



*Promoting Cooperative Solutions for Space Sustainability*

# **Global Space Situational Awareness Activities**

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- What is Space Situational Awareness (SSA)?
- Evolution of SSA over the last decade
- Recent developments
  - United States
  - Europe
  - Australia
  - Canada
  - Space Data Association (SDA)
  - International Scientific Optical Network (ISON)

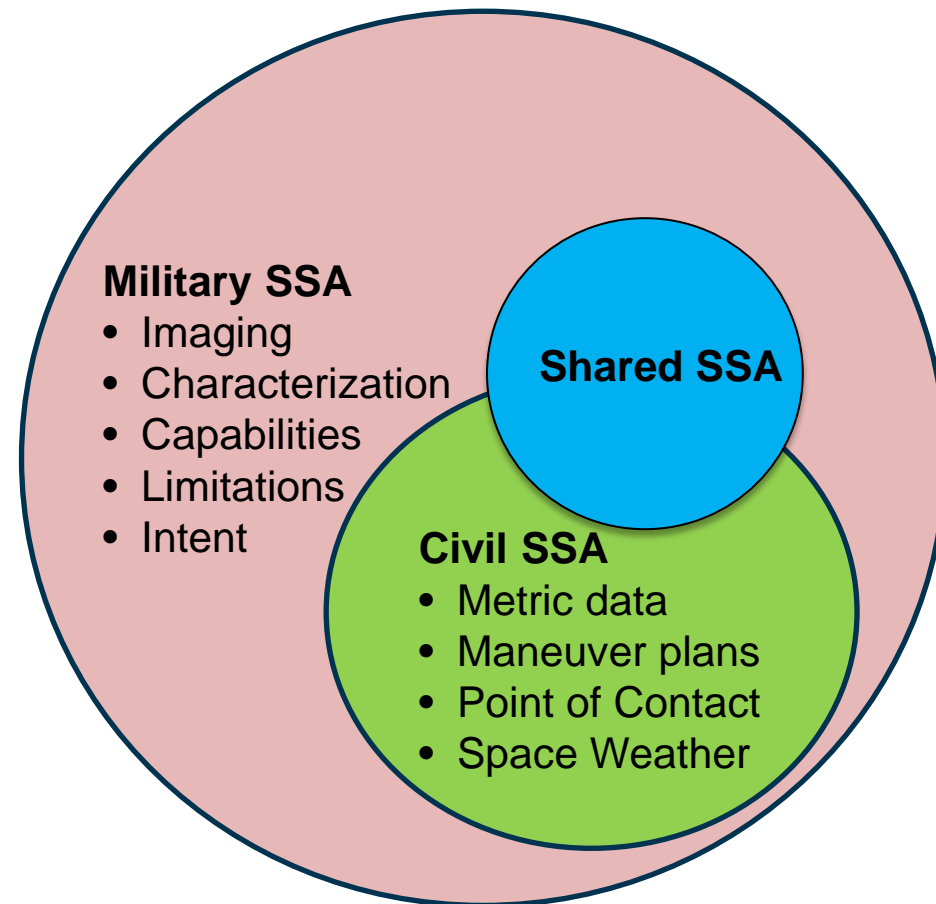


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# WHAT IS SSA AND WHY IS IT IMPORTANT?

- Space situational awareness (SSA) is information about the space environment and activities in space that can be used to:
  - operate safely and efficiently
  - avoid physical and electromagnetic interference
  - detect, characterize and protect against threats
  - understand the evolution of the space environment

- Currently, almost all SSA is done for **military** purposes
- Emerging recognition of the need for **civil** SSA to support safety
- Also need to consider some element of **shared** SSA
  - Sharing between allies
  - Sharing between gov'ts and commercial
  - Sharing publicly





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# RECENT DEVELOPMENTS

# United States – SSA History

- Since the 1960's, the United States military has had significant SSA capability
  - Largely based on the backbone of missile warning radars
  - Original impetus was the need to track Soviet missiles, nuclear warheads, and space-based threats
  - In recent years much more focused on protecting satellites
- Although it still has the best capabilities American SSA has significant shortcomings and is struggling to evolve
  - Radar coverage is almost entirely in the Northern Hemisphere
  - Most sensors are decades-old and expensive to maintain and upgrade
  - Software tools are years out of date

# United States – SSA Responsibilities

- U.S. Strategic Command is currently responsible for SSA activities
  - Runs the Joint Space Operations Center (JSpOC) at Vandenberg AFB in California
  - Air Force Space Command (AFSPC) is responsible for operations and maintenance of many of the SSA sensors & training crews
- JSpOC provides SSA data and services to many other entities
  - Provides data to NASA, ESA and other space agencies to help protect the International Space Station and human spaceflight
  - Provides a collision warning service to all satellite operators
  - Maintains the public satellite catalog at <http://www.space-track.org>



# United States – SSA Policy

- 2010 Obama National Space Policy focused on improving SSA
  - “Develop, maintain, and use space situational awareness information from commercial, civil, and national security sources to detect, identify, and attribute actions in space that are contrary to responsible use and the long-term sustainability of the space environment”
- 2011 National Security Space Strategy gave further guidance and direction to the U.S. military to improve SSA, cooperate with other countries, and share data
- A Combined Space Operations Center (CSpO) that would include allies and key partners is currently being discussed
  - U.S. has signed bilateral SSA agreements with France, Canada, Australia and Japan

# United States – SSA Developments

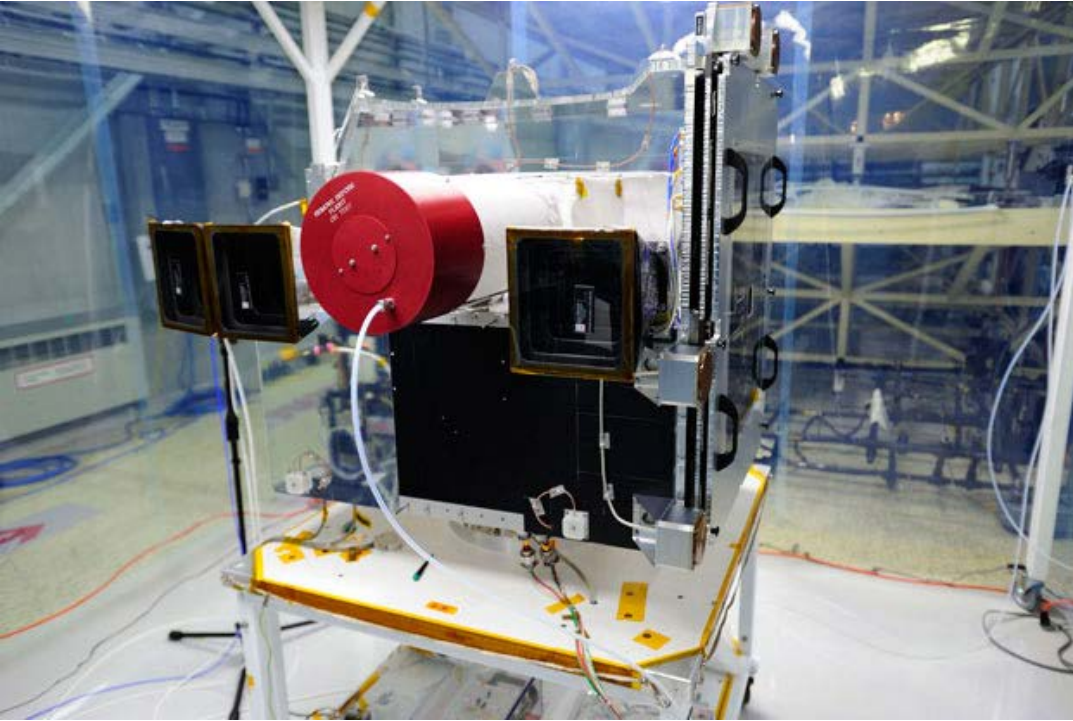
- Space-based Space Surveillance (SBSS) satellite
  - Launched in Sept 2010, deemed operational in August 2012
  - LEO satellite with optical telescope for tracking space objects
- S-Band Space Fence
  - First installation (of a planned two) will be on Kwajalein Atoll
  - Two American companies (Lockheed Martin and Raytheon) have contracts to develop prototypes
  - Initial operations expected in 2017
- JSpOC Mission System (JMS)
  - New computer system (hardware and software) for JSpOC
  - Delayed until at least 2015

- Individual countries (Germany, France, UK, Italy, Switzerland) have an assortment of SSA sensors and capabilities
- In 2008, Europe announced a program to develop a European SSA System
  - 2009-2011: Preparatory phase (data policy, architecture, prototypes)
  - 2012-2019: Operational services
- Preparatory phase was funded but currently a large debate about the operational phase

# Canada – History and Update

- Canada has been a partner in American SSA since the 1960's through the North American Aerospace Defense Command (NORAD)
- Transfer of SSA to USTRATCOM in the 2000's saw a diminished role for Canada due to missile defense politics that is only now beginning to change
- Canada set to launch Sapphire satellite to track space debris (first Canadian military satellite)

# Canadian Sapphire Satellite



Expected Launch: Dec 12, 2012

Orbit: 300 km

Cost: \$66 million

Mission: track objects between 6,000 and 40,00 km

- Australia has long been a partner of the U.S. in tracking space objects, including many human spaceflight missions
- Primary advantage is geographical location (Southern Hemisphere)
- Australia is preparing to release a National Space Policy that mentions space sustainability and international cooperation
- Recently signed SSA bilateral agreement with U.S., discussions of placing SSA sensors in Australia
  - Moving an unused C-Band radar from Antigua to Australia
  - Location for one of the S-Band Space Fence sites

- Non-profit entity formed in 2009 by several major satellite operators
  - Intelsat, Inmarsat, and SES
- Operates the Space Data Center (SDC) which collates information on active satellites provided by participants and provides services
  - Collision warnings
  - Collision avoidance maneuver planning
  - Radiofrequency interference and geolocation
- Providing services for 237 satellites from 15 GEO operators and 110 satellites from 7 LEO operators



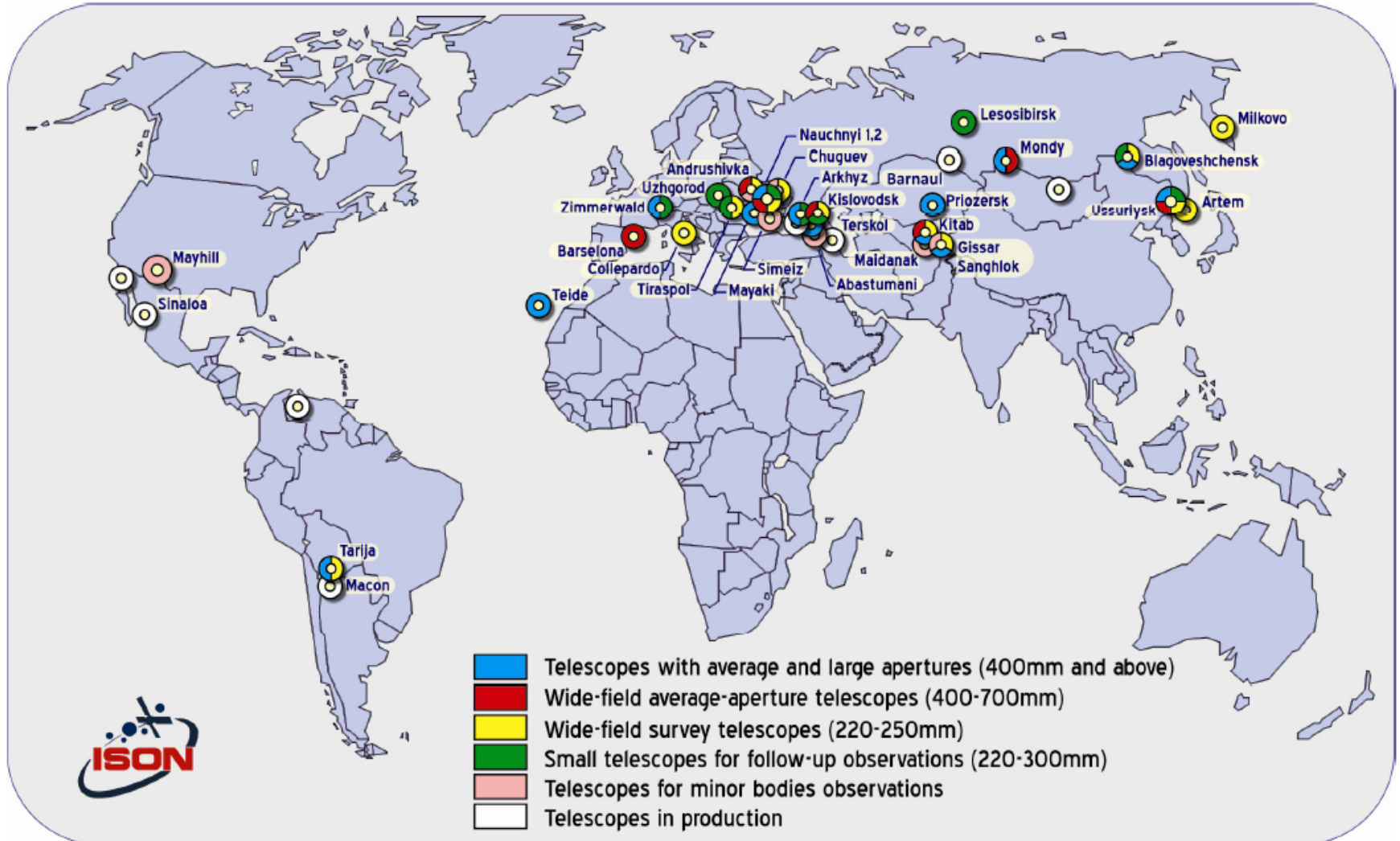
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# International Scientific Optical Network

- 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
- 42 telescopes, 27 observatories 12 countries
- Maintains catalog of over 1,700 deep space objects
- Data is nearly as good as the USG SP Catalog
- Data is freely available, working on website for distribution



# ISON Current Status





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# REMAINING CHALLENGES

# Unaddressed issues in SSA

- Change the culture of SSA from purely military/national security to include civil safety of spaceflight
- Increase sharing of SSA data between all space actors to improve safety while still protecting the data needed for national security
- Make use of the dozens (hundreds?) of potential SSA sensors in many countries around the world
- Evolve standards of responsible satellite operations based on best practices
  - Slow road towards “Space Traffic Management”?



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# Thank you!

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