HSTI Science Activities

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Topics

- Brief Review of HSTI Origin and Objectives

- HSTI Science Activities
  - Zero-Gravity Instrument Distribution Project
  - Educational Project

- Summary / Challenges
The Human Space Technology Initiative (HSTI)
- Launched by UNOOSA in 2010.
- Built on the relevant recommendations of UNISPACE III in 1999.
- Implemented under the framework of the United Nations Programme on Space Applications.

HSTI Objectives
- Promote international cooperation opportunities
- Exchange information and create awareness on human space technology (e.g. UN/Malaysia Expert Meeting)
- Build capacity on human space technology and its applications.
Zero-gravity Instrument Distribution Project

Why to distribute

- Zero-gravity, also called weightlessness or microgravity, is the absence of gravity. It is best illustrated by astronauts floating in their spacecraft.
- Zero-gravity can provide a better understanding of fundamental questions of science and for the solutions of problems on Earth.
- Life science research and experiments under zero-gravity will be needed for humans to venture beyond the Earth-bound existence.
- Since there are many methods to achieve zero-gravity, including ground-based, aircraft, suborbital and orbital providing different duration of microgravity, distributing ground-based zero-gravity instruments for education and research is possible.
- Zero-gravity research and education is a means of capacity building.
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Zero-gravity Instrument Distribution Project

- How to obtain zero-gravity
  - There are at least six methods to obtain or simulate zero-gravity.
    - Spacecraft (space station/space lab/space shuttle/satellite)
    - Sounding rocket flight
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Zero-gravity Instrument Distribution Project

- Airplane parabolic flight

20-30 seconds, $10^{-2}$

$L=(1/2)g t^2$

2.2-10 seconds, $10^{-4}$

- Drop tower (drop tube, drop shaft)
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Zero-gravity Instrument Distribution Project

- Neutral buoyancy simulator
- Slowly spinning an object

Simulation of effect
Encoding buoyancy
Months/days

Use rotation to negate the effect of gravity
Suitable rotation speed is needed
Months/days

Environment controllable clinostat
What to distribute
UNOOSA is planning to distribute two types of zero-gravity instruments:

- Clinostats for observing plant-growth and crystal growth:
  - Two-Axes Clinostat
    - Conduct experiments in three-dimensional random motions
  - One-Axis Clinostat
    - Conduct experiments in simulated zero-gravity
    - Train students to prepare and run scientific experiments

- Desktop drop-tube type instrument for observing short duration physical phenomena such as combustion and fluid motion.
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Zero-gravity Instrument Distribution Project

- How and when to distribute

### Cycle 1

- 2012
- 1: Selecting Instruments
- 3: Acquiring Instruments
- 6: Application / Selection
- 9: Distribution
- Announcement of Opportunities
- Selection

### Cycle 2

- 2013
- 1: Selecting Instruments
- 3: Acquiring Instruments
- 6: Application / Selection
- 9: Distribution
- Announcement of Opportunities
- Selection

### Cycle 3

- 2014
- Review
- 2015

- Cycle 1
- Cycle 2
- Cycle 3
- Cycle 4

UNOOSA
Educational Project

**Why**
- The development or utilisation of space technology requires knowledge and scientific competences
- Conducting education project is another means of capacity building

**Potential Target Groups**
- Researchers/Teachers: information, training
- Students: training, education
- General public: awareness

**Objectives**
- Inform researchers and students about possibilities and benefits of microgravity research and provide access to necessary information
- Motivate students for scientific studies and provide some basic knowledge in microgravity science and human space technology
- Create awareness on utilisation and benefits of human space technology
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Educational Project

How

- Develop and publish materials
  - HSTI brochure
  - Educational materials
    - What is zero-gravity;
    - How do humans live in space?
    - How to prepare a zero-gravity experiment?
    - ......
  - Training materials
    - How to design a zero-gravity experiment for a specific facility type (drop tower, RPM....) ?
    - How to train students for zero-gravity research?
    - ......
  - Information materials
    - What is human space technology and its benefits?
    - What are the possibilities for zero-gravity research?
    - What is zero-gravity research?
    - ......
According to request, UNOOSA invites experts and astronauts to give lectures:

- Technical Lectures for universities and institutions
  - Benefits and brief history of human space activities
  - Space policy
  - Space environment
  - Space system design
  - Space technology
  - Space business and management
  - Space applications
  - Space science
  - Space social science and humanity
  - …...

- Launch “An Astronaut in The Classroom” project for schools
  - Invite astronauts to classrooms to share their space experience
HSTI Objectives:
– Promote the use of human space technology and its application.

Planned activities:
– Distribution of zero-gravity instruments
– Distribution of training and education materials, organizing lectures at universities and schools

Challenges to be overcome
– In-cash / In-kind contributions for Zero-gravity Instrument Distribution Project
– Collaboration with experts on microgravity science and human space technology for Educational Projects
– Collaboration with space agencies and institutions for resources in space experiment, astronauts selection assistance, training and flights.
Let’s go to space, together!


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