

Japan's Current and Future Programs in Space Exploration

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Masazumi Miyake

Director, International Relations and Research Department
Japan Aerospace Exploration Agency

JAXA's Roadmap: 2020 and beyond



2015

▲ Basic Plan for Space Policy

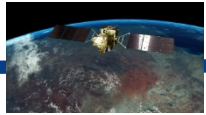
H-IIA

Epsilon

Enhanced Epsilon



GCOM-C/SLATS



GOSAT-2



EarthCARE



Advanced Optical Satellite



JDRS



Himawari



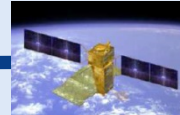
QZSS

2020

▲ Tokyo Olympics and Paralympics



First H3 Launch



Advanced Radar Satellite



Next Engineering Test Satellite



AMSR follow-on

International launch market

Social Infrastructure/
Societal Benefits

ISS



KIBO Utilization

HTV

HTV-X



~2024

LEO and beyond LEO

Human Space Technologies



Hayabusa2

Sample Return

Robotics Space Technologies

Moon, Asteroid and Mars science missions



ERG



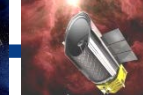
BepiColombo



SLIM



MMX



SPICA



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.



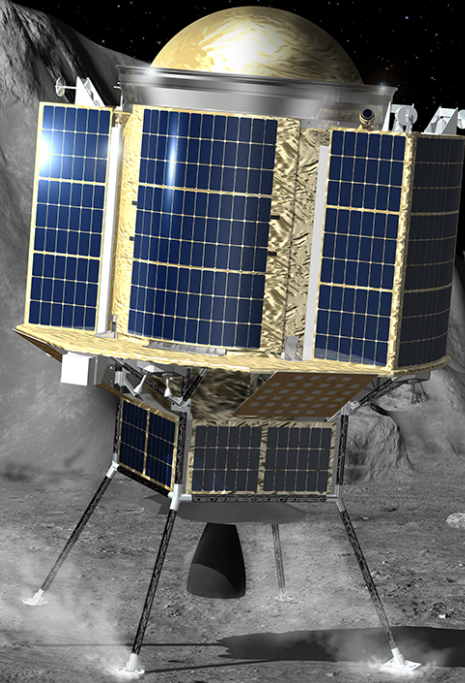
A. Koshida

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



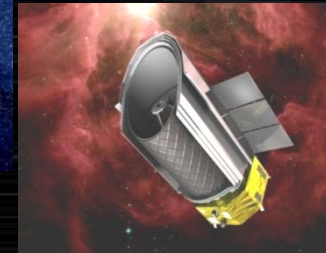
Courtesy: Akihiro Ikeshita

BepiColombo



**Mars Moon
eXploration (MMX)**

**Space Infrared
Telescope
for Cosmology
and Astrophysics
(SPICA)**

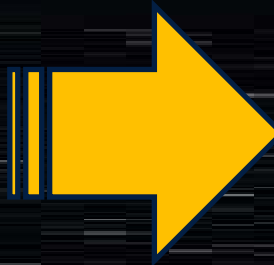


- ✓ **BepiColombo –a joint mission between ESA and JAXA, planned to reach Mercury in 2024.**
- ✓ **After 2020, MMX, a sample return mission to the two moons of Mars, and SPICA, a joint astrophysics mission with Europe, are JAXA's top priority missions, although still in concept phase.**

HTV-X: ISS Cargo Transportation



HTV



HTV-X



Launch in FY2021 by H3 Rocket

- ✓ 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

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

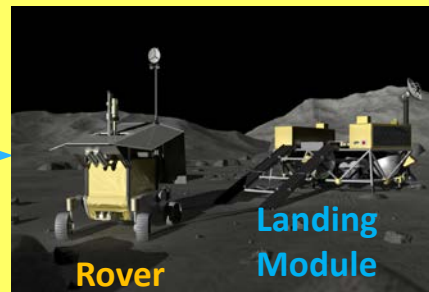
Cis-Lunar Missions preparing for Moon and Mars



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)

ISS Kibo as a Test-Bed to Demonstrate On-Orbit Technology For Future Exploration



Radiation Measurement



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

Environment Control and Life Support System (ECLSS)

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



Water Recovery System



Air-Recycling System

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.

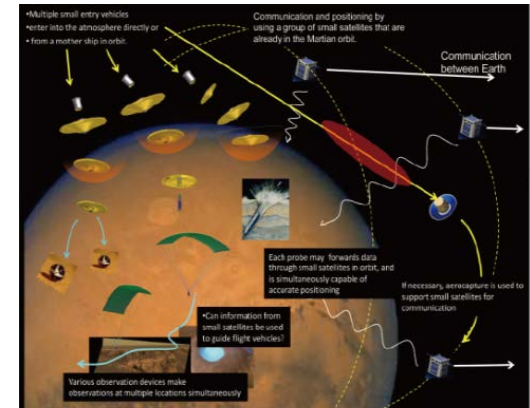
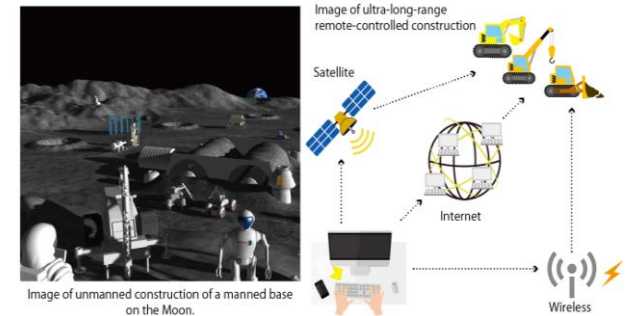


Image of cooperative exploration with multilanders

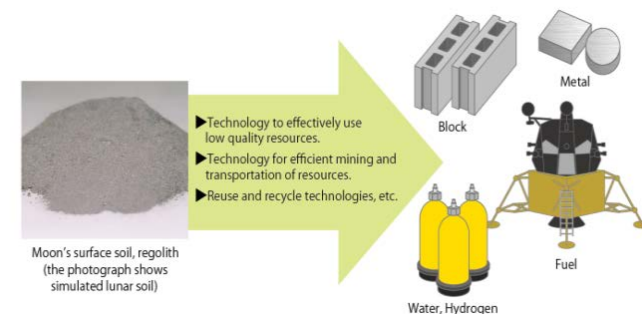
Automatic and autonomous exploration technology

- 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”.

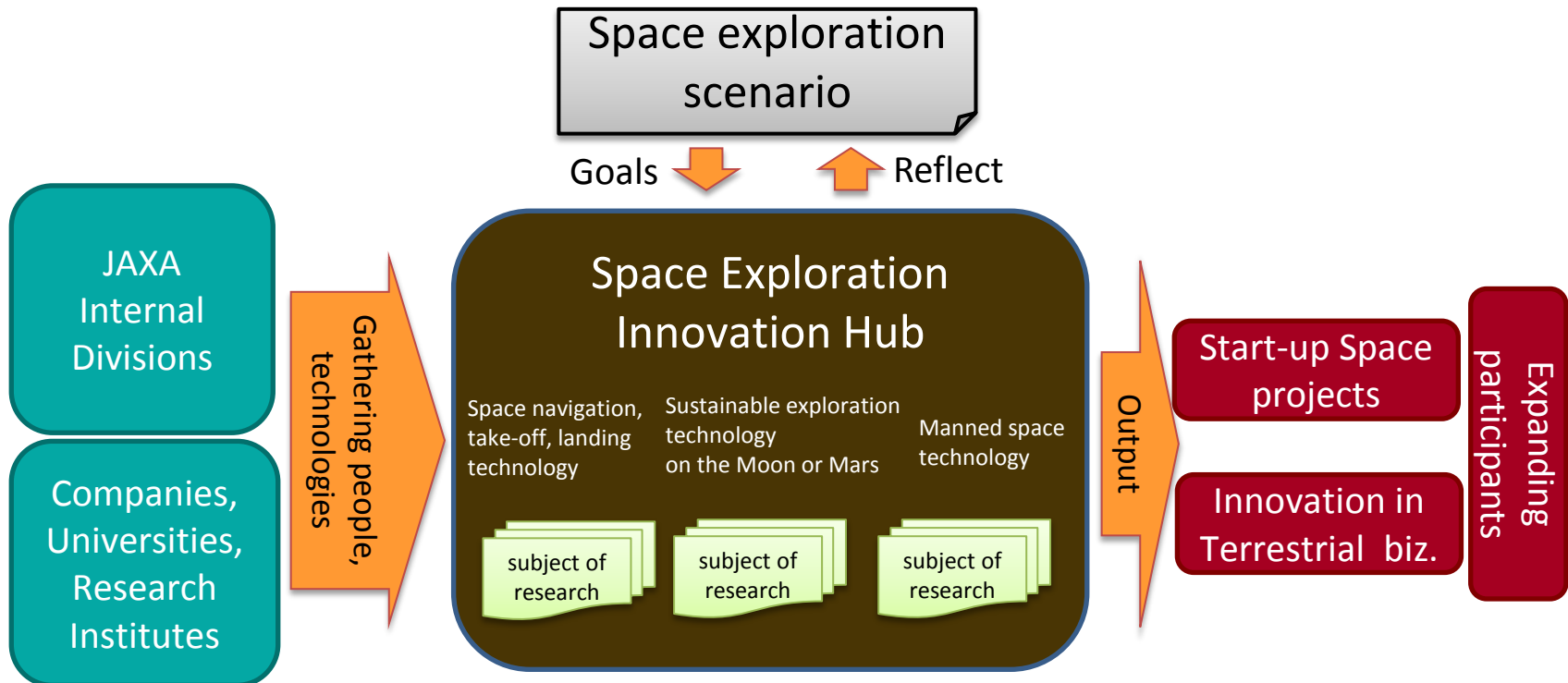


JAXA Space Exploration Innovation Hub Center

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



Technology Advancement
Node for SpAce eXploration

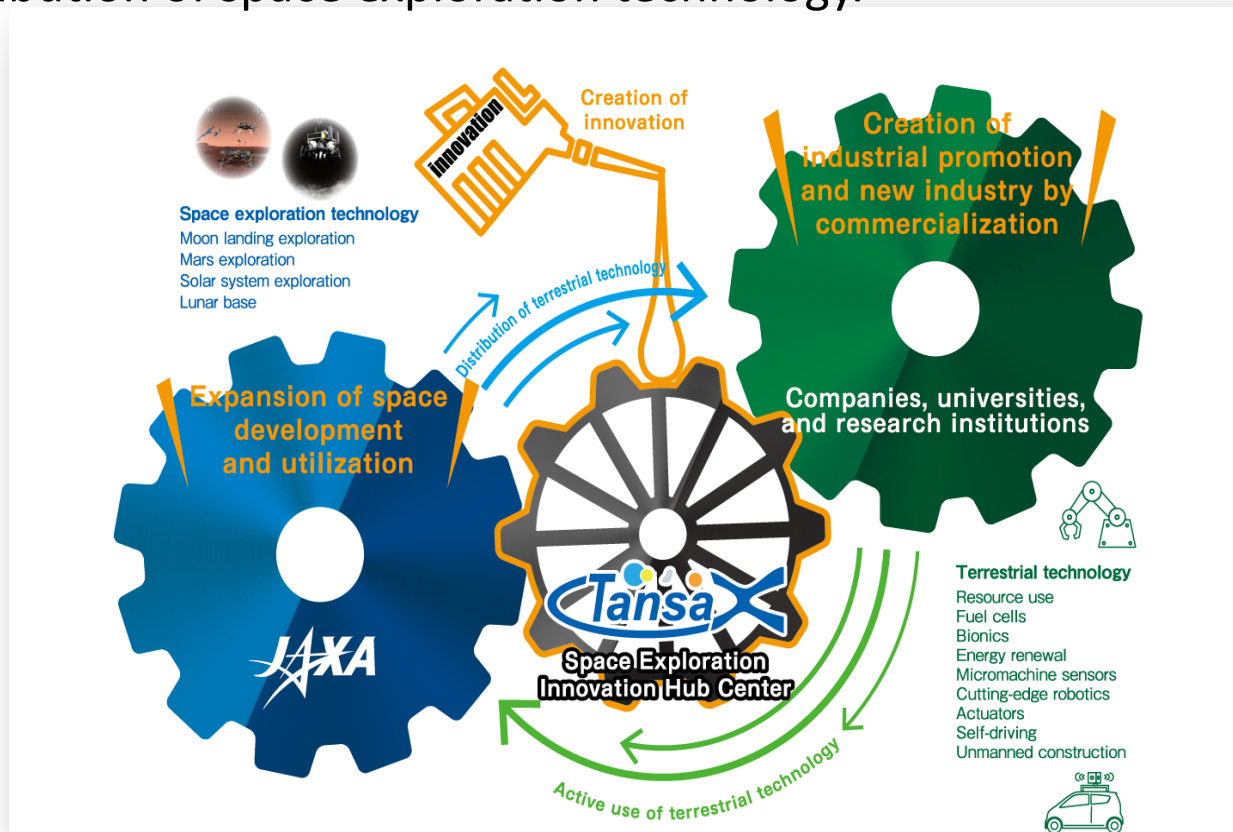


Space exploration technology

- 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.



Space Exploration as a Global Endeavour

- 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



Technology Advancement Node for
SpAce eXploration