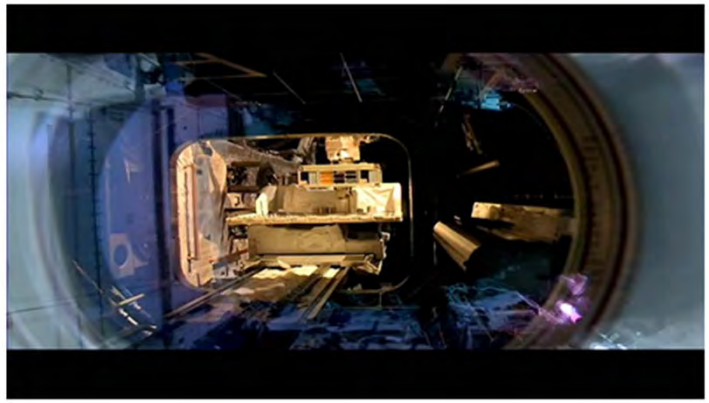
Kibo Exposure Experiments

（ExHAM: Exposed Experiment Handrail Attachment Mechanism)



APRSAF-22nd Kibo-ABC

Dec. 2015

Hideyuki Watanabe

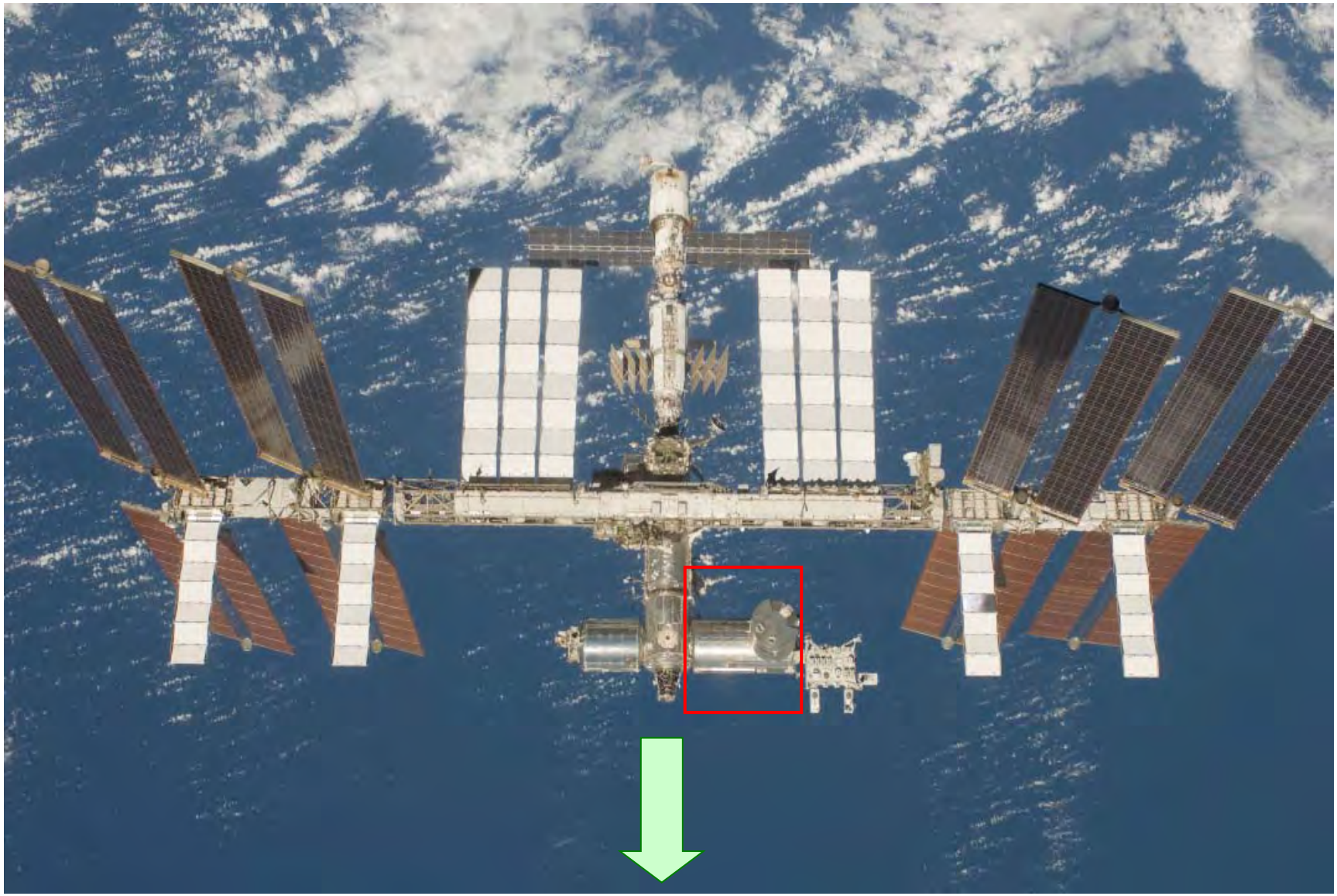
JEM Mission Operation and Integration Center

Human Spaceflight Technology Directorate, JAXA

NEW Exposure Experimental Device

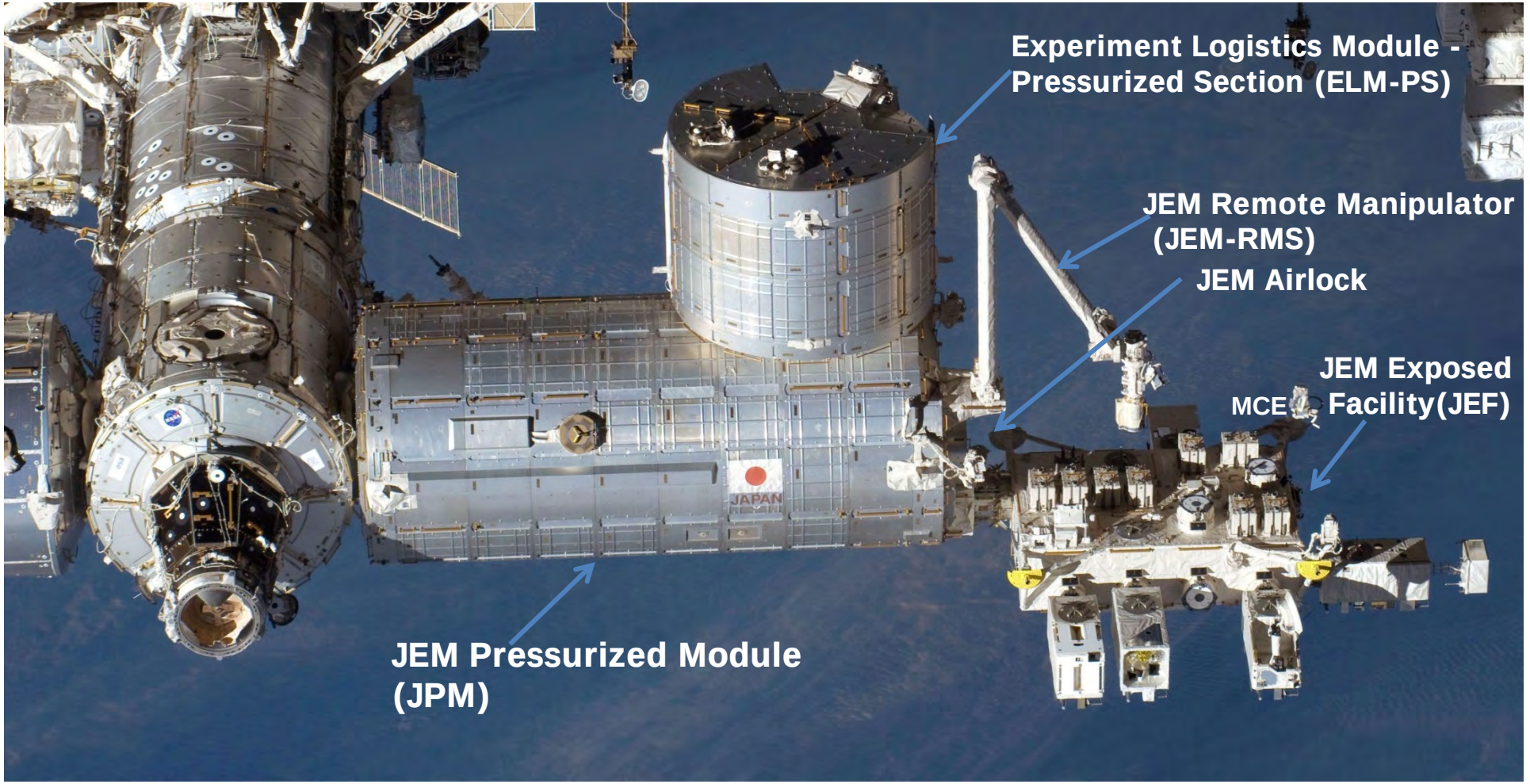
ExHAM

INTERNATIONAL SPACE STATION OVERVIEW



Kibo pressurized module

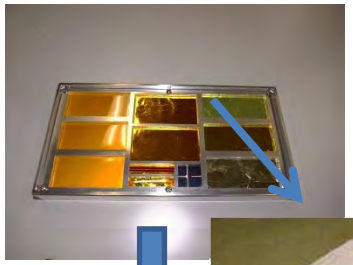
JEM "Kibo" Laboratory



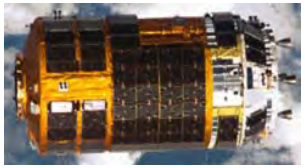
Mission Steps

JMX-2015432

1)Launch



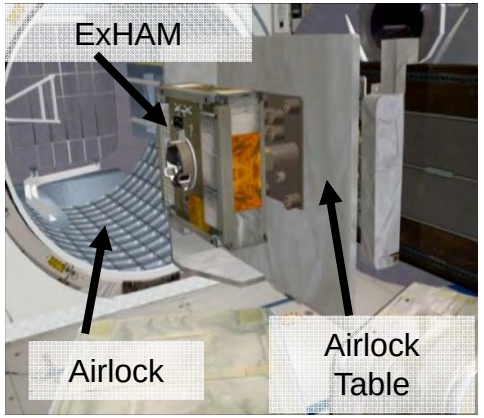
Mission Samples



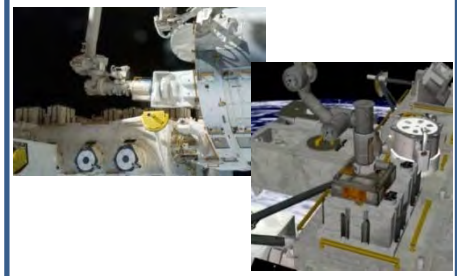
HTV

H-IIB

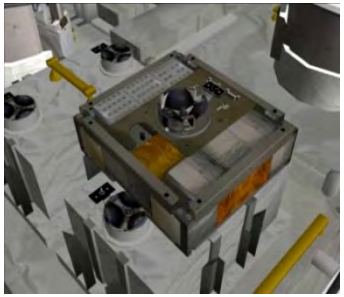
2)Installation to ExHAM



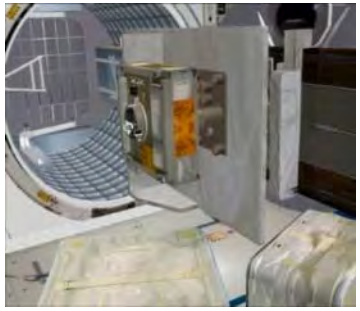
3)Installation to Handhold by JEMRMS



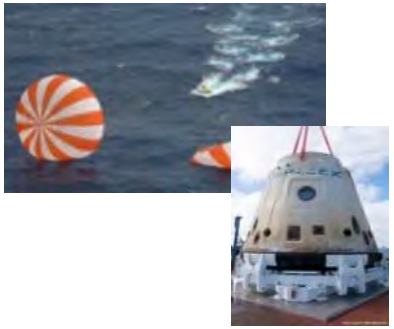
4)Exposure Experiment for a few month or a few years



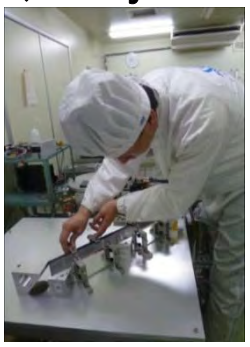
5)Retrieval into Kibo pressurized section



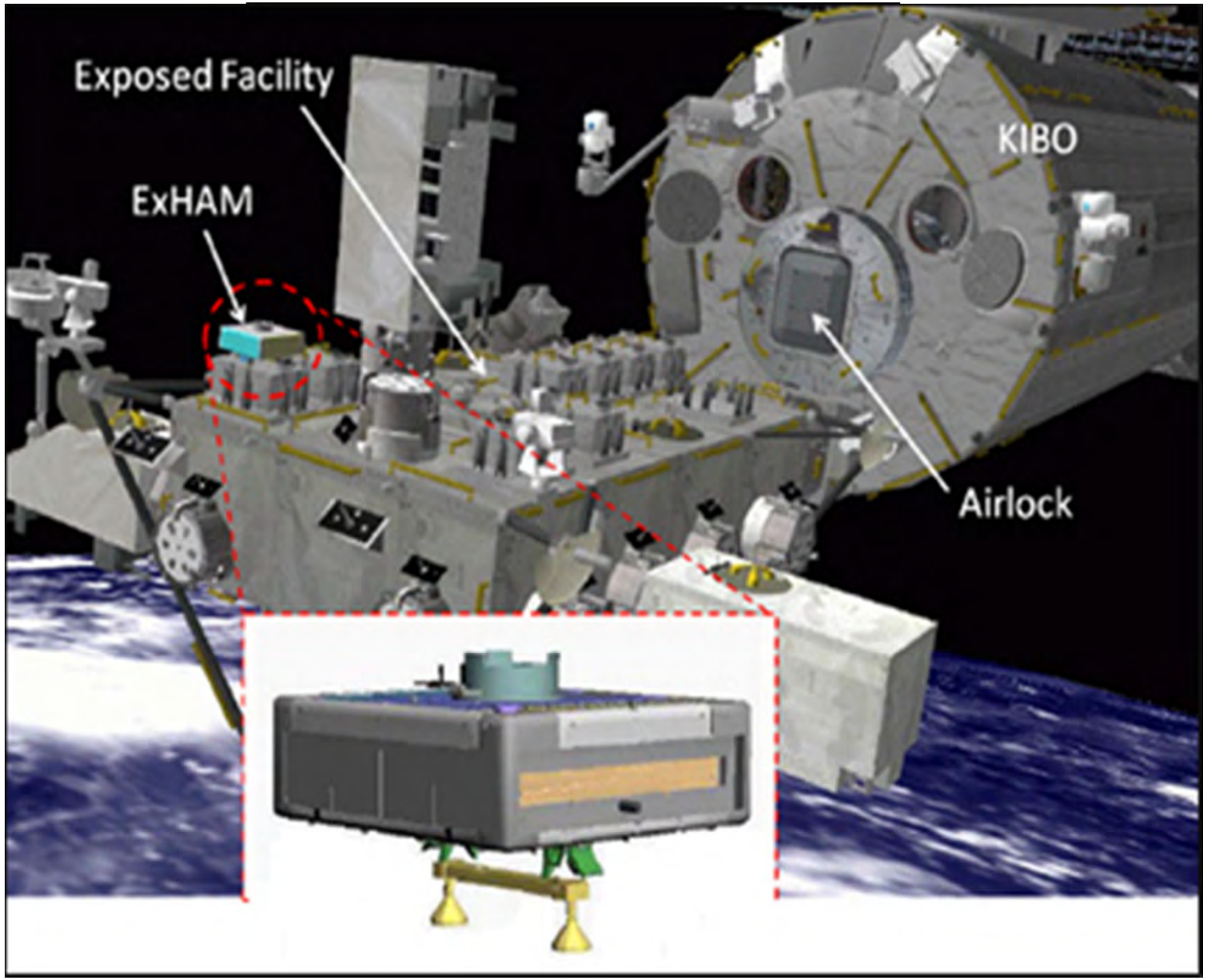
6)Return to the ground



7)Analysis

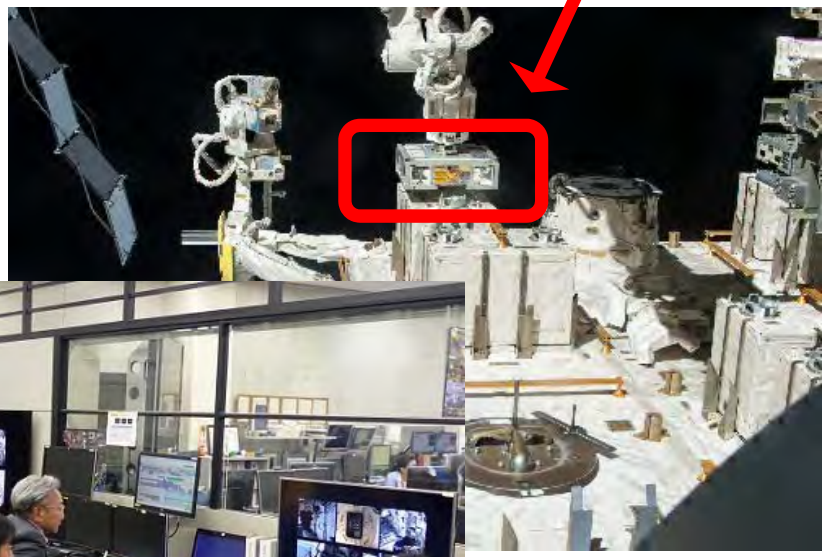


What is ExHAM ?



NEW Exposure Experiments start at Kibo/ISS 2015

(Movie)



ExHAM feature

ExHAM feature

◆**ExHAM provides easier and more frequent opportunities for small sized technical demonstrations or experiments.**

◆**Examples**

- **Material exposure**
- **Capture of space debris/aerosols**
- **Small device test**

ExHAM feature

- **New concept experiment tool. ExHAM**
- **What is ExHAM？**
  - **ExHAM is “Exposed experiment Handrail Attachment Mechanism”**
  - **Deploy small sized samples on the Exposed area of Kibo outside the cabin area.**
- **How to use ？**
  - **Prepare your samples on the ExHAM inside the ISS.**
  - **Transfer ExHAM with the samples to the exposed area through the JEM airlock**
  - **Install it to the handrail on JEM exterior by the JEMRMS small fine arm.**

Steps for satellites development

ExHAM help you in this phase.

Material development & verification

Paint, Polyimide, Kapton, OSR(*)
(for the satellite surface)

PEEK, CFRP
(for satellite structure)

CFRP
(for satellite Antenna)

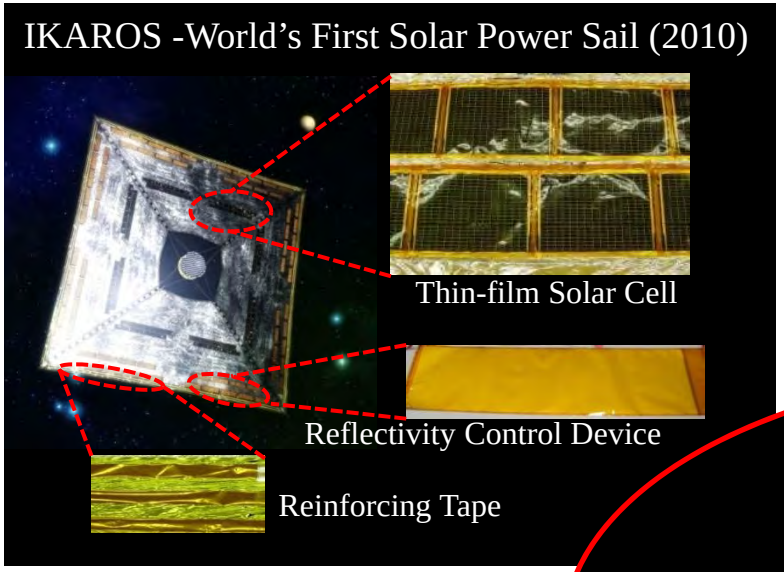
Component Development

Satellite System Integration

(* : Optical Solar Reflector)

Mission Example

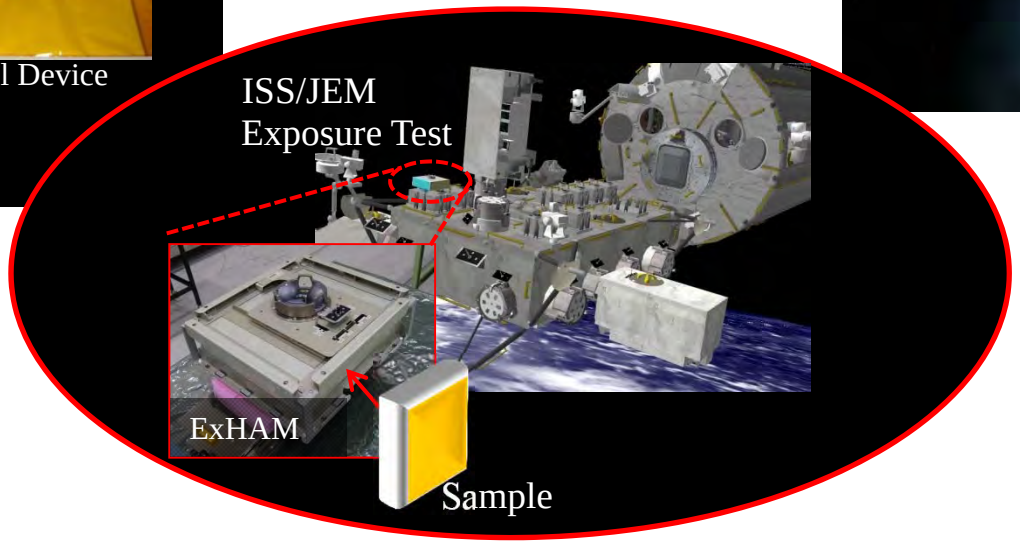
【Mission Example : Solar Sail】
Space Environment Exposure Test of Functional Thin Film Devices for Future Solar Sail Mission



Solar Power Sail

A novel spacecraft with hybrid propulsion of large-area solar sail and electric propulsion driven by thin-film solar cells on the sail.

Contribute to the design of future space missions



Compare the data of IKAROS with a sample exposure & return experiment

This experiment evaluates the effects of space environment exposure on thin film solar cells and other functional thin-film devices which constitute "solar power sail" proposed for future deep space exploration. By comparing with the flight data of the world's solar power sail demonstrator "IKAROS", the results of evaluation of the recovered samples will contribute to the development of functional thin film devices for future space missions.

【Mission　Example : CFRP Mirror】
Space Environmental Testing of Lightweight and High-Precision Carbon Composite Mirrors


Carbon Composite Mirror (Sample)

Four type of carbon composite mirrors:

1) Aluminum vapor deposition surface type
2) Aluminum vapor deposition surface with four-divided combination
3) Aluminum adhesion surface type
4) Aluminum thermal spraying surface type

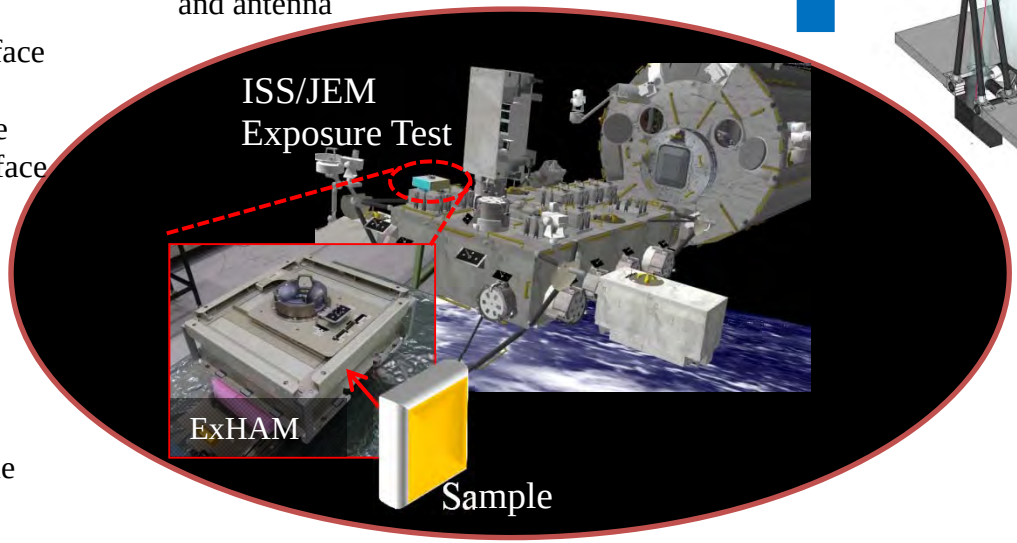
Compare the data of ground environmental tests with a sample exposure & return experiment

<u>Carbon Composite Mirror</u>

Lightweight and high-precision CFRP replicated mirrors will contribute to development of the antennas and telescopes of next generation‘s astronomical and earth observation satellites. Most importantly, carbon fiber composites can be designed with near zero CTE(Coefficient of thermal expansion).

Contribute to the lightweight and high-precision design of future space telescopes and antenna

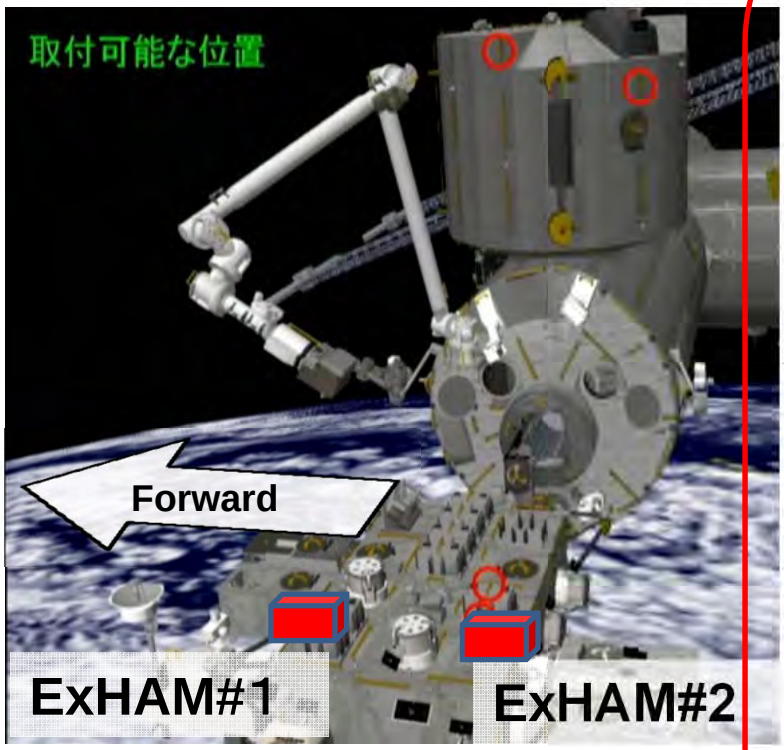
Future Mission : Submillimeter-wave atmospheric emission sounder for the future Japanese mars exploration orbiter

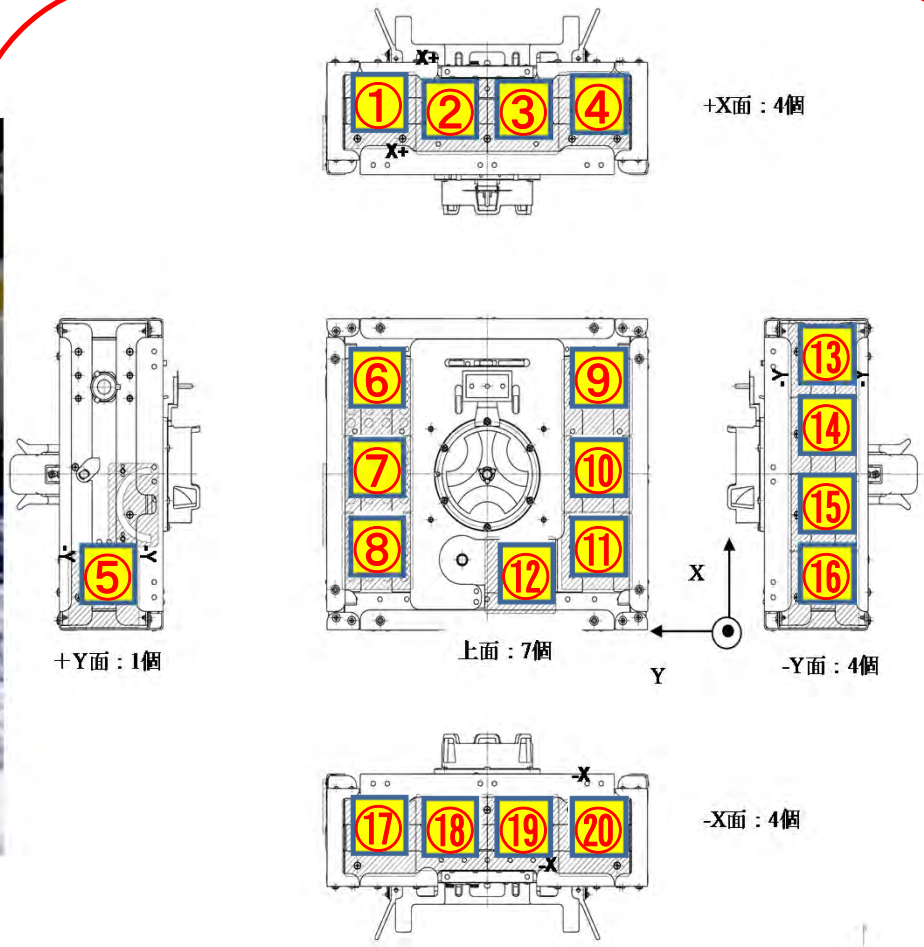


This experiment studies the deterioration and the long-term effect of the CFRP replicated mirrors when they are exposed to the complex space environment. In order to realize the lightweight and high-precision CFRP replicated mirrors applicable in the wavelengths from submillimeter to optical in space, it is necessary to be exposed over a long period in space, to determine the degradation and stability of the material.

Available Section for your experiment

Sample Installation to ExHAM



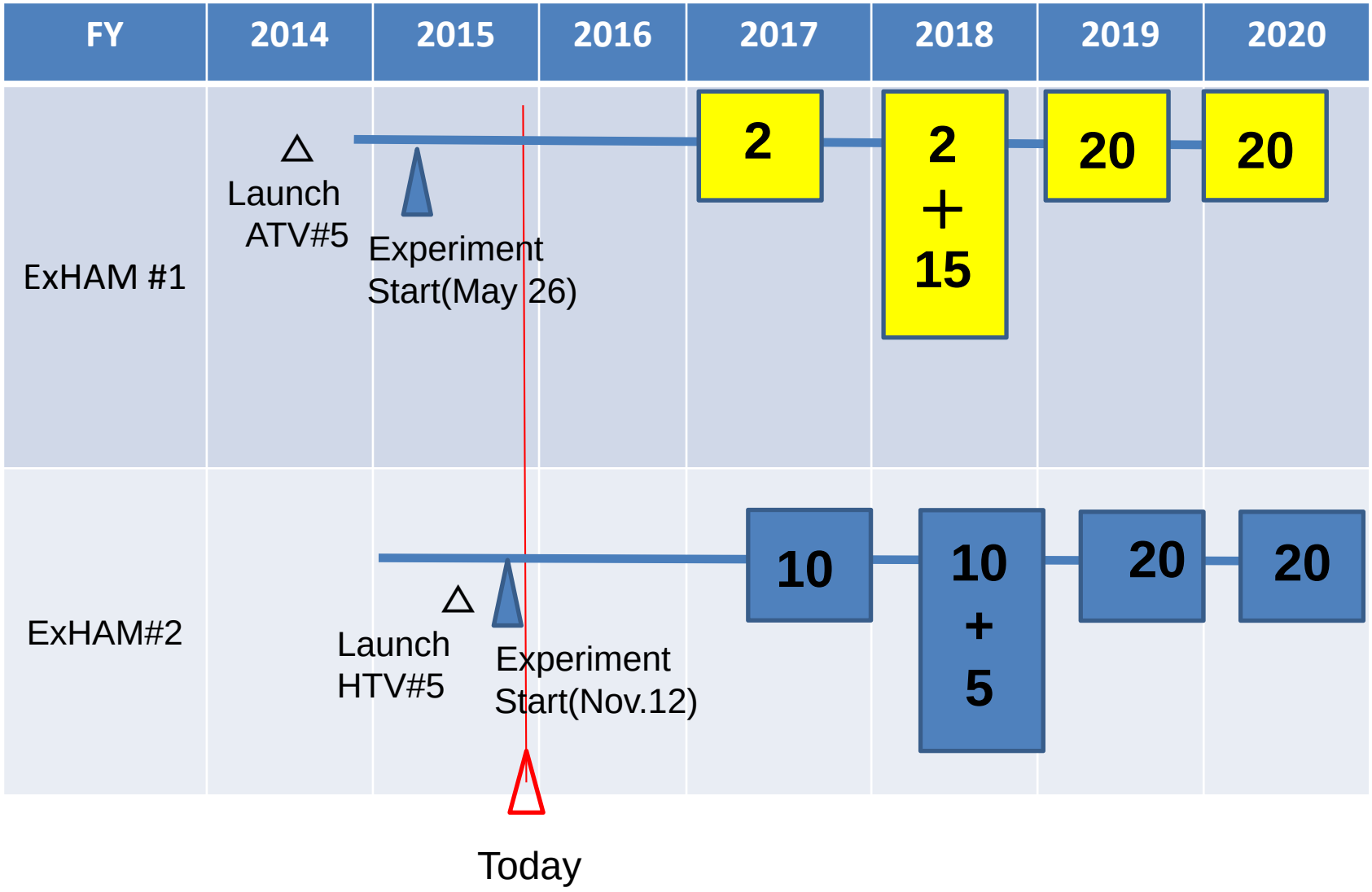


The sample Location(20sect.)

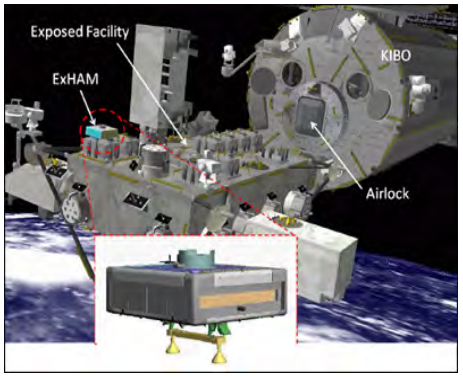
16

Available Section for future themes(2/2)

The number of available sections is below.
To be coordinated with other investigator.



Schedule Template



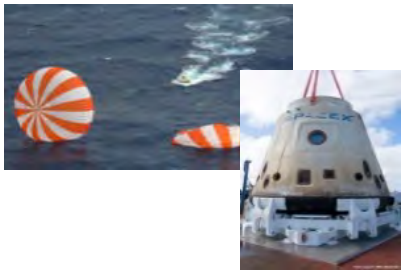
about 1 month

a few months, 1year,2years depend on the plan

about 1 month

Exposure start

Exposure complete



Manufacturing 6months depend on your sample

3~6 months depend on vehicle

2~3months

Manufacturing Start

H/O

Launch

Return to the ground

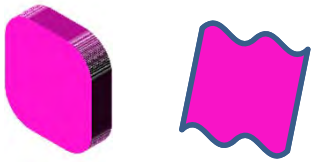
H/O

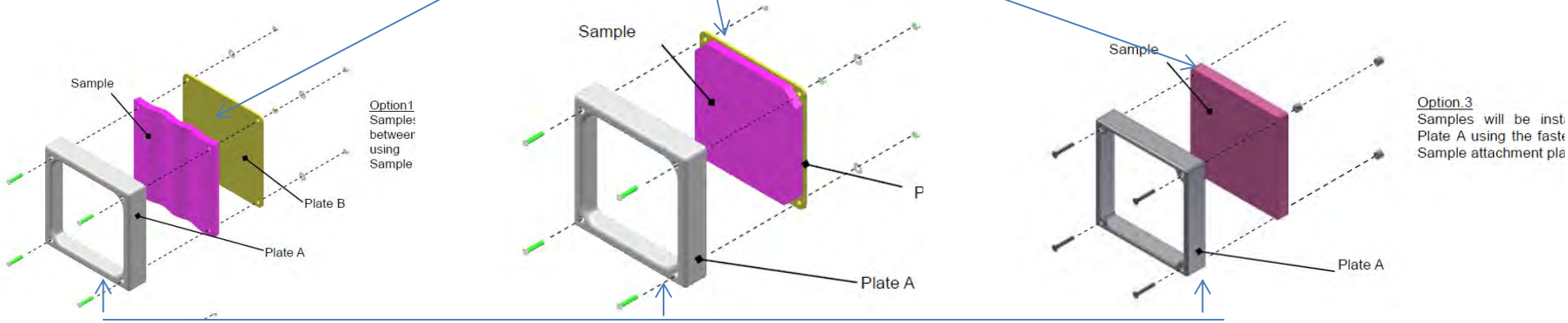
Back up chart

More flexibilities in Sample Preparation

If your sample is not solid, JAXA attachment plate is available for you.

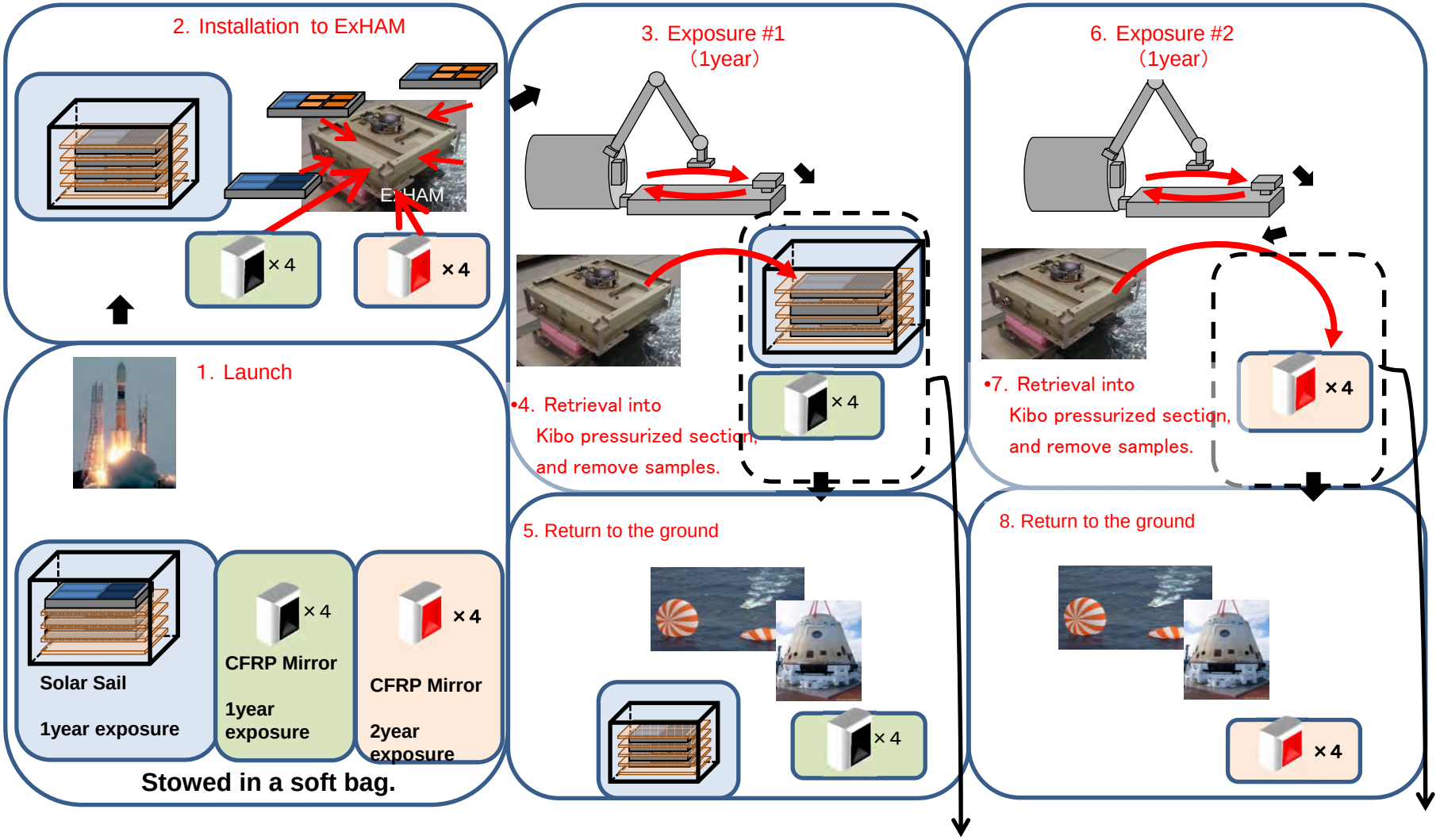
All you have to prepare is just a material.
Free shape is acceptable by using the attachment plate.



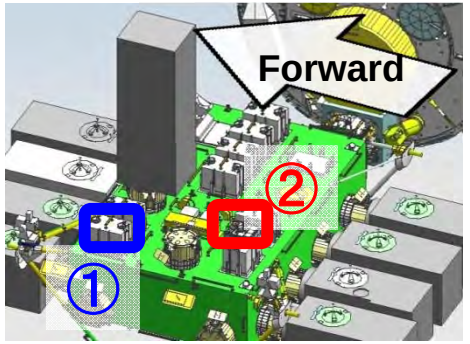


JAXA attachment plate

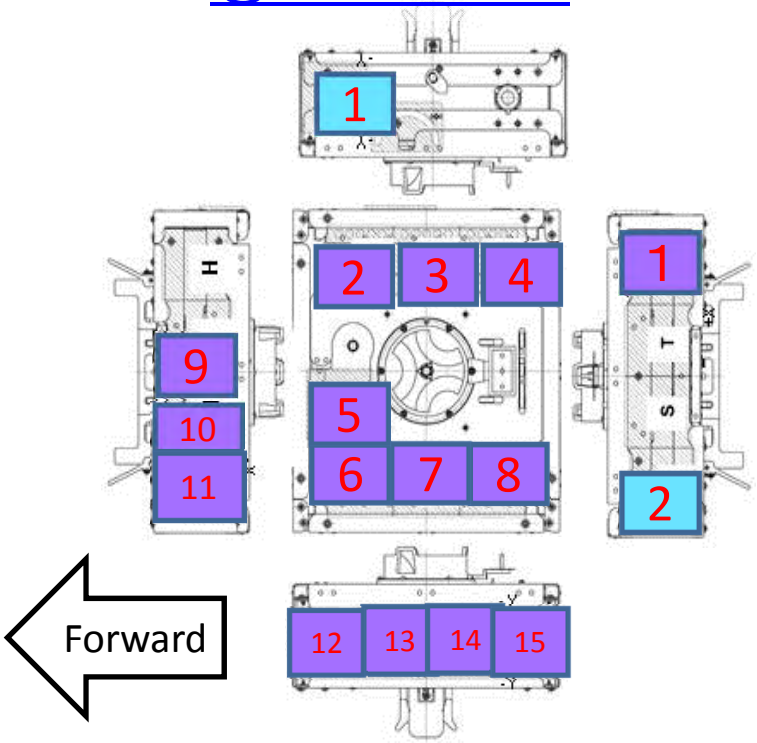
Consolidated experiments Scenario Overview JMX-2015432



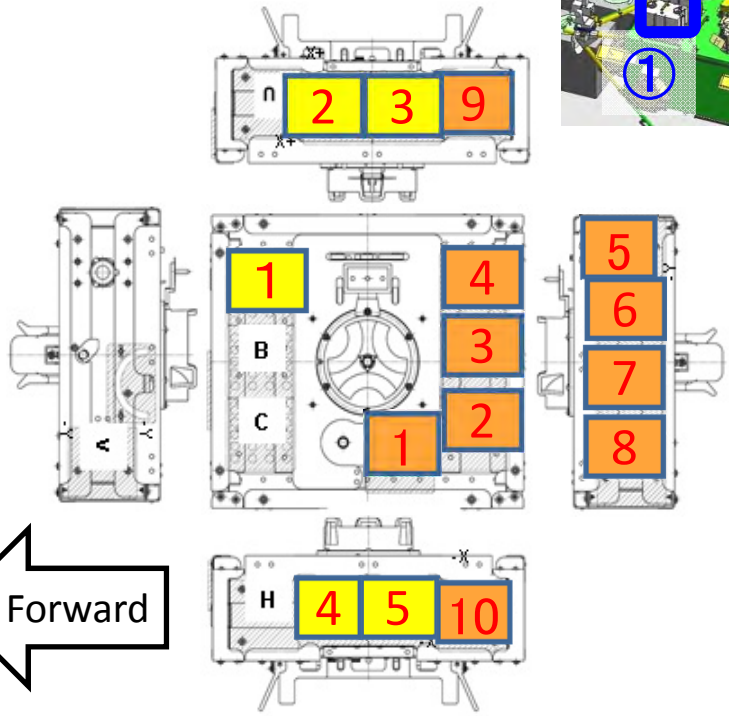
Available Section for future themes(1/2)



①ExHAM#1



②ExHAM#2



①ExHAM#1		②ExHAM#2
	Available after 2016 fall	
1 ~ 2	Available after 2017 spring	
	Available after 2017 fall	1 ~ 13
+ 1 ~ 15	Available after 2018 spring	
	Available after 2018 fall	+ 1 ~ 5