Japan’s Current and Future Programs in Space Exploration

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JAXA’s Roadmap: 2020 and beyond

2015
- Basic Plan for Space Policy
- H-IIA
- Epsilon

2020
- Tokyo Olympics and Paralympics
- Enhanced Epsilon
- Advanced Optical Satellite
- JDRS
- Advanced Radar Satellite
- Next Engineering Test Satellite
- AMSR follow-on
- Social Infrastructure/Societal Benefits
- HTV
- HTV-X
- Sample Return
- Robotics Space Technologies
- Human Space Technologies
- LEO and beyond LEO
- ISS
- KIBO Utilization

2025~
- International launch market
- Moon, Asteroid and Mars science missions
- Hayabusa2
- ERG
- BepiColombo
- SLIM
- GCOM-C/SLATS
- GOSAT-2
- EarthCARE
- MASR follow-on
- ErG
- BepiColombo
- SLIM
- MMX
- SPICA
- QZSS
H3 launch in 2020

- Launch from Tanegashima
- Starting engine test

- Robust engines
- Flexible in launch service capability
- Launch cost cut by half
- High Reliability
Hayabusa 2

✓ Reach target asteroid “Ryugu” in 2018
✓ Return to Earth in 2020.

(162173) Ryugu
Small lunar-lander (SLIM) to pinpoint landing technology demonstration

Precursor of full-scale lunar or planetary missions

- Image-based navigation utilizing Lunar terrain
- Autonomous obstacle detection
- Robust pin-point guidance
- Landing shock absorber
- High-performance propulsion
Future Exploration and Science Missions

- **BepiColombo** – a joint mission between ESA and JAXA, planned to reach Mercury in 2024.

- After 2020, MMX, a sample return mission to the two moons of Mars, and SPICA, a joint astrophysics mission with Europe, are JAXA’s top priority missions, although still in concept phase.
HTV-X: ISS Cargo Transportation

- Leverage technology with international advantage; enhance transport capability and operability, while reducing cost
- Technology demonstration using ISS cargo transportation opportunities
- Use for potential future missions

Launch in FY2021 by H3 Rocket
JAXA’s Space Exploration: 2020 and beyond

**2015**
- **LEO**: Space Exploration Technology Demonstration using ISS such as ECLSS, Radiation Monitoring, Space Medicine, etc.

**2020**
- **Moon**: Cis-Lunar Missions preparing for Moon and Mars
  - Step wise lunar missions for key technologies such as landing, roving and robots.
  - SLIM (Pin point Landing Tech Demo)
  - Water ice prospecting mission to the pole

**2025~**
- HTV-X will be leveraged for future LEO activity and Cis-Lunar mission
- Lunar Exploration with Partners

**Mars & Asteroids**
- Top science missions using Hayabusa heritage
  - **Hayabusa2**
  - Phobos/Dimos Sample Return Mission (MMX)
PADLES (Passive Dosimeter for Life-Science Experiments in Space)
- Compact / battery-less passive dosimeter
- High accuracy

PS-TEPC (The Position Sensitive Tissue-Equivalent Proportional Counter)
- Real-time measurement of Linear Energy Transfer

JAXA’s ECLSS Goals
✓ No water and oxygen supply
✓ No consumables
✓ High Reliability

Water Recovery System
- Recovery Rate exceeding 85%
- Low-Power System
- Small / Light weight

Air-Recycling System
- Low temperature CO2 Reduction
- Cathode-Feed type water electrolysis (O2 Generation)
- Methan Decomposition
Three Research Areas for Exploration

As a joint endeavor with the private sector.

Exploration technology in a wide range of unexplored areas

- Target: Actualize wide-ranging yet in-depth exploration of unexplored areas by distributing functions through multiple small spacecraft.

Automatic and autonomous exploration technology

- Target: Development of the construction technology for space bases to be constructed on the Moon and Mars in the future.

In-situ resource utilization (ISRU) technology

- Target: A paradigm shift from “shipping all necessities from Earth” to “procuring necessities on site”.

Image of cooperative exploration with multlanders

Image of ultra-long-range remote-controlled construction

Moon’s surface soil, regolith (the photograph shows simulated lunar soil)

Water, Hydrogen

Block

Metal

Technology to effectively use low quality resources.
Technology for efficient mining and transportation of resources.
Reuse and recycle technologies, etc.
JAXA Space Exploration Innovation Hub Center

- A new organization within JAXA starting from April 1, 2015.
- Aspiring towards open innovation through space exploration related researches.

Space Exploration Innovation Hub

- Gathering people, technologies
- Output
  - Start-up Space projects
  - Innovation in Terrestrial biz.

Goals → Reflect

Technology Advancement Node for Space Exploration

- JAXA Internal Divisions
- Companies, Universities, Research Institutes

Space navigation, take-off, landing technology
Sustainable exploration technology on the Moon or Mars
Manned space technology

Subject of research

Subject of research

Subject of research
Innovation in Space and on Earth

**Space exploration technology**

- Expansion of space development and utilization.
- Active use of terrestrial technology.

**Terrestrial technology**

- Creation of industrial promotion and new industry by commercialization.
- Distribution of space exploration technology.

Sponsored by the Japan Science and Technology Agency (JST)’s support program for starting up innovation hub
Space Exploration as a Global Endeavour
Space Exploration Dialogues at Global Level

- **2nd International Space Exploration Forum (ISEF-2)**
  - Hosted by the Government of Japan, JAXA
  - Early 2018 in Tokyo
  - Will bring together Ministers and high-level officials from approximately 50 nations to discuss the opportunities and challenges they share.

**Global initiatives toward promoting space exploration**

- **IAF Global Space Exploration Symposium (GLEX)** Beijing, June 2017
- **UNISPACE-50, June 2018**
  - Global partnership in space exploration and innovation
- **+ other initiatives including ISECG**
Thank you for your attention