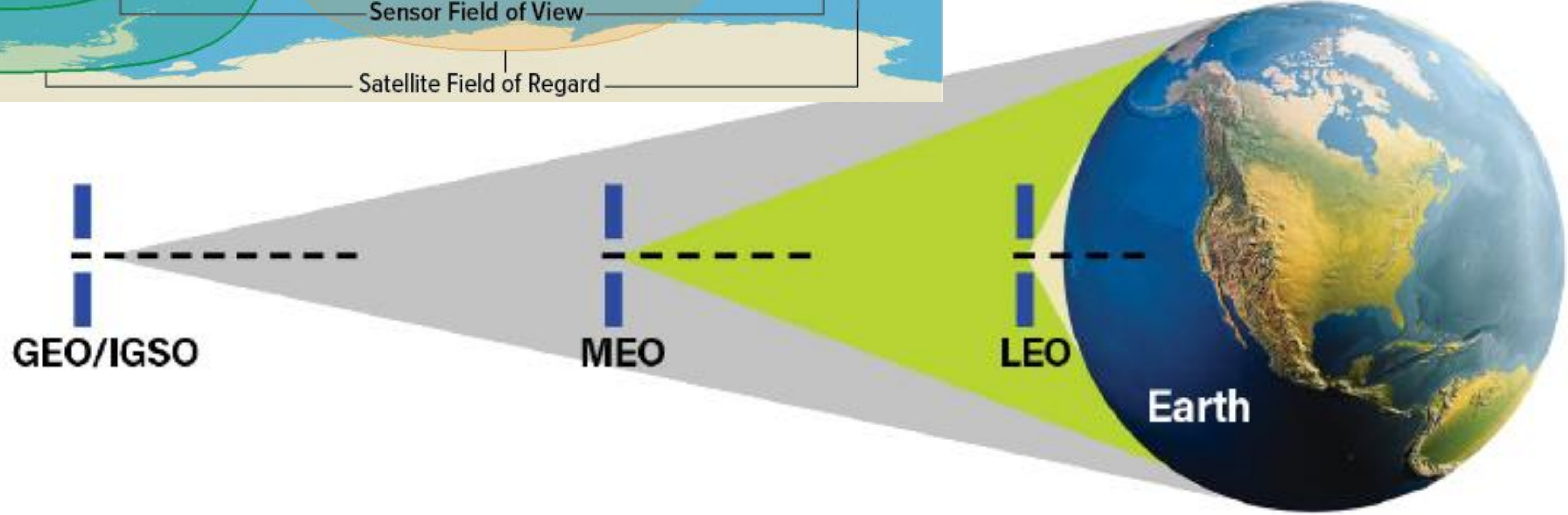




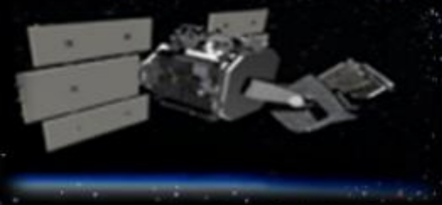
Space Environment:

Satellite footprints

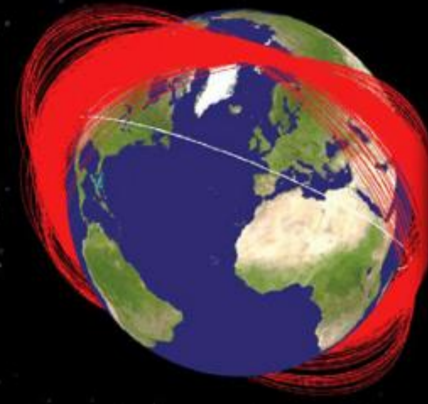


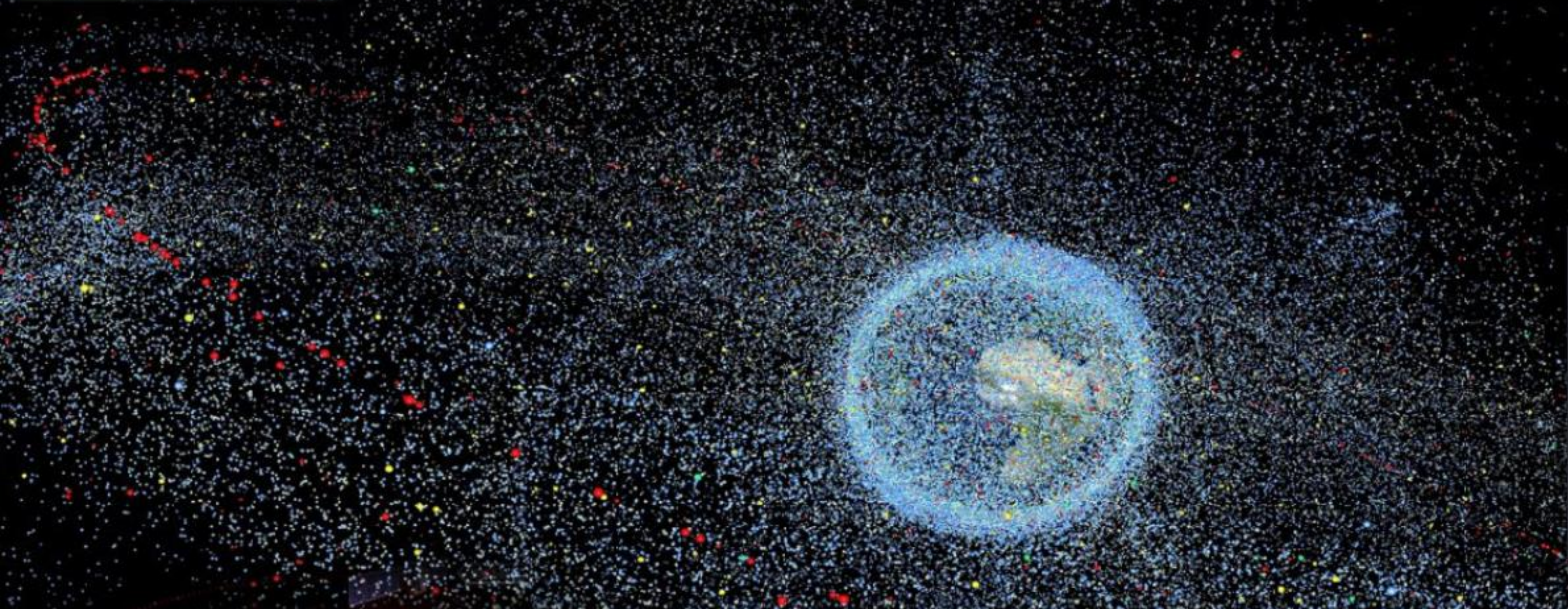


Satellite Growth



SPACE DOMAIN AWARENESS

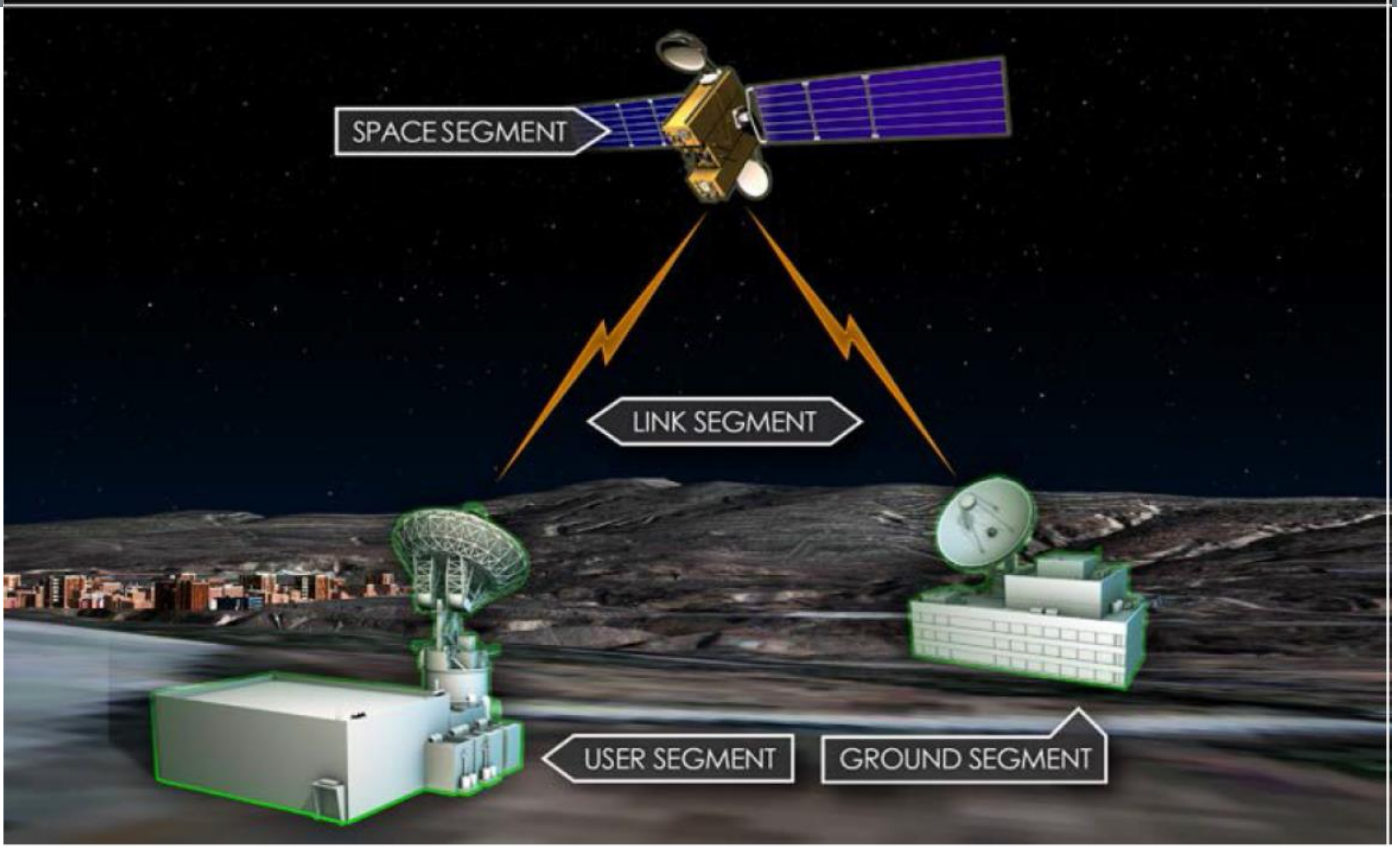




SPACE SCOREBOARD

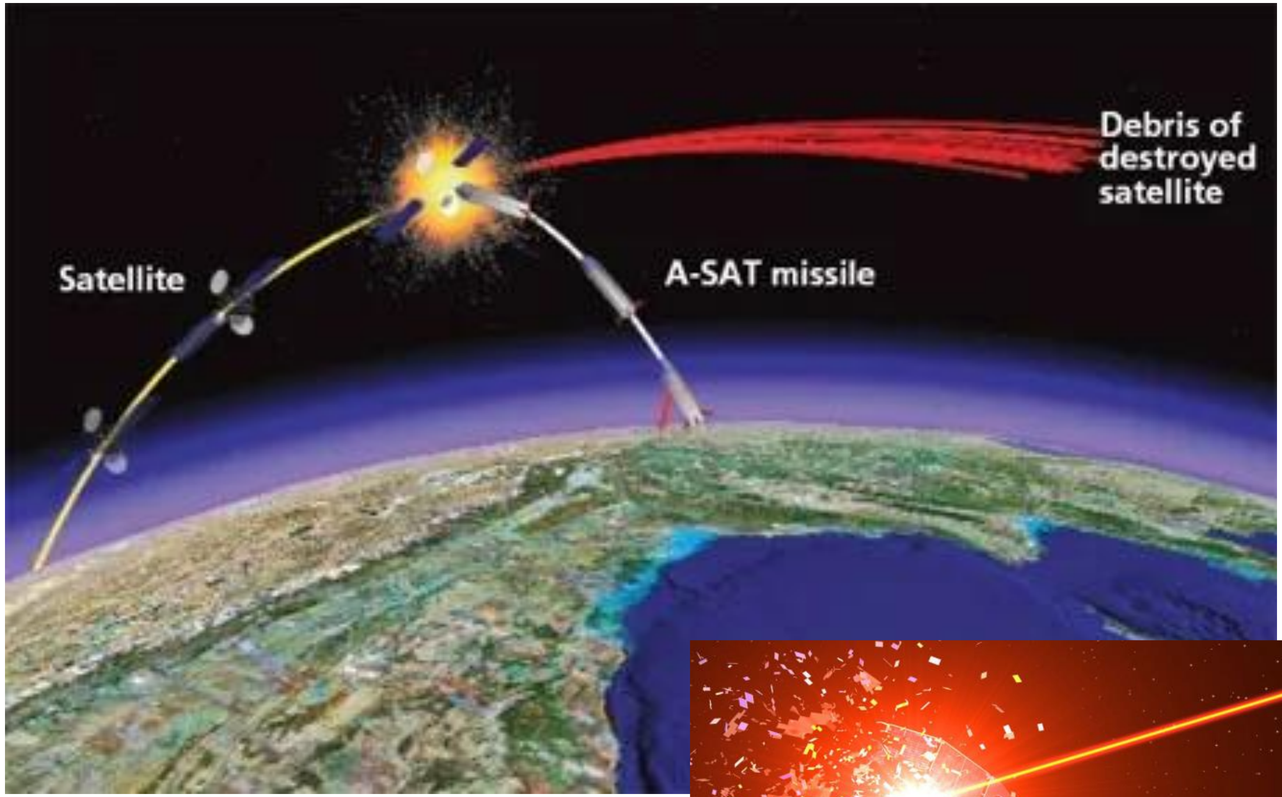
OBJECT TYPE	APPROX OBJECTS
Active Payloads	8400
Analyst Objects	17300
Debris	19200
Total	44900

Space System Segments



Attacks in Space

- Can be non-lethal (dazzling or temporarily/permanently blinding a satellite)
- Can be reversable (jamming)
- Can be kinetic (ASAT)
- Can be clandestine
- Can be difficulty to attribute
- Has secondary and tertiary effects
- May disrupt local space superiority

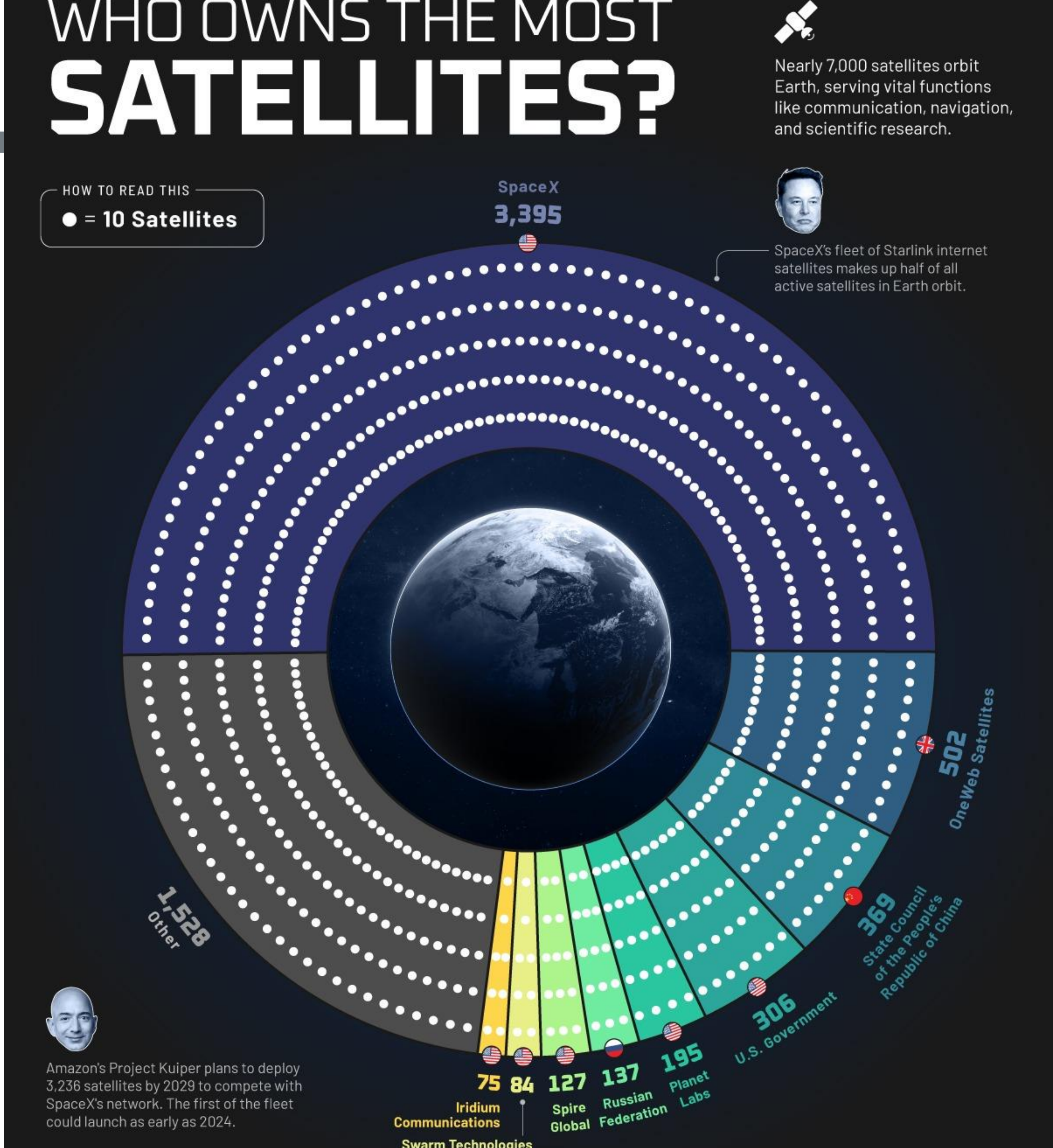


Space Environment: Satellite Growth

As of Apr 2025: ~ 12,000 active satellites

- 35% increase from 2023
- SpaceX owns half!
- US government ~ 306, other US ~354
- Russia ~ 137
- China ~ 369

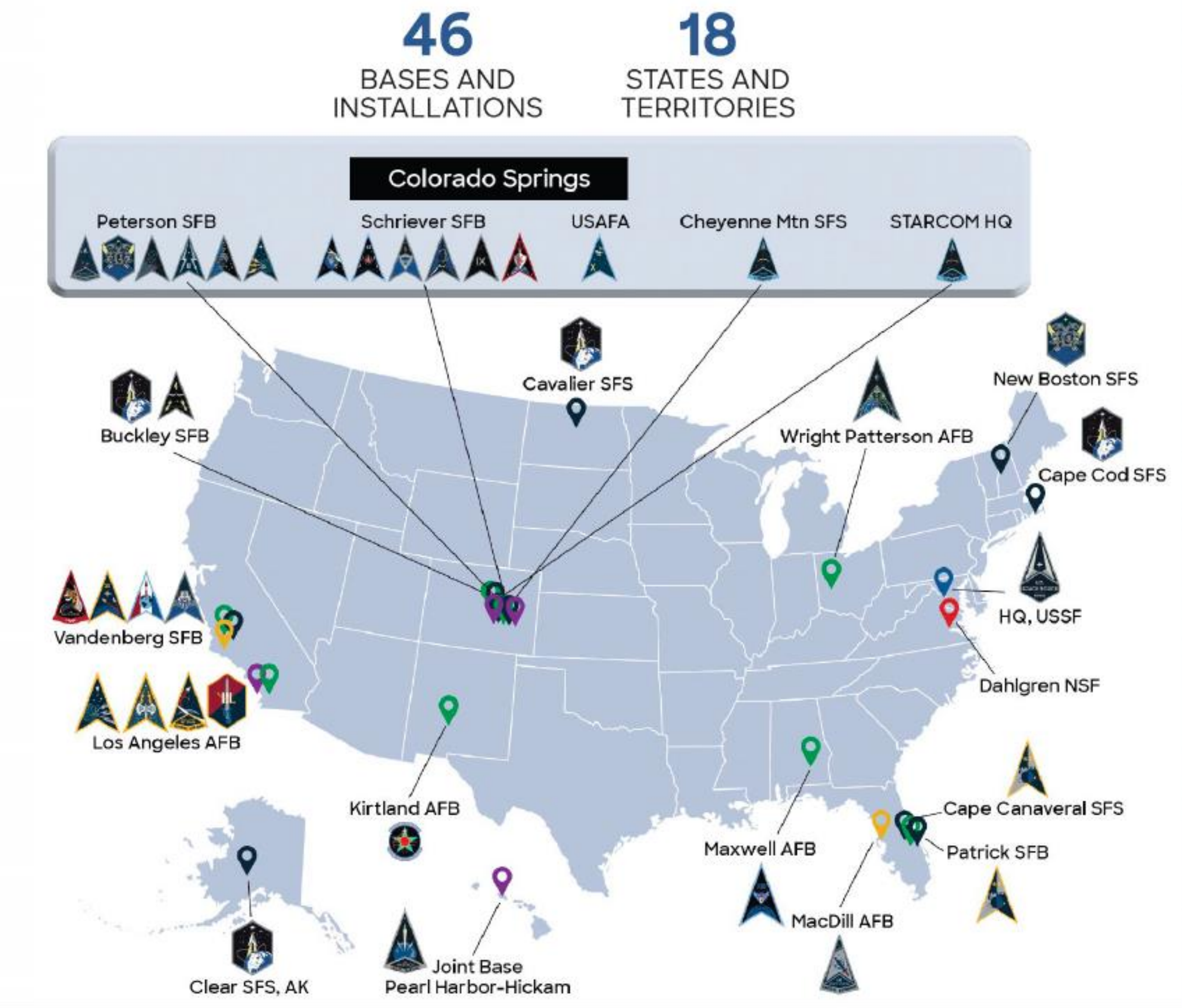
Satellite size comparison

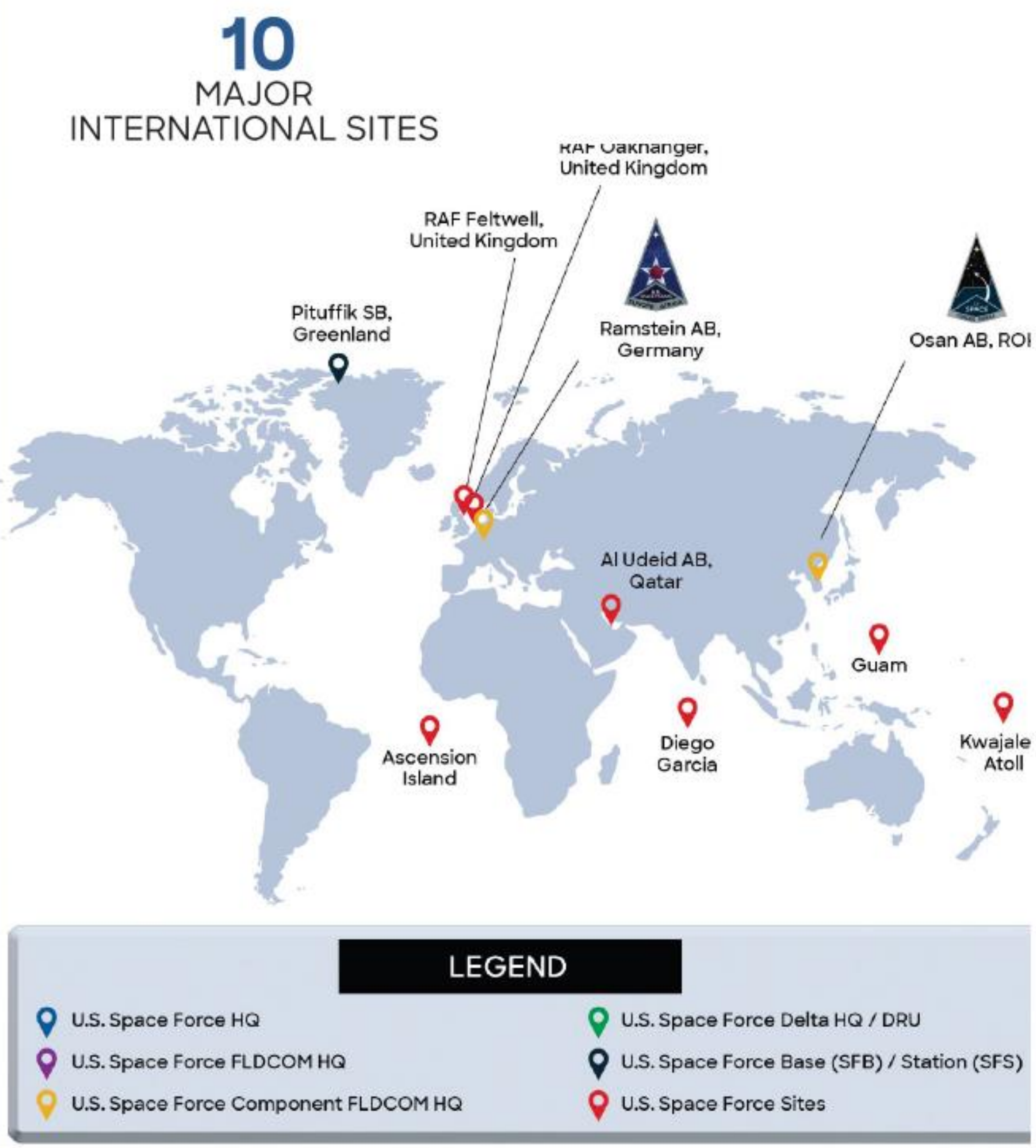


Space Force Missions

- Space Situational Awareness
- Space Control
- Position, Navigation & Timing
- Intelligence, Surveillance, Reconnaissance
- Satellite Communications
- Environmental Monitoring
- Missile Warning
- Nuclear Detonation Detection
- Spacelift
- Satellite Operations

The sun never sets on the U.S. Space Force





Pituffik Space Base Greenland

Competition in Space

Space is a player in all aspects of DIME

- Space **D**iplomacy
  - Status to have launch capability
- Space **I**nformation
  - Explosion in space-based information
- Space **M**ilitary
  - Multiple nations are now "spacefaring"
  - Space domain is now contested and congested
- Space **E**conomy
  - 2023 - $570B (>Ireland's GDP / Amazon's revenue)
  - 2035 - estimated $1.8T (> Australia's GDP)
  - Will counite to skyrocket

Space is yet another (complicated & expensive) venue for nations to compete

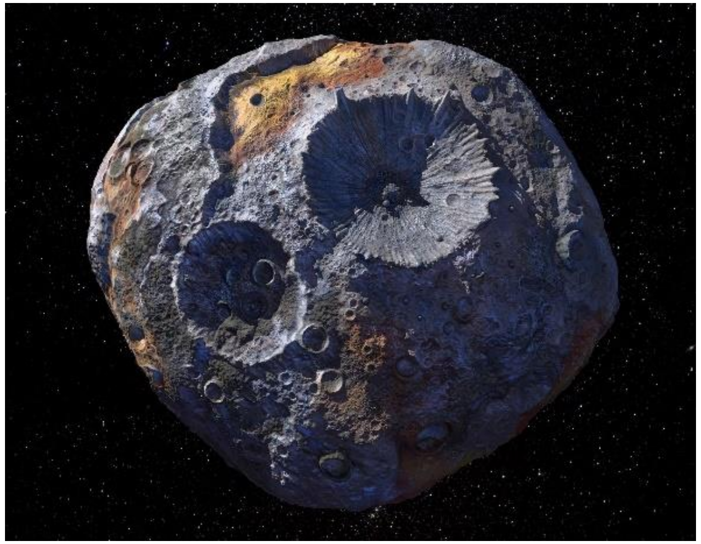
1st man-made object in space was a weapon: 3 Oct 1942 German V-2

US gift to USSR: Soviet flag & moon rock from Apollo 11

The Future Space Fight

- Competition!
- Proliferated Low Earth Orbit (pLEO)
  - Think StarLink
  - Targeting dilemma
- Partnership
- Cislunar Economy
  - Helium 3
  - Space manufacture
  - Ice harvesting (fuel, H20, O2)
  - Asteroid Belt mining
  - Strategic locations (Shackleton Crater, Lagrange points…)

Shackleton Crater
Lunar South Pole



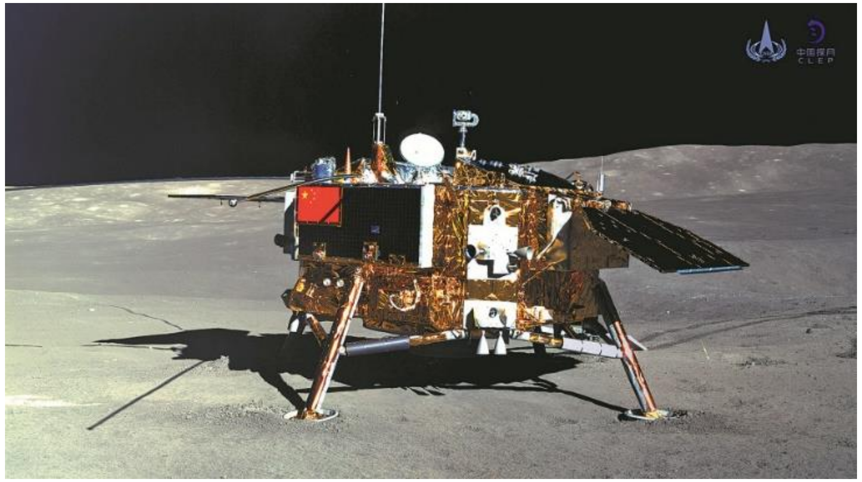
Asteroid Psyche
worth $27 Quintillion…

Planned Lunar Missions

US
- Artemis Accords – 48 nations
- Artemis II – Sep 2025 – lunar flyby
- Artemis III – Sep 2026 – lunar orbit
- Artemis IV – Sep 2028 – lunar Gateway & lunar landing
- Artemis V – Mar 2030 – delivery of Lunar Terrain Vehicle
- Artemis VI – Mar 2031 – delivery of Crew/Science Airlock

China
- 2021 – China & Russia announce plans for **International Lunar Research Station** (13 nations)
- Chang’e 7 – 2026 – robotic – south pole
- Chang’e 8 – 2028 – robotic – tech tester
- 1st crewed lunar landing – 2029-2030

Earthrise from the Moon as seen by Apollo 11, Jul 1969



Chinese Lunar Exploration Program - Chang’e 5 lander on the Moon, Dec 2020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