

Project website: <http://birds.ele.kyutech.ac.jp/>



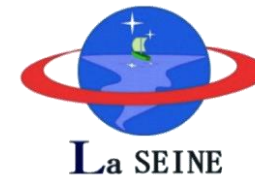
# BIRDS Project Newsletter

Issue No. 4 (16 May 2016)



*Edited by:*

G. Maeda, Tejumola Taiwo, M. Cho,  
Laboratory of Spacecraft Environment Interaction  
Engineering (LaSEINE),  
Kyushu Institute of Technology,  
Kitakyushu, Japan.



Note: **Boys' Day (こどもの日 Kodomo no Hi)** is a Japanese national holiday which takes place annually on May 5, the fifth day of the fifth month, and is part of Golden Week. It is a day set aside to respect children's personalities and to celebrate their happiness. Koi-no-bo-ri means "carp streamer", and it is the traditional symbol of this national tribute to children (originally, boys only) – wishing them to be strong and healthy.

Bangladesh



Nigeria



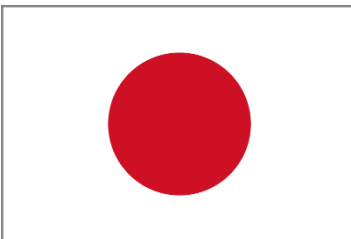
Mongolia



Ghana



Japan



## Contents of this Issue

1. BIRDS students meet two JAXA engineers
2. Ni-MH Battery Screening Process
3. BIRDS *Golden Week* Barbeque & Cooking Contest
4. Winners of the cooking contest
5. Subsystem Summary #8: EPS
6. Subsystem Summary #9: Antenna System
7. Subsystem Summary #10: SEL
8. BIRDS Project explained at RAST, Radio Amateur Society of Thailand
9. News from the ground station of ANUC, Ghana
- 10. BIRDS Summer Workshop** (formal title: *First International BIRDS Project Workshop and CDR*)

More subsystems will be covered in the next issue of the newsletter.

# 1. BIRDS students meet two engineers from JAXA (14 April 2016)

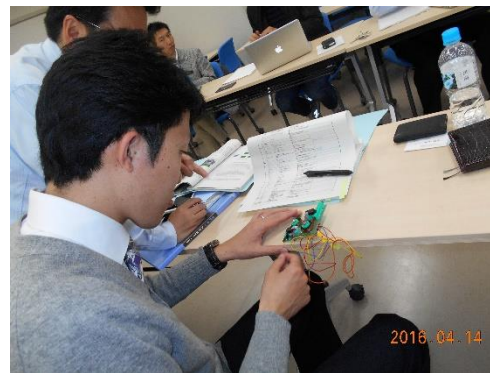


The two engineers from JAXA:  
*Left: Akagi-san. Right: Takata-san*

This meeting occurred right before lunch time in the Seminar Room of LaSEINE. It was a very productive exchange of information.



*Above: Antara shows to JAXA a video of antenna deployment (done by electric motor).*



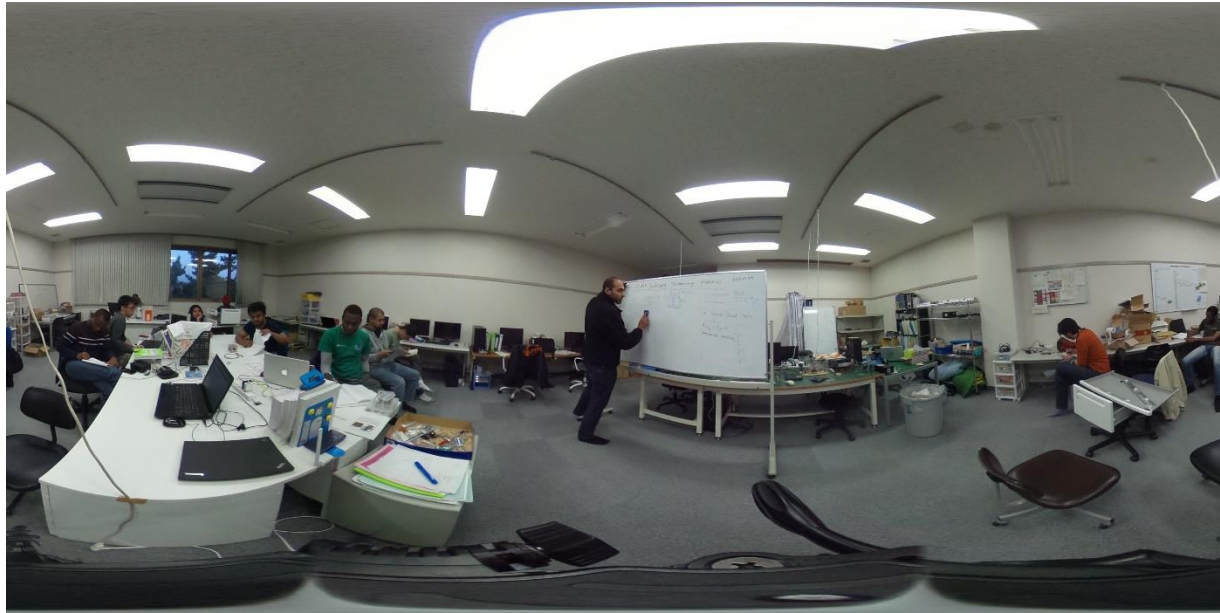
*At left: Engineer Akagi (a mechanical engineer) inspects Antara's handiwork (antenna sub-system).*



*At left: One by one, each student introduced himself or herself at the start of the meeting. Here, Taiwo (Nigeria) introduces himself.*



## 2. Ni-MH Battery Screening Process



### Guest Lecturer

Mohamed Yahia EDRIES,  
of Egypt, PNST Fellow,  
Phd candidate.



The synopsis below was written by Maisun of Team Bangladesh; he also provided this 360-degree photo.

**SYNOPSIS** - A special class on Battery Screening process for lean satellites was held on 29th April 2016. The class was conducted by Md. Yahia Edries, who designed the Electronic Power System of HORYU-4. HORYU-4 is now successfully operating in Earth orbit.

In this special lecture, Md. Yahia discussed the importance of the battery screening process: What happens when battery characteristics are not matched properly and what causes battery to deviate from standard characteristics.

This special lecture was organized ahead of the BIRDS Project's battery testing program. Team members of BIRDS project will soon move to Table Sat (Satellite components, laid on a table) integration.

# 3. Year 2016 BIRDS “Golden Week” Barbeque (and cooking contest)

Tempura by Team Japan →

Vegetable soup (*Efo-riro*)  
by Team Nigeria →

Turo’s wife (Boloroo) →

Meat dumplings  
(*Buuz*) by Team  
Mongolia →

Fried yam (*Koliko*) and  
bean stew (*Duah*) by  
Team Ghana →



← Salad by Team Bangladesh

← Rice by Team Bangladesh

# 4. Winners of the BIRDS Cooking Contest



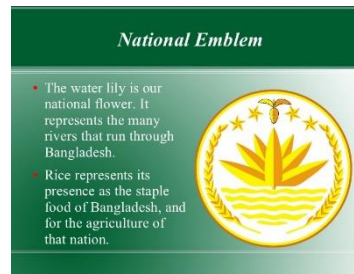
Name of this dish: **Chicken Biryani**  
 Biryani is the central dish for festive occasions in Bangladesh. Main ingredients are rice and chicken. It requires special “Polao” rice. This “Polao” rice is stir fried in oil. The chicken is cooked separately. At the final stage, every thing is mixed together with exotic spices, and then baked. -- by Kafi



Name of this dish: **Chicken Patisapta**  
 Chicken is first fried. As a special ingredient, cream cheese is added. Finally, it is wrapped in bread (“Roti”). This dish is mainly served as a snack during winter evenings in my country. -- by Kafi



Name of this dessert: **Shemai**  
 This is a typical dessert item of Bangladesh. It is also enjoyed as a light snack during festive occasions. Main ingredients are: Milk, Condensed Milk, Ghee, Sugar, Corn flour, and Vermicelli. -- by Antara.



**Dr Kim** (judge of the cooking contest, and newly arrived assistant professor of LaSEINE) gives Top Prize (3000 JPY) to *Team Bangladesh* during the award ceremony.



Name of this dish: **Green Salad**  
 This is a typical salad that Bengali people eat regularly. It is a simple mixture of diced Cucumbers, Carrots, Onions, Mustard oil and Salt. -- by Maisun.

# 5. Subsystem Summary #8

## Electrical Power System (EPS)

This summary prepared by:  
Erdenebaatar Dashdondog (Erka)  
Tejumola Taiwo Raphael  
Yasuhiro Tokunaga  
08 May 2016

# Electrical Power System Objectives

- The main purpose 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.
- The EPS of Cubesat consists of three separated elements: a solar-array photovoltaic energy source; Rechargeable storage batteries; a Power Management and Distribution (PMAD).
- In sunlight, the power is generated by solar cells. Peak power loads, which exceed the solar array's capabilities, are supplied from the batteries. During eclipse operations, all power is supplied by the batteries. At the end of each eclipse period, the batteries are started to recharge from the solar array.



# Main Functions of EPS

- Power Generation
  - Generate Power from 5 unit of Solar panels, each consists of two series connected 30% efficiency of Triple junction Solar cells, during sunlight
- Energy Storage
  - Store the Excess power into 3S2P Ni-MH batteries
- Power Conditioning, Control and Distribution
  - Regulate the generated power to properly charge the Batteries
  - Convert the Battery Voltage to +5V and +3.3V levels
  - Supply Unregulated line, +5V and +3.3V to Subsystems and OBC through ON/OFF controlled and overcurrent protected Lines
  - Provide Analogue measurements (Voltages and Currents) to OBC
  - Ensure Satellite Passivation at End-Of-Life (EOL)

# Electrical Power System Design Specifications

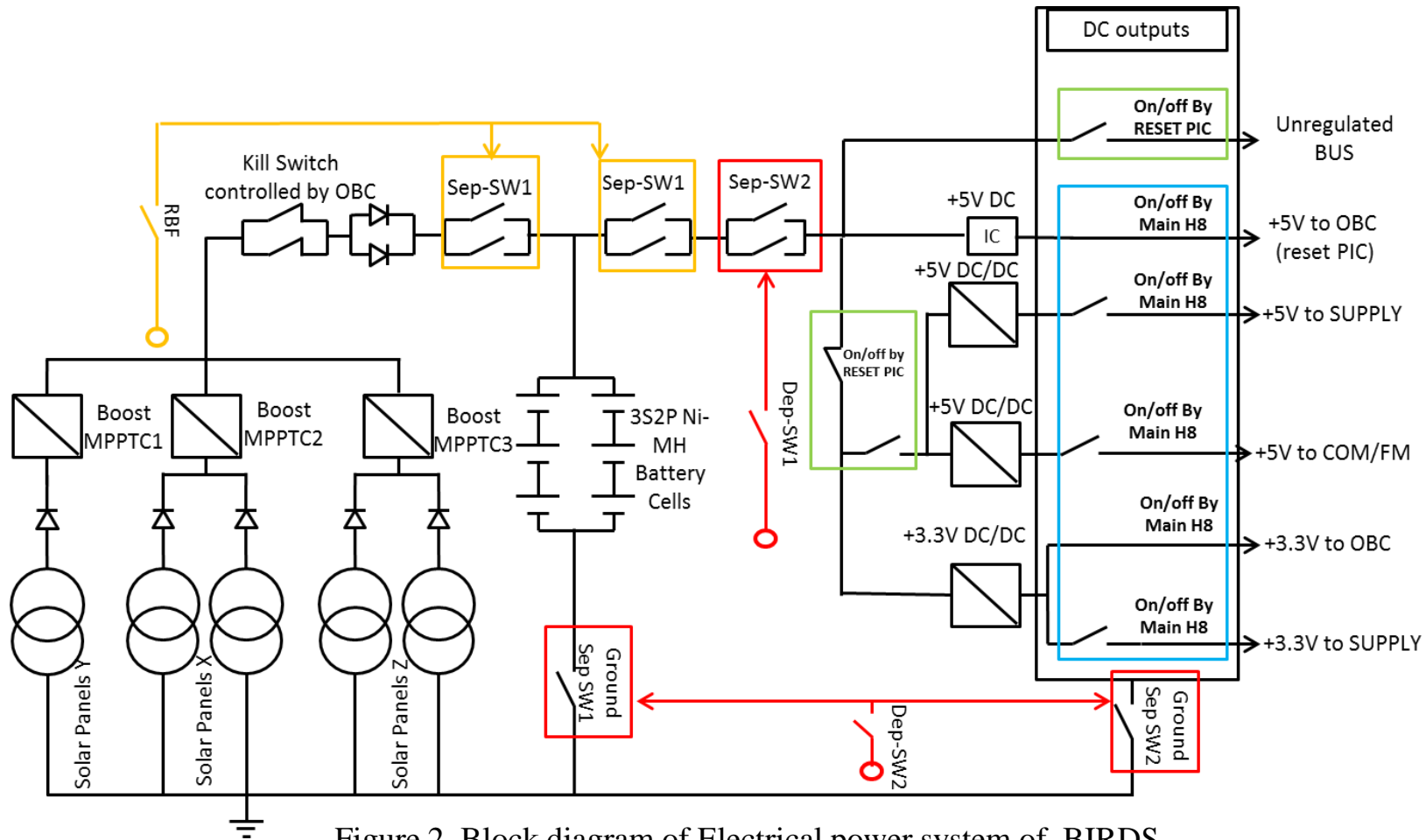


Figure 2. Block diagram of Electrical power system of BIRDS

## 6. Subsystem Summary #9

# Antenna System

Raihana Shams Islam Antara

Naoki Nakamura

Bonsu Benjamin

# BIRDS Antenna System

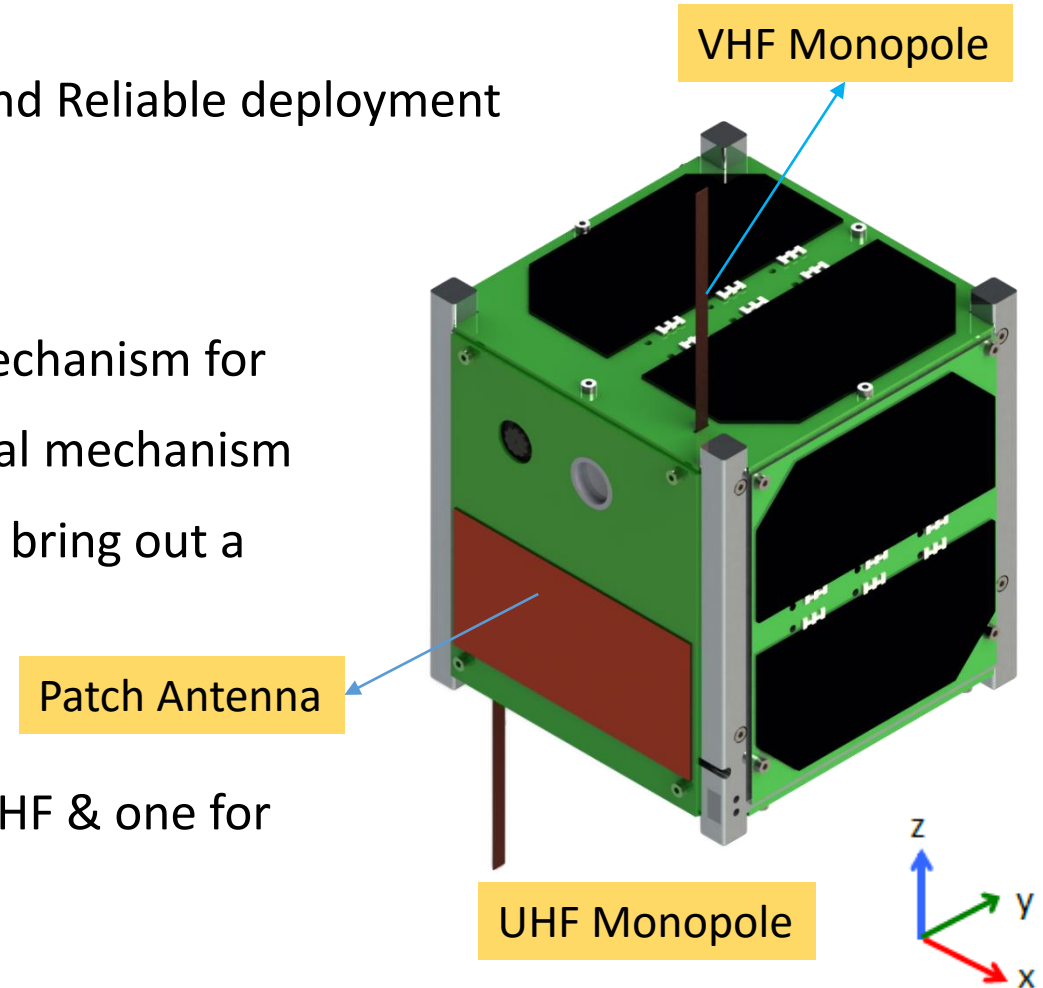
- One of the advantage of a satellite is the ability to collect data in an environment that is difficult for people to access and it is also capable to send them back down to different locations on Earth where humans do have access.
- For communication with earth , Satellite must have an Antenna to send and receive data where humans have access.
- Antennas are critical components in the onboard communication system of satellites.
- BIRDS will use two deployable Monopole Antenna and one Patch Antenna for Communicating with Ground Station.

# Antenna Deployment Mechanism Purpose

- The concept of 1U Cubesat makes the dimension limited to a 100 x 100 x 100 mm cube and mass to 1 kg which offers to design a mechanism with storage capacity and deployment for antennas.
- These antennas will not be sent into space already deployed because this would take up too much room on costly space flights.
- Here the deployment mechanism comes to play an important role because deployment mechanism allows Antennas to be folded during the journey and deployed once the satellite is in orbit.

# BIRDS Antenna Deployment Mechanism Introduction

- BIRDS Antenna deployment target is to develop an internal and Reliable deployment mechanism for 1U cubesat.
- Previously all the nano-satellite projects used the external mechanism for deployment but for BIRDS project the plan is using the internal mechanism for deploying two antennas at same time which purpose is to bring out a totally new concept of Antenna Deployment mechanism.
- There will be two deployable monopole Antennas: One for VHF & one for UHF. They will deploy from +Z and -Z axis of the satellite.



# BIRDS Antenna Deployment Mechanism Introduction

- There is a dedicated antenna board inside the satellite, where all the equipment for deployment mechanism will be attached.
- Antenna board is designed by maintaining design limitations & envelope size.
- BIRDS Antenna deployment mechanism will not use any burner circuit to start the mechanism. It will start deploying Antennas after getting command from ADCS -- 30 minutes after being deployed from the ISS.

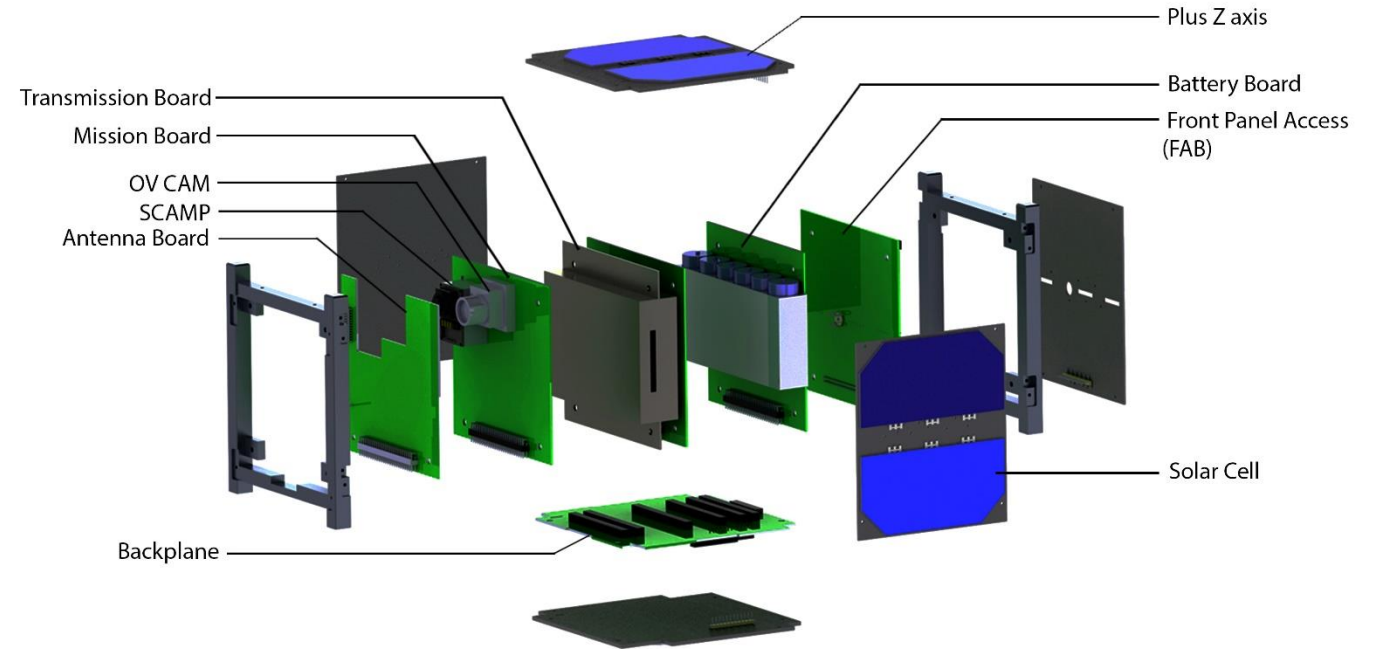
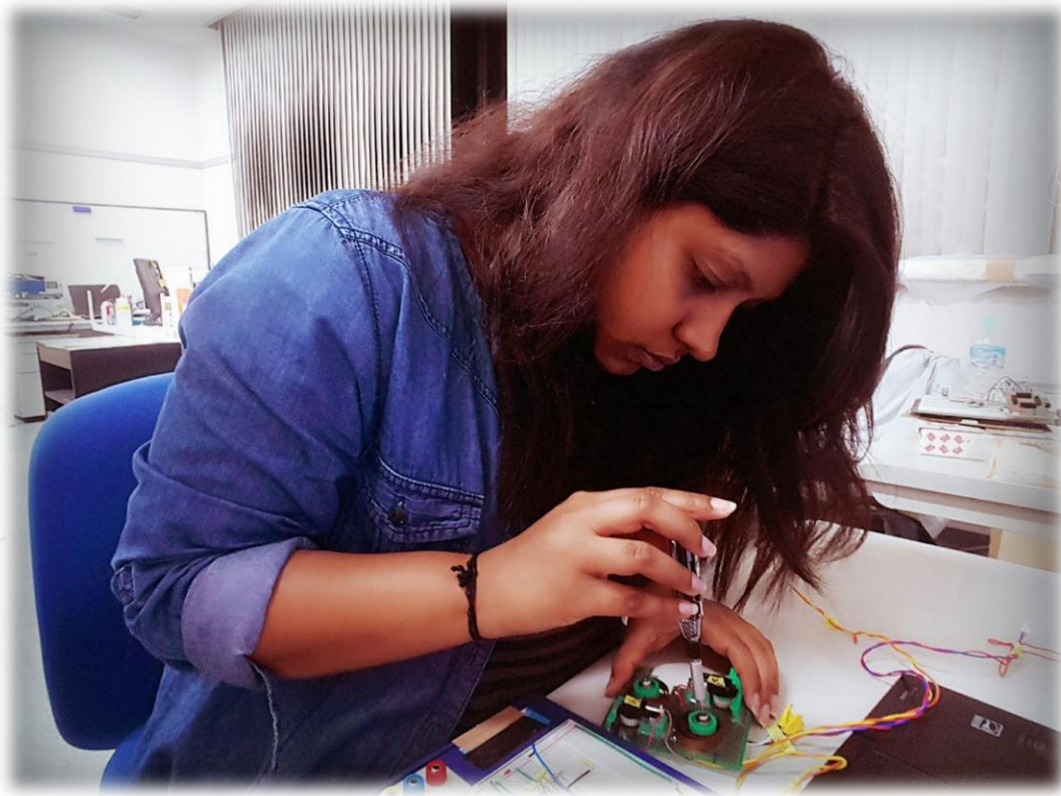


Figure : BIRDS Configuration

# The antenna system being developed



Student Antara assembling the Antenna Deployment Mechanism



Student Nakamura operating a 3D printer



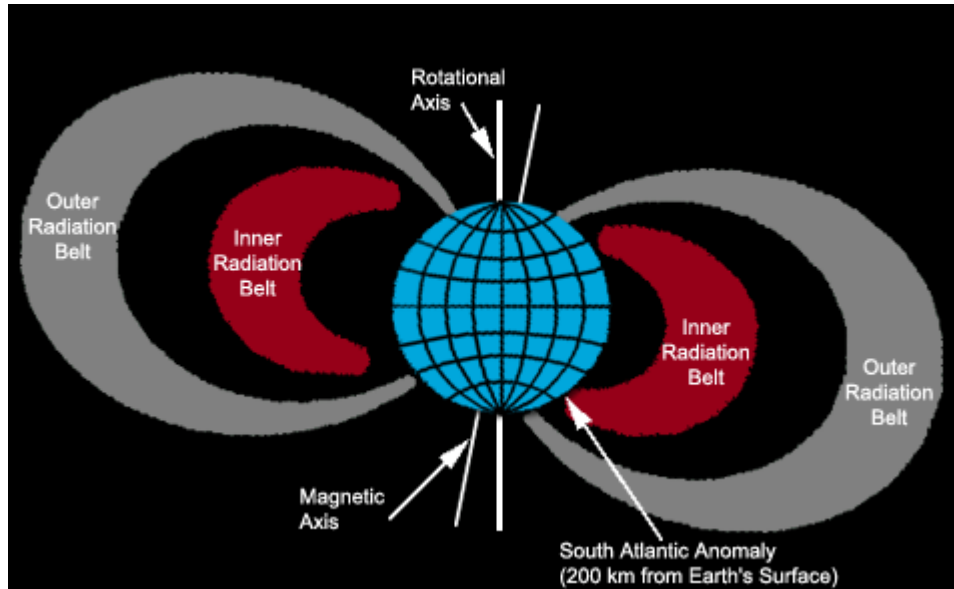
## 7. Subsystem Summary #10

# SINGLE EVENT LATCH UP MEASUREMENT

ABDULLA HIL KAFI

# SEL (Single Event Latch-up) Measurement Mission & Reset System Design

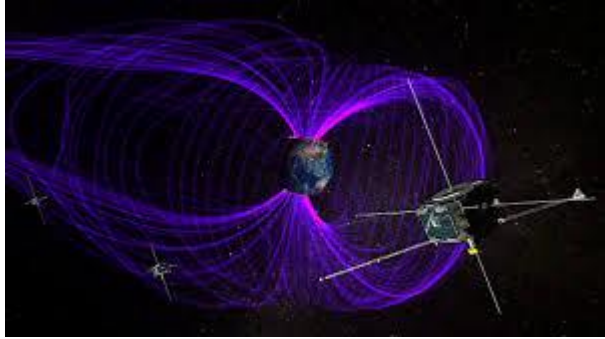
*Space is a merciless environment*



<http://srag-nt.jsc.nasa.gov/spaceradiation/what/SouthAtlanticAnomaly.gif>

## SEL Mission Objectives

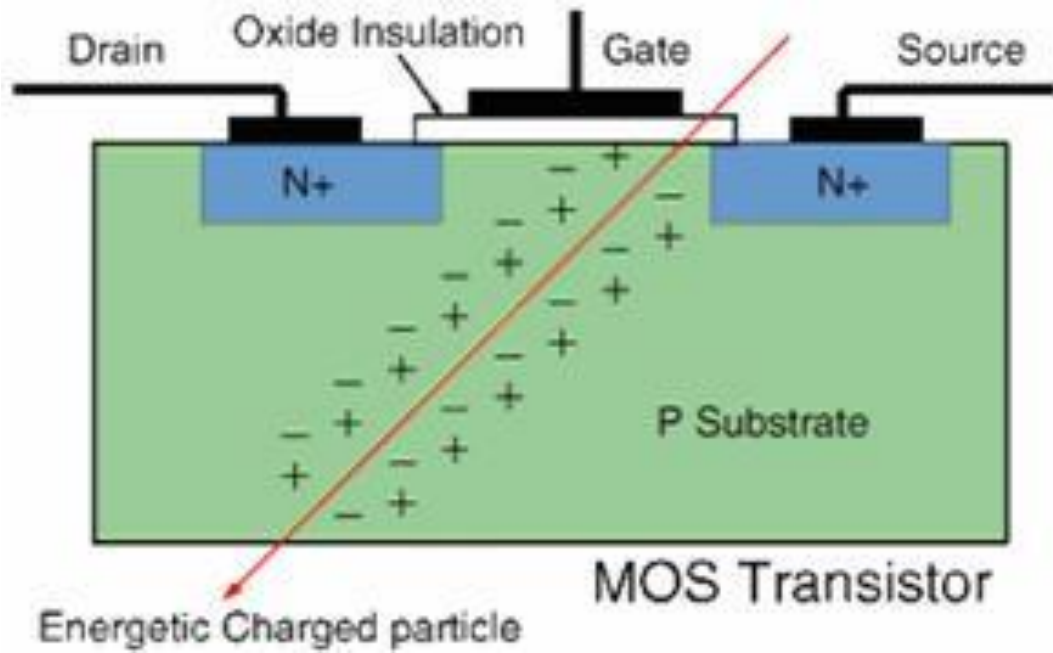
- To detect SEL occurrences during the lifetime of the mission;
- To identify correlation of SEL occurrences with satellite location, time, space weather, or other parameters;
- To build a database on SEL rate of microprocessor that can be compared with laboratory data.



[http://sourcetechn411.com/wp-content/uploads/2013/06/space\\_radiation\\_300x168.jpg](http://sourcetechn411.com/wp-content/uploads/2013/06/space_radiation_300x168.jpg)

# Merits of the SEL Mission

- **Perform science**
  - Identify any correlation of SEL occurrence with satellite locations, time, space weather, etc.
    - Increase the quantity of data by using 5 satellites that are identically the same
- **Improve technology**
  - Build database on SEL rate of microprocessor that can be compared with laboratory data
  - In future, we can predict SEL rate in orbit using the database. For example
    - In laboratory 10 SELs were observed in 1 hour, but 2 SELs were observed in orbit in 0.5 year

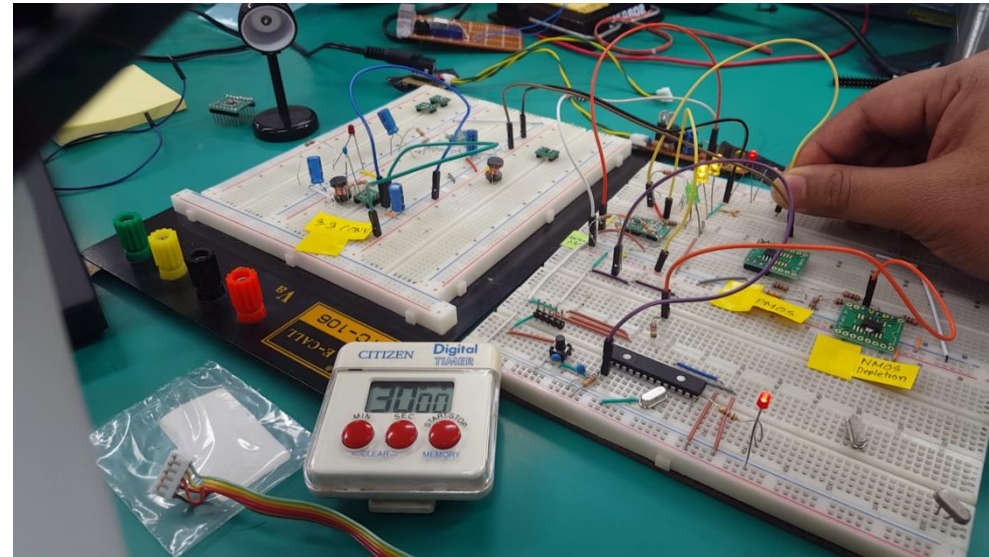


[http://www.etantonio.it/IT/Universita/MasterSatellitare/ESP/SistemiElettronici/ApplicazioniSpaziali\\_file/image004.jpg](http://www.etantonio.it/IT/Universita/MasterSatellitare/ESP/SistemiElettronici/ApplicazioniSpaziali_file/image004.jpg)

# Bread-boarding of reset circuitry

For the safety of the *On Board Computer* (OBC), the BIRDS satellite consists of these 5 modes of **RESET** :

- COM H8 **RESET** by Main H8
- Main H8 **RESET** by COM H8
- OCP **RESET**
- Satellite **RESET**
- Time Trigger **RESET**



## REFERENCES

- Layton, P.J., Czajkowski, D.R., Marshall, J.C., *et al.* (1997) Single Event Latchup Protection of Integrated Circuits. *4<sup>th</sup> European Conference on Radiation and Its Effects on Components and Systems*, Cannes, 15-19 September 1997, 327-331.
- Pengwei Li, Xiaoyun Fu, Lei Luo, Qingkui Yu. 'A New Analyzing Method of Single Event Latch-Up Protection Circuit Based on Current Comparing and Its Performance Verification'. *Journal of Modern Physics*, 2014, 5, 387-393

# 8. BIRDS Project explained at RAST -- Radio Amateur Society of Thailand

During Golden Week, Apiwat (Thai member of the BIRDS Project) attended the May meeting of RAST. He described the **BIRDS Project** as well as the **JAMSAT Symposium** held in Tokyo earlier this year.



JAMSAT Symposium (@Tokyo) is described in Section 4 of Issue No. 2 of this newsletter.

Apiwat is holding the microphone.

Below: **RAST Meeting** on May 1, 2016, at Sena Place Hotel, Bangkok, attended by 40 society members and guests. Apiwat is seated in the foreground at the right.



# RAST's ground station at Bangkok University



GS antenna is installed at the School of Communication Arts Building.



VHF/UHF Cross Yagi-Uda Antenna (on roof of the building).



This is the ground station's Control Room. The plan is to use this for the **J AISAT CubeSat Project**. J AISAT stands for "Joint Academy for Intelligent Satellites for Amateur Radio of Thailand", which is now under construction. J AISAT's launch is set for early 2018.

**Bangkok University is located just north of Bangkok.**

# King Mongkut's University of Technology North Bangkok



**KMUTNB**

มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าพระนครเหนือ

KMUTNB, was established in 1959 from the constructive cooperation between the Thai Government and the Federal Republic of Germany, it was initially known as the "North Bangkok Technical School" but generally called "Thai-German Technical School."



## Apiwat met the 3 KMUTNB students who will start at Kyutech in October of 2016

At satellite lab on on 28 April 2016



Mr. Phongsakorn

Mr. Pasut

Ms. Aekjira

## 9. News from the ground station of ANUC, Ghana

*ALL NATIONS UNIVERSITY COLLEGE* GROUND STATION  
(ANUC-GS) SUCCESSFULLY RECEIVED CW BEACON SIGNALS  
(HOUSEKEEPING DATA) FROM HORYU-IV NANOSATELLITE

By:

BENJAMIN BONSU

ERNEST MATEY

JOSEPH QUANSAH

(BIRDS members of Ghana)

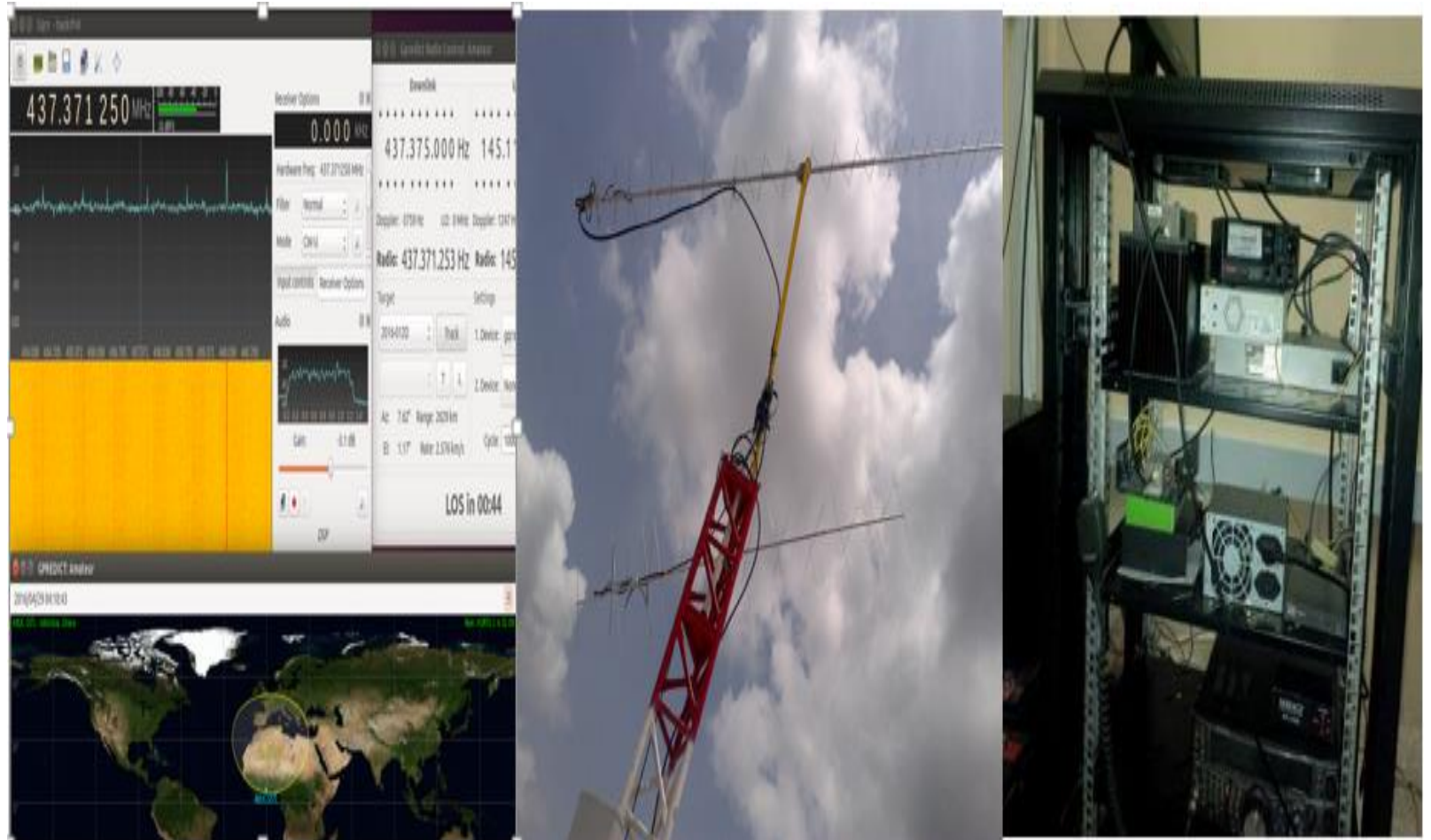


***ALL NATIONS  
UNIVERSITY COLLEGE***



# ANUC-GS SET UP DURING HORYU-IV OPERATION

- ANUC-GS received CW beacon signal on the 29<sup>th</sup> April 2016, at 6:42 UTC during HORYU-IV pass
- ANUC-GS team successfully decoded the Housekeeping (HK) data and sent to Kyutech GS team.
- This HK data is to enable Kyutech GS team to know the status and health of HORYU-IV when is orbiting the West-Africa Region.
- ANUC-GS is part of the BIRDS GS network



*Shows the ANUC-GS set up for HORYU-IV operations*

# ANUC-GS RECEIVES HORYU-4 QSL CARD

- QSL card confirms ANUC-GS successfully received CW Beacon Signals
- QSL CARD was officially signed by the HORYU-IV Principal Investigator, Prof Mengu Cho



ANUC-GS  
Call sign  
(9G2AA)

# 10. BIRDS Summer Workshop

(formal title: *First International BIRDS Project Workshop and CDR*)



27-29 June 2016

Kyushu Institute of Technology



Tentative agenda (still being hammered out) :

- (1) Tour of Kyutech research/educational facilities
- (2) **CDR** -- takes nearly a full day -- see the next slide for explanation
- (3) Press conference on the BIRDS Project (media will be invited)
- (4) Discussion opportunities -- for example, participants can exchange notes on the future of inter-university collaboration after the BIRDS Project
- (5) Information exchange between students and professors from their home countries.
- (6) . . . and more . . .



HORYU-4 press conference of 5 Jan 2016, where reporters asked a lot of questions.



Chilled そうめん

## What is “Critical Design Review (CDR)” ?

The CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test. CDR determines that the technical effort is on track to complete the flight and ground system development and mission operations, meeting mission performance requirements within the identified cost and schedule constraints.

The following are typical objectives of a CDR:

- Ensure that the "build-to" baseline contains detailed hardware and software specifications that can meet functional and performance requirements
- Ensure that the design has been satisfactorily audited by production, verification, operations, and other specialty engineering organizations
- Ensure that the production processes and controls are sufficient to proceed to the fabrication stage
- Establish that planned Quality Assurance (QA) activities will establish perceptive verification and screening processes for producing a quality product
- Verify that the final design fulfills the specifications established at PDR

[From: [https://en.wikipedia.org/wiki/Design\\_review\\_\(U.S.\\_government\)](https://en.wikipedia.org/wiki/Design_review_(U.S._government)) ]



← **Kyutech** is on the southern island of Kyushu

**END OF ISSUE NO. 4**