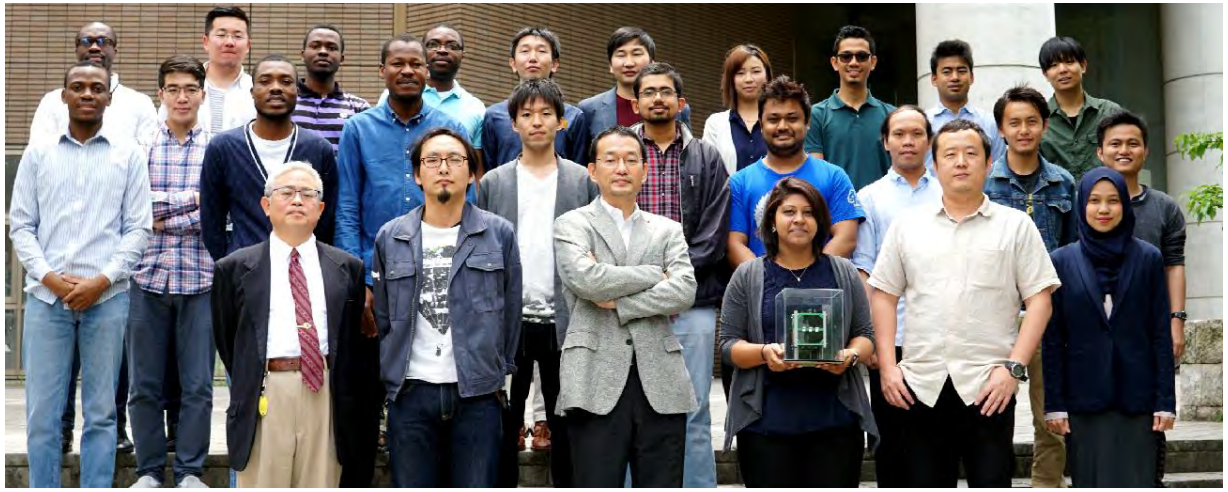
BIRDS Project Newsletter

Issue No. 16 (29 May 2017)



Members of BIRDS-1 and BIRDS-2 Teams (Tobata Campus) -- 16 May 2017.
Note the mock-up being held by Antara in the front row.

Edited by:
G. Maeda, Tejumola Taiwo, Joven Javier, M. Cho,
Laboratory of Spacecraft Environment Interaction Engineering (LaSEINE)
Kyushu Institute of Technology (Kyutech)
Kitakyushu, Japan

Project website: http://birds.ele.kyutech.ac.jp/
All back issues are archived at this website.

La SEINE

SEIC Space Engineering International Course

All back issues of this newsletter can be easily downloaded. Go to here: **http://birds.ele.kyutech.ac.jp/**
At the top, click on the tab called NEWSLETTER. You will get a menu for all back issues.

Contents of this Issue

The Guest Box

In this issue (**No. 16**), there is a photo report by Benjamin Bonsu about his recent trip to Ghana. He is in the photo above standing at the right. It is an award ceremony where ANU received special recognition from Private University Students Association Games (PUSAG) 2017. Ben made it to several events during his recent trip.

Rev. Adriana Ion, ANU Registrar (left) and ANU Vice President of Student Affairs Rev. Dr. Twum Barima (center) received the PUSAG award on behalf of the university.

1. News about Bhutan's first satellite (BIRDS-2) is covered by newspaper in Bhutan

KUENSEL
THAT THE PEOPLE SHALL BE INFORMED
FRIDAY, OCTOBER 21, 2016 • Nu 15

Space

Bhutan to launch its first satellite in 2018

Around USD 280,000 will be spent on the effort

Younten Tshedup

Bhutan's first satellite, a nano-satellite (nanosat) or a CubeSat is expected to be in space by the mid of 2018. This will be the country's first venture into space technology.

The CubeSat will weigh about a kilogram and will be around 10cm in length.

Three Bhutanese engineers, Yeshey Choden, Kiran Kumar Pradhan and Cheki Dorji will be the pioneers involved in the designing, building, launching and operating of the country's first nano-satellite.

The three engineers will leave for Japan at the end of this month to pursue a two-year masters programme in space engineering at the Kyushu Institute of Technology (Kyutech).

Prime Minister Tshering Tobgay highlighted the importance of space technology and said that the country is already engaged in using satellite facilities and technology but many Bhutanese are unaware of its significance.

"Space technology is extremely important and it is relevant for Bhutan," said Lyonchoen. "If anything we are late, and we need to develop our capabilities as soon as possible on this front." Pg. 2

From Pg.1

The lack of capacity in this area has delayed the country's endeavour into exploring space technology so far. Lyonchoen said that the vision for the project is being provided by His Majesty The King. "His Majesty is the inspiration and it is only because of His Majesty that we have been able to fast track the whole process to this stage."

Because a space programme is important, Lyonchoen said that the government decided to fund the programme for the three engineers. Around USD 280,000 is expected to be incurred in the whole process from training the engineers to launching the nanosat and building a ground station in the country.

"This, however, is money well spent," said Lyonchoen, adding that for the first time in addition to using space technology, Bhutan will be developing to enter the frontier of space.

Annually the national broadcaster spends around Nu 9.5 million (M) to use the INSAT communication facilities to broadcast BBS TV throughout the country. Bhutan Telecom invests around Nu 3M to provide telecommunication services and the Department of Hydro-Met Services pays around Nu 1.2M every year for the GLOF early warning systems.

Once launched, the satellite will operate in a low altitude of about 500km to 1,500km. With the help of two high-end cameras fitted on the satellite, it will take high quality photographs of the country, help examine the conditions of the glaciers, lakes, forest covers and provide basic communication services said Lyonchoen.

Apart from launching the nanosat, Lyonchoen said that a space agency will also be setup within the information and communications ministry where the engineers would work.

Lyonchoen added that in addition to operating the nanosat, the engineers will also operate a transponder (a device for receiving a radio signal and automatically transmitting a different signal) on the SAARC satellite.

In the SAARC satellite, which is a geostationary satellite, a much larger earth-orbiting satellite that is placed at an altitude of approximately 35,800 kilometers above the earth, Bhutan has been given a transponder to be used.

The SAARC satellite is expected to be launched towards the end of this year.

The space station which will be developed under the information and communications ministry will be responsible for operating the transponder until the three engineers are back from Japan, said Lyonchoen.

"The long-term goal will be to operate our own geostationary satellite and possibly lease similar transponder to other countries."

After becoming a member of the International Telecommunication Union in 1988 Bhutan also received an orbital slot at 59.1-degree east longitude. The orbital slot, Lyonchoen explained is a property of Bhutan in space where a geostationary satellite can be stationed by the country.

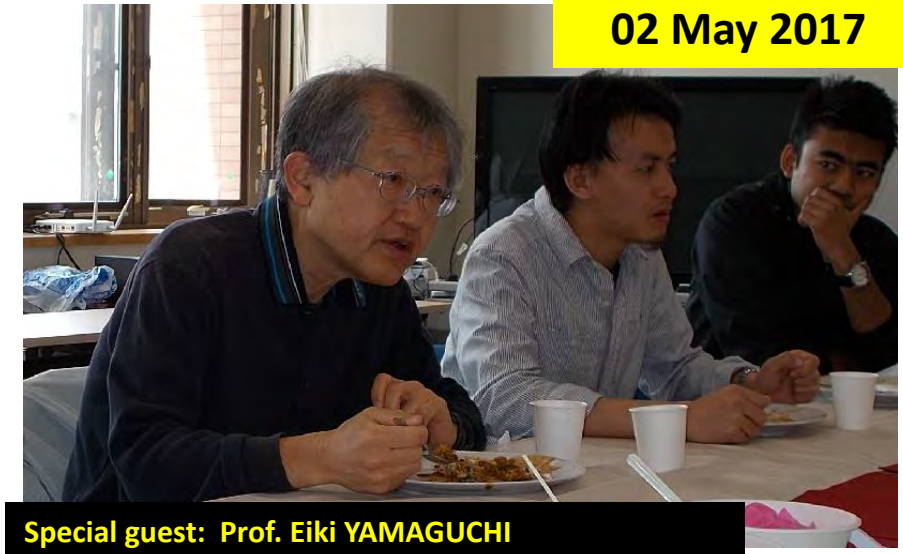
In 2000 another another orbital slot at 86-degree east longitude was also given to Bhutan. However, because of the lack of capacity, Lyonchoen said that two orbital slots are not utilised currently.

"We are not using them at all. In fact, we are not even managing our property in space because there are satellites near these areas that are already operating and their frequency could interfere with ours once we have our own satellite in the slots."

Lyonchoen said that once the space engineers complete their master's degrees, the goal will be to launch Bhutan's own geostationary satellite. "We have the orbital slots already allocated to us. We must develop a capacity to use our slots for our own purposes," he said, adding that all we need to do is learn how to manage it. "This I think is a huge first step in that direction."

2. Golden Week Lunch for the BIRDS-2 Team (another event to celebrate the completion of the PDR)

02 May 2017



Special guest: Prof. Eiki YAMAGUCHI
- Faculty of Engineering
Department of Civil and Architectural Engineering
- Kyutech, Vice President, international matters

BIRDS-1 Team represented by its Project Manager, Taiwo (in the white shirt)

Outstanding discussion over lunch !

Rice and corn-spinach curry provided by G. Maeda

BIRDS-2 Team Member Syazana (UiTM, Malaysia) kindly cooked these delicious items for us.

Mr Tokunaga pours cider soda for Syazana.

Bhutan Veggie Curry by the wife of Cheki.

Malaysian meat dish by the wife of Azami.

Thank you to all food contributors !!!

"Golden Week" is an annual week-long holiday in Japan, at the start of May.

3. BIRDS-1 Team Member has written an outreach guide for receiving BIRDS signals with a home-made antenna

The authors of this guide book are: Joseph (shown at the right) and Ms. Tae Nakano. Ms. Nakano wrote the Japanese-language guide book on which the English version is based; this book was published by Kyutech with all rights reserved.

Outreach Activities at Senior High Schools (Ghana)

Joseph says,
"I wrote this for anyone in the world who wants to teach his or her students how to receive satellite signals, easily. Making this home-made system will spark their interest in space. Even primary school kids can manage the construction."

This outreach guide (in pdf) can be downloaded from here:

http://birds.ele.kyutech.ac.jp/digi.html

If you invite the press to cover this topic or activity, please give credit to Mr. Joseph Neenyi Quansah (Ghana), Ms. Tae Nakano (Japan), and to Kyutech (Kyushu Institute of Technology, Japan).

Two Photo Reports about Ghana

[1] GHANA ACTIVITES TOWARDS BIRDS-1 OPERATION

and

[2] PREPARATIONS FOR THE 2ND BIRDS INTERNATIONAL WORKSHOP

By : Benjamin Bonsu (BIRDS-1, Ghana),

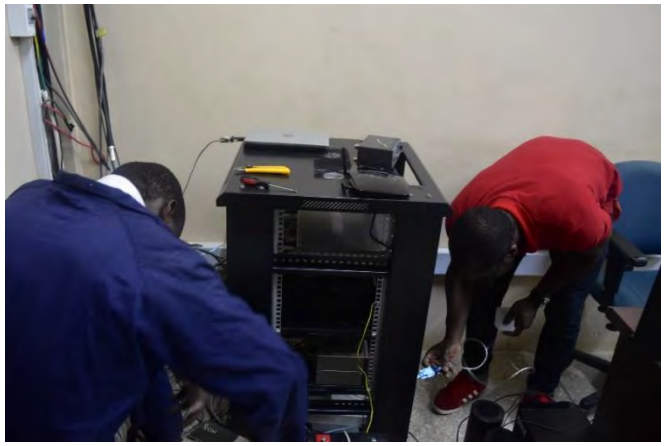
who visited Ghana from 17th March to 12th April, 2017.

GHANA ACTIVITES TOWARDS BIRDS-1 OPERATION

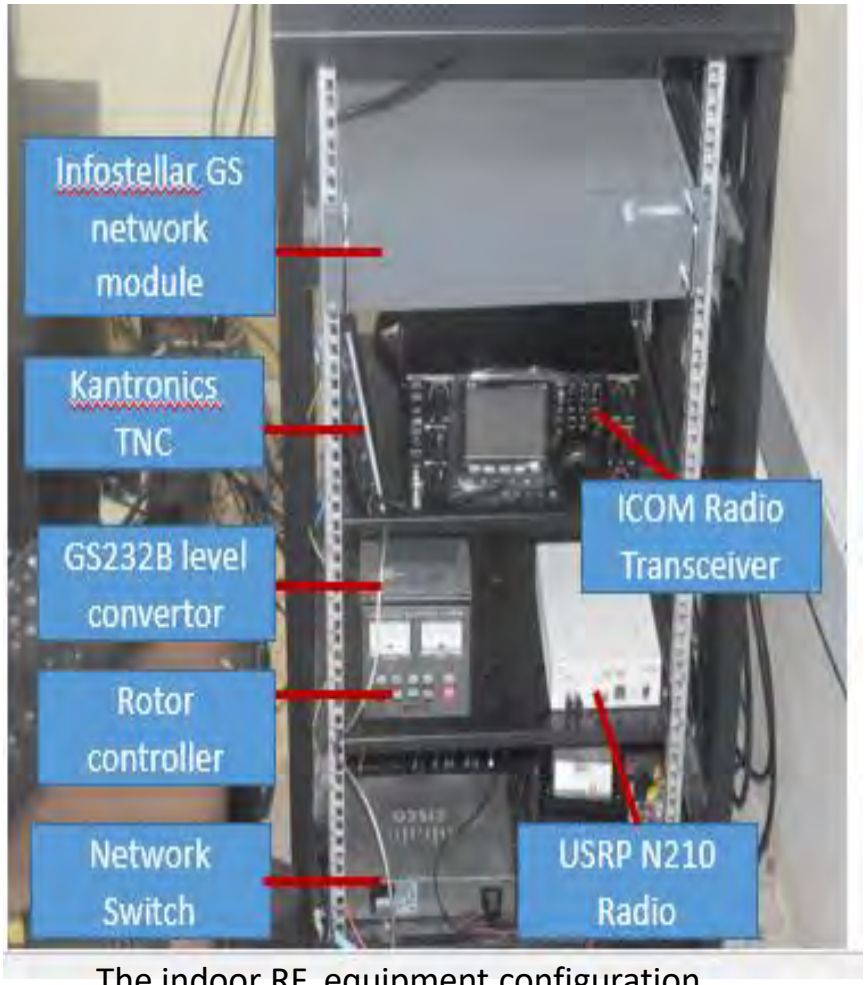
Preparing the home team to operate the Ghana
Ground Station (GS)
when their satellite is in orbit

Upgrade of ANU-GS towards BIRDS Operation

Benjamin (BIRDS-1 Member) and Aaron (ANU - SSTL member) performing maintenance check on the Roof top UHF/VHF antennas



Benjamin (BIRDS-1 Member) and Aaron (ANU - SSTL member) installing the Indoor RF equipment



The indoor RF equipment configuration installed in the rack

Roof Top UHF/VHF Antenna located at the ANUC Main Campus

Indoor RF equipment and GS computer for connected to the roof top antenna transmission lines

BEN'S TRIP TO GHANA

Benjamin teaching the students how to use the observatory tracking software (ORBITRON) to find the location of the satellite in orbit

Training of ANU-Students on how to operate GS towards BIRDS operation

Benjamin (middle) and Aaron (right) in a pose with new SSTL members in their 3rd semester

A picture of 7th semester students offering satellite communication classes visited the ANU –Ground station for training

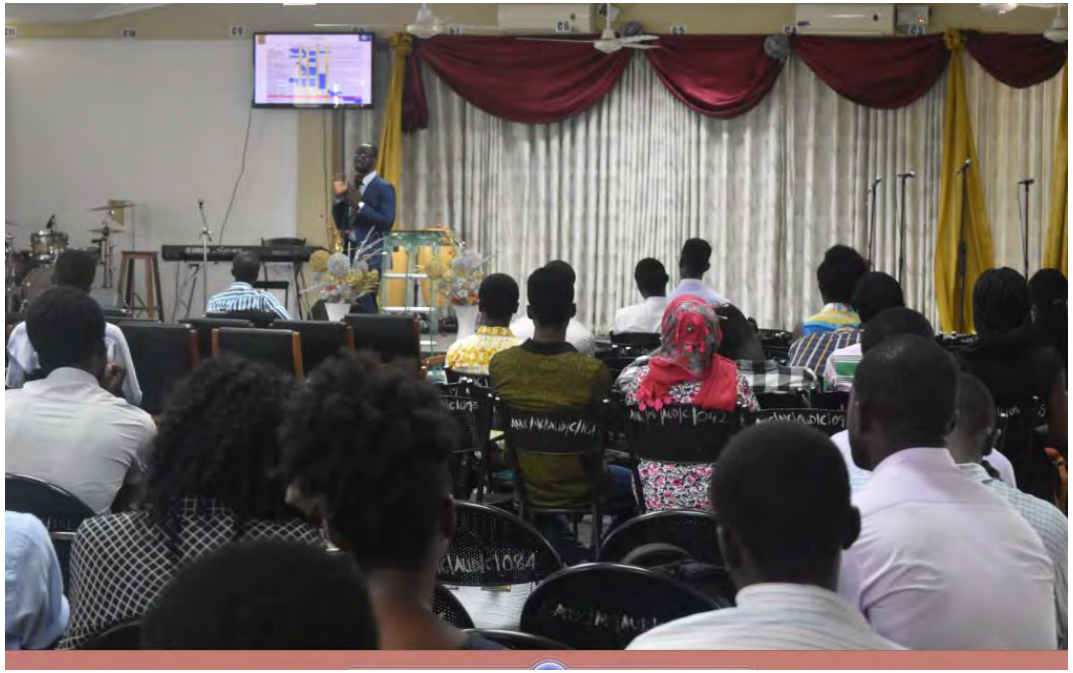
BIRD-G (GHANASAT-1) Presentation at the Ghana National Communication Authority (NCA)

On 5 April 5 2017, Benjamin gave a presentation about GHANASAT-1 (BIRDS-G) to the management of NCA. Present was Honorable Joe Anokye (left), the Managing Director of NCA.

Benjamin (right) being presented with a commemorative gift from Mrs Florence Matey, Head of Engineering Division at the Ghana National Communication Authority (NCA)

Benjamin (right) poses with Mr. Joe Anokye, Director General at the Ghana National Communication Authority (NCA) after GHANASAT-1 presentation

BIRD-G (GHANASAT-1) Presentation at All Nations University



On 12 April 2017, Benjamin gave a presentation about Ghanasat-1 (BIRDS-G) to the students, faculty, management of All Nations University.

Benjamin (right) having a chat with Rev Adriana Ion [Registrar of ANU] after his presentation.

BEN'S TRIP TO GHANA

PREPARATIONS FOR THE 2ND BIRDS INTERNATIONAL WORKSHOP

Work begins on laying the foundation for the second BIRDS international workshop. The first one was held in Japan (Tobata Campus of Kyutech) last year June (see back issues of this newsletter for photos). By visiting Ghana this time, Benjamin could explain several matters to the Local Organizing Team in Ghana.

There is a lot of work ahead of us.

Topics of Discussion

by the Local Organizing Team

- Conference Date Confirmation
  November 20-23
- Logistics
- Accommodations
- Media
- Transportation
- Workshop Web Site

The primary hall (venue) for hosting the *2nd BIRDS Int'l Workshop* at the main campus of ANU in Ghana.

BEN'S TRIP TO GHANA

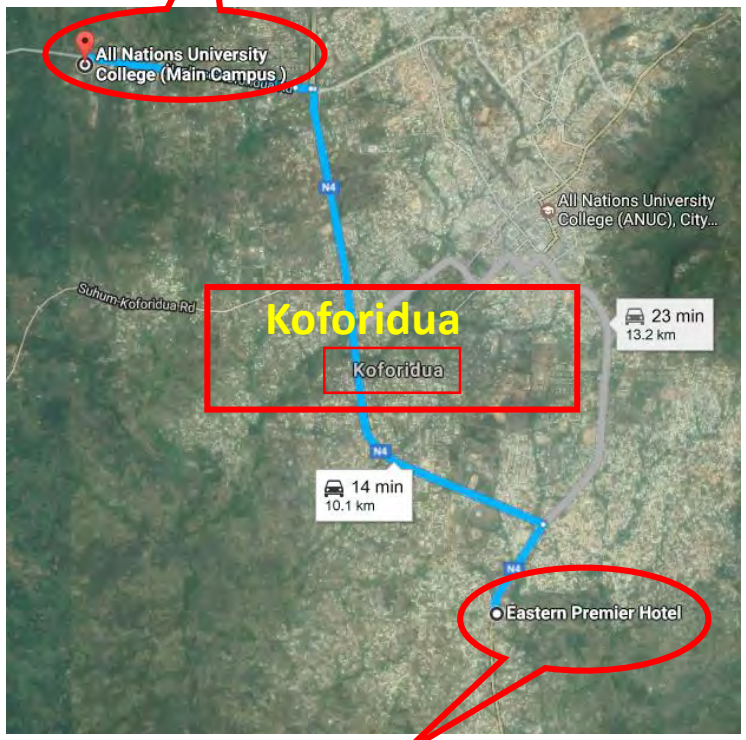
Accommodation for the participants "Eastern Premier Hotel".

SEE THE NEXT PAGE FOR MORE HOTEL INFO.

2nd Birds Workshop Local Organizing Team in Ghana led by Dr. Gloria Sraha (left) met on 28 March 2017 to discuss the way forward to host a successful workshop.

ALL NATIONS UNIVERSITY COLLEGE

http://www.anuc.edu.gh



EASTERN PREMIER HOTEL
KOFORIDUA

http://easternpremierhotel.com/

CONTACT

Editor's Note: From the hotel's website

Eastern Premier Hotel offers 3-Star comfortable accommodation in a stylish and sophisticated facility.

The beautiful architecture, outstanding and tasty food, peaceful surroundings and the sense of total escape, personal ownership and relaxation are offered to every guest at Eastern premier Hotel.

Kindly, contact us for your inquiries and reservations.

P.O Box, 405, Koforidua, Ghana

Main Mile 50 Road, Koforidua, Ghana.

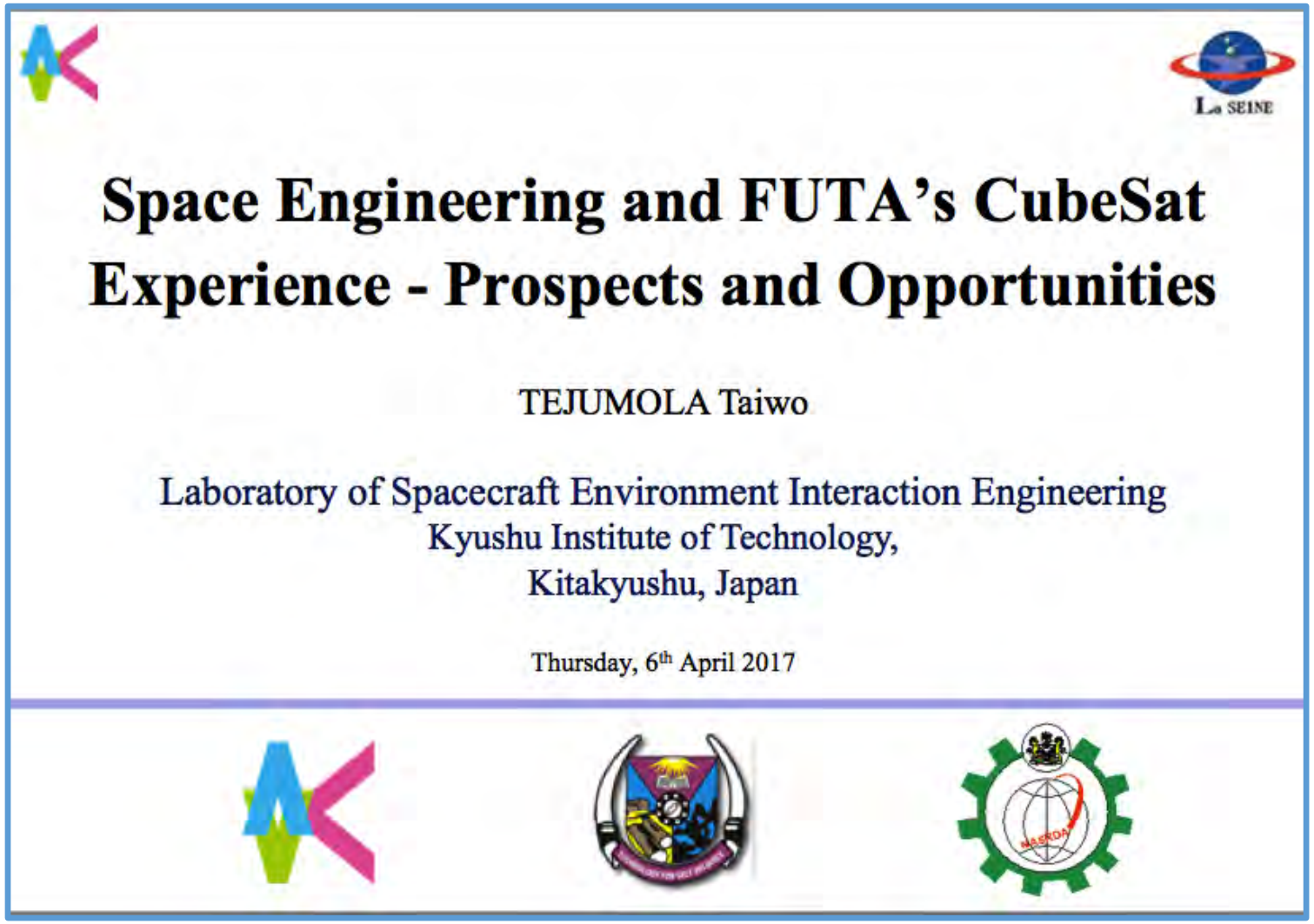
+233-247-319-319 / +233-342-024-205

info@easternpremierhotel.com

reservations@easternpremierhotel.com

BEN'S TRIP TO GHANA
-- the end.

5. Trip report to Nigeria -- by Tejumola Taiwo, who was there 16 March to 25 April, 2017



Editor's Note:
← Presentation slide used by Taiwo in the seminars conducted in Nigeria.

Seminar

FUTA Engineering Staff

First seminar on BIRDS Project for FUTA Staff members on 30st March 2017.

Attendance: 28 staff, and 19 Graduate students

Seminar

FUTA Students

6th April 2017

Second seminar on BIRDS Project for FUTA student members on 6th April 2017

Attendance: 56 students (Engineering and Sciences), 5 staff members

Group photo: FUTA Students and Staff

In front of FUTA's School of Earth and Mineral Sciences

6. Tokyo unveils its logo for international branding

The Year 2020 is a big, big deal in Japan. It is the year the Olympics take place in Japan. All over Japan, but mainly in Tokyo, preparations are underway for the Olympics as large numbers of visitors are expected.

- The Editor.

May 11, 2017
The Japan News
by The Yomiuri Shimbun

The Yomiuri Shimbun

The Tokyo metropolitan government has revealed a new logo to promote Tokyo abroad.

The logo uses the catchphrase, "Tokyo Tokyo Old meets New," with the left "Tokyo" written in black brushstrokes and the right in light-blue Gothic font.

The design is intended to express the coexistence within Tokyo of traditions dating back to the Edo period (1603-1867) and a cutting-edge culture.

Between the words is a red seal representing the "scramble" crossing in front of Shibuya Station, a spot that is well known overseas.

While the "& Tokyo" logo created under former Tokyo Gov. Yoichi Masuzoe is for domestic use, the new logo is to be used overseas.

Tokyo unveils logo for intl branding

The Scramble

The famous "scramble" crossing of Shibuya

http://content.time.com/time/travel/cityguide/article/0,31489,1897812_1897772_1897742,00.html

7. UPD Members of the BIRDS-2 are interviewed by ANC of the Philippines

ABS-CBN NEWS CHANNEL

Pinoy scientists see bright future for cube satellites

ABS-CBN News
Posted at May 18 2017 05:55 PM

ABS-CBN News Channel, commonly known as **ANC**, is a global subscription television news network targeted to Filipino audience. It is notable for being the country's first all-news cable network, the country's first 24-hour news network, and the country's first English language news network. -- Wikipedia

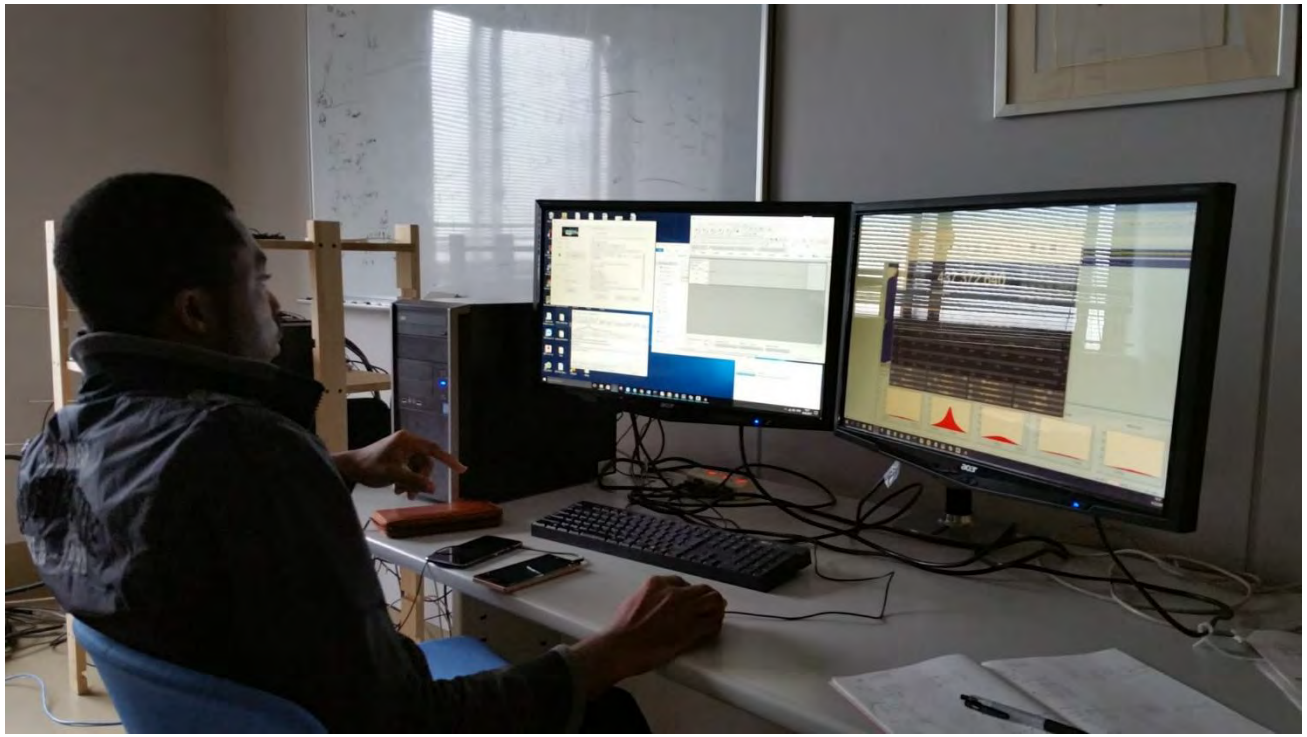
The Department of Science and Technology (DOST) recently marked the first year in space of the Philippines' first ever microsatellite, Diwata-1. The same team of Filipino engineers who built Diwata-1 during their training in 2 Japanese universities are now also building Diwata-2 that's scheduled to launch by second quarter of 2018.

However, a separate team of Filipino scientists in Japan are working on a different space project called Cube Satellites or "Cubesats."
Cubesats are packed with sensors but are just 10 cubic centimeters in size, weigh about 1 kilogram and are way cheaper than regular satellites.
Watch [video link is below] Filipino student scientists Adrian Salces, Joven Javier, and Prof. Yukihiro Takahashi of Hokkaido University discuss innovations and the Philippine space program on ANC.
-- ANC Future Perfect, May 17, 2017

SEE THE VIDEO (it is about ten minutes—and it is quite good)
http://news.abs-cbn.com/video/life/05/18/17/pinoy-scientists-see-bright-future-for-cube-satellites

8. Operational rehearsal of BIRDS-1 (preparing for the operation of five BIRDS-1 satellites while on orbit)

Reported by Maisun (Bangladesh), Joseph (Ghana), and G. Maeda (Editor)



Joseph Control Desk of the BIRDS Ground Station, 8th floor of the LaSEINE building – the same room used by the Horyu-4 ground station.

From the 20th to 26th April 2017, assuming that the BIRDS-1 satellite was flying in the ISS orbit, the satellite was operated for a full week by the BIRDS-1 team. The purpose of this test was:

- Acquaint operators with the procedures and protocol
- Test for software bugs
- Get an idea of how the actual operation will be after deployment into space

Important things were found out.

Continued on the next page

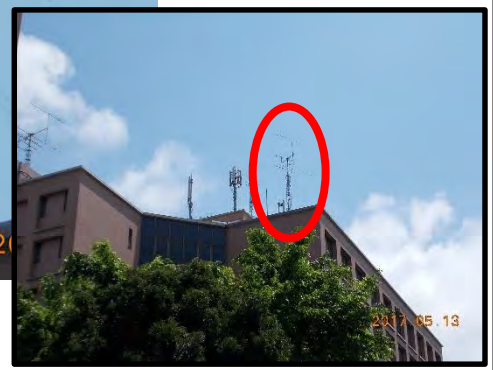
KYUTECH TOBATA CAMPUS

Note that this map is inverted – north is downward.

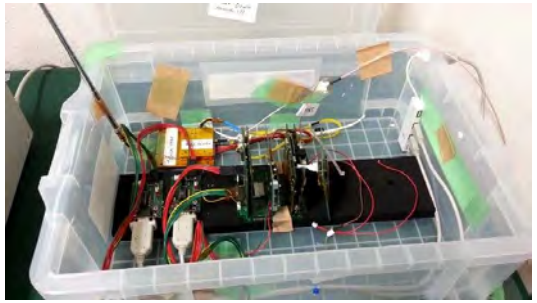
- The SVBL Building is No. 23 on this map.
- The LaSEINE Building (a.k.a., **S-2** Building) is No. 15 on this map.

On the LaSEINE Building (S-2) . . .

The ground station VHF-UHF antenna was pointed towards the SVBL building for this test



In the SVBL Building . . .



"Table Sat" – this simulates the BIRDS-1 Flight Model

The test configuration for the operational rehearsal – end-to-end testing of the final software

9. “The Big Power of the Small Sat Revolution” (Via Satellite Magazine)

Read the article here

http://interactive.satellitetoday.com/via/asia-edition-2017/the-big-power-of-the-smallsat-revolution/

The Big Power of the Smallsat Revolution

Launch rates in Asia are set to eclipse U.S. figures by 2025, showing that the region is on the path to reap significant returns. The benefits of Asia's proliferation of smallsats include disaster management, agriculture, fast and affordable data, job creation and an expected new wave of business opportunities.

ADRIENNE HAREBOTTLE

Inside the article is this photo:

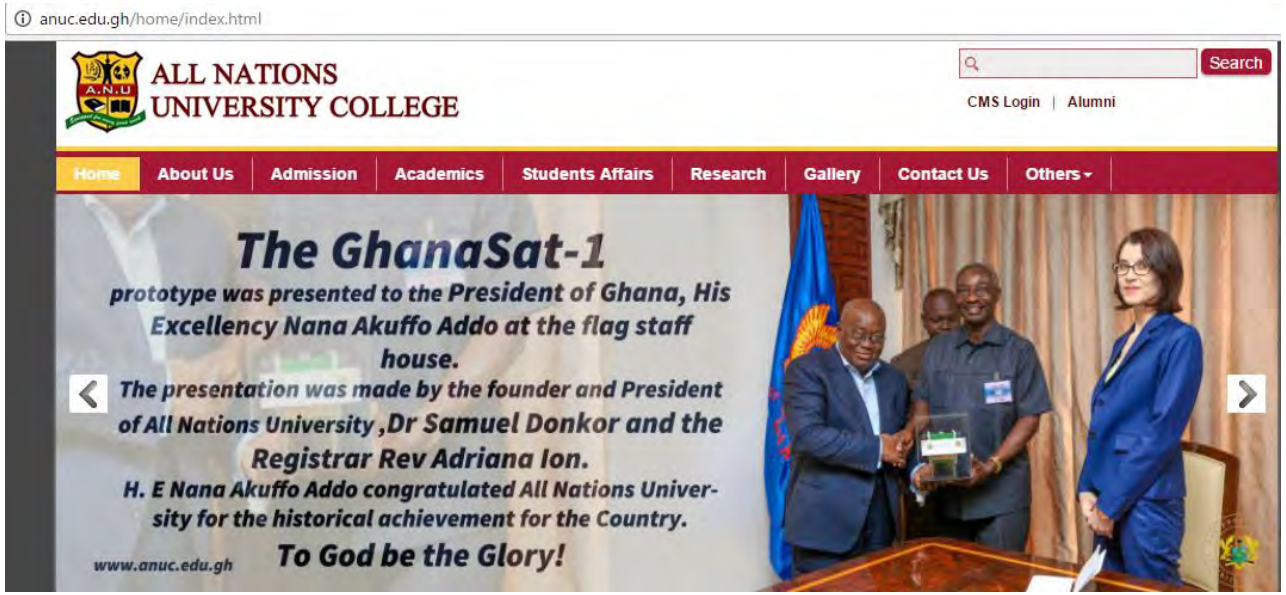
Brac University students Abdulla Hil Kafi, Maisun Ibn Monowar and Raihana Shams Islam Antara along with their mentors.

Prof Cho is quoted at the end of this article:

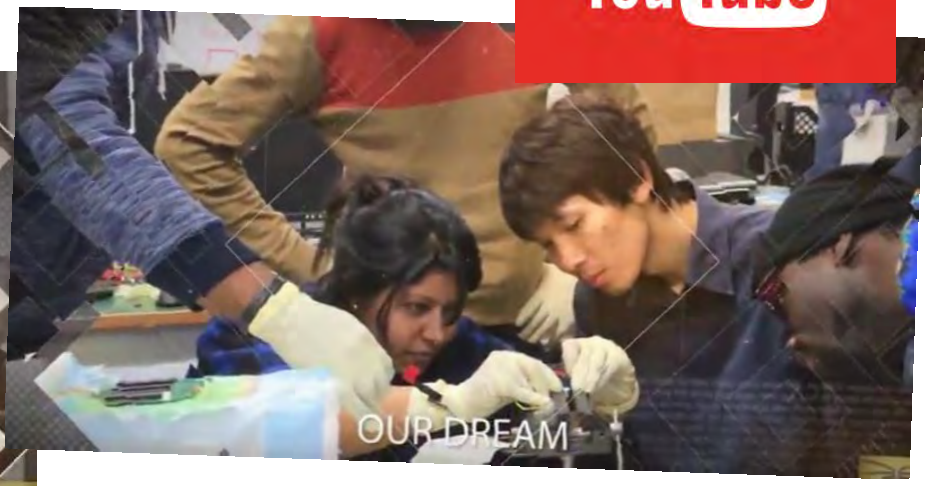
“Overall, global efforts are underway in Asia to develop satellite-based technologies, but also ground stations and launch capabilities. Thanks to the miniaturization of satellites and the smallsat revolution, these efforts are not only concentrated in government or private-led entities, but also educational entities, which can serve as a catalyst to build a country’s capacities, to develop infrastructures, and advance human knowledge,” says Cho.

10. Satellite news at the ANUC's main website (Ghana)

These three web pages were being shown at http://anuc.edu.gh/home/index.html on 14 May 2017.
ANUC proudly shows it leap into the Space Age, becoming the technology leader in West Africa.



11. Great new video by the BIRDS-1 Bangladesh Team – check it out



https://www.youtube.com/watch?v=bqEcv4Bqnno&feature=youtu.be

12. Fellowship Program of: The Matsumae International Foundation

From their website:

Eligibility Requirements

Applicants of non-Japanese nationality; a Doctorate degree; must be 49 years old or under; not have been in Japan previously; have firm positions and professions in their home nations; etc.

Host Institution In Japan:
Applicants are free to select host institutions (university research laboratories, national research institutions or the corresponding facilities of private industry)

Fellowship Details:
Stipend for research and stay, Insurance, Air transportation (a round-trip air ticket to/from Tokyo) and Lump sum on arrival

Period & Number of Fellowships:
For a period of from three to six months; the number of fellowships is about 20 persons each year.

Please consider this fellowship if you have students in Japan and you wish to do research alongside them for 3-6 months. It is only open to persons who have never been to Japan, by the way.

http://www.mif-japan.org/?hl=en

13. June Launch of BIRDS-1: Press Release by the Bangladesh Team

BRAC ONNESHA LAUNCH DAY CONFIRMED

WWW.TEAM-CENTURIONS.COM
centurions.science@gmail.cm

BRAC ONNESHA is a CubeSat project under taken by BRAC university, with technical assistance from Kyushu institute of Technology. BRAC ONNESHA is a part of the BIRDS-1 Project, CubeSat constellation project, undertaken by Kyushu Institute of Technology.

BRAC ONNESHA will be placed in orbit in two steps.

In Step 1, ***On June 2nd, 03:55 am BST***, BRAC ONNESHA will be launched from Kennedy Space Center, Florida, by SpaceX's Falcon 9 rocket. BRAC ONNESHA will be delivered to International Space Station (ISS) as one of the cargo, among many other in this mission (CRS11).

In Step 2, Japan's Kibo module of ISS will deploy BRAC ONNESHA with its robotic arm. Date of deployment will be announced after successfully docking of the cargo CRS11.

Continued on the next page

Launch time, 03:55 am, 2 June, 2017 BST.

Launch Will be from Kennedy Space Center, Florida.

Nation's First Satellite will start operating late June.

3 Makers

Abdulla Hil Kafi

Raihana Shams Islam Antara

Maisun Ibn Monowar

CubeSat is a size constraint satellite standard, which falls under the category of Nano-Satellite. CubeSats are satellites which are no larger than 10cm x 10cm x 10 cm. This standard was first framed by Prof. Bob Twiggs and Prof. Jordi Puig-Suari, with an aim for creating more opportunity for universities to build, launch and operate
satellite projects within a reasonable time frame. CubeSats being a standardized media, it has quickly gained popularity for conducting REAL experiments in space. CubeSat was further popularized as International Space Station offered frequent and easy launch opportunity for CubeSats. International Space Station has resupply mission on multiple time, every year. Among its cargo, one can place a CubeSat, to be released into space by International Space Station's robotic arm.

Once deployed from International Space Station, BRAC ONNESHA will have a 400-km orbit, similar to that of International Space Station itself. During its short lifetime, it'll perform 6 mission.

Mission 1: Capture image of Homeland Country

Natural resource monitoring is one of the most used application of satellite technology. The main mission of BIRDS satellites is to capture a picture of respective homeland countries and send it back to respective country's ground station. BRAC ONNESHA has 2 cameras onboard. The primary camera is a 5 MP CMOS camera. We expect it capture 100 km/pixel spatial resolution picture of the earth. The auxiliary 0.3 MP camera serves as a backup camera.

Mission 2: Digi-Singer

BRAC ONNESHA will broadcast our National Anthem from space. This mission aims to motivate the young enthusiastic minds for career in space engineering. Anyone with a UHF receiver can receive and listen to our national anthem, played from space. For more details: http://birds.ele.kyutech.ac.jp/digi.html

Mission 3: SEL Detection (SEL)

Single Event Latch up or SEL is a phenomenon related to harsh space environment. For Galactic Cosmic Radiation, microprocessors sometimes experience internal short circuit. This disrupts satellite operation. BIRDS constellation, aims to map SEL events for LEO and provide a statistical database for interested audience.

Mission 4: Atmospheric Drag Measurement (ATM)

By using data from all 5 of the CubeSats, BIRDS project aims for measuring atmospheric drag more reliably by observing the decay rate of satellites. This data will provide more in depth data for our atmosphere and its effect on CubeSat mission lifetime.

Mission 5: Precise Satellite Position Detection System (POS)

In addition to 5 countries building satellites, Taiwan and Thailand are also participating in BIRDS project by sharing their ground station. 7 ground station in total enables us to experiment a reverse GPS system. This way, we can track our satellite without using any GPS.

Mission 6: Ground Station Network (NET)

One of the limiting factor for University based CubeSat project is, limited mission life and communication window. A ground station network can effectively increase the communication window. BIRDS project aim to demonstrate such a network operation for CubeSats. Participating countries are, Japan, Ghana, Mongolia, Nigeria, Bangladesh, Taiwan & Thailand.

Read more on BIRDS Project, please read: http://digitalcommons.usu.edu/smallsat/2016/TS13Education/8/

Due to the high atmospheric drag of International Space Station orbit, BRAC ONNESHA's mission lifetime is limited to 6 months. After 6 months, the satellite will naturally enter earth's atmosphere and burn up.

Ground Station located at BRAC University will be used for operating BRAC ONNESHA. Ground station located at BRAC university is also strategically important for 2 of the mission (NET, POS) performed by BIRDS constellation. 6 Students of BRAC University will operate this ground station.

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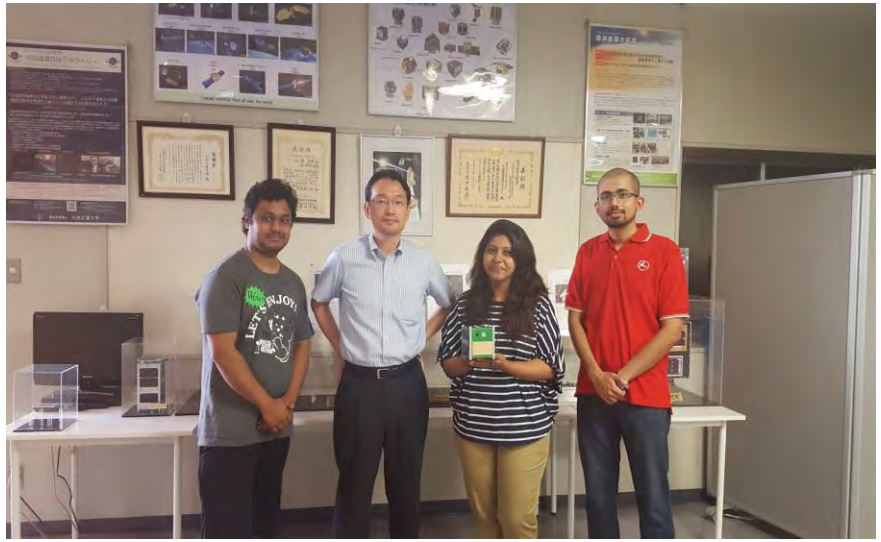
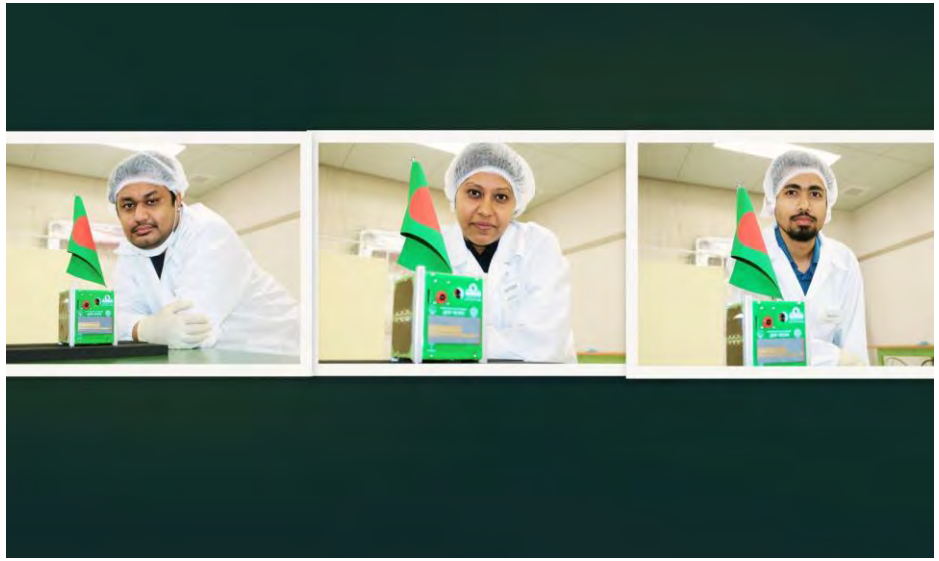


From Left:
Abdulla Hil Kafi, Prof. Mengu Cho, Raihana Shams Islam Antara, Maisun Ibn Monowar.
Antara is holding a replica of BRAC ONNESHA.

Prof. Mengu Cho, is the principal investigator for BIRDS project. He is also the supervisor for the 3 Bangladeshi students, Abdulla Hil Kafi, Raihana Shams Islam Antara & Maisun Ibn Monowar, who have built BRAC ONNESHA. Dr. Arifur Rahman Khan, assistant professor of University of Texas El-Paso (previously working at Kyushu Institute of Technology), is one of the key person who put their best effort into gathering momentum for this project. Dr. Md. Khalilur Rhaman of BRAC University is the country coordinator for Bangladesh in BIRDS Project. [continued next column]



We are hopeful that, BRAC ONNESHA will open up a new chapter of space research in Bangladesh.

With Regards,
Abdulla Hil Kafi, Raihana Shams Islam Antara, Maisun Ibn Monowar. (Centurions.)

centurions.science@gmail.com
www.team-centurions.com

End of Press Release by the Bangladesh Team – received 15 May 2017 by the Editor.

Editor's Note: Subsystem Reports 01 through 10 are in **Issue No. 15** of this newsletter.

Electrical Power System

Daiki Yamaguchi
Japan

Objectives

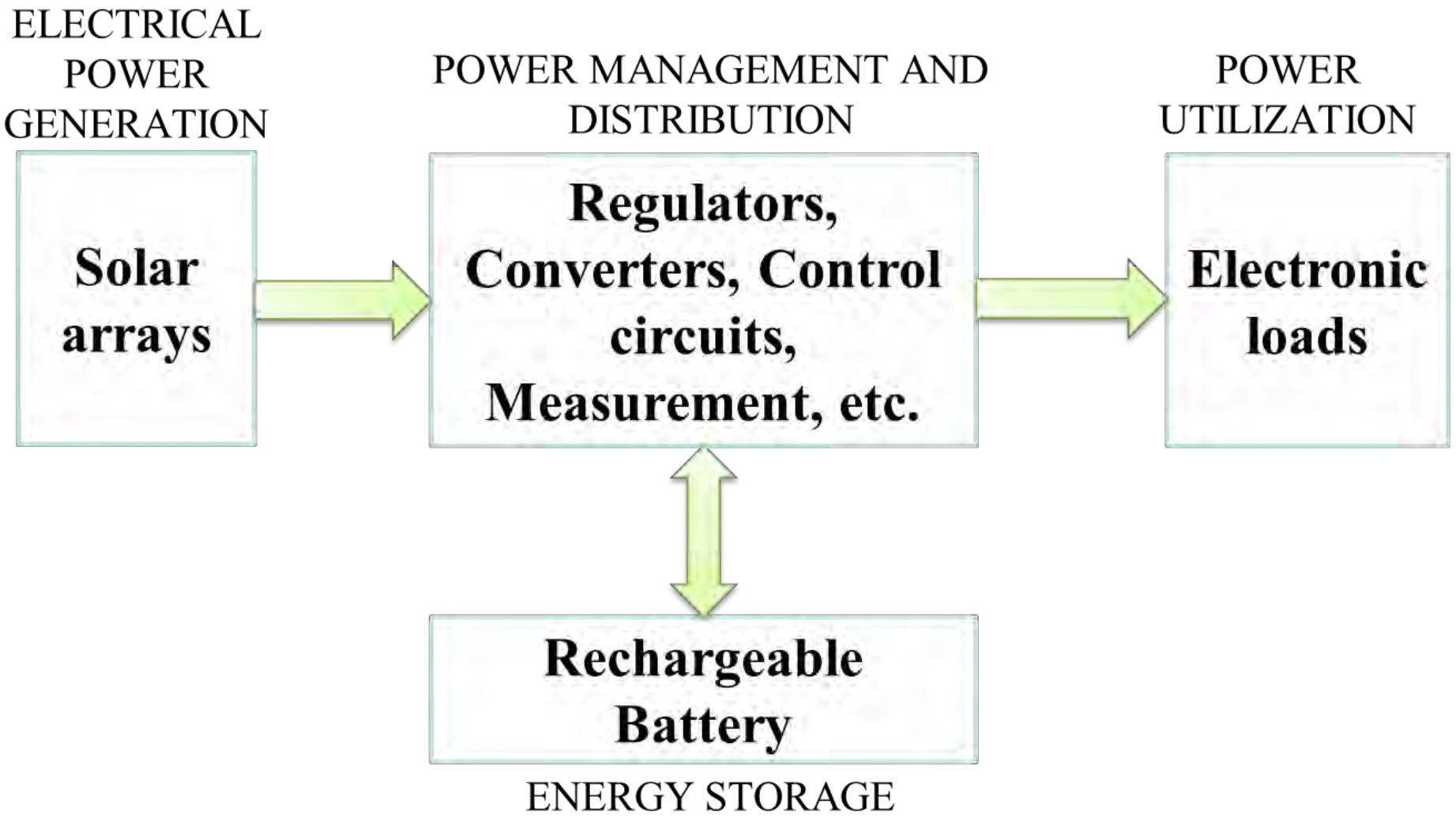
- Generate electrical power
- Store energy in rechargeable battery
- Control charging and discharging of battery
- Supply voltages to multiple outputs
- Protect outputs against over current
- Provide values of characteristics of EPS to OBC
- Work on launching mode

Objectives

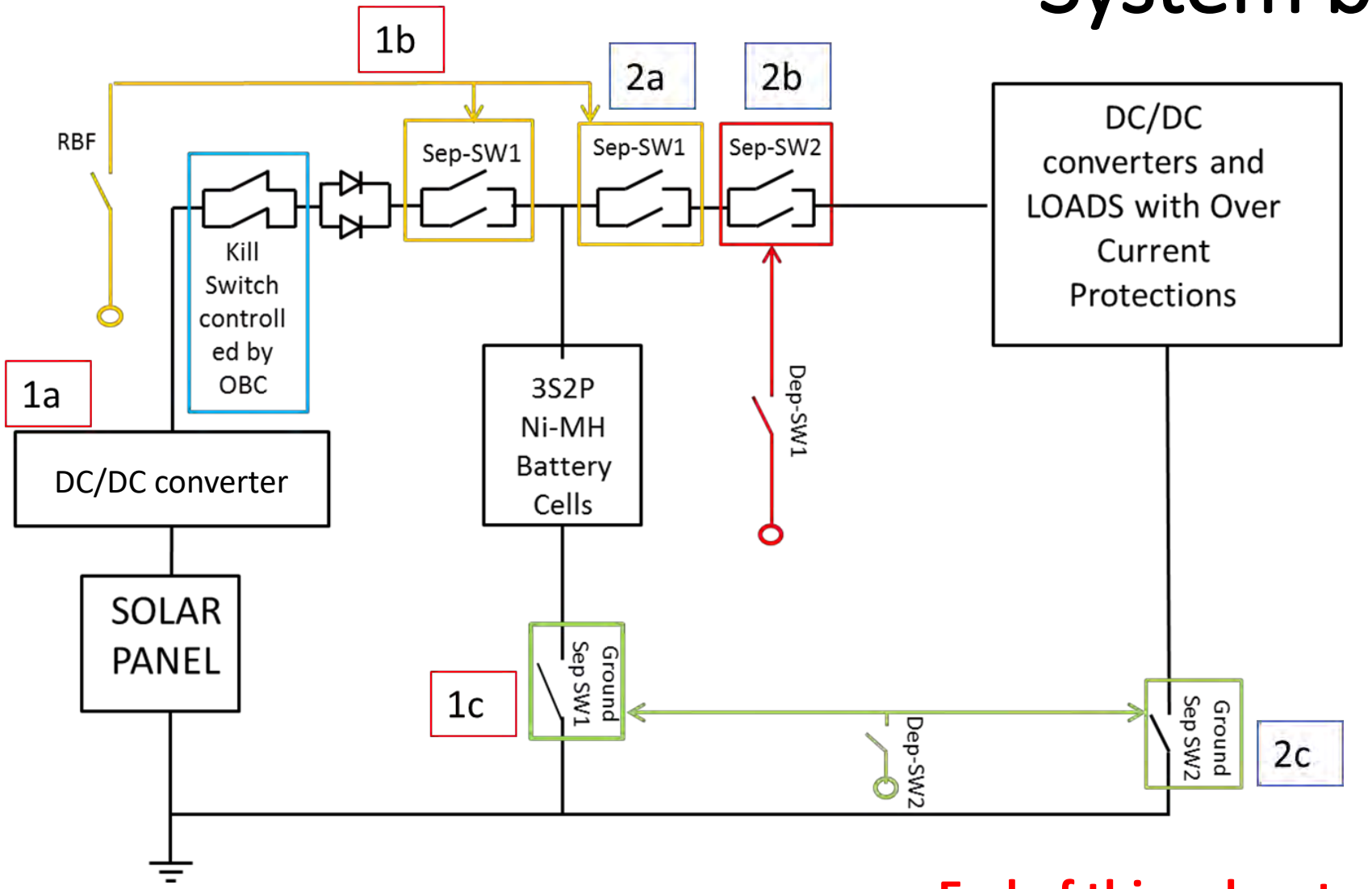
- The job of the Electrical Power Subsystem (EPS) is to provide uninterrupted power to on-board electronics both in sunlight and in eclipse.

- The choice of an appropriate power system depends on the amount of power required, the duration of the mission, constraints on mass and volume, and the impact of the system's hardware on the spacecraft design.

EPS SYSTEM


ELECTRICAL POWER GENERATION
POWER MANAGEMENT AND DISTRIBUTION
POWER UTILIZATION
Solar arrays
Regulators, Converters, Control circuits, Measurement, etc.
Electronic loads
Rechargeable Battery
ENERGY STORAGE

System block diagram



Over charge protection	1a,1b,1c
Over discharge protection	2a,2b,2c

End of this subsystem report (about the EPS)

[this is continued from the previous newsletter issue]

1U Cubesat Structure

Tomoki Uemura
Japan

Objectives

- Satellite structure performs the following functions
  - provide mechanical support for all other subsystems
  - protect all subsystems from external environment
    - Launch Environment
    - Space Environment
  - provide for separation from the J-SSOD.
- Structure provides for proper arrangement of the payload and bus systems to accomplish the above listed functions.

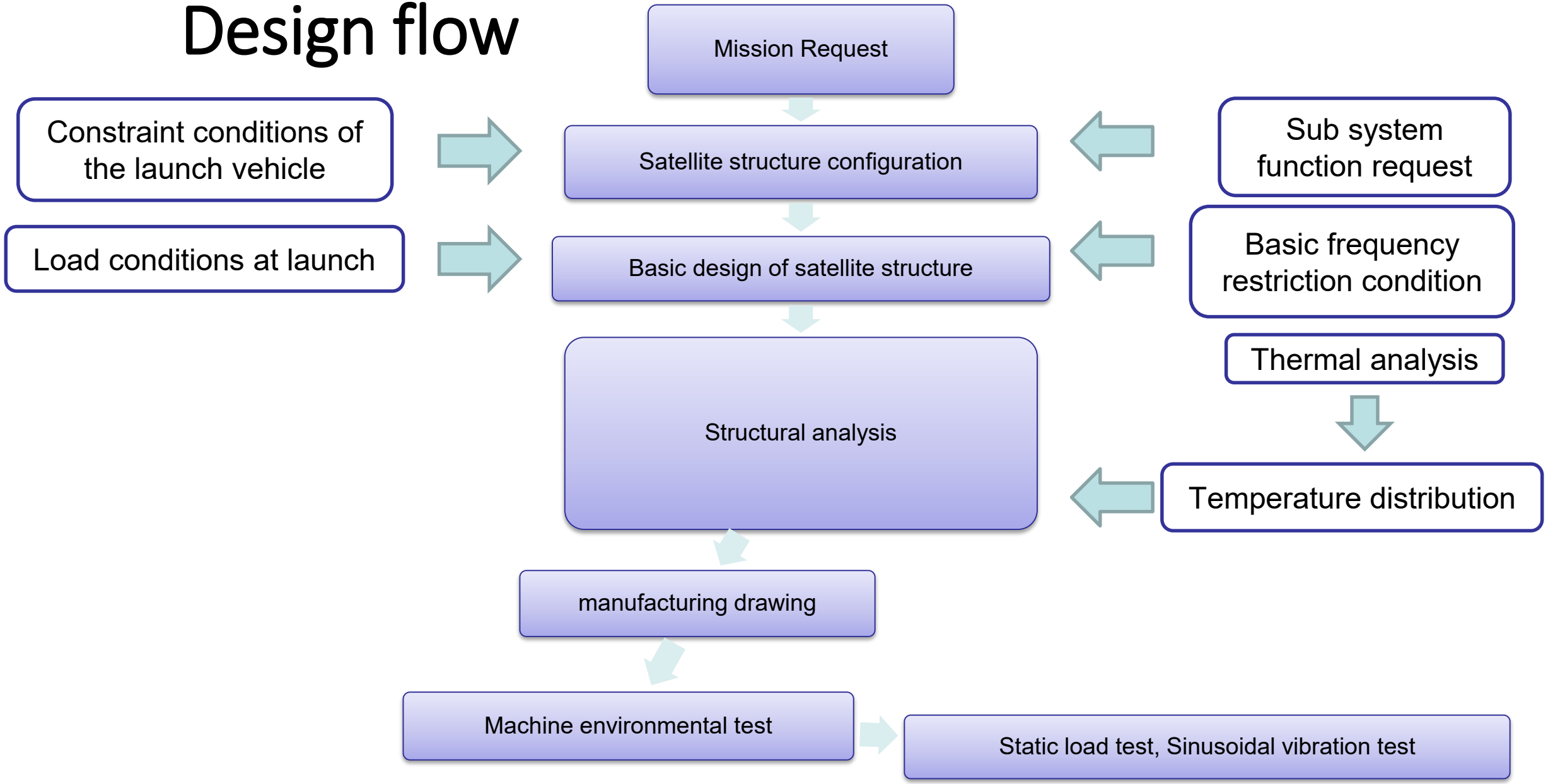
Function

1. Keep the onboard equipment safely through out all mission periods.
2. Provide predetermined rigidity so that the satellite structure has a higher fundamental frequency than the rocket so as not to resonate with the rocket during launch.
3. Provide enough strength to withstand earth handling and transport, launch and mechanical environment on orbit.
4. Provide the necessary alignment and dimensional stability to the on-board equipment.
5. Provide required thermal control characteristics, conductivity.
6. Make it easy to assemble, disassemble, test and transport satellites.

Key considerations

1. Satellite structure configuration
2. Structure style, mechanism, material
3. Performance
4. Environmental resistance, On-board equipment environmental condition
5. Design verification
6. Structure creation, test
7. Satellite level mechanical test

Design flow


Mission Request
Constraint conditions of the launch vehicle
Load conditions at launch
Satellite structure configuration
Basic design of satellite structure
Sub system function request
Basic frequency restriction condition
Thermal analysis
Structural analysis
Temperature distribution
manufacturing drawing
Machine environmental test
Static load test, Sinusoidal vibration test

Design Process

1. Goal setting
2. Determination of equipment arrangement
3. Confirmation and evaluation of load conditions
4. Selection of structural style and structural arrangement
5. Implementation of load analysis
6. Selection of structure element type
7. Eigenvalue analysis
8. Strength analysis
9. Dimensioning of structural element members
10. Selection of manufacturing method
11. Design of fastening part
12. Structural assembly procedure manual and alignment
13. Create drawings

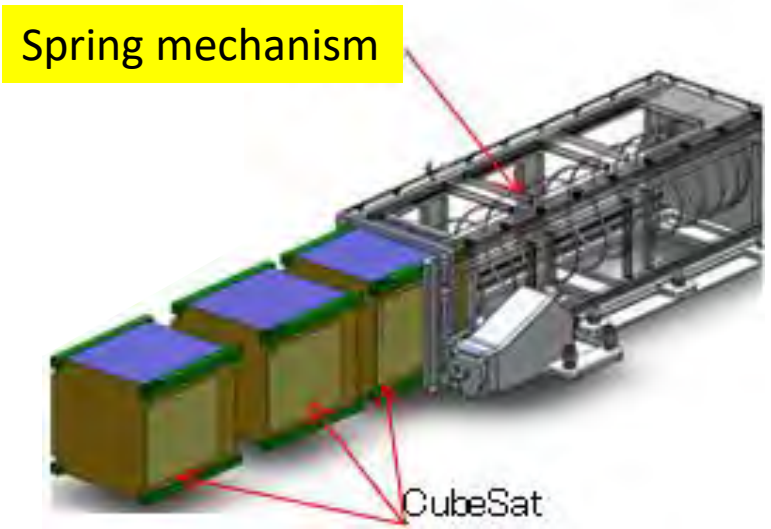
Design conditions

In the case of deployment from the International Space Station (ISS) experiment building "Kibo“, BIRDS satellites are released by a release-system called “J-SSOD”

The design conditions are established by JAXA

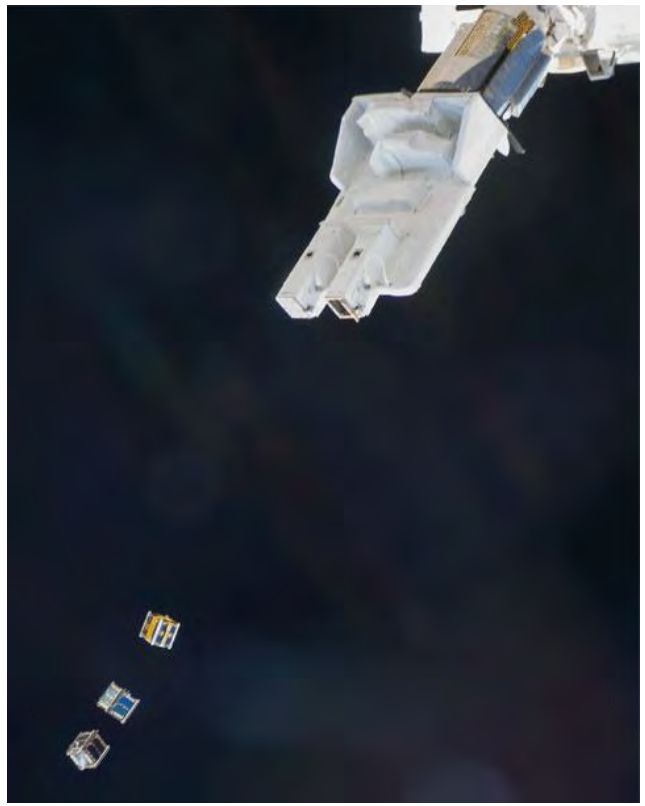
Launch

From http://www.asahi.com



J-SSOD

From http://iss.jaxa.jp



Release

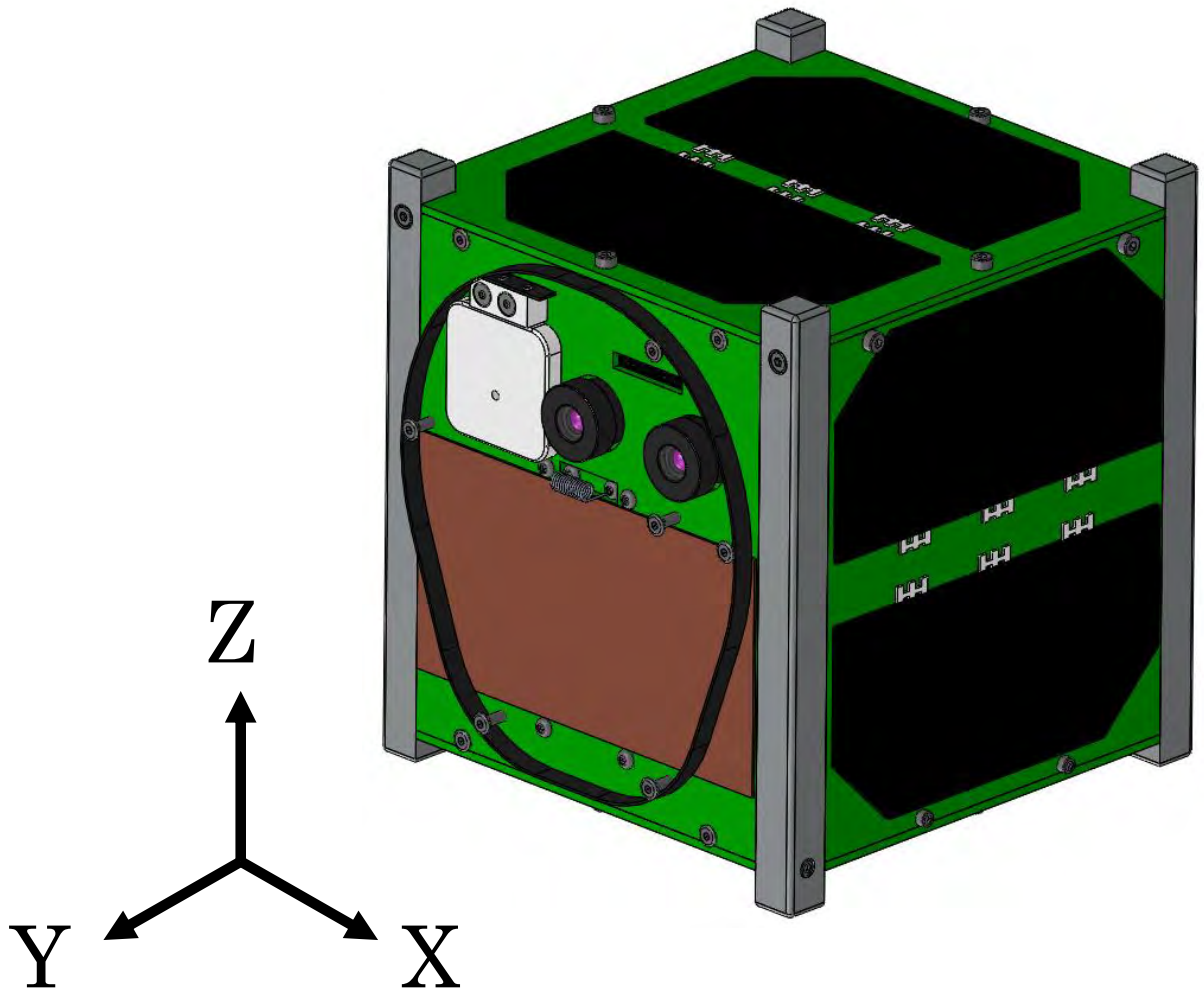
From https://hiveminer.com

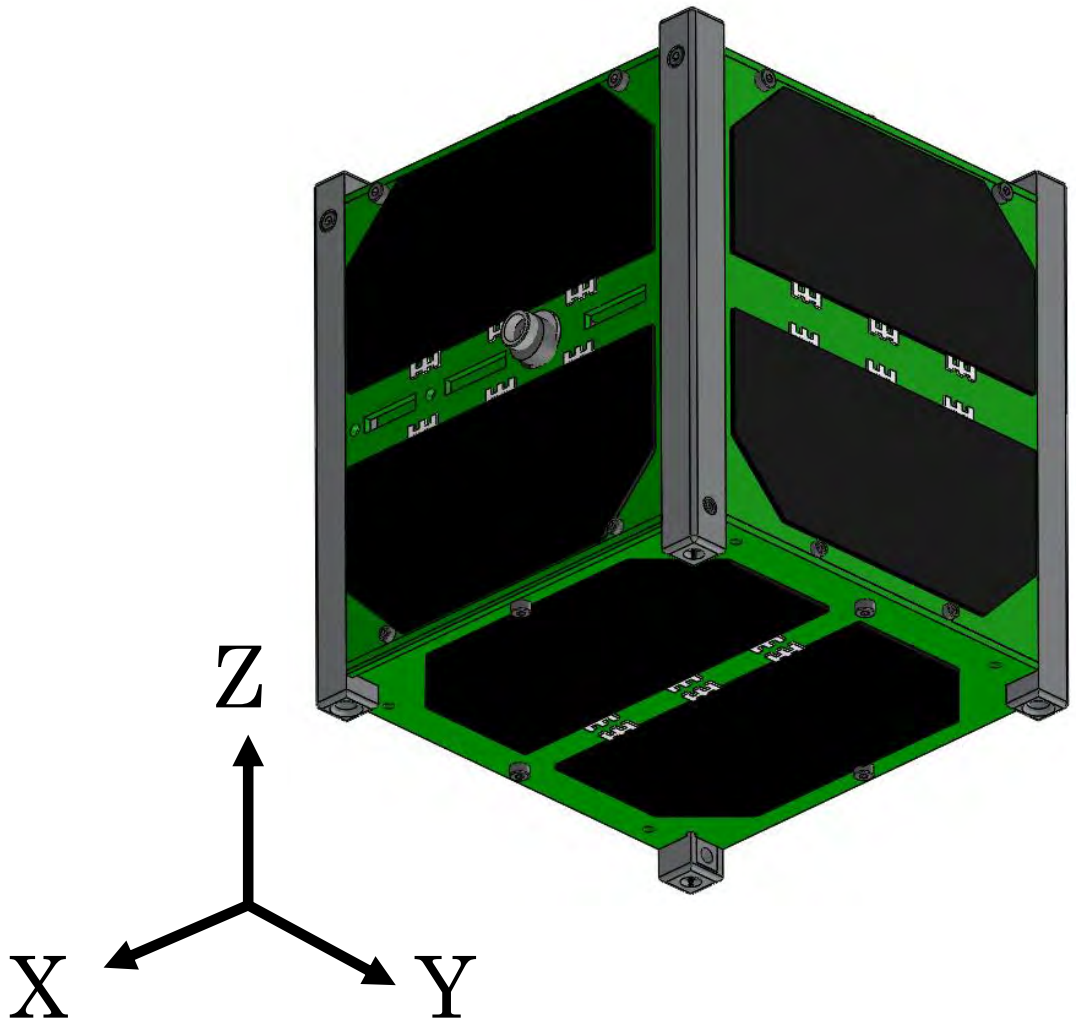
Design Requirements

There are about 20 other requirements as well

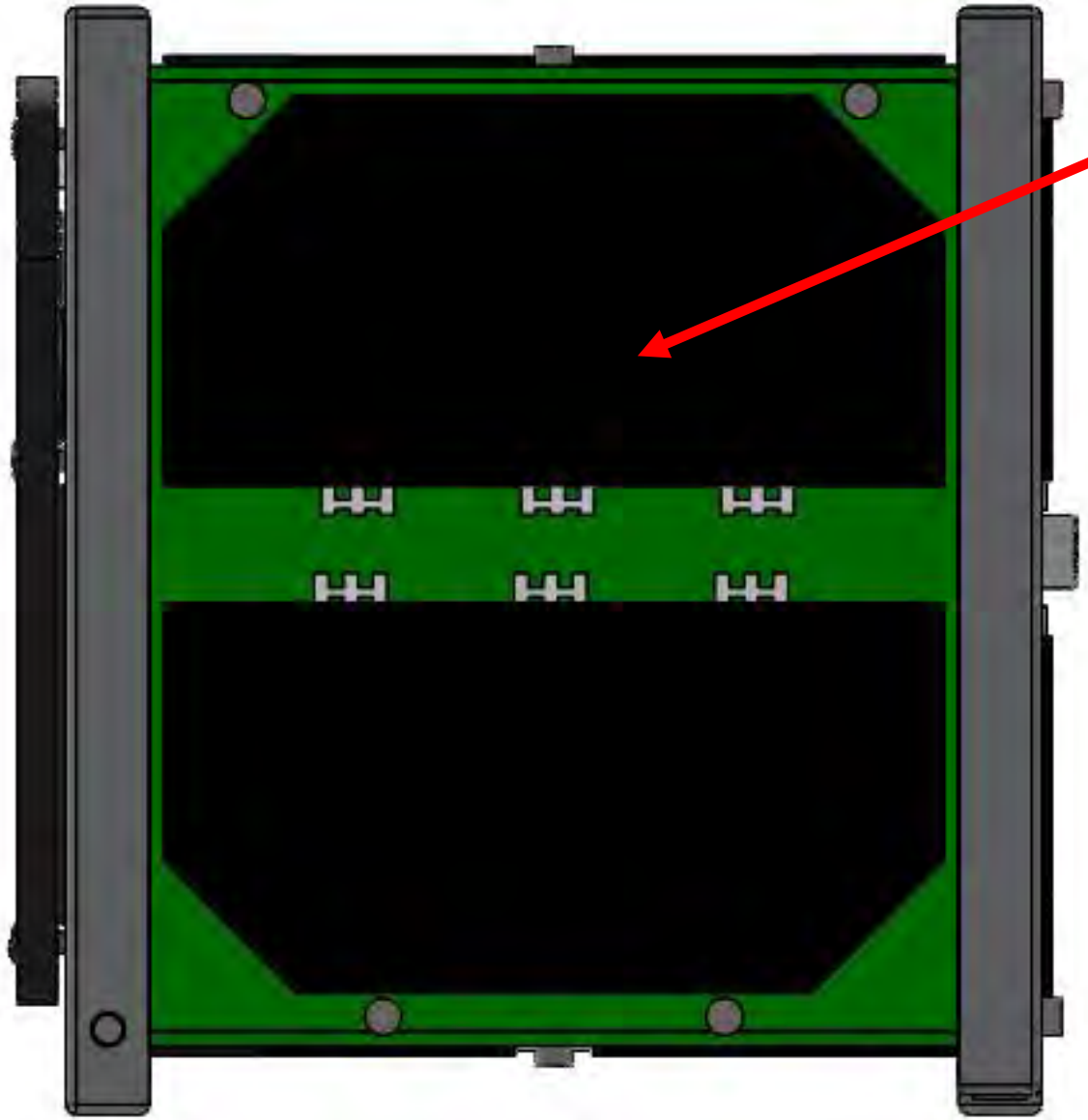
System Requirements	Design Requirements	Margin	Verification Method	Observed value
Dimensional Requirements	X, Y, Z = (100, 100, 113.5) mm	+/- 0.1 mm	Review of Design	X, Y, Z = (100, 100, 113.5) mm
Envelope Requirements	6.5 mm all sides	6.5 mm max protrusion from sides	Fit test Review of Design	Confirmed
Mass requirements	0. 13 kg < mass < 1.33 kg	1.33 kg max mass	Inspection	0.8 kg
	COG within 2 cm of Geometric center	GC+/- 20 mm max	Analysis	Confirmed
	Calculate Ballistic Number (BN)	100 kg/m^2 max	Analysis	36.7 kg/m^2
Access Requirements	Access port location	-Y or +X	Review of Design	-Y
Strength Requirement	Factor of safety (FOS) > 1	FOS = 1 min	Static analysis	-

Modified design by PDR



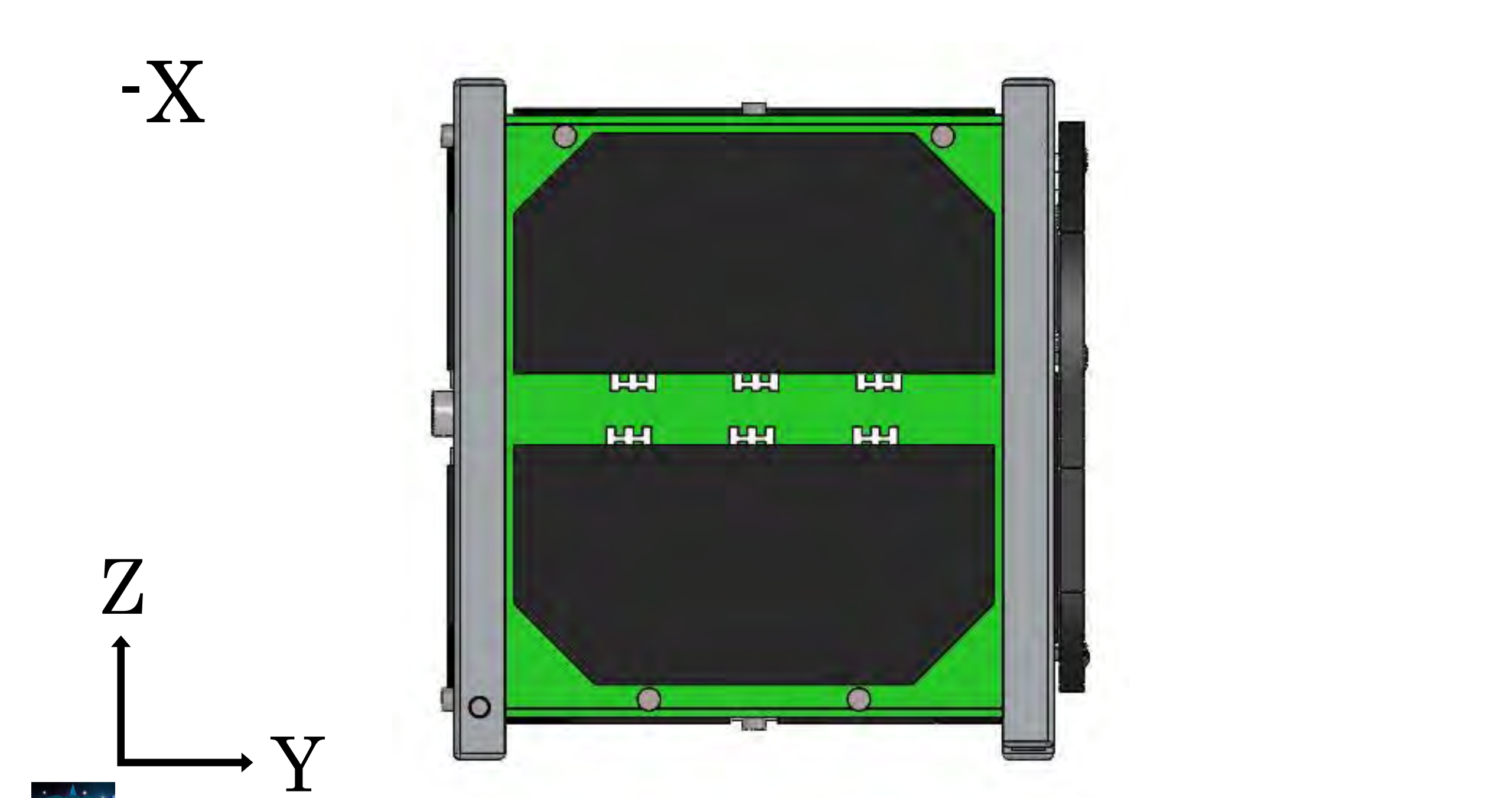


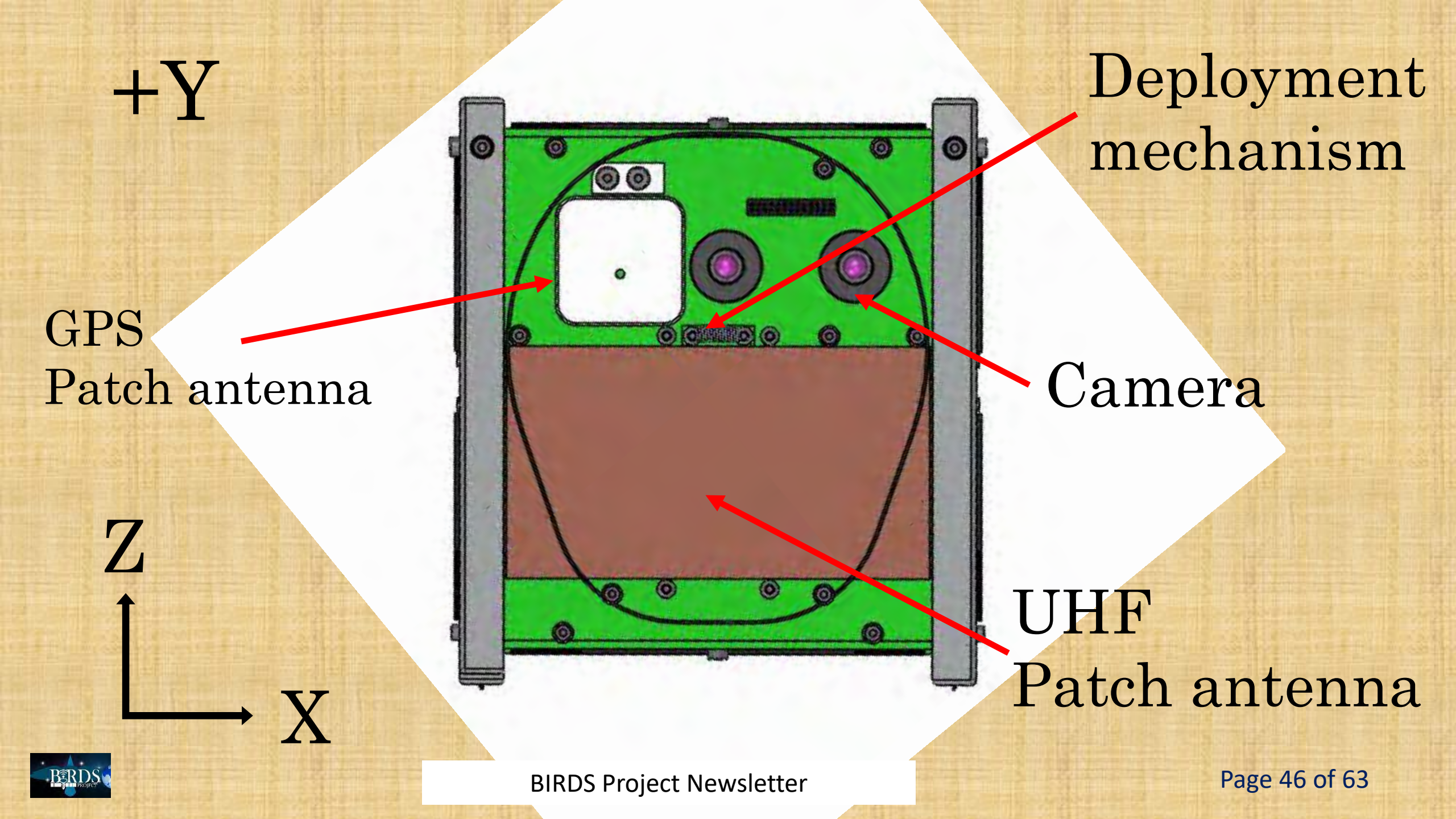
+X



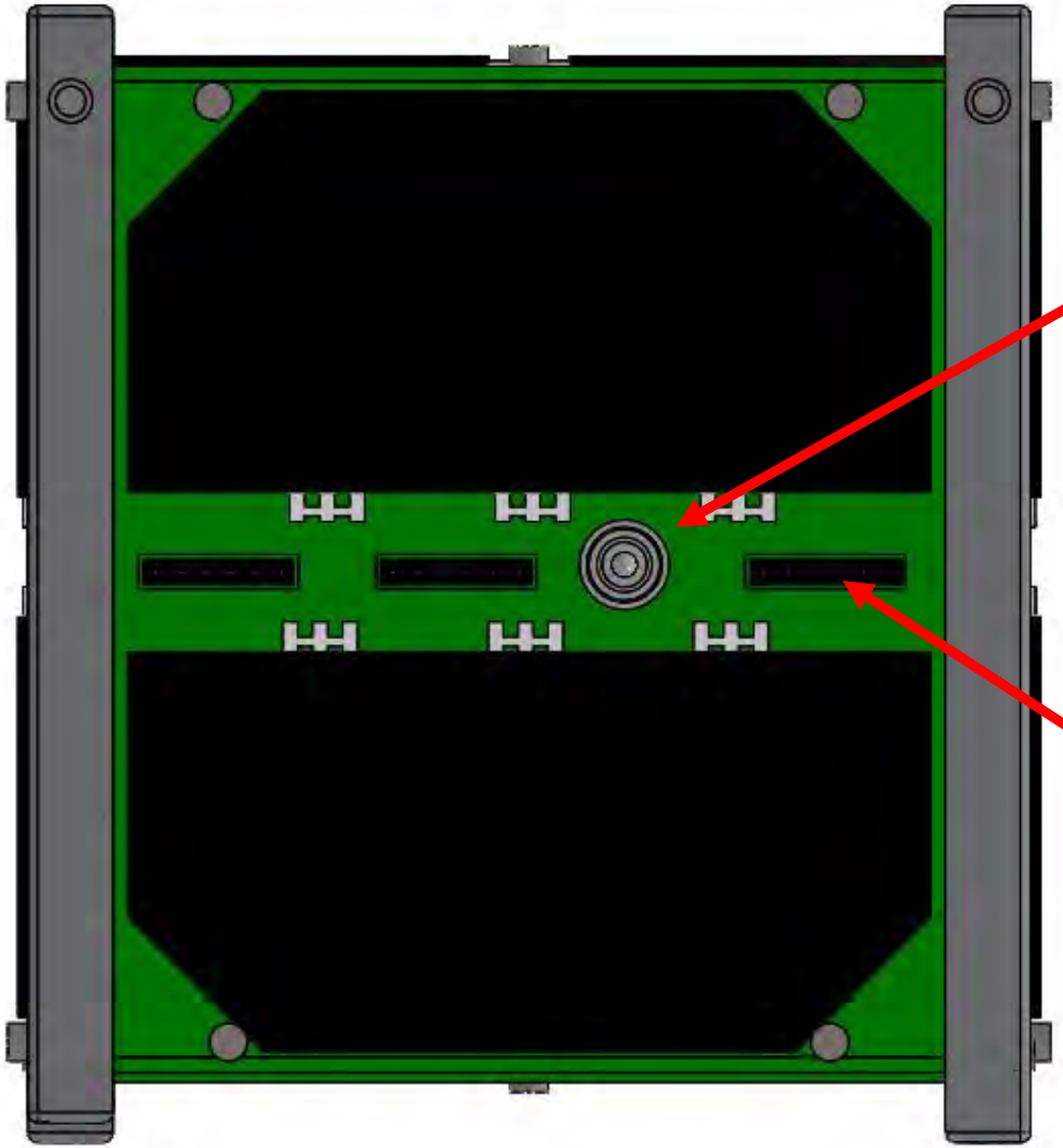
Z

Y


-X
Z
Y


+Y
Deployment mechanism
GPS Patch antenna
Camera
Z
X
UHF Patch antenna

-Y

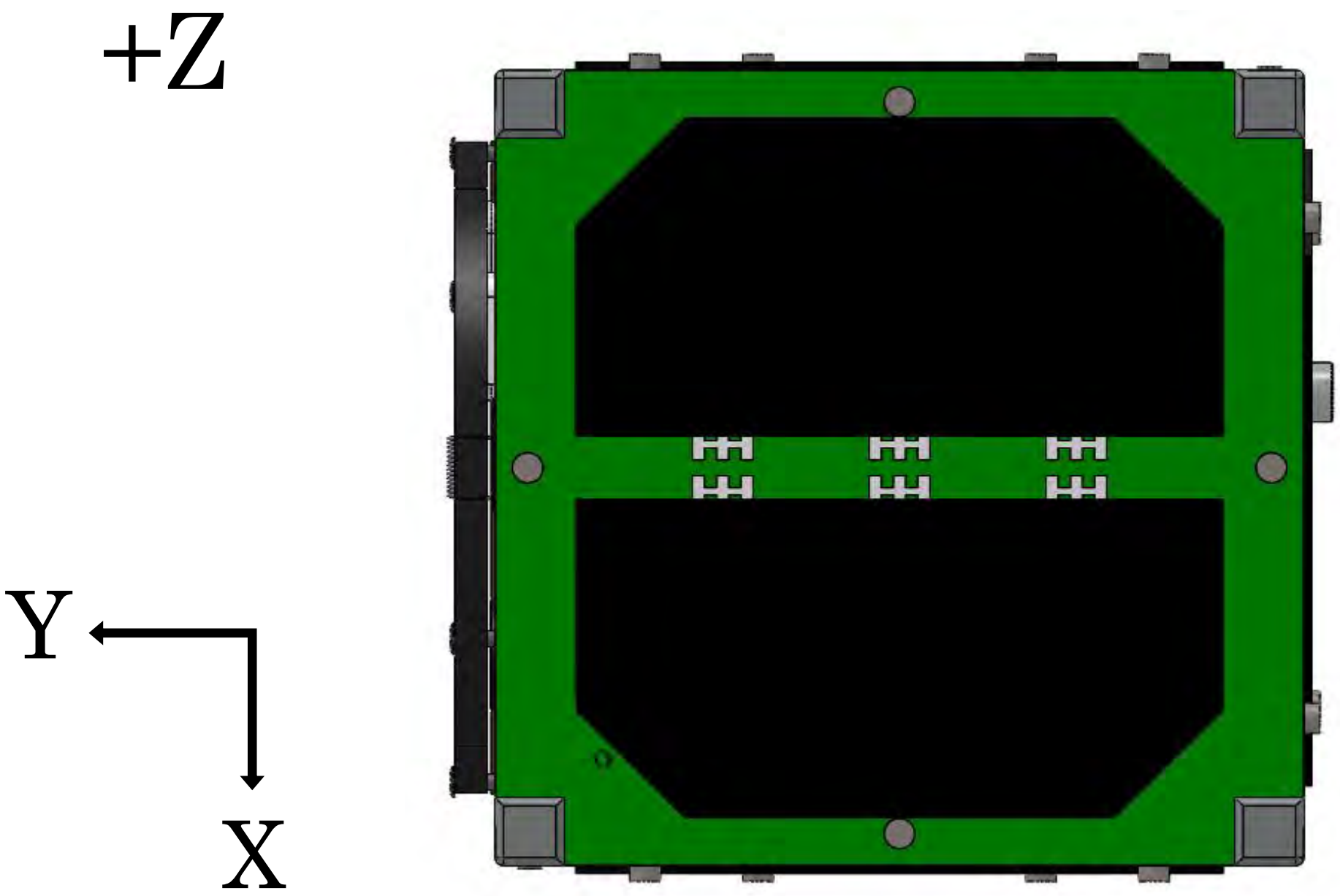


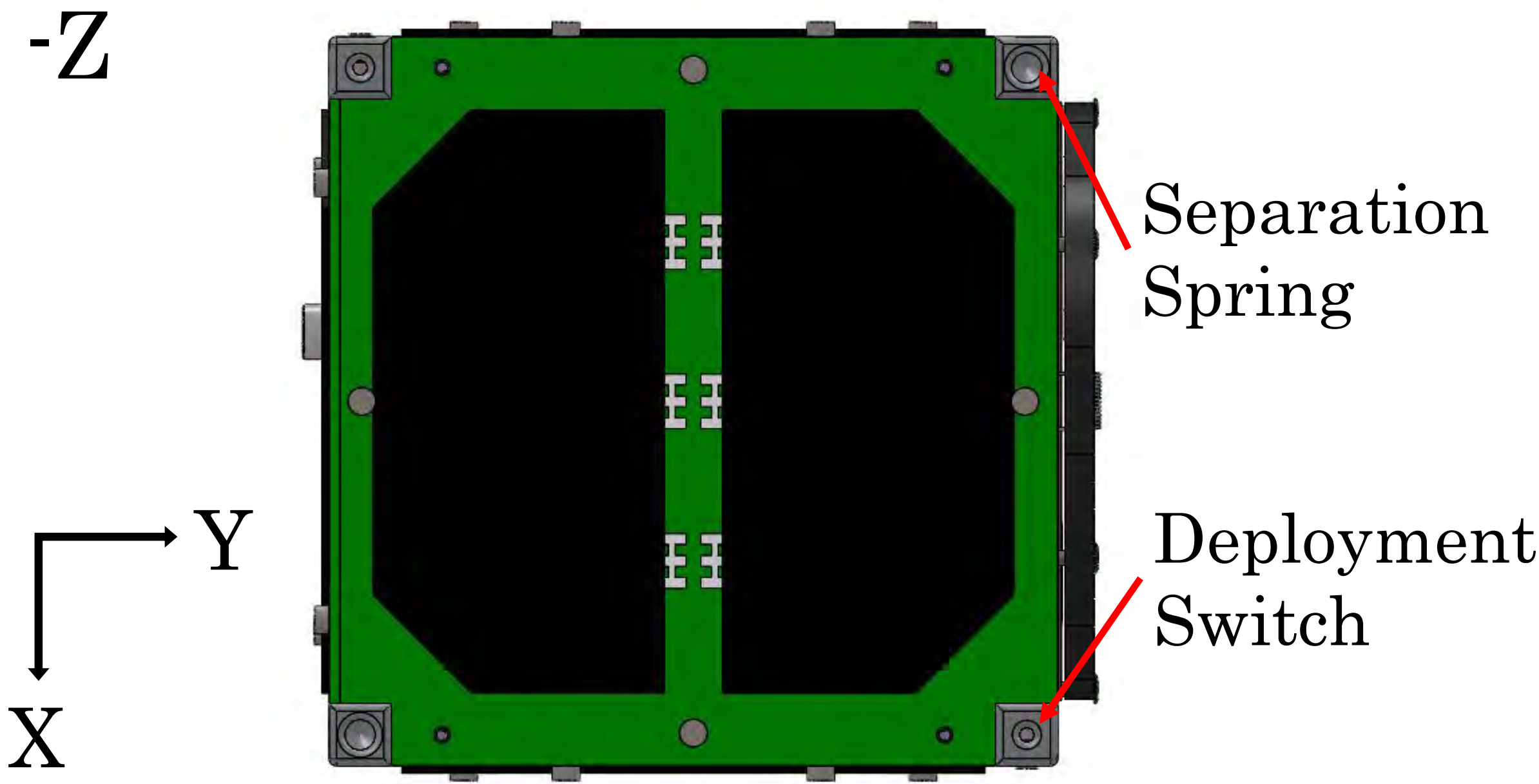
Z

X

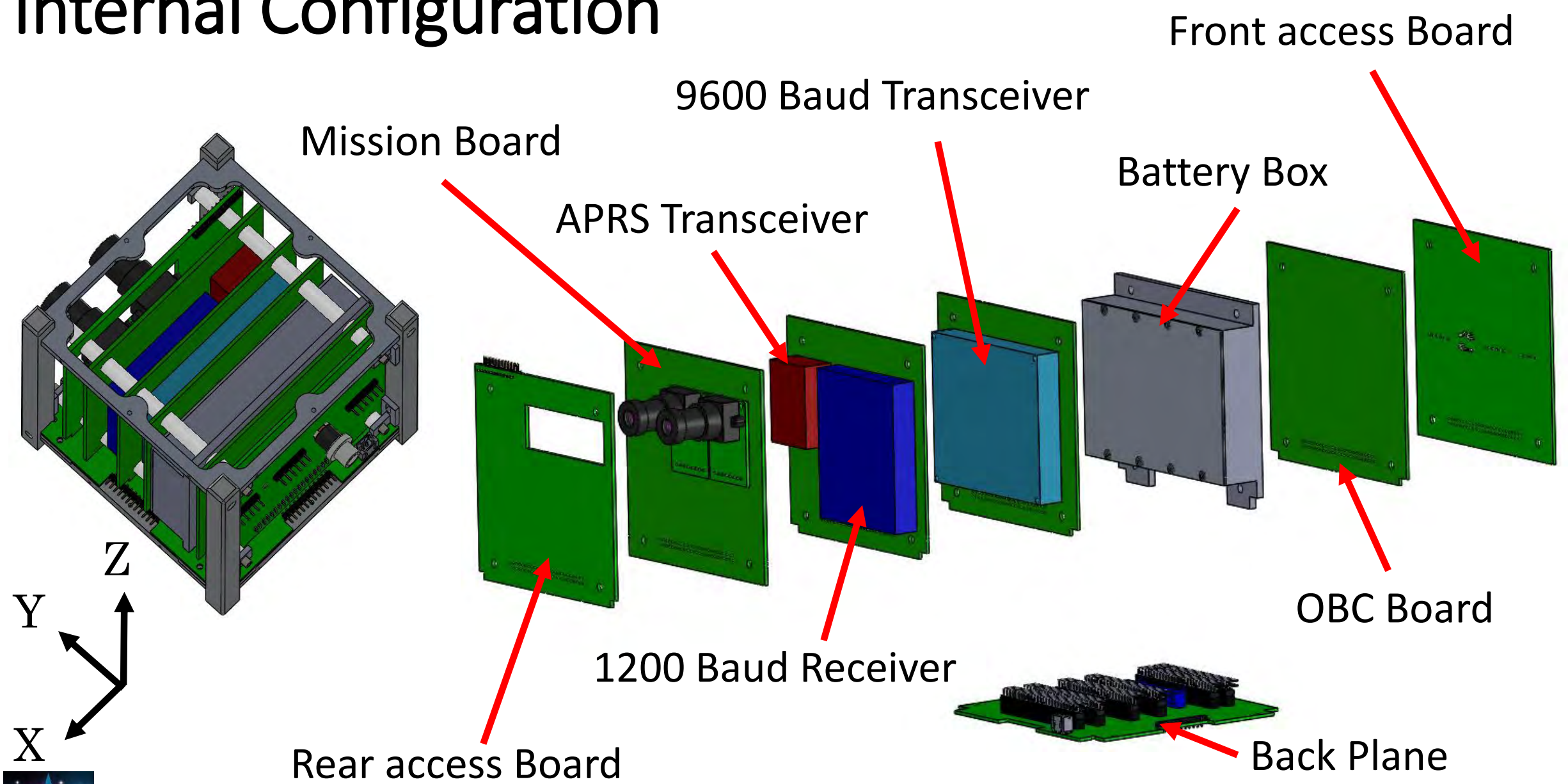
"Remove Before Flight" Pin

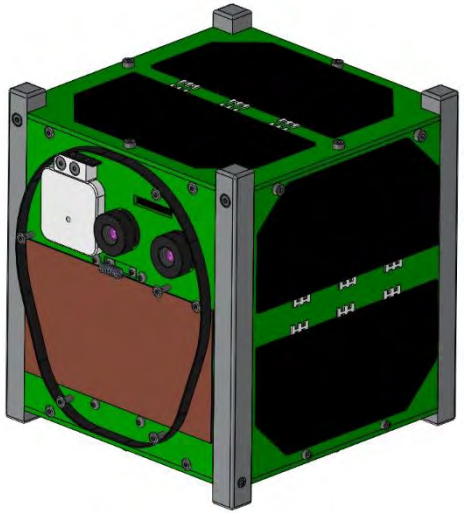
Access port


+Z
Y
X


-Z
Separation Spring
Deployment Switch
Y
X

Internal Configuration





VHF
Monopole
Antenna

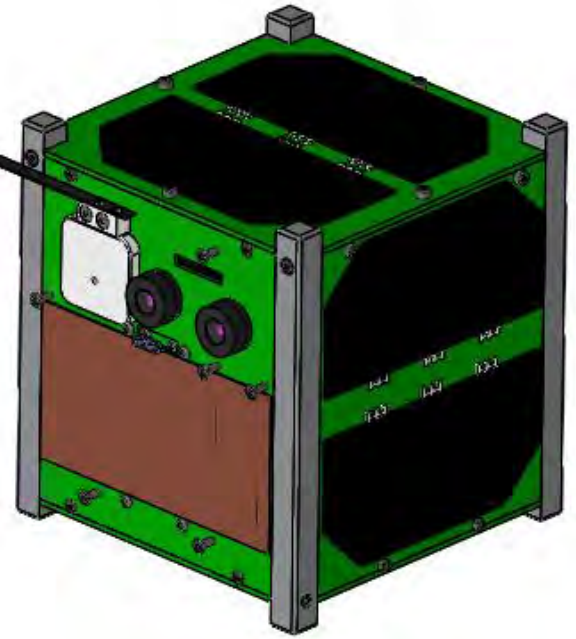
Before Deployment

Note: The antenna is coiled. It is unleashed by burning a piece of nichrome wire.

Z

Y X

After Deployment



End of this subsystem report (about structure)

16. Tentative plan for the BIRDS-2 CDR of July 18-19

prepared by Joven and Yeshey of the BIRDS-2 Team

Tentative Agenda BIRDS-2 Critical Design Review (CDR) Activity For guest participants from the Philippines, Malaysia and Bhutan **The BIRDS-2 CDR**		
Monday 17th July, 2017		
	Arrival in Japan	
Tuesday 18th July, 2017		
1000-1200	Courtesy call	Prof. Cho
	Lunch	@cafeteria
1300-1700	CDR	
1800	Reception dinner	@Nakamura Hall
	Photo session	

Wednesday 19th July, 2017		
0900-1000	Facility tour	Brochure
	LaSEINE Control room lab 4th floor	
	SVBL Space Environment Testing Facility	
	BIRDS room laboratory	
1000-1200	Joint forum discussion	Agenda
	- BIRDS-2 member countries / stakeholders promotional plans/preparation before and after satellite launch and deploy in space in commemorating the nations first cubesat. - Possible and future research collaboration of space engineering activity after each member student graduated and go back to there home country.	
	Lunch	
1300	Breakout session	Per Country's Agenda

There will be a special presentation by Dr Huzaimy and two of his undergrad students from UiTM Malaysia.

This is the BIRDS-2 Development Team

Members talk about themselves and their work

Work Experience

Present:

- *Science Research Specialist II*, Department of Science and Technology, Advanced Science and Technology Institute (DOST-ASTI) - Republic of the Philippines

Past:

- *Intern Engineer,* Philippine Atmospheric, Geophysical, Astronomical and Services Administration (DOST-PAGASA)- Republic of the Philippines
- *Product Safety and Compliance Specialist*, SONY Philippines Inc.
- *Technical Support Engineer*, LG Electronics Philippines Inc.

My Name: Joven C. Javier

My Country: Republic of the Philippines

Undergrad Degree: Bachelor of Science in Electronics & Communications Engineering, New Era University, Quezon City, Philippines

Currently: Master in Space Engineering International Course - Kyushu Institute of Technology
Project Manager, BIRDS-2 Cube Satellite Development

For BIRDS-2 Project, My main responsibility is making sure that development and task progress are comprehensively monitored, supervised, coordinate according to project timeline. As well as to maintain solidarity and teamwork. Organize team members task all throughout the project cycle from Mission definition to Preliminary design, to Critical design stage, to Flight Model design and Satellite Operation up to its disposal.

I am also inserting myself in technical duties of cube satellite development such as COTS (Commercial-of-the-shelf) GPS Testing, Single-Event Latch up Mission, Electronics and PCB Design.

My name is: Syazana Basyirah Binti Mohammad Zaki

My country is: Malaysia

My major in college: Bachelor of Electronics Engineering (Telecommunication Electronics)

Master of Science (Electrical & Electronic Engineering) in the field of research Microwaves & Satellite Systems

My role in the BIRDS-2 Project:

In BIRDS-2 project, I am working on a Anisotropic Magneto Resistance Magnetometer (AMR-MM) mission which is a triple axes sensor that applied in Attitude Determination and Control System (ADCS), mainly to conduct measurement of magnetic field in space. The magnetic field measurement in space will work as a support data for geomagnetic mapping of South Asian region. The magnetic field data will be stored and send downlink to be compared with the existing geomagnetic field data. AMR-MM will work together with the gyro sensor in ADCS to detect the Earth direction during the CAM mission operation (target mode).

In addition, I am also responsible for Antenna Deployment system in BIRDS-2 project. The initial plan for BIRDS-2 was to use patch antenna for both UHF and VHF. Since BIRDS-2 APRS mission requires higher gain to achieve successful communication, we have decided to design the VHF monopole deployable antenna using the nichrome burn wire release mechanism, allowing the deployable antenna on the satellite to actuate. I find this quite challenging as it involves numerous experiments, modifications and testing. I really hope that VHF monopole antenna will successfully deployed after the launch of BIRDS-2.

In general, I am very proud to be part of BIRDS-2 project. This project expands the range of my knowledge in space engineering field and benefits the development of nanosatellite in my home country.

My Name is: Kiran Kumar Pradhan

My Country is: Bhutan

My Major in college: Bachelors of Technology in Electronics and Communications Engineering

My Role in BIRDS-2 Project:

I am working on the On-Board Computer (OBC) subsystem for the BIRDS-2 CubeSats. The architecture of the OBC is inherited from the BIRDS-1 CubeSats. The primary function of the OBC is to manage operation of the CubeSats like receiving commands and executing it, initiating downlink of data or telemetry, monitoring health of the satellite, power supply control and so on.

It is a privilege to get an opportunity to be a part of such an intriguing multination project with a huge prospect of gaining hands on experience.

I am very excited and looking forward to enhance my knowledge and build experience.

Name: Adrian C. Salces

Country: Philippines

Education: B.S. Electronics and Communications Engineering (UPD)

M.S. Electrical Engineering (specialized in wireless communications, UPD)

Current: Doctor of Engineering (enrolled in Space Engineering International Course, Kyutech)

My Role in the BIRDS-2 Project:

I am handling three main assignments in BIRDS-2 Project.

First role is the Communication Subsystem of the satellite whose functions are (1) to receive uplink command from the ground station, (2) to download satellite telemetry (housekeeping and health status) data and mission data (high-resolution image, S&F, AMR-MM, etc.) and (3) to transmit CW beacon signal. For this subsystem, we are working with a Japanese company to build, test and integrate a UHF transceiver that can perform all of these in a single unit.

Second role is to continue the work started in BIRDS-1 on the establishment and operation of a ground station network (in collaboration with Japanese company InfoStellar, Inc.). Ten member ground stations will be connected and operated, three of which are new additions to the network (ground stations of UPD, UiTM and DITT of Bhutan). My main responsibility is to plan the configuration of BIRDS-2 ground stations and help facilitate their addition to the BIRDS GS network. I might also do some work on the ground station software for BIRDS-2 operation.

Third role is the Store-and-Forward (S&F) mission whose objective is to demonstrate a S&F system consisting of a cubesat constellation and to investigate communication and technical challenges of such a system. As part of this research, the three BIRDS-2 cubesats will be used to collect data from ground terminals equipped with sensors. The collected data will be stored in an onboard memory and downloaded to a BIRDS ground station for processing.

Being in the BIRDS-2 Project is both fun and challenging.
Together with the team, I've been facing quite difficult technical
engineering problems, system engineering, trade-offs
and decision-making, but the experience and environment is nurturing.

My name is: **Daiki Yamaguchi**

My country is: Japan

My major in college: Bachelor of Integrated System Engineering

Master of Applied Science for Integrated System Engineering

My role in the BIRDS-2 Project:

In BIRDS-2 project, I am working on a Electrical Power System(EPS). It is an important part for the satellite to function well in space. So, I have to calculate generated power and estimate power budget and supply requested power. We design the circuit of EPS with Sagami Tsu-shin, which is a Japanese company. We have borrowed the BIRDS-1 EPS design, and we are improving it for the needs of BIRDS-2.

In addition, I am in charge of procurement (of parts and components). We often procure parts from Japan, because we are developing in Japan. To negotiate with Japanese companies, my Japanese-language skills are necessary. The international students need me, therefore.

In the future, this experience of participating in the BIRDS-2 project will be my lifelong asset. I'm not good at speaking English. But usually everyone speaks in English in this project. So for me, this a tough and challenging environment. But my BIRDS-2 colleagues are very kind. Without being shy, I can chat and joke with them easily. This project is proving to be a meaningful and stimulating experience for me.

My Name: Yeshey Choden
My Country: Bhutan
Education: Bachelors of Civil Engineering (National University of Singapore)

My Role in the BIRDS-2 Project:

1. APRS-DP mission (Automatic Packet Reporting System – Digipeater)

The main objective of this mission is to demonstrate functionality of low cost commercial-off-the-shelf (COTS) digipeater on board 1U CubeSat. Primarily, this mission will provide real-time message relay communication service for amateurs over a large area. This application can be further enhanced by using the APRS-DP as an alternative medium of communication during emergencies. It can also be utilized to educate the youth and amateurs about radio communication.

There are two key activities that must be carried out in parallel in order to derive maximum value from this mission. The first activity relates to designing, development, integration and testing of APRS-DP payload itself for BIRDS-2 CubeSats. The second, which is also the most important activity, is development of APRS-DP implementation plan for respective home countries in order to realize the mission optimally. The implementation plan is essential especially for a country like Bhutan where the amateur community is near non-existence. If successful, the plan will not only serve to fulfill the mission but also sow a seed for amateur community development in the country. It can also interest youths to learn more about such technology.

2. Frequency Coordination

BIRDS-2 CubeSats is anticipating to utilize amateur radio frequencies for primary communication as well as for some mission related communication. The permission to utilize frequencies must be obtained from relevant authorities such as JARL and IARU.

3. Requirements Management

For any satellite project, design requirements that meet the stakeholders' requirements must be properly documented and reflected upon through the entire development process. While design requirements will guide the team on what each subsystem and payload must fulfill, it is also inevitable that design requirements must be changed when necessary.

My name is: Cheki Dorji
My country is: Bhutan
My major in college is: Civil Engineering

My role in the BIRDS-2 Project:

I look after the Attitude Determination and Control Subsystem (ADCS) of the satellite. The goal of the subsystem, in general term, is to act as an ‘eyes’ of the CubeSat. Since one of the missions is to take photograph of our homeland, it is imperative that the face of CubeSat carrying camera faces the Earth before taking pictures. However, it is easier said than done! Besides working on ADCS, I’m also assigned a task to support the structure team whenever required.

I feel fortunate to be able to take part in this project, especially because I come from civil engineering background (what are the odds?!). This is definitely the highlight of my life.

My name is: Muhammad Hasif Bin Azami
My country is: Malaysia
My major in college: Bachelor of Engineering (Mechatronics)

My role in the BIRDS-2 Project:

I am working on Camera (CAM) mission of BIRDS-2 project. CAM is one of the main mission of BIRDS-2 project which main objective to capture images of 4 countries homelands. The camera system consist of 2 identical cameras but have different particular mode. The primary camera is dedicated mainly for capture a high resolution image, while the secondary camera is to maximize the functionality of the camera by short video mode (extra successful level mission). The extra mode is very challenging for me as the satellite has limited power supply and limited capacity for downlink data. Camera system is very related to COM-UHF and ADCS systems.

Furthermore, I also assigned as secondary person for Attitude Determination and Control System (ADCS). It is very interesting task because camera mission depends on ADCS for taking a steady and beautiful picture from low Earth orbit (LEO).
I love the environment of the BIRDS-2 project as all of us come from different backgrounds and different countries. Let the BIRDS-2 journey begin!

My name is: **Tomoki Uemura**

My country is: Japan

My major in college: System Engineering

My role in the BIRDS-2 Project:

My role in this project is to design the structure and its thermal design. The structure has the critical role of protecting other subsystems in the harsh space environment. Therefore, I am playing an important part to make this project successful, and so I will offer my best effort to this project.

The satellite designed in this project is a cube with 10 cm on each side. The basic design was inherited from BIRDS-1. But a noteworthy difference is the use of a deployment antenna and two cameras. Especially, it was difficult to design the antenna system.

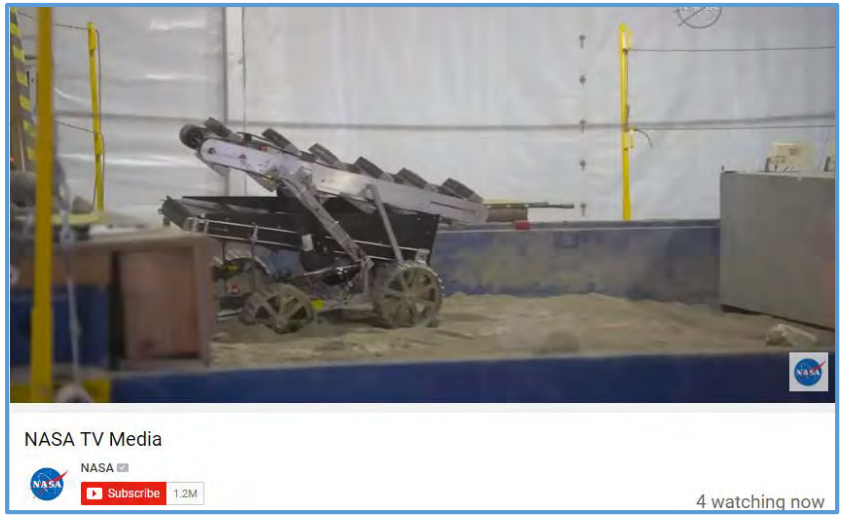
My English needs improvement, so I would like to improve it by engaging with all project members. The team is very international and we must break the cultural and language barriers to work as one team.

I wish the project success !

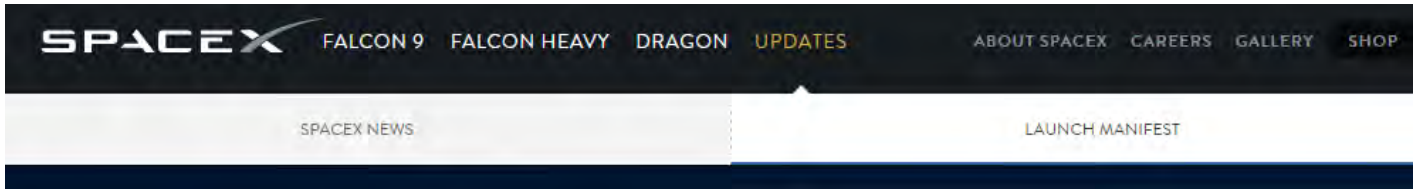
18. Viewing the launch of BIRDS-1 via the Web

Two websites to consider for viewing the launch

This NASA site:
https://www.youtube.com/watch?v=P11y8N22Rq0



Or, this SpaceX site:
http://www.spacex.com/missions



Started streaming on May 9, 2017

NASA TV airs a variety of regularly scheduled, pre-recorded educational and public relations programming 24 hours a day on its various channels. Programs include "NASA Gallery", which features photographs and video from NASA's history; "Video File", which broadcasts b-roll footage for news and media outlets; "Education File", which provides special programming for schools; "NASA Edge" and "NASA 360", hosted programs that focus on different aspects of NASA; and "This Week @ NASA", which shows news from NASA centers around the country. Live ISS coverage and related commentary is aired daily at 11 a.m. EST and repeats throughout the day.[7]

The network also provides an array of live programming, such as 24-hour coverage of Space Shuttle missions, ISS events (spacewalks, media interviews, educational broadcasts), press conferences and rocket launches. These often include running commentary by members of the NASA Public Affairs Office who serve as the "voice of Mission Control," including Rob Navias, Josh Byerly, Nicole Cloutier and Brandi Dean.

END OF ISSUE NO. 16