

Perspectives on Space Security

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Secure World Foundation

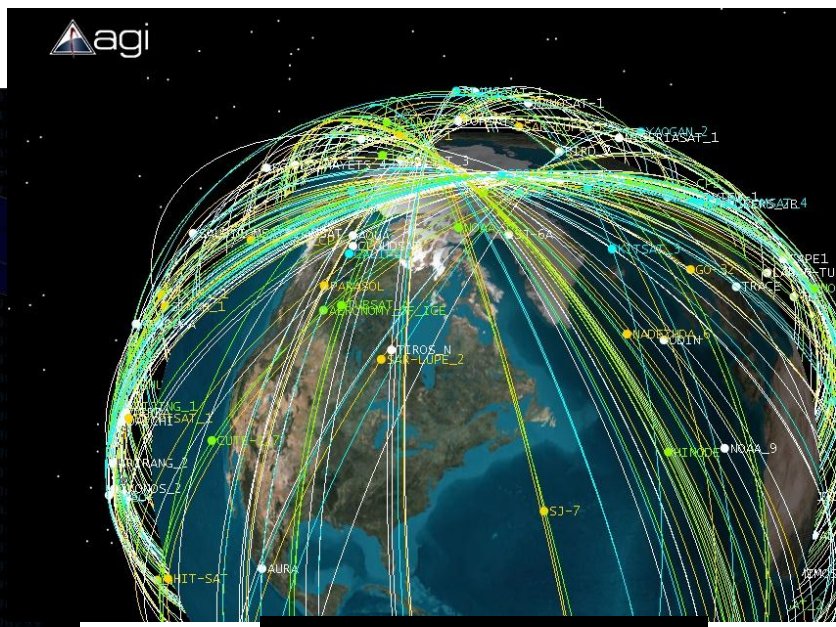
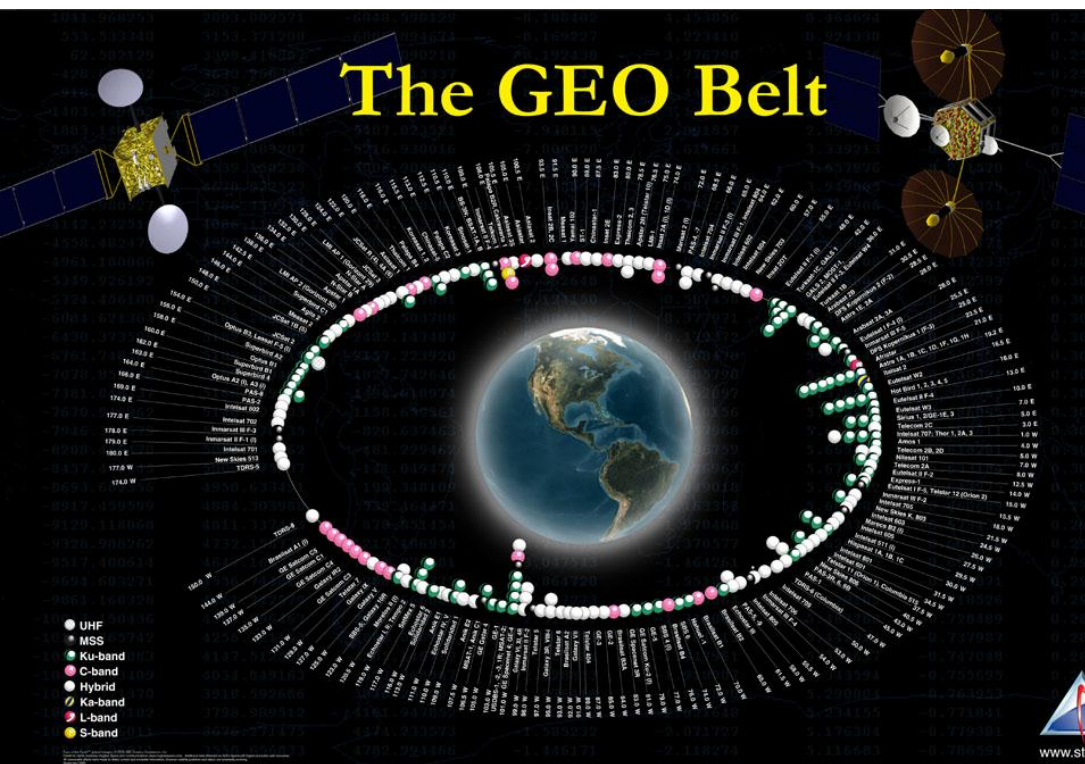
- Introduction—the state of the space commons
- Issues in Governing Outer Space
- Space situational awareness (SSA)
- Secure World Foundation

- Legally, outer space is a “commons”, or a shared resource
 - **1967 Treaty on Outer Space, Article I:**
 - The exploration and use of outer space ...shall be carried out for the benefit and in the interests of all countries...and shall be the province of all mankind.
 - Outer space...shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.
 - There shall be freedom of scientific investigation in outer space...and States shall facilitate and encourage international co-operation in such investigation.
 - **Article II**
 - Outer space...is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

Near-Earth Space is a Limited Resource

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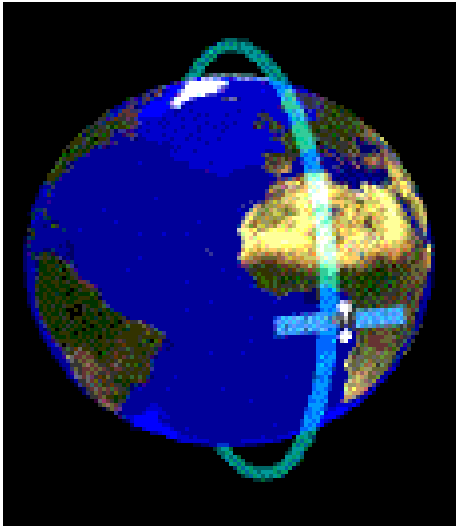
- Crowding in Polar orbits (Earth observation satellites)
- Crowding in Geosynchronous orbits (communications satellites)



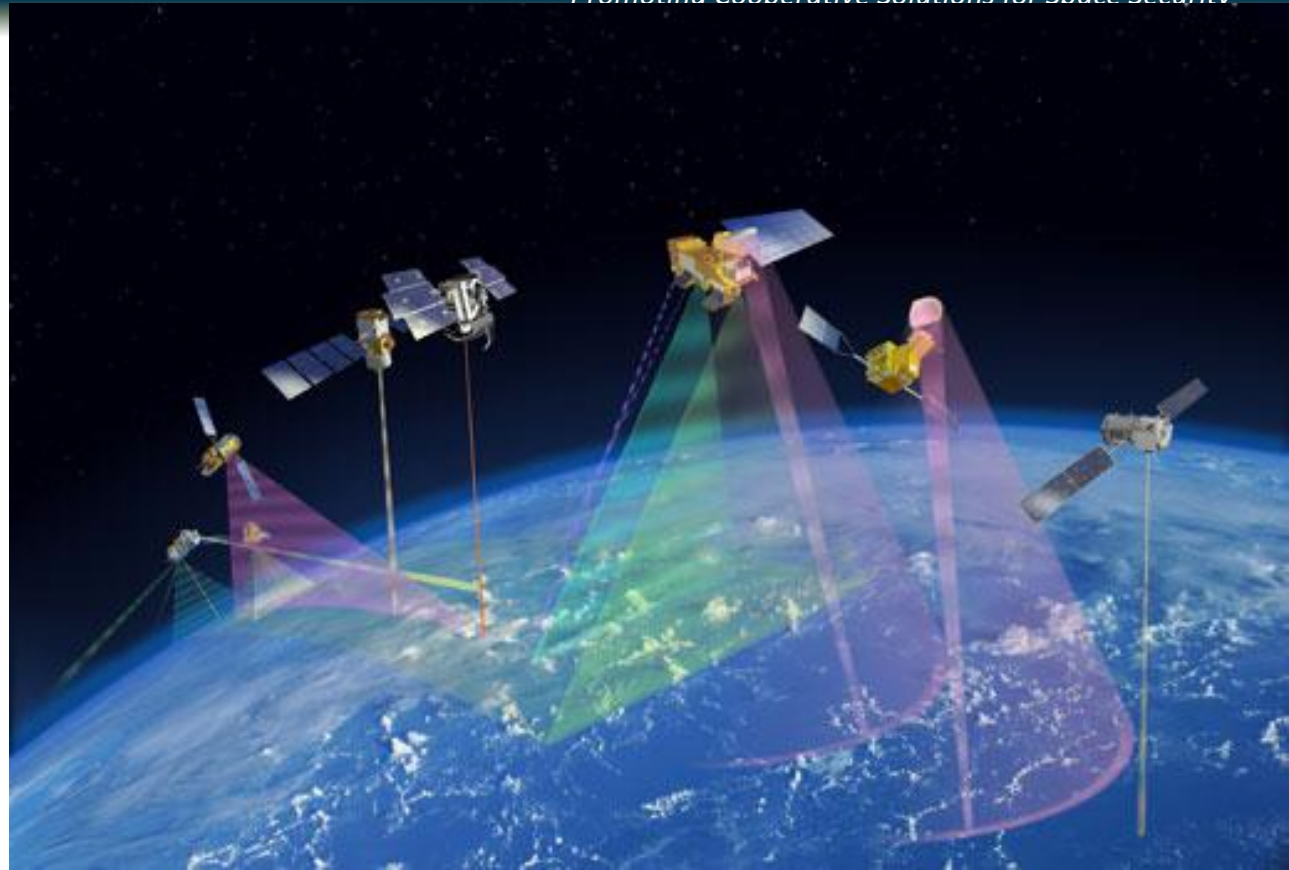
Polar Orbits

Most RS Satellites Fly in Polar Orbit

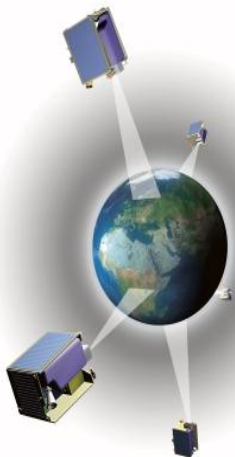
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Polar Orbit



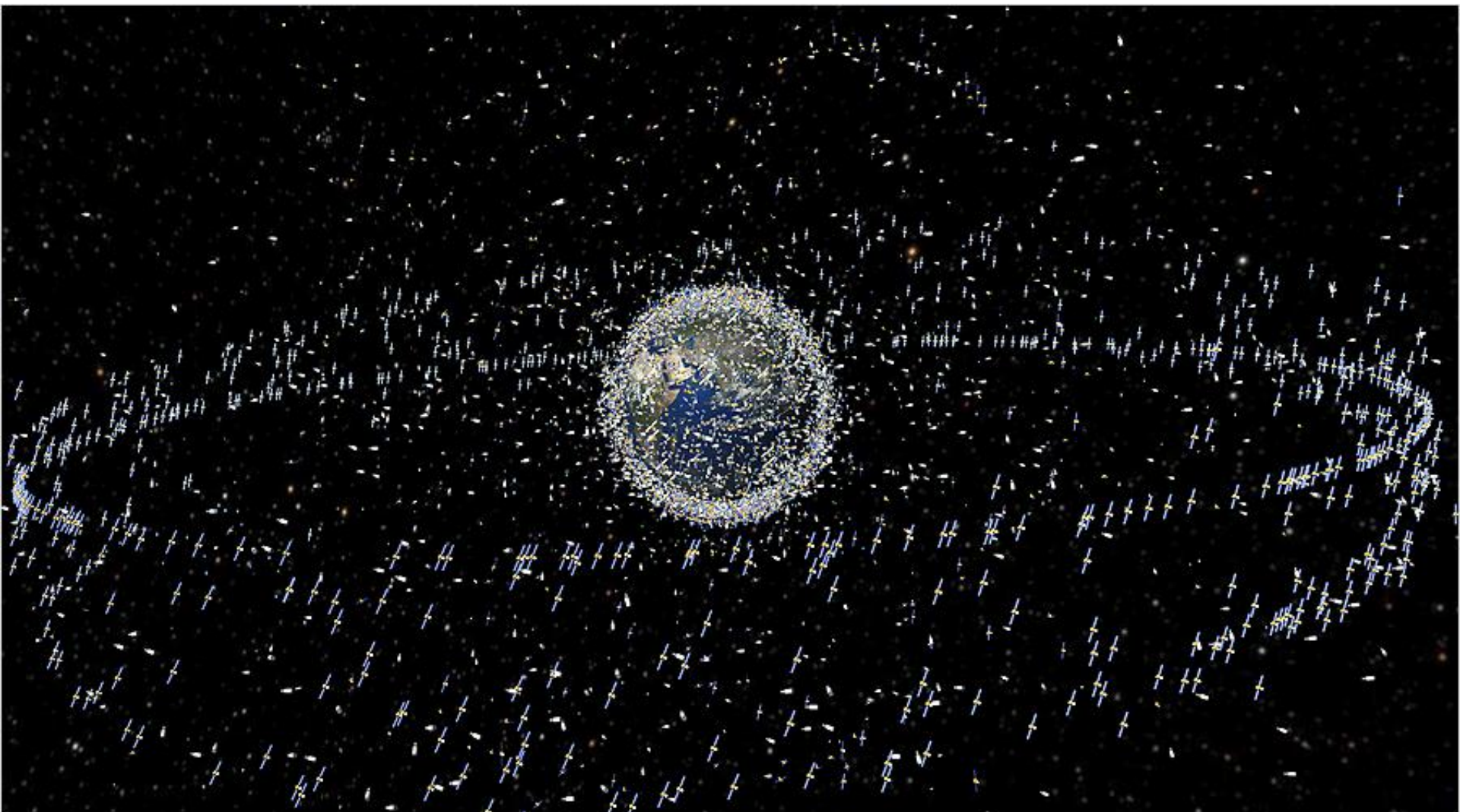
NASA takes the A-Train

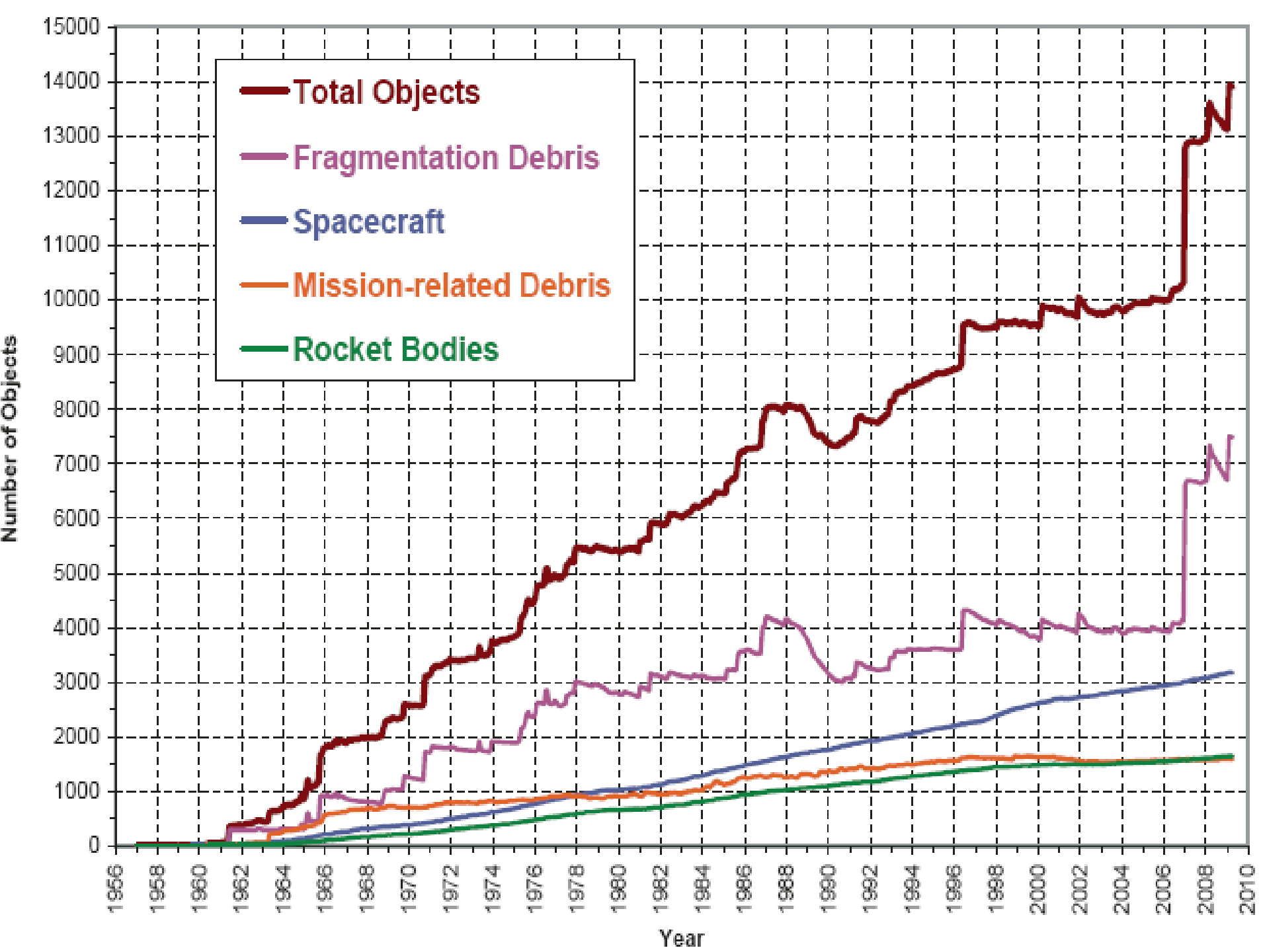


**DMC
Constellation**

Debris in Orbit

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- **The “Tragedy of the Commons”**
 - Refers to a dilemma in which multiple actors, acting independently, and solely and rationally consulting their own self-interest, ultimately deplete a ***shared limited resource*** even when it is clear that it is not in anyone's long-term interest for that to happen.
 - Important and vexing economic problem
- **“Tragedy of the Anticommons”**
 - Where rational actors, acting separately, collectively waste a given resource by under-utilizing it especially with regard to cooperation and coordination in the use of space systems to support environmental and human security needs.

By frequency interference

- Accidental because of orbital crowding in GSO
- Deliberate interference for political reasons

By natural space weather events

- Solar flares and other solar eruptions that interfere with satellite operations, especially in high orbits such as geosynchronous

Energetic Electrons

Solar Flare Protons



Damage to spacecraft electronics



Ionospheric currents

GPS Signal Scintillation

Geomagnetically induced currents in power systems

HF Radio wave disturbance

Radiation effects on avionics



Induced effects in submarine cables

Magnetic interference in exploration surveys

Telluric currents in pipelines

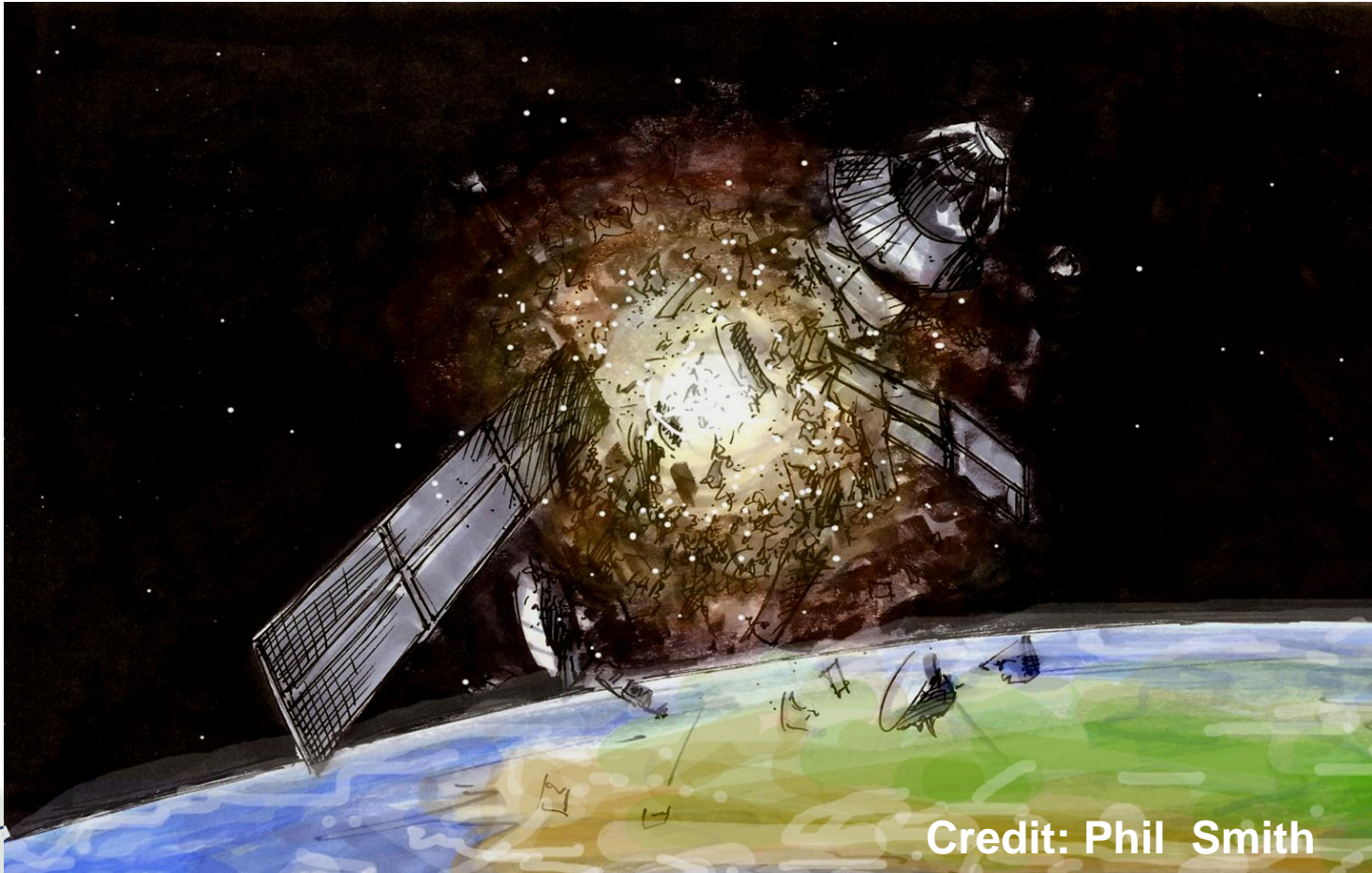


- Crowding in key orbits
- Debris in orbit
 - 21,000 objects currently tracked by U.S. Stratcom
 - About 1,000 active satellites
- Frequency interference from neighboring satellites
- Space weather effects
- Avoiding both the tragedy of the commons and the anti-tragedy of the commons
- Debris-causing weapons in outer space
- Low level of member states ratifying space treaties

The Challenge

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- To avoid accidental collisions, such as occurred on 10 February 2009.
- Or deliberate, debris-causing satellite destruction



- To devise and adopt a set of international “best practices” that guide the operations of space systems and make space activities more sustainable
- To devise ways to make civil space situational awareness (SSA) available to all States
 - To allow satellite operators to know where debris and other satellites are so they can be avoided, where possible
- Together, these lay the foundations for making possible a “space traffic management” regime aimed at increasing the safe and efficient use of outer space

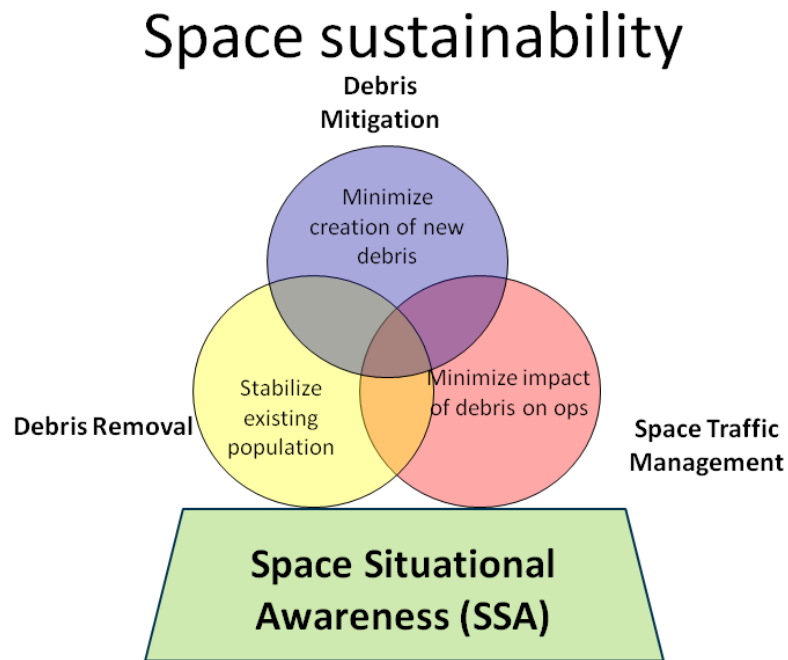
- What is Space Sustainability?
 - One definition: Using outer space in such a way that all humanity can continue to use it for socioeconomic benefit and peaceful purposes
- Reaching sustainability of activities in outer space will require
 - International cooperation;
 - Discussion; and
 - Agreements designed to ensure that outer space is safe, secure and peaceful.

- Limit creation of new debris
 - UN COPUOS resolution to limit debris adopted by General Assembly, October 2007
 - Based on InterAgency Debris Coordinating Committee (IADC) Guidelines
 - But voluntary only
- Additional controls on creation of debris needed
 - Needs to be mandatory within States
 - Many States have reported moves to institute mandatory regulations on launch and space operations
 - Need prohibition on debris-causing Asats
- Research needed on methods to clean up existing debris

Sustainability Will Require SSA

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Need for an international cooperative approach to “Space Situational Awareness,” the ability to know where working spacecraft and major debris are at all times and condition of space environment; perform conjunction analysis



- Currently, only the United States has a well-developed SSA capability; the accurate data are classified
- Steps by Europe, Russia, China, and civil society to develop SSA systems and self interest have stimulated U.S. interest in a cooperative approach
- Need to improve space weather monitoring and coordinate and share information and predictions internationally

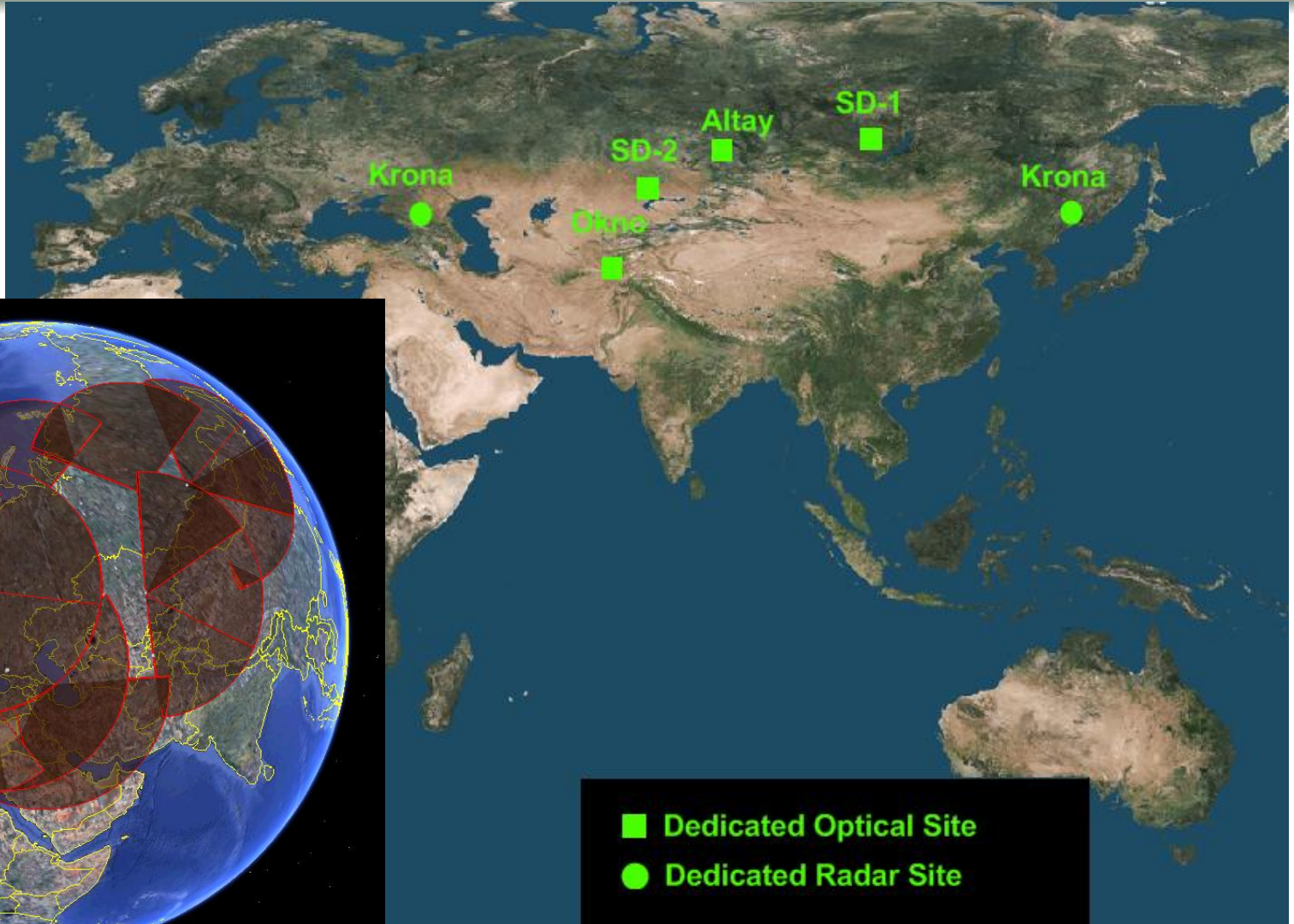
- Several countries in Europe have SSA sensors but there is no overall network



- Europe started a program to develop indigenous SSA capabilities in 2009
 - Three elements: *space surveillance, space weather, NEO tracking and warning*
 - Originally sought \$300 million over 10 years
 - Council of Ministers approved \$50 million over 3 years for first phase
 - First phase is study on best way forward
 - Second phase is connecting existing sensors to share data
 - Third phase is construction of new sensors
 - Few technical hurdles but many policy and legal hurdles
 - Concern over “federalization” of national military assets
 - Separation of civil and military use
 - Data security

Russian SSA capabilities

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Okno (“Window”) and Krona

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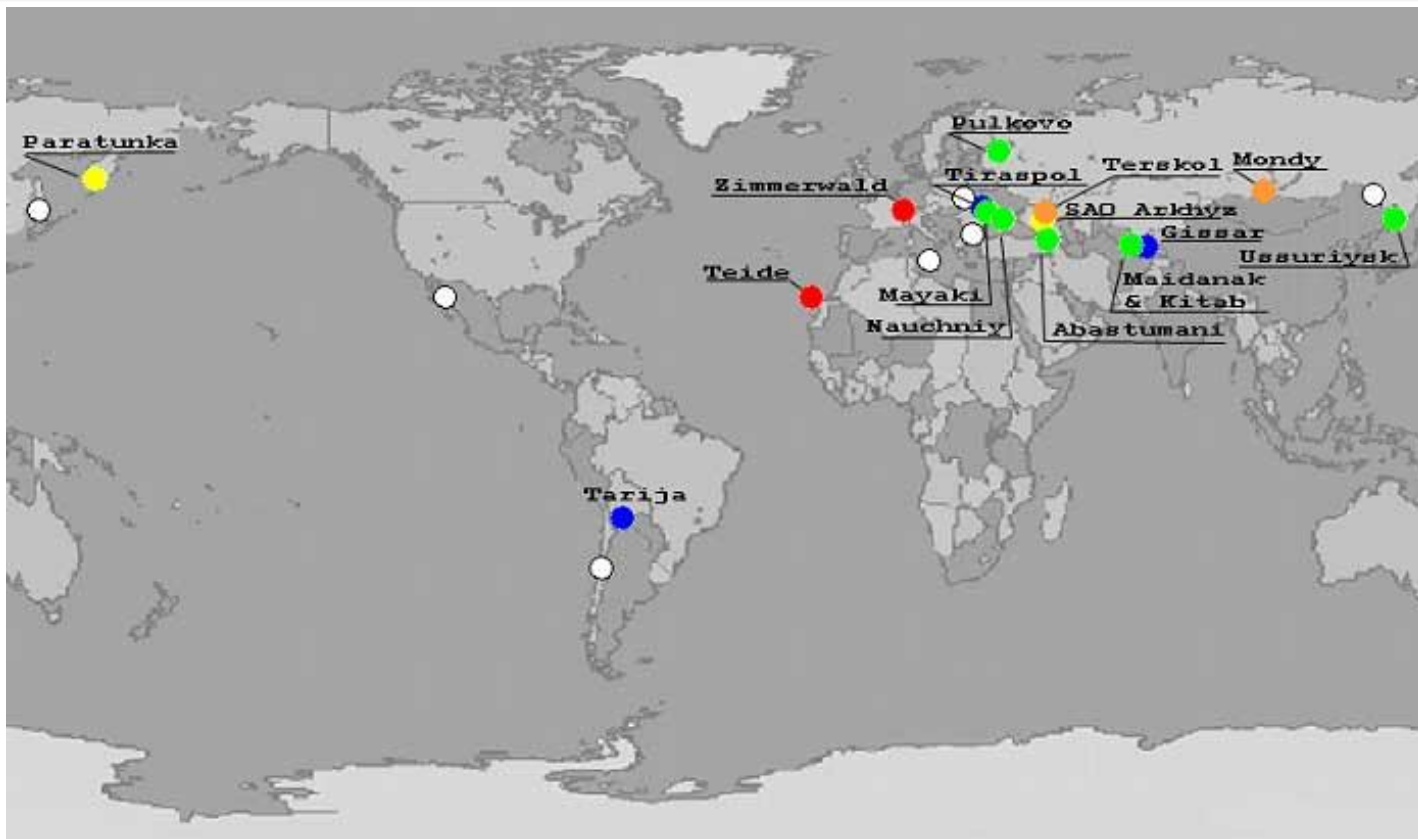
www.war



Chinese SSA capabilities

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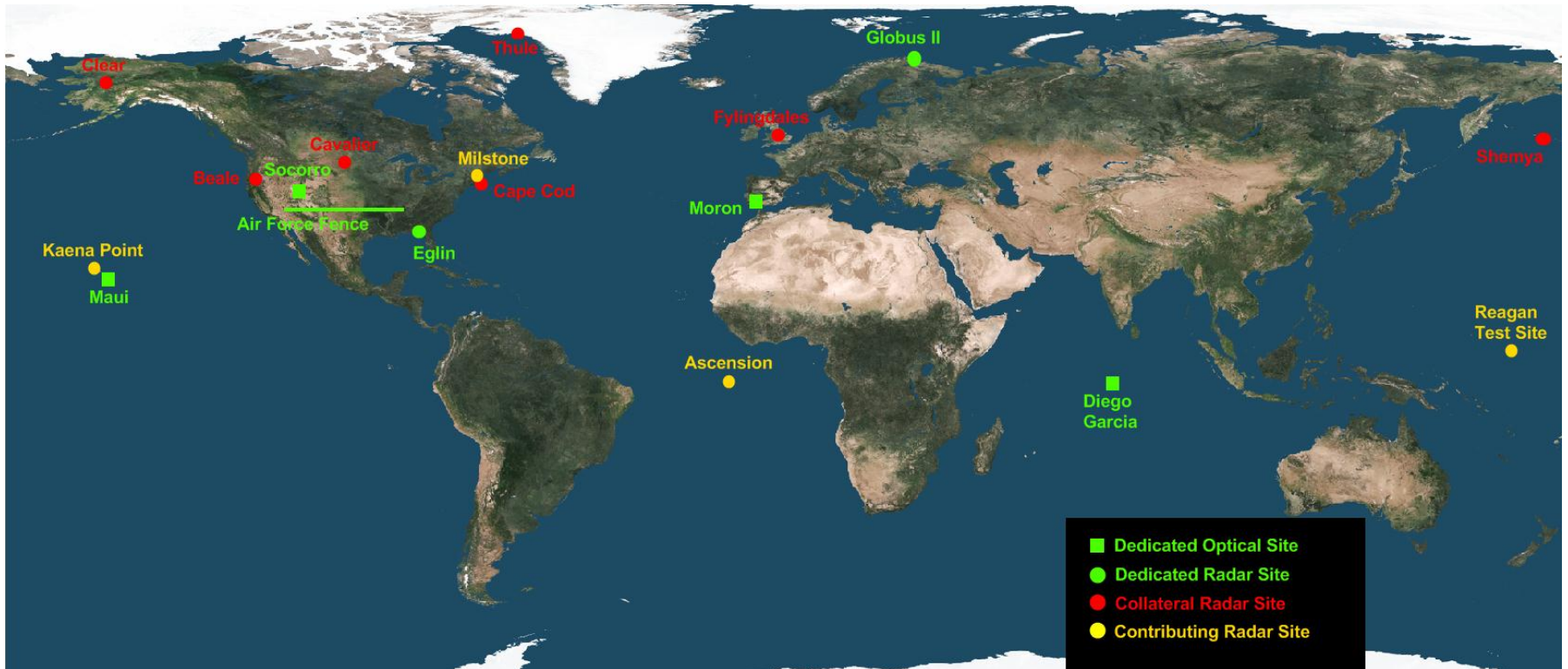




- 25 telescopes at 18 institutions in 9 States
- Coordinated through Russian Academy of Sciences
- SP-quality data, looking to move expand past GEO/MEO to LEO

Complementary to US SSN?

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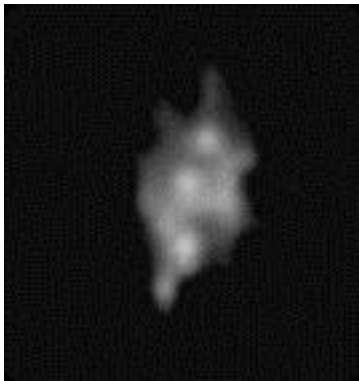
- No Southern Hemisphere coverage
- No coverage over South America, Africa, Asia, Australia
- Limited deep space capacity

*“The last Titan rocket, 4B-26, was launched on Oct 19. It deployed USA 186, a classified NRO satellite, into polar orbit. **Hobbyists have observed the satellite and determined its orbit to be 264 x 1050 km x 97.9 deg. This confirms that the satellite is one of the imaging reconnaissance satellites, replacing a satellite launched in 1996.**”*

– Jonathan's Space Report, Nov 2005



USA 186



**USA 193, as imaged by
amateur in England**

- Amateurs alerted that the classified U.S. DSP 23 was going to drift through the Hotbird (13°E), ASTRA (19°E), and ASTRA (23°E) clusters **two weeks** before USG did:

“Yes, DSP-23 is in trouble. In **addition to not receiving radio signals from it** on the 6th Nov 2008 the satellite is no longer keeping station **but is slowly drifting eastward with a rate due to gravity alone**. Radio signals were received from it on the 23rd November by Paul Marsh and by myself on 24th November when I tried again but appeared weaker than previously.

Optically it looks the same – I’ve just finished observing for tonight and this was one of the objects observed and I saw nothing unusual in its behavior and it’s still drifting”

- Message posted to See-sat list on 15 Nov 2008

- All actors in space have a responsibility to operate in a safe and secure manner
- Certain actions in space can have severe long term consequences
- The actions of one or two actors in space can potentially affect all actors
- Most actors in space do not have the resources to provide indigenous SSA capabilities
- States that do have resources to provide SSA are often limited by national security and military restrictions from sharing it

- Civil SSA requires a geographically distributed network of optical and radar sensors
- Very expensive for one State to do this unilaterally
- Much of the sensor capacity to do this already exists
- Two big questions going forward:
 - How can we *link all the existing SSA assets in a data sharing scheme?*
 - How do we provide *analytical capacity to all space actors for civil uses?*

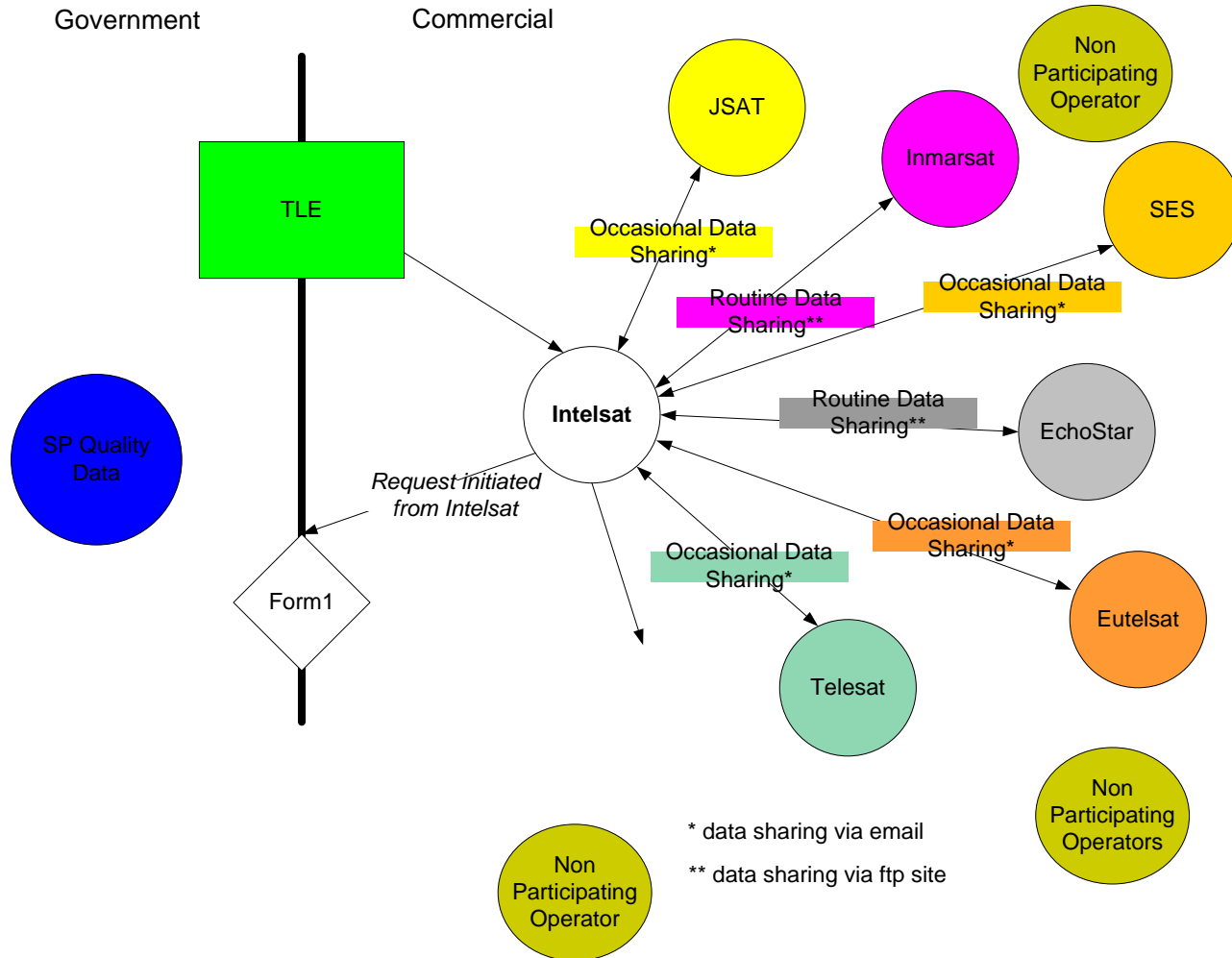
Some Reasons for Optimism

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- Recently, the U.S. Department of Defense (DoD) has shown its willingness to open some of its currently classified positional data to “allies and trusted entities” willing to share their own data
- Other countries and private satellite operators have signaled their interest to participate in an international solution
- Need only the positional data, which removes most of the concern over releasing data currently classified (which includes estimates of condition and characterization of the object)

Current Intelsat Monitoring

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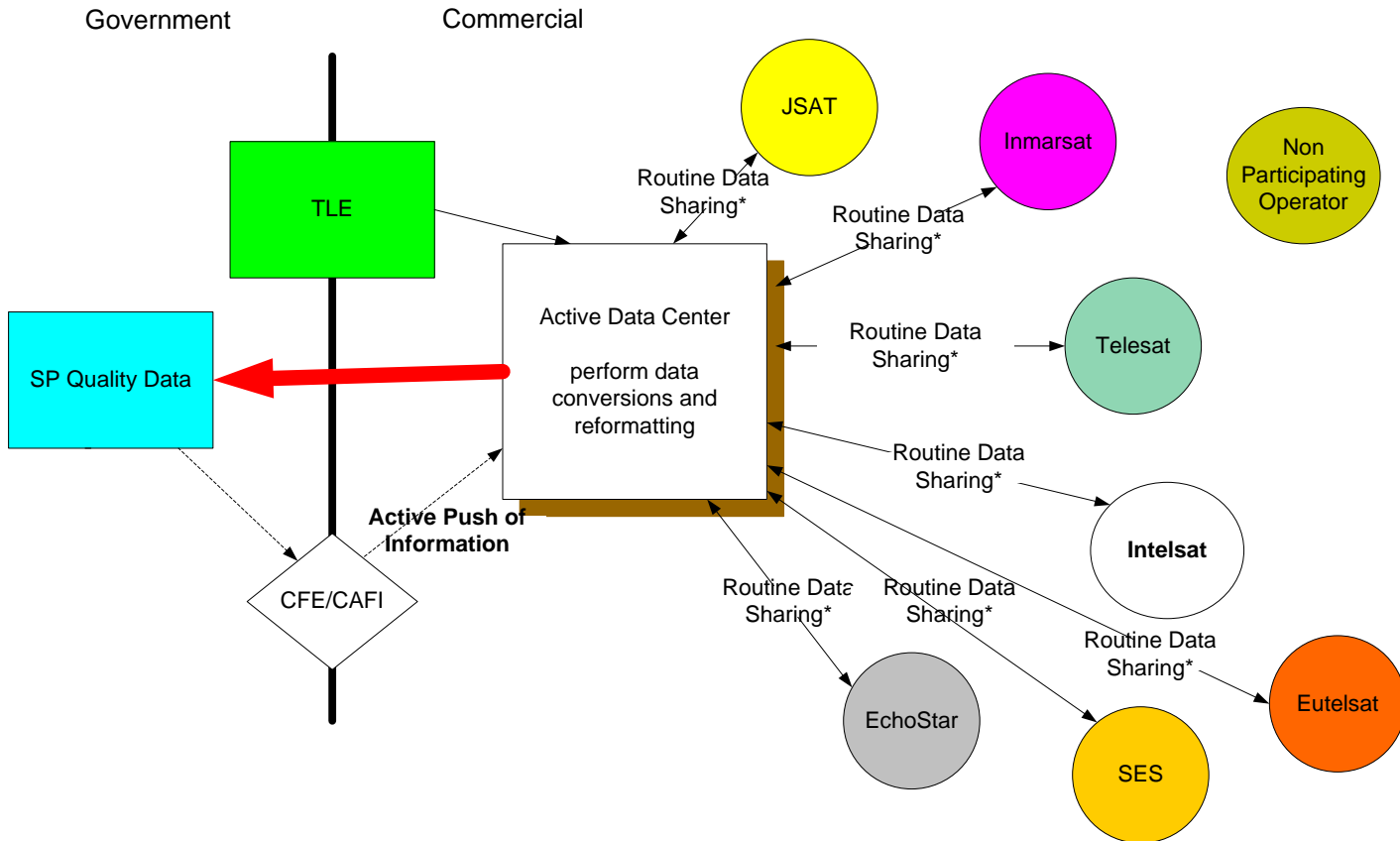


- **Space Data Association Data center concept:**
 - Consortium supported by international satellite operators
 - Active processing center – conjunction monitoring and reporting
 - Rules and protocol based on different levels of conjunction alerts
 - Member data are protected and secured
 - Technical support available for close approach mitigation



Future Owner/Operator Monitoring

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Secure World Foundation (SWF) is a private operating foundation dedicated to the secure and sustainable use of space for the benefit of Earth and all its peoples.

What does the Foundation do?

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- **Engages** with academics, policy makers, scientists and advocates in the space and international affairs communities to support steps that strengthen global space sustainability.
- **Promotes** the development of cooperative and effective uses of space for the protection of Earth's environment and human security.
- **Acts** as a research body, convener and facilitator to advocate for key space security and other space related topics and to examine their influence on governance and international development.

- **Space sustainability**
 - Protection of continued utility of space resources
- **Policy development in Emerging Space States**
- **Human & environmental security**
 - Development and disaster assistance
 - Environmental change
- **Planetary threats**
 - Mitigating the threat of collision from a Near-Earth Object (NEO) through the establishment of effective international governance for response

Questions?

Thanks!