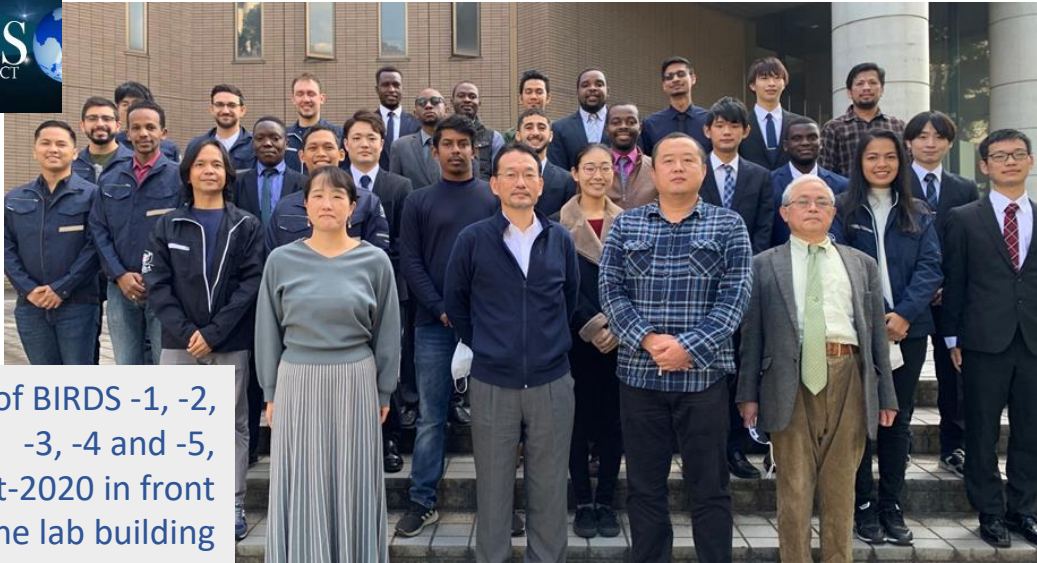




According to Bryce Space & Technology Co., among academic operators, Kyutech is No. 1 in number of small satellites launched



Members of BIRDS -1, -2, -3, -4 and -5, on 30-Oct-2020 in front of the lab building

**Archive website:** <http://birds1.birds-project.com/newsletter.html>

All back issues are archived at this website.

**Acknowledgment of support:** This newsletter is supported, in part, by *JSPS Core-to-Core Program, B. Asia-Africa Science Platforms.*

ISSN 2433-8818

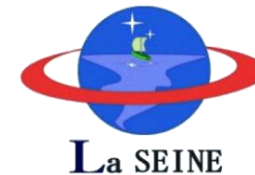
# BIRDS Project Newsletter

**Issue No. 71**  
(27 Dec. 2021)

*Edited by:*

G. Maeda

**革新的宇宙利用実証ラボラトリー**  
*Laboratory of **Lean Satellite Enterprises***  
*and **In-Orbit Experiments (La SEINE)***  
Kyushu Institute of Technology (Kyutech)  
Kitakyushu, Japan



All back issues of this newsletter can be easily downloaded.

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

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## From Sri Lanka The Guest Box



The [Aukana](#) Buddha statue is a religious sight to Sri Lankans. It is located in the village of Aukana near Kekirawa in north central province Sri Lanka. It is quite similar to near by [Sasseruwa](#) Buddha Statue. It was built by one person named Barana. It took nine years to complete. The statue which has height of more than 46 feet was carved out of a large granite rock face during 5th century.

The story behind the two statues mentions that they were built by a master and his pupil as a part of a competition between master and pupil. The story goes that the master constructed Aukana statue while the pupil made the Sasseruwa statue. The first to complete his statue had to notify the others by ringing a bell. Master (Barana) managed to complete Aukana statue first and won the competition.

-- Submitted by Chamaya (9-yr-old relative of Tharindu)

# *JSPS Reminder*

**When you publish a paper on a topic related to BIRDS, please include this acknowledgement in the paper:**

**This work was supported by JSPS Core-to-Core Program, B. Asia-Africa Science Platforms.**

**JSPS provides the airfare funds of BIRDS International Workshops and for Ground Station Workshops.**







## Ugandans were ecstatic when they saw the first satellite newscast

By OMARA Bonny

December 11, 2021





BY PAUL MURUNGI

Uganda has joined 12 African countries in the space technology race in a very big way by propping into orbit the first satellite dubbed – PearlAfricaSat-1 with expected launch in August 2022.

The PearlAfricaSat-1 is the latest mission from the Joint Global Multi-Nation Birds Satellite project, a multinational programme to help countries build their first satellite.

Numerous countries from across the globe including; Africa, Asia, and South America have benefitted from this programme.

The initiative to build Uganda's first satellite began in October 2019, as part of a directive by President Museveni to the Ministry of Science, Technology, and Innovation to put in place a National Space Agency and Institute.

The collaborative research agreement was signed with Kyushu Institute of Technology (Kyutech), Japan to enroll and upskill three graduate engineers to design, build, test, and launch the first satellite for Uganda.

Consequently, three Ugandan graduate engineers were successfully enrolled by Japan among them; Bonny Omara, Edgar Mujunu, and Derrick Tebuseke to undertake a cause that was envisaged to last for a period of two and half years.

# Ugandans were elated to see the first satellite newscast.



The first publication was made by the Uganda Media Group, shortly before the internet was launched, as well as local radio stations in Uganda and throughout Africa.



Newspaper snippet



# Uganda to Launch its First Satellite in 2022

By Joshua Faleti - December 8, 2021



Uganda's President Yoweri Museveni attends his swearing-in ceremony at the Independence grounds in Uganda's capital Kampala, May 12, 2016. REUTERS/Edward Echwalu - RTX2E18C

Uganda is preparing to launch its first satellite by August 2022. The satellite, PearlAfricaSat-1, is the latest mission from the Joint Global Multi-Nation Birds Satellite project. The initiative began in October 2019 as part of a directive by Uganda's President to develop a National Space Agency and Institute.

<https://africanews.space/uganda-to-launch-its-first-satellite-in-2022/>

# Bloggers



**Africa Facts Zone**  
December 8 at 8:31 PM · 🌐

UGANDAN SCIENTISTS COUNTDOWN TO FIRST SATELLITE LAUNCH 🇺🇬

Three Ugandan graduate engineers were successfully enrolled by Japan among them; Bonny Omara, Edgar Mujunu, and Derrick Tebuseke to undertake a cause that was envisaged to last for a period of two and half years.

Uganda has joined 12 African countries in the space technology race in a very big way by propping into orbit the first satellite dubbed – PearlAfricaSat-1 with expected launch in August 2022..... See more



Emmanuel Chagara, Nimal Fernandu and 409 others

112 Comments 46 Shares

**Mashoto Mash II**  
Congratulations Uganda  
Love from South Africa 🇿🇦  
Like · Reply · 3d

**Ashraf Ezz**  
Bravo Uganda. Soon to be a catalyst of East Africa development along with Somalia. 🙌 from Egypt  
Like · Reply · 3d · Edited

**ritetvug** @ritetvug · 4d  
UPDATE: Uganda has joined 12 African countries in the space technology race in a very big way by propping into orbit the first satellite dubbed – PearlAfricaSat-1 with expected launch in August 2022. For more 🖱️🖱️ [buff.ly/3GggLj4](https://buff.ly/3GggLj4)  
#RiteTVNewsUpdates  
#RiteTV



17 79 174

**OPILA THOMAS** @OpilaTho... · 3d  
Replying to @ritetvug  
Thus good and it show ugandan's seriousness in developing Africa

**Tito Okello** @Mabingwa26 · 4d  
Replying to @ritetvug  
This makes me more proud as a Ugandan.





Uganda's Space engineers at the centre of developing the satellite in Japan. A satellite is an artificial or man made object, which can be placed or deployed in orbit around the earth or another planet to collect information for communication. PHOTO/COURTESY

**SATELLITE TECH**

**Benefits**  
A satellite is an artificial or man made object, which can be placed or deployed in orbit around the earth or another planet to collect information for communication.  
With Uganda's satellite technology and capabilities developed, these services can be undertaken locally by Ugandans, at a lower cost, with better sovereign data security and sustainability plans, while providing employment to locally based scientists and engineers.

object, which can be placed or deployed in orbit around the earth or another planet to collect information for communication.  
Satellites generally consist of earth observation or remote sensing satellites, communication satellites, navigation and positioning satellites, and those for space exploration.  
For Uganda's case, Bonny Omara, a space scientist currently based in Japan, says Uganda is launching the first earth observation satellite into orbit. This means the country shall mark an end on dependency syndrome on foreign countries for satellite data which has been costing the country huge sums of money while compromising security and secrecy of the country.  
According to Omara, the core missions for PearlAfricaSat-1 are a multispectral camera payload which is the first to be

implemented amongst all satellites launched by African countries.  
The Multispectral Camera mission will provide not less than 20 metre resolution images for the country to facilitate analysis of water quality, soil fertility, and land use and cover.  
The satellite is expected to play a key role in the oil and gas operation by closely monitoring the East African crude oil pipeline, making accurate weather forecasts by collecting remote sensor data for predicting the occurrences of landslides, drought and infestation of pests and diseases.  
**Planned launch**  
A flight model- which is the actual satellite to be sent in space is in advanced stages of development. The satellite will undergo space environment tests in March 2022 to ensure that it survives

The Daily Monitor  
7 December 2021

**BIRDS-5  
Uganda  
is in the news.**

FREE EVERY TUESDAY WITH YOUR DAILY MONITOR DECEMBER 7, 2021

**Tech & innovation.** Scientists in countdown to Uganda's first satellite. **P.25**

**Business insights.** Do tax incentives influence start-up investments? **P.25**

**Interview.** We need to exploit the COMESA market more —Amb. Kabonero. **P.24**




# Prosper



## Reopening economy: Making it count

**Recovery plans.** The country is likely to still face a stop-start recovery until there is wider coverage of the Covid-19 vaccine to allow full reopening of the economy. **P.22-23**



**Appointment.** Dr Iyamulemye reappointed to head UCDA. Uganda Coffee Development Authority (UCDA) managing director, Dr Emmanuel Iyamulemye Niyibigira, has pledged to attain results for the coffee sub-sector following his reappointment. **P.26**



**Currency markets.** The local currency found support in a fairly stable market environment characterised by lack of vigour on the demand side against sufficient supply levels. Trading was confined in a tight range of 3550/60. **P.20**





## **Kyutech receives honors from the Government of Paraguay on 21 November 2021**

**Photo report by T. Wakabayashi**  
***International Affairs Division of Kyutech***  
**16 December 2021**

# Kyutech President receives the National Order of Merit "José Falcon" from the Republic of Paraguay

on 21st November (Sunday) at 18:30-19:30 hours at the official residence of the Ambassador of Paraguay to Tokyo

Dr. Yuji OIE, the President of Kyutech received the National Order of Merit "José Falcon" from H.E. Dr. Euclides ACEVEDO CANDIA, Minister of Foreign Affairs of the Republic of Paraguay who were visiting Japan.

The Merit was awarded for Kyutech's contribution for the success of Paraguay's first satellite named "GuaraniSat-1" which was developed by Paraguayan international students participating the "Joint Global Multi-Nations BIRDS Satellite Project (BIRDS-4)" at the Graduate School of Engineering of Kyutech; and was deployed from the International Space Station (ISS) Japanese Experiment Module "Kibo" in March this year supported by Japan Aerospace Exploration Agency (JAXA).



Figure 1: (Right) H.E. Dr. Euclides ACEVEDO CANDIA, Minister of Foreign Affairs of the Republic of Paraguay



Figure 2: H.E. Ambassador Raúl FLORENTÍN ANTOLA (right), Dr. Hiroshi YAMAKAWA, President of JAXA (left),



In his acceptance remarks, Dr. Yuji OIE stated that the honor of receiving the Merit should be shared with Prof. Mengu CHO for his remarkable commitment as the director/supervisor of the BIRDS Program and with the international students from Paraguay for their hard work with the BIRDS-4 project members to make the historic achievement of the 1<sup>st</sup> Paraguayan satellite (*GuaraniSat-1*).



Figure 3: Awarding remarks by the Minister ACEVEDO



Figure 4: Acceptance remarks by the President Yuji OIE



Dr. Yuji OIE also expressed his respect and sincere gratitude to the Republic of Paraguay, Agencia Espacial del Paraguay (AEP), and JAXA for their support for the project and acknowledgement of this Merit. He also stated that Kyutech would like to make further commitments to enhance Japan-Paraguay partnership development through not only the area of Space Engineering but also various areas of science and technology.

To celebrate this Award, there were 25 participants including JAXA staff, the officials of the Ministry of Foreign Affairs of Japan (MOFA), Ambassadors of Uruguay, Chile, Brazil, Ecuador, Mexico, and Argentina.



Figure 5: H.E. Ms. Melba María Pría Olavarrieta, the Ambassador of Mexico to Japan

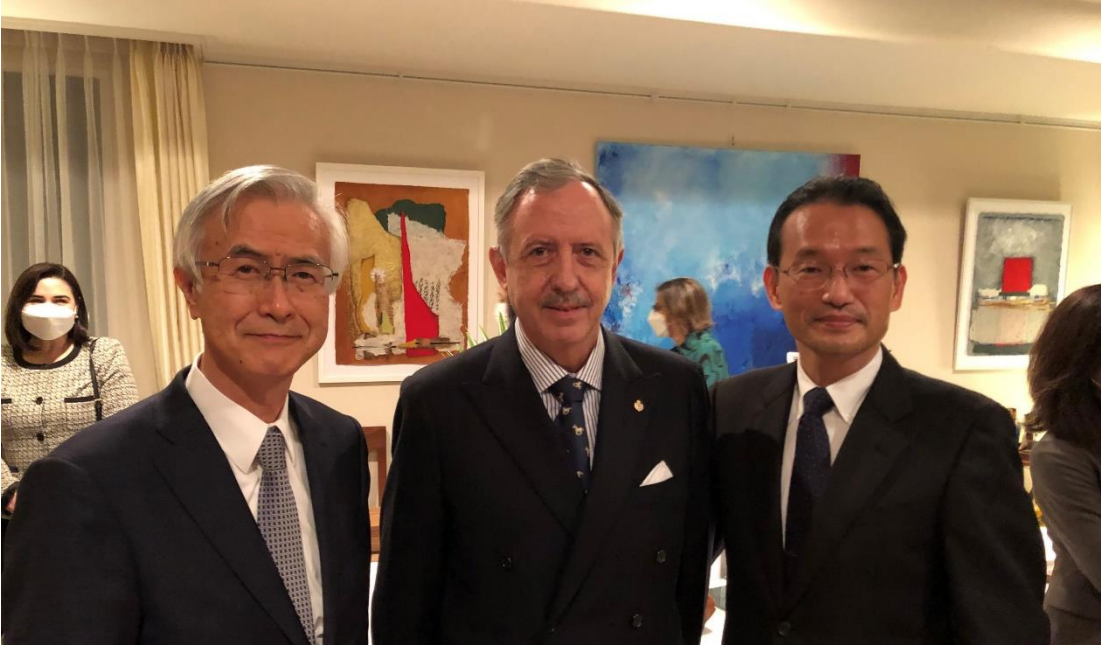


Figure 6: H.E. Mr. Guillermo Juan Hunt, Ambassador Designate of the Argentine Republic to Japan



The delegates from Kyutech were: the President Yuji OIE, Prof. Dr. Mengu CHO, Mr. Toshiro WAKABAYASHI of International Affairs Division (author of this photo report), and Kyutech international students from Paraguay (Mr. JARA CESPEDES Adolfo Javier, Mr. FRETES RUIZ DIAZ Esteban Rafael, Mr. MANABE SAFI Ariel Mazaru).



Figure 7: Prof. Mengu CHO (second from the left), and Mr. Adolfo JARA (third from the right)



Figure 8: Mr. Adolfo JARA gives the photo of Paraguay taken by the BIRDS-4 satellite to the Minister ACEVEDOH.E.



Figure 9: Kyutech's Paraguayan delegates



Figure 10: the National Order of Merit "José Falcon"



*The Ceremony ended with beautiful music played with Paraguayan traditional instruments*

**END OF THIS PHOTO REPORT**



## 03. Also mentioned at Kyutech's website

### パラグアイ共和国より国家功労勲章が授与されました

更新日:2021.11.25

2021年11月21日、本学の尾家祐二学長が、訪日中のパラグアイ共和国外務大臣・エウクリデス・ロベルト・アセベド・カンディア閣下より、「ドン・ホセ・ファルコン」国家功労勲章を授与されました。

本学の超小型衛星開発プロジェクト「BIRDSプロジェクト」を通じて開発され、今年3月に宇宙航空研究開発機構(JAXA)により国際宇宙ステーション(ISS)「きぼう」日本実験棟から放出された、パラグアイ共和国にとって歴史上初となる衛星「GuaraniSat-1」によって、同国への功績と貢献が認められ、今回の受章となりました。BIRDSプロジェクトの責任者である、本学・大学院工学研究院/宇宙システム工学研究系の趙孟佑教授及びGuaraniSat-1の開発に成功した本学のパラグアイ人留学生らも同席し、この名誉ある受章の喜びを分かち合いました。

尾家学長は受章の挨拶で、パラグアイ共和国、パラグアイ宇宙機構、及びJAXAの関係者への敬意、そして感謝の意を表するとともに、今後は宇宙工学のみならず、様々な科学技術分野において日本とパラグアイの更なる友好関係の強化と発展に協力する考えを表明しました。



国家功労勲章の授与(右:アセベド・パラグアイ共和国外務大臣)



国家功労勲章證書の授与

### Kyutech President receives the National Order of Merit "José Falcon" from the Republic of Paraguay

Update:2021.11.25

On 21st November, Dr. Yuji OIE, the President of Kyutech received the National Order of Merit "José Falcon" from H.E. Dr. Euclides ACEVEDO CANDIA, Minister of Foreign Affairs of the Republic of Paraguay who were visiting Japan.

The Merit was awarded for Kyutech's contribution for the success of Paraguay's first satellite named "GuaraniSat-1" which was developed by Paraguayan international students participating the "Joint Global Multi-Nations BIRDS Satellite Project (BIRDS-4)" at the Graduate School of Engineering of Kyutech; and was deployed from the International Space Station (ISS) Japanese Experiment Module "Kibo" in March this year supported by Japan Aerospace Exploration Agency (JAXA).

In his acceptance remarks, Dr. Yuji OIE expressed his respect and sincere gratitude to the Republic of Paraguay, Agencia Espacial del Paraguay (AEP), and JAXA for their support for the project and acknowledgement of this Merit. He also stated that Kyutech would like to make further commitment to enhance Japan-Paraguay partnership development through not only the area of Space Engineering but also various areas of science and technology.



(Right) H.E. Dr. Euclides ACEVEDO CANDIA, Minister of Foreign Affairs of the Republic of Paraguay



Awarding remarks by the Minister ACEVEDO

<https://www.kyutech.ac.jp/whats-new/topics/entry-8679.html>

<https://www.kyutech.ac.jp/english/en-news/topics/entry-8678.html>



**On the occasion of Kyutech receiving the National Order of Merit "José Falcon" from the Republic of Paraguay, the Head of the Paraguayan Space Agency (AEP) issued this letter (dated 21 Dec 2021) to Kyutech President Oie.**



**GOBIERNO NACIONAL**

*Paraguay de la gente*

*Presidencia de la República - Agencia Espacial del Paraguay*

21 December 2021.

*Nota AEP N° 654/21*

*Dear  
Mr. Yuji Oie  
Kyushu Institute of Technology (KYUTECH)  
Japan*

*The Paraguay Space Agency greets and congratulates you on receiving the Order of Merit "José Falcón" conferred by the National Government of the Republic of Paraguay and delivered by His Excellency Mr. Euclides Acevedo, Minister of Foreign Affairs of our country.*

*This great event reinforces the commitment between our institutions to continue working for greater collaboration and provide more and better opportunities for our young people.*

*The Paraguay to Space Project with GuaraniSat-1 is a success, for which AEP is very grateful, and I hope that AEP and KYUTECH continue working together on this and other projects, to achieve high institutional goals and strengthen space science and technology in our country. To move forward in the field of space cooperation, the AEP representatives who will be in contact with Kyutech, are:*

- General Director of Development Aerospace: Alejandro José Román Molinas. [aroman@aep.gov.py](mailto:aroman@aep.gov.py). +595971205095.*
- General Director Legal and International Affairs: Hebe Luisa Romero Talavera. [hromero@aep.gov.py](mailto:hromero@aep.gov.py). +595981866521.*

*In the hope of being able to count on your distinguished collaboration, I take this opportunity to greet you with the highest consideration. Happy year 2022 for all of Japan.*



*Cnel DEM (R) Liduvino Vielman Díaz  
Minister  
Head of Paraguayan Space Agency*

Avda. Mcal. López y 22 de Setiembre, bloque B, piso 7  
Email : [info@aep.gov.py](mailto:info@aep.gov.py)  
Web : [www.aep.gov.py](http://www.aep.gov.py)

Asunción - Paraguay  
Tel.: +595 212490242

## 04. Paraguay's first satellite, GuaraniSat-1

ラテンアメリカ時報 2021年夏号(表紙カバー)



Issue No. 1435  
Summer of 2021

Paraguay's  
first satellite,  
"GuaraniSat-1"

### 特集 変貌を遂げる南米内陸国パラグアイ

- ◆ パラグアイ外交概観 -対南米二大国、対米関係及び台湾承認国の現状- 頼信 幸枝
- ◆ パラグアイにおけるカルテス政権以降の政治経済情勢 磯田 沙織
- ◆ パラグアイにおける農牧業の概況 -大豆産業を中心に- 林 瑞穂・下保 暢彦
- ◆ パラグアイの牛肉生産の現状と展望 -可能性を秘めた畜産大国- 林 英二郎
- ◆ 南米のヘソパラグアイ -変わりゆくビジネス環境 田中 クリスティーナ
- ◆ パラグアイの経済および社会開発のための協力について 福井 康
- ◆ パラグアイ初の人工衛星“GuaraniSat-1” 趙 孟佑
- ◆ 内陸国パラグアイは南米大陸横断回廊の恩恵を享受できるのか? -建設工事の現状とパラグアイの主要な輸出先に着目して- 小谷 博光
- ◆ パラグアイ COPANI 大会 -次世代へのエールをアルベルト 松本
- ◆ パラグアイにおけるグアラニー語教育の制度化とその課題 -新世代への新しいアプローチに向けて- 藤掛 洋子

In 2021, the *Japan Association of Latin America and the Caribbean* published this summer issue of its main publication: *ラテンアメリカ時報*. It contains an article about Paraguay's first satellite – and it was written by Prof Cho in Japanese. It is reprinted on the following pages. English and Spanish translations were published in Issue No.70 of the *BIRDS Project Newsletter*.

# パラグアイ初の人工衛星「GuaraniSat-1」

九州工業大学 革新的宇宙利用実証ラボラトリー 趙孟佑

## 1 はじめに

2021年3月14日、国際宇宙ステーション(ISS)の日本実験棟「きぼう」から、人工衛星「GuaraniSat-1」が放出され、パラグアイにおかれた地上局にて衛星からの電波を受信した(図1)。衛星のサイズは10cm x 10cm x 10cmと小さいが、パラグアイにとっては自国初の人工衛星が放出された歴史的瞬間であった。GuaraniSat-1は、国立大学法人九州工業大学(北九州市、以下九工大)がパラグアイ宇宙機関(AEP, Agencia Espacial del Paraguay)およびフィリピン大学ディルマン校(UPD, University of the Philippines Diliman)と共同開発したBIRDS-4衛星3基のうちの一つである。本稿では、パラグアイ初の人工衛星実現に至った経緯と、同国にとって本衛星がもつ意義について簡単に述べたい。



図1 ISSから放出されるBIRDS-4衛星(右から2番目~4番目。GuaraniSat-1は4番目)(写真提供:宇宙航空研究開発機構(JAXA))



## 2 BIRDSプログラムとは

2000年代に入ってから、超小型衛星の開発・利用が世界中に拡まった。超小型衛星の特徴は、従来の衛星が「厳しい宇宙環境でも絶対に動く」ことを至上命題として開発されてきたことに対して、少々の失敗を許容してでも安く・早く衛星を作ることを目指している点にある。個々の衛星は失敗するかもしれないが、教訓を取り入れた次号機をすぐに打ち上げて信頼性をあげていく戦略をとっており、従来の衛星が宇宙用の非常に高価で長納期の部品で作られているのに対して、安価・短納期の民生用部品を多用している。今では1年間に200基を超える超小型衛星が世界で打ち上げられている。超小型衛星、特に10cm立方のサイズで規格化されたいわゆるCubeSatは、宇宙開発・利用への技術的・金銭的参入障壁を大きく下げることにより貢献し、これまで宇宙とは縁遠かった大学・企業・国が宇宙参入を果たすための格好のツールとなっている。特に、途上国・新興国でCubeSatを使った宇宙参入が盛んであり、パラグアイはその29番目である。ラテンアメリカでは、コロンビア(2007年)、エクアドル(2013年)、ペルー(2013年)、ウルグアイ(2014年)、コスタリカ(2018年)、グアテマラ(2020年)といった国々がCubeSatによる宇宙参入を果たしている。このうちコスタリカとグアテマラの衛星は衛星の開発や打ち上げを日本が支援した。

途上国・新興国の中では、超小型衛星を通じた宇宙能力構築のための人材育成への強い需要がある。九工大は、2010年に開設した超小型衛星試験センターのインフラを活用したハンズオン教育を行うべく、2011年から国連宇宙部と連携した留学生事業を始めた。2013年からは大学院に宇宙工学国際コース(SEIC)を開設し、途上国・新興国の宇宙能力構築育成に本格的に乗り出した。

そのような中、2015年度10月にJoint Global Multi-Nation Birds (略称 Birds)プログラムを立ち上げた。Birdsプログラムの目的は、「各国初の衛星を成功裏に打ち上げ、運用することにより、独立した持続可能な宇宙プログラム形成の第一歩とする」ことである。衛星開発を担うのはSEICに在籍する大学院生である。衛星プロジェクトの最初から最後までの一連のプロセスを学び、帰国後は母国にて宇宙教育・研究プロジェクトを立ち上げる人材となることを狙っている。

衛星プロジェクト	開始	軌道投入	衛星数	参加国・地域（下線は衛星の所有国）
BIRDS-1	2015/10	2017/7	5	日本、 <u>ガーナ*</u> 、 <u>モンゴル*</u> 、 <u>ナイジェリア</u> 、 <u>バングラデシュ*</u> 、 <u>タイ</u> 、 <u>台湾</u>
BIRDS-2	2016/11	2018/8	3	日本、 <u>ブータン*</u> 、 <u>マレーシア</u> 、 <u>フィリピン</u>
BIRDS-3	2017/10	2019/6	3	日本、 <u>スリランカ*</u> 、 <u>ネパール*</u>
BIRDS-4	2018/11	2021/3	3	日本、 <u>パラグアイ*</u> 、 <u>フィリピン</u>
BIRDS-5	2020/7	2022(予定)	3	日本、 <u>ジンバブエ*</u> 、 <u>ウガンダ*</u>

## 表 BIRDSプログラムの概要



BIRDSプログラムは、各世代毎に全く同じ設計の複数の衛星を作り、これまでに5世代の衛星プロジェクトを実施している(表1)。プログラムの短期的目標は、衛星を実際に作って運用し、学生達に「やればできる」という自信を与えることである。しかし、それだけでは充分ではなく、学生達が母国に帰ったときに彼ら自身の宇宙プログラムを始められることを確実にしなければならない。その意味では、学生達が母国に帰ったあとで、第2号の衛星を開発し運用できたところがプログラムの成功である。そのため、学生達に衛星プロジェクトの全プロセスを学ばせることを企図している。学生達は、衛星開発の各フェーズで何が必要か、どのような決断を下さないといけないか、どのようにして決断をくだすか、どのようにしてリスクを評価し対処するか、といったことを学ぶ。

BIRDSプログラムは、宇宙教育・研究に関する多国間ネットワーク(BIRDSネットワーク)の形成を目指している。このネットワークは、人的ネットワークと地上局ネットワークの二つから成る。学生達は、2年間の集中的な衛星プロジェクトを通じて、宇宙プロジェクトにおけるチームワークと協同作業の大事さを骨身に刻み込む。BIRDSプロジェクトを通じて築きあげた人的ネットワークは、揺籃期の宇宙プログラムが試練を乗り越えていく上で大きな助けとなりうる。地上局ネットワークは、多国間ネットワークの背骨となるものである。地上局ネットワークを通じて、各機関が衛星をもっていなくても、パートナーの衛星の運用に参加することで宇宙教育・研究を実施することができる。

BIRDSネットワークの活動は学術振興会の研究拠点形成事業の支援を受けて行われており、ラテンアメリカからはコスタリカとパラグアイが加わっている。その他、BIRDSプログラムの詳細は、月1回発行のBIRDSニュースレター(電子版, <https://birds1.birds-project.com/newsletter.html>)でも発信中である。

### 3 パラグアイ参加の経緯とBIRDS-4プロジェクト

超小型衛星による宇宙参入はラテンアメリカ諸国で活発に行われており、2017年時点で南米の主要国で宇宙参入を果たしていないのはパラグアイだけであった。2018年4月に九工大の前田助教がアルゼンチンを訪れ、コルドバにてセミナーを行った。セミナー終了後に、パラグアイから参加した若い技術者(このセミナーのためにアスンシオンからバスに乗ってやってきた)がAEPのAlejandro Román局長の名刺を渡し、「パラグアイでも小型衛星を用いた宇宙参入に興味をもっているので連絡が欲しい」という伝言を残していった。

前田助教が帰国後にRomán局長に連絡をとったところ、同年6月にウィーンで開催される国連宇宙部のUNISPACE+50にAEPがLiduvino Vielman Díaz 長官をはじめとする代表団を送るので、そこで打ち合わせをしましょうということになった。同会議には趙も出席しており、会期中にBIRDSプログラムや九工大の教育プログラムについてじっくりと話し合う時間をとることができた(図2)。

その後話が加速し、7月末にはBIRDS-4への参加が決まり、11月初旬にはAEPからAdolfo Jaraが九工大に派遣された。パラグアイとフィリピンの学生が揃ったこともあり、BIRDS-4プロジェクトが11月12日に正式に始まった。なお、パラグアイからはもう1名の技術者Anibal Mendozaが2019年3月に来日し、両名ともに4月から九工大大学院に入学している(図3)。





図2: 2018年6月のウィーンでの初会合(右端が著者、その隣がLiduvino Vielman Díaz 長官)



図3: AEPから九工大に留学した Anibal Mendoza (右) と Adolfo Jara(左)

BIRDS-4はGuaraniSat-1を含む3基のCubeSatにより構成されている。3基の衛星は全て同一の設計である。2018年11月12日にプロジェクトを開始した後、2020年10月6日に筑波宇宙センターに衛星3基(図4)を納入した。わずか10cm立方の小さな衛星にできることは限られているが、今後の宇宙利用に活かせるような実験を行う予定である。それ以外にも、一般の人々に宇宙を身近に感じてもらえるように、軌道上から撮影したパラグアイやフィリピンの写真を公開する予定である。BIRDS-4で実施する実験の一つに、Store&Forward実験がある。これは、地上の端末から送信されたデータを一旦衛星内のメモリに蓄え(Store)、衛星が地上局上空に来た時にデータを転送(Forward)するというものである。BIRDS-4ではアマチュア無線免許さえあれば誰でも参加できる。地上の端末は手のひらにおさまる程度の小ささであり、多くの応用が期待される。例えば、AEPが考えている実験では、僻地の農村部にシャーガス病を媒介するサシガメと呼ばれる虫を捕らえる罠を仕掛け、捕らえられた虫の数を電波で衛星に伝えることを計画している。フィリピンでは、離島からの気象データを送る実験を考えている。



図4: BIRDS-4衛星のフライトモデル



BIRDS-4衛星は、パラグアイ時間で2021年2月20日13時36分に米国ワロップ島からシグナス15号機によりISSに向かって打ち上げられた。人口700万人のパラグアイで290万人がこの打ち上げのTV中継を見たと言われている。その後、3月14日のパラグアイ現地時間で朝7時にISSから放出された。BIRDS-4衛星はISSから放出されてから30分後にビーコン信号の送信を開始し、パラグアイ局を始めとする世界各地のアマチュア無線局で3基全ての衛星からの電波受信をすることができた。BIRDS-4衛星の運用は現在も継続して行われており、電波免許が正式に交付された後にデータを公開していく予定である。

#### 4 今後への期待

GuaraniSat-1により、パラグアイもついに宇宙参入を果たしたが、これは最初の一歩に過ぎない。速やかに2号機の衛星開発に着手し、BIRDS-4プロジェクトで得られた勢いを途切らせることなく、宇宙開発・利用を進めていって欲しい。超小型衛星であれば、自国のニーズに沿った衛星を自前で安価に開発・運用することができ、使ったお金以上の恩恵を人々の生活向上や経済の発展にもたらすことが可能である。

農業国であるパラグアイにとって、農業への衛星データ（画像や土壌センサーデータ等）の利用は大きな可能性を秘めており、超小型衛星で取得したデータであっても十分に利用可能である。また、通信インフラが脆弱な僻地での気象・環境・防災データをStore&Forwardにより収集したり、BIRDS-4衛星でも試しているような伝染病対策にも使える。これらの衛星データを自前で取得し、自前で解析し、人々の生活向上に役立てるというサイクルを自らで回していくことで、より大規模の宇宙利用へのステップを確実に登っていくことができる。そのために何よりも必要なのは宇宙を使ってできること、宇宙を使うために必要なことを理解した人材である。超小型衛星はプロジェクトを早く安く回していくことができ、そのような人材育成には最適なツールである。九工大には、先にあげた2名に加えて、さらに2名の留学生がAEPから送られてきており、現在BIRDS-4衛星の運用や別の衛星プロジェクトに参加したりしている。今回のBIRDS-4衛星でできた縁を大切に、今後パラグアイの宇宙プログラムの発展の手助けをするとともに、日本・パラグアイ共同での衛星プロジェクトなどを進めていきたいと思っている。

**THE END**

# 05. Highlighting Japan: The Charms of Japan's Islands

HIGHLIGHTING  
**Japan**

**November 2021**

The Charms of Japan's  
Islands



## No. 162 (November-2021)

\*\*\*\*\*

November 2021 edition of *Highlighting Japan* is now available.

Japan is not connected to a continent, and the entire country is composed of islands. Many of them are characterized by their rich biodiversity and unique culture, and some have been inscribed as UNESCO World Heritage Sites for these reasons. In this month's issue, we take a look at some of the beautiful and diverse islands of Japan.



**GO HERE TO DOWNLOAD THE PDF OF ISSUE NO. 162**

<https://www.gov-online.go.jp/eng/publicity/book/hlj/20211101.html>

**Feature** THE CHARMS OF JAPAN'S ISLANDS

Omura Beach on Chichijima Island, one of the Ogasawara Islands  
Photo: Courtesy of Ogasawara Village Tourism Bureau

Yellow daylilies on the cliffs of Sado Island  
Photo: Courtesy of Niigata Prefectural Tourist Association

**THE CHARMS OF JAPAN'S ISLANDS**

A cat takes a leisurely stroll on Tashirojima, "Cat Island"  
Photo: Courtesy of Tohoku Tourism Promotion Organization

View from the summit of Mt. Misen overlooking islands in the Seto Inland Sea  
Photo: dhaba.PIXTA





## 06. IAA Latin American Symposium on Small Satellites - Quito - March 2022

Subject: IAA Latin American Symposium on Small Satellites - Quito - March 2022  
From: Livio Rafael Gratton <gratliv\*iit.edu>  
Date: 2021/12/11

Estimada/o Colega (\*English text is at the right\*):

Quería agradecerle su participación y/o interés en las ediciones anteriores del Simposio Latinoamericano de la Academia Internacional de Astronáutica sobre Pequeños Satélites, organizados en Argentina, y pedir su apoyo para el tercer evento, que tendrá lugar en Quito, en marzo próximo:

<https://www.sideralisfoundation.org/iaa2022la>

La fundación Sideralis, con el apoyo de EXA y otros organismos ecuatorianos están realizando un gran esfuerzo para organizar un evento exitoso y productivo. Este año será de carácter conjunto, con el Workshop de Cubesats, que se venía realizando en Brasil desde el año 2015.

Contamos con su colaboración en la difusión del evento, y estamos ansiosos por recibir sus abstracts para enriquecer las sesiones técnicas con sus ideas y logros.

¡Esperamos verla/o en Quito!

Livio Gratton  
Co-Chairman

Dear colleagues:

I want to thank you for your interest/participation in the past International Academy of Astronautics Latin American Symposia on Small Satellites in Argentina, and ask for your support for the 3rd edition, to take place next March, in Quito, Ecuador:

<https://www.sideralisfoundation.org/iaa2022la>

The Sideralis Foundation, with the support of EXA and other Ecuadorian organizations, are making a big effort to host a great event. This time it will be done jointly, with the Cubesat Workshop, organized before in Brazil since 2015.

We count on your collaboration in sharing this information with other experts, and we are eager to receive your abstract to enrich the technical sessions with your ideas and achievements.

We hope to see you in Quito!

Livio Gratton  
Co-Chairman



# KITSUNE Delivery to JAXA

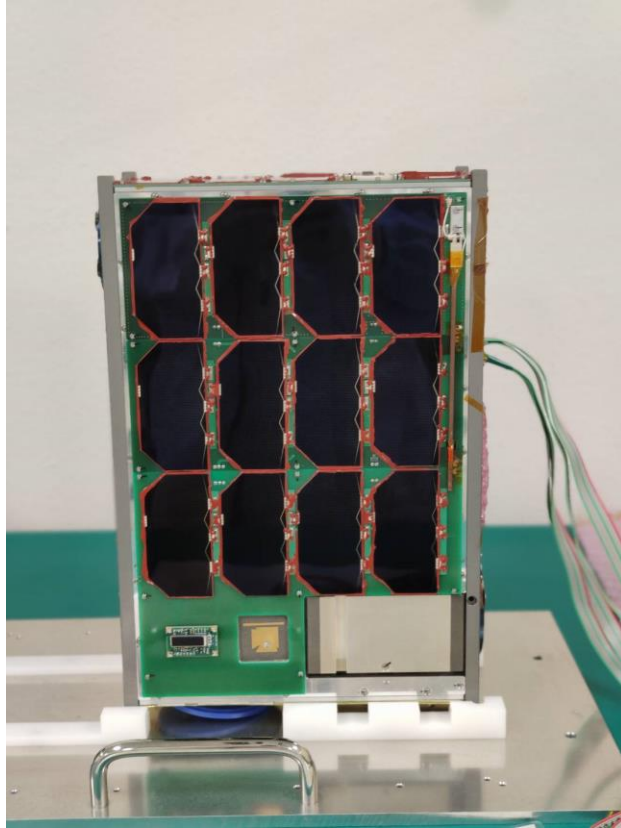


by Pooja Lepcha (PNST, Phd, Bhutan)

November 18<sup>th</sup>, 2021

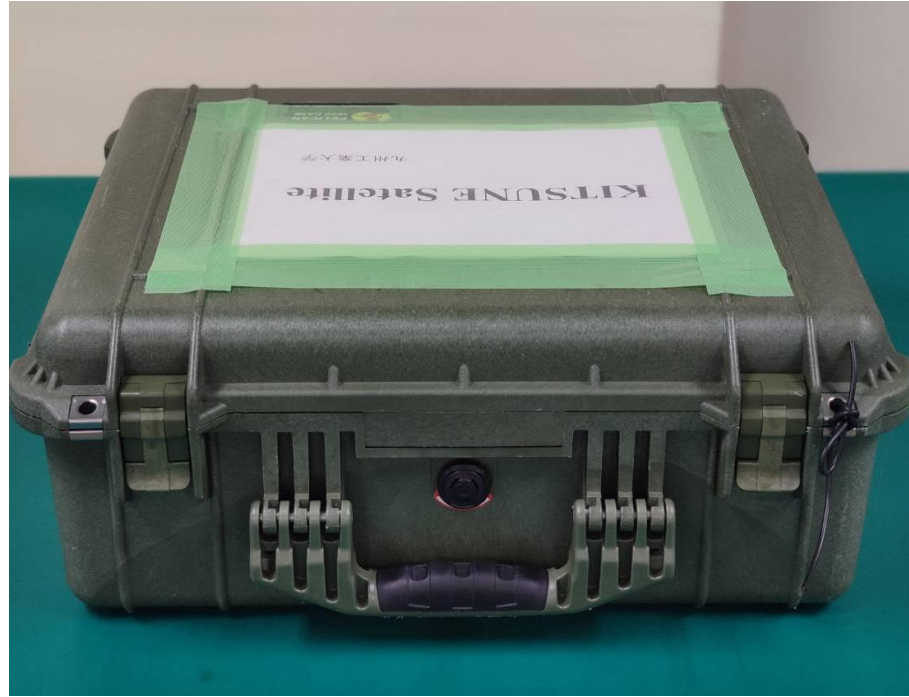


# Satellite preparation before delivery



The satellite's battery was fully charged and memories for all the PIC were reinitialized by the software team for both main bus and SPATIUM II.

# Satellite preparation before delivery



Tobata Campus  
(destination JAXA@Tsukuba)

The satellite was then packed into a protective case and safely packed into a Pelican case. The satellite was picked up by a trucking company (shown above).



# Day 1 Target: Reaching Tsukuba Station



Necmi and I started early in the morning from Kokura



This was our Shinkansen



Arrival at Tsukuba Station



We stopped briefly in Tokyo station for lunch before heading to Tsukuba





# Day 2 Target: Delivering KITSUNE



We started the day early with a *hearty* breakfast. We took a taxi from Tsukuba station to JAXA Space Center.



When we arrived at JAXA, the truck carrying KITSUNE also arrived at the same time



Necmi carrying KITSUNE satellite @JAXA



# Day 2 Target: Delivering KITSUNE



We were led inside JAXA clean room and fit check was performed. It was an exhilarating experience when HTV engineers brought the actual JSSOD POD and performed fit check with KITSUNE.

We completed the delivery procedure and bid final farewell to KITSUNE after having worked on it for almost 2 years.





# Visiting the Space Dome



As I was already at JAXA center, I thought it would be a good experience to visit the space dome. Due to COVID restrictions, they allowed visitors only with reservations made at least a month before. Thankfully, I was allowed to enter despite not having made a reservation.

It was an amazing experience to see actual size satellite models that were developed by JAXA.



**End of Pooja's Photo Report**





# UiTMSAT COLUMN

Column No. 24

## 08. Column #24 from Malaysia

Editor: FATIMAH ZAHARAH BINTI ALI ([ali.fatimahzaharah@gmail.com](mailto:ali.fatimahzaharah@gmail.com))  
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UNIVERSITI  
TEKNOLOGI  
MARA

*UiTM Sentiasa Di Hatiku  
"UiTM Always in My Heart"*

## A VISIT TO FIG FARM FOR GST INSTALLATION PLAN

**A**S an initiative to expand the application of ground sensor terminal (GST), UiTM team has conducted a visit to a fig farm located in Selangor, Malaysia, in order to see the potentiality to support the existing system of the vegetation process through a satellite technology. The visit has been done together with a local startup company as a collaborator in the ground sensor project. The fig farm belongs to a local agriculture company that offers opportunity to researchers to provide any prospective advancement for smart plant monitoring system.

GST is one of technologies that can be used for smart plant monitoring. Through the satellite's transmission network, the data collected by GST can be transmitted to the ground station located far away from the farm. The data collected by GST will be a sensor data measuring the health status of the plant.



By having the data from GST, operator(s) at the ground station can analyze the received parameters to see any anomalies (detection process) for further action to be taken. The process can reduce the number of times for



a personnel to visit the farm, thus, reduce the cost and time as well. GST is an application that can effectively complement the existing system used at the farm by providing an early monitoring data through the transmission of satellite's signal.

The fig farm that we have visited is using a greenhouse farming practice, as shown in the pictures here. With the conditions of the plants in the greenhouse, it seems possible to install the ground sensor to monitor any crucial parameters such as soil moisture, temperature, and NPK level.



As explained by the owner of the farm, the fig tree requires dry and hot weather to survive, though frequent fertilization and watering are needed to ensure the fruit production and healthy plant.

The pictures here show the condition of a fig tree with fruits in a greenhouse. The fig trees here were pruned regularly to ensure the trunk does not overgrow and aggravate the personnel to harvest the fruits.

There is an irrigation system that provides constant water and fertilizer to the plants in each of the greenhouse. However, with smart monitoring system, it can reduce the cost of the vegetation process by providing an adequate data on when and how much water and fertilizer needed for each of the plants.

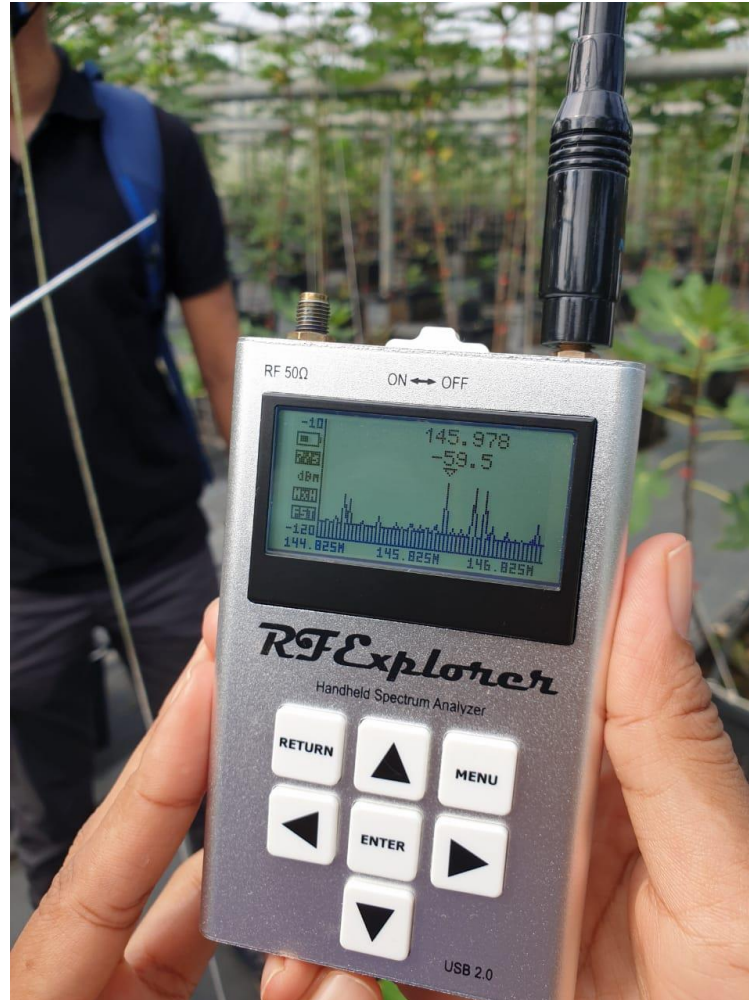






The picture on the left shows the condition on how each of the fig trees acquire the water and fertilizer for the soil.

During the visit, we have conducted a test to see the possibility to use the



frequency of GST's antenna such as LoRa and VHF band. The test was conducted using the handheld spectrum analyzer named as RF Explorer. The instrument showed that at some areas at the fig farm, the frequencies within the set range are currently used as the gain obtained were quite high. Thus, it is not advisable to install the GST at that particular areas to avoid any unwanted interference. The location of the GST installation was determined during the visit including on where the solar power system and antenna will be located to ensure a success signal transmission.





The visit to the fig farm was very fruitful in which a lot of inputs and information were gathered and exchanged in order to ensure the success of the GST installation and process. The visit did not just end at the fig farm. We continued our site visit activity to an oil palm plantation located near to the fig farm. This visit will be covered in the next issue.

**End of Malaysia's  
Column for this  
month**



# UPDATES FROM THE PHILIPPINES



Philippine  
Space  
Agency

*STAMINA4SPACE*

Space Technology and Applications Mastery, Innovation and Advancement  
(STAMINA4Space) Program

Funded by:



Monitored by:



Implemented by:



DECEMBER





**Philippine  
Space  
Agency**

**PREPARED BY:**

*Public Relations and  
Information Division  
Philippine Space Agency*

## 4th Space Council meet, bolster inter-agency cooperation for SSTA in PH

4th Philippine Space Council Meeting 07 December 2021



Members of the Philippine Space Council (PSC) convened for the 4th Philippine Space Council Meeting on 07 December 2021. The meeting was hosted by the Philippine Space Agency (PhilSA) as council secretariat, and was conducted in a hybrid set-up.

The meeting tackled updates on PhilSA's build-up of a local knowledge workforce, expansion of the local space industry, updates on international cooperation efforts, and SSTA policies.

The PSC acts as the principal advisory body for the coordination and integration of policies, programs and resources affecting space S&T applications.

<https://philsa.gov.ph/news/4th-space-council-meet-bolster-inter-agency-cooperation-for-ssta-in-ph/>



## PhilSA's first institutional video seeks to inspire the next generation

The Philippine Space Agency (PhilSA) released its first institutional video on the occasion of the 4th Philippine Space Council (PSC) meeting.

The video seeks to inspire the next generation, young girls most especially, to seriously consider Science, Technology, Engineering, and Mathematics (STEM), and working with PhilSA in their life decisions. In the future, we hope to contribute to closing the gender gap in the space sector—an industry that flourishes with innovation. Innovation, as we know, is further nurtured by diversity and representation.

Read more:

<https://philsa.gov.ph/news/philippine-space-agency-institutional-video/>



Screen grabs from: <https://youtu.be/aqV5NfN3v0Y>



## PhilSA launches AD ASTRA Scholarships

The PhilSA is inviting Filipino students to apply for the Advanced Degrees for Accelerating Strategic Space R&D Applications (AD ASTRA) Scholarships Program.

PhilSA AD ASTRA Scholarships are open to students who have completed their Bachelor's degree and are pursuing postgraduate studies in space science, technology, and applications (SSTA) and its allied fields in local or international higher educational institutions (HEIs). Applicants may apply for full, partial, lateral, or sandwich program scholarships.

The full guidelines, eligibility, and requirements are here: <https://philsa.gov.ph/news/philsa-advanced-degrees-for-accelerating-strategic-space-rd-and-applications-philsa-ad-astra-scholarships>



Philippine  
Space  
Agency

# AD ASTRA

## Scholarships Program

Open to Filipinos pursuing postgraduate studies in space science, technology, and applications

### Deadlines for Applications:

15 December 2021 (1st batch)

02 May 2022 (2nd batch)





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## Meeting for the 1st time!

Due to the pandemic, access to laboratories has been limited. Most activities have been done remotely, including engaging new team members. For the first time, by coincidence, the STeP-UP Project technical team were all present in the laboratory on this particular day. This makes this the tech team's first complete team photo during the pandemic. Hello to our new members, Xio, Lance, and Regi, and also wishing JP all the best as he prepares to leave for his studies in Kyutech.

Capping the day with a burger treat care of our STeP-UP Project Leader, Sir Paul Jason Co!

Thanks, SIR PJ!!!





# Knowledge Sharing



Photos courtesy of UST Applied Physics Society

Researchers from our Ground Receiving, Archiving, Science Product Development and Distribution (GRASPED); Matthew Medrano and Cara Canlas, presented in the University of Santo Tomas (UST) Applied Physics Society's webinar "Ad Astra Per Aspera: A Webinar About Satellite Development and Earth Observation"!



Photos courtesy of DOST PCIEERD

The STAMINA4Space Program was also a part of the 2nd virtual conference of the National Research and Development Conference 2021 last November 17 and was represented by our Program Leader, Dr. Maricor N. Soriano.





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Let's t@lk!

MAYA-3 AND MAYA-4 CUBE  
SATELLITE



## TEEECHTalks: Maya-3 and Maya-4: A Bird's Eye View

On November 25, 2021, two (2) members from the STeP-UP Batch 1 Scholars participated in the technology workshop dubbed "TEEECHTalks" hosted by the UP-Electrical and Electronics Engineering Institute (UP-EEEI). Derick and Renzo provided a talk on their experiences in the development of Maya-3 and Maya-4.

TEEECHTalks aims to share how space technology development works, and the kind of disciplines and expertise that are needed. Its target audiences are professionals, researchers, and students from different HEIs in the Philippines.

**TEEECHtalks**

### Maya-3 and Maya-4: A Bird's Eye View

November 25, 2021 (Thursday) | 1:30 - 2:30 PM | Via Zoom

**Speakers:**

**Derick Canceran**  
MS EE Student, UP-EEEI  
Derick is currently an MS Electrical Engineering Student at the UP-EEEI under the Space Science and Technology Profederation through University Partnerships (STeP-UP) project. He's in charge of the attitude determination and control subsystem of Maya-3 and Maya-4.

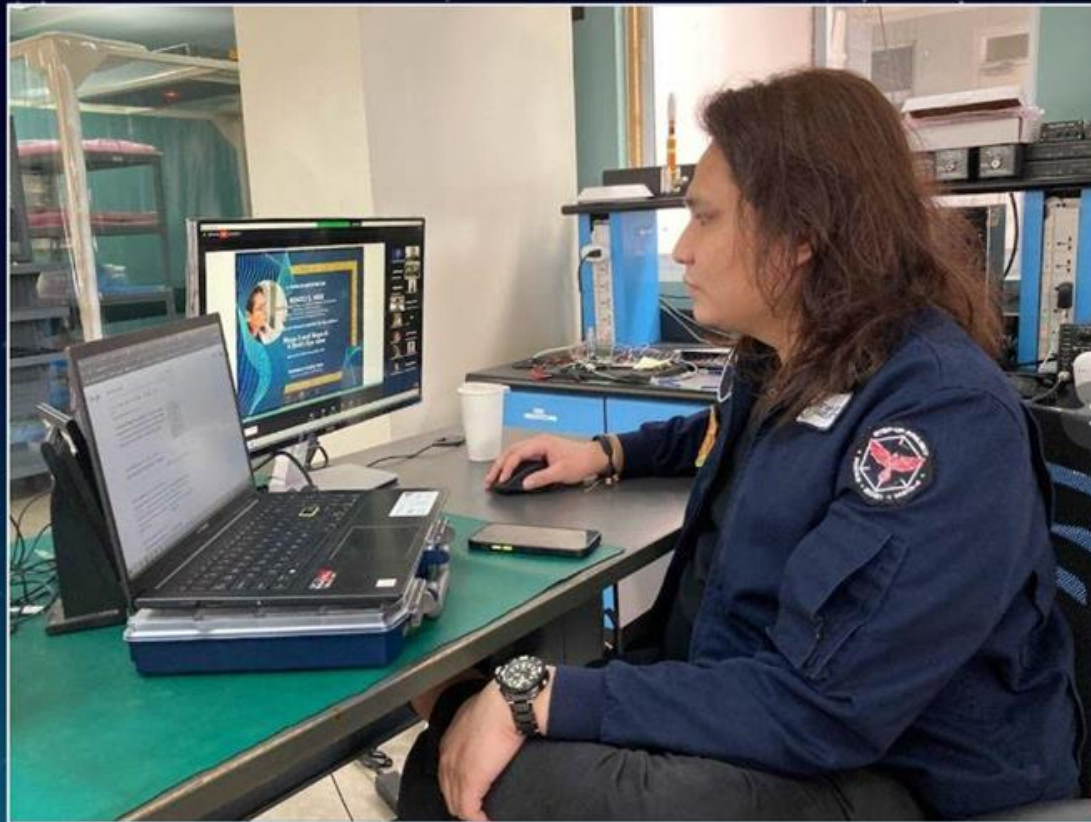
**Renzo Wee**  
MS EE Student, UP-EEEI  
Renzo is the project manager of the Maya-3 and Maya-4 satellite development and has also handled the structure subsystem and space environment testing including the safety review of the CubeSats. He is finishing his MS Electrical Engineering Nanosatellite Engineering degree at UP-EEEI.

Register through: [https://bit.ly/S4Space\\_ABirdsEyeView](https://bit.ly/S4Space_ABirdsEyeView)

Image source: UP EEEI FB Page



## TEEECHTalks: Maya-3 and Maya-4: A Bird's Eye View



STeP-UP Batch 1 scholars, Renzo Wee and Derick Canceran, are the speakers of the said event where they presented an overview of the Maya-3 and Maya-4 satellite development under STAMINA4Space Program - STeP-UP project, as well as on how to track Maya-3 and Maya-4.



# STeP-UP Batch 1 Scholars at the e-AGM 2.0 of IECEP



The Institute of Electronics Engineers of the Philippines (IECEP), Inc. celebrated its 71st Annual General Meeting and Convention virtually on November 28 - December 3, 2021 with the theme “Embracing Digital Transformation in the Time of New Normal”. Members of IECEP and also STeP-UP Batch 1 scholars, *Engr. Renzo Wee* and *Engr. Judiel Reyes*, joined the said event and presented the team’s journey in the Maya-3 and Maya-4 Development.



# STeP-UP Batch 1 Scholars at the e-AGM 2.0 of IECEP

IEEEP e-AGM 2021

### Technical Overview



Maya-3 and Maya-4 CubeSats (stowed antenna)

- Class: Nanosatellite (CubeSat)
- Dimensions: 10cm × 10cm × 11.35cm (Stowed State)
- Mass: 1.15 kg
- Beacon Frequency: 437.375 MHz
- Orbit: Low Earth Orbit (LEO)

DECEMBER 02 8:32 PM

IEEEP e-AGM 2021

### Phase D: System Assembly, Integration and Test, Launch



Structure Fit Check of Maya-3 and Maya-4

DECEMBER 02 9:07 PM

Aside from speaking about their journey in developing the Maya-3 and Maya-4 CubeSats, Engr. Wee and Engr. Reyes briefly discussed what comprises the CubeSats, their mission, technical specifications, and on how the Philippines will benefit from making them.







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**Genesis Remocaldo**  
**Chandler Timm Doloriel**  
**Ronald Collamar**  
Contributing Writers



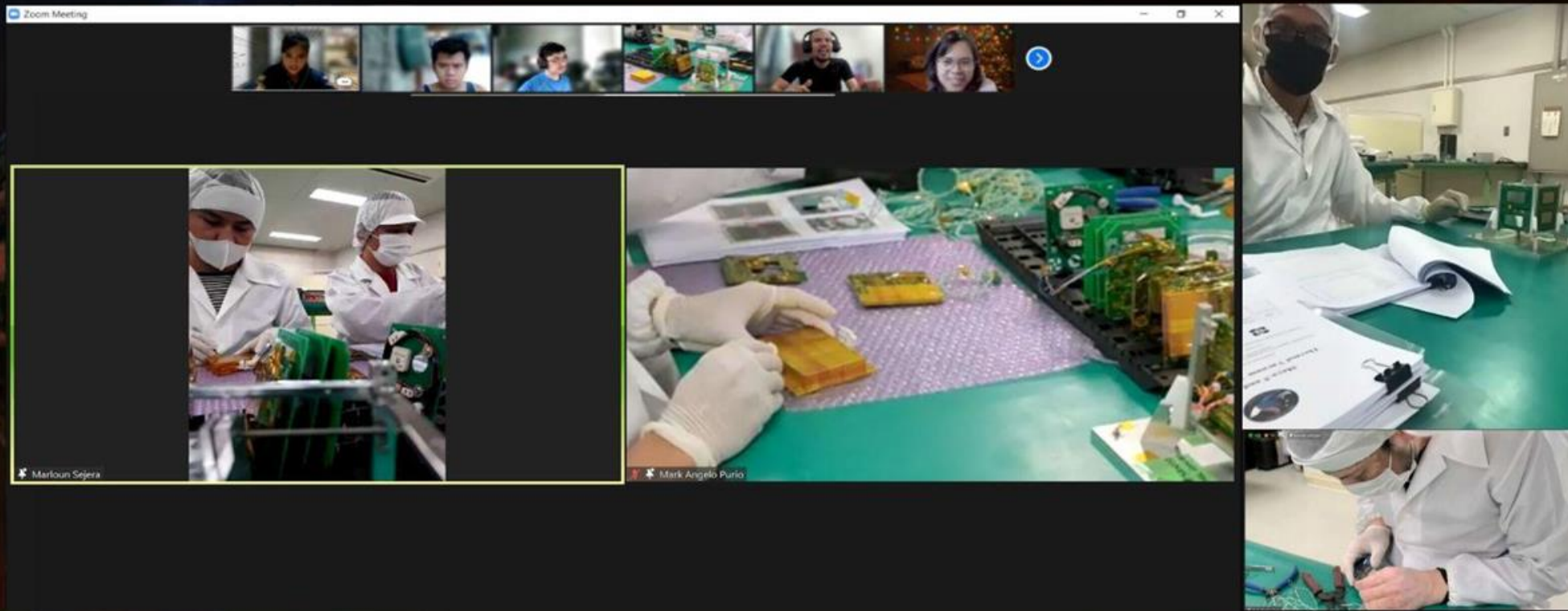
# SAFE TRAVELS, MAYA-6!

STeP-UP Batch 2 scholars perform final functionality tests on the Maya-6 cube satellite in preparation for the packing and sending of the engineering model to Kyutech for space environment testing.

*Pasalubong naman d'yan, Maya-6!*



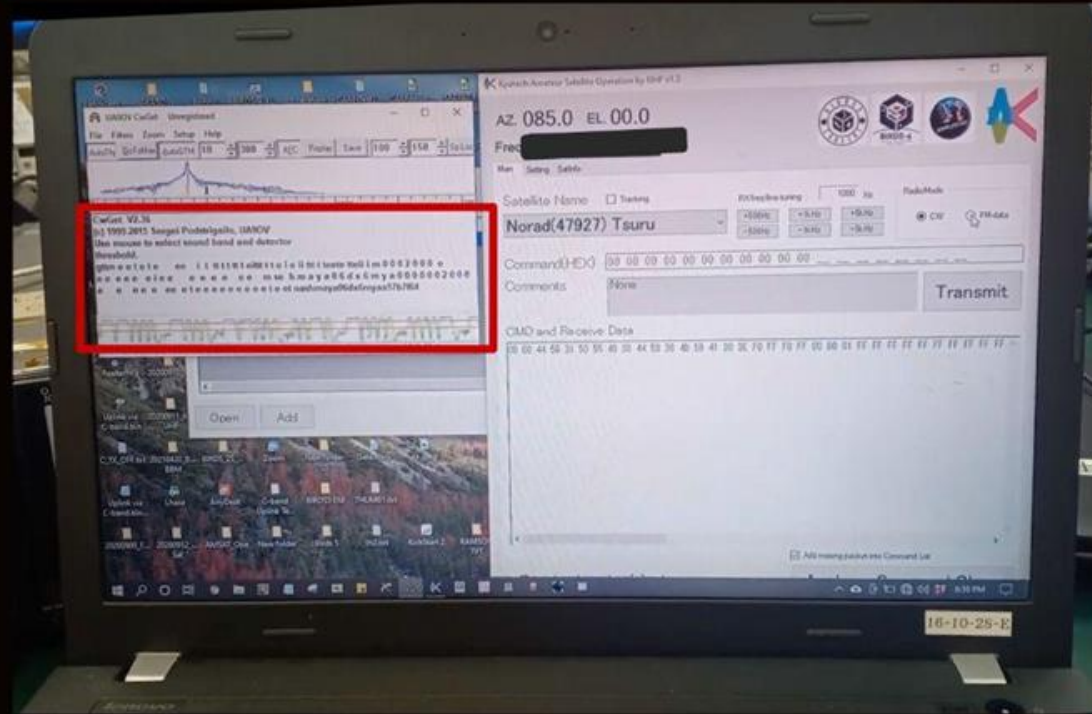
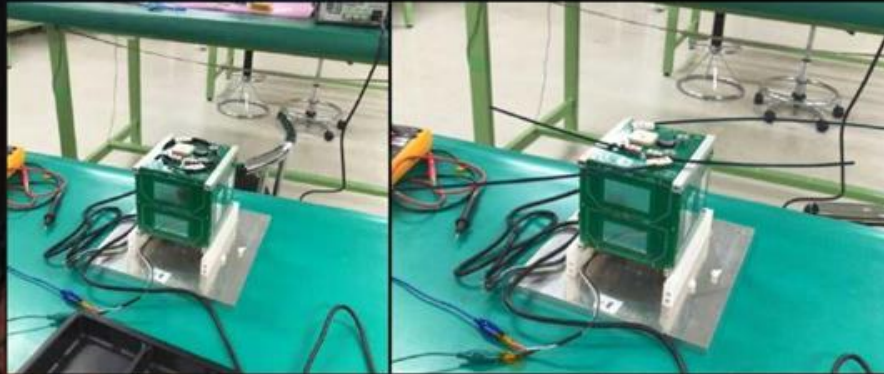
# POST-SHIPMENT TESTS



Upon arrival of the CubeSat, the unpacking of the CubeSat and post-shipment tests were led by BIRDS-4 members Dr. IZ Bautista, Sir Marloun Sejera, Sir Mark Purio, and Sir Hari Shrestha. The Batch 2 team here are seen remotely assisting and overseeing the process via Zoom. We would like to send our gratitude to the BIRDS teams and staff for helping us in this part of our development. *Arigatou gozaimasu!*



# POST-SHIPMENT TESTS

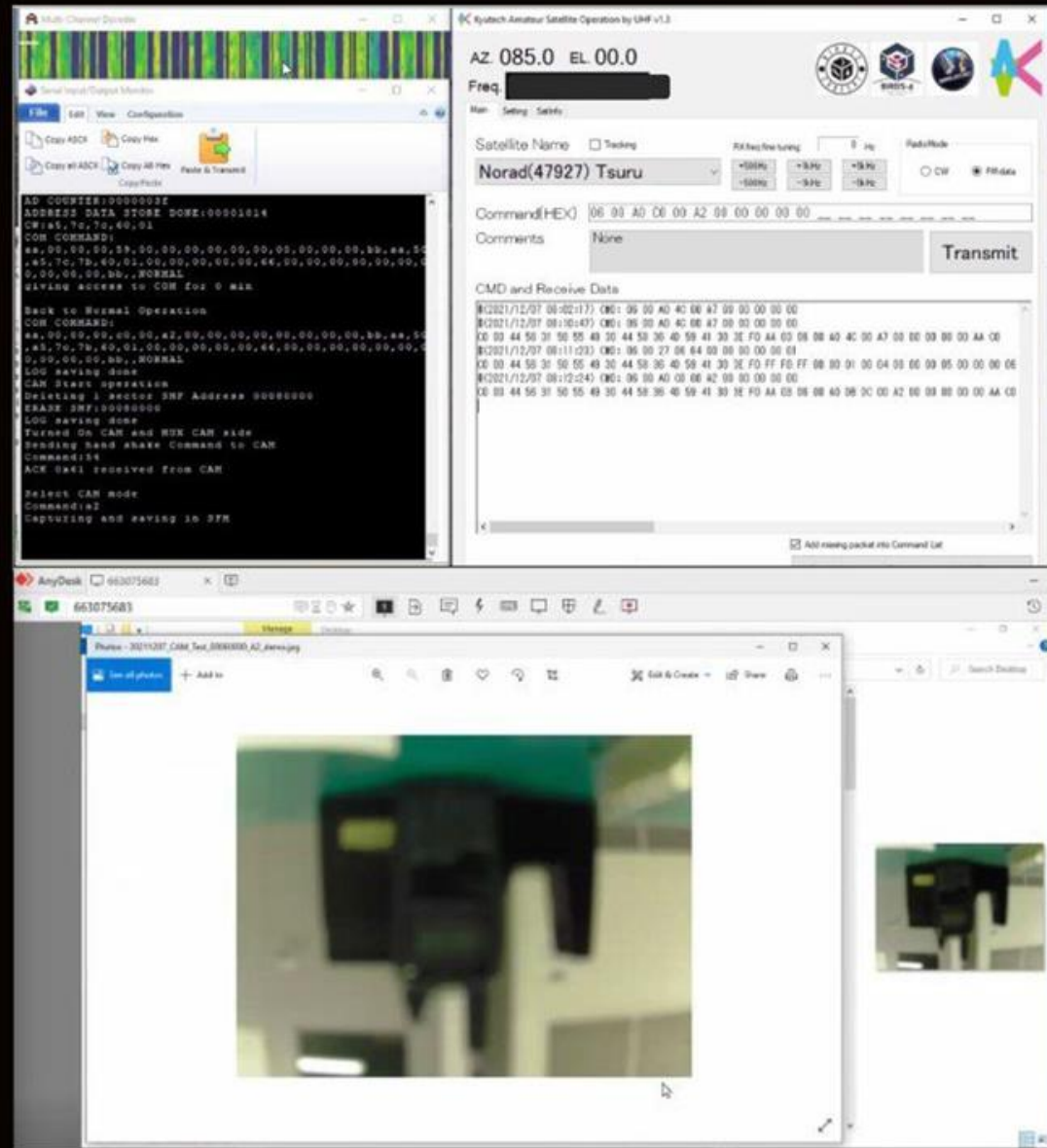


The first test conducted on Maya-6 after visual inspection was the antenna deployment test. Once the satellite was powered up and the serial monitors to the OBC were installed, the deployment sequence was activated. After the 30-minute waiting time, both UHF and VHF dipole antennas were successfully deployed. Moreover, a CW beacon was transmitted by the CubeSat to the ground station setup, where it was also successfully decoded, proving that the UHF antennas are working. For VHF, packets were successfully received by the hand-held radio through the APRS-DP mission.

# POST-SHIPMENT TESTS

Other missions and subsystems also underwent functionality tests. The images on the right show the results of the tests performed on the CAM mission, which was triumphant in taking a photo in the clean room.

More of the results will be shared once the EM tests are completed.





# THERMAL VACUUM TEST PREPARATION

After the post-shipment tests, the CubeSat is then prepared for the thermal vacuum test (TVT) through the attachment of thermocouples and placement inside a jig lent to the team by BIRDS-4. The TVT will involve several cycles of hot and cold soaks inside the small thermal vacuum chamber to simulate extreme temperatures in space.

As of writing, the setup is ready for vacuuming, pending the functionality tests before TVT.







*On behalf of all the space science & technology teams from the Philippines, we wish everyone a safe and peaceful holiday season! Thank you for being a part of our 2021.*



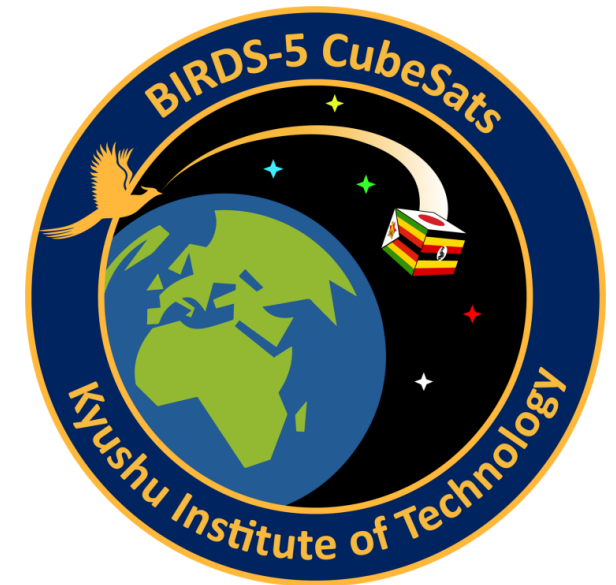
## 10. ZIMSAT-1 Ground Station Progress



# Zimbabwe National Geospatial And Space Agency



By : Tatenda G. S. Marimo  
Acting Outreach Officer  
13 December 2021



# Self Introduction

- Tatenda Marimo works in the Space Operations and Launch Services department for the Zimbabwe National Geospatial and Space Agency (ZINGSA).
- His areas of specialty are Electronic engineering and Telecommunications.
- He holds the following qualifications:
  - MSc Communications Engineering
  - Post Graduate Diploma in Education
  - BSc Telecommunications Honours
  - National Diploma in Electronic Engineering (Communication Systems)
  - National Certificate in Electronic Engineering (Communication Systems)
  - Class 1 Signal Artisan Certificate.
- His roles at ZINGSA include:
  - providing expertise for the preparation and implementation of earth observation missions;
  - managing communication between spacecraft, ground stations and control centers;
  - and participating in various strategic projects.



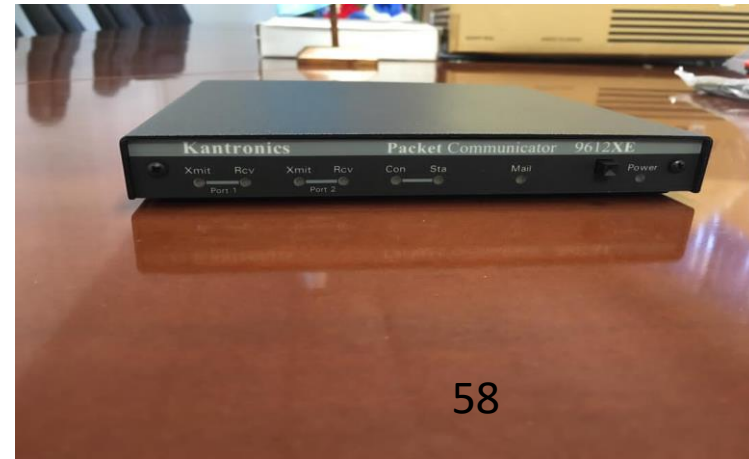
**Tatenda G. S. Marimo**  
**Ground Station Progress Report**  
**Presentation**



## ZIMSAT-1 Ground Station progress

- Efforts are under way to develop the Ground Station for ZIMSAT-1.
- Construction of the Ground Station Mast has been completed, attachments to be added soon.
- Mast has been delivered to site.
- Control room renovations initiated
- Procurement and delivery of Ground Station Equipment is at 92%
- Most of the remaining shipped equipment awaits clearance at customs offices

# Shipped and Received components



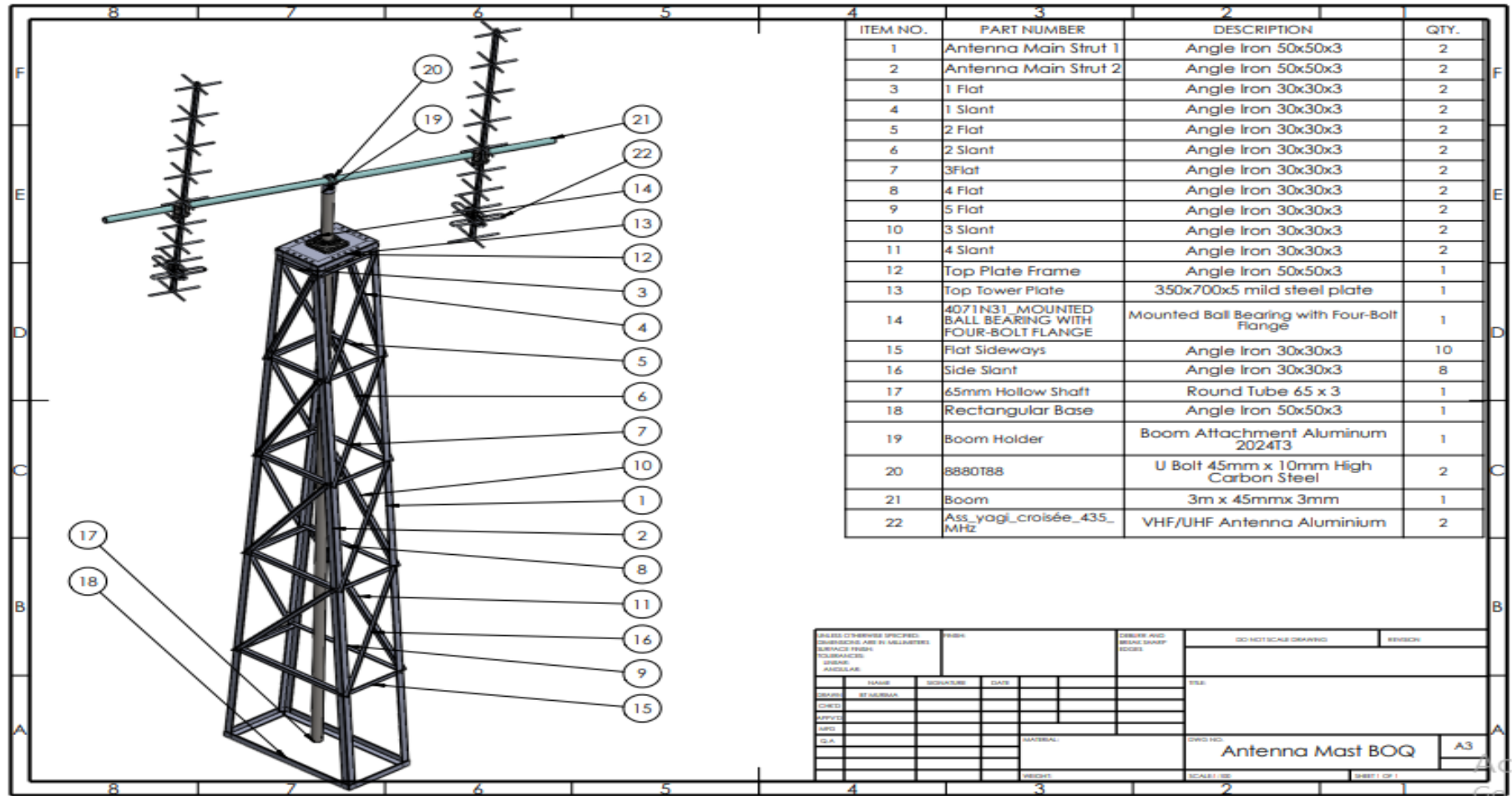
58

**Figure 1: Part of the procured radio equipment for the Ground Station (RF cable, ICOM radio, Terminal node controller and cable connectors).**

- The above images show a sample of equipment delivered to ZINGSA.
- The remaining imported components are in the process of being cleared at the Customs office.
- Those being cleared include both the azimuth and elevation rotators.



# Mast Design



**Figure 2: Preliminary mast design**

The above diagram shows part of the CAD mast design developed by ZINGSA engineers. A structural analysis was carried out and the mast was subsequently manufactured locally.

# Ground Station Location



**a) Satellite imagery of the Ground Station**

**b) Relative Ground Station Location to surrounding environment**

The above images show the Mazowe Earth station, the location where the mast was delivered and awaits installation.



## Work in Progress



**Figure 3 a): Assembling of mast**



**b) Mast being prepared for hoisting**



**c) Mast hoisted onto the rooftop**

- Figure 3a) shows an almost complete mast being designed and fabricated by ZINGSA engineers at the workshop.
- The mast was delivered to the GS site about 32 km from ZINGSA Head Office and was hoisted onto the roof top where final touches are being done before being erected.



## Mast Location site



Figure 4) Mast after first white coat was applied

- White paint was applied to the mast before the orange stripes were added.
- The Mast is painted for protection from weather elements and also to ensure that it is visible to planes in line with aviation regulations.



# Ground station Building



**Figure 6a) Mast position on rooftop**

Control room



**Figure 6b) Outside view of Control room**

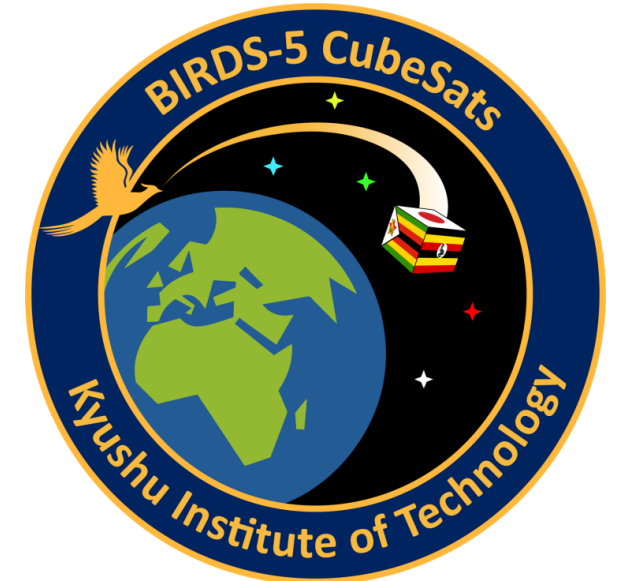
- The depicted building a) show the position on which the mast was delivered awaiting to be erected on the indicated point.
- Figure 6b) then shows another angle of the same building where the ZIMSAT-1 Control room is located.
- An interior section of the Control room is shown by 6c) and renovation works have been initiated.



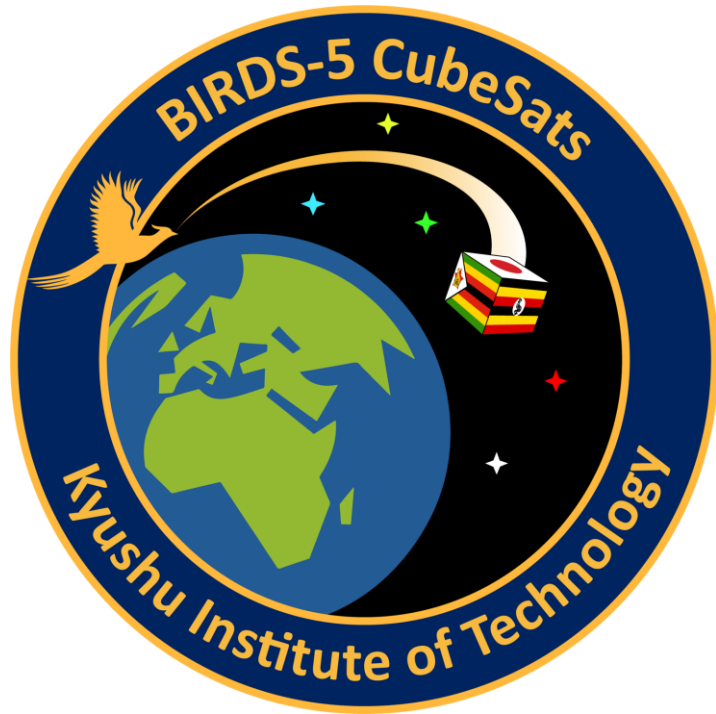
**Figure 6c) Inside view of a section of the GS Control Room**

End of Article

THANK YOU







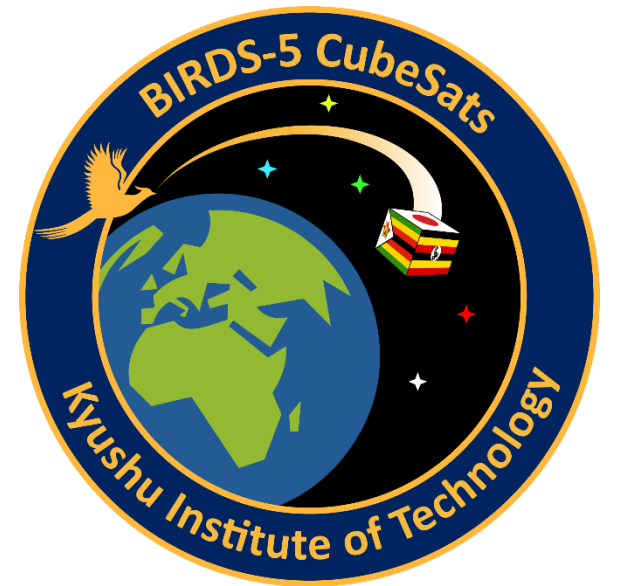
# **The following sections are the BIRDS-5 articles for December 2021**

**(compiled by Timothy of Zimbabwe)**

# OBC subsystem

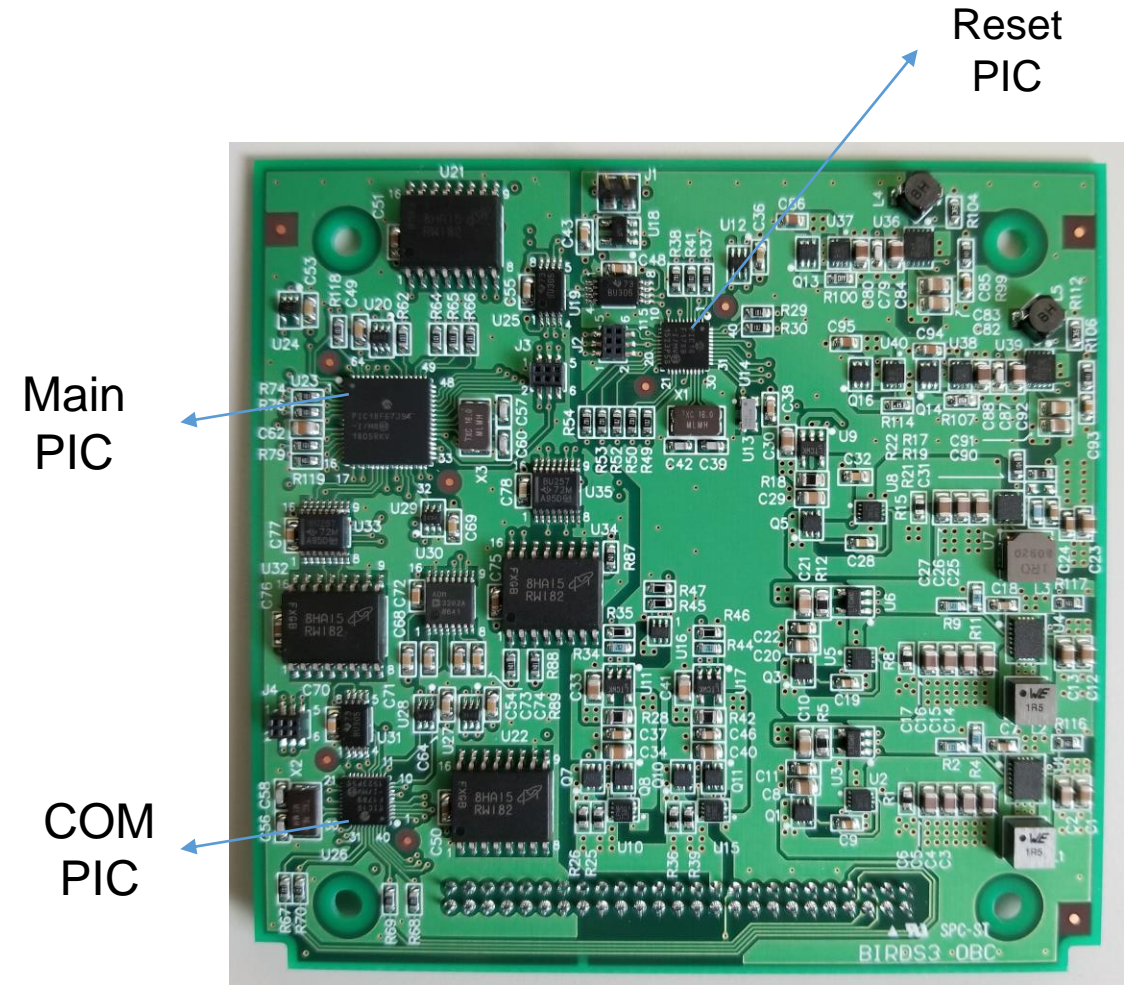


- By: Keenan Chatar
- 13/DEC/2021





- Send the Continuous Wave (CW) Beacon
- Collect, store and transmit Housekeeping and Mission Data
- Analyze the Uplink commands received from Ground Station
- Execute mission commands and store mission data
- Monitor the general status of the satellite and survive space environment.

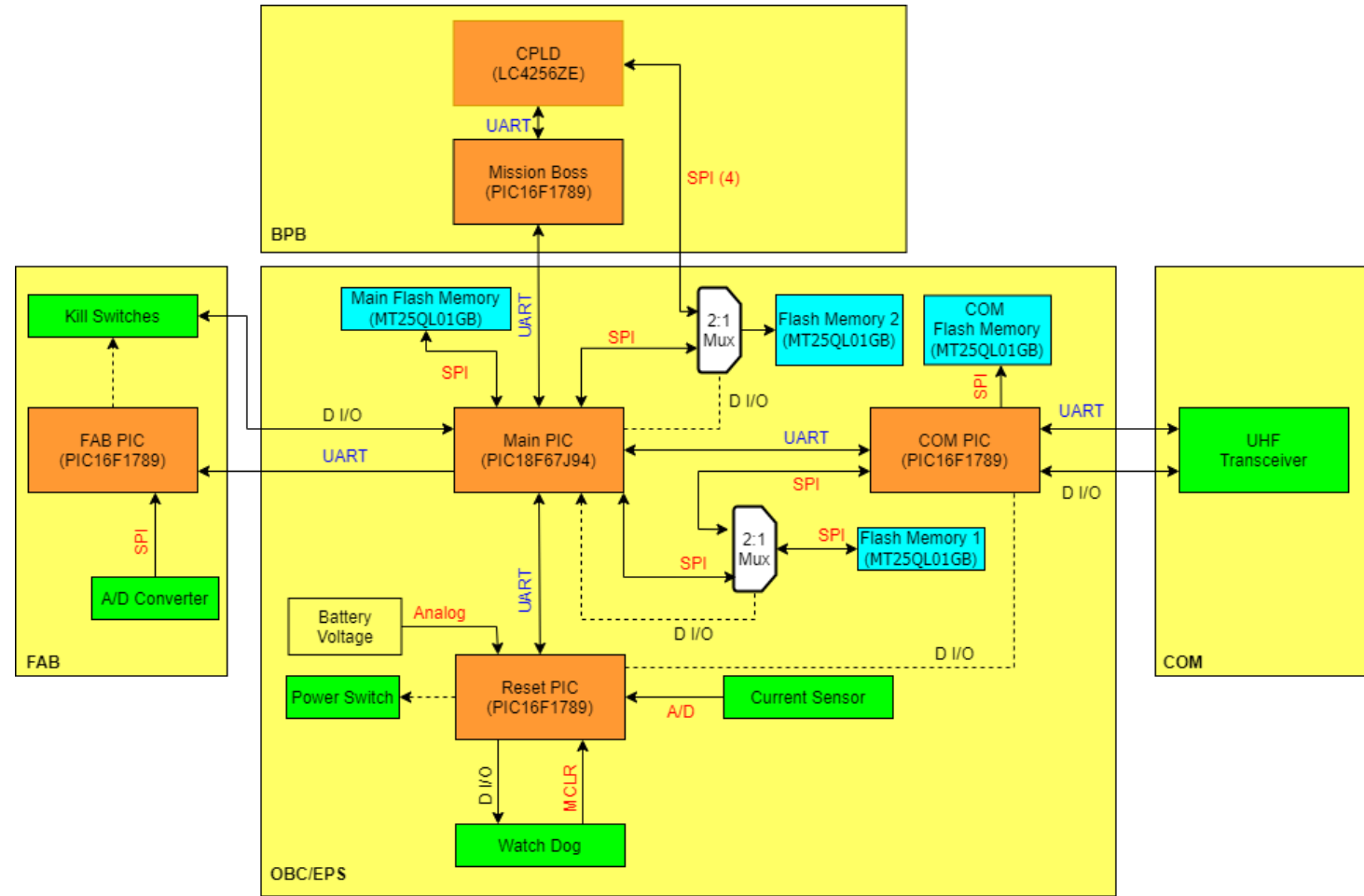


- Primary Systems:

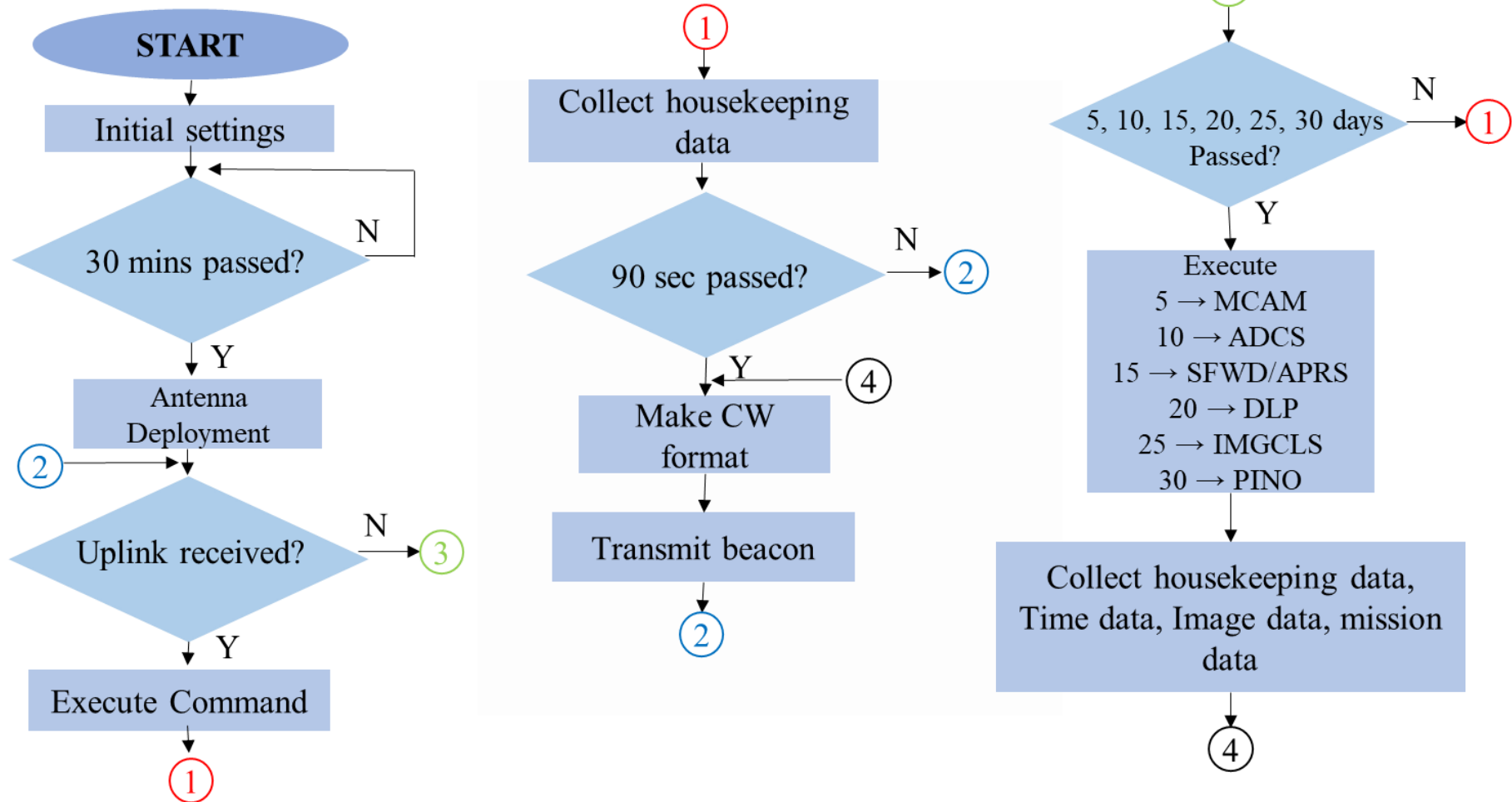
- 1) OBC/EPS
- 2) BPB/Missions
- 3) FAB
- 4) COM

- OBC manages data interface:

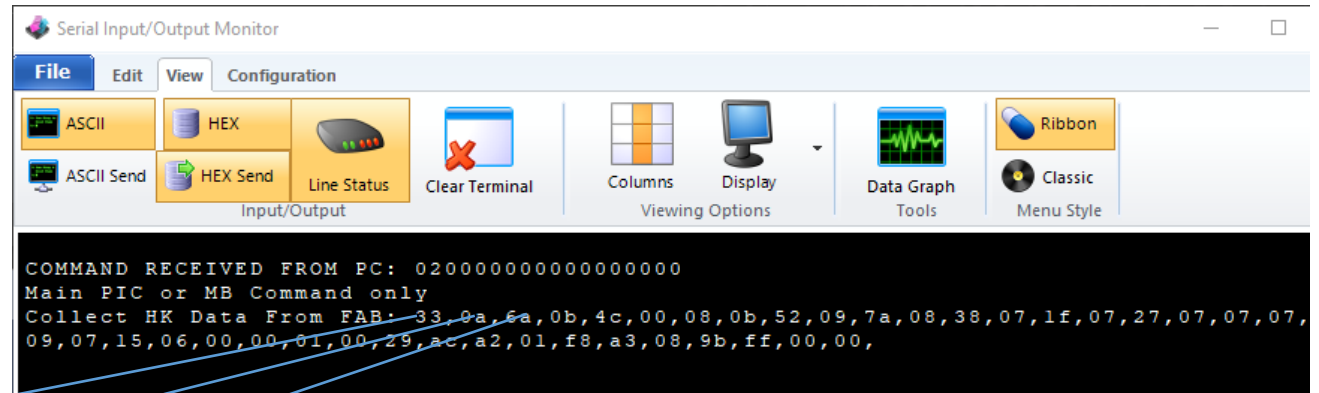
- Big data is handled by flash memory and multiplexer
- Regular messages interface is performed by UART







# System Interaction



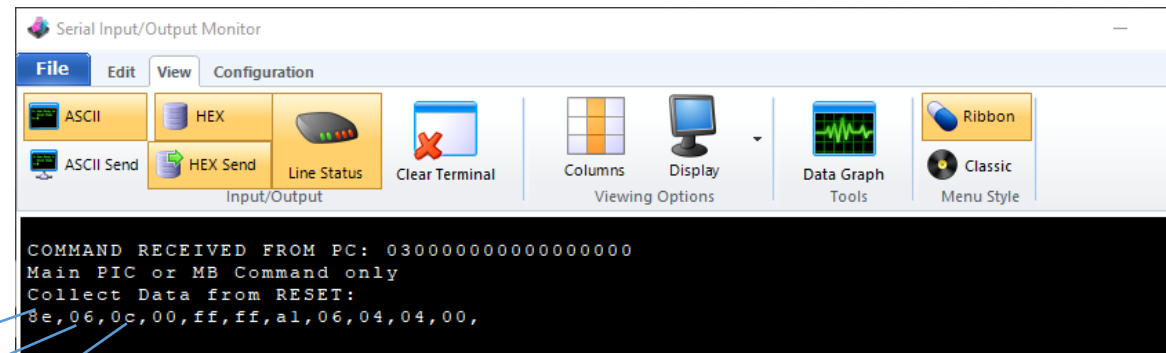
## Request for FAB Data

- From Main to FAB

0X33	Temp_pX H	Temp_pX L	Temp_mY H	Temp_mY L	Temp_mZ H	Temp_mZ L	Temp_py H	Temp_py L	Temp CPLD H
Temp CPLD L	Temp_pZ2 H	Temp_pZ2 L	Vol_pX H	Vol_pX L	Vol_mY H	Vol_mY L	Vol_mZ H	Vol_mZ L	Vol_py H
Vol_pY L	Vol_pZ H	Vol_pZ L	I_out +X	I_out -Y	I_out -Z	I_out +Y	I_out +Z	I_Raw	Src_Voltage
Raw_voltage	SRC_current H	SRC_current L	PWR_Bat	Batt_Current H	Batt_Current L	Batt_Temp	Batt heater stat	Kill Status	

## Request for RESET Data

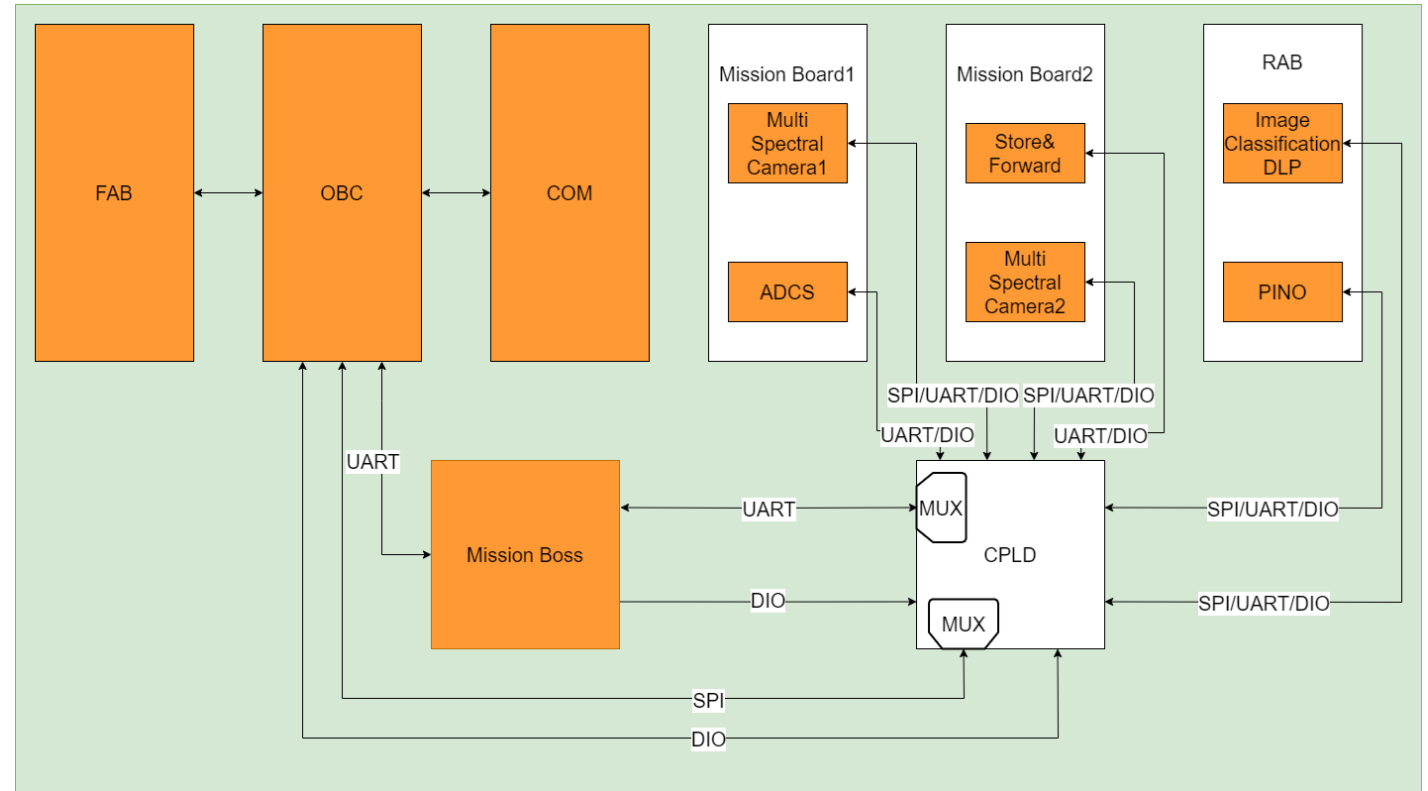
- From Main to RESET



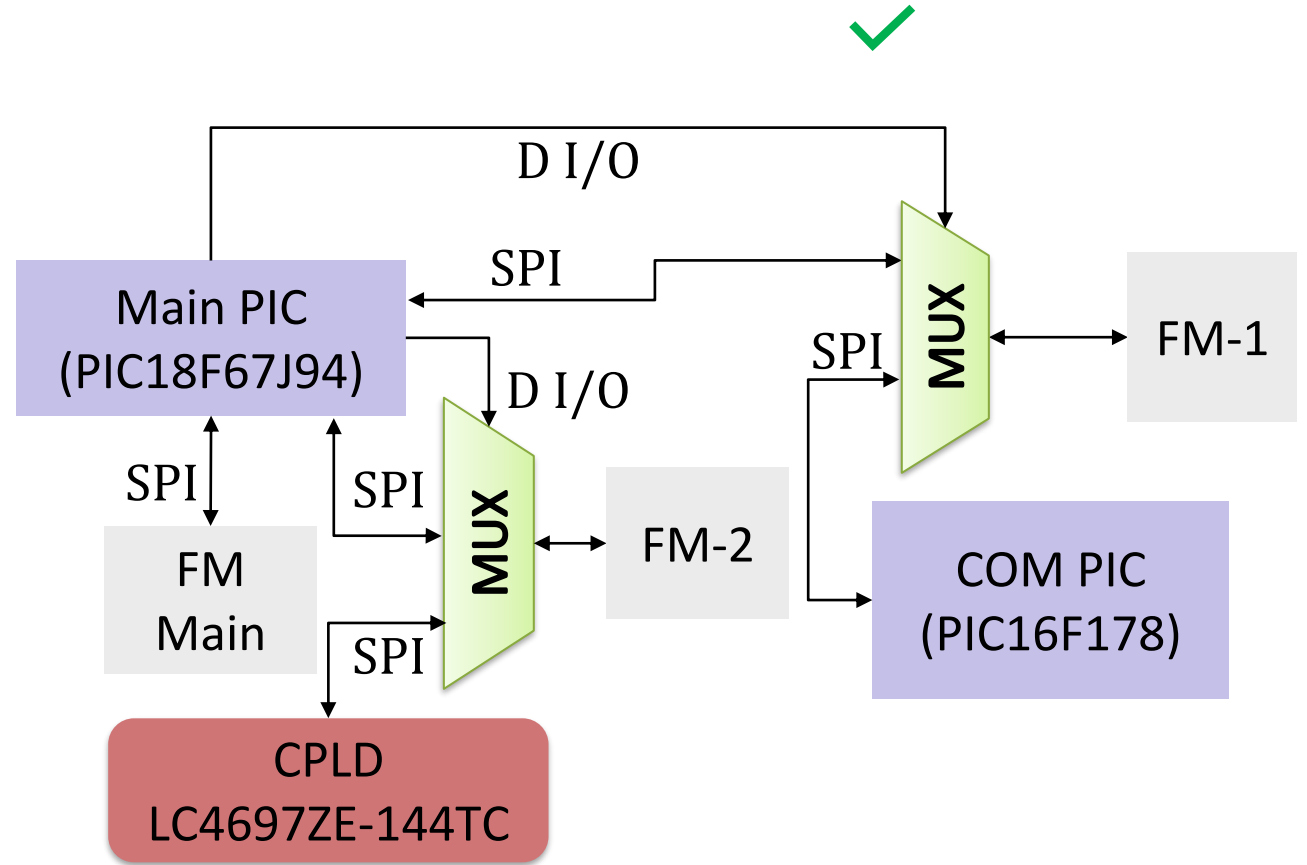
0x8e	Sec	Min	Hou	Day_H	Day_L	V out Raw	I out 3V3#1	I out 3V3#2	I out Unreg#1	I out 5V
------	-----	-----	-----	-------	-------	-----------	-------------	-------------	---------------	----------



Primary functions:  
Control Mission Switch  
Communication to missions  
via UART



Primary Functions:  
Manage SPI switches  
Manage SPI communication

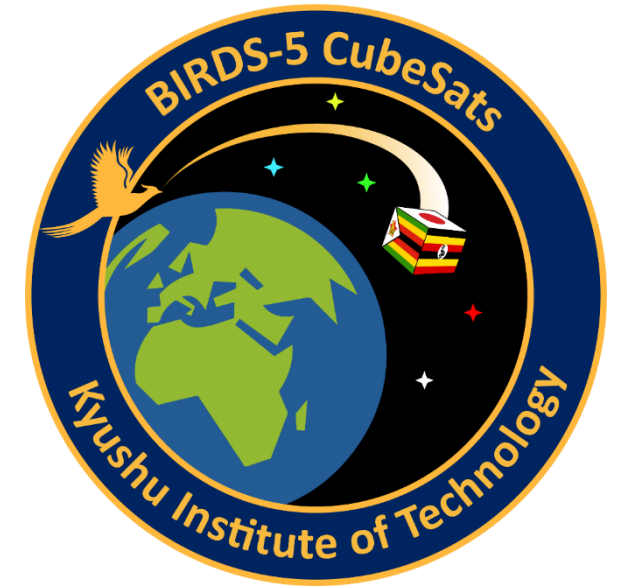




# BIRDS-5 & Lean Management Approach



By : Derrick TEBUSWEKE  
Date: 16th December, 2021



## What is Lean Management Approach?

An approach that supports the **concept of continuous improvement** by using as **less resources (time, money, effort)** as possible.

**BIRDS Program:** The Joint Global Multi-Nation Birds Satellite Project.

The program has built and launched 14 Cubesats since 2015.

**Key Lessons** learned since then:

- Reduction of waste.
- Standardizing the satellite bus.



BIRDS-1Cubesats

[www.semanticscholar.org](http://www.semanticscholar.org)



BIRDS-2 Cubesats

© STAMINA4Space



BIRDS-3 Cubesats

[www.Kyutech.ac.jp](http://www.Kyutech.ac.jp)



BIRDS-4 Cubesats

[www.Kyutech.ac.jp](http://www.Kyutech.ac.jp)



BIRDS-5 Project Logo

[www.birds5.birds-project.com](http://www.birds5.birds-project.com)



**Lean Management** approach leads to **improved efficiency** in a Satellite Project.

## Essential Rules For Efficiency Improvement In Satellite Development:

Aim for Simplicity	Standardize-on:	Rationalize Product Design	Use the Widest Possible Tolerances	Choose Materials to Suit Function and Product Process	Minimize Non-Value-Adding Operations	Design for Process	Teamwork	Include All Stakeholders Early in the Process
<ul style="list-style-type: none"> <li>• Minimize part numbers, part variety</li> <li>• Simplify assembly sequences</li> </ul>	<ul style="list-style-type: none"> <li>• Component usage</li> <li>• Aim for as many off-the-shelf components as possible</li> </ul>	<ul style="list-style-type: none"> <li>• Standardize on components, sub-assemblies to reduce costs.</li> <li>• Employ modularity</li> <li>• Just In Time production</li> </ul>	<ul style="list-style-type: none"> <li>• Increase the tolerance on non-critical components to reduce operations and processing times</li> </ul>	<ul style="list-style-type: none"> <li>• To ensure product reliability.</li> </ul>	<ul style="list-style-type: none"> <li>• e.g handling, excessive finishing and inspection; to reduce costs and lead time.</li> </ul>	<ul style="list-style-type: none"> <li>• Leverage advanced process capabilities to reduce unnecessary components.</li> </ul>	<ul style="list-style-type: none"> <li>• Establish a project-based development</li> </ul>	<ul style="list-style-type: none"> <li>• get the external contributors involved right at the concept stage</li> </ul>



BIRDS-5 Keeps no big inventory, We Buy What We need. Keeping Big Inventory = Losses



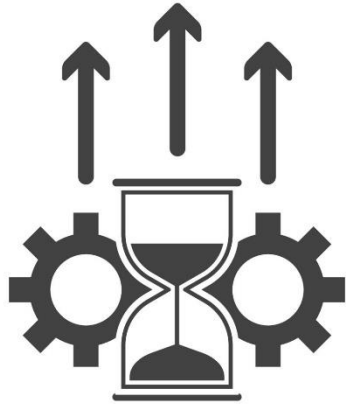
Modular boards in BIRDS-5 Simplify Satellite Integration process.



BIRDS-5 Cameras are Off-the-Shelf components to reduce costs.



Each BIRDS-5 Subsystem leader has an assistant to emphasize Teamwork.



Efficiency

## Those rules will help satellite projects to:

- ❑ Concentrate on developing **Satellite Missions**, since the bus is already standardized.
- ❑ Reduction of losses in unused components by keeping little inventory.
- ❑ **Shorter development time for the satellite.**

Hence **Lean Management Approach ideas** should be utilized for an **efficient satellite project / Agency.**

## THE END

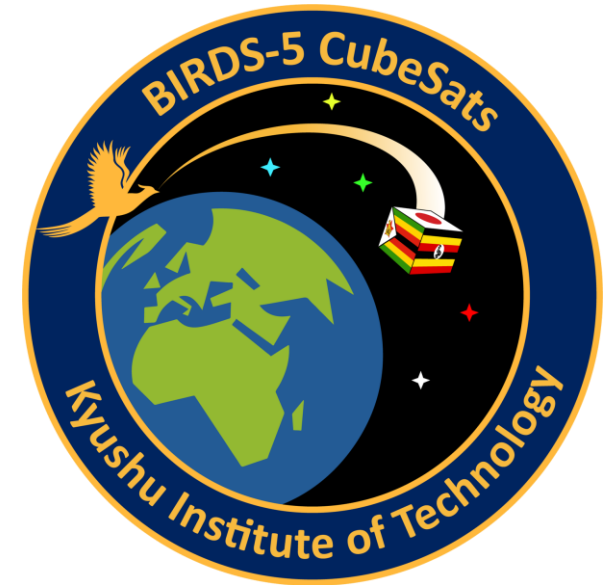
Reference: *James R. Wertz, David F Everett and Jeffery J. Puschell. "Space Logistics and Manufacturing." Space Mission Engineering: The New SMAD, Microcosm Press, 2011, pp. 744-750.*



# PINO Power Line



By : Kohei Kamitani  
2021/12/11



# PINO Power Line

- The BIRDS-5 Japanese satellite, Taka, is equipped with a mission instrument developed by JAXA called *PINO*.



Fig.1 Taka



Fig.2 RAB board

- PINO and the satellite bus system exchange power, commands, and other information via an access board called RAB.
- The power lines for the PINO were designed on the RAB.



# Problems of Power Line

- When PINO was integrated with the bus system for functional testing, it could not supply the voltage required by PINO.
- When we investigated the cause, we found that there was a voltage drop on the RAB power line.
- The PINO power line uses an N-MOSFET as a switch function, and the large ON resistance of this MOSFET is thought to be the cause of the voltage drop.

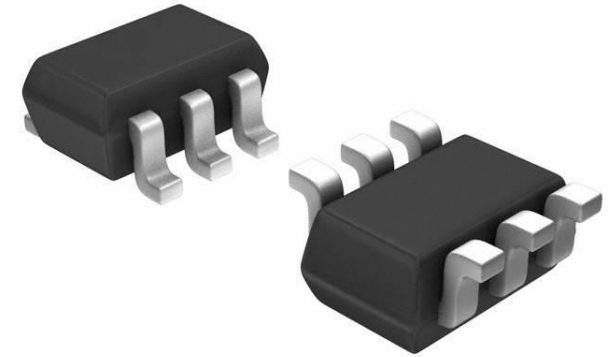
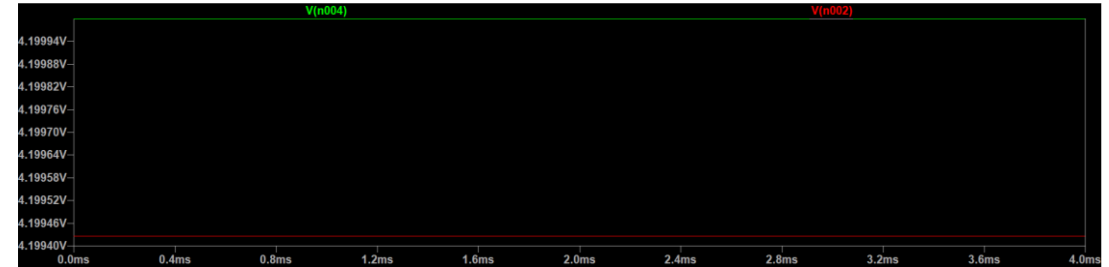


Fig.3 N-MOSFET

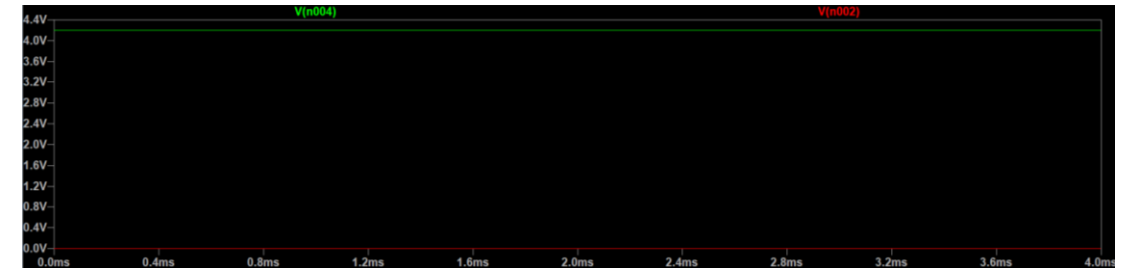
# Modification of Power Line

- The N-MOSFET was changed to with the another one with a smaller on-resistance to solve this problem.
- MOSFETs was connected in parallel to lower the resistance more.
- LTspice was used to simulate the modified power line and confirmed that the voltage drop became smaller.
- The RAB with modified power lines is currently on order and will be tested for integration with PINO after its arrival.



Input(green) : 4.2000000(V)    Output(red) : 4.1994257(V)

Fig.4 When the switch is turned on



Input(green) : 4.2000000(V)    Output(red) : 31.90002 × 10<sup>-6</sup>(V)

Fig.5 When the switch is turned off

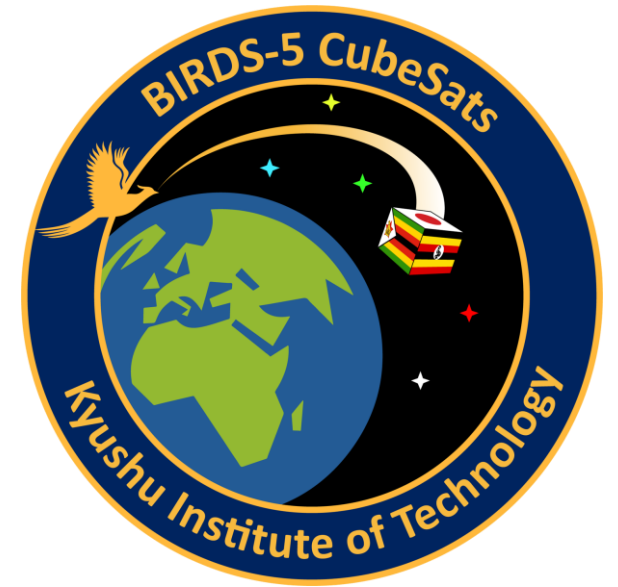
The figure shows the simulation results in LTspice. From the above figure, we can see that the switching function is working properly.



# Genetic Algorithm

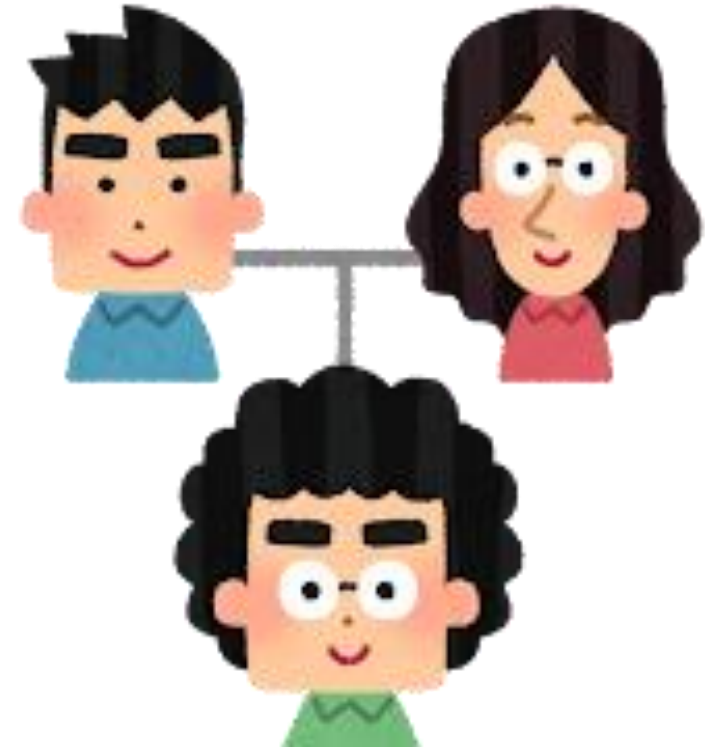


**By : Fukudome Shoma**  
**2021/12/11**



# What is Genetic Algorithm?

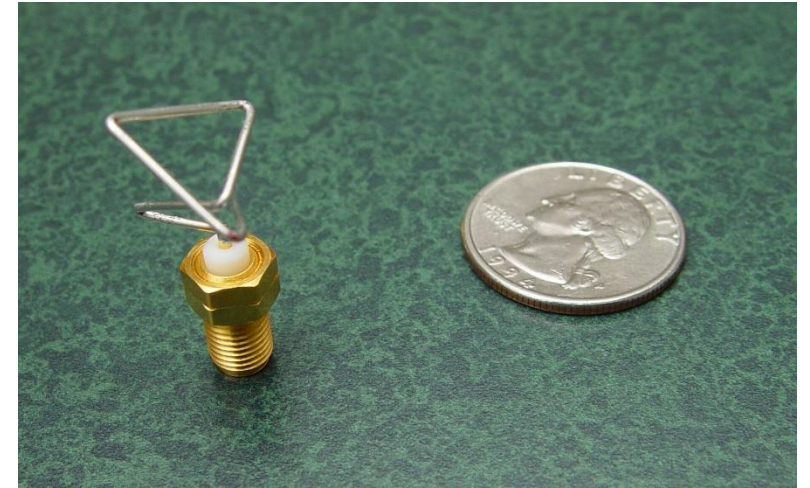
- GA is an algorithm that mimics the mechanism of biological evolution.
- Frequency of genes in the population changes over generations





# Space Technology 5

- The antenna shape that was for the three satellites of Space Technology 5 was designed by using GA.



<https://www.nasa.gov/centers/ames/news/releases/2004/antenna/antenna.html>

# N700 Shinkansen

- This Shinkansen's front nose was also designed by using GA



<https://xtech.nikkei.com/it/article/COLUMN/20070705/276691/>

# Terms that used for GA

- **gene**

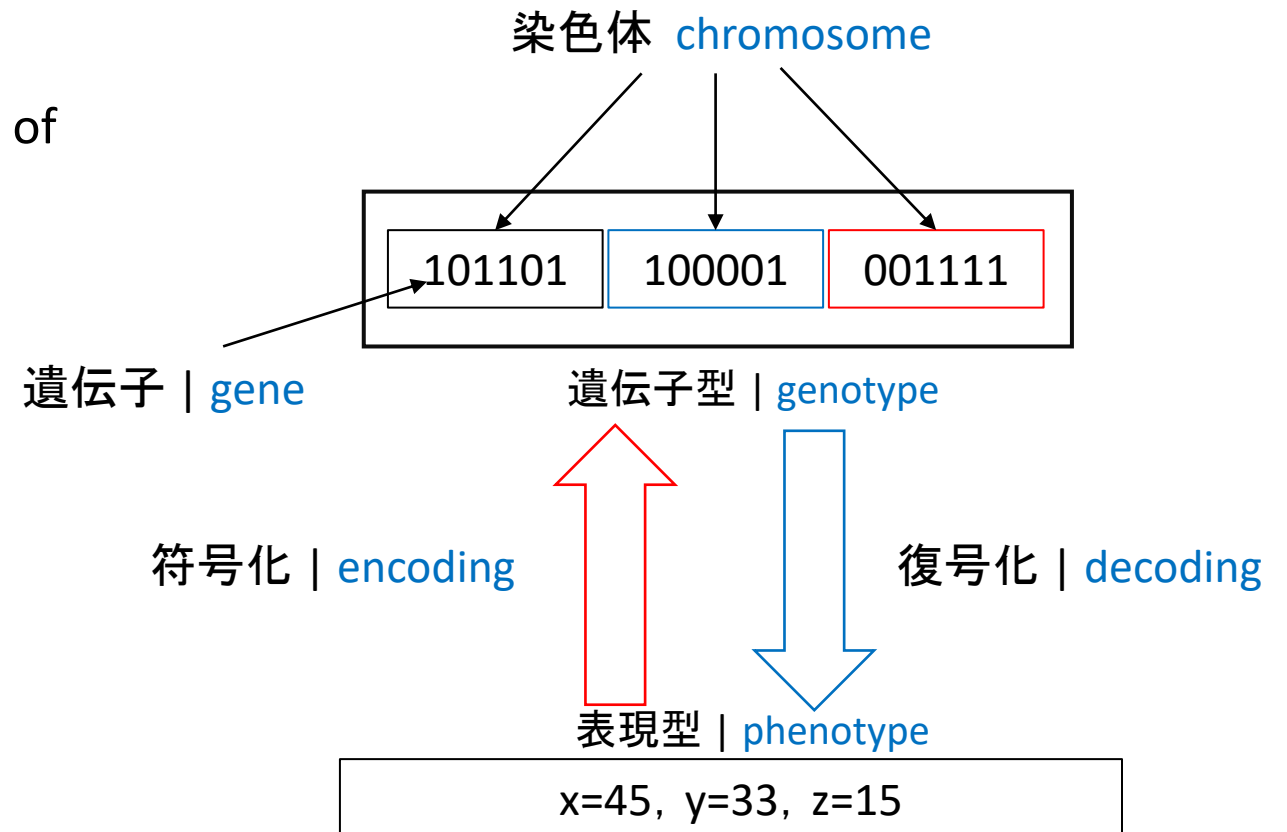
- The basic building blocks for the expression of individual traits.

- **chromosome**

- A collection of multiple genes

- **individual**

- Candidate solutions composed of chromosomes





# Terms that used for GA

- **population**

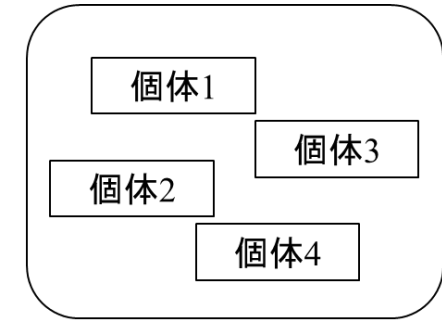
- A group of various individuals

- **genotype**

- Expression inside a GA using genes

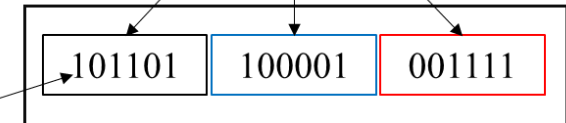
- **phenotype**

- Expression outside a GA. What we can see.



遺伝子プール | population

染色体 | chromosome



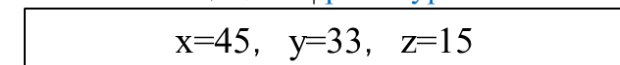
遺伝子 | gene

遺伝子型 | genotype

符号化 | encoding

復号化 | decoding

表現型 | phenotype



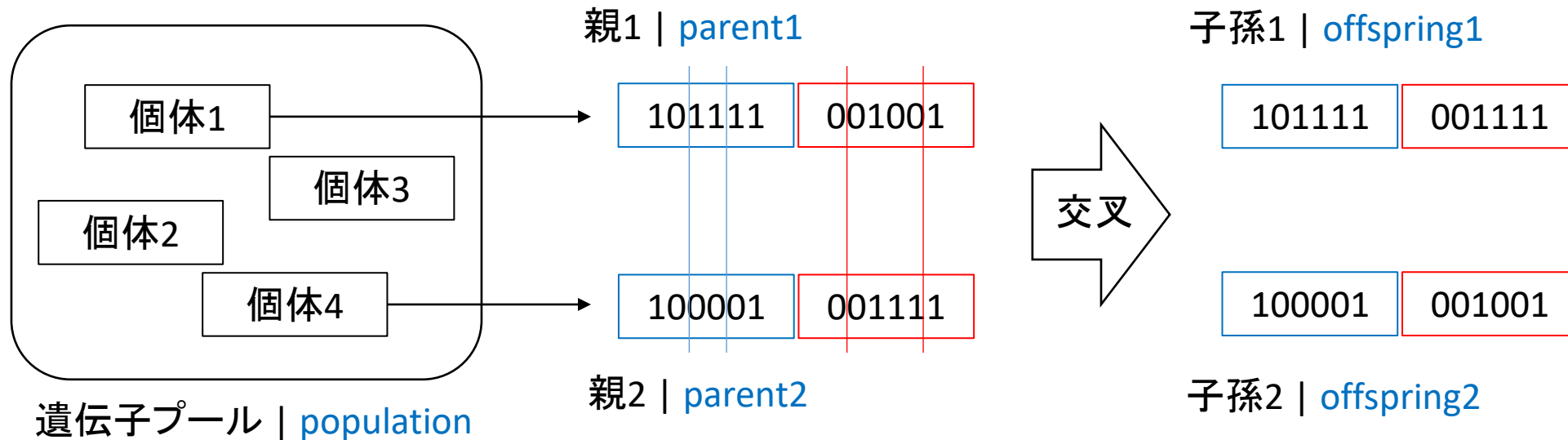
# Terms that are used for GA

- **selection**

- Operations that select targets based on their score.

- **crossover**

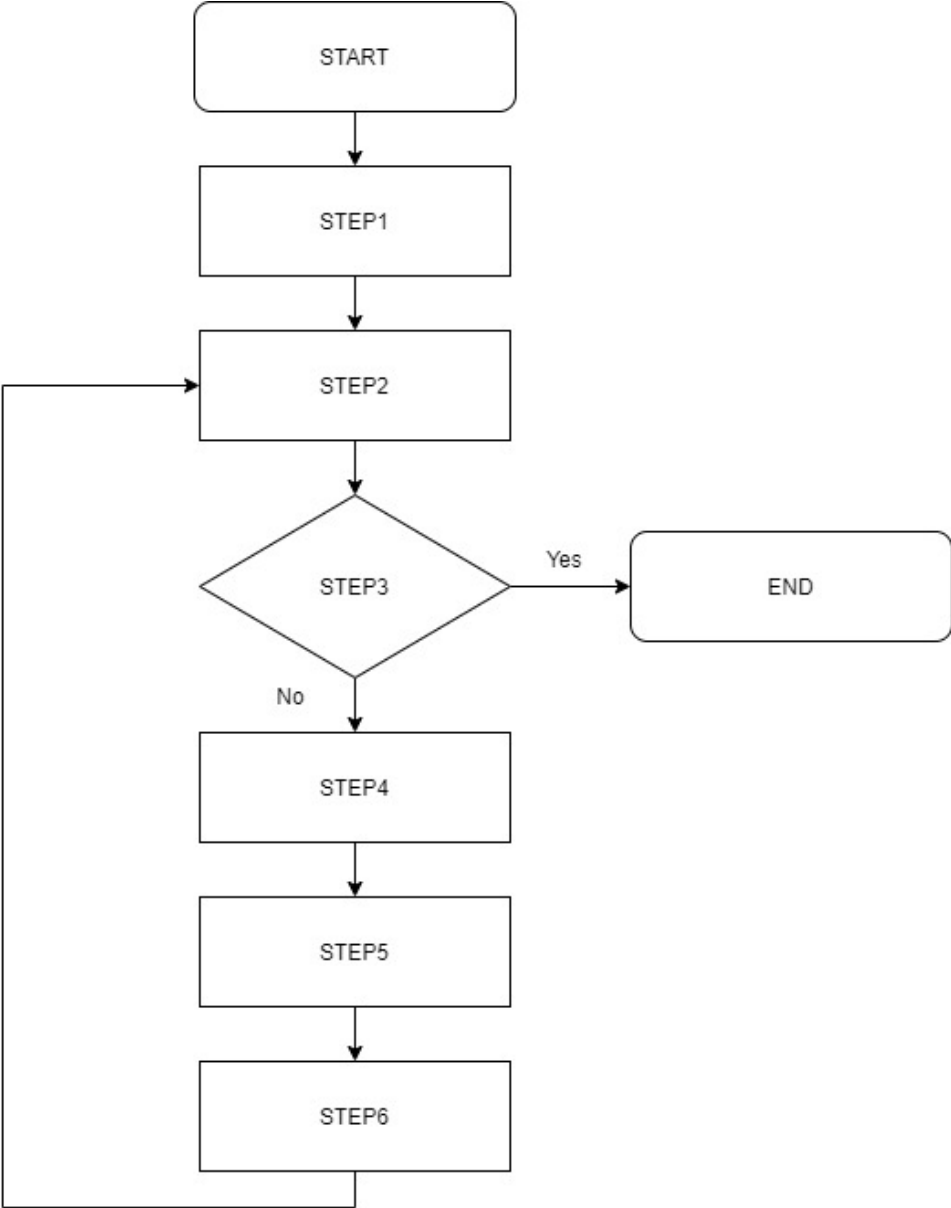
- An operation that swaps a portion of the genes of two selected individuals.





# How to operate Genetic Algorithm

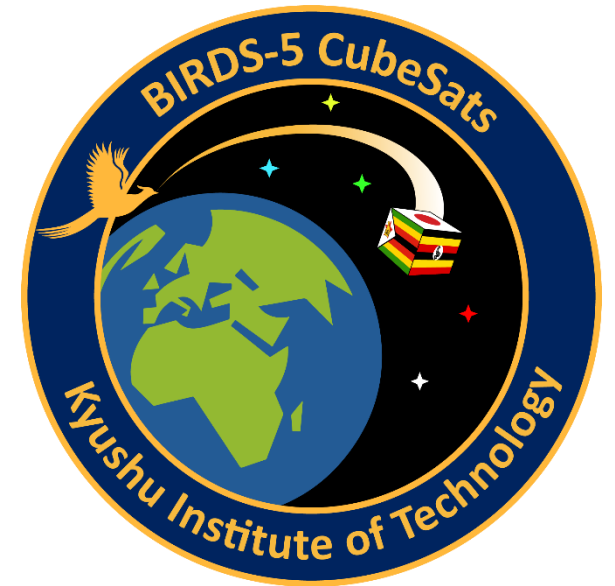
- STEP1 : Make Population
- STEP2 : Evaluation
- STEP3 : End condition
- STEP4 : Selection
- STEP5 : Crossover
- STEP6 : Mutation



# BPB and PINO integration test



By: Yukihiisa Otani  
December/13/2021





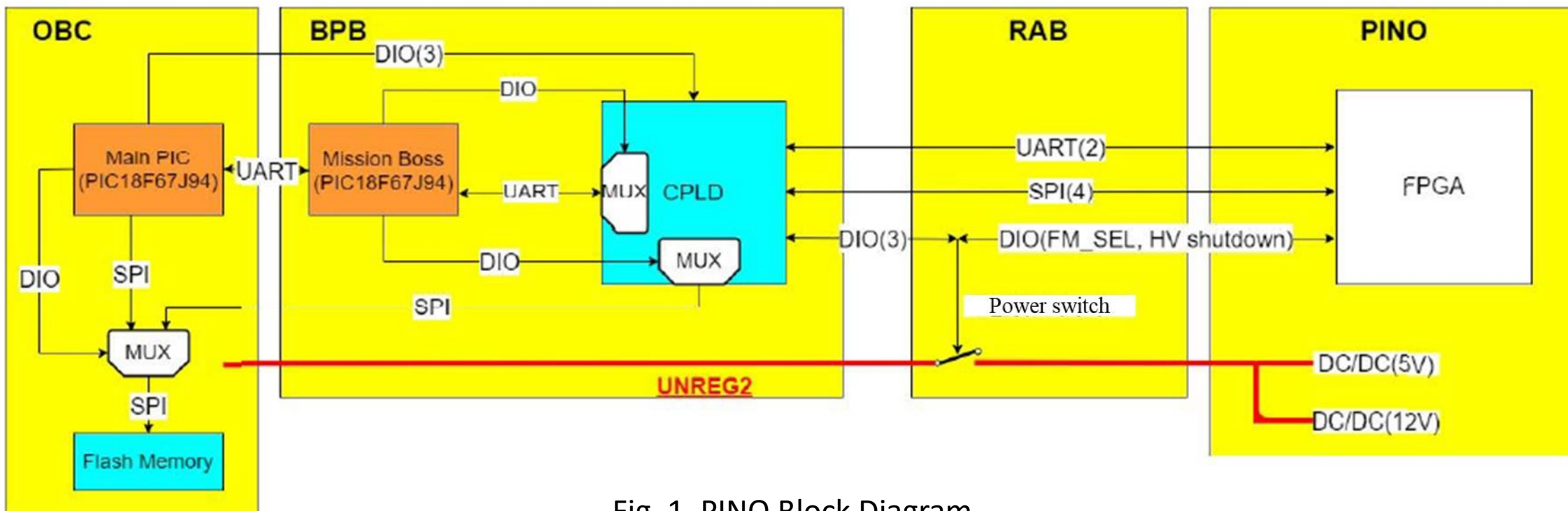


Fig. 1. PINO Block Diagram

- Main PIC controls the DIO lines for PINO
- Mission Boss switches the CPLD configuration and does the command transfer

## Integration testing details

- PINO turn on: **Not fully functional**  
→After turning on PINO, PINO MCU read the Flash Memory  
→The power switch circuit on RAB doesn't work, but the action on PINO MCU after turning on is successful.
- PINO UART communication: **Successful**  
→Main PIC receives the command from laptop and forwards to Mission Boss.  
→Mission Boss analyzes, changes the CPLD configuration, and forwards to PINO MCU.
- PINO SPI communication: **Successful**  
→PINO reads and writes the data on Flash Memory.

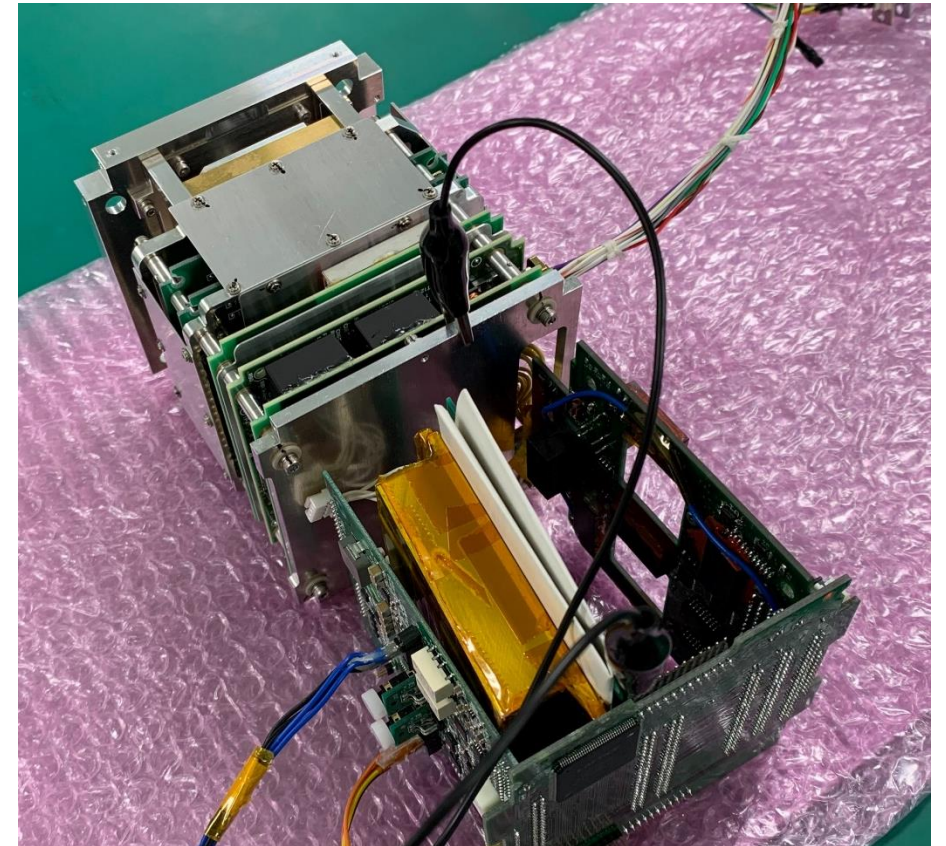
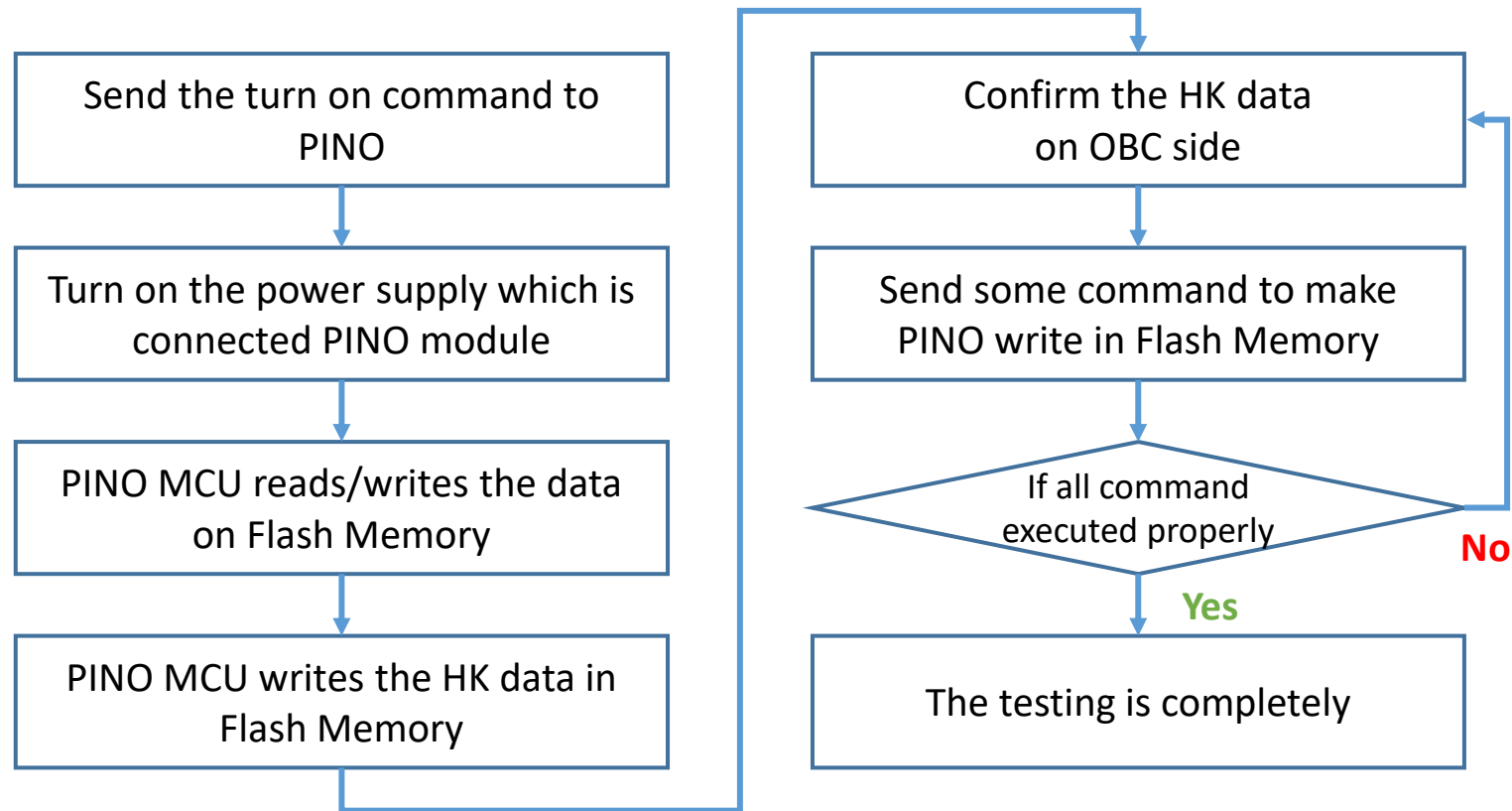


Fig. 2. PINO integration test





In the final testing, there was no error → Successful!

- PINO ON testing
- PINO sensor ON testing
- PINO power consumption check
- E2E test for PINO mission
- TVT testing

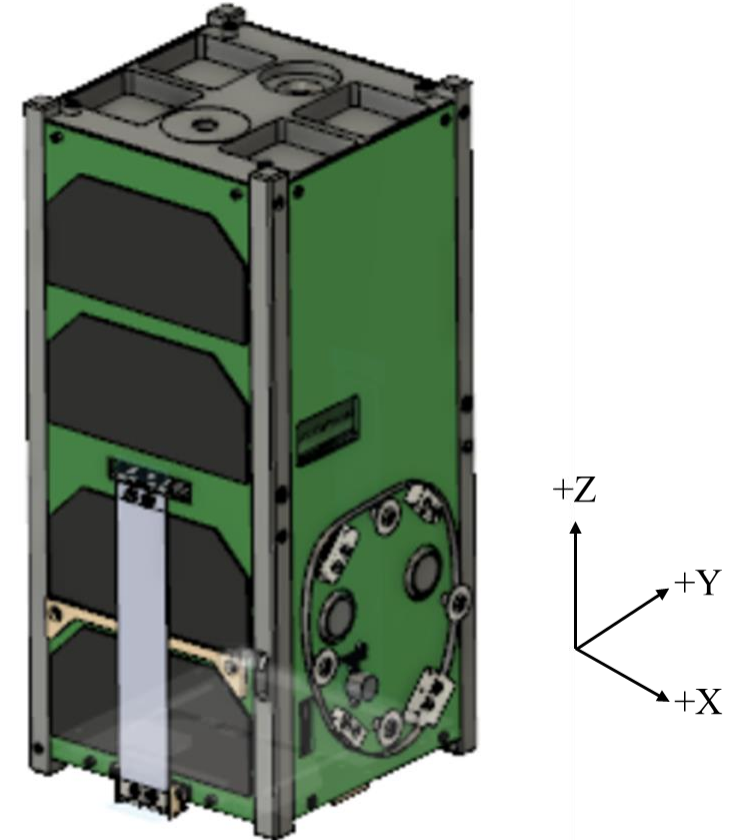


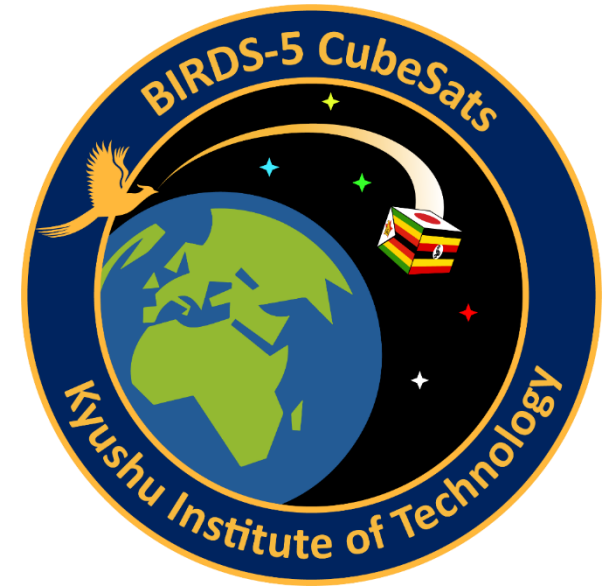
Fig. 3. BIRDS-5 TAKA



# Space activity law

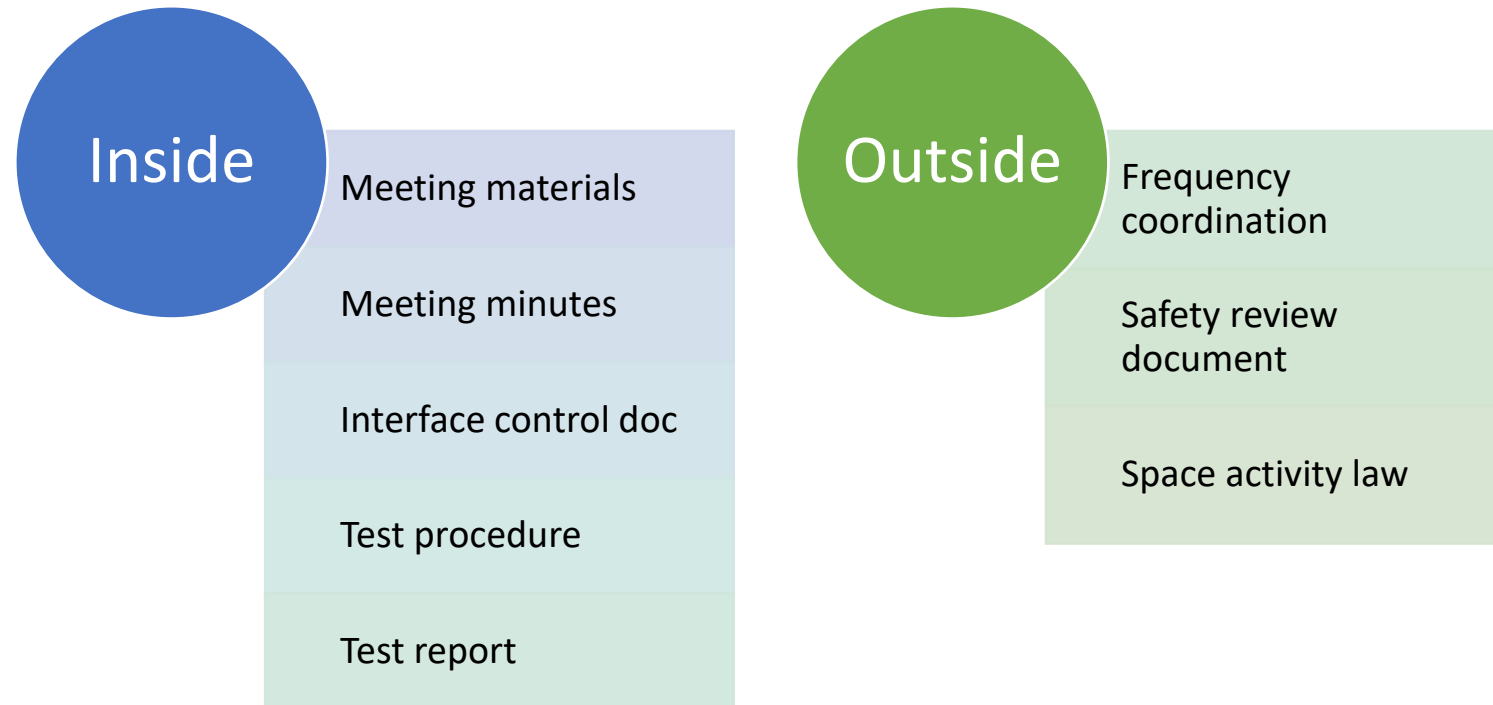


By : Takashi Oshiro  
2021/12/13



# Documentation needed for satellite launch

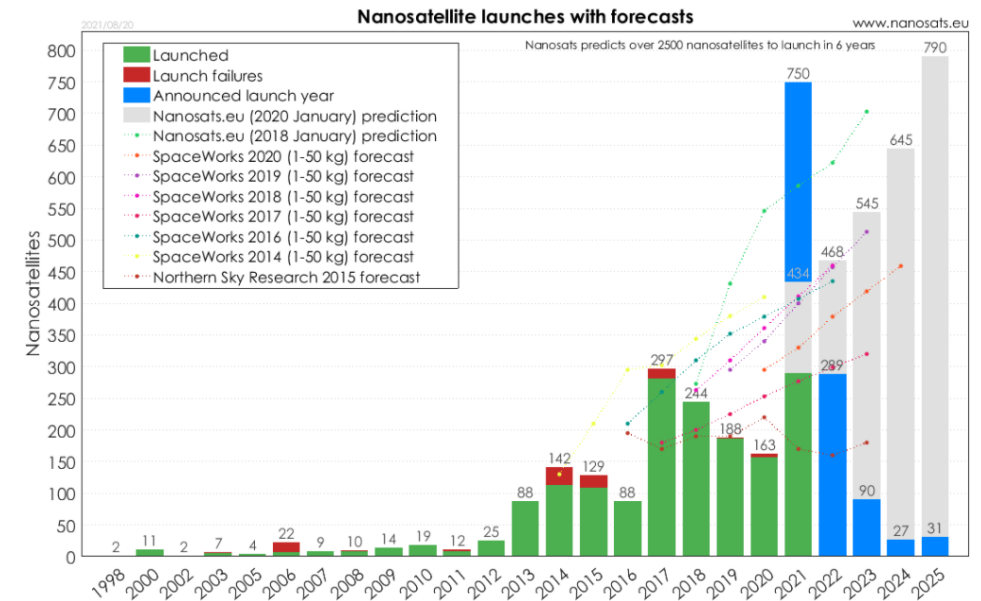
- Satellite cannot be launched without efforts for documentation.
- Documentation can be classified into two types .
- One is documentation for team (inside), another one is for outside.





# Space activity law

- Space activity law became effective on Nov 15<sup>th</sup> 2018 in Japan.
- Space development had been done by only the government.
- But recently, many private companies have joined the space field.
- So there was need to set a law concerning space activity.



[https://iss.jaxa.jp/en/kiboexp/jssod/1808\\_en\\_cubesats9.html](https://iss.jaxa.jp/en/kiboexp/jssod/1808_en_cubesats9.html)

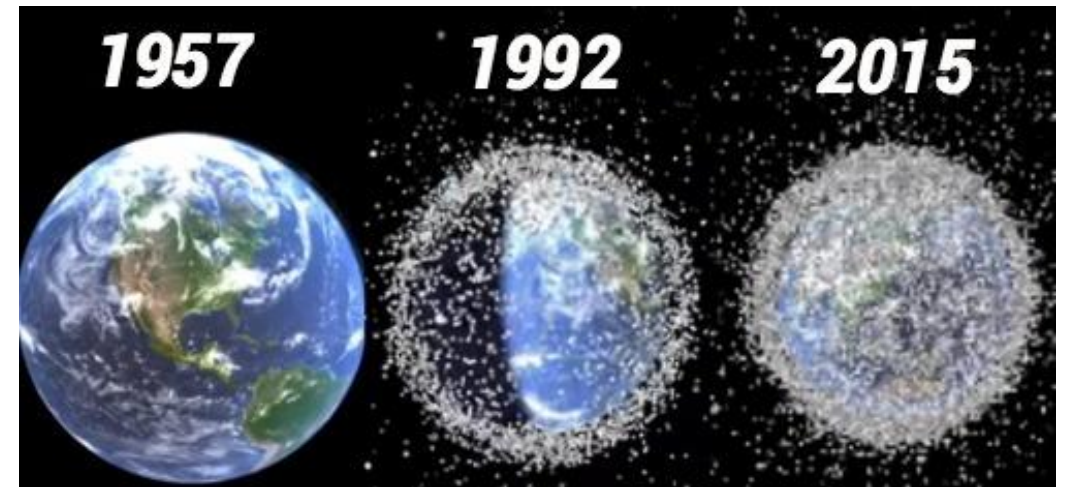
<https://www.nanosats.eu/>

# Space activity law

- One of the main purpose to set the law is to avoid generation of space debris.
- In the document, there is a section to describe that our satellite will not generate debris



<https://phys.org/news/2018-11-space-debris-cleanup-national-threat.html>



<http://lasnievesmagazineb.blogspot.com/2016/05/what-happens-to-space-remaining-after.html>



## **Safety Review**

- To ensure the satellite conforms to the required specifications by the launcher
- Safety review is being done with JAXA

## **Frequency Coordination**

- To ensure that the satellite will not cause harmful interference to other operating satellites
- Frequency Coordination with the International Telecommunication Union (ITU)

# Space activity law

Safety review and Frequency coordination are done in English. But Space activity law will be reviewed in Japanese since this document is submitted to Japanese government.

## Example of the contents of this document

- Simple diagram of satellite whole system
- Electric power circuit diagram
- Explanation of our missions
- Deployment items
- How we tested and verified
- Calculation of orbiting period
- Ground station information

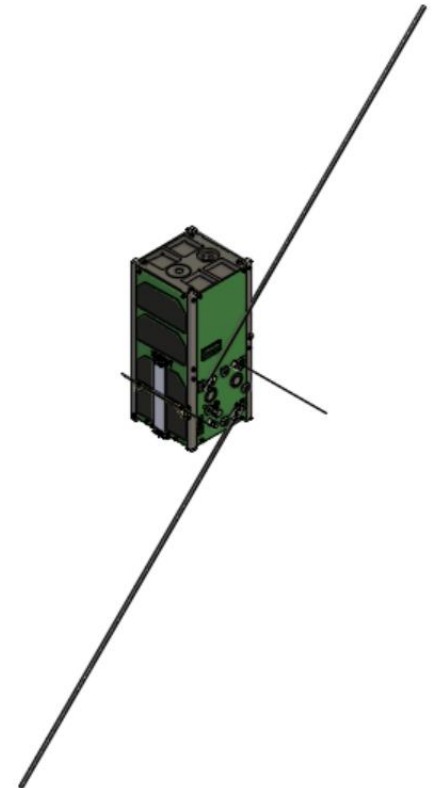
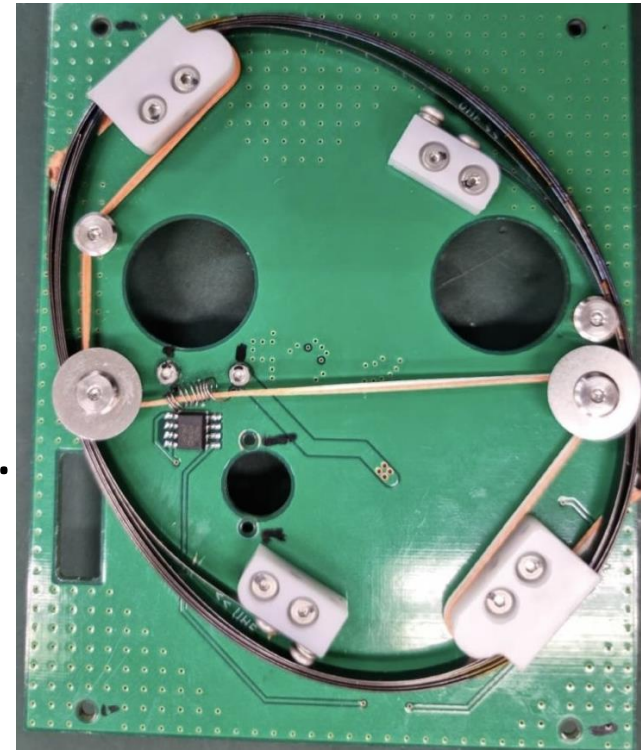


Space activity law document for BIRDS-5 will be prepared soon...



# Deployment items

- One of things we need to write is deployment item.
- In BIRDS-5 satellite, we deploy 2 sets of antennae for UHF and VHF communication.
- During the deployment, any space debris should not be generated.
- So, we need to show that our deployment system neither touch other satellite components nor generate space debris.
- And also, we have to show FM vibration test result to verify our antenna doesn't deploy during required vibration condition.



# End of BIRDS-5 reports for this month





# End of this **BIRDS Project Newsletter**

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