



*Promoting Cooperative Solutions for Space Sustainability*

# **The Global Space Situational Awareness Sensors Project**

Brian Weeden

Technical Advisor, Secure World Foundation

©2011 Secure World Foundation. Used with Permission



*Promoting Cooperative Solutions for Space Sustainability*

# SPACE SITUATIONAL AWARENESS

## ***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”

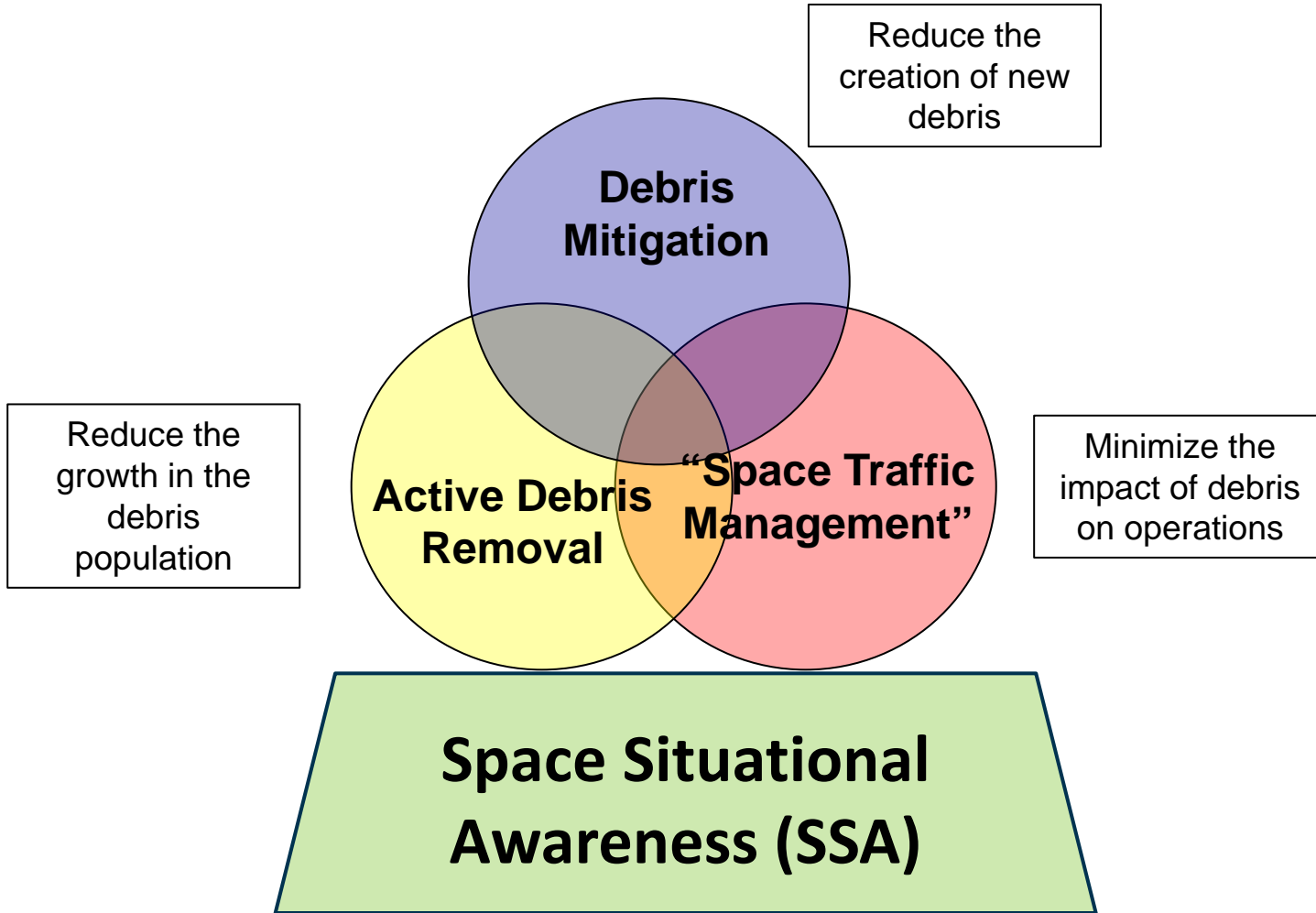
## ...and its impact on SSA

- 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

# Space Sustainability





*Promoting Cooperative Solutions for Space Sustainability*

# THE GLOBAL SSA SENSORS PROJECT





Promoting Cooperative Solutions for Space Sustainability

# The Global SSA Sensors Project

- Objective: To develop a database of global SSA sensors and networks
  - Based on open source information
  - Publicly accessible
  - Crowdsourced
- Rationale
  - Increase awareness of global SSA capabilities and highlight opportunities and deficiencies
  - Enable analysis of future shared/collaborative/cooperative architectures
  - Leverage the “wisdom of the crowd” in compiling the data set



# Global SSA Sensors Website

- Initial set of data on sensors around the world published
  - Vallado, David and Griesbach, Jake “Simulating Space Surveillance Networks”, AAS 11-580, 2011 AAS/AIAA Astrodynamics Specialists Conference, Girdwood, Alaska
- Developing a website to hold the database
  - Mash-up of a wiki and Google Earth
  - Still in beta
  - Hope to roll-out in early 2012
- Will be recruiting a global community of users to help update the website

SEARCH FOR SSA SENSORS

6 SENSORS FOUND [SWITCH TO GOOGLE EARTH VIEW](#) | [ADD ENTRY](#)

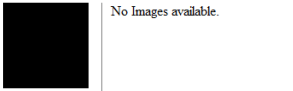


SENSOR(S) DETAILS [CLICK ON A SENSOR FROM THE MAP ABOVE TO VIEW ITS DETAILS](#)

[Ground Optical Sensor](#) | [Discussion](#) | [Edit](#) | [History](#)

**Eglin Sensor test 2 - no model**

Cras aliquet, enim vitae lobortis ullamcorper, lectus nunc sagittis dolor, a rutrum dui ipsum ut risus. Proin convallis elit quis arcu euismod quis mollis ipsum semper. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Nulla vel neque sed odio laoreet posuere ut eu urna. Vestibulum dignissim lorem non mauris aliquet fermentum. Suspendisse rutrum, lacus sit amet hendrerit commodo, nisi diam scelerisque magna, non commodo sapien metus vel leo. Aliquam lacinia lorem in dui egestas vel pretium dui vulputate. Donec viverra felis vel est volutpat vulputate. In pharetra, sem tempor molestie ultrices, lectus massa porta leo, ac aliquam orci libero vel dolor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Sed dui massa, blandit a consequat eget, viverra at felis. Sed dignissim nisl lorem.



Sensor Name	Eglin Sensor test 2 - no model
Country	Albania
Location	Albania
Telescope Type	

SEARCH FOR SSA SENSORS

6 SENSORS FOUND [SWITCH TO GOOGLE MAPS VIEW](#) | [ADD ENTRY](#)



SENSOR(S) DETAILS [CLICK ON A SENSOR FROM THE MAP ABOVE TO VIEW ITS DETAILS](#)

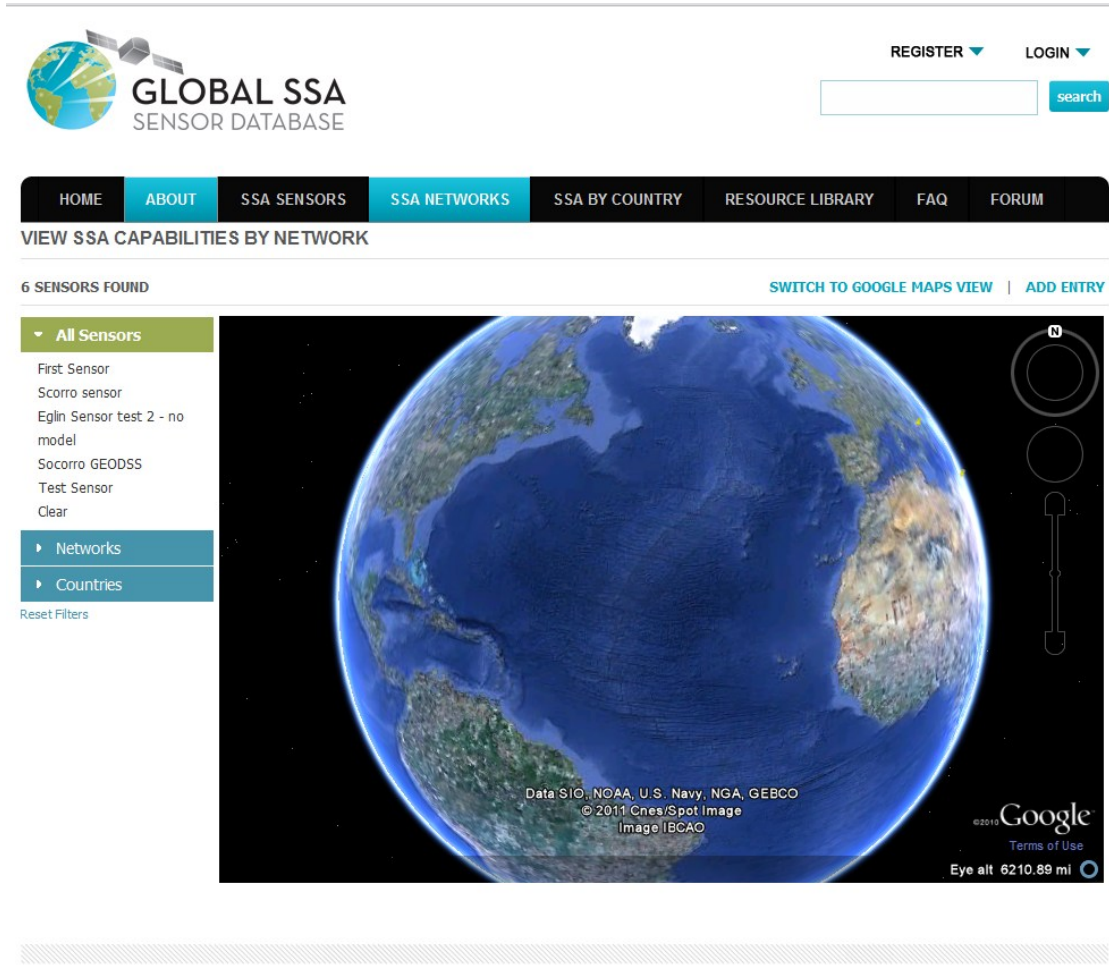
[Ground Optical Sensor](#) | [Discussion](#) | [Edit](#) | [History](#)

**Eglin Sensor test 2 - no model**

Cras aliquet, enim vitae lobortis ullamcorper, lectus nunc sagittis dolor, a rutrum dui ipsum ut risus. Proin convallis elit quis arcu euismod quis mollis ipsum semper. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Nulla vel neque sed odio laoreet posuere ut eu urna. Vestibulum dignissim lorem non mauris aliquet fermentum. Suspendisse rutrum, lacus sit amet hendrerit commodo, nisi diam scelerisque magna, non commodo sapien metus vel leo. Aliquam lacinia lorem in dui egestas vel pretium dui vulputate. Donec viverra felis vel est volutpat vulputate. In pharetra, sem tempor molestie ultrices, lectus massa porta leo, ac aliquam orci libero vel dolor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Sed dui massa, blandit a consequat eget, viverra at felis. Sed dignissim nisl lorem.



Sensor Name	Eglin Sensor test 2 - no model
Country	Albania
Location	Albania
Telescope Type	



The screenshot shows the Global SSA Sensor Database website. At the top left is the logo for the Secure World Foundation, featuring a satellite and the text "SECURE WORLD FOUNDATION". Below the logo is the tagline "Promoting Cooperative Solutions for Space Sustainability". The main header area includes the "GLOBAL SSA SENSOR DATABASE" logo, a search bar with a "search" button, and links for "REGISTER" and "LOGIN". A navigation menu contains the following items: HOME, ABOUT, SSA SENSORS, SSA NETWORKS (highlighted), SSA BY COUNTRY, RESOURCE LIBRARY, FAQ, and FORUM. Below the navigation menu is the heading "VIEW SSA CAPABILITIES BY NETWORK". A sub-heading indicates "6 SENSORS FOUND" and provides links for "SWITCH TO GOOGLE MAPS VIEW" and "ADD ENTRY". On the left side, there is a filter menu with a dropdown for "All Sensors" (expanded) listing: First Sensor, Scorro sensor, Eglin Sensor test 2 - no model, Socorro GEODSS, Test Sensor, and Clear. Below this are expandable sections for "Networks" and "Countries", and a "Reset Filters" link. The main content area is a satellite map of the Earth from Google Maps, showing the Atlantic Ocean and parts of North and South America. The map includes a compass, zoom controls, and copyright information: "Data SIO, NOAA, U.S. Navy, NGA, GEBCO © 2011 Cnes/Spot Image Image IBCAO". The Google logo and "Eye alt 6210.89 mi" are visible in the bottom right corner of the map.



*Promoting Cooperative Solutions for Space Sustainability*

# CONCLUSIONS & FUTURE WORK

- 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

- There is a global deficit in knowledge about what sensors/networks are available and their capabilities
- There is a lack of technical/political capability to combine or share data between sensors/networks
- There are significant hurdles to overcome with data sharing, but none appear to be insurmountable
- Global SSA Sensor Website/Database is seen as first step to increasing knowledge and awareness



*Promoting Cooperative Solutions for Space Sustainability*

# Questions?

[bweeden@swfound.org](mailto:bweeden@swfound.org)

©2011 Secure World Foundation. Used with Permission