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

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BIRDS Project Newsletter

Issue No. 70
(24 Nov. 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

Archive website: http://birds1.birds-project.com/newsletter.html
All back issues are archived at this website.
Acknowledgment of support: This newsletter is supported, in part, by *JSPS Core-to-Core Program, B. Asia-Africa Science Platforms.*

La SEINE

SEIC Space Engineering International Course

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 Dubai — The Guest Box

Acceptance speech by Prof. Tsuda (ISAS), the Project Manager of Hayabusa-2, during the opening ceremony of **2021 IAC in Dubai**. The JAXA/ISAS team of Hayabusa-2 received the IAF's World Space Award. *-- submitted by G.Maeda*

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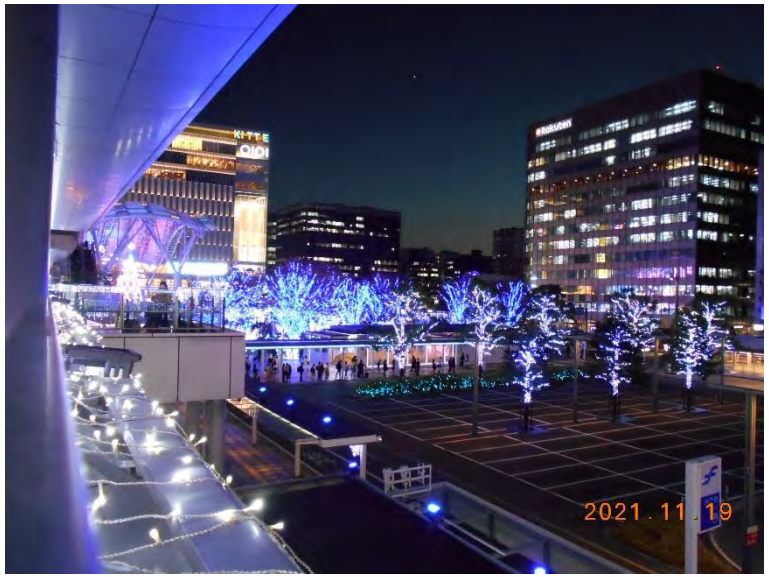
Hakata Station
19 Nov 2021



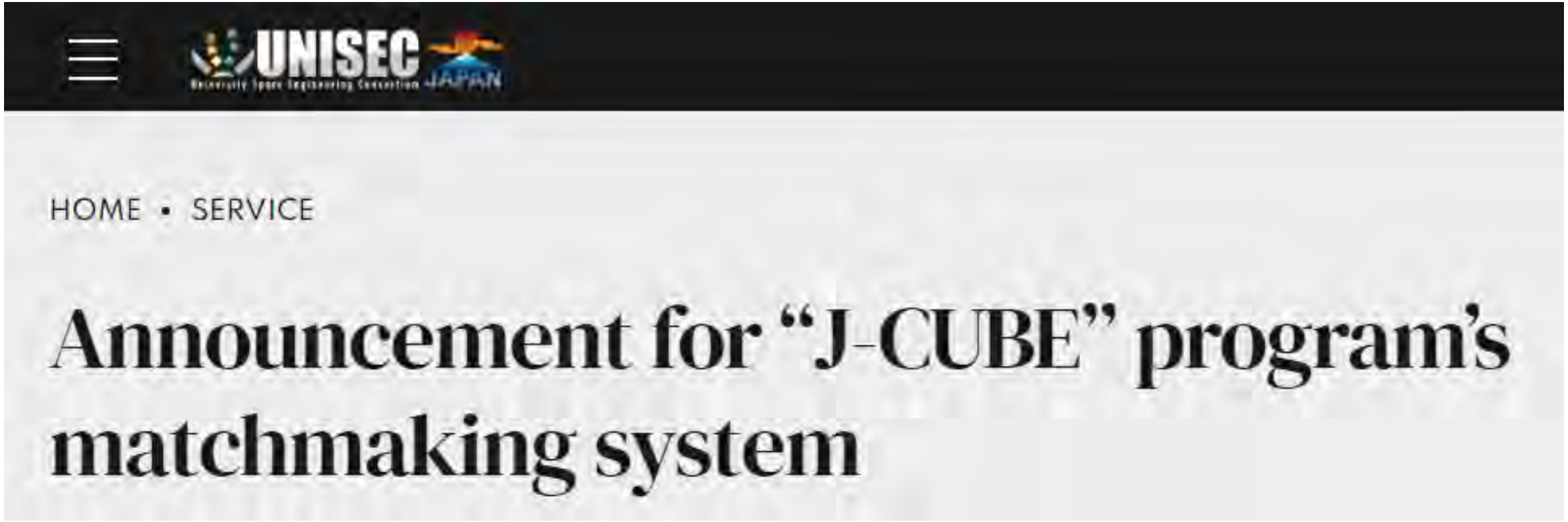
JSPS Reminder

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 <u>BIRDS International Workshops</u> and for <u>Ground Station Workshops</u>.

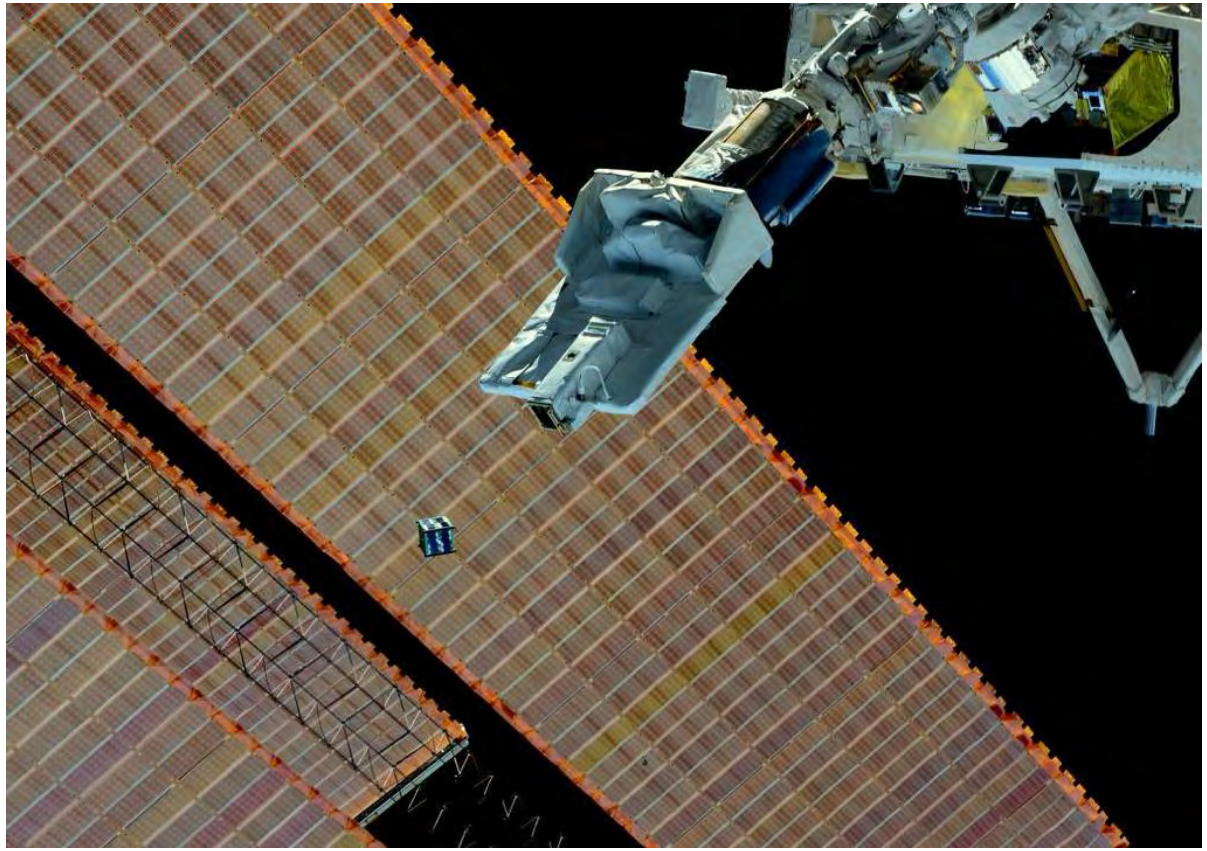
01. J-CUBE announcement



All details are here:
http://unisec.jp/serviceen/j-cube

Contact

J-CUBE office : info-jcube(at)unisec.jp



Both J-Cube and KiboCUBE programs rely on deployment from the ISS

Who should consider J-Cube?

If you are an emerging nation with an interest to launch small satellites (1U, 2U, or 3U), and you need a rocket launch, then consider J-Cube.

How does it differ from KiboCUBE?

KiboCUBE is a program conducted jointly between UNOOSA and JAXA. It offers 1 or 2 free launches per year. (J-Cube is not free.) However, it is hard to get KiboCUBE slots because each year it receives over ten applications. Your odds of getting it are, therefore, quite low. J-Cube is not free, but it is low cost – far below commercial fees.

02. KiboCUBE Academy: Season 2

UNITED NATIONS
Office for Outer Space Affairs

Kibo CUBE

JAXA

Details for KiboCUBE Academy (Season 2)

1. Overview

KiboCUBE is the long-standing cooperation between the United Nations Office for Outer Space Affairs (UNOOSA) and Japan Aerospace Exploration Agency (JAXA) that offers developing countries with the opportunity to deploy a Cube Satellite (CubeSat) from the International Space Station Japanese Experiment Module "Kibo". The selected teams are required to develop, operate and utilize their CubeSats.

Through KiboCUBE Academy Season 1, conducted from January-February 2021, UNOOSA and JAXA along with the support of the University Space Engineering Consortium (UNISEC) Global conducted a webinar series of 4 days, for future KiboCUBE applicants to be able to gain technical knowledge on how to design, develop and test their CubeSat, how to operate it once it is in space, and how to utilize the data that they acquire from their CubeSats to develop useful applications on Earth. It also supported on building a better plan for the project. From Fall 2021, KiboCUBE Academy Season 2 will be opened for all.

KiboCUBE Academy returns with Season 2

For full details go here:

https://www.unoosa.org/documents/pdf/psa/access2space4all/KiboCUBE/AcademySeason2/KiboCUBE_Academy_Season_2_Details_set.pdf

03. Science observation during the extended mission of Hayabusa 2

「はやぶさ2」拡張ミッションでの科学観測

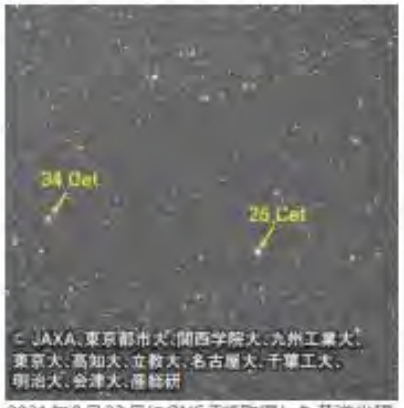
「はやぶさ2」は、地球に再突入カプセルを帰還させた後も、「拡張ミッション」として運用を続けています。目的地は、1998 KY26という大きさが30mくらいの非常に小さな小惑星。この小惑星に到着するのは2031年の予定です。これは大変な長旅となりますが、「はやぶさ2」にはONC-Tという望遠の光学航法カメラが搭載されていますから、ONC-Tを使って行うことができる科学観測として黄道光と小惑星に向かうクルージング期間中に観測を行うことにしました。「はやぶさ2」に搭載されたONC-Tは、太陽系内を移動する小型宇宙望遠鏡と言うことができます。

まず、黄道光観測についてです。黄道光とは惑星間塵による太陽光の散乱光のことで、その観測から惑星間塵の組成や分布等を調べることができます。しかし地球からの黄道光観測では常に地球のそばにある惑星間塵の散乱光が視線に入ってしまうので、惑星間塵の分布を調べる精度には限界があります。一方で拡張ミッションでは太陽からの距離が0.7-1.5 auの範囲で観測位置が変化することを利用して惑星間塵の分布をより良い精度で決定できるのです。これまでにONC-Tで行った黄道光観測のデータを解析したところ、黄道光と考えられる信号が確かに得られています。今後も月に1回程度の頻度で黄道光の観測を継続していく予定で、積み重ねたデータを入念に解析することで惑星間塵の分布を明らかにしたいと考えています。長期にわたり太陽系の様々な位置から黄道光を観測できるまたとない機会を最大限に活かして良い成果が得られるように頑張りたいと思います。

次に、系外惑星観測についてです。系外惑星とは、太陽以外の恒星の周りを公転している惑星のことですが、現在、すでに約5000個の系外惑星が確認されています。「はやぶさ2」では、探査機がクルージングを行っているときに、ONC-Tを用いて、トランジット法という手法で系外惑星を観測することを計画しています。トランジット法では、系外惑星が主星の前を横切るときに主星がわずかに暗くなる現象を利用して、惑星の大きさや主星からの距離などを求めます。ONC-Tは小口径であるので、高感度の地上望遠鏡では不向きな明るい恒星の観測に適しています。また、宇宙空間から系外惑星を観測する試みは日本では初めてのことですし、世界的にも最小口径の望遠鏡での観測となりますので、超小型衛星搭載光検出器による系外惑星の観測技術の開発にも資するデータの取得が期待されます。

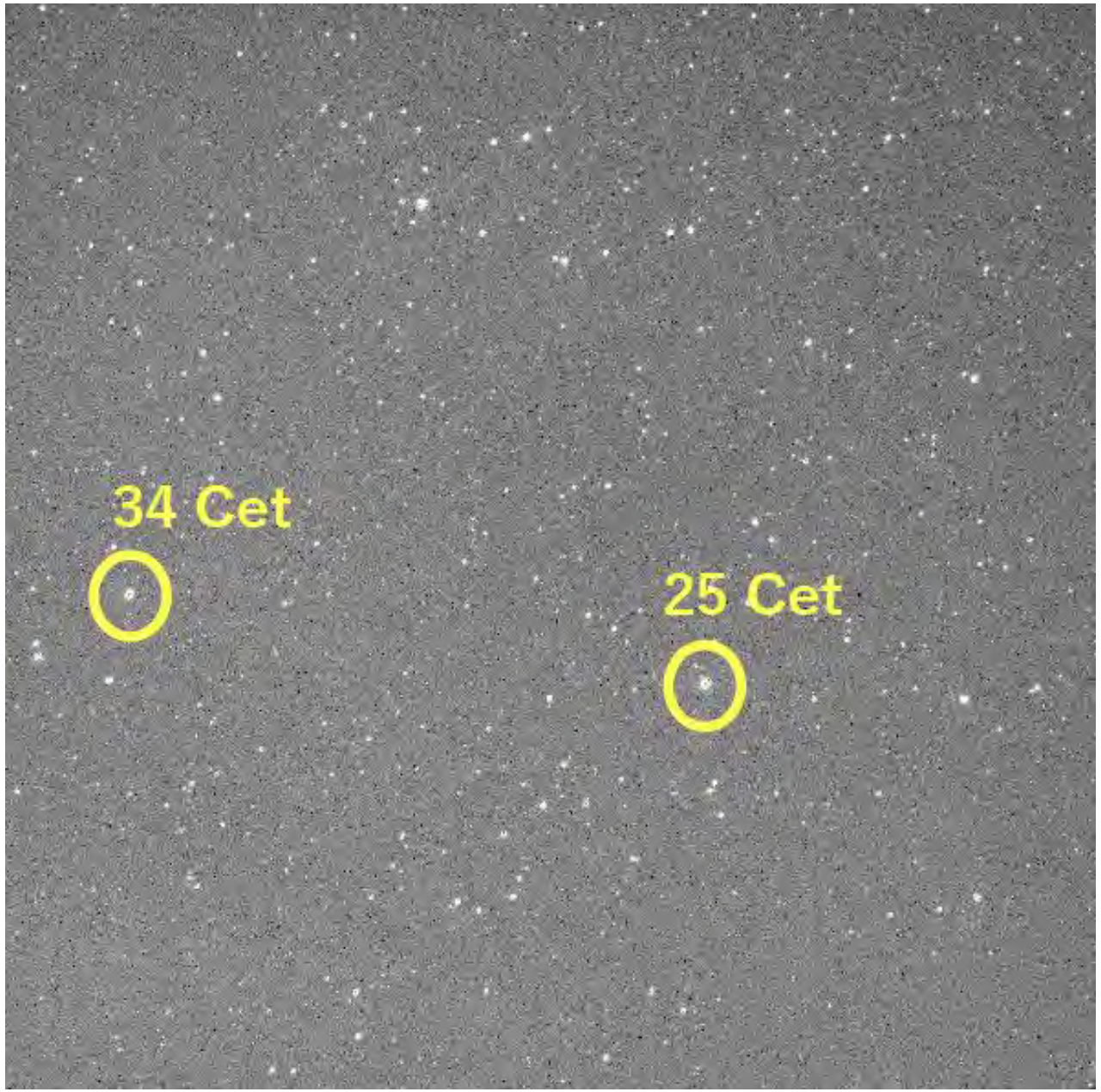
黄道光と系外惑星の観測は、拡張ミッションの長いクルージング運用の時間を利用した観測になりますが、何が分かるか楽しみです。

（津村 耕司／東京都市大学、松浦 周二／関西学院大学、
杉田 精司／東京大学）



2021年8月23日にONC-Tで取得した黄道光観測データ。検出された恒星をマスクし、何も写っていない「暗い夜空の明るさ」を測定することで黄道光の明るさを調べる。Cetは、くじら座の略符である。

Asteroid samples were returned to Earth by Hayabusa-2, but the main spacecraft itself has continued into deep space for more exploration. Some of that is discussed in Issue 487 of *ISAS News*. See next page for some explanation in English.



The following was written by Dr Sano of Kyutech on 10 Nov. 2021.

The extended mission – an overview

After coming back to the earth from Ryugu, Hayabusa 2 has been operated for 'extended mission'. The destination is a small asteroid 1998KY26. Hayabusa 2 will arrive at the asteroid in 2031. During the cruising period, we can use a camera instrument ONC-T onboard Hayabusa 2 to observe zodiacal light, which is sunlight scattered by interplanetary dust. Therefore, ONC-T can be regarded as a small space telescope moving around the solar system.

We can study spatial distribution of interplanetary dust by observation of zodiacal light. However, precise study of the spatial distribution is difficult from the earth because dust-scattered light from near-earth orbit dominates zodiacal light. In contrast, the present mission conducts observation from various positions between 0.7 and 1.5 au from the sun and determines the spatial distribution precisely. We have already conducted several observations so far. We plan to continue the observation about once a month and try to reveal the distribution of interplanetary dust.

Image:

← Astronomical image obtained by ONC-T/Hayabusa 2 in 8/23/2021

Participating institutes:

JAXA, Tokyo City University, Kwansei Gakuin University, Kyushu Institute of Technology, The University of Tokyo, Kochi University, Rikkyo University, Nagoya University, Chiba Institute of Technology, Meiji University, Aizu University, AIST

04. A good overview of Perovskite solar cell technology

This 14-min. video is a comprehensive summary of Perovskite solar cell technology covering the full range of its pros and cons.

BIRDS-4 has onboard a Perovskite solar cell experiment.

A good summary:
https://www.youtube.com/watch?v=YWU89g7sj7s

05. A CubeSat project from Mitsui Bussan Aerospace Co., Ltd.

FULL STORY HERE:

https://prtimes.jp/main/html/rd/p/000000021.000074539.html

人類史上初!?「宇宙を翔ける熊手プロジェクト」地球をまわって福をかき集める“スペシャルな熊手”が11月9日(火)浅草酉の市で発売！

宇宙規模のご利益が 破格の2,021万円！たったひとつしかない“あなたの熊手”が宇宙を翔けめぐる
三井物産エアロスペース株式会社（本社：東京都千代田区、社長：大杉定之、以下「当社」）は、新たな成長分野として注力する宇宙事業の基幹案件として「国際宇宙ステーション日本実験棟”きぼう”からの超小型衛星放出事業（J-SSOD事業）」を推進しています。J-SSOD事業を大学、研究機関、宇宙関係企業だけでなく、一般消費者にも宇宙を利用いただく機会にするため、恐らく人類史上初となるプロジェクト「宇宙を翔ける熊手プロジェクト」を始めます。

本プロジェクトは、創業明治三年 熊手の生産量全国トップシェアを誇る老舗メーカー株式会社面亀の協力のもと、新型コロナウイルスの早期収束と、コロナ禍のあおりを受けた商売の復活を願い、宇宙にひとつしかないオリジナルの熊手を超小型衛星に搭載し宇宙へ放出するという今までにない壮大なものです。縁起がいいスペシャルな熊手として11月9日（火）からの販売開始を予定しています。

公式サイトURL：https://mba-space.com/kumade

「宇宙を翔ける熊手プロジェクト」について

当社は、2019年から宇宙航空研究開発機構（JAXA）のJ-SSOD事業を履行しており、2021年2月に2機の超小型衛星を初めて宇宙に放出いたしました。この度の「宇宙を翔ける熊手プロジェクト」は、J-SSOD事業を一般消費者にご利用いただく契機とするための挑戦とも言える取り組みです。

「宇宙を翔ける熊手」は、老舗メーカー面亀の協力のもと製作する、宇宙にひとつしかないオリジナル熊手です。購入者さまには宇宙へ送るオリジナル熊手の他に、地上でまつることの出来る同じ仕様の熊手が提供されます。宇宙に送るオリジナル熊手は、一旦購入者さまにお引渡ししたあと当社が引取り、独自に開発、製造する10cm立方の超小型衛星に搭載します。オリジナル熊手を搭載した超小型衛星は購入者さま立ち合いのもとJAXAへ引渡されたのち、ロケットによる打上げを経てきぼうモジュールに運ばれ、そこから宇宙に放出いたします。
放出された超小型衛星は、半年～1年程度宇宙の福をかき集めながら高度約400kmで地球をぐるぐると翔けめぐり続け、徐々に高度を下げて大気圏で燃え尽きます（宇宙ゴミとして残ることはありません）。

プロジェクト実施の背景

いま、コロナ禍による閉塞感が地球を覆う一方で、民間人だけの宇宙旅行が成功したり、宇宙で映画撮影が行われたりと、宇宙開発には明るいニュースが続いています。これから宇宙は、もっともっと身近になっていくはず。その第一歩として当社は、伝統産業と宇宙産業のタッグに挑戦しました。一本2,021万円の熊手は誰もが買えるものではありませんが、応援してくれるすべてのみなさんの期待を受けて、宇宙に飛び立って行きます。願わくはこの小さな熊手が、来年の日本を、世界を明るく照らす光となって、私たちを見守ってくれますように。

商品詳細

恐らく人類史上初めて宇宙に放出される「宇宙を翔ける熊手」には、お買い上げ下さるお客さまの商売繁盛祈願はもちろん、コロナの収束や、人類や地球の幸福など、様々な願いを詰め込みました。熊手を構成するひとつひとつの意味を見つめ、こだわりぬいた世界にただ一つの熊手です。

「宇宙を翔ける熊手」に込めた15の願い

① 熊手の福の象徴である「おかめ」は、岩戸隠れの神話などに登場する「アメノウズメノミコト」という世に光を取り戻した女神様です。「お多福」とも呼ばれ幸せを招く「おかめ」には宇宙での長旅のために宇宙服(ヘルメット)をかぶせました。

② 福の神として有名な七福神は「七つの災難を除き、七つの幸福を授ける」と言われています。七福神が乗り、宝物を積み込む宝船を宇宙船にアレンジしました。
③ コロナ退散の縁起物「アマビエ」で、人類がコロナ禍から抜け出すことを祈願しました。
④ 水星から海王星の「惑星」や、星を散りばめました。熊手は太陽(天照大神)に向けて飾る為、太陽はあえて入れていません。
⑤ 古代に火を起こしたという縁起から神聖な木材とされる「檜(火の木)」の立札には、購入者さまのお名前を入れさせていただきます。
⑥ 購入者さまの商売繁盛を願い、「ご希望のオリジナル飾り」を入れさせていただきます。
⑦ 福を鷲掴みするという意味を持つ「熊手の爪」は、12本がぐるっと放射状に伸びる金色の爪に。爪の先には各月の誕生石（パワーストーン）を模したラインストーンを配し、12ヶ月を通して360度から福をかき集め、また、地球を鷲掴みするようなデザインにすることで、宇宙からすべての人類と生物の幸福を願います。
⑧ 熊手の「台紙」正面には宇宙空間の図柄、背面には地球の図柄を配し、宇宙一のご利益を祈願します。
⑨ 紅白の縁起物「鯛」が宇宙の海を泳ぎ、人類史上初と思われる試みがめでたく成功するよう祈願します。
⑩ 五穀豊穣の象徴「米俵」には、実り多き未来と豊かな世界を祈願しました。
⑪「しめ縄」は張られた場所が清浄であることを示し、神域と現世を隔てる結界の役割があります。穢れの無い熊手に宇宙を翔けて欲しいとの願いを込めました。
⑫ 熊手の飾りとして伝統的な「小判・大福帳・千両箱・大入り」等の縁起物を配しました。金運・財運の祈願はもちろん、温故知新、伝統と未来の融合もイメージしています。
⑬ 実るほど頭を垂れる稲穂かな、でお馴染みの「稲穂」を末広がりの八の字に配し、豊作・開運を祈願します。
⑭ 熊手の飾りを挿す「土台」は、盛り上がる宇宙時代の礎をイメージし、星の地表を想起させる千代紙を使用しました。
⑮ 持ち手の竹には、宇宙空間をイメージして「黒竹」を使用しました。成長早く真っ直ぐ伸びる竹は、若さと長寿と強さのシンボルであり、未来への希望を表します。時を経ても色褪せることのない黒竹に、末永い繁栄の願いを込めました。

プロジェクト特典「7つの福」

「宇宙を翔ける熊手」は、あなただけの10cm立方の超小型衛星（オリジナル衛星）への搭載、JAXAへの引渡し、放出など、宇宙空間を旅するために必要なステップを踏んだのち、宇宙を翔けめぐります。購入者さまがそれらの節目や、ご自分の熊手が飛んでいる実感をより得られる体験をしていただけるサービスを「7つの福」として提供いたします。

1. オリジナル熊手（衛星搭載用）は一定期間あなたのもとで飾れます！（期間は購入後の調整）
2. あなたのオリジナル熊手を搭載する宇宙放出用のオリジナル衛星を作ります ！
3. 地上保管用の熊手が入ったオリジナル衛星のレプリカを差し上げます！
4. オリジナル衛星の組立て＆熊手の衛星搭載作業を見学できます！
5. 熊手を搭載したオリジナル衛星に名前をつけることができます！
6. オリジナル衛星をJAXAへ引渡すシーンに立ち合い＆引渡し完了証明書をお渡しします！
7. オリジナル衛星の放出作業をLIVE映像で観られます！

※新型コロナウイルスの状況・JAXAの施策変更によってサービス内容が変更となる可能性がございます。
※見学や立ち合いは、強制ではありません。
※オリジナル衛星は購入者さまが所有者となります。

1

熊手の引渡し

2

オリジナル衛星作成の
作業イメージ

（「きぼう」から放出される超小型衛星
「Irazu」（コスタリカ）引渡しの様子）

3

JAXAへの引渡し
イメージ

（「きぼう」から放出される超小型衛星
「BIRDS-3」ミッション参加国メンバー
と JAXA 関係者）

End of this section

06. Self-introduction by Rafiki Yves of Rwanda

Rafiki Yves NDAYISHIMIYE (Satellite Communication Specialist, Rwanda Space Agency) will enter SEIC in April of 2022 under JICA's "*Human Resource Development for Space Technology Utilization Scholarship*" program.

He has written a self-introduction.

Rafiki Yves NDAYISHIMIYE
Satellite Communication Specialist
Rwanda Space Agency
14th October 2021

PERSONAL

- **Birthday:** December 15
    - **My motivation for Space Engineering**

• Few decades ago, Space technologies was owned by few countries however as technology evolved it becomes space for all. Am dreaming to see my contribution in the development of my country citizens life through JICA Scholarship; Human Resources Development for Space Technology Utilization" masters' course in a world class university Kyushu Institute of Technology, Japan.

- **Hobbies:** Reading, playing Basketball
- **Favorite food:** Cassava bread & Chicken
    - https://www.visitrwanda.com/

VISIT RWANDA

Visit of Asst. Prof George Maeda Sensei in CLTP 10 at Nihon University (Team Rwanda)

Recommended Place for Visitors

Akagera National Park Vast Savannah with wildlife & wetlands

Gorilla National Park Gorilla, Volcano and hiking

Nyungwe Forest National Park

Nyanza Palace Museum

Academic Background

Degrees Taken

- Bachelor's degree in Electronics and Telecommunication Engineering.

Future Academic Plans

Applicant in Masters of International Space Engineering Course (SEIC) at Kyushu Institute of Technology under Prof. ASAMI Kenichi Sensei, Academic Year 2022.

Academic Interests

- Satellite development Engineering
- Satellite Communication Engineering

Academic Work

- Learning Facilitator in the Giants Electronics Lab

Technical Skills

Programming Skills

- C Programming language
- C++ Programming language
- Python Programming language
- Java for Android Programming language
- Assembly language

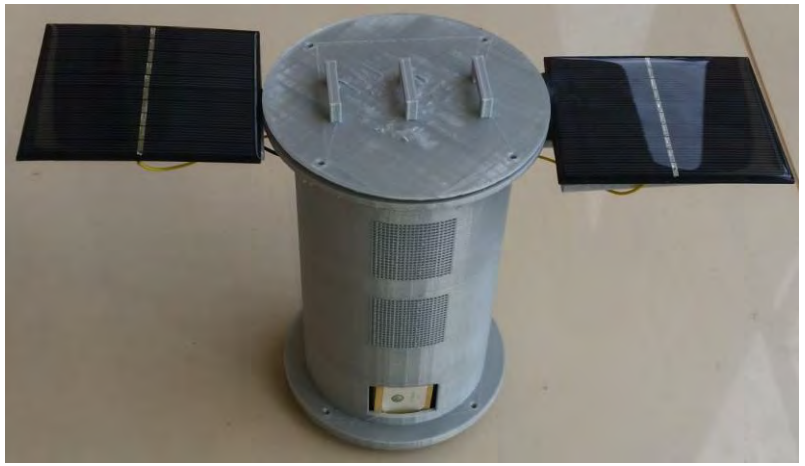
Design Skills

- Printed Circuit Board (PCB) art work
- Model (3D) Design

Languages

- Kinyarwanda (mother tongue)
- English (Proficient)
- French (Intermediate)

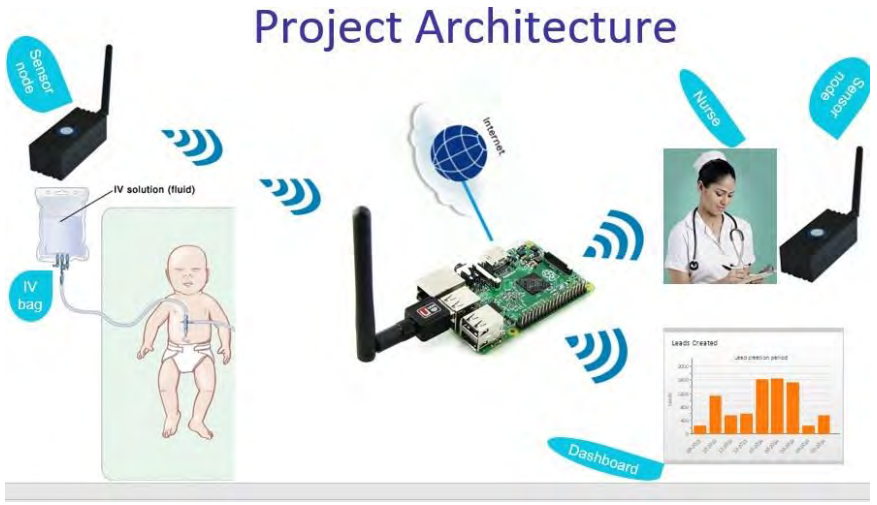
Engineering Projects



CanSat_Rwa; Can-sized satellite in Rwanda, can be used as an educational tool of space technology

PCB creation of Mobile online and offline attendance system

Telecommunication Engineer



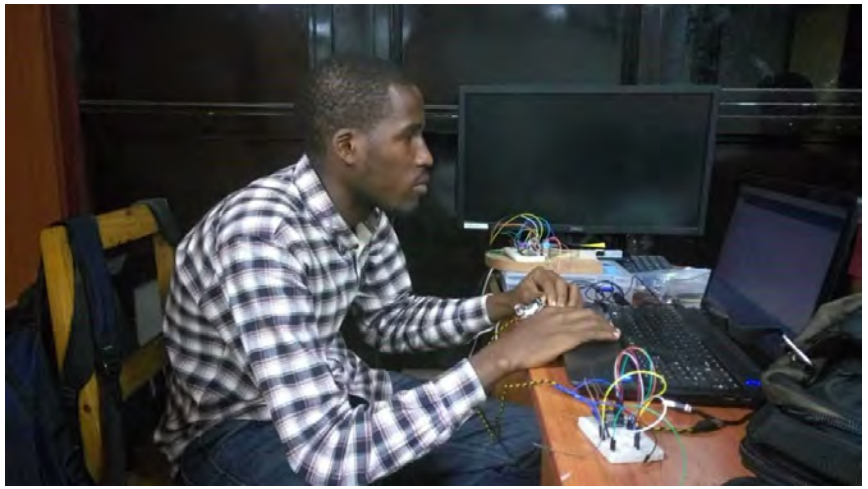
Patient Health Monitoring System

Training

CanSat Leader Training Program (CLTP10)

HEPTA-Sat training Program

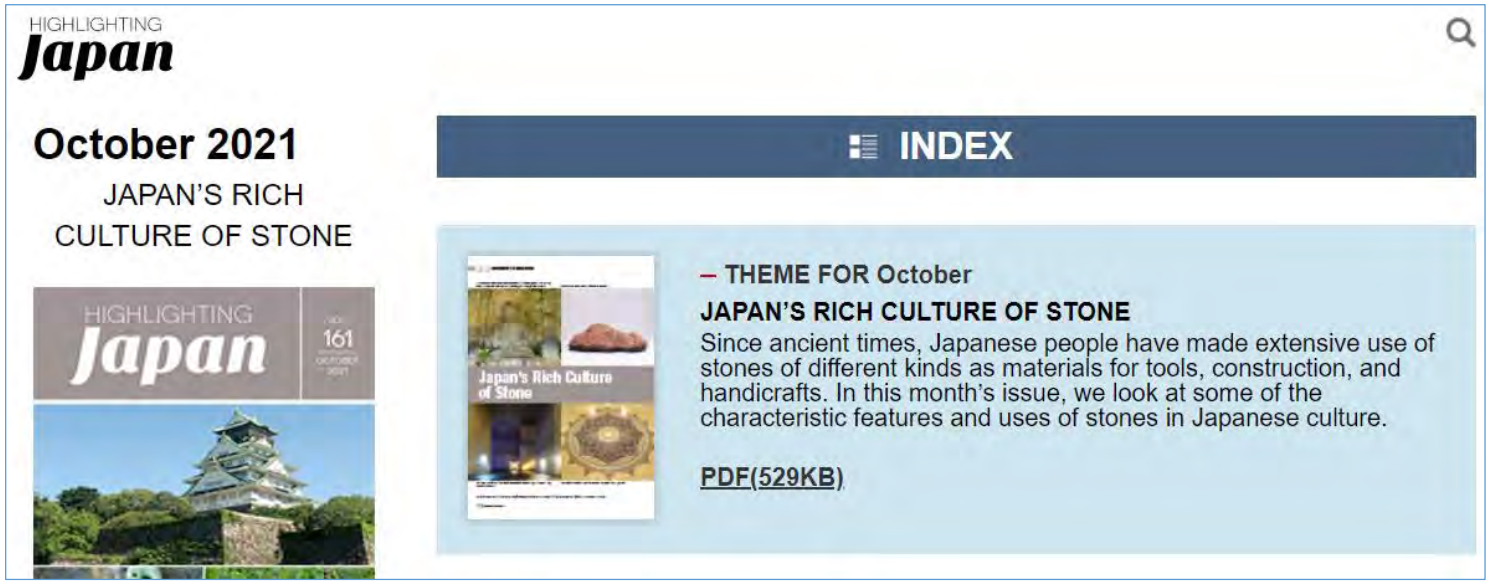
Fiber-Optic Training workshop



ICT Engineer Development Training Course (IoT and Leadership) & Rapid Prototyping for Internet of things offered by JICA

Thank you
&
See you in Japan

07. Japan's rich culture of stone



Download the October issue from this link:

https://www.gov-online.go.jp/pdf/hlj/20211001/hlj202110_all_JAPANS_RICH_CULTURE_OF_STONE.pdf

08. A survey of communication constellations in operation

The following survey (the next few pages) was prepared by Ms. Polimey IM (shown at the left) of Cambodia. She is a PNST Fellow at Kyutech. Please see her self-intro on pages 52-57 of Issue No. 63 of this newsletter.

This semester, she is taking SEIC PBL and she prepared this survey as homework for the class.

This semester, the main task of the PBL class is to enter MIC-8 (Mission Idea Contest No. 8). See http://www.spacemic.net/

Kyutech
Kyushu Institute of Technology

La SEINE

PBL Subject

Homework Presentation

Lecturer: George Maeda

Polimey IM
Kyushu Institute of Technology (Kyutech)

November 02, 2021

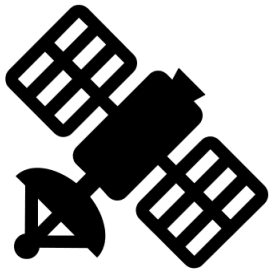
Operational communications satellite constellations

- ☐ Broadband Global Area Network (BGAN)
- ☐ Global Xpress (GX)
- ☐ European Aviation Network (EAN)
- ☐ Globalstar
- ☐ Iridium
- ☐ O3b
- ☐ Orbcomm
- ☐ Defense Satellite Communications System (DSCS)
- ☐ Wideband Global SATCOM (WGS)
- ☐ ViaSat
- ☐ Eutelsat
- ☐ Thuraya
- ☐ Starlink

Broadband Global Area Network (BGAN)

The **Broadband Global Area Network** (**BGAN**) is a global satellite network with telephony owned by Inmarsat using portable terminals.

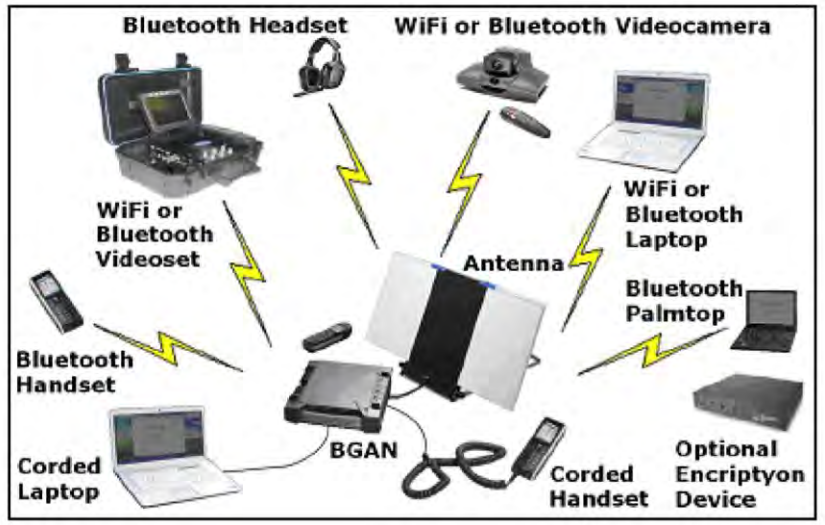
Operational



Inmarsat Satellites

BGAN

Devices:



The Inmarsat is supporting the **Broadband Global Area Network (BGAN)**, which provides up to 492 Kb/s Voice, Data and Video (VDV) including Internet access for mobile, fixed and portable multimedia and many others advanced applications.

Image Source:
https://en.wikipedia.org/wiki/Broadband_Global_Area_Network#/media/File:Hughes_9202_BGAN_Terminal.jpg
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiJrNOzkPfzAhUA8XMBHbJSDQoQFnoECB8QAQ&url=https%3A%2F%2Fbeei.org%2Findex.php%2FEEI%2Farticle%2Fdownload%2F2136%2F1403&usg=AOvVaw0gwJyo2vXU_FNhPGIonAGp

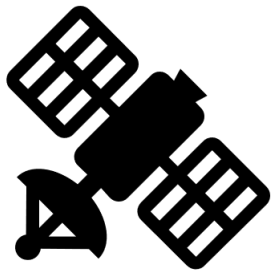
Inmarsat Satellites

Table 1. Comparison of inmarsat satellites main parameters

Inmarsat Satellites	No. Satellite-Band	Coverage/Band	Mobile Link EIRP	Channellization	S/C Dry Mass	Solar Array Mass
 Inmarsat-2	4 – L/ -band	1 Global Beam	39 dBW	4 Channels (4.5 to 7.3 MHz)	700 kg	14.5 m
 Inmarsat-3	5 – L/C-band	7 Wide Spots 1 Global Beam	49 dBW	46 Channels (0.9 to 2.2 MHz)	1000 kg	20.7 m
 Inmarsat-4	2 + 1 – L/C-band	228 Narrow Spots 19 Wide Spots 1 Global Bema	67 dBW	558 Channaels (EOL) (200 KHz)	3340 kg	45 m
 Inmarsat-5	4 – Ka-band	69 Wide Bands 6 Stearable Spots 1 Global Beam	77 dBW	72 CH (Forward) 72 CH Return)	6100 kg	33.8 m

Global Xpress (GX)

Operational



Inmarsat Satellites

Global Xpress Terminal

The Inmarsat-5 satellite Global Xpress (GX) operate with a combination of fixed narrow spot beams that enable Inmarsat to deliver high speeds through more compact terminals, plus steerable beams so additional capacity can be directed in real-time to where it's needed.

Inmarsat Global Xpress system

More Info: https://youtu.be/oOn6MWd6-kY

Image Source: https://www.jrc.co.jp/eng/product/lineup/jue60gx/system.html
https://store.orbitalconnect.com/intellian-gx100nx-1m-maritime-global-xpress-terminal-5w-buc-adu-only-10w-buc-adu-only-or-10w-buc-nx-bdt/

Applications supported by Global Xpress

- Voice over Internet Protocol (VoIP) support and managed VoIP service
- Video teleconferencing
- Branch office applications (eg VPN access, SAP, Citrix, email)
- Real-time video and audio streaming
- Real-time interactive collaboration and situational awareness
- High-speed broadband for internet access
- High-speed file transfer
- Video surveillance
- Inmarsat reliability

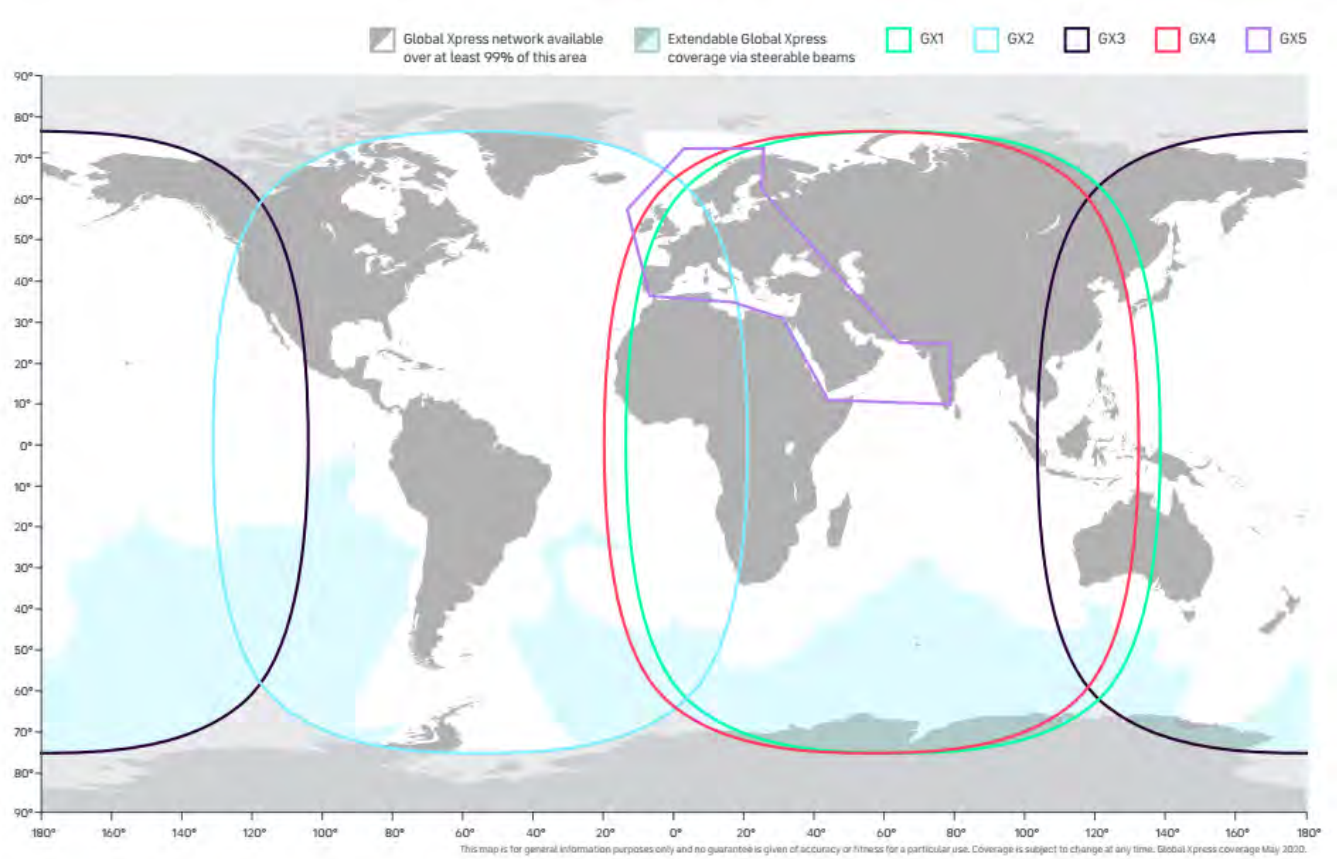


Image Source: https://www.marsat.ru/en/global_xpress

European Aviation Network (EAN)

- The **European Aviation Network** is a hybrid-network built by Deutsche telekom and Inmarsat in cooperation with their technological partner Nokia.
- Offer flight WIFI for domestic flights within Europe and contains a LTE ground network supported by a satellite connection.
- Data rates up to **75 Mbit/s** downstream and **20 Mbit/s** upstream per airplane, with a total capacity of **50Gbps**.
- Airlines that already support the EAN on some aircraft:

❑ British Airways

❑ Aer Lingus

❑ Iberia

❑ Vueling

❑ Lufthansa

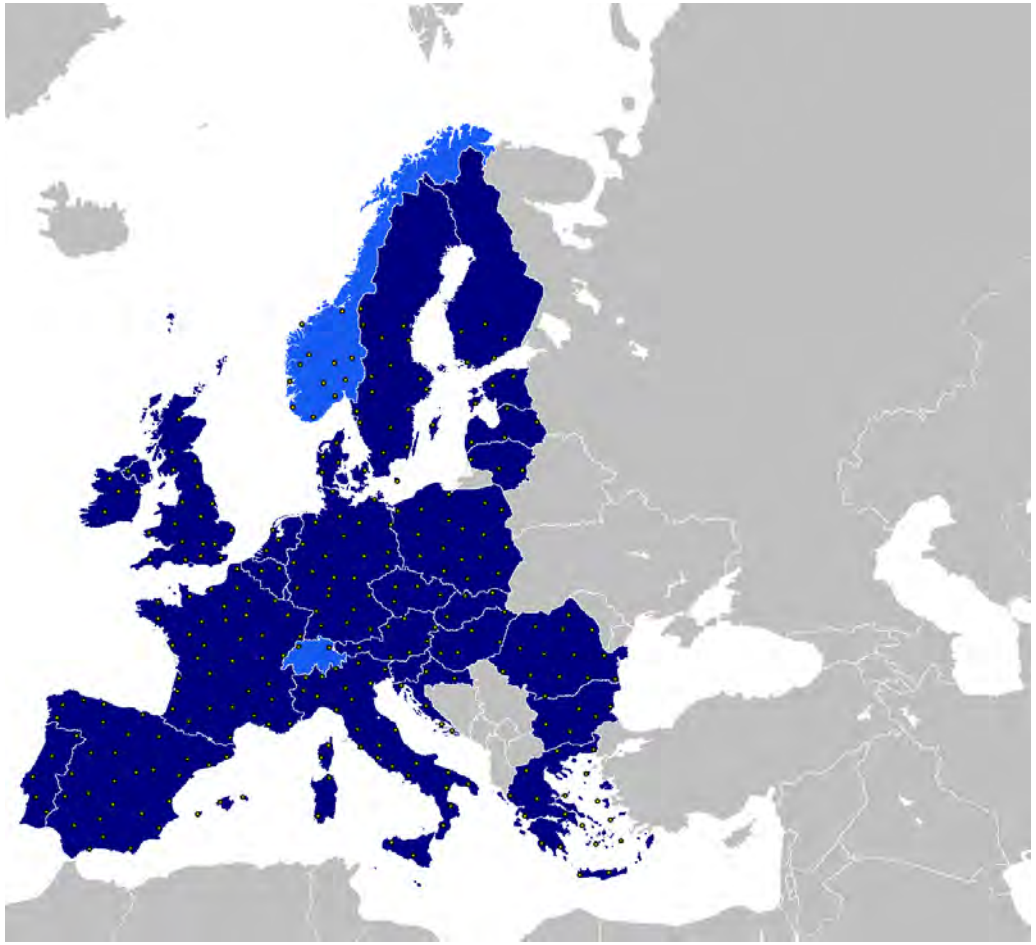
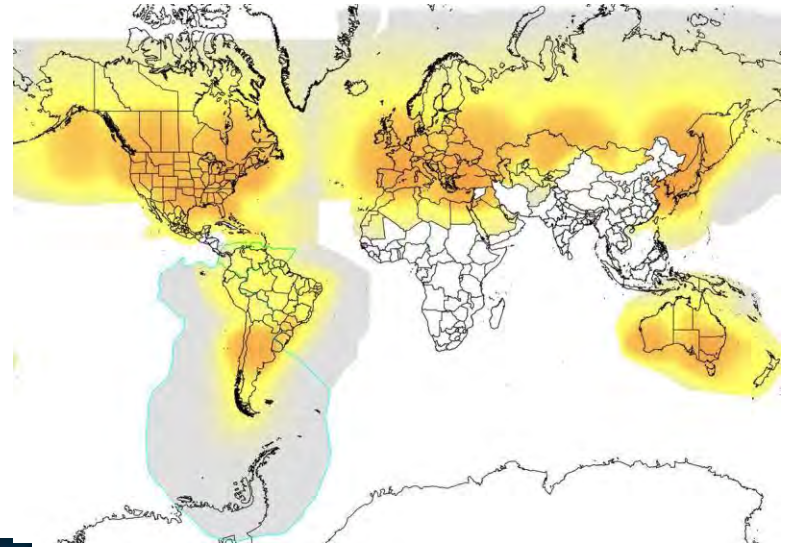


Image Source: https://en.wikipedia.org/wiki/European_Aviation_Network#/media/File:EAN_Standorte_EU.png

Globalstar

Operational

- **Globalstar, Inc.** is an American satellite communications company that operates a Low Earth Orbit (LEO) satellite constellation satellite phone and low-speed data communications.
- Globalstar phones look and act like mobile or fixed phones with which you're familiar. The difference is that they can operate virtually anywhere, carrying call / data over an exceptionally clear, secure Code Division Multiple Access (CDMA) satellite signal.



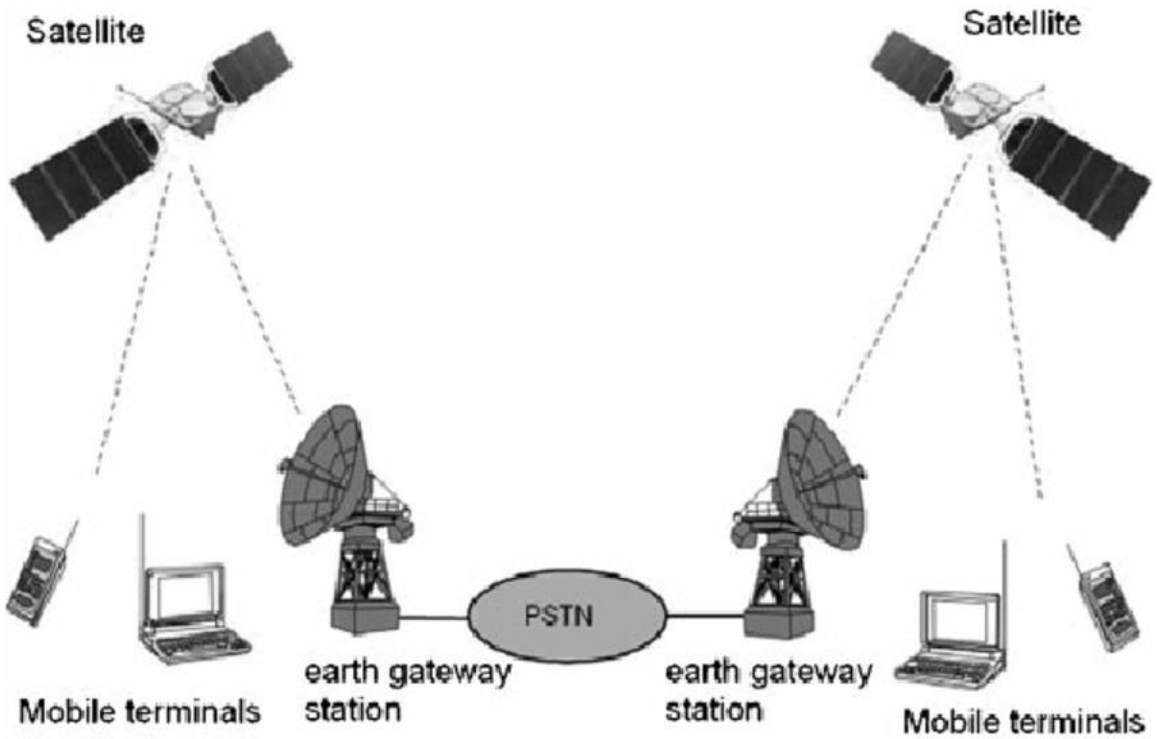


Image Source: https://www.researchgate.net/profile/Giovanni-Giambene/publication/220123796/figure/fig2/AS:305701013475333@1449896209628/Pictorial-view-of-the-Globalstar-system-without-ISL.png
https://satellitephonestore.com/uploads/custom_images/45/voice-coverage_map_lg_june19_14.jpg

Products and Services

Portable telephones
- Globalstar GSP-1600
- Globalstar GSP-1700 (current)

Simplex data modems
- Globalstar STX-2
- Globalstar STX-3
- Globalstar ST-100
- Globalstar SmartOne C
- Globalstar SmartOne Solar

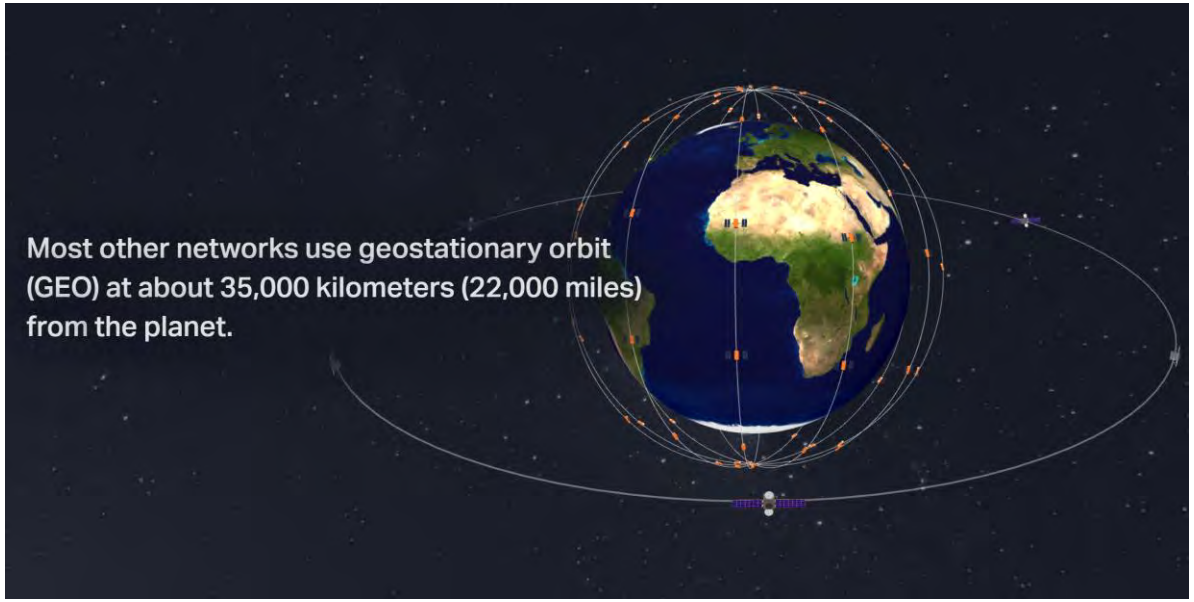
Duplex data modems
- SPOT X
- SPOT X with Bluetooth

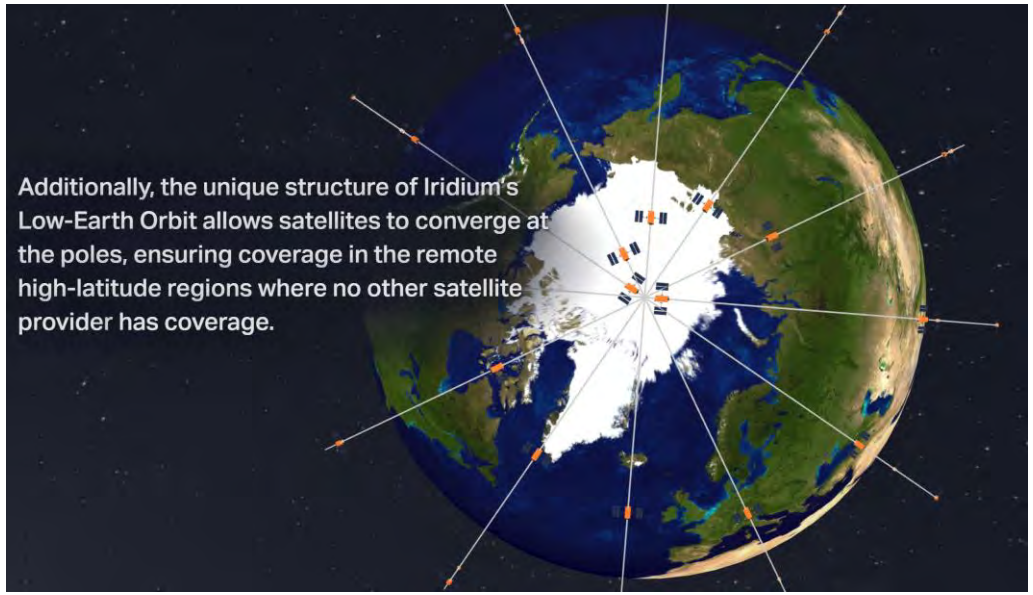
Duplex voice/data modules
- Globalstar GSP-1720

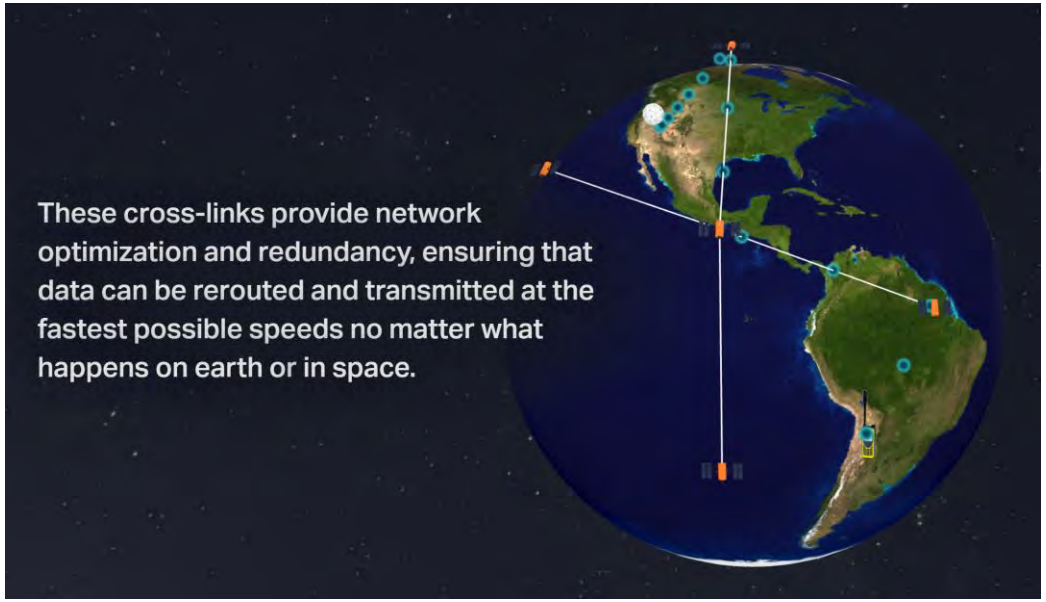
Services
- Voice Telephony
- One-way mobile-terminated SMS Text messaging
- 9,600 bit/s circuit-switches data calls
- 9,600 bit/s packet-switched Internet access
- One-way mobile originated short-burst messages (simplex devices only)
- Two-way mobile originated / mobile terminated short-burst messages (SPOT X device only)
- Device geolocation within approximately 30 km

Discontinued Products and Services
- Sat-Fi2 (Satellite WiFi Hotspot) and Sat-Fi2 RAS (Remote Antenna Station)
- 72 kbit/s packet-switched Internet access (on 2nd-gen WCDMA network)

Iridium

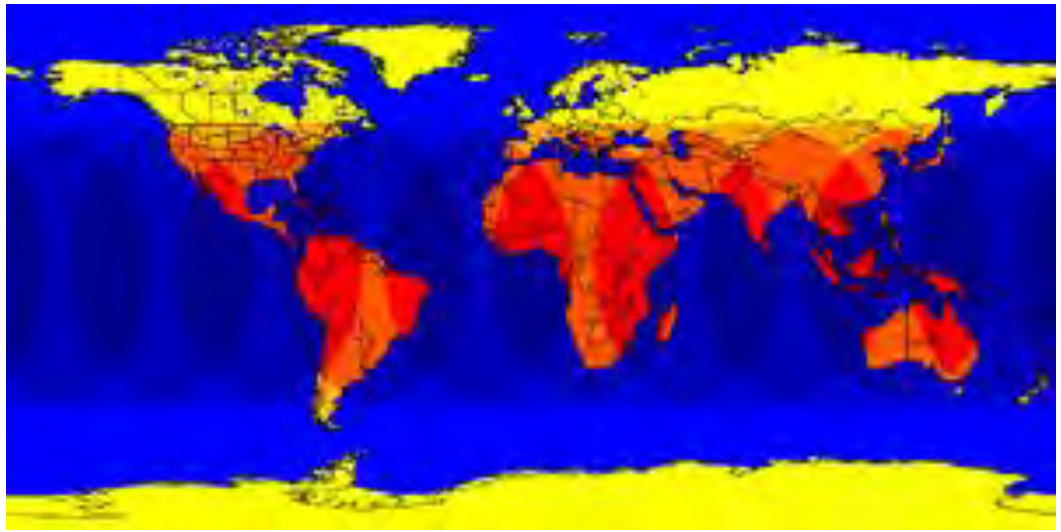

Most other networks use geostationary orbit (GEO) at about 35,000 kilometers (22,000 miles) from the planet.


Additionally, the unique structure of Iridium's Low-Earth Orbit allows satellites to converge at the poles, ensuring coverage in the remote high-latitude regions where no other satellite provider has coverage.


These cross-links provide network optimization and redundancy, ensuring that data can be rerouted and transmitted at the fastest possible speeds no matter what happens on earth or in space.

O3b

- O3b is a satellite constellation in Medium Earth orbit owned and operated by SES, and designed to provide low-latency broadband connectivity to remote locations for mobile network operators and internet service providers, maritime, aviation, and government and defense.



Artistic rendition of the O3b Networks' constellation.

Image Source: https://cdn.globaltt.com/images/O3B/image027.jpg
https://upload.wikimedia.org/wikipedia/commons/thumb/0/0e/O3b_satellite_constellation.png/600px-O3b_satellite_constellation.png

Orbcomm

- **Orbcomm** is a family of low Earth Orbit communications satellites, operated by the United State satellite communications company Orbcomm. As of July 2014, 51 satellites have orbited Earth, with 50 still continuing to develope.
- The three main components of the Orbcomm system are:

❑ The space segment: the constellation of satellites

❑ The ground segment: gateways, which include the Gateway Control Centres (GCCs) and Gateway Earth Stations (GESs) and the Network Control Centre (NCC), located in the USA

❑ The subscriber communicators (SCs) - hand-held devices for personal messaging, as well as fixed and mobile units for remote monitoring and tracking applications

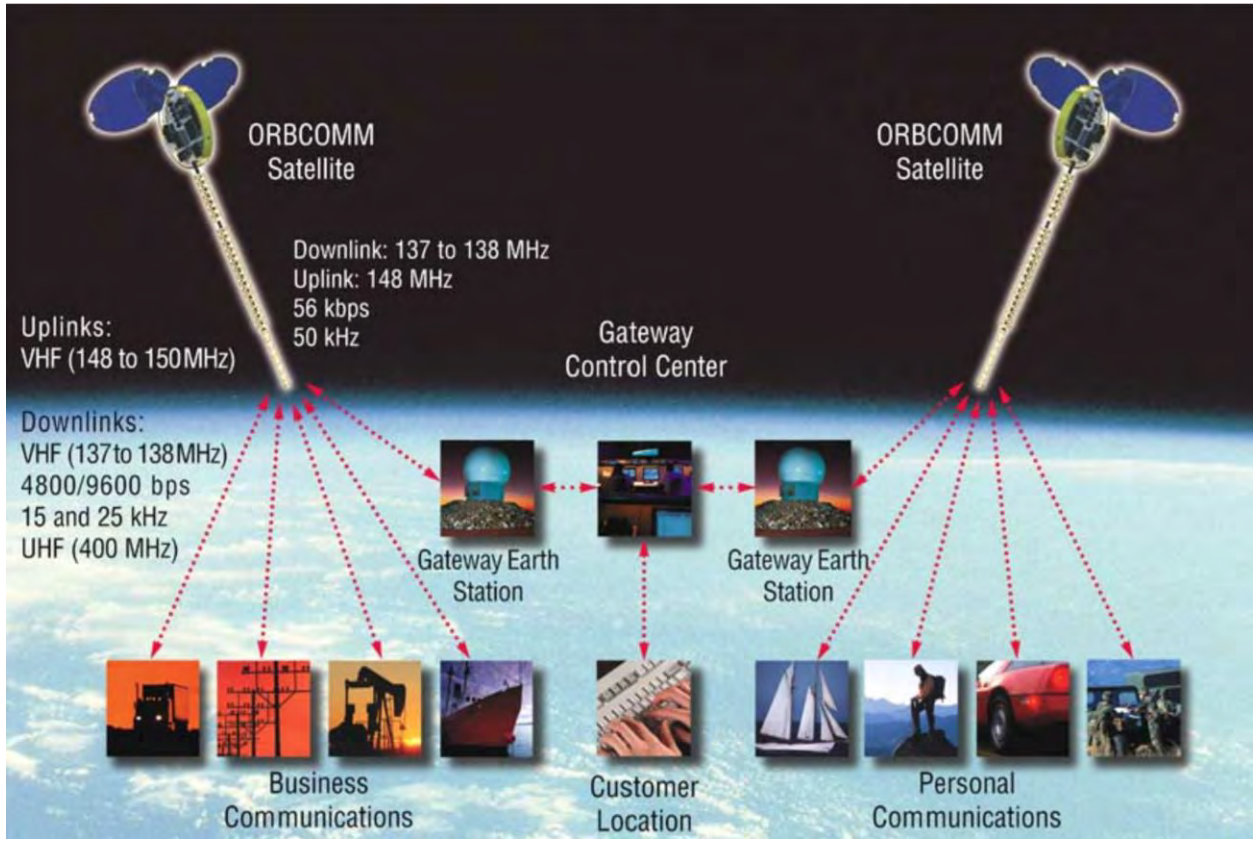


Image Source: https://www.dlr.de/rd/Portaldata/28/Resources/dokumente/RK/kassebom_orbcomm_ohb.pdf

Defense Satellite Communications System (DSCS)

- The **Defense Satellite Communications System** (**DSCS**) is a United State Space Force satellite constellation that provides the United State with military communications to support globally distributed military users.
- **Defense Satellite Communications System** (**DSCS**) constellation provides long haul communications to users worldwide through contested environments.
- **DSCS** supports: the defense communications system, the military's ground mobile forces, airborne terminals, ships at sea, and Department of Defense (DOD).

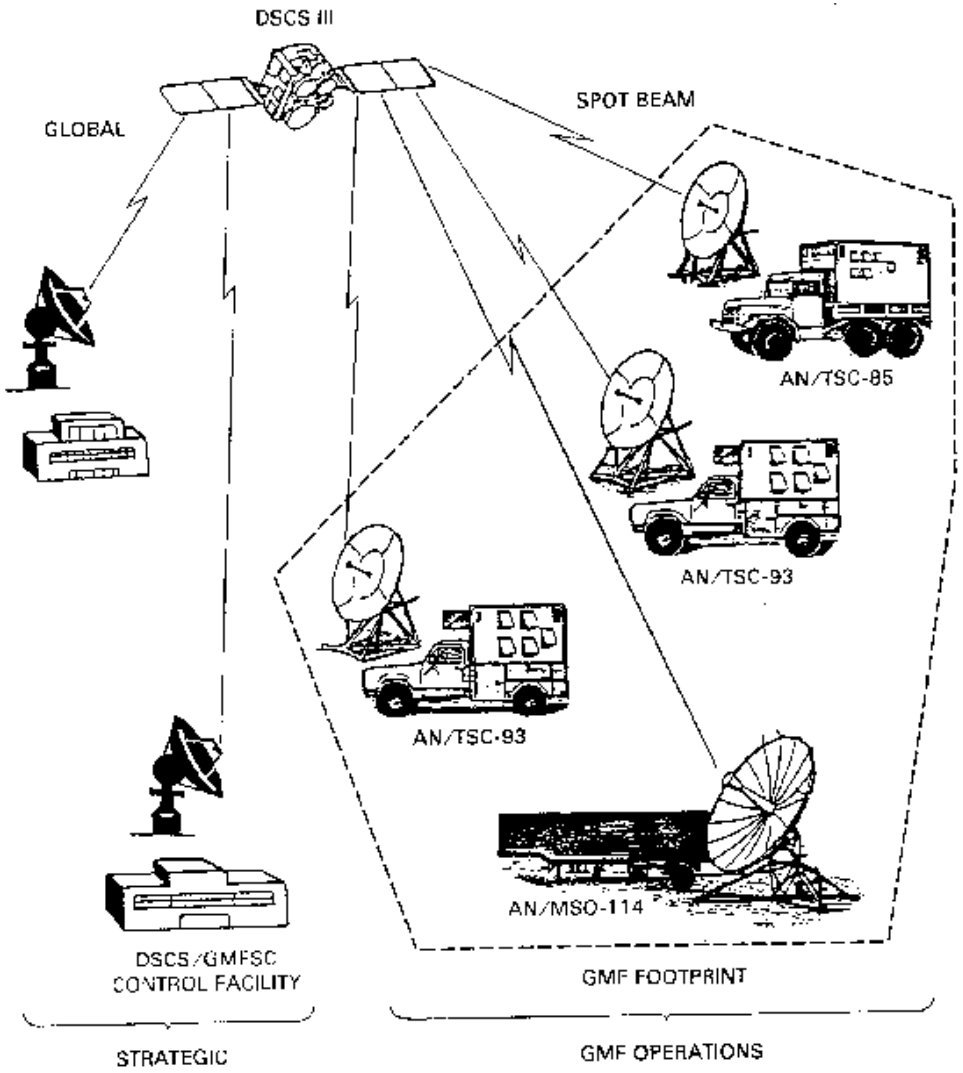


Figure 7 1. Ground Mobile Forces Satellite Communications Network

Image Source: https://www.globalsecurity.org/military/library/policy/army/fm/11-24/fig7-1.gif

Wideband Global SATCOM (WGS)

- The **Wideband Global SATCOM system** (**WGS**) is a high capacity United State Space Force satellite communication system planned for use in partnership by the United States Department of Defense (DoD).
- The system is composed of the Space Segment satellites, the Terminal Segment users and the Control Segment operators.

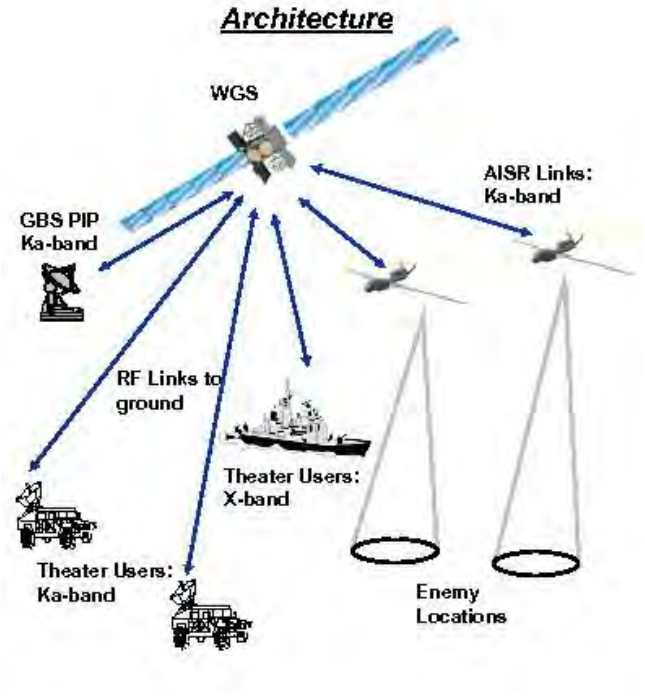
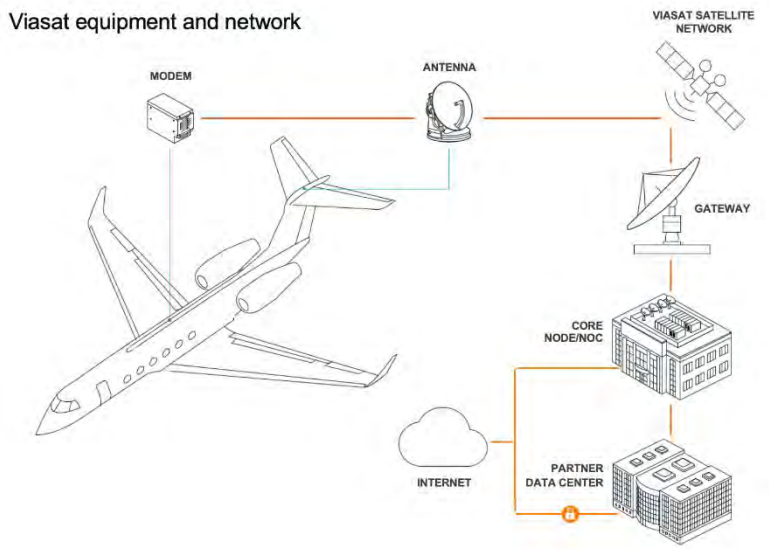


Image Source: https://upload.wikimedia.org/wikipedia/commons/thumb/7/72/MC-2941_Wideband_Global_SATCOM_Satellite.png/650px-MC-2941_Wideband_Global_SATCOM_Satellite.png
https://present5.com/presentation/7349cb7231364b77b52a9918bfa2af55/image-8.jpg

ViaSat

- **Viasat Inc.** is an American communications company based in Carlsbad, California, with additional operations across the United States and worldwide.
- Viasat is a provider of high-speed satellite broadband services and secure networking systems covering military and commercial markets.



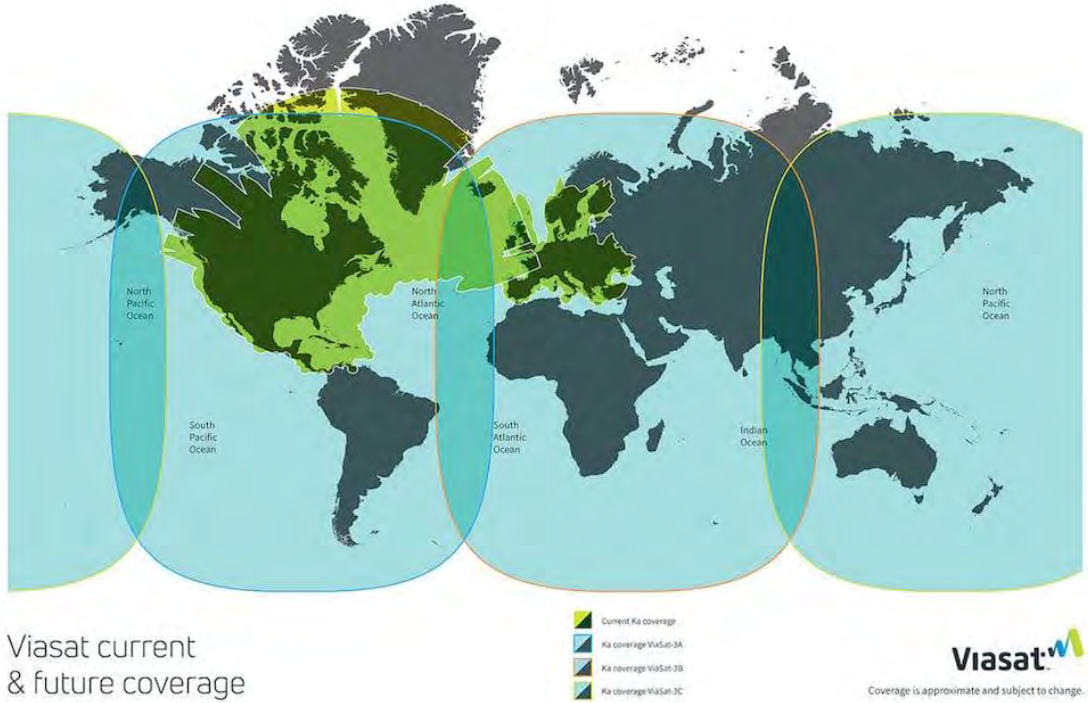
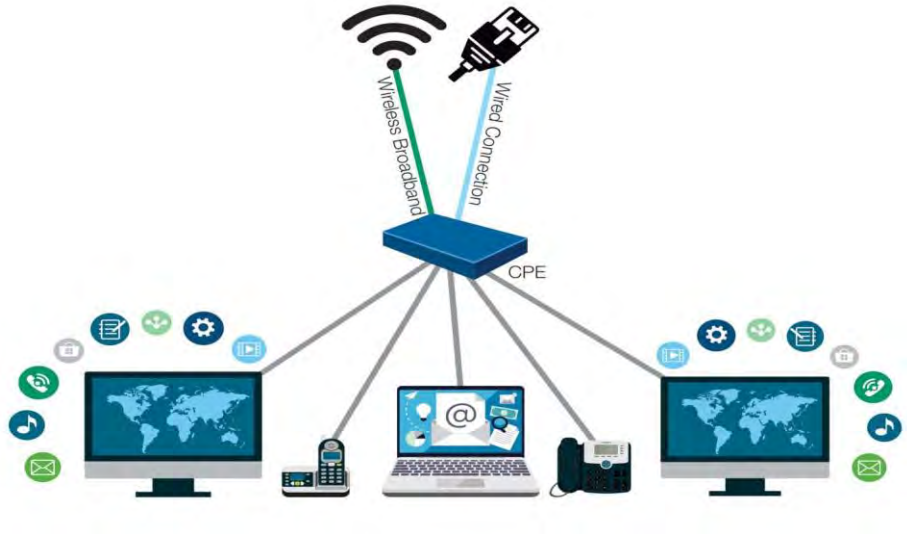


Image Source:
https://www.aviationtoday.com/wp-content/uploads/2020/07/viasat-business-aviation-connectivity-diagram-copy-1024x742.png
https://www.aviationtoday.com/wp-content/uploads/2020/07/viasat_ka-band_coverage-map-1024x682.jpeg

EutelSat

- **Eutelsat S.A.** is a European satellite operator. Providing coverage over the entire European continent, the Middle East, Africa, Asia and the Americas, it is the world's third-largest satellite operator in terms of revenues.
- Eutelsat's satellites are used for broadcasting nearly 7,000 television stations, 1,400 are in high-definition television, and 1,100 radio stations to over 274 million cable and satellite homes.



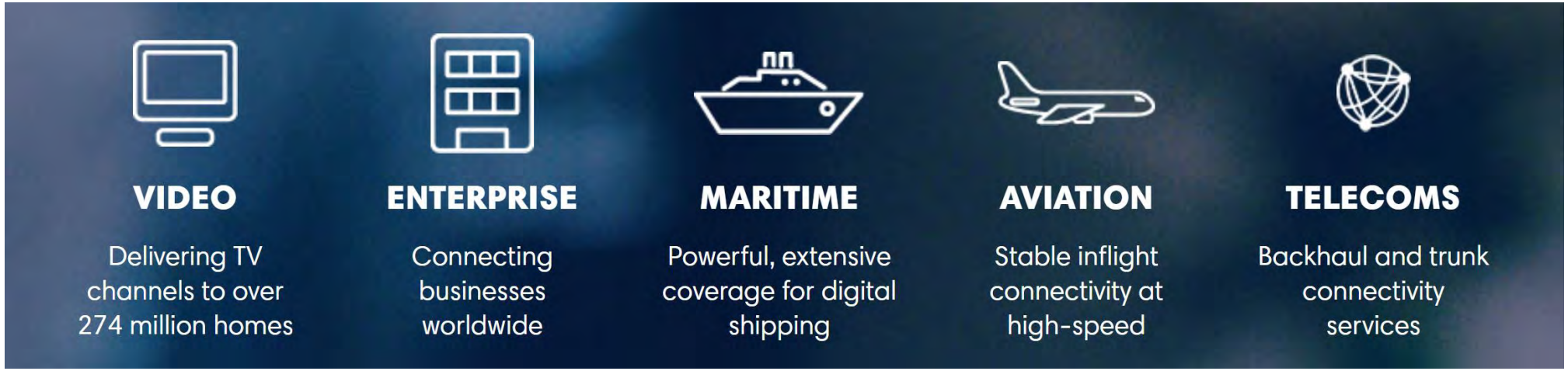


Image Source: https://714493.smushcdn.com/1603085/wp-content/uploads/2021/02/Wireless-Broadband-Infographic_1600x900.jpg?lossy=1&strip=1&webp=1

Thuraya

- **Thuraya** is a regional mobile satellite phone provider. The company is based in the United Arab Emirates; it provides mobile coverage to more than 110 countries in Europe, the Middle East, North, Central and East Africa, Asia and Australia.
- Thuraya also offers GSM roaming services over land-based mobile GSM networks. As well, Thuraya sells a dual mode satellite phone with both GSM and satellite capabilities.
- Thuraya has 3 satellites, 2 in geosynchronous orbit (Thuraya 2and Thuraya 3). The Thuraya 1 satellite originally launched for testing purposes, has now reached the end of it's life.

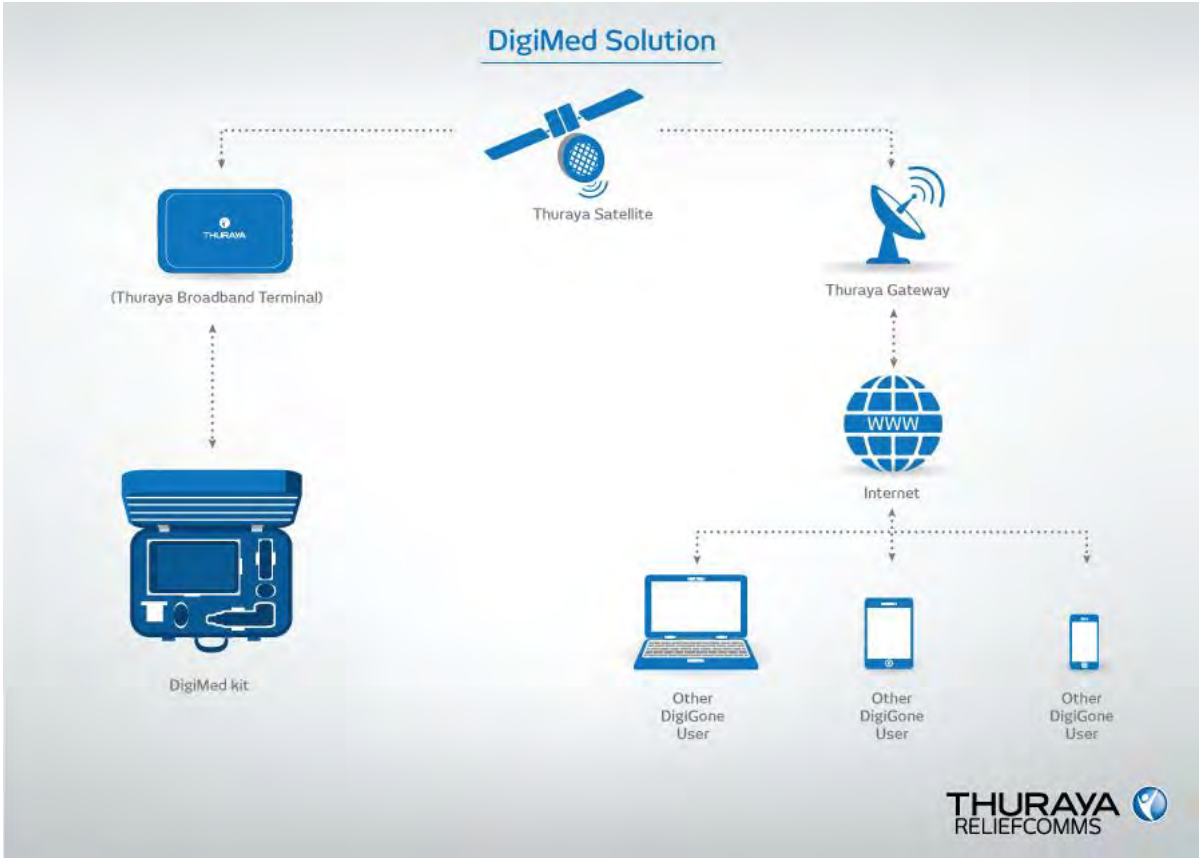


Image Source: https://www.thuraya.com/-/media/thuraya/partners/images/digimed-kit.jpg?la=en&hash=0CD8D5F5B20834A164E049967F279A058211A2C4

Starlink

- The system will not directly connect from its satellites to handsets (unlike the constellations from Iridium , Globalstar, Thuraya and Inmarsat). Instead, it will be linked to flat user terminals the size of a pizza box, which will have phased array antennas and track the satellites. The terminals can be mounted anywhere, as long as they can see the sky.

Fig1: Starlink user terminal

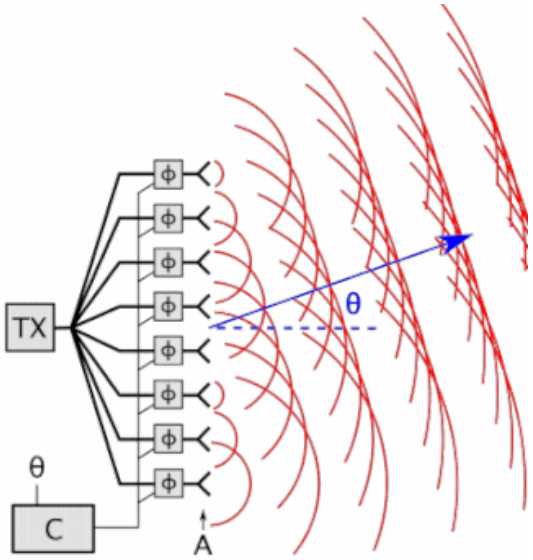


Fig3: Phased array

Fig2: Starlink Router

END OF SURVEY BY POLIMEY

Image Source:

https://upload.wikimedia.org/wikipedia/commons/thumb/0/0f/Starlink_Lieferumfang_%2851227435151%29.jpg/440px-Starlink_Lieferumfang_%2851227435151%29.jpg
https://upload.wikimedia.org/wikipedia/commons/thumb/d/df/Starlink_Router_%2851228513015%29.jpg/440px-Starlink_Router_%2851228513015%29.jpg

09. Paraguay's first satellite, GuaraniSat-1

ラテンアメリカ時報　2021年夏号(表紙カバー)

Issue No. 1435
Summer of 2021

Paraguay's first satellite, "GuaraniSat-1"

特集 変貌を遂げる南米内陸国パラグアイ

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

In 2021, the *Japan Association of Latin America and the Caribbean* published this summer issue of its main publication: ラテンアメリカ時報. It contains an article about Paraguay's first satellite – and it was written by Prof Cho in Japanese. On the following pages, you will find this article's English and Spanish versions. Translations were done by Adolfo Jara (Kyutech Phd student).

Paraguay's first satellite, GuaraniSat-1

(Translated from Japanese)

Kyushu Institute of Technology. Laboratory of Lean Satellite Enterprises and In-Orbit Experiments.
Prof. Mengu Cho

1. Introduction

On March 14, 2021, the artificial satellite "GuaraniSat-1" was released from the Japanese Experiment Module “Kibo” on the International Space Station (ISS), and the satellite radio waves were received by the ground station in Paraguay. (Fig. 1). The size of the satellite is small (10cm x 10cm x 10cm), but for Paraguay the release of its first satellite was a historic moment. GuaraniSat-1 is one of three BIRDS-4 satellites jointly developed by Kyushu Institute of Technology (hereinafter referred to as “Kyutech”) with the Paraguay Space Agency (AEP) and the University of the Philippines Diliman (UPD). In this article, I would like to briefly describe the background for the realization of Paraguay's first artificial satellite and the significance of this satellite for the country.

Figure 1: BIRDS-4 satellites released from the ISS (second to fourth from the right, GuaraniSat-1 is the fourth)
(Photo courtesy of Japan Aerospace Exploration Agency (JAXA))

2. What is the BIRDS program?

Since the 2000s, the development and use of nanosatellites has proliferated around the world. Conventional satellites have been developed with the requirement of "absolutely working even in a hostile space environment". A characteristic of nanosatellites is that their development is “cheaper and faster”, even tolerating some faults. That is the goal we are aiming for. Although individual satellites may fail, the strategy is to immediately launch the next satellite incorporating the lessons learned to improve reliability, and while conventional satellites are made of expensive parts designed for space and with long-delivery time. Small satellites, on the other hand, often use parts with low cost and short delivery times. More than 200 nanosatellites are launched around the world each year. The so-called CubeSat, which is standardized at a size of 10 cm cubic, has contributed to significantly lowering the technical and financial barriers enabling entry to space development and utilization. Hence, the CubeSat is a great tool for universities, companies and countries that have previously been barred from space due to high cost. In particular, emerging countries are actively entering space using CubeSats, and Paraguay is the 29th of them. In Latin America, countries such as Colombia (2007), Ecuador (2013), Peru (2013), Uruguay (2014), Costa Rica (2018) and Guatemala (2020) have entered space with CubeSats. Of these, satellites from Costa Rica and Guatemala received support from Japan during development and launch.

Among emerging countries, there is a strong demand for human resource development for space capacity building through nanosatellites. In 2011, Kyutech started a project for international students in collaboration with the United Nations Office for Outer Space Affairs (UNOOSA) in order to provide hands-on education utilizing the infrastructure of the Center for Nanosatellite Testing (CeNT) which was opened in 2010. In 2013, the Space Engineering International Course (SEIC) was established at the graduate school and began full-scale development of space capacity building in emerging countries. Under such circumstances, the Joint Global Multi-Nation Birds (abbreviated as “BIRDS”) program was launched in October 2015. The purpose of the BIRDS program is to "make the first step towards an independent and sustainable space program by successfully launching and operating the first satellite of each country". Graduate students enrolled in SEIC are responsible for BIRDS satellite development. After learning about the process of the satellite project from the beginning to the end, the student aims to become a resource who will launch a space education and research project in his home country after returning from Japan.

BIRDS Project	Project start	Satellite deployment	Number of satellites	Participating countries (Underlined country is the owner of satellite)
BIRDS-1	2015/10	2017/7	5	Japan, Ghana*, Mongolia*, Nigeria, Bangladesh*, Thailand, Taiwan
BIRDS-2	2016/11	2018/8	3	Japan, Bhutan*, Malaysia, Philippines
BIRDS-3	2017/10	2019/6	3	Japan, Sri Lanka*, Nepal*
BIRDS-4	2018/11	2021/3	3	Japan, Paraguay*, Philippines
BIRDS-5	2020/7	2022 (planned)	3	Japan, Zimbabwe*, Uganda*

Table: BIRDS Program Overview

Asterisk indicates the first satellite of that nation.

The BIRDS program has created multiple satellites with exactly the same design for each generation and has implemented five generations of satellite projects so far (Table 1). The short-term goal of the program is to build and operate satellites. This gives the students the confidence to repeat in their home nations. But that is not enough. We must ensure that students can start their own space programs when they return to their home countries. In that sense, the success of the program is only achieved when the students are able to develop and operate the second satellite after returning to their home countries. Therefore, we intend to teach students the entire process of satellite projects. Students will learn what is needed during each phase of satellite development, what decisions must be made, how to make decisions, and how to assess and address risks.

The BIRDS program aims to form a network (“BIRDS Network”) for space education and research. This network consists of two components: a human network and a ground station network. Through a two-year intensive satellite project, students will immerse themselves in the importance of teamwork and collaboration in space projects. The human network built through the BIRDS project can be a great help for the space program in its beginnings to overcome the challenges. The ground station network is the backbone of the network. Through the ground station network, even if an institution does not have a satellite, it is possible to carry out space education and research by participating in the operation of the partner's satellite. The BIRDS Network is supported by the Research Center Formation Project of the Japan Society for the Promotion of Science, with Costa Rica and Paraguay joining from Latin America. Details of the BIRDS program are also available in the monthly BIRDS Project Newsletter (Archive: http://birds1.birds-project.com/newsletter.html).

3. Background of Paraguay participation and BIRDS-4 Project

Space entry by nanosatellites is actively carried out in Latin American countries, and as of 2017, Paraguay was the only major South American country that did not enter space.

In April 2018, Dr. Maeda, an assistant professor at Kyushu Institute of Technology, visited Argentina and held a seminar in Cordoba. After the seminar, a young engineer from Paraguay (who came by bus from Asuncion for this seminar) handed over the business card of AEP Director Alejandro Román, and left a message saying, "I am interested in entering space using small satellites in Paraguay, please contact me." When Assistant Professor Maeda contacted Director Román after returning to Japan, he said that AEP would send a delegation including President Liduvino Vielman Díaz to UNISPACE+50 of the United Nations Office for Outer Space Affairs to be held in Vienna in June of the same year, so he proposed to have a meeting there. Prof. Cho was also present at the conference, and during the session, he was able to discuss the BIRDS program and the educational program of Kyutech (Fig. 2). After that, the story accelerated, and at the end of July, it was decided to participate in BIRDS-4, and Adolfo Jara was dispatched from AEP to Kyutech in early November. The BIRDS-4 project officially started on November 12th, partly due to the gathering of students from Paraguay and the Philippines. Another engineer from Paraguay, Anibal Mendoza, came to Japan in March 2019, and both have been enrolled in Kyutech Graduate School since April (Fig. 3).

Figure 2: First meeting in Vienna in June 2018 (author on the far right, next to President Liduvino Vielman Díaz)

Figure 3: Anibal Mendoza (right) and Adolfo Jara (left) from AEP who studied abroad at Kyutech.

BIRDS-4 consists of three CubeSats, including GuaraniSat-1. All three satellites have the same design. After starting the project on November 12, 2018, we delivered the satellites (Fig. 4) to the Tsukuba Space Center on October 6, 2020. There is a limit to what a small satellite of only 10 cm on a side can do, but we plan to conduct experiments that can be used in future space applications. In addition, we plan to publish photos of Paraguay and the Philippines taken from orbit so that the public in general can feel closer to the universe. One of the experiments carried out with BIRDS-4 is the Store & Forward experiment. In this experiment, the data transmitted from the terminal on the ground is temporarily stored in the memory inside the satellite (Store), and when the satellite comes over the ground station, the data is forwarded (Forward). Anyone with an amateur radio license can participate in BIRDS-4. The terminal on the ground is small enough to fit in the palm of a hand, and many applications are expected. For example, in an experiment that AEP is considering, it is planned to set a trap to catch insects called kissing bugs that transmit Chagas disease in remote rural areas, and to transmit the number of caught insects to the satellites by radio waves. In the Philippines, they are considering an experiment to send meteorological data from remote islands.

Figure 4: Flight Model of BIRDS-4 Satellites

The BIRDS-4 satellites were launched from Wallops Island in the United States toward the ISS at 1:36 p.m. on February 20, 2021, Paraguay time. It is said that 2.9 million people watched the launch on TV in Paraguay, which has a population of around 7 million. It was then released from the ISS at 7am local time in Paraguay on March 14. The BIRDS-4 satellite started transmitting beacon signals 30 minutes after the release from the ISS, and amateur radio stations around the world, including the Paraguay station, were able to receive radio waves from all three satellites. The BIRDS-4 satellites are in operation, and the data will be released after the radio license is officially issued.

4. Expectations for the future

With GuaraniSat-1, Paraguay finally entered space, but this is only the first step. I would recommend Paraguay to start the second satellite development promptly and proceed with space development and utilization without interrupting the momentum gained with the first satellite in the BIRDS-4 project. With nanosatellite technology, it is possible to develop and operate satellites that meet the needs of their country at low cost, and it is possible to bring benefits beyond the money spent to improve people's lives and economic development.

In Paraguay, an agricultural country, the use of satellite data (images, soil sensor data, etc.) for agriculture has great potential, and even data obtained by nanosatellites can be fully used. It can also be used to collect weather, environmental, and disaster prevention data in remote areas where communication infrastructure is fragile through Store & Forward, as well as to combat infectious diseases such as those tested with BIRDS-4 satellites. By collecting these satellite data, analyzing, and going through the cycle of using them to improve people's lives, they can surely climb the steps toward larger-scale space utilization. What is needed most of all for this is human resources who understand what can be done using space and what is necessary to use space. Nanosatellites can bring projects to life quickly and cheaply and is the best tool for human resource development. In addition to the two students mentioned above, two more international students have been sent from AEP to Kyutech, and they are currently operating the BIRDS-4 satellite and participating in other satellite projects. We will continue supporting the development of the Paraguayan space program and promote joint satellite projects between Japan and Paraguay, valuing the ties created by the BIRDS-4 satellite.

END OF ENGLISH TRANSLATION

l primer satélite de Paraguay, GuaraniSat-1

(Traducido del japonés)

Kyushu Institute of Technology. Laboratory of Lean Satellite Enterprises and In-Orbit Experiments.
Prof. Mengu Cho

1. Introducción.
El 14 de marzo de 2021, el satélite artificial "GuaraniSat-1" fue lanzado desde el Módulo Experimental Japonés "Kibo" en la Estación Espacial Internacional (EEI), y las ondas de radio del satélite fueron recibidas por la estación terrena en Paraguay. (Figura 1). El tamaño del satélite es pequeño (10 cm x 10 cm x 10 cm), pero para Paraguay el lanzamiento de su primer satélite fue un momento histórico. El GuaraniSat-1 es uno de los tres satélites BIRDS-4 desarrollados conjuntamente por el Instituto de Tecnología de Kyushu (en adelante, “Kyutech”) con la Agencia Espacial del Paraguay (AEP) y la Universidad de Filipinas Diliman (UPD). En este artículo, me gustaría describir brevemente los antecedentes para la realización del primer satélite artificial de Paraguay y la importancia de este satélite para el país.

Figura 1: Satélites BIRDS-4 lanzados desde la EEI (segundo al cuarto desde la derecha, GuaraniSat-1 es el cuarto) (Fotografía cortesía de la Agencia de Exploración Aeroespacial de Japón (JAXA))

2. ¿Qué es el programa BIRDS?

Desde la década del 2000, el desarrollo y uso de nanosatélites ha proliferado en todo el mundo. Los satélites convencionales se han desarrollado con el requisito de "trabajar absolutamente incluso en un entorno espacial hostil". Una característica de los nanosatélites es que su desarrollo es “más barato y rápido”, tolerando incluso algunas fallas. Ese es el objetivo al que aspiramos. Aunque los satélites individuales pueden fallar, la estrategia es lanzar inmediatamente el próximo satélite incorporando las lecciones aprendidas para mejorar la confiabilidad, y mientras que los satélites convencionales están hechos de piezas costosas diseñadas para el espacio y con un tiempo de entrega prolongado, los satélites pequeños, por otro lado, suelen utilizar piezas de bajo costo y plazos de entrega cortos. Cada año se lanzan más de 200 nanosatélites en todo el mundo. El llamado CubeSat, que está estandarizado en un tamaño de 10 cm cúbicos, ha contribuido a reducir significativamente las barreras técnicas y financieras que permiten el acceso al desarrollo y la utilización del espacio. Por lo tanto, el CubeSat es una gran herramienta para universidades, empresas y países a los que anteriormente se le dificultaba el acceso al espacio debido a su alto costo. En particular, los países emergentes están ingresando activamente al espacio utilizando CubeSats, y Paraguay es el número 29 de ellos. En América Latina, países como Colombia (2007), Ecuador (2013), Perú (2013), Uruguay (2014), Costa Rica (2018) y Guatemala (2020) han alcanzado el espacio utilizando CubeSats. De estos, los satélites de Costa Rica y Guatemala recibieron apoyo de Japón durante el desarrollo y lanzamiento.

Entre los países emergentes, existe una fuerte demanda de desarrollo de recursos humanos para la creación de capacidad espacial a través de nanosatélites. En 2011, Kyutech inició un proyecto para estudiantes internacionales en colaboración con la Oficina de Asuntos del Espacio Ultraterrestre de las Naciones Unidas (UNOOSA) con el fin de proporcionar educación práctica utilizando la infraestructura del Centro de Pruebas de Nanosatélites (CeNT) que se inauguró en 2010. En 2013, el Curso Internacional de Ingeniería Espacial (SEIC) se estableció en la escuela de posgrado y comenzó el desarrollo a gran escala de la creación de capacidad espacial en países emergentes. En tales circunstancias, en octubre de 2015 se puso en marcha el programa Joint Global Multi-Nation Birds (abreviado como "BIRDS"). El objetivo del programa BIRDS es "dar el primer paso hacia un programa espacial independiente y sostenible mediante el lanzamiento y operación exitosos del primer satélite de cada país". Los estudiantes de posgrado inscritos en SEIC son responsables del desarrollo de los satélites BIRDS. Después de conocer el proceso de un proyecto satelital desde el principio hasta el final, el estudiante aspira a convertirse en un recurso que pondrá en marcha un proyecto de educación e investigación espacial en su país de origen después de regresar de Japón.

Proyecto BIRDS	Inicio del proyecto	Puesta en órbita de los satélites	Número de satélites	Países participantes (los países subrayados son los propietarios de los satélites)
BIRDS-1	2015/10	2017/7	5	Japón, Ghana*, Mongolia*, Nigeria, Bangladesh*, Tailandia, Taiwán
BIRDS-2	2016/11	2018/8	3	Japón, Bután *, Malasia, Filipinas
BIRDS-3	2017/10	2019/6	3	Japón, Sri Lanka*, Nepal*
BIRDS-4	2018/11	2021/3	3	Japón, Paraguay*, Filipinas
BIRDS-5	2020/7	2022 (planificado)	3	Japón, Zimbabue *, Uganda*

Tabla Descripción general del programa BIRDS

El programa BIRDS ha creado múltiples satélites con exactamente el mismo diseño para cada generación y ha implementado cinco generaciones de proyectos satelitales hasta la fecha (Tabla 1). El objetivo a corto plazo del programa es construir y operar satélites. Esto les da a los estudiantes la confianza para replicar en sus países de origen. Pero eso no es suficiente. Debemos asegurarnos de que los estudiantes puedan iniciar sus propios programas espaciales cuando regresen a sus países de origen. En ese sentido, el éxito del programa solo se logra cuando los estudiantes son capaces de desarrollar y operar el segundo satélite después de regresar a sus países de origen. Por lo tanto, pretendemos enseñar a los estudiantes todo el proceso de un proyecto satelital. Los estudiantes aprenderán qué se necesita durante cada fase del desarrollo del satélite, qué decisiones deben tomarse, cómo tomar decisiones y cómo evaluar y abordar los riesgos.

El programa BIRDS tiene como objetivo formar una red ("Red BIRDS") para la educación y la investigación espacial. Esta red consta de dos componentes: una red humana y una red de estaciones terrenas. A través de un proyecto satelital intensivo de dos años, los estudiantes aprenderán la importancia del trabajo en equipo y la colaboración en proyectos espaciales. La red humana construida a través del proyecto BIRDS puede ser de gran ayuda para que el programa espacial supere los desafíos en sus inicios. La red de estaciones terrenas es la columna vertebral de la red. A través de la red de estaciones terrenas, incluso si una institución no cuenta con un satélite, es posible llevar a cabo educación e investigación espacial participando en la operación del satélite de una institución asociada. La Red BIRDS es apoyada por el Proyecto de Formación de Centros de Investigación de la Sociedad Japonesa para la Promoción de la Ciencia, con Costa Rica y Paraguay uniéndose desde América Latina. Los detalles del programa BIRDS también están disponibles en el boletín mensual del proyecto BIRDS. (Archivo: http://birds1.birds-project.com/newsletter.html).

3. Antecedentes de la participación de Paraguay y el Proyecto BIRDS-4

La incursión en el espacio mediante nanosatélites se lleva a cabo activamente en países de América Latina y, en 2017, Paraguay era el único país sudamericano importante que no accedía al espacio.

En abril de 2018, el Dr. Maeda, profesor asistente del Instituto Tecnológico de Kyushu, visitó Argentina y realizó un seminario en Córdoba. Luego del seminario, un joven ingeniero de Paraguay (que vino en bus desde Asunción para este seminario) entregó la tarjeta de presentación del director de la AEP, Alejandro Román, y dejó un mensaje que decía: "Me interesa incursionar en el espacio usando pequeños satélites en Paraguay, por favor póngase en contacto conmigo." Cuando el profesor asistente Maeda se puso en contacto con el director Román después de regresar a Japón, este le dijo que la AEP enviaría una delegación que incluía al presidente Liduvino Vielman Díaz a UNISPACE+50 de la Oficina de Asuntos del Espacio Ultraterrestre de las Naciones Unidas que se celebraría en Viena en junio del mismo año, así que le propuso tener una reunión allí. El profesor Cho también estuvo presente en la conferencia, y durante la sesión, pudo discutir el programa BIRDS y el programa educativo de Kyutech (Figura 2). Después de eso, la historia se aceleró y, a fines de julio la AEP decidió participar en BIRDS-4, y Adolfo Jara fue enviado desde la AEP a Kyutech a principios de noviembre. El proyecto BIRDS-4 comenzó oficialmente el 12 de noviembre, en parte debido a la necesidad de reunir a los estudiantes de Paraguay y Filipinas. Otro ingeniero de Paraguay, Anibal Mendoza, llegó a Japón en marzo de 2019, y ambos se inscribieron en la Escuela de Graduados de Kyutech desde abril (Figura 3).

Figura 2: Primera reunión en Viena en junio de 2018 (el autor de este artículo sentado en el extremo derecho, junto al presidente Liduvino Vielman Díaz)

Figura 3: Anibal Mendoza (derecha) y Adolfo Jara (izquierda) de la AEP, estudiantes extranjeros en Kyutech.

BIRDS-4 consta de tres CubeSats, incluido el GuaraniSat-1. Los tres satélites tienen el mismo diseño. Después de iniciar el proyecto el 12 de noviembre de 2018, entregamos los satélites (Figura 4) al Centro Espacial Tsukuba el 6 de octubre de 2020. Hay un límite de lo que puede hacer un pequeño satélite de solo 10 cm de lado, pero planeamos realizar experimentos que puedan usarse en futuras aplicaciones espaciales. Además, tenemos previsto publicar fotos de Paraguay y Filipinas tomadas desde la órbita para que el público en general pueda sentirse más cerca del universo. Uno de los experimentos llevados a cabo con BIRDS-4 es el experimento Store & Forward. En este experimento, los datos transmitidos desde la terminal en tierra se almacenan temporalmente en la memoria dentro del satélite (Store), y cuando el satélite pasa sobre la estación terrena, los datos se reenvían (Forward). Cualquier persona con una licencia de radioaficionado puede participar en BIRDS-4. La terminal en tierra es lo suficientemente pequeña como para caber en la palma de la mano, y se esperan muchas aplicaciones. Por ejemplo, en un experimento que está considerando la AEP, se planea colocar una trampa para detectar insectos llamados chinches que transmiten la enfermedad de Chagas en áreas rurales remotas, y transmitir la cantidad de insectos detectados a los satélites por ondas de radio. En Filipinas, están considerando un experimento para enviar datos meteorológicos desde islas remotas.

Figura 4: Modelo de vuelo de los satélites BIRDS-4

Los satélites BIRDS-4 se lanzaron desde la isla Wallops en los Estados Unidos hacia la EEI a la 1:36 p.m. el 20 de febrero de 2021, hora de Paraguay. Se estima que 2,9 millones de personas vieron el lanzamiento por televisión en Paraguay, que tiene una población de alrededor de 7 millones. Luego fue lanzado desde la EEI el 14 de marzo a las 7 am hora local en Paraguay. El satélite BIRDS-4 comenzó a transmitir señales de baliza 30 minutos después de la puesta en órbita desde la EEI, y las estaciones de radioaficionados de todo el mundo, incluida la estación de Paraguay, recibieron las ondas de radio de los tres satélites. Los satélites BIRDS-4 están en funcionamiento y los datos se publicarán después de que se emita oficialmente la licencia de radio.

4. Expectativas para el futuro

Con el GuaraniSat-1, Paraguay finalmente accedió al espacio, pero este es solo el primer paso. Recomendaría a Paraguay que comience el desarrollo del segundo satélite rápidamente y proceda con el desarrollo y la utilización del espacio sin interrumpir el impulso ganado con el primer satélite en el proyecto BIRDS-4. Con la tecnología de nanosatélites, es posible desarrollar y operar satélites que satisfagan las necesidades del país a bajo costo, y es posible traer beneficios más allá del dinero invertido para mejorar la calidad de vida y el desarrollo económico de las personas.

En Paraguay, un país agrícola, el uso de los datos satelitales (imágenes, datos de sensores de suelo, etc.) para la agricultura tienen un gran potencial, e incluso los datos obtenidos por nanosatélites se pueden aprovechar al máximo. También se pueden utilizar para recopilar datos meteorológicos, ambientales y de prevención de desastres en áreas remotas donde la infraestructura de comunicación es frágil utilizando Store & Forward, así como para combatir enfermedades como las probadas con los satélites BIRDS-4. Al recopilar estos datos satelitales, analizarlos y pasar por el ciclo de su uso para mejorar la vida de las personas, seguramente podrán avanzar hacia la utilización del espacio a mayor escala. Lo que más se necesita para esto son recursos humanos que entiendan qué se puede hacer usando el espacio y qué es necesario para usar el espacio. Los nanosatélites pueden dar vida a proyectos de forma rápida y económica y son la mejor herramienta para el desarrollo de recursos humanos. Además de los dos estudiantes mencionados anteriormente, dos estudiantes internacionales más fueron enviados desde Paraguay a Kyutech, y actualmente están operando los satélites BIRDS-4 y participando en otros proyectos satelitales. Continuaremos apoyando el desarrollo del programa espacial paraguayo y promoviendo proyectos satelitales conjuntos entre Japón y Paraguay, valorando los lazos creados por los satélites BIRDS-4.

END OF SPANISH TRANSLATION

10. Nihonbashi Space Week

宇宙の今を知り、未来を切り開く
日本のスタートアップ企業を中心に宇宙ビジネスの最前線に立つ企業が集結する国内最大級の宇宙ビジネス展示会

「TOKYO SPACE BUSINESS EXIHIBITION 2021」

をはじめ、同時期開催イベントとして、エンターテイメントイベントやビジネスアイデアコンテストなど様々な宇宙関連イベントが開催されます。

12/13(月)より日本橋にて開催されるアジア最大級の民間による宇宙ビジネスカンファレンス

「SPACETIDE 2021 Winter in NIHONBASHI」

とも連携し、日本橋を舞台にますます盛り上がりをみせる“宇宙”を是非ご体感ください。

DETAILS ARE HERE:

https://www.x-nihonbashi.com/spaceweek2021/

11. AGU mentions BIRDS-5: "Zimbabwe's Scientists Look Forward to Country's First Satellite"

Eos Science News by AGU

ABOUT SPECIAL REPORTS TOPICS PROJECTS NEWSLETTER SUBMIT TO *EOS*

Zimbabwe's Scientists Look Forward to Country's First Satellite

ZIMSAT-1 promises to expand Zimbabwe's remote sensing capabilities and allow it to better monitor natural resources.

CONTINUED ON THE NEXT PAGE

By **Munyaradzi Makoni** 12 November 2021

ZIMSAT-1, scheduled for launch in 2022, will be a CubeSat like these. Credit: NASA

Zimbabwe plans to launch its first satellite, ZIMSAT-1, in February 2022. The CubeSat will host a multispectral camera and image classification tool, as well as a device to transmit and receive signals from amateur radio operators. Scientists said these tools will allow stakeholders to more quickly and fully assess data for issues like ground cover and drought.

ZIMSAT-1 is the latest mission from the Joint Global Multi-Nation Birds Satellite (BIRDS) project, a multinational program to help countries build their first satellite. ZIMSAT-1 was built by Zimbabwean engineers working with the Kyushu Institute of Technology in Japan, and the Japan Aerospace Exploration Agency will launch it. In addition to the satellite itself, BIRDS supports a free app (BIRDS-NEST) with which satellite images from ZIMSAT-1 can be downloaded onto smartphones.

READ THE ENTIRE ARTICLE:
https://eos.org/articles/zimbabwes-scientists-look-forward-to-countrys-first-satellite

12. Column #8 by Fatima of El Salvador

BPN Español

- No. 8 -

Fatima Duran

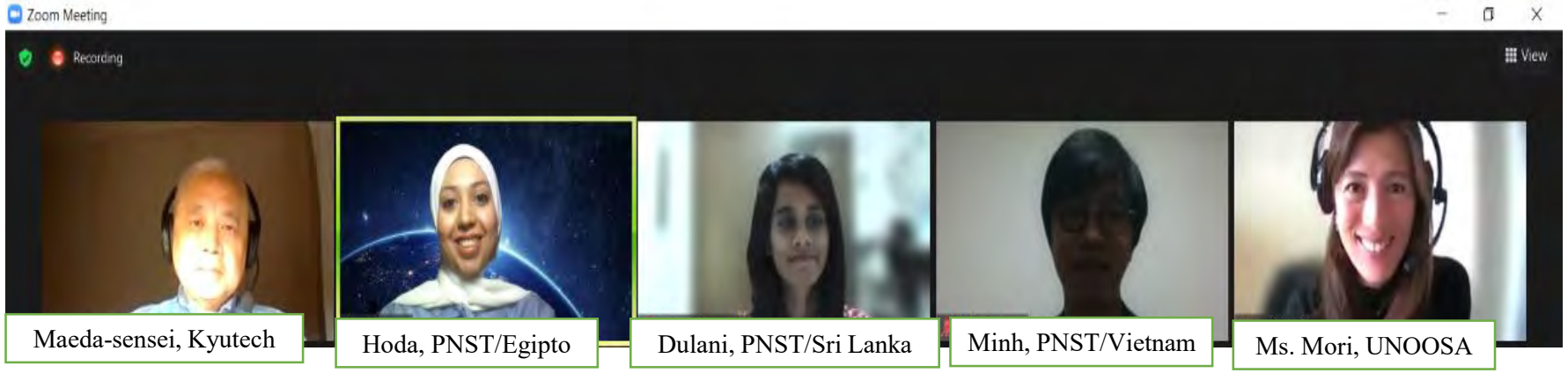
El Salvador

Estudiante SEIC/PNST

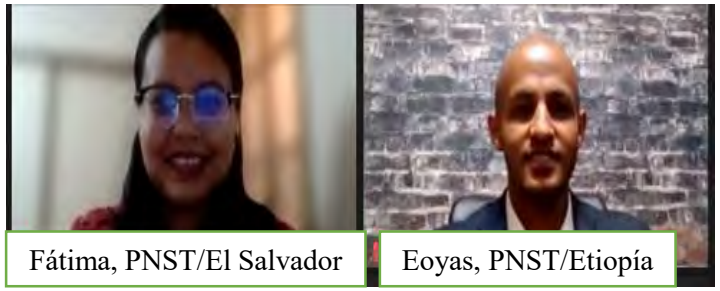
Noticias

¡Hola! En esta columna #8 de BPN Español te compartiré un poco sobre algunas actividades recientes en Kyutech.

Becarios actuales y ex-becarios del programa PNST/SEIC en Kyutech, participaron en un webinar organizado por la Oficina de Asuntos del Espacio Ultraterrestre (UNOOSA, por sus siglas en inglés), en donde compartieron su experiencia como parte del programa PNST/SEIC y sus estudios en Kyutech, así como también su motivación por aplicar al programa, lecciones aprendidas y su experiencia viviendo en Japón.



Maeda-sensei, Kyutech | Hoda, PNST/Egipto | Dulani, PNST/Sri Lanka | Minh, PNST/Vietnam | Ms. Mori, UNOOSA



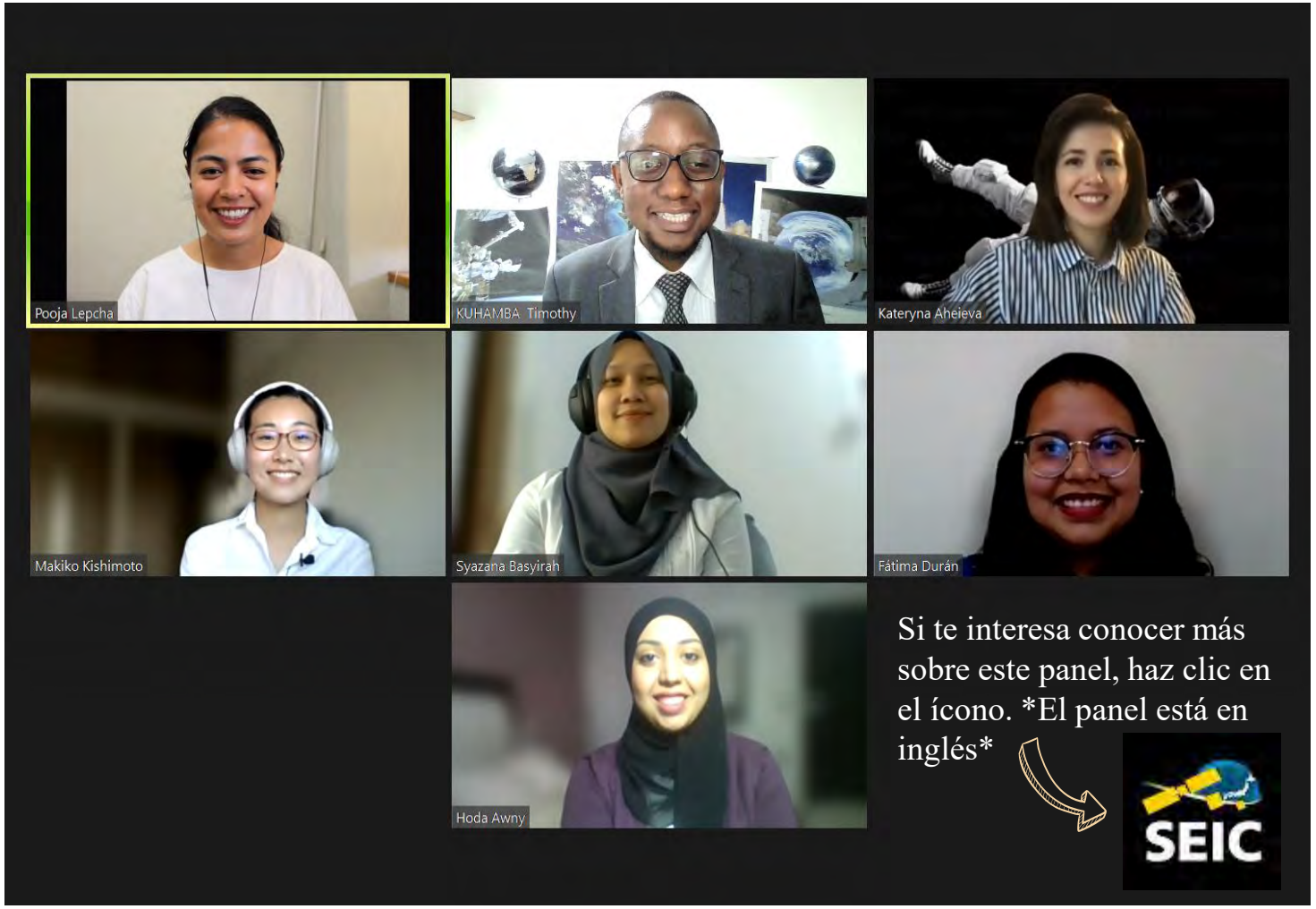
Fátima, PNST/El Salvador | Eoyas, PNST/Etiopía

Si deseas aplicar al programa PNST/SEIC, te invito a visitar el siguiente enlace y conocer de primera mano de qué se trata el programa PNST/SEIC y cómo es estudiar en Kyutech:

Para más información…

Noticias

Dentro de las celebraciones de la Semana Mundial del Espacio (World Space Week 2021), que se llevó a cabo en octubre, y bajo el tema 'Women in Space' , tres alumnas y tres ex-alumnas de Kyutech tuvimos la oportunidad de compartir nuestra experiencia tanto académica como laboral, en el caso de las segundas. Yo también tuve la oportunidad de participar de este panel, en el cual, aprendí diferentes perspectivas de cada una de mis compañeras y *seniors*. Me inspiró muchísimo la experiencia de cada una de ellas, sus retos, sus sueños y sus metas. En especial me inspiró saber mis *seniors*, mujeres profesionales graduadas de Kyutech, están liderando y participando activamente en el desarrollo de la industria espacial, algo que no dudo es el sueño de cada estudiante en esta fascinante rama de la ciencia.



Saturday, 13 Nov. 2021

Final Presentations of MIC-7

Hybrid Format

UNISEC-Global in Tokyo

http://www.spacemic.net/

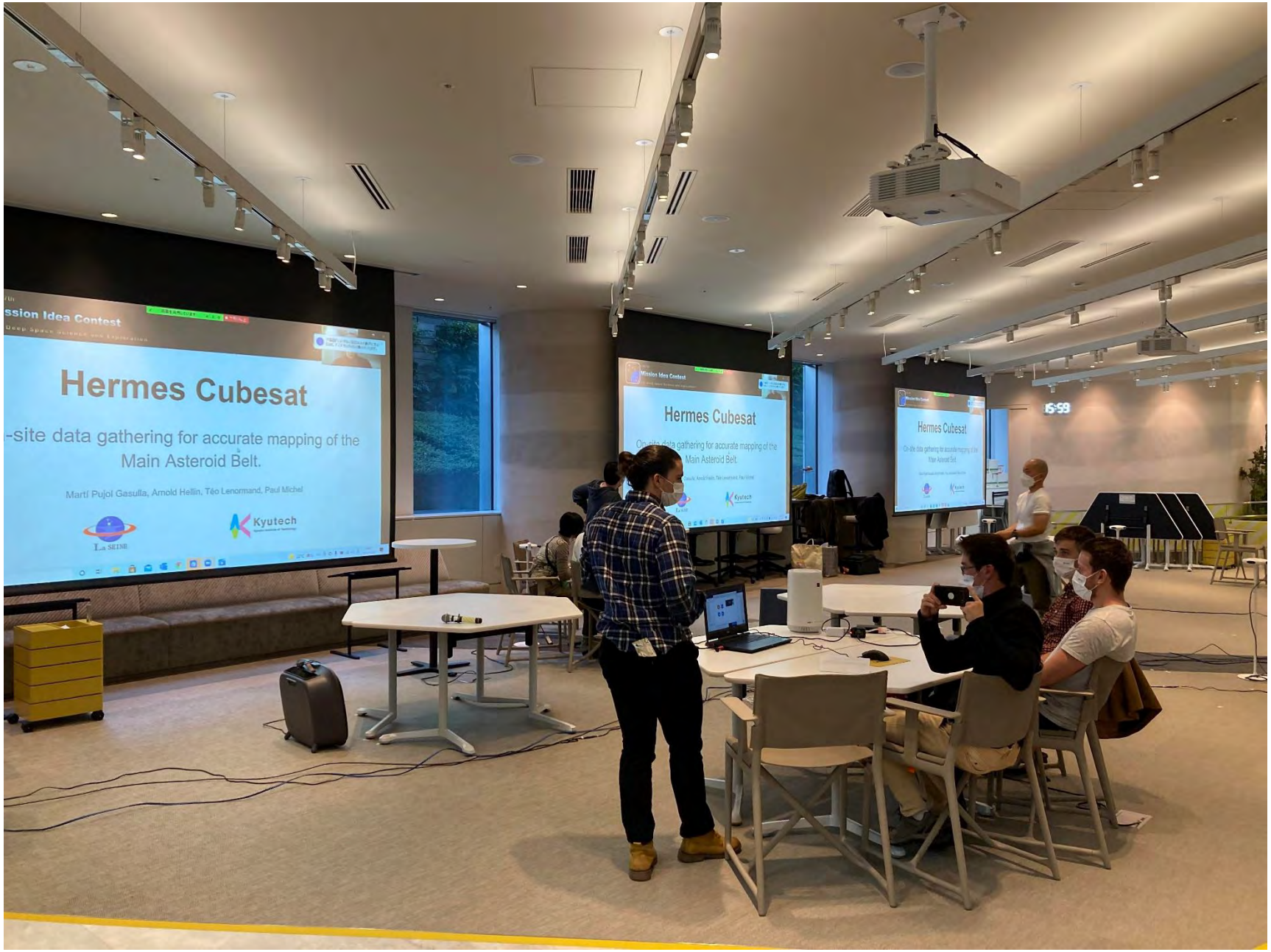
Kyutech Team

Program for the 7th Mission Idea Contest Final Presetation Session

November 13, 2021

Moderator: Shunichiro Nomura, University of Tokyo

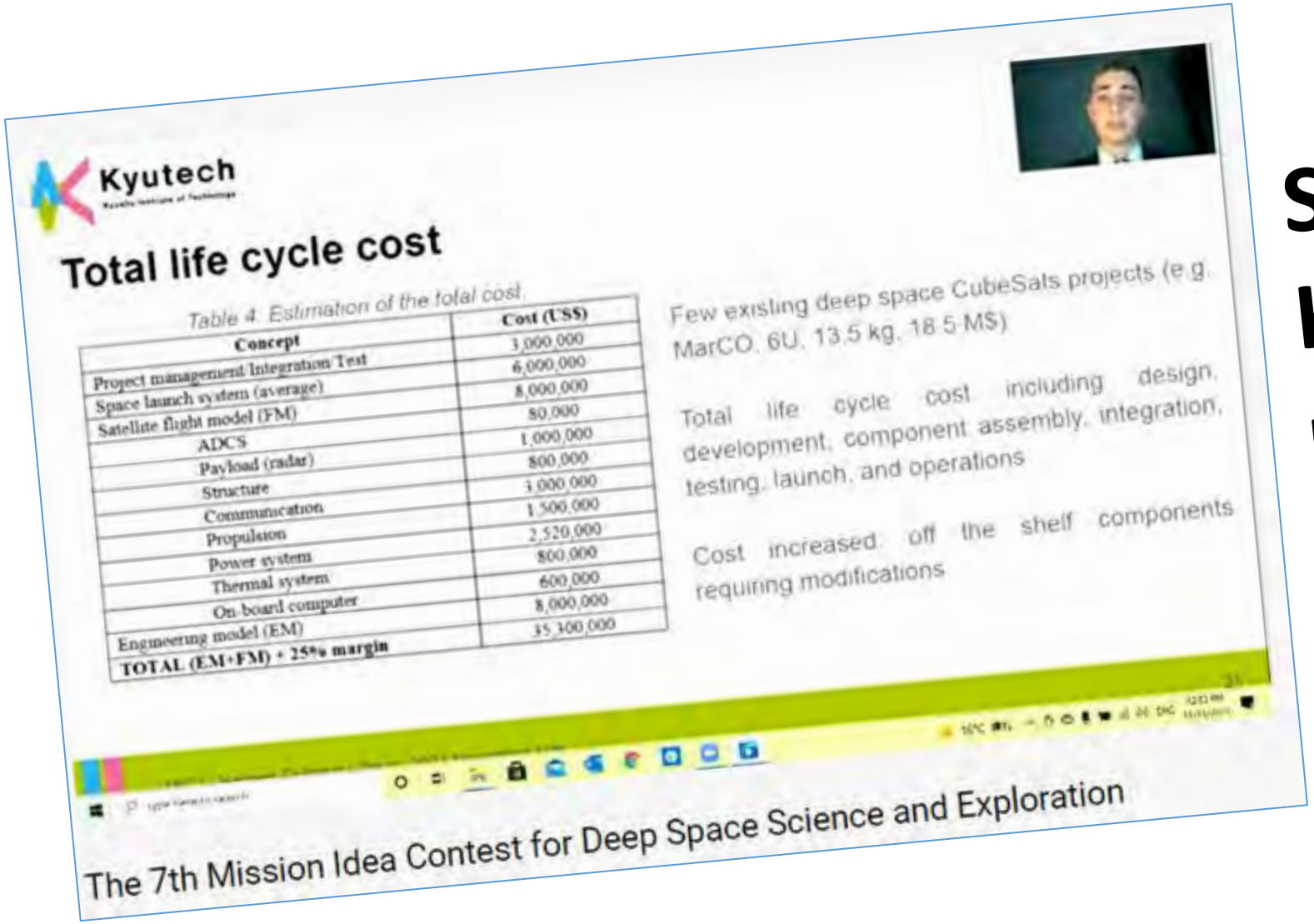
JST	JST	Title of presentation	Presenter(s)
9:00	9:10	Opening Speech	Shinichi Nakasuka, the University of Tokyo
9:10	9:40	Keynote Speech: Expand our planet, Expand our future- Japanese companies taking on commercial lunar exploration	Takahiro Nakamura, Director & COO, ispace, inc.
9:40	10:05	Disrupting Herpes virus investigation in lunar orbit: A system for animal cells analysis	André Arias Ovares, Andrés Cubero Salas, Ariadna Hernández Montoya, Carlos Montoya Marín, Daniel Chacón Mora, Fabián Fernández Aguilar, Karol Melissa Cerdas Mejías, Kenneth Chacón Fernández, Kevin Sánchez Ramírez, Marco Corrales Barrantes, María Francini Mora Chacón., Universidad de Costa Rica and Instituto Tecnologico de Costa Rica
10:05	10:30	Observation of Telomere Length Changes in Deep Space Radiation Environment	Jose Leonardo Brenes, David Limpus, Dayanna Vargas, Maria Fernanda Guerrero, Marlon Narvaez, Vanderbilt University, Universidad de Costa Rica, Universidad Autónoma de Centroamérica
10:30	10:45	Coffee Break	
10:45	11:10	LWISAT:Lunar Water Index Satellite Constellation	Karina Obando, Hector Gomez, Eduardo Leandro, Karolina Herrera, Sofia Alvarado, Antony Ramirez, Kimberly Leon, José Maria Jimenez Coronado, Universidad de Costa Rica and Instituto Tecnologico de Costa Rica, Universidad Invenio, Universidad del Valle de Guatemala, Indian Hills Community College
11:10	11:35	MINERVA: A CubeSat for demonstrating DNA damage mitigation against space radiation in C. elegans by using genetic modification	Sumeth Klomchitcharoen, Tanchanok Tangwattanasirikun, Jin Tangkijngamwong, Mahidol University
11:35	11:40	Photo session	
11:40	12:45	Luncheon Break	
12:45	13:10	Hermes CubeSat: on-site data gathering for accurate mapping of the Main Asteroid Belt	Marti Pujol Gasulla, Arnold Hellin, Teo Lenormand, Paul Michel, Kyushu Institute of Technology
13:10	13:35	ILNSS : Network for position on Lunar surface and interplanetary prototype	Thanapat Chotipun, Witchaphas Phopumyen, Tapaneeya Odmung, Bodindecha (Sing Singhaseni) School
13:35	14:00	Mission ACE: Apophis Close Encounter	Ying Liao, National Central University
14:00	14:15	Coffee break	
14:15	14:40	PARS: Precursor Asteroid Remote Survey	Batu Candan, Cansu Yildirim, Derya Sarmisak, Mehmet Esit, Sahin Ulas Koprucu, Sefa Cengiz, Semra Sultan Uzun, Sirin Yakupoglu, Middle East Technical University
14:40	15:05	Melchior - Microsatellite Explorer to a Long-period Comet in a Heliocentric Inner Orbit	Luigi Falanga, Giulia Caso, Andrea Ciccarelli, Francesco Cuomo, Sara De Masi, Federica Della Vecchia, Daniele Di Maio, Stefano Gala, Stefano Piatti, Alfonso Saveriano, Martina Scamardella, Dario Scilla, Raffaele Tarone, University of Naples Federico II
15:05	15:30	SCORE: Observation and Exploration of a Long Period Comet using Micro-Satellites	Vincenzo Porrino, University of Naples Federico II
15:30	16:00	Inivited speech: Novel Robotic Solutions for Space Exploration and Colonization	Stéphane Bonardi, ISAS/JAXA
16:00	16:30	Inivited speech : Juventas CubeSat in Support of Hera Mission	Mehdi Scoubeau, Gom Space
16:30	16:50	Award Ceremony	
16:50	17:00	Photo session	
17:00	17:10	Closing	



← Rehersal by the Kyutech Team on 12 Nov. 2021 at Tokyo site.

The 7th Mission Idea Contest For Deep Space Science and Exploration

Photo courtesy of Rei Kawashima



Screenshot of Kyutech presentation (distributed live on YouTube)

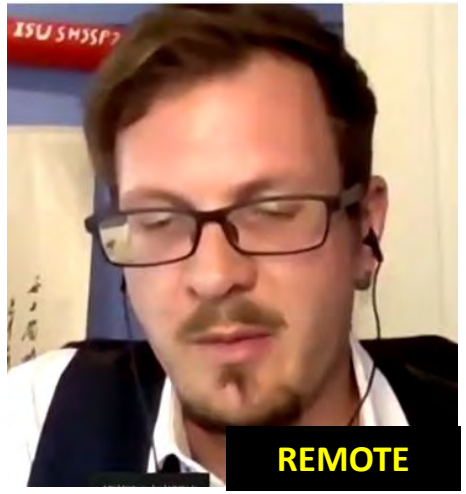
YouTube

The Q & A portion of the presentation by Kyutech Team

Prof. Funase

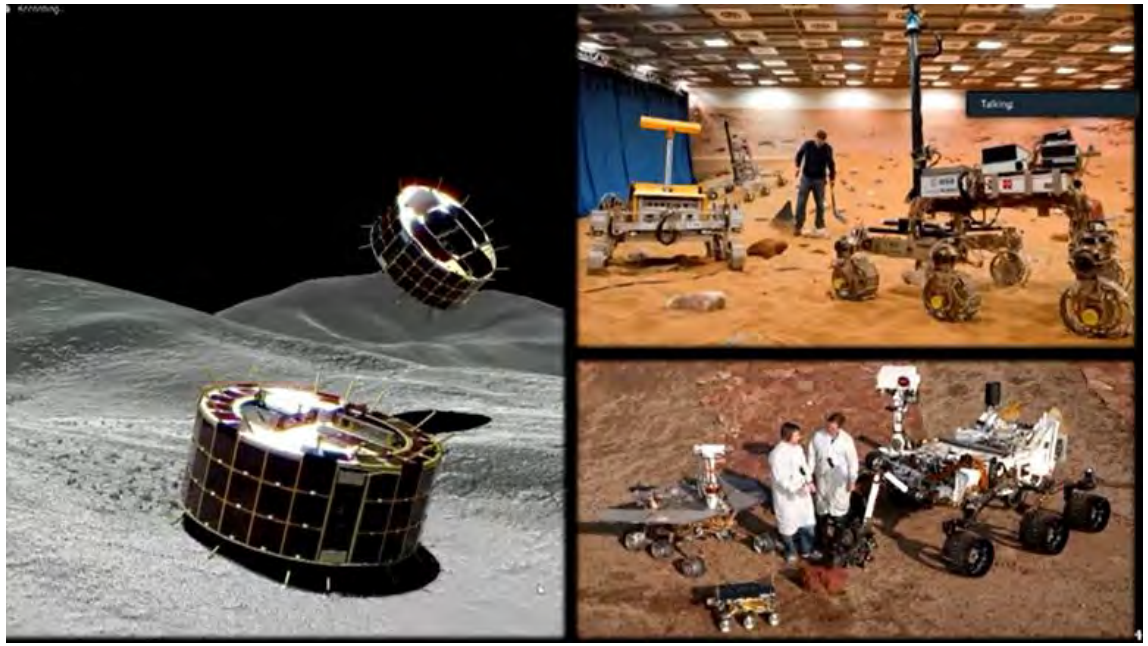
Prof. Nakasuka

Prof. Herman Steyn
(South Africa)



Nate Taylor
(Australia)

← Kyutech team responds to tough questions from the MIC-7 committee



Invited talk:

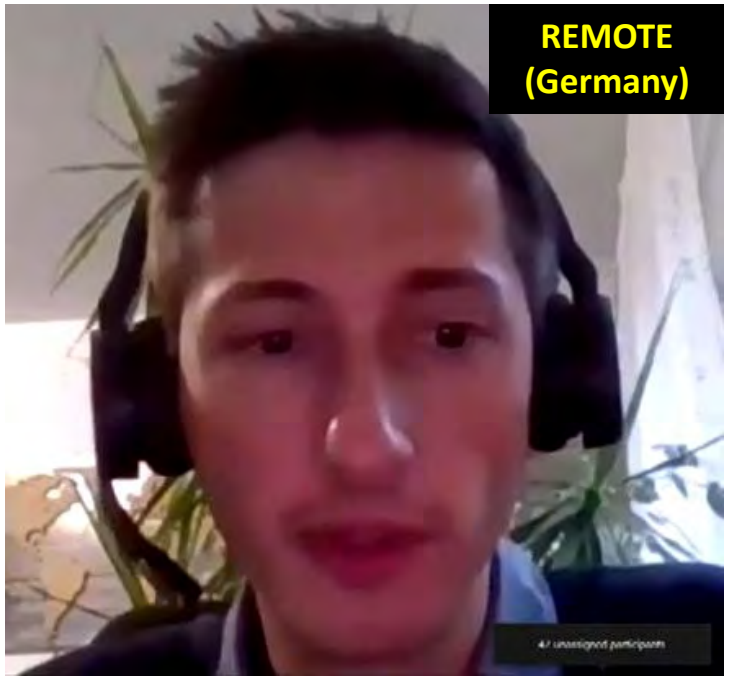
Novel Robotic Solutions for Space Exploration and Colonization

15:30-16:00

Stephanie Bonardi
ISAS/JAXA

Saturday
13 Nov 2021

The 7th
Mission Idea Contest
For Deep Space Science and Exploration



Invited talk:

Juventas CubeSat in Support of Hera Mission

16:00-16:30

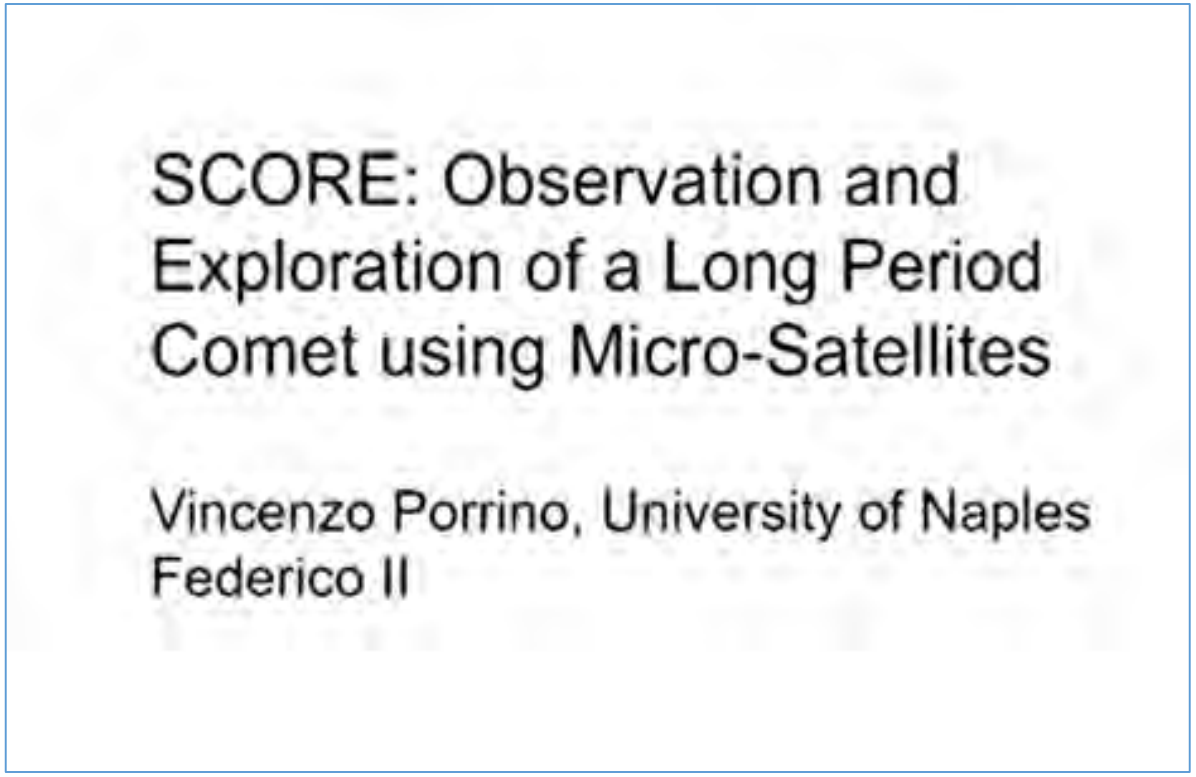
Mehdi Scoubeau
GOM SPACE


MISSION IDEA CONTEST 7
AWARD CEREMONY
MIC7 Final Presentation
November 13, 2021

16:30-16:50

Student Awards (2 were awarded)

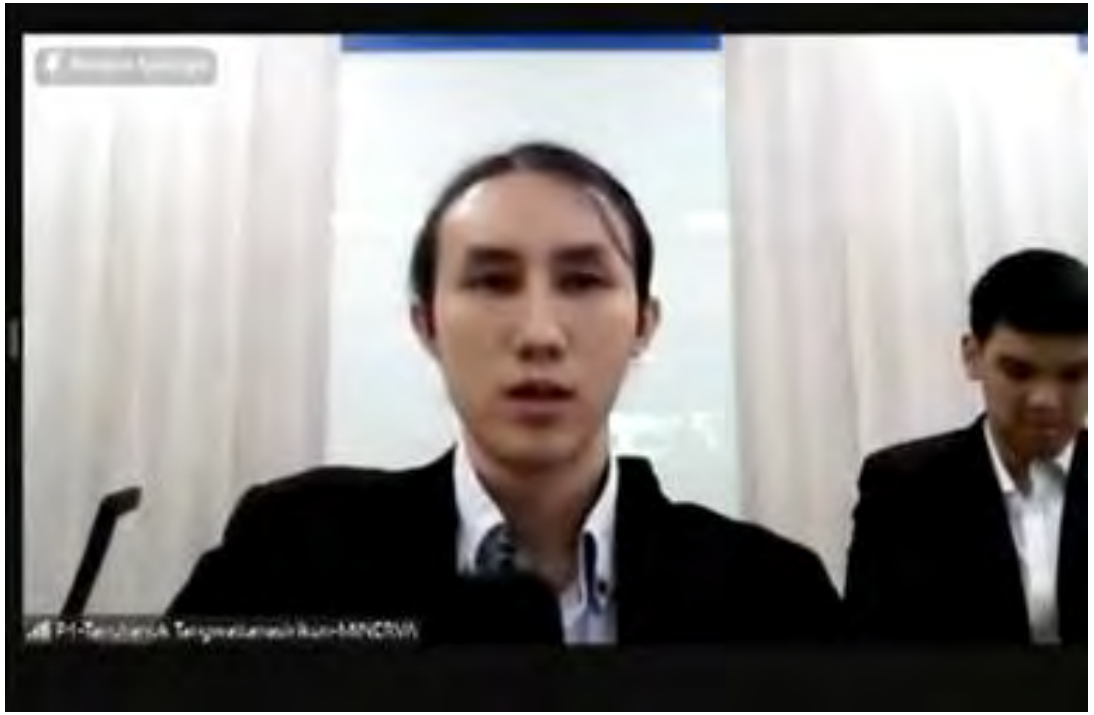
Costa Rica



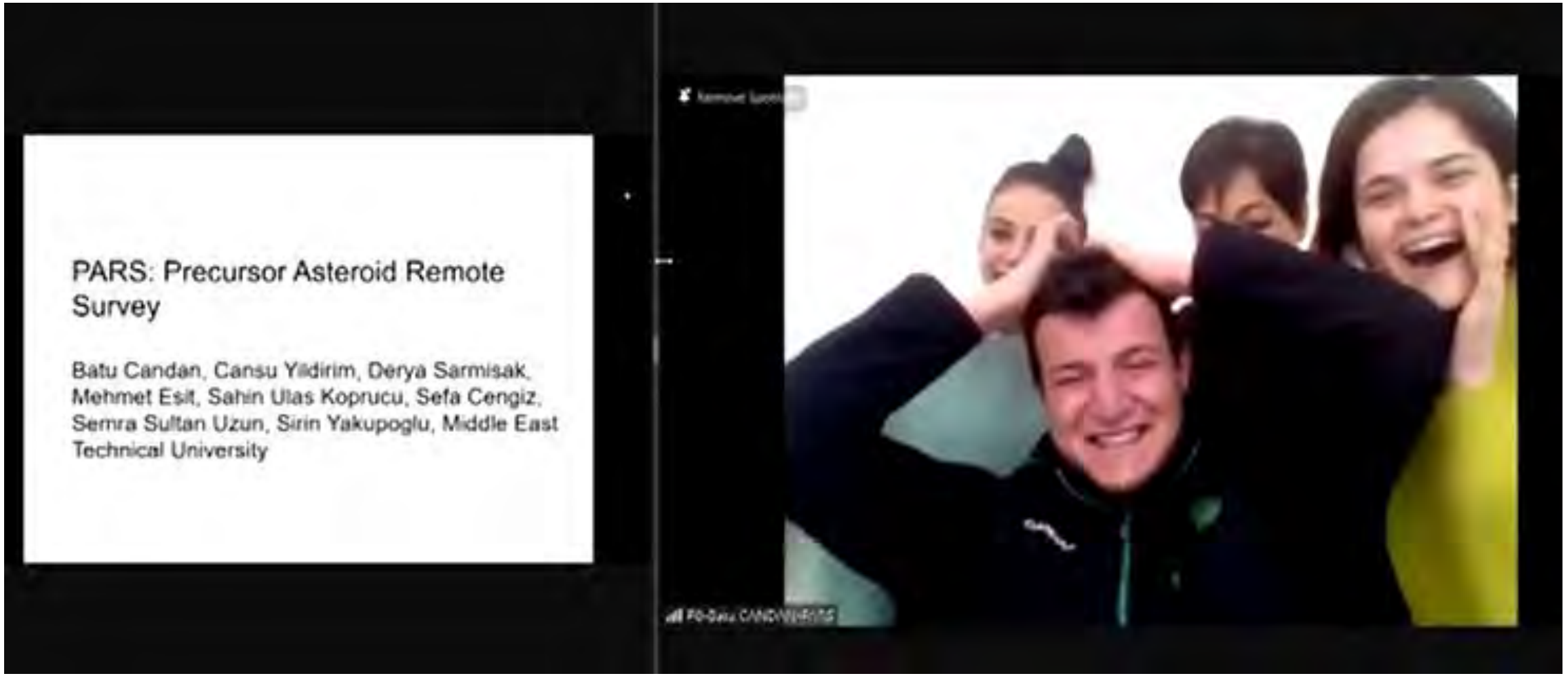
Italy

MINERVA: A CubeSat for demonstrating DNA damage mitigation against space radiation in C. elegans by using genetic modification

Sumeth Klomchitcharoen, Tanchanok Tangwattanasirikun, Jin Tangkijngamwong, Mahidol University



2nd place award to Thailand



Immediate jubilation

1st place award to Turkey

Prof. Nakasuka conveys certificates of appreciation to the Kyutech team

Well done to all!
– G. Maeda

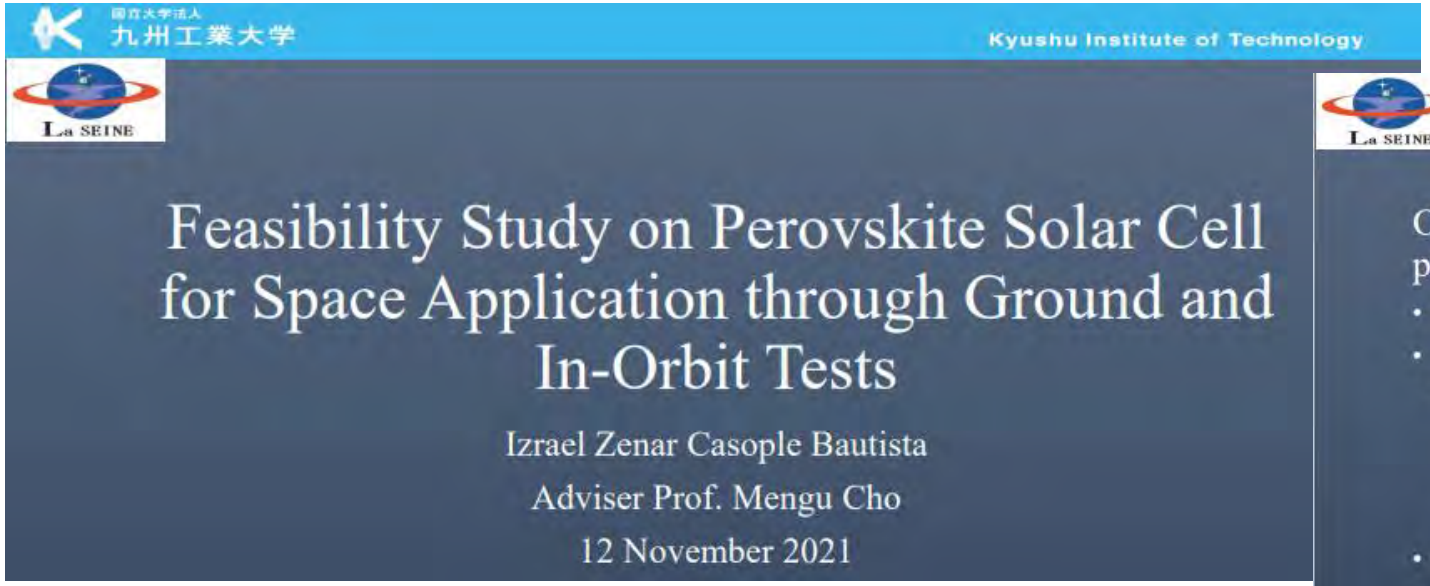
Group photo and closing remarks by Rei Kawashima (Secretary General of UNISEC-Global)

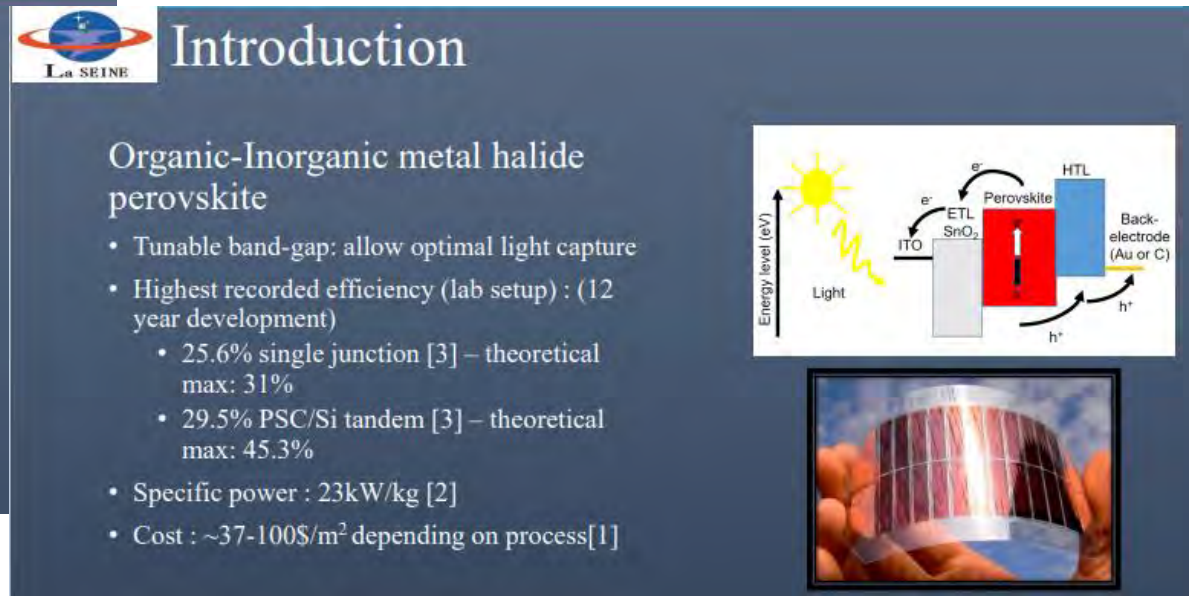
Check out this superb 2.5 minute long video summary of MIC-7:

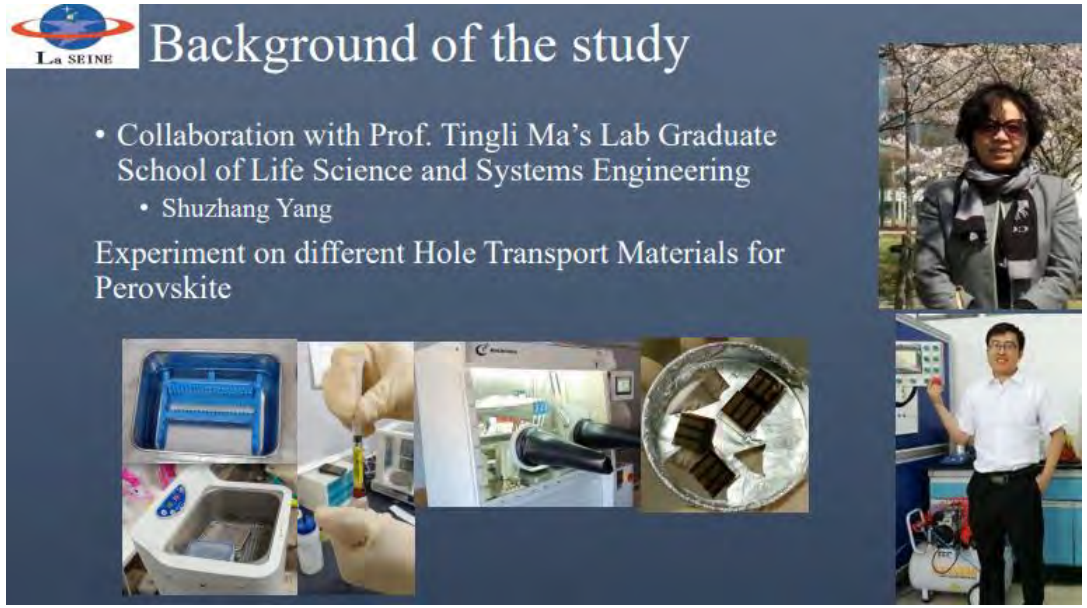
https://youtu.be/jJv5j8G7GVk

END OF THIS SECTION

14. Izrael Bautista defended his Phd thesis on 12 November 2021





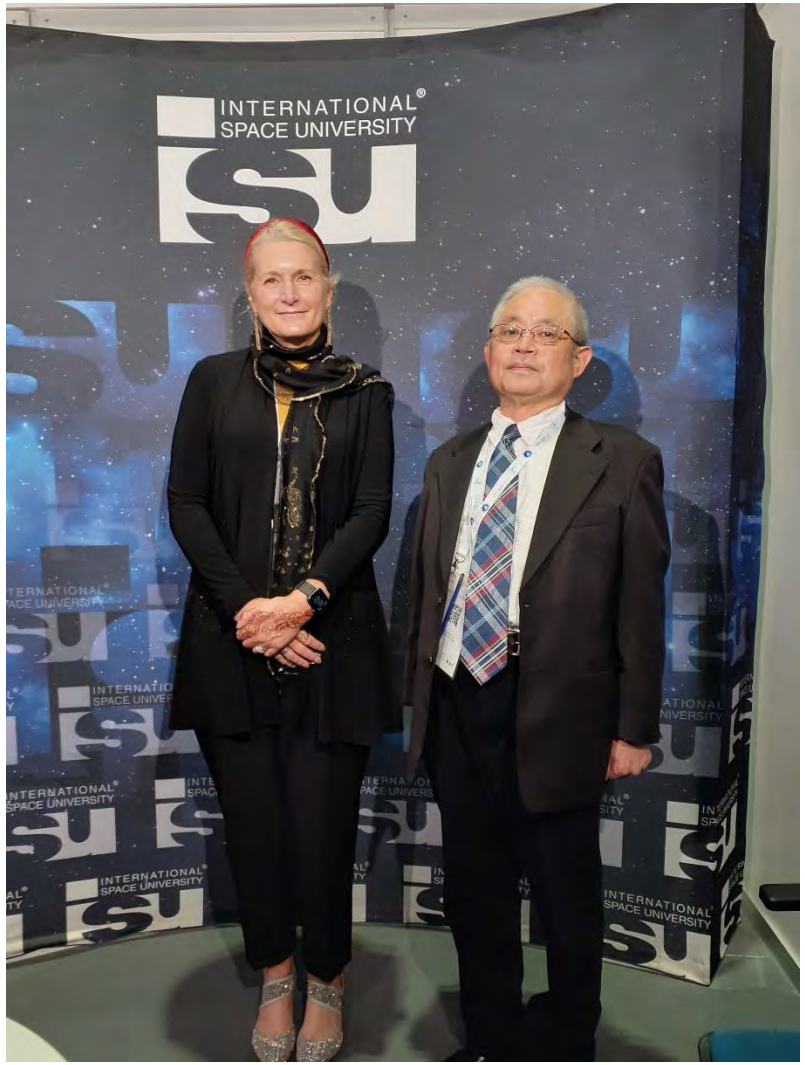


Izrael (Project Manager of BIRDS-4) successfully defended his doctoral thesis in public on 12 Nov 2021 via ZOOM. His presentation file (83 pages) can be viewed with this link:

https://www.dropbox.com/s/6i45t51toh1wzqj/Izrael_Phd_Thesis_public_defense_presentation_12NOV2021.pdf?dl=0

Note: This link is active for only 3 months.

15. During 2021 IAC in Dubai: Kyutech and ISU renew MoU in a small ceremony



Renewal of the MoU between
ISU (International Space University)
and
Kyutech (Kyushu Institute of Technology)
at
the 2021 IAC booth of ISU
on
Wednesday, 27 October 2021
10:30 AM UAE time

Officially signing for ISU:
Prof. Pascale Ehrenfreund,
President of IAF
President of ISU

Pretending to sign for Kyutech:
Assistant Prof. George Maeda

Two copies of MoU were signed:

- **One set for ISU**
- **One set for Kyutech**

Kyutech set will be signed by Prof. Teruhisa Ohno (Faculty of Engineering)

Witnesses to the signing: **(this photo was taken by Turo)**

① ISU official
② Hoda, Egypt
③ Prof. Pascale Ehrenfreund, President of ISU and IAF
④ Fahd, Morocco
⑤ Mr. G. Maeda, Kyutech
⑥ ISU official
⑦ Mr. Satoru Kurosu, Yokogawa Electric Corporation

END

15. Photo report about UN/IAF workshop and 2021 IAC in Dubai

Lily of Cameroon (moderator of this workshop session)

The following photo report was submitted to the *BIRDS Project Newsletter* on 14 November 2021 by Ms. ASONGFAC "LILY" ROSPEEN of Cameroon. It covers the UN/IAF workshop and the 2021 IAC in Dubai.

She received a travel grant from UNOOSA to attend the two space events of Dubai.

28th Workshop on Space Technology for Socio Economic Benefits:
"Space Exploration – a source of inspiration, innovation and discovery"

22nd to 24th October 2021

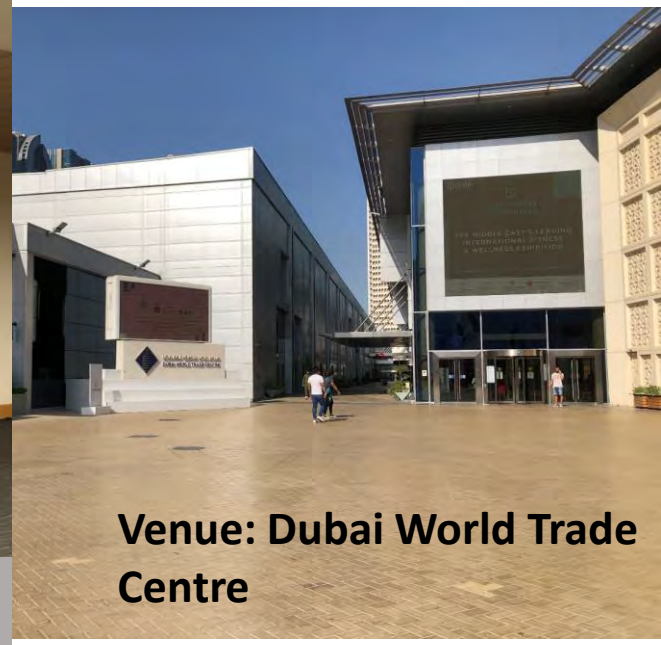
Organized by the United Nations Office for Outer Space Affairs (UNOOSA)
and the International Astronautical Federation (IAF)

Hosted by the Mohammed Bin Rashid Space Centre(MBRSC)

Opening Ceremony

Simonetta Di Pippo, UNOOSA Director delivering opening remarks

High table, MBRSC Deputy Director and IAF President

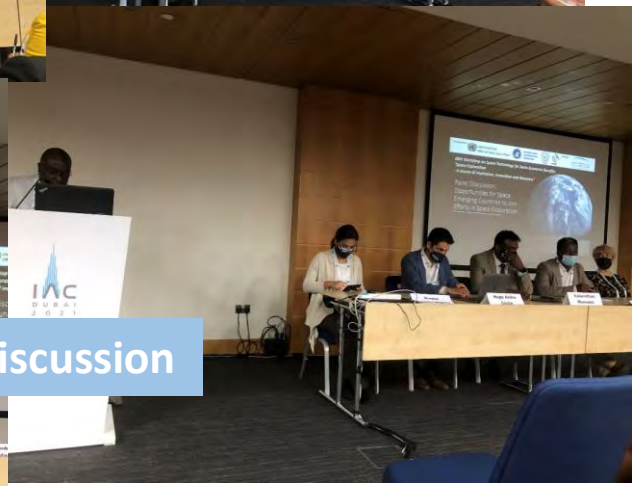


Venue: Dubai World Trade Centre

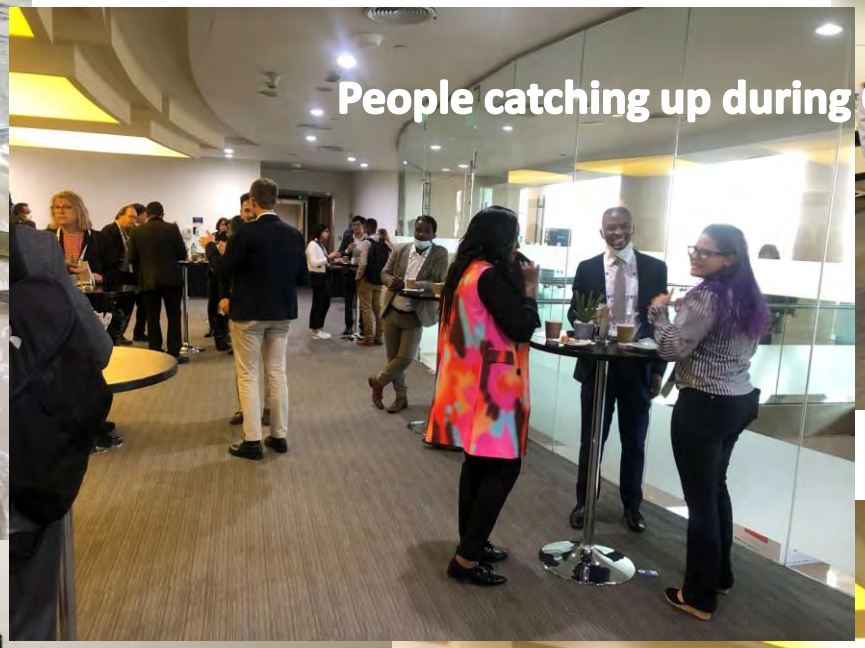
Several interesting presentations were made by speakers during the different sessions

Breakout session presentations

Panel discussion



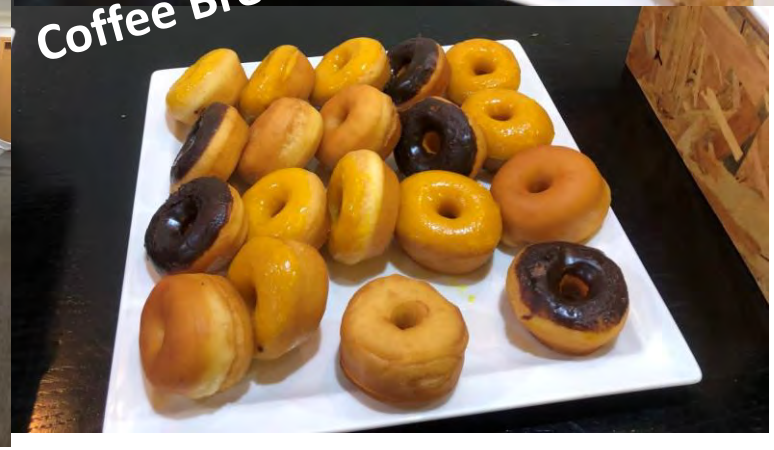
Dessert



People catching up during Coffee Break

Coffee Break

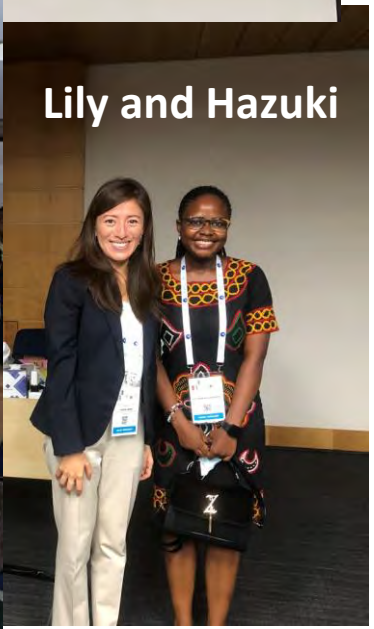
Lunch on one of the days



Closing Session

Lily and friends at cocktail

Group Picture at Closing Ceremony

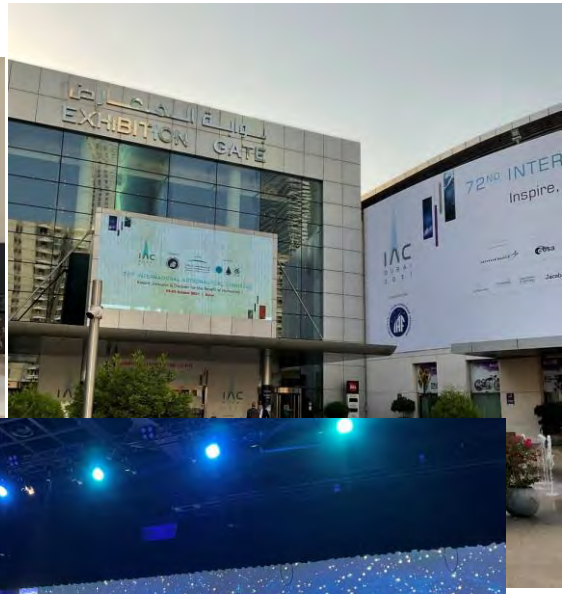


Lily and Hazuki

72nd International Astronautical Congress (IAC 2021)

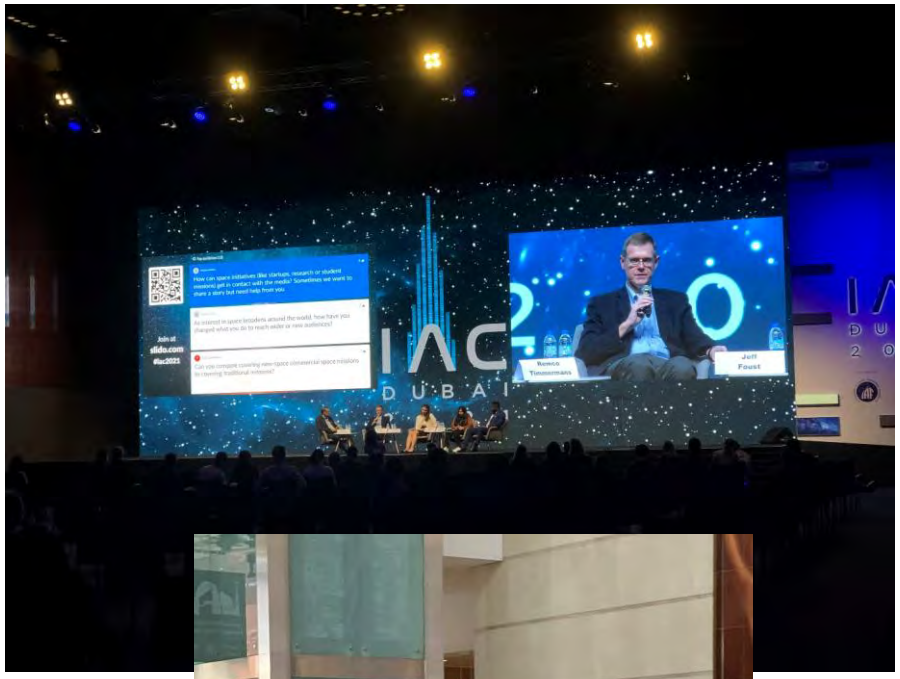
organized by the International Astronautical Federation (IAF)
held in the Middle East for the first time and hosted by the Mohammed Bin Rashid Space Center (MBRSC)

Opening Ceremony



IAF President's opening speech

IAF World Space Award to Hayabusa2 team



Some Astronauts and Cosmonauts with the Ruler of Dubai, His Highness Sheikh Mohammed Bin Rashid Al Maktoum

Plenary Events

Some technical paper presentations

Some exhibition booths

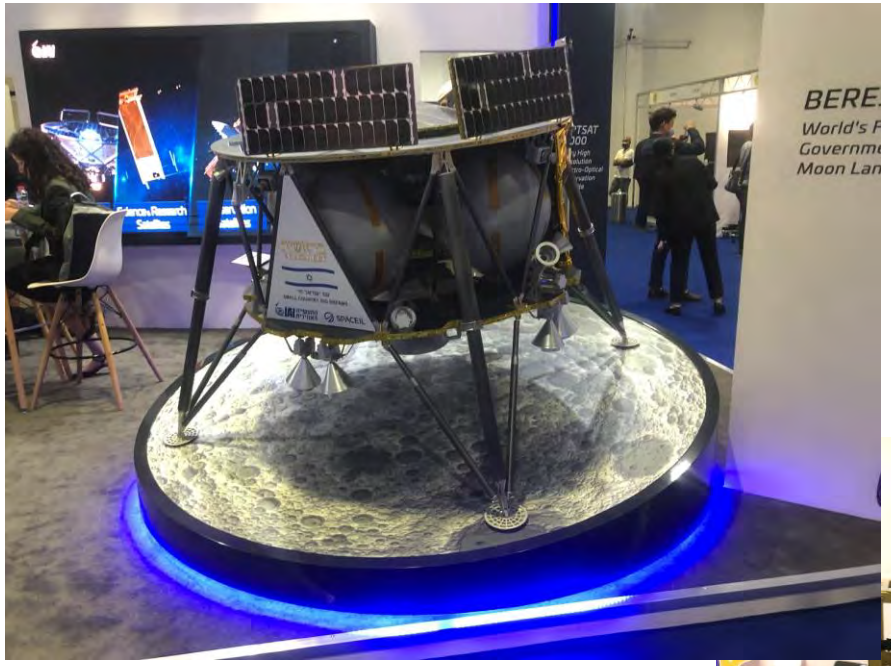

USA


dubai
astronomy
ground


Discovery
United States
NASA
Space Shuttle Discovery STS-31

Young professionals IAC opening dinner

Prof G Maeda and Lily



Little future astronaut at IAC 2021 public day

End of photo report by Lily

World Science Day Uganda

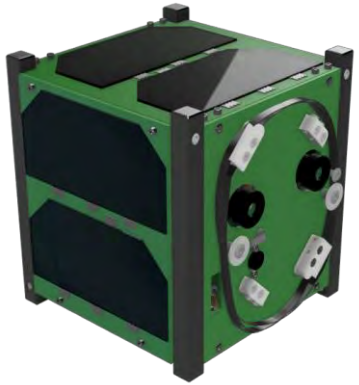
OMARA Bonny

November 15, 2021

AN OVERVIEW OF UGANDA'S NATIONAL SCIENCE DAY!

"The future of Science Technology and Innovation in Uganda: *Breaking the Silos and leveraging Synergies for a skilled and Sustainable Workforce for National Economic Transformation*."

Electric Buses developed by KMC



Uganda's first Satellite to be launched by 2022

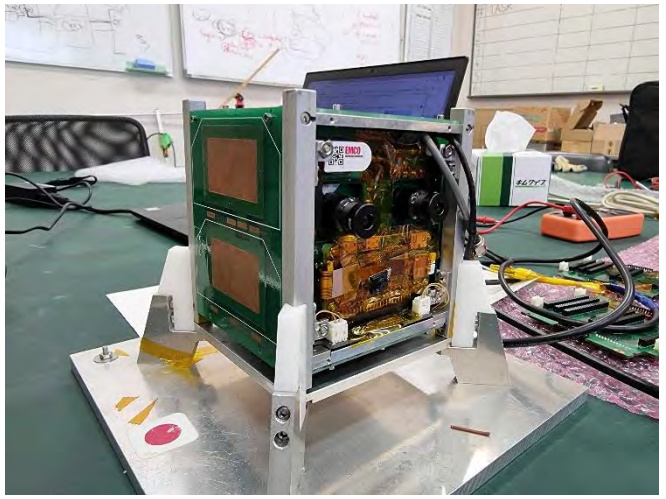
World Science day for peace and development is annually celebrated on October 10 globally. It was initiated by UNESCO in bid to recognize and promote Science and Technology in advancement of societies since 1937.

Electric Vehicle by Kiira Motors Cooperation!

Uganda developed a long-term Technology partnership to build core capabilities to develop, make and sell motor vehicles and components in Africa on a mission to build a better Uganda through Automation Technology.

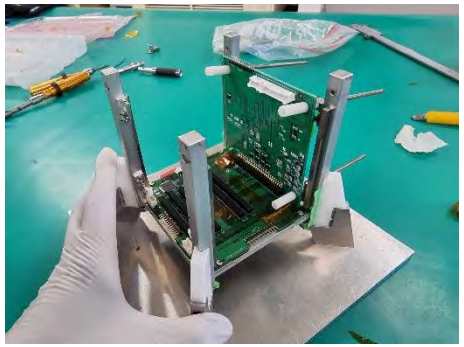
'*Seeing is believing*' according to Ambassador designated to Italy. She was in love with the black ride from Kiira Motors.

Uganda's first satellite *'PearlAfricaSat-1'*



The government of Uganda through Ministry of Science Technology and Innovation in partnership with Kyushu Institute of Technology is training 3 graduate Engineers to design, build, teste and launch the first satellite for Uganda.

The ultimate target for this partnership is to equip and mentor the 3 graduate Engineers to design, build, test and launch satellites from Uganda while addressing real challenges facing the citizenry .



Electric Motorcycle Project by IUEA

The excitement of riding for the first time an electric bike made in Uganda.

Various Innovators

Anti-tick Vaccines for the Control of Ticks Affecting Livestock are under development in UGANDA.

YIST products include but no limited to; wines and Juice.

End of report from Uganda

17. Report from Africa: Senegal's first-ever satellite to go into orbit in 2023

(Ecofin Agency) - Senegal will launch its very first satellite into space in 2023. The project is the result of an MoU signed two years ago with the National Center for Space Studies of France and Ariane Group.

In a recent interview with Le Quotidien, Gayane Faye (pictured below) said three students from local engineering schools were sent last year to the Montpellier Space Center for training in space science, as part of the project. Faye is the head of the applied remote sensing lab of the Institute of Earth Sciences (IST) at Cheikh Anta Diop University (UCAD),

According to him, 10 more people, including 5 technicians and 5 engineers, will be sent to Montpellier. The trainees will be in charge of building Senegal's nanosatellite. Construction is expected to start in March next year. The launch of this equipment was initially scheduled for this year but the Covid-19 pandemic disrupted the process, Faye said.

"After this is done, we will work on larger satellites, with other applications, processing and use of data," he added. The government will use the data collected by the nanosatellite to better monitor bush fires, floods, and erosion, and to develop agriculture.

The project also includes the design, development, and construction of a Center for satellites weighing less than 50 kg (CubeSat). Ultimately, the government aims to create a genuine local ecosystem of scientific research and industrial innovation in the space sector, in partnership with universities and companies.

Muriel Edjo **Thursday, 04 November 2021**

https://www.ecofinagency.com/telecom/0411-43154-senegal-s-first-ever-satellite-to-go-into-orbit-in-2023

UiTMSAT COLUMN

Column No. 23

18. Column #23 from Malaysia

Editor: FATIMAH ZAHARAH BINTI ALI (*ali.fatimahzaharah@gmail.com*)
PhD CANDIDATE, LABORATORY OF SPACE WEATHER AND SATELLITE SYSTEM
SCHOOL OF ELECTRICAL ENGINEERING, COLLEGE OF ENGINEERING
UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR, MALAYSIA

UNIVERSITI TEKNOLOGI MARA

UiTM Sentiasa Di Hatiku
"UiTM Always in My Heart"

SATELLITE IN THE EYES OF THE ACADEMICIANS

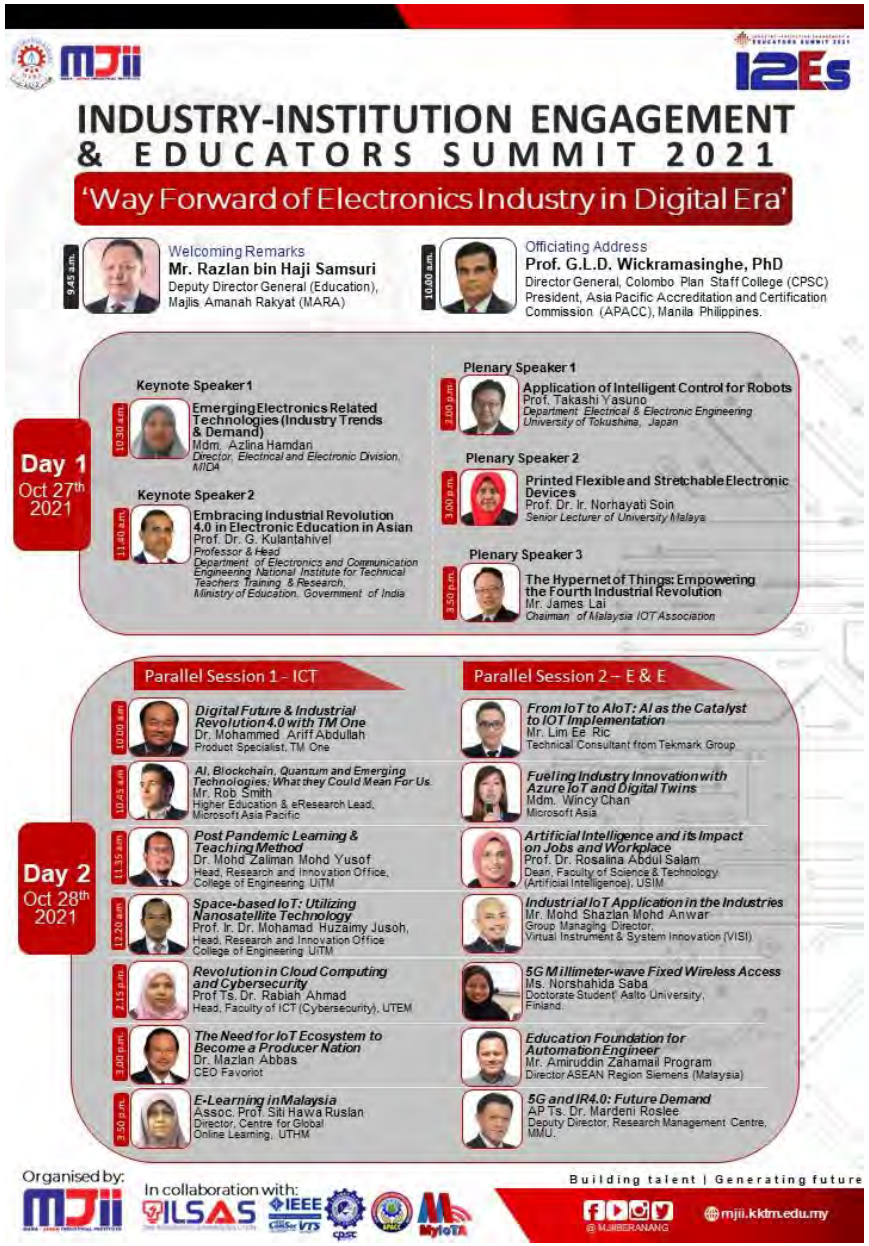
IT is well-known that the technology of satellite nowadays has become the new digital advancement in the growing digital era. In Malaysia, apart from the engineers and researchers in the space field, academicians from various level of institutions are also inclining in accepting the new space age by allowing more exposure to be delivered to the academia. They have seen the space field as one of the areas for research and development.

In creating an opportunity to discover the technology of space and satellite, Prof Dr Mohamad Huzaimy has been invited to share the knowledge and his experiences in the related field through talks in webinar, conference, and summit. The events were managed by members of academic institutions.

Politeknik Ungku Omar was one of the academic institutions that conducted the webinar for knowledge sharing session in satellite application. Politeknik Ungku Omar is one of the polytechnic institutes under Ministry of Higher Learning in Malaysia that emphasizes the practical and skills learnings. Aware of the importance of the space technology, the polytechnic institute has taken a step to expose their academia to this new growing era by conducting the free webinar. The targeted audiences were academicians and researchers who enthuse in satellite and space applications. Prof Dr Mohd Huzaimy shared on the application of Internet of Things (IoTs) in space field with his talk title of "Nanosatellite Technology: Space-Based Internet of Things (IoTs) in New Space Era". The webinar was conducted virtually on 30th September 2021.

The image on the right side was the poster of the aforementioned webinar.

The next satellite talk given by Prof Dr Mohamad Huzaimy was in the conference of 7th International Exchange and Innovation Conference on Engineering & Sciences (IEICES2021) on 21st October 2021. The conference was organized by Kyushu University, Japan through virtual platform. The talk was given in the keynote session of the conference in which Prof Dr Mohamad Huzaimy shared on the current project of ASEANSAT. Through this session, the feasible model implemented in ASEANSAT as an international satellite collaboration project was delivered.



On 28th October 2021, another talk related to satellite applications in IoTs was given by Prof Dr Mohammad Huzaimy in the Industry-Institution Engagement & Education Summit 2021 (I2Es). Summit is another talk event that gather all professionals in sectors of industries and educations to meet and discuss based on the agenda designed. Experts in particular fields will be invited as the speakers in the summit to deliver the information and knowledge related to the theme of discussion. I2Es brought a theme of "Way Forward of Electronics Industry in Digital Era" as the main topic of the talk. As part of the electronics engineering fields, satellite technology was also included as one of the sessions in the event.

Talk events are a good medium for professionals in various sectors to obtain and exchange knowledge and expertise. It will also be able to attract more people to get involved in the interest field for more researches and projects. This will enhance the development of the technology advancement,

End of Malaysia's Column

19. Report from the Philippines

#PhilippineSatelliteWatch: Seeing the World from Space

October was a celebration of the world, from World Space Week, to United Nations Month, to Expo 2020 Dubai.

To punctuate the month-long series of activities, the Space Technology & Applications Mastery, Innovation and Advancement (STAMINA4Space) Program and the Department of Science and Technology-Advanced Science and Technology Institute (DOST-ASTI) captured images of the world for #PhilippineSatelliteWatch.

Philippine Satellite Watch is a campaign by the PhilSA, STAMINA4Space, and DOST-ASTI to showcase the country's local space imaging capabilities.

Read more:
https://philsa.gov.ph/news/philippinesatellitewatch-seeing-the-world-from-space/

Osaka Ports, Japan, captured by the Diwata-2 satellite on 04 January 2021. Captured, processed, and laid out by the STAMINA4Space Program's GRASPED Project.

PhilSA joins Dubai Expo, International Astronautical Congress in UAE

The Philippine Space Agency (PhilSA) joined Expo 2020 Dubai Space Week led by Director General Dr. Joel Joseph S. Marciano, Jr.

Director General Marciano represented the Philippines in a panel discussion held on 20 October at the Women's Pavilion entitled "Mission Equality: Expanding Equal Opportunities in the Space Economy."

From 25 October to 29 October, the PhilSA delegation consisting of Dr. Marciano, PhilSA Director for Space Policy and International Cooperation Atty. Noelle Riza D. Castillo, and Director for Space Technology Missions and Systems Bureau Dr. Marc Talampas participated in the 72nd International Astronautical Congress. Respective bilateral talks between the delegation and representatives of the UNOOSA, the UAE Space Agency (UAESA), and the Japan Aerospace Exploration Agency (JAXA) have been scheduled during the Congress. The delegation also conducted a visit to the Mohammed Bin Rashid Space Centre (MBRSC) and held a town hall with the Filipino community in Dubai.

https://philsa.gov.ph/news/philsa-joins-dubai-expo-international-astronautical-congress-in-uae/

Image source: virtualexpo.dubai.com

PhilSA at the Expo 2020 Dubai Space Week panel
https://philsa.gov.ph/news/philsa-joins-dubai-expo-international-astronautical-congress-in-uae

PhilSA visits the Mohammed Bin Rashid Space Centre (MBRSC)
https://www.facebook.com/PhilSpaceAgency/posts/247527960754148

PhilSA @ Expo 2020 Dubai, in photos

PhilSA-UNOOSA bilateral meeting
https://philsa.gov.ph/news/philsa-un-forge-ahead-with-cooperation-deal

PhilSA–JAXA bilateral meeting
https://philsa.gov.ph/news/philsa-jaxa-undertake-collaborative-projects-on-space-applications

PhilSA–UAESA bilateral meeting
https://philsa.gov.ph/news/philsa-uaesa-set-sights-on-signing-space-agreement

PhilSA @ Expo 2020 Dubai, in photos

PhilSA and the Filipino community in Dubai
https://www.facebook.com/PhilSpaceAgency/posts/250908547082756

Happy 3rd birthday in space, Diwata-2!

On this day three years ago, our second microsatellite, Diwata-2, was launched to space and directly into orbit via an H-IIA F40 rocket from Tanegashima Space Center, Diwata-2 has since captured over 72,308 images all over world, and has covered around 85.13% of the Philippines' area. As the satellite enters the fourth year of its space journey, Diwata-2 will continue its Earth observation tasks.

Diwata-2 was developed under the Development Philippine Scientific Earth Observation (PHL-Microsat) Program (now STAMINA4Space). Both programs are funded by the DOST monitored by DOST PCIEERD, and implemented by DOST Advanced Science and Technology Institute and UP Diliman. The satellite was built by a team of Filipino engineers in cooperation with Tohoku University and Hokkaido University. With the Philippine Space Agency having been established with more satellite plans coming up, Diwata-2's legacy will live on and have a home even after the STAMINA4Space Program ends.

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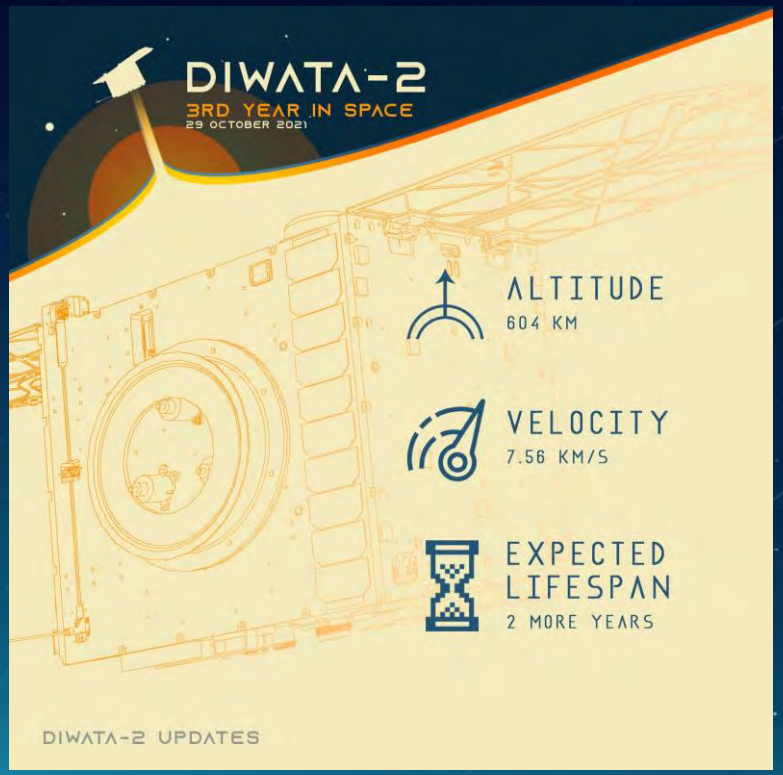
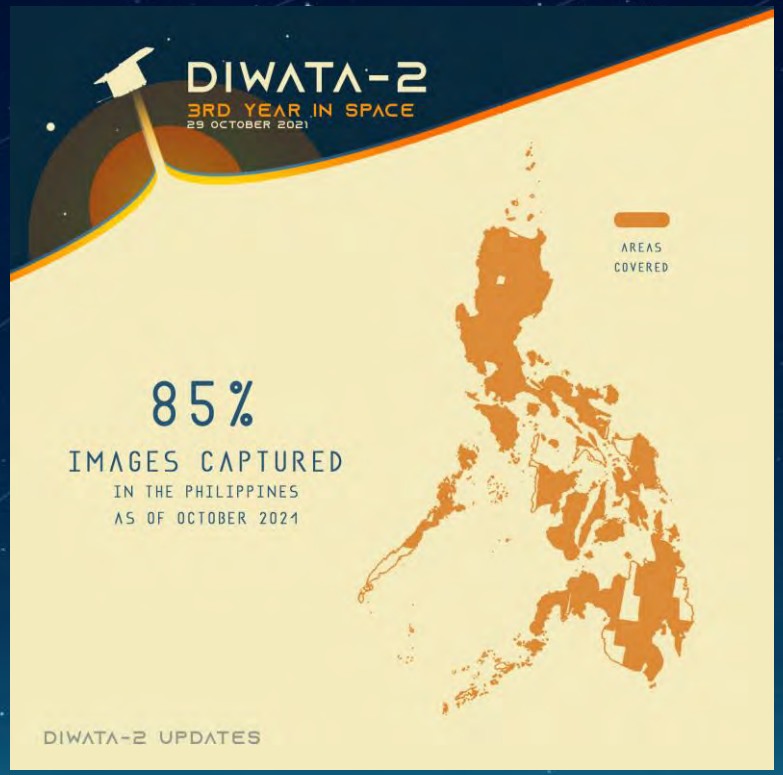
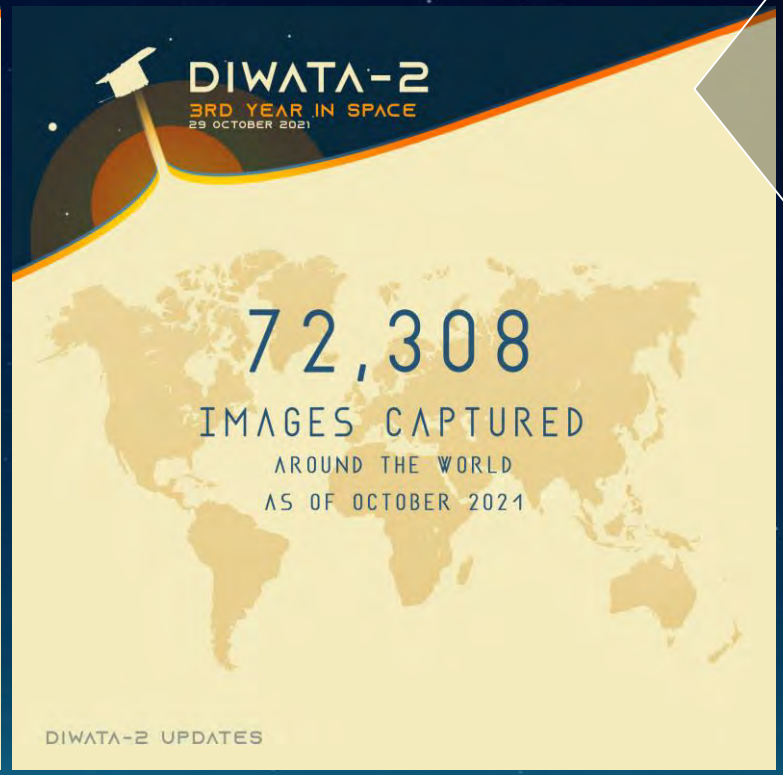
Diwata-2 updates

Learn more about Diwata-2's journey so far: https://stamina4space.upd.edu.ph/diwata-2/







NASA Space Apps Philippines

On October 2-3, 2021, the National Aeronautics and Space Administration (NASA) invited coders, entrepreneurs, scientists, designers, storytellers, makers, builders, artists, and technologists to participate in a virtual hackathon - the NASA International Space Apps Challenge. During a period of 48 hours, participants from around the world created virtual teams and used Earth observation data to develop solutions to issues our world is facing.

STAMINA4Space researchers Julius Sempio, Mark Jayson Felix, Angela Chua, and Xiorence Cai were part of the NASA Space Apps hackathon as mentors, and Dr. Czar Zakiri Sarmiento was invited to be one of the local judges.

Photos courtesy of NASA Space Apps Philippines

United Nations Month

Here are some of the image captured by Diwata-2 around the world. They are being shared as part of the Philippine Satellite Watch Campaign by STAMINA4Space, DOST-ASTI, and PhilSA. Access Diwata images from our data distribution site: https://data.phl-microsat.upd.edu.ph.

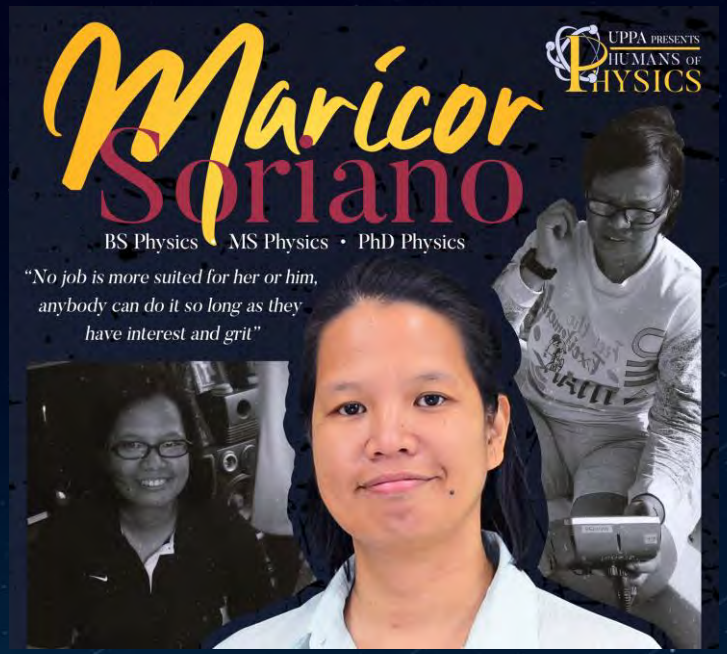
Man-made irrigated crops in portions of Indianola and Alliance in Nebraska, USA

Snow-capped mountains of Bayanzürkh in Ulaanbataar, Mongolia

Ice formations in Vladivostok, Russia

View of the Andaman Sea

FEATURE



Know more about our program leader, Dr. Maricor Soriano, in her feature in UP Physics Association Human of Physics. In this feature, she talks about her career and research, and shares a message to aspiring scientists. Dr. Soriano is also the project leader of the Optical Payload Technology, In-depth Knowledge Acquisition, and Localization (OPTIKAL) Project and is a Professor at the UP Diliman National Institute of Physics (NIP).

Read here: https://bit.ly/30t3Gne

Photo courtesy of UP Physics Association

Check out the video featuring some of the Multispectral Unit for Land Assessment (MULA) engineers during the preliminary design phase of their know-how transfer training at the Surrey Satellite Technology Ltd. (SSTL) in the UK from April to August this year.

ICYMI, read the last MULA virtual press briefing:
https://stamina4space.upd.edu.ph/.../philsa.../

Watch video here: https://www.youtube.com/watch?v=II0Le7pWArA

Video courtesy of SSTL in coordination with the Philippine Space Agency

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Gladys A. Bajaro
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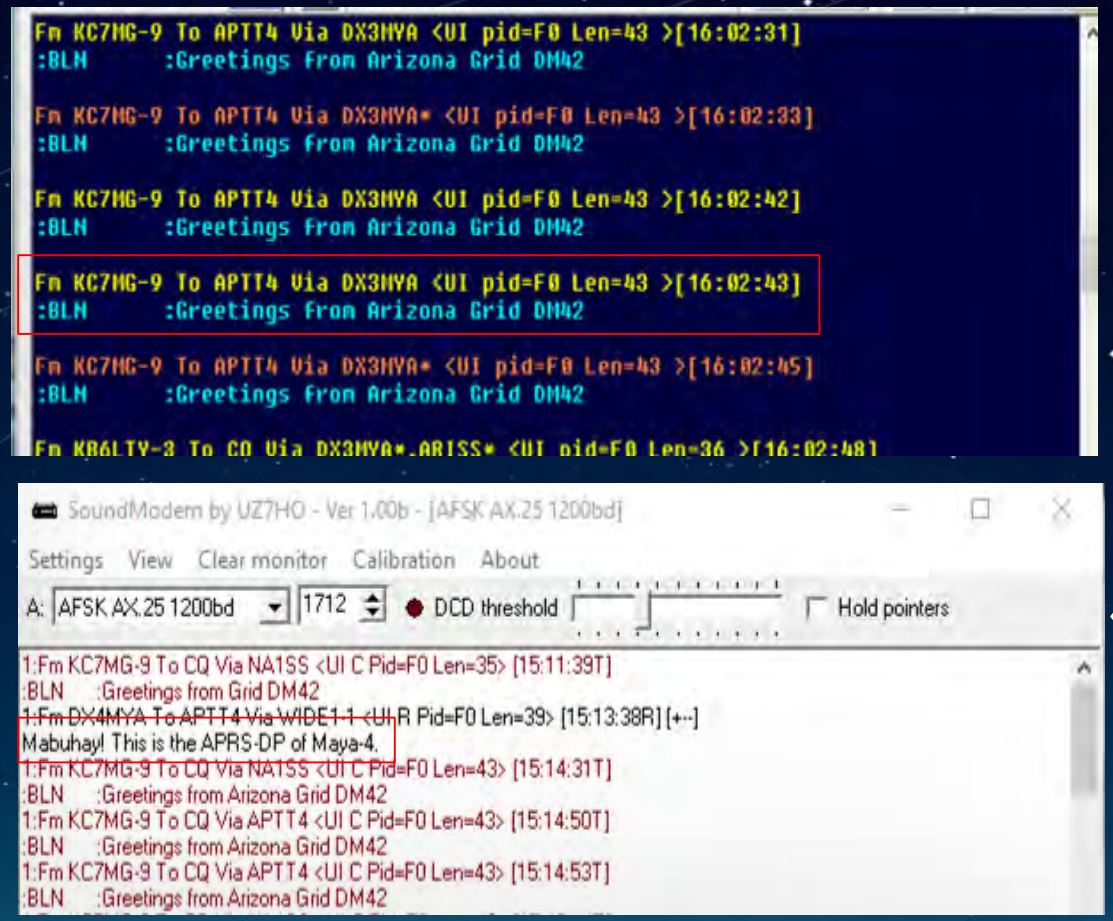
MISSION ACCOMPLISHED! Maya-3 and Maya-4 APRS Digipeating and GPS Locking

"MISSION ACCOMPLISHED!" The Automatic Packet Reporting System (APRS) mission of Maya-3 and Maya-4 was successfully activated on October 12, 2021. HAMs from different parts of the world were able to receive the APRS beacon and perform its digipeating capability. The team is immensely grateful for the enthusiastic participation of the HAM community in the overall operations of the Maya-3 and Maya-4 cube satellites. As a show of appreciation and acknowledgement, QSL cards will be given to the HAMs.



An image snap from a HAM in Arizona, USA.

Image source: AMSAT Facebook

Philippine Space Agency

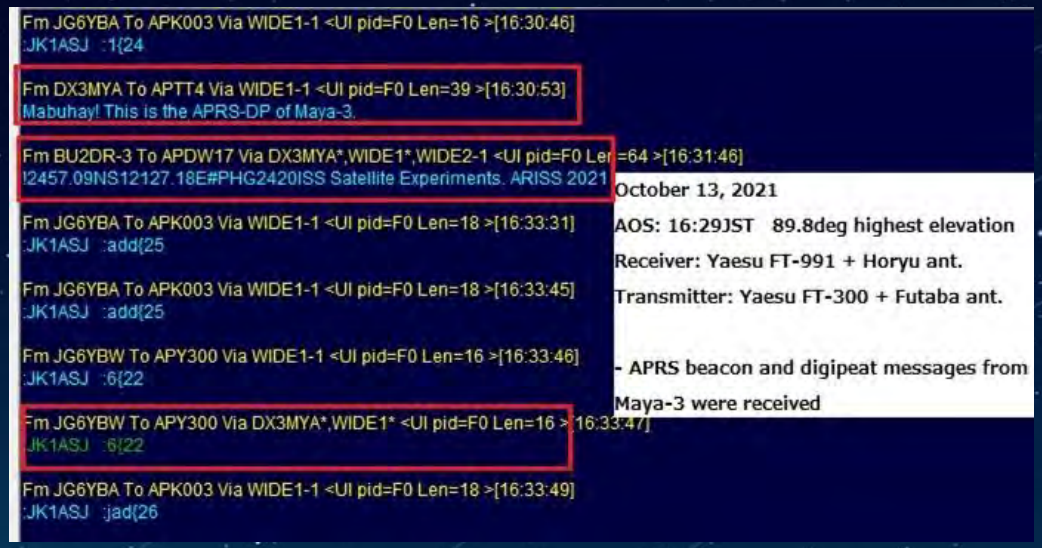
STAMINA4Space Program

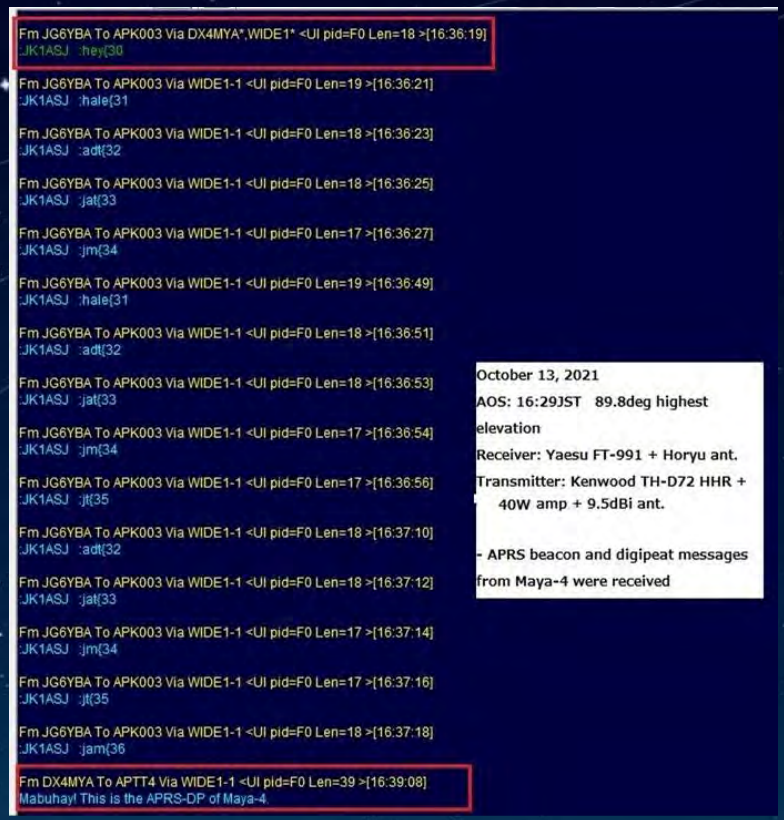
STeP-UP Scholars Batch 1

STeP-UP Scholars Batch 2

MISSION ACCOMPLISHED! Maya-3 and Maya-4 APRS Digipeating and GPS Locking

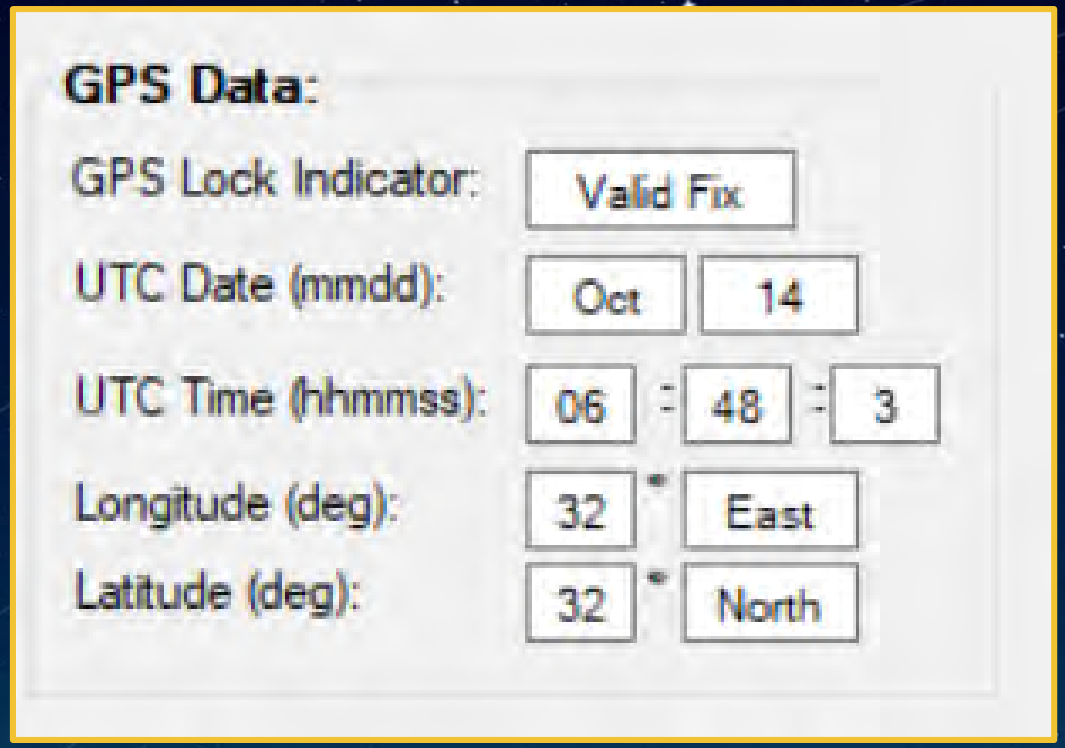
From Kyutech, Japan





With the achievement of this milestone, we are brought one step closer to advocating the utilization of the satellites carrying amateur radios to complement existing infrastructure for emergency communication systems. The team envisions that this mission will be carried further through the next generation of cube satellites, developed locally and outside of the Philippines.

MISSION ACCOMPLISHED! Maya-3 and Maya-4 APRS Digipeating and GPS Locking



The GPS payload recorded successful fix. This can be used by the CubeSat for onboard position determination. The data above are from the type-3 beacon of Maya-3. The next step now is to download the GPS data via command.

MISSION ACCOMPLISHED! Bryan's Successful Thesis Defense Presentation

The STeP-UP Scholars Batch 1 would like to congratulate Bryan, the Maya-3 and Maya-4 antenna system lead, for successfully defending his thesis for the degree of MS in Electrical Engineering last October 18, 2021. His thesis is about determining the feasibility of utilizing the frame chassis of a 1U and 3U cube satellite as an antenna, through the application of characteristic mode analysis and genetic algorithm.

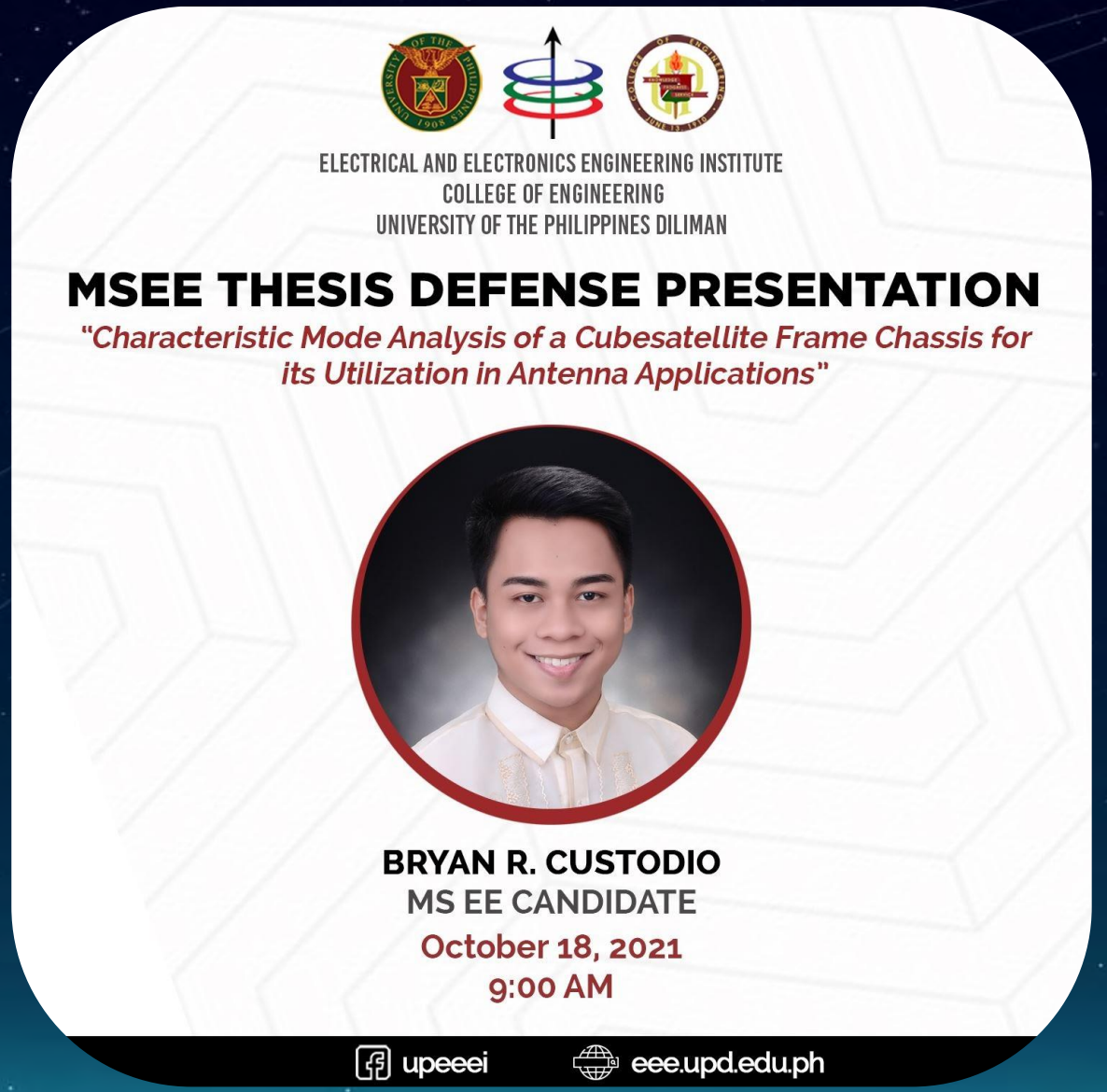


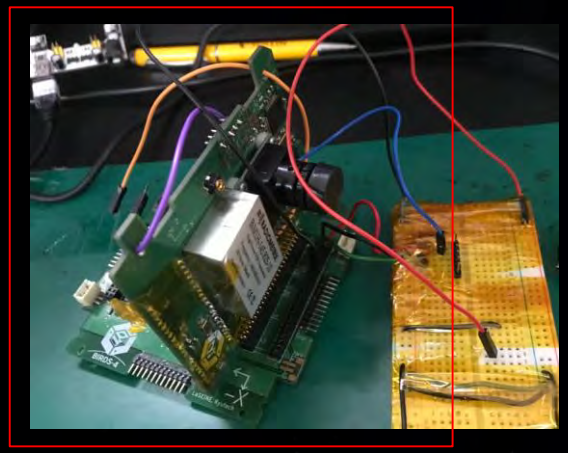
Image courtesy of UP Electrical and Electronics Engineering Institute Facebook page

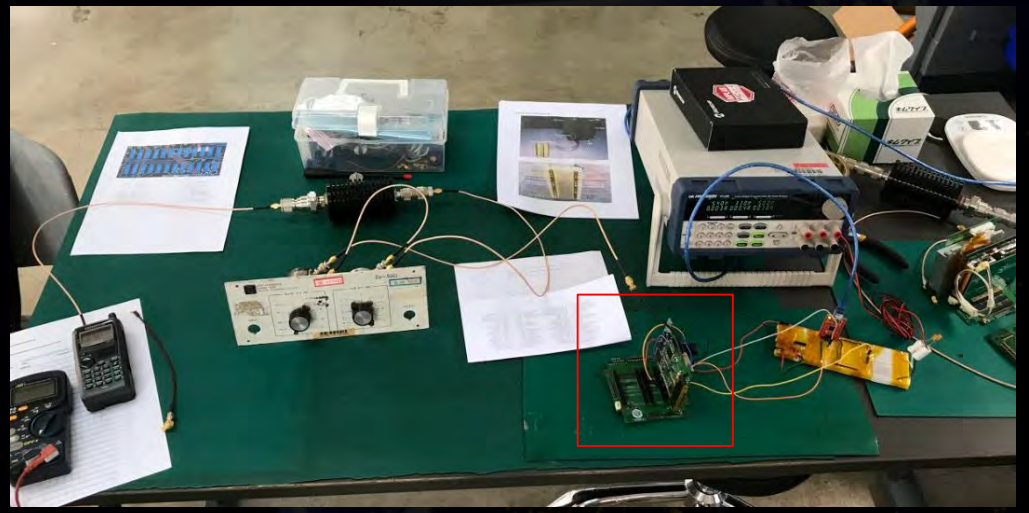
Happy Birthday Derick and Lorilyn!

With his family, Derick celebrated his birthday last November 8. He is a team member of the STeP-UP Scholars Batch 1, primarily responsible for the design of the Attitude Determination and Control System of Maya-3 and Maya-4. We wish you good health and all the best in your career!

Lorilyn celebrated her birthday last November 10. She is a team member of the STeP-UP Scholars Batch 1 responsible for the "brain" of Maya-3 and Maya-4, the On-board computer (OBC). We wish you the best in all things in the world!

INTEGRATION TEST PREPARATION





The end-to-end system integration tests require that each mission and subsystem passes their stand-alone tests. On the left is the mission board 2, which contains the SFWARD and the APRS-DP mission payload. The SFWARD's final working code is uploaded successfully in preparation for the integration and functionality tests. On the right is the test setup for the APRS-DP VHF wired sensitivity tests. The test's goal is to verify the minimum signal sensitivity of the transceiver radio and compare its performance with the datasheet. The results show that the VHF transceiver radio is within the acceptable range of the signal sensitivity.

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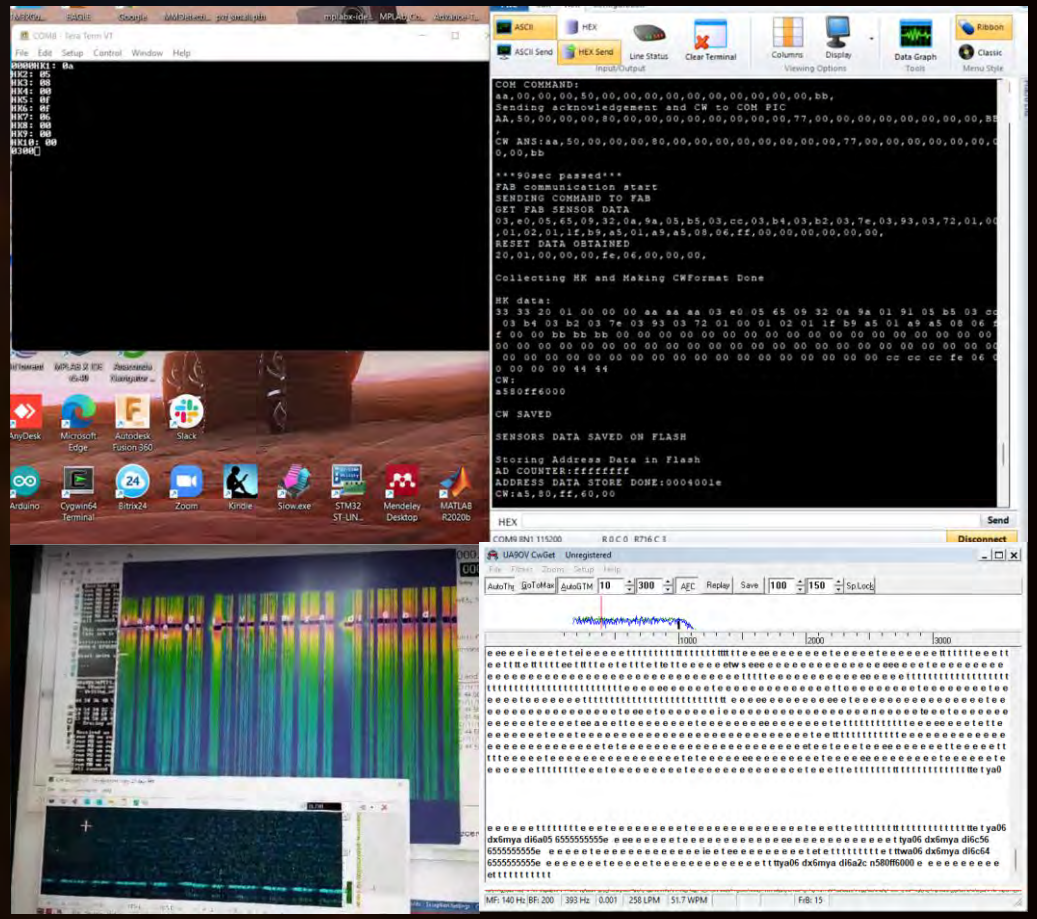
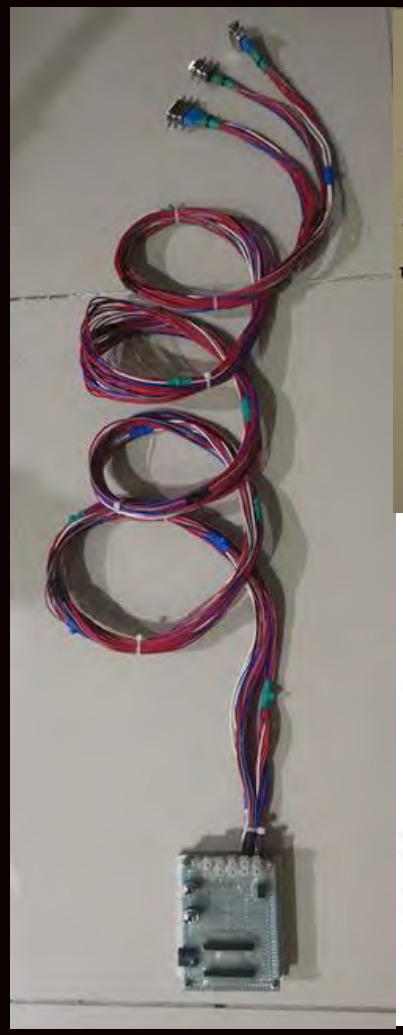


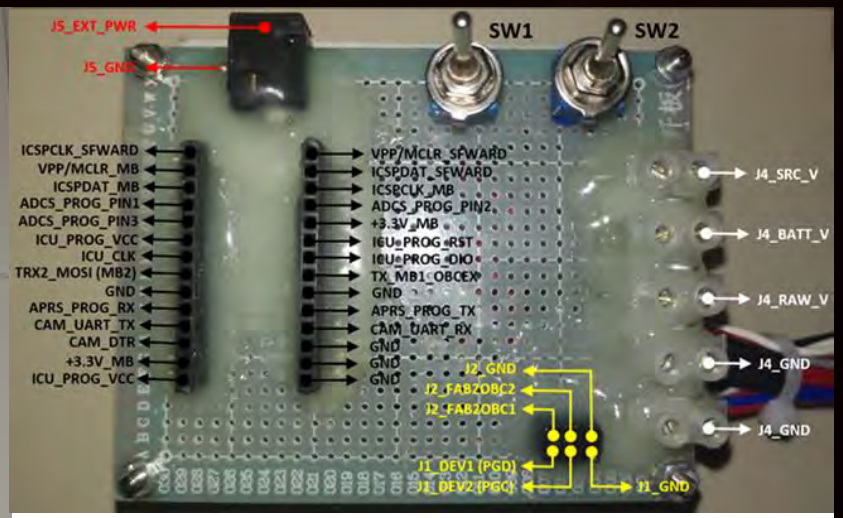
INTEGRATION TESTS

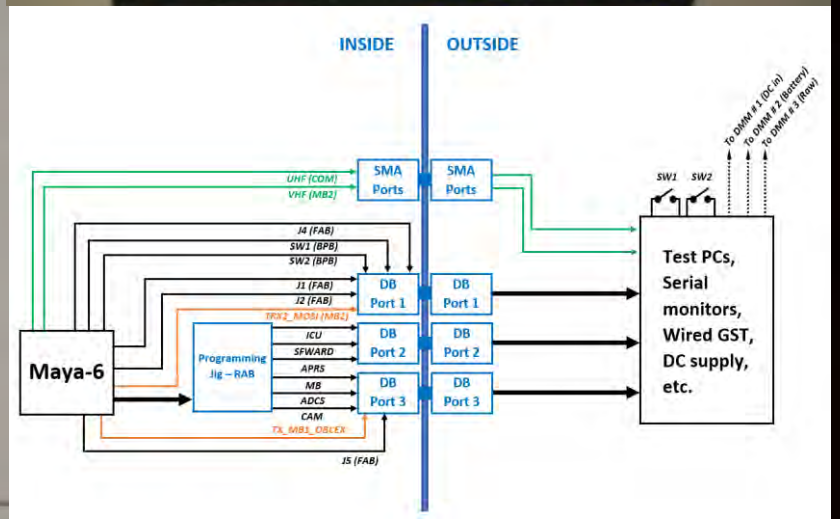
One of the tests involves the downlink of CW beacon, which contains the housekeeping data of the CubeSat from the MAIN PIC to the COM PIC to the ground station. The photos show that the COM PIC was able to receive the HK data from the MAIN PIC as seen in the serial monitoring PC, and the GS was able to receive and decode the CW beacon through the CWget software.

EM TEST BOARD JIG

This is the test board jig for the Maya-6 EM thermal vacuum test (TVT). This will surveil the serial monitors of the missions and subsystems during TVT while the cube satellite is inside the chamber. It is also capable of enabling and disabling the payloads.







END OF REPORT FROM THE PHILIPPINES

20. Nikkei Virtual Global Forum: The Future of Space

ENGLISH: https://www.global-nikkei.com/nvgf-space/en/

日本語: https://www.global-nikkei.com/nvgf-space/

CONCEPT

Space, once the realm of science fiction, has become a familiar extension of terrestrial life.

Japan's success in retrieving soil from an asteroid with the Hayabusa space probe has occasioned continuing excitement about space exploration, and Japanese astronauts have long since become regular members of the crew on the International Space Station. Legislation has cleared the way for the private sector to develop business in space development in Japan, as it has in other nations.

Talks and discussions in the **Nikkei Virtual Global Forum, The Future of Space**, will highlight different facets of space development, such as lunar travel, new business opportunities, and international cooperation, especially the crucial role of Japanese-US collaboration.

The content promises to be engaging for viewers of all ages and backgrounds.

かつて遠い存在の象徴として語られた宇宙が様々な面で身近な存在になりつつあります。
SF映画の世界の出来事だった宇宙旅行が現実に語られ、小惑星探査機「はやぶさ」の活躍などで日本でも空前の「宇宙ブーム」が到来しています。

宇宙ビジネスに目を向ければ、長らく世界の宇宙開発をリードしてきた米国では、いち早く官からの民間企業への産業移管がすすみ多くの新規プレーヤーが活躍しています。日本においても近年、宇宙関連法の整備がすすみ、民間企業が宇宙開発に参入する道が広がり、宇宙ビジネスに関するニュースも頻繁に見聞する時代になってきました。

当フォーラムでは、米国と日本の連携をバックボーンとして、月旅行から新たなビジネスチャンスとしての場、そして未来のパワーゲームの舞台など宇宙を巡る様々なトピック、案件、ビジョンを多岐にわたって議論し、老若男女が一様に宇宙に関する知識、教養を高められる包括的な「宇宙シンポジウム」を目指します。

==========
You can choose to attend this event remotely or onsite.
==========

* Pre-registration required.

To attend remotely（livestreaming）:
Application deadline is December 7, 2021（TUE）(JST).

The URL for the livestreaming will be sent via email by the day before the event.

To attend onsite:
Application deadline is November 30, 2021（TUE）(JST).

A lottery may be held if applications exceed the venue capacity. The result will be announced in a message to registered email addresses. We will inform those who applied for onsite attendance of the URL for the livestreaming whether they win an onsite ticket or not.

END OF THIS SECTION

21. Our new SEIC student (JP) with JICA scholarship explains JICA space training

Last month, JICA organized a space training program called *Policy Making of Space Technology Utilization for SDGs*. John Paul Almonte participated in it and wrote this detailed report about it (the next few pages).

John Paul Almonte, an M1 student at Kyutech, is one of the participants of the KCCP being under the JICA-JAXA Network for Utilization of Space Technology (JJ-NeST) program of JICA. “

See his self-intro: Pages 38-43 of Issue No. 68 of this newsletter.

JP writes the following introduction:

"JICA has been providing educational programs (Knowledge Co-Creation Programs or KCCPs) to developing countries under a mutual relationship approach in which both sides gain knowledge from each other and develop together. The program is: *Policy Making of Space Technology Utilization for SDGs*. It is one of the KCCPs organized by JICA for developing countries to gain knowledge about legal frameworks, equipment operations and industrial policies by referring to case studies in Japan. The program also aims to discuss actions for improving space technology and satellite data utilization for SDGs.”

JICA Training: Policy Making of Space Technology Utilization for SDGs

JICA Tokyo International Center
October 22 at 3:47 PM ·

(英文記事につづいて日本語が表示されます)
JICA Knowledge Co-Creation Program "Policy Making of Space Technology Utilization for SDGs has started on Oct. 18 and will continue up to Oct. 28, 2021.

"Space, A Final Frontier" is the famous opening words of TV movie. However we still have so many unknown issues on the earth which the mutual learning are required for tackling.

This online program is designed for the participants to acquire the knowledge about legal frameworks, equipment operations and industrial policies by referring to the Japanese case-studies.
And to discuss and consider any necessary actions together for improving the space technology and satellite data utilization for SDGs.

The active and interactive discussion by 13 participants from 6 countries are now ongoing.

JICA Knowledge Co-Creation Program "SDG s に資する宇宙技術の利活用政策" が10月18日から28日まで今開催されています。

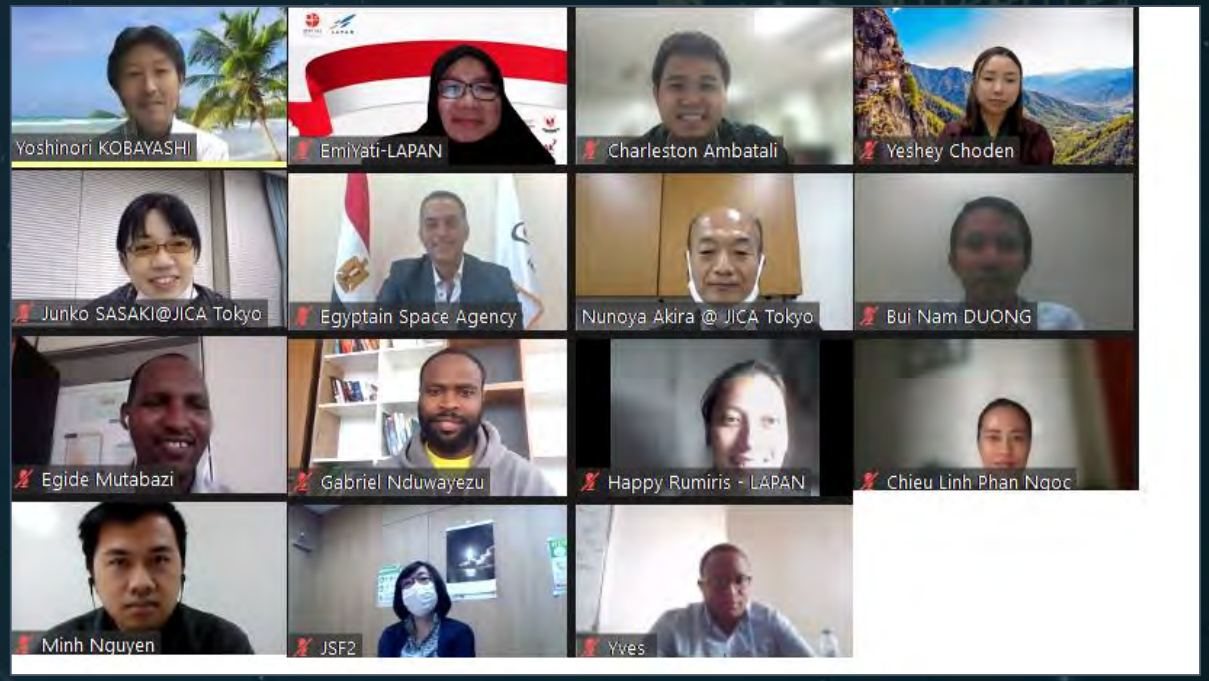
"宇宙は人類の残された最後のフロンティアである" これはあるテレビ映画の有名なオープニングの一節ですが、残念ながらこの地球上には依然として皆の学びを結集して取り組まなければならない課題が山積しています。

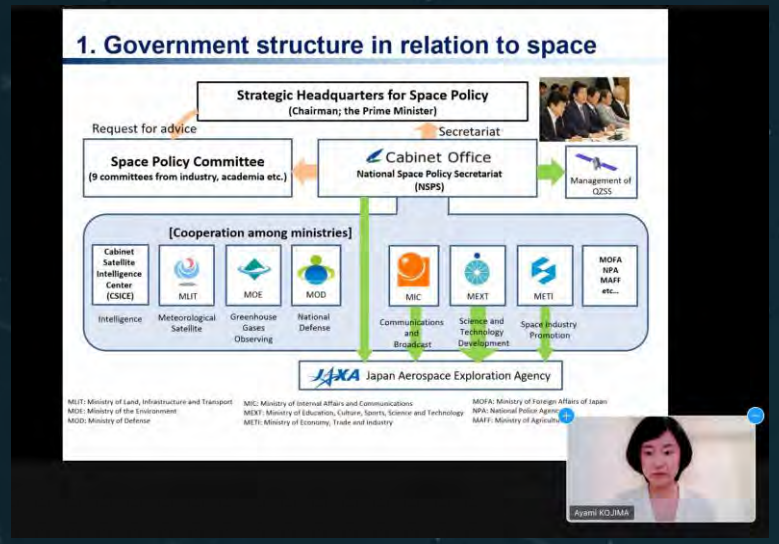
このオンラインプログラムは、研修員が宇宙技術分野の日本の事例を参照にしながら法的整備、機器操作、経済的政策等の知識を学び、SDG s 実現の為の宇宙技術の利活用政策を議論する場となっています。

６か国１３名の研修生が今積極的、且つ インターラクティヴな議論を展開しています。

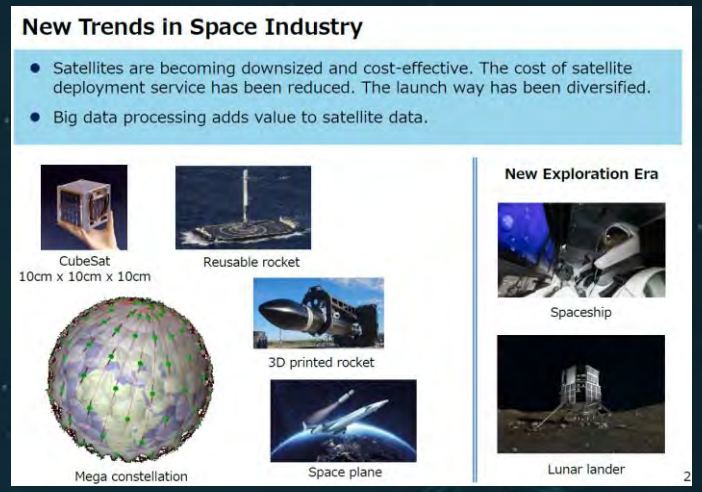
#jicatokyo #space #SDGs #KCCP

JICA organized a training program: "Policy Making of Space Technology Utilization for SDGs" last October 18 - 28 2021 implemented by Japan Space Forum (JSF)

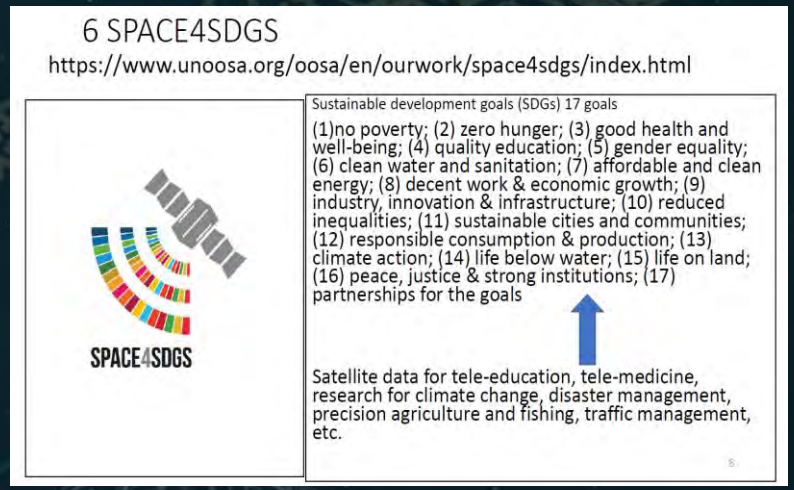




Ms. Ayami KOJIMA of Japan's National Space Policy Secretariat Cabinet Office presented an introduction of Japan's Space Activities

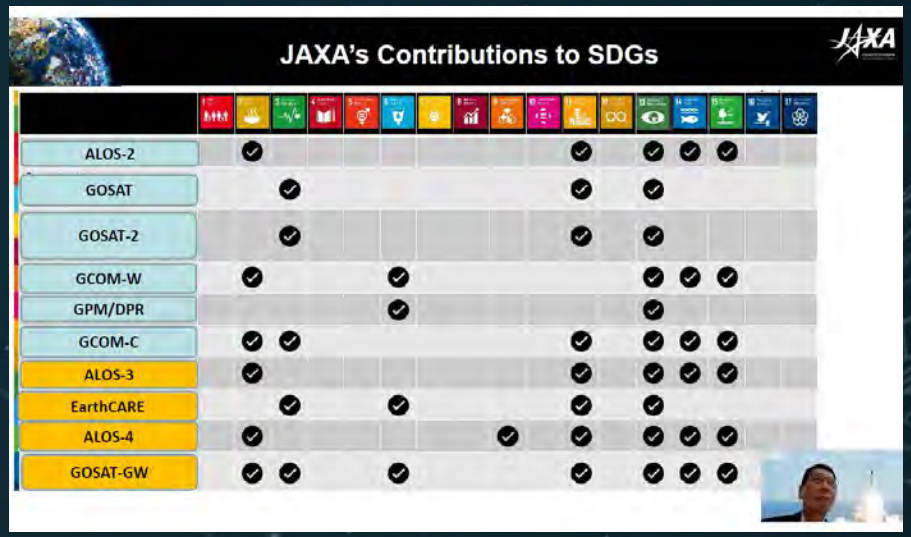


Mr. Motoki KORENAGA of the METI in his discussion of the government of Japan's policy for space equipment industry and satellite data utilization business



Professor Setsuko Aoki of Keio University Law School presenting about space law for the sustainable use of outer space

Presentation of JAXA Activities and its contributions to achieving SDGs



Verification

What to do when we build a satellite?

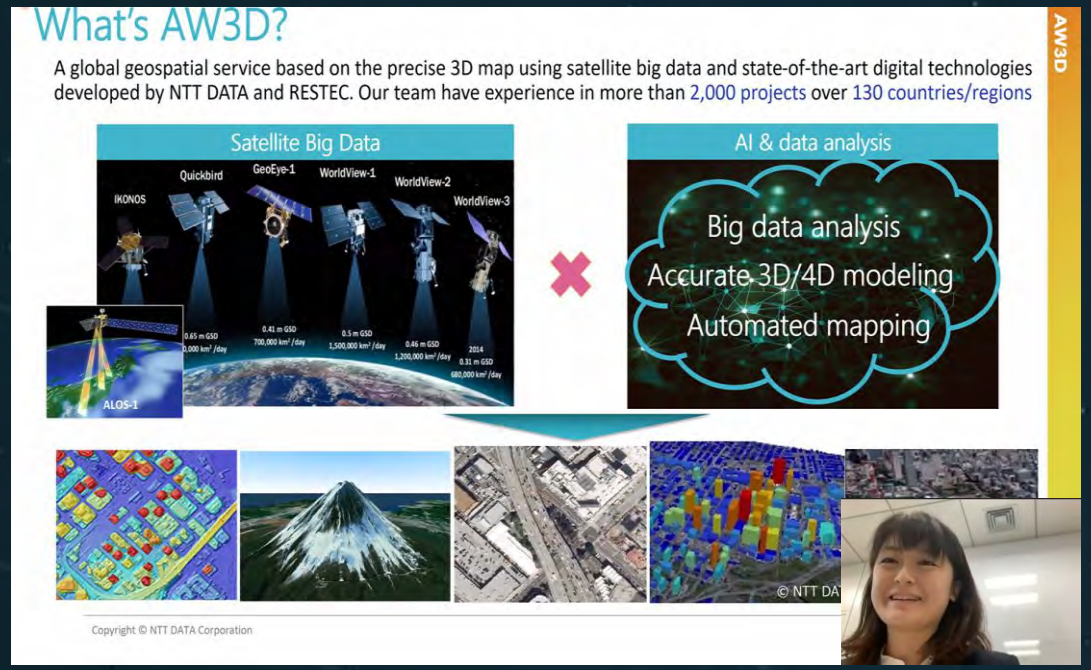
- Ask stakeholders/customers/users what needs they have (customer requirement)
  - Think about how the satellite solves the needs (mission requirement)
    - Overall specification of the satellite to meet the mission requirement (system requirement)
      - Specification of each component (component requirement)
      - Verify components against component requirement
    - Verify system against system requirement
  - Validate system against mission requirements

Verification: Is the system built right?
Validation: Is the right system built?

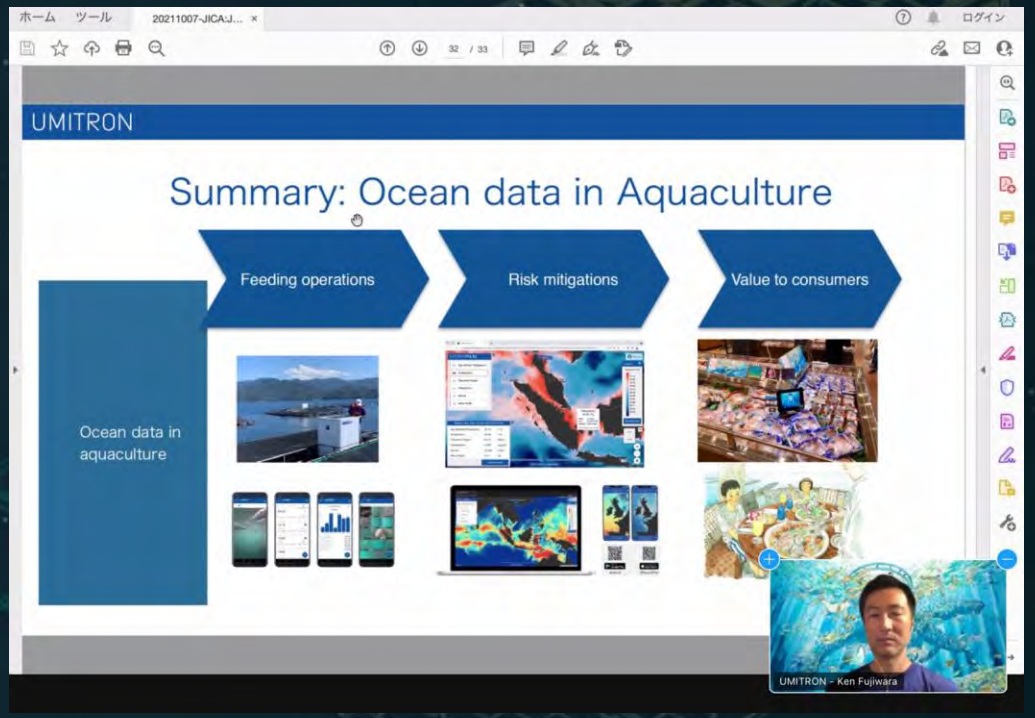
Professor Mengu Cho from Kyushu Institute of Technology presenting about satellite testing methods and its importance

Professor Shinichi Nakasuka from University of Tokyo discussing about development and utilization of space technology at university

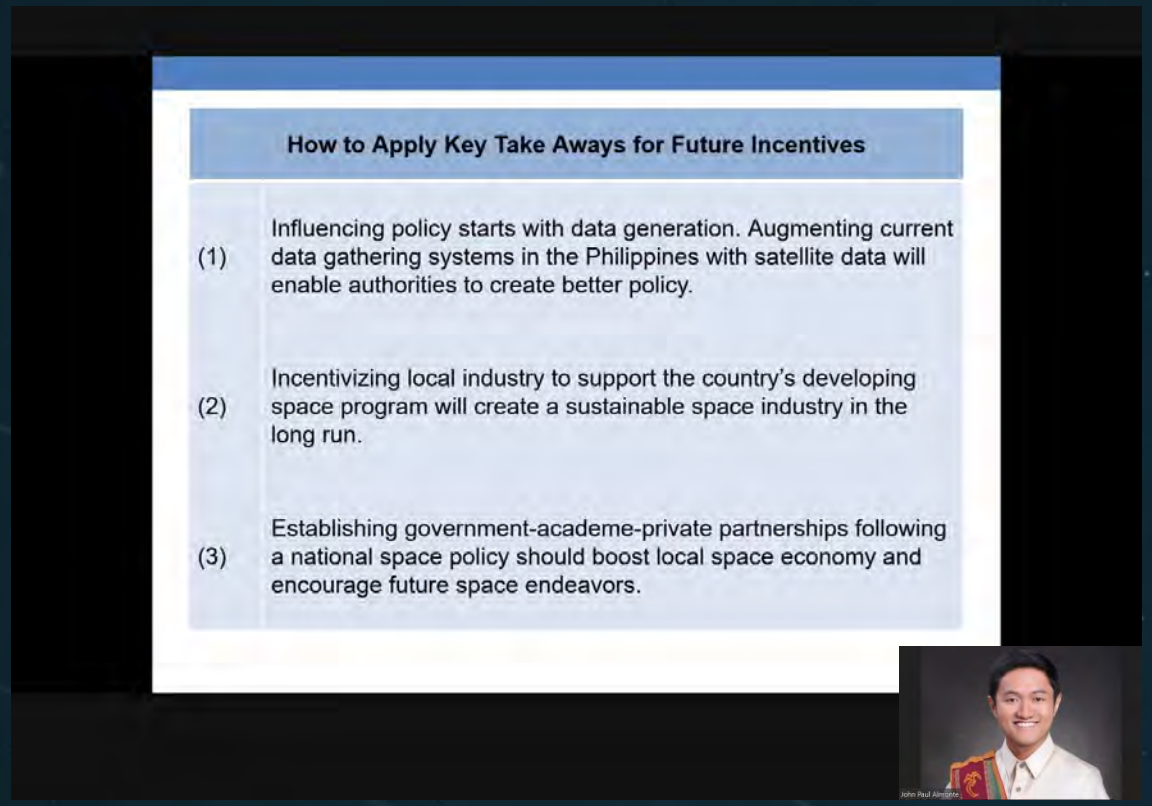
Presentations from the Private Sector

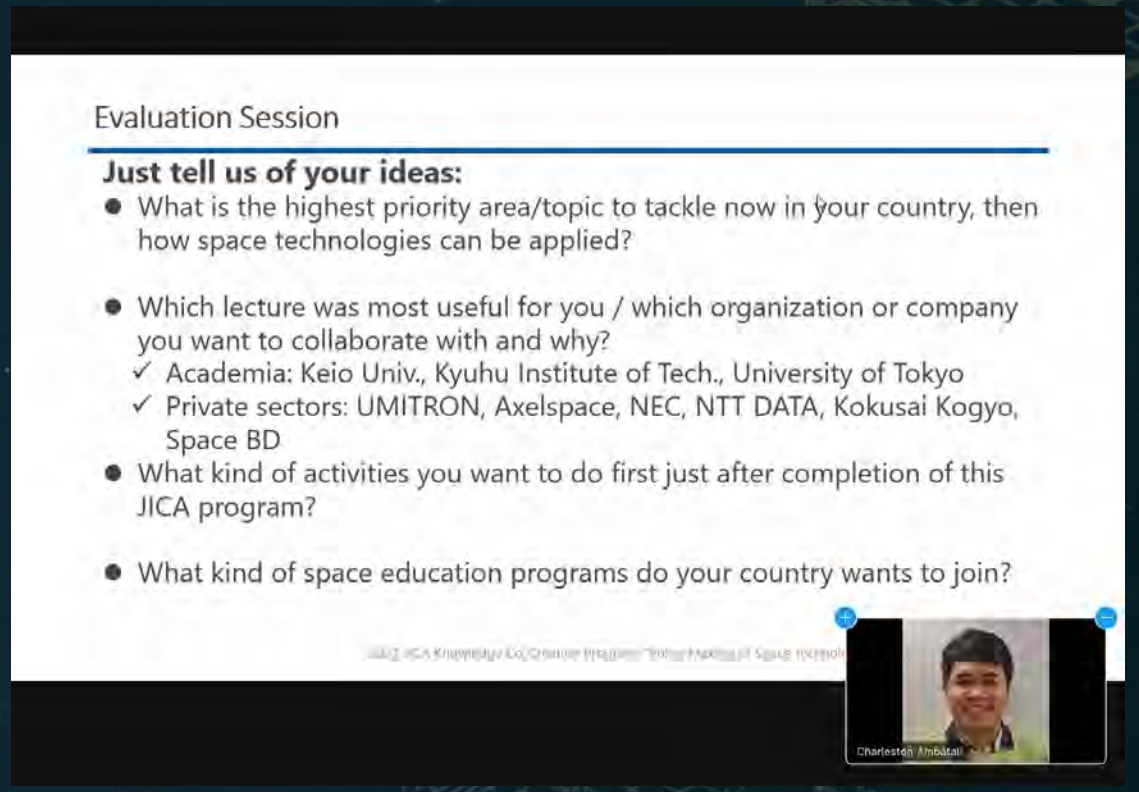


Ms. Aya Take from NTT Data discusses the global high-resolution 3D map application for achieving SDGs



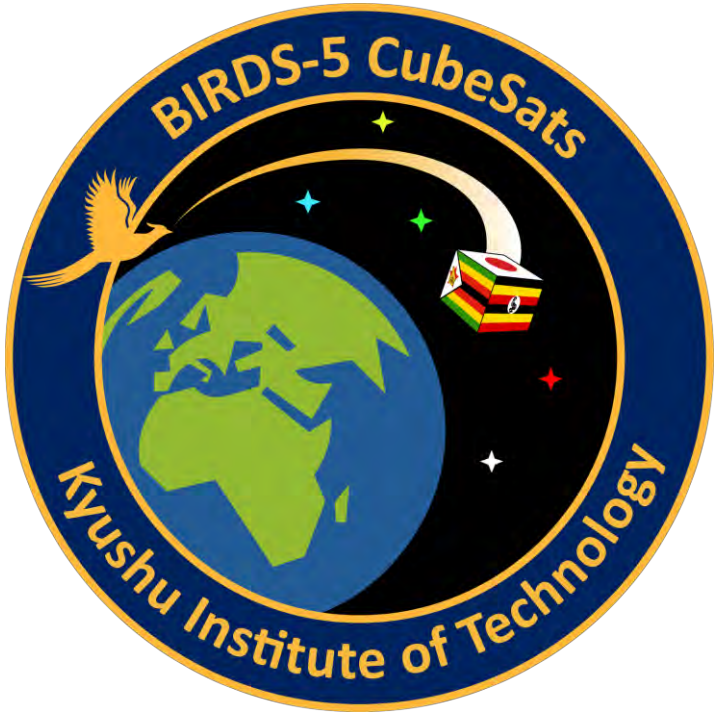
Mr. Ken Fujiwara from UMITRON presenting the application of ocean data from satellites in aquaculture





On the last day two days of the program, participants presented their key takeaways from the lectures and JSF held an evaluation session to conclude the program

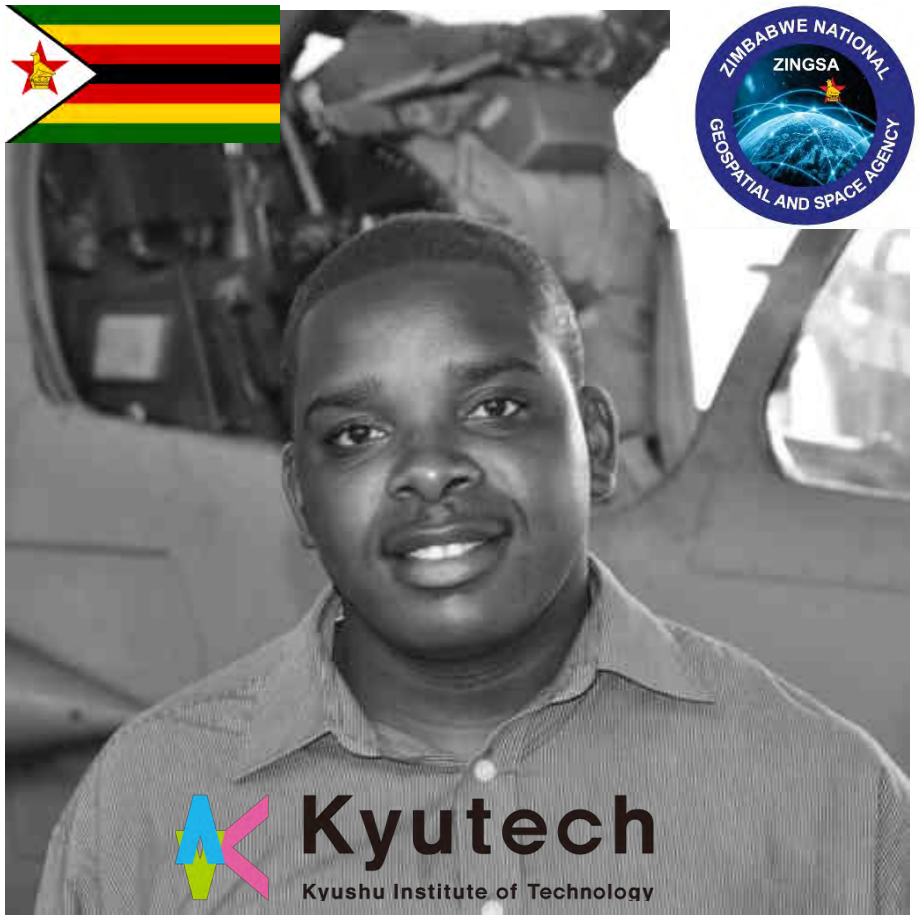
END OF THIS SECTION



The following sections are the BIRDS-5 articles for November 2021

(compiled by Timothy of Zimbabwe)

BIRDS 5 Vibration Analysis



By :

Victor Mukungunugwa,

BIRDS-5 Project Manager

13/NOV/2021

Why We Need Testing

- Vibration testing on a shaker is to verify compliance with certain structural and mechanical requirements, specifically to establish confidence that the spacecraft structure, payload(s), equipment, and other hardware can withstand and function as needed after exposure to the highest load during the mission (strength verification and verification that relative alignment of critical components or interfaces is maintained);
- The above spacecraft hardware can withstand and function as needed after (and during, for any equipment that must operate during launch) exposure to cyclic loading associated with launch vibration and, to some extent, verify fatigue life of the materials;
- Electrical connectors will remain seated during the launch environment;
- The satellite will maintain general integrity, e.g., no bolted joints loosening because of lost fastener preload and no parts coming loose or free from containment;
- The satellite meets any specified constraints on natural frequencies (typically applies to the launch configuration in order to avoid dynamic coupling with the launch vehicle and subsequent high loads).

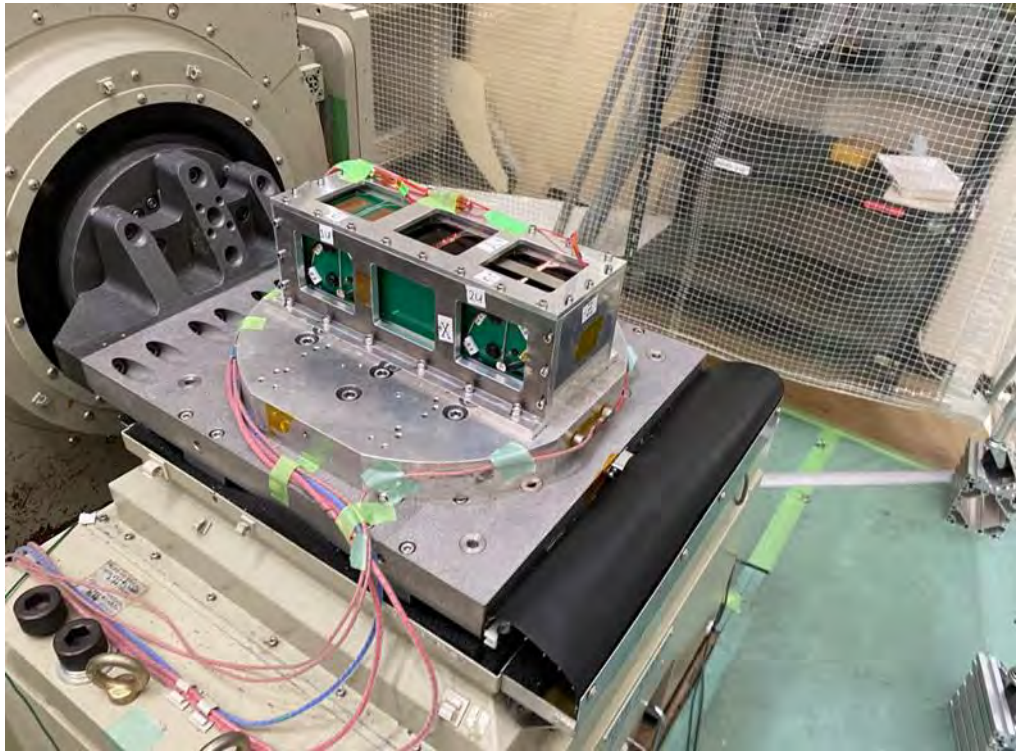
Common Types of Tests on a Shaker

- **Sine-burst test**, the shaker introduces a sinusoidal acceleration at the base of the test article, with steadily increasing, then maintained, and finally decreasing amplitudes, all at constant frequency. The sinusoidal frequency is selected to be significantly lower than the fundamental vibration frequency of the test article in order to minimize dynamic response or amplification of the acceleration. In this way, we subject the test article to near-uniform acceleration, analogous to a quasi-static load, which is often used for structural design.
- **Random vibration test**, an electro-dynamic shaker is controlled to introduce vibration at frequencies typically between 20 and 2000 Hz in the space industry. All frequencies within the applicable range are introduced simultaneously at random amplitude and phase. One of the objectives of a random vibration test is to verify strength of secondary structures, which include equipment housings, mounting brackets, and electronics boards. Because the test is not truly flight-like, we must be careful to avoid unrealistic and excessive loading, i.e., loads significantly higher than the maximum expected mission loads, which is of most concern for the primary structure. When properly justified, force limiting

Class of Test

- A **qualification (or simply qual) test** is done on dedicated hardware that is not intended to fly, with the objective of establishing confidence in a design; if the hardware passes the test, we say the design is qualified. The qualification hardware is built to the same design and with the same manufacturing processes as the flight hardware, and it's tested to environments that are more severe than anything the flight hardware will see.
- An **acceptance test** is a test done on flight hardware, typically to MPE. If the design has already been qualified by successful qualification testing, the purpose of acceptance testing is to confirm process control, including workmanship. In other words, although the qualification margin accounts for some degree of build-to-build variation, we test each build for acceptance to screen out defects that are outside the demonstrated qualification margin
- A **proto-qualification** (a.k.a. proto-qual) test (military term) and a proto-flight test (NASA term) are very nearly the same thing a test of the flight hardware to levels that are more severe than MPE in absence of a previously qualified design although there are subtle differences that we won't explore here. This test approach may be selected in lieu of separate qualification and acceptance tests when production volume is low and building and testing dedicated test hardware is not affordable.

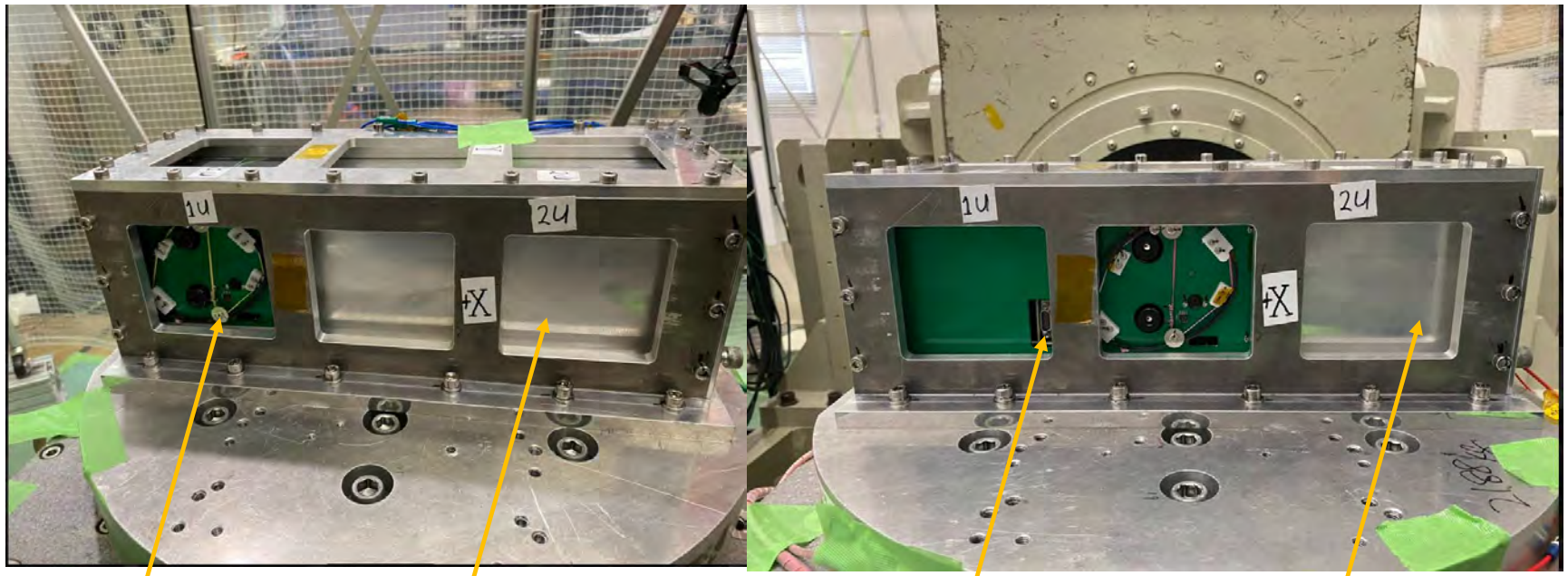
Test Configuration



No.	Name	Type	Manufacture	Quantity	Note
1	Accelerometer	731-B	EMIC	4	For control and monitor
2	Accelerometer	2222C	Endevco	11	For monitor
3	Accelerometer	M357B06	TOYO Tech.	3	For monitor
4	Charge Amp.	4035	SHOWA	3	
5	DAQ system	9215	National Instrument	1	
6	Analysis device	PC	-	1	
7	Coaxial cable for accelerometer	-	-	16	
8	Coaxial cable for connect between DAQ and Amp	-	-	16	

Test Configuration

3U CAD MODEL



1U satellite

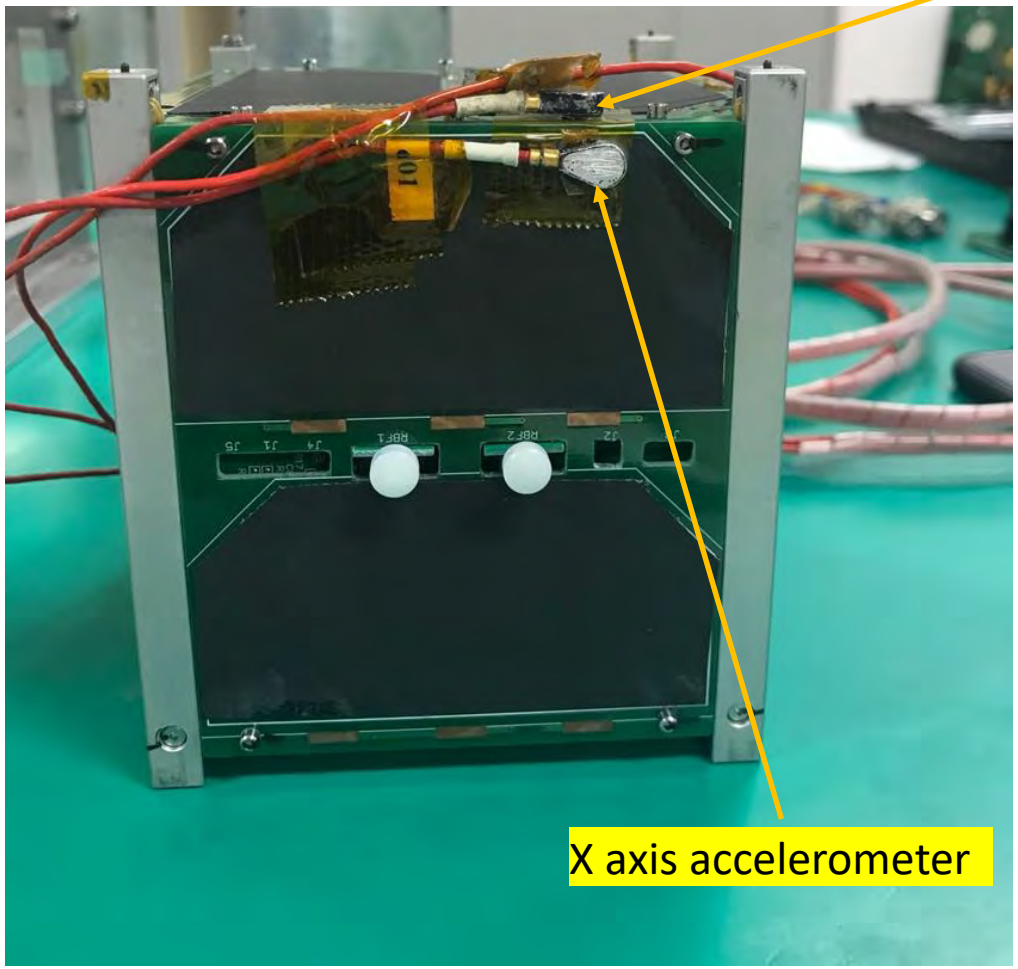
2U Dummy load

2U satellite

1U Dummy load

The satellites could not be tested mutually because there was only 1 back plane board working that had to be interchanged within the satellites

Accelerometer Mounting



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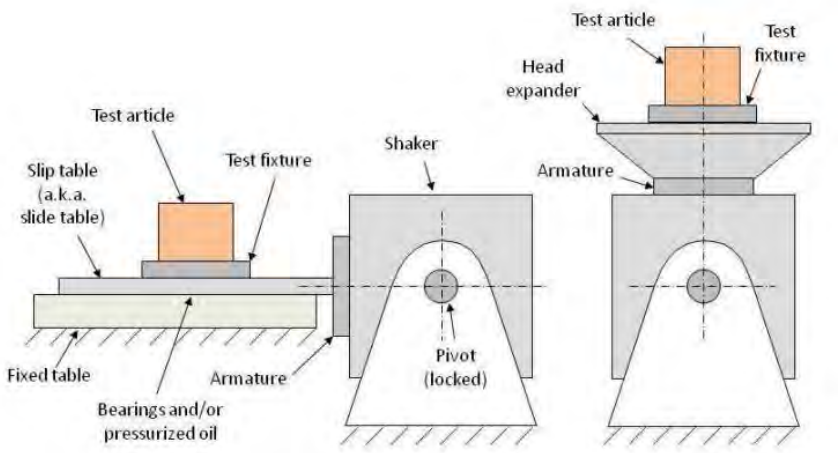
4	Charge Amp.	4035	SHOWA	3	
5	DAQ system	9215	National Instrument	1	
6	Analysis device	PC	-	1	
7	Coaxial cable for accelerometer	-	-	16	
8	Coaxial cable for connect between DAQ and Amp	-	-	16	

Vibration Testing System Specification

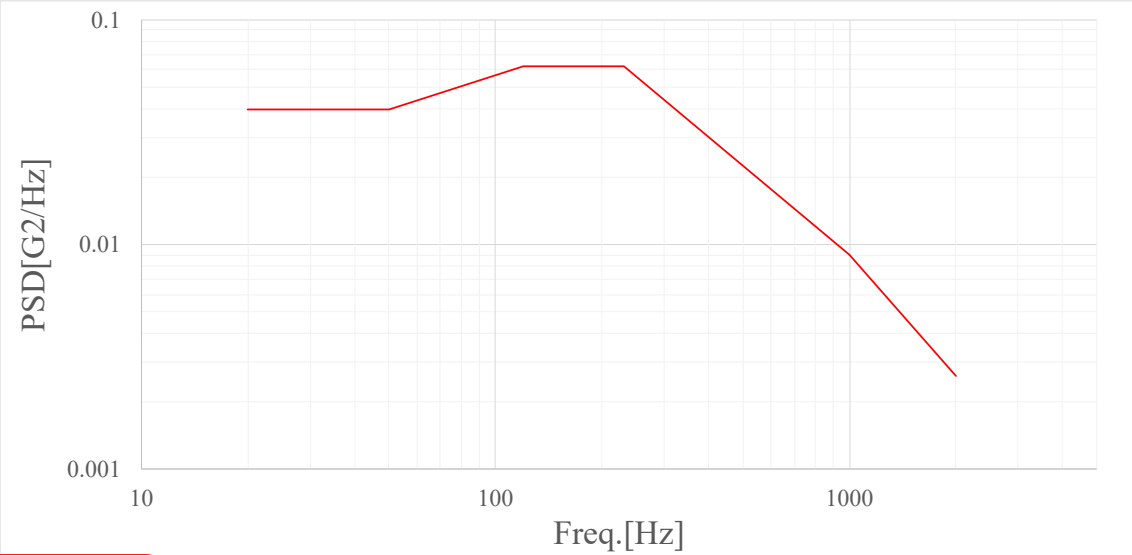


Schematic view of testing material

Pictorial view of testing material

No.	Items	Specification		
1	Type	F-35000BD/LA36AP(made by EMIC)		
2	Exciting Force	Sine		35.0 kN
		Random		28.0 kN
		Shock		87.5 kN
3	No-load maximum acceleration	Vertical	Sine	1060.0 m/s^2
			Shock	1470.0 m/s^2 (0-p)
		Horizontal	Sine	460.5 m/s2
			Shock	1151.3 m/s^2 (0-p)
4	Maximum loading mass	Vertical		400 kg
		Horizontal		500 kg
5	Horizontal vibration table size	50cm×50 cm		
6	Power	49.0 kVA		

Random Vibration PSD Profile

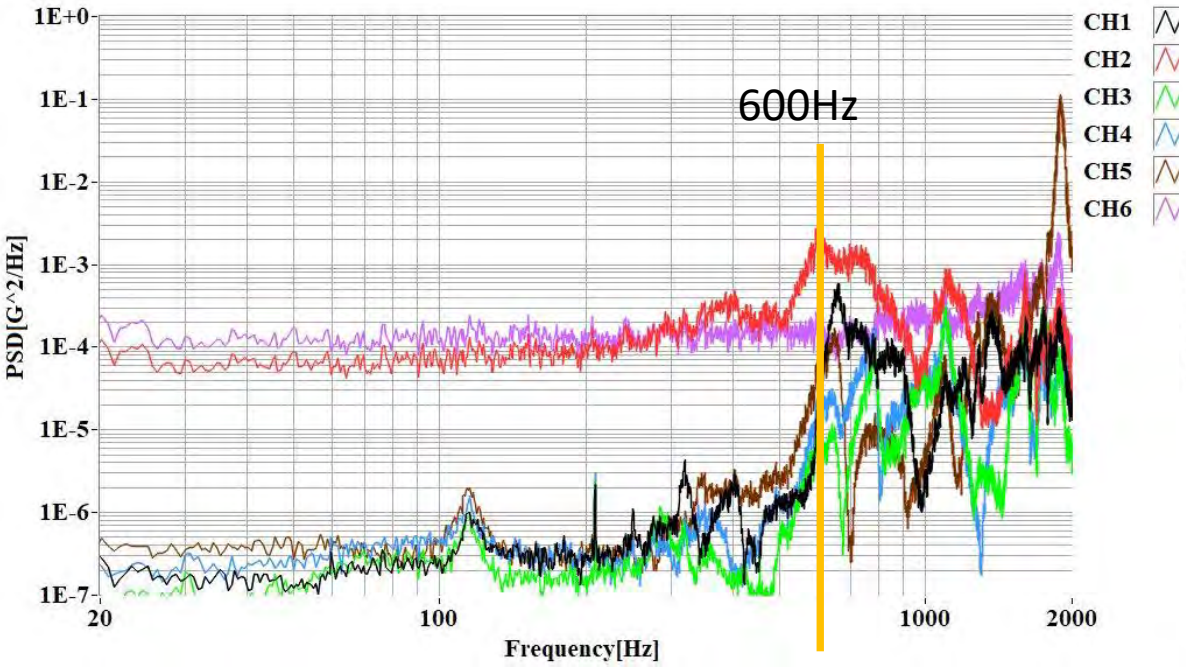


- Kyutech uses the HTV-X PSD profile to test or the nano satellite Quality and Acceptance test

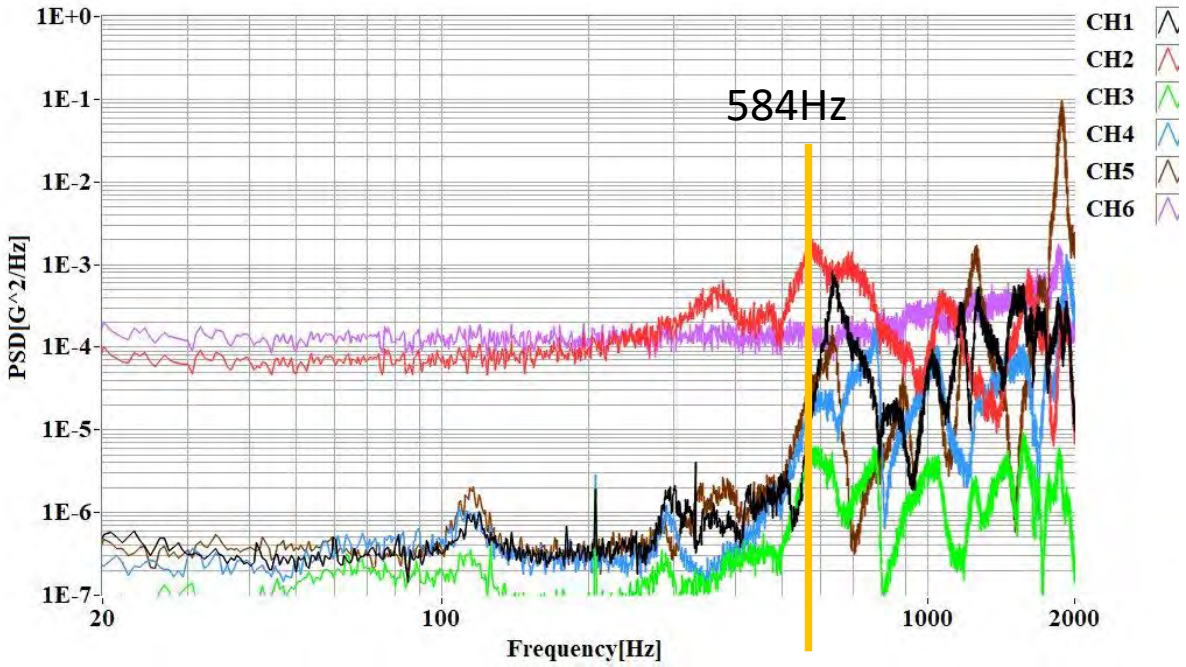
HTV-X		SpX DRAGON		NG Cygnus	
Freq. (Hz)	**PSD (g2/Hz)**	**Freq. (Hz)**	**PSD (g2/Hz)**	**Freq. (Hz)**	**PSD (g2/Hz)**
20	0.01	20	0.04	20	0.008
50	0.04	200	0.04	30	0.008
120	0.062	2000	0.002	70	0.03
230	0.062			150	0.03
1000	0.009			2000	0.0012
2000	0.0026				
Overall (grms)	5.73	Overall (grms)	4.53	Overall (grms)	3.45

Envelope (QT)	
Freq. (Hz)	**PSD (g2/Hz)**
20	0.04
50	0.04
120	0.062
230	0.062
1000	0.009
2000	0.0026
Overall (Grms)	5.77
Duration (s)	120

Y axis before and after vibration



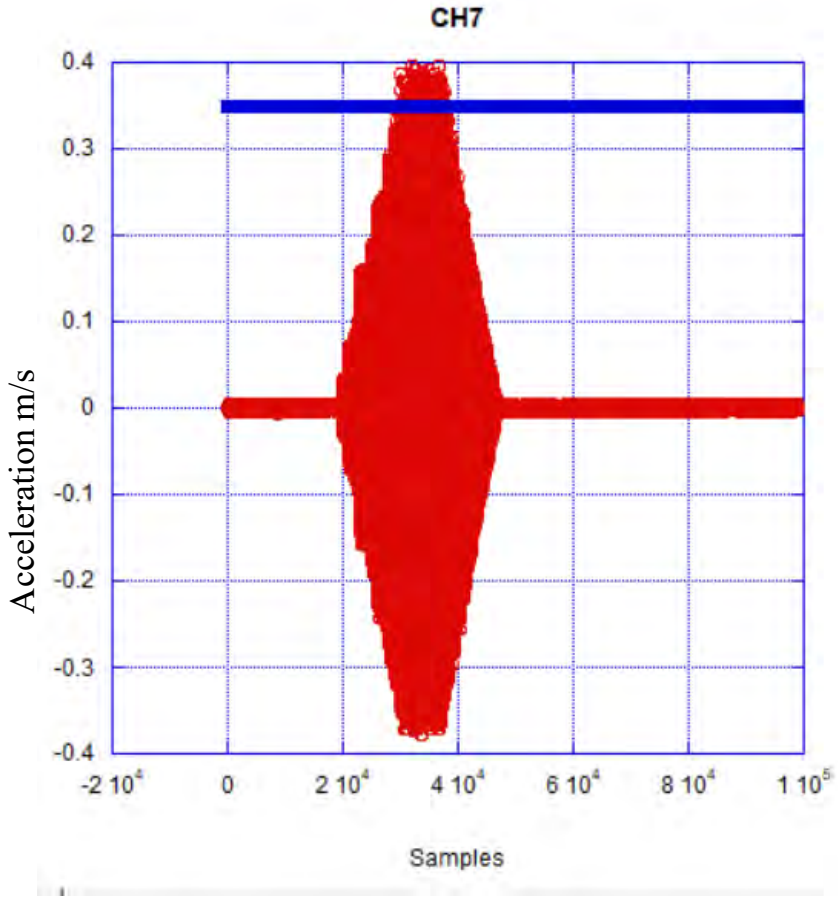
Before



After

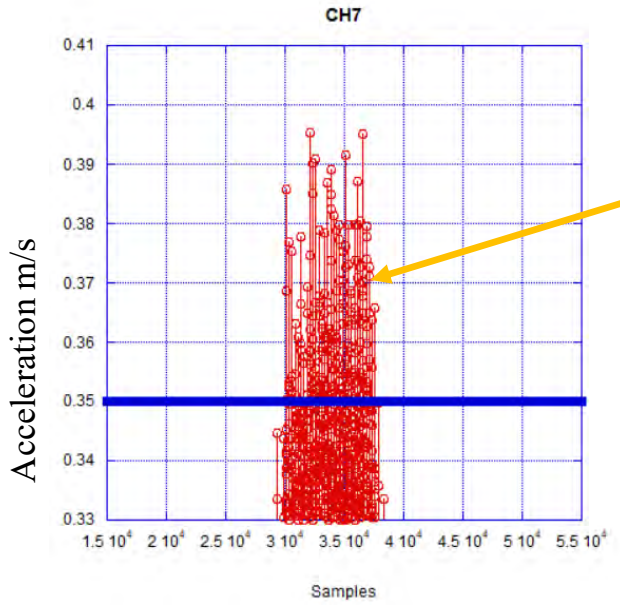
The peak values are the natural frequency of the satellite before and after random vibration , 5% shift in THE natural frequency is allowed by JAXA

Sine Burst QT Z-axis



Sine-burst Profile

SINE BURST QT			
Direction	**Freq. [Hz]**	**QT**	
		Number of waves	**Acceleration [G]**
Vertical axis (Y)	10~40	10 or more	11.25
Horizontal axis (X, Z)	10~40		11.25
			11.25

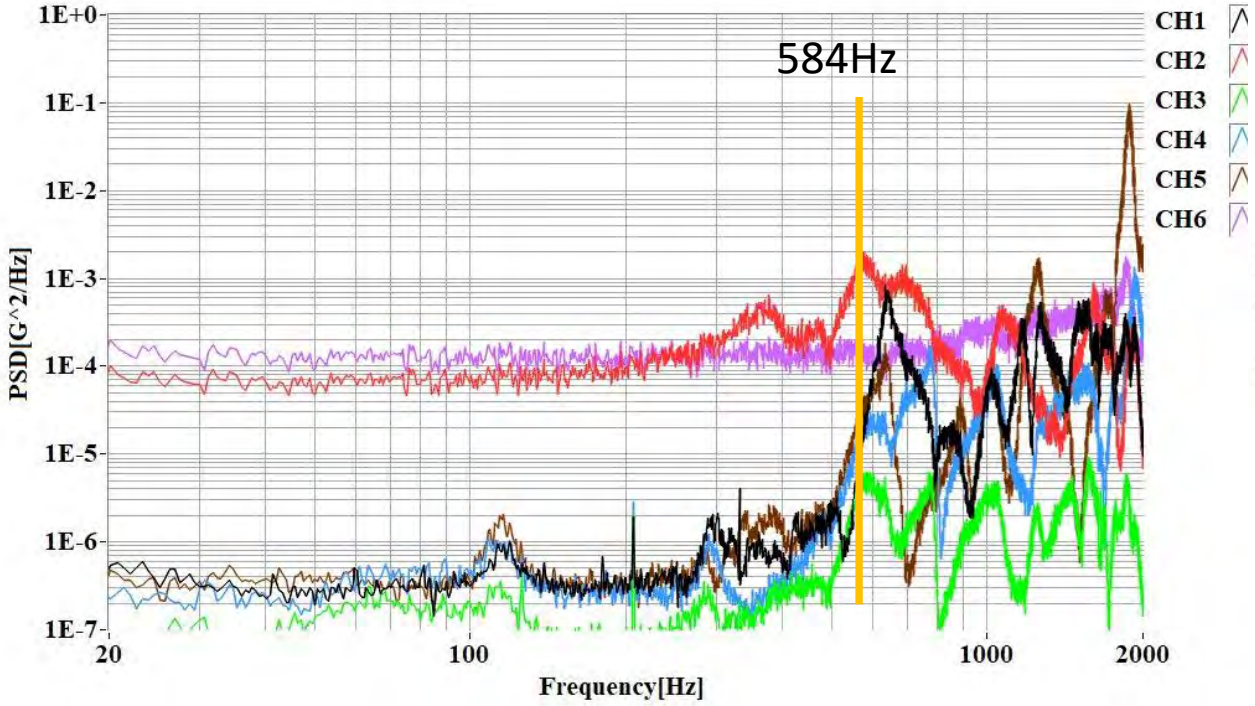


$$Test\ level\ boundary\ = \frac{11.25}{31.6} = 0.356$$

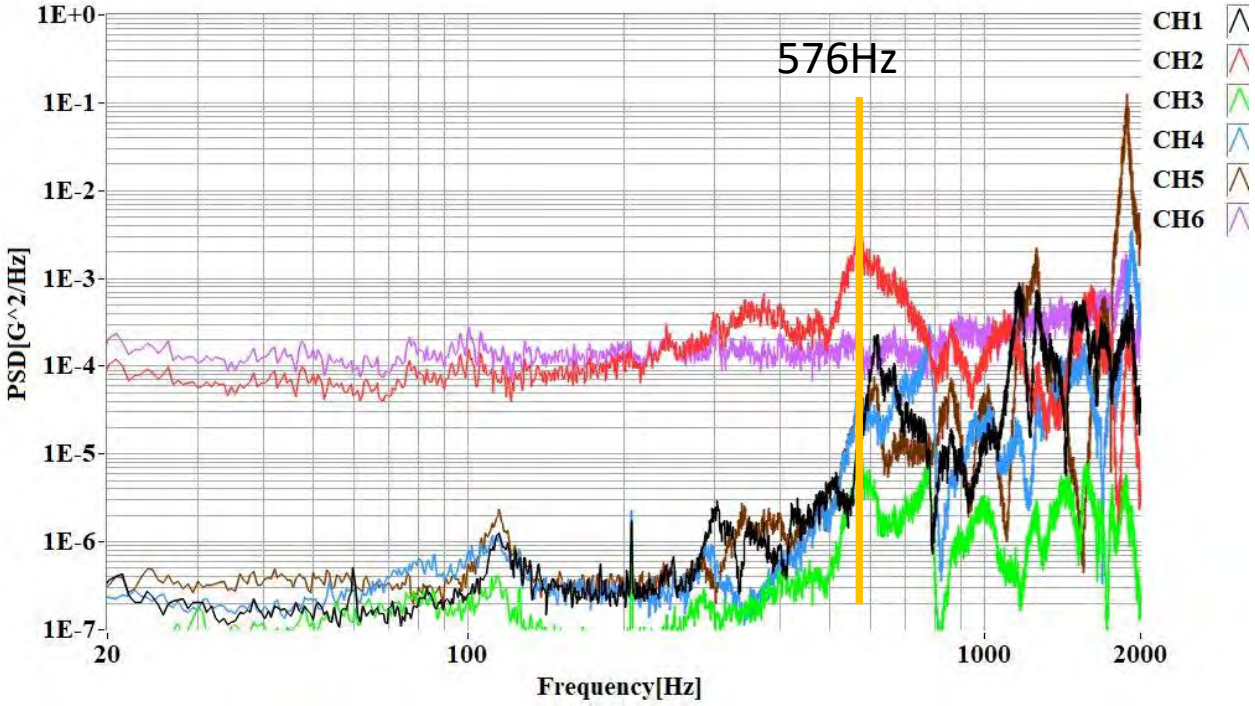
JAXA requires 10 or more Octaves

Y axis before and after sine

We compare the modal survey natural frequency before and after sine burst to see if there is any change and this shows the quality of workmanship



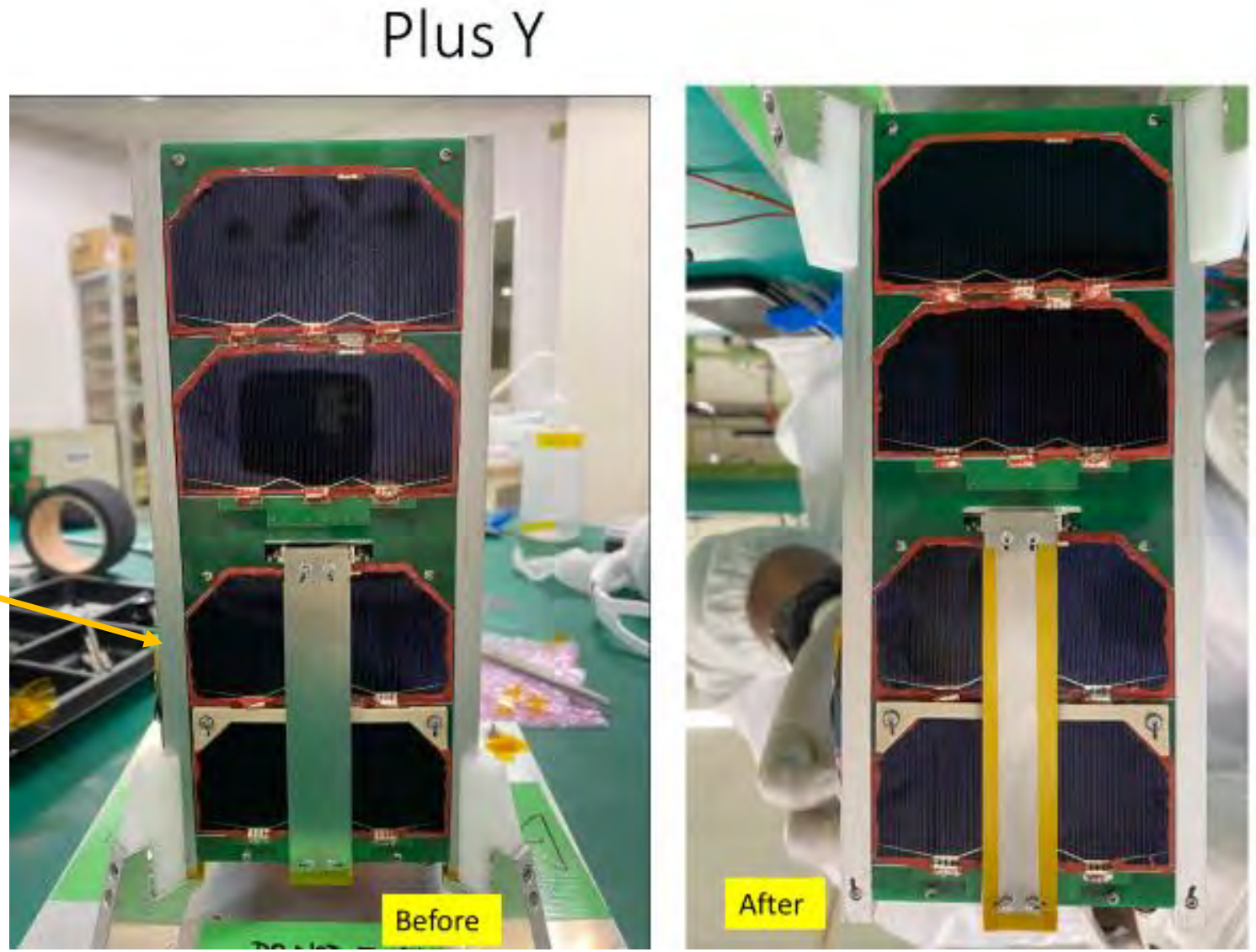
Before



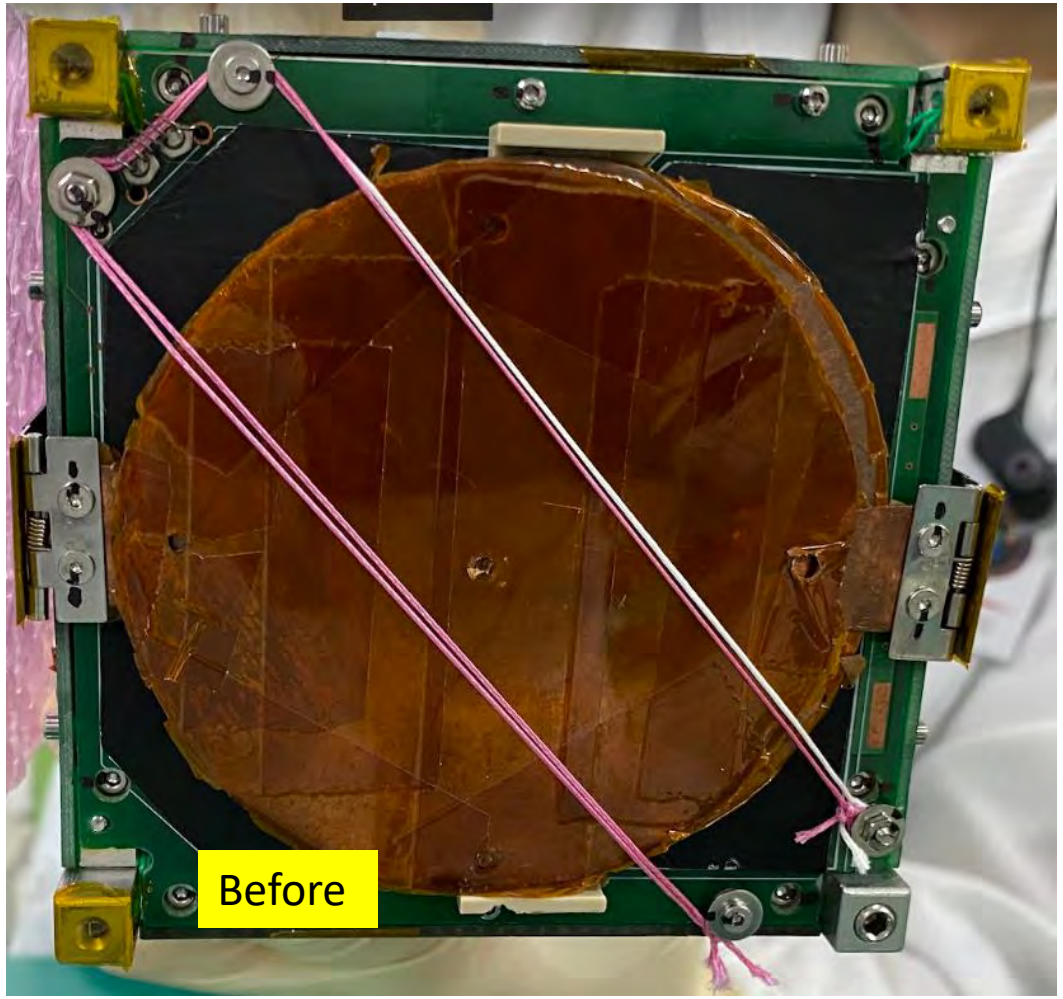
After

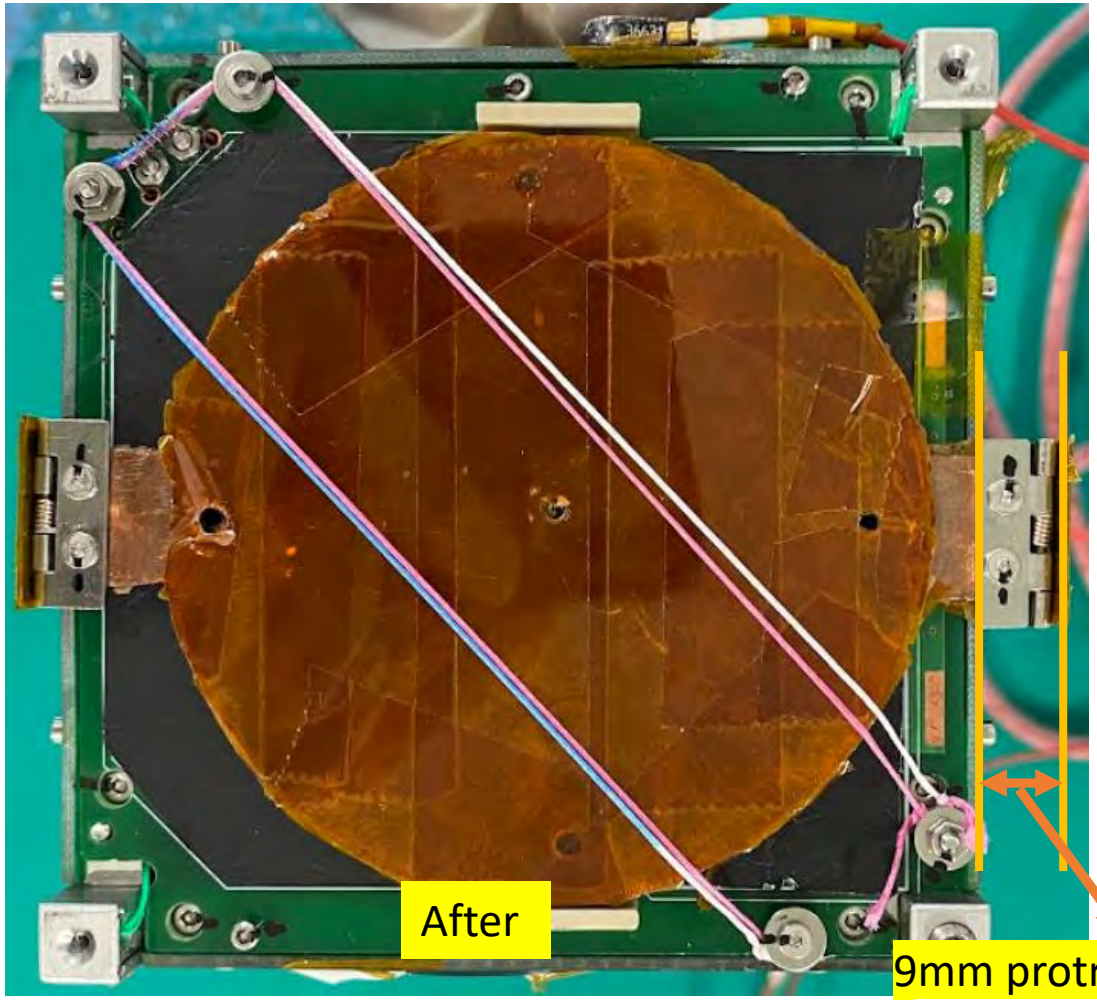
Solar Panel Vibration Testing

- The solar panels were mounted on the plus Y panel, and they were not damaged after the vibration analysis.
- The solar panels were protected from DLP damage using the guide



DLP Quality Test Assessment

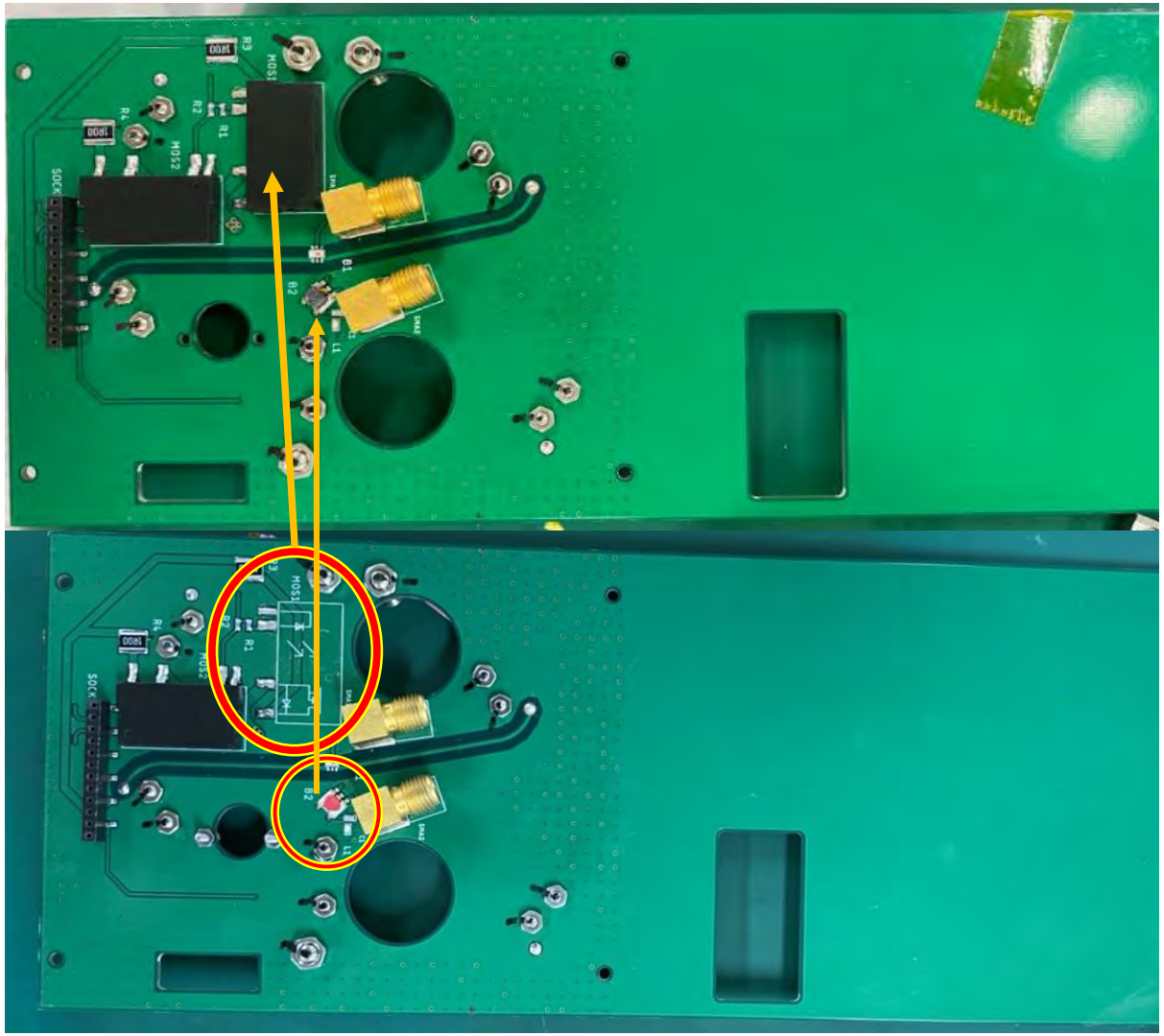




The DLP was slightly deployed outside the envelop and there is need or a solution to this problem or it is a safety problem

+ X Panel Integrity Before & After Vibration Test

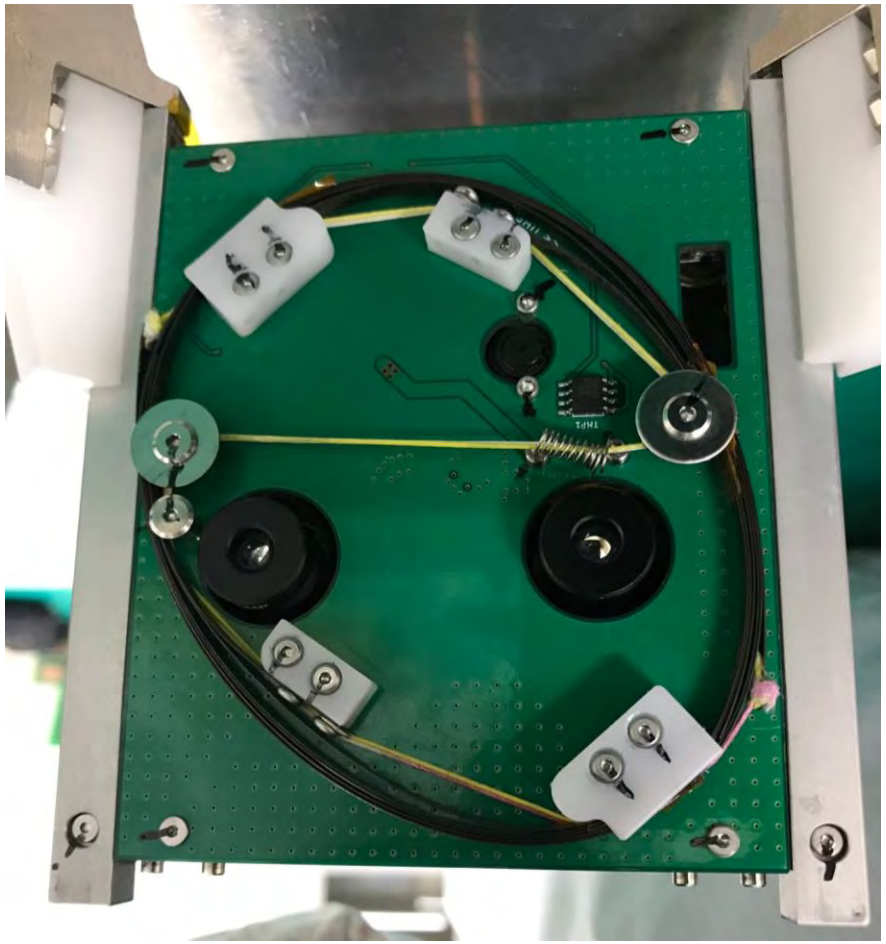
The mosphet and balun of the antenna panel were removed during the vibration
And or light model they will be glued by RTV glue to prevent this damage.



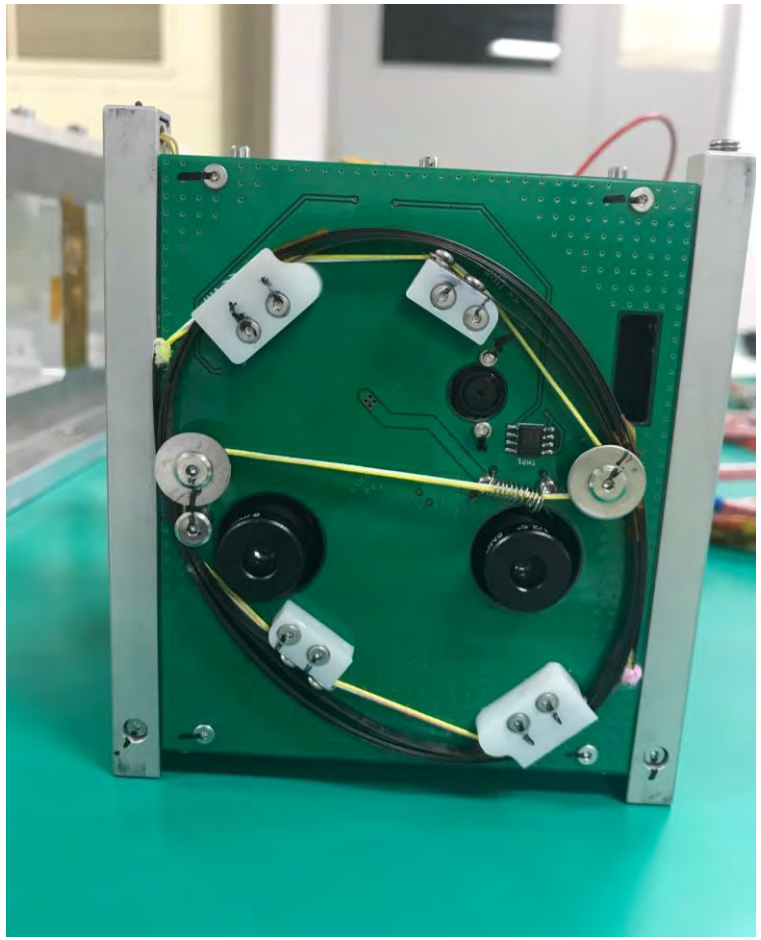
Before Vibration

After Vibration

Plus, X Panel(Antenna)



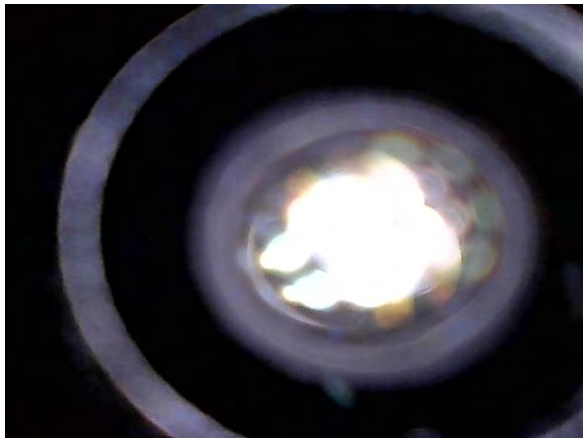
Before

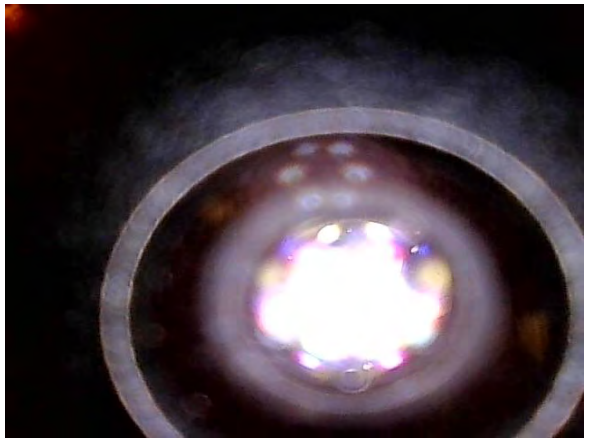


After

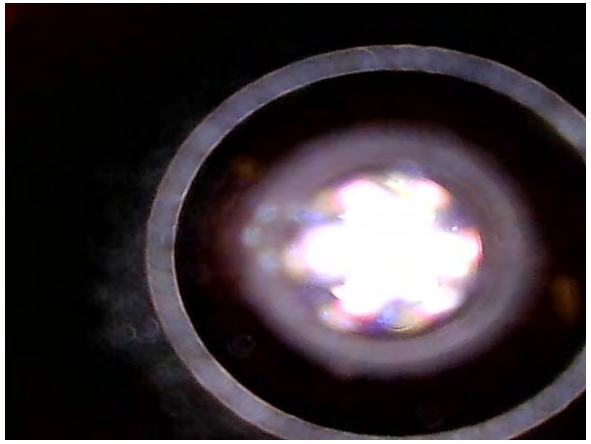
The antennae was not deployed during the vibration testing

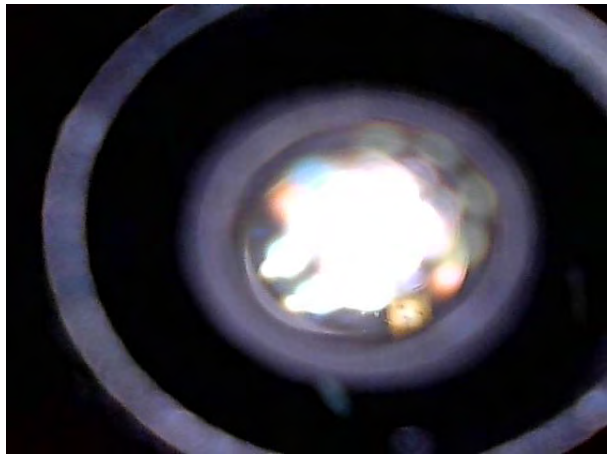
Camera Filter Integrity Before And After Vibration Testing





1U Camera





2U Camera

Before

After

The camera filter images above were taken by a NIDAGE endoscope, the images reveal that the filters didn't break during vibration

Summary of Results 1U

Task No.	Axis	Test	Torque marks	Picture /Video	Test parameters	Accelero-meter	Test criteria No.	Comments
08	X	Setup	-	-	-	-	2: pass 3: pass	-
09	X	Modal	-	-	0.5 Grms, 60 sec	-	4: pass	Natural frequency: 450Hz
10	X	Random QT	✔	✔	6.8Grms, 120sec	✔	5: pass	-
11	X	Modal	-	-	0.5 Grms, 60 sec	-	4: pass 5: pass	Natural frequency: 408Hz, 0% change
	X	Sin burst	✔	✔	11.3G	✔	4: pass	-
12	X	Modal	-	-	0.5 Grms, 60 sec	-	5: pass	Natural frequency: Hz, 9.3% change
13	Z							
14	Z	Setup	-	-	-	-	2: pass 3: pass	-
15	Z	Modal	-	-	0.5 Grms, 60 sec	-	4: pass	Natural frequency: 835Hz
	Z	Random QT	✔	✔	6.8Grms, 120sec	✔	5: pass	-
16								
17	Z	Modal	-	-	0.5 Grms, 60 sec	-	4: pass 5: pass	Natural frequency: 798Hz, 4% change
18		Sin burst	✔	✔	11.3G	✔	4: pass	-
19	Z	Modal	-	-	0.5 Grms, 60 sec	-	5: pass	Natural frequency: 805Hz, 0.8% change
20	-	Open total for check	-	-	-	-	1:pass	All torques good. String do not cut and loose.
21	-	-	-	-	-	-	-	-

Modal> sine> modal>Random >modal test were carried out. The natural frequency comparison before and after each survey is below the 5% change as per the JAXA requirements hence in the Y axis the structure pass the qualification test in the X and Z axis

Summary of Results 2U

Task No.	Axis	Test	Torque marks	Picture /Video	Test parameters	Accelero-meter	Test criteria No.	Comments
13	Z							
14	Z	Setup	-	-	-	-	2: pass 3: pass	-
15	Z	Modal	-	-	0.5 Grms, 60 sec	-	4: pass	Natural frequency: 805Hz
	Z	Random QT	✔	✔	5.77Grms, 120sec	✔	5: pass	-
16								
17	Z	Modal	-	-	0.5 Grms, 60 sec	-	4: pass 5: pass	Natural frequency: 813Hz, 0.99% change
18		Sin burst	✔	✔	11.3G	✔	4: pass	-
19	Z	Modal	-	-	0.5 Grms, 60 sec	-	5: pass	Natural frequency: 805Hz, 0.99% change
20	-	Open total for check	-	-	-	-	1:pass	All torques good. String do not cut and loose.

Task No.	Axis	Test	Torque marks	Picture /Video	Test parameters	Accelero-meter	Test criteria No.	Comments
07	X							
08	X	Setup	-	-	-	-	2: pass 3: pass	-
09	X	Modal	-	-	0.5 Grms, 60 sec	-	4: pass	Natural frequency: 315Hz
10	X	Random QT	✔	✔	6.8Grms, 120sec	✔	5: pass	-
11	X	Modal	-	-	0.5 Grms, 60 sec	-	4: pass 5: pass	Natural frequency: 314Hz, 0.3% change
	X	Sin burst	✔	✔	11.3G	✔	4: pass	-
12	X	Modal	-	-	0.5 Grms, 60 sec	-	5: pass	Natural frequency: Hz, 0.6% change

Modal> sine> modal>Random >modal test were carried out. The natural frequency comparison before and after each survey is below the 5% change as per the JAXA requirements hence in the Y axis the structure pass the qualification test in the X and Z axis

END OF VIBRATION TEST RESULTS

BIRDS-5 Ground Sensor Terminal

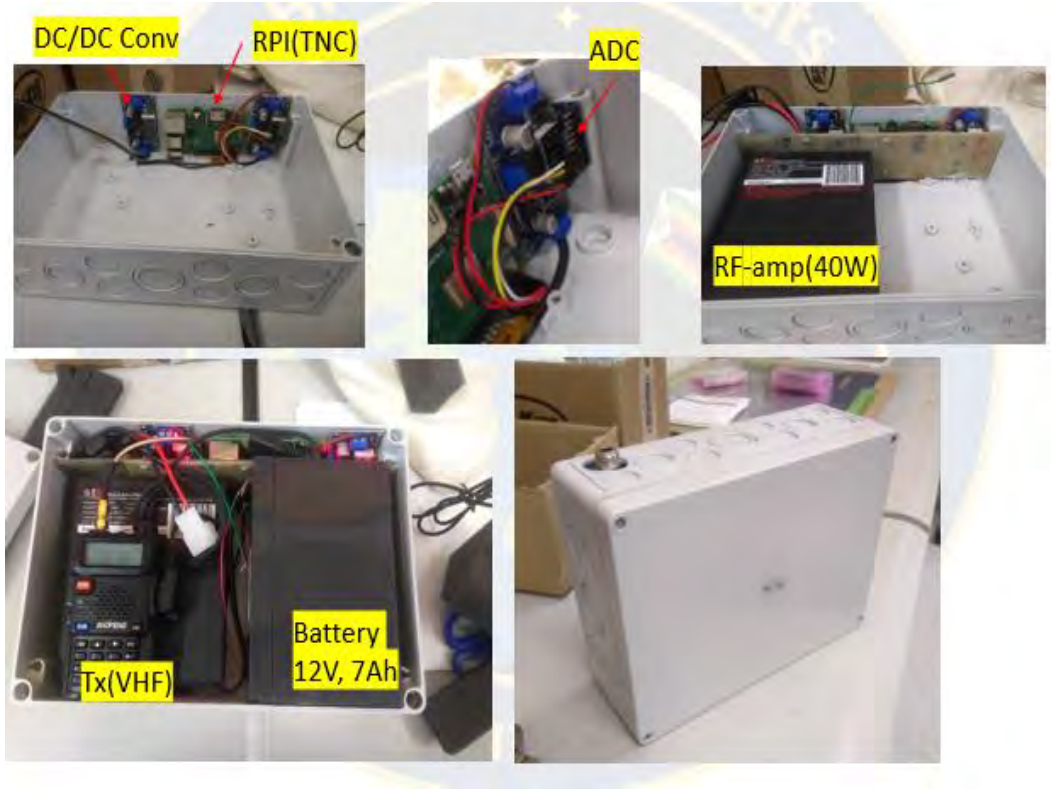
By: Edgar MUJUNI

13th November 2021

GST Upgrade

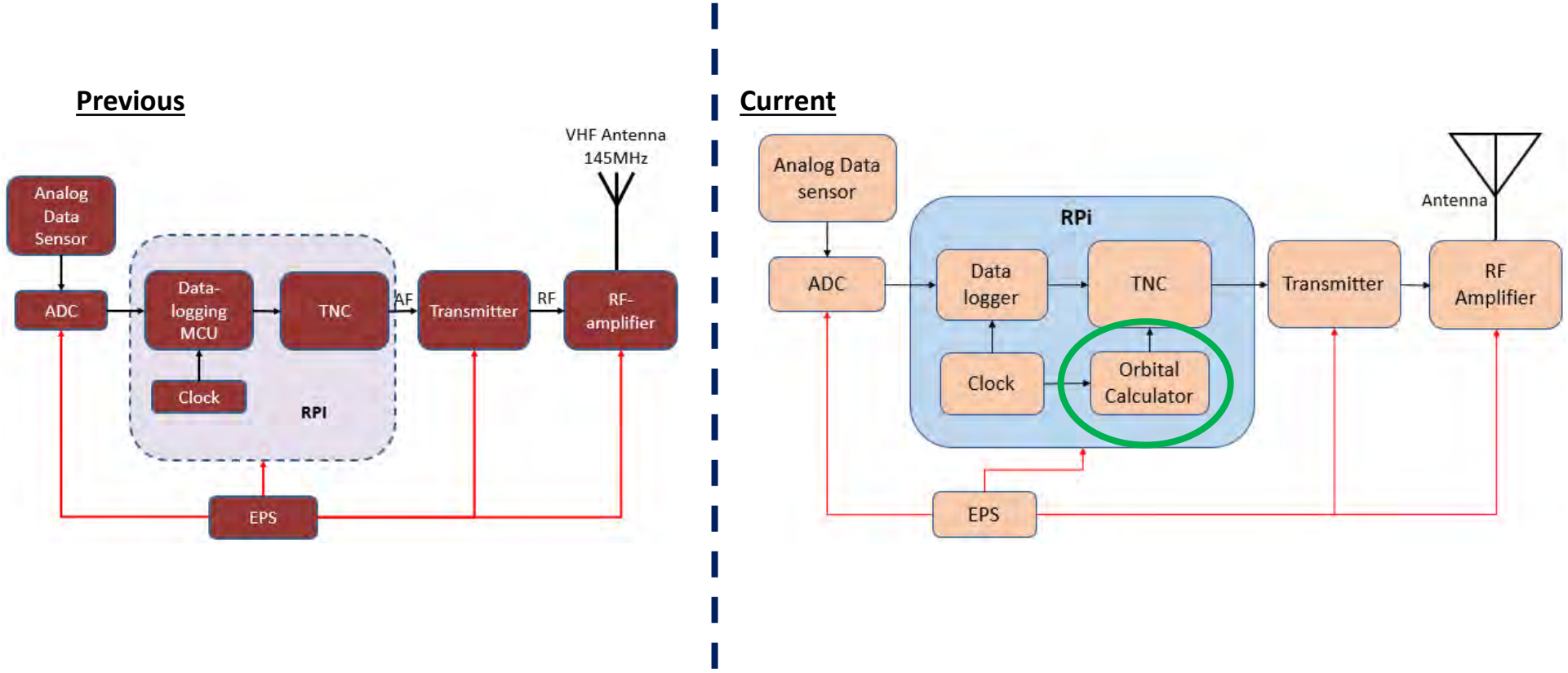
One of the main missions of Birds5 satellites is the Store & Forward Mission.

- Ground sensor terminals will be located in different parts of our countries to basically collect remote sensor data.
- Initially the plan was that these GSTs uplink real-time sensor data at regular intervals, regardless of whether the satellite is above the horizon or not.
- This is a basic way, but it has its challenges when it comes to power consumption and communication channel usage efficiency.
- The better way is to uplink only when the satellite is with in reach.
- This calls for our GSTs to be a little more intelligent.



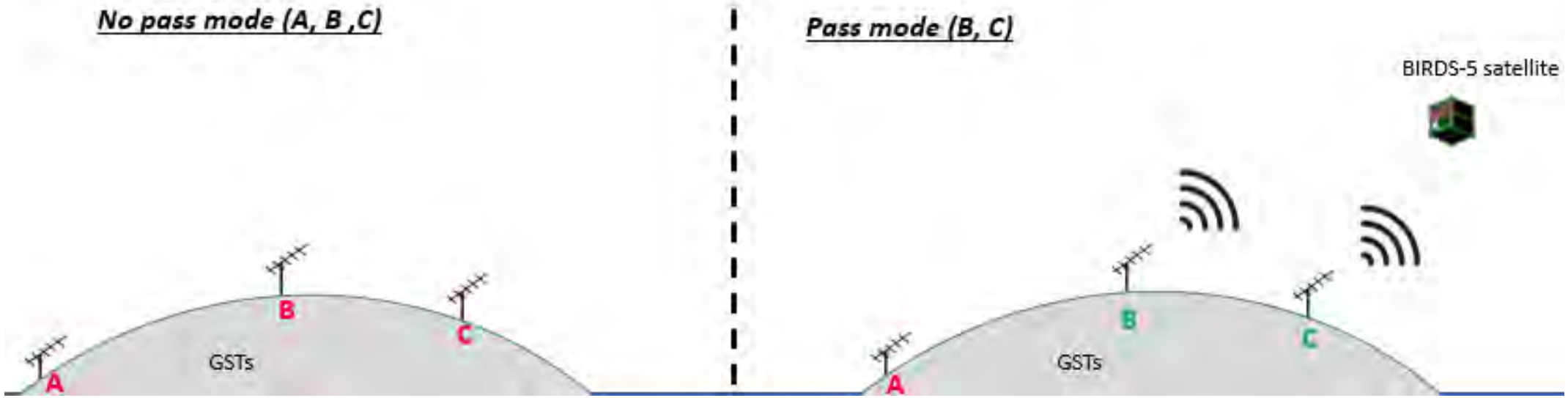
GST Upgrade

The upgrade we are making is to include satellite **Orbit Calculator** to our GSTs. This constantly tracks the satellite position in the orbit and will activate uplinks whenever satellite is in line of sight.



GST Upgrade

- More so, satellite tracking is dependent on ground location, therefore the Orbit calculator will require GST location as one of the parameters in addition to Satellite TLE among others.
- Each GST will be configured according to its geographical location.
- Generally, the GSTs will have two modes, Nominal(No pass) Mode & Uplink(Pass) Mode.
- This will greatly improve on frequency utilization efficiency and GST power budgets.



24. BIRDS-5: Environmental Control and Life Supporting Systems (ECLSS) for Space Stations and Deep Space

Email: munyaradzi.nyamukondiwa-ramson769@mail.kyutech.ac.jp

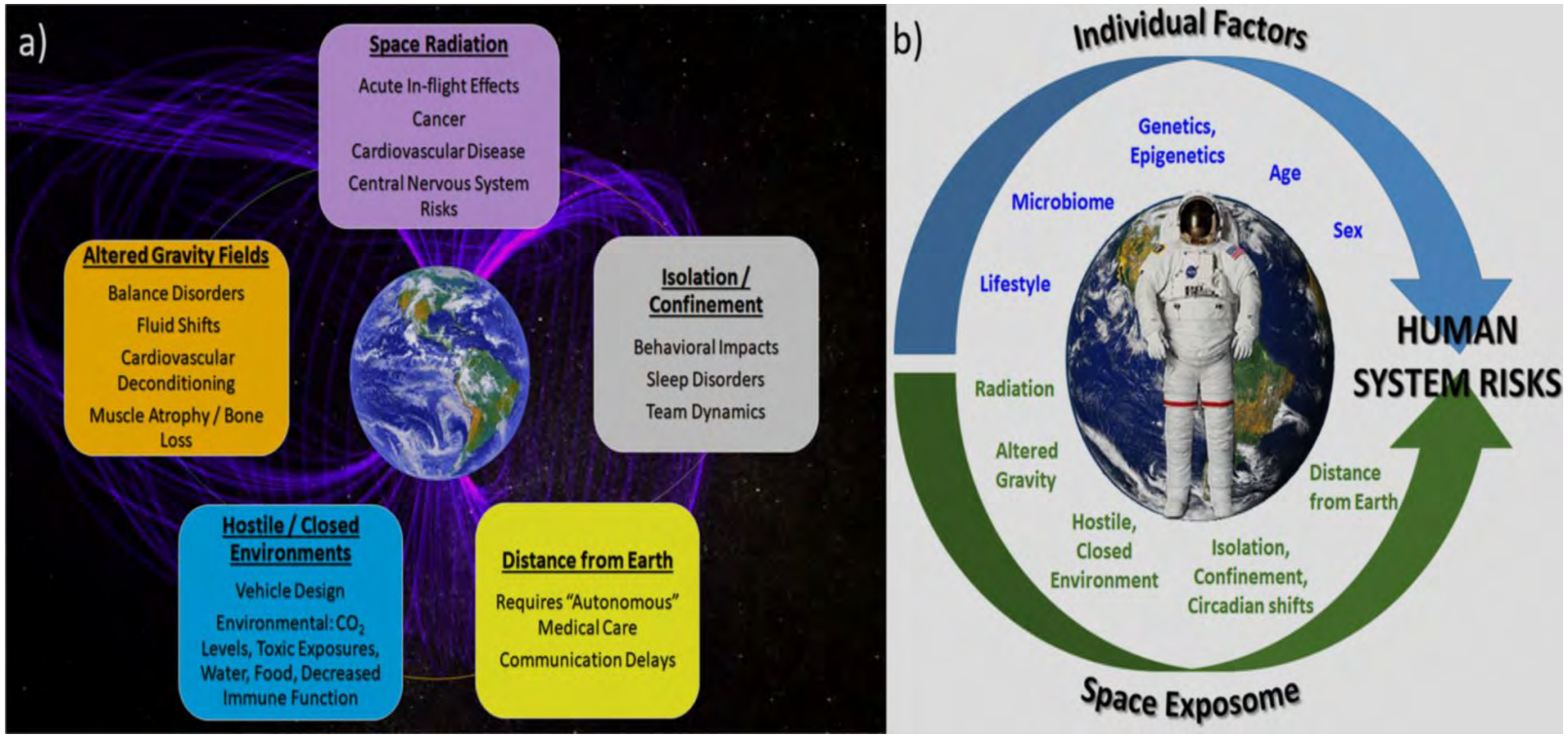
Environmental Control and Life Supporting Systems (ECLSS) for Space Stations and Deep Space

By : Ramson Nyamukondiwa

Date: 13/11/2021

Background of ECLSS

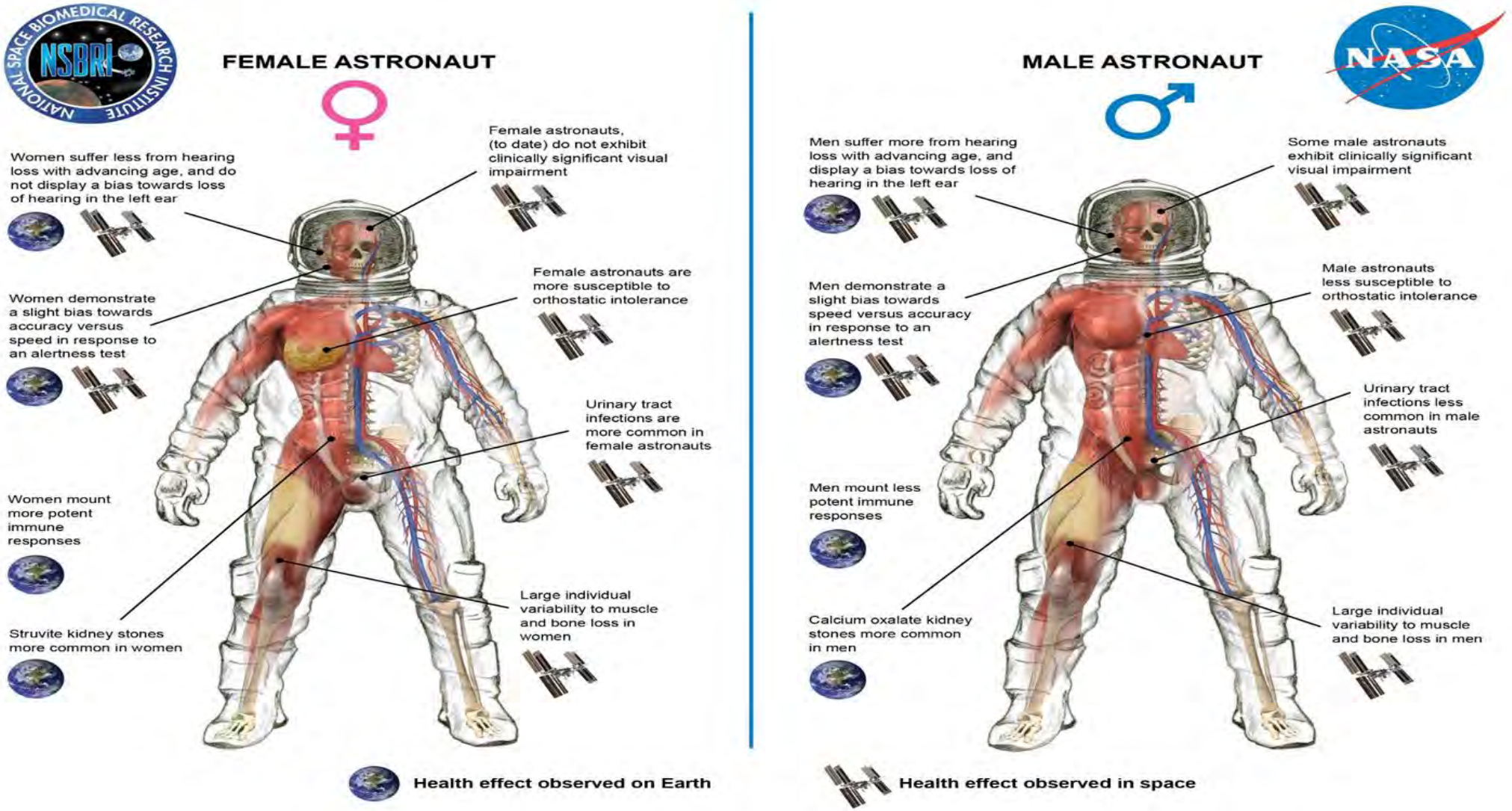
- Space Environment was not meant for humans to live.
- Like on Earth, humans on space missions for example Astronauts at Space Stations needs essentials of life supporting systems.
- They are also exposed harsh space environments as shown in Fig a) and b)
- Under space environment humans can suffer severe health problems and/ or death.
- Therefore a proper habitable Environmental Control and Life Supporting System (ECLSS) must be put in place.



https://www.nature.com/articles/s41526-020-00124-6/figures/1

- ECLSS is a life support system that provides or controls atmospheric pressure, fire detection and suppression, oxygen levels, waste management and water supply.

Health Effects Observed in Orbit : Due to Unfavorable Space Conditions



https://www.nasa.gov/hrp/bodyinspace

Essentials of Life Support Systems provided by ECLSS

- Air
  - Constituent control
    - O2, N2 makeup
    - CO2 scrubbing
    - Humidity control
  - Temperature control
- Water
- Food
- Waste management
- Others: Exercises, Protection to Radiation etc

Earth

https://www.dreamstime.com/stock-illustration-planet-earth-clouds-isolated-white-background-d-render-image41754327

In space or deep space (As we leave Earth We still Need)

Average Human Metabolic Balance (lb./person-day)

Sustaining people in Space requires managing all of their ins and outs

- **Oxygen (O2) 1.84**
- **Water (H2O) 7.77**
  - Drink 3.56
  - In food 2.54
  - Food Prep 1.67
- **Food Solids 1.36**
  - Oxygen 0.44
  - Hydrogen 0.08
  - Carbon 0.60
  - Other 0.24
- **Total In 10.97**

- **Carbon Dioxide (CO2) 2.20**
- **Water 8.53**
  - Urine 3.31
  - Sweat and Resp 5.02
  - Feces 0.20
- **Solids 0.24**
  - Urine 0.44
  - Sweat 0.08
  - Feces 0.04
  - Other
- **Total Out 10.97**

https://www.nasa.gov/content/nine-station-crew-members-gather-for-portrait

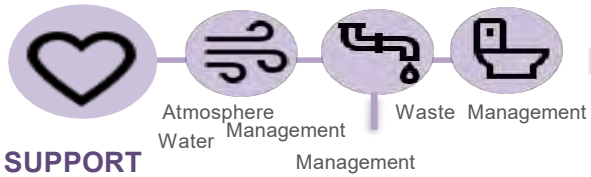
Systems Elements for ECLSS: ISS and Deep Space

Habitation Systems Elements

TODAY
ISS

FUTURE
Deep Space

1

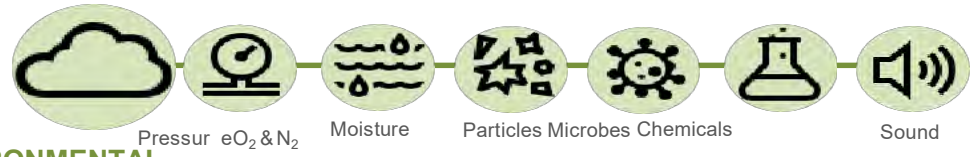


LIFE SUPPORT

- 42% O_2 Recovery from CO_2
- 90% H_2O Recovery
- < 6 mo mean time before failure (for some components)

- 75%+ O_2 Recovery from CO_2
- 98%+ H_2O Recovery
- >30 mo mean time before failure

2

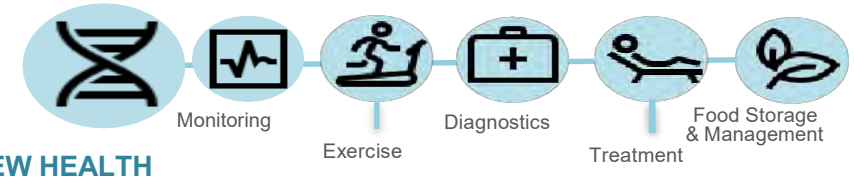


ENVIRONMENTAL MONITORING

- Limited, crew-intensive on-board capability
- Reliance on sample return to Earth for analysis

- On-board analysis capability with no sample return
- Identify and quantify species and organisms in air & water

3

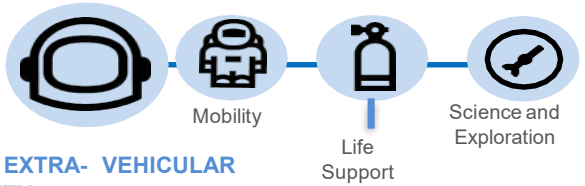


CREW HEALTH

- Bulky fitness equipment
- Limited medical capability
- Frequent food system resupply

- Smaller, efficient equipment
- Onboard medical capability
- Long-duration food system

4

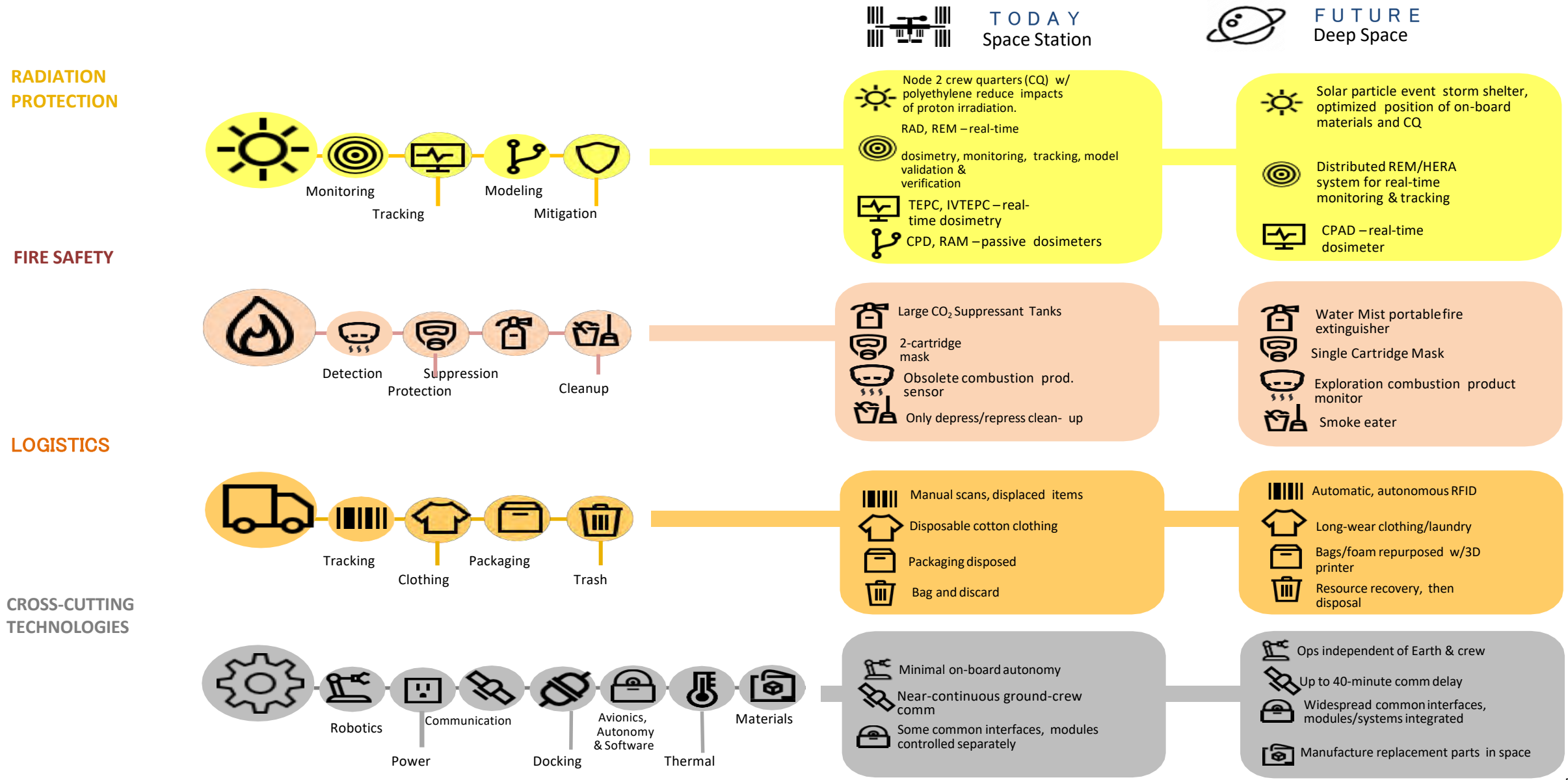


EVA: EXTRA- VEHICULAR ACTIVITY

- High upper body mobility for limited sizing range
- Low interval between maintenance, contamination sensitive, and consumables limit EVA time
- Construction and repair focused tools; excessive inventory of unique tools

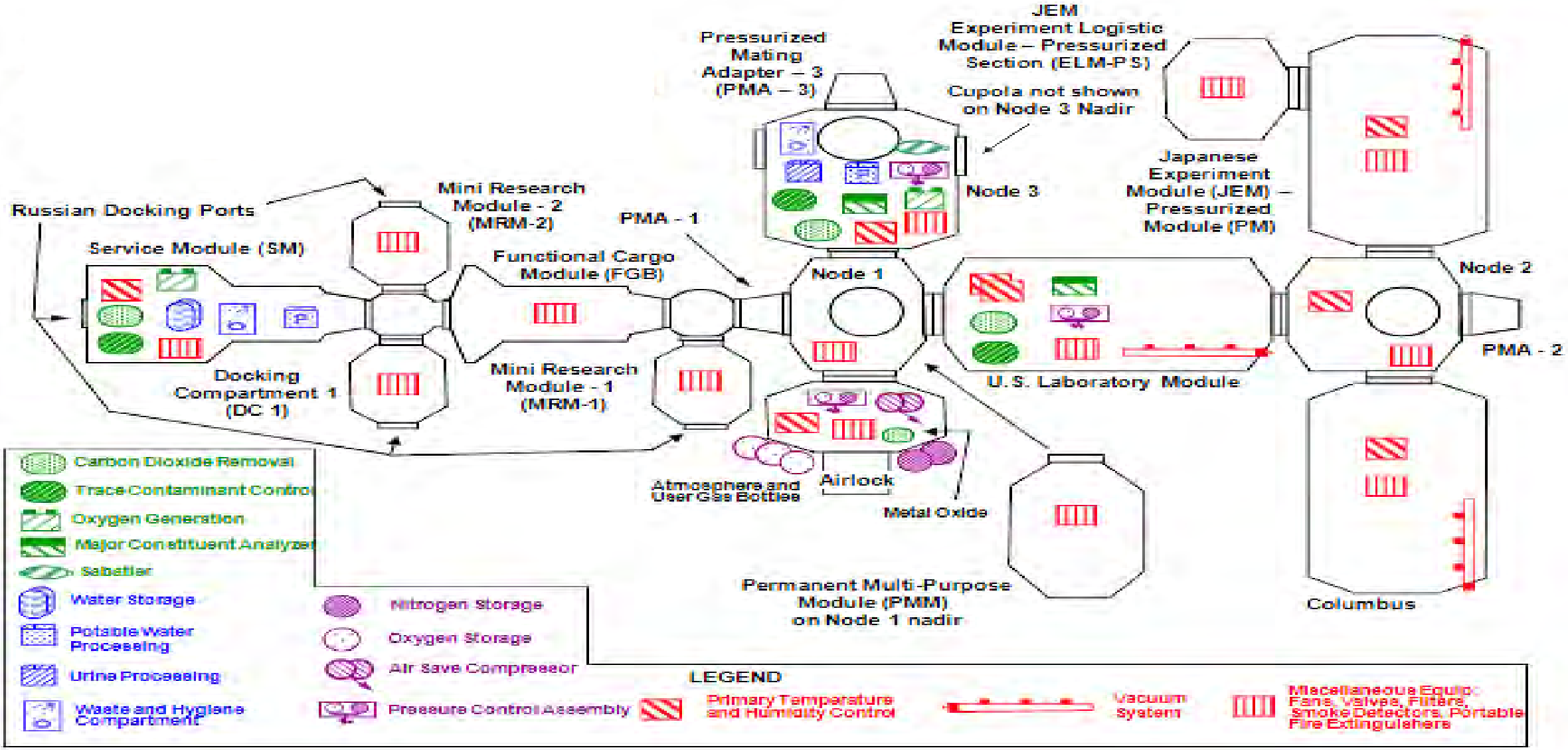
- Full body mobility for expanded sizing range
- Increased time between maintenance cycles, contamination resistant system, 25% increase in EVA time
- Geological sampling and surveying equipment; common generic tool kit

Systems Elements for ECLSS at ISS and Deep Space



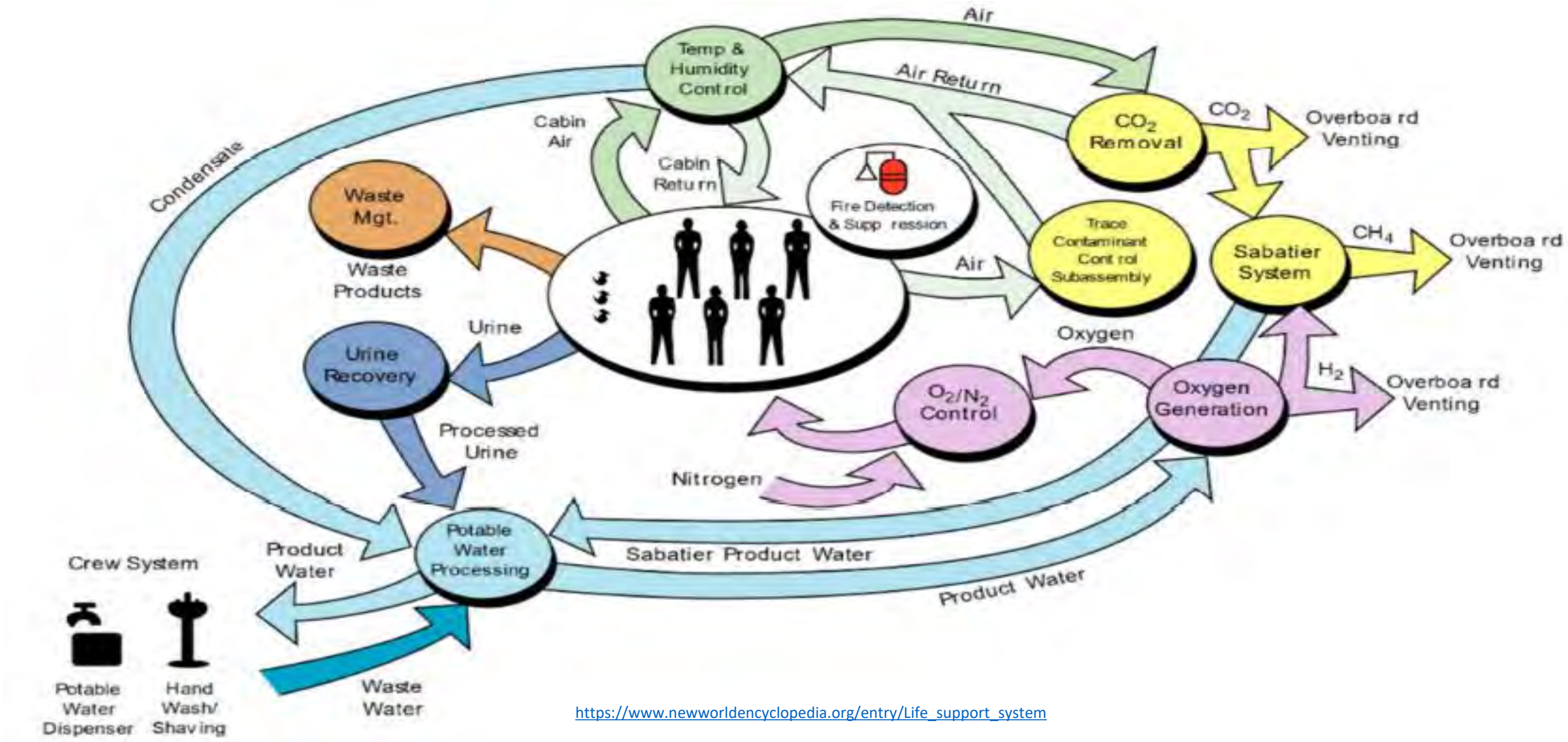
5

International Space Station (ISS) ECLS Hardware Distribution



http://wsn.spaceflight.esa.int/docs/Factsheets/30%20ECLSS%20LR.pdf

Recycling in ISS ECLSS



https://www.newworldencyclopedia.org/entry/Life_support_system

ISS ECLSS Capability Gaps

Function	Capability Gaps	Gap criticality
• CO_2 Removal	• Valve reliability; $ppCO_2$ <2 mmHg	5
• O_2 recovery from CO_2	• Recover >75% O_2 from CO_2	5
• Urine brine processing	• Water recovery from urine brine >85%	5
• Metabolic solid waste collection	• Low-mass, universal waste collection	5
• Trace Contaminant Control	• Replace obsolete sorbents w/ higher capacity; siloxane removal	4
• Condensing Heat Exchanger	• Durable, chemically-inert hydrophilic surfaces with antimicrobial properties	4
• Water microbial control	• Common silver biocide with on-orbit redosing	4
• Contingency urine collection	• Backup, no moving parts urine separator	4
• Urine processing	• Reliability, 85% water from urine, dormancy survival	4
• Atmosphere monitoring	• Small, reliable atmosphere monitor for major constituents, trace gases, targeted gases	4

Gap Criticality

5 = high

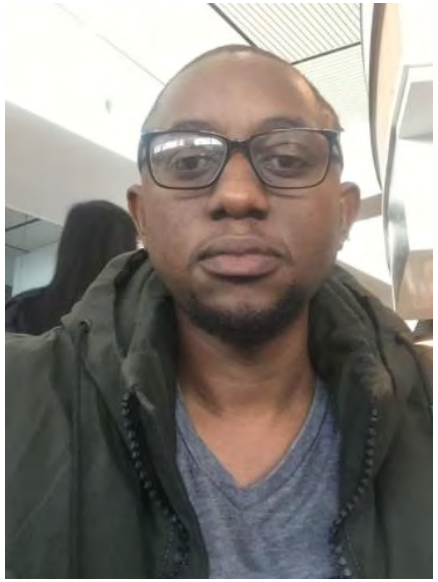
1 = low

ECLSS Capability Gaps

Function	Capability Gaps	Gap Criticality
• Water monitoring	• In-flight identification & quantification of species in water	4
• Microbial monitoring	• Non-culture based in-flight monitor with species identification & quantification	4
• O_2 generation	• Smaller, reduced complexity, alternate H_2 sensor	3
• High pressure O_2	• High pressure (3000 psi) O_2 for EVA/on-demand O_2 supply for contingency medical	3
• Wastewater processing (WPA)	• Reliability (ambient temp, reduced pressure catalyst), reduced expendables, dormancy survival	3
• Non-metabolic solid waste	• Volume reduction, stabilization, resource recovery	3
• Particulate monitoring	• On-board measurement of particulate hazards	3
• Particulate Filtration	• Surface dust pre-filter; regen filter	2
• Atmosphere circulation	• Quiet fans	2
• Logistics Reduction	• 10:1 volume reduction logistical and clothing	2
• Metabolic solid waste treatment	• Useful products from metabolic waste	1

World Space Week OCTOBER 4-10

World Space Week National Coordinators



By : Timothy Kudzanayi Kuhamba

Date: 19 November 2021

Roles of National Coordinator

- The National Coordinator is the linking pin between the global team and the event organizers, national and local media and key contacts in a country

1. Throughout the year, invite organizations around the country to participate in World Space Week. Potential participants include space-related government agencies, companies, science centers, museums, universities, schools and media.
2. By September 15, ensure that each participant has entered their planned WSW activities into the global WSW calendar on this web site.
3. Before World Space Week, provide your national media with this calendar and encourage them to publicize the national celebration.
4. By December 1, ensure that each participant has updated their WSW calendar entries to include a brief summary of the results, attendance, and media impressions, and has uploaded the best photos of its WSW events to the World Space Week Flickr group.
5. Provide a brief national summary to go into the UN WSW Annual Report.

WSW National coordinators

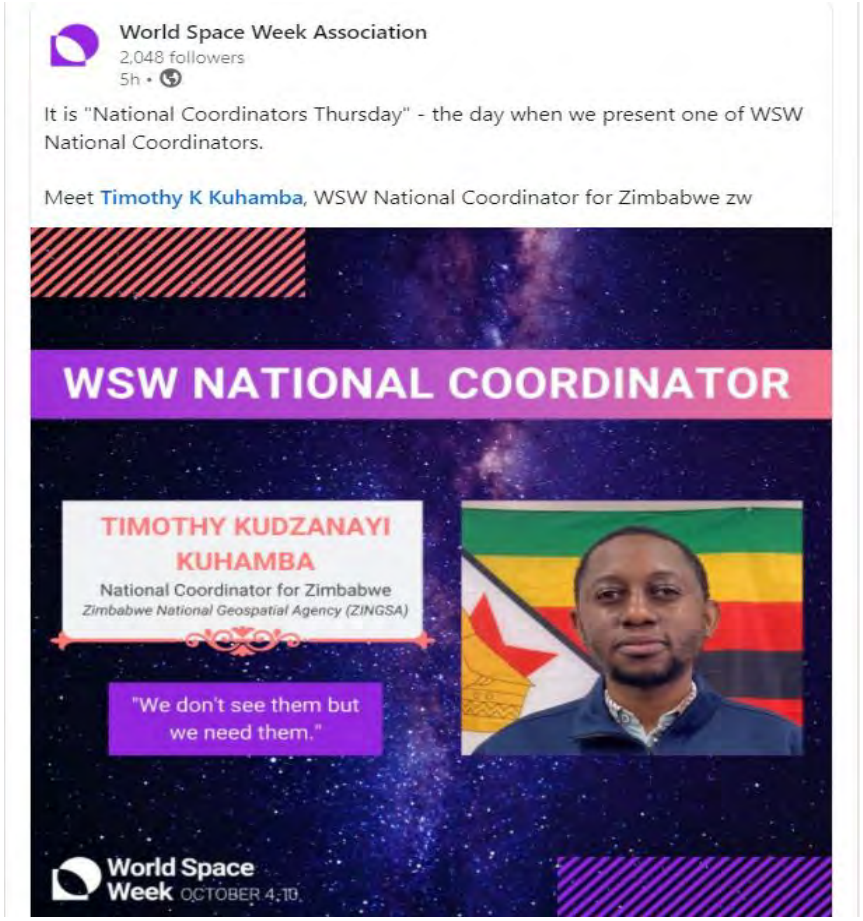
- Every WSW Thursday profiles WSW profiles national coordinators

on their social media platforms

- Over 80 National Coordinators across the World
- The link below shows the list of the National coordinators

https://www.worldspaceweek.org/national-coordinators

WSW National Coordinators



Every Thursday World Space Week Profiles National Coordinators on their social media platforms

WSW National Coordinators

https://www.worldspaceweek.org/national-coordinators/

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How to become involved

- As a donor. We are always looking for organizations and individuals willing to support our cause. See http://www.worldspaceweek.org/donors/become-donor/
- As a partner. We are looking for organizations that share our vision and goals. See http://www.worldspaceweek.org/partners/partner-us/
- As a global volunteer. We are always looking for individuals with specific skills, willing to devote some of their valuable time to World Space Week. See http://www.worldspaceweek.org/working-with-us/vacancies/
- As a national coordinator. We are present in about half of the world's countries, but not in all of them yet. We are also seeking local coordinators to promote World Space Week in their region or city. See http://www.worldspaceweek.org/working-with-us/coordinator-duties/
- As an event organizer. We are seeking event organizers. If you want to get involved and need further information or help, get in touch with your Local or National Coordinator. See http://www.worldspaceweek.org/events/how-to/

END

End of BIRDS-5 reports for this month

End of this **BIRDS Project Newsletter**

(ISSN 2433-8818)

Issue Number Seventy

This newsletter is archived at the BIRDS Project website:
http://birds1.birds-project.com/newsletter.html

When a new issue is entered in to the archive, an email message is sent out over a mailing list maintained by the Editor (G. Maeda, Kyutech). If you wish to be on this mailing list, or know persons who might be interested in getting notification of issue releases, please let me know.

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