BIRDS Project Newsletter

Issue No. 18 (30 July 2017)

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

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Yeshey gives a public talk on "Bhutan in Space" at Kyutech Library

Presentation without Jargon – Share your knowledge
@ Kyutech Library 1F
21st June, 2017 (18:00-19:30)
by Yeshey (BIRDS-2, Bhutan) on 22nd June, for this newsletter

The event was organized by Kyutech Library Learning Commons Supporter Matsukawa-san. There were 5 presentations in total. All the other topics were very interesting and stimulating. They were “Is it possible to change your personality?”, “About Language Lounge”, “A study on influence of partial shadow in solar panel” and “Water-resistant materials”. Other presenters were also students from various departments. The aim of the seminar was to communicate our research idea to the audience with no jargon whatsoever.

The audience (about 20 people) were primarily Kyutech students from various departments and a few library staff.

I presented about my research, i.e., Sustainability of Space Programs in developing countries with Bhutan in focus.

Due to rapid reduction in cost of satellites many developing countries as well as private companies are now able to build and launch satellites. However, are these sprouting space activities sustainable? Are they progressive and innovative? What does it take to ensure sustainability and progressiveness? And how do we measure sustainability exactly?

I knew about this event because I am serving as a Learning Commons Supporter (LCS) at Kyutech Library. I hold 3 hours of consultation every week with students to help them with learning English, about satellite technology and student life in general.
How did the BIRDS Project begin?

It began as a vision. This conference paper (see the next five slides) outlines that vision. Prof Cho and his LaSEINE staff had this visionary plan for BIRDS --- it was carefully considered and conceived. [At the time of this conference paper (IAA-Rome, Italy-2015), Dr John Polansky was no longer a member of the staff, but he too was one of the architects of the BIRDS concept and a major contributor to its initiation.]

Remarkably, LaSEINE at Kyutech is executing that plan faithfully. BIRDS-1 ... BIRDS-2 ... BIRDS-3... BIRDS-4... We are just warming up.

- The Editor.
IAA-CU-15-01-16
Five-nations CubeSat constellation; An inexpensive test case for learning and capacity building

Arifur R. Khan*, George Meade**, Hirokazu Matsui*, JGAMNE project member* and Mengyu Che**

Abstract
A five-nation (Japan, Ghana, Mongolia, Nigeria and Bangladesh) CubeSat constellation has been designed and named as “Joint Global Multi-Nation Birds,” shortly “Birds.” University students will design, manufacture, assemble, integrate, test, and operate a constellation of five identical IU CubeSats, along with disposal. Preliminary mission has been designed as Earth observation, outreach, message relay, precise location determination, space environment measurement, technology demonstration, etc. UHF/VHF amateur radio band will be used while interlinking the ground station of the seven countries. Students will make it as a part of graduate academic education in Space Engineering International Course at Kyutech. Five IU satellites will be sent to International Space Station (ISS) and later will be deployed to LEO. Advantages of this five-nation constellation is that each country will have more than 10 satellite-pass per day. This Birds project will lay down foundation of sustainable space program by accumulating human resources in universities and launching a university space research and education program.

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Introduction

Now a days, small satellites are getting more and more attention due to short launch time, low cost, and availability of highly scalable and efficient COTS components. Even a small group of university students can assemble, test, launch and operate in orbit if launcher is available, if students are well trained. Therefore, hands-on training is the vital factor for students who are planning to build and launch their own first small satellite, especially the first satellite. Therefore, small satellite, like 1U CubeSat is the best platform for this hands-on training through systems engineering course. Moreover, through the mixing of 1U CubeSat, many high risk technology demonstration missions can be fulfilled in space. And if it is a CubeSat constellation, precise satellite location determination, space weather monitoring, telecommunications, earth observation, surveillance, etc. even risk-taking single even launch, could be designed and performed. Some significant advantages of small satellite constellation are high performance and robustness. It is productionized rather than projected, better in economic quantities instead of custom quantities. It can maintain flexibility in application and it has an ability to evolve the technology.

Recently, five-nation (Japan, Ghana, Mongolia, Nigeria and Bangladesh) CubeSat constellation has been designed and named as “Joint Global Multi-Nation Birds,” shortly “Birds”. Five identical Cubesats will be designed, manufactured, assembled, integrated, tested, and operated by the students. Each country will be responsible for one CubeSat. After the assembling and testing, with the help of NASA (upon agreement), it will be sent to ISS for deployment to the LEO. It will be operated from ground station of each country and other collaborating countries by amateur radio band. Through this process, it can be demonstrated that 1U CubeSat can be built and operated successfully in a time frame shorter than two years even for countries with limited (or zero) satellite experience with proper design and planning.

The mission of the Birds project is to make the first step toward indigenous space program at each country by successfully building and operating the first satellite of nation. It has the following three specific objectives.

- Learn the entire process of a satellite program from mission planning to satellite disposal
- Lay down foundation of sustainable space program by accumulating human resources in universities and launching a university space research and education program
- Create international human networks to assist the infant space programs each other

This paper explains the Birds mission as small satellite constellation.

Implementation and Value

Birds project is a student satellite project. The project team members are made of students from Japan, Ghana, Mongolia, Nigeria, Bangladesh and Thailand. The students come from single institution of each country. They are enrolled at Space Engineering International Course (SEIC) of Kyutech as full time graduate students at either Master course or Doctoral course. The conditions to participate the Birds constellation are the following:

- Have a contract with Kyutech for satellite development and launch
- Send three or more students to Kyutech from one organization
- Have UHF/ VHF ground station
- Continue the satellite education/research/development activities at home country

After completion of the project, students will return to their home countries and initiate a space research laboratory in their home institutions. A sustainable and robust space program, that is less susceptible to political change, can be started with minimum budget at universities in any emerging or developing country. The Birds project currently aims at a university.

The Birds project has a significant advantage compared to other satellite technology transfer and human resource development programs. The project is run as a university satellite project that offers significant low-cost solution and hands-on opportunity. The project is also run as a part of post-graduate degree program, which is suitable for train academic staff. By employing constellation, the data throughput and program robustness are significantly increased. Use of ISS instead of other launch platform helps lowering the launch cost and having a secure launch plot.
An institution that wants to build a CubeSat through the BIRDS project has to make contract with Kyutech to secure launch slot and procure hardware. Proper amount of financial resource, though it is much lower compared to other similar programs, must be secured. In return, the participating institutes will gain:

- International and national reputation
- Scientific papers
- Membership of international ground station network
- Space research laboratory

**Satellite mission**

The ultimate objective of this project is to build and operate the first satellite of nation that triggers the first step toward indigenous space program at each country. Students can achieve this by learning the entire processes of a satellite program from mission planning to satellite disposal. It also help lay down foundation of sustainable space program accumulating human resource in universities. This will also create inter-institutional human networks to assist the infant space programs each other. In order to accomplish this achievement, BIRDS project has been designed to make a constellation of five identical IU CubeSat with six missions, such as, Camera (CAM), Digi-singer (SNG), Precise positioning (POS), atmospheric density measurement (ATM), constellation network operation (NET) and single-event latchup (SEL).

**Camera (CAM):** The objective of this mission is to capture the photograph of motherland of size 640x480 pixels and 259x1944 pixels with a resolution of roughly 100m/pixels, store the data and transfer the image data to the ground.

**Digi-singer (SNG):** This mission might be renamed as ‘Singing from Space’. By uploading MIDI-file to SNG memory through OBD, music data will be converted to analog signal by the vocal synthesizer module of Digi-singer subsystem. Any amateur band radios on the surface can listen the music coming from space.

**Precise positioning (POS):** Accurate positioning of one CubeSat can be achieved from the time difference (1, 12, 13 and 14, as shown in Fig. 1) of the satellite signal reception among the three or more ground stations as shown in the schematic below. This mission attempts precise tracking of IU CubeSat that is too small to afford onboard GPS receiver.

![Figure 1: Precise satellite-positioning tracking schematic.](image)

**Atmospheric density measurement (ATM):** By measuring the precise position and altitude at two different times, velocity and atmospheric drag can be determined, which derives the atmospheric density and its change accurately.

**Constellation network operation (NET):** It will demonstrate network operation of 5 CubeSat constellation via amateur radio band as shown in Fig. 2. Since all ground stations are connected by internet having synchronized clock with zero time lag and by a central server, run by the same software, it will be a real time ground station. This synchronized GS can access each of the CubeSat (identified with some code) while flying over it. The network operation can increase the data throughput of CubeSat drastically.
Satellite Operation

Each country should establish a ground station with necessary equipment to communicate the BIRD by UHF/VHF frequency band. Each GS will be connected by Internet and time-synchronized by GPS clock to avoid any time lag. Students should design communication software that will be identical for all the GS connected to one server. GS and can communicate a specific CubeSat simultaneously as shown in Fig. 2. Each GS can communicate the satellite more than 10 times per day.

In addition to the owner countries of the five satellites (Japan, Ghana, Mongolia, Nigeria, and Bangladesh), Thailand and Taiwan plan to participate in the ground station network. The central server provides tracking information of each satellite. It lists which ground station sees what satellite at what time. It also lists the operation mode to be conducted at each ground station. By connecting the server, operators at each ground station know what to do within next few days and operate the ground station to conduct the tasks assigned. Data downlinked at each ground station will be forwarded to the server. After data analysis, the data will be shared by the member countries, as well as amateur radio community.

Mission Outcome

Through this multinational constellation, students of developing countries learn the entire processes of a satellite program from mission planning to satellite disposal. It helps each country lay down foundation of sustainable space program by accumulating human resource in universities and launching a university space research and education program. Not only that, this opportunity creates international human networks to assist the infant space programs each other.

Schedule

BIRD project had a kick-off meeting in October 2016. The project is now at the stage of finalizing the mission concept. From December 2016, hardware work will be started. It is envisioned that the satellite will be delivered to JAXA by the end of December 2016 and launched.
to ISS in Spring 2016. We anticipate their release from ISS to occur by Summer 2016. The project was designed to fit into two year time-frame, so that a Master student can experience the project from the beginning to the end.

Concluding Remarks

A five-nation (Japan, Ghana, Mongolia, Nigeria and Bangladesh) CubeSat constellation has been designed and named as “Joint Global Multi-Nation Birds,” shortly “Birds”. University students will design, manufacture, assemble, integrate, test, and operate a constellation of five identical IU Cubesats, along with disposal. Preliminary mission has been designed as Earth observation by a COTS camera and Outreach through Digisinger, a sound relaying COTS device. Along with this, other mission could be message relay among other countries, Multi-point simultaneous space environment measurement, technology demonstration, etc. UHF/VHF amateur radio band will be used while interlinking the ground station of seven countries. Students from different countries will make it as a part of graduate academic education in Space Engineering International Course at Kyutech. After completing the flight model [FM], five IU satellite will be sent to International Space Station (ISS) with the agreement of JAXA and later will be deployed to LEO. Advantages of the constellation are drastic increase of data throughput to distributed ground station network and program robustness. This “Birds” project will lay down foundation of sustainable space program by accumulating human resource in universities and launching a university space research and education program. Together with this, it will create international human networks to assist the infant space programs each other and demonstrate that a constellation of IU Cubesats can have synergistic mission value and capability via international operation.

The Birds project is strongly tied with Kyutech’s space engineering curriculum, Space Engineering International Course, which provides hands-on educational experience to students from all over the worlds. Kyutech is currently under negotiation with several countries that showed interest in the Birds project. The project can be formatted into two-year educational/research program. With enough number of participating countries, Birds-II project can be started in October 2016.

References

03. JSPS funding for 3 years of BIRDS International Workshops

JSPS Core-to-Core Program (shown at the right) has approved funds for Kyutech to use to conduct BIRDS international workshops for the next three years.

In the table at the right, you can see the institutions that are eligible to receive air fare for attending the workshops.

The workshops will be held in the following places:
- 2017 - Ghana (All Nations University)
- 2018 – Mongolia (National University of Mongolia)
- 2019 – Bangladesh (BRAC University)

The central purpose of these workshops is to fortify the BIRDS Network – this is a human network of all BIRDS participants. Through this network, members can exchange notes, discuss new collaboration, show research results, and brainstorm on a variety of topics.

http://www.jsps.go.jp/english/e-c2c/adapted_b.html
04. Apiwat (BIRDS-1 member) recently visited Kyutech

Recently, Mr.Apiwat Jirawattanaphol visited Kyutech with his RAST colleague, Mr.Anan Paenthongkham.

RAST=Amateur Society of Thailand.

Apiwat starts as a PNST Fellow (Phd candidate) in October of 2017.

Concerning this June trip to Kyutech, he writes as follows:

“I came back to Kyutech for 1 week during June 19-22 to test satellite components from Thailand. At Kyutech, I met BIRDS team members and joined the BIRDS weekly meeting. We discussed ground station operations after BIRDS constellation deployment from the ISS on July 7.”

Apiwat, it was a pleasure to see you again here. - G. Maeda.
Dr. Amelia Greig (assistant professor at Cal Poly) received her 辞令 (letter of appointment) from Prof. Serikawa (Dean of the School of Engineering, Tobata, Kyutech) at 10:00 AM on Tuesday, 27 June 2017. She is now officially a member of Kyutech staff.

At 11:30 AM, on the same day, the BIRDS-2 team and Dr. Amelia celebrated her appointment with lunch at the student cafeteria. We had fun.
The BIRDS Project is conducted by LaSEINE, Laboratory of Spacecraft Environment Interaction Engineering, whose director is Prof. Mengu Cho.

The laboratory issues an annual report (mainly in Japanese) each year in March – the cover of the March 2017 issue is shown at the left. It covers fiscal year 2016.

All back issues are available as pdf. Please go to this web link to download any one of them:

http://laseine.ele.kyutech.ac.jp/download/download.html

-- The BIRDS Project Newsletter Editor
07. Delivery of BIRDS-1 to the ISS is reported in APRSAF News Mail No. 150

On June 5, 2017 (UTC), five 1U CubeSats of the Joint Global Multi Nation Birds Satellite Project (BIRDS Project) were delivered to the International Space Station (ISS) Japan Experiment Module "Kibo" by the SpaceX Dragon cargo vehicles. The BIRDS Project, led by Japan’s Kyushu Institute of Technology (Kyutech), is a cross-border interdisciplinary satellite project with Bangladesh, Ghana, Mongolia, Nigeria and Thailand. These five CubeSats, including the first satellites assembled and integrated by students in Bangladesh and Mongolia, will be deployed from the ISS "Kibo" on July 7, 2017.

NASA ISS Daily Summary Report:
https://blogs.nasa.gov/stationreport/2017/06/05/

BIRDS Project Facebook:

Joint Global Multi-Nation, BIRDS 1:
http://birds.ele.kyutech.ac.jp/birds1.html
08. Prof Shibata (robotics research, Kyutech) promotes SEIC at AIR in India

All BIRDS students are enrolled in SEIC, Space Engineering Int’l Course of Kyutech.

At a recent robotics conference in New Delhi, Prof Tom Shibata (Wakamatsu Campus) distributed SEIC brochures at the conference.

Thank you, Prof. Shibata.

- G. Maeda
09. BIRDS Project written up in the LaSEINE Annual Report (issued in March of 2017)

Note: all back issues of the LaSEINE Annual Report can be downloaded – explained elsewhere in this newsletter.
10. Japan changes landing permission sticker

The next time you land in Japan, have a look at what is affixed to your passport.
Gladys Oppong started a one-week visit to Kyutech on 10 July. She is with All Nations University in Ghana. She has just completed her masters degree in India. In the fall, she will pursue a PhD in a field related to business/management.

She has come to Kyutech on a fact-finding mission. Dr Donkor is her father.
Мазаалай Монголын Анхны хиймэл дагуул - Numsat-1u
June 26 at 10:00am -
#Мазаалай #Хиймэл #дагуулын хөөргөх хувилбарын сүүлийн хэсгийн угсарлын бичлэгийг (хурдан хувилбар) та бүхэнд хүргэж байна. Шувууд (#BIRDS) төслийн оролцогч таван улсын баг вээр ерөнхий хиймэл дагуулаа “Clean room” буюу ариун орвоо дагуу угсарч буй байдлыг дараах дүрс бичлэгээс харж болно. Хиймэл дагуул зохицохноо том байксаас ул хамааран тодорхой дээс дараалал, ерөнхийлөөд бичгийн тоглолтын дагуу угсарлын яваалт явагдалаа агаарын усахаар бүррийг зурагдаж баримтуулж байдалтай байдаг.

Хиймэл дагуул маань задгай сансарт гарахад 11 хоног уулзлаа.
#BIRDS_Project, Joint Global Multi Nation Birds - BIRDS project #Flight_model #assembly #Clean #room 九州工業大学 Kyushu Institute of Technology, #Mazaalai #Cubesat

https://www.facebook.com/NUMSAT.Mazaalai/videos/1262880753824222
13. BIRDS-2 Solar Panel Assembly Practice

BIRDS-2
Solar Panel Assembly Practice
All BIRDS-2 team members trained by Dr. Pauline Faure
Place: 2nd level, SVBL, Kyutech, Japan
Date: 26-27 June, 2017

By Azami (BIRDS-2, Malaysia), 11 July 2017.
List of Apparatus

1) Weighing scale (resolution of 0.1g)
2) Dotite (conductive glue)
3) RTV silicone
4) Rectangular weight and rectangular rubber
5) Solar Cell (use Glass cover plate for practice)
6) Timer
7) FR4 PCB board (use aluminum square sheet for practice)
8) Ethanol (as cleaning liquid)
9) Vacuum pump
10) Aluminum cup
11) Stainless steel lab spatula
Procedure

I. Prepare all apparatus for solar panel assembly
II. Clean all tools using ethanol
III. Calculate the ratio of RTV (according to area, density, and thickness needed)
IV. Put the mixture of RTV inside vacuum chamber (according pressure and time needed)
V. Apply RTV on the PCB carefully
VI. Apply Dotite on the rectangular conductive trace carefully and quickly (because it will dry very soon)
VII. Put the solar cell slowly according to the trace line
VIII. Put the rectangular rubber above the solar cell first and put the rectangular weight on top of it
IX. Let the RTV and Dotite to be dried (about 24 hours)
X. Clean up all the tools again using ethanol

Picture of procedure III
Pictures from the practice...

Yeshey (left) and Uemura (right)

Adrian (left), Cheki (middle), and Joven (right)

Kiran (left) and Yamaguchi (right)

Azami (left) and Syazana (right)
Near the end of last year (17 December 2016) the Bhutan Team of BIRDS-2 celebrated their big national day with the entire BIRDS-2 Team. See the photos:

**Issue No. 12** of the newsletter:

[Section 3] *BIRDS-2 Team celebrates 109th National Day of Bhutan.*

This time, the Malaysian Team will do something similar. Their announcement is shown at the right.
This section [15] covers the deployment of the BIRDS-1 CubeSat constellation using non-JAXA photos.

The next section [16] does the same thing using JAXA photos.
On 8 July 2017 the Ghana delegation (in this photo: Dr Carlene, Dr Donkor, and his wife) made a “pre-visit” to the JAXA Tsukuba Space Center. They pose at the engine end of JAXA rocket models.

Below is a side view of the photo of the left.

The delegation from Ghana
BIRDS-1 deployment day -- 7 July 2017

JAXA displays the flags of the participating nations:
1. Bangladesh
2. Ghana
3. Japan
4. Mongolia
5. Nigeria

On the grounds of the JAXA Tsukuba Space Center
There was a 30-minute tour of JAXA’s “Space Dome” for the guests of BIRDS deployment.

The main engine of the H2A rockets. It is called the LE-7A, and it can generate a thrust of 110 tons -- the same level of a jumbo jet.
7 July 2017 – deployment of BIRDS-1 CubeSats

After deployment Astronaut Jack Fischer posted this comment via Twitter.

Another great example of International Cooperation today on @Space_Station -- launched 5 micro-satellites from 5 countries off the JAXA arm!
The BIRDS-1 Team right after ISS deployment of their satellites on 7 July 2017
Ambassadors of
Nigeria   Mongolia  Bangladesh  Ghana

THE PRESS CONFERENCE

Photos of this page were taken by T. Wakabayashi of Kyutech

Ambassador of Bangladesh receives certificate from JAXA President

Dr Donkor and the Ambassador of Ghana receive certificate from JAXA President

President of Kyutech (right) receives certificate from JAXA President (left)

Program Manager Wakata (ISS astronaut, standing at the far right) introduces the JAXA “BIRDS” staff and G. Maeda during a reception after the press conference.

Dr Donkor makes a comment – this screenshot was taken at Kyutech

Lots of media attendance
1. Mr. Bello Kazaure HUSSEINI, Charge d'Affaires ad interim of Nigeria
2. Mr. Batjargal, Minister of Mongolian Embassy
3. H.E. Ms. Rabab FATIMA, Ambassador of Bangladesh
4. H.E. Mr. Sylvester Jude Kpakpo PARKER-ALLOTEY, Ambassador of Ghana
5. JAXA: Dr. Okumura, President
6. Kyutech: Dr. Oie, President

Photos of this page were taken by T. Wakabayashi of Kyutech

Group Photo taken at the end of the evening
- BIRDS-1 Deployment Viewing, 7 July 2017
- JAXA’s Tsukuba Space Center
BBC reports the deployment of BIRDS-1-Ghana


Posted on 7 July 2017

Ghana has successfully launched its first satellite into space.

GhanaSat-1, which was developed by students at All Nations University in Koforidua, was sent into orbit from the International Space Centre.

Cheers erupted as 400 people, including the engineers, gathered in the southern Ghanaian city to watch live pictures of the launch. The first signal was received shortly afterwards.
Congratulations to the BIRDS-1 Team.

On 8 July 2017, the amateur radio community certified that all BIRDS-1 satellites are active.
Small celebration party at Kyutech right after deployment

Waiting for first signals from the BIRDS-1 satellites

All photos on this page are from Dr. Kim of LaSEINE.
BIRDS Project Facebook – you are invited

https://www.facebook.com/permalink.php?story_fbid=485067075176050&id=171403156542445&substory_index=0
This section [16] covers the deployment of the BIRDS-1 CubeSat constellation using photos from JAXA.
The Deployment Viewing Booth for VIPs

Note:
The chart shows the original plan. Due to last minutes cancellations, the photo is slightly different from the plan – but the plan reveals what kind of VIPs were in attendance. By and large, the plan is correct.
First deployment: Japan (Toki), Ghana (GhanaSat-1), and Mongolia (Mazaalai)

5:50 PM on 7 July 2017
Second deployment: Bangladesh (BRAC Onnesha) and Nigeria (Edusat1)

6:10 PM on 7 July 2017
Joyous reactions after deployment

Kyutech, Japan

©JAXA

JAXA Mission Control, Japan

©JAXA

BRAC University, Bangladesh

©JAXA

All Nations University, Ghana

©JAXA

National Univ. of Mongolia

©JAXA
This momento (postcard size) was given to each Deployment Guest as he or she left TKSC.

Signed by Program Manager K. Wakata

This concludes the photos covering deployment viewing at Tsukuba on 7 July 2017.
17. BIRDS-1 deployment viewing in Thailand

This slide was prepared by Apiwat on location.

BIRDS-1 deployment viewing was held at KMUTNB Space System Laboratory on 7 July, 2017. Apiwat gave a short lecture to Lab members about the BIRDS Project and how satellites will be deployed from Kibo, the Japanese Experiment Module (JEM) of the ISS.

During BIRDS-N and B deployment!!

Successful Deployment of BIRDS Satellites

We had a small pizza party together after the BIRDS-1 deployments and while waiting for the first pass to receive satellites beacon signal.
“Naadam” is a major festival-holiday in Mongolia. Accordingly, the Mongolian students of Kyutech (half of them are members of the BIRDS-1 Project) celebrated Naadam on 11 July 2017 at the International House (dormitory) on Tobata Campus with the feast shown above. Second from the left is Turo’s younger sister – visiting Kyutech for one month as a summer holiday. Professors Yamaguchi, Omura, and Cho, attended this event.
19. JA1GDE sent a signal report for BIRDS-1

We are receiving signal reports from the amateur radio community .... here is one such person.

Dear George san,

It is a clunky shack, but I send you my photo. Please do Twitter at (@ BIRDs)

73
*
* Toshio Kasei
* ja1gde(at)jarl.com
* Twitter : @JA1GDE

14 July 2017
Hi George,
Find my picture attached.

Here is my gear:
• YAESU FT-736R + SDR-IQ
• 2x20 element X-Yagi 435SHS20 MASPRO, 13.4 dBD....see the page after next.
• 20 dB preamp SSB-electronics

QTH: Kirchbrombach, Germany JN49LR

73 Mike
DK3WN

16 July 2017

SEE THE NEXT PAGE FOR ONE OF HIS SIGNAL REPORTS
BIRDS Project Newsletter – No. 18

BIRDS-1 CW beacon signals visually displayed by DK3WN (Mike in Germany)

SEE THE NEXT PAGE FOR THE QSL CARDS HE HAS RECEIVED

16072017 04:20 UTC

jg6yjs birdbb c07dd8f8e2e69ab0
jg6yjr birdnn b274dcf8e1e89830
jg6yjq birdmm c794dbfbe5e79a..

BIRD B = TLE #42823
BIRD M = TLE #42822

... continued from the previous page.
Mike holding his BIRDS-1 QSL cards sent from Japan.

Behind him is his 2x20 element X-Yagi antenna for tracking satellites.

Dear Mike:
Thank you for these fabulous photos of your equipment. Your Yagi antenna is fantastic .... no wonder you get the signals so well at your station.

73,
George Maeda,
Editor.

... see the next page for the cards that we received from Mike.
QSL cards received from Mike (DK3WN) of Germany.

All photos on this page are from Dr Kim of LaSEINE.
22. Arrival of the 5-person delegation of Bhutan for the BIRDS-2 CDR

The 5-person delegation of Bhutan safely arrived in Kitakyushu on 17 July. They have come to Kyutech to attend the CDR (Critical Design Review) of BIRDS-2 on 18 July 2017.

This CDR will be covered in detail in the next issue of the BIRDS Project Newsletter (August Issue).

The delegation of Bhutan, with the students (Cheki, Kiran, and Yeshey) and G. Maeda in the lobby of APA Hotel Kokura – 11:15 AM on 17 July 2017.
REPORT:
VISIT TO KYUSHU INSTITUTE OF TECHNOLOGY (KYUTECH)
11-13 JULY 13, 2017

Author: Ms. Gladys Yaa Saah Oppong
Country: Ghana
Position:
Administrator of All Nations University
Space Science and Technology Laboratory (ANU-SSTL)
Background:
Masters in Business Administration

This 9-page report was submitted by Ms. Gladys to the BIRDS Project Newsletter on 15 July 2017. She is a member of ANU management.
Arrival at the Laboratory of Spacecraft Environmental Interaction Engineering (LaSEINE), Kyushu Institute of Technology.

Picture with GhanaSat1 members namely, Mr. Benjamin BONSU (left) Ms. Gladys (middle) and Mr. Joseph Quansah (right) on July 11, 2017
Tour at the LaSEINE NanoSatellite Exhibition Center

Ms Gladys Oppong (Right) Pose with Mr Quansah Joseph (Left) at the LaSEINE Nanosatellite Exhibition Center

← Ms Gladys Oppong takes the tour at the
LaSEINE Nanosatellite Exhibition Center
Tour at the Center for Nanosatellite Testing (CENT)

The front view and Entrance of CENT, Kyushu Institute of Technology.

← Observing the Small Vacuum Chamber for testing Cubesats at CENT
Meeting with BIRDS Project Team Members

Pose with BIRDS Project Team Members (Bangladesh, Nigeria and Ghana) after presenting Ghana Chocolate as a souvenir from Ghana and congratulated them for their successful deployment into earth orbit.
Meeting with Prof. Mengu Cho

Pose with Prof Mengu Cho (right), the Director of LaSEINE and Project Investigator of BIRDS Satellite Project on 11 July 2017.
Dr. Pauline Faure (Left) as my tour guide explaining the types of vacuum chambers used for testing Nanosatellites at different Orbits at LaSEINE on July 13, 2017.
Tour of the Kyutech Amateur Ground Station (GS) Control Room on the 8th floor

Pose with the Ghana team at the GS control room during Birds Satellite operation on July 13, 2017 during the 1 am to 9 am passes

Pose with Dr. Pauline (Right) at the GS control room
Summary

On behalf of President, Dr. Samuel H. Donkor the ANUC Management, Staff and Students of All Nations University College (ANUC), I would like to give special thanks to Kyushu Institute of Technology, Professor Mengu Cho, Assistant Professor George Maeda and everyone who has helped and supported BIRDS project to come to reality.

I also want to use this opportunity to thank Japan Aerospace Exploitation Agency (JAXA) and the BIRDS team.
Cheers to the never giving up team!
All the extra hours, all the sacrifices, all the sleepless nights and early mornings have finally paid off. It is never easy to hold on when things get tough or to shut out the negative vibes and work hard at what you want.

Your success is proof that indeed, at the end of the tunnel there is light. We are impressed and proud of you all.
Congratulations on your success.
(Ayekoo in Ghana language).

Arigato Gozaimasu! Thank you!

Gladys Yaa Saah Oppong
24. Nikkei writes about the deployment of BIRDS-1 constellation

Nikkei is the leading business newspaper of Japan – all corporate people read it each day.
25. “Certificates of Appreciation” given out during BIRDS-1 Deployment Party

Sunday
16 July 2017

Prof Cho receives from Maisun

Asst. Prof. Masui receives from Taiwo

Kokura

Dr Yamauchi receives from Antara; Dr Faure receives from Joseph; Ms Ward receives from Turo.
26. Report on the ground station in the Philippines

UP EEEI Amateur Radio and Satellite Ground Receiving Station (ARSS)

This 6-page (including this page) report was created on 18 July 2017 by the Electrical and Electronics Engineering Institute (EEEI) University of the Philippines (UP) Diliman, Quezon City, Philippines
The UPEEEI ARSS

- A platform for tracking and communicating with satellites operating in amateur band for research and educational purposes
- Communication node for terrestrial communication in case of emergency
- Assist in the proliferation of knowledge in satellite technology by providing assistance and guidance to universities/schools that wish to establish their own ARSS

System configuration of UP EEEI ARSS

- PC with several COM ports and the following softwares installed: SATPC32, APRSSIS32, Digipan, Airlink Express, Hyperterminal, AccessPort
- VHF and UHF Antennas (mounted to rotator)
- Computer Controller connected to rotor controller through Dual 5-pin to DIN (connector included in controller)
- Other transmitters/transceivers (connected to monopole antennas for close-range testing)
- All components are connected to well-regulated power supplies and are properly grounded to avoid hazards.

ICOM 9100 and Yaesu FT-991
VHF and UHF antennas connected to appropriate ports
Settings set to expected radio signal (usually Digital, FM)

DIN-6 to DIN-6 (for Signalink)
DIN-6 to Serial (for KAM XL)

USB to RJ45 (for Signalink)
Male Serial to Male Serial (for Kam XL)

Serial to Serial (to Computer Controller)

Serial to Serial (to Computer Controller)
Equipment

- Radios: ICOM9100
- Antennas: VHF, HF and UHF (not yet fully functional)
- Rotor controllers: Yaesu G5500 and Yaesu 450
- TNC: KAM XL
- Sound card: Signalink USB
- Softwares Used: SatPC32, Digipan, Airlink Express, APRSIS32, Hyperterminal
- Power distribution and conditioning system
Development Progress

• Transmissions Received
  • ISS SSTV, XW-2F, XW-2B, IO-86, AO-85, AO-73, UKube-1, DUCHIFAT, Tanusha-1

Received SSTV image from ISS  Received beacon from AO-85
Future tasks

• Automation of tracking
  • Recently purchased Ham Radio deluxe license

• Track satellites using UHF antenna
  • Currently using UHF/VHF cross yagi

• Obtain Radio station License
  • Currently 13 people with license. 12 people from Holy Angel University (partner university) will join the Amateur Radio club of UPEEEI
  • Conduct Amateur radio seminars to facilitate licensing of students interested in amateur radio on September

• QIKCOM-2 project development
  • Problem with interfacing of modules
People Involved

• Engr. Izrael Zenar Bautista, DV1PUI – ARSS Operations Head
• Engr. Charleston Dale Ambatali, DV1QNE – ARSS Technical Head
• Students
  • Hanns Christian Chua, 4F1XIH – antenna and radio and operations support
  • Sophia Ralota – blog site administrator and operations support (in process of applying callsign)
  • Carlos Ramos, DW1QVL – APRS implementation and R&D of USNA’s QIKCOM-2
  • Bernalyn Decena, DW1QJK – Frequency tracking and automation
  • Angel Aquino – operations support (in process of applying callsign)
• Faculty adviser: Dr. Marc Talampas

END OF REPORT FROM THE PHILIPPINES
– Thanks to all the photo above. The Editor.
The Tobata Gion Yamagasa festival (戸畑祇園山笠) is a popular local Japanese festival (matsuri) which takes place annually in Tobata, a ward of Kitakyushu in Fukuoka prefecture, Kyūshū, Japan. It is held for three days (Friday–Sunday) before and after the fourth Saturday of July. The festival is a national cultural asset of Japan, and is centred on the parading of the "Yamagasa" (山笠).

The Yamagasa (or Yamakasa) are very large floats, and are the focal point of the festival. There are four regions of Tobata which participate: Higashi, Nishi, Tenraiji and Nakabaru. Each region has a large Yamagasa for men and a small one for boys, making eight main floats in total.

During the festival in the daytime, the eight official floats with twelve great flags hoisted on the four large ones are carried for a parade, followed by some small floats for children. But in the nighttime, the floats are completely transformed into pyramids of light—huge Lantern Yamakasa floats, their decorations with the flags removed. Each with twelve layers of 309 lanterns, 10 meters high, and 1.5 tons in weight, is shouldered by about 100 carriers.

To move the Yamagasa is an art which requires concerted lifting by all the carriers. To ensure that they do it successfully, they all shout "yoitosa, yoitosa" together in a rhythmic chant with drums and cymbals.

All of the above text is from Wikipedia: https://en.wikipedia.org/wiki/Tobata_Gion_Yamagasa_festival

Newspaper of 23 July 2017
28. BIRDS-2 Logo

This is the BIRDS-2 logo, which was designed by committee of BIRDS-2 members.

It is used on the BIRDS-2 official jacket. Photos of the jacket will be in the next issue of this newsletter.
BIRDS-2
Antenna Gain & Radiation Pattern Measurement

This report was prepared by:
Syazana Basyirah (Malaysia)

Sequence of activities (Year 2017)
3 July........Setting-up Anechoic Chamber
4 July........Equipment Preparation & Antenna Setup
5-8 July.....Gain & Radiation Pattern Measurement (UHF&VHF)
9-10 July...Results Analysis
11 July......Anechoic Chamber Clean-up
Setting-up Anechoic Chamber, Equipment Preparation & Antenna Setup

The walls, ceilings and floor are lined with special electromagnetic wave absorbing material.

BIRDS-2 member after preparing anechoic chamber absorber installation for antenna measurement.

First Set Setup
- Don’t Care Antenna (Dipole Antenna)
- Reference Antenna (Log Periodic Antenna)

Second Set Setup
- Antenna Under Test (BIRDS-2 UHF & VHF Antenna)
- Reference Antenna (Log Periodic Antenna)

UHF & VHF Frequency Tuning by using VNA
Why and How We Perform Antenna Measurement for BIRDS-2?

Purposes:

- To perform antenna measurement in ideal condition where no reflection occurs and simulate measurements that would be performed in space.
- To perform the UHF and VHF antennas test for BIRDS-2 satellite measuring the gain and radiation pattern of both antennas attached to the CubeSat structure.
- To investigate the results of the gain and radiation pattern of both UHF and VHF whether meets the Link Budget calculation value and Omni-directional pattern or not.

Requirement:

- To acquire the gain and radiation pattern results according to JAXA requirement.

Method:

- By using 3 antennas and 2 setups; UHF and VHF antennas with the Reference Antenna and Don’t Care Antenna with Reference Antenna. The desired result for both UHF and VHF antenna gain will be around 0-2.2 dBi (according to Link Budget calculation).
UHF Patch Antenna Radiation Pattern

Sweep 1: Horizontal
Degree of Rotation: Counter Clockwise
UHF Patch Antenna Radiation Pattern

Sweep 2: Vertical
Degree of Rotation: Clockwise

2D Radiation Pattern in Polar Coordination

Reference Antenna (Log Periodic Antenna)

Antenna Under Test (BIRDS-2 CubeSat)

222 cm

210 240 270 300 330
0 30 60 90 120

Power Received (dBm)

Angle of Rotation (Degree)

Main Lobe

Side Lobe

Back Lobe

Side Lobe
Reference: BIRDS-2 Structure assembly Procedure by Tomoki Uemura

Photos are courtesy of: All BIRDS-2 members and Dr. Kim

Article prepared by:
Kiran Kumar Pradhan (Bhutan)
21 July 2017
CubeSat Assembly Procedure

• Typically a 2-day procedure.
• One day is for preparation:
  • Prepare all the tools and parts necessary.
  • All parts requiring RTV adhesive work should be carried out on first day for before.
• Assembly protocol should be read and strictly followed.
• The axes of the CubeSat is defined as shown in Fig.1.

Tools Required
1. Rubber gloves
2. Hair Cap
3. Face mask
4. Dustproof coat
5. Torque Driver
6. Torque Driver Socket
7. Allen Wrench
8. Tweezers
9. Kempton tape
10. Isopropyl alcohol
11. Kim Wipes
12. Digital Multimeter
13. Anti-static strap
14. Vernier Caliper
15. Height gauge
16. Marker

Fig. 1: CubeSat axis definition
Day-1 (Preparation)

Precautions
• Do not place the structure on its side, always use the support provided
• Ensure correct torque is applied on fasteners
• Prepare checklist of all the tools and parts required and confirm it

Circuit Board Preparation
• Fix modules with RTV
• Cut protruding pins on all PCBs
• Insulate all metallic parts with Kempton tape

Fig. 2: Assembly preparation for BIRDS-2 EM

Fig. 3: (STEP-1) Preparation of battery box

Fig. 4: (STEP-2) Preparation of +Y panel for circuit burner for monopole antenna and holding it before deployment
Day-2 (Assembly)

Fig. 5 (Above): (STEP-3) Assembly of base frame with side rails and the installation of backplane

Fig. 6 (above): (STEP-4) Attaching the magnets on rails and all the boards including battery box

Fig. 7 (left): (STEP-5) Assembly of all the side boards with solar cell and the +Y panel with antennas
BIRDS-2 EM Assembly Pictures

See Section 21 for a group photo of relevant persons.
BIRDS-2 Project
Vibration Test Activity

*Reference*: BIRDS-2 Vibration Test Procedure by Yasuhiro Tokunaga

*Photos are courtesy of*: All BIRDS-2 members, including Dr. Kim

Article prepared by:
Joven C. Javier (Philippines)
25 July 2017
Launch Environment – BIRDS-2 EM Vibration Test

Why the need for vibration test?

• Rocket launch is first harsh environment the CubeSat will encounter before the getting in to space. It will receive severe random vibration from the rocket that can damage its internal or external structures or components.

• Hence vibration testing is essential for all satellites to test the survivability of the satellite’s structure and component’s inside and out.

• This test simulates the actual environment that the CubeSat will experience during rocket launch and it enables an analysis for design modification if necessary based on the test results.
Vibration Testing

In order to have effective and efficient test, it is important to first develop a test plan. The test plan is a document that shows detail test procedure, the test set-up, needed tools and equipment and test sequence. And this also includes to prepare the “Test Article”. Figure 1 shows the BIRDS-2 EM as test article.

Next, the to prepare the necessary tools like as torque wrenches, drivers, accelerometers (pick-ups) and adhesives are collected for easy reach. All pick-ups are connected to the satellite body and designated data acquisition terminals (DAQ).

Fig. 1: BIRDS-2 EM after Assembly

Fig. 2: Dr. Masui helping BIRDS-2 Team prior to testing
Vibration Testing

It is important that every bolts and nuts are fixed properly and labelled with a clear torque mark in order to observed and identify any movement or displacement outside the test article. Loose bolts, nuts and other fasteners imply that insufficient torque was applied. Care should be taken to apply required torque when tightening fasteners.

*Fig. 3: EM inserted and fixing into the POD*
Vibration Testing

During Vibration Test the team is divided accordingly

1. Observer and checker of the test article before and after each vibration.

2. Operating the software and inputting the values

The CubeSat must withstand certain forces with sufficient margin. Each Rocket provider gives the profile of loads impacted by the launch vehicle, so that the satellite can be designed to withstand such load.
BIRDS-2 team after vibration testing
End of BIRDS Project Newsletter
– Issue Number Eighteen

This newsletter is archived at the BIRDS Project website:

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

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 purpose of it is to keep BIRDS stakeholders (the owners of the satellites) informed of project developments.