# The BIRDS Paradigm

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Co-organized by *the United Nations Office for Outer Space Affairs* and *Samara National Research University*
Co-sponsored by the *European Space Agency (ESA)*
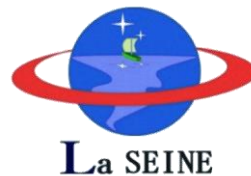
In this talk, Kyutech presents a new way to create effective *space engineers for non-space-faring nations.*

← **Students assemble the EM of BIRDS-2**

What is wrong with the old way?

◆Takes too much time …. students usually graduate before they can complete their projects …. this is no good

◆Takes too much cash …. Including launch costs, often exceeds half a million dollars

◆Ineffective …. students rarely see the whole picture …. only parts of it

◆Too much theory and not enough hands-on lab work

◆Students graduate with a lack of confidence of undertaking a satellite project in their home country

All of the above deters non-space-faring nation from taking the critical first step

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The Time Is Ripe for Change

Smash the mould

http://heaven-now.org/wp-content/uploads/2014/04/paradigm-shift.jpg

Make a new one

Introducing the *BIRDS Paradigm*

Teach to grad-level engineering students the entire development cycle using a 1U CubeSat – from design, to integration, to test, to in-orbit operation. It is ambitious.   But it can be done.

1. to acquire this know-how, students must design, build, and test, satellites with their own hands, and with minimal supervision,
2. the duration of the entire project (including operation time in orbit) must be held to just 24 months (the time it takes to earn a masters degree in Japan),
3. Kyutech actively recruits BIRDS students from non-space-faring nations in Asia, Africa, etc.
4. assign 2 or 3 students from the same nation to build that nation's first satellite (thereby creating substantial history and pride for that nation),
5. assemble several national teams per 24-month-long BIRDS Project,
6. require each participating nation to bear all project and student costs,
7. lower launch expenses by releasing BIRDS satellites from the ISS,
8. initiate BIRDS (n+1) Project 12 months after BIRDS (n) Project has started, so that each project overlaps the previous one by 12 months.

I will cover each of these 8 points

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#1

To acquire this know-how, students must design, build, and test, satellites with their own hands, and with minimal supervision

The Pressure Cooker – 7 days per week

BIRDS weekly mtg

Mongolian Team

Serious brainstorming

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Maeda - 31-Oct-2017 - UN Workshop, Samara, Russia

This is the essence: Learn the *entire* satellite development process from start to finish

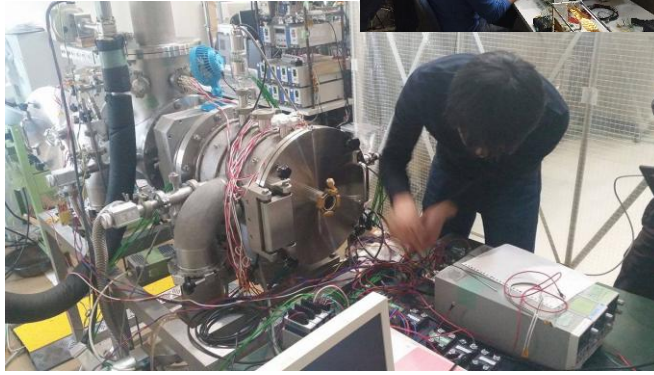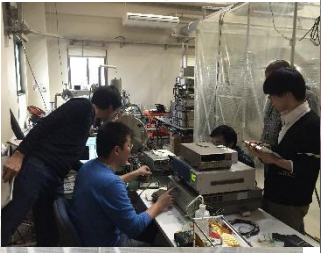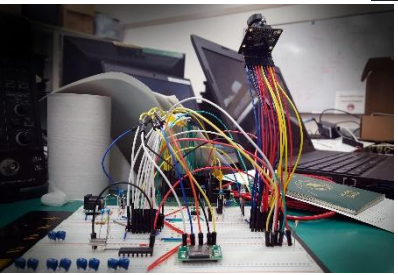**Flight Model**

Deploy in space

End

Engineering Model

Breadboard

Design

Start

Extensive environmental testing

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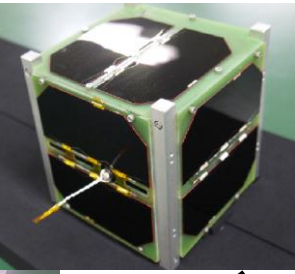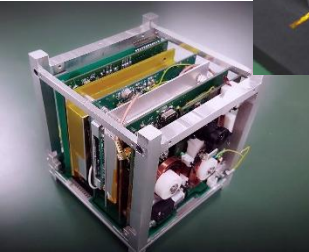
- Mainly, the students are on their on.

- There is a weekly meeting where staff and students discuss progress and problem areas.

- The Project Manager is also a student.

- For the first three months, the students work together to come up with a common design. All satellites are built to this common design.

- Then they break up into the national teams – about three students per team.

- The time pressure is severe because delaying the launch is never an option.

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#2

The duration of the entire project (including operation time in orbit) must be held to just 24 months (the time it takes to earn a masters degree in Japan)

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THE TIME LINE FOR BIRDS-1

Master students enter Kyutech; Kick Off **October, 2015**

MDR (Mission Design Review) **November, 2015**

PDR (Preliminary Design Review) **February, 2016**

CDR (Critical Design Review) **June, 2016**

Completion of Flight Models **December, 2016**

Hand-off to JAXA **January, 2017**

Launch to the ISS **June, 2017**

Deployment from the ISS **July, 2017**

Students return to home countries **September, 2017**

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THE TIME LINE FOR BIRDS-2
The same, with a one-year offset.

The Critical Time Constraint

Kick-off of the project
to
Operation on orbit

Must be kept to under 2 years.
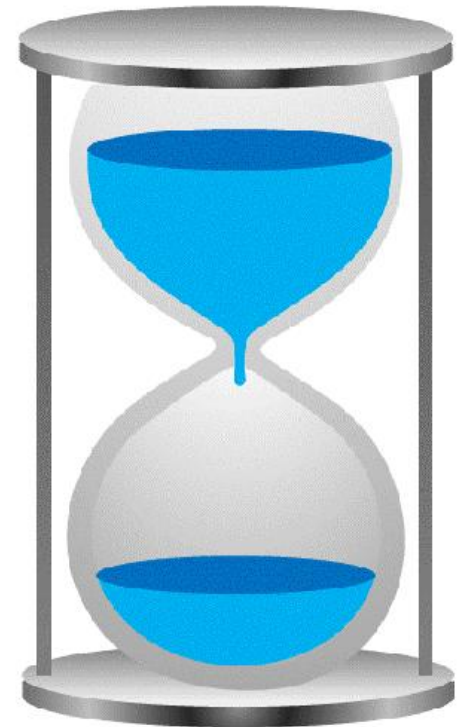
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#3

Kyutech actively recruits BIRDS students from non-space-faring nations in Asia, Africa, etc.

[It is a lot of work.]

Bangladesh

Nigeria

Mongolia

Ghana

Japan

The nations
of the
BIRDS-1 Project

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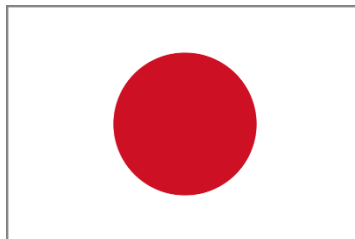
The nations of the BIRDS-2 Project

Bhutan
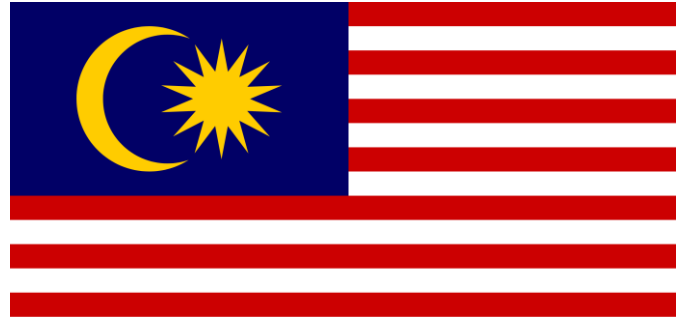
Malaysia
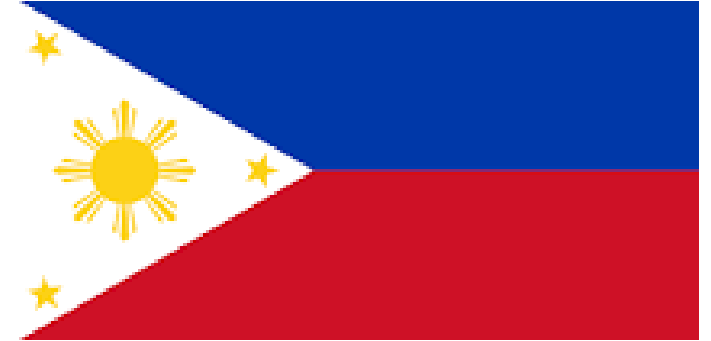
Philippines
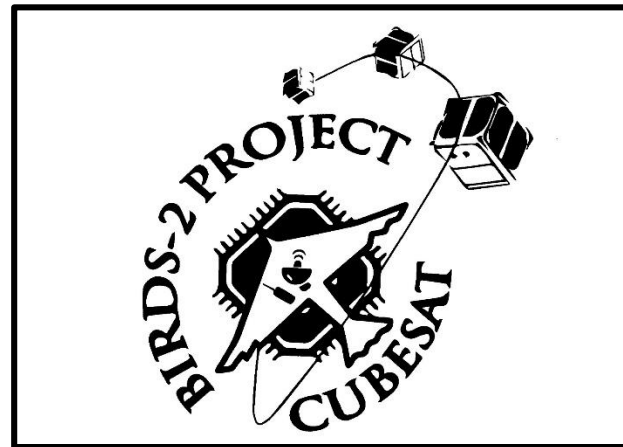
Finding BIRDS partners

◆There are no short cuts: You need to make visits, and explain the goals face-to-face.

◆Universities are better bets than governments because professors make long-term partners – space agencies are too affected by elections and politics, and so are more unstable in our experience.

◆The smaller the organization, the faster it makes decisions; so governments are the slowest.

◆On the other hand, the smaller the organization, the less money it has.

◆Use all the available communication tools: Skype, fax, email, telephone, etc. Do not over use email.   We find Skype to be effective.

◆Work with the United Nations, especially when dealing with developing nations.

◆Start a newsletter to publicize your activities – more on this later.

The good news: The market is large.   Most nations have not done their first satellite.

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#4

Assign 2 or 3 students from the same nation to build that nation's first satellite (thereby creating substantial history and pride for that nation)

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Press coverage of our three students building Bangladesh's first satellite has been staggering – scores of newspaper articles and countless interviews on TV and radio.

Antara   **Kafi**   **Maisun**

On Mongolian national TV: 30-minute program about the country's first satellite

https://www.youtube.com/watch?v=O5SmSz-m_pg&feature=youtu.be
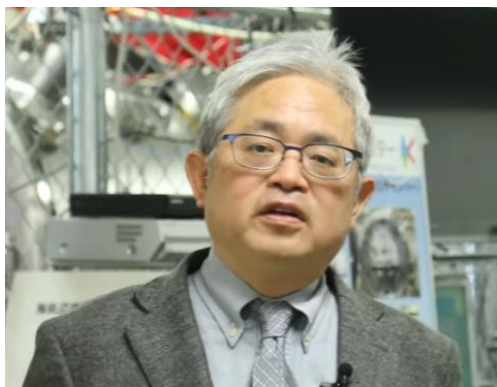
MNB came to Kyutech to interview project members.

Turo

Erka

Amar

ISS

Maeda - 31-Oct-2017 - UN Workshop, Samara, Russia

#5

Assemble several national teams per 24-month-long BIRDS Project

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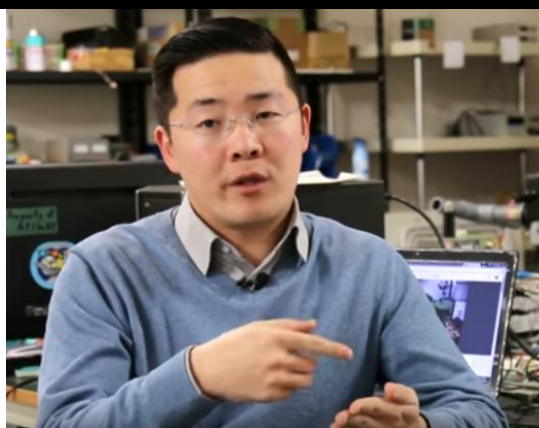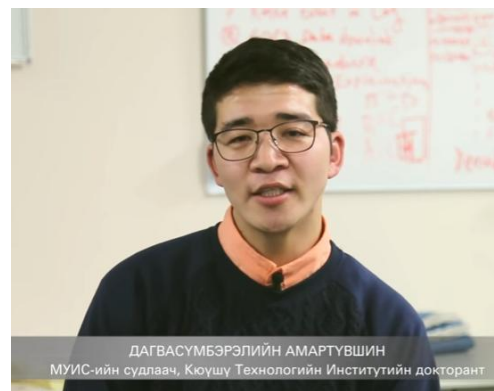
[1] Design Phase

The first three months is the Design Phase. Students work together to create a common design. In this phase the students cooperate – no competition.

[2] Fabrication Phase

They break up into national teams – so the competition heats up a little. But in all cases, they need to learn to work maturely with people of different ages, different races, different cultures, and different gender.

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Students hand carry their CubeSats to JAXA near Tokyo

©JAXA
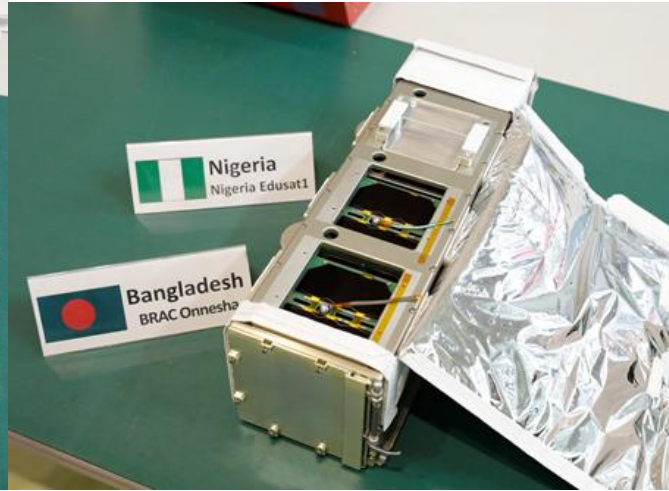
©JAXA

©JAXA

The two long white cases are J-SSOD pods.   As you can see, three BIRDS-1 cubesats go into one pod, and the other two BIRDS-1 cubesats go into the other pod.   The J-SSOD is lifted to the ISS in a rocket.

©JAXA
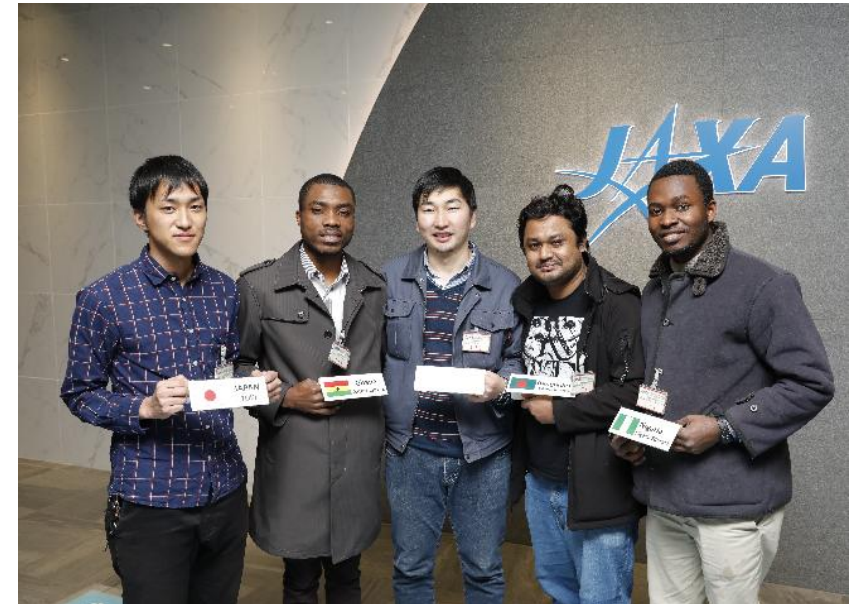
Nakamura-Joseph-Turo-Kafi-Ibukun   ©JAXA

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The creative QSL cards of BIRDS-1 countries

#6

Require each participating nation to bear all project and student costs

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Cost Structure

☐ Hardware and launch fee: Exactly 15 million Japanese yen, or about 140,000 USD.   This covers the hardware needed for the satellite, and its launch via the ISS.

☐ Need 2 or 3 students to build the satellite: The cost is well below 25,000 USD per student per year. This covers tuition, living expenses …. everything.

☐ Need a ground station – this is a good project for local university students to undertake because it creates interest (and perhaps passion) in space.

#7

Lower launch expenses by releasing BIRDS satellites from the ISS.

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
Our experience

- ✓ Avoid free launches – you do not get reliable service. Pay some money and get good (better) service.

- ✓ In principle, the first satellite for a non-space-faring nation is a proof-of-concept mission, and therefore a mission length of 6-12 months is sufficient; later missions can use higher but more expensive launches.

- ✓ Deployment viewing provided by JAXA is a tremendous PR bonanza – see the next two slides.

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JAXA puts on a good performance for international guests for deployments from the ISS.

Shown at the right are VIPs viewing the deployment of BIRDS-1 satellites on 7 July 2017 at the JAXA Tsukuba Space Center near Tokyo, Japan.
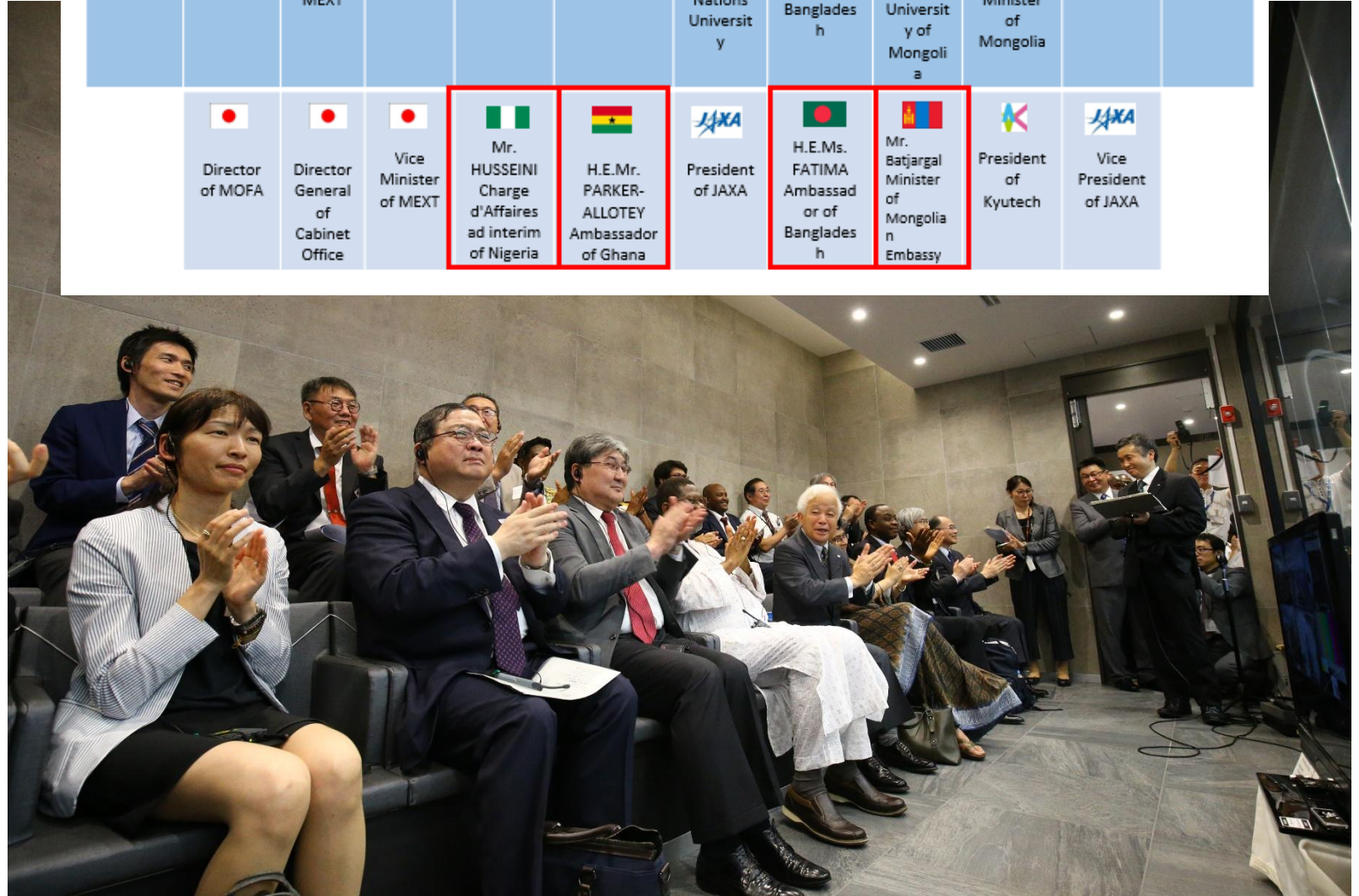
JAXA does a press conference after ISS deployments

This stuff has impact on non-space-faring nations

1 2 3 4 5 6 7

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. Dr. Okumura, President of JAXA
6. Dr. Oie, President of Kyutech
7. Vice minister of MEXT

Group Photo taken at the end of the evening
- BIRDS-1 Deployment Viewing, 7 July 2017
- JAXA's Tsukuba Space Center

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#8

Initiate BIRDS (n+1) Project 12 months after BIRDS (n) Project has started, so that each project overlaps the previous one by 12 months.

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BIRDS-1 (duration of 2 years)

Finished

Projects overlap by one year

BIRDS-2 (duration of 2 years)

Halfway done

BIRDS-3 (duration of 2 years)

Just started

BIRDS-4 (duration of 2 years)

Now canvassing for partners

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BIRDS-I (2015-2017)
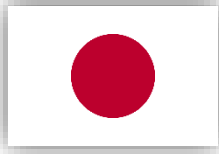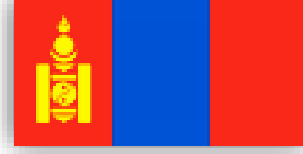
JAPAN   GHANA   MONGOLIA   NIGERIA   BANGLADESH   THAILAND   TAIWAN

BIRDS-II (2016-2018)

BHUTAN   MALAYSIA   PHILIPPINES
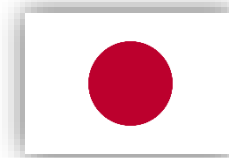
BIRDS-III (2017-2019)

JAPAN   Sri Lanka   Nepal

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This issue was released last week

BIRDS Project Newsletter

Issue No. 21 (25 October 2017)

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

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Kitakyushu, Japan

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

La SEINE

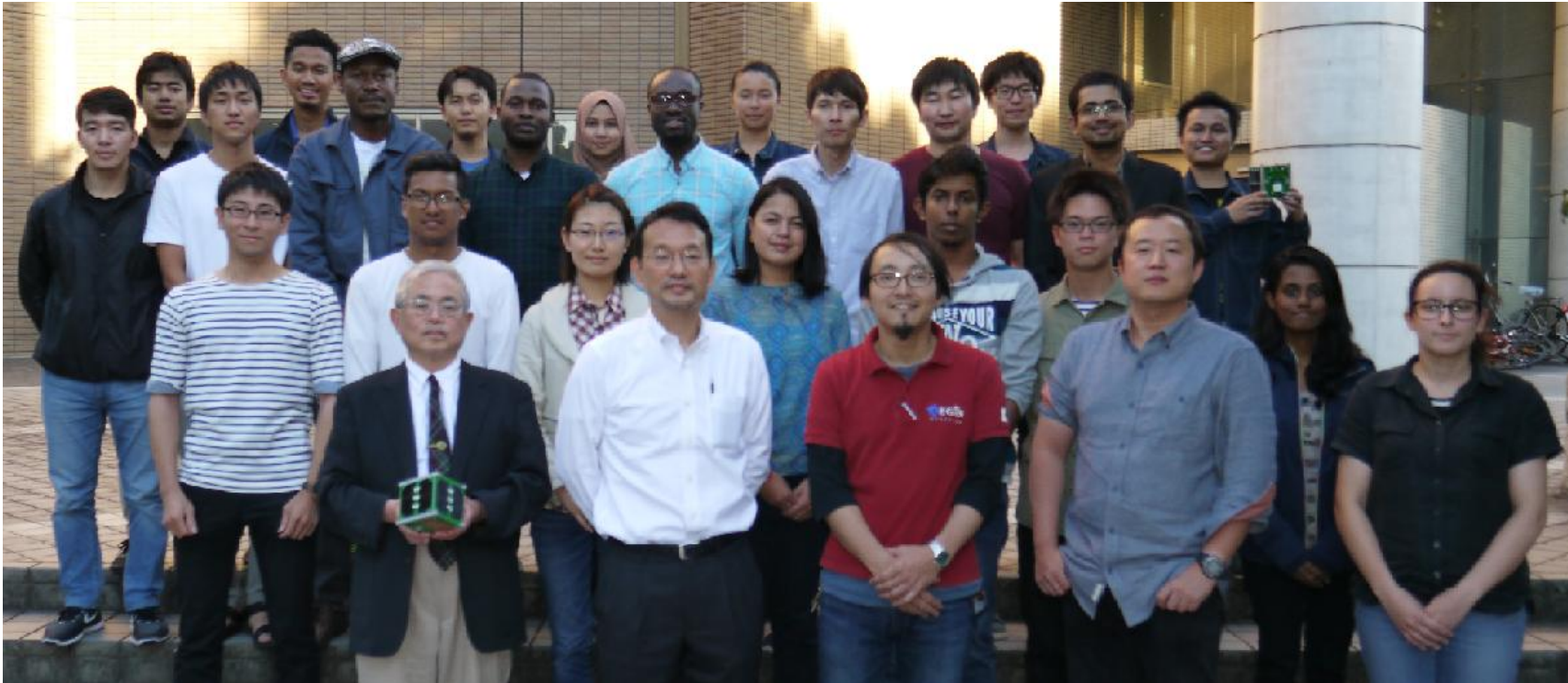Space Engineering International Course

OBJECTIVES OF THE NEWSLETTER

[1] Informs stakeholders of what is going on with the project – keep their confidence.

[2] Useful marketing tool – to get new partners – by providing photographic evidence.

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GEDC Airbus Diversity Award

The **BIRDS Project** won the 2017 GEDC (Global Engineering Deans Council) Airbus Diversity Award out of 45 entries from 18 countries.

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Thank you for your attention from the BIRDS Family

BIRDS   -1   -2   and   -3

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