KIBO Utilization Scenarios toward 2020

Japan Aerospace Exploration Agency

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- JAXA has defined its Kibo Utilization scenarios toward 2020,
  - ✓ to obtain ISS/Kibo utilization results which have major impacts on science technology, industry, and society,
  - ✓ to make Kibo fully utilized in efficient manner.

- Kibo Utilization scenarios scope research areas in the fields of "life science", "space medicine", and "physical science“ to be performed in Kibo pressurized module (PM) toward 2020.

- The scenarios summarize prioritized areas and goals for each research field according to the view points as follows;
  1. Forefront scientific research only enabled by ISS/Kibo,
  2. Fundamental research and development for the future space activities.

Prioritized goals in the field of Life Science

Prioritized Goal 1

Integrative comprehension of adaptation process by living organisms to the space environment

Prioritized Goal 2

Building-up scientific knowledge bases to expand human activity into space

Prioritized targets corresponding to model organisms

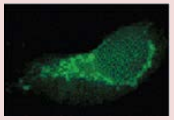
Plants

Fundamental research on plant utilization in space

Microorganisms

Research on microbial involvement in human space activities

Cells



Observation of Intracellular dynamics in space and genome-wide analysis

Vertebrates (fish)

Integrative understanding of space environmental and long-term effects

Mammals

Integrative research on space environmental effects aiming application in human

Cross-cutting fields

- **Gravitational biology:** Elucidation of gravity sensing and responding mechanisms
- **Radiation biology**: Biological effects of space radiation environment inside the pressurized module

Prioritized goals in the field of Space Medicine

◆Prioritized Goals of Space Medicine

■ Goal1：Space medicine research to improve health care technologies of astronauts.

■ Goal 2：Space biomedical research to elucidate fundamental mechanisms of the effects of space flight on humans and animals

◆ Prioritized Research Areas and Critical issues

(1) Physiological Countermeasure

- Countermeasures to prevent bone loss and metabolic disorder of bone mineral
- Monitoring & countermeasure to sleep and biological rhythms
- Evaluation & preventive countermeasure to muscle atrophy

- Mechanism clarification & preventive measures to bone loss and muscle atrophy
- Space environmental stress responses in cardio-vascular, neuro-vestibular, and immune systems
- Multi-generation effects of space flight by use of model animals (medaka fish, mouse, rat)

(2) Psychological Support

- Monitoring/ countermeasure of Stress/Fatigue

(4) Space Environmental medicine

- Monitoring of water, air, microorganism, and noise & work environmental management

(5) Space Telemedicine

- Bio-monitoring & Disease prevention

(3)Health Care against Space Radiation

- Advanced space radiation dose monitoring technology

- Dose assessment of low-dose, long-duration space radiation exposure & Development of bio-marker
- Prevention & protection of biological effects from space radiation exposure

Prioritized areas in the field of Physical Science

◆ Precondition to identify prioritized areas

1. **Scientific areas most academically significant or social spillover is expected, as well as the systems are most notably and significantly affected by gravity.**
2. **Placing priority on new research areas where space experiments have not been sufficiently conducted.**
3. **It is not necessary for experiment themes to be connected with the existing facilities in setting priority areas.**

◆ Prioritized areas

Guideline 1:Forefront scientific research only enabled by ISS/Kibo

- Long-term issues
  - ✓ Contribution to new combustion technology for mitigating environmental loads.
  - ✓ Science and technology of bubbles, droplets and films.
  - ✓ Equilibrium and non-equilibrium phenomena under extreme and plasma environments.
- Short-term issues
  - ✓ Producing new materials from super cooled phase by container-less processing.
  - ✓ Survey of useful soft matter to society.

Guideline 2: Fundamental research and development for the future space activities

- ✓ Fundamental research for international fire safety standard in space.