



*Promoting Cooperative Solutions for Space Sustainability*

# Space Situational Awareness: The Big Picture

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# WHAT IS SSA?

## ***Fusing data on the space environment, human activities in space, and their interrelationships to create actionable information***

- Metric Data (Catalog)
  - Locations of objects in space and the ability to predict where objects were in the past and will be in the future
- Space Weather
  - Measurement, warning, and forecasting of the effects of Solar activity on objects in orbit
- Object Status
  - Health, telemetry, planned maneuvers (usually provided by owner/operator)
- Intelligence
  - Information about objects in orbit (images, signals, capabilities, behavior) collected on objects in orbit

# Paradigm shift in space regime...

- SSA was born during the Cold War as part of protecting the US and USSR from nuclear attacks
  - Nuclear threat progressed from airplanes to ballistic missiles (and satellites?)
  - Use of space for warning, intelligence, treaty verification
  - Two super powers controlled virtually all aspects of space
- Today's world is vastly different
  - 10 countries have indigenous space launch capability (Iran is the newest)
  - Over 70 entities operate satellites
  - 21,000+ pieces currently tracked, about 1,000 active payloads
  - Space is “crowded, congested, & contested”

- Although the space regime is much different today, SSA has not kept up
  - Still done primarily for military/national security purposes by the military
  - Bureaucracy/security needs have hampered upgrades and modernization, particularly for computer hardware/software and algorithms
- Certain actions in space can have long-term negative consequences for all
- All space actors (launching/operating satellites) need a basic level of data and analytical tools to operate in a safe & efficient manner
- Most space actors do not have this basic data

# SSA is inherently international

- “Good” SSA requires a *geographically distributed* network of both radar and optical sensors and *combining sensor observations with owner-operator data*
- Theoretically, building the sensor network can be done unilaterally
  - Large economic cost
  - Need “friends in the right places”, basing agreements
  - Long logistical tails
- Every space actor needs a certain level of SSA for safe and efficient space activities, but few have the resources to build a complete network
  - Many actors can make partial contributions



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# RECENT DEVELOPMENTS AND INITIATIVES

- High priority for SSA and ensuring the long-term stability and sustainability of space activities
  - June 2010 National Space Policy
  - January 2011 National Security Space Strategy
- Refocused efforts to increase sharing of SSA data through SSA Sharing Program
  - Prompted by the 2009 Iridium-Cosmos collision
  - JSpOC screens 1000+ active satellites daily for conjunctions, notifies owner/operators
    - 190 warnings per week, 60+ maneuvers in 2010
  - Data sharing partnerships with 35 commercial entities
  - Bilateral agreements with Australia, Canada and France
  - Still debating sharing of high accuracy catalog

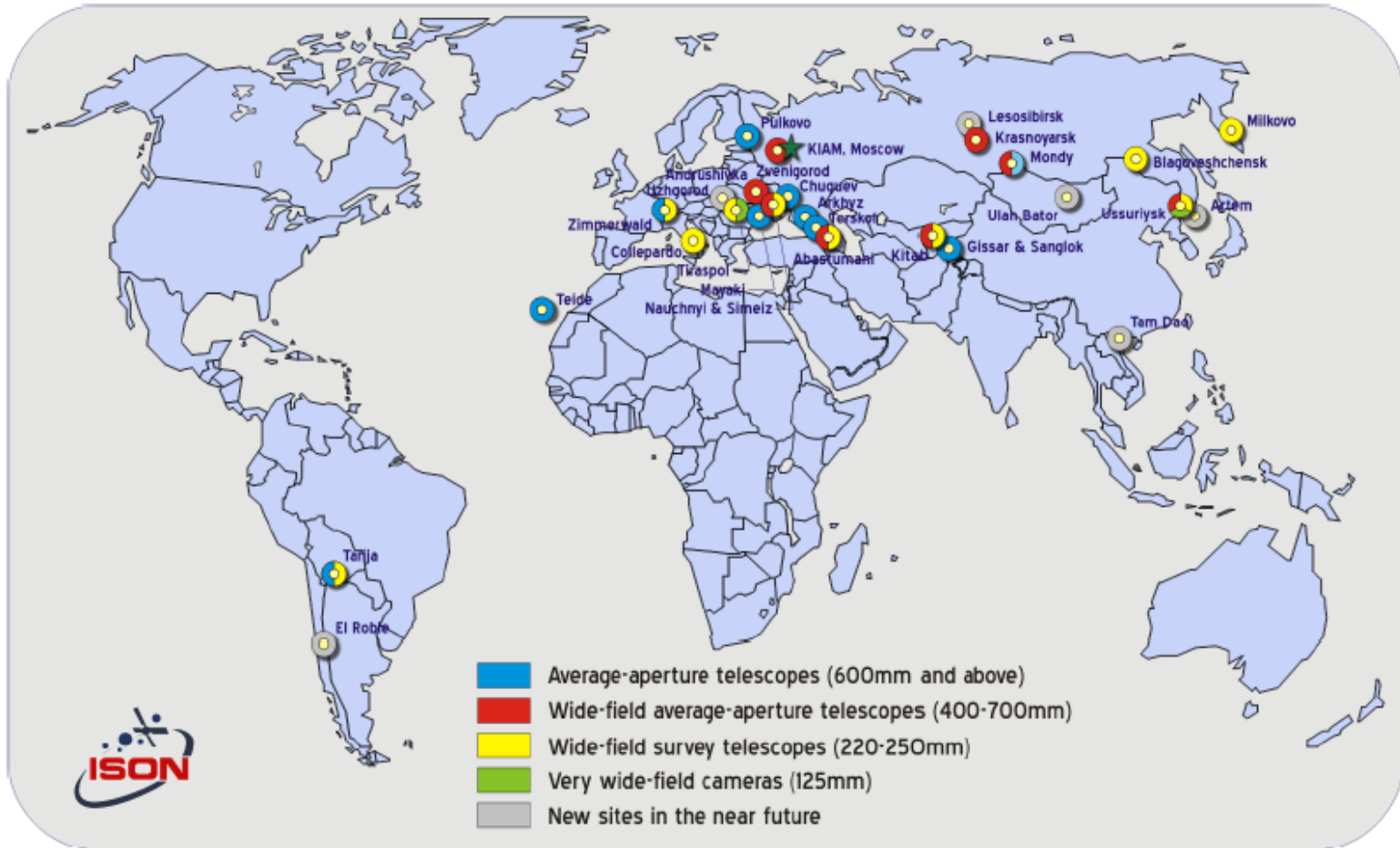




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# International Scientific Optical Network (ISON)

- Collection of international scientific telescopes to provide data for scientific analysis, created in 2001
- Civilian project coordinated by the Keldysh Institute of Applied Mathematics (KIAM) of the Russian Academy of Sciences
- 30 telescopes, 20 observatories, 10 countries
  - Global deep space coverage
- Maintains catalog of over 1,000 deep space objects
  - Including a few hundred debris objects that are not in the USG catalog
- Data is nearly as good as the USG SP Catalog
- Data is freely available, working on website for distribution



# Space Data Association (SDA)

- Not-for-profit entity created by major commercial satellite operators
- Purpose: “facilitate the controlled, reliable, and efficient sharing of SSA data to improve the safety of satellite operations”
- Created Space Data Center (SDC)
  - Initial operations in July 2010
    - Automated conjunction assessment for 128 GEO satellites
    - Web-based access
  - Full operations in early 2011
    - RFI mitigation
    - Automated warnings
    - Avoidance maneuver planning
- Looking to partner with other data providers

- In 2010, United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) created a new agenda item on the *long-term sustainability of outer space activities*
- Draft agreement to create a set of Expert Working Groups to draft recommendations and guidelines
  - Sustainable space utilization supporting sustainable development on Earth
  - *Space debris and SSA*
  - Space weather
  - Space operations (regulations and procedures)

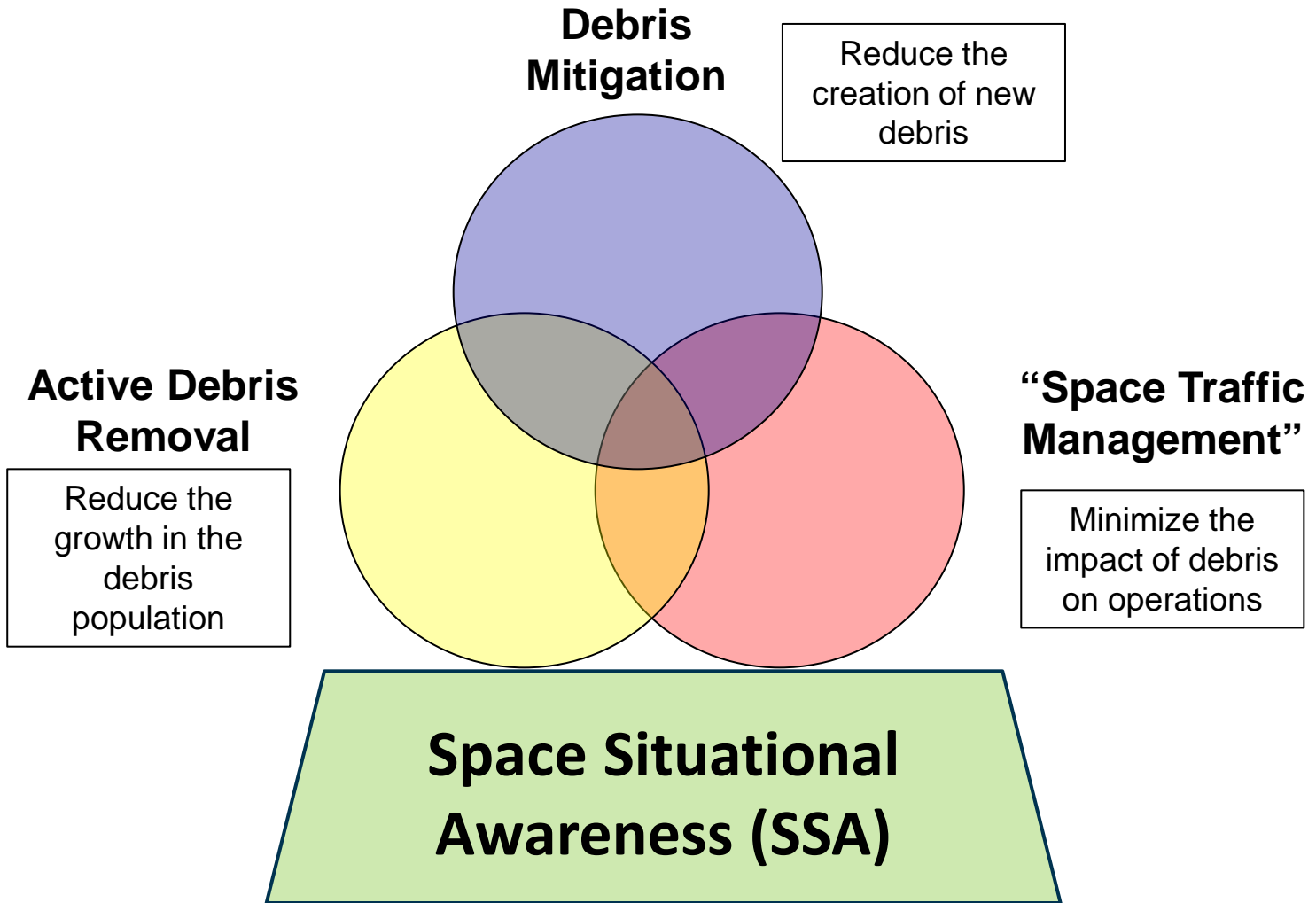


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# THE BIG PICTURE OF WHY SSA IS IMPORTANT

# Space situational awareness applications

- Predicting and preventing collisions on orbit
- Space traffic management
- Diagnosing spacecraft failures and malfunctions
- Calculating the risk to spacecraft due to environmental threats
- Detecting launches of new space objects
- Predicting atmospheric re-entry of space objects
- Monitoring behavior of spacecraft
- Detecting threats and attacks on spacecraft



# Stability and preventing conflict

- Conflict in space can severely degrade or damage the ability of *all* space actors to use space for peaceful uses
  - Debris-causing hyperkinetic anti-satellite weapons
  - Broad spectrum RF and EM weapons
  - Nuclear detonations
- Incidents in space could be a flash point for conflict on Earth
  - Anomaly resolution is “long distance detective work”
  - Did my satellite cease operations because of debris, space weather, manufacturing defect, or a deliberate attack?
- “Sharing monitoring” is essential to establishing responsible behavior and detecting irresponsible behavior



# Current Security Initiatives

- International
  - Russian-Chinese proposed Treaty on the Prevention of the Placement of Weapons in Outer Space” (PPWT)
  - European proposed “Space Code of Conduct”
  - Russian proposal for a UN Group of Governmental Experts (GGE) on Transparency and Confidence Building Measures (TCBMs)
- United States
  - National Space Policy supports “verifiable” arms control agreements
  - National Security Space Strategy focus on establishing norms of behavior, deterrence, cooperation/partnerships, resilience

- It is impractical for a single actor to achieve “good” SSA by themselves
- Fundamentally, SSA requires data sharing and cooperation between different actors
  - Networks of telescopes and radars distributed around the globe to track debris
  - Satellite owner/operators with telemetry, health, and planned maneuvers
- Multiple independent sources of SSA data are good
  - Greater accuracy and redundancy
  - Independent monitoring and validation



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# Secure World Foundation

- Non-profit operating foundation founded in 2004
- Funding comes from a private endowment
- Offices in Colorado, Washington D.C. and Brussels
- Dedicated to the *ensuring the long-term sustainability of space*
- We *inform, facilitate,* and *promote*
- Strong role policy development in both the international and domestic policy communities



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# Thank you. Questions?

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