

Space Research Perspectives from JAXA

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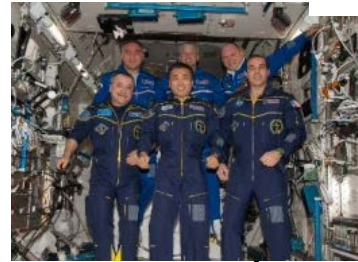
History of JAXA Astronauts' Challenges

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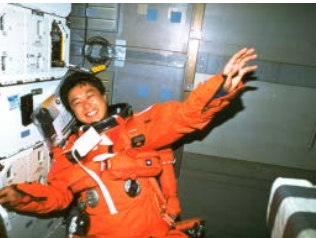
Association of Space Explorers
XXXVIII Planetary Congress
20- 27 September 2015, Sweden



2013-2014:
Wakata assumed
**the first Japanese
ISS Commander**



2009:
First HTV's flight



1997:
Japanese first EVA

1992:
Mohri's first flight on
the Space Shuttle



2008-2009:
Kibo construction



Kibo Construction



2015: Yui's first flight



ONISHI



KANAI

1985:
Mohri, Mukai and Doi were selected as astronauts

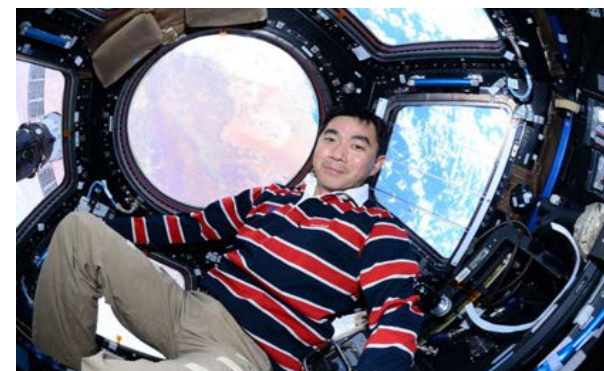


Astronaut Yui's First Spaceflight



Yui Kimiya Expedition 44/45 Crew

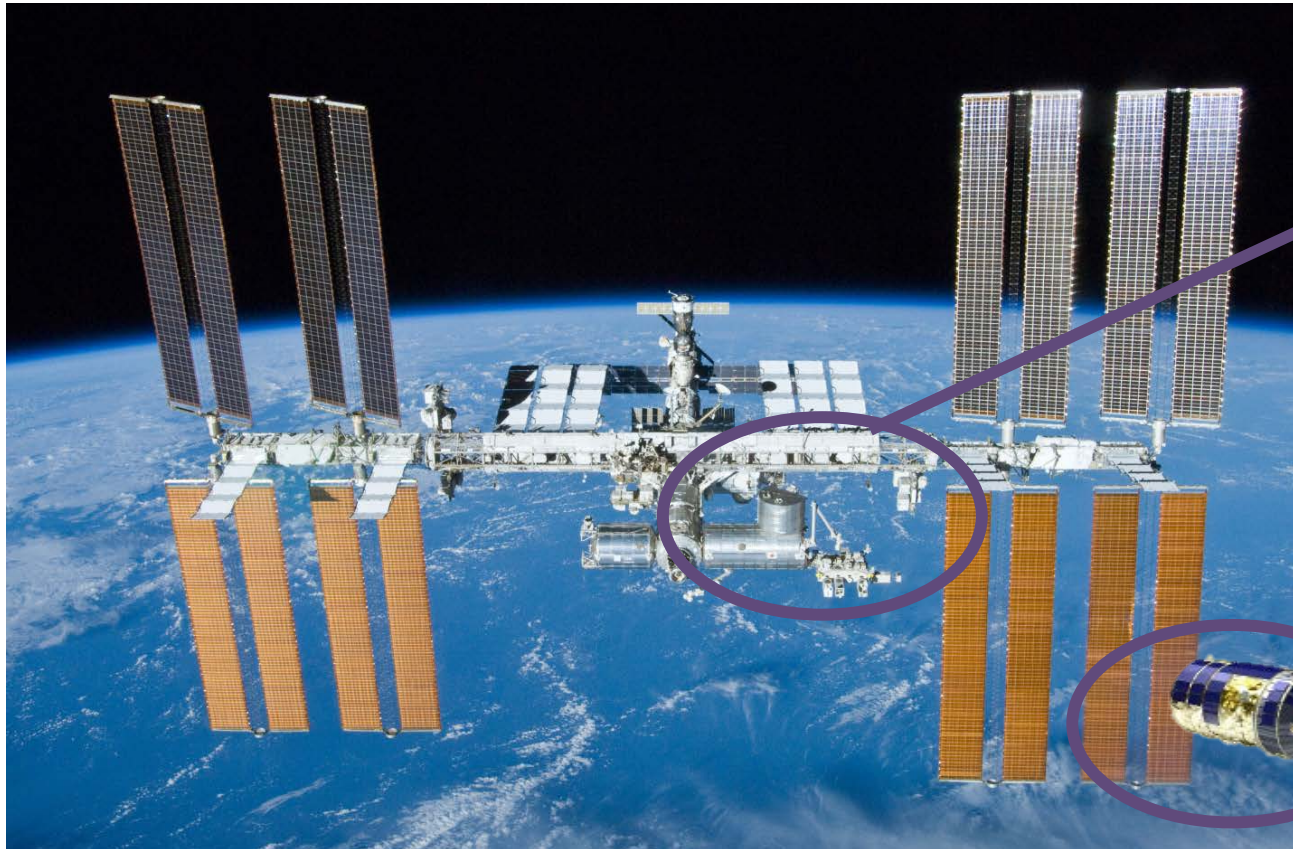
- Chosen to be an astronaut candidate in 2009.
- In 2012, assigned as a crewmember for ISS Expedition 44/45 crewmember.
- Arrived at ISS on 23 July on Soyuz and began 5-month stay.



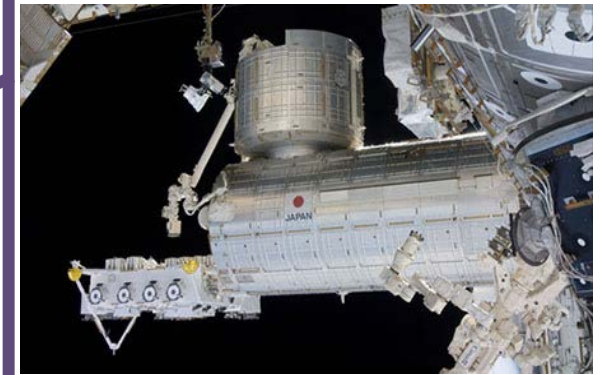
Japan's Achievement in ISS Programme

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Kibo



HTV



- ☐ Kibo and HTVs, making significant contributions in ISS
- ☐ Human space system technologies developed from Shuttle experiments



H-IIIB

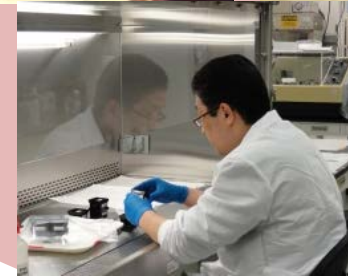
Positive Effects on the Ground

Ground Team



- ☐ Independent operation skills acquired by Ground Team
- ☐ Broadened research fields, and experienced researchers.
- ☐ Space photos and experiments inspiring children

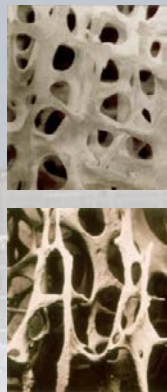
Scientific Research



Space Education



- ❑ 4 Japanese astronauts completed 5 long-duration stays on ISS
- ❑ Various experiments for space medicine, micro-g research and future space exploration



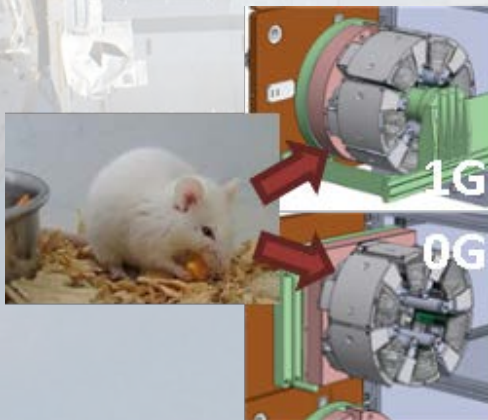
Bisphosphonates



Radiation Dose Measurement



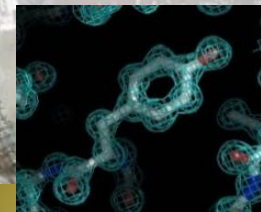
Biological Rhythms



Rodent Research



Protein Crystallization



Small Satellites
Deployment

Japanese Module KIBO

Japanese Experiment Module "Kibo"

- Japan's First Manned Experiment Facility
- About 650 Japanese enterprises joined the Kibo developing project.

Pressurized Section

This storage module is kept at the same air pressure as on ground.



Pressurized Module



In this main facility, various space experiments are conducted.



inside:

Airlock



Way-out of experimental equipment.

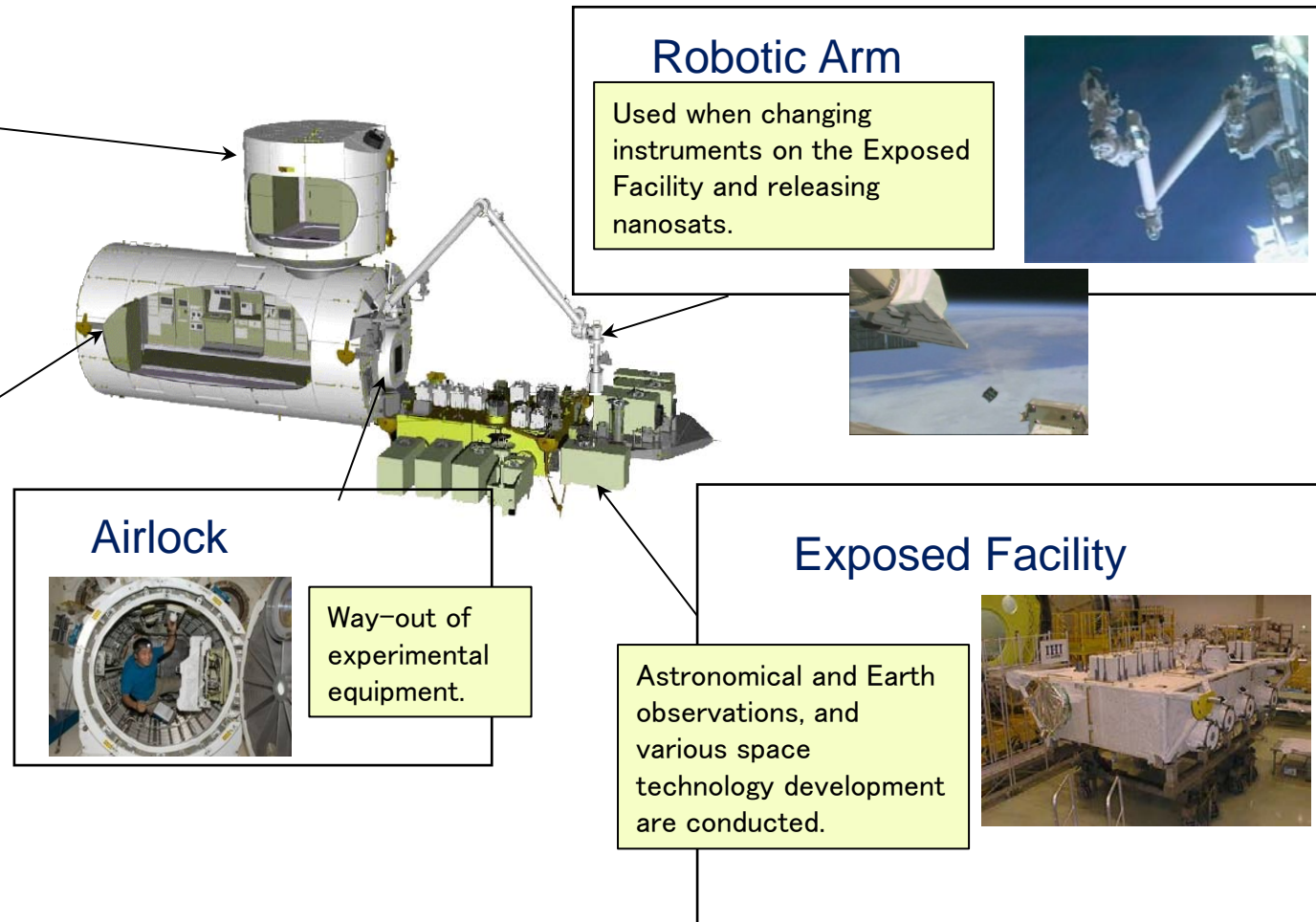
Robotic Arm

Used when changing instruments on the Exposed Facility and releasing nanosats.



Exposed Facility

Astronomical and Earth observations, and various space technology development are conducted.



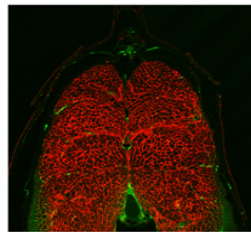
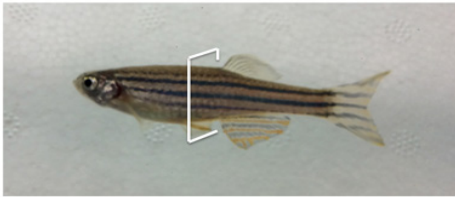
KIBO Utilizations



Zebrafish Muscle

(in-progress)

- Study Zebrafish muscle to find whether muscle atrophy occurs in microgravity, and how the mechanism works.

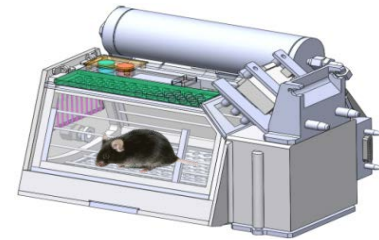


Transgenic Zebrafish and the surface of its muscle

Epigenome Research and Mouse Habitat Unit(MHU)

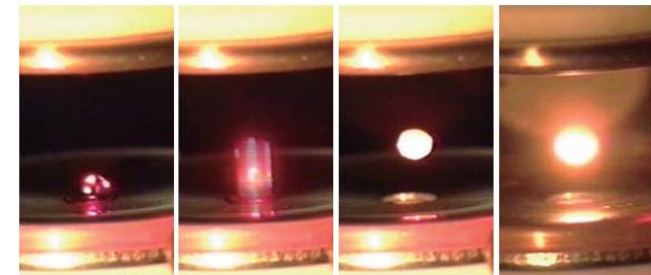
(under development)

- MHU keep mice under μG and 1G environment to investigate the effect of the gravity on gene expression patterns.
- MHU consists of 12 mouse cages with life support, environment control and observation system
- To be launched in 2015.



Electrostatic Levitation Furnace(ELF) (under development)

- ELF can hold the sample's position with electrostatic force and heat it above 2000 degree Celsius using semiconductor laser from four different directions.
- JAXA plans to measure the thermal properties of melted oxides in ISS, which are impossible on ground.
- To be launched in 2015.



levitation of a sample between electrodes and heating up with laser beams

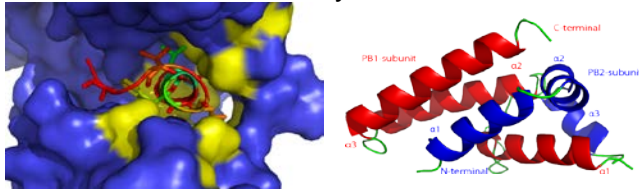
Commercial Usage of Kibo



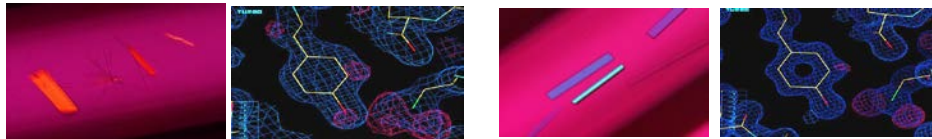
High Quality Protein Crystallization (In-Progress)

- Make high quality protein crystals under microgravity environment.
- Analysis by Japanese synchrotron radiation facility "SPring-8" gives fine protein structure that is useful for designing new medicine.
- Universities and pharmaceutical companies have been joining the research.

Influenza Virus RNA Polymerase



Prostaglandin D Synthase



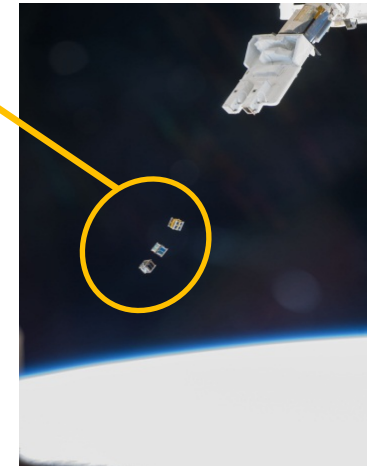
Ground

Space

CubeSat Deployment from Kibo (In-Progress)

- CubeSat deployment with JEM Small Satellite Orbital Deployer (J-SSOD), for commercial usage.
- Both domestic and international commercial users.
- Brazilian CubeSat was deployed in early 2015.

(Right) Deployed CubeSat
(Below) Vietnamese CubeSat
"PicoDragon"



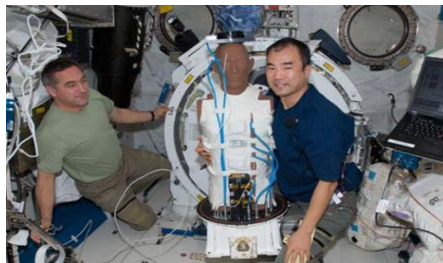
Preparing for Future Exploration

Radiation Measurement (in-progress)

- Measure radiation doses on ISS using “PADLES”, compact battery-less radiation dosimeter package and analysis system
- Joint research with ROSCOSMOS Matroshka-R



PADLES



Matroshka-R experience in Kibo. PADLES and other active radiation dosimeters are built in a Phantom.

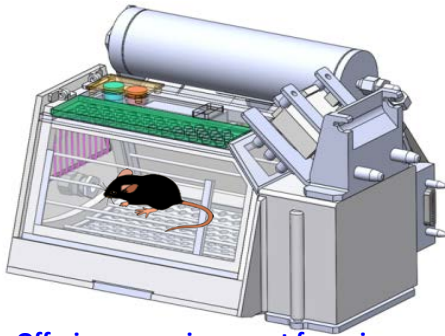
Environmental Control and Life Support System (ECLSS)

(under development)

- Water Recovery System:
 - Full scale model in ground test.
 - Subscale model in flight model development for flight.
 - Scheduled for launch by 2016.
- Air-Recycling System:
 - Applies a low-temperature reactor in CO₂ deoxidization and water electrolysis.
 - Flight test of oxygen generation assembly on ISS is planned.

Astronaut Yui's Experiments Onboard

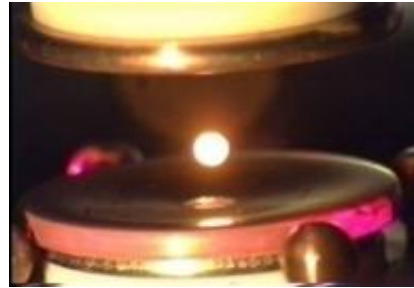
Utilization onboard "KIBO"



Offering an environment for aging mechanism research & experiments related to diseases and treatment

Breeding and experimental device for small animals

The small animal breeding device helps to obtain correlational life information between accelerated aging under microgravity and diseases on earth, by utilizing the space-specific acceleration of biological effects similar to those on the elderly on earth, and its application to research on diseases and new drugs.

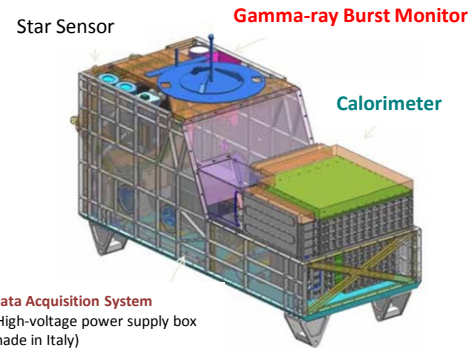


Property research on high melting point materials with industrially high added values

Electrostatic Levitation Furnace (ELF)

The Electrostatic Levitation Furnace (ELF) is the world's only furnace that can handle various materials ranging from metals to insulators and measure the thermal data of unknown high temperature melts over 2000°C. The device will help to create new-function materials through microgravity-specific and container-less deep supercooling.

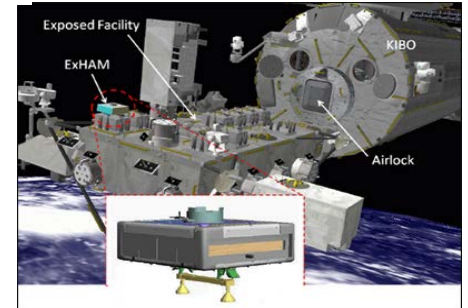
Outboard utilization



Discovery of dark matter and elucidation of the origin of cosmic rays with a cutting-edge detector

High-energy cosmic-ray observation equipment (CALET)

The CALorimetric Electron Telescope (CALET) realizes the first long-term observation of high-energy cosmic rays in history, and contributes to studies about the origin of cosmic rays and the observation of "dark matter."



Quality assurance of space equipment materials (Qualified by "KIBO")

Exposed Experiment Handrail Attachment Mechanism (ExHAM)

The Exposed Experiment Handrail Attachment Mechanism (ExHAM) offers an environment for demonstrating the durability of space equipment materials in order to help develop internationally competitive materials for space.

Contribution to national science & technology strategies and policies
Acquisition of space utilization technology and enhancement of industrial competitiveness

Expansion & full-scale space utilization by private companies