International Space Safety Efforts on Debris Mitigation and SSA

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Secure World Foundation
• Private, non-profit foundation founded in 2007

• HQ just outside of Denver, offices in DC and Vienna (Austria)

• Dedicated to the **secure and sustainable use of space for the benefit of all humanity**

• *Inform, facilitate, advocate*

• Strong role in both the international and domestic policy communities, linking technical and policy/legal initiatives
Overview

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- International space forums, treaties, and “progress”

- The IADC Debris Mitigation Guidelines as a workaround

- The Rise of Space Security

- Current international initiatives

- Space situational awareness around the world

- Future initiatives and Civil SSA
INTERNATIONAL SPACE

“Beware, there be monsters here...”
United Nations has two major forums where space issues are discussed:

- **Committee on the Peaceful Uses of Outer Space (COPUOS)**
  - Formed in 1959 and Located in Vienna, Austria
  - Has 69 member States and 27 permanent observers (consensus body)
  - Deals with civil space and peaceful uses

- **Conference on Disarmament (CD)**
  - Formed in 1979 Located in Geneva, Switzerland
  - Has 67 member States
  - “One-stop-shop” for multilateral disarmament and arms control negotiations
  - Deals with military space

- Space issues are also occasionally discussed at the Committees, Security Council and General Assembly in NYC
• Five major treaties form the basis of international space law
  – Outer Space Treaty (1967)
  – Rescue and Return of Astronauts (1968)
  – Liability Convention (1972)
  – Registration Convention (1975)
  – Moon Treaty (1979)

• *None explicitly deal with space debris* but a few touch on it and lay out general principles

• Since 1980 there has been *deadlock* in these forums on new legally binding agreements
  – Mainly due to US policy and strategic importance of space for several nations
Many realized that debris was an issue and needed a way to get around this

The Interagency Debris Coordination Committee (IADC) was formed in the mid-1990’s

- Made up of representatives from the space agencies of the major space powers
- Sidestepped the lawyers and diplomats and worked from a **technical standpoint** and not a legal or diplomatic one

Produced the IADC Debris Mitigation Guidelines in 2007

- Set of **voluntary guidelines** for minimizing the creation of debris through activities in space
- Focuses on launch, on-orbit, and re-entry phases
- Can be found at [http://www.iadc-online.org](http://www.iadc-online.org)
Ignoring the lawyers (for the time being)

• The IADC Guidelines were injected back into UN COPOUS through the Scientific and Technical Subcommittee (STSC)
  – Developed UN COPOUS version of guidelines in 2008
  – Guidelines were then endorsed by a full General Assembly Resolution
  – Completely bypassed the Legal Subcommittee

• Since the guidelines are voluntary, it is up to each State to implement through national mechanisms

• US, China, Russia, France, Canada, Germany, Japan, and several others have either implemented or are implanting debris mitigation regulations (with varying degrees of effectiveness)
THE RISE OF SPACE SECURITY
What is space security?

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• Many definitions
  – US: need to protect our space assets because they are essential to *national and economic security*
  – Europe: space is essential for *providing human security* for our citizens
  – Asian: a little from column A, a little from column B, some don’t know
  (see the work done by GWU’s Space Policy Institute for details: [http://www.gwu.edu/~spi](http://www.gwu.edu/~spi))

• Secure World’s definition
  – Guaranteeing the *long-term sustainability* of space
  – Freedom of access to space for *socioeconomic benefit* for all of humanity
  – Peaceful use of space for *human and environmental security* on Earth
Space sustainability
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Debris Mitigation
- Minimize creation of new debris

Debris Removal
- Stabilize existing population

Space Traffic Management
- Minimize impact of debris on ops

Space Situational Awareness (SSA)

Current Initiatives

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• COPOUS adopts new agenda item for “Long Term Sustainability of outer space activities

• CD agreed on work plan for the first time in 12 years
  – Nuclear weapons, fissile material, arms race in outer space, security guarantees to non-nuclear States

• Progress on “Code of Conduct” proposed by Europe
  – Voluntary code that would establish what is responsible and irresponsible behavior

• A great deal of discussion and interest in SSA
SPACE SITUATIONAL AWARENESS

“Do you see what I see?”
• SSA has been mainly associated with military use of space in the past

• More States are recognizing the strategic need for SSA to protect national security assets in space from natural and unnatural harm

• But there is an emerging consensus that some degree of SSA is also important for civil use of space
  – Many more States have civil and commercial space assets than military ones
  – Space is becoming an essential part of the global economy
  – Increasing interest in human spaceflight (tourism?)

• Precedent in other services like GPS, remote sensing, weather
The problem with space sustainability

- 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*?
• 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 parts: *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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Chinese SSA capabilities

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International Scientific Optical Network (ISON)

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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?

- No Southern Hemisphere coverage
- No coverage over South America, Africa, Asia
- 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 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 (see my SeeSat report around about that date) 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 its still drifting”

- Message posted to See-sat list on 15 Nov 2008
Other major international space safety topics

- ISO space safety standards (data interoperability, design and engineering)
- Re-entry warning and COLA with air traffic
- Code of Conduct of responsible ways to operate on-orbit
- Active debris removal
• International Association for the Advancement of Space Safety
  – Holds a major space safety conference about every 18 months
  – 3rd Conference was in Rome in Oct 2008

• Designing safety into space vehicles
• Safety on long duration manned missions
• Safety of extravehicular activities
• Launch range safety (current and future)
• Spacecraft re-entry safety
• Payload safety
• Nuclear safety for space systems
• Human factors and performance for safety
• Safety critical software design and IVV

• Safety risk management
• Probabilistic risk assessment
• Organizational culture and safety
• Regulations and standards for safety
• Space-based safety critical systems
• Space traffic control and management
• Space materials safety
• Lessons learned from space accidents
Fourth IAASS Conference
International Association for the Advancement of Space-Safety

Making Safety Matter

Huntsville (AL) - USA
19-21 May 2010
Questions?

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