



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.

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# BIRDS Project Newsletter

Issue No. 60

(25 Jan. 2021)

*Edited by:*

G. Maeda

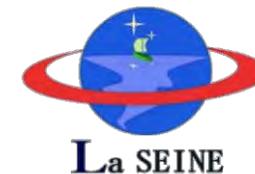
**革新的宇宙利用実証ラボラトリー**

*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 Japan

## The Guest Box



Almost all Japanese people have been to Onsen. Onsen is the Japanese name of the hot spring, which is placed next to Fukuoka. Oita is well known as the “onsen prefecture” in Japan. There is one of the famous sightseeing spots “Jigoku-Meguri”. “Jigoku” points out the Onsen and means “hell”. It is because the water temperature reaches 98 °C. This sightseeing spot consists of seven Onsen. They have some differences such as name and history and they are much interesting. Also, boiled egg and pudding which are made at Onsen are delicious. If you have an opportunity to go to Oita, please try to go to see them.

-- 大谷, Otani, BIRDS-5, Futaba Project



Participants of the BIRDS-5 PDR via ZOOM

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# *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 Int'l Workshops and for Ground Station Workshops.**

# 01. A Message from IAF President

<https://www.iafastro.org/>

\*\* End Of The Year 2020: A Letter From IAF President

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\*\* On behalf of the International Astronautical Federation,

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I would like to share a few thoughts with you as the year 2020 comes to an end. 2020 has been a truly challenging year as well as an incredible journey. For the Federation, the Bureau, the Secretariat, and for the entire IAF community worldwide. During these unprecedented times the IAF is more committed than ever to support the global space dialogue and make the space sector more resilient.

The year started with the participation to the 12<sup>th</sup> European Space Conference in Brussels on 21<sup>st</sup> of January 2020. The IAF hosted a networking lunch in partnership with the French Space Agency, CNES which allowed promoting the Federation to key decision makers in Europe. The conference converged on the topic “New Decade, Global Ambition: Growth, Climate, Security and Defence”, a theme in line with the IAF Global Advocacy Agenda 2019-2022.

Then, unfortunately the COVID-19 pandemic developed and all over the world people were forced to stay at home, cancel their travels and participate in the fight against COVID-19 by maintaining social distance. This was the reason why we took the difficult decision to cancel the IAF Spring Meetings 2020 and hold it in a 100% virtual format instead. 40 Meetings of committees, IPC, the Bureau etc. and more than 400 people met online, confirming that the IAF is and always will be the network platform for the engaged and enthusiastic space community worldwide.

After the decision to postpone the IAC 2020 in Dubai to 2021 and the IAC 2021 in Paris to 2022, we worked strenuously with the Bureau and the Secretariat to create an IAF event in 2020 that could reach everyone, everywhere. We decided to organize the 71<sup>st</sup> International Astronautical Congress, IAC 2020, as a CyberSpace Edition and offer this congress without registration fee to the global space community. For three days, from 12<sup>th</sup> to 15<sup>th</sup> October 2020, space experts from all over the world had the opportunity to attend more than 20 live sessions, including 3 plenaries, 2 highlight lectures, 5 IAF Global Networking Forums, and 2 Special Sessions. Thanks to the amazing response from the IAF community, we created a Technical Presentation Gallery which included more than 1.300 video lectures, and a virtual exhibition with more than 30 booths, accessible 24-hours a day.



The IAC 2020 – The CyberSpace Edition will leave a remarkable legacy. I am happy to report that more than 13.600 registered participants from 135 countries have joined the IAC 2020 making it a great success.

As part of the current IAF Space Advocacy Agenda, we also launched a new initiative: the “IAF Space Economic Platform – Bringing Space Down to Earth/Bringing Earth Up to Space”. Through this platform, the IAF aims to propel and support the new space economy by integrating new space actors, entrepreneurs, non-space industry and organizations through new dedicated activities and events. More details can be found here ([https://www.iafastro.org/activities/the-iaf-space-economic-platform-\(isep\).html](https://www.iafastro.org/activities/the-iaf-space-economic-platform-(isep).html) ) .

Another recent IAF initiative is the launch of the IAF Launchpad Mentorship Programme, that aims to facilitate career development and leadership capabilities of the mentee, and provides a platform for enhanced communication between the various generations represented within the IAF community. More details can be found here (<https://www.iafastro.org/activities/iaf-launchpad-mentorship-programme.html> ) .

Moreover, I am very glad to inform you that 19 new IAF members were approved in our latest IAF General Assembly (held in a virtual format), bringing the total number of IAF members to 407 from 71 countries, and further enlarging our broad network. IAF continues thus to be the largest space advocacy network in the world and I want to thank all of you for your efforts. The General Assembly also ratified the creation of two new Technical Committees: the IAF Committee on Space Habitats and the IAF Space Traffic Management Committee. We have thus today 46 IAF Committees covering the complete spectrum of space activities.

We are also incredibly proud of the official launch of the **IAF Digital Library**, the world’s largest online space repository with over 50.000 digital papers covering 70 years of space achievements and international cooperation since the inaugural International Astronautical Congress which took place in 1950. The IAF Digital Library aims to be a destination where knowledge goes beyond economic and geographic barriers to reach everyone, extending the boundaries of the past, envisioning the future and establishing itself as an infinite source of information, innovation, and inspiration for the benefit of the space community. Please visit the IAF Digital Library here (<https://dl.iafastro.directory/> ) .

Bureau members and myself are promoting IAF activities regularly at many fora and conferences and our IAF GNF Space Conversation Series highlights biweekly interesting topics chosen by our IAF members. More details can be found here

(<https://www.iafastro.org/events/iaf-gnf-space-conversations-series/> ) .

A new year is ahead of us. A particularly important year because 2021 will mark the 70<sup>th</sup> anniversary of the Federation. For the past seven decades, the IAF has stood the test of time by providing platforms for the global space community to meet, share and connect. With this philosophy the IAF expanded year after year its memberships and portfolio. It is an anniversary that makes us extremely proud and grateful to be part of the remarkable space sector that plays an ever-increasing role in our daily lives.

**For 2021, our activities will progress throughout the year and we would like to invite you already to attend and be involved in our main events that will be:**

- The IAF Spring Meetings 2021: the IAF is pleased to invite you to the Spring Meetings 2021. Due to the on-going pandemic and knowing that travelling to Paris may still be difficult and risky for many of us, we took the decision of holding this edition again in a 100% virtual format, from 23 – 25 March 2021. We are planning to meet again, in person, in 2022, please save the date for the IAF Spring Meetings 2022: from 22 – 24 March 2022 in New CAP Conference Centre, in Paris, France.
- The Global Space Exploration Conference, GLEX 2021, co-organized with State Space Corporation “Roscosmos”, will be held in St. Petersburg, Russia, from 14 – 18 of June 2021 and will consist of a technical programme, featured keynote speakers, plenary events and GNF sessions. GLEX 2021 will offer an ideal platform for discussion on recent results, current challenges and innovative solutions and it will contain several opportunities to learn about how space exploration investments provide benefits as well as discuss how those benefits can be increased through thoughtful planning and cooperation. We hope you will be able to join us for this exciting event. More details can be found here (<https://www.iafastro.org/events/global-series-conferences/glex-2021/> ) .
- The 72nd International Astronautical Congress, IAC 2021, will be hosted by the Mohammed Bin Rashid Space Center – MBRSC, and it will take place in Dubai, UAE, from 25 – 29 October 2021. For the very first time, the IAC will open its doors to the global space community in the United Arab Emirates, the first Arab country to host the IAC since its establishment in 1950. With the theme “Inspire, Innovate & Discover for the Benefit of Humankind”, the IAC 2021 looks forward to making a contribution to humanity and to science by strengthening and enhancing cooperation between all countries in the space sector. The IAC is not only a Congress, but a gathering of the international space community that, every year, contributes to and shapes a different and exciting programme. There are numerous different ways that you can actively be part of the congress; for detailed information, please consult our website and check our “How to actively engage in the IAC (<https://www.iafastro.org/assets/files/events/iac/2021/how-to-engage-in-the-iac-guide-04-11-20.pdf> ) ” guide. We look forward to your participation!



We are living in unprecedented times and I can only stress the significance of space technologies such as remote sensing applications, satellite and communications technology, artificial intelligence, and telemedicine when addressing a global health crisis such as the one we are currently facing.

We are privileged to be together as a Federation and we will continue reaching out to connect the global space community. Thank you for your engagement, your support, and your trust. I hope that you and those around you are and remain safe.

I wish you and your loved ones peace, resiliency and all the best for 2021 during this challenging time. I look forward to welcoming you to the 2021 IAF meetings and the celebration of the 70th anniversary of the Federation in December 2021.

With my very best personal regards,

Prof. Pascale Ehrenfreund  
IAF President



**Pascale EHRENFREUND**

Research Professor,  
George Washington University

# 次世代太陽電池「ペロブスカイト」

## 効率向上、脱炭素へ期待

東京大学が、ペロブスカイト太陽電池の効率向上に成功したと発表。従来のシリコン太陽電池よりも高い効率を達成し、脱炭素社会の実現に貢献する可能性がある。研究チームは、ペロブスカイト太陽電池の構造を改良し、光電変換効率を大幅に向上させた。この成果は、再生可能エネルギーの普及に大きく貢献する可能性がある。

**NIKKEI** 大型化・耐久性に課題  
2020.12.21



田村教授は、ペロブスカイト太陽電池の製造コストを削減し、大規模な生産を実現する必要があると指摘している。また、ペロブスカイト太陽電池の耐久性を向上させるための研究も進められている。この技術は、再生可能エネルギーの普及に大きく貢献する可能性がある。

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## 02. Perovskite solar cells in Japanese-language press

← This is a Japanese-language newspaper article about Perovskite solar cells (日本経済新聞; 21 Dec 2020).

These solar cells have been written up in this newsletter in the past as BIRDS-4 has a Perovskite solar cell mission. See these two items:

- ① *What are Perovskite solar cells?* Page 115 of Issue 38
- ② *BIRDS-4 PDR – Missions* Page 60 of Issue 39

## 03. Revitalizing the regions of Japan: Museums as hubs

**PUBLIC RELATIONS OFFICE**  
GOVERNMENT OF JAPAN

[Home](#) > [Highlighting JAPAN](#) > [Highlighting JAPAN December 2020](#)

HIGHLIGHTING  
**Japan**

**December 2020**  
REVITALIZING THE  
REGIONS: MUSEUMS  
AS HUBS

**INDEX**

— THEME FOR December  
**REVITALIZING THE REGIONS: MUSEUMS AS HUBS**  
Japan is home to a large number of museums, and these are located in regions throughout the country. Beginning this year (2020), the Agency for Cultural Affairs, Government of Japan has designated qualifying museums as regional hubs for the promotion of cultural tourism. In this month's issue, we introduce several such museums as well as the regions and cultures which they promote.

**Access the December 2020 issue here:** <https://www.gov-online.go.jp/eng/publicity/book/hlj/20201201.html>

## 04. SpaceX SN8, and the meaning of failure according to Elon Musk



The fiery end of SN8 *THE ECONOMIST, 12 DEC 2020*

“Failure is an option here. If you are not failing, you are not innovating.” So said Elon Musk a few years after he had set up SpaceX, his private rocketry firm. And fail, at the end, his most recent test did. On December 9th SN8, the latest incarnation of SpaceX’s Starship, a craft intended as the second stage of a rocket that will be able to carry 100 tonnes of payload, people included, into orbit, and thence to the Moon and Mars, took off perfectly from its pad in Boca Chica, Texas. It rose to an altitude of 12.5km, cut its three engines and manoeuvred itself parallel with the ground to fall back to Earth. Just before touch down it restarted its engines and lifted itself upright to land. But it came in too fast, and the result can be seen above. Nothing daunted, Mr Musk said that the flight had provided “all the data we needed” before its RUD. For those not in the know, RUD is SpaceX jargon for “Rapid Unscheduled Disassembly”.

**I think the comment by Elon Musk (above) is profoundly correct.**

**- Editor**

# 05. Archaeology from space

「宇宙考古学の冒険」という本  
書はタイトルを、古代の宇宙人が  
出てくるトランプ本と勘違いして  
スルーした人は少なくないだろ  
う。その面白さを呼び戻し、書庫の  
しらべはせたい。考古学の現在  
と未来の姿を伝えた、最大級の  
新しい科学書だからである。

タイトルは「宇宙」は、人上南  
洋がとる宇宙空間のほか、飛行機  
やロケットの高度も含めた「上空」  
のすべてが入る。つまり、地球をト  
から俯瞰して見守る空間が舞台を  
舞台とした考古学の本書の上巻だ。

星を眺めながら考古学者は、地  
上に立ち、スコープや竹ペラで遺  
跡をすすから掘り出す。これが必  
ずの大冒険だ。今も、今も、今も、  
それ以上に、宇宙からの衛星画像  
を解析し、地下に眠る未知の都市  
の姿を透視できる。森林に閉ま  
れて人類未踏の土地を、マローン  
P. 100

Author is a professor at the Univ. of Alabama

## 宇宙考古学の冒険 NIKKEI

2020.11.07

サラ・パーカック著

### 古代の謎空から解き明かす

に精進な立体像を再現できる。  
この新世代衛星写真を引くはる書  
が、試行錯誤を経て重要な発見  
にいたる過程を随筆体たうりに  
語るのが最初の楽しみである。こ  
こで遠隔技術の力を借りたりと  
んだ読者は、その成果を味わう  
世界の表に出る。彼等は、著者が  
専門とする古代エンジニア、最新の  
遠隔技術は、それを補って不足  
に補う。この新世代衛星写真を引くはる書  
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世界の表に出る。彼等は、著者が  
専門とする古代エンジニア、最新の  
遠隔技術は、それを補って不足

や遺物分析の成果から、無地に付  
を築いた。女性の生誕をトランプ風  
に描き、4千年以上の前の社会と人  
類を生きたきとよみがえらせる。  
後半の楽しみは、この新世  
代考古学とともに浮き彫りになっ  
た深刻な問題と、それを乗り越え  
る勇気だ。遠隔技術による高度に  
よって前進して数が増える世界  
の冒険は、その冒険の記録し、促  
すのである。いまだに繰り返す  
戦や政治的勢力による遺跡の破壊か  
ら、それらをどう守って未来に残  
すのか。一つの策として、衛星  
像に世界の市民がアクセスし、遺  
跡を保護するというプロジェクトに、  
彼女は参加をいざなわれる。ア  
タラシく世に開放し、方法や成果や  
価値観を共有することが、これが  
日本の考古学の目指すべき道だ。

日本の試みが出てこないのは悲  
しいが、著者と書を見習う日本  
人考古学者の河江博樹さんが、  
宇宙上の遺跡を踏まえたわたりや  
すい船を未来に載せている。こ  
こから読むのも、懐古な本を書き  
つくり残すには良い手だ。

（評）国立歴史民俗博物館教授  
佐木 真樹

宇宙考古学の冒険  
の冒険

原題—ARCHAEOLOGY FROM SPACE (船谷玲美訳、光文社・2100円)  
▼著者は米アラバマ大考古学教授。エッジワース宇宙賞。16年にはTED Prizeを受賞。



**"Archaeology from space"**  
[https://www.ted.com/talks/sarah\\_parcak\\_archaeology\\_from\\_space?language=en](https://www.ted.com/talks/sarah_parcak_archaeology_from_space?language=en)  
**Sarah Parcak** -- Satellite archaeologist + TED Prize winner.  
 Like a modern-day Indiana Jones, Sarah Parcak uses satellite images to locate lost ancient sites. The winner of the **2016 TED Prize**, her wish is to protect the world's shared cultural heritage.

## 06. Botswana Launches National Space Program

### Botswana Launches National Space Program

By Space in Africa -December 23, 2020



Botswana President, Mokgweetsi Masisi

President of Botswana, Mokgweetsi Masisi has recently launched an ambitious satellite project which will see Botswana developing its own space programme. The programme will lead to the Southern Africa country owning a home-grown nanosatellite.

The launch of the space programme is in line with Masisi's development agenda of harnessing a knowledge-based economy as he proudly singled out the Botswana International University Of Science And Technology for its remarkable response to his rallying call. He mentioned that despite the hardship brought about by the ongoing pandemic, it is these adverse effects of the pandemic that had emboldened commitment to investing in the satellite project and harnessing it.

“It will take three years, will require full commitment and selfless dedication. It will be demanding as it is the first time the nation will be launching a satellite into space. However, if we capitalise on the data and apply it in various industries (current focus is on Agriculture), it would contribute to the growth and development of the nation” the President added.

The program aims to launch an Earth observation 3U nanosatellite into space in the next three years with the ambition of launching bigger satellites such as 6U and 12U in the future in order to create a constellation. This program will domicile in the Botswana International University of Science, Technology (BIUST) in collaboration with local, regional and international partners. . . . .

**Read the entire article:**

[https://africanews.space/botswana-launches-national-space-program/?fbclid=IwAR3EiOXcnQjr\\_a8oNqP4akJGyYy5ArVo5EC3HV2IJHxUFN3e6kfj2OZHbNE](https://africanews.space/botswana-launches-national-space-program/?fbclid=IwAR3EiOXcnQjr_a8oNqP4akJGyYy5ArVo5EC3HV2IJHxUFN3e6kfj2OZHbNE)

## 07. Special report about thermal imagery from Univ of Cambridge (UK)



4-DEC-2020

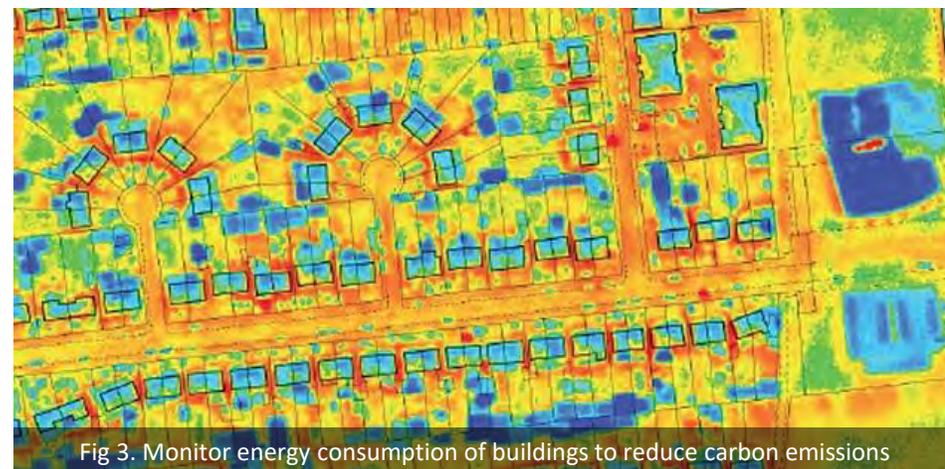
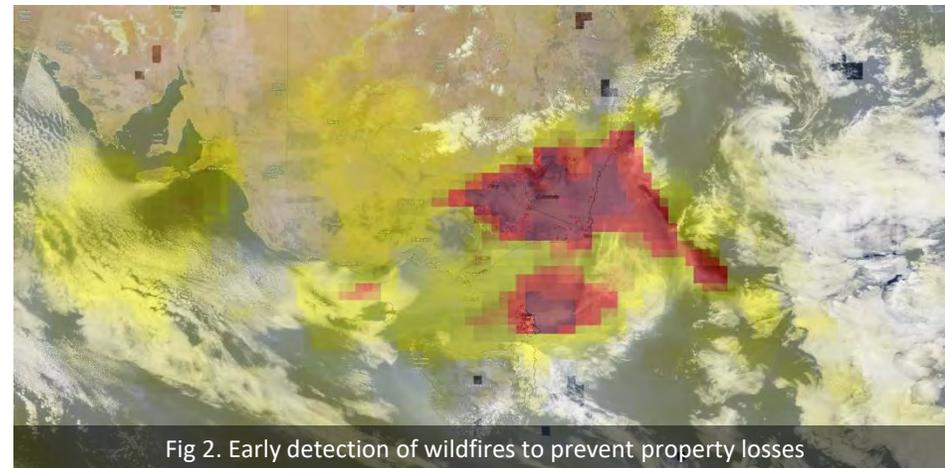
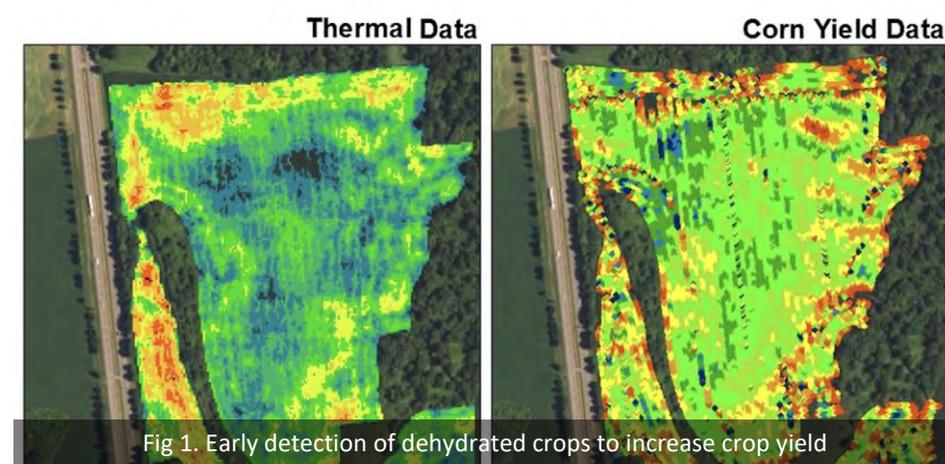
**Marco is renting this house in  
Cambridge**

**This report (the next three pages) was furnished by Marco Gomez-Jenkins, Research Assistant, Institute of Astronomy, University of Cambridge, UK.**

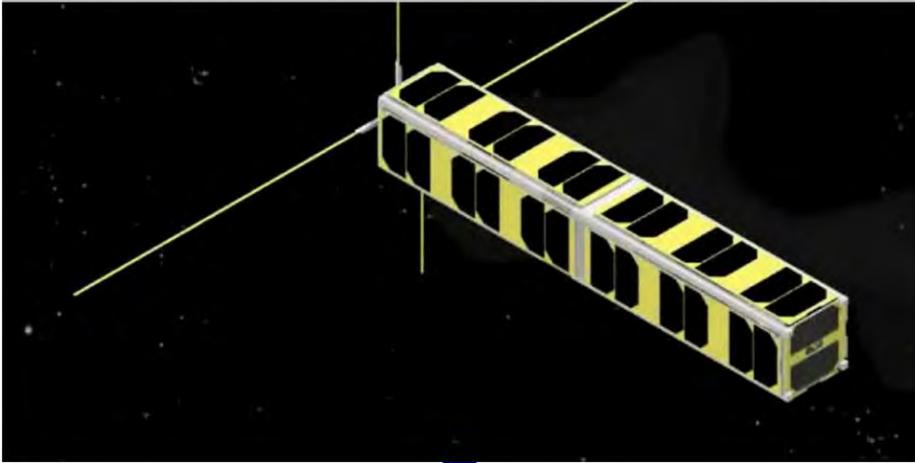
**He has a long-time association with BIRDS. Also, he was the Project Manager of *Irazu*, the first satellite of Costa Rica. He now lives and works in the UK.**

# Thermal Infrared Satellite Images

Thermal Infrared (TIR) satellite images give unique insights that can be used for a variety of applications (Fig 1-3). The difference between optical and TIR sensors is that the former detects photons that are reflected from a surface, while the latter detects photons emitted by a body, meaning that it can measure its emitted energy. This unique characteristic provides distinct advantages over optical data, such as: (1) TIR data can be captured day and night: This is useful to detect objects at night for defence and security purposes, such as tracking illegal fishing vessels (2) TIR sensors can detect energy fluxes: By calculating temperature differences, an end user can detect how much energy is being lost or generated by a body using TIR images. (3) TIR sensors are less susceptible to cloud coverage: this means that they can capture images with moderate cloud formation that obstruct optical images. The problem with TIR satellite images is that there aren't any satellite currently in operation that can deliver the images resolution required at a high revisit rate.

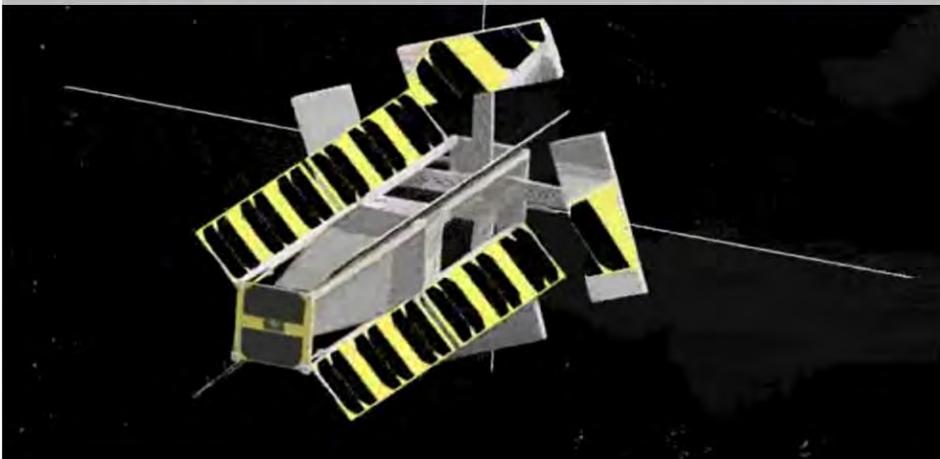


SUPER-SHARP: A 10kg shoebox size satellite...



that unfolds  
to become

... a self-aligning telescope with a 50cm aperture



# Super-Sharp Space Telescope

- At the University of Cambridge, we are working on a deployable, self-aligning space telescope to capture high resolution TIR images.
- Our patent pending self-alignment technology which accurately positions the optics to better than a millionth of a metre.
- This technology allows high-resolution TIR imaging (5-10 m) in a small package (CubeSat standard), therefore enabling satellite constellations to achieve a high revisit rate.
- Our research group created a spin-out company (Super-Sharp Space Systems) to commercialize our deployable space telescope technology. We recently won a UK Space Agency grant to develop a prototype of our satellite and to study commercial applications.



UNIVERSITY OF  
CAMBRIDGE  
enterprise



UK SPACE  
AGENCY



Science and  
Technology  
Facilities Council

Observatory Building at the  
Institute of Astronomy, Cambridge



Thanks to Prof Maeda for inviting me to contribute to the BIRDS newsletter. Feel free to contact me at [mag96@cam.ac.uk](mailto:mag96@cam.ac.uk) if you would like any advice on starting a space company. It is really hard work but incredibly rewarding.

**Marco Gomez-Jenkins**

Research Assistant

Institute of Astronomy

University of Cambridge

# 08. Official visit by the Foreign Minister of Japan to Paraguay



“Kyutech”



Email →  
from Director Roman, of the  
Paraguay Space Agency



Model of  
**Guaranisat-1**  
(BIRDS-5 of  
Paraguay)



**GOBIERNO  
NACIONAL**

Subject:  
*Official visit of HE Toshimitsu Motegi Minister of Foreign Affairs of Japan to Paraguay.*  
From: Alejandro Román, AEP  
Date: 2021/01/08 23:10  
To: George Maeda  
CC: Mengu Cho

**Email from AEP**

Dear Maeda-sensei,  
cc. Cho-sensei

We are very proud to inform that AEP presented to the Minister of Foreign Affairs of Japan, Toshimitsu Motegi, in the official visit to Paraguay on behalf of Japanese Prime Minister Yoshihide Suga, the model of the first Paraguayan satellite Guaranisat-1 highlighting the cooperation of the Government of Japan, Kyutech and JAXA; also we mentioned that this project reinforces the ties of friendship and collaboration, marking the beginning of another line of cooperation within the area of space science and technology between our countries.

When the explanation of Mr President Liduvino Vielman and myself ended, the final expression of Minister Motegi was "Excellent". I am sharing with you some photos of the event.

Kindest regards,  
Alejandro R

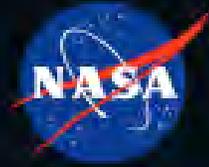


## 09. Snow descends on the Tobata Campus of Kyutech



**Snow descended on many parts of Kyushu during 7-10 January 2021, which is unusual for Kyushu. Freezing temperatures caused apartment water pipes to freeze – I heard this from several students.**

## 10. NASA discusses BIRDS-4



### Space Station Research Explorer on NASA.gov

[NASA](#) • [ISS](#) • [Research & Technology](#) • [SSRE Home Page](#)

[Experiments](#) [Technology Development and Demonstration](#) [BIRDS-4 Project](#)

### Joint Global Multi-Nation Birds Project



**GO TO THE ORIGINAL NASA WEBSITE TO SEE THE FULL ARTICLE ON BIRDS-4:**

[https://www.nasa.gov/mission\\_pages/station/research/experiments/explorer/Investigation.html?id=8447](https://www.nasa.gov/mission_pages/station/research/experiments/explorer/Investigation.html?id=8447)



## 11. Fukuoka Prefecture takes an interest in the space industry

# 福岡県だより

FUKUOKA PREFECTURE NEWS 奇数月発行/通巻141号

### ●超小型レーダー衛星「イザナギ」とは？

令和元年12月11日、インド・サティシュ・ダワン宇宙センターから打ち上げられた。夜間や悪天候時も地表面を観測でき、車の判別もできるほどの高解像度の性能を持つ。衛星本体は県内企業16社をはじめ、九州の地場企業が協力して開発。令和2年12月以降、2号機「イザナミ」を打ち上げる予定。

2021 1 JANUARY Vol.141

FUKUOKA PREFECTURE NEWS 奇数月発行/通巻141号

株式会社QPS研究所 代表取締役社長 大西 俊輔さん × NPO法人円陣スペース エンジニアリングチーム 理事長 当房 睦仁さん × 福岡県知事 小川 洋

特集 特別対談

THIS IS PUBLISHED BY THE FUKUOKA PREFECTURE GOVERNMENT

九州から宇宙へ From KYUSHU to SPACE.

県人口/5,108,038人(令和2年9月1日現在) ← current population of Fukuoka Prefecture (01 Sept 2020)

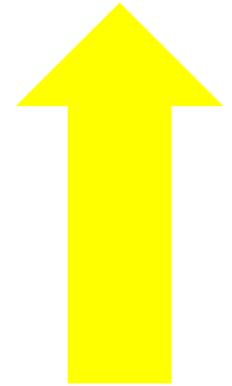
発行/福岡県総務部県民情報広報課 印刷/福岡総合印刷株式会社 作成日/令和2年11月30日

(九州ロゴマーク) 九州・山口各県と経済界で定めた「九州」のマークです

九州 KYUSHU

## 日本語記事:

<https://www.pref.fukuoka.lg.jp/somu/ken-dayori/202101/html/special.html>



See the article on the next page.

# 大西 俊輔さん×當房 睦仁さん×小川 洋

宇宙ビジネスは、人工衛星やロケット関連製品だけでなく、衛星データを活用したサービスの提供など、今後大きく成長することが期待されています。

今回、小川知事は、令和元年12月に世界最高レベルの超小型レーダー衛星「イザナギ」の打上げに成功された大西俊輔さんと、ものづくり企業の技術を結集してその衛星開発に貢献された當房睦仁さんをお迎えし、宇宙ビジネスの魅力や衛星開発に懸ける思いについて語り合いました。



株式会社QPS研究所 代表取締役社長  
大西 俊輔(おおにしゅんすけ)さん

九州大学大学院 航空宇宙工学専攻、博士(工学)。大学院在学時より小型人工衛星開発プログラムに従事し、平成25年、株式会社QPS研究所(福岡市)に入社。翌年、代表取締役社長に就任。「イザナギ」の打上げ成功により、九州から世界の宇宙産業にインパクトを与える。



NPO法人円陣スペースエンジニアリングチーム 理事長  
當房 睦仁(とうぼうむつと)さん

平成9年、睦美化成(久留米市)代表取締役に就任。平成19年、円陣スペースエンジニアリングチーム(e-SET)を結成し、地元企業10数社と協力して宇宙産業に参入。平成24年、e-SETをNPO法人化し、次世代の産業育成と技術者の地域定着を図る。

## 「イザナギ」の打ち上げ成功、2号機「イザナミ」の打ち上げへ

**知事:** 初号機「イザナギ」の打上げが成功した瞬間は、県庁のパブリックビューイングで県民の皆さんと喜びを分かち合いました。子どもたちや宇宙に関心のある人をはじめ、多くの県民の皆さんに夢や希望を与える、まさに快挙でした。2号機「イザナミ」の打上げも楽しみですな。

**大西俊輔さん(以下、大西):** ありがとうございます。初号機の打上げ成功により多くの反響がありました。そして2号機は、令和2年12月以降、アメリカの宇宙開発企業スペース・エックス社の主力ロケット「ファルコン9」に搭載されて宇宙に旅立つ予定です。

**知事:** いいよですね。2号機はどんなところが進化しているのですか？

**大西:** 太陽電池パネルが増えて、より多くの電力が取り込めるようになりました。またイザナギとイザナミの2機体制になることで、得られるデータがより増え、スムーズな地表面の観測が可能になります。最終的には令和7年を目標に36機打ち上げる計画で、実現すれば、昼夜、天候を問わず地表面を観測でき、より詳細な画像が10分間隔で取得できます。特に、地上で現地確認が困難な災害時には、宇宙からの画像が迅速な災害対応に大いに役立つと思います。

**知事:** 夢やロマンだけでなく、衛星を利用して、暮らしを豊かにするビジネスまでも見越して取り組む時代になってきています。この衛星の開発に携わった県内16社を中心とした企業は「福岡版下町ロケット」としても話題になりました。樹脂加工が本業の當房さんが宇宙ビジネスに参入されたきっかけは？

**當房睦仁さん(以下、當房):** 平成19年に九州大学の講演会で宇宙ビジネスの話聞いて、当時所属していた久留米市の異業種交流団体のメンバーに相談すると、12社が「面白そう!」と興味を示し、そこから皆で衛星開発への挑戦を始めました。

**知事:** ものづくりと言っても、衛星の開発はご苦労も多かったのでは？

**當房:** 私はものづくりはプロですが、宇宙のことは素人なので求められる品質の水準が分からず、手探りでした。衛星の部品は軽さを要求される一方、打上げ時の振動や衝撃などに耐えうる強度も求められます。メンバーで知恵を出し合い、いろいろ試行錯誤を重ねました。九州地場の企業のみで製作した製品で打上げが成功したことは大きな自信になりました。

## 福岡県が持つポテンシャル

**知事:** 令和2年9月、本県は、国から「宇宙ビジネス創出推進自治体」に選定されました。お二人から見た、福岡県の



▲イザナギ打上げのパブリックビューイングの様子

強みや特長を教えてください。

**大西:** 宇宙ビジネスの発展には、宇宙から得たデータが、実際に人々の生活に役立つサービスになっていくことが必要です。福岡県は元々、ITやソフトウェアの企業が集積しているので、ハードとソフトが両輪となってサービスを生み出していく土壌があることが強みだと思います。

**當房:** 私は久留米が地盤ですが、筑後地方は製造業の歴史が古く、業種が多岐にわたっていて、それぞれの技術力は世界でも十分戦えるレベルです。また、地理的にも九州のハブとして各地との交流があることも強みなので、教育・研究機関との連携により、さらに奥行きのある技術革新が可能になると思います。

**知事:** 心強いお言葉です。令和2年9月、お二人をパネリストにお招きした「福岡県宇宙ビジネスフォーラム」では、約200人が参加し、ウェブ配信でも300人が視聴し、宇宙への関心の高まりを実感しました。今後、お二人に続く人が増えていくことを期待しています。

## 宇宙ビジネスへの期待 県民の皆さんへのメッセージ

**知事:** 最後に、宇宙を夢見る子どもたちや宇宙ビジネスへの参入を目指す企業に向けてメッセージをお願いします。  
**大西:** 私が宇宙に興味を持ったのは小学生の頃、ペットボトルでロケットを作る科学教室に参加したことで。試行錯誤して最後には上手に飛ばせた経験が今につながっています。皆さんも失敗を恐れず、まずは一歩踏み出してみてください。また、宇宙ビジネスに関心のある人は、他

業種の人と知り合う機会をいかに多く持つか、業種を問わず同じ思いを持って高め合うことが大切です。県主催の「福岡県宇宙ビジネス研究会」などの交流会にぜひ積極的に参加してみてください。私も、宇宙ビジネスを目指す皆さんと語り合いたいです。

**當房:** 行動力は大事ですね。私たちが13年前の講演会を聞いたから新しい挑戦に踏み出せました。出会いの場が新しい何かを生むのだと思います。そして最初の旗上げ役になって周囲を巻き込むことも重要ですね。

**知事:** 子どもたちにはいろんなことに挑戦して、面白いと思ったことは続けてほしい。失敗してもその原因を考え、行き詰まったとしても試行錯誤しながらやり続けてほしい。それを実践してこれたのがお二人だと思います。また、當房さんは13年前、まさに旗上げ役となって仲間を集められました。県では、その橋渡し役として、これからも業種を越えた出会いや交流のきっかけの場を作っていきます。とりわけ、令和2年は新型コロナウイルスにより多くの事業者が影響を受けました。ピンチをチャンスに変えるため、新しいビジネスに挑戦して未来を切り開く企業を力強く後押ししてまいります。



▲試作アンテナを囲むe-SETのメンバーの皆さん

## ●超小型レーダー衛星「イザナギ」とは？

令和元年12月11日、インド・サティッシュ・ダワン宇宙センターから打ち上げられた。夜間や悪天候時も地表面を観測でき、車の判別もできるほどの高解像度の性能を持つ。衛星本体は県内企業16社をはじめ、九州の地場企業が協力して開発。令和2年12月以降、2号機「イザナミ」を打ち上げる予定。



手前にあるのは、衛星開発の中で生み出された部品の数々

※この対談は、十分な距離の確保、換気の実施など、新型コロナウイルス感染症対策を講じ、10月26日に実施しました

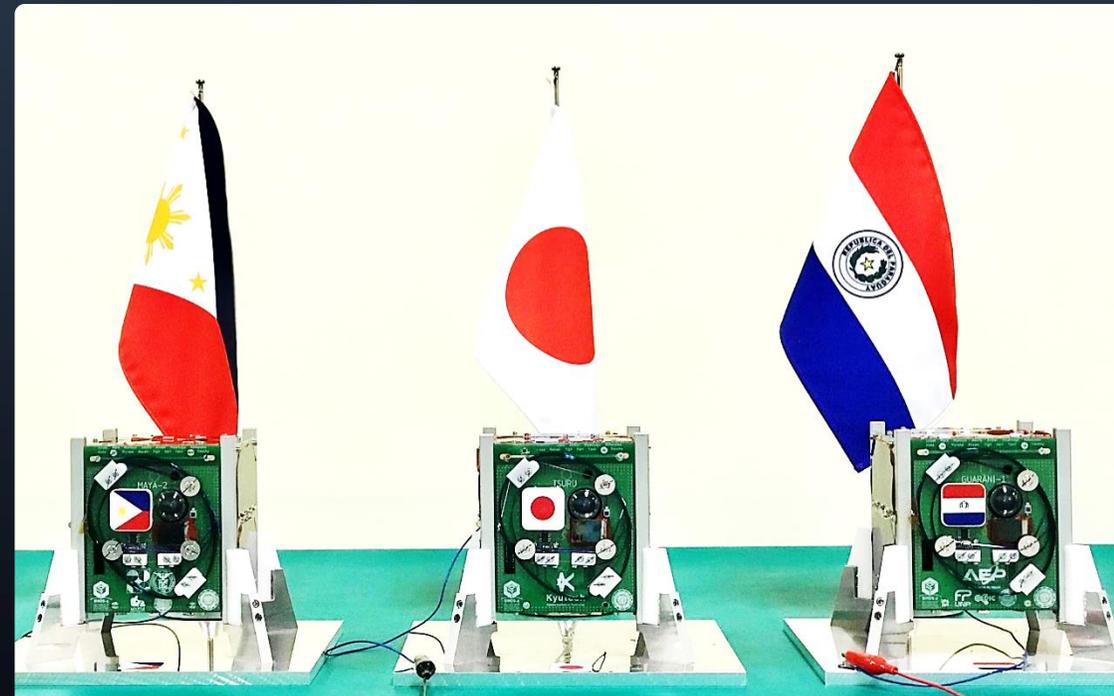
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## 12. How to test battery cells and other topics



### Battery (Cells) Screening & Its Testing Safety Procedure method on Charger Discharger System

Hari Ram SHRESTHA, BIRDS-4  
12 January 2021

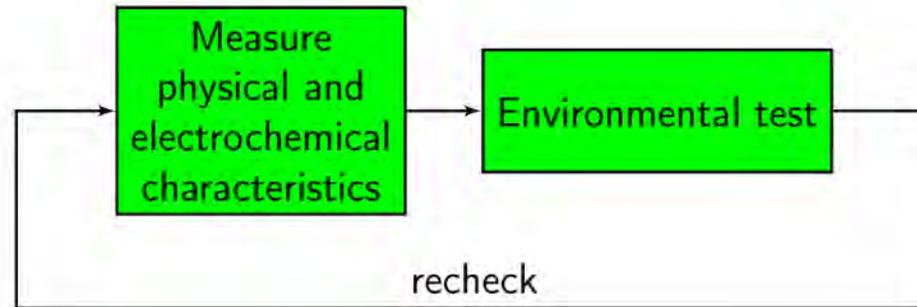


# Introduction of Battery(Cell) screening Test

Battery (cells) screening test is a process that is performed to match the battery(cells) for before assembling the battery box. This battery (cell) screening process is essential to select the batteries(cells) with suitable characteristics and construct the battery assembly for the satellite.

The main objective of the cell screening test is to detect the defect(s) of the batteries(cells) based on the characteristics of the battery(cells)'s: open-circuit voltage, capacity, internal Dc resistance, and physical properties.

## Cell screening process



### Characteristics

- Open circuit voltage
- Capacity
- Dimensions
- DC resistance\*
- Charge retention
- Mass

\*and/or AC impedance

## OBJECTIVE

- Find defects
- Select best batteries for assembly



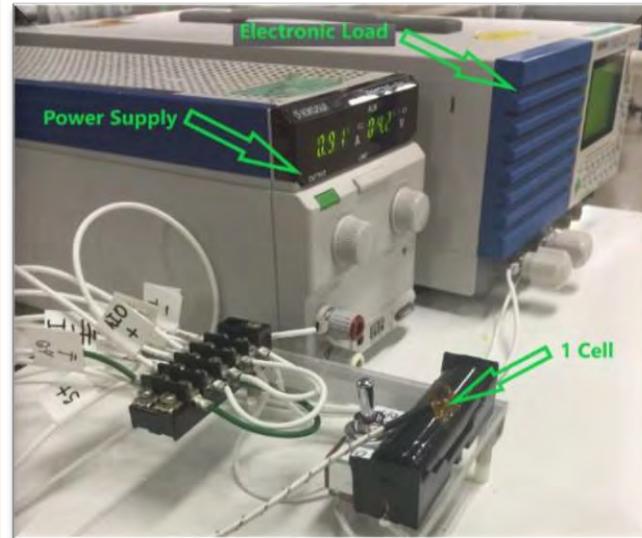
Article by:

Hari Ram SHRESTHA



# Design & Fabrication the System

The chemistry of the battery(cells) is measured at room temperature by the charger-discharger system. The charger-discharger system characterizes the battery(cells) chemistry before and after the environmental tests. Whereas the low-pressure vacuum test and the vibration test(qualification test level) are environmental tests for the cell screening process. It is also called the battery(cells) cells acceptance test.



Previous setting for Battery Cell screening test

## Problems:

- Powerful equipment, high cost
- Availability
- Inaccuracy of measurement
- Limited qualified users
- One cell at time (Change  $\approx$  6 h)

Average testing time (20 cells, one cycle): 8 days



NiMH eneloop and eneloop plus



Battery(cell) Screening adopted satellites projects.

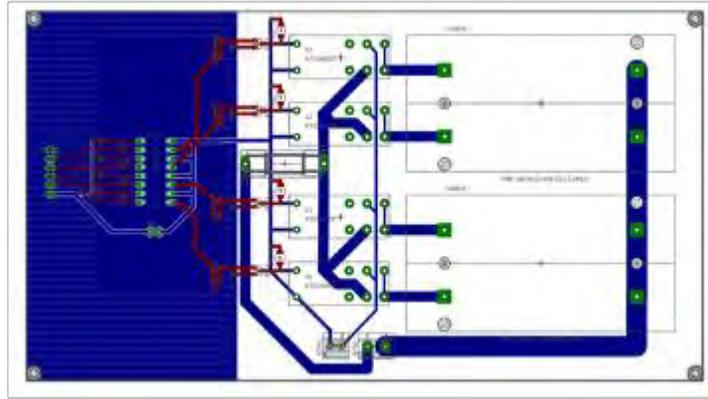
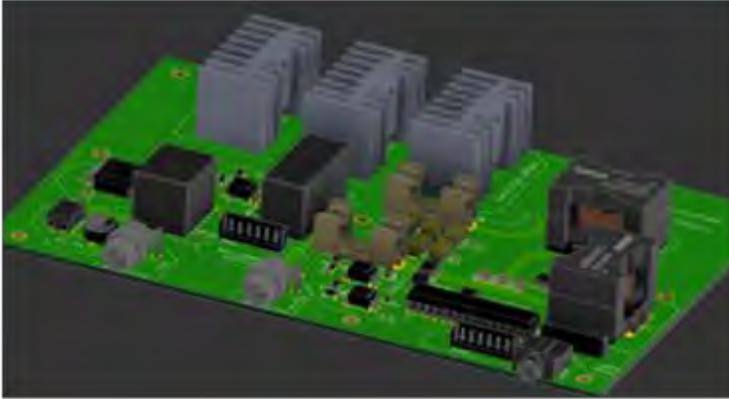


Article by:

Hari Ram SHRESTHA



# Design & Fabrication of the System



References: Dr.  
Juan J. Rojas,  
former PhD  
student ,LaSEINE

[https://www.researchgate.net/profile/Juan\\_Rojas24](https://www.researchgate.net/profile/Juan_Rojas24)

## Method:

1. Design and build of a 4 -cell switcher for (NiMH and Li ion) battery (cell) with temperature and voltage sensors.
1. Design and fabrication of a charger/discharger using a buck/boost Zeta converter.
2. Design and implementation of an embedded converter controller.
3. Design and implementation of an embedded state machine to control discrete events.
4. Implementation of logger software in LabVIEW.



Article by:

Hari Ram SHRESTHA

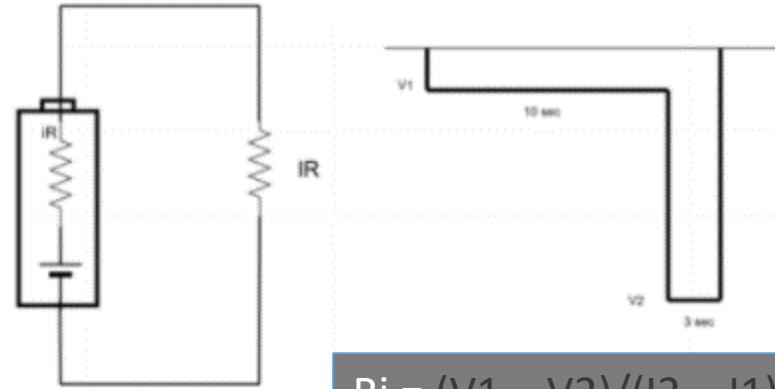


# Design & Fabrication the System

## Internal DC resistance:

The battery's (cell) internal resistance can be measured from the current-voltage relationship given by two points in a discharge curve. The Charger-discharger system, the two-tier DC loading method offers a different method by applying two sequential discharge loads of different currents and intervals.

For example, first discharge at the low current rate (0.3 C) for 10 seconds, then high current rate use (2 C) for 3 seconds, then Ohm's law calculates the resistance values.



$$R_i = (V_1 - V_2) / (I_2 - I_1)$$

## Equivalent circuit with Two-tier DC load

Ref.: RobertoF43, Arduino Battery Tester With WEB User Interface.



KITSUNE Satellit also used the charger discharger system for battery (cell) screening

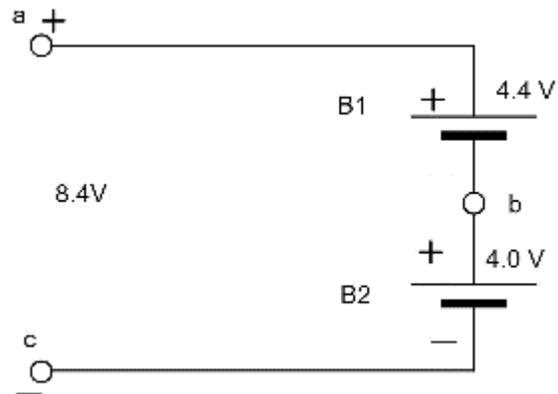


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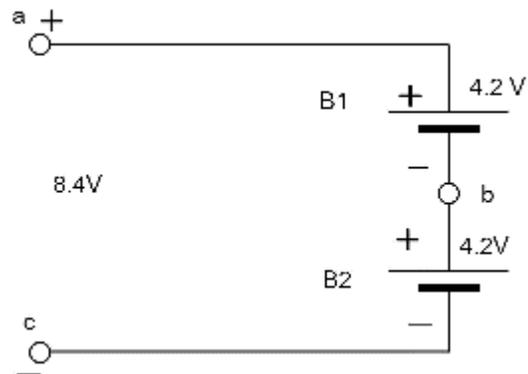
Hari Ram SHRESTHA



# Cell Matching



cells were NOT matched



cells were matched

- Cell Matching:

It is necessary to improve the performance and life cycle of the battery. Therefore, the battery pack that has more than one cell in series connection or parallel-series connection must be balanced in battery pack based on Open Circuit Voltage, Capacity, self discharge rate, internal DC resistance and the temperature characteristics. This also protects the batteries from the overcharging, over heating and possibility of catching fire.



Article by:

Hari Ram SHRESTHA



# Procedure steps to use the system: Li ion or NiMH



Article by:

Hari Ram SHRESTHA



## 2. Clean, sort and shine

- a) Keep all the components and devices of the system properly arranged
- b) Always keep the extra batteries away from the work/test bench
- c) Do not place metallic conductive material near the battery charging place
- d) Keep away any heat source (i.e. soldering iron) near the system

## 3. Keep the Fire Extinguisher near about the test system

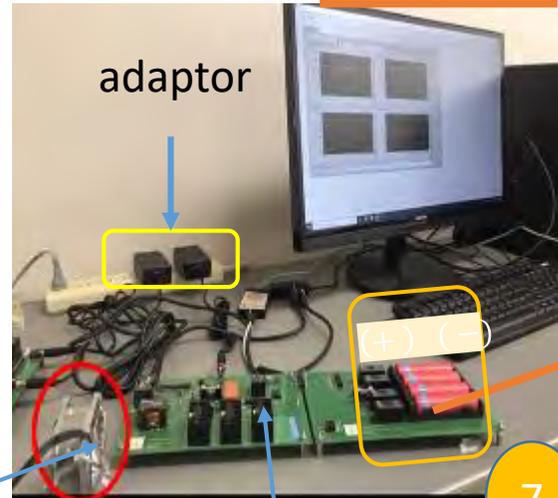




## Charger-Discharger System

LAB VIEW

6



adaptor

Cooling Fan

7

1<sup>st</sup> Install  
four cells at  
Cell Switcher

6. Connect the required cables and turn on all components and devices for System (Adaptor, Cooling Fan, Computer, software)

7. Put the battery(cells) properly into the battery holder with on cell switcher. (Cell switcher is different for NiMH and Li ion)

4



SANYO NCR 18650  
GA (Li Ion)



Panasonic  
eneloop NiMH

4. Before the test check the appearance for:

- Scratch
- Rust
- Dirt
- Deformation
- Discoloration
- Leakage
- Full charge (At new batteries the first time)

5

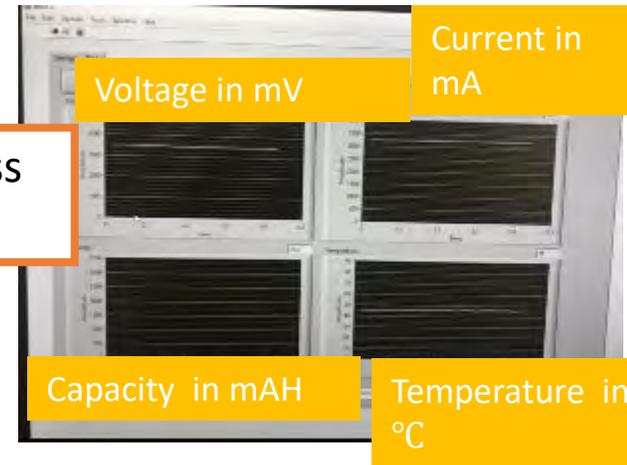
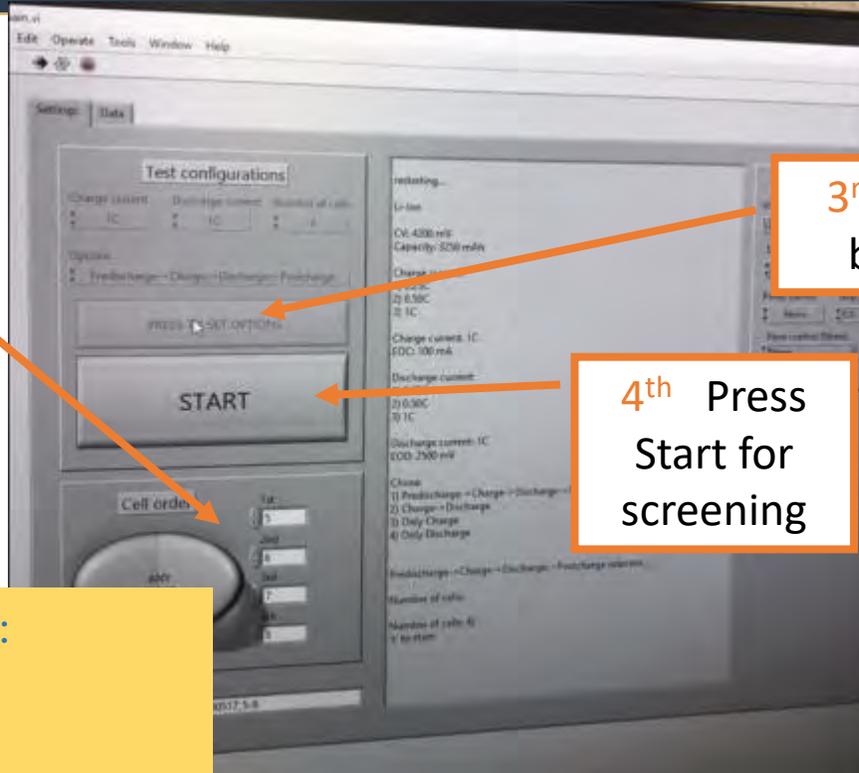
5. Make sure to not mix the batteries on test (e.g. old & new, different chemistry or different model). Also make sure to choose the right LABVIEW programming for Li-ion and NiMH.

# Conti..



on.jp Article by:

Hari Ram SHRESTHA



## Cell screening steps:

1. Pre discharge
2. Full charge
3. Full discharge
4. Post Charge

Total time for test: 17 hours for 4 batteries

7. Do not leave the system during operation

8. Monitor the battery temperature frequently from display or by touching the cells. If you notice the battery is getting hot, then the system should be turned off and remove the battery

## 9. Do not touch and move the system during test time



Cell pre-screening selection															
Capacity (discharge)	Capacity (charge)	Resistance	Self-discharge rate	Visual inspection	Final										
Initial OCV	Length	Diameter	Mass	Capacity (discharge)	Fully Charged DCR	Fully Discharged DCR	Fully Charged OCV								
[mV]	[mm]	[mm]	[g]	[mAh]	[mΩ]	[mΩ]	[V]								
3.624	PASS	65.20	PASS	18.20	PASS	85.8956	PASS	2604.6	PASS	94.600	PASS	91.100	PASS	4.153	PASS
3.626	PASS	65.20	PASS	18.20	PASS	85.7429	PASS	2631.2	PASS	88.800	PASS	96.900	PASS	4.154	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.8794	PASS	2674.1	PASS	86.500	PASS	90.700	PASS	4.160	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.9699	PASS	2467.9	PASS	131.900	FAIL	119.600	FAIL	4.167	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.6736	PASS	2602.8	PASS	88.400	PASS	84.200	PASS	4.151	PASS
3.626	PASS	65.20	PASS	18.20	PASS	85.6929	PASS	2637.5	PASS	92.300	PASS	86.500	PASS	4.157	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.6489	PASS	2668.2	PASS	95.700	PASS	98.400	PASS	4.154	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.7080	PASS	2663.7	PASS	94.200	PASS	91.500	PASS	4.153	PASS
3.626	PASS	65.20	PASS	18.20	PASS	85.8179	PASS	2631.6	PASS	80.700	PASS	86.500	PASS	4.157	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.7883	PASS	2663.2	PASS	84.600	PASS	90.300	PASS	4.156	PASS
3.626	PASS	65.20	PASS	18.20	PASS	85.8811	PASS	2619.9	PASS	87.600	PASS	94.200	PASS	4.158	PASS
3.626	PASS	65.20	PASS	18.20	PASS	85.7874	PASS	2631.6	PASS	93.400	PASS	98.800	PASS	4.170	PASS
3.626	PASS	65.20	PASS	18.20	PASS	85.8022	PASS	2607.3	PASS	84.200	PASS	87.600	PASS	4.153	PASS
3.627	PASS	65.20	PASS	18.20	PASS	85.9580	PASS	2619.5	PASS	93.400	PASS	91.600	PASS	4.155	PASS

Example of screening data

During Li ion battery testing time on charger discharger system

Example : Li ion battery screening data

## 10. After completing the test, stop the system and properly remove the batteries(cells).

End of article

Article by:

Hari Ram SHRESTHA



## 13. Key space sector economic figures of 2020

FROM: <https://digital-platform.euroconsult-ec.com/>

- ◆ Consolidated revenues of the Space Economy totaled \$384.5 billion in 2020. Commercial revenues accounted for \$302 billion in 2020 down from \$319 billion in the previous year, partially as a result of the Covid-19 pandemic affecting certain commercial markets. And Government space budgets accounted for the remaining \$82.5 billion of the total space economy value.
- ◆ Upstream commercial revenues total \$9 billion, while downstream commercial revenues total \$293 billion, posting 2% and 5% 5-year CAGRs, respectively.
- ◆ Satellite Communications commercial revenues totaled \$138 billion in 2020, though recently overtaken by Satellite Navigation commercial revenues.
- ◆ Growth forecasts are however less positive for the satcom segment with a general decrease, particularly for high-mobility markets segments such as aero, cruise, offshore oil and gas.
- ◆ Satellite Navigation is nearly exclusively focused on the downstream, with revenues of \$171 billion in 2020, driven mostly by consumer items (smartphones and sport and health wearables).
- ◆ Earth Observation commercial revenues totaled \$5.5 billion in 2020, of which over 85% in the downstream sector.



Euroconsult



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# 14. IAF Young Professional Newsletter (Dec 2020 issue)

**CHECK IT OUT:**

<https://www.iafastro.org/assets/files/publications/wd-ypp/december-2020-ypp-newsletter-vol-2-issue-3.pdf>





**Q&A**

**Nobu Okada**  
 Founder and Chief Executive Officer  
 AstroScale Holdings Inc.

Vice President, Space Economy and  
 Sponsorship, IAF

*How did you first get involved with the International Astronautical Federation (IAF)?*

I attended my first IAC in 2013, where I learned about the IAF. That was just a few months after I founded AstroScale. We then joined IAF in 2014.

*As a newly elected IAF VP, what will be your role over the next three years?*

I'll be Vice President of Space Economy and Sponsorship for the next three years. My goal is to contribute to the IAF as a representative of Japan and the Asian region, an advocate for orbital sustainability, and a voice for the emerging new space sector.

*You have been in many leadership roles, but how did your career start? What did you want to be when you finished your studies? Was your space career always part of your plan?*

As a child, many adults asked me "what's your dream?" and "what would you like to be?" I was always quite uncomfortable about these questions, as I had no clear ideas about my dreams or direction. It took 40 years until I found something I can be passionate about – the issue of space sustainability.

*What was the turning point that made you focus on entrepreneurship and then space? Did you have any mentors or sponsors at the time?*

I began my career at the Japanese Ministry of Finance. Then, I became a strategy consultant and later managed IT companies in Japan, China, India, and Singapore. However, eight years ago, as I was struggling to find satisfaction in my career, I learned of the growing issue of space debris and remembered Mamoru's note. I thought there must be better ways to address orbital sustainability than the ideas I was hearing, so in 2013 I used my personal funds to found AstroScale. Since then, we have grown to more than 150 team members in five countries, all dedicated to our mission of securing the safe and sustainable development of space for the benefit of future generations.

*What was your biggest challenge? What inspired and motivated you most?*

I have faced various challenges in previous companies: our products didn't sell well, team members left suddenly, I saddled myself with huge debts and problems like that. However, I believe I have tried to admit to and embrace these challenges and slowly move forward. I truly feel that's the best approach when you're in a tough situation.



**IAF SPRING MEETINGS**

**Save the Date:**  
**23 – 25 March 2021**  
**Virtual Event**



Dear IAF Community,

The International Astronautical Federation (IAF) is pleased to invite you to Spring Meetings to take place virtually from 23-25 March 2021.

During these three days IAF Administrative and Technical Committees meet. The International Programme Committee (IPC) selects the abstracts to be presented during the IAC 2021 in Dubai.

For programme details, click below:  
<https://www.iafastro.org/events/iaf-spring-meetings/iaf-spring-meetings>

We look forward to seeing you in the meetings!

Best regards,  
 IAF Secretariat

**Ayami Kojima**

Ms. Ayami Kojima is the Unit Chief of International Affairs within the Japanese Government's National Space Policy Secretariat (NSPS) Cabinet Office. Prior to joining NSPS, she served as an expert at the United Nations Office for Outer Space Affairs (UNOOSA) and contributed towards sending Kenya's first CubeSat to be deployed into the orbit in history. During her time at UNOOSA, she was also devoted to space education and youth engagement and led the launch of the Space for Youth programme at the office, amplifying voices of young people to space policy decision makers. She started her career at Japan Aerospace Exploration Agency (JAXA) after graduating from Keio University. Her responsibilities ranged from Public Affairs, Finance and Space Education, leading us to her recent special assignments to the United Nations and Japan Cabinet Office. She loves yoga, dancing and traveling. She was born in Japan, and spent her junior high school in Singapore.



IAF WD/YPP COMMITTEE

**MEMBER OF THE MONTH**

JANUARY 2021





72<sup>nd</sup> INTERNATIONAL ASTRONAUTICAL CONGRESS

**25-29 October 2021 | Dubai**

Inspire, Innovate & Discover  
 for the Benefit of Humankind

IAC2021.ORG



**SAVE THE DATES**

The International Astronautical Congress IAC 2021 will be a 72<sup>nd</sup> conference year, branded as the "IAC 2021 - Inspire, Innovate & Discover for the Ben Humankind. For registration and congress related details, go to IAF News or 26-28. Follow us on:

 @iafastro
  @iafastro
  @iafastro

## 15. SEIC teaches a lot of space law + policy to students



Special 2018 4<sup>th</sup> quarter SEIC 2-credit course:

### The International Dimension of Space Activities: Space Law and Policy for Engineers

Taught by:

- ◆ Dr. Werner Balogh, WMO of the United Nations
- ◆ Dr. Yuri Takaya, 高屋 友里 先生



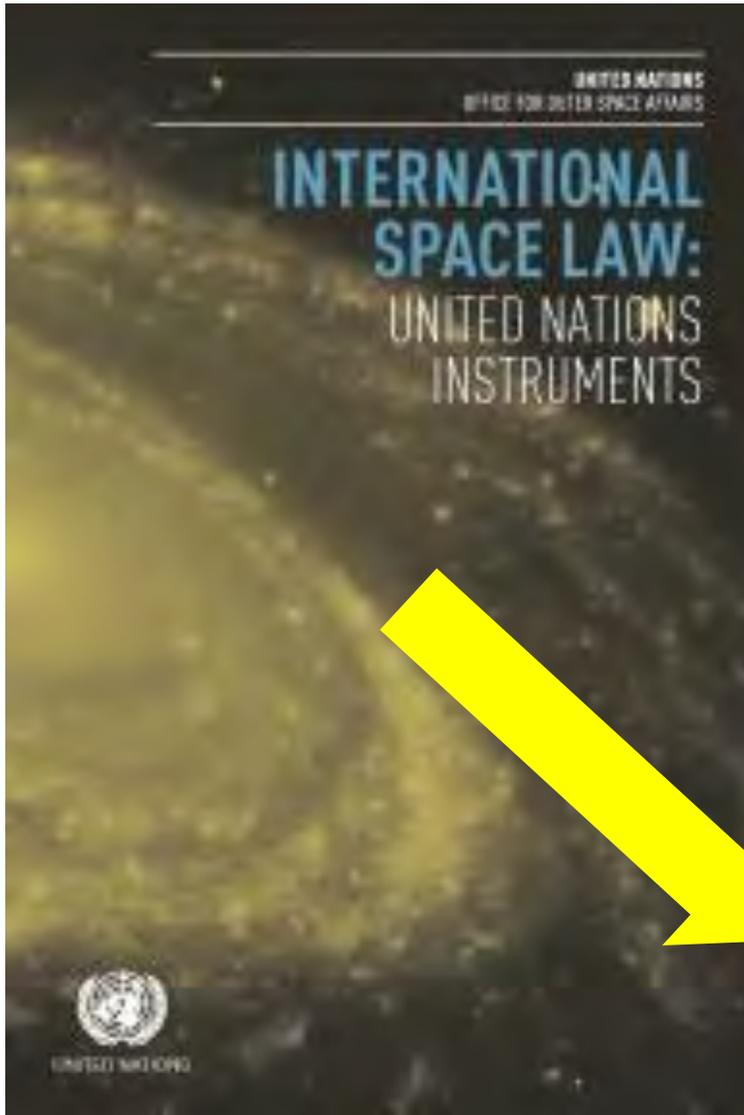
On several occasions during the past few years, SEIC has invited external experts to teach topics related to space law and policy.

Subject: Space Law Course;  
Date: Sun, 6 Jan 2019 09:50:40 +0100

Dear Maeda Sensei,  
Glad to know that Dr. Werner is doing the space policy and law class again.  
It is very important class for Kyutech trained Engineers -- the class helped me a lot.

Best regards,  
Tejumola Taiwo, Ph.D

**CONTINUED ON THE NEXT PAGE**



← This is the basic textbook that Dr Balogh uses for his space law classes. It is an official UN document that can be downloaded with the link below. It is available in the six official languages of the UN (Arabic, Chinese, English, French, Russian, and Spanish).

SYMBOL	ST/SPACE/61/Rev.2	
TITLE	International Space Law: United Nations Instruments	
SUBTITLE		
YEAR	2017	
SERIES	ST/SPACE/	
DOCUMENT FILES	عربي 中文 English Français Русский Español	
SUBJECTS	<a href="#">International Space Law</a> <a href="#">Space Objects</a> <a href="#">Capacity Building</a> <a href="#">Nuclear Power Sources</a> <a href="#">National Space Law</a> <a href="#">Space Debris</a>	

**DOWNLOAD FROM HERE:**

[https://www.unoosa.org/oosa/oosadoc/data/documents/2017/stspace/stspace61rev.2\\_0.html](https://www.unoosa.org/oosa/oosadoc/data/documents/2017/stspace/stspace61rev.2_0.html)



# UiTMSAT COLUMN

Column No. 13

16. Column #13 from Malaysia

Editor: FATIMAH ZAHARAH BINTI ALI ([ali.fatimahzaharah@gmail.com](mailto:ali.fatimahzaharah@gmail.com))  
PHD CANDIDATE, LABORATORY OF SPACE WEATHER AND SATELLITE SYSTEM  
COLLEGE OF ENGINEERING  
UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR, MALAYSIA



UNIVERSITI  
TEKNOLOGI  
MARA

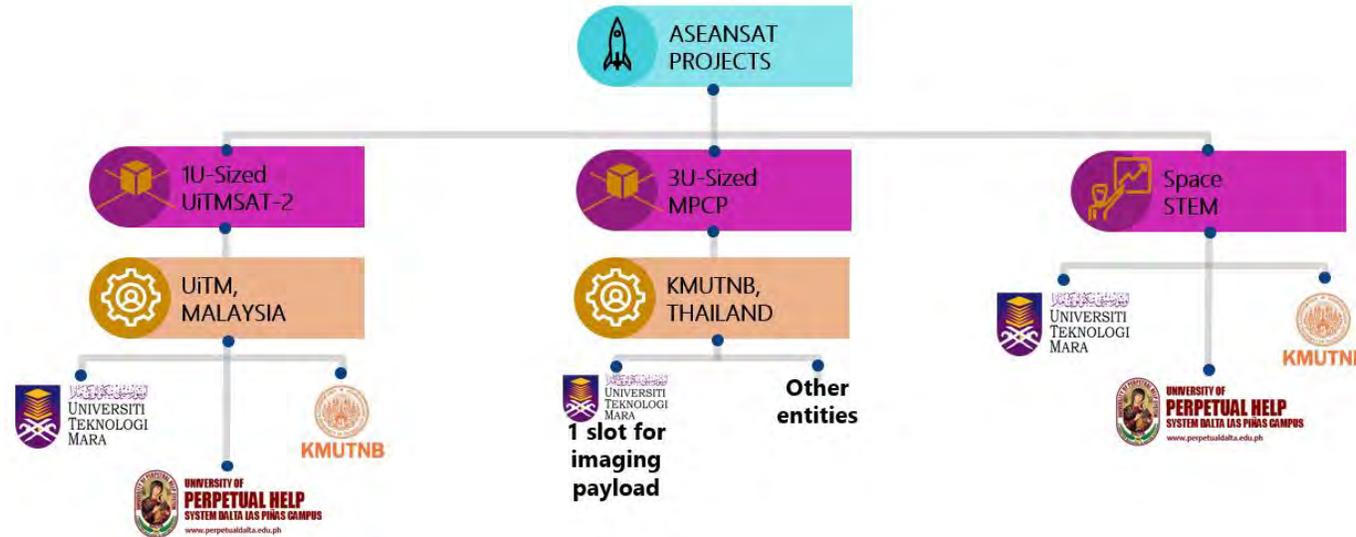
*UiTM Sentiasa Di Hatiku*  
*"UiTM Always in My Heart"*

## Moving Forward: UiTMSAT-2 & ASEAN Collaboration

In supporting the encouragement in developing second Nanosatellite domestically after the successful launch of UiTMSAT-1, the Centre for Satellite Communication, College of Engineering, Universiti Teknologi MARA (UiTM) is currently doing a project called ASEANSAT. ASEANSAT is a multination collaboration project that involves teams from three (3) different countries:

- UiTM from Malaysia,
- King Mongkut's University of Technology North Bangkok (KMUTNB) from Thailand,
- University of Perpetual Help System DALTA (UPHSD) from Philippines.

# ASEAN Collaboration



*Fig. 1: ASEANSAT Collaboration Project.*

Under the ASEANSAT Projects, there are three (3) sub-projects as illustrated in Fig. 1.

## 1U-Sized UiTMSAT-2:

UiTM is leading a collaboration project of developing a 1U-sized CubeSat with improved ground sampling distance (GSD) for the onboard imaging system. In Malaysia, the CubeSat will be called as UiTMSAT-2 as the successor to UiTMSAT-1. The project has the involvement of UPHSD and KMUTNB as institutions to provide facilities for space environment testing during EM stage and other related services.

### **3U-Size MPCP:**

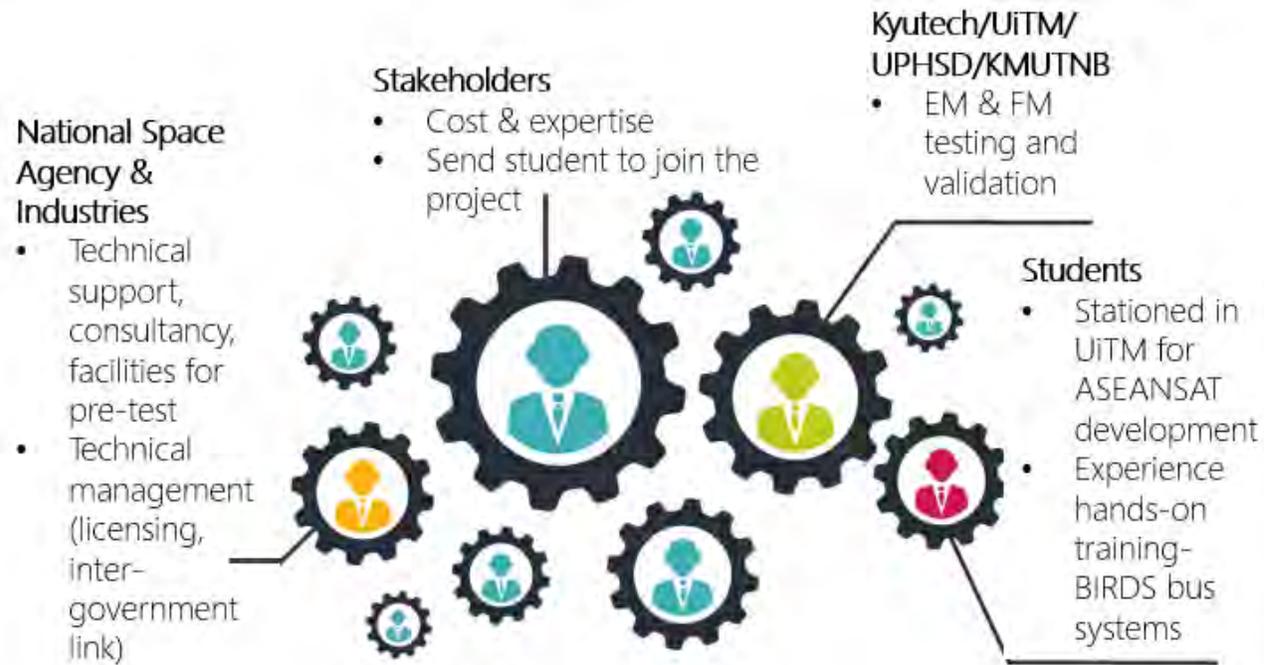
As part of ASEANSAT incorporation, UiTM also joins the INSTED's (KMUTNB, Thailand) CubeSat Project, that is Multi-Payload CubeSat Platform (MPCP). In this project, UiTM will design a camera mission payload for the 3U-sized MPCP.

### **Space STEM Program:**

The incorporation has also come out with a Space STEM Program for academic institutions such as schools and universities. In this program, a curriculum-based module that maps with the interdisciplinary approaches and institutions' requirements will be developed. This is inline with the education evolvement and its integration in four (4) specific fields (science, technology, engineering, and mathematic).

## **UiTMSAT-2 Overview**

The 1U-sized ASEANSAT Project (UiTMSAT-2) will be the first ASEAN collaboration project for Nanosatellite development with involvement from South-East Asian institutions. Through this project, the international collaboration will be promoted, and space related technologies will be stimulated. The Nanosatellite project will also provide the opportunity for involved partners to utilize the data from the satellite. This will introduce the platform for data sharing.



*Fig. 2: The overview of ASEANSAT (UiTMSAT-2) sub-project.*

Apart from the partners in the ASEANSAT project, there will also be involvement from other entities such as Kyutech as an institution to assist in space environment testing and validation during the stage of flight model (FM), ministries, government agencies, industries, and NGOs.

In December 2020, Malaysian Ministry of Science, Technology and Innovation (MOSTI) has awarded UiTM with the amount of RM 500,000 for the development of FM for the UiTMSAT-2. In regard to this, Malaysian

Space Agency (MYSA) will take part in the project as space governing body to assist in any related activities such as policy and governance. UiTMSAT-2 will be the Nanosatellite development project that fully utilizes the local facilities that are available in Malaysia.



Fig. 3: Assoc. Prof. Ir. Dr. Mohamad Huzaimy is the project leader for UiTMSAT-2. This is a poster by the Faculty of Electrical Engineering to congratulate Dr Huzaimy for the secured grant.

RM 500,000 is roughly  
120,000 USD

End of  
Malaysia's  
Column

## 17. Virtual 5BIW (5<sup>th</sup> BIRDS International Workshop)

Due to COVID-19, 5BIW (5th BIRDS International Workshop) could not be conducted in Manila in 2020 as originally planned. We plan to conduct it in the later part of 2021. To tide us over, a virtual 5BIW was conducted on 12 Jan 2021. The two video links (ZOOM recordings) are as follows:



*1st half of virtual meeting:*

[https://www.dropbox.com/s/46hgjr9l4eae5t/002\\_Virtual%205BIW%20--%20%2012%20Jan%202021%20%28First%20Half%29.mp4?dl=0](https://www.dropbox.com/s/46hgjr9l4eae5t/002_Virtual%205BIW%20--%20%2012%20Jan%202021%20%28First%20Half%29.mp4?dl=0)



*2nd half of virtual meeting:*

[https://www.dropbox.com/s/sqqrjma029n7i7j/003\\_Virtual%205BIW%20--%20%2012%20Jan%202021%20%28Second%20Half%29.mp4?dl=0](https://www.dropbox.com/s/sqqrjma029n7i7j/003_Virtual%205BIW%20--%20%2012%20Jan%202021%20%28Second%20Half%29.mp4?dl=0)



The virtual meeting was only 2.5 hours --- it was not long enough to cover the entire Kyutech agenda. Accordingly, below, find the link for Prof Cho's PowerPoint presentation, and also the link for a 36-min. video that he recorded before the virtual meeting.



[1]

*PDF presentation by Prof Cho for "Virtual 5BIW" of 12 Jan 2021:*

[https://www.dropbox.com/s/w49yxsfumpr0mdm/2021\\_01\\_12\\_BIRDS\\_Virtual\\_Workshop\\_cho\\_v1.pdf?dl=0](https://www.dropbox.com/s/w49yxsfumpr0mdm/2021_01_12_BIRDS_Virtual_Workshop_cho_v1.pdf?dl=0)



[2]

*Supplemental video presentation by Prof Cho for "Virtual 5BIW" of 12 Jan 2021:*

[https://www.dropbox.com/s/jb7nsw4yp19bktc/2021\\_01\\_12\\_BIRDS\\_VWKSHP\\_cho\\_2.mp4?dl=0](https://www.dropbox.com/s/jb7nsw4yp19bktc/2021_01_12_BIRDS_VWKSHP_cho_2.mp4?dl=0)





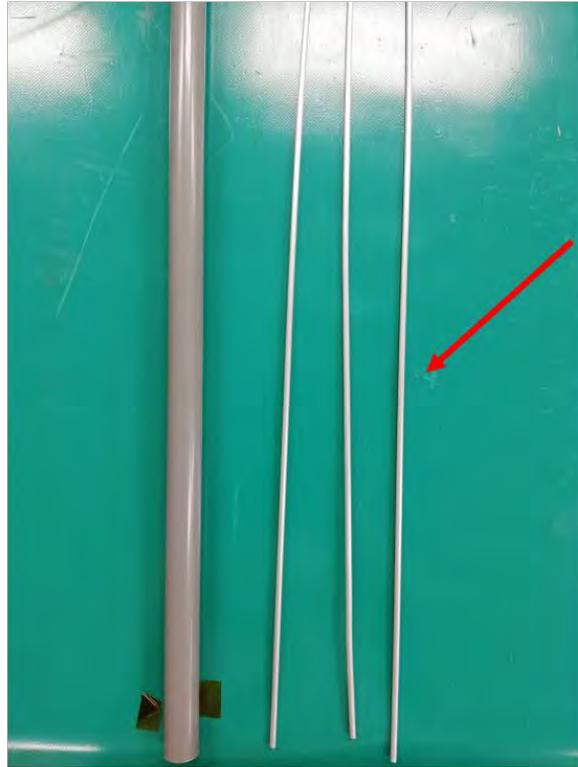
# GST Column

## Fourth Issue

### *GST Antenna Design*

by Pooja Lepcha

# Things required



PVC pipe – 0.5 m, 10mm dia internal

M3 size, 15mm screws with washer and nuts – 4 nos

Hollow aluminum rods, 3mm dia, 2-3m



Male SMA connector



M3 size screw without head 10cm with screws



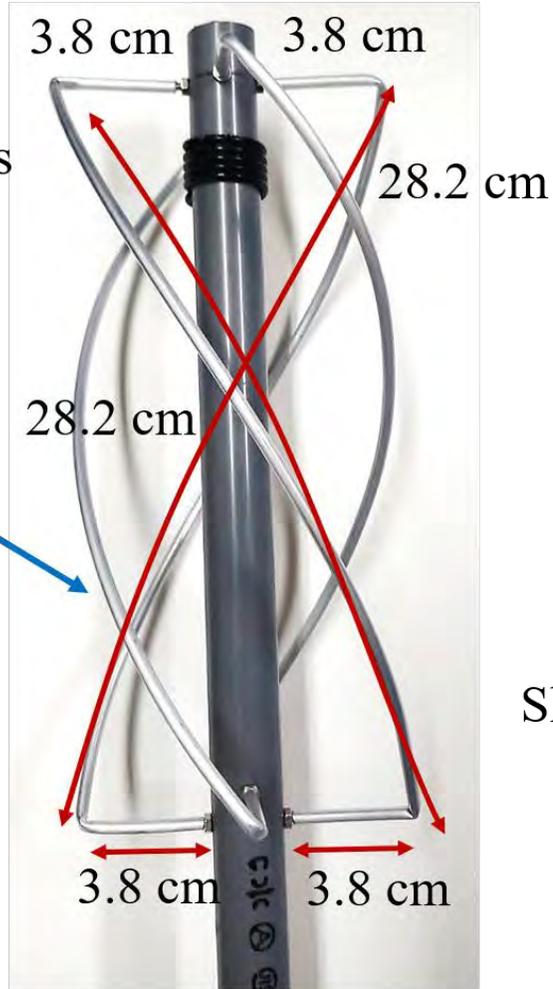
50 Ohm cable, at least 1m



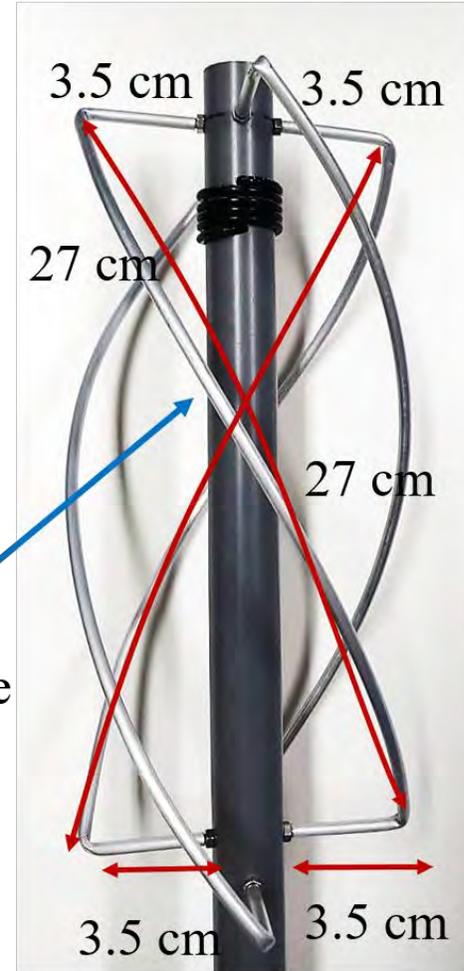
# Step 1: Measure the aluminum rods

There are two different heights for the holders

Longer one



Shorter one

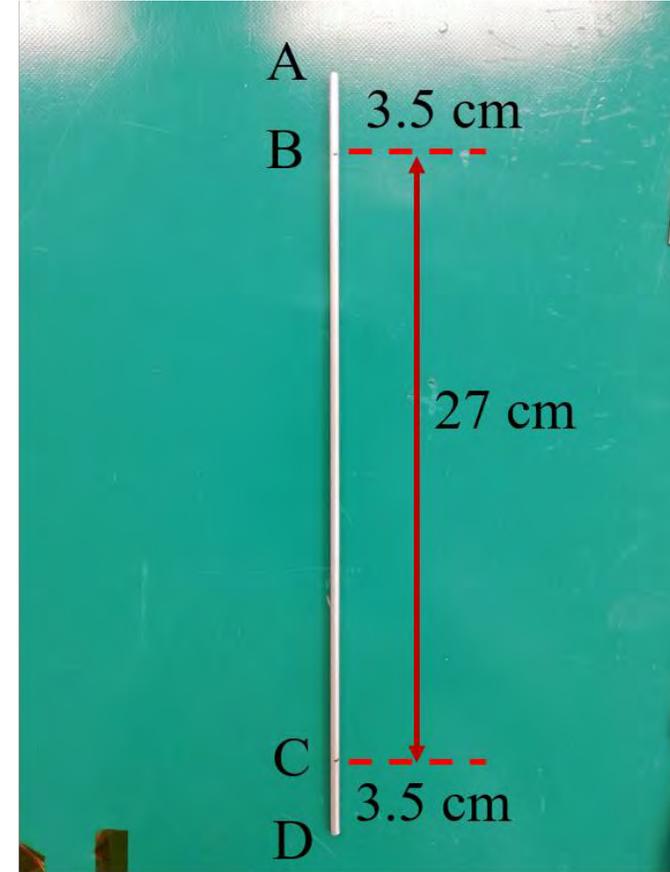
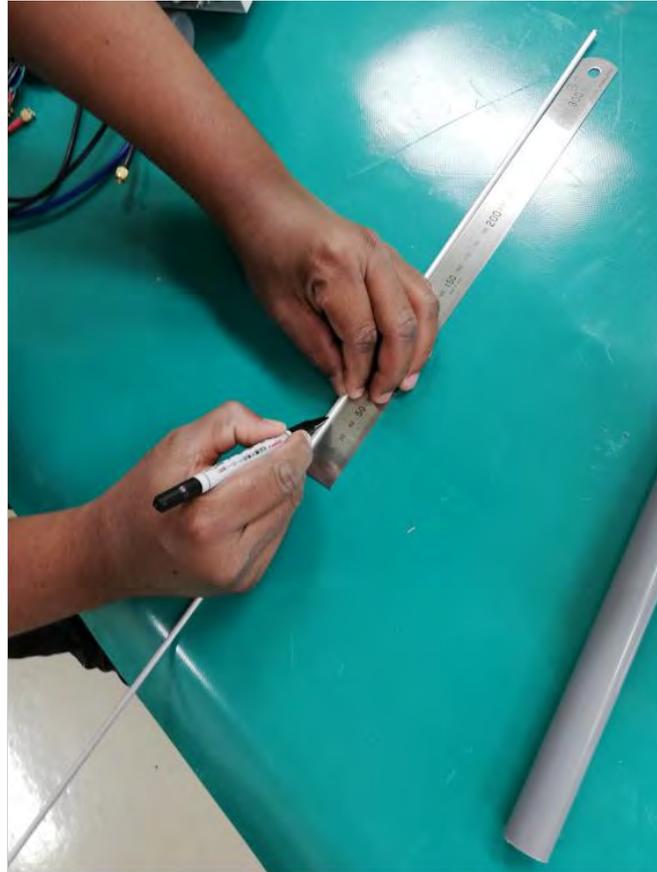
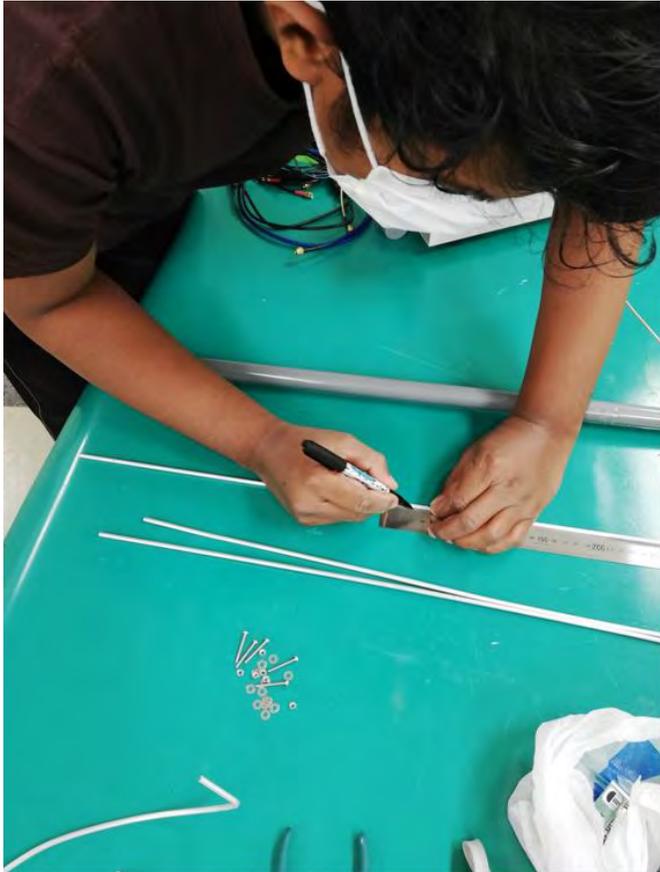


The left one is longer one, the right one is shorter

The dimensions mentioned is the total length



# Step 2: Cut the aluminum rods in the mentioned dimension



Measure and mark

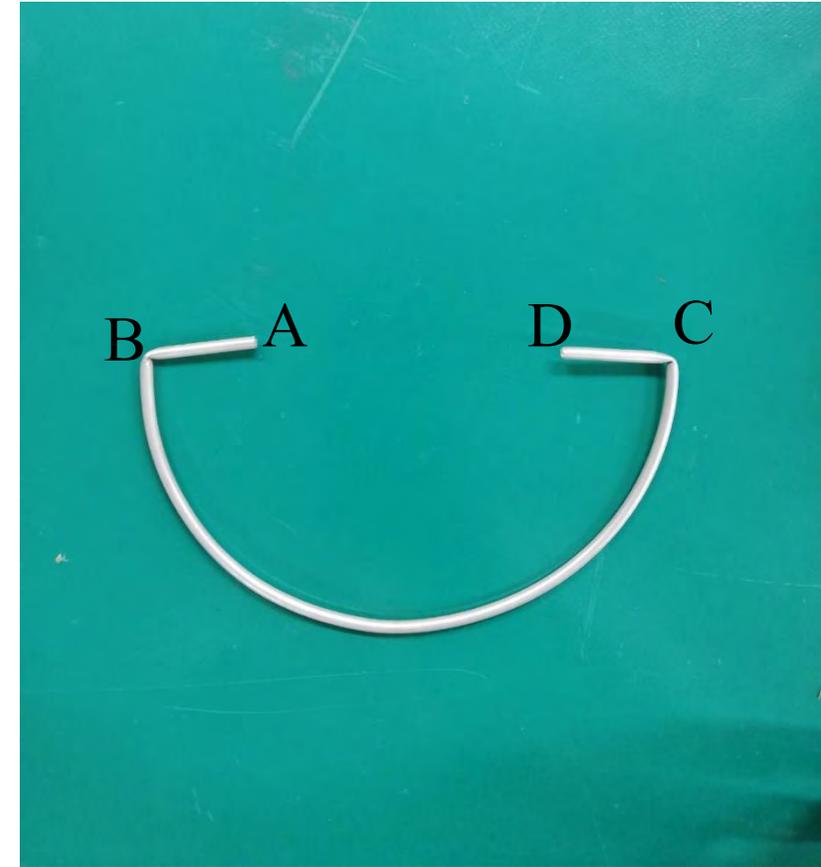
# Step 3: Bend at the markings



Take a cylindrical shape and make and arc between point B and C

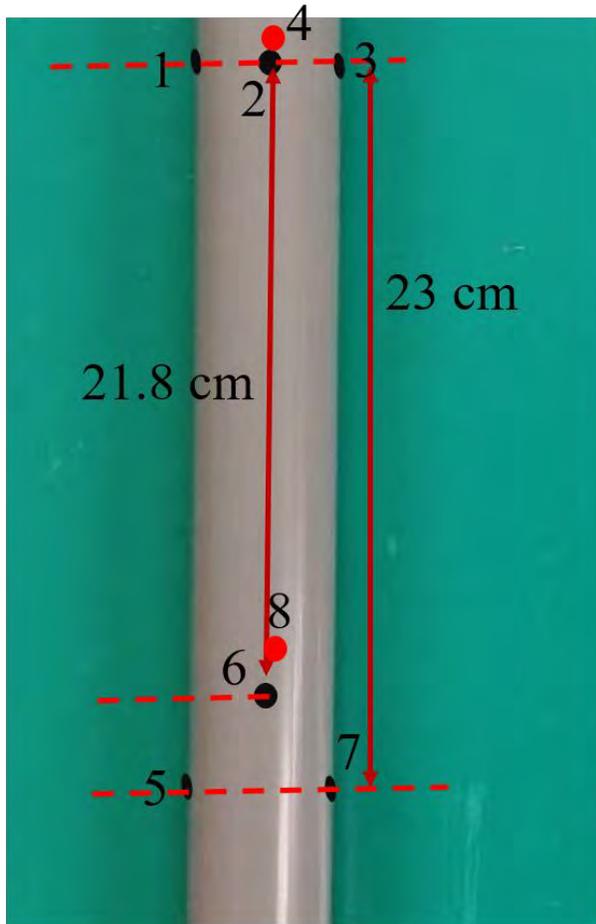


From point A to B and C to D make it 90° using a plier



Make the shape look like the above picture

# Step 4: Prepare the stand

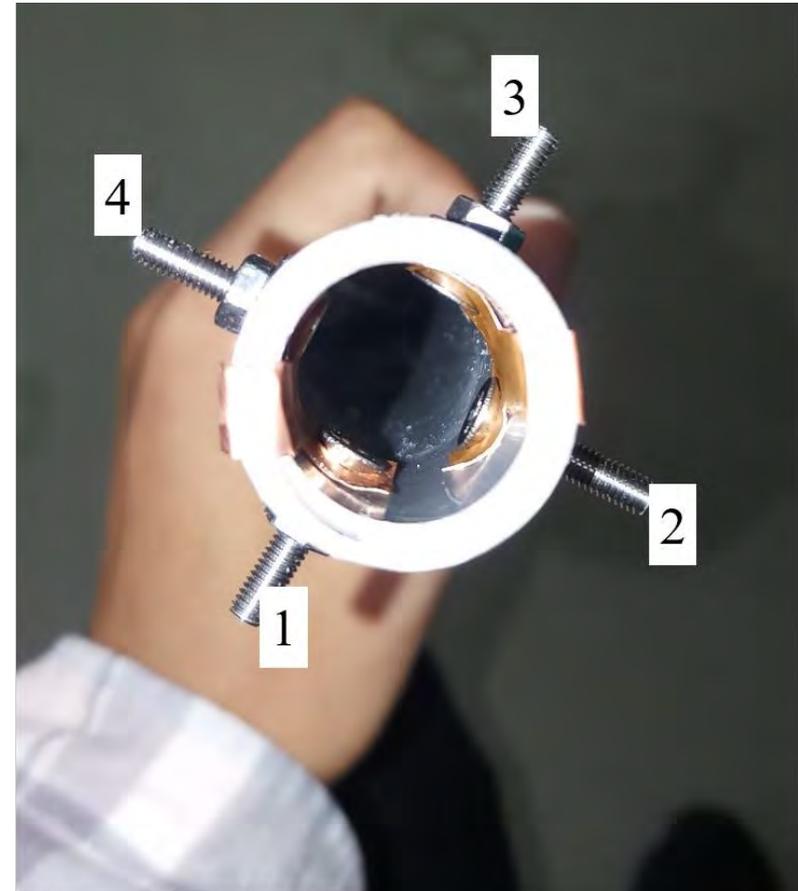


Red dots are on the opposite side

Take a drilling machines, or anything that can drill a hole through the PVC pipe. I used M3 size drill since my screws are also M3 size.

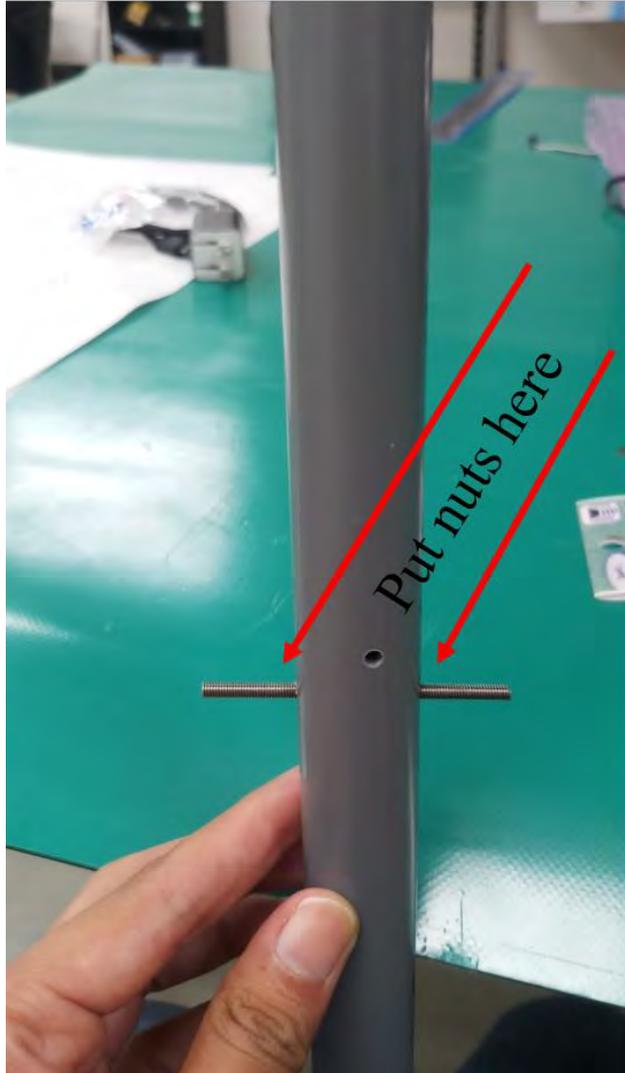
Leave some space from the top end and make a hole passing from one side straight to another. On the same level make other two holes 90 degree from the previous hole.

Measure the length mentioned in the left image and mark on the pipe. Drill the hole straight through. Note that the distances are different for each side



If you look from top side, it should look like this. Make sure the screws can get through the holes. Don't put the screws yet on the top side.

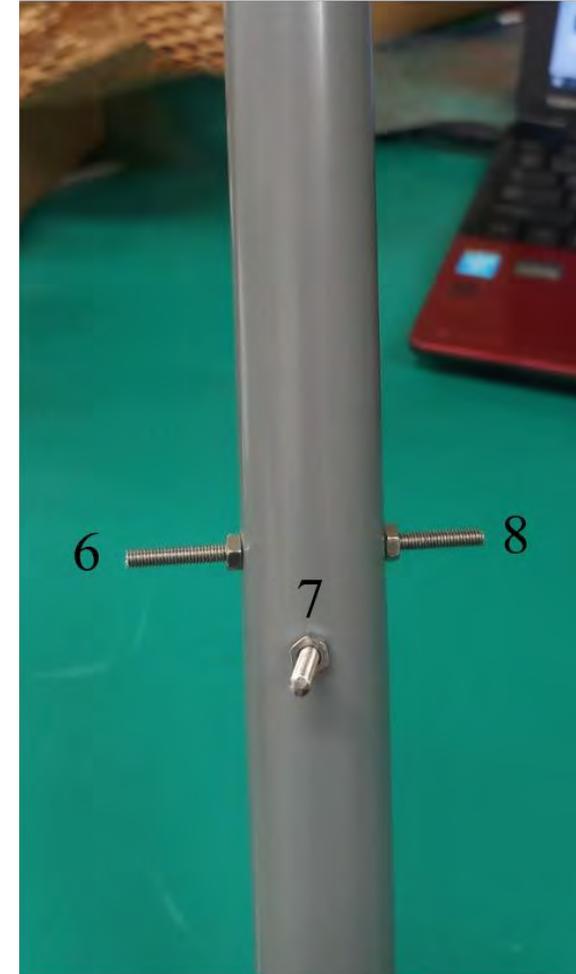
# Step 4: Prepare the stand



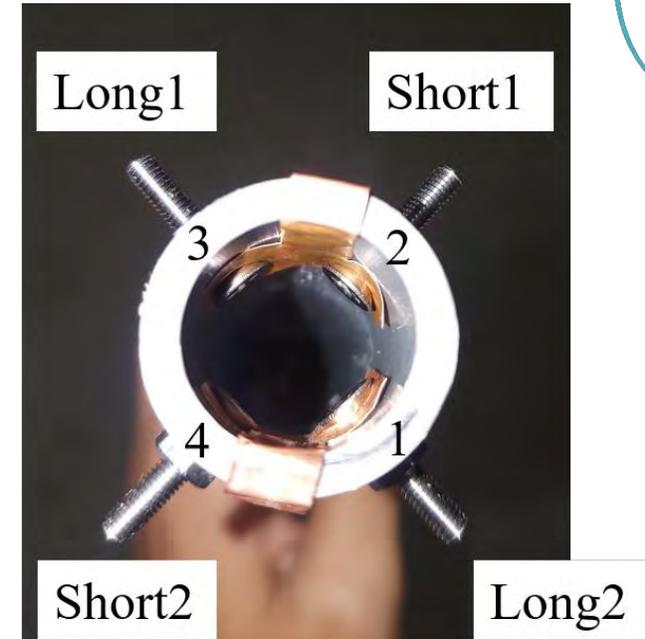
Take the screw without a screw head and put it inside the bottom drills all the way through. Make equal lengths on both sides. Secure the position using nuts from outside.

Repeat the same procedure for the other bottom drills.

It should look like the image on the right



# Step 5: Feeding the antenna

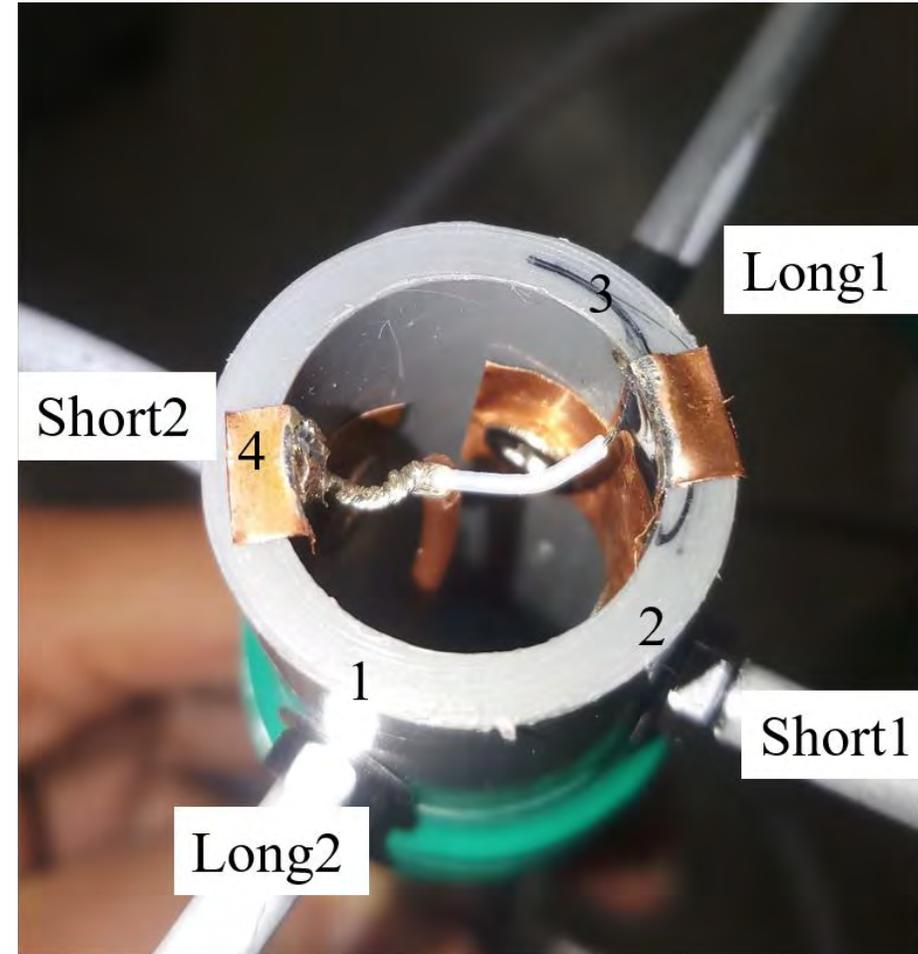


Take a thin copper strip and cut it in a T shape as shown in the second picture. Insert from the top side of the stand and make the drills for screws. Make two T shapes of copper. Next place the T shape as shown in the third image and insert the screws. Secure the screws using nuts and washers from outside. Test for connectivity, Long1 and Short1 should be connected, Long2 and Short2 should be connected

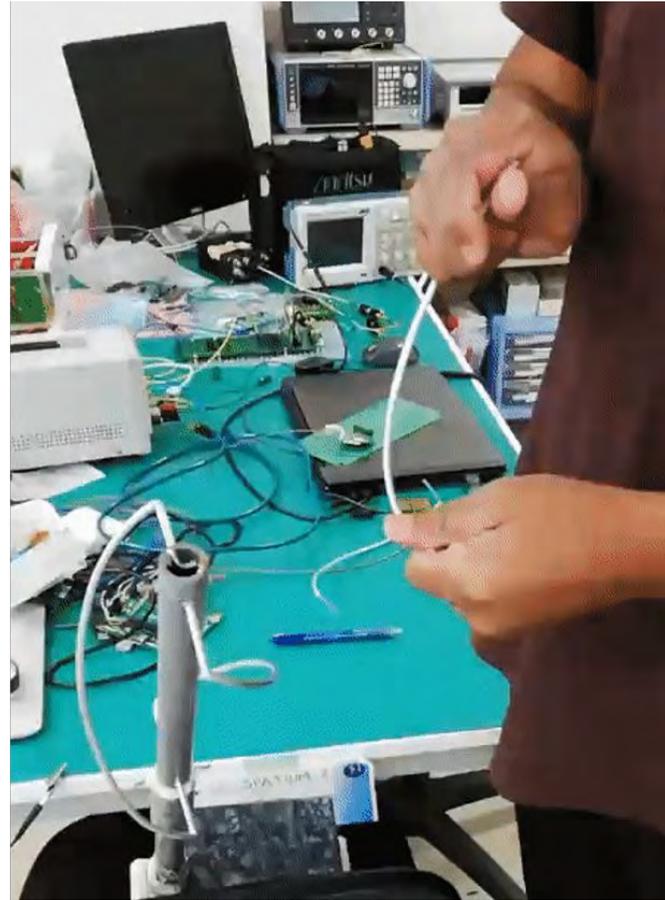
# Step 5: Feeding the antenna



Take the 50 Ohm cable and clean the wire as shown above. Separate the centre wire and the shielding wire. Solder the centre wire to the copper plate between short1 and long1. Solder the shielding wire between short2 and long2.



# Step 6a: Making the external antenna shape



The external rods should look like the figure above. Two for short and two for long

# Step 6b: Making the external antenna shape



Assemble the rods by inserting the hollow rod to the screws protruding out of the antenna stand.



After assembling, the antenna should look like the figure in the middle when viewing from side and should look like the figure on the right when viewing from the top.



# Step 7: Making the SMA Connector

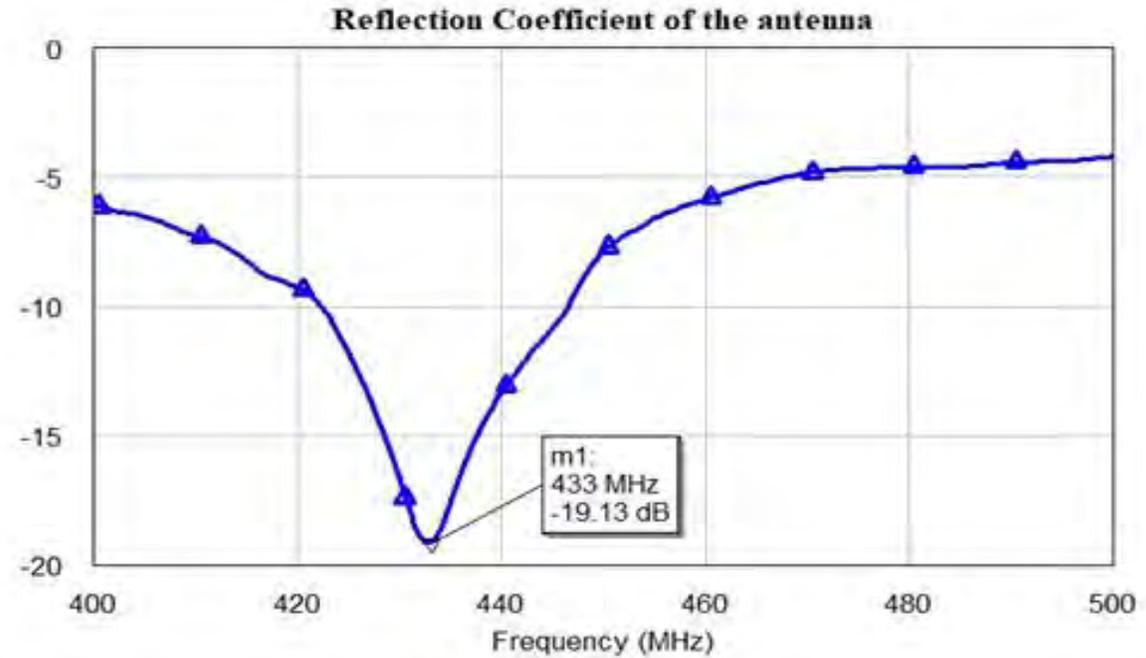
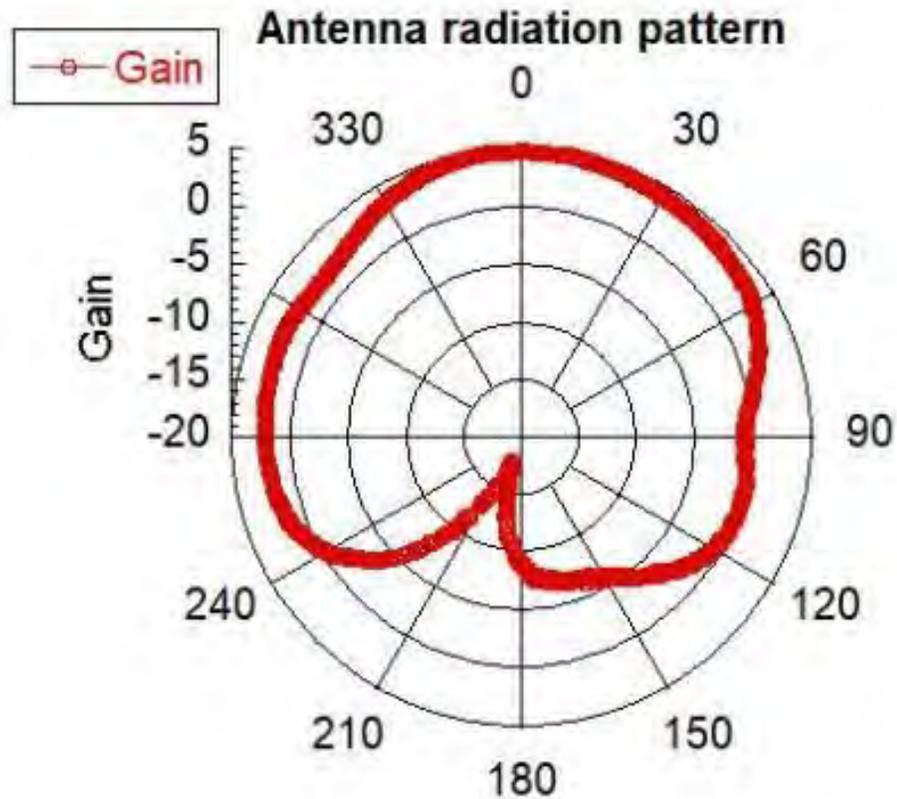
Clean the other end of the 50 Ohm cable and separate the center wire from the shielding wire. Take the SMA connector male type and assemble it using the guide mentioned in the YouTube link below (you can find more YouTube videos related to it):



The antenna is ready to be used. It can be also used to get CW from satellites transmitting in the 433MHz range

[www.youtube.com/watch?v=zeGYWW-cPpk&ab\\_channel=Messi%26PaoloniSRL-CoaxialCables](http://www.youtube.com/watch?v=zeGYWW-cPpk&ab_channel=Messi%26PaoloniSRL-CoaxialCables)

# Antenna Radiation Pattern and S11 Parameter



Check for the S11 parameter using network analyzer and antenna radiation pattern. The reference result is given in the figures above.

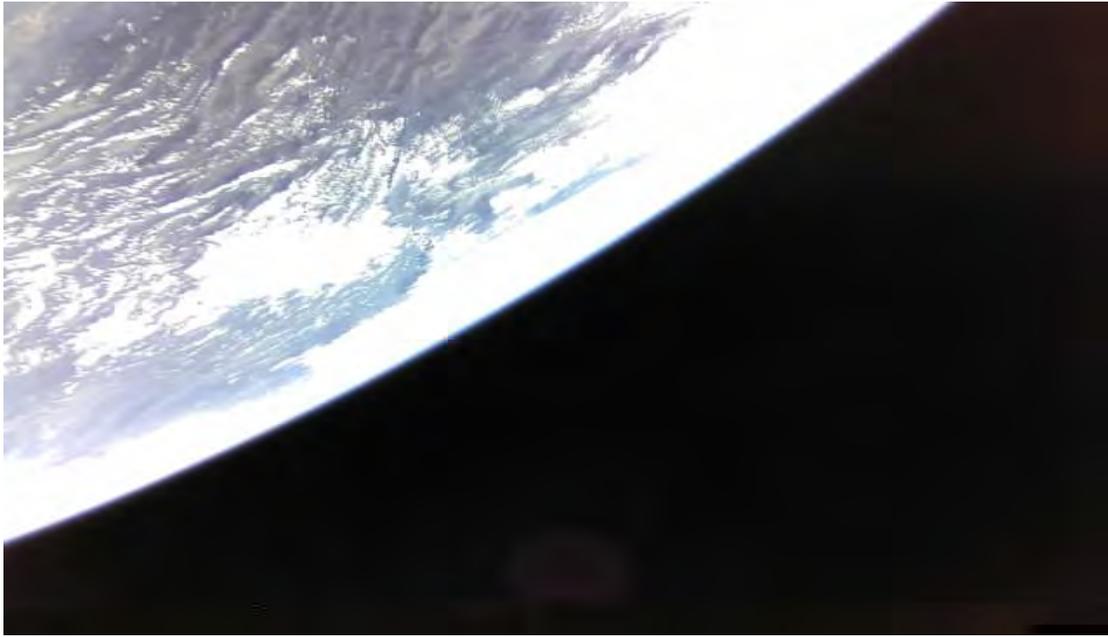
**END OF COLUMN NO.4**

# Ground Station is Operational

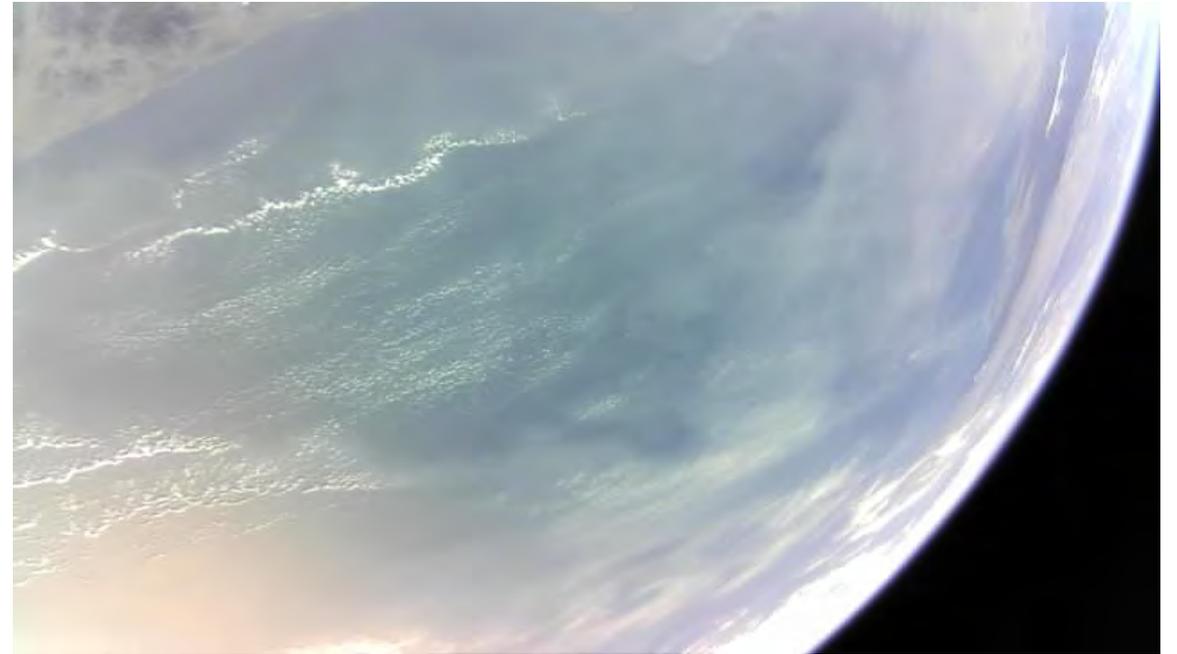
- NAST Ground Station Operating Successfully from 21<sup>st</sup> December 2020. We are receiving Telemetry data and commanding BIRDS-3 Satellites for missions and System Operations.



Nepalisat-1 Earth Images from NAST Ground station

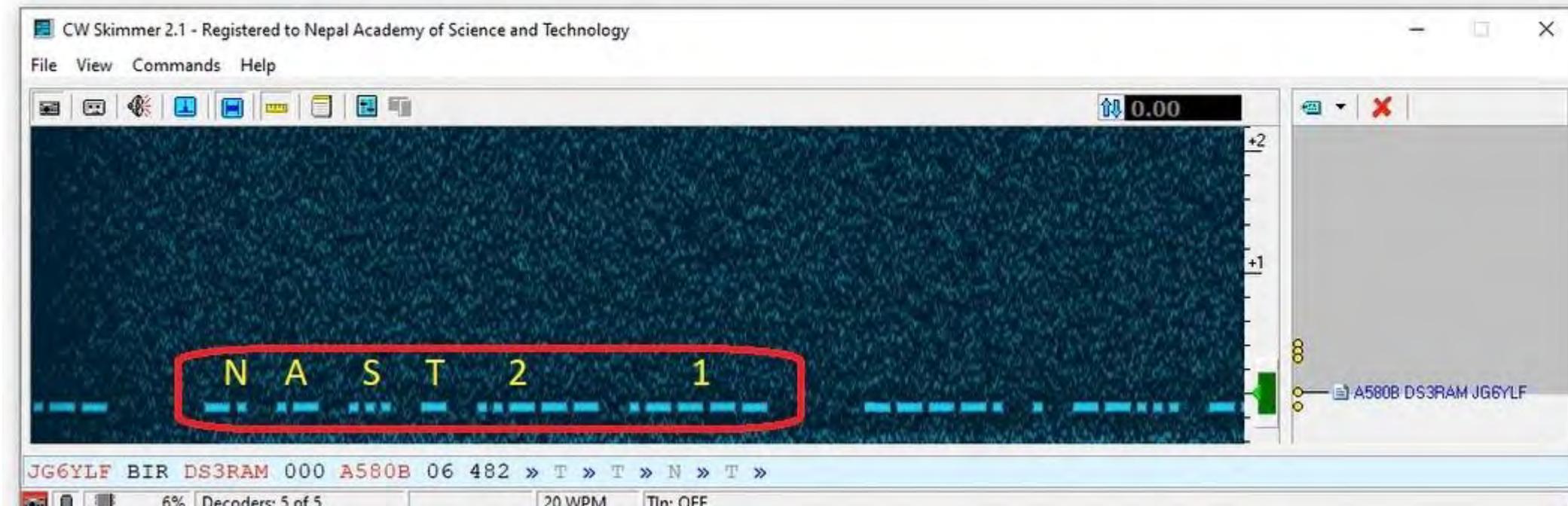


Earth images from Satellite  
*Uguisu* -- received at NAST  
Ground Station



# Thanks giving to Nepalisat-1 Supporters through CW Mission

- We started transmitting the name of people and organizations who supported NepaliSat-1 and BIRDS Project through CW SMS Mission. We are expressing our gratitude to people and organizations.



# Problem faced for Ground Station Operation

- Incorrect Radio Device:  
we ordered ICOM IC-9700 ( Updated Version) but it does not support TNC

## Technical Problems:

### 1. Rotor Problem

- a. Rotor is moving but angle is not displayed in the controller
- b. Disassemble of Azimuth rotor we found the water molecules inside the motor.

### 2. Hall Sensor Defective

- a. Because of air molecules PCB Circuit is damaged.
- b. No Power supply to the hall sensor so we are not able to receive the feedback signal in controller



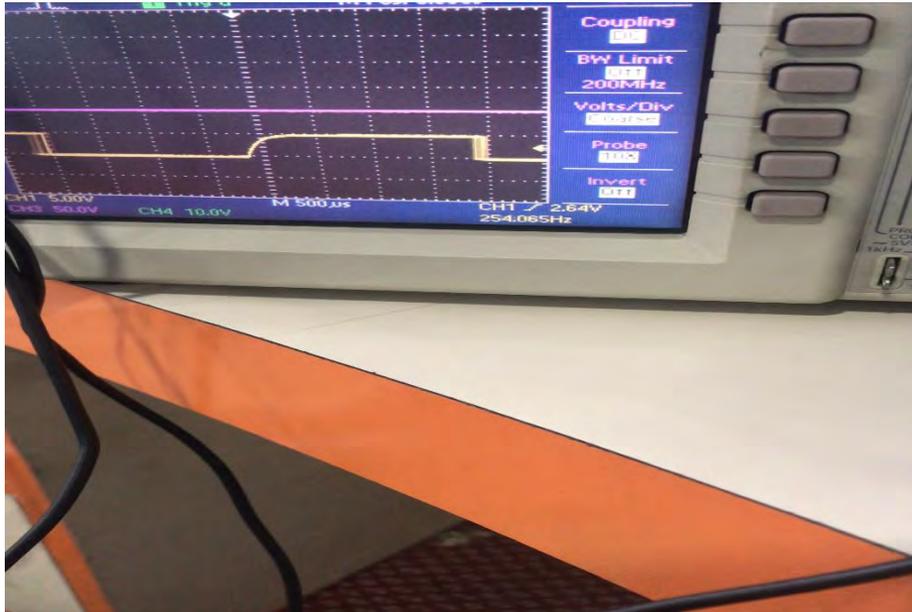
Fig:1 water molecules in the motor



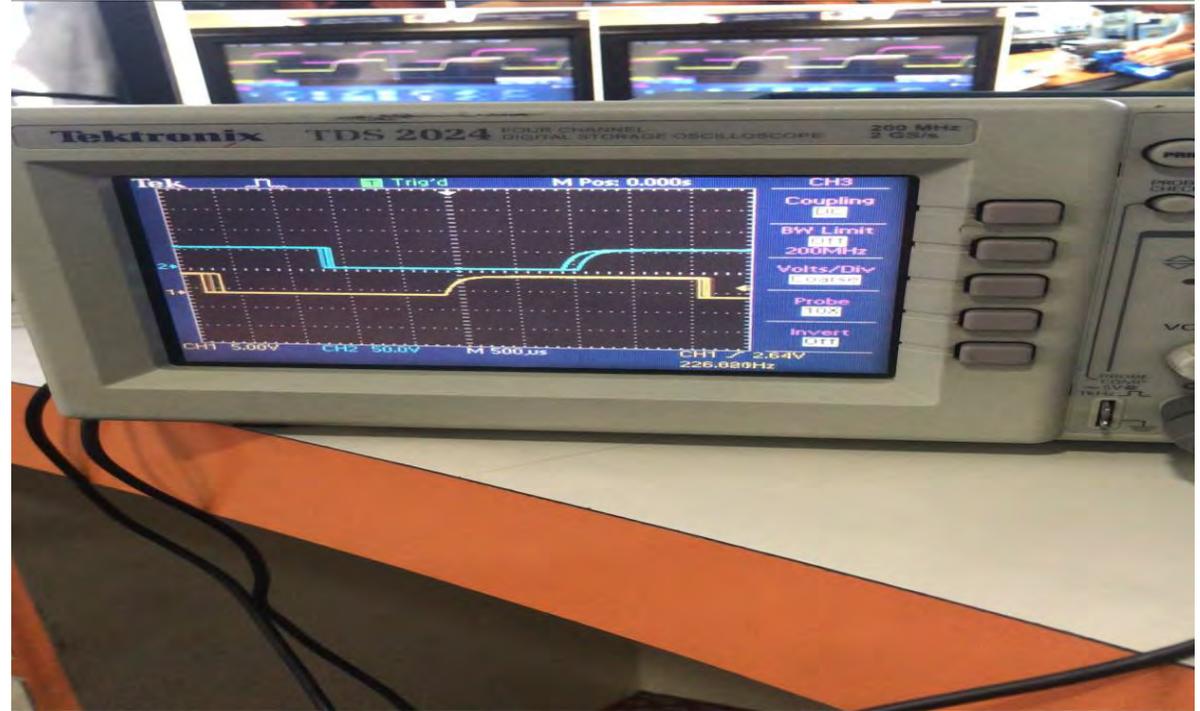
Fig:2 Hall Sensor Defective

# Action taken

- Availability of Appropriate Radio  
IC- 9100 Radio is bought to support TNC.
- Dismantling Azimuth rotor, Internal Components are cleaned and dried.
- PCB of hall sensor is repaired providing appropriate power supply to the sensor.



Only Receiving signal from encoder A before repairing In oscilloscope



Receiving signal from both Encoder A & B after repairing Azimuth Rotor

**END OF REPORT FROM NEPAL**

## 20. The BIRDS-2S team of the Philippines come to Kyutech for environmental testing of their satellites, Maya-3 and Maya-4



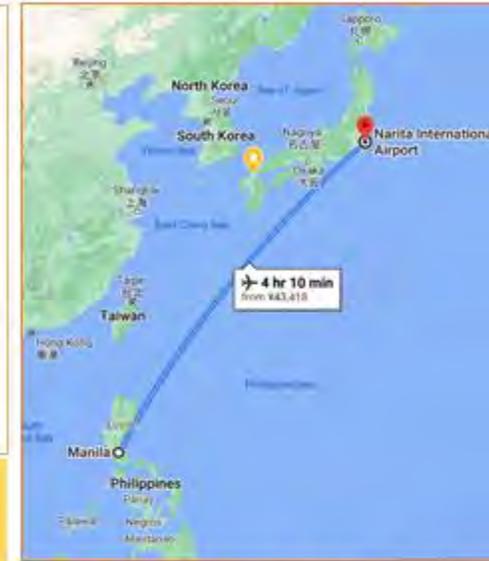
### Article by

- Marloun Sejera
- Mark Angelo Purio
- Izrael Bautista

[The Philippine members of the BIRDS-4 Project]

# BIRDS-4 assists BIRDS-2S Space Environment test

Despite the on-going pandemic, eight members of the BIRDS-2S team flew from Manila, Philippines to Narita, Japan on December 4, 2020. Their mission is to conduct space environment tests of the 1<sup>st</sup> locally made satellites of the Philippines: Maya-3 and Maya-4 satellites. Before travelling to Kyutech, they needed to stay in Ueno, Tokyo for 14 days as part of the mandatory quarantine. They finally travelled to Kitakyushu City, Fukuoka via Shinkansen on December 19 where the BIRDS-4 members welcomed them and guided them to the place they would stay.



*A four-hour travel on plane from Manila to Narita, 4 December 2020*



*A five-hour travel on Shinkansen from Tokyo to Kitakyushu, 19 December 2020*



*Group photo upon arrival at Kokura Station*



Article by:

Marloun Sejera  
Mark Angelo Purio  
Izrael Bautista



# BIRDS-4 assists BIRDS-2S Space Environment test

For the next four weeks they stayed in the International Guest House, Sensui-sou, which is only a five-minute walk to Kyutech's SVBL (Satellite Venture Business Laboratory).

The laboratory provided all that they needed for their activities: cleanroom, where they conducted solar cell attachment, functionality tests and satellite assembly; thermal chamber for antenna deployment test; thermal vacuum chamber; and shaker for vibration tests.

The team were also able to conduct wireless test within the campus to verify the end-to-end connectivity between the satellite and ground station.



*BIRDS-2S members while preparing their satellites for Space environment tests*



Article by:

Marloun Sejera  
Mark Angelo Purio  
Izrael Bautista



# BIRDS-4 assists BIRDS-2S Space Environment test



*Fit check of the assembled satellites.*

BIRDS-2S members were assisted by BIRDS-4 members through out their space environment test.



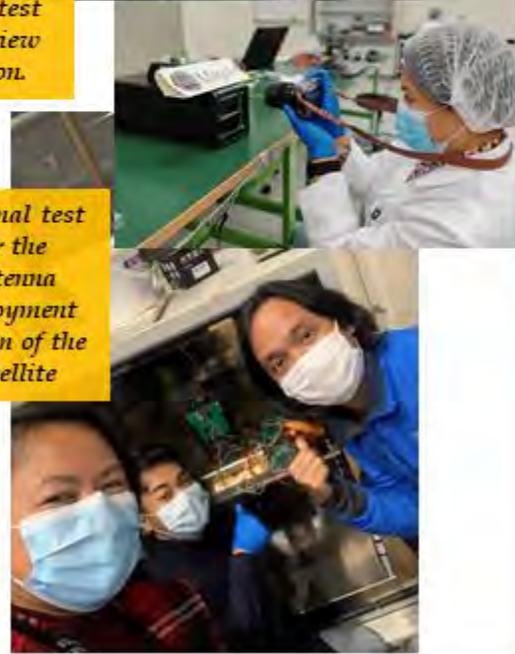
*Final assembly, inabit switch test, functionality test and safety review documentation.*



*Photos taken during the vibration test with Dr. Masui, Dr. Yamauchi and BIRDS-4 Filipino members.*



*Thermal test for the Antenna deployment system of the satellite*



Article by:

Marloun Sejera  
Mark Angelo Purio  
Izrael Bautista



# BIRDS-4 assists BIRDS-2S Space Environment test

In the week of the New Year, Prof. Mengu Cho gave lectures on space environment testing. The team learned a lot on this 3-day lecture. After the series of lecture and trainings, the work for the satellites continued as it is prepared for flight model assembly, and additional environmental tests.



*BIRDS-2S members with Prof. Mengu Cho after class on January 1, 2021*



*Group photo with the assembled satellites.*



Article by:

Marloun Sejera  
Mark Angelo Purio  
Izrael Bautista



# BIRDS-4 assists BIRDS-2S Space Environment test

Despite the very hectic schedule, the team were able to squeeze in fun activities.



Winter wonderland at Nanzoin Temple



Night-time view of Kitakyushu from Mt. Sarakura



Sightseeing and Shopping at Fukuoka



Late night Snowman making in KIT campus



Kokura Castle visit during a rare snowstorm



Article by:

Marloun Sejera  
Mark Angelo Purio  
Izrael Bautista



# BIRDS-4 assists BIRDS-2S Space Environment test

To cap-off their activities in Kyutech, the BIRDS-2S team took a photo with the laboratory staff and BIRDS-4 members.

We hope for the success of their satellite!



*Photo before their departure from Fukuoka Airport going back to the Philippines. For health security protocol, they are now under quarantine as of writing this article*



Article by:

Marloun Sejera  
Mark Angelo Purio  
Izrael Bautista



## 21. JICA and Startups in Africa

The advertisement features the 'Startups in AFRICA' logo on the left, which includes a stylized map of Africa with a rainbow gradient. The main title 'アフリカ新興テック' (Africa New Tech) is written in large white characters on a red background, with 'ピッチ決勝戦' (Pitch Battle) in a green circular badge to the right. Below the title, the date '2021年2月26日 金 19:00~21:30' is displayed. A green box indicates '参加無料' (Free participation) with a note '日程IDの事前登録が必要です' (Pre-registration of the event ID is required). Another green box states '定員3000名【先着順】' (Limited to 3000 seats, first-come, first-served). A circular badge on the left says '生配信 Zoom利用' (Live streaming via Zoom). At the bottom, there are three small images: a man in a blue jacket, a woman speaking into a microphone, and a man in a suit. To the right of these images is the JICA logo and the text '主催 日本経済新聞社' (Organized by Nikkei).

One result of the **TICAD** (see below) conferences is some criticism from African countries that Japan is not investing enough in Africa – with both public and private funds.

In response, JICA has been campaigning Japanese businesses to give more consideration to doing business with Africa, and in Africa. The left is an example of this JICA effort.

← **THE LINK FOR THIS WEBSITE**  
<https://events.nikkei.co.jp/33538/>

**What is TICAD?** TICAD stands for Tokyo International Conference on African Development. The Government of Japan has been leading this conference since 1993, co-hosted by United Nations, United Nations Development Programme (UNDP), World Bank and African Union Commission (AUC).

**TICAD7** was held on 28th - 30th August, 2019 at Pacifico Yokohama, Yokohama city, Japan, with more than 10,000 participants, including 42 African leaders from 53 African countries, 52 development partner countries, 108 heads of international and regional organizations, and representatives of civil society and the private sector. Prime Minister Abe co-chaired with President El-Sisi of Egypt (AU Chair). Promotion of business was the main focus of TICAD7. TICAD8 will be held in 2022 hosted by the Republic of Tunisia.

<https://www.mofa.go.jp/region/africa/ticad/what.html>

# UPDATES FROM THE PHILIPPINES

January 15, 2020

University of the Philippines Diliman  
Quezon City, Philippines

**PREPARED BY:**

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Science Writer, ASP Project  
Contributing Writer and Editor

# Careers in Space S&T (For Kids)

December 5, 2020

## Countries With Citizens Who Have Flown to Space



Dr. Julie Ann Banatao, Chief Science Research Specialist of the STAMINA4Space Advanced Satellite Development and Know-How Transfer for the Philippines (ASP) Project, was one of the guest speakers for the "Careers in Space S&T (For Kids)" virtual webinar.

They presented about the Philippines' space technology and satellite updates to inspire kids to pique kids' curiosity about space and inspire them to pursue STEM careers. Their questions were impressive!



Photos courtesy of Career Coach for Pinoy Kids



# STAMINA4Space Research Papers

January 12, 2020

Manuals and research papers co-authored by STAMINA4Space members are now available for download on our website!

Check them out here:

<https://stamina4space.upd.edu.ph/research-papers/>

## Research Papers

Download these research papers written by members of our team



### BENGUET FOREST FIRE BURNED AREA & TAAL ASH EXTENT ESTIMATION USING SUPPORT VECTOR MACHINE & THRESHOLDING TECHNIQUES

Arla Jayson Sabulto (1), Caro Patricia Carico (1), Mark Jayson Felix (1), Gay Jane Perez (1)

<sup>1</sup> Institute of Environmental Science and Meteorology, University of the Philippines, Diliman, Quezon City, 101, Metro Manila, Philippines

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### IMAGE COREGISTRATION AND MOSAICKING OF DIWATA MICROSATELLITE IMAGERY

Panj F. Batoiswara (1), Arla Jayson C. Sabulto (1), Harry C. Mendo (1), Mark Jayson B. Felix (1), Gay Jane P. Perez (1)

<sup>1</sup> STAMINA4Space Program, Institute of Environmental Science and Meteorology, University of the Philippines, Diliman, Quezon City, 101, Metro Manila, Philippines

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### Reforestation and Deforestation in Northern Luzon, Philippines: Critical Issues as Observed from Space

Gay Jane Perez (1,2), Josefino C. Comiso (3), Lammual V. Aragonés (1), Harry C. Mendo (1) and Ferry S. Ong (4,†)

<sup>1</sup> Institute of Environmental Science and Meteorology, University of the Philippines Diliman, Quezon City 101, Philippines; [josefino.c.comiso@nasa.gov](mailto:josefino.c.comiso@nasa.gov) (J.C.C.); [lragones@isem.upd.edu.ph](mailto:lragones@isem.upd.edu.ph) (L.V.A.); [harmendaj@up.edu.ph](mailto:harmendaj@up.edu.ph) (H.C.M.)

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<sup>4</sup> Institute of Biology, University of the Philippines Diliman, Quezon City 101, Philippines

\* Correspondence: [gppez@up.edu.ph](mailto:gppez@up.edu.ph); Tel: +632-8981-3893

† Deceased.



### Performance of Empirical Co-Derivation Algorithms on the Coastal Waters of Bagac and Polilio

Jamaica Pangasinan, Mark Jayson Felix and Gay Jane Perez University of the Philippines, Quezon City, Metro Manila, Philippines

e-mail address: [jamaica.pangasinan@gmail.com](mailto:jamaica.pangasinan@gmail.com)\*



# PUGAD's Logo

January 12, 2020

The logo symbolizes the connectivity between Earth (or ground) and space. Its modernized form is inspired by the shape of a nest, which is the english translation of "pugad".

\* PUGAD is a network of Amateur Radio and Satellite Stations across different Philippine universities. They serve as a training ground to establish terrestrial and satellite communications in the amateur radio bands. In parallel with its goals, it is equipped to send/receive signals to/from picosatellites, nanosatellites, and microsatellites with stable analog and digital communications and amateur satellites currently in orbit. In addition, PUGAD, with its base radio station, can double as an emergency node for communication, coordination, and response during emergencies and disasters.



# PUGAD

**Philippine Universities  
Ground Archiving and Data Reception**

# Celebrating the Holidays

STAMINA4Space virtual year-end party!

Even if we are cities and regions away from each other, the pandemic did not stop us from having a quick, much-needed virtual year-end get together.



Participants in the virtual year-end party, including: Giselle Marie Dela Cr..., Kat C. Coballes, Floyd Fortes, Elaiza Pontrias, Ericka Picar, Nikki Ignacio, Giselle Marie Dela Cr..., Kat C. Coballes, John Leur Labrador, Kenneth John Iba..., Vanessa Pataueg, Floyd Fortes, Elaiza Pontrias, Gelo, John Leur Labrador, Delburg Mitchao, Ariston Gonzalez, Joash Rodriguez, Anne Vera Candelaria, Kenneth John Iba..., Vanessa Pataueg, Delburg Mitchao, Ariston Gonzalez, Jeric Brioso, Christy Raterta, Ariston Gonzalez, Marianne, Joash Rodriguez, Anne Vera Candelaria, Jeric Brioso, and Christy Raterta.

## Celebrating the holidays during the pandemic



"I was lucky enough to have gotten to safely visit family over Christmas, but for New Year, we had to settle for a video call celebration with my sister. Now that I'm back away from them, I'll miss my mom's cooking very much."

- Nikki Ignacio  
Information Officer, PHL-50



*Congratulations  
Vanessa!*

"I started 2021 as a woman who fulfilled her lifelong dream. Despite the pandemic and a whole lot of adjustments, Louie, my husband, and I were able to push through with our plans of getting married last December 31, 2020."

- Vanessa Pataueg  
Project Development Officer,  
STeP-UP

## Celebrating the Holidays during the pandemic



"I'm happy that we are all safe and healthy. It's always a feast during the holidays here in our home. Even our dog is part of the celebration!"

- Kat Coballes  
Project Assistant, PHL-50



"In the Philippines, we call the day/period before Christmas "Noche Buena", which is the Spanish word for Christmas Eve.

I was lucky enough to go home to my family for the holidays and continue our yearly tradition (you can see our noche buena feast in the photo).

I tested negative for COVID before going home. Safety is a priority!"

- Ericka Picar  
Information Officer, STeP-UP



"Celebration-wise, a simple family dinner. But given the long days of rest that accompanied the holiday season, I devoted much of my time doing my other passion: digital arts, in particular comics making."

- Julius Sempio  
University Researcher, GRASPED

**To the BIRDS Network:**

**Wishing you all a happy, healthy, and  
prosperous year ahead!**

*Warm regards,  
The STAMINA4Space Team*

# Updates from STEP-UP

scholars

*"The 15<sup>th</sup> step..."*

January 2021

University of the Philippines- Diliman  
Quezon City, Philippines

*Prepared by STeP-UP scholars*

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# Maya-3 & Maya-4 Flight Model Acceptance Test

Christy A. Raterta / Marielle Magbanua-Gregorio



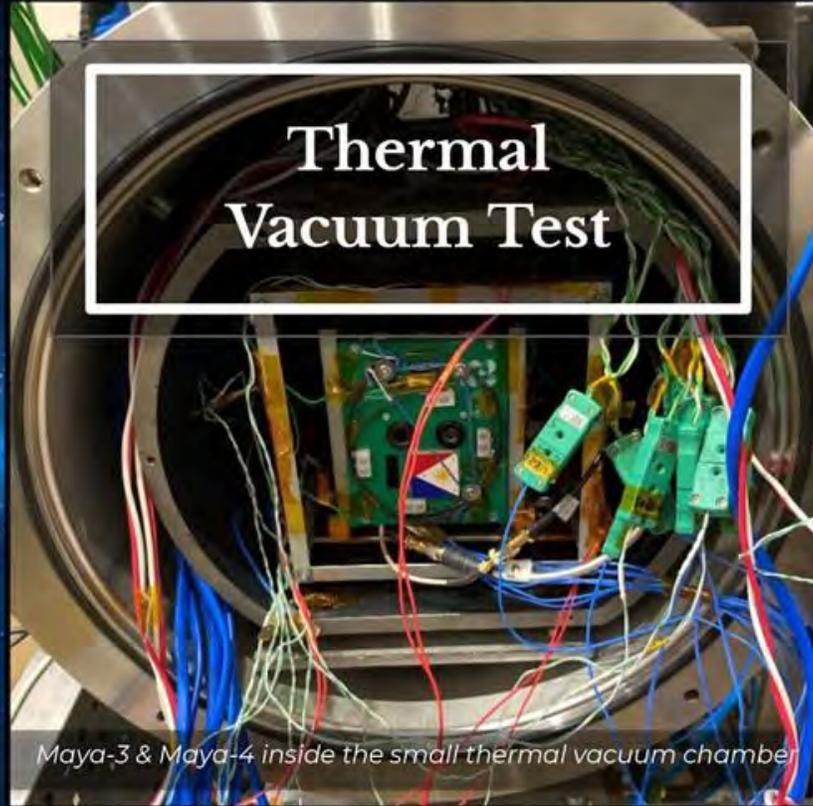
The flight models of the Maya-3 and Maya-4 cube satellites underwent the Acceptance Test from December 20, 2020 to January 12, 2021 at the Kyushu Institute of Technology (Kyutech). The tests conducted include Thermal Vacuum Test, Vibration Test, Fishline Strength Test, Inhibit Switch Check, Fit Check, and Sharp Edge Check. Aside from these, the team also conducted other qualification tests such as blocking diode testing, battery voltage inspection, antenna deployment test, magnetometer calibration, camera focusing, and communications long range test. Solar cell attachment and verification method using the solar simulator were also done during this duration. In addition to the advance nanosatellite development tutorial, the scholars also attended a 3-day lecture with Prof. Mengu Cho, and shock test training by Prof Yamauchi.

# Maya-3 & Maya-4 Flight Model Acceptance Test

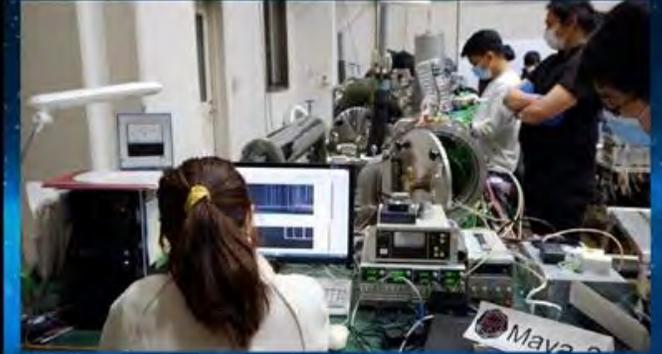
Christy A. Raterta / Marielle Magbanua-Gregorio



Attachment of thermocouples to the satellite boards under test



Maya-3 & Maya-4 inside the small thermal vacuum chamber



Setting up the TVT control monitor and the Ground Station



Setting up for TVT at the Small Thermal Vacuum Chamber



Thermal Vacuum Test (TVT) during the Acceptance Test of the flight models is performed to ensure that the satellites can survive the extreme hot and cold temperatures in space. Functionality Tests were performed during the hot and cold soaks of the satellite.

# Maya-3 & Maya-4 Flight Model Acceptance Test

Christy A. Raterta / Marielle Magbanua-Gregorio



Preparing the vibration test machine



## Vibration Test



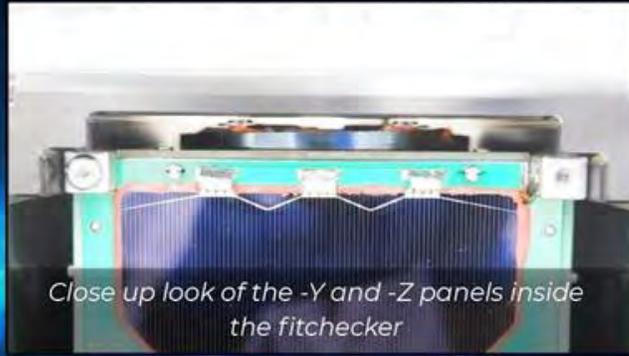
Applying torque marks and testing the accelerometers



Setting up the vibration test control computers

# Maya-3 & Maya-4 Flight Model Acceptance Test

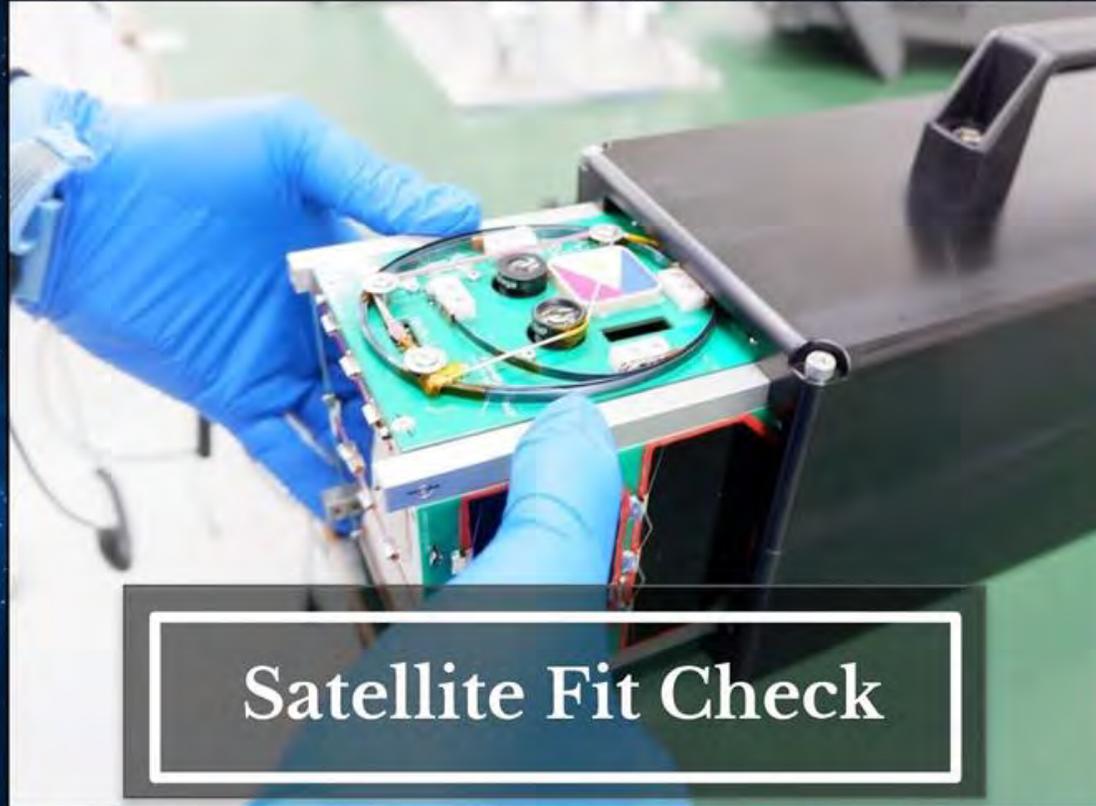
Christy A. Raterta / Marielle Magbanua-Gregorio



Close up look of the -Y and -Z panels inside the fitchecker



Team members ensuring that the antenna is properly stowed prior to fitchecking



## Satellite Fit Check



Enzo checking the smooth fit checking of the satellite

# Maya-3 & Maya-4 Flight Model Acceptance Test

Christy A. Raterta / Marielle Magbanua-Gregorio



Solar cell attachment practice with BIRDS-4 Filipino members



## Solar Cell Attachment and Verification



Attachment of solar cells to Maya-4 FM Solar Panel Boards



Verification of Solar Panel Board after cell attachment

The solar cell attachment was done at the clean booth, 3F of LaSEINE, where the small rotary vacuum pump, chemicals, and tools were placed. The BIRDS-2S team were taught and assisted by BIRDS-4 Filipino members and a member from BIRDS-2. After the solar cell attachment, all FM solar panel boards were verified and measured using the sun simulator and the electronic load devices.

# Maya-3 & Maya-4 Flight Model Acceptance Test

Christy A. Raterta / Marielle Magbanua-Gregorio



The Maya-3 and Maya-4 Flight Models (FMs)

Happy 13th Birthday, Gradysss!

STeP-UP Scholars

PHL  
MICROS T

STAMINA  
SPACE



Happy birthday, ghorl!

*Doumo arigatou gozaimasu!*

どうもありがとうございます

*Christy A. Raterta*

PHIL  
MICROSAT

STAMINA  
SPACE



Group photo with the professors of Kyutech's Laboratory of Spacecraft Environmental Interaction Engineering (LaSEINE) and the Filipino members of BIRDS-4. Japanese mentors were also given simple tokens from the Philippines.  
*Doumo arigatou gozaimasu, Sensei!*

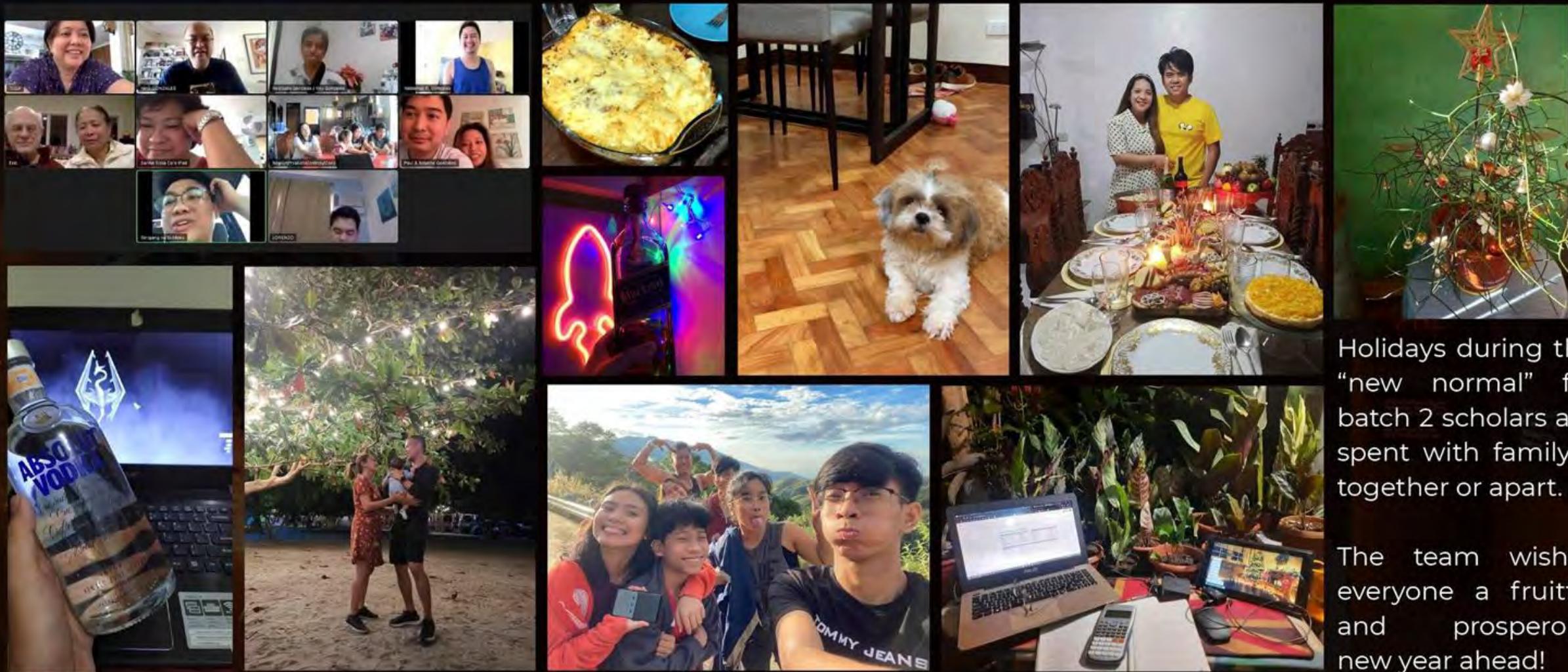




Parts of Maya-5 and Maya-6 from Kyutech arrived at the UP EEI on January 4, 2021.

After inventory, scholars can then proceed with the testing and development phases to prepare for their critical design review in a few months and for their EM testing stage in Kyutech.

## MAYA PARTS ARRIVE FROM KYUTECH



Holidays during the “new normal” for batch 2 scholars are spent with family— together or apart.

The team wishes everyone a fruitful and prosperous new year ahead!



# NEW NORMAL HOLIDAYS

Also featured on the previous page is a tasty lasagna baked by JJ, which he served during the holiday festivities. Here is the recipe:



250g lasagna sheets  
Parmesan cheese (for topping)

For the cheese sauce:

2 tbsp butter  
2 tbsp flour  
2 cups milk  
125g mozzarella or cheddar, or mix of both  
Salt and pepper

For the meat sauce:

2 tbsp olive oil  
1 onion, chopped finely  
1 carrot, chopped finely  
1 clove of garlic, crushed  
500g ground beef  
800g canned tomatoes  
5 tbsp tomato paste

2 cups chicken stock  
A pinch of nutmeg  
Salt and pepper

To make the meat sauce, soften onions, carrots, and garlic in a heated saucepan with oil. Then add the ground beef and cook until brown. Add in the tomato paste, canned tomatoes, stock and season with salt, pepper, and nutmeg. Simmer for 20 minutes while stirring occasionally.

In a separate pan, melt the butter for the cheese sauce. Create a bechamel base by stirring in the flour for around 2 minutes over gentle heat. Gradually pour in the milk and stir until thick. We can add the cheese after seasoning the bechamel with salt and pepper. Stir until cheese is melted.

Start assembling the lasagna with a layer of meat sauce, then alternate with lasagna sheets, meat sauce and cheese sauce. Sprinkle parmesan on top and bake in a preheated 180°C oven for 35-40 minutes.

Enjoy!

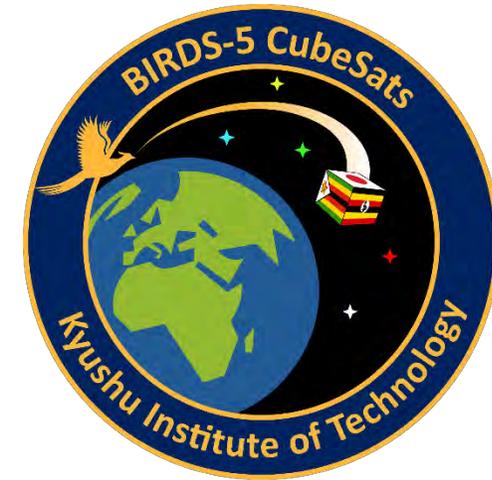


# FOODIE GOODY!

**END OF REPORT FROM THE PHILIPPINES**



**BIRDS-5 Team on 30-OCT-2020 (Dr. Masui is missing in this group photo)**



**BIRDS-5 reports  
of this month  
are on the  
following pages**

# 3D Printer



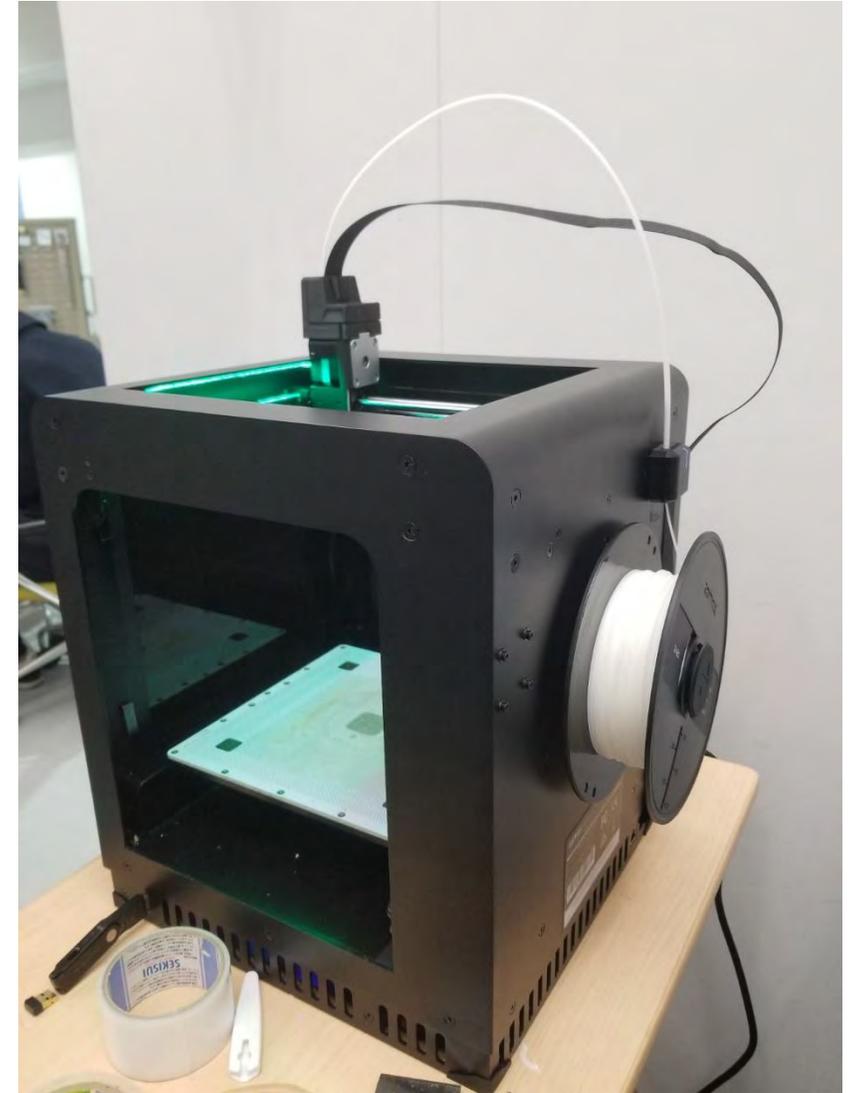
OMARA Bonny

January 8, 2021



# What is a 3D Printer?

- ❑ Also known as additive manufacturing, it was first introduced in the late 1980s.
- ❑ An automated process of building a three-dimensional object by adding material rather than taking materials away by drilling or machining.
- ❑ It was first commercially used as a rapid prototyping method in the aerospace and automotive industries.



3D Printer at Kyutech

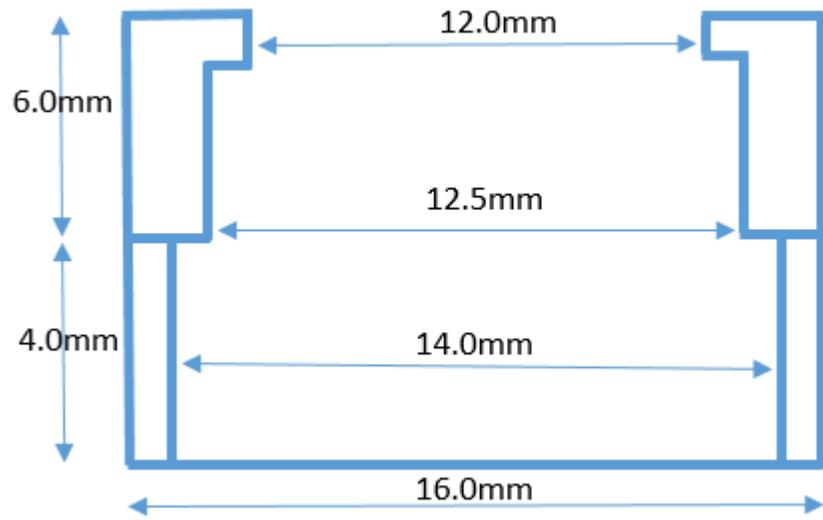
# Design Preparation of Prints

From an idea to a 3D-printed object must always pass through two software tool technologies:

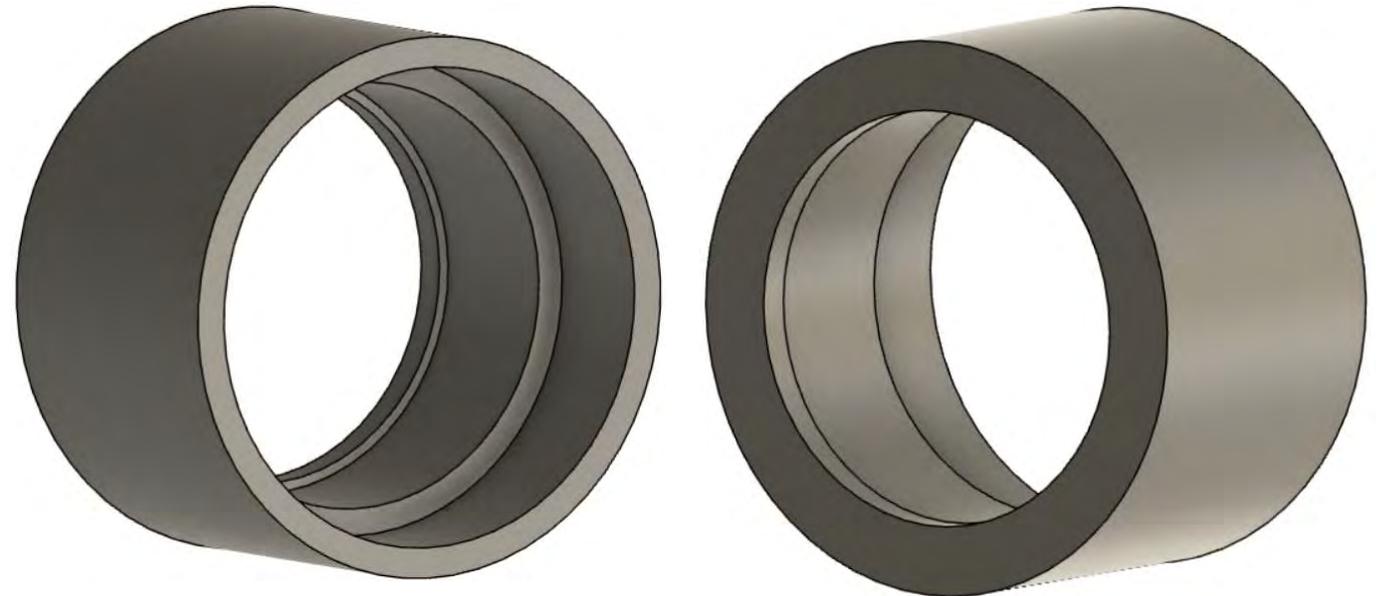
- ❑ 3D-modeling (or CAD) software
- ❑ Slicers.

## Case study: Developing a casing for the lens and filter

Step 1: Get the measurement for your component.



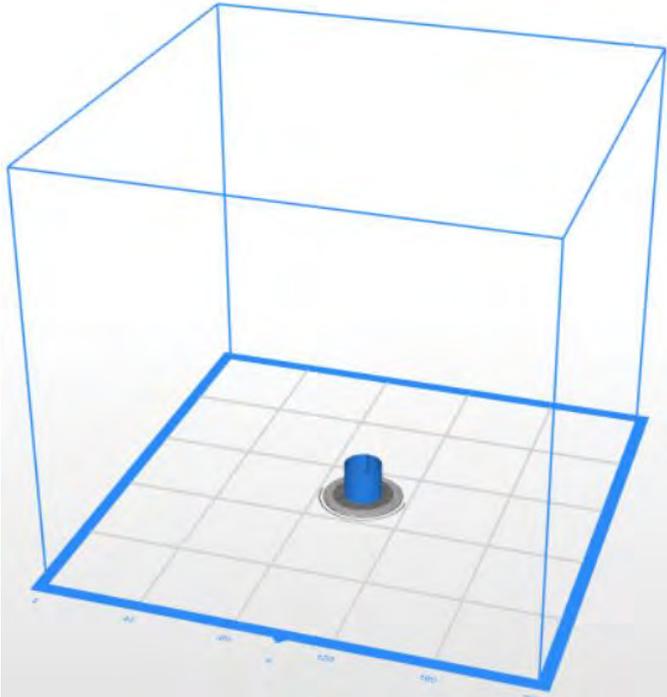
Step 2: Transform your measurement into a 3D CAD modeling. (Using Fusion or any other design tool.)



# How does 3D printing work?

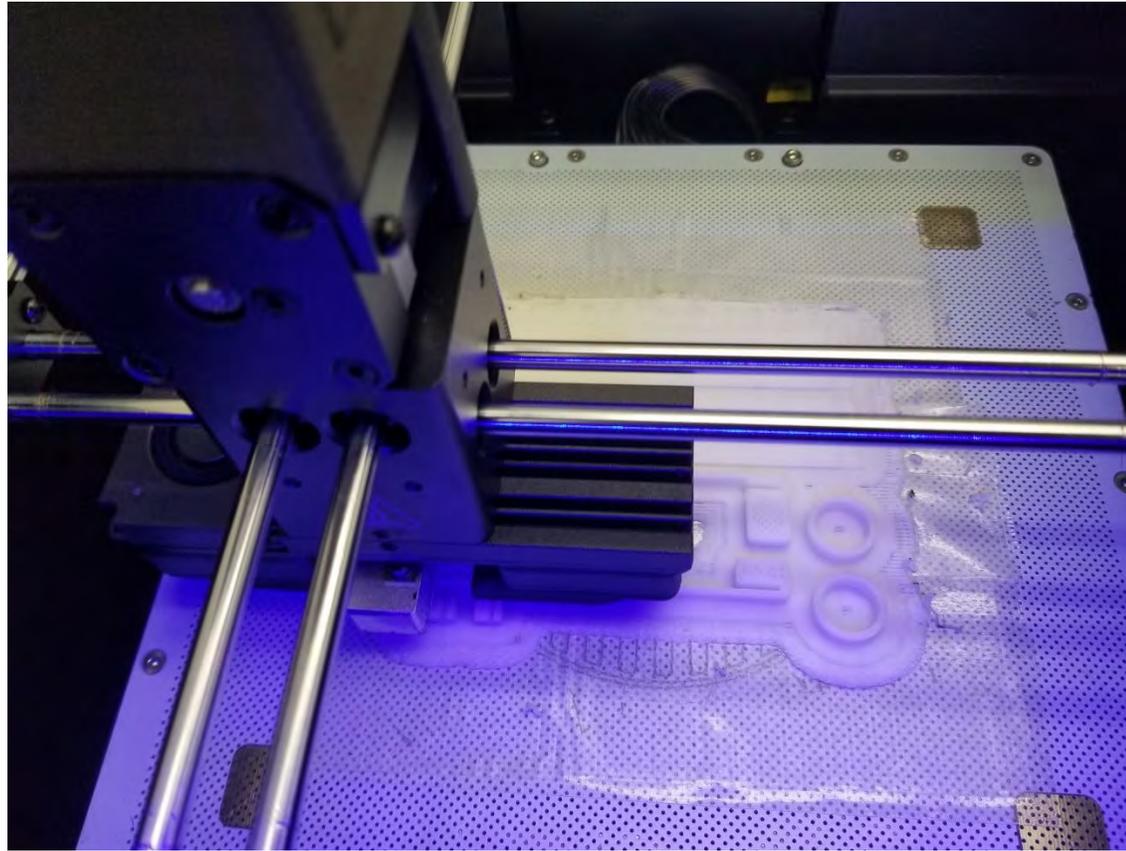
## Developing a casing for the lens and filter

Step 3: Converting STEP using slicing software.



Slicing software tells the printer how to print your model

Step 4: Printing



Final Product.



# 3D Printer Safety Measures and benefits

## Safety:

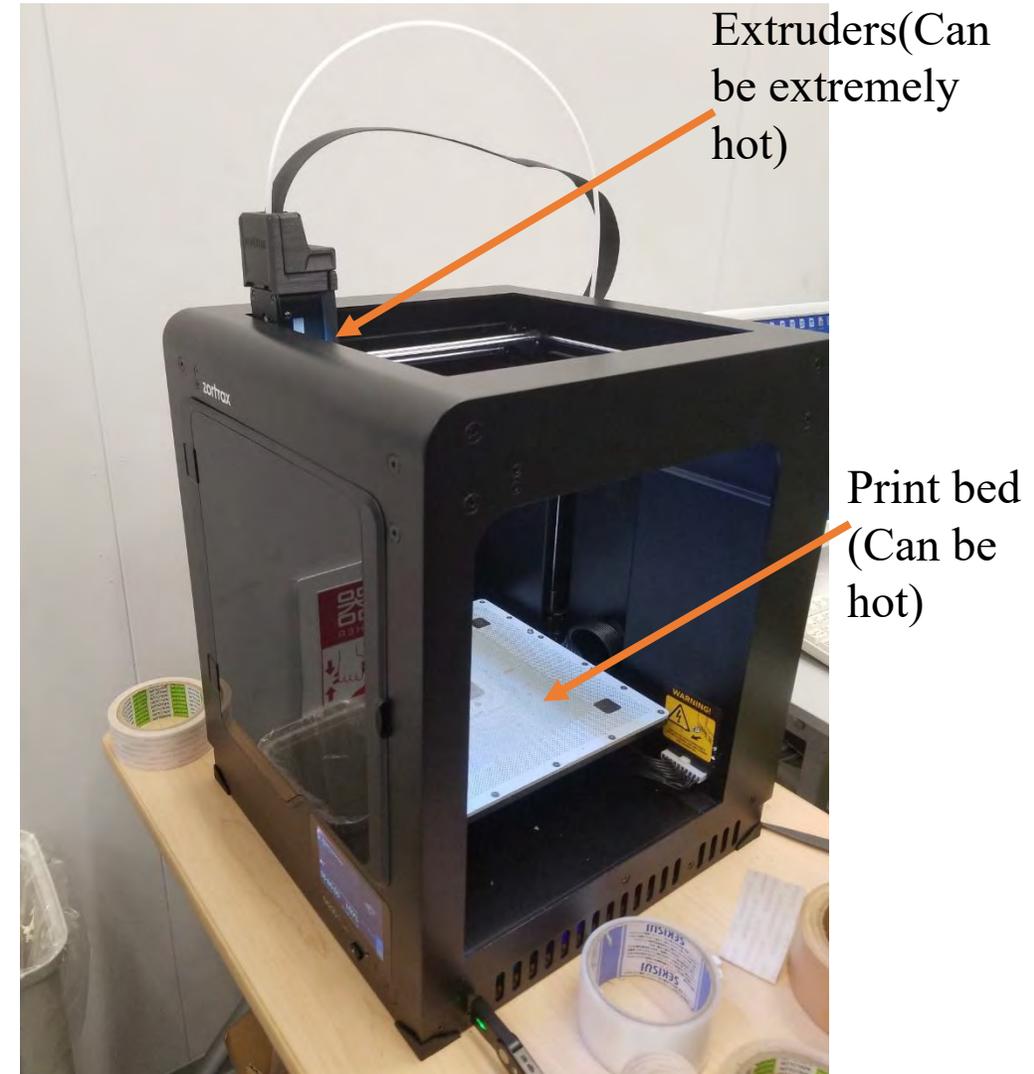
- ❑ The most important thing to remember is that **you are working with heated plastics**. Extruders, plastics and in some printers, the print bed itself can get very hot and can cause bad burns if you are not careful.
- ❑ Some printers have no enclosure around the print area; practice extra caution with these printers.



This model took 25 minutes.

## Benefits:

- ❑ Provide students the **capacity to learn in a more hands-on way**.
- ❑ Elevate student's **critical thinking** during a project development stage **with physical realistic prototypes**.
- ❑ **Encourages creativity** and exposes students to professional tools used by a wide range of industries, preparing them for the future.



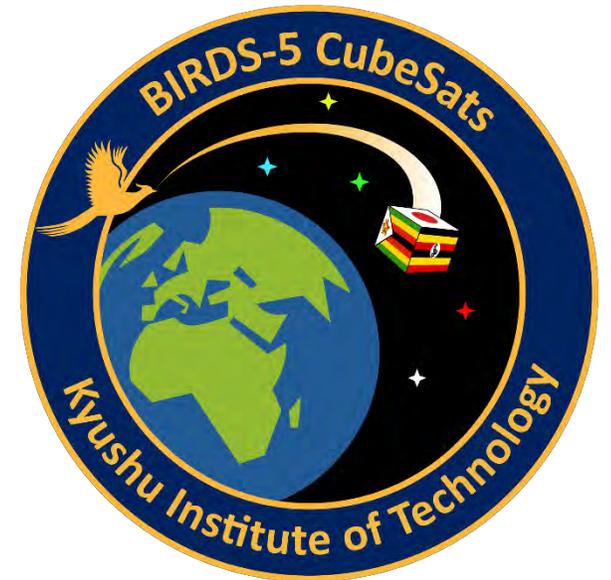
# Learning Japanese with an arubaito



By : Fahd MOUMNI  
18/01/2021

## Editor's Note:

“Arubaito” (アルバイト) is the Japanese word for a part time job. The origin of this word is explained in this article.



# Methods of learning japanese

- When I came to Japan (October 2019) my Japanese level was limited to the « Arigatou » (Thanks) and « Konnichiwa » (Hello)
- I wanted so hard to use the language for my daily life just to take the best out of living in Japan and because it helps appreciate the culture in the fullest way
- One method is to get the japanese classes within Kyutech : Classes are good, but parallely taken with other classes and research work, the amount of self-work can be very limited, even during classes you may lack of attention as you put all of your energy on other matters.
- Another method is to talk to anyone and everyone within Kyutech, everyday...It can be really rewarding but also requires some energy to sustain this effort.
- I was suggested to get a japanese girlfriend also...that can be a very good way but I guess you still need a minimum amount of language if you want to succeed getting one first. And if you have a girlfriend who speaks good English, you may never use japanese as you will naturally use the easiest way, meaning, you will always use English.
- Then, I saw that all japanese students had an arubaito...

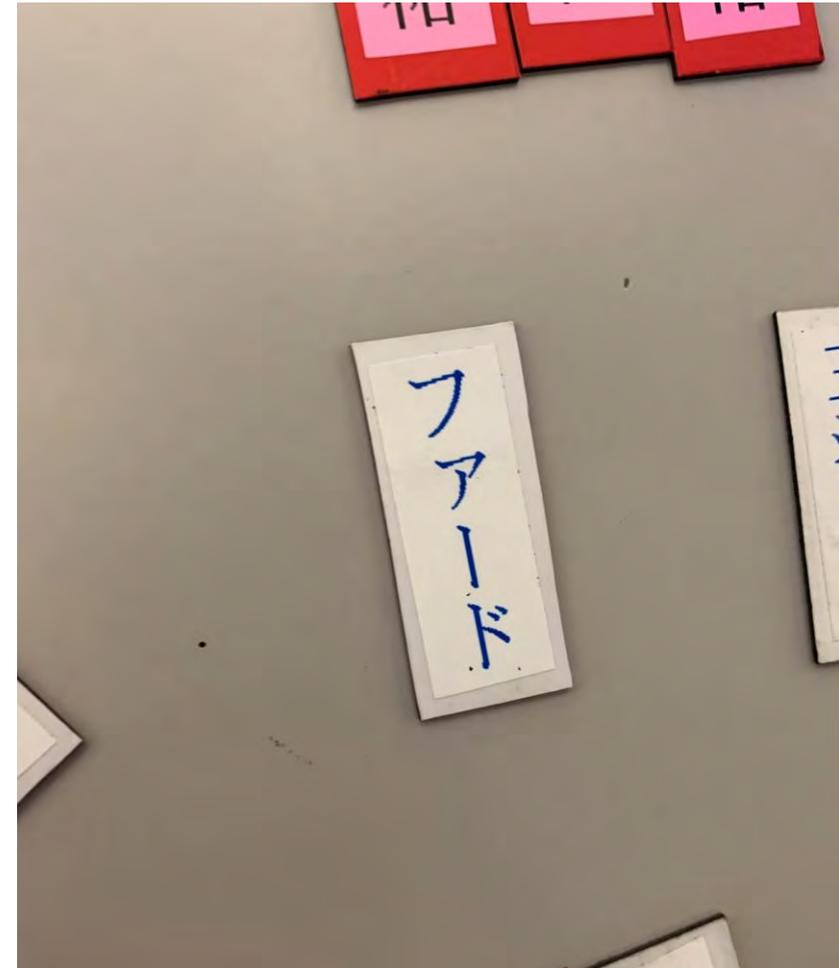


Some of what you get to see going early (top) or late (bottom) to your arubaito



# The *arubaito*

- The word « arubaito » comes from the german word « arbeit » which literally translates to « work » but in japanese it precisely mean « part-time job »
- Having an « arubaito » or « baito » is very common in Japan, almost all japanese students work part-time in all kinds of places (restaurants, bars, small/big companies, cram schools, convenience stores...). Earning some money helps a lot in the daily life within the university especially when you do not get any scholarship.
- I always thought that if I want to speak the language of a country, I need to live like the people of that country !
- I was therefore looking for an arubaito : truth is, it may be very difficult to find one if your level is literally 0... but you must never give up !!



My name on a magnet to be put on the task assignment board

# Finding an arubaito

- I asked many Japanese friends : « which arubaito does not need much Japanese but can help me improve it » ?
- Their reply was « you should work somewhere where you get to meet people but where you don't need to talk to them much » = you need to work with your hands where there can be people but « communication » should not be necessary for your job.
- Then I asked many people about the arubaito that they were doing : most of them were in restaurants = difficult for communication
- A very close friend of mine however suggested me to come with him to his arubaito : a moving company called « Nippon Express » = you carry furniture from a location to the other and you get to work with a team and meet clients but you do not have to always talk, just be attentive enough for instructions (that can be taught by gestures)
- Then I officially started working part-time with the company



7:00 AM, me in my uniform in front of the company

# How did I learn japanese through arubaito ?

- The simple answer would be by hearing everyone speak **only japanese**, by being able to communicate **only in japanese**, and by trying so hard to say things so that when you learn those words later you never forget them.
- Even if I did not talk much, communication was essential, especially « listening ».
- I used to talk to my colleagues and ask them names of all furnitures, surrounding places, just common things to develop my vocabulary
- I would keep a memo file in my phone that I filled everytime I went to work : I would write words to verify later or I would write their « supposed » meaning or what I have understood from the explanation given (gestures, using simpler words, or just the translator, but that was rare)
- For reading I would ask again the co-workers about how to read *kanjis* whenever we are in front of an advertisement or anything drawing attention: and the more I saw the ad, the faster I would be able to read it (Example : advertisements about safety within the company)
- I downloaded an application to read *kanjis*, so on the truck, when I felt like I was wasting my time, I would take out my phone and exercise. The longer the trip, the more I learned. Sometimes, in order not to show a lack of respect I used to show the *kanjis* to the co-workers and make them enjoy that task with me (on breaks -- not while driving)

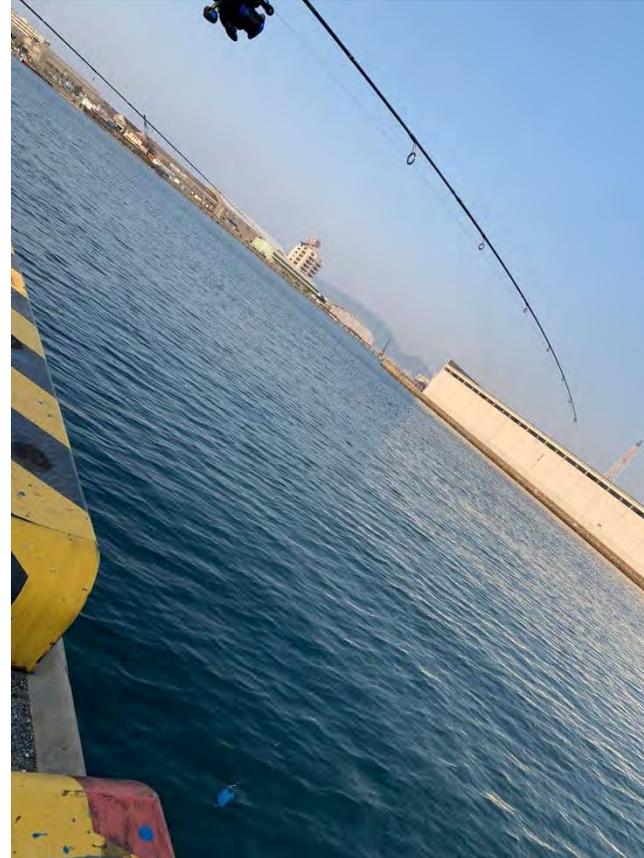


Getting lunch in typical Japanese restaurants !



# What I gained

- Lots of funny and bad words...obviously, but that is the most interesting part of it. Japanese students are so surprised when they hear me use those words, and they may even feel closer to me ! Knowing those little words or « shimoneta » (weird jokes) make you funnier among your group of Japanese friends for sure !
- Conversational Japanese : I used to talk by using very simple words, but now, my level is still not there but I feel much more comfortable in talking to anyone and live a better life in Japan. People who did not see me in a while could see the improvement.
- Japanese company manners and behavior : the Japanese company has some unique manner codes that you can only learn by being there or by working with Japanese people. I personally got to learn many of the main aspects of this professional culture, and this can be extremely useful even for working in different conditions.



Going fishing with the co-workers after our shift



In the truck,  
learning (JP) or  
teaching (EN)  
some new words

**END**

**Speak a new  
language so that  
the world will be a  
new world.**

**Rumi**

teamjapanese.com

## ***Editor's note about the previous article***

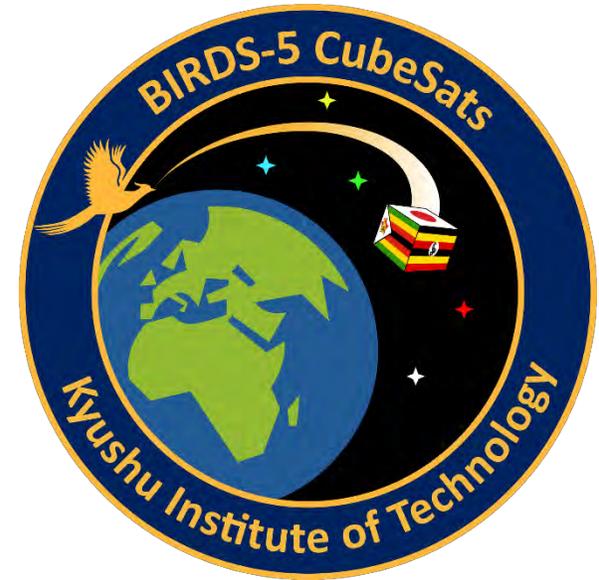
**I admire Fahd's intensity to learn Japanese, or Nihongo. Working for a moving firm is demanding work. In summer, it can be brutally hot. In the winter, it can be mercilessly cold.**

**However, everything you get out of life depends on what you put into it. Through this tough part time job Fahd vastly improved his Nihongo skills, and in addition learned a lot about the people, the lifestyle, and the culture, of Japan. This rich experience will serve him well for the rest of his life.**

# The JR 3-day Kyushu foreign student pass + Fukuoka Science Museum

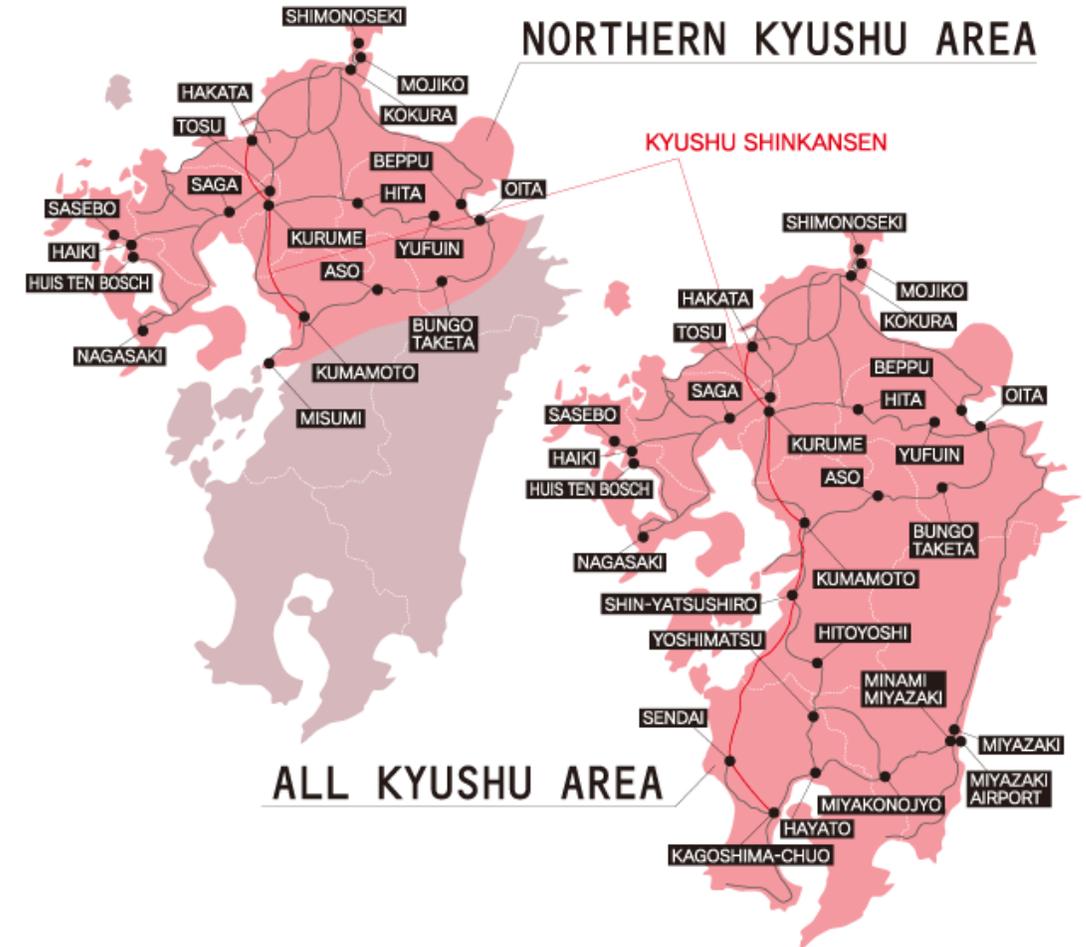


By : Fahd MOUMNI  
19/01/2021



# The context

- As being a member of a cubesat project, you may not have many vacations (for instance, summer vacation was fully spent working to advance in our project, which was very helpful).
- One of the only opportunities to get some rest, especially after PDR (Preliminary Design Review, please check Victor MUKUNGUNUGWA's article in this same newsletter), was the winter vacation (7 days – 2 days for PDR = 5 days)
- There was a need to find a fast, simple and cheap way to enjoy the amount of time given : the best idea was to use to the **JR Kyushu 3-day Foreign Student Pass !**
- If you are a temporary foreign student, living in Kyushu, and are very curious to discover a big part of Japan, then this is for you !!
- You get the chance, on 3 days, to take all the express trains to go around, either the North of Kyushu (7330 yen), or all of it (14670 yen). The Shinkansen (very fast train) is allowed only between Hakata in the very North and Kagoshima in the very South of the island of Kyushu)



Maps to be found with all information about the pass on [https://www.jrkyushu.co.jp/english/jrkyushu\\_foreign\\_studentpass/index.html](https://www.jrkyushu.co.jp/english/jrkyushu_foreign_studentpass/index.html)

# Planning a trip during a pandemic

- How do you plan a trip during a pandemic ?? Especially if you are working with a team that you meet quite everyday... Well, you must study where you go before taking any decisions, but the risk is always there.
- Thankfully Kyushu island is one of the least affected areas (especially in the south), therefore, balancing between the interest to visit a city, the number of contaminations recorded, a route was planned as below :

Day 1 : Kitakyushu to Kumamoto

Day 2 : Kumamoto to Kagoshima (for Sakurajima volcano) then Miyazaki

Day 3 : Miyazaki to Aoshima (beach for the first sunrise of the year) then Beppu to visit Onsens (see the Guest Box by Otani san) and going back Kitakyushu

- Organisation is the key of a kind of trip like this ! It can be stressful but you should never worry : in Japan, it is difficult NOT to get help
- Obviously , avoiding very populated or closed areas can be the main behaviour to keep during this kind of trip



Discovering  
ONE PIECE  
culture in a  
snowy  
Kumamoto

# Not missing the opportunity

- Getting the first « all-Kyushu » pass got me motivated to continue the adventure : I got a North-Kyushu pass to go to :

Day 1 : Kitakyushu to Hakata (Fukuoka city to check the science Museum)

Day 2 : Hakata to Nagasaki (a historical city)

Day 3 : Nagasaki to Huis Ten Bosch then Sasebo (to visit the Kujukushima islands) and go back to Kitakyushu

- As for the first pass, you need to be well organized with the timings and you should be ready to change your plan if an event is cancelled or if the place you want to visit is closed (due to the pandemic or just because of holiday timing)



Getting to Sakurajima

# Discoveries

- Sakurajima volcano in Kagoshima
- Aoshima Beach in Miyazaki
- Suginoi Hotel in Beppu
- Itoshima/Fukuoka Science Museum in Fukuoka City
- Peace Sculpture in Nagasaki
- Kujukushima islands in Sasebo

Heiwadai  
Park in  
Miyazaki



The first sunrise of 2021 in Aoshima  
(Title of this picture : « A new hope »)



# About the *Fukuoka Science Museum*

- Passionated about science I heard about the museum before, the only thing I did not was that there was a focus on space ! Even QPS (Research company from Fukuoka, working on CubeSats) were displaying some of their material in the museum!
- AI (Artificial Intelligence) was also subject of exposition.
- The Museum is big enough to occupy 4 different floors (there are other interactive labs but those are closed because of the pandemic).
- The best part is that you get to interact with science in the funniest way (little games and machines making you learn by playing !)
- I even got to attend a show about constellations in the Museum planetarium (360°view, laying on your back and just enjoying it !)
- **The CubeSat exposition is open til 23rd February !**

Get to know more about AI and QPS !!



Satellite made by QPS and displayed in the museum

# Recommendations and advices

- If you did not have time to prepare your trip, whenever you arrive at the train station look for an information desk and tell them how much time you have and what is the best recommendation they can give you : it is free and very efficient !
- If you like « ONE PIECE » like me, you can get the chance to take a picture with « Monkey D. Luffy san » in Eichihiro Oda's hometown Kumamoto !
- For Sakurajima volcano in Kagoshima, there is a one hour bus going all around the volcano island and stopping in many « look-out » sites. Be careful with the timing !
- Bring a swimsuit wherever you go ! I needed it for the Suginoi Hotel onsen in Beppu.
- Learn as much japanese as you can before any trip, even if you forget it later, it does not matter as long as it becomes useful during your trip!
- Huis Ten Bosch can be interesting BUT the price is very expensive (7000 yen for a 1-day pass): The price stopped me from entering, however I enjoyed just being around there and buying some (edible) souvenirs from their shop.
- In Sasebo, if you are able to be in the cruise ship for Kujukushima islands, keep your ticket as you can get some discount when visiting the aquarium in front of the port !!
- Go get burgers from « Hungry Heaven » in Fukuoka city !



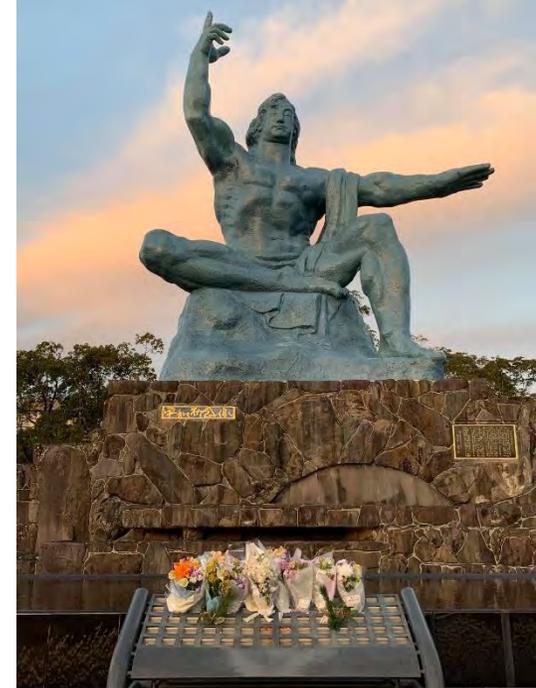
One of Beppu « Hells » (above) and the Aqua Garden of the Suginoi Hotel (below)



# Recommendations and advices

- Protect your pass in a very safe area, if you lose it, things could go bad for you (financially talking) : I used to put it in a very safe pocket on my coat that I would open and close with full attention.
- Don't forget souvenirs (omiyage) for your friends !! It means a lot
- For hotel reservations in Japan you can find very good offers on <https://www.agoda.com/>, HOWEVER !! Always bring more money than showed in the website as cleaning taxes are always added (could even double up the price) + always bring the amount of money with you : do not believe that « reserving with your credit card » means « paying with your credit card »
- In some of the hotels, you can find small onsens open for the customers : go for it !! You may find nobody if you go a bit early (7 pm for example) which is perfect on the current conditions !
- Look for gastronomic specialties of the city you are going to !
- Check if the entrance prices are changed on holiday period whenever you are going to a public area requiring a ticket.

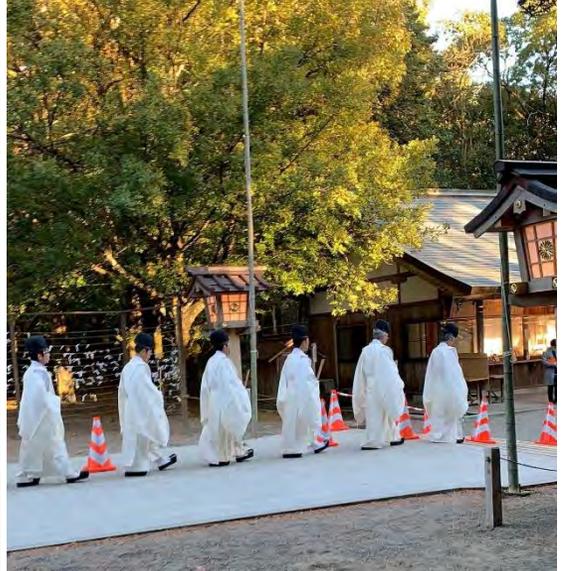
Nagasaki  
Peace  
Statue



The Atomic Bomb  
Museum Entrance

# More pictures

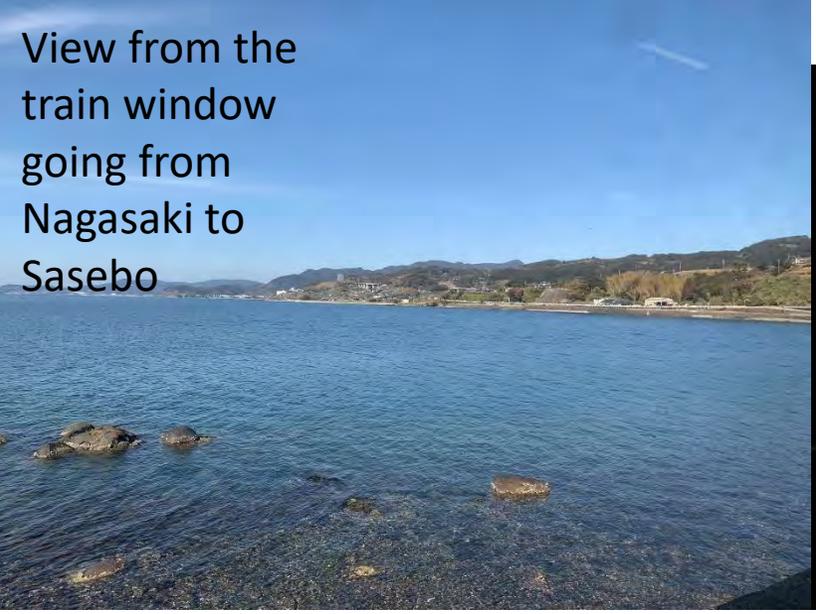
Itoshima's  
Sakurai  
Futamigaura



Shinto monks at a Sumiyoshi Shrine (New Year Ceremony in Miyazaki)



Some Udon eaten on the way back from Sakurajima (on the ferry)



View from the train window going from Nagasaki to Sasebo

Fountain show at the Suginoi Hotel Aqua Garden



Egg and Pudding made from Onsen vapor

# More pictures

Views from the Huis Ten Bosch Station



Views from the Cruise ship for Kujukushima islands

# More pictures



A « Hungry Heaven » Burger



Would you go on the pirate (Mirai) or luxurious (Pearl Queen) cruise ?

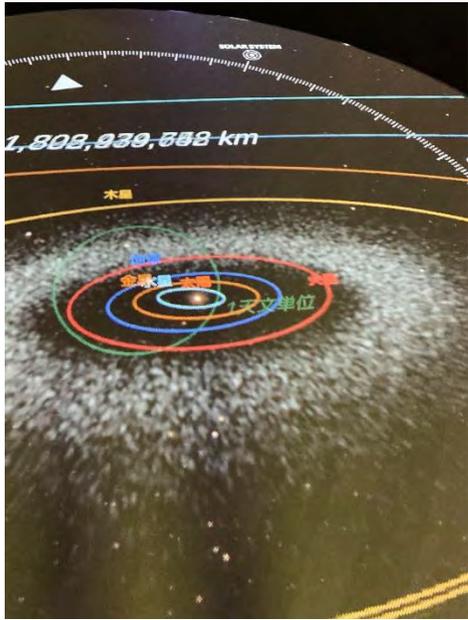


Some edible Omiyage from Beppu

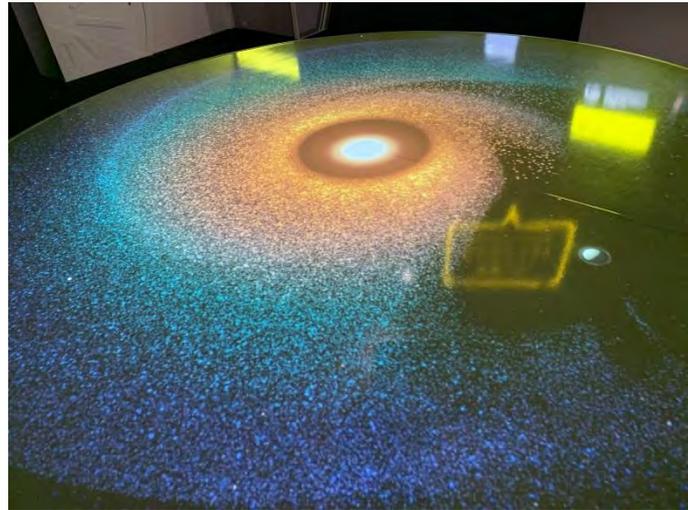


Jumping dolphins at Kujukushima's aquarium !!!

# More pictures about the *Fukuoka Science Museum*



How far do we know about the universe ?

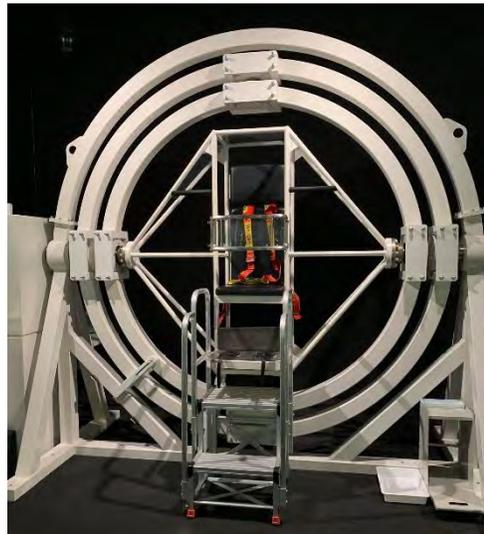


Make planets with your own hands How much do you know about planets ?



How many « layers » does a satellite have ?

Have you ever experienced 0G ?



Have you ever seen « japanese » robots ?

# More pictures about the *Fukuoka Science Museum*



Human head is very complex !



Hayabusa presentation for kids



Have you ever seen yourself jumping ?



Small satellite identification game



Try yourself on a flight simulator !

# More pictures about the *Fukuoka Science Museum*



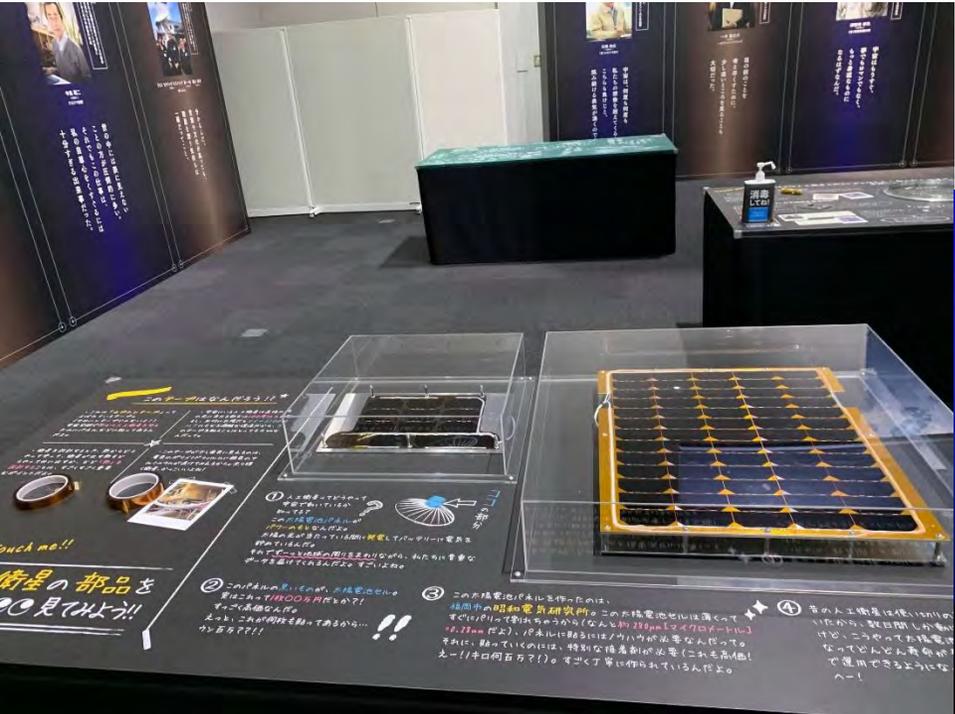
Get some space food and JAXA goodies on the go !

Another view of QPS satellite



Get to know more about QPS !

# More pictures about the *Fukuoka Science Museum*



Solar panels used on the QPS satellite

Only few people will recognize him...Don't wake him up !



Other components used on the QPS satellite structure

**END**

## 26. BIRDS-5: Preliminary Design Review (PDR)



UGANDA



JAPAN



ZIMBABWE



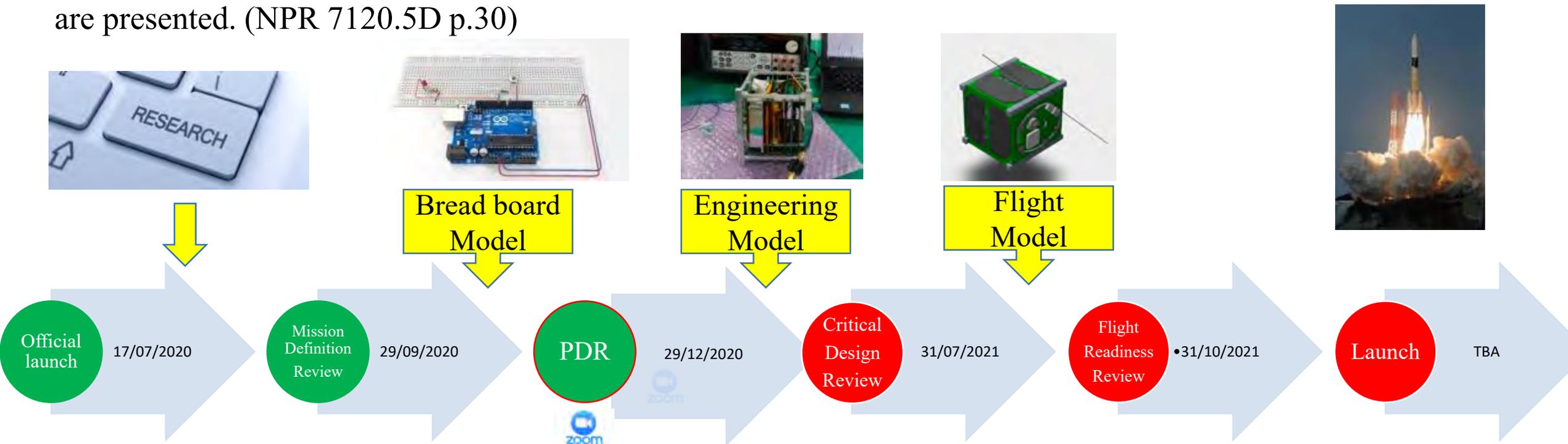
By : Victor Mukungunugwa  
**BIRDS 5 Project Manager**  
11/JAN/2021



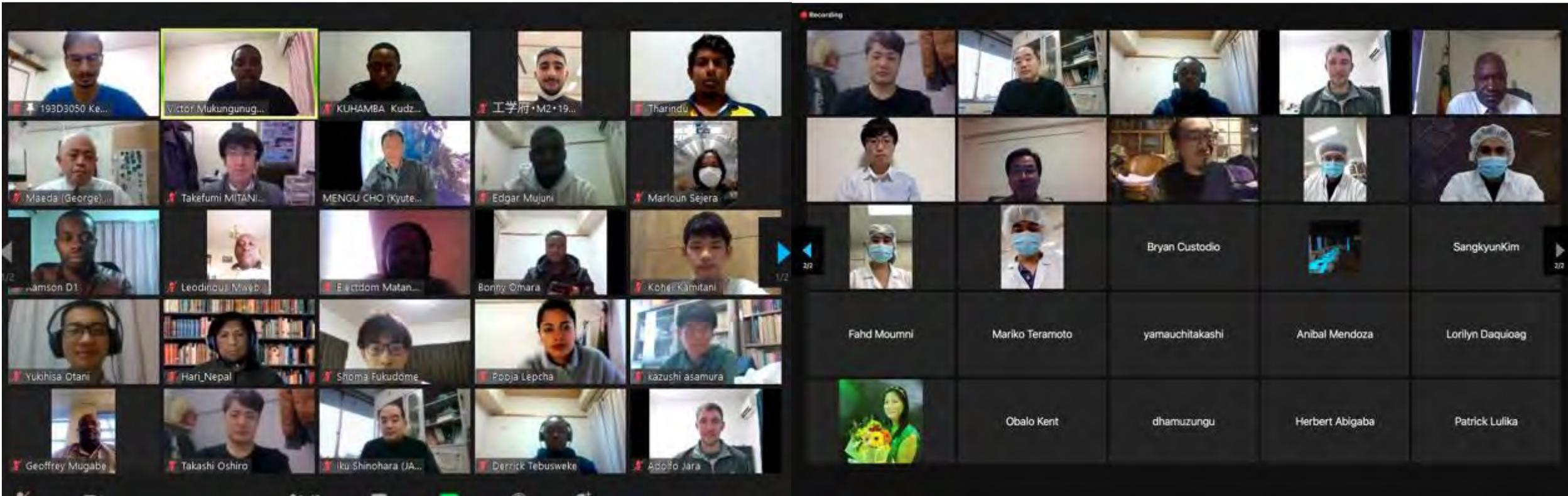
# BIRDS-5 PRELIMINARY DESIGN REVIEW

## Preliminary design Review (PDR)

- The PDR demonstrates that the overall program preliminary design meets all requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It shows that the correct design options have been selected, interfaces have been identified, and verification methods have been described. Full baseline cost and schedules, as well as all risk assessment, management systems, and metrics are presented. (NPR 7120.5D p.30)



# BIRDS-5 PDR PARTICIPANTS



BIRDS-5 PDR was attended by a total of 47 participants from various countries and organisations.



The Republic of Uganda

MINISTRY OF SCIENCE TECHNOLOGY AND INNOVATION



# BIRDS-5 PDR PRESENTATIONS



**Victor Mukungunugwa: PDR Overview**

## BIRDS Project Overall Mission Statement

Make the first step towards creating an indigenous space program by designing, building, testing, launching and operating, the first satellites for participating nations.

## BIRDS-5 Mission Statement

Build Uganda and Zimbabwe's first satellite while improving the standardized bus system for future missions while giving continuity to the satellite development of Japan and previous missions from BIRDS-1,2,3 and 4.

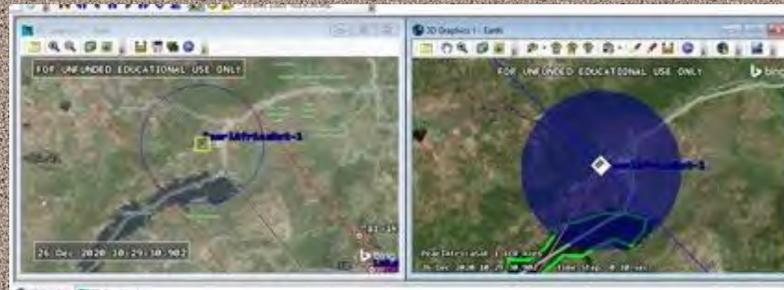
	Japan	Uganda	Zimbabwe
Name	TAKA	PearlAfricaSat-1	ZIMSAT-1
Size	2U	1U	1U
Image			



**Timothy K Kuhamba: Attitude visualisation**

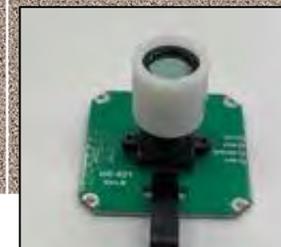
## Mission Scenario

1. Compute the access times, swaths of the satellite to different target areas
2. Check which target areas can be covered
3. Check the orientation of the satellite sensor before satellite passes the target
4. If the satellite sensor is facing to the earth
5. Send a shutter command to the satellite when the satellite is passing the target area



**Bonny Omara :Multispectral camera**

SR 1.1 – MULTI-SPEC system shall capture multiple high-quality multispectral images for mission analysis							
ID	Design Requirements	ID	Verification Requirements	Verification Method	Status		
DR 1.1.1	Ground Resolution shall be less than 175m per pixel (160m)	VR 1.1.1	Verify camera imager resolution	<ul style="list-style-type: none"> <li>Conduct imager specification calculations</li> <li>Conduct capture tests and extrapolate results</li> </ul>	△		
DR 1.1.2	Ground Swath shall be greater than 70km x 70km (4900km <sup>2</sup> ) (128X100) = 12800km <sup>2</sup>	VR 1.1.2	Verify lens focal length, field of view and working distance	<ul style="list-style-type: none"> <li>Conduct Lens research/FOV/focal length calculations</li> <li>Conduct capture tests and extrapolate results</li> </ul>	○		
DR 1.1.3	Shall capture the necessary band ranges for mission analysis (550nm, 680nm, 720nm, 790nm)	VR 1.1.3	Verify filter can allow appropriate band ranges	<table border="1"> <tr> <td>Marg in</td> <td>±10 nm</td> </tr> </table> <ul style="list-style-type: none"> <li>Check specifications of filter.</li> <li>Confirms via multispectral capture and analysis tests</li> </ul>	Marg in	±10 nm	△
Marg in	±10 nm						



# BIRDS-5 PDR PRESENTATIONS



**Keenan Chatar: Image Classification**

**MISSION GOAL**

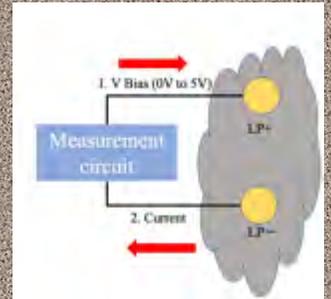
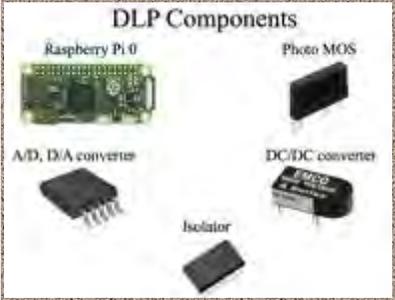
- G-1: Capture high-quality RGB images of earth from space
- G-2: Improve efficiency of the data downlinking process for 1U CubeSats
- G-3: Demonstrate simple image classification on-board CubeSats
- G-4: Develop a large CubeSat image dataset for future machine learning applications



**Kohei Kamitani: Double Langmuir Probe (DLP)**

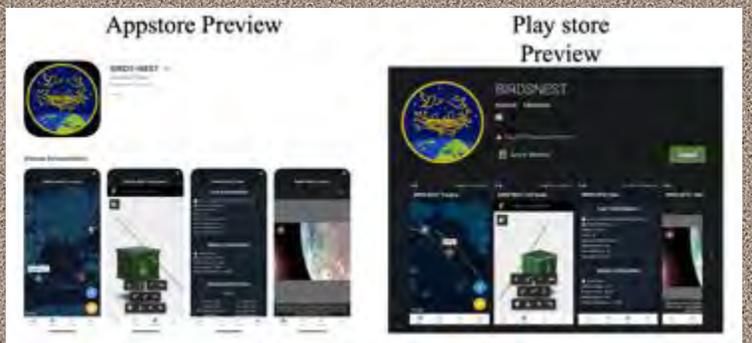
**How to measure plasma (1)**

1. Voltage from 0V to 5V is applied to the Langmuir probe (LP+)
2. Measure the current flowing in the other Langmuir probe (LP-)
3. The electron temperature and electron density of the plasma can be measured from the characteristics of the voltage applied to LP+ and the current flowing in LP-.



**Fahd Moumni: BIRDS NEST**

**Mission background:** Visualisation of the project by stakeholders and VIPs + Out-reach effort.  
**Mission Statement:** BIRDS NEST is a phone application displaying data from the Network of BIRDS satellites through a cloud database  
**Mission Objective:** To centralize all BIRDS Projects data and make it visible by everyone who holds a smartphone.



# BIRDS-5 PDR PRESENTATIONS



**Edgar Mujuni: Store & Forward**



**Takefumi Mitani-sensei  
:Particle Instrument for Nano-satellite  
(PINO)**



**Fahd Moumni: 1U Structure**

## Data to be used:

- 1.To collect average solar illumination measurement from remote sensors in various regions of the country.
- 2.To collect data on the amount of rainfall, humidity and temperature levels, and soil movements that can be used to predict landslides in landslide-prone areas.

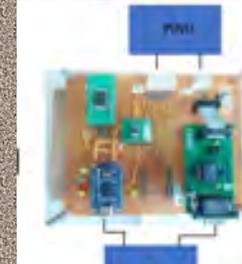
## End users:

1. Energy & power Development sectors
2. Disaster & Preparedness ministries



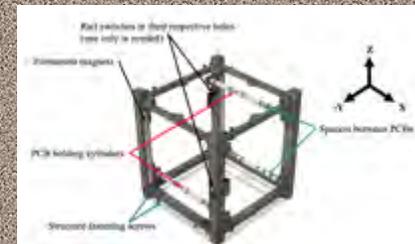
## PINO mission statement

- Dynamic variation of the Earth's radiation belts is one of the most crucial space weather phenomena to be understood to utilize geo-space.
- In the variation, the loss of high energy particles into the upper atmosphere possibly affects the upper atmospheric environment.
- PINO will measure high energy electrons precipitating into the upper atmosphere and will contribute to monitoring space weather at a low earth orbit and to understanding the loss process of the radiation belt electrons and its influence on the upper atmospheric environment.



## Subsystem Function

- To meet 1U CubeSat design requirements and provide mechanical support for all subsystems
- Provide enough strength and safety margin to keep onboard equipment safe in launch and space environments
- Provide (mechanical) interface for separation from J-SSOD-R
- To store and to properly arrange the payload and bus system in the satellite
- To design the main frame to be easy to assemble, disassemble and test



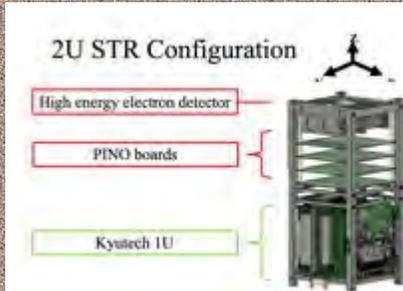
# BIRDS-5 PDR PRESENTATIONS



## Takashi Oshiro: 2U Structure

### Subsystem Function

- To meet 2U CubeSat design requirements and provide mechanical support for all subsystems
- Provide enough strength and safety margin to keep onboard equipment safe In launch and space environments
- Provide (mechanical) interface for separation from J-SSOD-R
- To store and to properly arrange the payload and bus system in the satellite



## Otani Yukihsa: Back Plane Board

### Subsystem Function

1. Connect between each Sub System boards.
2. Make it easy to integrate Bus System and Mission System
3. Reduce the difficulty in assemble of CubeSat.
4. Reduce usages of harnesses in CubeSat.



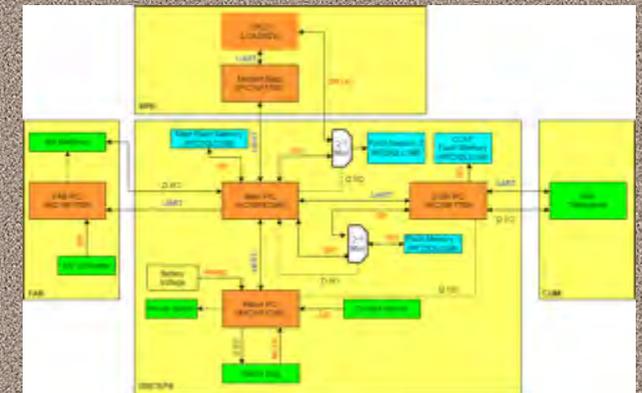
Backplane Board (BPB)



## Otani Yukihsa: OBC

### Subsystem Function

1. Send Continuous Wave (CW) data to COMM
2. Send FM data to COMM
3. Analyse the Uplink command
4. Send the command to Mission Boss and get the mission data
5. Monitor the satellite situation



# BIRDS-5 PDR PRESENTATIONS



**Derrick Tebusweke : EPS**

## Power Generation

For 1U:

Generate Power from 5 units of Solar panels, each consists of two series-connected 30% efficiency Triple Junction Solar cells, during sunlight (60min).

For 2U:

Generate Power from 5 units of Solar panels: nMX=4 (2S2P), nMZ=2 (In Series), nPY=4 (2S2P), nMY=4 (2S2P).



**Ramson M Nyamukondiwa:  
Communications**

## Background:

- Provides a link to relay data findings and send commands
- Satellite and ground station.
- It provides the interface between the satellite and ground systems.
- Receives and demodulates uplink signals, modulates and transmits downlink signals.

## Data Relayed:

- Operator commands (command data)
- House keeping data
- Mission data



**Timothy K Kuhamba: ADCS**

## Mission Scenario

1. On release from ISS (initiate System check mode)
2. Boot MCU and check all sensory components
3. Verify sensor results and calibrations
4. Load into Determination mode and Stabilization mode (always occurring)
5. Read sensor data (Magnetometer, IMU, Solar Cells)
6. Communicate data to Mission Boss (communicates to PINO, MULT-SPEC and IMG-CLS)
7. Repeat from step 5 every five (5) seconds... forever



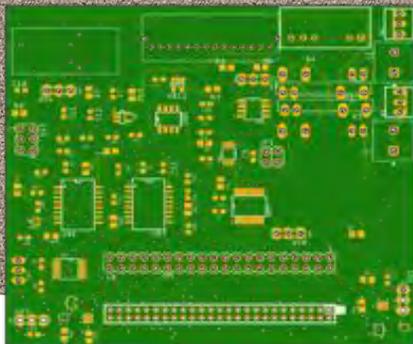
# BIRDS-5 PDR PRESENTATIONS



## Shoma Fukudome: Rear Access Board

### Functionality

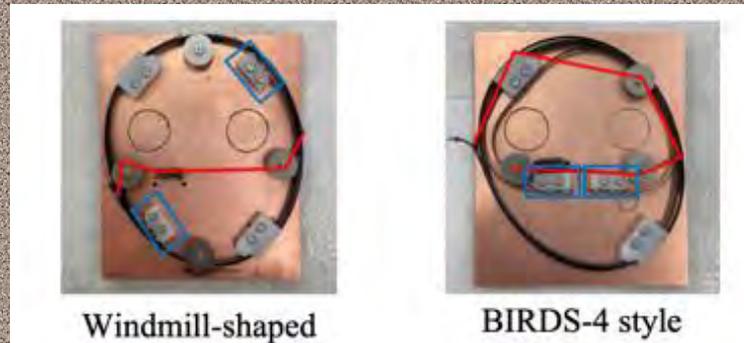
1. It is difficult to access processors that mounted on MB1 MB2 and RAB once satellite is assembled.
2. To solve this problem, each processors have programming line and they are connected to Programming Access Port mounted on RAB through BPB.
3. For BIRDS-5, we have two types of RAB.
4. One is for 1U, the other is for 2U.



## Tomoya Iwase : Antenna Deployment

### Comparison

1. Comparison between the mechanism used in BIRDS-4 and the new windmill-shaped mechanism.
2. The main changes are the position of the UHF antenna holder (blue block) and the way the antenna fixing thread (red line).



Windmill-shaped

BIRDS-4 style

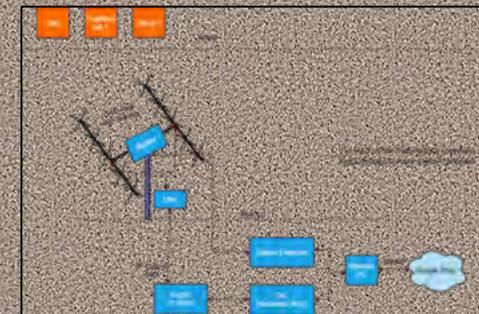


## Ramson M Nyamukondiwa: Ground Station

### Ground Station Function

1. Send Command (GMSK, 4800bps)
2. Receive CW beacon
3. Receive Telemetry (GMSK, 4800bps)
4. Data processing
5. Track Satellite Position
6. SatPC32
7. BIRDS Nest
8. Attitude Visualization

### Block Diagram



# BIRDS-5 STAKEHOLDER COMMENTS



**Mr Leodinius Mwebembezi**  
Director ST&I Regulations  
Ministry of Science, Technology and Innovation

We are very happy that the training (BIRDS 5 Project) is going well and Uganda has high expectations. We hope to fulfill the promise we have made to the Ugandans to have our own satellite, built by Ugandans for Ugandans. If we can achieve that we shall be very happy.

I was listening in the presentations and it is possible that we will meet our target of having a satellite by 2022.

We are having a long term program for Uganda which is under preparation now. What ever designs and recommendations from Kyutech we will implement that and I can see that we are inline .We are happy and appreciate the work that Kyutech has been doing and we would want to arrange and organise virtual meetings with Zimbabwe to prepare the ground station and if the situation permits we shall meet. I wish you success and a Happy 2021 and I look forward to come to Kyutech.



**Dr. Electdom Matandirotya**  
Senior Lecturer at University of Zimbabwe  
(ZINGSA) Department of Space Science and Applied Physics

It was a very enlightening process for us as a team to see the progress that is going on the BIRDS 5 Project. What is interesting is that the Zimbabwean team is taking this not just as learning curve but also to finish in time and also get results from it.

We can thank with words what the mentoring team in Japan is doing but we can only wish the best for the mentoring team while they are working with the Zimbabwean team there. As a space scientist what I have listened to and witnessed today is an eye opener to the nation that we still have a lot of work to do here and there. What is coming out of the presentation is that the team is working hard to meet deadlines and this is very encouraging.

Thank you team Japan, thank you team Uganda for the job you are doing. Back home we are working hard concerning the ground station, we have beefed up our team in the previous two weeks and I am hoping we will have our control rooms and ground station ready to sustain the project. To the team : keep soldiering we will have our own satellite, thank you.

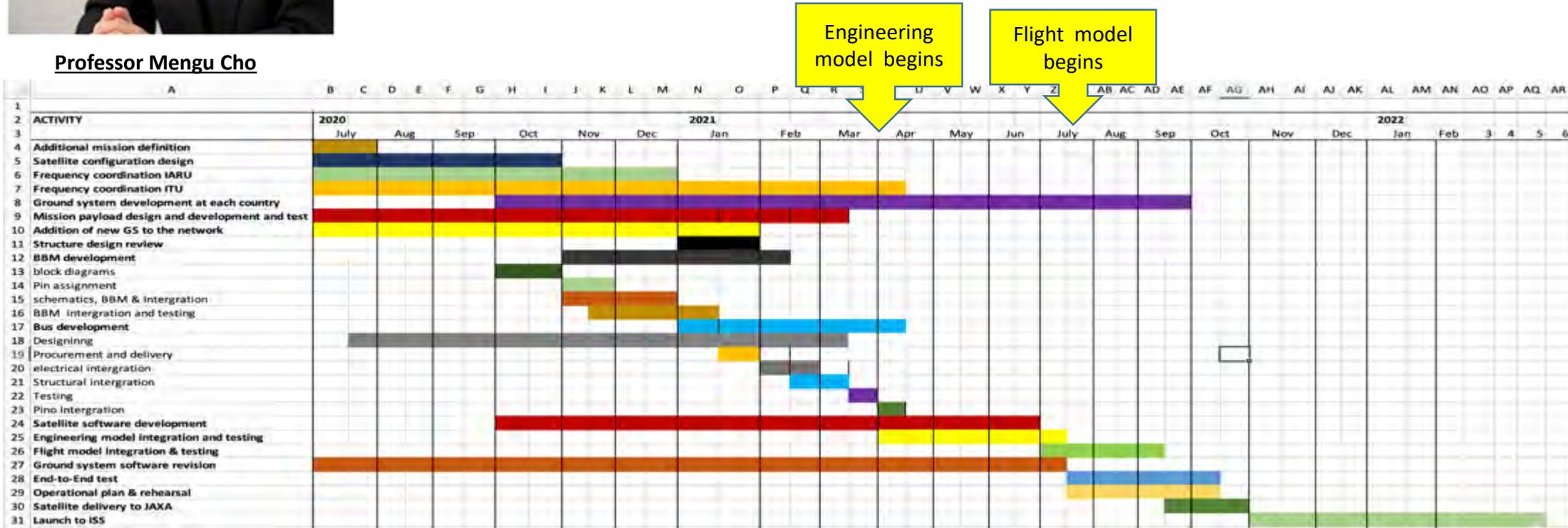
# Professor Cho's comments on the PDR



**Professor Mengu Cho**

Professor Cho indicated that now it is December but we need to have a structural design review by the end of January 2021. He further shared that the worry is on the DLP, hence there is need for the structure team and DLP team to work and fix the structure design and safety issues soon. He alluded that once the structure design is fixed we need to order it for the engineering model. Furthermore, he said that the antenna deployment also needs to be fixed and the windmill design can work. The BBM development will be done in February since the team has not yet ordered BBM boards.

After checking the schedule with Victor (Project Manager), he seconded the suggestion of starting the engineering model by April and the flight model (FM) to start July. However, he shared his wise thoughts that the FM will go from July to October ending and there is need to change dates for the satellite hand over to JAXA and the launch to the International Space Station. He tasked the team to order bread board models as soon as possible. He concluded by comparing timings for BIRDS 5 to other projects and made remarks that the BIRDS 5 initially was 3months ahead and now is 2 months ahead as a month was lost.



# Remarks and references

For more information about the PDR (particularly on the small-scaled figures), please contact LaSEINE or reach out to one of BIRDS-5 members.

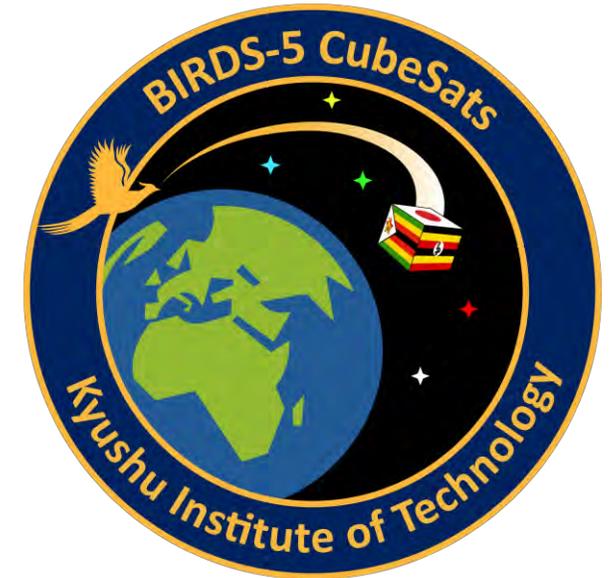
- <https://www.turbosquid.com/Search/3D-Models/breadboard>
- <https://danspace77.wordpress.com/2017/08/07/jaxa-h-ia-to-launch-michibiki-3-communication-satellite/>
- <http://4biw.bracu.ac.bd/speakers/mengu-cho/>

**END**

# New Design of the DLP Structure



By : Kohei Kamitani  
2021/1/14



# Original Design of the DLP

The DLP mission needs to attach two Langmuir probes (Fig1) to the satellite to measure plasma.

For the tip, we use a 1.5mm thick copper plate, and for the boom, a measuring tape to be fixed as shown in Figure 2.

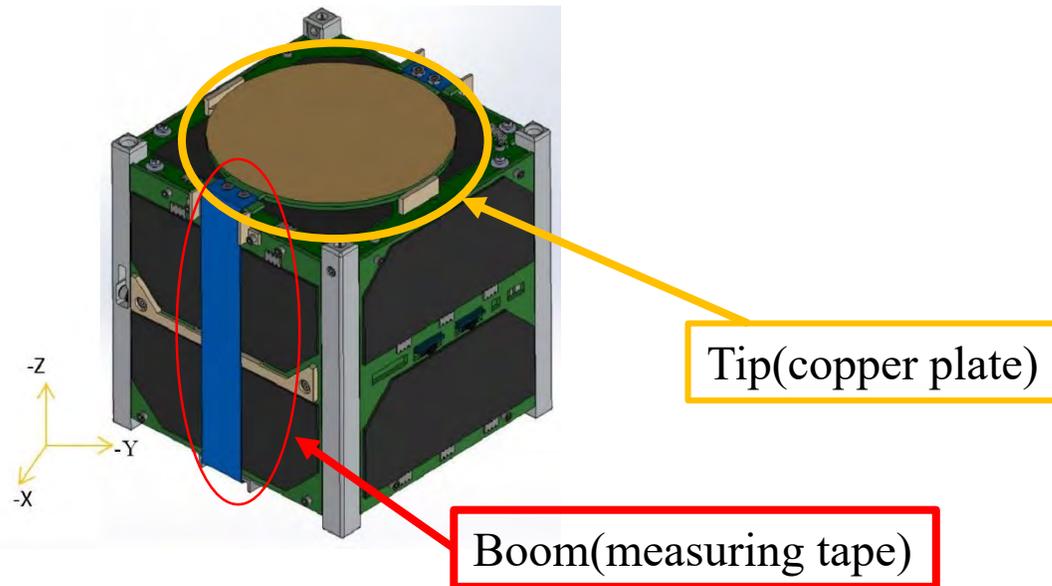


Fig.2 How to fix DLP

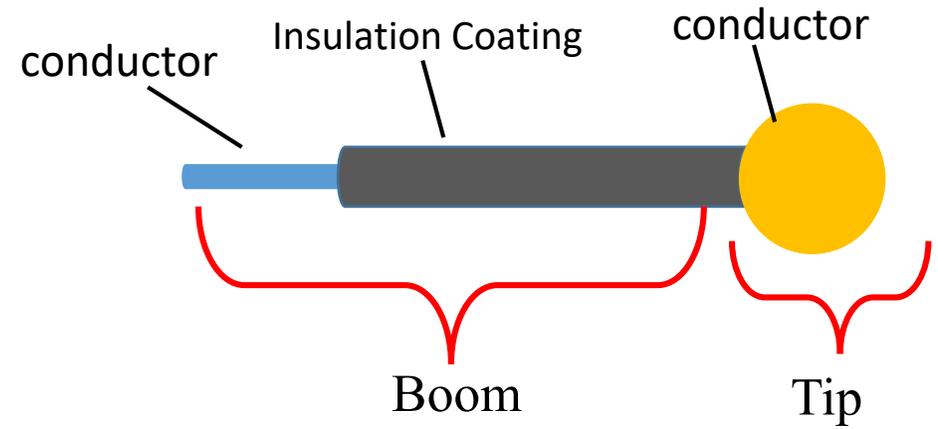


Fig.1 Langmuir Probe

After release into space, we burn off the fishing line that fixes the Tip  
The bent measuring tape returns to its original shape.  
And DLP is deployed as shown in Figure 3.

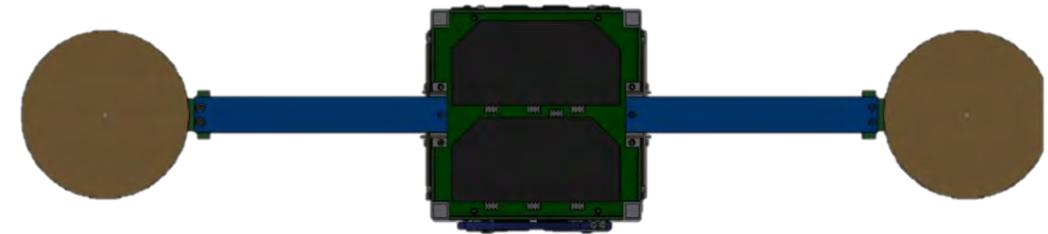


Fig.3 After deployment

# Problems of original design

Using a model of a satellite, I actually attached the DLP to the satellite.

In order to launch a satellite into space, it must meet the size requirements of the “Japan Aerospace Exploration Agency (JAXA)”.

Table 1 shows the comparison between the measurement results and JAXA's required size.

From Table 1, it was found that the original design did not meet JAXA's requirements.

This was due to the use of a measuring tape for the Boom and a thick copper plate for the Tip.

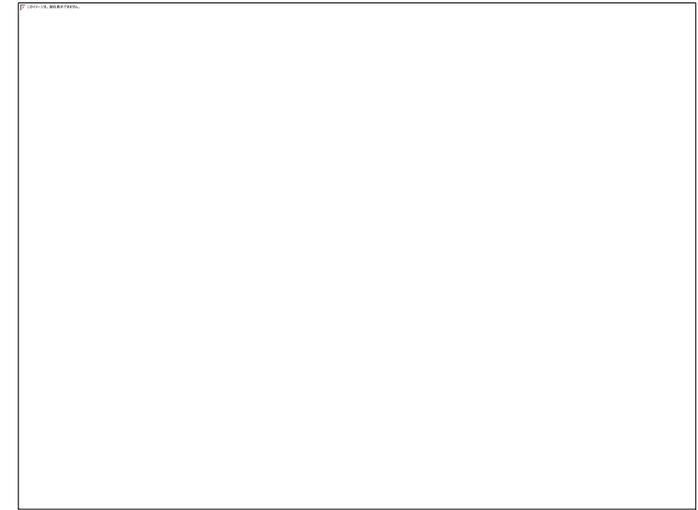


Fig.3 Satellite model and DLP

Table.1 Comparison of JAXA's requirements and measurement results

Panel Name	Measurement results	JAXA's requirements
-Z	7.4 mm	< Rail height(5mm)
±X	8 mm	< 6.5mm

# New Design

To solve this problem, the design was modified as shown in Figure 4.

For the DLP tip, the thickness was changed from 1.5 mm to 0.5 mm.

The Boom is made of plastic parts and it is fixed to the panel using spring hinges.

After release into space, the fishing wire that holds the Tip in place is burned off with the nichrome wire, then the DLP is deployed by the spring hinge.

In the future, I will be testing this deployment mechanism to verify that it meets JAXA's requirements.

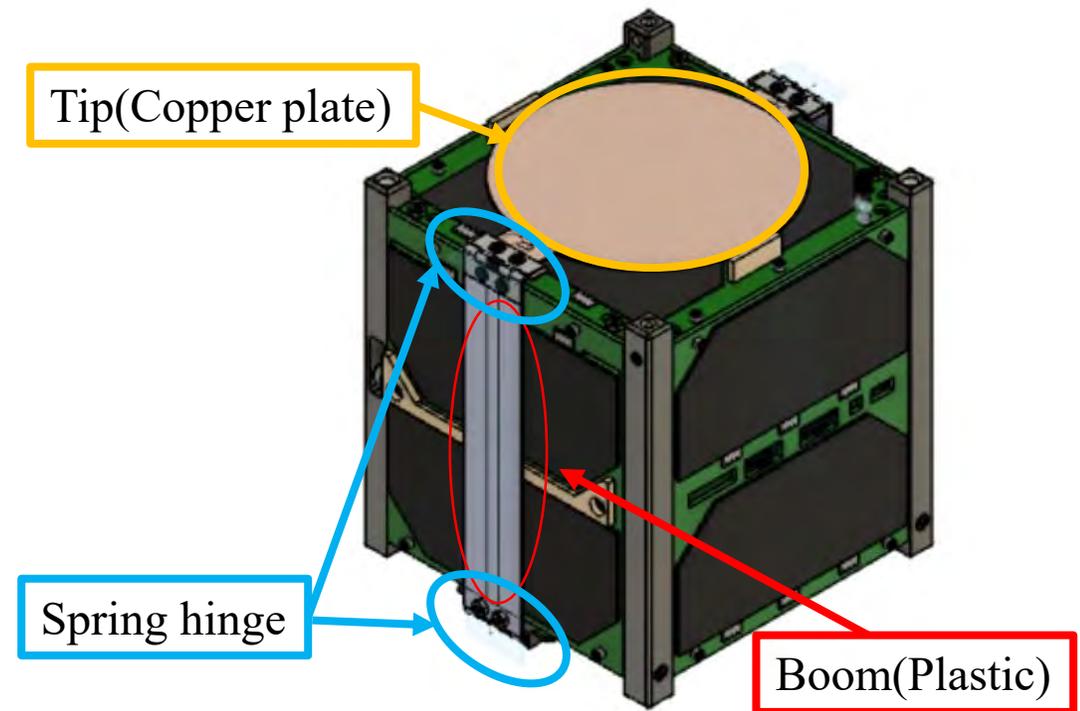


Fig.4 New design of DLP

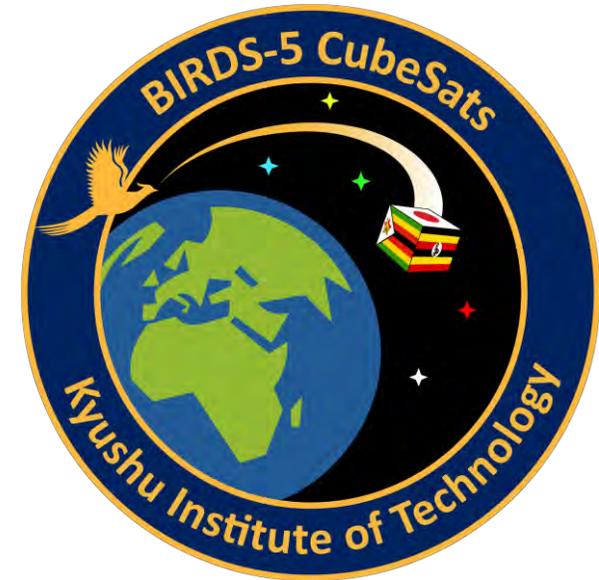


Fig.5 After Deployment



By: Edgar Mujuni

8<sup>th</sup> January 2021





APRS (Automated Packet Reporting System) was first implemented in 1980s by Bob Bruninga, a US-Navy Aerospace Engineer. It is an amateur radio-based system for real time digital communications of information of immediate value in the local area. Data is typically transmitted on a single shared frequency. General APRS Data may include; GPS coordinates, Text messages, Announcements, Queries, etc

BIRDS satellites utilize APRS;

- In Store & Forward Mission data collection from Ground sensor terminals in remote areas.
- To serve armature Radio community through Digi-peating.



APRS MCU on  
BIRDS-4  
Mission Board

# APRS Station Equipment

The system requires three pieces of hardware:

- ① Transmitter/Receiver (Transceiver)
- ② Packet Terminal Node Controller (TNC)
- ③ Data source (sensor)

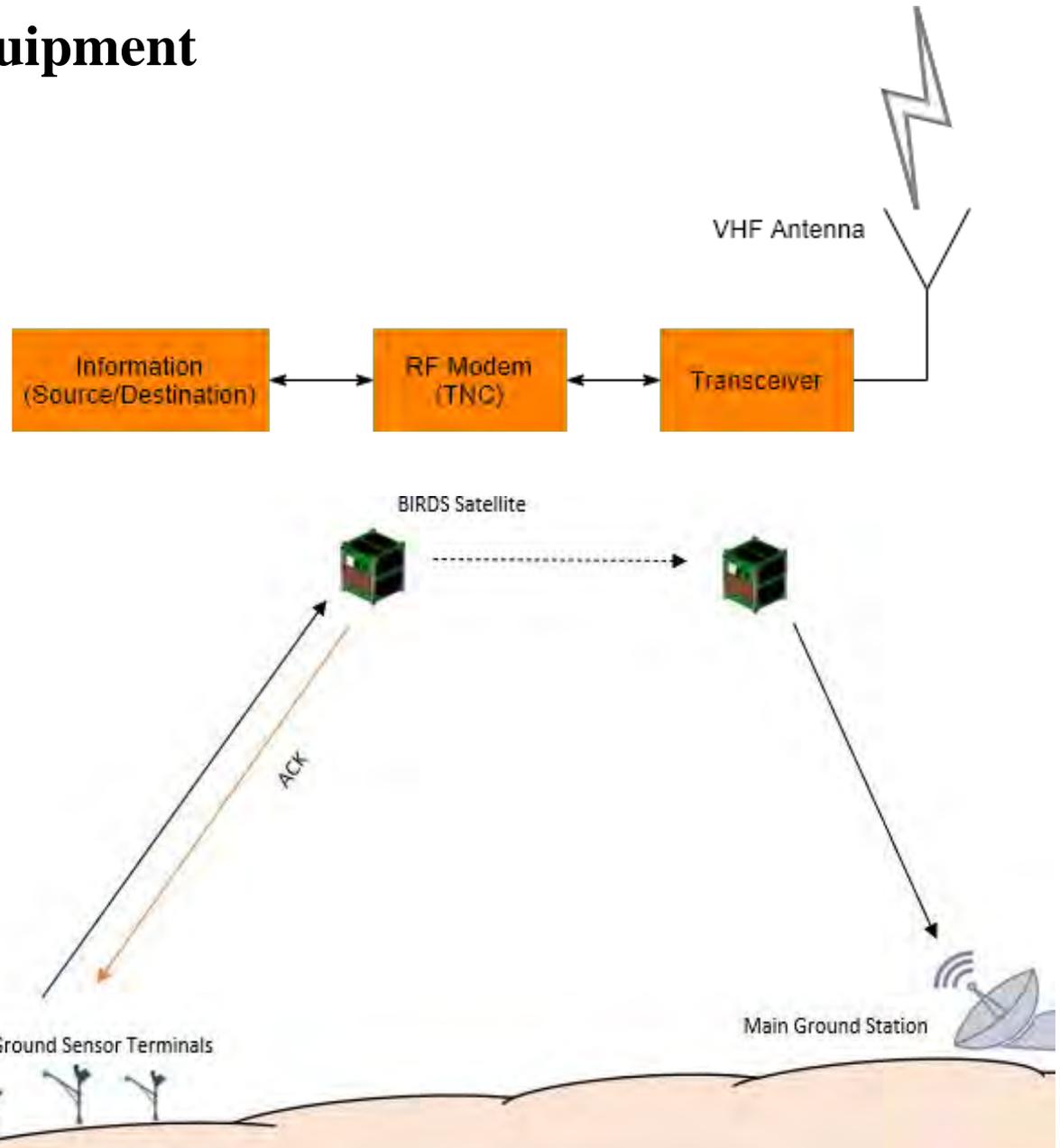
A TNC is basically a Radio or RF Modem. It connects the transceiver to the telemetry data output terminal, converting its data into AX.25 Packet protocol.

## APRS in SF-ward Missions

In store-and-forward missions, the Ground Sensor Terminals (GSTs) use the Slotted multiple access to send their packets to the satellite and wait for an acknowledgement from the Satellite.

The satellite stores the correct packets on its on-board storage system. When a BIRDS satellites are over partner Country ground stations, these packets are downlinked through UHF.

This provides the unique way to collect data from remote sites all over the globe to one main station.



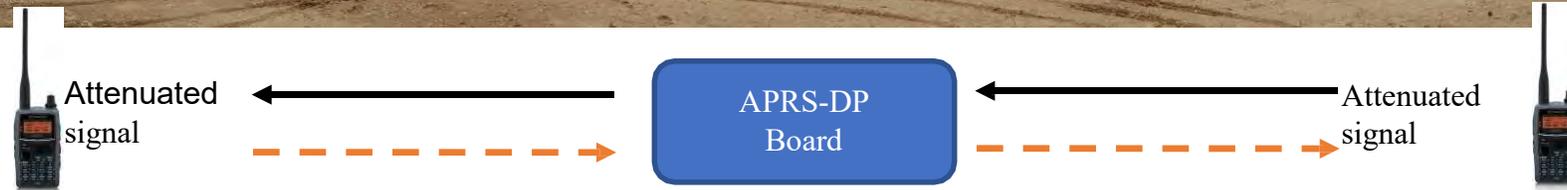
# Digi-peating

Digipeater simply means a Digital Repeater specifically Digital data (Packets).

As signals propagate through the atmosphere, the strength decreases with the increase in distance. Unlike Voice Data Transmission, the packet must be received perfectly to recover any data from out of it. This calls for the repeater terminal, to receive, amplify and re-transmit again. In APRS this is called a **Digi-peater**.

Traditional Repeaters are usually located at the top of the mountain because that's the highest they can go.

BIRDS satellites implement Digipeating operation of Very High Frequencies (VHF~145MHz) to the Amateur community utilizing these frequencies.



Digi-peating test operation done by BIRDS-4 team

**END**

# The Geomagnetic field

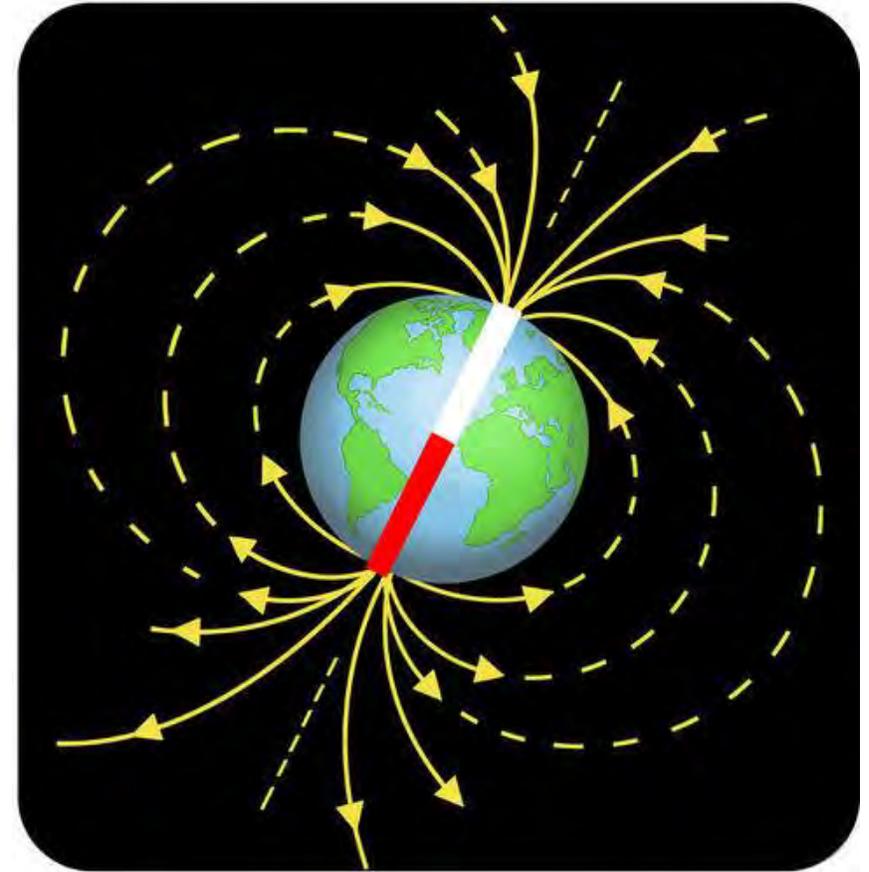


Mariko Teramoto and PINO team  
January 17, 2021



# The geomagnetic field

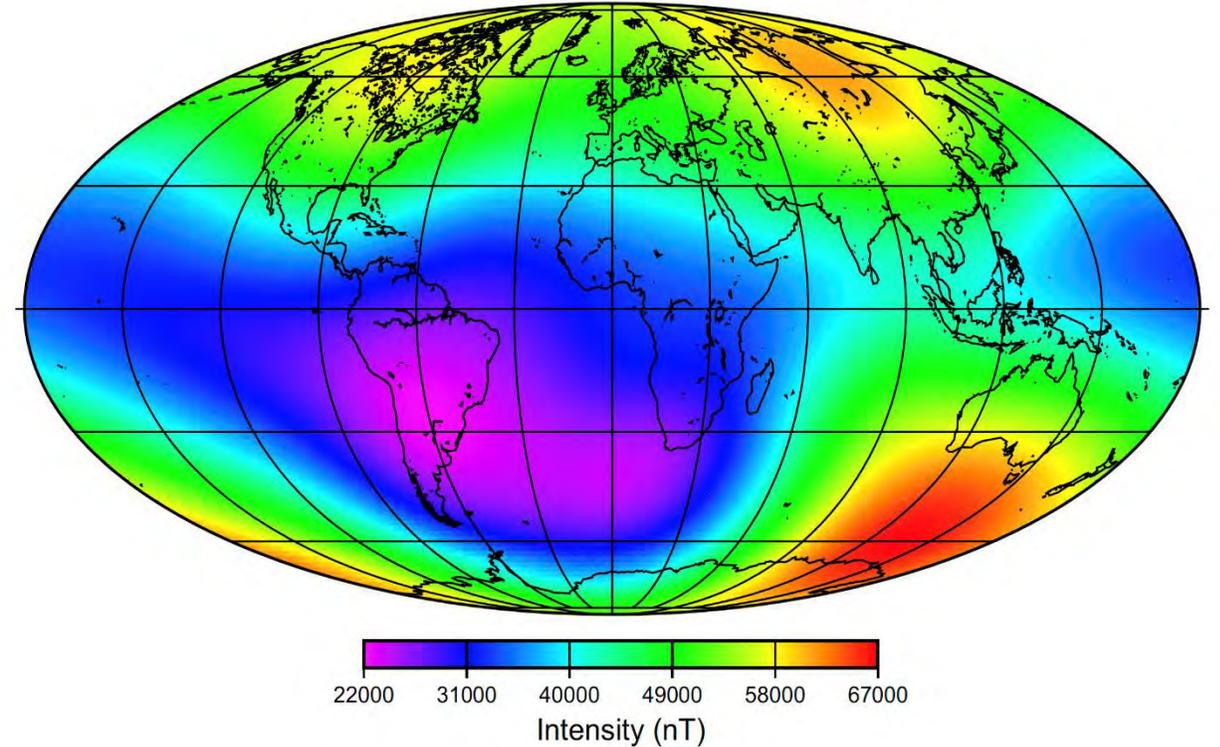
- The Earth has a magnetic field. The Earth's magnetic field is called "**the geomagnetic field**"
- In an educational book for kids, the geomagnetic field is drawn as the magnetic field generated by a bar magnet inside the Earth.
- In reality, there is no bar magnet inside the Earth.



<https://www.ck12.org/book/ck-12-physical-science-for-middle-school/section/24.2/>

# The intensity of the geomagnetic field

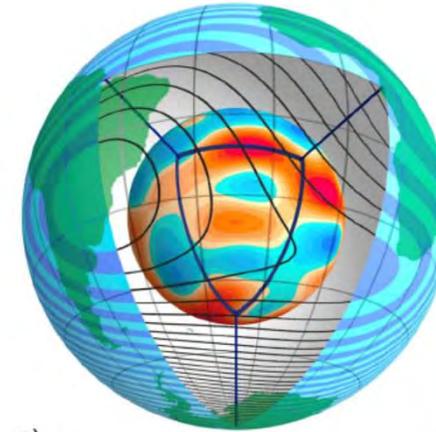
- If the geomagnetic field is perfectly dipolar like a bar magnet, the two strongest points of the magnetic field intensity are seen near the South and North Poles at the Earth's surface. However, the shape of the geomagnetic field is more complex than a bar magnet.
- Over South America and the southern Atlantic Ocean, the geomagnetic field is the weakest ( $\sim 22000\text{nT}$ ). This region is named the **South Atlantic Anomaly (SAA)**.



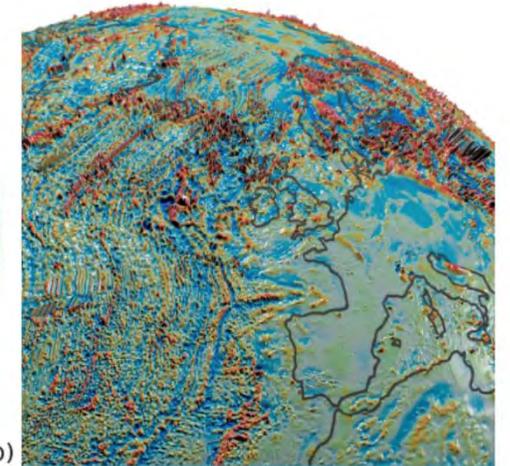
Magnetic field intensity at the Earth's surface calculated from the core field model IGRF-13 for epoch 2020.5  
[Mandea and Chambodut]

# The geomagnetic field sources

- The geomagnetic field has its sources inside the Earth and outside it.
- The internal sources are (a) **the core field** generated from a self-sustaining dynamo in the Earth's fluid outer core and (b) **the lithospheric field** of the Earth generated in rocks containing minerals carrying the magnetization.
- Solar-terrestrial interactions create the external sources. **The strong electric currents produced in the plasma of (c) the ionosphere and (d) the magnetosphere** disturb the geomagnetic field.



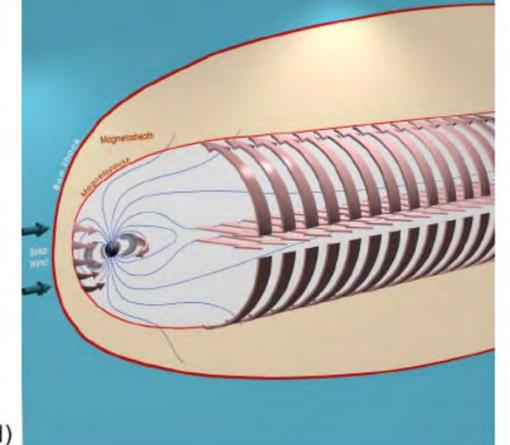
a)



b)



c)

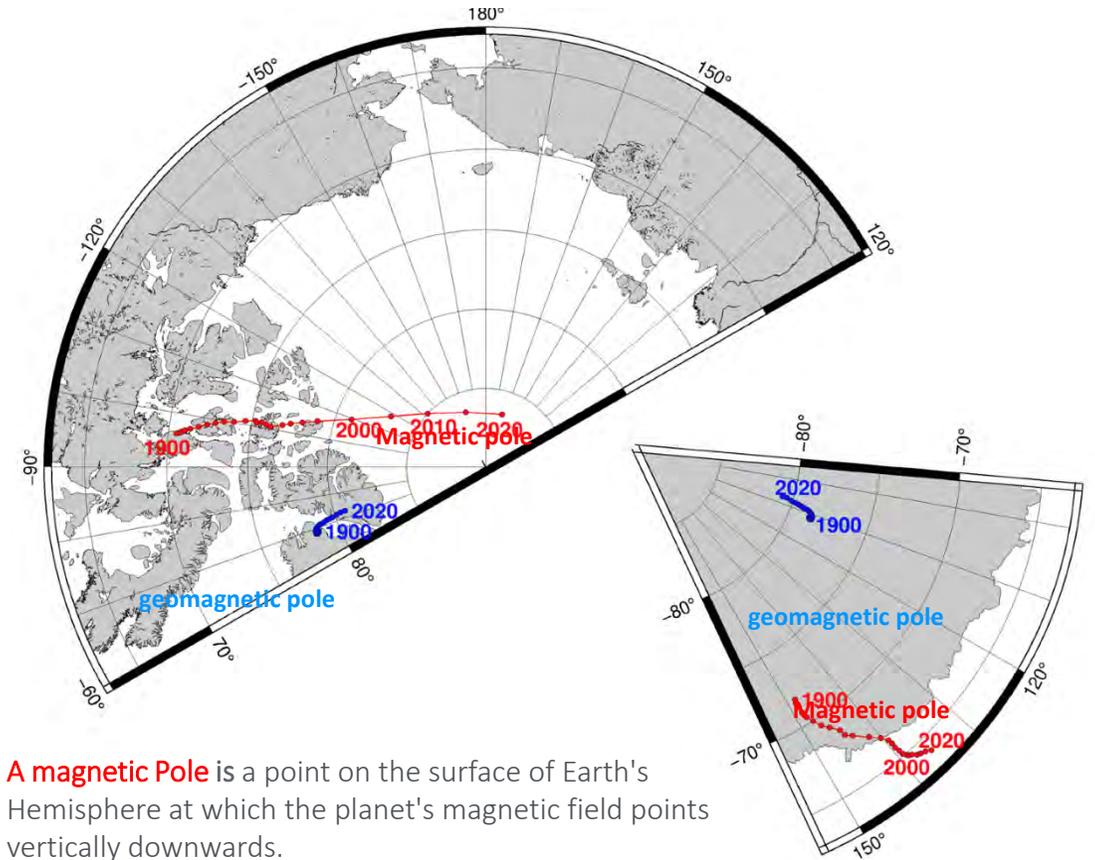


d)

Korte and Mandaia (2019)

# The annual variations of the geomagnetic field

- The geomagnetic field is unstable. It is constantly changing.
- It's thought that the fluid motion in the Earth's core makes annual variations of the geomagnetic field.
- The positions of the magnetic and geomagnetic poles gradually change.
- The strength of the geomagnetic field has also been decreasing over the past century.



A **magnetic Pole** is a point on the surface of Earth's Hemisphere at which the planet's magnetic field points vertically downwards.

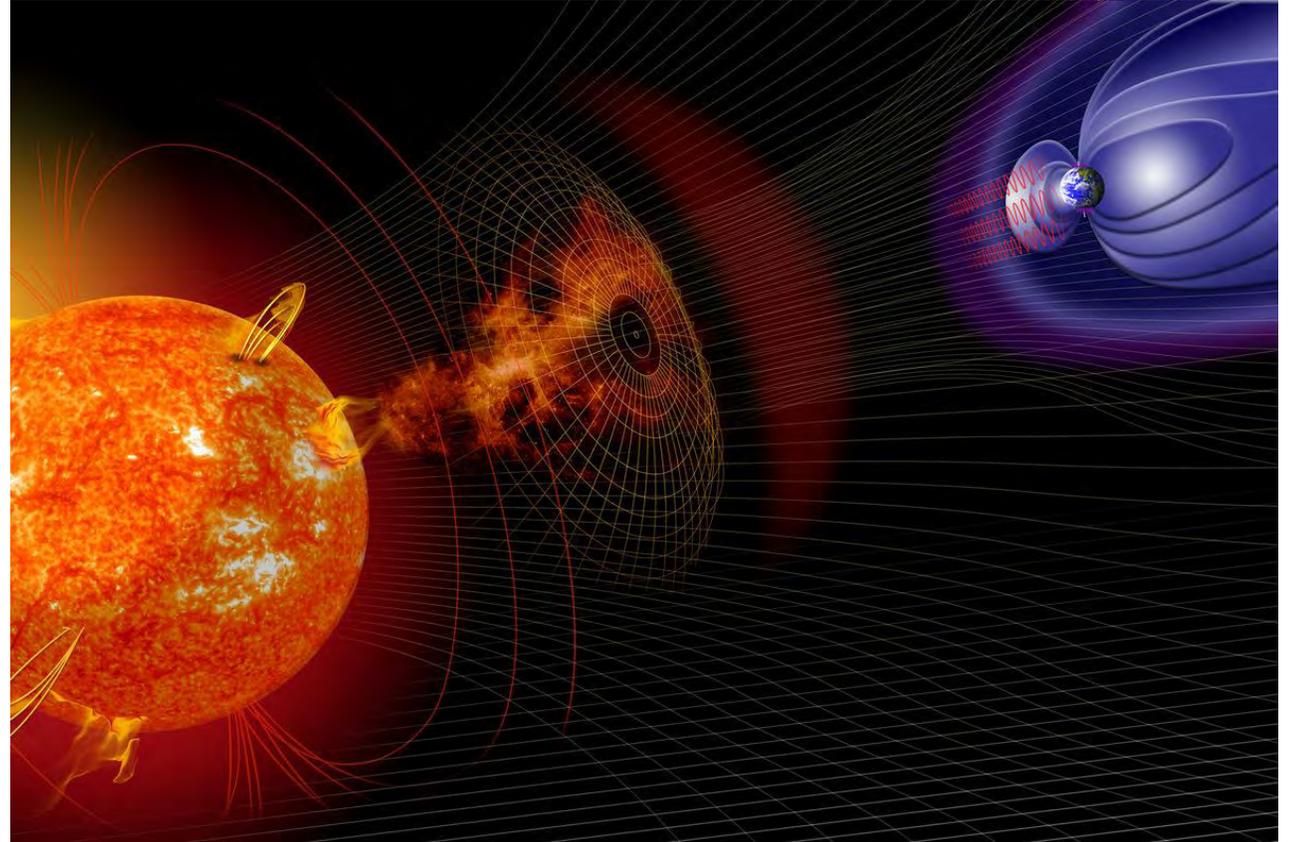
A **geomagnetic Pole** is an intersection of the Earth's surface and the axis of a bar magnet hypothetically placed at the center the Earth.

The geomagnetic field is not really a dipole field so that the locations of both poles are not same.

Korte and Mandaia (2019)

# The diurnal variations of the geomagnetic field

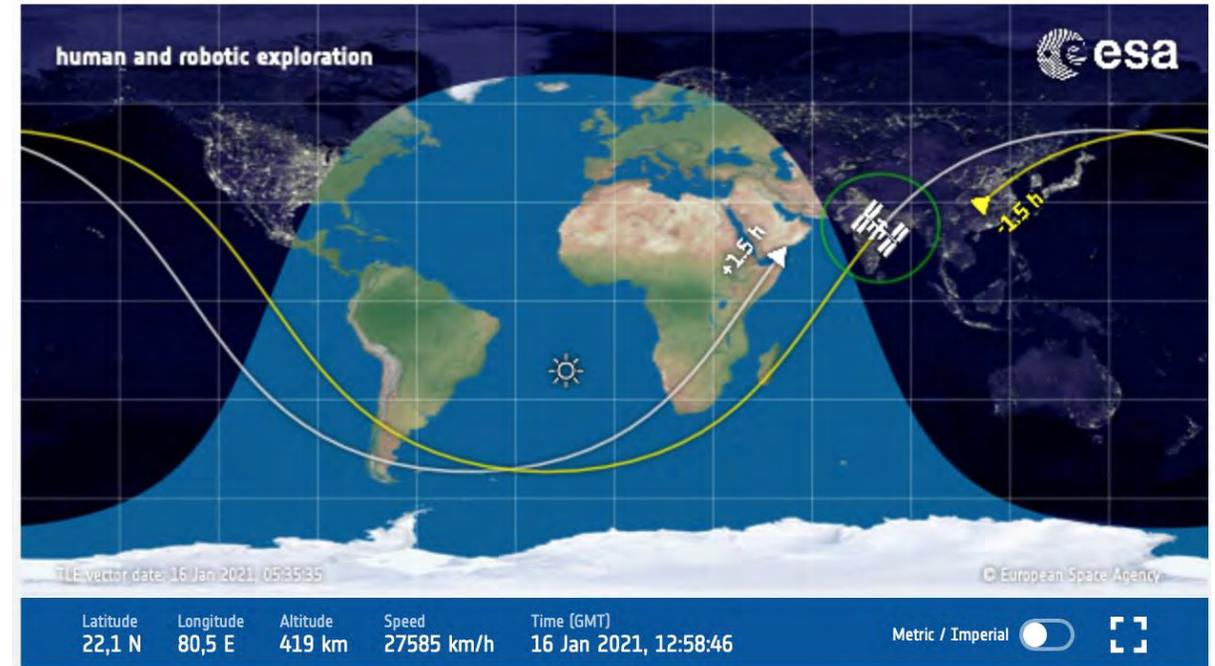
- The external source has diurnal variations of the geomagnetic field.
- The magnetic fields of solar wind affect the geomagnetic field.
- The electric currents in the ionosphere and magnetosphere also make diurnal variations of the geomagnetic field.



Credit: NASA

# The geomagnetic field at 400-km altitude

- The BIRDS satellites orbit at ~400 km altitude around the equator, where the internal source is dominant.
- Comparing the geomagnetic field model with the magnetic field observations by BIRDS-5, we can estimate the attitude of BIRDS-5.
- However, permanent magnets and hysteresis damper, which make magnetic noises for the magnetic field observations, will be installed on the BIRDS-5.
- We need to **consider cautiously the magnetic environment of BIRDS-5** itself to measure the geomagnetic field.

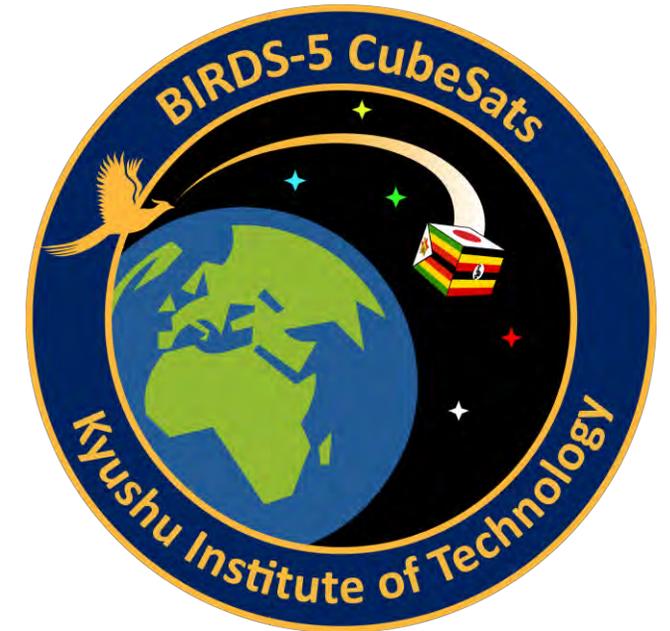


**END**

# BIRDS Ground Station Software



By : Ramson  
Date: 11/JAN/2021



## Preliminary aspects to grasp

- Satellite Tab
  - Builds the list of the satellites you want to keep track of
- Accy Tab
  - Count Down (Shows all the satellites you are watching)
    - Updated from Satellite Tab
- Frequency Tab
  - Frequencies set to the radio
  - Constantly changing to compensate the Doppler effect
- Rotor Tab
  - Parks the rotor
  - Do some rotor configurations (for azimuth and elevation)
- Mode=>Doppler correction (UL and DL), display in frequency window, Rx and Tx addresses
- CAT Tab
  - Downlink and uplink frequency, interval and speed calibration
- ? Tab
  - Auxiliary files
    - Visualize the Doppler
- Setup => rotor setup, radio setup, observer, options (what to show on display)

# Satellite Tracking Software (SATPC32 V. 12.8d)

The screenshot shows the SATPC32 V. 12.8d software interface. The main window displays satellite tracking data for NEPALISAT-1. The interface includes a control panel at the top with various tabs (File, Tracking, Satellites, CAT, Rotor, Mode, Setup, Programs, Accy, ?) and a central map showing satellite paths (Orbit) and the satellite's current position. The bottom of the window features a data table with columns for Azimuth, Elevation, MA, Height, Range, Lon, Lat, Orbit, Squint, and A B C. The table shows data for NEPALISAT-1: Azimuth 64.3, Elevation 8.1, MA 105.9, Height 382, Range 1523, Lon 146, Lat 39, Orbit 8611, and Squint --. The A B C columns are highlighted, indicating the satellite is active. Annotations with red arrows point to various parts of the interface: 'Satellite name' points to 'NEPALISAT-1'; 'Control Panel of interface' points to the top menu bar; 'Satellite paths (Orbit)' points to the map; 'Satellite position' points to the satellite icon on the map; 'Downlink frequency shown here (hidden)' points to the '-5.584' value; 'Uplink frequency shown here (hidden)' points to the '5.557' value; 'Angle of elevation, azimuth, height, range etc. shown here' points to the data table; and 'A highlighted => NEPALISAT-1 Active' points to the highlighted A B C columns.

Azimuth	Elevation	MA	Height	Range	Lon	Lat	Orbit	Squint	A	B	C
64.3	8.1	105.9	382	1523	146	39	8611	--			

<http://www.dk1tb.de/indexeng.htm>

# Control Panel Keys

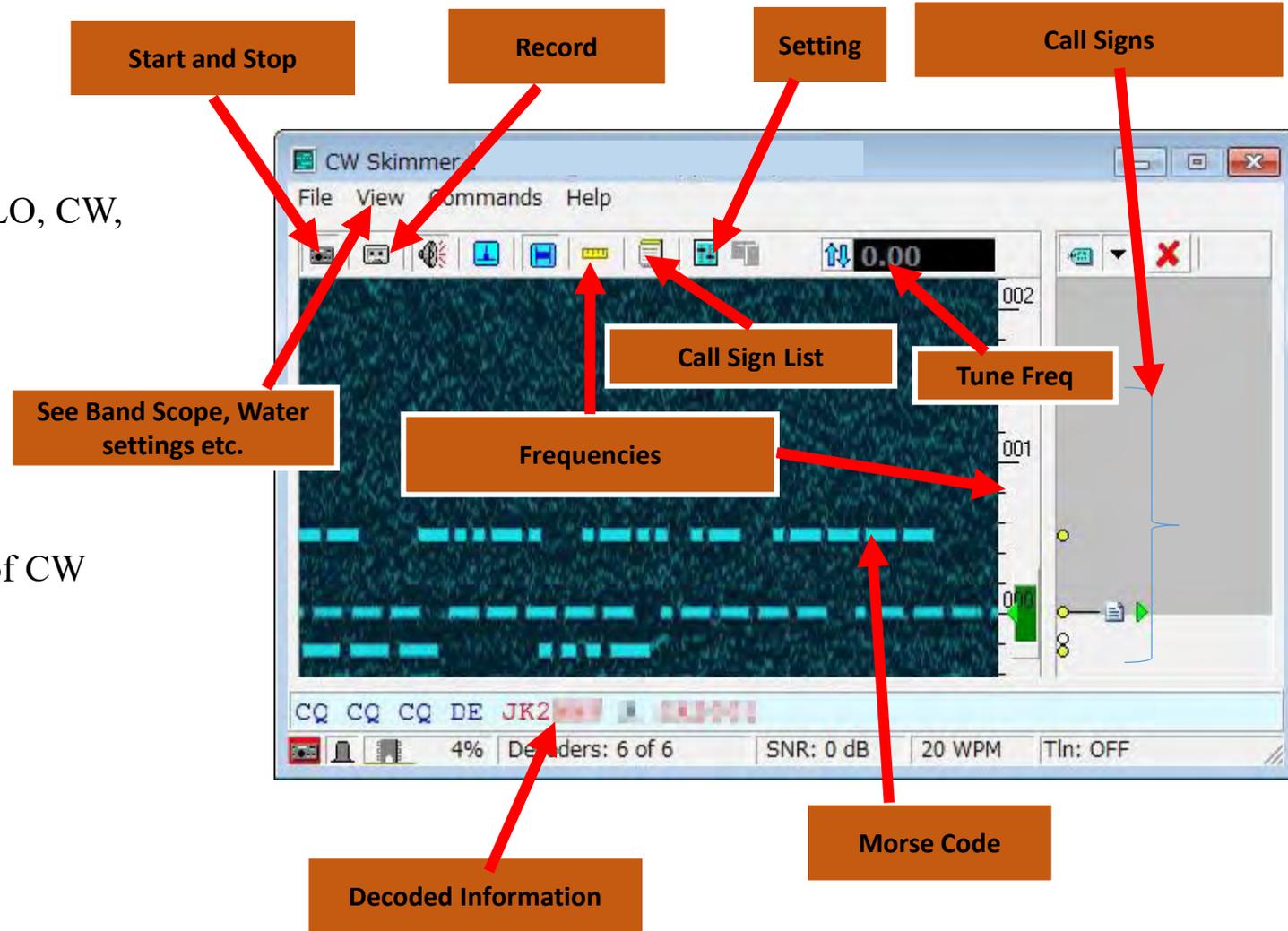
- CW => CW mode on and off**
- M (+/-) => display multiple satellite on and off**
- Z(1/2)=> zoom factor**
- G (+/-) => display ground track off/ continuously on/ temporarily on**
- S (+/-) => display sunline on and off**
- D (+/-) => display direction arrows**
- W3(1/2/3/4/5) => swith program window size**
- 2D (+/-) => 3D or 2 Don and off**
- L or U=> Switch between UTC and Local Time**
- AL=>Show AOS/LOS time or Count down(Ct) with world map**
- R(+/-) => rotor on and off**
- C (+/-) => Cat control on and off**
- A (+/-) => Automatic satellite change on and off**
- VFO (+/-) variable frequency oscillator**
- TO (+/-) => Subaudible is a tone that is used to trigger an automated event at a radio station. A subaudible tone is audible; however, it is usually at a low level that is not noticeable to the average listener at normal volumes.**
- BM switch political (PI) and physical (BM) world map**

## Abbreviations

- ✓ **AOS** stands for **A**cquisition of **S**ignal (or **S**atellite). AOS is the time that a satellite rises above the horizon of an observer.
- ✓ **TCA** stands for **T**ime of **C**losest **A**pproach. This is the time when the satellite is closest to the observer and when Doppler shift is zero. This usually corresponds to the time that the satellite reaches maximum elevation above the horizon.
- ✓ **LOS** stands for **L**oss Of **S**ignal (or **S**atellite). LOS is the time that a satellite passes below the observer's horizon.

# CW Skimmer 2.1

- Multi-channel CW decoder and analyzer
- CW read in Morse Code
- Settings Tab
  - Radio
    - Hardware type, sampling rate and frequencies (LO, CW, Audio IF)
  - Audio
    - Signal I/O device, volume and channels
  - CAT
    - Configure to radio settings
  - Misc
    - Select the IARU region you are in and number of CW decodes
  - Operator
    - Call sign, first name etc
  - Telnet
    - Link to telnet
  - Calls
    - Minimal, normal, aggressive, paranoid.
  - Command=> Tune at freq., blind mode(disable decoding)

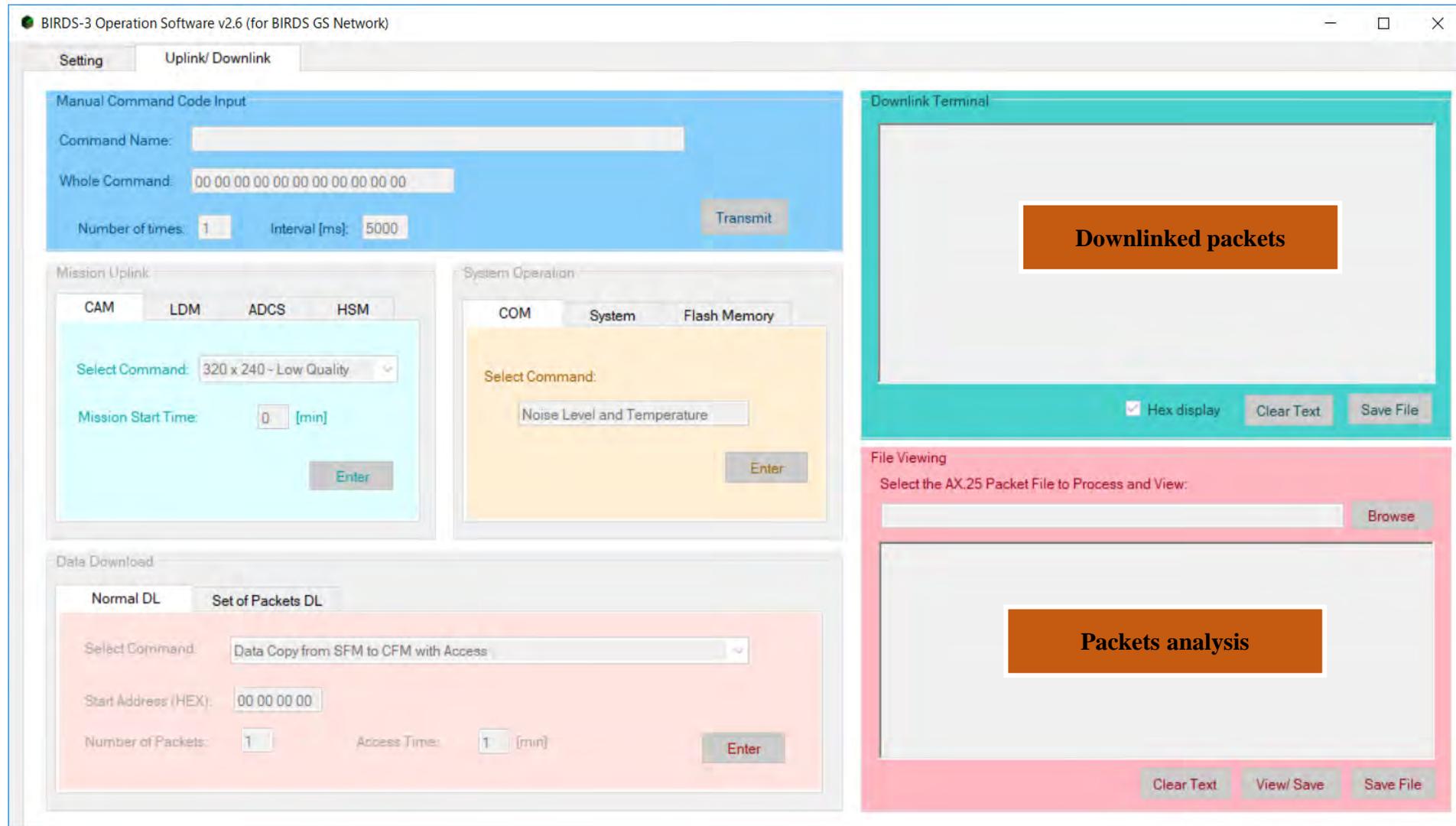


<http://www.dxatlas.com/CwSkimmer/>

<http://www.dxatlas.com/CwSkimmer/Files/Skimmerintro.pdf>

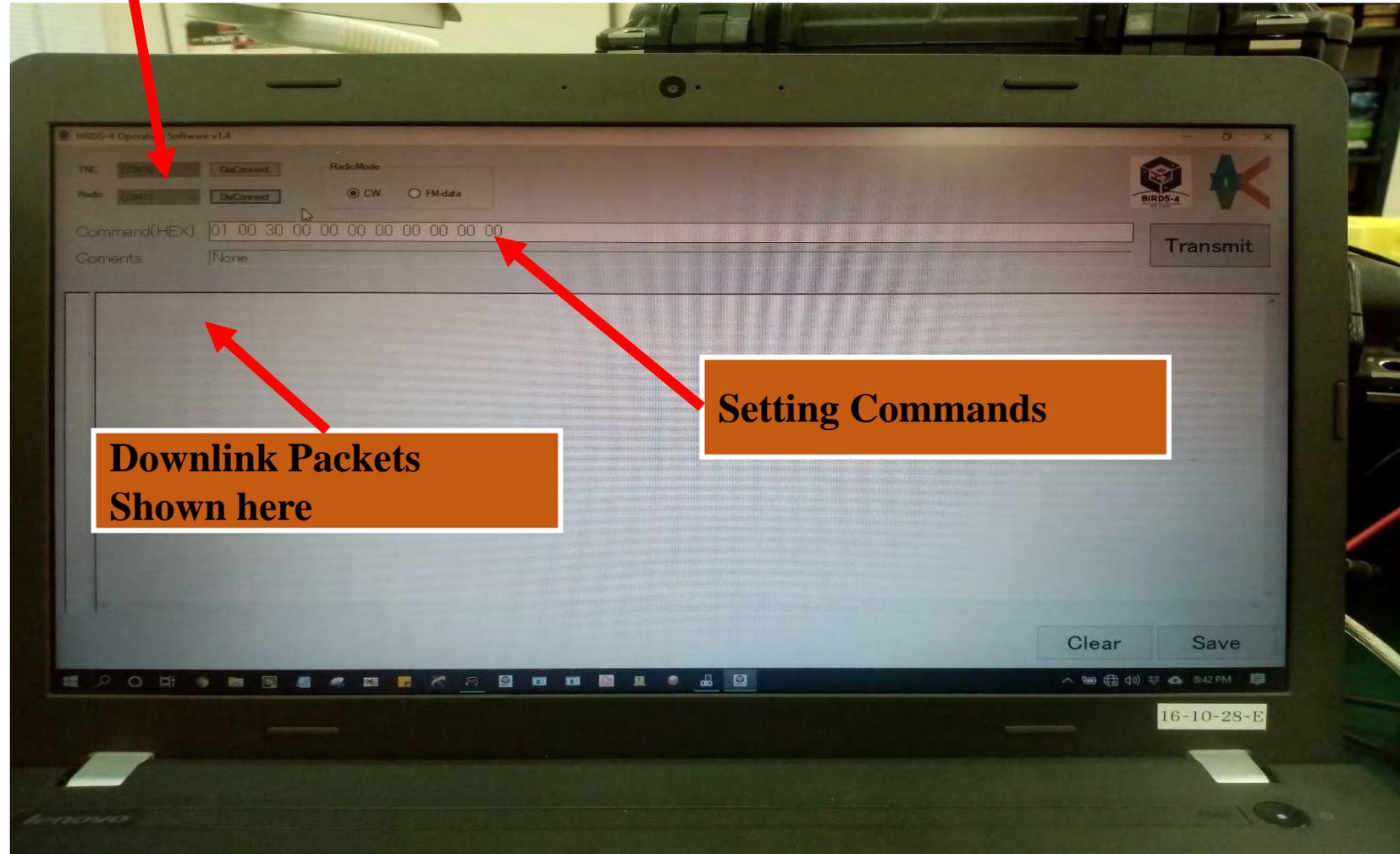


# BIRDS-3 operation software



# BIRDS-4 Operation Software

Connecting to the ICOM  
Radio and TNC

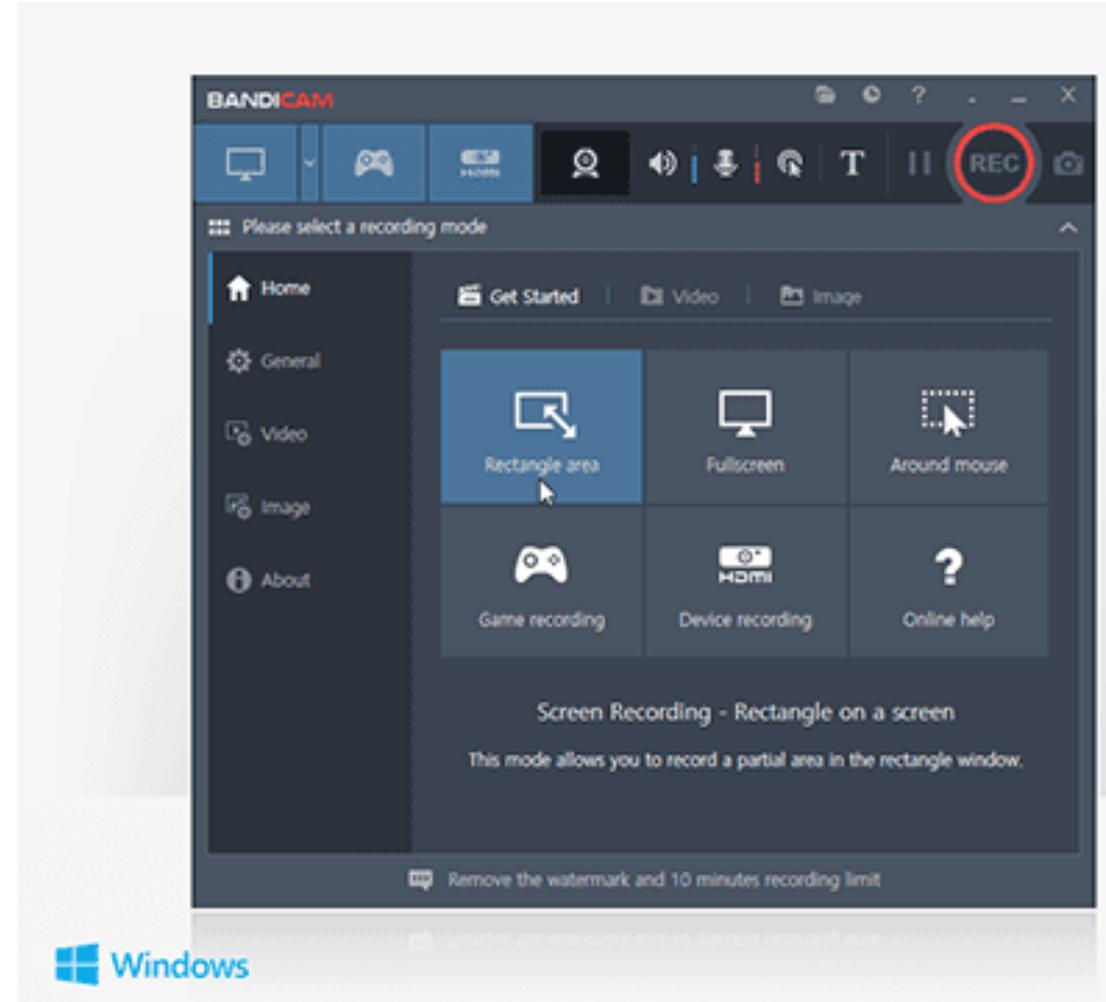


Downlink Packets  
Shown here

Setting Commands

# BandiCam

- [Bandicam](#) is a lightweight [screen recorder software](#) for Windows that can capture anything on your PC screen as high-quality video.
- Record Ground Station Operation for reference.
- Capture CW Morse code to read it correctly and verify later.
- This app also makes it possible to record a certain area on a PC screen
- Bandicam will help you carry out a screen capture with high compression ratio, while keeping the video quality closer to the original work
- Provides performance far superior to other screen capture software that provides similar functions.
- Can add boxes, arrows, mouse effects, won logo and text
- Audio start recording at you own time

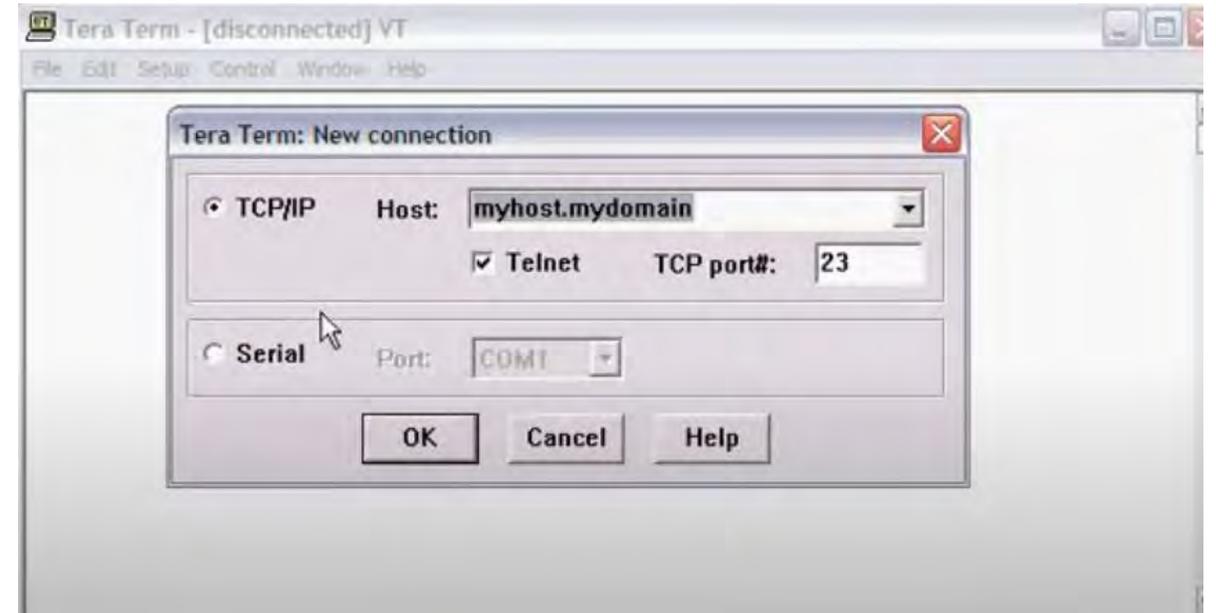


<https://www.bandicam.com/>

<https://www.youtube.com/watch?v=Aox3fR8j68U>

# TeraTerm

- Tera Term is an open-source, free, software implemented, terminal emulator program.
- It emulates different types of computer terminals, from DEC VT100 to DEC VT382.
- It supports telnet, SSH 1 & 2 and serial port connections.
- It also has a built-in macro scripting language and a few other useful plugins
- Reset, reload and configure ports



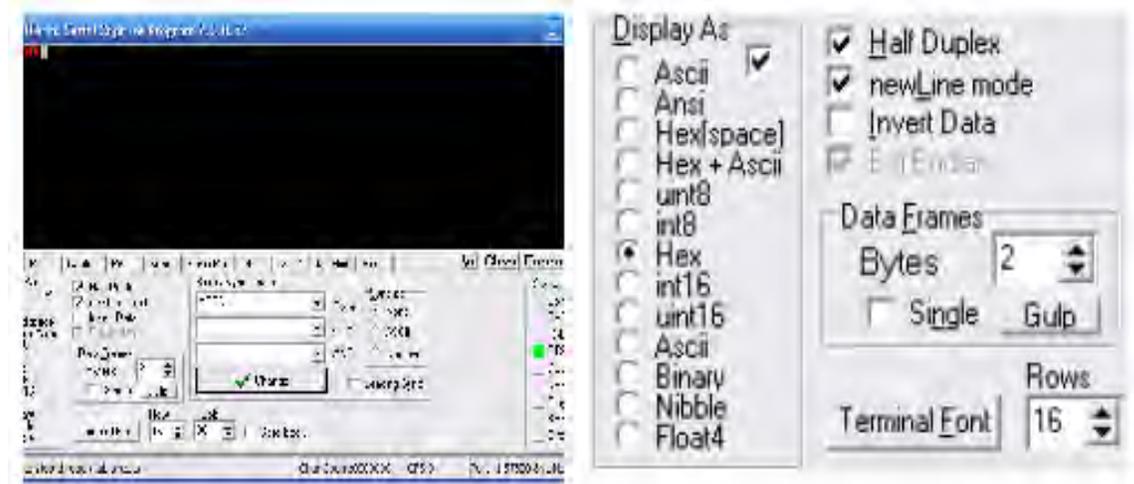
<https://osdn.net/projects/ttssh2/downloads/72009/teraterm-4.105.exe/>

# RealTerm: Serial/TCP Terminal

- Serial terminal program for engineering. Ideal for development, reverse engineering, debugging, data logging and capture, and automatic test.

## Features

- Support for Comms Ports, Virtual/USB comports & TCP / Telnet connections.
- [I2C](<http://www.i2cchip.com>),SPI,1-Wire Bus control support
- Binary display modes -hex,int,float,signed/unsigned
- Capturing and sending files
- Syncing and Timestamps
- Full activeX interface and full command-line control. Command and INI files. Use as a serial port component for other programs. (Excel etc)
- Bridging between two ports/tcps and Monitoring modes using second Echo Port
- Normal, MiniTerminal, Fullscreen, Invisible (tray) views
- Send String shortcuts and Global Hotkeys, CRC's and Checksums
- Phone Unlocking support for Samsung and others



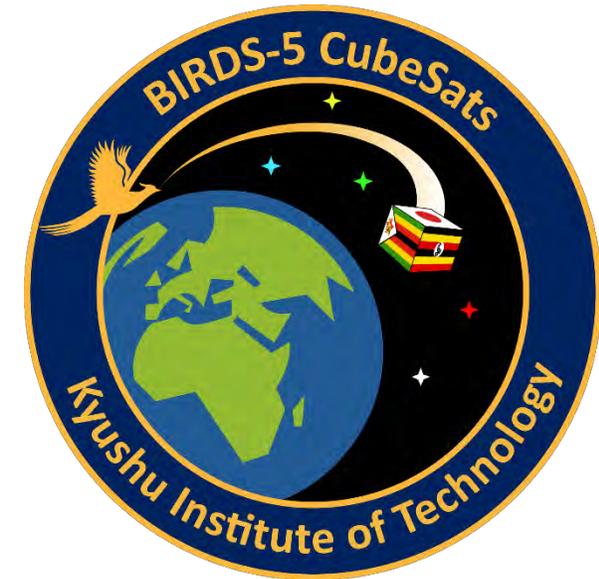
<https://sourceforge.net/projects/realterm/>

**END**

# Raspberry Pi



By: Keenan Chatar  
18/01/2021



# Introduction

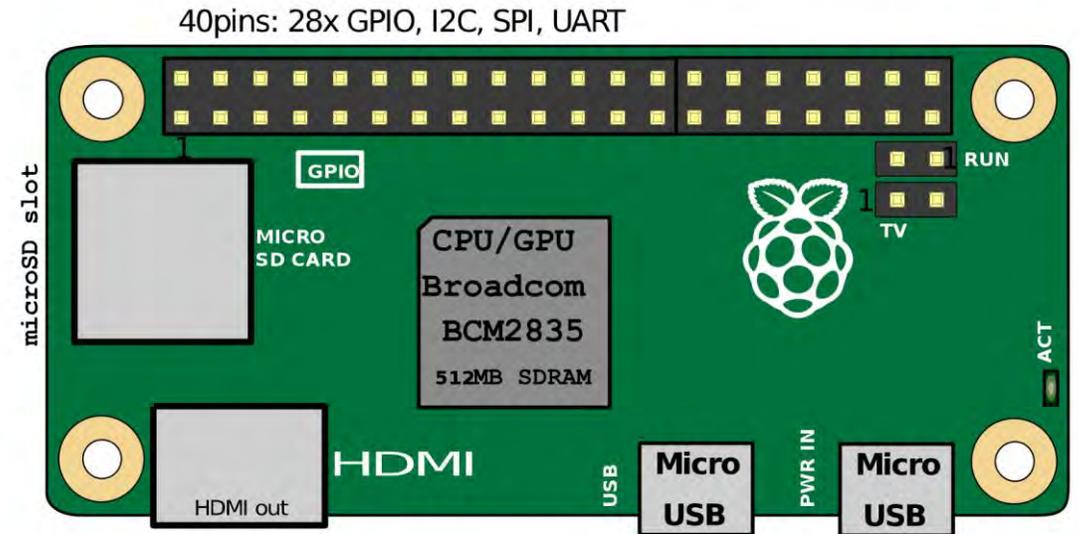
- The Raspberry Pi is a small, affordable and versatile computer-on-a-board
- The Pi can be used for a variety of applications such as:
  1. Robotics
  2. Education tool
  3. Weather Monitoring
  4. Security



Raspberry Pi Zero  
Source: [www.raspberrypi.org](http://www.raspberrypi.org)

# Hardware

- The primary specifications of the Pi Zero are:
  - Broadcom BCM2835 CPU
  - 512MB RAM
  - MicroSD slot
  - HDMI slot
  - Micro USB slot x2
  - GPIO Header
  
- Board Design:
  - Dimensions: 65 x 30 x 5.4mm
  - Weight: 9g



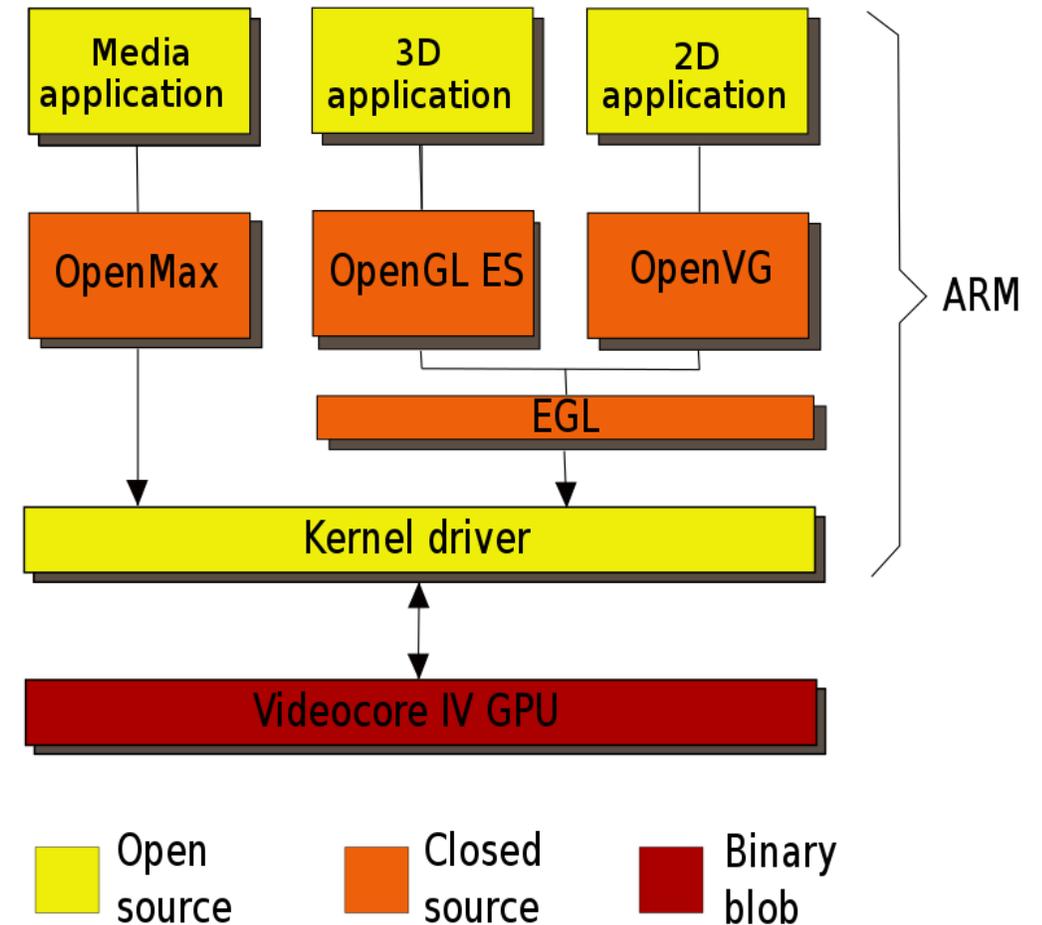
Raspberry Pi Zero Specifications

*Source:*

<https://commons.wikimedia.org/w/index.php?curid=53282392>

# Software

- Primary Operating System (OS):
  - Raspberry Pi OS (Raspbian)
- Other OS can be used such as:
  - Ubuntu
  - Windows 10
  - RISC OS
- The primary programming languages are:
  - Python
  - C Programming



Raspberry Pi Zero Specifications

*Source:* By Wirepath - Own work, CC By-SA 3.0,  
<https://commons.wikimedia.org/w/index.php?curid=19207877>

# BIRDS-5 Missions

BIRDS-5 has three missions that use the Raspberry Pi Zero:

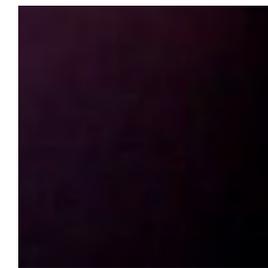
- Image Classification (IMG-CLS)
- Double Langmuir Probe (DLP)
- Multispectral Camera (MULT-SPEC)

# Image Classification

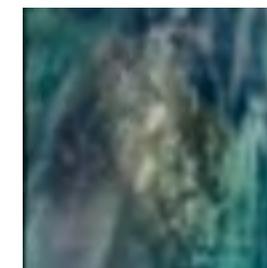
- Classify images captured in space as a “Good” image or a “Bad” image

```
pi@raspberrypi:~  
File Edit Tabs Help  
type: <class 'numpy.float32'>  
== Output Details ==  
name: Identity  
shape: [1 2]  
type: <class 'numpy.float32'>  
Press Enter to start...  
/usr/lib/python3/dist-packages/picamera/encoders.py:521: PiCameraAlphaStripping:  
using alpha-stripping to convert to non-alpha format; you may find the equivalent  
alpha format faster  
"using alpha-stripping to convert to non-alpha"  
/usr/lib/python3/dist-packages/picamera/encoders.py:544: PiCameraResolutionRound  
ed: frame size rounded up from 100x100 to 128x112  
width, height, fwidth, fheight)))  
[[0. 1.]]  
Press Enter to start...  
[[1. 0.]]  
Press Enter to start...  
[[0. 1.]]  
Press Enter to start...  
[[0. 1.]]  
Press Enter to start...  
[[1. 0.]]  
Press Enter to start...
```

```
VGACapture.py x testing.py x  
1 import time  
2 import numpy as np  
3 from tensorflow import lite as tflite  
4 from picamera import PiCamera  
5 from datetime import datetime, timedelta  
6  
7 interpreter = tflite.Interpreter('cubnsatnet_v1.tflite')  
8 interpreter.allocate_tensors()  
9  
10 input_details = interpreter.get_input_details()  
11 output_details = interpreter.get_output_details()  
12  
13 print('== Input Details ==')  
14 print("name:", input_details[0]['name'])  
15 print("shape:", input_details[0]['shape'])  
16 print("type:", input_details[0]['dtype'])  
17  
18 print('== Output Details ==')  
19 print("name:", output_details[0]['name'])  
20 print("shape:", output_details[0]['shape'])  
21 print("type:", output_details[0]['dtype'])  
22  
23 while True:  
24     input("Press Enter to start...")  
25  
26     with PiCamera() as camera:  
27         camera.resolution = (640, 480)  
28         date = datetime.now().strftime("%d %b %Y-%H-%M")  
29         camera.start_preview()  
30         time.sleep(2)  
31         file1 = "/home/pi/Captures/" + date + ".jpg"  
32         file2 = "/home/pi/Datasets/" + date + "_dataset.jpg"  
33         output = np.empty((112 * 128 * 3), dtype=np.uint8)  
34         camera.capture(file1)  
35         camera.capture(file2, resize=(100,100))  
36         camera.capture(output, 'rgb', resize=(100,100))  
37         output = output.reshape((112, 128, 3))  
38         output = output[:100, :100, :]  
39         input_data = np.array(output, dtype=np.float32)  
40         input_data = np.expand_dims(input_data, axis=0)  
41  
42         interpreter.set_tensor(input_details[0]['index'], input_data)  
43         interpreter.invoke()  
44         output_data = interpreter.get_tensor(output_details[0]['index'])  
45         print(output_data)
```



[0, 1]



[1, 0]

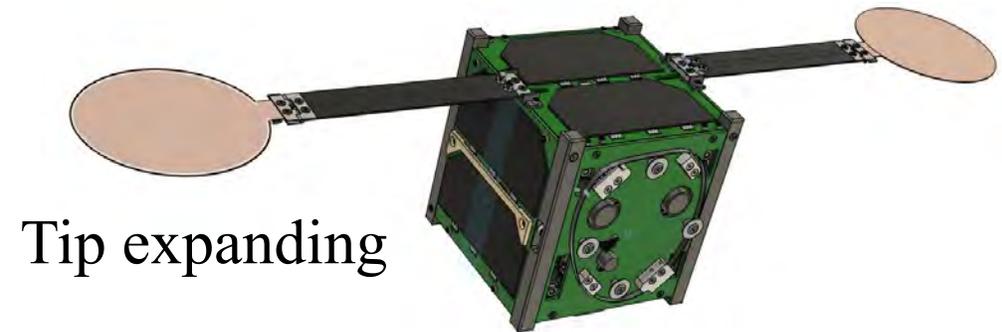
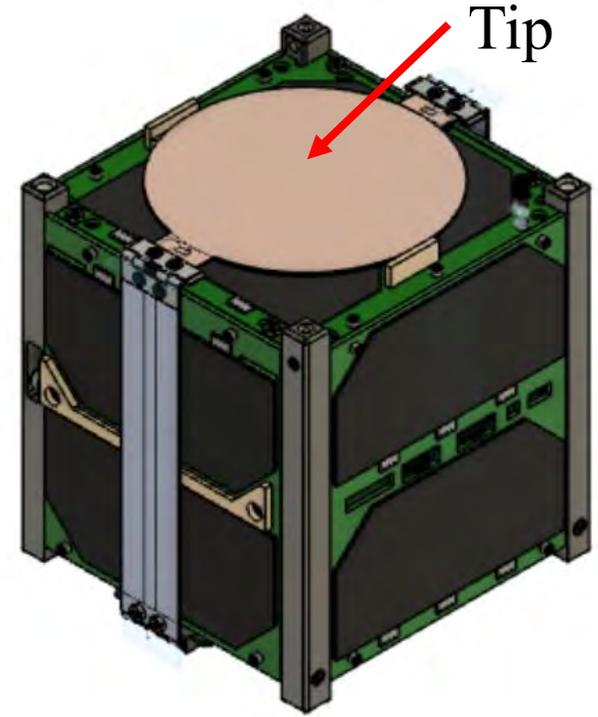


[1, 0]

[Good, Bad]

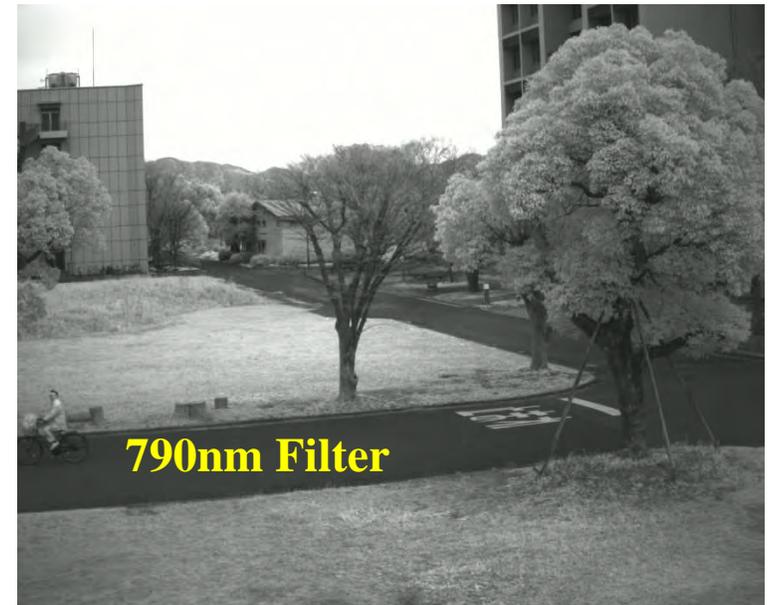
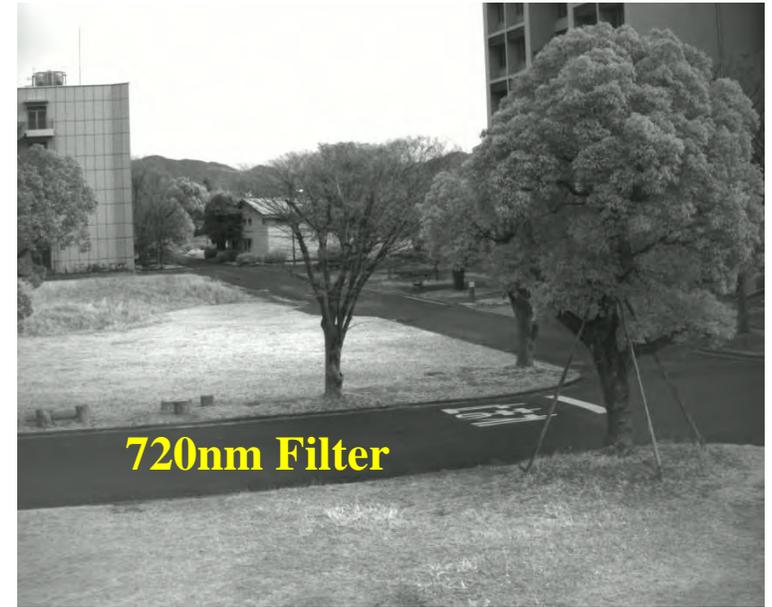
# Double Langmuir Probe

- Measures plasma above the Earth using two probe tips
- Components:
  - Raspberry Pi Zero
  - DC/DC Converter
  - A/D, D/A Converter
  - Photo MOSFET
  - Isolator



# MULTI-SPEC

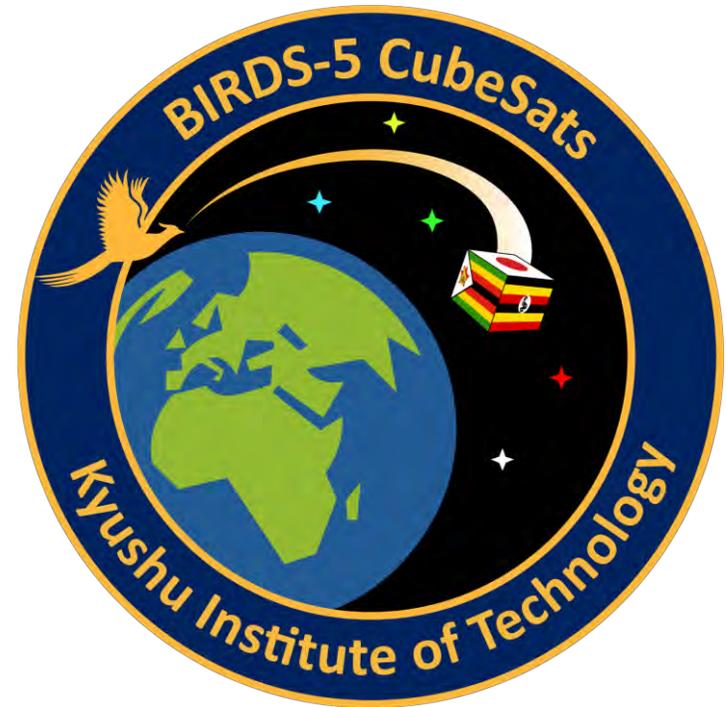
- Capture Multi-spectral images with various filters for vegetation and water quality analysis



# End of BIRDS-5 reports for this month.

*Thanks to Fahd for the compilation work.*

*- Editor*



# End of this **BIRDS Project Newsletter**

(ISSN 2433-8818)

## Issue Number Sixty

This newsletter is archived at the BIRDS Project website:

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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.