KARI's Activities in 2015 for Space Environment Utilization Research

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The 6th Korean Microgravity Society Spring Conference (April 2015)

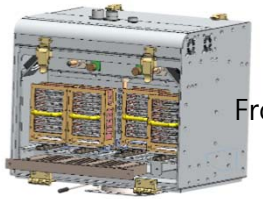
- Date/venue : April 16th~17th, 2015 / Daejeon in Korea
- Attendee :
  - Organizer : Korean Microgravity Society(KMS) with support of KARI
  - Around 70 persons attended
- Contents
  - Around 34 presentation in Planetary Lecture, Oral Presentation, and Student Poster Session as the following field:
    - Life Science and Bioengineering
    - Combustion Science and Microgravity Applications
    - Material Science and Electrostatic Levitation
    - Facilities and Techniques of Microgravity Experiments
    - Ground-based Microgravity Research

The 12th Korea-Japan Joint Seminar on SEU Research (Oct. 2014)

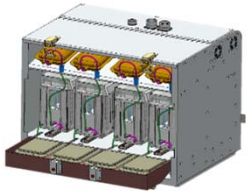
- Date/venue : October 20th~21st, 2015 / Yonsei University(Incheon Songdo, International Campus) in Korea
- Attendee :
  - Universities, Research institutes, Private industries, etc. from Korea and Japan
  - Around 35 persons attended
- Contents
  - 17 presentations in the field of space program introduction, life science, molecular & biomedical engineering, material science, combustion science etc.

International Cooperation: ISS Utilization Joint Mission with JAXA - History

Next step preperation for joint mission !



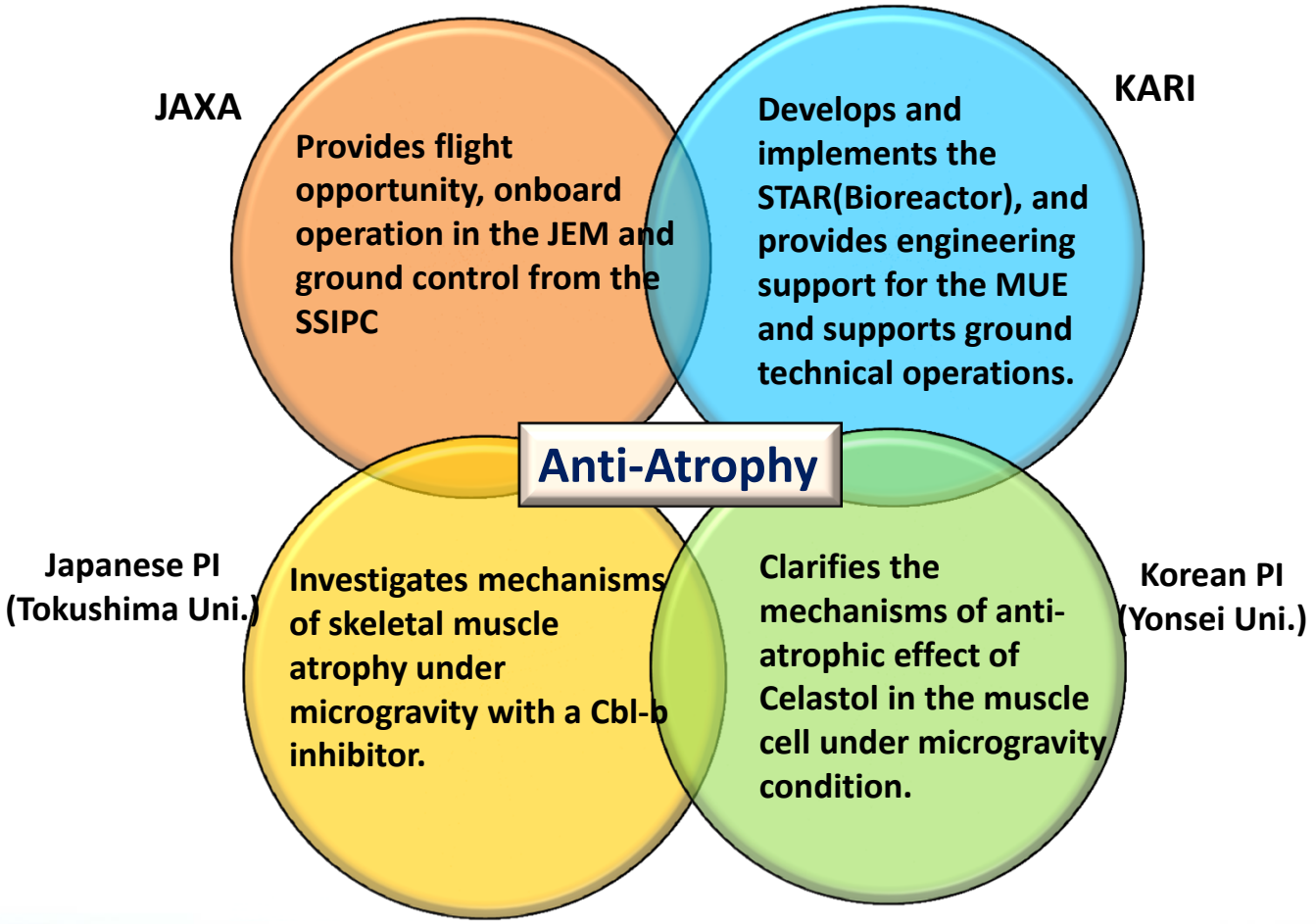
Front



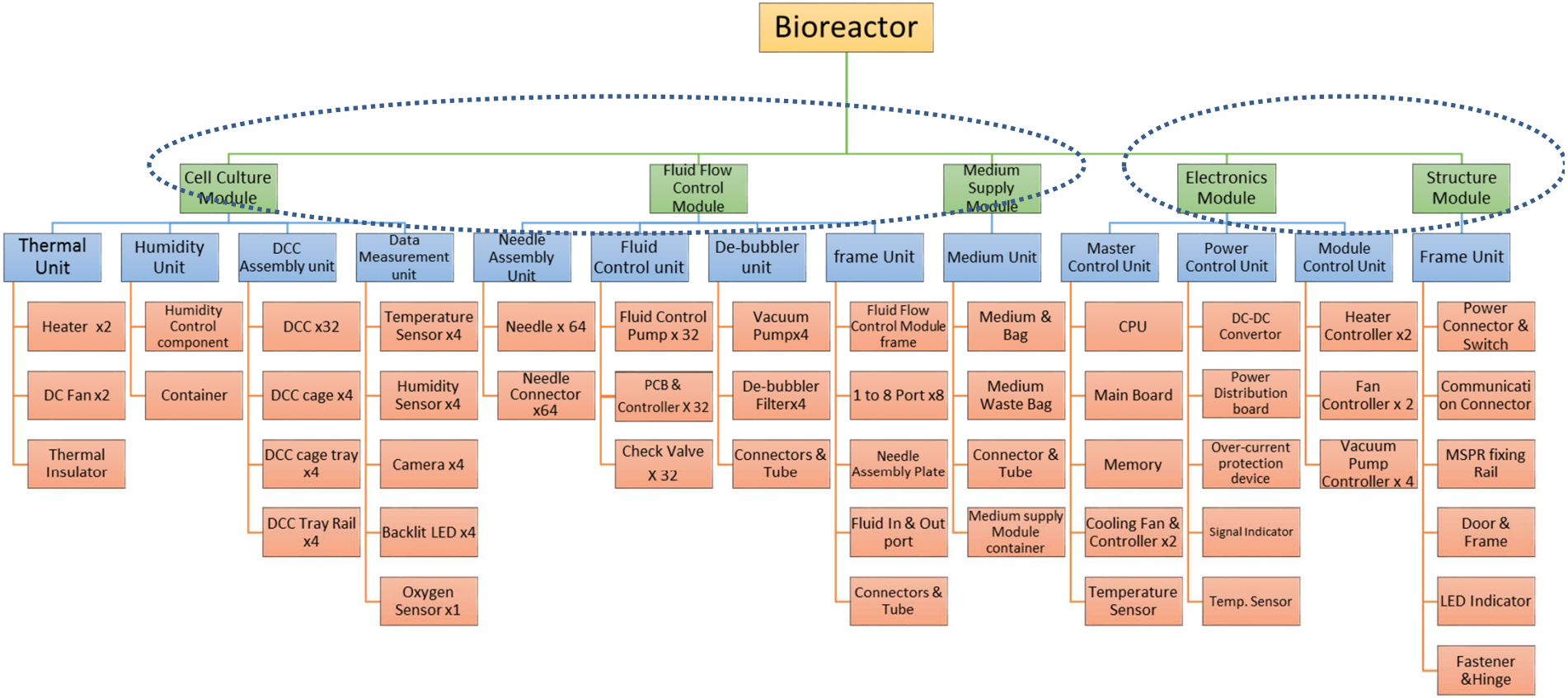
Back

- **Development of Flight Model (FM)** — ‘15. 1~
- **Development of Engineering Model (EM)** — ‘14. 12
- **MDR/SDR (Mission Definition Review/System Design Review) for Joint space Experiment**
  - Development of Bioreactor & Cell Experiment — ‘13. 10
- **Implementing Agreement between KARI and JAXA on the Preparation of a Joint Space Experiment onboard JEM (ongoing)** — ‘12. 12
- **Final Report on the Joint Feasibility Study for JEM Utilization** — ‘11. 12
  - Muscle Atrophy Research Proposed as Flight Experiment
- **Protocol for Joint Feasibility Study for JEM Utilization** — ‘08. 6
- **Collaboration for ISS Experiments through Korean Astronaut Program (KAP)** — ‘08. 4
  - PADLES Experiments / HDV Cooperation
- **MoU between KARI and JAXA for the Cooperation in Aerospace** — ‘06. 6
  - Collaboration for ISS Utilization Suggested

- Collaboration Frame for the Joint Mission

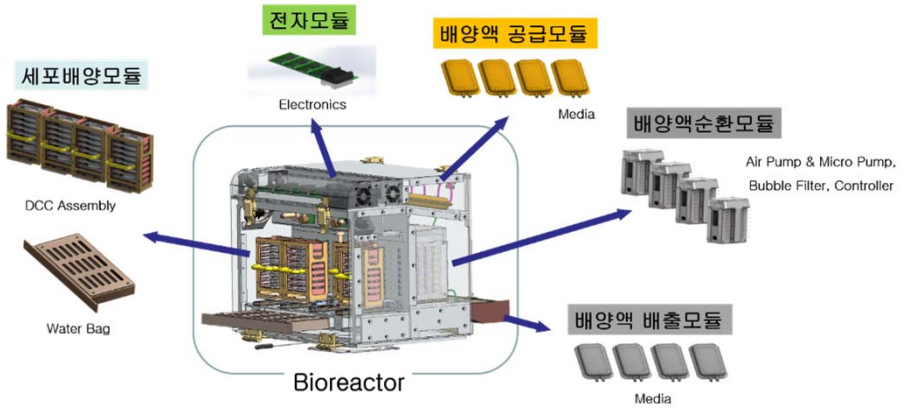


- Bio-Reactor Structure (5 major parts)



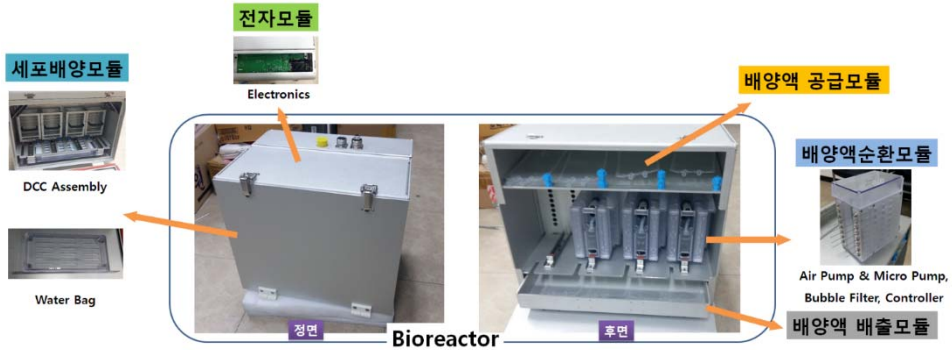
Bio-Reactor Development for KARI-JAXA Joint Mission on ISS JEM

- Bio-Reactor(for Cell Culturing) FM(Flight Model) Design



- **Size : 480 × 376 × 432 (mm^3)**
- **Weight : Under 45kg**
- **Power : 28V,130W@Max**

- Bio-Reactor FM H/W & S/W development



<GUI display control>

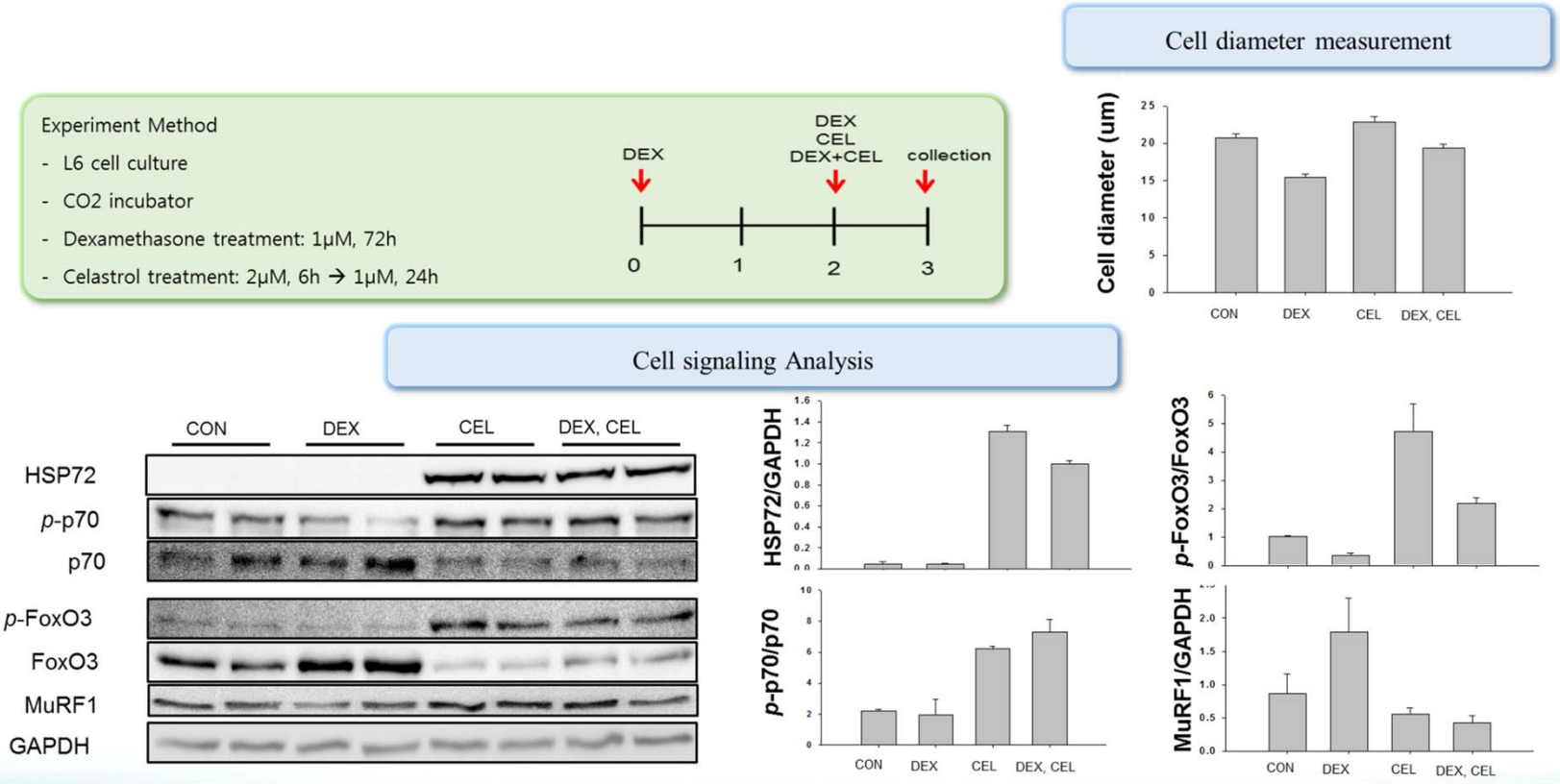
- Ongoing Bio-Reactor FM Performance & Space Environment Test
  - Functional test for cell culturing condition
  - EMC, Vibration/Shock Test, Space environment test, etc.



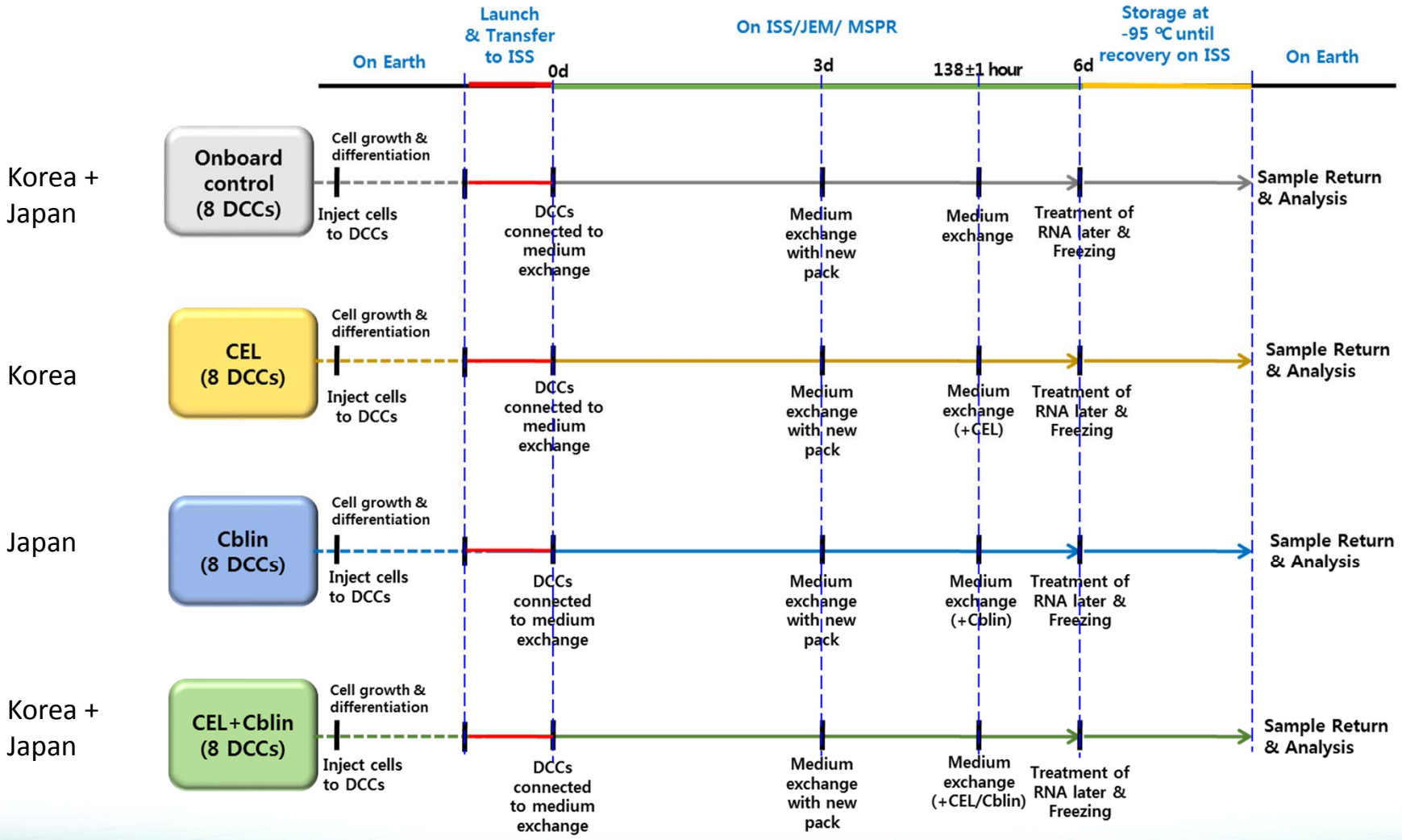
- Space Environment Test Plan

Test Item	Detailed Test Item
1. Inspection	Mass, Volume, Sharp Edge, Cleanliness, Bonding, etc @ KARI
2. Functional	Temp./Humidity, Media Flow, Cell Culture @ KARI
3. Leakage/Proof	Water, Media @ KARI
4. EMC	CE, CS, RE, RS @ KARI
5. Vibration	Quasi-static, random vibration @ KARI
6. Acoustic Noise	NC40 @ KARI
7. Micro-G Turbulence	@ JAXA
8. Off-Gassing	@ JAXA with KARI
9. System Interface	@ JAXA (MSPR, Laptop, LEHX) with KARI
10. COTS Screening	Temp Cycle, Burn-in, Vibration @ KARI with JAXA

- Ground-Based Cell Culture Experiment for Space Experiment Protocol Establishment (w/Yonsei Univ.)
  - L6 muscle cell culturing conditions
  - Medicinal substances(DEX, Celastrol) protocol establishment(time, concentration, etc.)

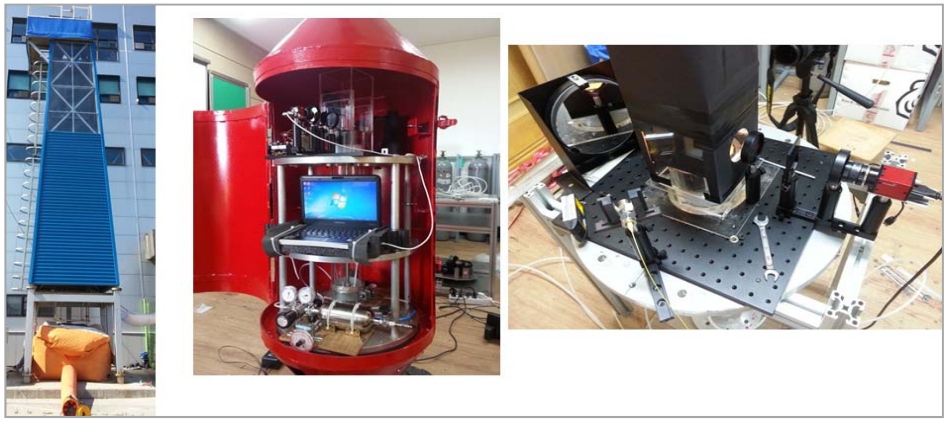


International Cooperation: ISS Utilization Joint Mission with JAXA – Mission Operation

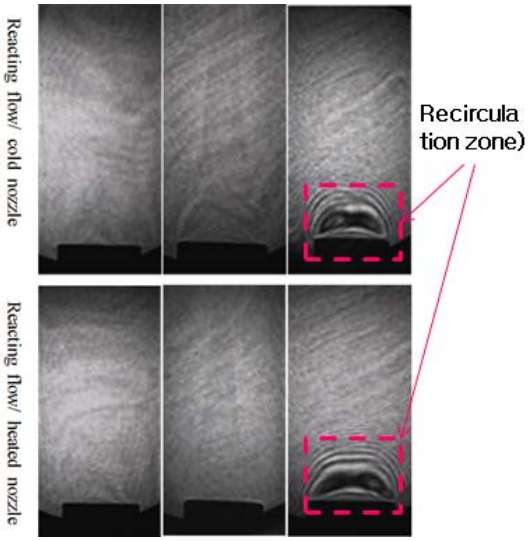


Combustion Science Research using 15m Drop-Tower

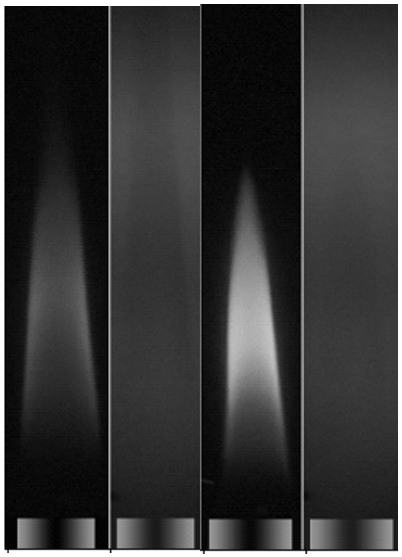
- 1.5 sec Drop-tower facility (w/KMOU)
  - G level: ~ 10-3 g
  - 1.5 sec of microgravity time
  - 15 m long (10 m of free fall distance)
  - Used for experiments that need a short duration of microgravity time such as combustion
- Soot and CNT composition research using Drop-Tower and combustion instrument



Drop-tower and Capsule



<확산화염에서 부력의 영향(1g), CH_4, C_2H_4, C_4H_{10}>



<Soot volume fraction(μ-g), 0.3g & 1.0g>

Concluding Remarks

- **Cooperation activities for micro-g research in 2015**
  - KARI had the meeting with JAXA for ISS Joint Mission (Oct., 2015)
  - KARI & JAXA hosted the 12th J-K Joint Seminar for Space Environment Utilization Research (Oct., 2015)
  - KARI supported and participated in the 6th KMS Spring Conference (April, 2015)

- **Microgravity research activities are in progress**
  - KARI is developing the FM of Bio-reactor for ISS Joint Cell Culture Mission with JAXA and studying the space experiment protocol with Yonsei University
  - Utilizing the Drop-Tower, several microgravity utilization experiments in a ground-level are being conducted

하늘로 띄운 꿈, 우주에서 찾는 미래

Thank you!

KARI Korea Aerospace Research Institute