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宇宙利用の長期持続性と宇宙空間平和利用委員会の役割

Long Term Sustainability of Outer Space and Role of UNCOPUOS

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Yasushi Horikawa (Chair of UNCOPUOS)

Space science and technology and their applications, such as satellite communications, Earth observation systems and satellite navigation technologies, provide indispensable tools for achieving viable long-term solutions for sustainable development and can contribute more effectively to efforts to promote the development of all countries and regions of the world, to improving people's lives.
In recent years, the utilization of space has seen an increasing number of States, non-governmental organizations, private sector entities and even universities expanding their presence.
In an era where we are seeing space becoming increasingly crowded with new players, the need to show strong commitment to sharing responsibilities and acting responsibly in space to help prevent mishaps, misperceptions and mistrust has never been greater.
The proliferation of space debris and the increased possibility of a collision interfering with or causing damage to space objects raises concerns about long term sustainability of space activities, particularly the low-Earth orbit and geostationary orbit environment.
With regard to the long term sustainability of outer space, the role of UNCOPUOS and the current status of discussions among the related states will be presented.

Biography - - - - -

Yasushi HORIKAWA (Japan)

He is a technical counselor of Japan Aerospace Exploration Agency (JAXA), Tokyo Japan. He graduated at Tokyo University and he received PhD from Tokyo University on Electrical Engineering. He worked in the field of spacecraft design. He contributed to the implementation of Japanese meteorological satellite programs and the Earth observation programs. He also contributed to the achievement of the Japanese space station program as the Program Manager. After that, he was responsible for the application satellite programs as an executive director of JAXA, including Earth observations, communications and broadcasting, and global positioning satellites and those operation and utilization as well. At the present time, he is advising to the activities of the Japanese application satellite development and utilization programs in JAXA. He is a president of Japan society of cost estimate and analysis since 2011. He is a professor of Tokai University and he is a chairman of UN COPUOS for 2012-2013.
He is a member of IEICE, JAAS, AIAA, IAA, JRS, JSCEA and SCEA.

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Operational Satellite in Space

Categories:

- Communication
- Broadcasting
- Weather Forecast
- Earth Observation
- Positioning, Navigation and Timing
- Engineering Experiment
- Science
- Exploration
- Manned
- Security
- Military

Orbit	Operational Satellites
LEO	~ 450
MEO	~ 55
GEO	~ 400

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“ Space is helping us to address some of today’s most urgent problems. Space technology has produced tools that are transforming weather forecasting, environmental protection, humanitarian assistance, education, medicine, agriculture and a wide range of other activities.”

Former United Nations Secretary-General Kofi Annan, on the occasion of the World Space Week, 2001

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Launch Activity 1957 - 2012

A total of 80 space launches reached Earth orbit or beyond during 2011, the most since the year 2000.

Nicholas Johnson, NASA

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Coordination Mechanisms for the Use of Outer Space

CEOS-GEOSS----------Earth Observation
UN-ICG----------Global Positioning
WMO: CGMS----------Meteorological
Space Station Partners------Space Station
Science Community----------Science
Amateur Community---------Amateur
ITU Frequency allocation----Most Satellites with Exception

No Coordination Mechanisms
- Small Satellites
- Commercially procured
- Security
- Military

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Objectives of the COPUOS

UNCOPUOS to facilitate;

- the activities and resources of the United Nations, the specialized agencies and other international bodies relating to the peaceful uses of outer space;
- international cooperation and programmes in the field that could appropriately be undertaken under United Nations auspices;
- organizational arrangements to facilitate international cooperation in the field within the framework of the United Nations; and
- legal problems which might arise in programmes to explore outer space.

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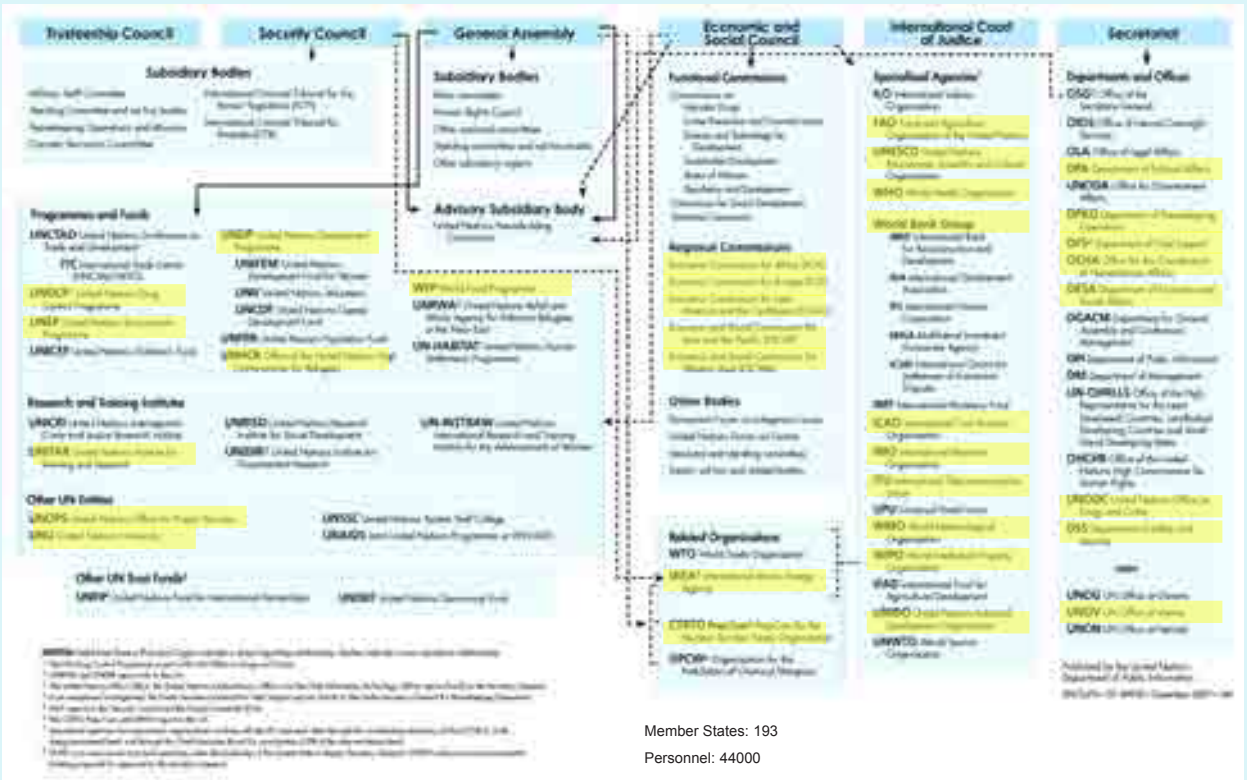
Space and the United Nations System



Member States: 193

Personnel: 44000

UN and Outer Space: Early Years

- 1959: UN General Assembly resolution 1472 (XIV) reaffirmed the role of COPUOS and mandated the Committee to:
  - Review international co-operation
  - Study space-related activities that could be undertaken under United Nations auspices
  - Encourage and assist with national space research programmes
  - Study legal problems which may arise from the exploration of outer space;

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Committee on the Peaceful Uses of Outer Space

- 1961: Establishment of two Subcommittees
  - Scientific and Technical Subcommittee (STSC)
  - Legal Subcommittee (LSC)
- Membership to date:74 member States and 32 organizations with permanent observer status
- Reports to the Fourth Committee of the General Assembly
- Adopts an annual resolution on “International Cooperation in the Peaceful Uses of Outer Space”

United Nations Office for Outer Space Affairs

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United Nations Committee on the Peaceful Uses of Outer Space

74 Participating Member States for COPUOS

Albania, Algeria, Argentina, Australia, Austria, Azerbaijan, Belgium, Benin, Bolivia, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Chad, Chile, China, Colombia, Cuba, Czech Republic, Ecuador, Egypt, France, Hungary, Germany, Greece, India, Indonesia, Iran, Iraq, Italy, Japan, Kazakhstan, Kenya, Lebanon, Libya, Malaysia, Mexico, Mongolia, Morocco, Netherlands, Nicaragua, Niger, Nigeria, Pakistan, Peru, Philippines, Poland, Portugal, Republic of Korea, Romania, the Russian Federation, Saudi Arabia, Senegal, Sierra Leone, Slovakia, South Africa, Spain, Sudan, Sweden, Switzerland, Syrian Arab Republic, Thailand, Tunisia, Turkey, the United Kingdom of Great Britain and Northern Ireland, the United States of America, Ukraine, Uruguay, Venezuela & Viet Nam, Costa rica, Jordan, Armenia

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Space Treaty, Principle and Guideline

Outer Space Treaty	
1967	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies
1968	Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space
1972	Convention on International Liability for Damage Caused by Space Objects
1976	Convention on Registration of Objects Launched into Outer Space
1984	Agreement Governing the Activities of States on the Moon and Other Celestial Bodies
Principle and Guideline	
1963	Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space
1982	Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting
1986	Principles Relating to Remote Sensing of the Earth from Outer Space
1992	Principles Relevant to the Use of Nuclear Power Sources in Outer Space
1996	Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries
2004	Application of the concept of the “launching State”
2007	Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects
2007	Space debris mitigation guidelines of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space
Framework	
2009	Safety Framework for Nuclear Power Source Application in Outer Space

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Highlights and main results of COPUOS and its two Subcommittees

Recent achievements:

- Establishment of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), (2006)
- Establishment of the International Committee on Global Navigation Satellite Systems (ICG) (2006)
- Space Debris Mitigation Guidelines (2007)
- GA Resolution on enhancing the practice of States and international intergovernmental organizations in registering space objects (2007)
- Safety Framework for the Use of Nuclear Power Sources in Outer Space (2009)

Current issues - Space Agenda Today:

- Space applications for developing nations
- Space debris
- Long-term sustainability of space activities
- Near-Earth objects
- Space and climate change
- National space legislation
- Definition and delimitation of outer space
- Use of Geospatial Data for Sustainable Development

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SPACE AGENDA TODAY

- GREENING SPACE:
Mitigating Space Debris

▸Space debris includes defunct satellites, discarded sections of rockets and parts of satellites that have exploded. Most numerous of all are tiny particles such as paint chips and liquid droplets.

▸ Space debris orbits the Earth at incredibly high speeds, normally several kilometres per second, making even small particles a hazard to active satellites and space missions.

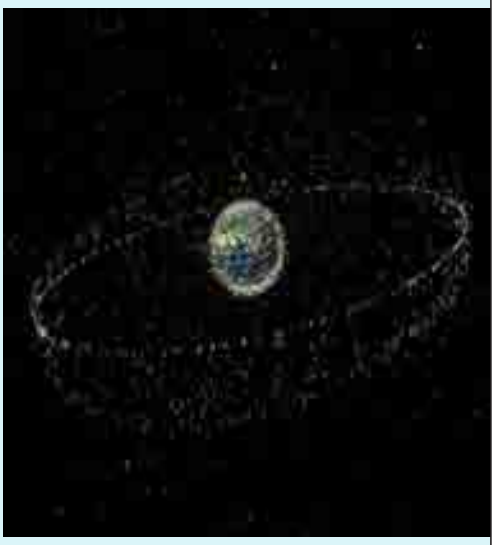

Image: Artist's impression ©ESA

▸In 2007, COPUOS achieved a major result by adopting its own **Space Debris Mitigation Guidelines.** There is general agreement among States that the implementation of these voluntary guidelines for the mitigation of space debris at the national level would increase mutual understanding on acceptable activities in space, thus enhancing stability in space and decreasing the likelihood of friction and conflict.

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SPACE AGENDA TODAY

- THREATS FROM ASTEROIDS:
Near-Earth Objects

▸Near-Earth objects (NEOs) are asteroids, comets and large meteoroids whose orbit intersects the Earth's orbit and may therefore pose a danger of collision.

▸ NEOs with a diameter of over 1 km hit the Earth a few times in a million years.

▸COPUOS works on establishing international procedures and decision-making mechanisms for dealing with a potential NEO threat.

Photo: Japan's Hayabusa space probe travelled to the Itokawa asteroid and in 2010 returned the first samples of an asteroid to Earth. Photo ©JAXA

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SPACE AGENDA TODAY

Long-term sustainability of outer space activities:
SUSTAINABLE SPACE = SUSTAINABLE DEVELOPMENT ON EARTH

- **Sustainable development on Earth is not possible without sustainable space.**

- **Space applications such as earth observation, communications, navigation, timing and positioning provide strong support for the implementation of the actions called for in the United Nations development agenda.**

- **COPUOS works on issues such as:**

“Space and sustainable development”

-the use of space technology and its applications climate change, food security, monitoring of natural resources, agriculture….

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United Nations Register of Objects Launched into Outer Space

- **Established in 1962, the Register is the central repository of official information provided by States on space objects in accordance with the Registration Convention and on a voluntary basis.**
- **The Register contains information received from the Member States and also complementary information collected from external sources on all functional objects launched into outer space since 1957.**
- **Space debris and non-functional objects are not included.**
- **Search could be performed using different parameters (name, international designator, launching State, date of launch, orbital status, etc.)**
- **The links between space objects and their relevant registration documents are provided. This way, every user can download and print any registration document.**
- **All information contained in the Register is publicly available via the UNOOSA website:**

www.unoosa.org

- **Since 1957, about 38.300 space objects have been tracked in Earth orbit or beyond. Approximately 6.400 are “functional” (i.e. satellites, probes, manned spacecraft and/or space station components). The rest are spent rocket boosters, shrouds and detached components or other residual nonfunctional components resulting from the launch, operation or termination of the space object, collectively known as “non-functional”)**

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Domestic legislation

- National legislation domesticates international treaty obligations
- National register of space objects
- Licensing and other regulatory practices allows States to implement non-binding international norms into national practices
- Non-binding does not mean non-legal

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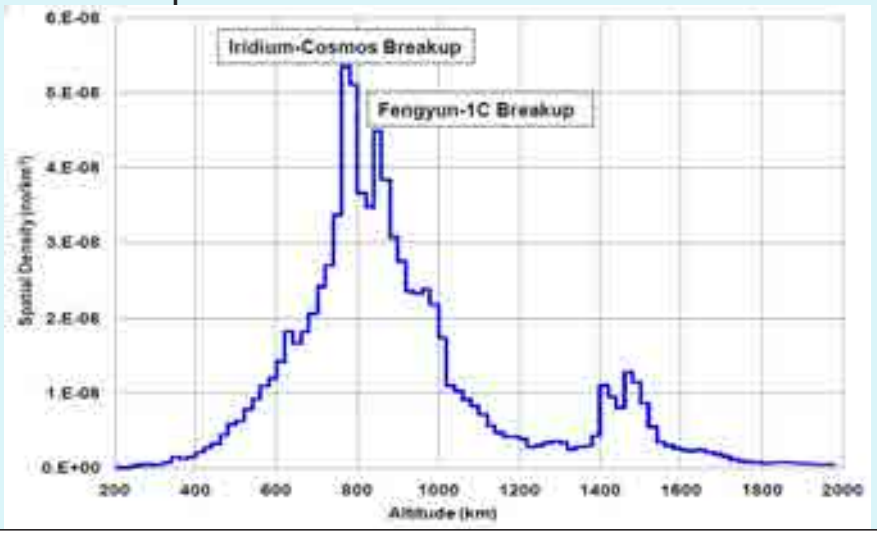
The concern

- The growing population of space objects in orbit may in time make activities in regions of near-Earth space hazardous and extremely expensive
- U.S. now tracks about 17,000 objects in Earth orbit
  - ~ 1,000 working satellites
  - ~ 21,000 debris pieces > 10 cm



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But that's not all…

consistentlyでなければトラックできている？

- Objects smaller than 10 cm are not consistently trackable
  - There may be as many as 500,000 objects of 1-10 cm size
  - Perhaps as many as 10s to 100s of millions < 1 cm
- No active collision avoidance is possible for such objects
- These objects can cripple or destroy spacecraft and endanger astronauts
- Total mass ~ 6300 tons

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Sources of debris

- Defunct spacecraft
- Mission debris
- Rocket bodies
- Fragmentation debris
  - Explosions
  - Degradation
- Collisions
- Deliberate debris creation
  - ASAT tests

Images: ESA

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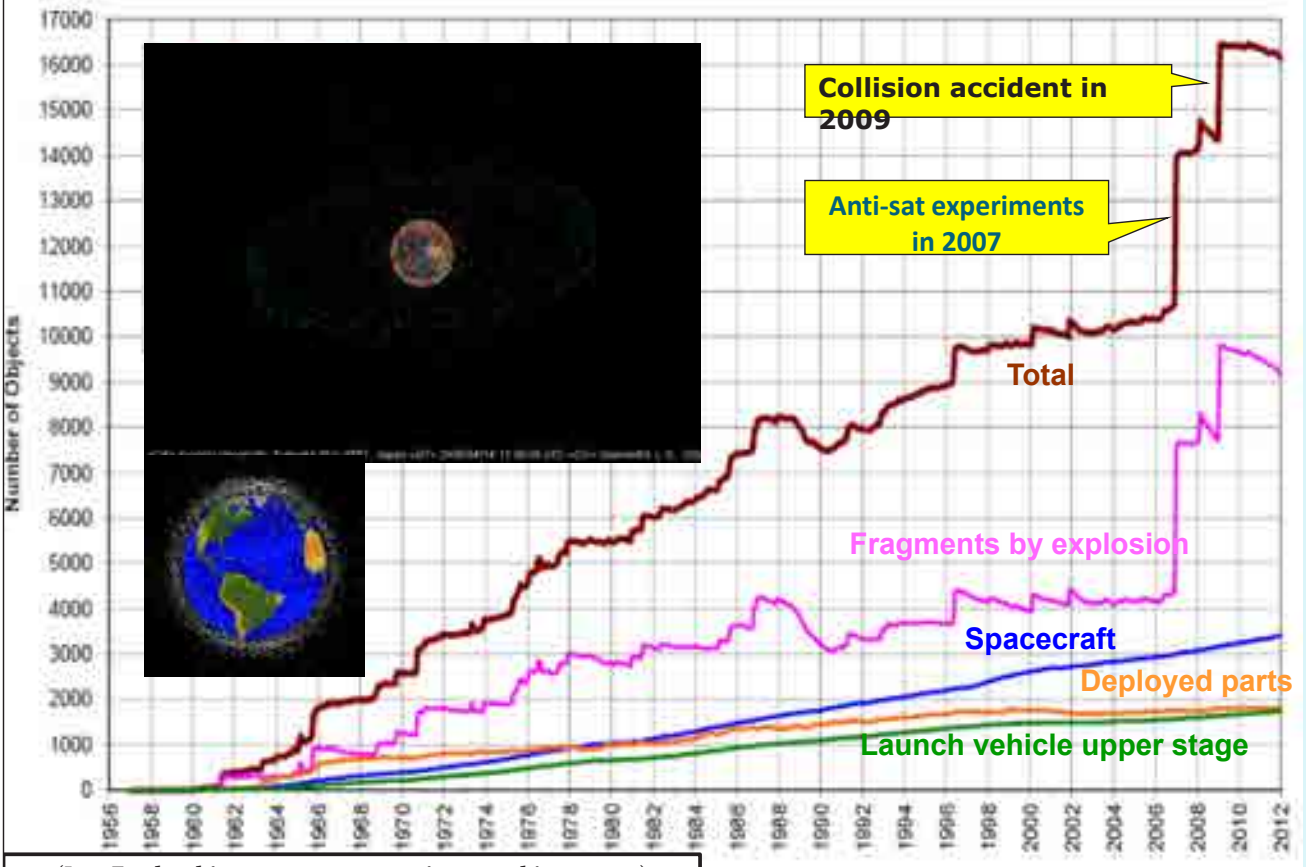
Number of Objects in Earth Orbit by Object Type



(Low Earth orbit: over 10cm, geostationary orbit: over 1m)

Catalog data of Space Surveillance Network, NASA

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Working Group on Long-term Sustainability of Outer Space

Objectives of the Working Group

- To identify and examine a wide range of issues and concerns to the long-term sustainability of space activities
- To prepare a consolidated set of practices and operating procedures and guidelines.

a. sustainable space utilization;
b. space debris mitigation;
c. safe space operations and collision avoidance;
d. space situational awareness;
e. impact of space weather phenomena on operational space systems;
f. national regulatory frameworks, including guidance for actors in the space arena and technical standards,
g. technical and legal capacity-building

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Clustering

A. Expert group on sustainable space utilization supporting sustainable development on Earth
Co-Chairs: Filipe Duarte Santos (Portugal) and Mr. Enrique Pacheco Cabrera (Mexico)

B. Expert group on space debris, space operations and tools to support collaborative space situational awareness
Co-chairs: Claudio Portelli (Italy) and Dick Buenneke (USA)

C. Expert group on space weather
Co-Chair: Takahiro Obara (Japan) and Mr. Ian Mann (Canada)

D. Expert group on regulatory regimes and guidance for actors in the space arena
Co-Chair: Sergio Marchisio (Italy) and Anthony Wicht (Australia)

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Space Situational Awareness (SSA)

- Aims towards a full knowledge of the dynamic near-Earth space environment
- Three main pillars of SSA
  - Space weather
  - Space debris
  - NEOs
- Makes use of a variety of optical and radar techniques
- Requires coordinated, multisite networks of sensors
  - On Earth (& in space)

http://globalssasensors.org/

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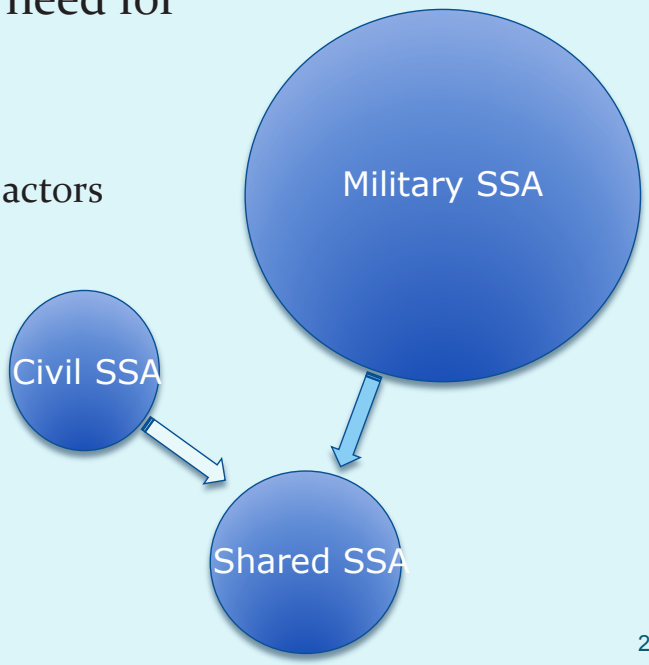
SSA – Broadening the SSA base

- Currently, almost all SSA is done for ***military purposes***
- Emerging recognition of the need for
  - Civil SSA to support safety
  - Sharing of SSA between
    - Government and commercial actors
    - With other governments
    - With the public



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UN GGE on TCBMs

- UN Group of Govt Experts on Transparency and Confidence Building Measures (TCBMs) for Outer Space Activities
- UN General Assembly Resolution A/Res/65/68 of 2010
- 15 Experts selected for geographical balance & knowledge
- The GGE is to conduct a study on outer space transparency and confidence-building measure
  - making use of relevant reports of the UN Secretary-General
  - without prejudice to the substantive discussions on the prevention of an arms race in outer space within the framework of the CD
  - and to submit to the General Assembly at its sixty-eighth session (in 2013) a report with an annex containing the study of governmental experts
- TCBMS are meant to be voluntary and not legally binding

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Code of Conduct

- **Proposed by EU**
- **Principles**
  - **freedom for all to use outer space for peaceful purposes**
  - **preservation of the security and integrity of space objects in orbit**
  - **due consideration for the legitimate security and defence interests of States**
- **All-encompassing in scope**
- **Focuses on establishing norms of behaviour and proscribing irresponsible behaviours**
- **Not legally-binding, a political commitment**

EU lacks a multilateral mandate. Process needs to be “multilateralised”

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Conference on Disarmament (CD)

- Some States believe that conflict in outer space would have such terrible consequences that they would like to ban the use of weapons in space through a legally binding treaty
  - However, there are definitional problems
- CD has discussed Prevention of an Arms Race in Outer Space (PAROS) for a number of years
- However, CD is deadlocked because States cannot agree on its agenda, so there has been no progress on PAROS
- In 2008 China and Russia introduced draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (PPWT)
- PPWT has support of many States, but not all, because of definitional issued and verification concerns of the PPWT

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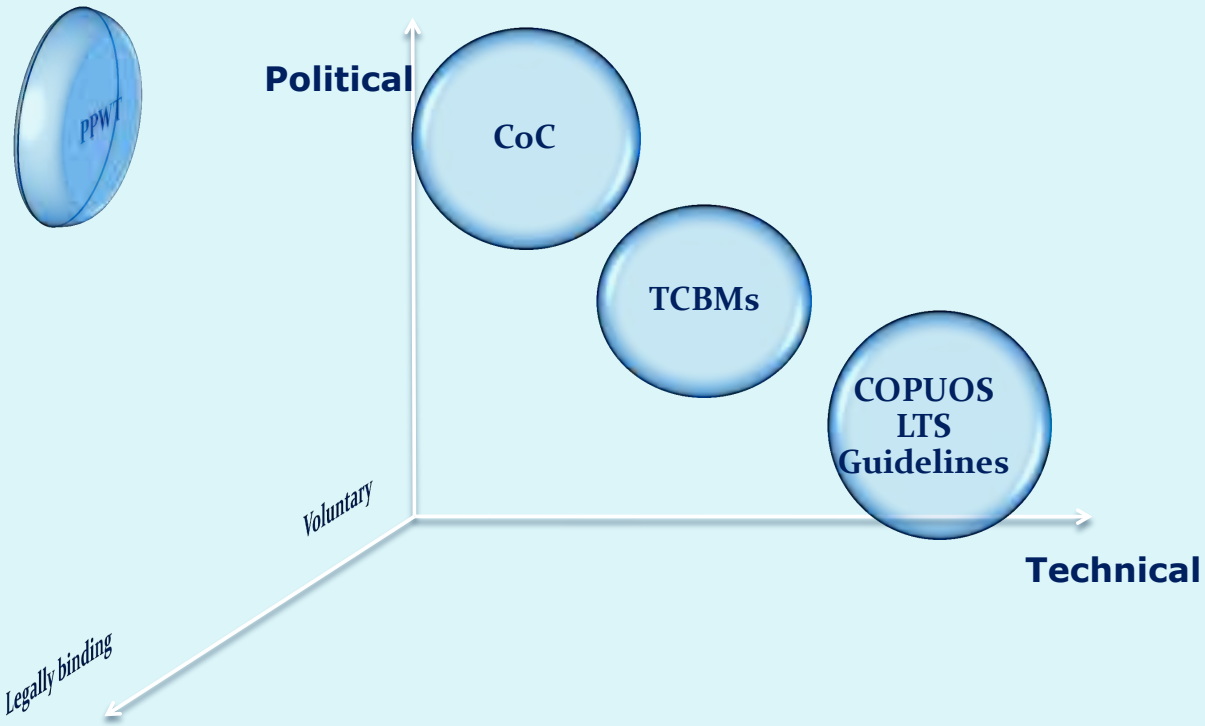
How do these initiatives relate to each other?



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Concluding Remarks

- To succeed world-class mission:

  Firm advanced mission requirements, high reliability and assured quality, operational life, and low life cycle cost

- Advancement of technical capability:

  Well structured development process, standardization, incorporation of lessons learned, and thorough review

- Advanced launch notification and information exchange of the space objects for sustainable use of outer space

- Coordination for international cooperation and capacity building for the long term sustainability of outer space

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Thank you for your attention!

Visit to UNOOSA Website :

http://www.oosa.unvienna.org/oosa/COPUOS/copuos.html

"Bringing the benefits of space to humankind"

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