

Report on Post Asian Student Team Parabolic Flight 2013 Activities by Malaysian Team

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Abstract

We participated in the parabolic flight campaign to do an experiment under microgravity environment. We performed an experiment to visualize resonance profile in air column during Asian Student Team Parabolic Flight 2013. In this article we report activities related to the project including exhibitions, talks, educational outreach, awards and academic conferences. We devised a simple survey to know what is expected by the public on the influence of gravity on resonance profile, after giving brief explanations about the physical phenomenon in the air column. It is interesting to see that the majority of respondents associated microgravity with the concept of random flotation.

Keyword(s): Parabolic flight, Resonance tube

Received 17 J September 2015, Accepted 4 April 2016, Published 30 April 2016

1. Introduction

A development of space science in Malaysia is in line with the country's vision to become a developed nation by the Vision 2020 and the success of Malaysia's first astronaut sent to the International Space Station (ISS) in October 2007¹. The first Malaysian Astronaut programme was an eye-opener for Malaysians to appreciate the space science activities and created a new dimension in space-related researches in Malaysia. Under the framework of Asia-Pacific Regional Space Agency Forum (APRSAF), Asian universities students were offered an annual chance to experience microgravity through parabolic flight. On its initiative, Malaysia started to send student team from 2007².

2. Report

2.1 Project

In July 2013, the project entitled 'The Dancing Particles: The Formation of Sound Resonance Profile in Tube' grabbed the rare once-a-year opportunity to fly in Parabolic Flight 2013 (PF2013) mission. The team from Sultan Idris Education University represented Malaysia for the Asian Student Team Parabolic Flight 2013 scheduled on December 25th and 26th, 2013 in Nagoya. The parabolic flight was operated by Diamond Air Service (DAS) using Mitsubishi, Gulfstream II aircraft. The team consisted of two paronauts (Kok Ken Hong and Mohd Tarmimi Ilias), mission control 1 (Shahrul Kadri Ayop), mission control 2 (Mohd Helmy Hashim), engineer (Mohd Ikhwan Hadi Yaacob), and advisor (Rosly Jaafar). This is the second experience from the same university to be selected, the first

being Asian Student Team Parabolic Flight 2012^{1,3}.

The project aimed to observe true resonance profile of air column in tubes under microgravity. It has been shown that the resonance in air column can occur at the right tube length and supplied sound frequency⁴. For visualisation of such effect, Kundt's tube can be used⁵. However, a mountain-liked particle distribution in the Kundt's tube does not assemble the true air molecular distribution in an air column. Therefore, an experiment was proposed to see what happens to the particle distribution if gravity is reduced. Polystyrene beads were used as particle to visualise the resonance profile. The beads fill in air rarefaction parts in the tube when resonance is achieved.

Figure 1 shows two snapshots recorded in the experiment. For each snapshot, the top is one-end-closed tube tuned at 230 Hz and the bottom is both-ends-closed tube tuned at 467 Hz. Polystyrene beads filled the rarefaction part of the air column. Under microgravity, the beads are uniformly distributed in a series of circular plates, compared to series of mountain-liked plates under normal G.

2.2 Paronaut Notes

The parabolic flights were successfully performed. The following are experiences noted by the paronaut.

"So on the 25th December, 2013 it was my turn to experience the parabolic flight. When the plane was approaching the area to start the parabolic flight, I was nervous but yet excited.

Initially I was adapting to the sudden change in gravity (from 2 G to 0 G and back to 1.5 G). It was cool though as I was even analyzing the happenings in tubes (especially the vertical tubes)

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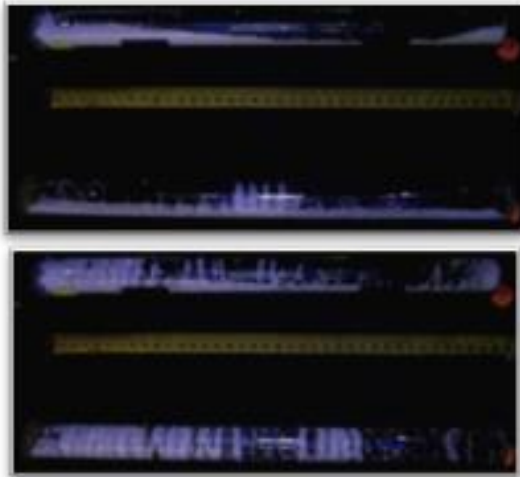


Fig. 1 Particle distribution under 1 G (top) and 0 G (bottom) in tube of length 36 cm and diameter 26 mm.



Fig. 2 Helmy and Kok in BERNAMA Radio 24.

during microG until I felt a sudden numbness all over my body. This started on the 3rd cycle. Well I managed to complete all my objectives but I was not able to move afterwards. Some might call it air sickness but I thought it might be due to over hunger.”

Parabonaut 1, Kok

“After the first 10 seconds, I felt like there was a force pushing myself down and back which caused my body heavier. It was in hypergravity!! Suddenly, I realized my body was getting lighter. The captain announced 'NOW!' meaning that microG had begun. I saw a pencil in front of me was floating. It was like a dream! Then my body was floating. I felt the situation of me being upside down, like my head was turning down. Meanwhile, everything at the surrounding was floating too. I am afloat!. It's amazing! At that moment, I felt very excited and enjoyed. It was fun!”

Parabonaut 2, Tarmimi



Fig. 3 The talk about the program was broadcast nationwide in National Television (RTM1).

2.3 Media Coverage

The project received national media coverage after returning. On January 24th 2014, the team was invited to a radio talk program Ala Carte by BERNAMA Radio 24 delivered by Helmy and Kok (**Fig. 2**). On March 15th 2014, Helmy gave a talk about the parabolic flight mission on National FM radio.

On 21st January 2014, Helmy, Ikhwan, Kok and Tarmimi appeared on Selamat Pagi Malaysia program by for National Television (RTM1) (**Fig. 3**). On 27th January 2014, the interview with the team was published in the form of video in online newspaper Utusan Malaysia.

2.4 Education Outreach

The team has been invited to many schools to give motivation and science talks, but due to time and commitment constraint, we have to refuse large number of invitations. **Table 1** lists out some of the education outreach.

Table 1 Education outreach list.

Date	Event	Person
22/02/2014	Exhibition at SK Dato' Ishak Primary School, Lumut	Ikhwan, Kok
26/02/2014	Talk and Workshop at SMK Khir Johari National Secondary School, Tg. Malim, Perak	Ikhwan, Kok
21/09/2014	Forum at Galeria, Petrosains Kuala Lumpur Convention Center (Fig. 4)	Kadri, Helmy, Ikhwan, Kok, Suhaila
27/09/2014	Talk at Sek. Men. Al-Hidayah Ipoh, Perak	Ikhwan
27/10/2014	Talk at MARA Junior Science College Lenggong, Perak	Ikhwan, Tarmimi
26/02/2015	Talk at Gunung Rapat National Secondary School, Ipoh, Perak	Ikhwan

2.4 Award

The project produced an educational kit for learning wave. Mobile-phone-based Sound Wave Experiment Kit received a Winner Prize for Science Education Award in Malaysian Toray Science Foundation 2014⁶. The kit consisted of the resonance tube of the same design as in parabolic flight and signal amplifier, but controlled by the smartphone with preinstalled signal generator application (**Fig. 5**). The award winning team was led by Rosly with Kadri and Ikhwan as members. Several schools requested the kit for teaching and learning for their schools and small-scale in-lab production is carried on our best effort to fulfill the demand.

The kit is useful for learning the following concepts in physics education.

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

2.5 Public Survey

We devised a simple survey consist of 6 choices of answer



Fig. 4 Forum at Galeria Petronas.

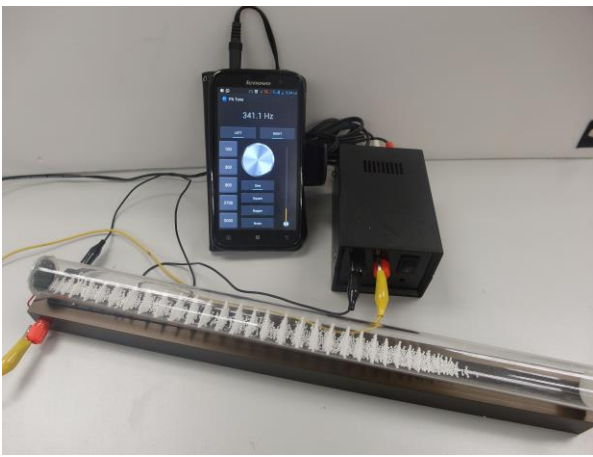


Fig. 5 Mobile-phone-based sound wave experiment kit.

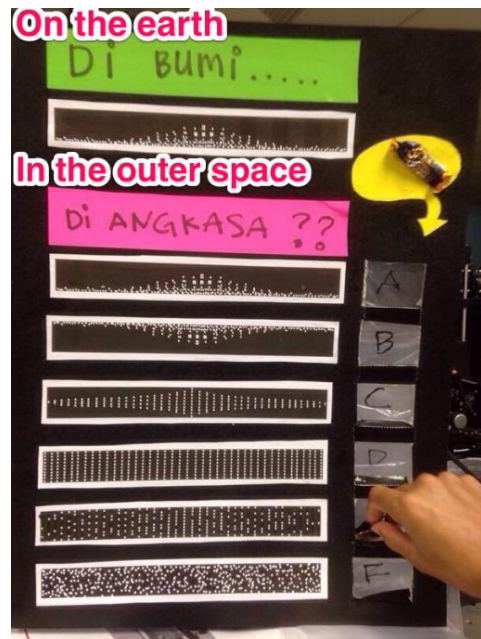


Fig. 6 A simple survey.



Fig. 7 Kok explained the phenomena in the resonance tube to visitors

(**Fig. 6**). No specific group of sample is selected in the survey because the aim is to get public responses regardless of their background. They were obtained during our education outreach tours. Respondents were asked voluntarily to predict the resonance profile by putting the wrap of the sweet into their opinion box.

First, we explained and made demonstration of the formation of resonance profile by tuning the speaker at the correct frequency using our experimental rack. Most of our visitors were surprised to observe the accumulation of the beads at particular spot and beads were dancing. Then, explanation is given according to question asked by visitors. After being explained with the working principle of the resonance tube, visitors were given a sweet (**Fig. 7**).

The data from the survey was collected and calculated in

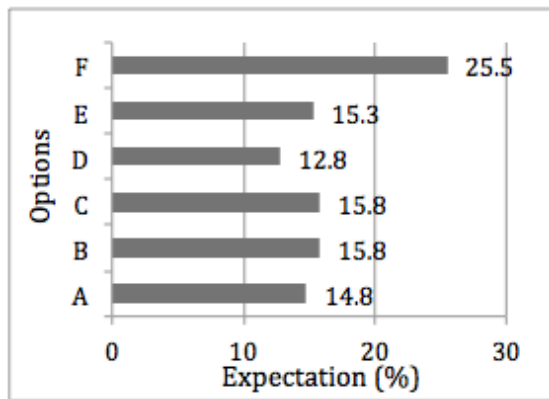


Fig. 8 Public votes on the survey.

percentage. 196 respondents voted the survey. **Figure 8** shows response from public collected until February 2014.

The correct option is 'E' as selected by 15.3 % of the respondents. One fourth of them chose 'F' for their prediction. The rest were distributed into 5 other options with close percentages. It is very interesting to see majority of them chose 'F' where beads are randomly distributed. We expected that the visitors related no-gravity environment to random floatation of an object. They did not notice the acoustical force is still in action holding beads at particular position.

2.6 Academic Conference

Tarmimi presented an oral presentation entitled "Public Survey on the Gravity Influence of Resonance Profile of Air Column" in 2nd International Postgraduate Conference on Science and Mathematics (IPCSM2014). The conference was held in Tanjung Malim, Malaysia on October 18th 2014.

On October 30th 2014, Kadri gave a keynote speech entitled Resonance Profile of an Air Column: Observation on the Earth and in the Simulated Microgravity in 10th Asian Microgravity Symposium held in Seoul, South Korea.

4. Conclusion

We reported activities related to the project selected for Asian Student Team Parabolic Flight 2013. Most of the activities were aimed at the dissemination of knowledge and awareness about space related activities at all level of ages in Malaysia. We found during the exhibition tour, visitors were curious and surprised with the project. Public awareness is important to support the continuity of such program in future. It is hoped that young generation are motivated and excited by curiosity to explore more about the space for the sake of the nation.

Acknowledgments

We would like to acknowledge the following agencies that support this project; Sultan Idris Education (UPSI), Ministry of Science, Technology and Innovation of Malaysia (MOSTI), National Space Agency of Malaysia (ANGKASA), Japan Aerospace and Exploration Agency (JAXA), Japan Space Forum (JSF) and Diamond Air Service (DAS). This project is partly supported by Malaysia Ministry of Science, Technology and Innovation (MOSTI) via UPSI grant code 2013-0172-102-03.

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