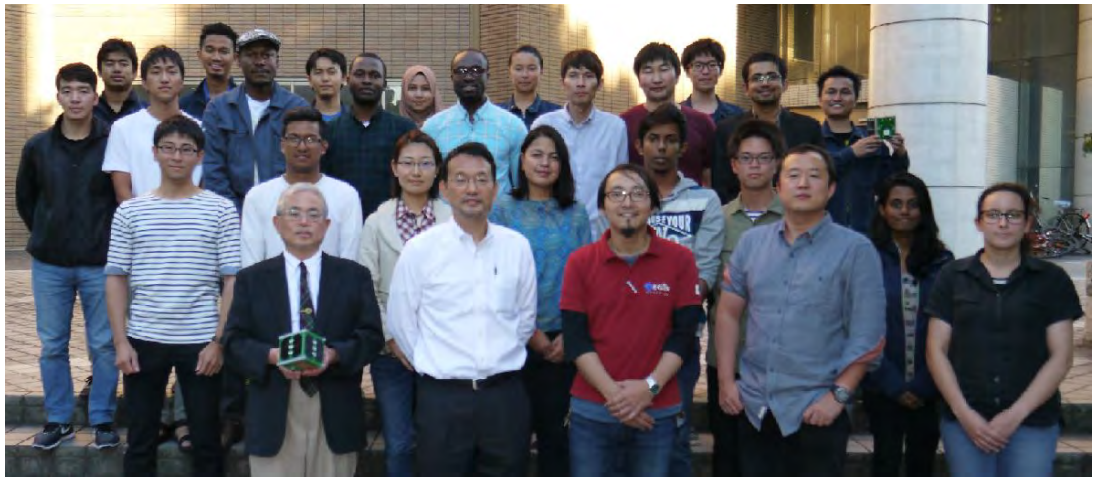

Members of BIRDS -1, -2, and -3 on 4 October 2017, at Tobata Campus

Archive website: http://birds1.birds-project.com/newsletter.html
All back issues are archived at this website.

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BIRDS Project Newsletter

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(21 June 2018)

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Kyushu Institute of Technology (Kyutech)
Kitakyushu, Japan

Space Engineering International Course

All back issues of this newsletter can be easily downloaded.

Go to here: http://birds1.birds-project.com/newsletter.html and scroll down to the desired issue.

Table of Sections

The Guest Box

From the Philippines (BIRDS-2)

Boracay Island in Caticlan, Aklan is known as the beach capital of the Philippines. Its white sand beaches makes it a go–to place of Filipinos and foreigners alike once the dry season comes.

However, Philippine President Rodrigo Duterte claimed improper sewage management in the island damaged the beauty of the paradise. On April 26, 2018, Duterte ordered the temporary closure of the island for rehabilitation. The government estimates a six–month rehabilitation period before the island will be opened again to tourists.

The chances of success for rehabilitation efforts would increase with more regular environmental monitoring. Remotely sensed data such as those from satellite imagery can offer clues to changes in land cover, land use, and coastal erosion. Satellites with optical payloads, in particular, can contain multispectral bands that can read different environmental features which are not visible to the human eye. These can detect changes in water quality that may denote harmful effects to the ecosystem.

- by Yvette and Nikki (BIRDS-2 Home Team)

PHL MICROSAT

Development of a Ground Sensor Terminal in the Philippines

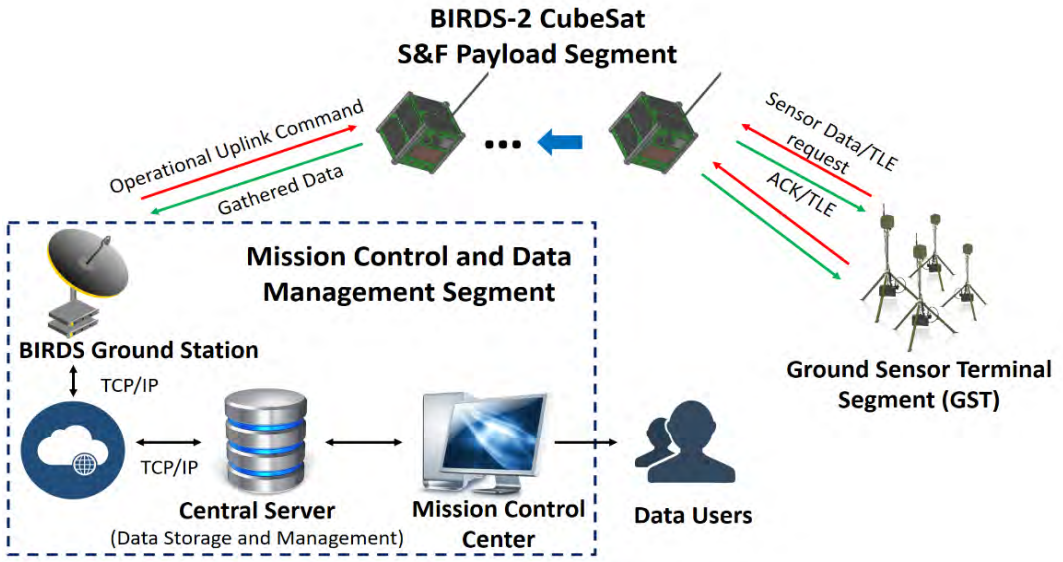
Development of a ground sensor terminal in the Philippines

MARY ANN Z. CONSTANTE (authored this report)
GLADYS A. BAJARO
YVETTE B. MORALES
CARLO D. PASTORAL
ARVIN OLIVER S. NG

PROJECT LEADER
DR. MARC CAESAR TALAMPAS

MAYA-1: STORE-AND-FORWARD

Maya-1 of the Philippines is part of the cubesatellite constellation built under the BIRDS-2 Project along with Bhutan, Malaysia, and Japan. One of the missions of these cubesatellites is the Store-and-Forward (S&F) system. The BIRDS-2 S&F nanosatellite-based remote data collection system (RDCS) consists of three main segments: (1) Ground Sensor Terminal Segment (GST), (2) Nanosatellite onboard S&F Payload Segment (S&F Payload), and (3) Mission Control Center (MCC) and Data Management Segment (DMS).



End users of the S&F system would require a GST to communicate and send data to the satellite. In the "store" phase, the S&F Payload will collect data from any properly-configured GST within its footprint and saves them in an onboard flash memory. In the "forward" phase, the gathered data are downloaded to the MCC in Kyutech or in any member ground station. Downloaded data are transferred to a central server for further processing and distribution to users.

STORE-AND-FORWARD: WHY IS THERE A NEED IN THE PHILIPPINES?

The S&F system can meet a niche application in a country like the Philippines. With the Philippines' geographic features, providing communications to remote areas like smaller islands and mountains is very difficult and unprofitable to regular communications providers. In a typical scenario, one has to go down the mountains or take a 4-hour boat ride from an island to a city to get connectivity and send messages. As such, useful and sometimes critical information are often left untransmitted and unknown to intended users. An example of such information is the water content or saturation of soil in the mountains. In 2011, at least 1,000 people died and almost 20 million USD[1] economic losses were recorded after Tropical Storm Washi spawned rains to mountainous areas in Mindanao which saturated the soil and triggered flash floods. The catastrophic event happened at night when most people were already asleep, which caught them off-guard. As there are no infrastructure to collect data from these remote mountainous locations and send them to authorities, alarms weren't set off to warn people to evacuate.

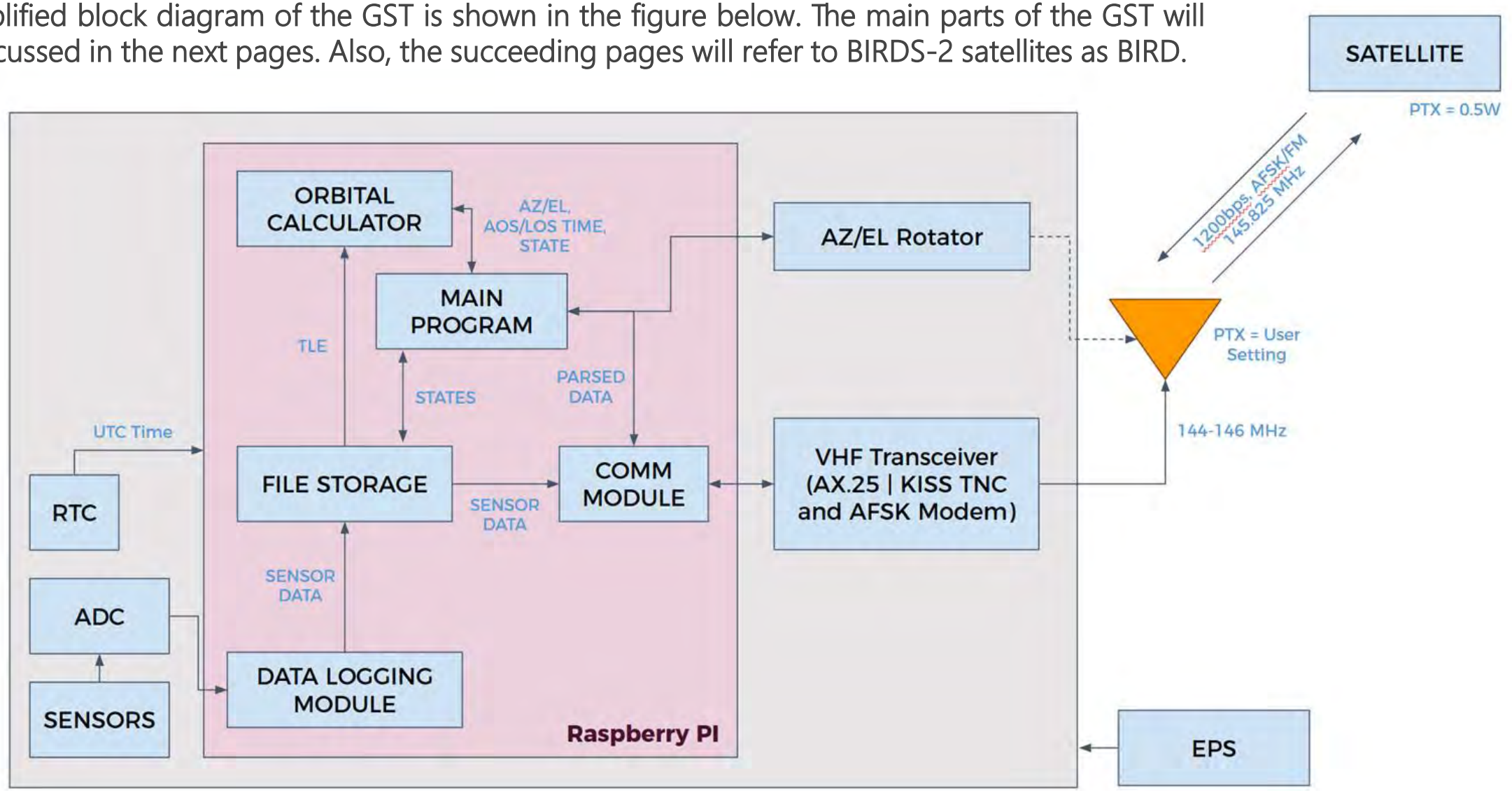
Aftermath of Typhoon Washi: Images taken from http://www.dailymail.co.uk/news/article-2076124/Philippines-Typhoon-Washi-Pictures-carnage-wrought-communities.html

The S&F system can therefore be used as infrastructure to send information from remote locations to their intended users. Other applications of this system in the Philippines include health monitoring for people in remote areas, early detection of landslides and river swelling, monitoring sea-surface temperature, and tracking endangered species. To be able to utilize the S&F system, the PHL-Microsat Team is developing a GST.

[1] https://www.rappler.com/nation/485-sendong-damage-reaches-almost-p1-b

GROUND SENSOR TERMINAL: BLOCK DIAGRAM

A simplified block diagram of the GST is shown in the figure below. The main parts of the GST will be discussed in the next pages. Also, the succeeding pages will refer to BIRDS-2 satellites as BIRD.



GROUND SENSOR TERMINAL: CONTROLLER MODULE (CM)

The CM acts as the GST's brain and performs the following:

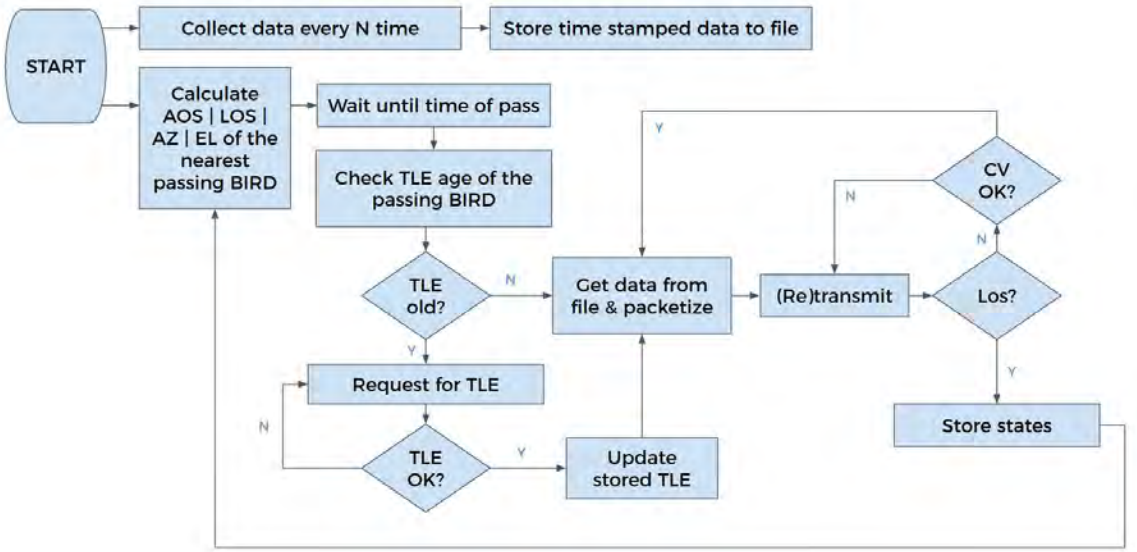
- Collect data from sensors or nodes and store them to memory
- Estimate the pass of the next passing BIRD
- Relay the AZ/EL information to the rotator
- Update the stored TLE through a passing BIRD if necessary
- Packetize the data and transmit it to a passing BIRD using a VHF transceiver/TNC module

A basic flow of the program running in the controller module is shown on the top figure. **The complexity of the system being developed is attributed to the target performance and reliability**:

- Better link budget using a satellite tracking setup
- No data loss due to handshake implementation (acknowledgement)

If desired, the functions of CM ***can be easily simplified by using an omnidirectional antenna*** and ignoring acknowledgement of received data from the satellite. The APRS beacons from a BIRD can be used as signal for its arrival and start of data transmission.

Currently the CM for the PHL-Microsat Team's GST is able to communicate with a dummy S&F Payload sent by Kyutech for testing. All its expected functions are already implemented, and now only waiting to be integrated with other GST subsystems. A screenshot of the CM's successful reception of orbital information from the S&F Payload is shown on the bottom figure.




```
Exception triggered: parse
Retransmit TLE request
[192, 0, 74, 71, 54, 80, 72, 76, 48, 83, 38, 70, 71, 83, 84, 49, 62, 240,
packet is TLE
63
[49, 56, 48, 55, 56, 46, 57, 52, 55, 49, 48, 49, 54, 56, 53, 49, 46, 54, 5
6, 55, 53, 52, 50, 57, 57, 46, 50, 53, 52, 55, 49, 53, 46, 54, 50, 53, 53,
18
078.94710168
51.6367
290.8233
0003069
060.8754
299.2547
15.62552108
1 00000  000000   18078.94710168  .00000000  0000000  0000000 0  0001
2 00000  51.6367 290.8233 0003069 060.8754 299.2547 15.62552108000008
Valid TLE
[83, 38, 70, 71, 83, 84]
1 00000  000000   18078.94710168  .00000000  0000000  0000000 0  0001
2 00000  51.6367 290.8233 0003069 060.8754 299.2547 15.62552108000008
```

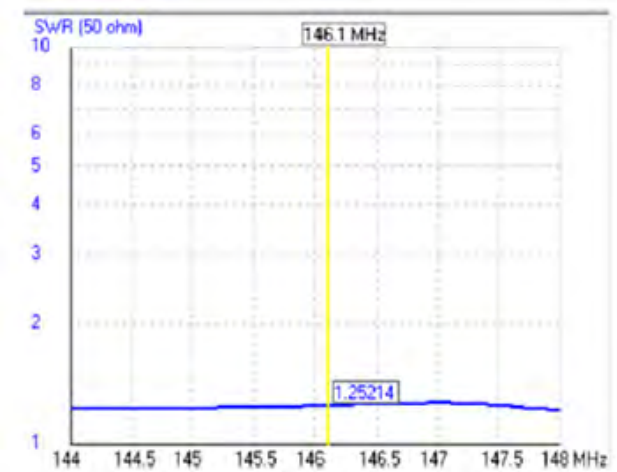
GROUND SENSOR TERMINAL: ANTENNA

The antenna that will be used for the GST is a directional cross-yagi antenna with the following actual specifications:

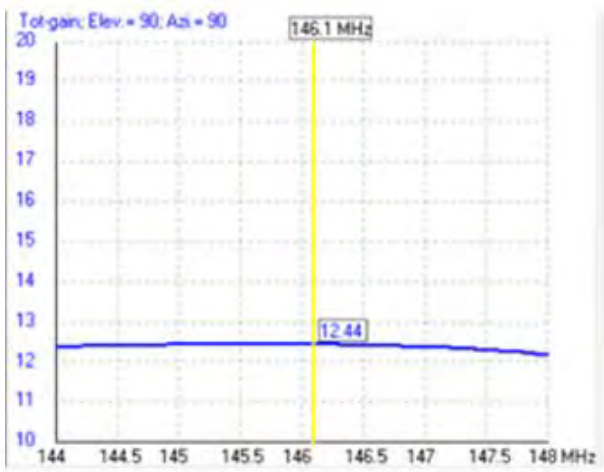
- SWR @ 145MHz: 1.12
- Gain @ 145MHz: 11.8
- Beamwidth: 70°

The position of the antenna will be adjusted to follow the satellite's path using the rotator described in the next pages. The fabricated antenna is shown in the figure below.

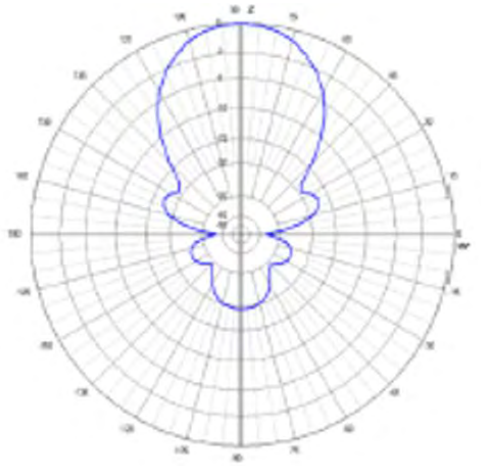
Prior to fabrication, simulations were conducted and are



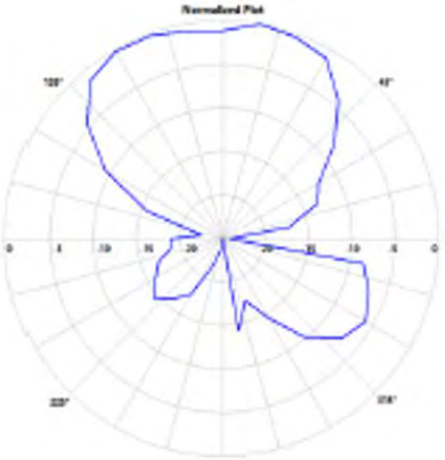
Simulated SWR



Simulated Gain



Simulated Radiation Pattern



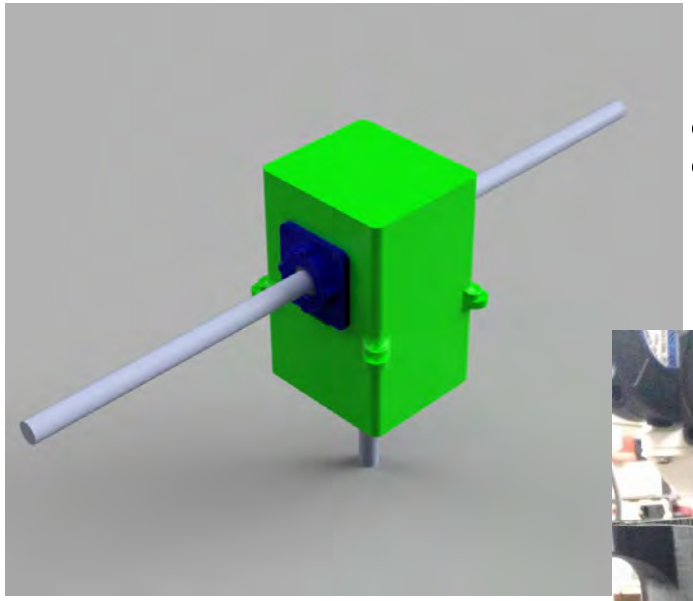
Actual Radiation Pattern

GROUND SENSOR TERMINAL: ANTENNA ROTATOR

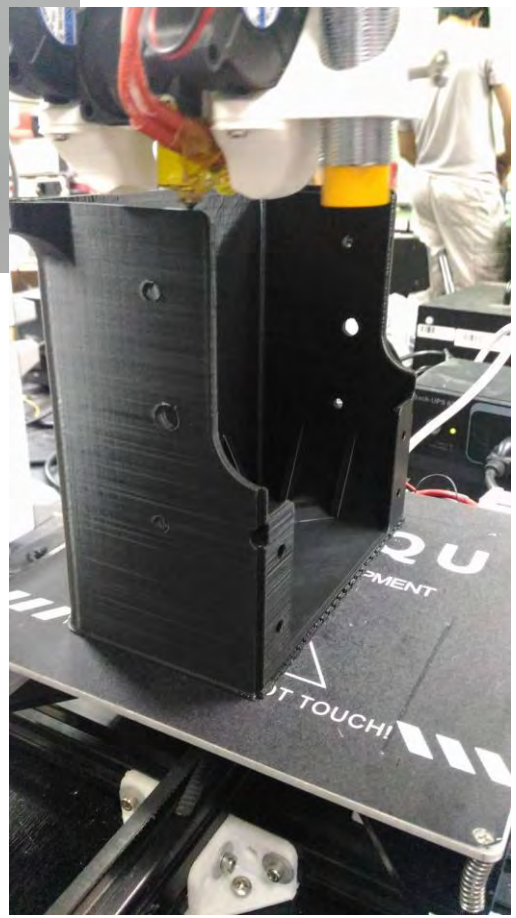
The antenna rotator was inspired by SatNOGS rotator, an open source design for a satellite tracking rotator which has 3D printed parts such as gears and mounting brackets, and aluminum extrusions for its chassis. To minimize the cost and utilize existing parts in UPD laboratory, the design of the SatNOGS rotator was modified, making it possible to 3D print most of the parts including the chassis. In the final design, only four bearings, a screw rod, and one whole length PVC pipe were purchased.

Most of the development time was spent on 3D printing the parts. The chassis was divided into four pieces to fit on the 3D printer platform, and each piece took 26 hours in printing (excluding design iterations and repeats). Iterations were also made on the design of the gears especially in the spur to worm gear translation. In the initial design, the two gears were separated and were just connected by a snug fit mechanism. However, due to the heavy load, the snug fit mechanism easily wore out and loosened. The design was updated to join the gears together, making it more rigid and accurate.

As of the last week of April, printing of all the mechanical parts were completed. The team is now working on the electronics and programming part. A challenge expected in this phase is fine tuning the control system to accurately point the antenna to the trajectory of the satellite with respect to time and speed of the satellite's travel.



▷▶ Rendered image of the chassis design. The whole chassis was 3D printed

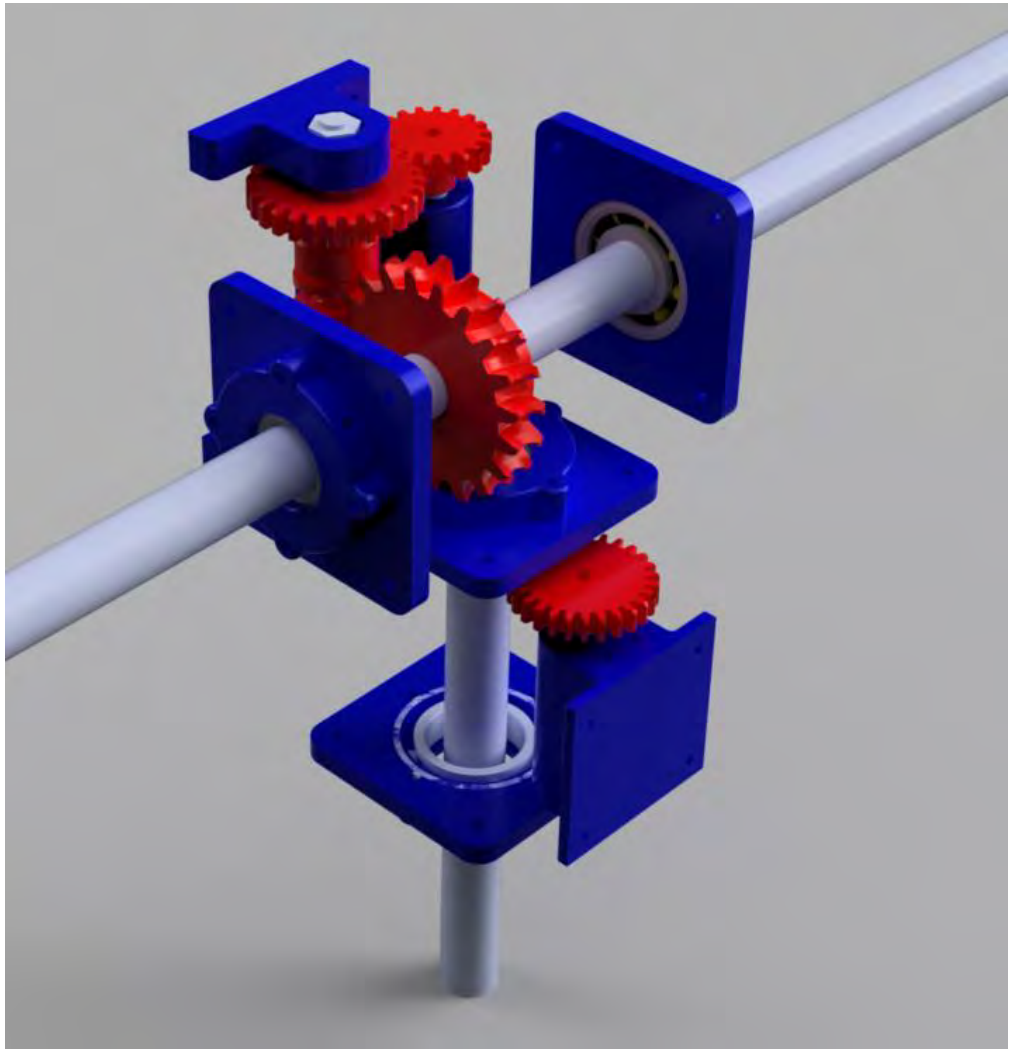


Actual 3D printed part ◀◁
One of the four parts of the chassis.

All 3D printed parts were printed with honeycomb type of infill and three layers of shell. These features made the parts stronger at the cost of longer 3D printing duration.

The next page shows the design and other printed parts.

GROUND SENSOR TERMINAL: ANTENNA ROTATOR



▷▶ Internal Mechanical Design.
All gears and mounting brackets were 3D printed

▷▶ Spur to worm gear translation

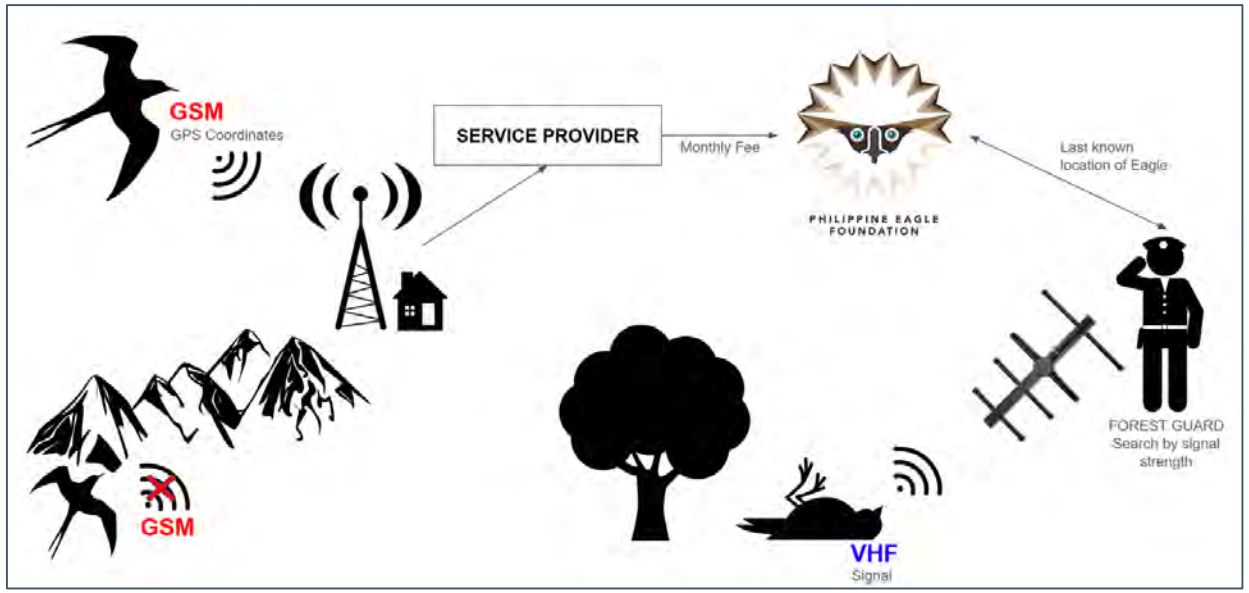
▷▶ The rotator and its gears

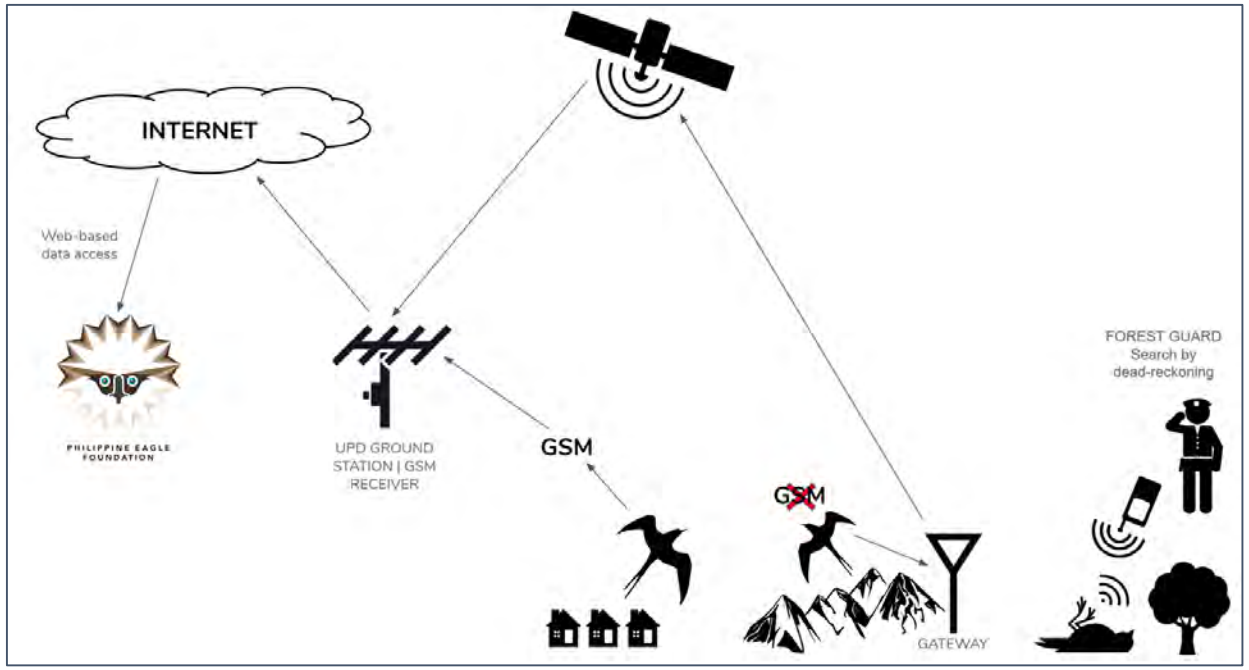
WHAT'S NEXT: TARGETING AN APPLICATION

Currently, the team is working on the individual parts of the GST for integration in the coming weeks. The team has also started working on a potential application of the S&F System in the country. Recently, a group of scientists visited the PHL-Microsat team to propose a collaborative project to track the country's endangered species in aid of wildlife conservation. During the meeting, it was decided that the first version of the system will be designed for tracking the Philippine Eagle.

▷▶ SAVING ENDANGERED SPECIES
Members of the PHL-Microsat team met with the UP Institute of Biology and the Philippine Eagle Foundation on April 24 to discuss how satellite technology can help track endangered species in the country like the Philippine Eagle in Visayas and Mindanao, tamaraws in Mindoro, and pangolins in Palawan. The group also talked about the significance of tracking these species and how critical their remaining population is.

▷▶ Philippine Eagle "Dakila" | Photo from the Philippine Eagle Foundation The Philippine Eagle (Pithecophaga jefferyi) is the country's "national bird," according to a 1995 Presidential Proclamation. As early as 1970, the Philippine government declared it a protected bird and mandated the Department of Environment and Natural Resources to preserve the species. The Philippine Eagle is endemic to the Philippines. According to estimates, there are only about 400 pairs remaining in the wild.





▷▶ CURRENT SYSTEM USED BY PHILIPPINE EAGLE FOUNDATION

The Philippine Eagle Foundation, a non government organization which aims for the protection and conservation of the Philippine Eagle, has an existing system for tracking the said species. However, the number of tracking devices deployed were very limited due to the cost of each unit. Further, the foundation also pays a monthly fee for data access, a scheme that may not be sustainable for a non-profit organization.

Aside from the operating costs, the current system also faces challenges in terms of connectivity. Since the system relies only on GSM for connectivity, transmission delays of up to a week may be experienced when the tracking device is in a location with weak GSM signal.

▷▶ PROPOSED SYSTEM FOR EAGLE TRACKING

The proposed system shall retain the use of GSM as the main communications link due to readiness of this infrastructure. However, to address connectivity issues in remote areas, the new system shall have a separate radio capable of long-range transmission. This new radio shall be activated when there is no GSM signal.

Prior to the tracking systems' deployment, gateways shall be established in remote sites. These gateways shall communicate to a central GST capable of communicating with the BIRDS-2 satellite. The long-range radio attached to the Eagle can communicate with any nearby gateways which will then relay the message until it reaches the GST. The radio can also send data directly to the GST if it is within range.

EAGLE TRACKER: SYSTEM DESIGN

END OF REPORT

Thank you for reading our report

02. About the PHL-Microsat Team

Editor's Note: PHL-Microsat Team is a part of BIRDS-2 and BIRDS-4.

ABOUT THE PHL MICROSAT TEAM

Access to satellite images is of paramount importance to a disaster-prone archipelagic country like the Philippines.

The PHL-Microsat team, composed of engineers who build the satellites and scientists who interpret data, seeks to make satellite images more accessible to Filipinos to help manage disaster risk and improve agriculture.

Another aim of the program is to build capacity of Filipino engineers to build its own satellites.

This section seeks to give a face to some of the diligent engineers and scientists working inside laboratories to capacitate the Philippines in space technology.

This article was written by Yvette Morales.

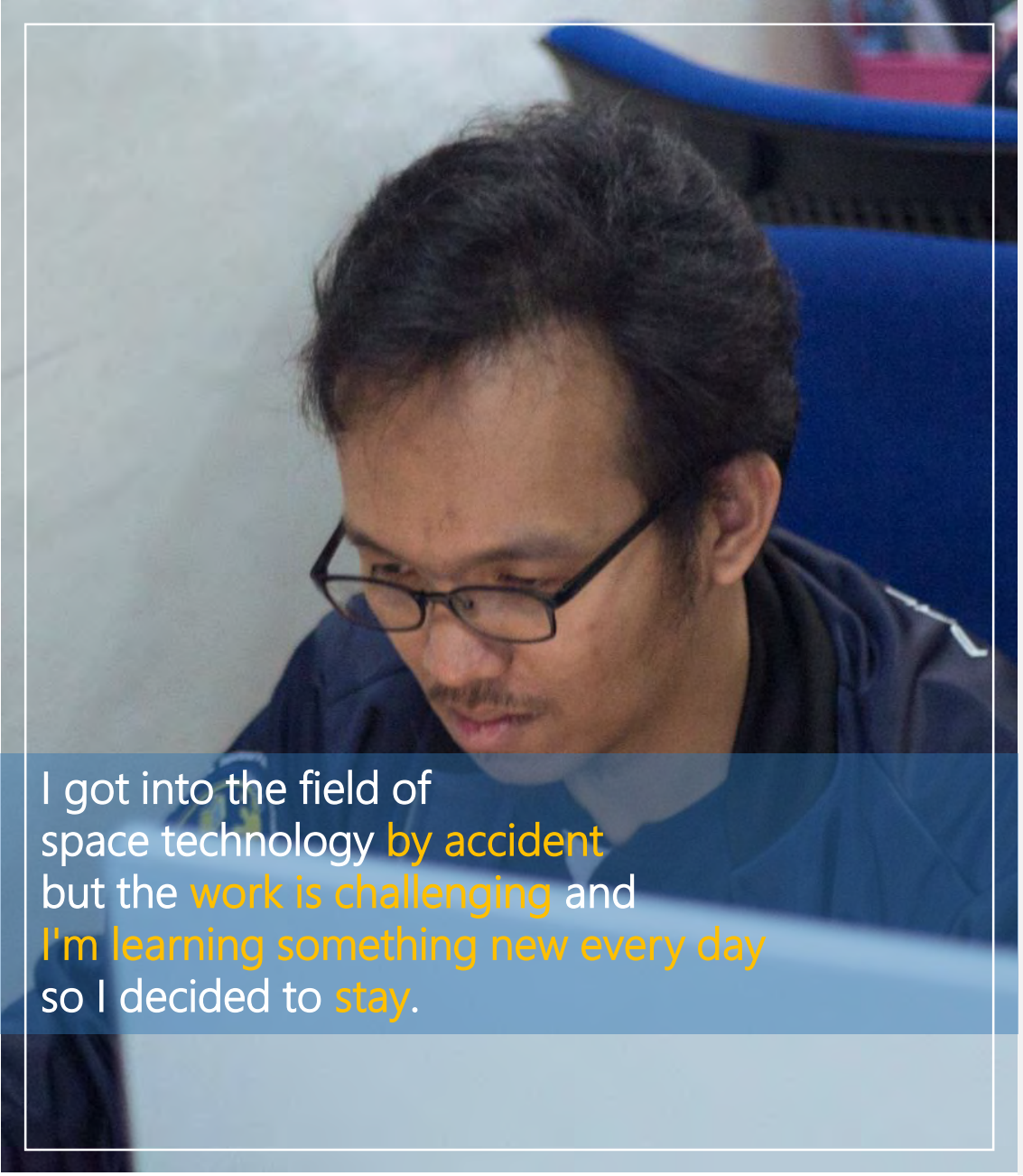
Name: **Charleston Dale Macutay Ambatali**
Age: **23**
Degree: **Master of Science in Electrical Engineering**
University of the Philippines – Diliman

Charleston is the technical head of the Amateur Radio Satellite Station (ARSS) in UP Diliman. He also works on the test and experimentation of Diwata-1's store and forward protocol.

His fascination with astronomy was rekindled when the Philippines ventured into space technology through the PHL-Microsat program.

Now, Charleston helps nurture the youth's interest in space technology as one of the lecturers at the Electrical and Electronics Engineering Institute (EEEI) in UP Diliman.

He oversees the can satellite development and teaches the systems engineering component of the Introduction to Satellite Systems, a 3-unit elective for EEEI students.



Name: **Romer Kristi D. Aranas**
Age: **32**
Degree: **Master of Science in Geomatics Engineering, Major in Geoinformatics**
University of the Philippines – Diliman

RK leads the software development team of the data processing, archiving, and distribution component of the PHL-Microsat program. He is in charge of the data processing pipelines as well as integrating the outputs of the research and software development sub teams.

RK says his journey in space technology is by accident. He fell in love with GIS and remote sensing when he shifted to geodetic engineering after being kicked out of computer engineering in his junior year in college.

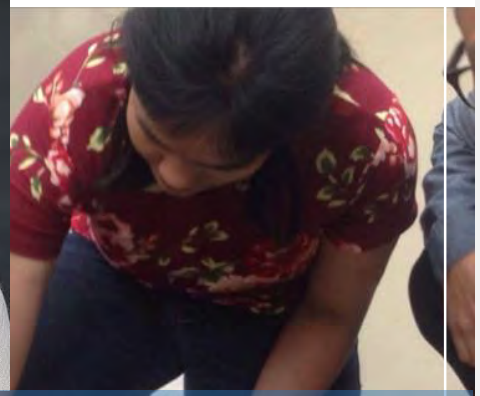
He was taking his master's degree in UP when the PHL-Microsat program took off. RK was invited by one of the project leaders to join the team and as they say, the rest is history.

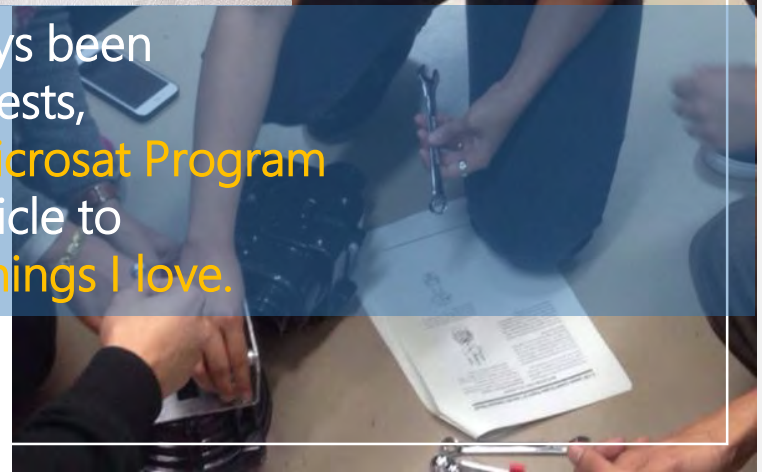
Name: **Izrael Zenar Casople Bautista**
Age: **25**
Degree: **Master of Science in Energy Engineering**
University of the Philippines – Diliman

The challenges which come with space technology enticed IZ to pursue the field.

IZ is one of the engineers who develops the amateur radio unit (ARU) for Diwata-2. The ARU is one of the new payloads of the Philippines' second microsatellite. It aims to provide for an alternative means of communication – a valuable feature for a disaster-prone country like the Philippines.

Aside from working on Diwata-2, IZ also leads the operation of the amateur radio satellite station and the ground station terminal for BIRDS-2.





Space has always been one of my interests, and the PHL-Microsat Program served as a vehicle to let me do the things I love.

Name: **Mary Ann Zabanal Constante**
Age: **28**
Degree: **Bachelor of Science in Electronics and Communications Engineering**
University of the Philippines – Diliman

Mary Ann is the acting manager of the PHL-Microsat technical team. She plans the technical activities and trips, checks the team's deliverables, and coordinates operations-related matters such as procurement and budgeting.

She also works on the amateur radio payload for Diwata-2 and the Ground Sensor Terminal for the BIRDS-2 project.

Mary Ann also helped develop the course on space technology in UP Electrical and Electronics Engineering Institute. She introduced the prototyping course in can satellite development to undergraduate students.

The future is in space.

Name: **Ariston N. Gonzalez**
Age: **28**
Degree: **Master of Science in Aerospace Engineering**
Tohoku University, Japan

Ariston is one of the engineers working on Diwata-2. He researches on the satellite attitude determination and control systems and develops cost-effective experimental attitude estimation module.

He also leads several phases of the development of microsatellites. Among his tasks in PHL-Microsat are test system preparation and performance evaluation using a combination of custom and proprietary resources, structural and mechanical design of the satellite using SolidWorks™, and module programming using C++ and Verilog (FPGA).

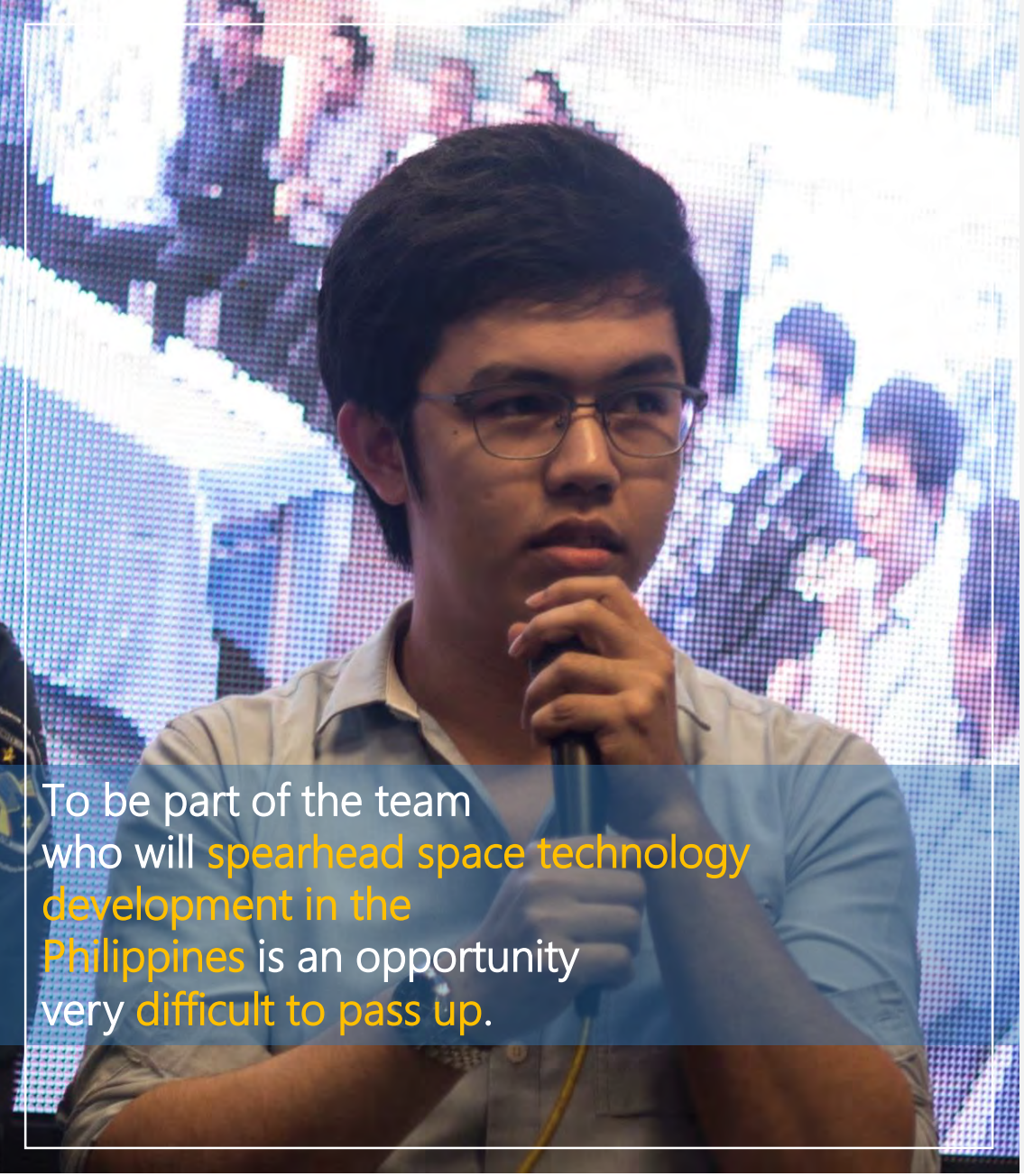
He is also involved in electronic board prototyping and development using EagleCAD, structural Analysis using FEMAP with NX Nastran, and the development of ground station interface software using C# (Visual Studio).

Name: **Gabriel Kevin A. Mabini**
Age: **25**
Degree: **Bachelor of Science in Mechanical Engineering**
University of the Philippines – Diliman

Gabriel is one of PHL-Microsat's mechanical engineers. He works on the design, drawings, and fabrication of the antenna deployment, as well as the structural design, analysis, and simulation of the microsatellite vibration analysis.

He is also part of the team who works on the technology research and development of the ground station antenna rotator.

Gabriel says being part of a team who develops space technologies realizes his childhood dream of being able to make something that would contribute in making space accessible to mankind.



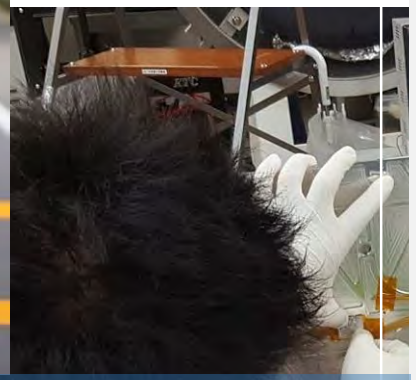
Name: **Benjamin Jonah Perez Magallon**
Age: **27**
Degree: **Master of Science in Cosmosciences**
Hokkaido University, Japan

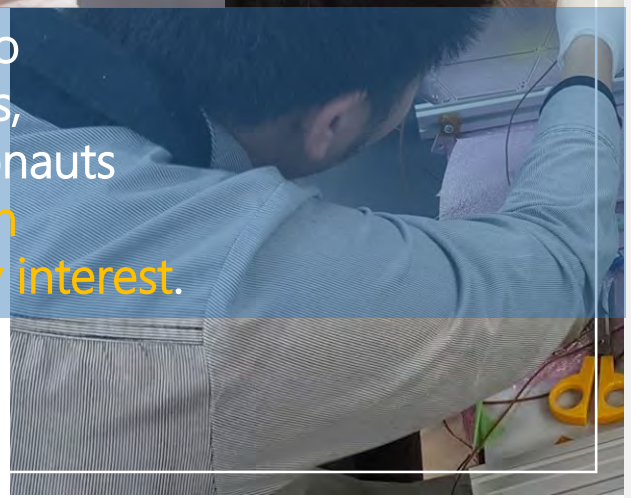
Benjamin is the data processing and operations head of PHL-Microsat Project 3.

He works on the preprocessing and assessment of Diwata-1 images -- from digital numbers to reflectance image processing up to cloud cover analysis and contrast assessment.

He is also doing orbit analysis for Diwata-1, as well as other future satellites. He also relates the orbit to the images captured and other factors like the sun position relative to the satellite, which aims to improve satellite operation.

Benjamin finished his master's degree in Japan in 2017. His interest in space technology was ignited by reading books on outer space when he was a child.





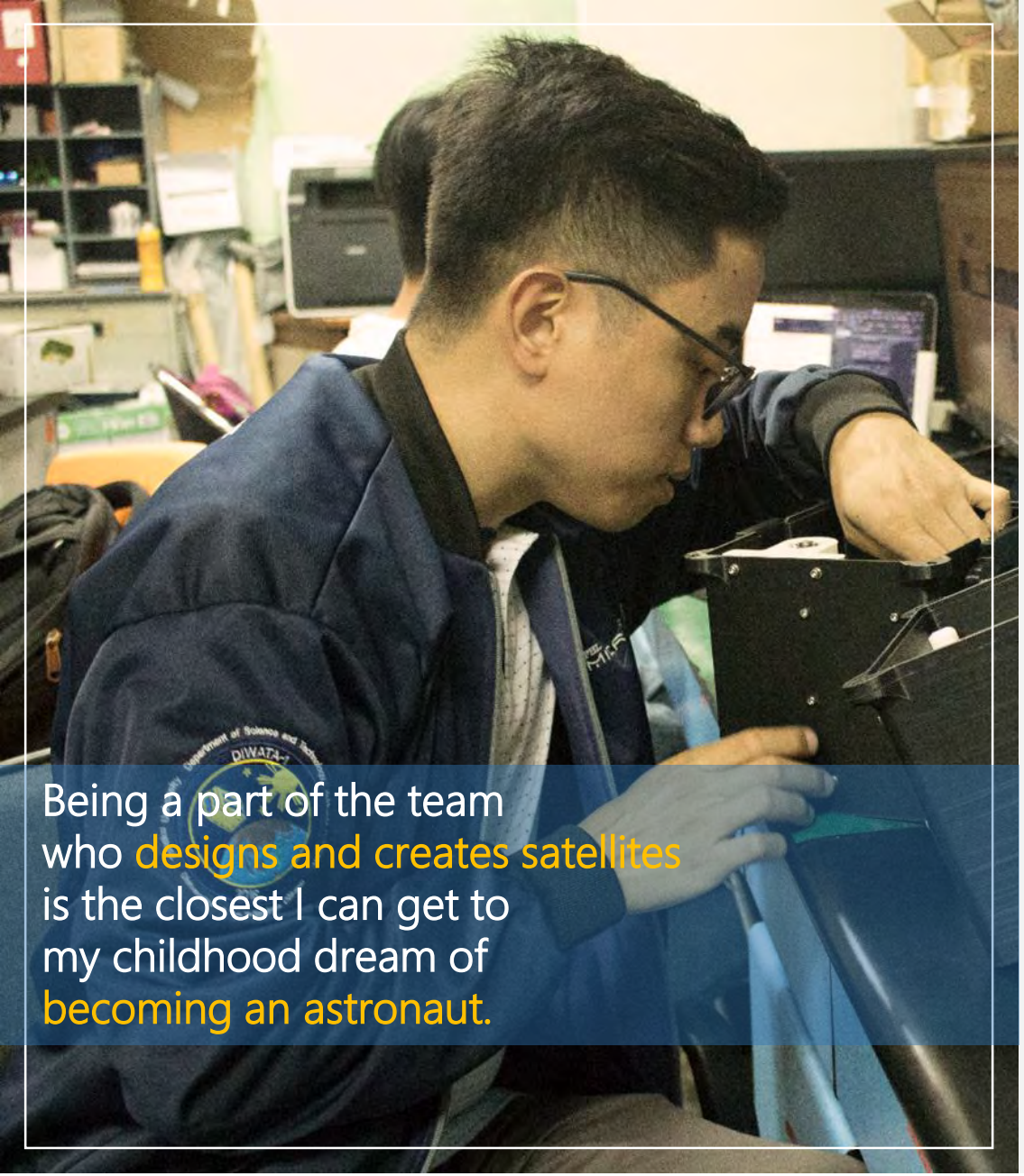
I read books related to space shuttles, rockets, moonwalks, and astronauts since life beyond Earth has always piqued my interest.

Name: **Delburg Mitchao**
Age: **24**
Degree: **Master of Engineering in Mechanical and Space Engineering**
Hokkaido University, Japan

Delburg is a thermal subsystem engineer – he designs the thermal subsystem of the Diwata satellites using passive thermal control techniques to ensure survival despite the extreme thermal environment in space.

He also leads and plans thermal vacuum chamber tests necessary to qualify experimental spacecraft components, and assesses the satellite's performance while in orbit.

Like some Diwata engineers, Delburg also dreamed of being an astronaut when he was a kid. He read books on space shuttles, rockets, moonwalks, and astronauts since as he says, "life beyond Earth has always piqued my interest."



Name: **Arvin Oliver S. Ng**
Age: **25**
Degree: **Bachelor of Science in Mechanical Engineering**
University of the Philippines – Diliman

Oliver is one of the PHL-Microsat's mechanical engineers.

He works on the CAD modelling and rapid prototyping – specifically the 3-D printing – of parts like the ground sensor terminal rotator.

He also conducts tests on the mechanical parts of Diwata-2, such as the antenna deployment mechanism.

For Oliver, being a part of the team who designs and creates microsatellites is the closest he can achieve his childhood dream of becoming an astronaut.

Space technology offers a new avenue for us to take advantage of.

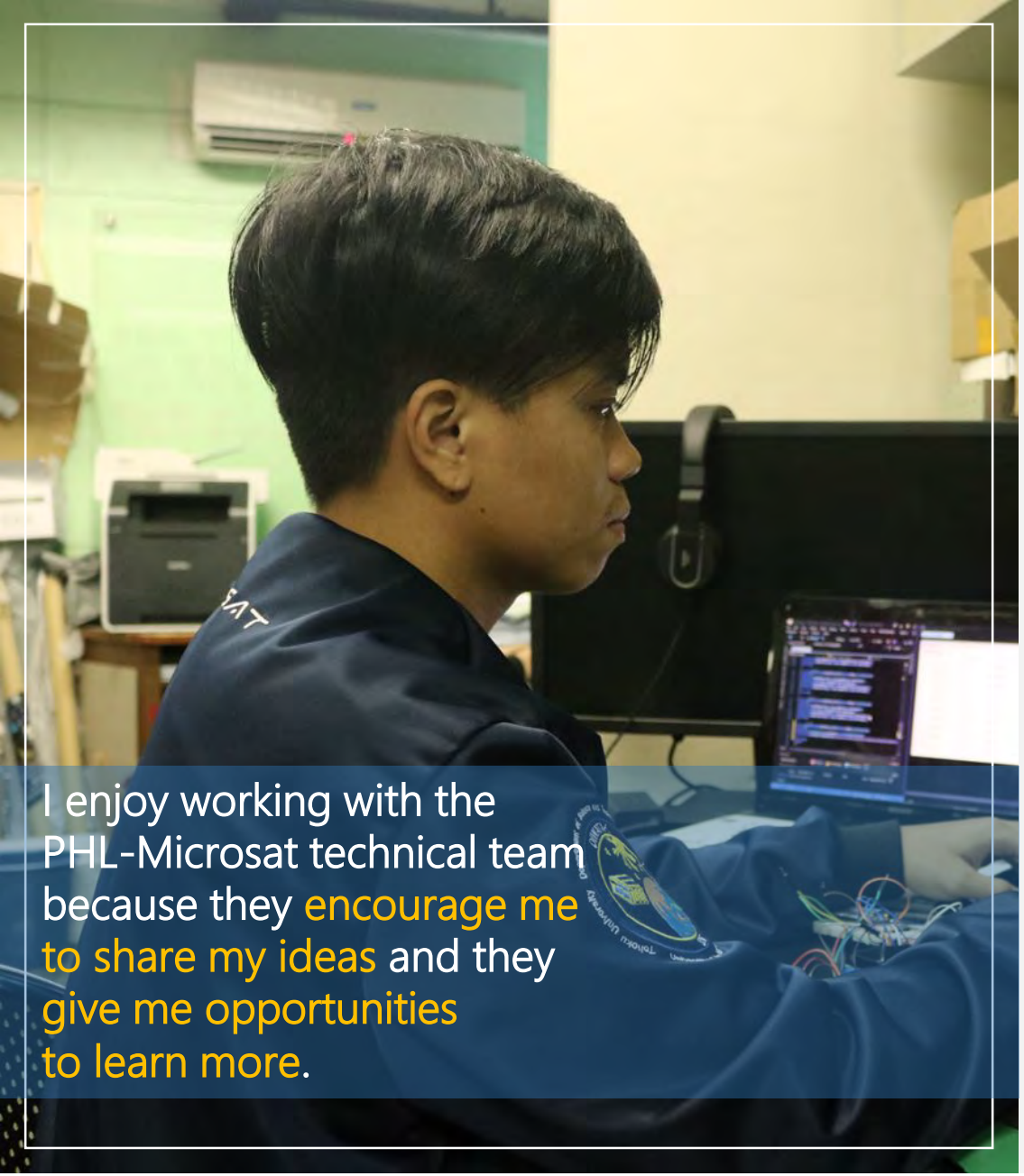
The possibilities on what it can offer and the impact it can create are some of the reasons which excite me, moving forward.

Name: **Harold Bryan S. Paler**
Age: **37**
Degree: **Bachelor of Science in Electronics and Communications Engineering**
Ateneo de Davao University, Philippines

Bryan is the operations head at the Department of Science and Technology Advanced Science and Technology Institute Ground Receiving Station.

He manages the daily operations of Diwata-1 like uploading commands and downloading images. He also manages subscriptions from commercial satellites and the maintenance of the 3.7-meter antenna and its relevant infrastructure.

Bryan says as an engineer, he always want to be in the loop on latest technological advancements. With this perspective, the opportunity to be involved in space endeavors is something he says he cannot refuse.



Name: **Carlo Dizon Pastoral**
Age: **22**
Degree: **Bachelor of Science in Computer Engineering**
Cavite State University, Philippines

Carlo started working for the PHL-Microsat right after he graduated from college with a degree in Computer Engineering.

He says he never imagined going into space technology after graduation, and considers his work a "calling."

At such a young age, Carlo says he enjoys working with the PHL-Microsat team as they give him opportunity to learn and share his ideas.

He currently works on the BIRDS-2 Store and Forward payload and the can satellite course. This includes the development of Ground Station Terminal Antenna Rotator and the development of comet microcontroller board.

Name: **Nash Frederic M. Prado**
Age: **27**
Degree: **Master of Science in Geomatics Engineering in Remote Sensing (ongoing)**
University of the Philippines – Diliman

Nash is part of the team who works on the ground station operations and tasking of Diwata-1. His team uploads the commands and downloads the data from Diwata-1.

He works at the Ground Receiving Station (GRS) at the Department of Science and Technology Advanced Sciences and Technology Institute (DOST-ASTI). Aside from Diwata-1, the GRS also caters to other satellites the Philippines subscribes to.

For Nash, it will be an honor to be part of the team who will possibly pioneer the proposed Philippine Space Agency.

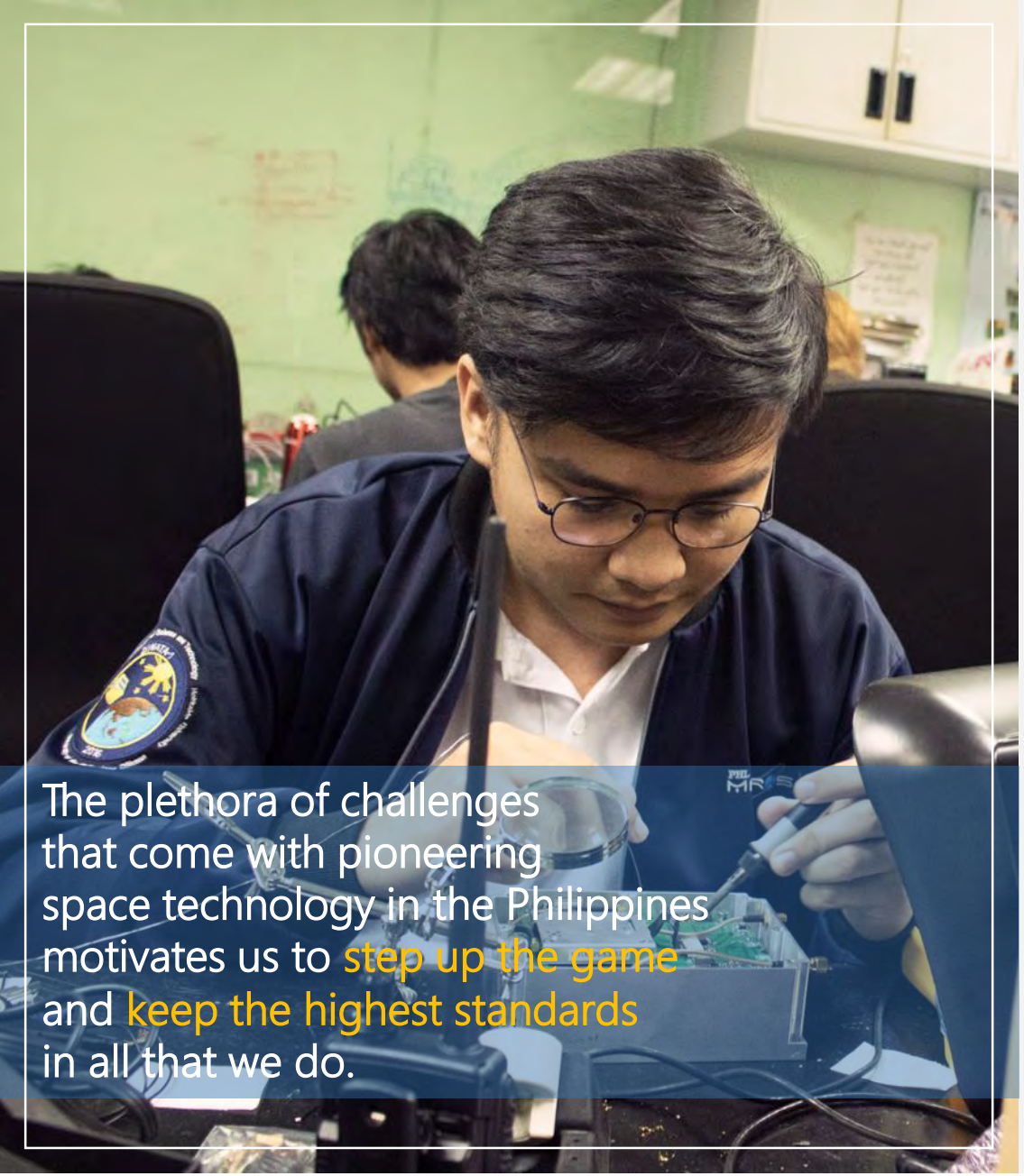
For an archipelagic country like ours, space technologies can offer services that transcend natural boundaries and traditional hindrances thereby allowing the delivery of services even in remote and far-away areas.

Name: **Alvin E. Retamar**
Age: **44**
Degree: **Master in Technology Management**
University of the Philippines – Diliman
Master in Business Administration
International University of Japan

Alvin is the project leader of the Ground Receiving Station for the PHL-Microsat, which receives images and data from the microsatellite.

He is also the Chief Science Research Specialist at the Department of Science and Technology Advanced Science and Technology Institute (DOST-ASTI) who handles the Solutions and Services Engineering Division (SSED).

Alvin says space technology is beneficial for an archipelagic country like the Philippines since it enables operational, monitoring, exploration, and other research activities. It has seen applications in agriculture, forestry, mapping, as well as disaster mitigation.



Name: **Lorenzo Sabug, Jr.**
Age: **27**
Degree: **Master of Science in Electrical, Information, and Computer Engineering**
RWTH Aachen University, Germany

Lorenzo, one of PHL-Microsat's research associates, manages the development of the amateur radio payload of Diwata-2, the Philippines' second microsatellite to be launched in the second half of 2018.

He also contributes to the experimental attitude determination module for Diwata-2.

For Lorenzo, it is an exciting opportunity to work with the team of Filipino scientists and engineers who are taking small yet meaningful steps for the Philippines' debut in the space-faring community.

Name: **Arvin Joseff Tan**
Age: **29**
Degree: **Bachelor of Science in Electronics Engineering**
Ateneo de Naga University, Philippines

Arvin is one of PHL-Microsat's science research specialists.

He is part of the team who designs and develops the Experimental Attitude Control Unit (ACU-Ex) and the Sun Aspect Sensor-Z axis (SAS-Z) modules for Diwata-2, which aims to explore small satellite attitude/orientation determination and control using commercial-off-the-shelf parts.

Arvin says he joined PHL-Microsat as he has always been fascinated with space and astronomy since he was a child. He believes mankind is meant to venture into space, and he wants to help make it a reality by learning and building space technologies.

End of article by Yvette Morales.

03. JAXA writes up the handover of BIRDS-2 from Kyutech to JAXA

関連トピックス

- BIRDS-2衛星の完成について（Joint Global Multi Nation Birds（九州工業大学プレスリリース））（2018年2月26日）
- BIRDS第1弾の放出について
- 九州工業大学の「BIRDS Satellite Project」が「GEDC Airbus Diversity Award 2017」を受賞
- 国際宇宙ステーション・「きぼう」からの超小型衛星利用に関するJAXA、九州工業大学との包括的な連携協力について（JAXA/九州工業大学プレスリリース）（2017年4月19日）

THE LINKS ABOVE CAN BE ACCESSED AT THIS SITE

See the whole article here:

http://iss.jaxa.jp/kiboexp/news/180517_birds-2.html

2018年5月15日、ブータン、フィリピン、マレーシアの留学生たちが設計・製作した3機の超小型衛星がJAXA筑波宇宙センターにおいて、JAXAに引き渡され、夏頃の放出に向けて衛星搭載作業が実施されました。

今回引き渡された衛星はBIRDSプロジェクト（※）の第2弾でJAXAと九州工業大学の戦略的パートナーシップ契約に基づき、「きぼう」日本実験棟からの超小型衛星放出を行うもので、今後、ドラゴン補給船運用15号機（SpX-15）により米国フロリダ州から打ち上げられる予定です。

BIRDS-2は、日本、ブータン、フィリピン、マレーシアの4ヵ国が参加し、およそ1年間で、ブータン、フィリピン、マレーシアの各国がそれぞれ1機、計3機の1辺10cmの小型立方体からなるキューブサットと呼ばれる超小型衛星を開発しました。それぞれの衛星の名称は「BHUTAN-1」（ブータン）、「MAYA-1」（フィリピン）、「UiTMSAT-1」（マレーシア）です。ブータンにとっては自国初の人工衛星となります。

BIRDS-2 members deliver their handiwork to JAXA

「きぼう」の小型衛星放出機構（JEM Small Satellite Orbital Deployer: J-SSOD）と超小型衛星を前に記念撮影を行う「BIRDS-2」ミッション参加国メンバーとJAXA関係者ら
（出典：JAXA）

※ BIRDSプロジェクト（正式名: Joint Global Multi Nation Birds）は、日本の九州工業大学とアジア・アフリカ諸国が参加して、超小型衛星を共同開発・運用する国際的な衛星開発プロジェクトです。今回引渡しされた3機の超小型衛星は、その第2弾となります。

END OF ARTICLE BY JAXA

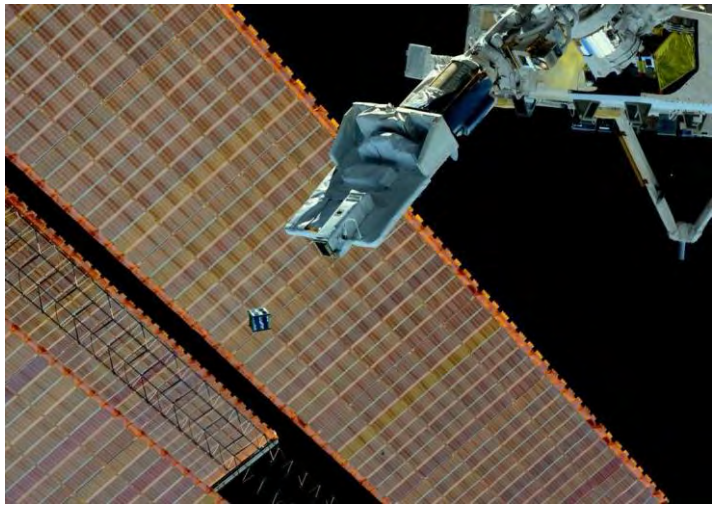
04. JAXA creates an adhesive decal for KiboCUBE ★ BIRDS

SEE THE NEXT PAGE

In addition, JAXA created a lapel pin with the same design

For more info about **J-SSOD** (JEM Small Satellite Orbital Deployer) see http://iss.jaxa.jp/en/kiboexp/jssod/

05. What is KiboCUBE?



Deployment of a CubeSat from the ISS.
Photo: NASA/JAXA

The answer is here:

http://www.unoosa.org/oosa/en/ourwork/psa/hsti/kibocube.html

06. Nigerian Union's annual Momochi Beach Party was attended by some members of BIRDS

Kyutech students participating in the annual ***Nigerian Union Beach Party*** at Momochi Beach, Fukuoka City, Saturday, 19 May 2018, Noon-6:00 PM

Photos above are from **Nigerian Union**'s Facebook on 20 May.

NU Facebook: https://www.facebook.com/Nigerian-Union-Kyushu-Japan-121626377912510/

07. Establishing space activities in non-space faring nations – examples from BIRDS

Acta Astronautica 148 (2018) 220–224

Contents lists available at ScienceDirect

Acta Astronautica

journal homepage: www.elsevier.com/locate/actaastro

Establishing space activities in non-space faring nations: An example of university-based strategic planning

Pauline Faure*, Mengu Cho, George Maeda

Kyushu Institute of Technology, Laboratory of Spacecraft Environment Interaction Engineering, 1-1 Sensui-cho, Tobata, Kitakyushu 804-8550, Fukuoka, Japan

A paper on the subject has been published

Journal website:
https://www.journals.elsevier.com/acta-astronautica

ARTICLE INFO

Keywords:
Capacity building
Developing countries
Small satellite
STEM

ABSTRACT

In 2015, Kyushu Institute of Technology initiated the Joint Global Multi-Nation Birds Satellite (BIRDS) program. As of September 2017, young professionals from Bangladesh, Ghana, Nigeria, Thailand, Mongolia, Philippines, Malaysia, and Bhutan are being involved in BIRDS program. To help the young professionals acquiring the right tools and preparing them to successfully establish indigenous space activities, the space strategic planning project was established in February 2017. During the project, young professionals from Bangladesh, Ghana, Mongolia, and Bhutan were invited to think about the strategy their home country should be following in the next ten years to achieve their country's goals in terms of space sciences, engineering, and utilization, while respecting the country needs and constraints. In this paper, the efforts undertaken by the different young professionals are reported and the guidelines for each country space strategic planning are described. From this work, the authors aim at promoting space activities development in non-space faring nations and encouraging non-space faring nations to find their right strategy to achieve sustainable indigenous space activities despite the nation's constraints.

08. The API for BIRDS-2 Project has been published by ITU on their BR-IFIC release

Home : ITU-R : Space Services : SNL : Query result

Search

Radiocommunication Sector (ITU-R) | ITU Sectors | Newsroom | Events | Publications | Statistics | About ITU

SNL Part B - Query result

The Parts and Special Sections are not available online. They can be found in the collection of the BR WIC and BR IFIC DVD-ROM.
You can order it or get more information about this DVD-ROM

Your query : / Satellite network = BIRDS-2

Complete list - Explanations - Export in txt format - Export in Excel format

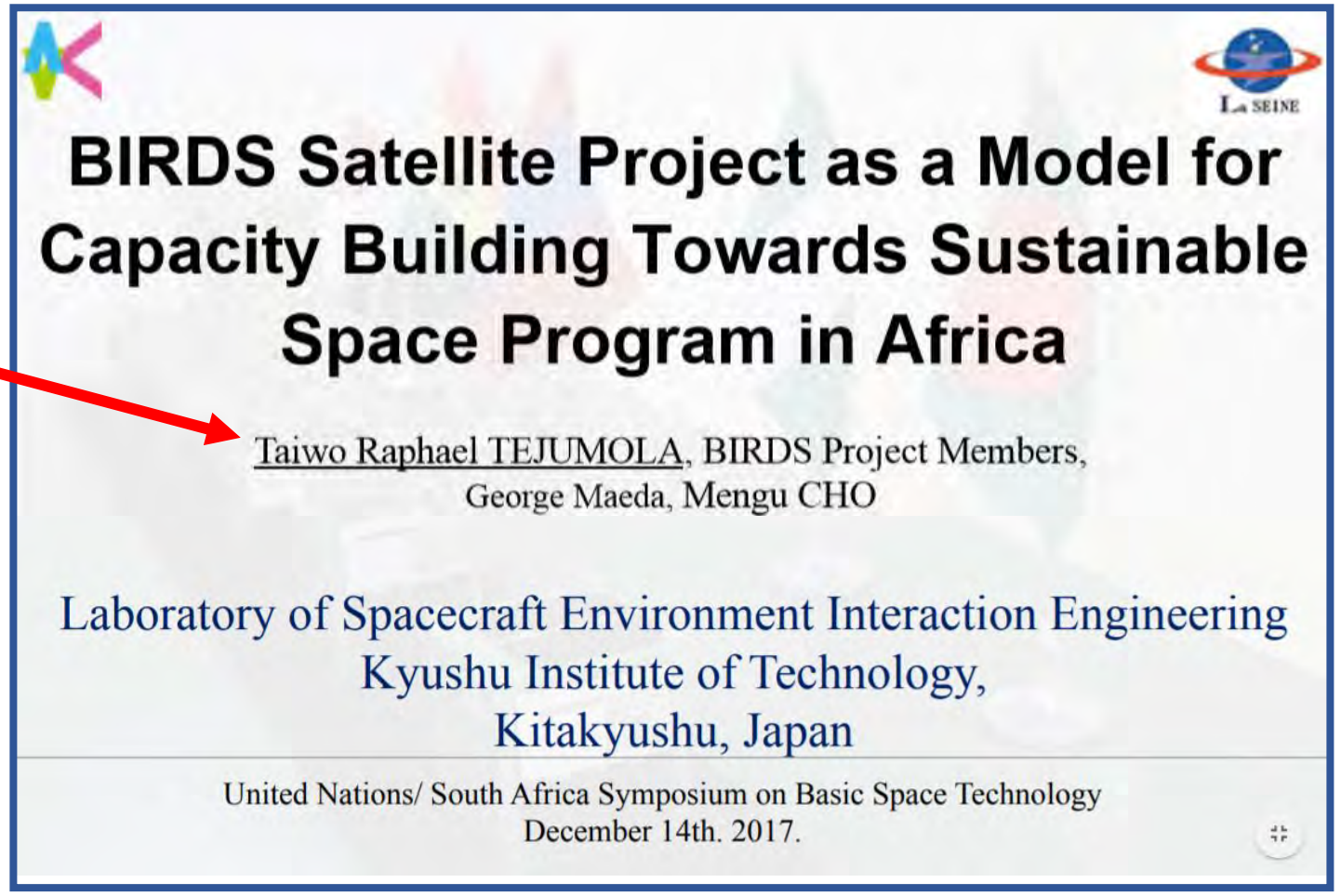
Total line = 1/1

ID number (SNS)	adm	ORG or Geo.area	Satellite name	Earth station	long_nom	Date of receipt	ssn_ref	ssn_no	ssn rev/ Sup	ssn rev no	removal	Part/ Art.	WIC/IFIC (ific.mdb)	WIC/IFIC date
118545034	J		BIRDS-2		N-GSO	21.02.2018	API/A	12140					2870	15.05.2018

https://www.itu.int/net/ITU-R/space/snl/bresult/radvance.asp?sat_type=A&sat_name=BIRDS-2&sel_satname=BIRDS-2&plan_id

09. BIRDS and Africa -- a presentation at UN workshop in South Africa

Taiwo was Project Manager of BIRDS-1



BIRDS Satellite Project as a Model for Capacity Building Towards Sustainable Space Program in Africa

Taiwo Raphael TEJUMOLA, BIRDS Project Members,
George Maeda, Mengu CHO

Laboratory of Spacecraft Environment Interaction Engineering
Kyushu Institute of Technology,
Kitakyushu, Japan

United Nations/ South Africa Symposium on Basic Space Technology
December 14th. 2017.

Pdf size:
7.8 MB

http://www.unoosa.org/documents/pdf/psa/activities/2017/SouthAfrica/slides/Presentation74.pdf

10. BIRDS-2 flight models

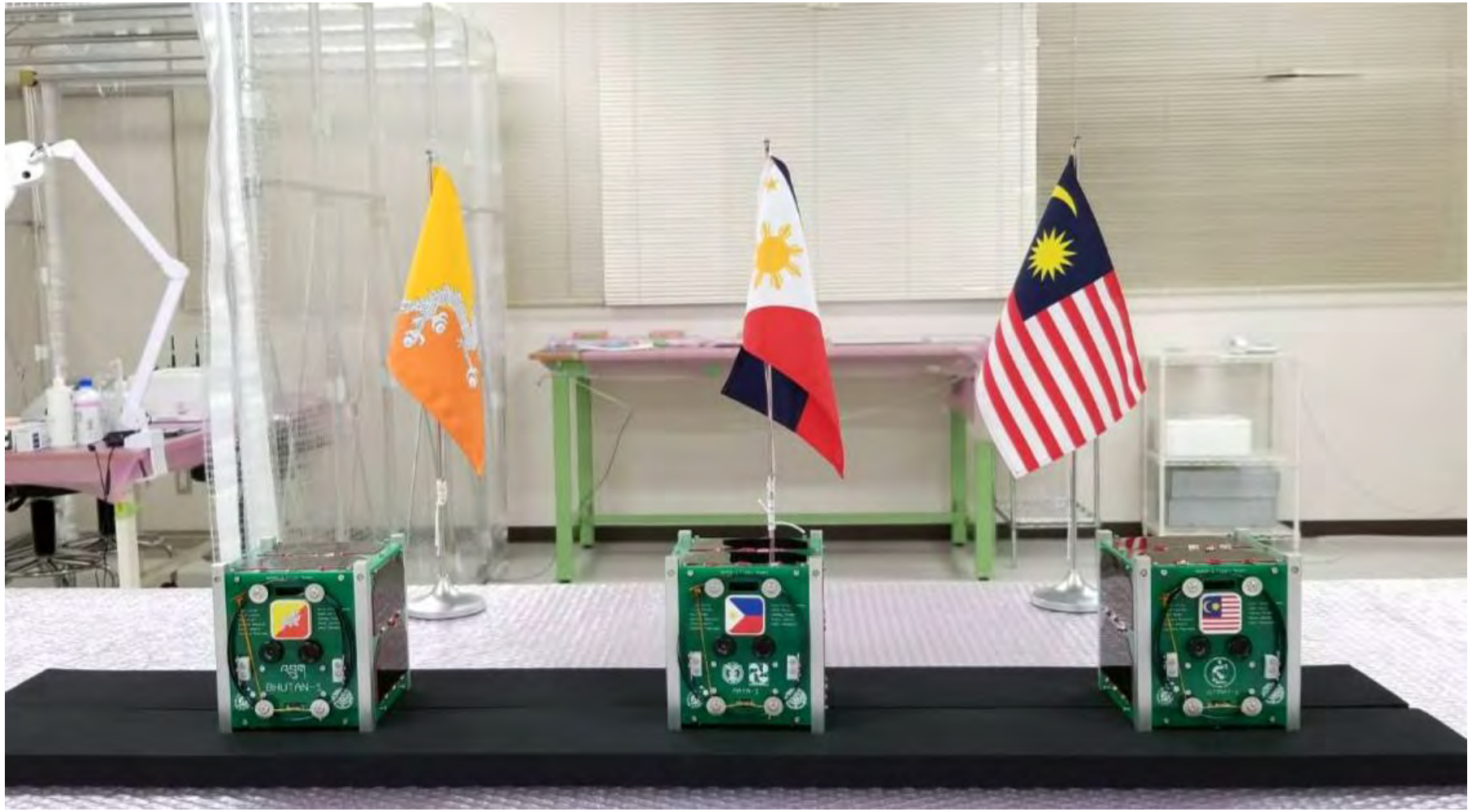


Photo courtesy of Joven

11. This newsletter is in the public domain

The entire contents of this newsletter (since Issue No. 1)
is available at this link

http://birds1.birds-project.com/newsletter.html

Accordingly, you may use this link and its contents freely
(there is nothing to stop you from doing so).

However, as its editor, if you use portions of the contents,
please provide credit by stating
"BIRDS Project Newsletter", the issue number,
and the pages referenced.

12. Zimbabwe to launch a national space agency

There is a chance that Zim will join a BIRDS Project in the future.

The Herald

10 JUNE 2018

/ LOCAL NEWS

Zim to launch national geo space agency

05 JUN, 2018 - 00:06 0 COMMENTS 1 IMAGES

Prof Murwira

Bulawayo Bureau

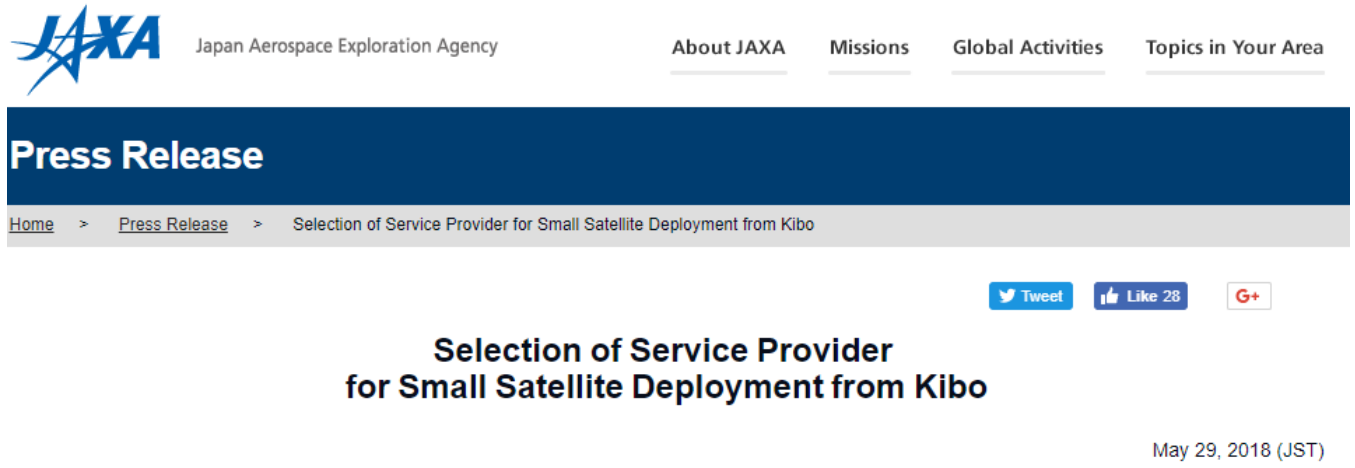
GOVERNMENT will soon launch the country's first National Geo Spatial and Space Agency aimed at harnessing satellite technology to solve problems.

The agency is being pioneered by the Ministry of Higher and Tertiary Education, Science and Technology Development as part of its 100-day plan.

In an interview yesterday on his ministry's 100-day goal achievements, Higher and Tertiary Education, Science and Technology Development Minister Professor Amon Murwira said President Mnangagwa is expected to officiate at the historic launch of the space agency.

Full article is here:
https://www.google.co.jp/amp/s/www.herald.co.zw/zim-to-launch-national-geo-space-agency/amp/

13. JAXA selects service provider


Japan Aerospace Exploration Agency

About JAXA | Missions | Global Activities | Topics in Your Area

Press Release

Home > Press Release > Selection of Service Provider for Small Satellite Deployment from Kibo

Tweet | Like 28 | G+

Selection of Service Provider for Small Satellite Deployment from Kibo

May 29, 2018 (JST)

On February 23, 2018, the Japan Aerospace Exploration Agency (JAXA) made an announcement to the private sector that it would compare proposals and select service providers capable of providing small satellite deployment services from Kibo on the International Space Station. And after carefully evaluating the proposals, JAXA has selected Space BD Inc. and MITSUI & CO., LTD. as the service providers. ***Continued next column.***

In line with the second version of the "Kibo Utilization Strategy" adopted in August 2017, JAXA intends to promote the private sector's autonomic activities in the module (private sector participation). These two companies were selected as service providers for small satellite deployment activities in the first phase of the strategy.

In 2012, JAXA developed the Small Satellite Orbital Deployer (J-SSOD) for assuming unique small satellite missions utilizing two advantageous technologies--the Robot Arm and Airlock of Kibo on the ISS. As of the end of May 2018, JAXA has successfully deployed more than 200 small satellites from Kibo, including deployment opportunities for the United States as well.

The market of small satellites is expected to further expand globally. JAXA has to date provided fee-based services on its own . . .

See here for the full press release: http://global.jaxa.jp/press/2018/05/20180529_microsat.html

Brief report of 15th ANNUAL CUBESAT DEVELOPERS WORKSHOP

April 29 – May 2 [2018]

San Luis Obispo, CA,

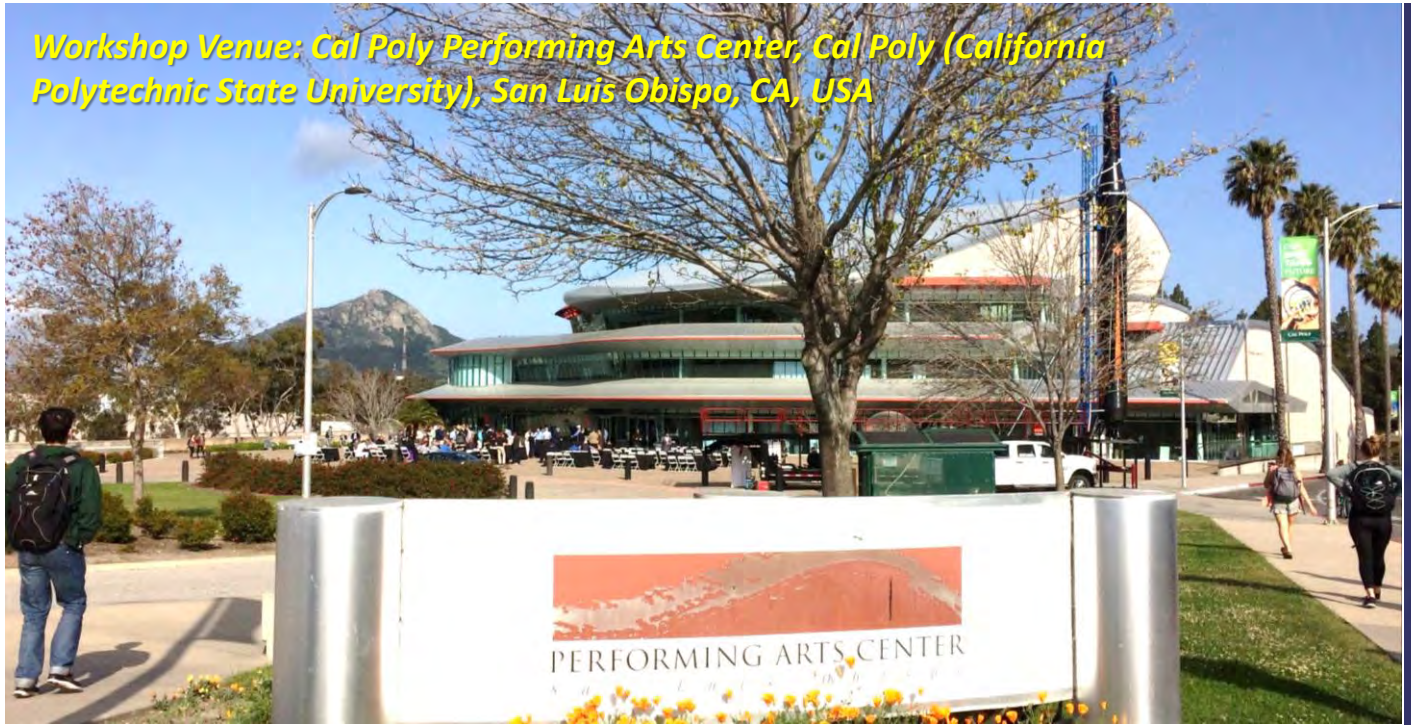
USA

Prepared by Turo of BIRDS-1 on 10 June 2018

15th ANNUAL CUBESAT DEVELOPERS WORKSHOP at CAL POLY

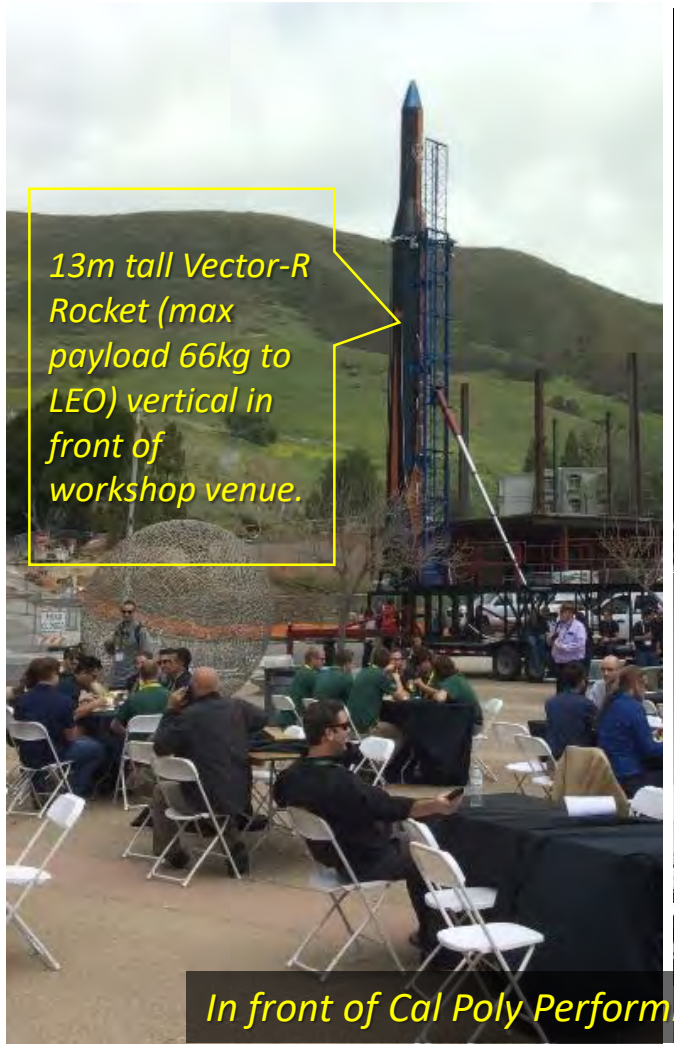
Organizers statement about CubeSat Developers Workshop:

This will be the 15th year that Cal Poly has hosted the CubeSat Developers Workshop in San Luis Obispo, California. At this workshop, CubeSat developers from academia and industry are brought together to share their knowledge and experience developing small satellites using the increasingly popular small satellite platform. This year the focus will be on the recent expansion of the CubeSat community with the increasing interest and participation from commercial sectors. This workshop will provide valuable insight for both new and current members of the CubeSat Community. Participants and exhibitors come from all over the globe to share information and to help further scientific exploration. Workshop website: www.cubesat.org



Workshop Venue: Cal Poly Performing Arts Center, Cal Poly (California Polytechnic State University), San Luis Obispo, CA, USA

15th ANNUAL CUBESAT DEVELOPERS WORKSHOP at CAL POLY

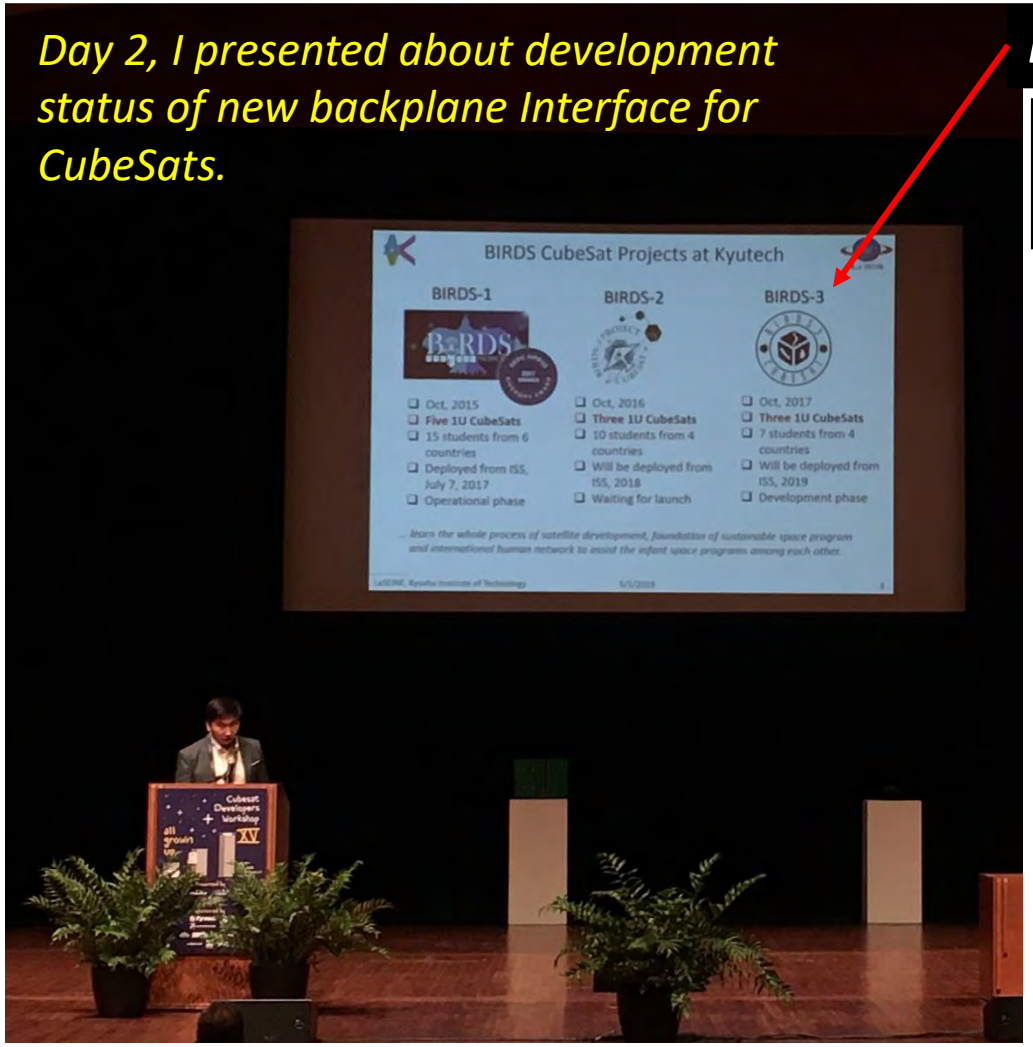


All the presentation are available through the CubeSat Workshop Archive. If you are interested, please check following links.

http://mstl.atl.calpoly.edu/~workshop/archive/2018/

15th ANNUAL CUBESAT DEVELOPERS WORKSHOP at CAL POLY

Day 2, I presented about development status of new backplane Interface for CubeSats.



BIRDS Projects mentioned here.

Masui sensei invited as a panel member

Dr. Amelia Greig

Dr. Masui Hirokazu

Day 3, Panel members discussing about International Collaboration.

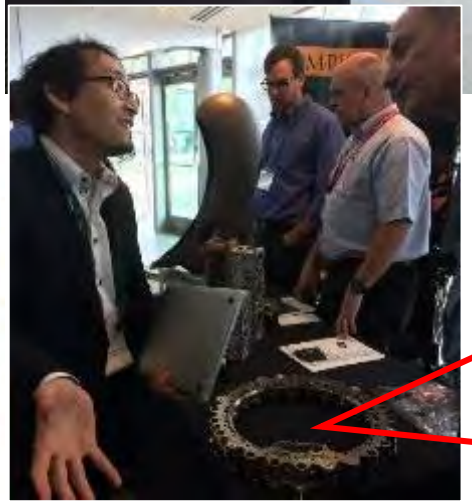
And he talks about International CubeSat projects at Kyutech as well as BIRDS, SPATIUM and AOBA-VELOX 3.

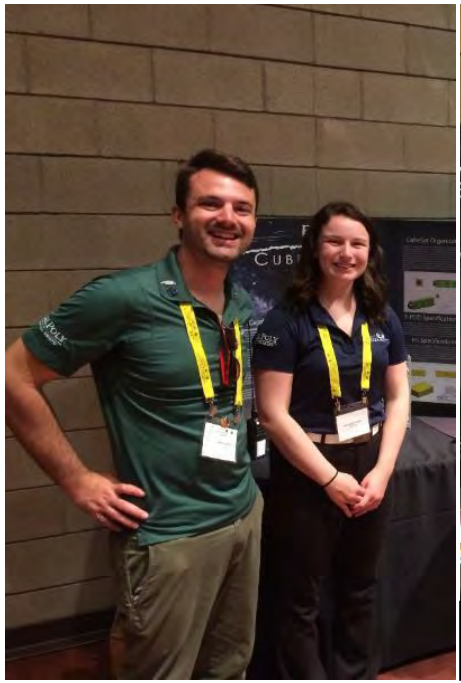
15th ANNUAL CUBESAT DEVELOPERS WORKSHOP at CAL POLY

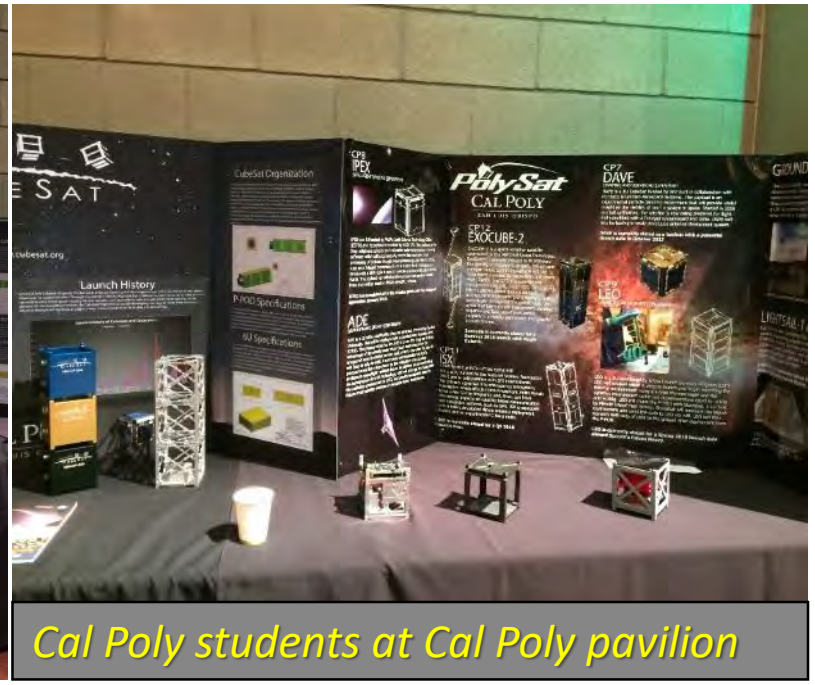
Look, who is there?

Workshop banner with participants signatures

Infosteller in the Main Lobby

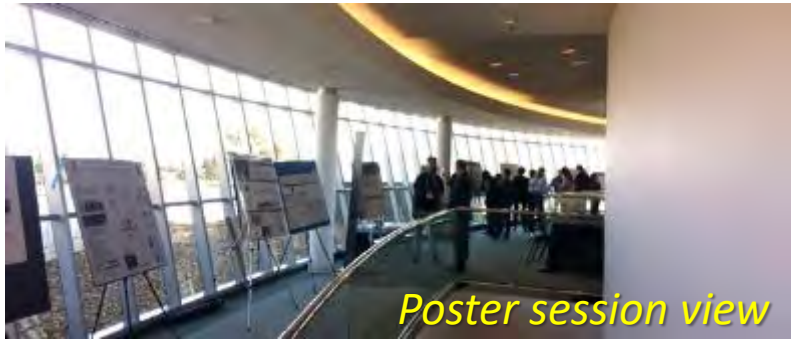






Cal Poly students at Cal Poly pavilion

New, cool satellite separation system.



Poster session view

End of Turo's report

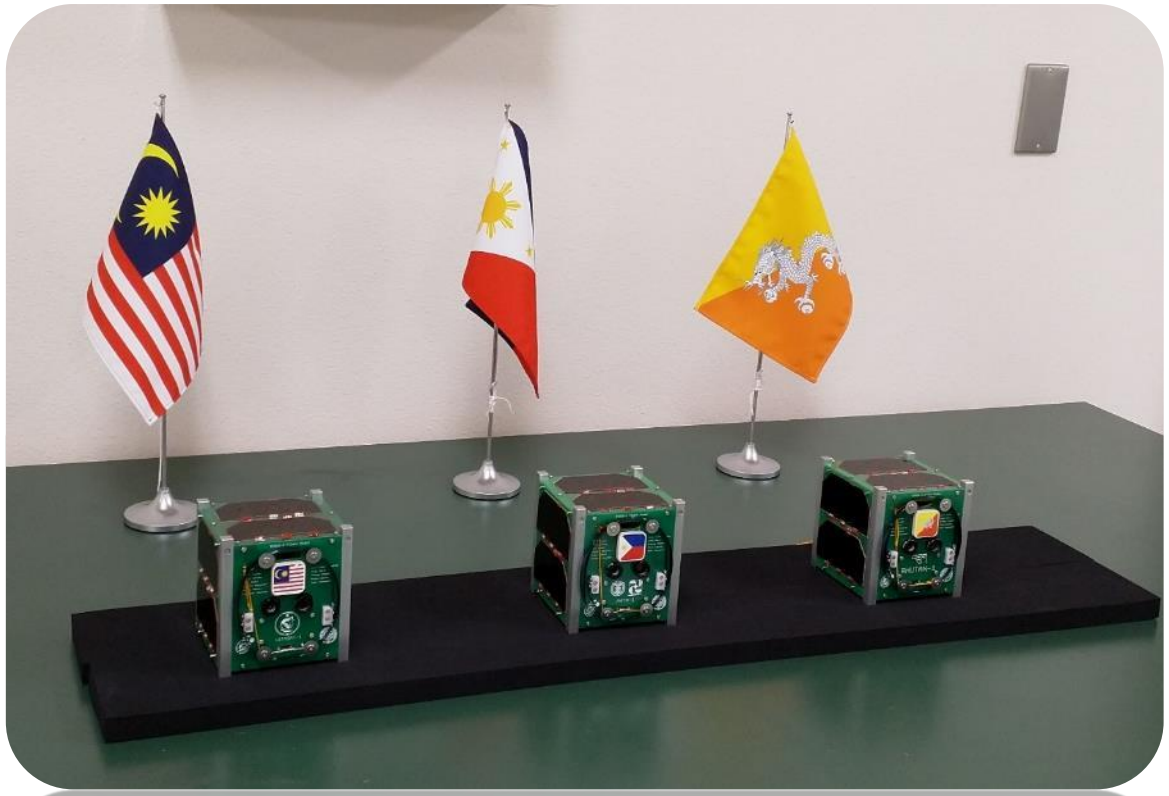
15. BIRDS-2 team delivers their satellites to JAXA in Tsukuba

The Journey Begins

Kitakyushu to Tsukuba, a report by Kiran

Four members of BIRDS-2 team hand delivered the three 1U CubeSats built by the team. The satellites traveled across Japan and crossed the Pacific Ocean, all the way to Florida, USA from where it will be launched to ISS and then finally get released into the orbit. The following pages capture the journey from KyuTech to JAXA.

Satellite Inspection



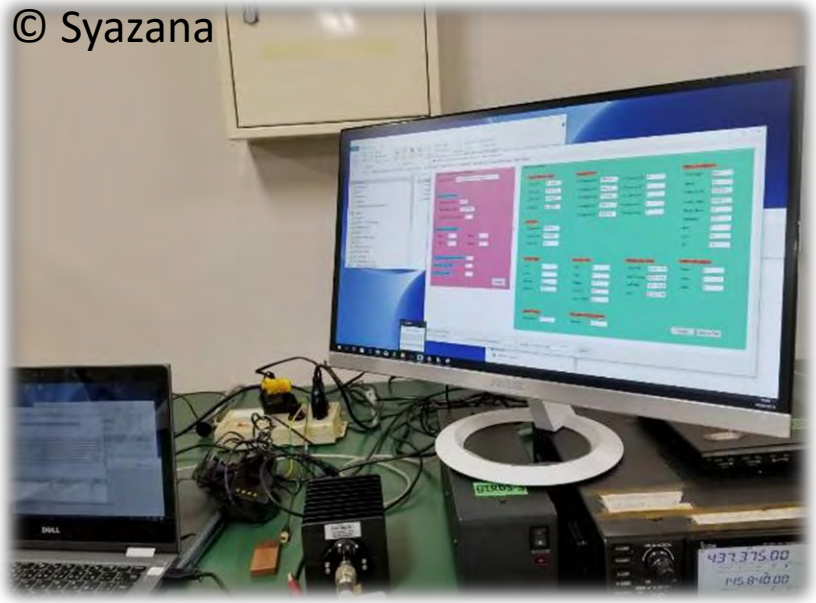
(*Above*) The three CubeSats on display for the inspection. From left, UiTMSAT-1, MAYA-1 and BHUTAN-1.

(*Below*) On April 26, 2018, officials from Kyushu General Communications Bureau conducted the inspection as part of the pre-licensing procedure.

Software Initialization

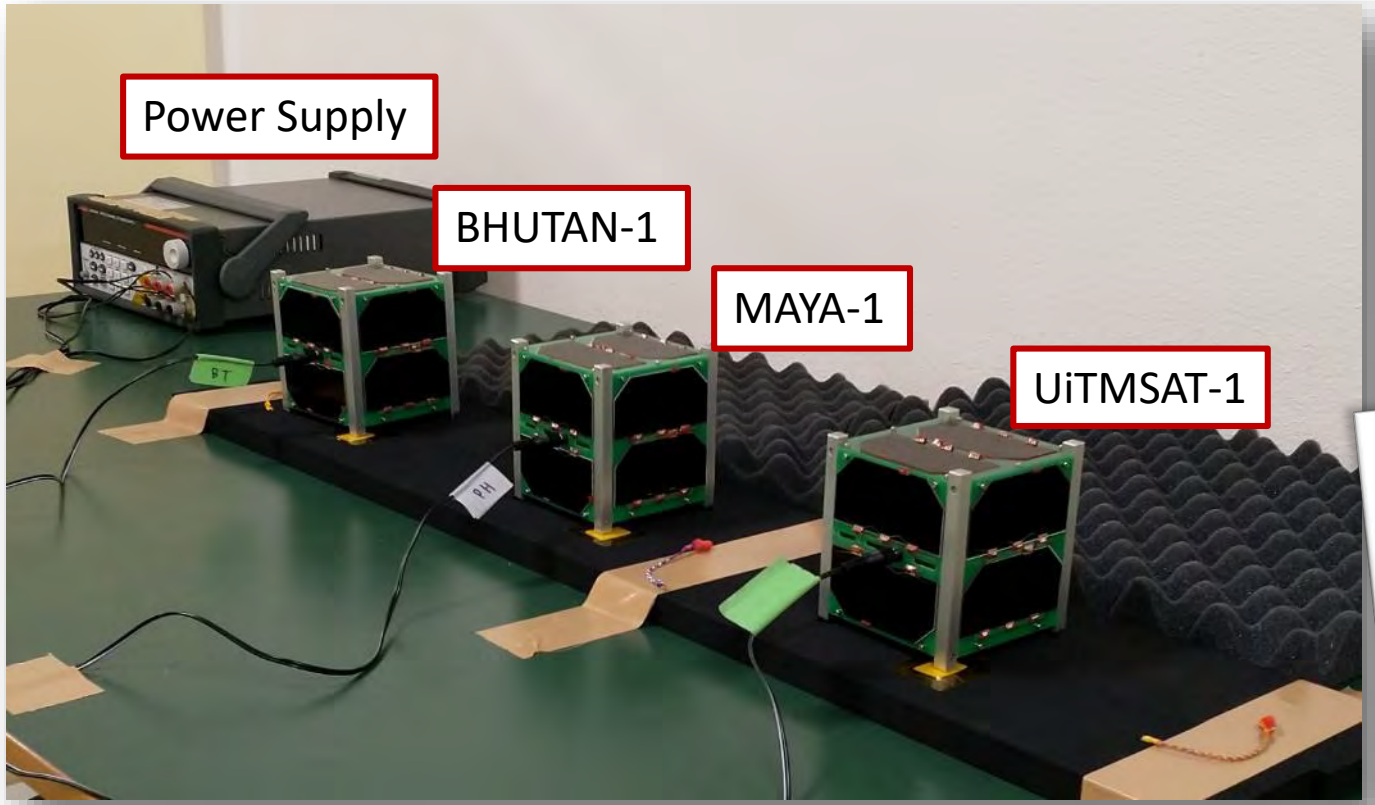
(*Above*) The members waiting for completion of software. The software for each MCU was loaded as per the software initialization document prepared by the team.

On April 28, BIRDS-2 team began the software initialization for the final time. A dummy ground station (*below*) was set up inside clean room as part of software verification process.

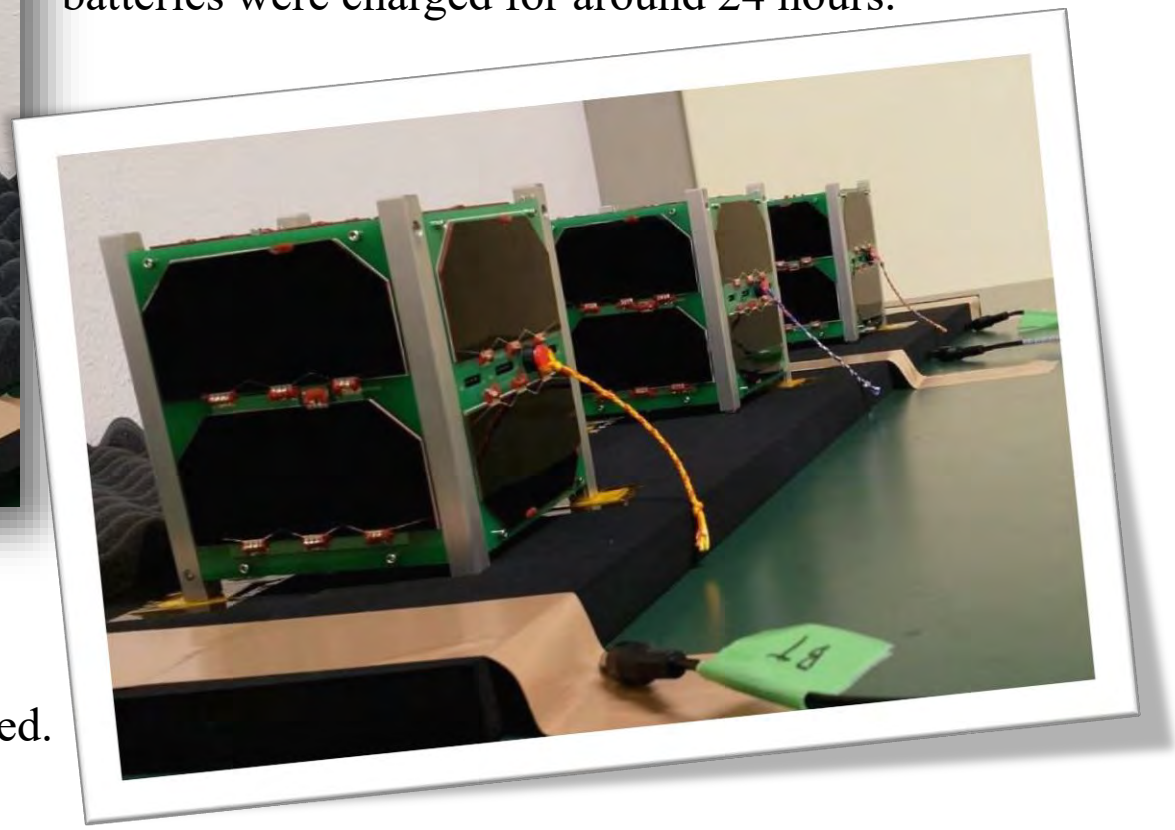


(*Above*) The antenna expert of BIRDS-2 team, Syazana, tying antenna for BHUTAN-1.

Battery Charging

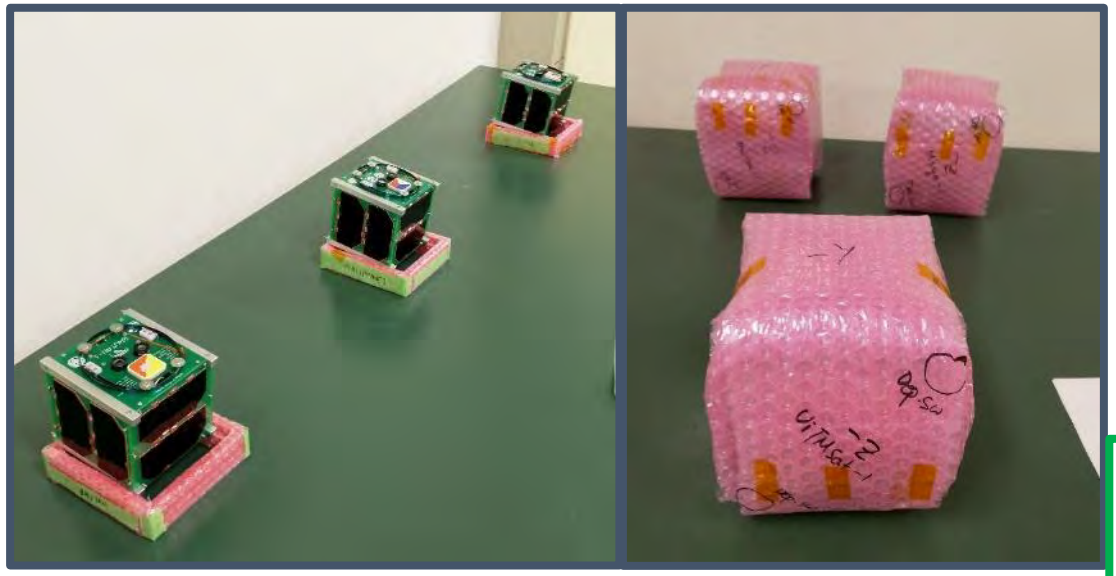


The batteries of the three BIRDS-2 CubeSats were charged to full capacity before delivery to JAXA. The Charging was carried out with satellites in off state. The picture (*Left*) shows the set up for charging. The batteries were charged for around 24 hours.

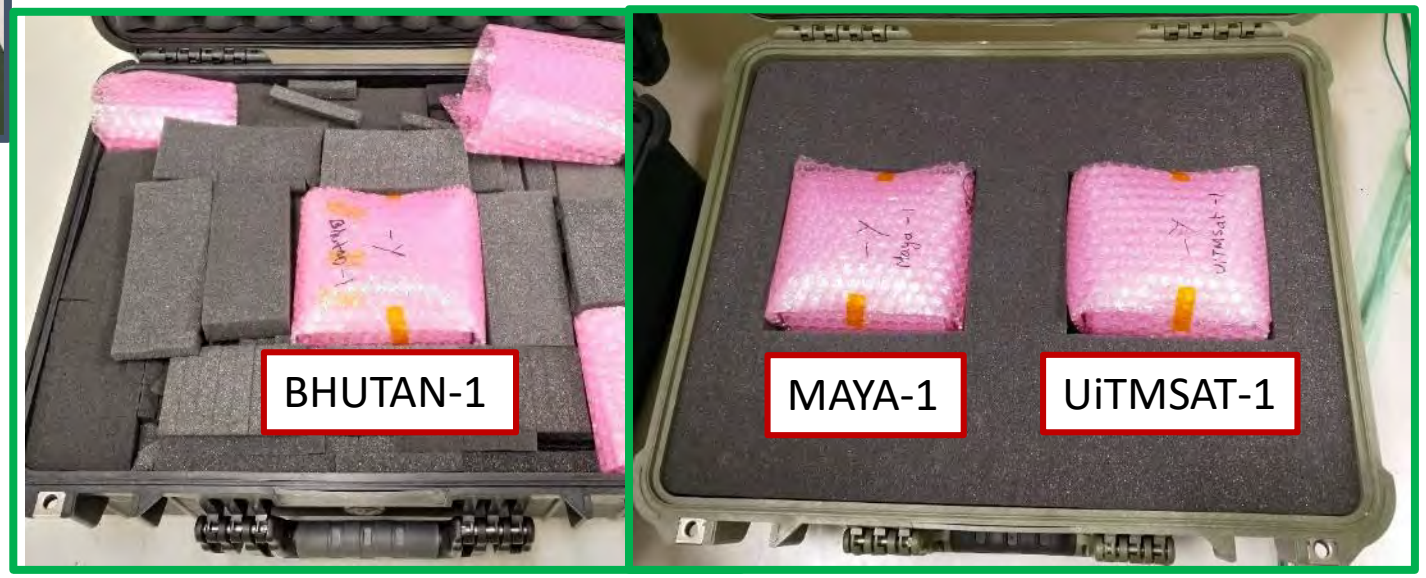


(*Right*) The flight models after the batteries were fully charged.

Satellite Packing



(*Left*) Each CubeSat were wrapped with multiple layers of bubble wrap covering all sides a day before the satellites were transported to Tsukuba. The bubble wraps were placed in such a way that the deployment switches were in the released position.



(*Right*) The wrapped satellites were then placed inside pelican boxes for transportation. Two boxes were used to carry three Flight Models of BIRDS-2.

Satellite Delivery Day 1: Transportation

(*Top*) Three members from BIRDS-2 started the journey towards Tsukuba from KyuTech at 8 AM of April 14, 2018. From Left, Yamaguchi (Japan), Adrian (Philippines), Kiran (Bhutan).

(*Below*) The team boarded Shinkansen from Kokura Station, going towards Tokyo station. Total time of journey between the two stations is about 4 and half hours.

(*Above*) Fourth member of the delivery team joined the journey from Kobe as she is doing internship at Kobe University, Syazana (Malaysia).

Satellite Delivery Day 1: Transportation

The satellite delivery team then took the Tsukuba express from Tokyo which takes about an hour to reach Tsukuba station. (*Left*) Syazana and Adrian seated on the train to Tsukuba. From the station, the team took taxi till JAXA office.

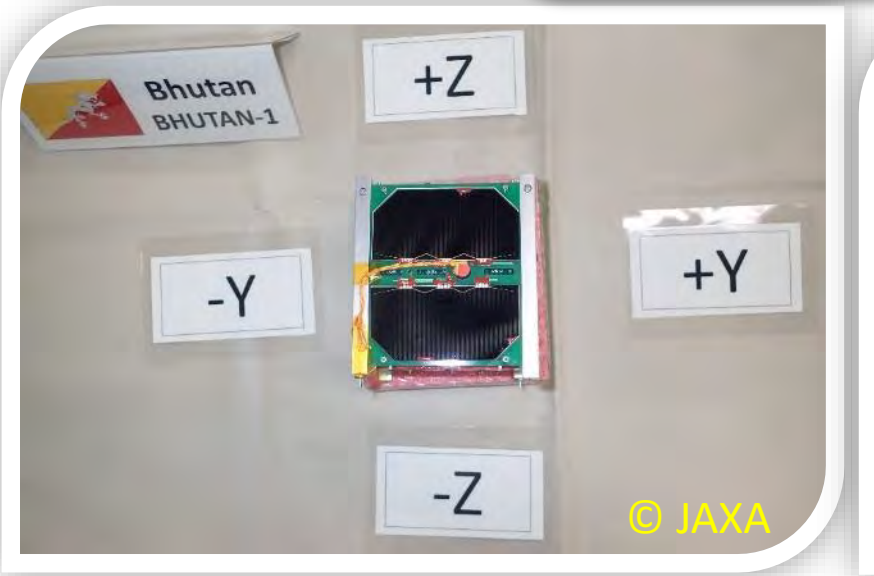
(*Left*) The delivery team after de-boarding Shinkansen at Tokyo station. The team took taxi from Tokyo station to Akihabara station.

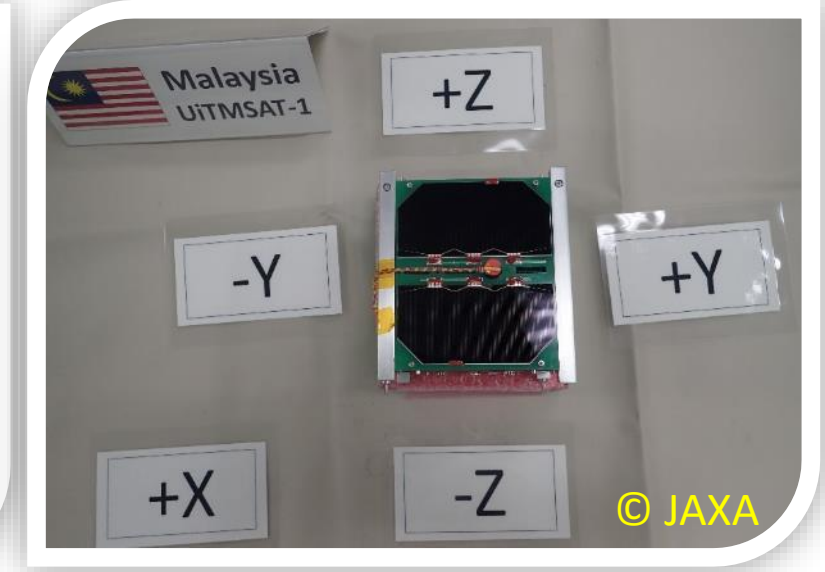
(*Right*) Team posing in front of the JAXA campus entrance after checking in.

Satellite Delivery Day 1: Inspection

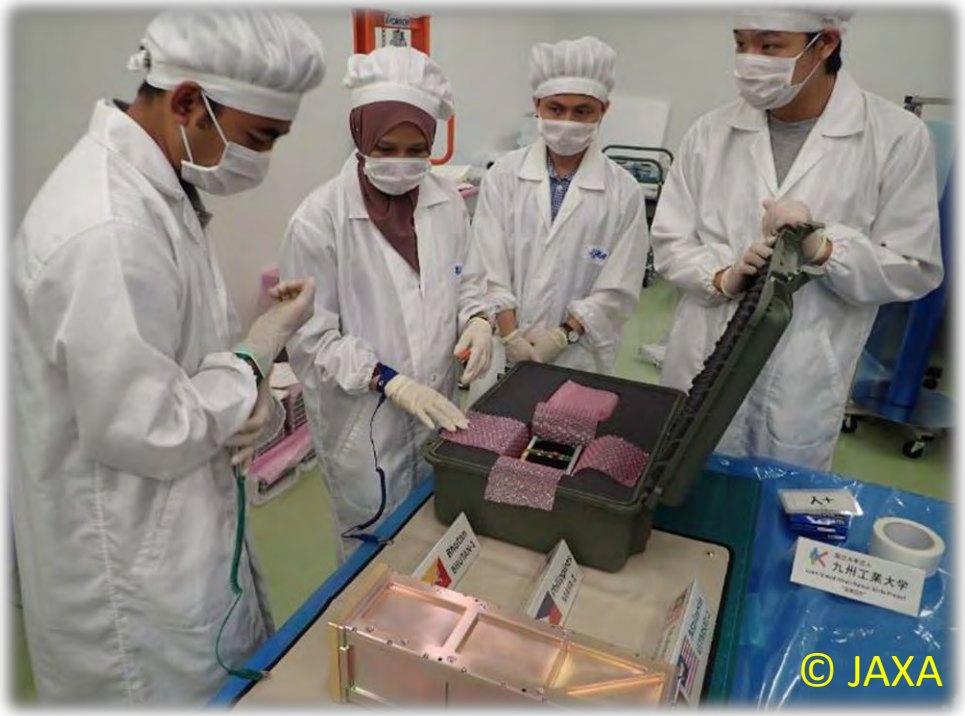
(*Right*) Team, outside JAXA office, waiting for JAXA official to guide the team into the clean room where the CubeSats will be integrated into the J-SSOD.

(*Below*) After entering the clean room, the team opened the satellite package and conducted physical inspection of the satellites to ensure that none of the solar cells or the antenna panels have any deformation because of the travel. The inspection was carried out in presence of JAXA officials. After confirming satellites were fine, the team left the satellites in JAXA's clean room and went to their hotel.



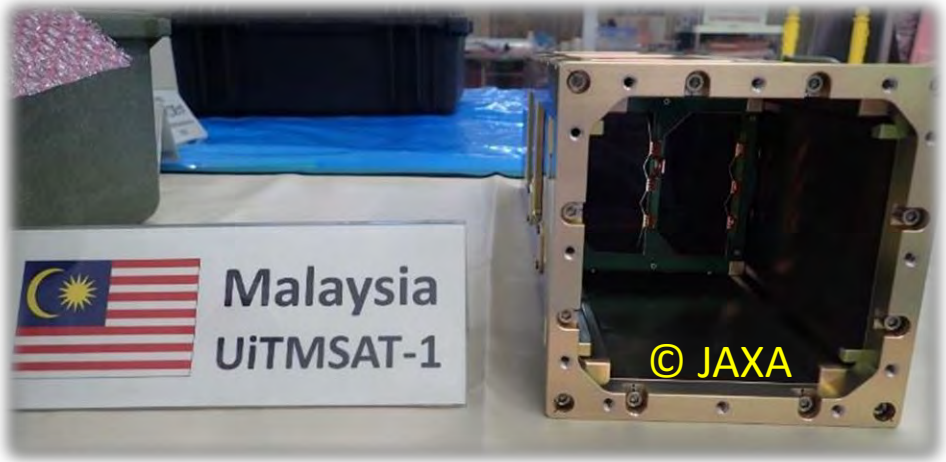


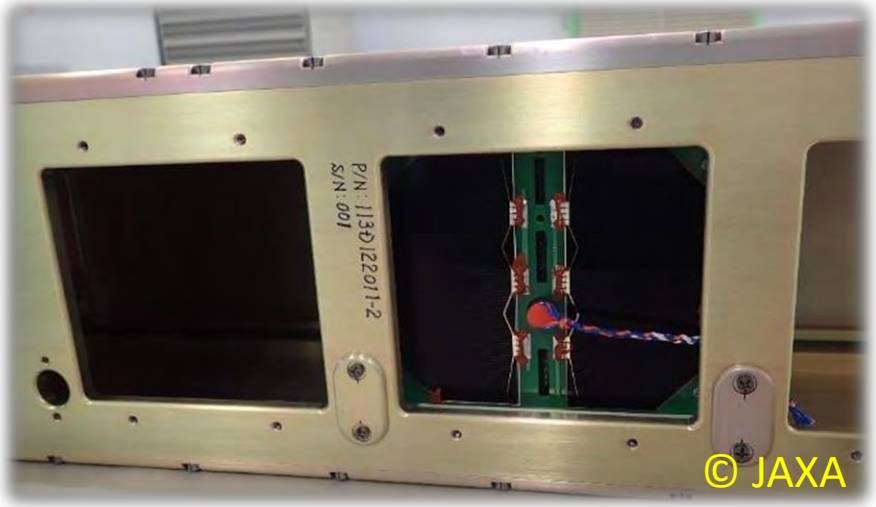
Satellite Delivery Day 2: Fit Check



On the second day, the team performed a fit check of CubeSats into the J-SSOD in presence of JAXA officials. Each satellite was inserted into the J-SSOD one at a time. (*Above*) The team removing UiTMSAT-1 for the fit check.

(*Right*) Malaysian satellite UiTMSAT-1 was the first satellite to go inside the pod. It went in smoothly and was followed my MAYA-1 and BHUTAN-1.

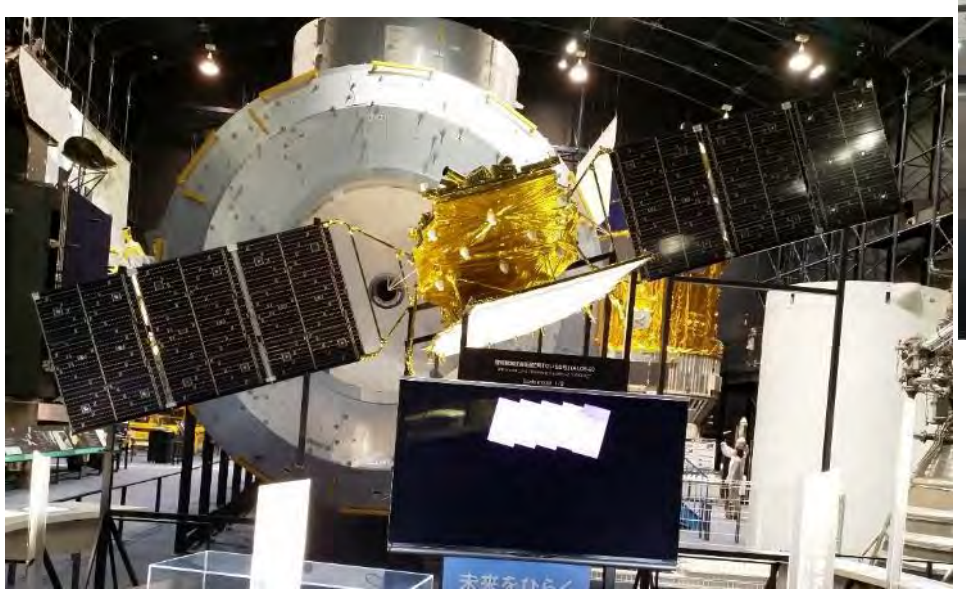




(*Left*) MAYA-1 inside the pod. After performing the fit check, the JAXA team and the BIRDS-2 team dispersed for lunch.

Satellite Delivery Day 2: JAXA Space dome

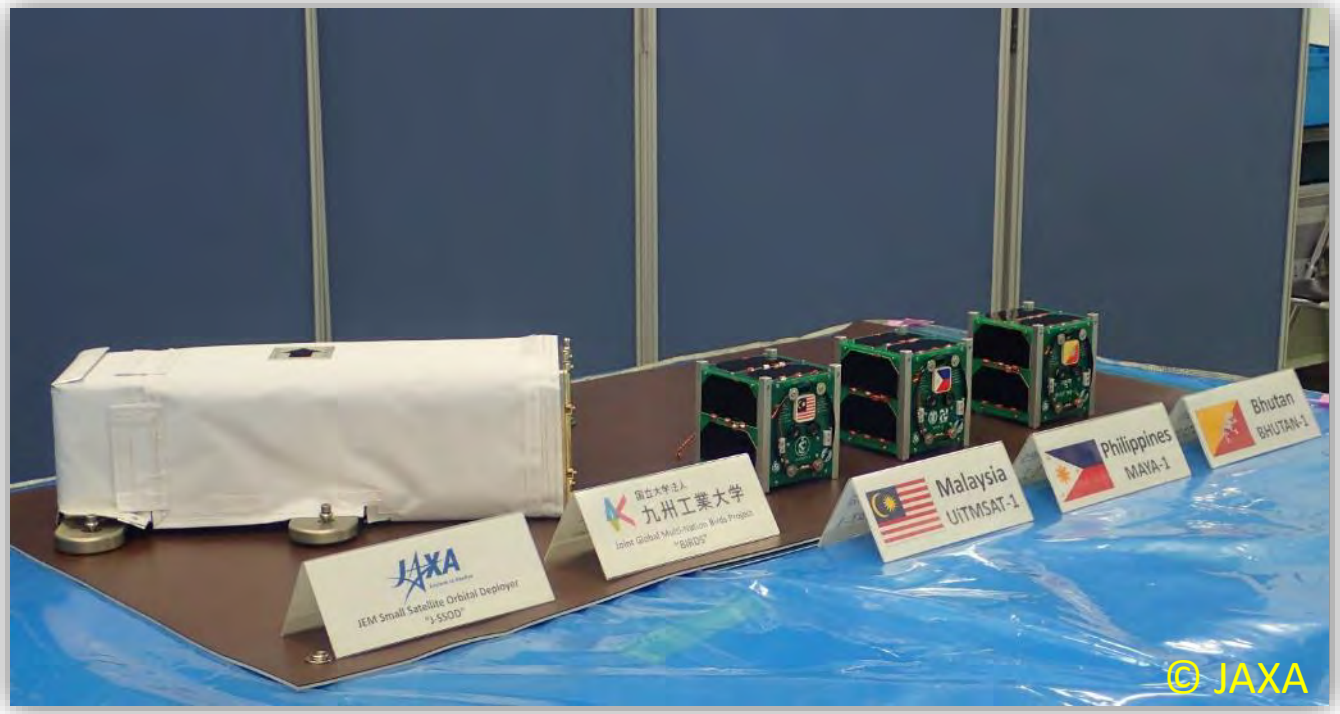
After lunch, the team made a short tour of the space dome where real life size models of all the spacecraft built by JAXA were at display. (*Left*) Team posing in front of H2A rocket model outside the space dome.



(*Right*) Model of ALOS-2 satellite which probably holds fond memory for most of the SEIC students.

(*Above*) BIRDS-2 members, from left, Kiran, Yamaguchi and Adrian, in front of real life size model of Kibo module of Japan, which is part of ISS.

Satellite Delivery Day 2: Integration with J-SSOD



After lunch and a short tour, the team then entered the clean room again. The team then placed the satellite near the J-SSOD as displayed in the picture (*above*), after which the satellites were officially turned over to JAXA and that was the last time the team touched the satellite.

Then the contractors of JAXA who manufactured the J-SSOD carefully inspected the three CubeSats and integrated them with the pod as per their manual. (*Below*) The three flight models of BIRDS-2 project inside J-SSOD. Last time the team saw the satellites.

Satellite Delivery Day 2: The Goodbye

(*Left*) The team returning with empty pelican boxes, having successfully delivered the satellites. The satellites were shipped to USA the next day from where they will be launched on SpaceX's next cargo ship to ISS.

(*Right*) The flag of each member country of BIRDS-2 project were hoisted on the second day, near the entrance of the JAXA campus.

(*Above*) Before leaving the JAXA premises, the team got an opportunity to appear in front of a camera to share their feelings about the project.

End of Report

Kiran Kumar Pradhan

16. Celebration of delivery of BIRDS-2 flight models to JAXA (see previous section)

12 June 2018 – 6:30 pm to 8:00 pm
Nakamura Memorial Hall
– Tobata Campus – Kyutech

continued next page

Four Project Managers

(BIRDS-2, BIRDS-3, BIRDS-1, SPATIUM)

Cont'd next page

Speeches by Prof Cho
and
each student of BIRDS-2 Team

End of this photo report

17. The latest promotional material from UNISEC-Global

These two fliers at the right have been reduced from full-size posters.

Full-size posters will be displayed during **United Nations COPUOS**, 20-29 June 2018.
See link to COPUOS below:

http://www.unoosa.org/oosa/en/ourwork/copuos/current.html

18. BIRDS-3: Activities during May - June 2018, by Abhas

Kakimoto Testing Backplane Board

Safety Review Session by Yamaguchi/Dr. Pauline

Solar Panel Integration Session by Dr. Pauline

BIRDS-3 Meeting, Dr. Kim makes a comment

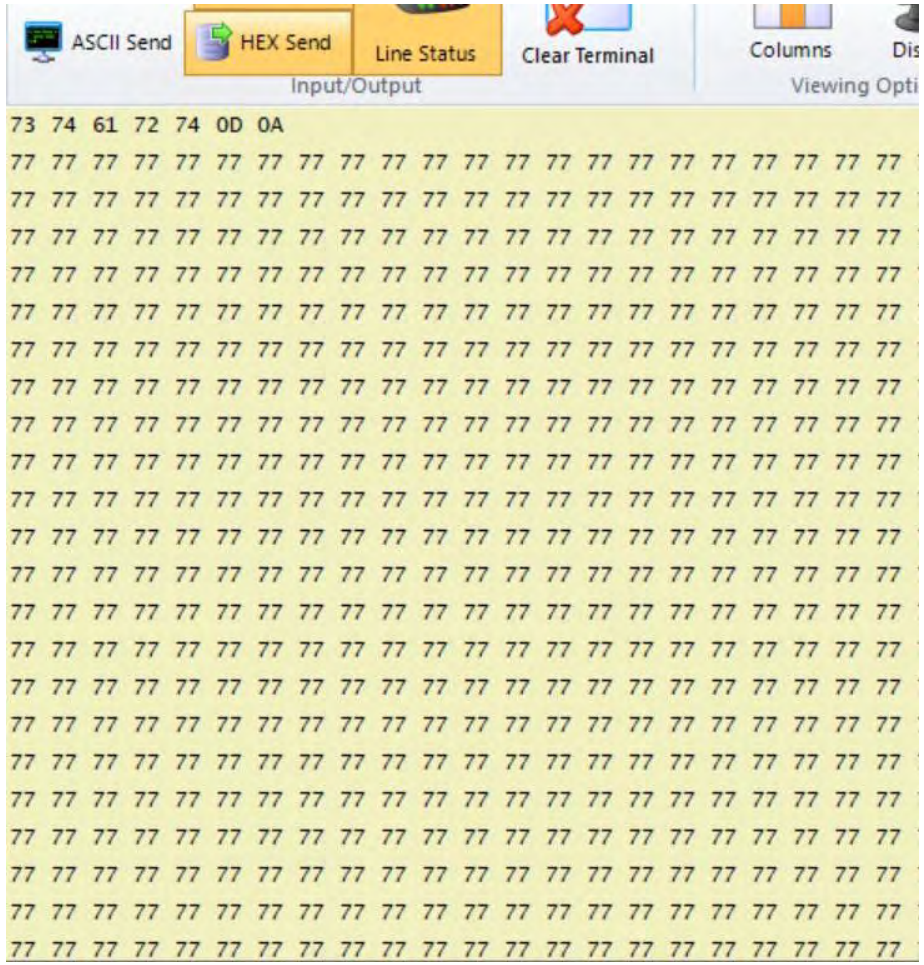
BIRDS-3 Mo:Mo: Party with Dr. Pauline

BIRDS-3 members are now working on their Engineering Model (EM) of their satellite constellation. The team will start their full system level integration tests from July as the space environment tests will begin from end of July. The results of this testing will be essential for **Critical Design Review (CDR)** which is scheduled for 31st August, 2018.

19. BIRDS-3: OBC Progress

Yuta Kakimoto, June 12, 2018

　現在のOBCの進捗状況についてです。
現在は主にADCSの動作試験のサポートをしているため、進捗はあまり多くありませんが、フラッシュメモリの書き込み、読み込み機能を追加しているところです。
　BIRDS-3では1Gbのフラッシュメモリを用いるため、多くの情報を保存することができます。ミッションでカメラのデータや、大量の姿勢データ、太陽電池の発電量データ等を保存するため、一度に多くの情報を保存、取り出しできるようにするための関数を作成しました。



フラッシュメモリーからパソコンに2000Byteのデータを転送した時の様子

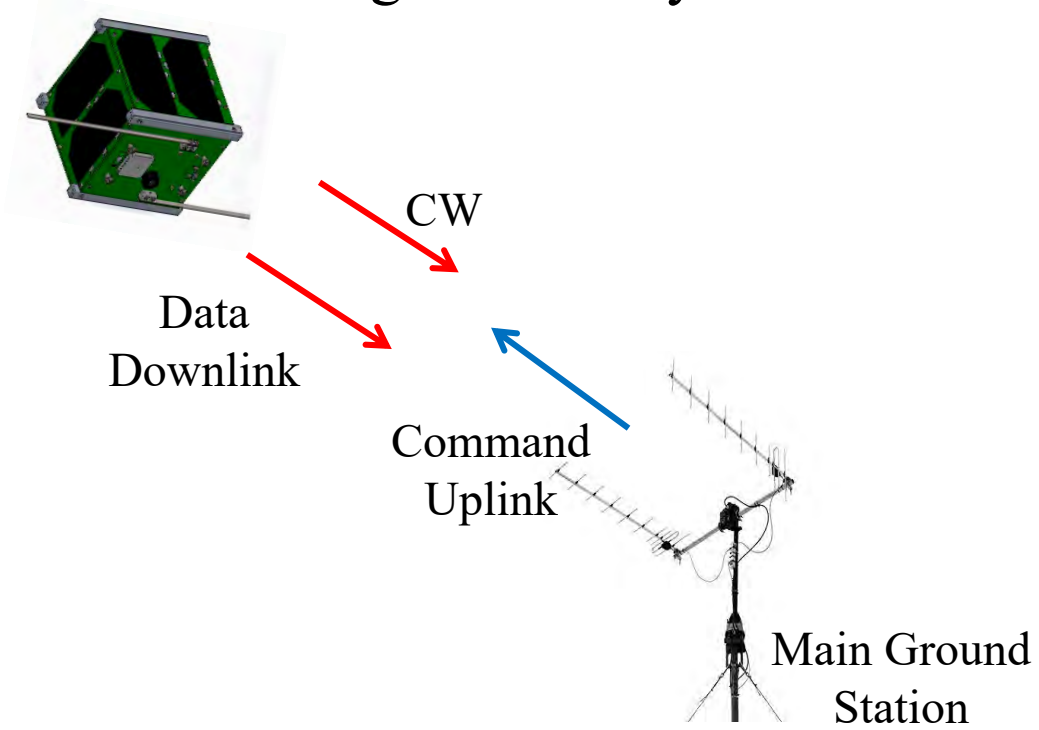
　また、PIC間におけるコマンドのやり取りをするためのバッファ作成に関しても、他の系のメンバーと取り組み始めています。

BIRDS-3 COMMUNICATION SUBSYSTEM

By: Tharindu Dayarathna (Sri Lanka)

Functions of Communication Subsystem

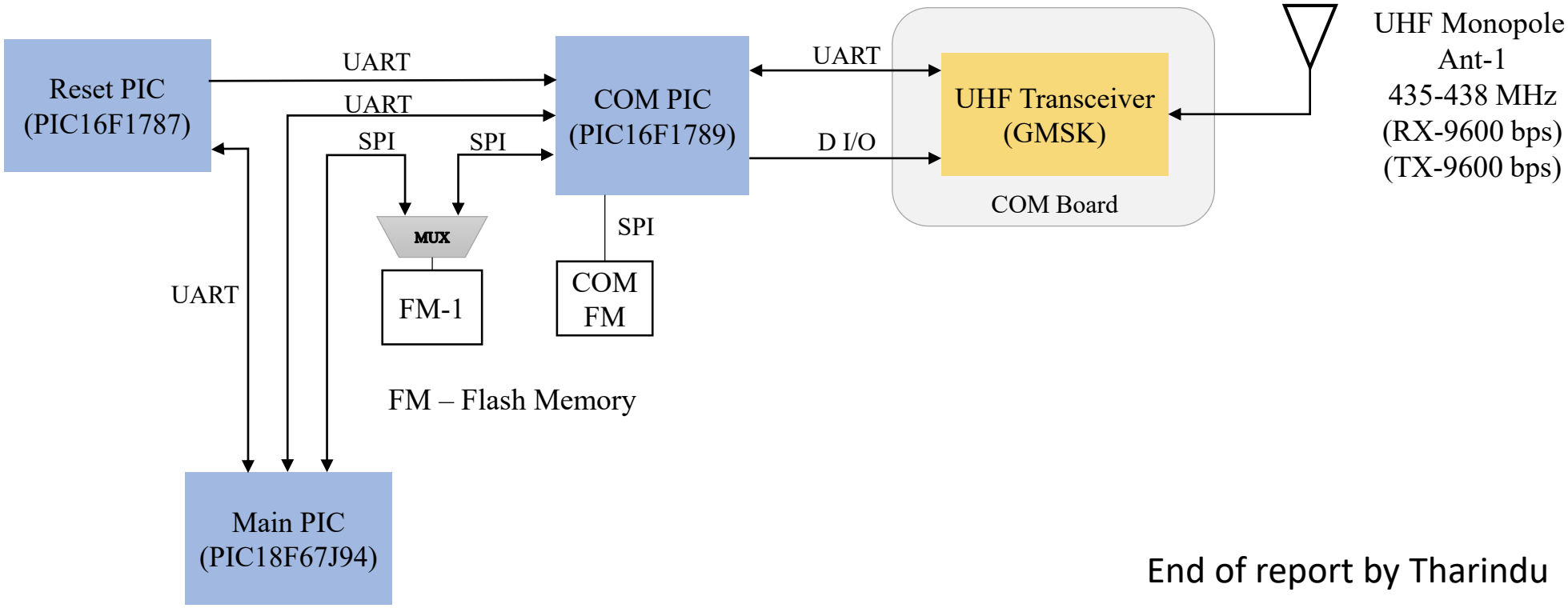
- Receive uplink command from the ground station.
- Send telemetry, image and other mission data to the ground station.
- Transmit Morse coded CW beacon generated by the COM PIC



BIRDS-3 Different Communication Links and their Properties

- Command uplink
  - 435 MHz, 9600 bps GMSK, AX.25 protocol
- Telemetry, image and other mission data downlink
  - 435 MHz, 9600 bps GMSK, AX.25 protocol
- Morse coded CW beacon
  - 435 MHz, ON/OFF keying, 20 words/min Morse Code

Block Diagram of Communication Subsystem

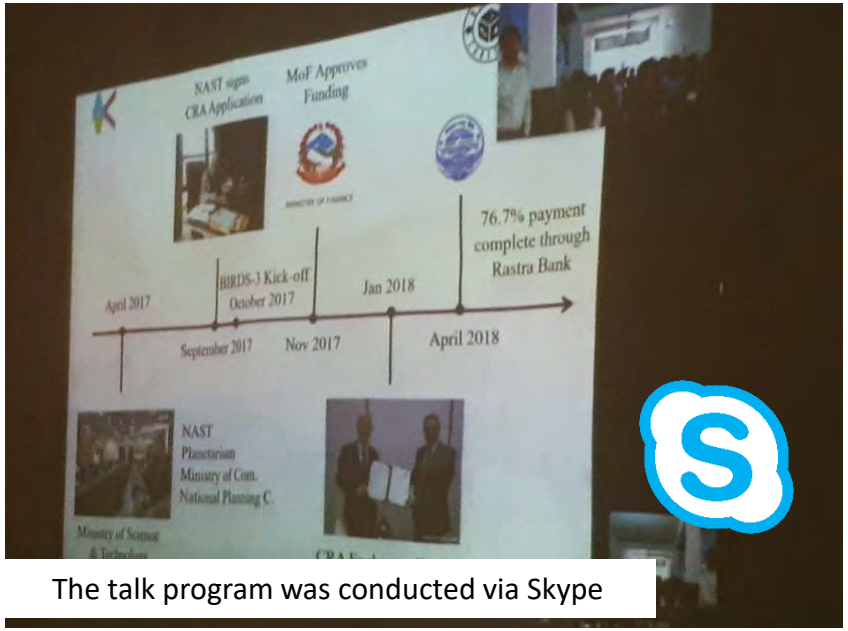


End of report by Tharindu

21. BIRDS-3: Outreach activity in Nepal, by Abhas

On 9th June, 2018, Abhas (Nepal) of BIRDS-3 gave introduction of the project in context of Nepal, how the satellite has been progressing and status of the funding. The program was organized by **Mr. Sudip V. Adhikari of Beyond Apogee.** The program also included presentations from other Nepalese working on satellite related sectors.

The talk program was held in Kathmandu



The talk program was conducted via Skype

Participants after the program

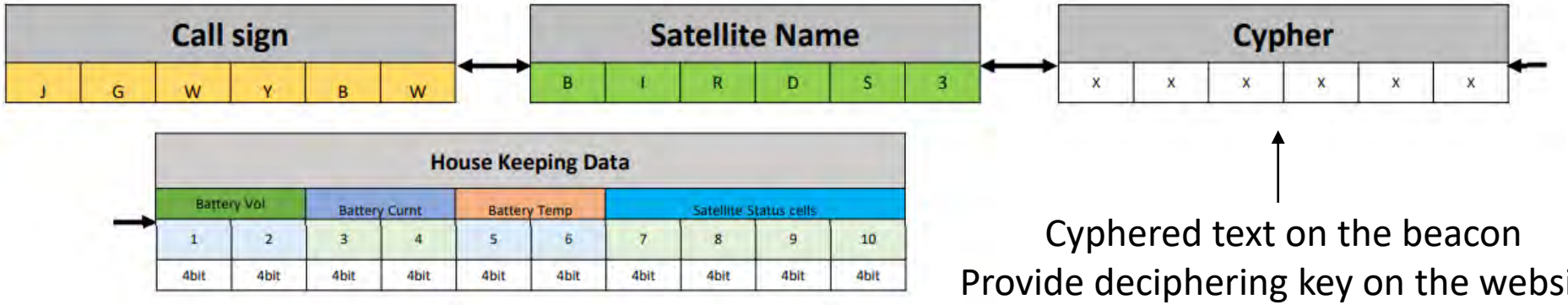
Frequency Coordination Issues

we are facing

Makiko Kishimoto (BIRDS-3, Japan)

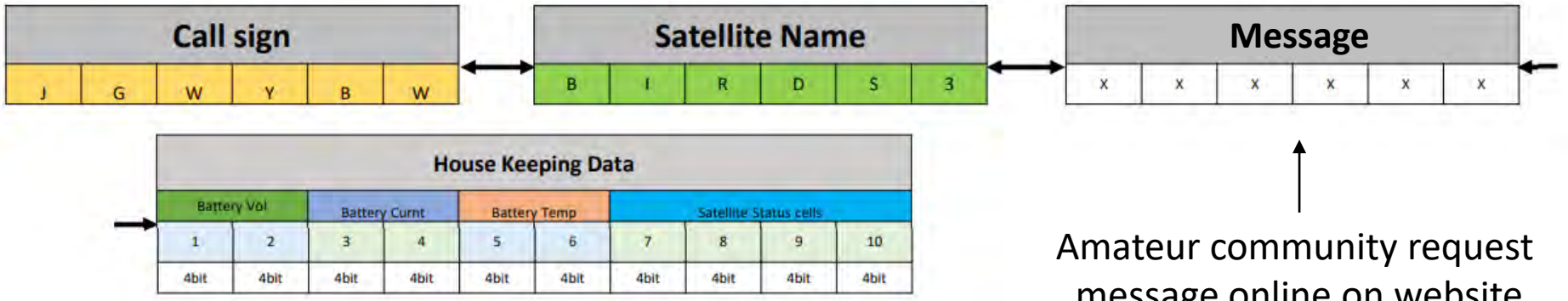
Problem 1. Encode in Amateur Spectrum

Initially, BIRDS-3 wanted to encode and decode short messages in mission, but it is not possible because the team cannot do it in amateur band. Instead, the team will send messages collected from amateur community through the official website and place it on the beacon



Cyphered text on the beacon
Provide deciphering key on the website

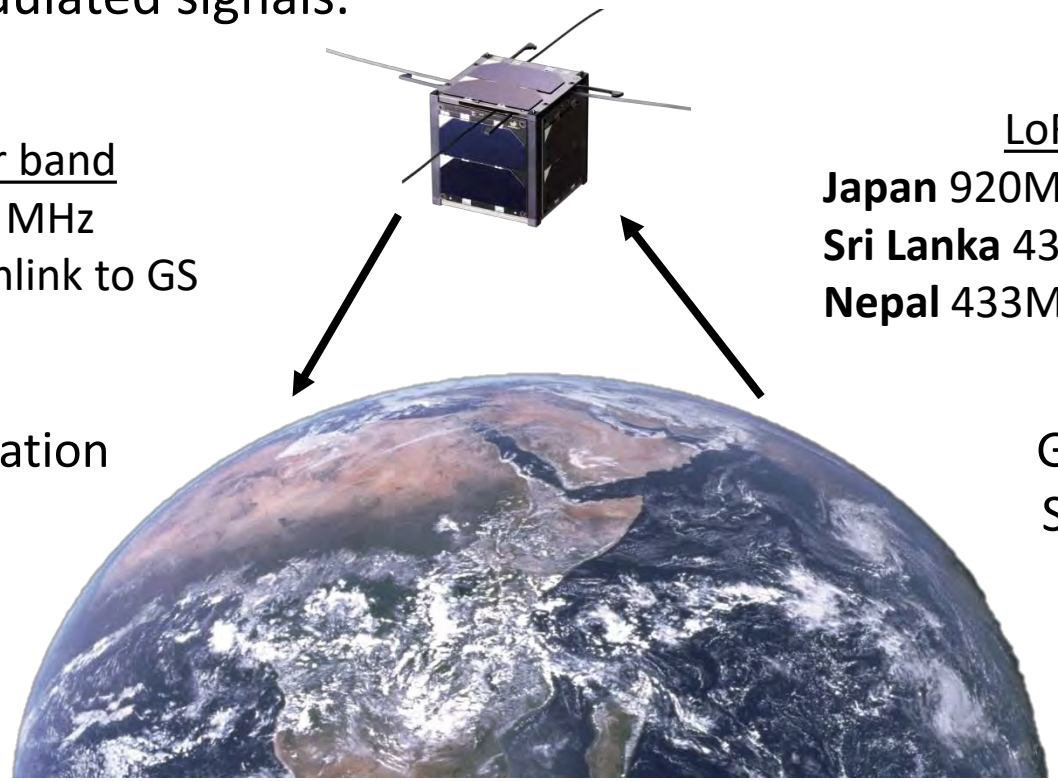
Solution?



Amateur community request message online on website

Problem 2. Use of unlicensed signals in Amateur Spectrum

Amateur band and unlicensed band cannot be used at the same time. Specifically, it is not good to send data from amateur bands received from non-amateur bands.
BIRDS-3 is trying to solve this problem. This problem will affect Data Collection Mission (DCM) which uses LoRa modulated signals.



Amateur band
437.xxx MHz
uplink/ downlink to GS

LoRa (Unlicensed band)
Japan 920MHz ISM band
Sri Lanka 433MHz ISM band
Nepal 433MHz Unlicensed Amateur band

BIRDS Ground Station Network

Ground Remote Sensor Terminal

End of report by M.Kishimoto

BIRDS-3 ADCS

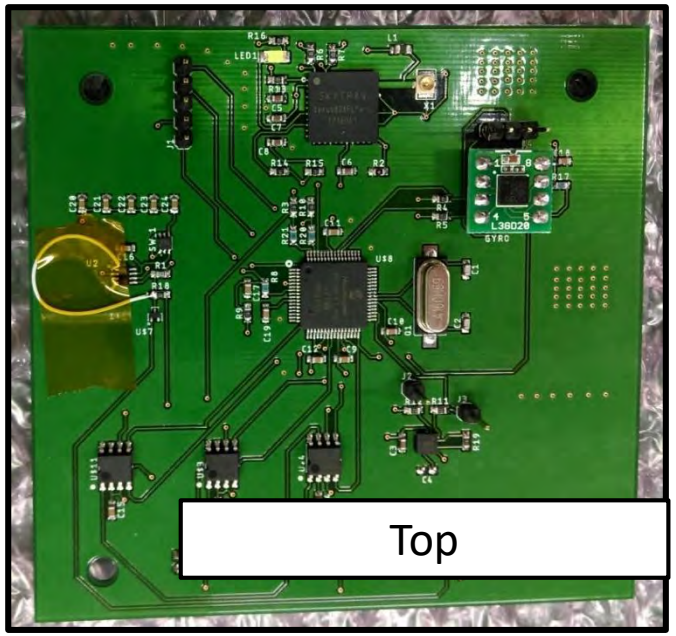
Dulani Chamika
(Sri Lanka)

Wikipedia on attitude control:
https://en.wikipedia.org/wiki/Attitude_control

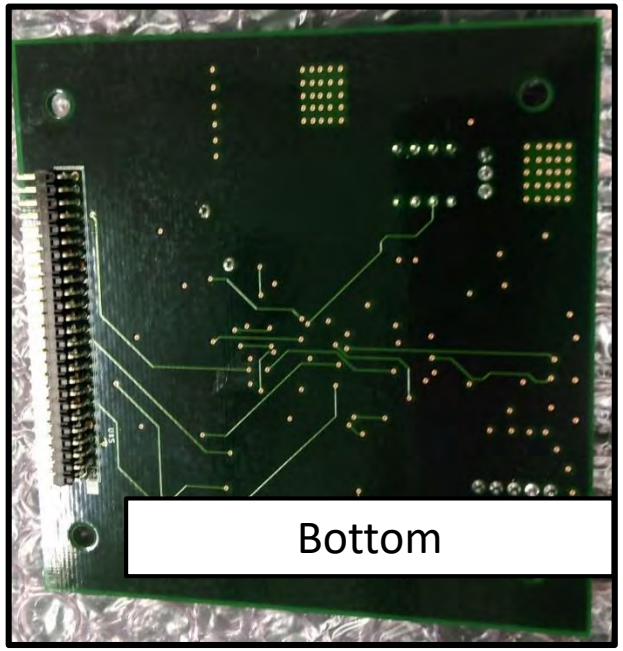
BIRDS-3 ADCS

BIRDS1 and BIRDS2 have used passive attitude stabilization. But BIRDS3 is trying to stabilize and align the satellite to the earth's magnetic field using active control by a magnetic sensor and magnetic torques.

Pictures of ADCS BBM Board

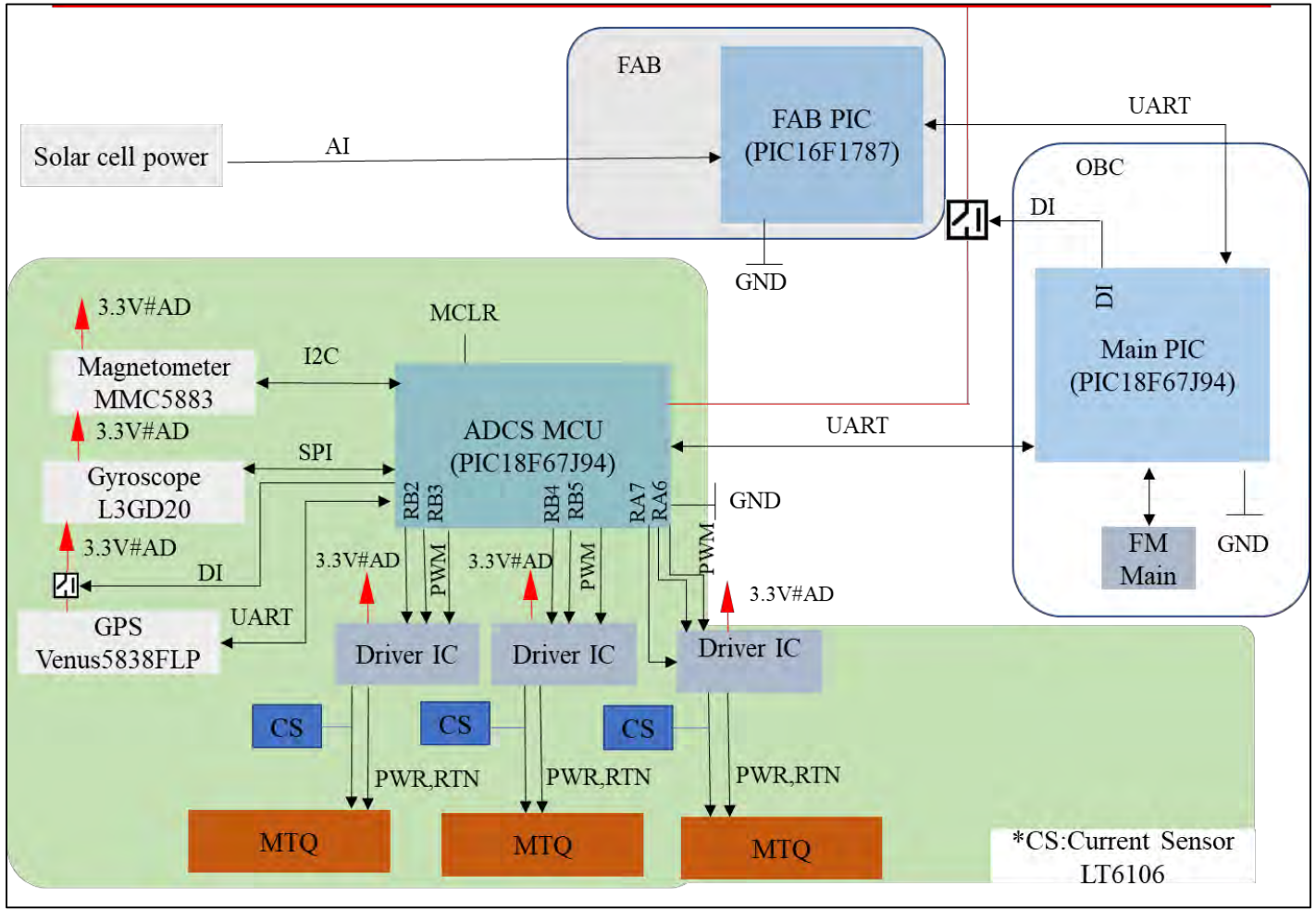


Top



Bottom

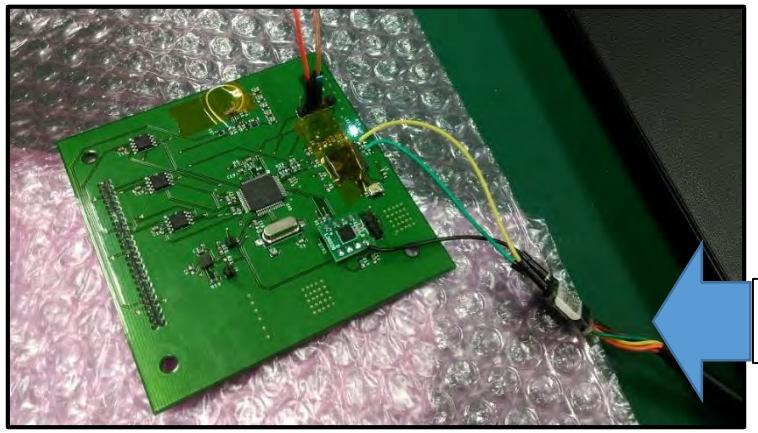
Block Diagram of ADCS Mission



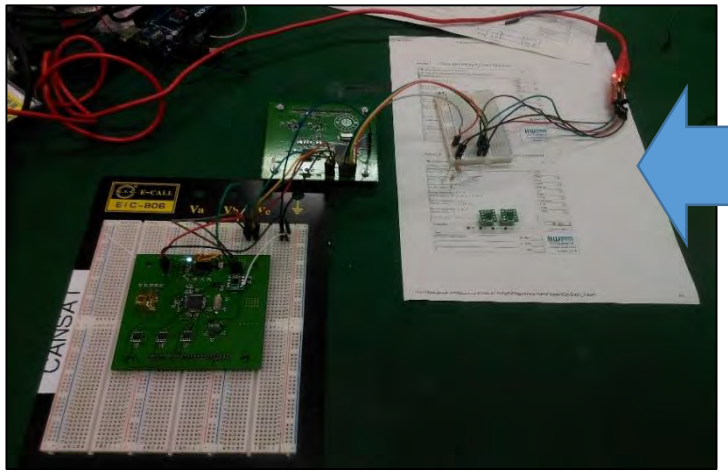
Before designing MTQ, the system is simulated in MATLAB to know the torque that we need to stabilize the satellite.

B dot algorithm will be used to determine the magnetic moment that need to stabilize the satellite onboard and alignment control

ADCS Testing

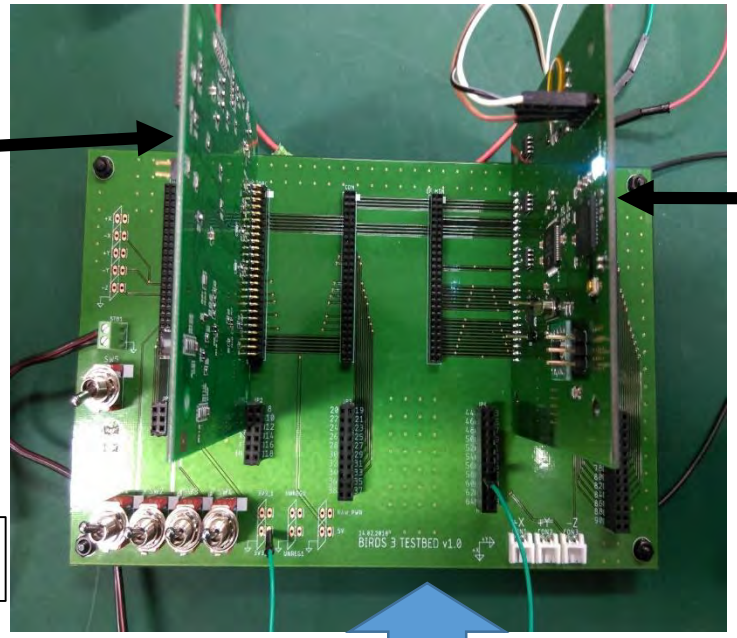


Testing the GPS



Testing the gyroscope

OBC



ADCS Board

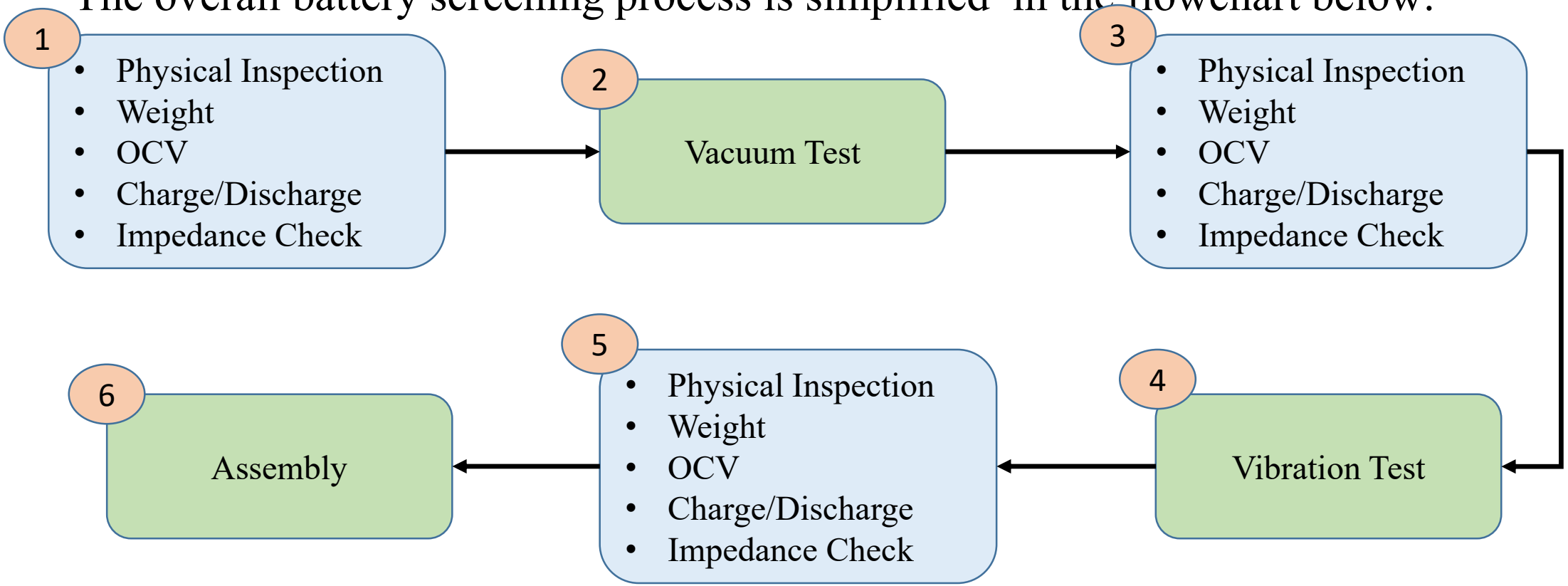
Testing ADCS board with OBC board using test bed

End of report by Dulani

Battery Screening for BIRDS-3

Pooja Lepcha (Bhutan)

- Battery screening is primarily done to select batteries with similar characteristics. This is to prevent internal shorts, external shorts, overcharge and over-discharge.
- The overall battery screening process is simplified in the flowchart below:



For BIRDS-3 case, there were 80 batteries out of which, 42 batteries had to be selected with very similar characteristics to make seven packs of six batteries with one spare pack for Engineering Model (EM) and Flight Memory (FM). Each satellite will have a battery box with a pack of six batteries. The batteries used are NiMH Panasonic *Eneloop* re-chargable batteries.

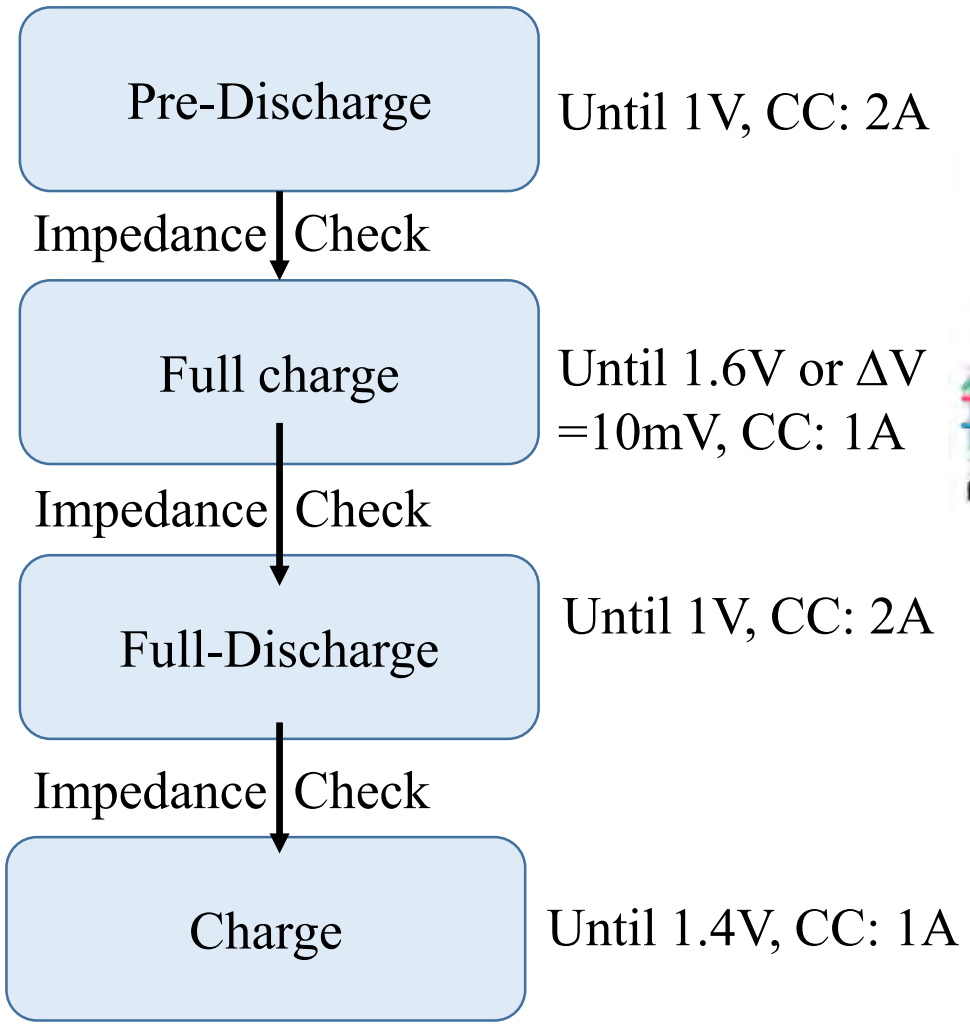
1 STEP 1

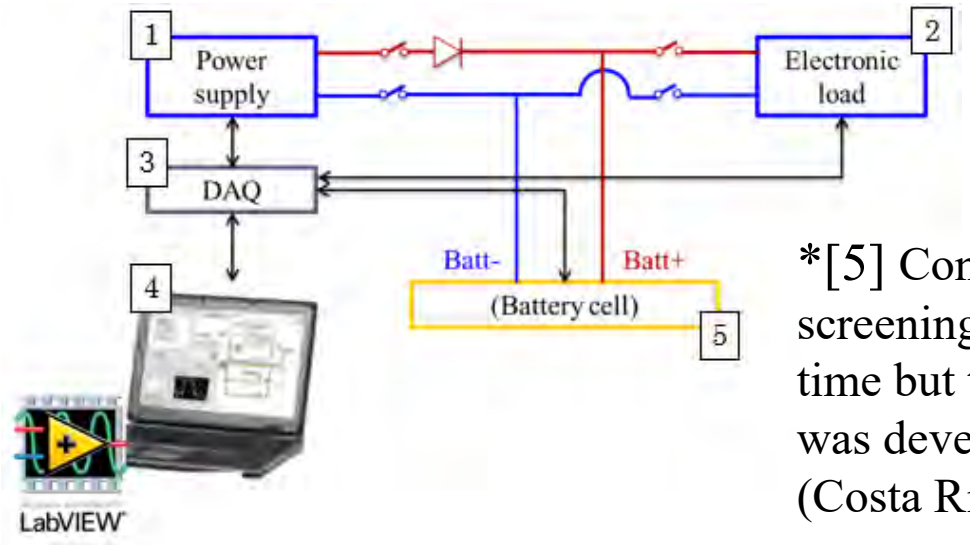
The STEP 1 includes physical verification for any rupture or abnormalities of the batteries. It also includes measurement of weights of the batteries.

Battery Initial Characteristics		
Battery No.	Weight	
	[g]	+/- 3σ??
1	26.44	PASS
2	26.38	PASS
3	26.59	PASS
4	26.42	PASS
5	26.45	PASS
6	26.46	PASS
7	26.44	PASS
8	26.40	PASS
9	26.20	PASS
10	26.46	PASS
11	26.38	PASS
12	26.67	PASS
13	26.58	PASS
14	26.79	FAIL
15	26.49	PASS
16	26.26	PASS
17	26.39	PASS
18	26.43	PASS
19	26.49	PASS
20	26.31	PASS
21	26.74	FAIL
22	26.36	PASS
23	26.26	PASS
24	26.37	PASS

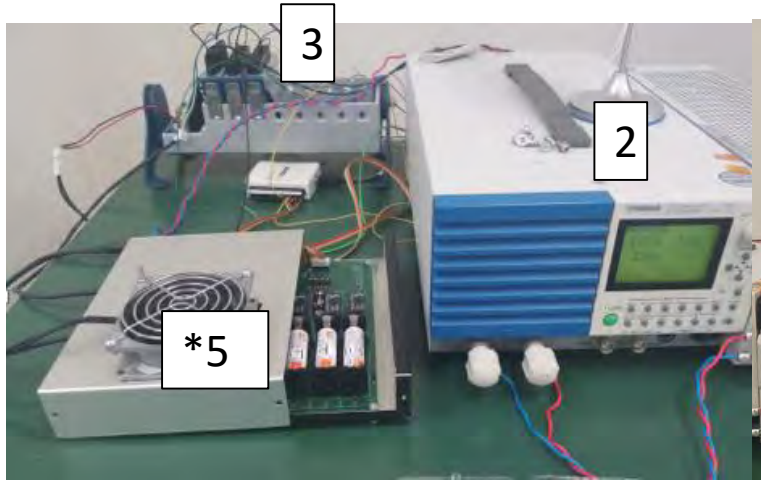
For the first measurement, the standard deviation of the weights of all the batteries are calculated and those batteries are selected within the deviation of +/-3σ

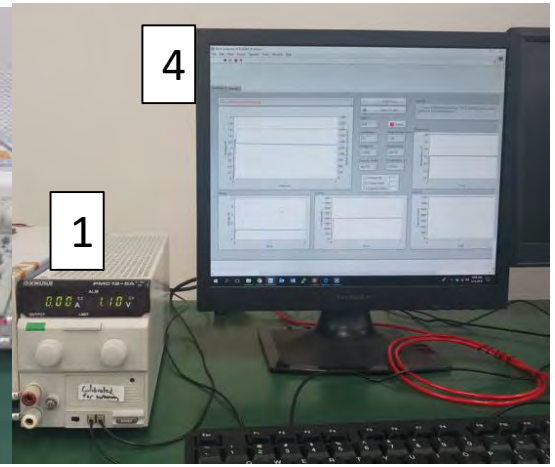
The next process is the battery charge and discharge cycles. The procedure is as follows:





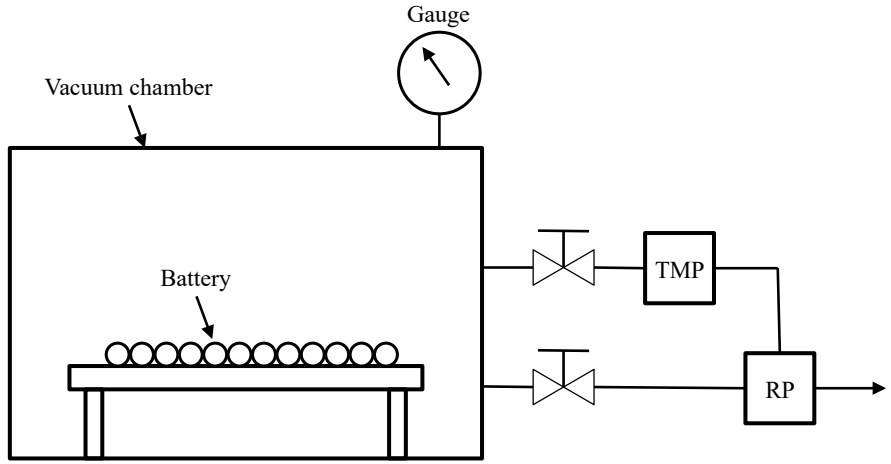
*[5] Conventional method is screening one battery at one time but this 4-battery system was developed by Juan (Costa Rica) of Cho Lab





2 STEP 2

Step 2 involves the vacuum leak test of the batteries. This test is performed to verify if any batteries are leaking. Batteries are installed in an aluminum holder and inserted in the vacuum chamber, which is set to reach $1x10^{-3}$ Pa. Once this pressure is reached the time count will start. After six hours, the test is stopped.



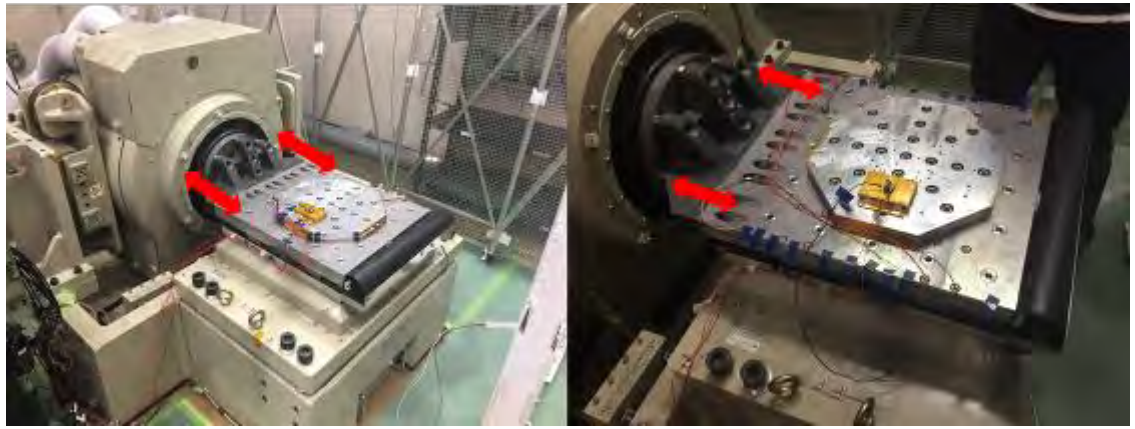
3 STEP 3

Step 3 is the repetition of Step 1. This is done to check if any of the batteries have change in its characteristics before and after the vacuum leak test. The OCV, mass, and capacity are measured before and after the vacuum test. The charge and discharge cycles are performed again for all the batteries.

4 STEP 4

Step 4 is Vibration test of the batteries. This test is performed to check if the batteries are tolerant to internal shorts. The vibration level is shown in the table below:

Freq. (Hz)	PSD (g^2/Hz)
20	0.010000
80	0.040000
350	0.040000
2000	0.007000
Duration(sec)	60



5 STEP 5

Step 5 is the repetition of Step 1. This is done to check if any of the batteries have change in its characteristics before and after the vibration test. The Open Circuit Voltage (OCV), mass, and capacity are measured before and after the vibration test. The charge and discharge cycles are performed again for all the batteries.

6 STEP 6

STEP 6 involves the final selection of the batteries. The selection criteria is:

- The change of capacity before and after each environmental test should be less than **5%.**
- Internal impedance of the cells should be equal as much as possible
- The change of mass and open circuit voltage during before and after vacuum leak test should be **less than 0.1%.**
- The change of mass and open circuit voltage during before and after random vibration test should be **less than 0.1%.**

End of report by Pooja

BIRDS-3 Structure

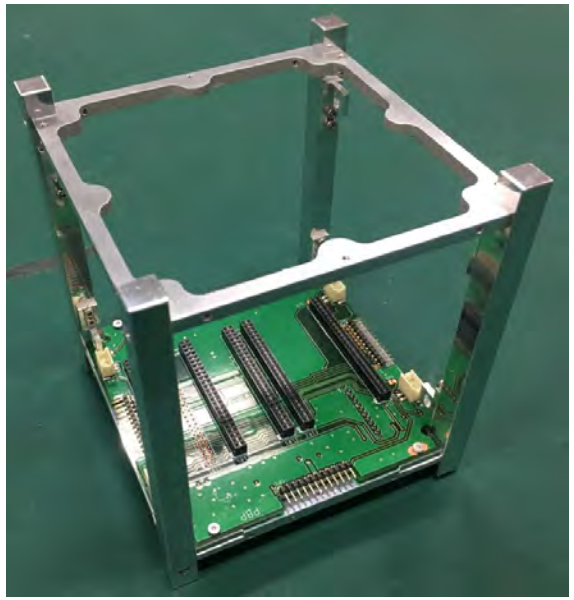
by Sasaki (Japan)

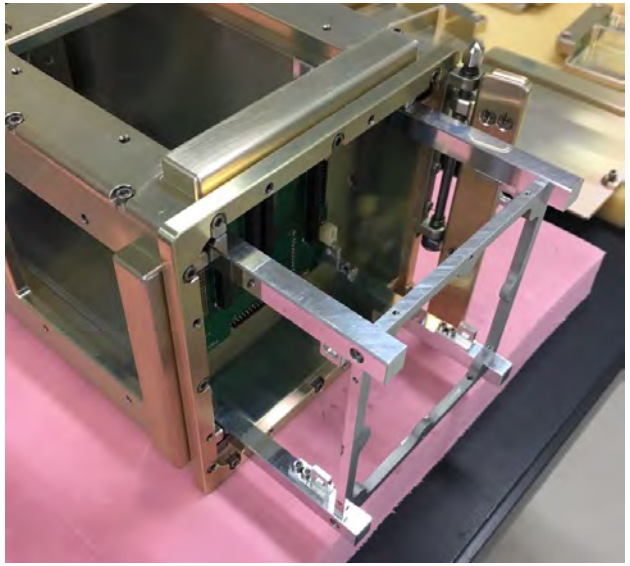
BIRDS-3で使うEM (Engineering Model) 用の構体が届きました。構体はBIRDS-2と同じ設計のものですが、購入先が異なります。購入先を複数にすることで以下の理由があります。

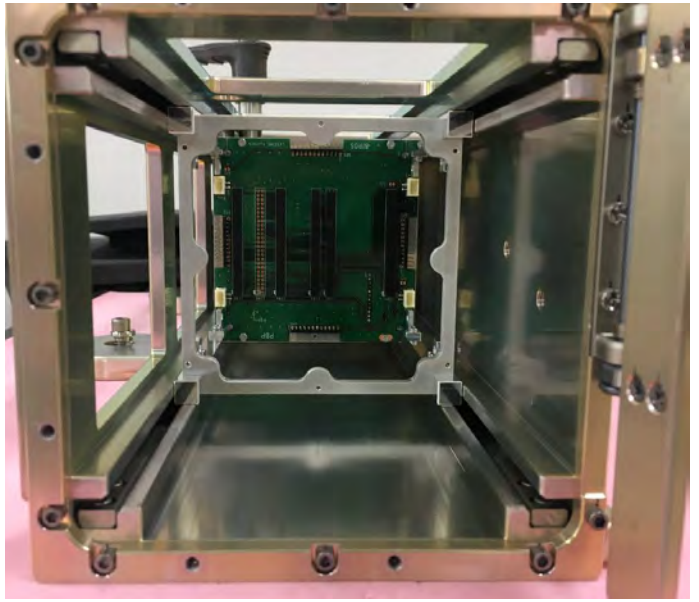
- FM (Flight Model) で複数の構体を購入する場合に安く購入できる。
- 仕入れ先を2社にしておくことで、不測の事態が起きてももう一方の会社から購入することが出来る。価格競争をして安くなる可能性が増える。
- 新しく買う会社の作る部品を評価するため。

Continued on the next page

新しく届いた構体の精度を確かめるためにフィットチェックを行いました。構体は放出されるときJ-SSODのポットに入れらるためその試験を地上で行います。衛星はきれいにポットの中に入ることが出来ました。これから内部コンポーネント、外面パネルを統合して環境試験をしていく予定です。







End of report by Sasaki

End of this **BIRDS Project Newsletter**

(ISSN 2433-8818)

– Issue Number Twenty-Nine

This newsletter is archived at the BIRDS Project website:
http://birds1.birds-project.com/newsletter.html

When a new issue is entered in to the archive, an email message is sent out over a mailing list maintained by the Editor (G. Maeda, Kyutech). If you wish to be on this mailing list, or know persons who might be interested in getting notification of issue releases, please let me know.

This newsletter is issued once per month. The main purpose of it is to keep BIRDS stakeholders (the owners of the satellites) informed of project developments.