Mitsuru Ohnishi/JAXA

-As the self-introduction-

Our Organization consists of

*Space Transportation Mission Directorate

*Space Application Mission Directorate

<u>*Human Space Systems and Utilization Mission Directorate</u>

<u>-Human Space Technology and Astronauts Department</u>

-> Human Space Technologies

<u>-Space Environment Utilization Center</u>

*Aerospace Research Development Directorate

<u>-Innovative Technology Research Center</u>

Space Base Unit -> ECLSS

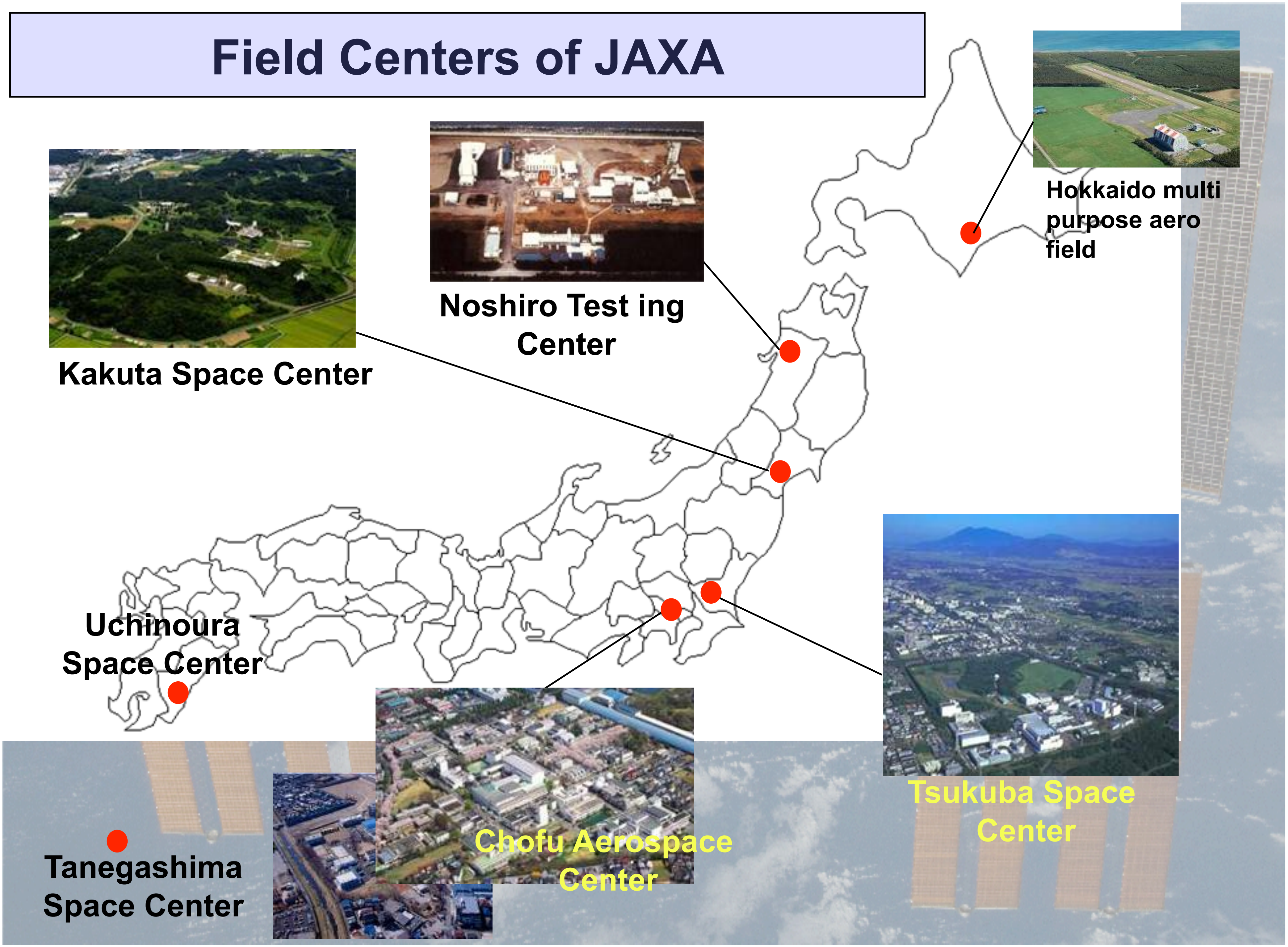
*Institute of Space and Astronautical Science

*Aviation Program Group

<u>*Lunar and Planetary Exploration Program Group</u>

-> Human Space Exploration

Field Centers of JAXA



Our Center consists of

* Innovative Technology Research Center

-Space Debris Unit -> Observation by telescope
-> Protection by damper
-> Removal by Satellite

-Space Base Unit -> Life Support System
- > Space Environment Utilization
-> Nano-technology
-> Regenerative Fuel Cell

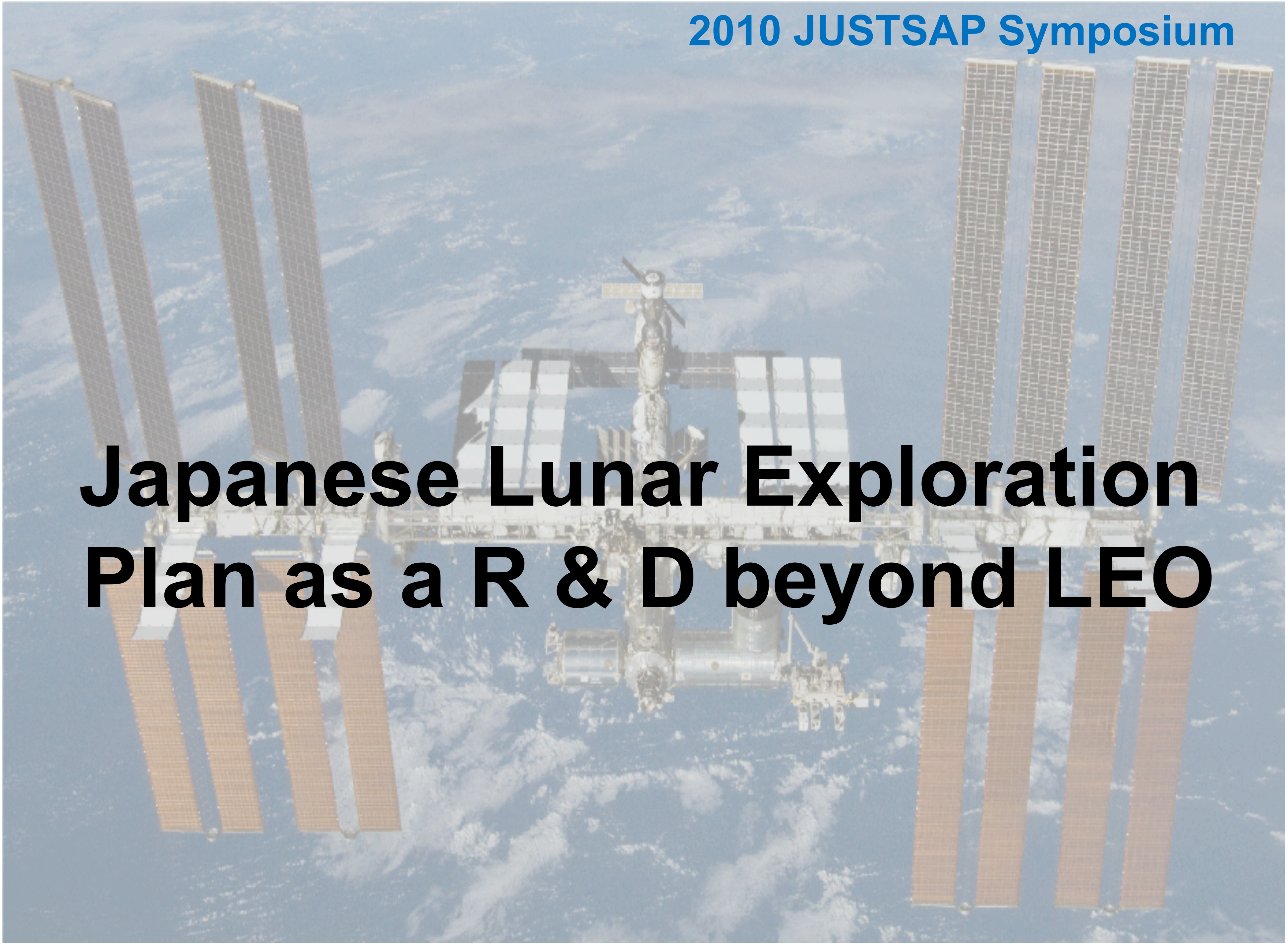
-Space Vehicle Section-> Aero-capture
-> Plane on Planets

+Robotics Research Group

+Advanced Mission Research Group

> - Space Solar Power System

2010 JUSTSAP Symposium



Japanese Lunar Exploration Plan as a R & D beyond LEO

Japanese Themes for Lunar Exploration

1. Develop space technologies for Solar system exploration

   - Stepwise approach: Moon is the nearest celestial body with partial gravity and so is the best target for technology development of, such as, landing and return.

2. Promote Japan’s Top-level Lunar Science

   - Based on excellent scientific results from SELENE, Japan’s position in lunar science should be continuously promoted.

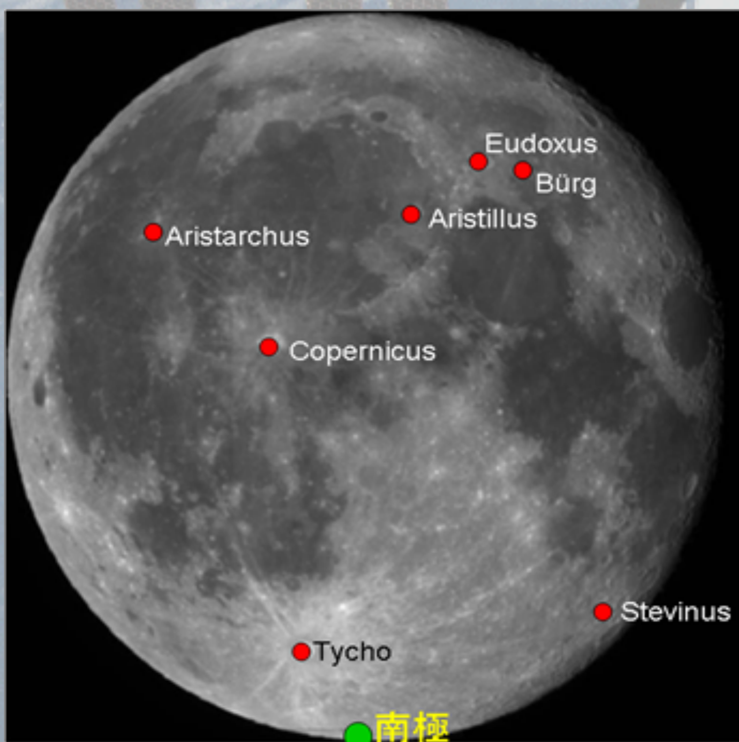
3. Establish Japan’s presence in the international community for lunar exploration and utilization

   - Japan should lead the related international community to the Moon by its continuous lunar activities and leading to make collaborative international guidelines on lunar development & utilization.

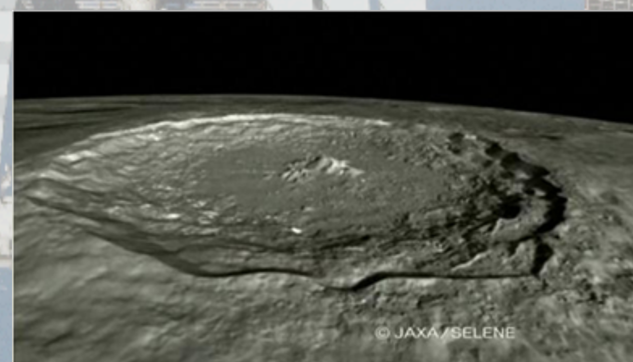
Mission for 2015 Robotic Lunar Exploration
- Near side -

1. Science:

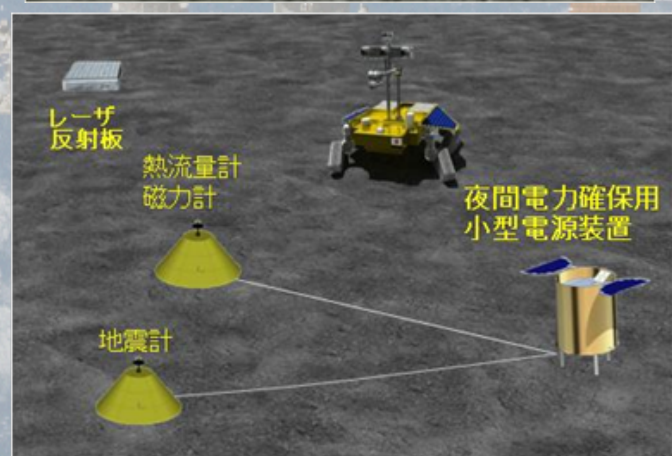
- Precise determination of lunar crust depth and lunar interior density, etc. (first time in the world)



Candidate landing sites



e.g.
Tycho crater



Lunar interior data acquisition by seismometer, etc.

Missions for 2015 Robotic Lunar Exploration
- Near side -

2. Technology development:

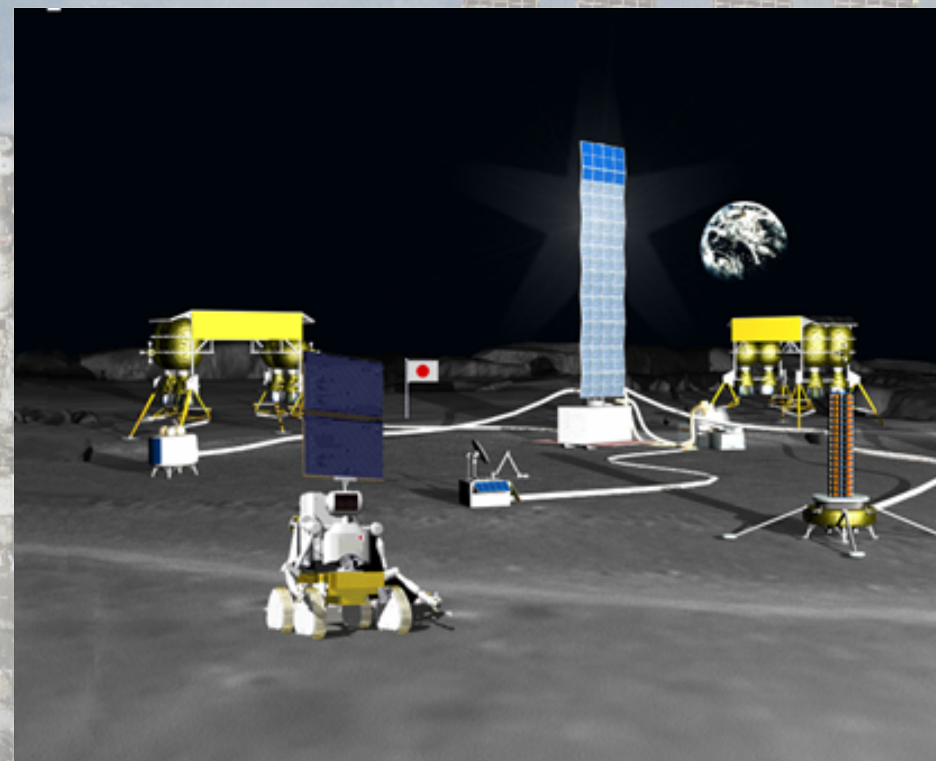
- Unmanned autonomous soft landing with approx. 100m accuracy (first time in the world)
- Lunar night survival demonstration by using solar cell and Li-ion battery (first time in the world)
- Robotic rover exploration on celestial body with gravity (first time in Japan)

Autonomous soft landing

Concept for 2020 Robotic Lunar Exploration
- South Pole Area -

1. Science:

- Precise determination of lunar interior density distribution and core size, and verification of the origin (first time in the world)
- More accurate history of lunar evolution by in-situ analysis and sample return of various lunar rocks created different time and/or from lunar mantle (first time in the world)
- Consideration of announcement of opportunity for lunar surface experiments by offering infrastructure resources (first time in the world)



Schematic image of robotic Exploration base on South Pole area

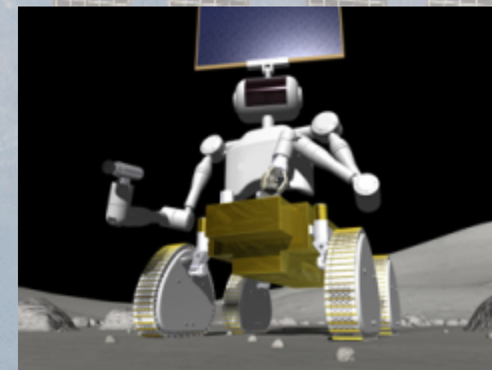
Concept for 2020 Robotic Lunar Exploration - South Pole Area -

2. Technology development:

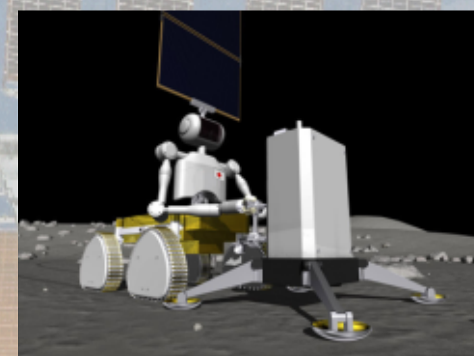
- ☐ Robotic exploration base construction and explorations of surrounding area for a few months and with more than 100km traverse(first time in the world)
- ☐ Long-duration (more than 1 year) power supply by using solar cell, Li-ion battery and regenarative fuel cell (first time in the world)
- ☐ Sample return from a celestial body with gravity (first time in Japan)

3. Utilization:

- ☐ Evaluation of lunar resource utilization by analyzing lunar rock composition, etc. (first time in Japan)



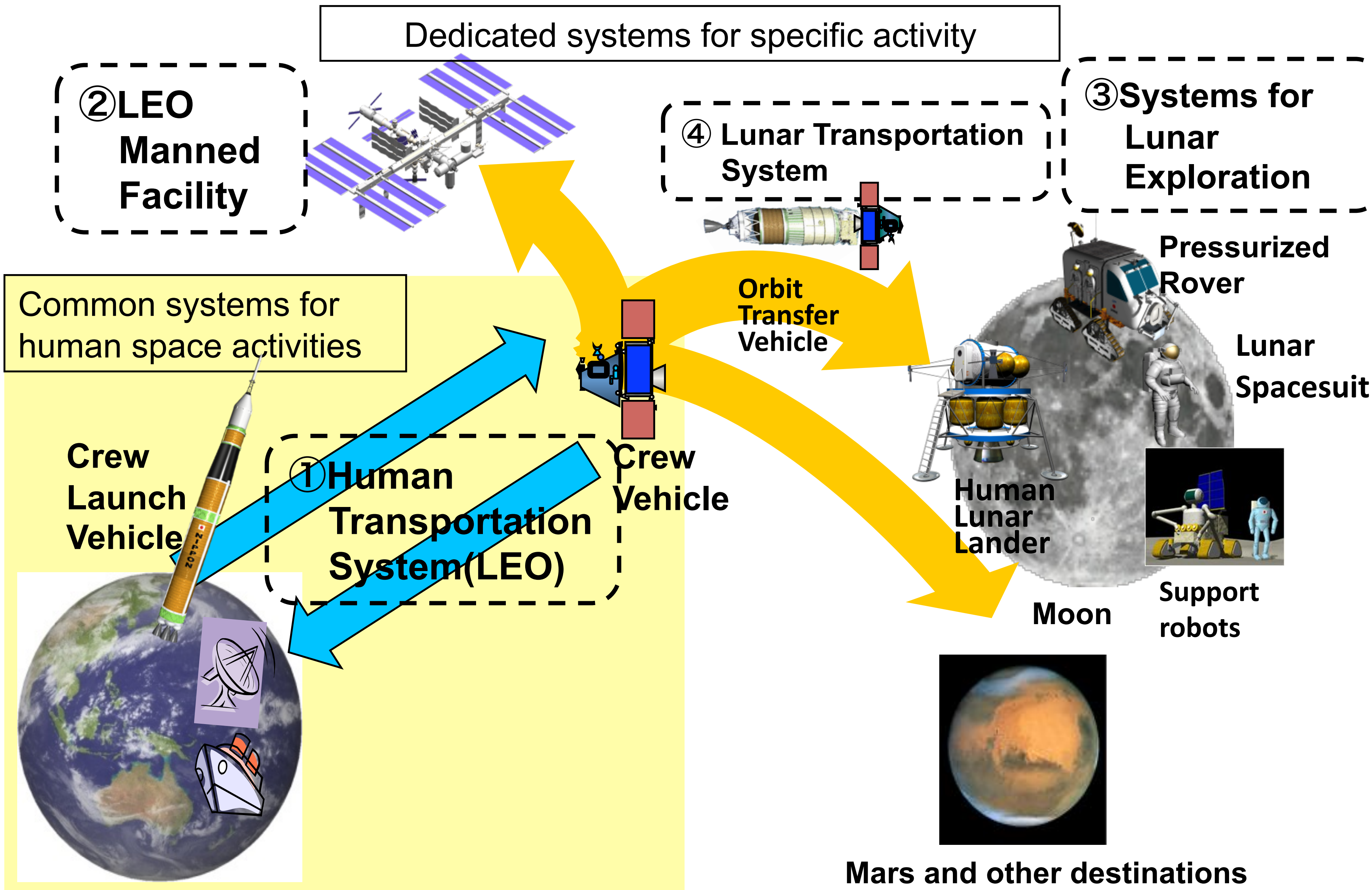
Sampling lunar rocks



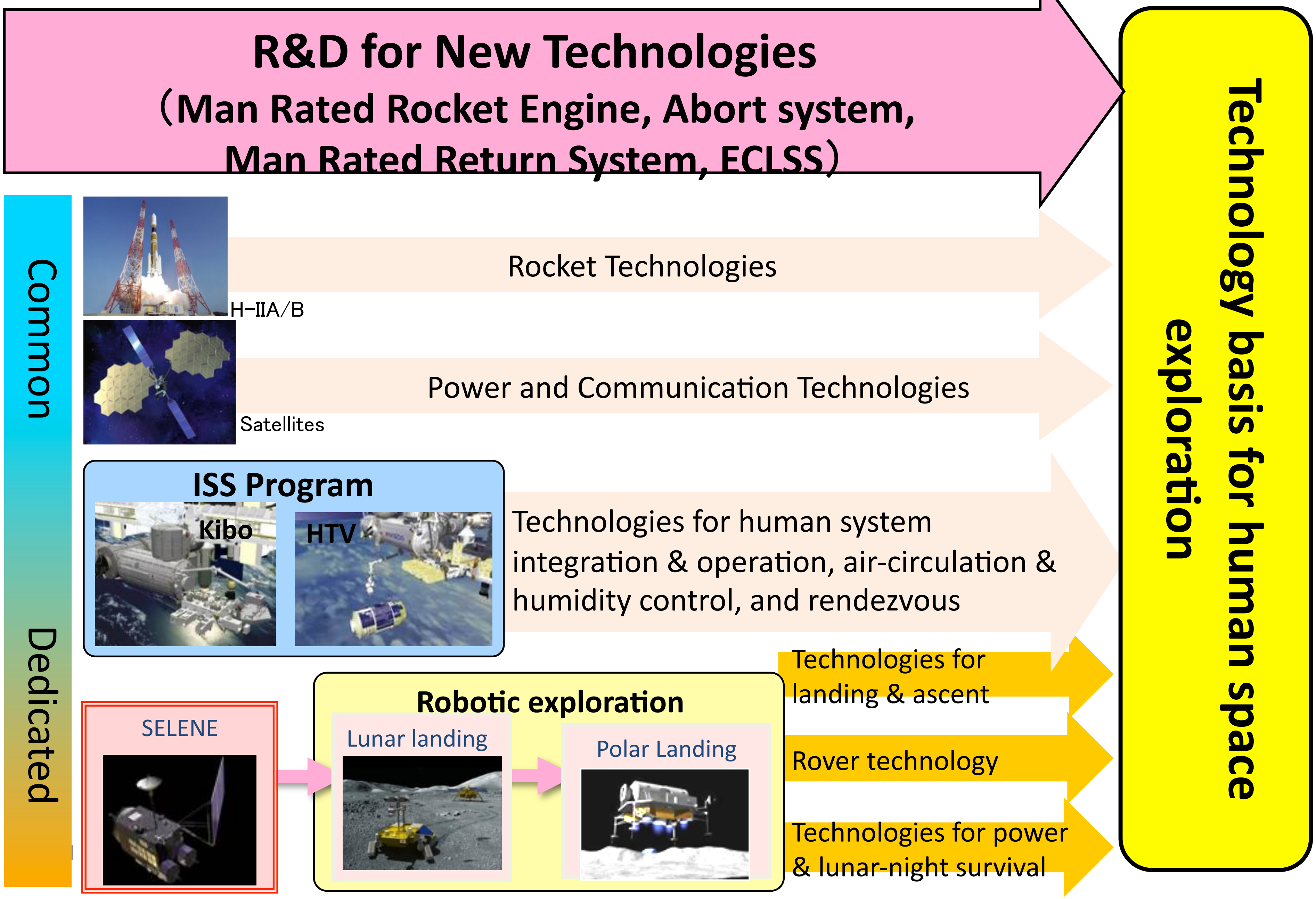
Equipment setting

Sample Return

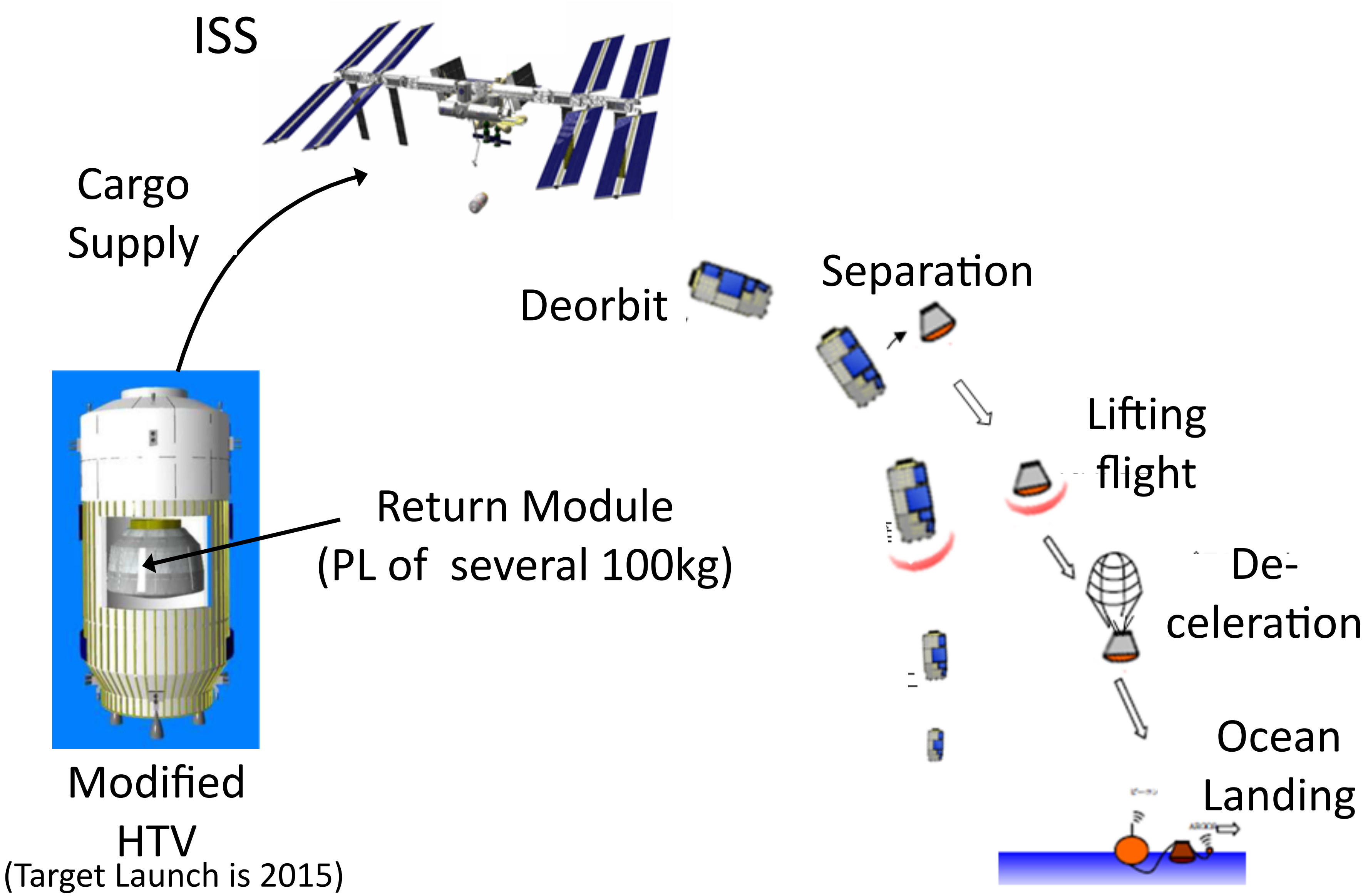
Systems for Human Space Activities



Technology Flow for Human Space Exploration



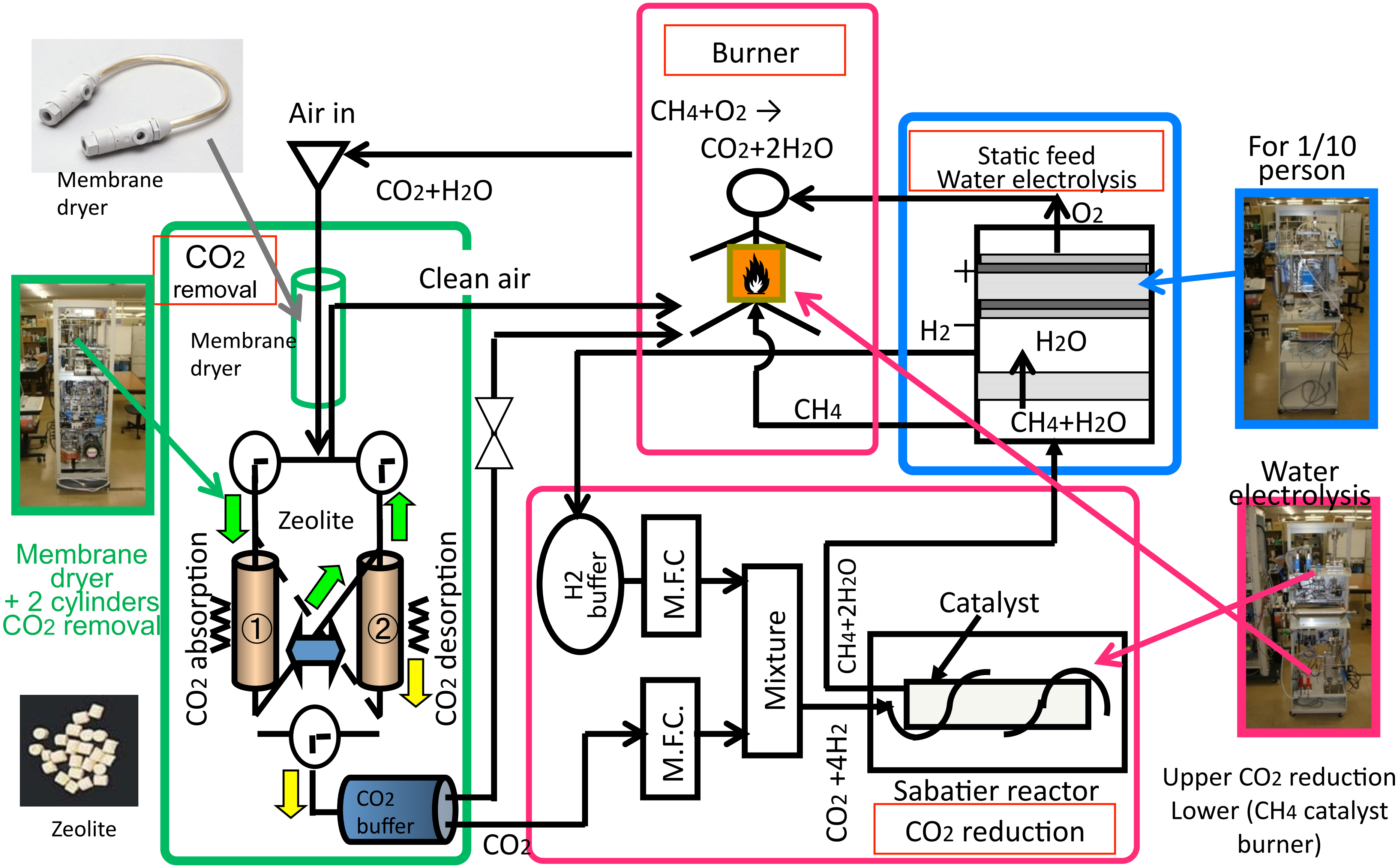
HTV Return Vehicle Concept



JAXA's R & D on ECLSS

M. Sakurai, M. Oguchi, A. Shima, M. Ohnishi
Aerospace Research and Development Directorate
Japan Aerospace Exploration Agency

Air Revitalization



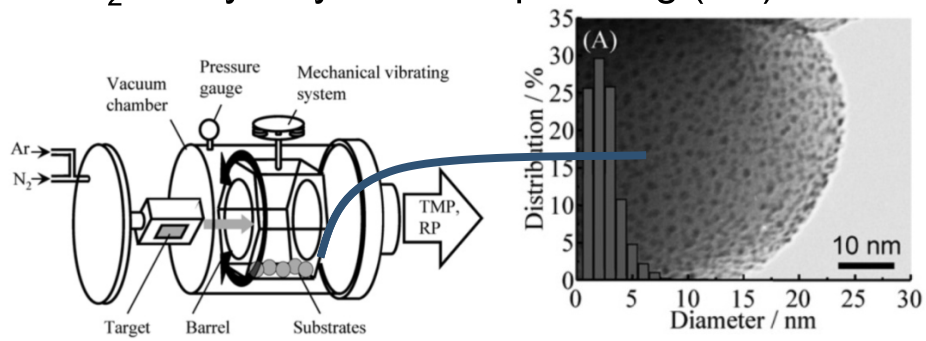
Sabatier Reaction Catalyzed by a Ru/TiO_2 Barrel-Sputtering (BS)-Catalyst

Points of Improving the Sabatier reaction

1.Using TiO_2-supported Ru (Ru/TiO_2) as a catalyst system (stable and high activity)

2.Distributing the smaller Ru nanoparticles on TiO_2 surfaces

〈Ru/TiO_2 catalyst by "Barrel-Sputtering (BS)" method〉



TEM image of the 0.8 wt% Ru/TiO_2 BS-catalyst

✓ High dispersion of Ru nanoparticles

✓ *ca.* 2.5 nm of the mean particle radius

$$CO_2 + 4\,H_2 \xrightarrow[160\ ^\circ C]{\text{BS-catalyst}} CH_4 + 2\,H_2O$$

> 99%

Substantial conversion of CO_2 at low temperatures by the BS-catalyst

T. Abe *et al.* (*Energy Environ. Sci.*, 2009, 2, 315-321.)

Concerns:

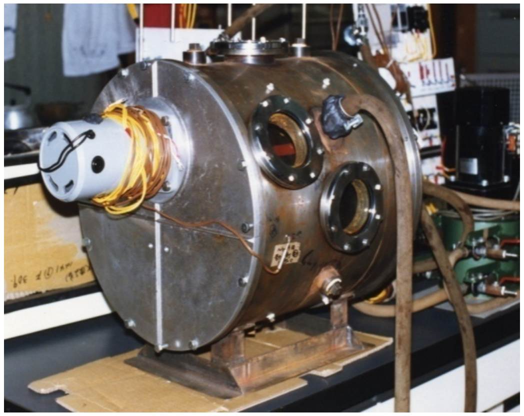
- ✓ Small-scale lab experiments using mixed gases diluted with argon
- ✓ The catalyst made by small customized equipment

Needs for mass-production and evaluation of BS-catalyst for practical use

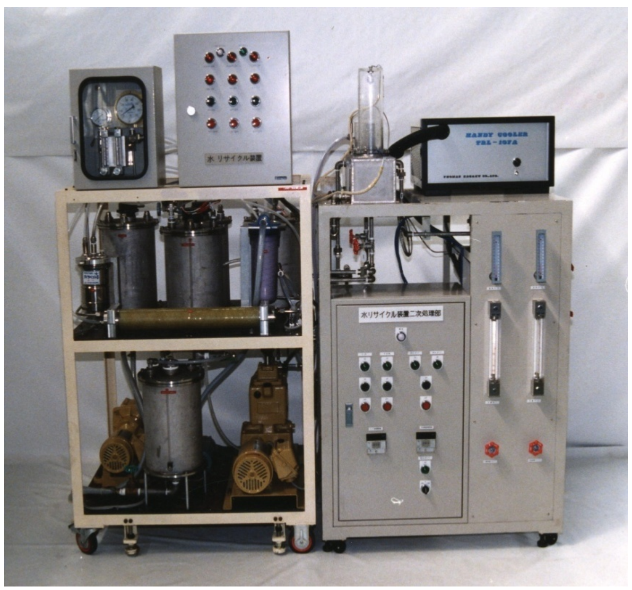
Water Recycling

Development on 2000

- **Recycle rate 60-70%**
- **Low pressure pump (0.4MPa)**



１９８８　JAXA-VCD



Disposal：25L/Day, W1200xD480xH1500
Power supply：3000W

Disposal rate:2ton/day,
W480xD900xH920
Power 400W

Water purifier with a reverse osmosis membrane - technology that has been transferred to the private sector