Japanese Space Industry's Efforts regarding Long-term Sustainability of Space Activities

14 Feb 2013

The Society of Japanese Aerospace Companies
(SJAC)

SJAC（The Society of Japanese Aerospace Companies）

＊ SJAC

・Sole Organization representing Japanese Aerospace Industry
（established in 1952）

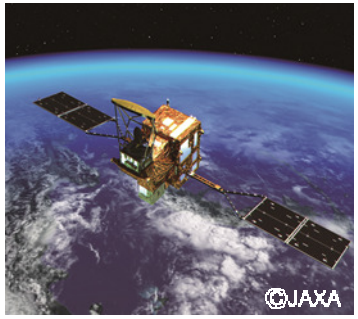
＊ Mission

・Promote aerospace industrial policies
・Build-up aerospace industrial foundation
・Survey aerospace industrial statistics
・Host international aerospace exhibition

＊ Members

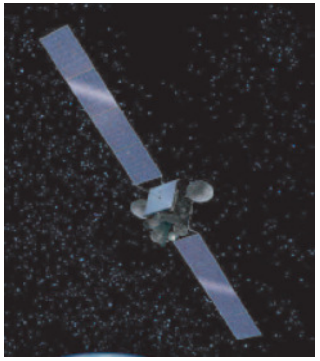
・Regular members: 100 companies
・Associated members: 50 companies

Japanese Space Industry

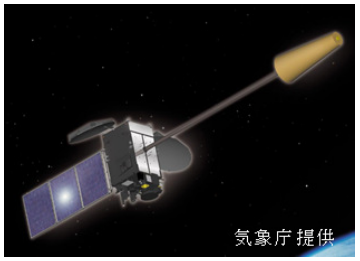


earth observation

space science &
planetary exploration

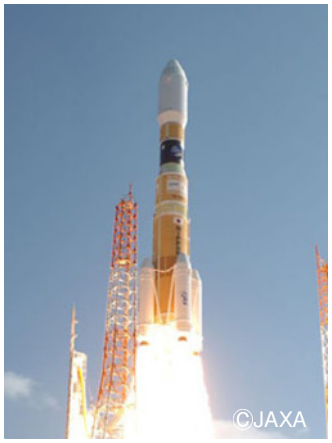


communications

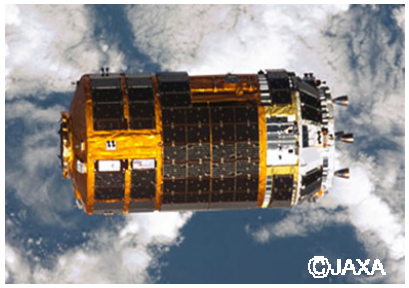


meteorological

navigation



launch vehicle



H-2 Transfer Vehicle
(HTV)

International Space Station
Japanese experiment module

space operation

SJAC

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SKY Perfect JSAT Holdings Inc.

NEC

Space Companies support Japanese Space Infrastructure.

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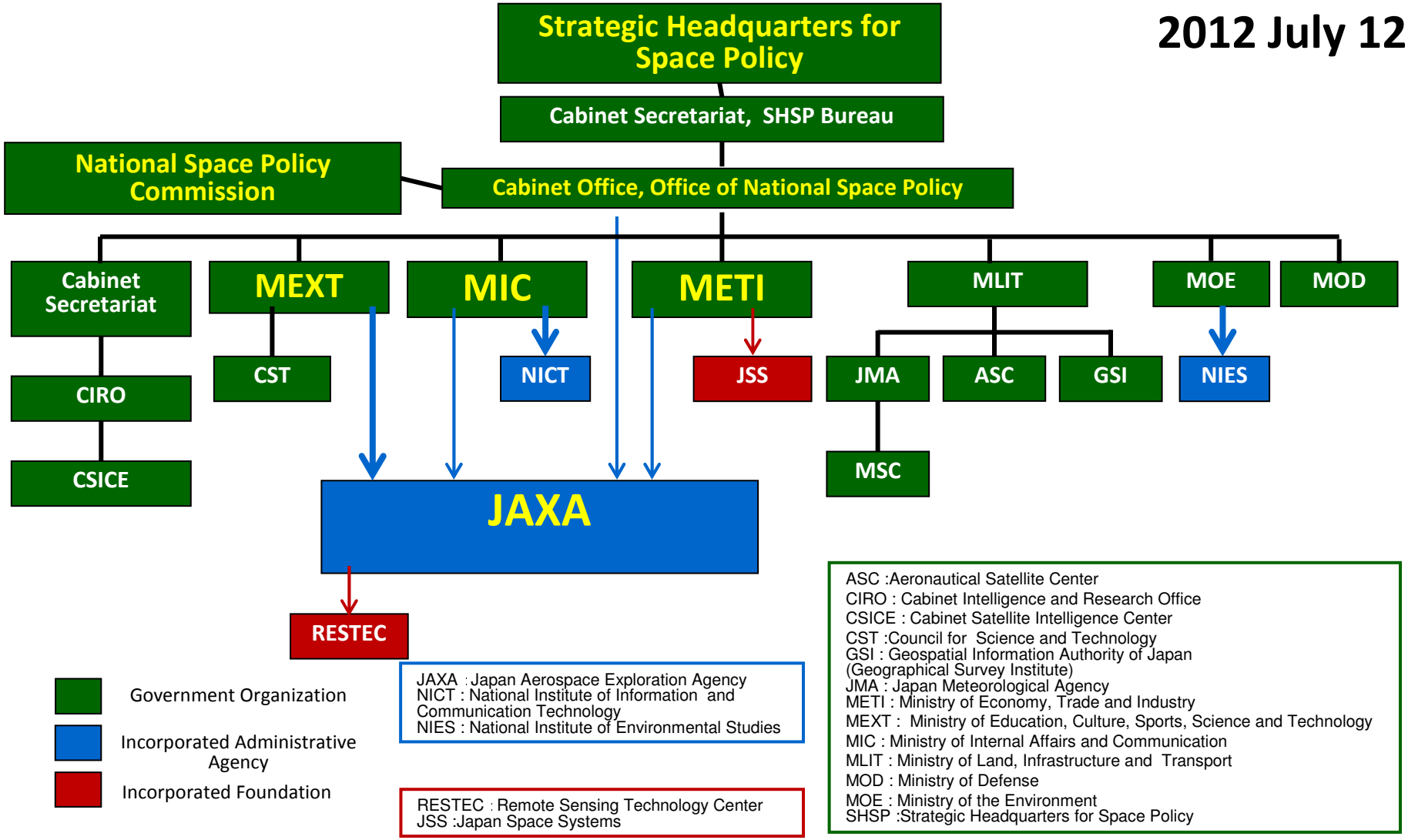
Organization Chart of the Space-Related Establishments



Japan's space policy

In 2008, the Japanese government established the "Basic Space Law" which stipulates the conservation of the space environment.

The Strategic Headquarters for Space Policy of JAPAN, established the new "Basic Plan for Space Policy" (January 25, 2013) to offer an overall picture and plan for the next five years (2013 to 2017 JFY).

"Consider the Environment"
The Government will adopt measures that consider both the global and space environment, such as the space debris issue.

Basic Plan for Space Policy (extract summary)

Consideration of the environment for sustainable space development and utilization

i. Promotion of an international dialog
In order to secure the stable and sustainable space environment, JAPAN positively contributes to UN/COPUOS, with productive activities of international norms on the practical use of space and other activities, and makes international contributions.

ii. Space Debris Mitigation Guideline
Promote the development and utilization of space, taking into account international recommendations such as the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, and ISO Standards.

iii Space Situation Awareness (SSA)
SSA is needed in order to secure the safe and sustainable space development and utilization in Japan as a measures to protect the International Space Station (ISS), satellites and astronauts from colliding with space debris. A suitable SSA organization will be examined.
Moreover, natural environments which affect space assets and infrastructures on the ground, and researches on space weather forecast should be furthered.

iv Technical Development of Debris Removal
Taking advantage of the strengths of our country, and in the spirit of international cooperation, JAPAN has developed debris removal technology, which is increasingly needed worldwide.

Industrial Activities regarding Long-term Sustainability

◆ Research and collective opinions regarding space debris problems
- SJAC/JAXA/space companies jointly conduct space debris research
- Participation in COPUOS long-term sustainability working group experts' meetings

◆ Activities for the establishment of international standards (ISO) regarding space environment preservation
- Contribution to long-term sustainability activities through improvement in reliability and efficiency of design
- Participation in space-debris related design standard activities
  - ➢ Japan proposed WG framework regarding debris at ISO/SC14/WG4 in May 2002
  - ➢ Debris WG started activities at ISO/SC14 in Tsukuba in 2003
- Participation in space data and information transmission system (ISO/SC13)
- Contribution to the space environment (space weather) standards

◆ Activities for the establishment of domestic standards regarding space environment preservation
- Companies participate in and cooperate as members in the JAXA standards establishment and revision-work committee
- Satellites/rockets are designed and produced according to ISO/JAXA standards
- JAXA and companies jointly study space debris reduction and removal measures.

◆ SJAC's outreach activities regarding space debris problems
- Publication of articles regarding ISO and space debris in its journal "Aviation and Space"
- SJAC hosted "Space Debris Symposium“ in 2010

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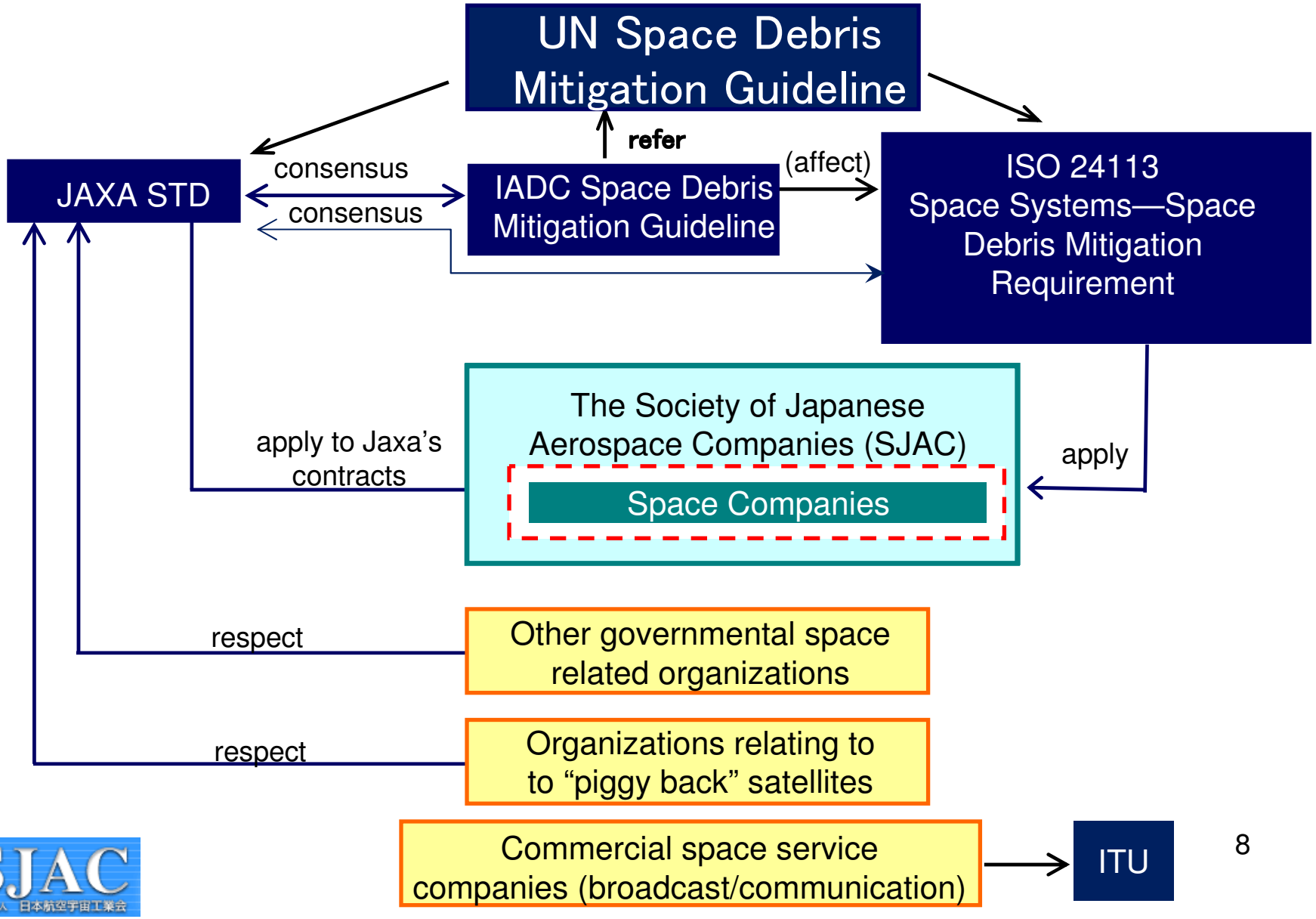
Overview of debris **mitigation** framework in JAPAN



Space industry' s efforts on long-term sustainability

Japanese Satellites and rockets designed and produced
according to ISO/JAXA Debris Related Standards
contribute to “Long-term Sustainability of Space Activities” Goal

Examples of satellite design, production, and operation according to Debris Mitigation Requirements

Provisions against debris impacts

- Allocation in satellite to protect critical equipment

- Improved survivability using Debris Shields or Bumpers

Limit debris released during operations in orbit

- Not releasing any parts such as fasteners or covers during expansions of solar array paddles, antennas, etc.

Prevention from break-ups in orbit

For batteries/propellants tanks with potential explosive

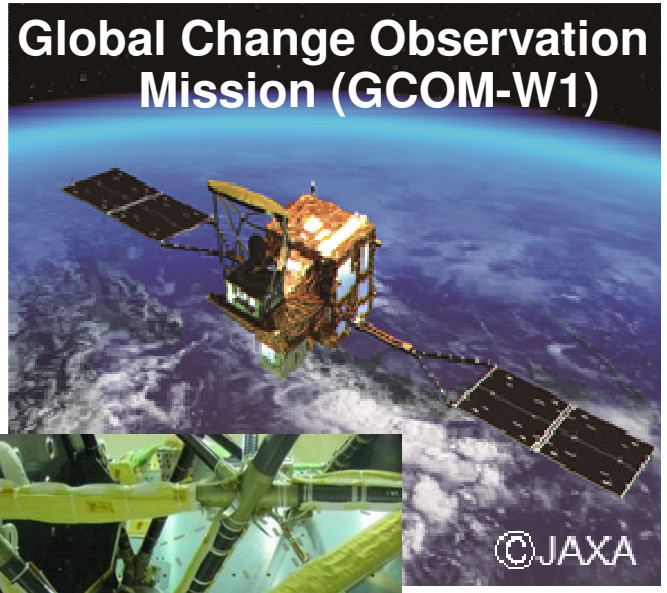
- Shut-off provision for battery charging lines

- Appropriate strength of pressure vessels

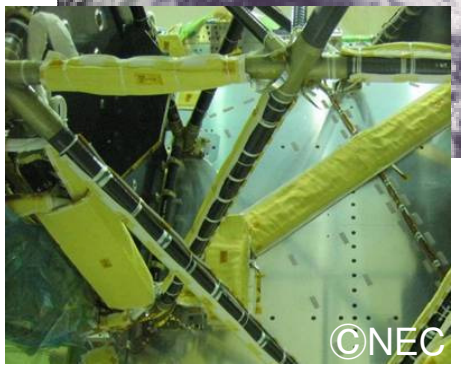
- Monitor and control of pressure/temperature

- Vent of residual propellants at the end of operation

Appropriate propellants to move into disposal orbits



Launched in 18 May 2012



Debris Shield (Yellow portions)

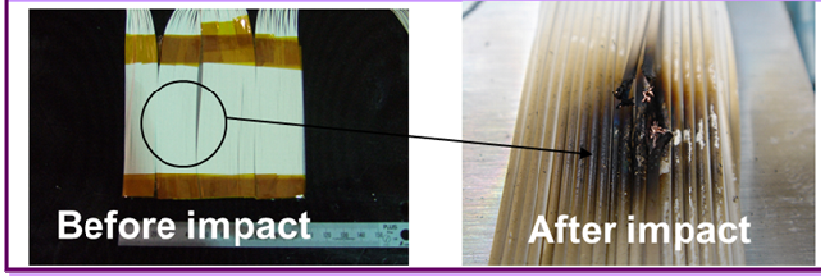
Space industry' s efforts on long-term sustainability

Examples of R&D activities for Space Debris Mitigation

- A debris-protection design working group consisting of JAXA, the university, and members of satellite manufacturers accumulates data by conducting hypervelocity impact tests and simulation analyses.

A result of hypervelocity impact tests

Depending on the size, impact may damage the wire harness and other equipment



Example experiment results:
- Projectile diameter: 0.3 mm
- Impact velocity: 4 km/s

(JERG-2-144-HB001 'JAXA Space Debris Protection Design Manual Appendix 2', 2008)

Space debris flux (number) for this size range not well known

- As protection materials, research for new materials instead of metallic bumpers

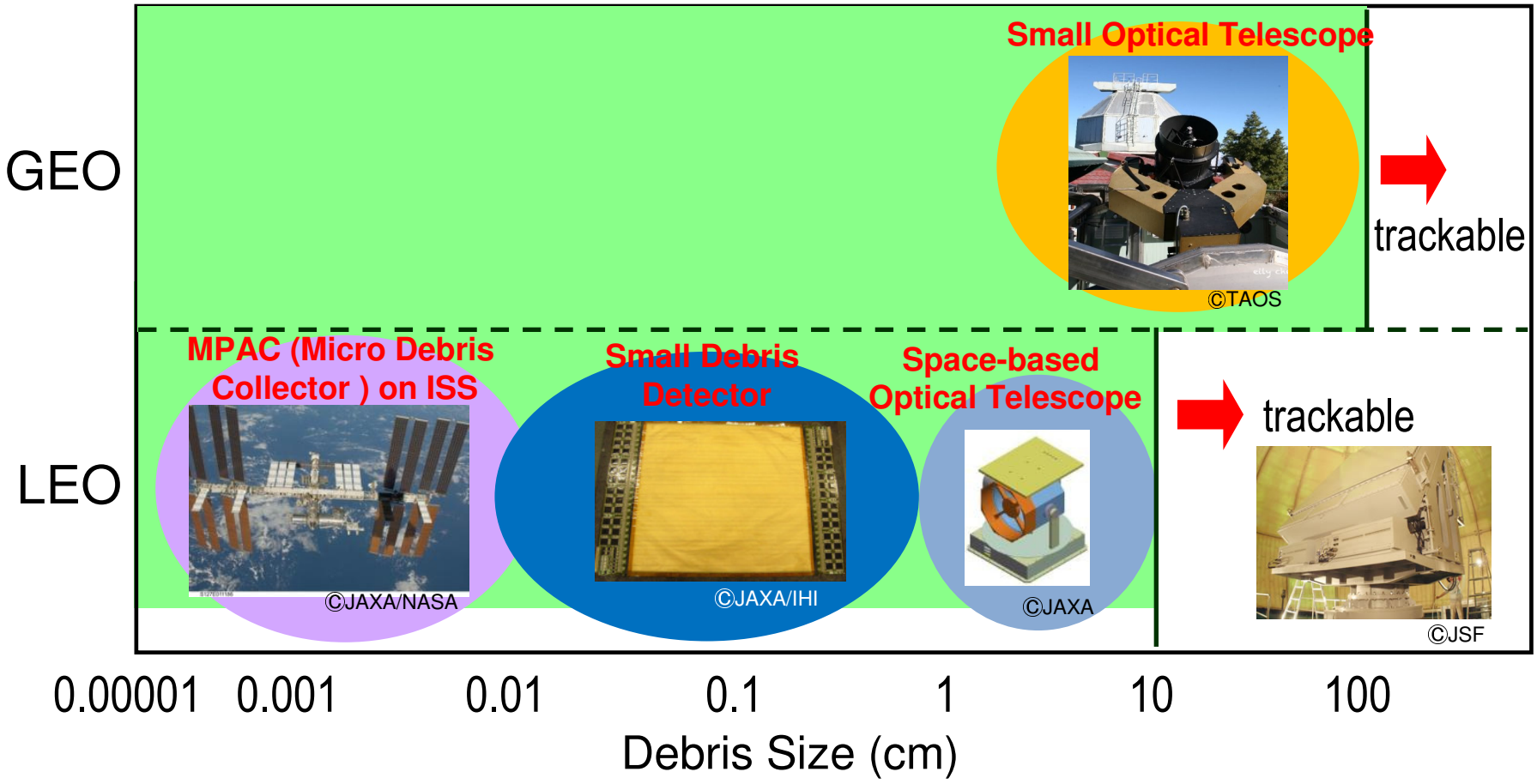
- R&D with JAXA on changing the propellant tank material from titanium to a material that will allow a space object to burn out at reentry to Earth

- Debris observations

- Debris removal

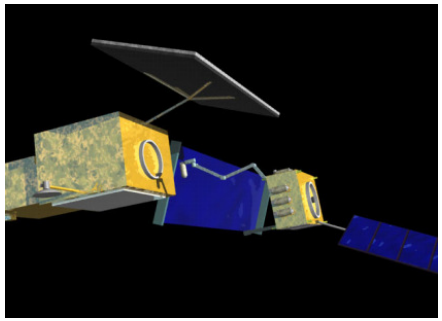
Space industry' s efforts on long-term sustainability

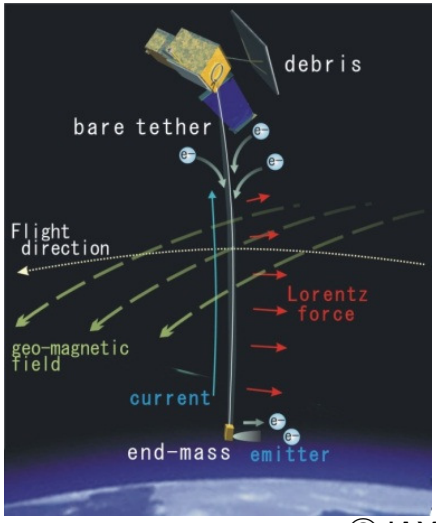
Research Activities on Debris Observation



Space industry' s efforts on long-term sustainability

Research Activities on Debris Removal





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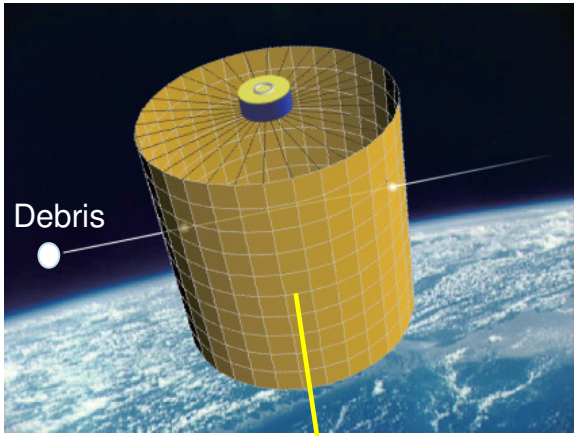
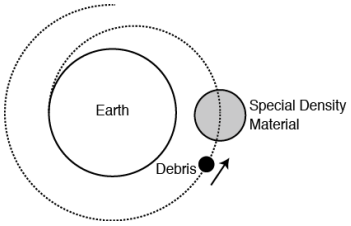
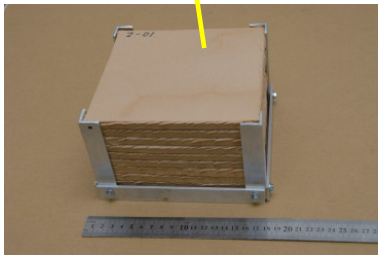
Schematic View of
JAXA's Active Debris Removal



Spacecraft for Passive Debris Removal



Principal



Spatial Density Material

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Schematic View of
Passive Debris Removal
(Hanada, et al.,2010)

Domestic satellite communication providers' efforts regarding long-term sustainability

- **Implementation of proper space object registration**

  Before launching geostationary satellites, domestic satellite communication providers implement the proper registration for space objects at the United Nations Office for Outer Space Affairs, through a related Japanese government agency.

- **Implementation of proper deorbit**

  After completion of operation, domestic satellite communication providers properly deorbit their geostationary satellites from the stationary orbit zone to an upper level.

- **Collision Avoidance Operation**

  An East-West collision avoidance maneuver is used in order to keep a safe distance at the time of CA

  - Implementation of collision avoidance maneuvers: twice (2) in the past 3 years

JCSAT-13

SKY Perfect JSAT Earth Station

Recommendation from Japanese space industry

"The greatest threat of space debris for geostationary satellite operators is part of a satellite or rocket remaining in geostationary orbit after completion of operation"

- **U.N. Space Debris Mitigation Guideline" should be respected by ALL**
  - Keep the parts of rockets and un-operated satellites away from protected GEO region
  - Construction of a surveillance system
- **International framework should be prepared so that operators can contact for each other at anytime**
  - Clarification of party responsible for management of space objects
  - Clarification of point of contact of the above parties
  - Establishment of a framework beyond national boundaries for exchange information among satellite operators

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Recommendation from Japanese space industry

- **Improvement of Space Surveillance Capability**
  - Expand the surveillance ability to smaller size objects in GEO
  - Improve the accuracy of orbit information
  - Establish international observation network for space objects
  - Ascertainment of distribution of debris population

- **Development of technologies of space debris removal should be supported**
  - Guidance and control of debris removal from GEO to outside area
  - Active Debris Removal of large debris in LEO

- **Establishment of International framework for space debris removal**
  - Initiate discussion on international framework for space debris removal under international consensus.

We expect actions to solve the issues under UN leadership.

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Thank you
for your attention