JAXA's initiative to mitigate Space Debris for Safety Satellite Operations: RABBIT

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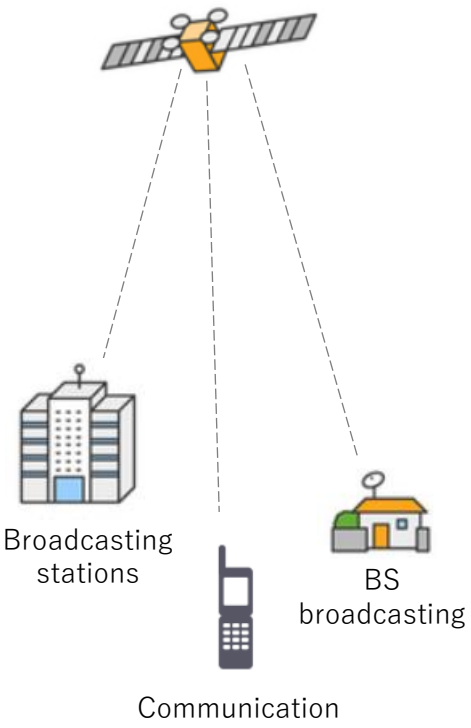
1. Roles of Satellites

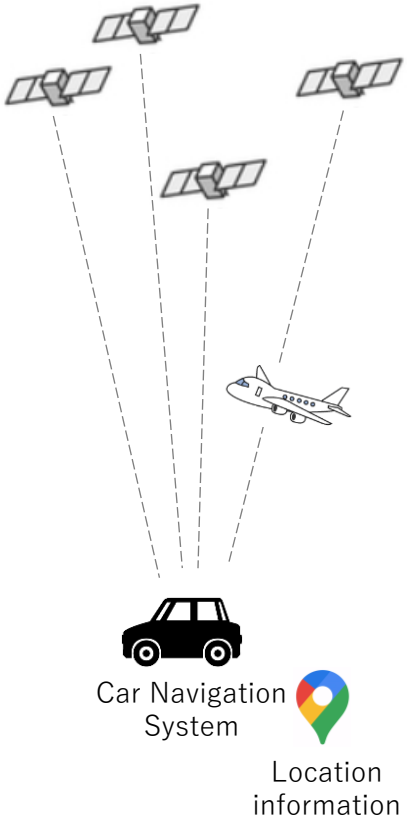
Satellites protect the Earth from space and make our lives safe and prosperous

Contributing to the achievement of the SDGs

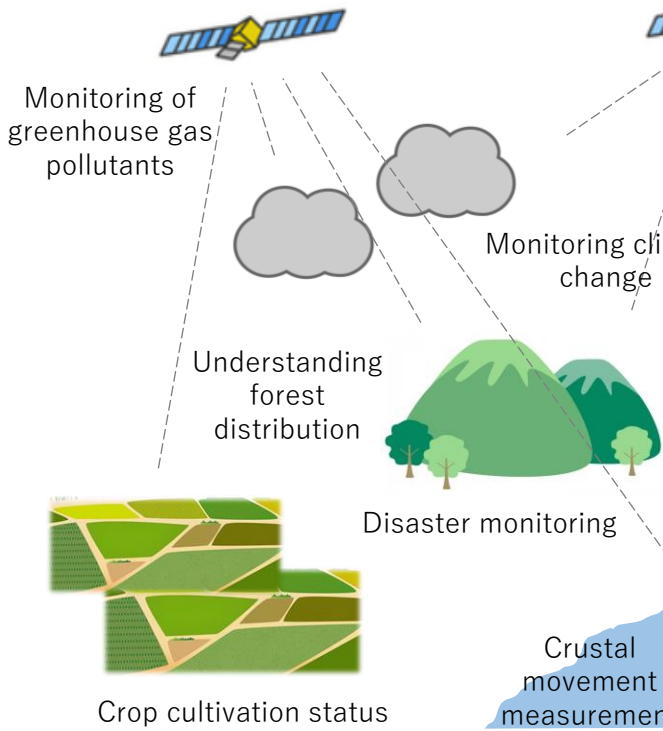
Communication/Broad-casting Satellite



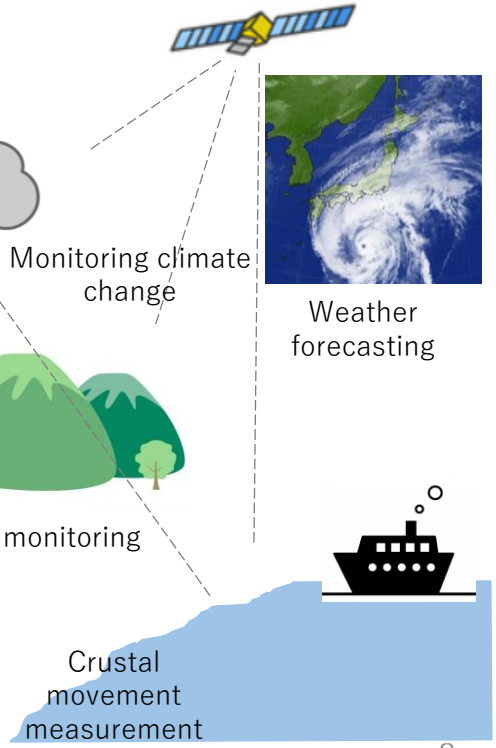
Positioning Satellite



Earth Observation Satellite



Meteorological Satellite

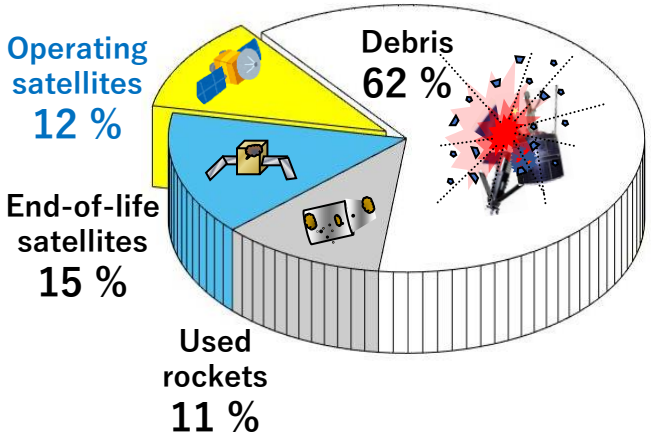


2. Space Debris Issue

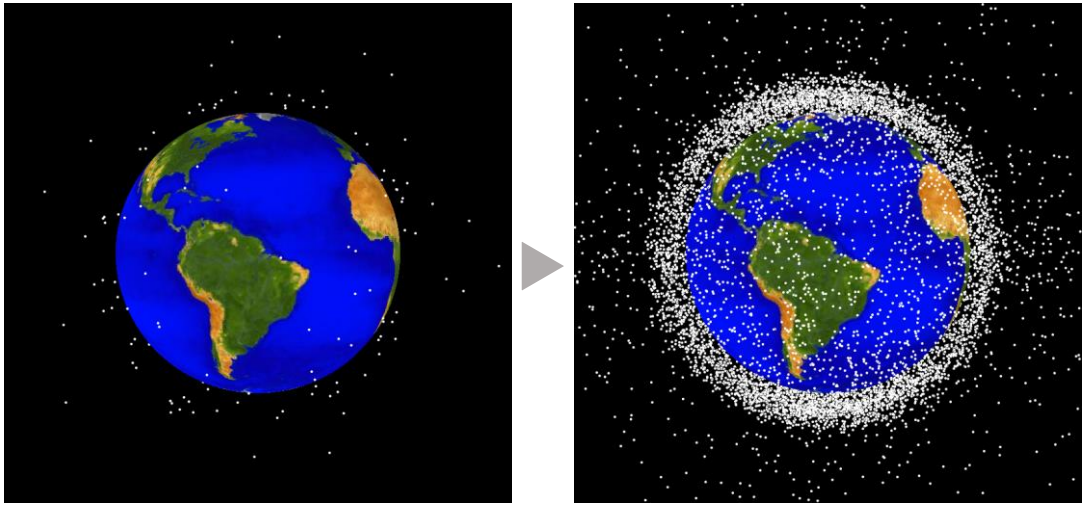
We must take some measures now to protect our satellites from space debris

Space debris has been increasing year by year and now space is full of junk. Of all the objects flying in space, 90% are junk, and only 10% are satellites that make our lives safe and prosperous. Space debris, even if it is small, has a great destructive power because it is moving at high speed.
This is why satellites are threatened by space debris every day. In other words, our lives, which have been made more convenient by the use of space, are now threatened by space debris.

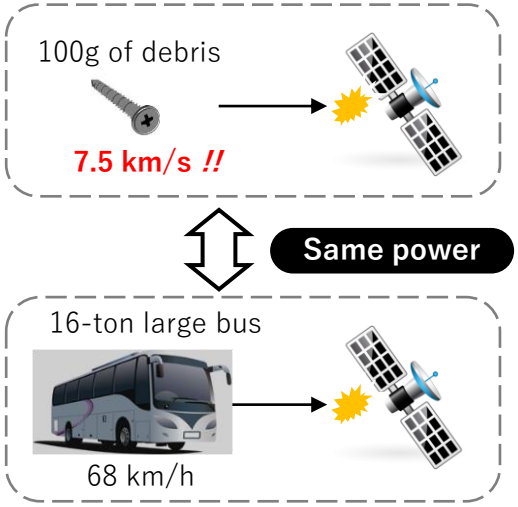
Space:
90% junk and 10% necessities



Our beautiful blue Earth is now surrounded by space debris.



Even a small piece has great destructive power



3. Measures by Guidelines

Guidelines adopted by COPUOS:

Space Debris Mitigation Guidelines

Guidelines for the Long-Term Sustainability (LTS) of Outer Space Activities

These guidelines have been established as good practices to be **voluntarily** implemented by Member States for the long-term sustainable use of space activities, including the mitigation of space debris and the safety of space objects.

Through the development and provision of the RABBIT*, JAXA assists all satellite operating organizations to operate their spacecraft in accordance with the COPUOS guidelines.

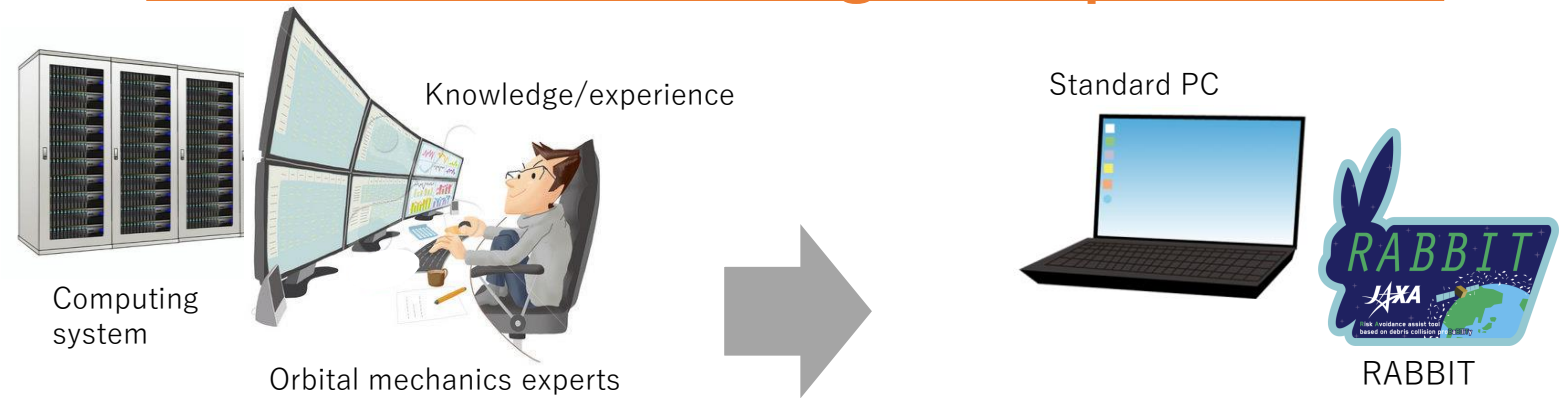
RABBIT greatly contributes to implementation of COPUOS guidelines by the satellite operating organizations

especially, to implementation of LTS Guideline B.4 Perform conjunction assessment during all orbital phases of controlled flight

＊ RABBIT：Risk Avoidance assist tool based on debris collision proBaBIliTy

4. What Can We Do with RABBIT?

To protect satellites from space debris, it is necessary to have a mechanism to prevent satellites from colliding with space debris



Used to be very challenging…

In the past, orbital mechanics experts who had knowledge and experience in space debris counter measures had devised solutions to avoid colliding with space debris. However, it was difficult for all satellite operating organizations to possess sufficient manpower and computing systems.

RABBIT makes it simpler!

RABBIT can easily find a way to avoid space debris with standard PC, regardless of knowledge or experience, even without an expert in orbital mechanics.

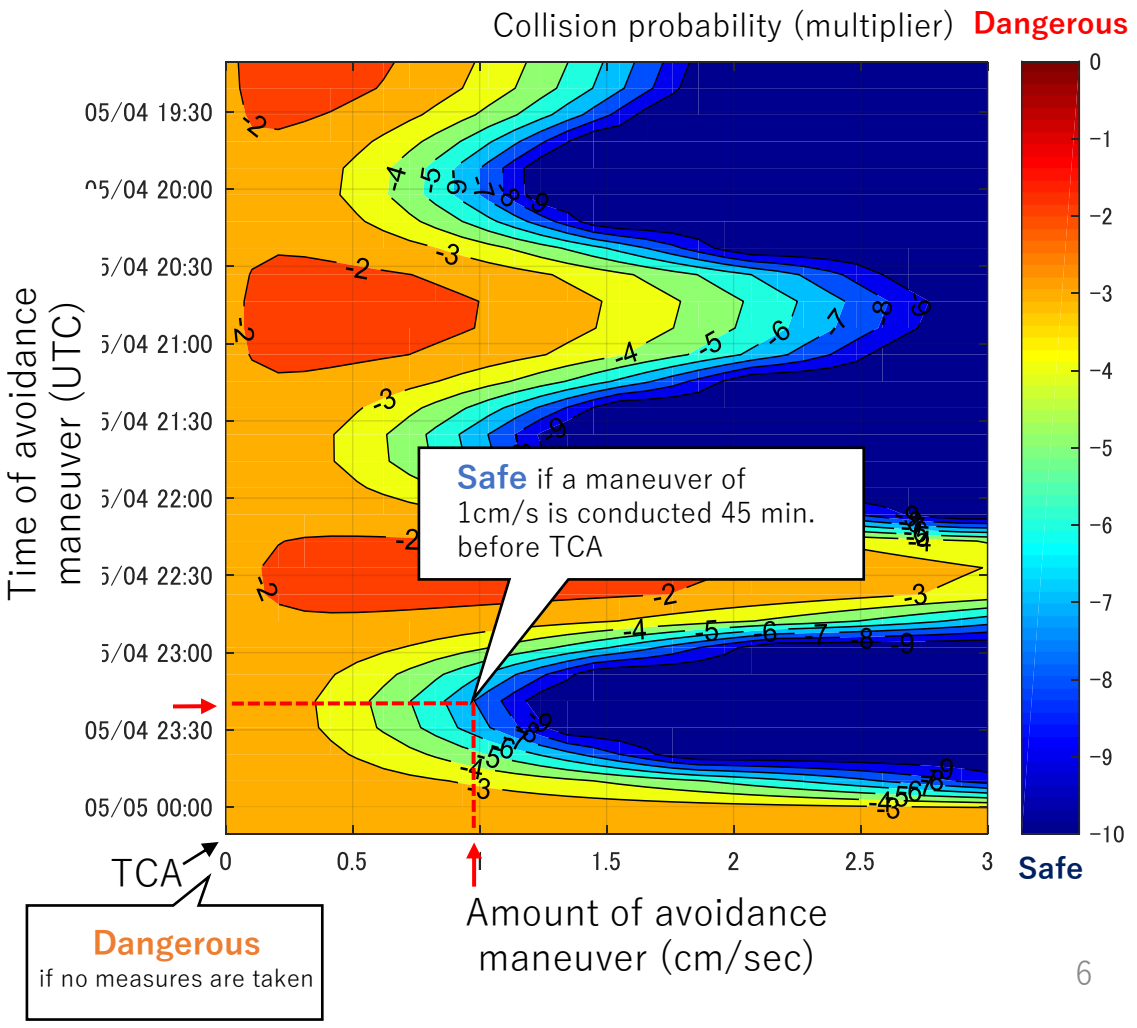
- Improves global space debris avoidance technology
- Protects satellites and maintains social infrastructure
- Raising public awareness of the space debris issues
- Raising awareness and consciousness of space environment conservation

5. Example of RABBIT Use

RABBIT quickly finds a way to avoid colliding with space debris

- The figure on the right shows an example of RABBIT use
- We can see that the collision probability at the time of the closest approach (TCA) of space debris (origin) is ORANGE (dangerous).
- By implementing the following, it is possible to reduce the collision probability to BLUE (safe).
  - ✓ Time: 45 minutes before TCA
  - ✓ Amount: **1.0cm/s**
- Other safe options for time and amount of maneuver can also be read out, so that an optimal debris avoidance control plan can be developed, considering mission operations and operational systems.

We can instantly and easily determine when and what kind of maneuver will reduce the probability of collision to ensure safety. This has been considered to be a craftsmanship.



6. How to Get RABBIT

You can download RABBIT free of charge by filling out the required information and agreeing to the terms of use on the following website.

https://sma.jaxa.jp/Software/RABBIT/index.html

RABBIT is used by about **40** organizations and protecting about **150** satellites.
(as of August 2021)

RABBIT aims to achieve **ZERO COLLISIONS** with space debris.

By promoting RABBIT, JAXA contributes to raising public awareness of the dangers of space debris and the need to protect not only the Earth's environment but also the space environment.