Malaysia Microgravity Program 2015

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APRSAF22

Space Environment Utilization Working Group (SEUWG)

1st Dec 2015

Bali, Indonesia

CONTENT

1. Introduction: The motivation
2. Objective of Malaysia Microgravity Program
3. Microgravity Program 2015
4. Conclusion

1.0 INTRODUCTION : THE MOTIVATION MALAYSIA TO INVOLVE IN MICROGRAVITY SCIENCES

- **BUILDING LOCAL CAPACITY**

[enables Malaysia to explore frontiers of education in science, technology and engineering, in ways never before envisaged by Malaysians. The Program involve scientists, educationists, general public and students (the next generation of explorers)]

- **BUILDING LOCAL CAPABILITIES**

[basic infrastructure/spacelab/equipment, research mechanism, identified national priority needs and development goals/outcome) as well as estimate the national readiness]

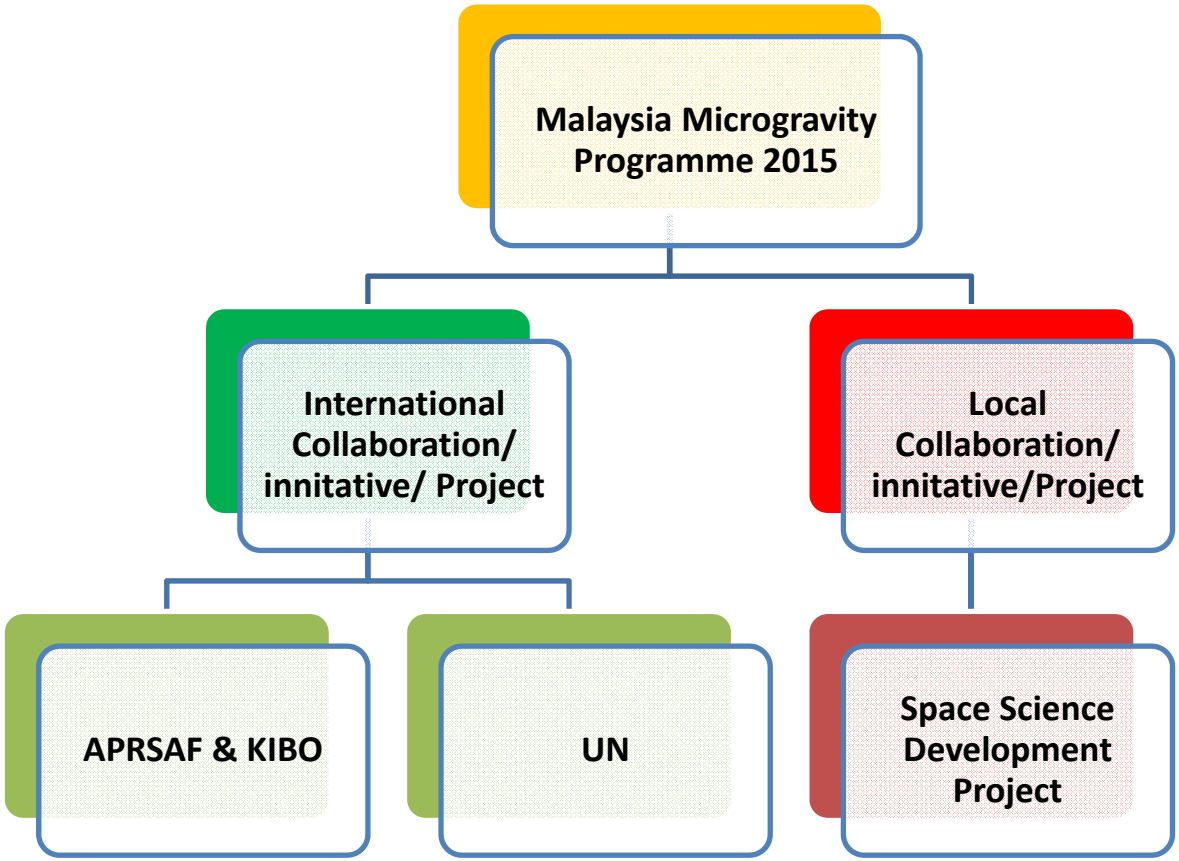
Through

INTERNATIONAL AND LOCAL COOPERATION!!

2.0 OBJECTIVES OF MALAYSIA MICROGRAVITY PROGRAM

- To **inspire** the peoples to strive for excellence and a unity of purpose and all instill a sense of identity that will promote national resolve and enrich their lives;
- **Gaining knowledge and experience** from Japan, Russia and other countries and using this acquisition as a base to expertise in space science and Microgravity applications;
- To send **experiments to the space** that will benefit to **science, technology and industry**;
- To instill the interest of the **young generation** to explore new areas of science and technology which are crucial to sustaining a long-term national competitiveness in a global era.

3.0 Microgravity Programme on 2015



4.0 Microgravity Programme on 2015

Malaysia want to be more actively participate in microgravity program. Two (2) major activities on microgravity programme for 2015 (highlighted):

i. Awareness Programme

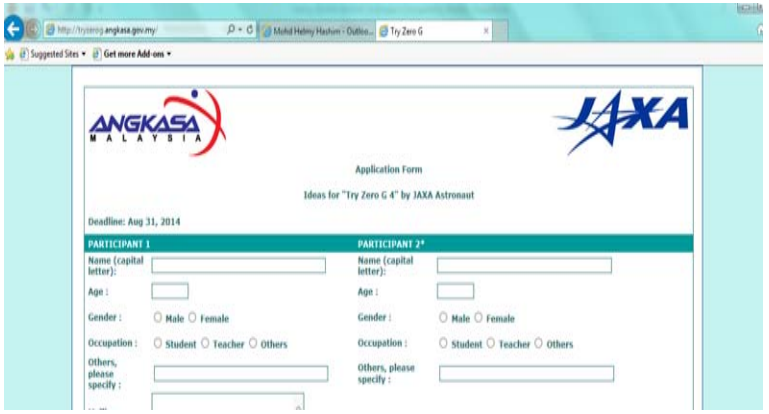
ii. Sciences Programme (Research)

MICROGRAVITY EDUCATIONAL AND AWARENESS PROGRAMME 2015

i. Awareness Programme

- Try Zero-G 2015
- Parabolic Flight & Microgravity Talk & Exhibition
- Live Communication with ISS
- Zero Gravity Instrument Project (ZGIP)

TRY ZERO-G



TRY ZERO G

•Under Kibo ABC Platform

•Looking for idea of simple zero-G activity to be conducted by Japan Astronaut in Kibo, ISS

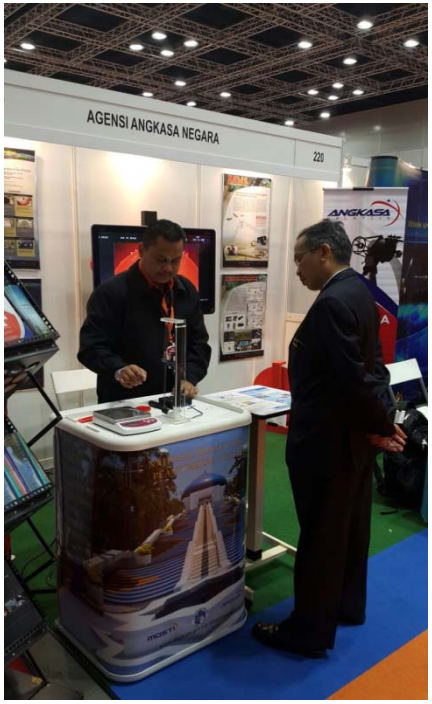
•Opened for RFP (online) from 4 June 2014 to 31 Aug 2014

•36 proposals received.

•Proposal selected for Try-Zero-G on board:

"Touch and spin a floating object (modified title)"
Demostrated by JAXA Astronaut, Mr. Kimiya Yui during ISS Expedition 44/45 mission on July 2015.

PARABOLIC FLIGHT & MICROGRAVITY TALK/ EXHIBITION (1/2)



22/5/2015 Booth exhibition, National Innovation Conference and Exhibition 2015 (NICE2015), Kuala Lumpur Convention Center (KLCC) (refer to attachment) – *Note - Explanation to Assistant Secretary General of MOSTI

22/5/2015 Special slot (Talk), National Innovation Conference and Exhibition 2015 (NICE2015), Kuala Lumpur Convention Center (KLCC) (refer to attachment)

PARABOLIC FLIGHT & MICROGRAVITY TALK/ EXHIBITION (2/2)

25/8/2015 Poster Presentation and Demonstration, Water Rocket Competition Event 2015, Universiti Malaya, Kuala Lumpur

LIFE COMMUNICATION WITH ISS

- Date: 9 October 2015 (Friday)
- Time: 16:00 MST or 08:00 UTC
- Venue: Microsatellite Building, National Planetarium, Kuala Lumpur
- Astronaut: KJELL N. LINDGREN (M.D.), NASA ASTRONAUT
- Participant: primary school students, 20 students from 3 different primary schools
- Duration: about 10 minutes
- Link for the Live Communication with ISS can be obtained here https://www.youtube.com/watch?v=VCMo_BkXOaI
- https://www.youtube.com/watch?v=AgQTTHmeoU4
- Media coverage


sains

Berkomunikasi dengan ISS

Pelajar teruja bertanya mengenai angkasa lepas dengan angkasawan


sains

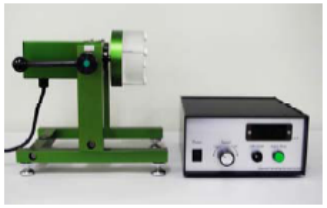
APA KATA MEREKA

Sangat Singh sebati dengan komunikasi ISS

Ketika itu saya begitu tertarik dengan radio amatur ini kerana merupakan antara alat komunikasi tercanggih"

ZERO GRAVITY INSTRUMENT PROJECT (ZGIP)

- ZGIP organized by United Nations of Outer Space Affairs (UNOOSA).
- First Annual report to UNOOSA – Dec 2015
- Contribute data based of clinotorated plant seeds to UNOOSA and also for educational purposes

Specification		Picture
1) Equipment size (cm):	Main body: 25 x 25 x 25 Control box: 23 x 20 x 11	
2) No. of rotation axes:	One	
3) Rotation speed:	0-90 rpm. 0-20 rpm: 0.5 rpm increment 20-90 rpm: 5 rpm increment Accuracy: 1%.	
4) Rotation axis angle:	0° (parallel to the ground) to 90° (perpendicular to the ground)	
5) Rotation direction:	CW or CCW	
6) Input voltage:	100V-240V	
7) Building materials:	Aluminum	
8) Experiment conditions: Maximum weight of samples is 500 g. Maximum diameter of a sample container is 10 cm.		

Date	Activities (Clinostat 1 – Planetarium)
10 April 2014 – 30 April 2015	Experiment conducted by 12 students and a teacher at SKJC Kuen Ching, Kuala Lumpur - Paddy seeds
18 June 2014 – 16 July 2015	Experiment conducted by students and teachers at SMK Bukit Indah, Selangor - Okra Seeds
31 Dec 2015	2nd annual report submission deadline

MICROGRAVITY SCIENCES PROGRAMME 2015

ii. Sciences Programme (Research)

Main activities on microgravity research programme to be highlighted for 2015 mostly focusing on Microgravity Ground Based Research:

- Parabolic Flight 2013 (follow up)
- Rice Seeds
- C-elegans
- Asian Herbs in Space (AHiS)
- Automated Cultivation System (ACS)

PARABOLIC FLIGHT 2013
"DANCING PARTICLES – FORMATION OF SOUND RESONANCE IN TUBE" (1/2)

Output:

1 experiment was performed under hypergravity and microgravityenvironment through parabolic flight mission in nagoya, Japan on 25 and 26 dec 2013.

Prototypes identified useful for wave propogation teaching material

HCD : 2 parabonauts, 1 microgravity scientist

Publication:

•Abstract Proceeding "Resonance Profile of an Air Column: Observation on the Earth and in Microgravity", **21st Asian Microgravity Conference**, 28 – 31 Oct 2014, Korea

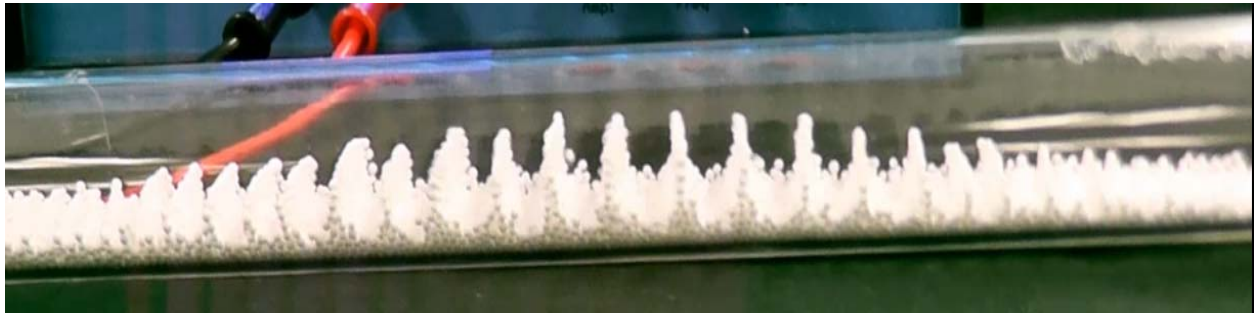
•Paper accepted: "Resonance Profile of an Air Column: Observation on the Earth and in Microgravity", **Journal of Microgravity Science and Technology"** (SCI, Springer).

•**Activities Report on Post Asian Student Team Parabolic Flight 2013 by Malaysian Team,** Int. J. Microgravity Sci. Appl., **35** (2) (2015) 23456

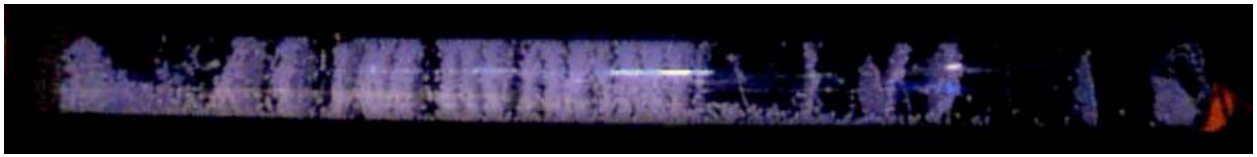
Award:

•Science Education Award of Malaysia, Malaysia Toray Science Foundation (2014), Kuala Lumpur, 2nd Dec 2014

Output:



Wave Resonans represented resonance which is represented by polystyrene beads in the tube after tuned by the frequency of sound in 1 G.



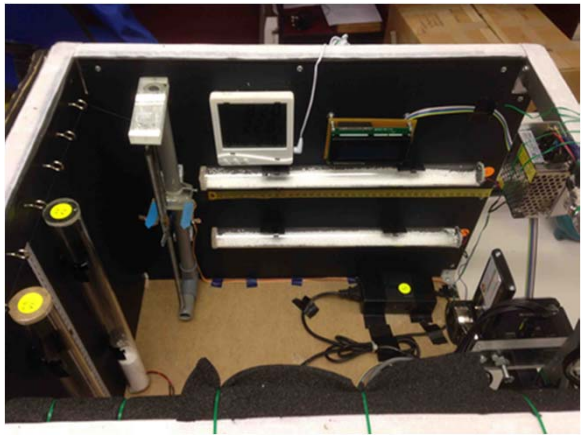
Wave Resonans represented resonance which is represented by polystyrene beads in the tube after tuned by the frequency of sound in micro G.

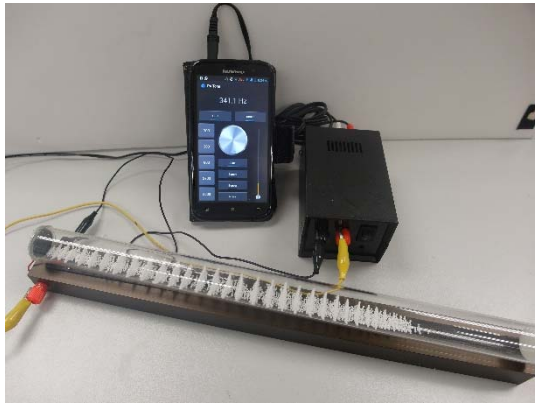
Objective: To observe visually a real profile of sound resonance

Results: beads agitated in plates in microgravity compared to the mountain-like striations profile in normal gravity – is it real wave shape?

PARABOLIC FLIGHT 2013
"DANCING PARTICLES – FORMATION OF SOUND RESONANCE IN TUBE" (2/2)

- On 2014/2015 -Simplify the experimental kit





Simplified exp. Kit
- Manipulate from android software (freq. generator); integrate to the tube

Social impacted:

❑Several schools requested the kit for teaching and learning for their schools and small-scale in-lab production
❑The kit is useful for learning the following concepts in physics education.

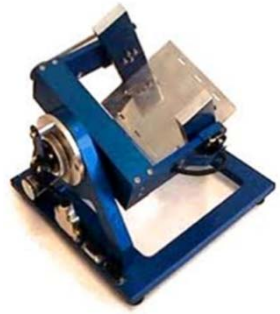
- The harmonics formation in air column as basis of wind musical instruments.
- The visual effect of acoustic force.
- Compression and rarefaction in sound propagation.

RNA INTERFERENCE-MEDIATED SILENCING EFFECTS OF GENES INVOLVED IN LONGEVITY, DNA REPAIR AND LOCOMOTION OF *CAERNOHABDITIS* ELEGANS EXPOSED TO MICROGRAVITY AND ORBITAL FORCES

- To study the knockdown effect on genes involved in longetivity (*dod-19 and dod-3),* DNA repair (*rad-51* and *him-6*) and locomotion (*mua-3, com-113*) of C-elegans exposed to microgravity simulation [Clinostat – Random Positioing Machine (RPM)]

- Project duration: 3 years (2012 – 2015), will be extended to Jun 2016
- Local Collaborator institute: ANGKASA & Universiti Kebangsaan Malaysia Medical Molceular Biological Institute (UMBI)

Image courtesy of NASA



- Random Positioning Machine (RPM) -3D Clinostat has been procured on Mac 2014

Progress:

9 genes are differentially expressed
In simulated Microgravity vs. Ground control.

Result:

Minimal changes in gene expression Profiles

- An indicator that long-term exposure to microgravity is not harmful?

Need to further analysis for next genes of life cycle and validation process through microarray analysis.

STUDIES ON THE EFFECTS OF MICROGRAVITY SIMULATION ENVIRONMENT ON SELECTED MALAYSIAN RICE (1/2)

- To study the effects of two-dimensional (2D) clinorotation using clinostat on susceptible (MR 219) rice seeds

Project duration: 3 years (2012 – 2015), extended to Dec 2017
Local Collaborator institutes: ANGKASA & MARDI

Publication:
•"Effect of Simulated Microgravity on growth Performance in Ground Grown Rice", National Conference on Agricultural and Food Mechanization 2014 (NCAFM 2014), 20-22 May 2014, Sabah, Malaysia

RESEARCH TO BE EXTENDED UNTIL 2017!

Conclusion:
Exposing the seeds to uniaxial clinostat for 10 days at 2rpm
-No significant different significant different on plant height, leaf width, lead length and SPAD between clinotored and controlled seeds – need to further determine in terms of whole performance and yield

Exposing the seeds to uniaxial clinostat for 10 and 20 days days at 2rpm and 10rpm
-No significant different on plant height, leaf width, lead length and the Soil Plant Analysis Development (SPAD) at different speed/condition.

STUDIES ON THE EFFECTS OF MICROGRAVITY SIMULATION ENVIRONMENT ON SELECTED MALAYSIAN RICE (2/2)

- Objectives

i) to investigate the effect on growth, gene expression analysis and various yield attributes in plants raised from rice seeds exposed to simulated microgravity and

ii) to establish a technique to enhance the quality of the selected rice seed by using low cost two-dimensional (2-D) clinostat.

Look forward to second generation of clinotored seeds.

Project duration: 2 years (2016 – 2017)
Local Collaborator institute: ANGKASA, MARDI & UPM

ASIAN HERBS in SPACE (AHiS) (1/2)

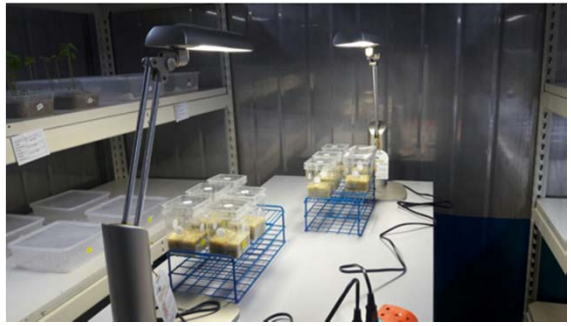
- Under Kibo-ABC implementation platform
- To send and germinate herbs seeds onboard Kibo, ISS
- To look the effect on herbs plant grow and germination under microgravity environment
- Target to be flown on board Kibo, ISS on March 2016
- Two kind of herbs were proposed:

  i) Hempedu Bumi (Andrographis paniculata)

  ii)* Holy Basil *(Oscimum Sanctum)

- Ground experiment has been conducted in MARDI Gene Bank Laboratory, Serdang, Malaysia
- ANGKASA team up with MARDI & UPM

ASIAN HERBS in SPACE (AHiS) (2/2)



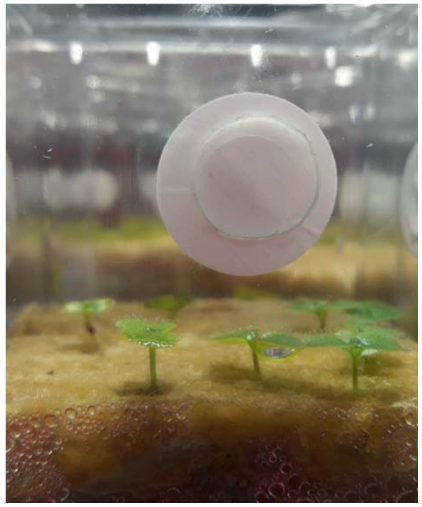
Temperature: 23 - 24°C
Light intensity: ~36 micro mol
Hyponex: None
Notes: No seed treatment

- Almost same to ISS conditions

Length of stem:
0.2 to 1.0cm

Average total germination: 74%

Holy Basil *(Oscimum Sanctum)*
15-days-old (on 16th Nov)



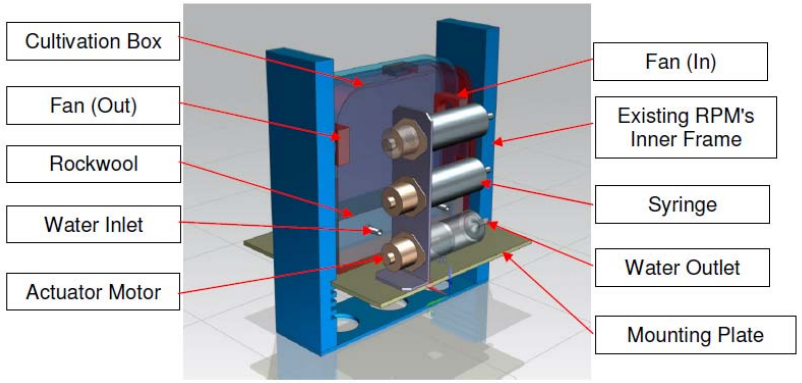
Hempedu Bumi (Andrographis paniculata)
24-days-old
(on 16th Nov)

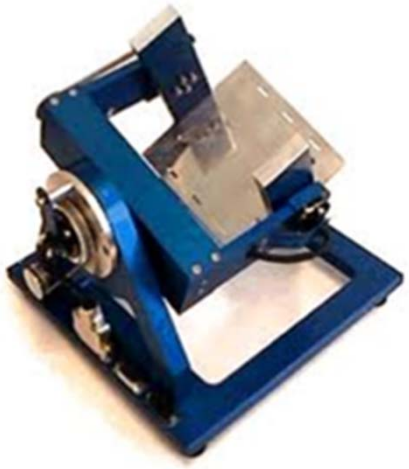
0.3 to 0.7cm length of stem.

Total germination is around 13%.

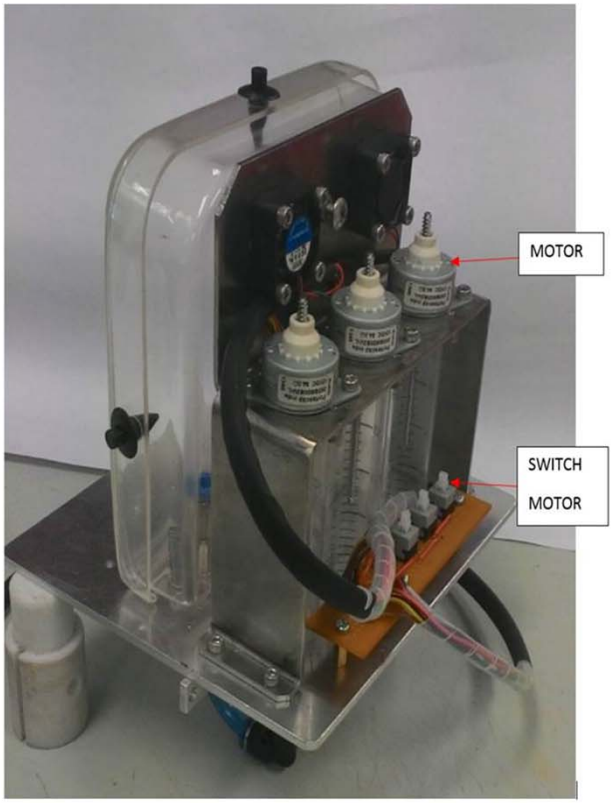
AUTOMATED CULTIVATION SYSTEM (ACS) (1/2)

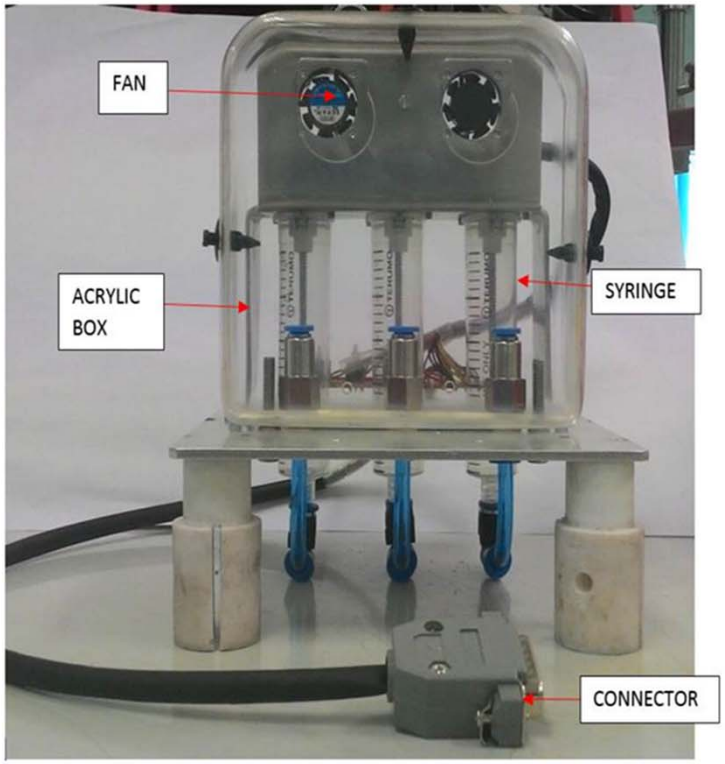
- New exercise for Malaysia on space hardware experiment development
- SSAF2013 inspiration – seeds germination under microgravity simulated environment
- Using Random Positioning Machine (RPM) – 3 Dimensional Clinostat
- ACS is a plant cultivation chamber equipped with automated watering and ventilation system
- Supporting AHiS and SSAF2013 continuation and any.





AUTOMATED CULTIVATION SYSTEM (ACS) (2/2)





ACS – A prototype

Conclusion

Malaysia is going to deeply involve in microgravity program for

"Sharing Solution through Synergy in Space"

"for the sake of knowledge generation, wealth creation and societal well-being."

Thank you