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6th International Workshop on Lean Satellite
2023
DEC.4-7, 2023
TOKYO, JAPAN

6th International Workshop on Lean Satellite

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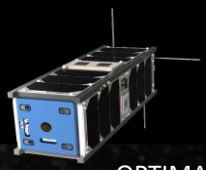
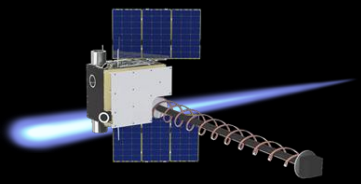
EQUULEUS
2022

RWASAT-1
2019

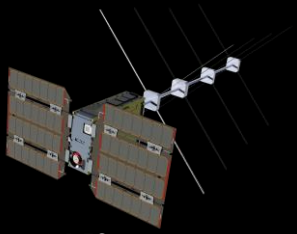


OPTIMAL-1
2023

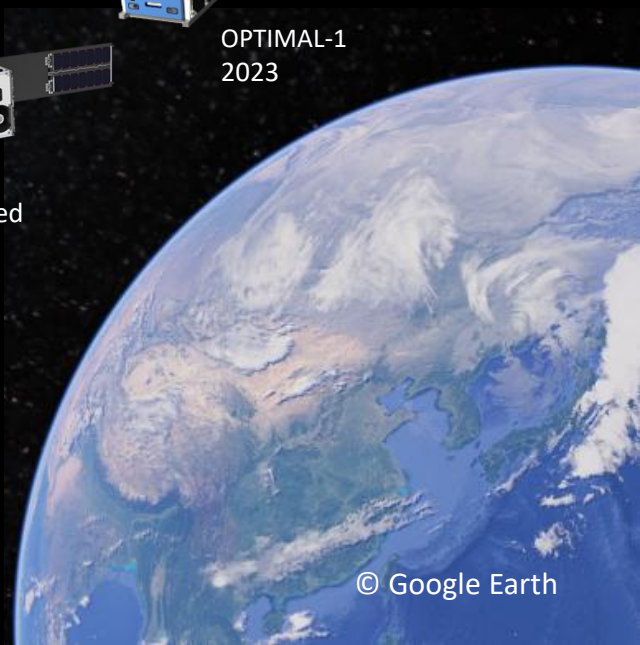


Comet Interceptor
To be launched

ONGLAISAT
To be launched



VDES
To be launched



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Day 1 (Monday, December 4, 2023)

9:30 - 9:50	MENGU CHO, Kyushu Institute of Technology Workshop overview
9:50 - 10:20	Nobuhiro Funabiki, ArkEdge Space Inc.
(Day1-1)	Development of 6U Standard Bus for Mass Production of Multiple Types of CubeSats
10:20 - 10:50	Toshihiro Obata, Synspective Inc.
(Day1-2)	Synspective's SAR satellite constellation and solutions
10:50 - 11:10	Coffee break
11:10 - 11:40	Fernando Aguado, University of Vigo
(Day1-3)	Spanish Contribution to the Atlantic Constellation
11:40 - 12:10	Michael Pham, Cal Poly Pomona | Bronco Space
(Day1-4)	Lessons Learned from 4 University CubeSats on 4 Back to Back SpaceX Transporter Launches
12:10 - 12:40	Daniel Rockberger, NSLComm
(Day1-5)	Beetlesat Constellation design considerations
12:40 - 12:50	Sponsor Presentation 1 ArkEdge Space Inc.
12:50 - 13:50	Lunch
13:50 -14:00	Sponsor speech METI
14:30 - 15:00	Cesar Bernal Franco, DHV
(Day1-6)	DHV's Innovations: Advanced SmallSat Power Systems
15:00 -15:30	Masanobu Tsuji, ArkEdge Space Inc.
(Day1-7)	Store & Forward mission on AE's CubeSat constellation
15:30 - 16:00	Marco Schmidt, University of Wuerzburg
(Day1-8)	5G communication in space - the UWE-5 project
16:00 - 16:30	Tuomas Tikka, Kuva Space
(Day1-9)	Hyperfield - Hyperspectral satellite constellation for improving life on Earth
16:30 -16:40	Sponsor Presentation 2 Sagami Tsuhin
16:40 -16:55	ispace Mission Control Centre Presentation and Q&A
16:55 -17:15	Coffee break

17:15 - 17:45	Tomoaki Yasuda, ArkEdge Space Inc.
(Day1-10)	VDES Satellite Constellations Enabling Maritime Digitalization
17:45 - 18:15	MIGUEL MUNOZ MARTINEZ, STARTICAL
(Day1-11)	STARTICAL, A CONSTELLATION DESIGNED FOR AIR TRAFFIC MANAGEMENT
18:15 - 18:45	Toshihiro Shibukawa, ArkEdge Space、Inc.
(Day1-12)	Conceptual Studies on Lunar Navigation and Communication Systems
18:45 - 19:15	Yung-Fu TSAI, Taiwan Space Agency
(Day1-14)	A Mission Design for GNSS-RO/R Constellation in Taiwan

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繊維から半導体分野、宇宙産業へ。セーレンは、最新のテクノロジーとイノベーションにより、
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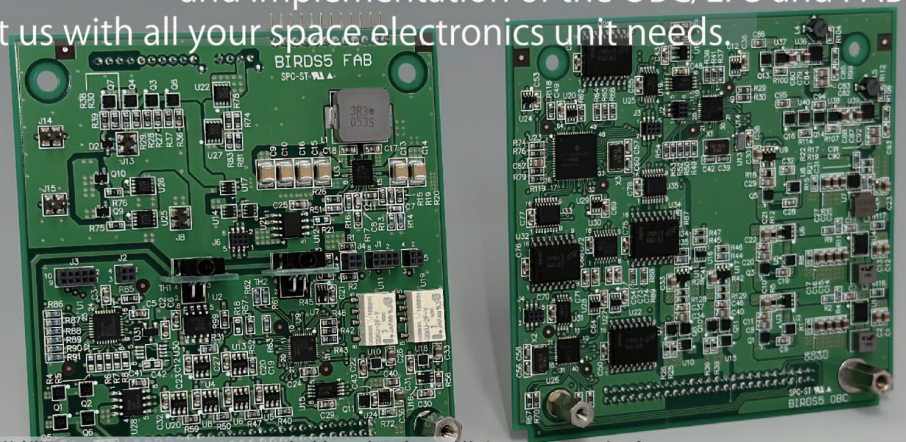

私たちは宇宙開発機器の電子ユニット実装・組立に携わっています。
実は先日打上げられた XRISM にも私たちが担当したユニットが搭載されているのです。
BIRDS project では OBC/EPS と FAB の回路設計～実装を担当しています。
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SAGAMI

Day 2 (Tuesday, December 5, 2023)

9:00 - 9:30	Yanina Hallak, UARX Space
(Day2-1)	Benefits of Constellation Deployment using an Orbital Transfer Vehicle
9:30 - 10:00	Takayuki Kawai, Space One Co.、Ltd.
(Day2-2)	Space One、New Launch Services Provider for Small Satellites
10:00 - 10:30	Pablo Gallego Sanmiguel, PLD Space
(Day2-3)	Successful MIURA 1 Maiden Launch and Next !
10:30 - 11:00	Tomohiro Maki, MHI
(Day2-4)	Launch of Constellations
11:00 - 11:20	Coffee break
11:20 - 11:50	Thomas Pfister, GomSpace A/S
(Day2-5)	Towards Next Generation Cubesat Platforms
11:50 - 12:20	Joseph Casas、(Joe), NASA MSFC
(Day2-6)	"Leaner" Collaborative Space Exploration Opportunities: Small Spacecraft Missions
12:20 - 12:50	alim rustem aslan, Istanbul Technical University
(Day2-7)	Challenges in Operating and developing CubeSats for various missions
12:50 - 13:00	Sponsor Presentation 3 SpaceBD
13:00 - 14:00	Lunch break
14:00 - 14:30	Kota Kakihara, ArkEdge Space Inc.
(Day2-8)	Start-up Company's Activities Related to Lean Satellites in Lunar and Deep Space Missions
14:30 - 15:00	Willem Herman Steyn, University of Stellenbosch
(Day2-9)	Attitude and Orbit Control Systems for Lean Satellite Constellations
15:00 - 15:30	Nori Ait-Mohammed, European Space Agency
(Day2-10)	ESA IOD CubeSat Missions: Current Status and Future Potential
15:30 - 16:00	Jose Rodrigo Cordova-Alarcon, Kyushu Institute of Technology
(Day2-11)	Lean satellite design approach of the 3U CubeSat CURTIS towards a mass-producible platform

16:00 - 16:10	Sponsor Presentation 4 Seiren
16:10 - 16:30	Coffee break
16:30 - 17:00	Paolo Marzioli, Sapienza University of Rome
(Day2-12)	The S5Lab actions on shared telemetry systems through Internet-of-Things devices: advances in the research on WildTrackCube-SIMBA、CORAL and the new lean satellite missions
17:00 - 17:30	Kei Sano, Kyushu Institute of Technology
(Day2-13)	VERTECS: 6U satellite for astrophysical science
17:30 - 18:00	Frederick A Slane, Space Infrastructure Foundation
(Day2-14)	The Evolving Role of Lean Satellites Within an Open Space Architecture
18:00 - 18:30	Mengu Cho, Kyushu Institute of Technology
(Day2-15)	Overview of Lean Satellite Related Standards
18:30 - 19:00	Hirokazu Masui, Kyushu Institute of Technology
(Day1-13)	Improvement of Structure Design and Testing Methods for Mass Production-Oriented Nano-Satellites

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Day 3 (Wednesday, December 6, 2023)
Closed session on ISO-19683 draft (invited only) at X-Nihonbashi Tower (9:30 Start)

Student and young engineers session at X-Nihonbashi Base

8:30 - 8:40	Karen Wendy Vidaurre Torrez, Universidad Catolica Boliviana "San Pablo" Sede La Paz (Remote)
(Day3-1)	Enhancing 1U CubeSat Capabilities through image On-Board Classification Testing with a Stratospheric Balloon
8:40 - 8:50	Esteban Fretes Paraguayan Space Agency (Remote)
(Day3-2)	Lean Satellite development in Paraguay - Guaranisat-2
8:50 -9:00	Alexander Kaloyanides, Loyola Marymount University (Remote)
(Day3-3)	Retractable Solar Sail for Attitude Control and Orbital Adjusting of LeanSat Satellites
9:00 - 9:20	Michela Boscia, Sapienza University of Rome
(Day3-4)	Best practices and lessons learned from standardization of CubeSat bus and AIV loops at Sapienza S5Lab: from WildTrackCube-SIMBA to CORAL with innovative technologies and new-era perspectives
9:20 - 9:40	Daisuke Nakayama, Kyushu Institute of Technology、IoT Network Innovation Research Center
(Day3-5)	S-band and X-band communication sub-system on VERTECS project
9:40 - 10:00	MUHAMMAD HASIF BIN AZAMI, Universiti Teknologi MARA
(Day3-6)	Optimizing Single-Board Computers/Computer-on-Modules for Deep Learning in CubeSat Applications: Hardware and Software Considerations
10:00 - 10:20	Juan Jose Rojas Hernandez, Instituto Tecnologico de Costa Rica
(Day3-7)	An integrated instrument for power system testing of constellations
10:20 - 10:40	MOUMNI Fahd, MicroOrbiter Inc.
(Day3-8)	Study Case for Public-Private Partnership in Lean Satellite Development
10:40 - 11:00	Coffee Break
11:00 -11:15	Carlos Alberto Lopez-Balcazar, Centro de Desarrollo Aeroespacial、Instituto Politecnico Nacional

(Day3-9) Free Web-Based Link Budget Calculator For satellite RF and OpticalCommunications

11:15 - 11:30 Fabian Ramirez-Lopez, Centro de Desarrollo Aeroespacial、Instituto Politecnico Nacional

(Day3-10) Logic Layer for a Low-Cost Mobile Earth Station Based on LPWAN Principles for Satellite Communications

11:30 - 11:50 NECMI CIHAN ORGER, Kyushu Institute of Technology

(Day3-11) Overview of LEOPARD 3U CubeSat: A Technology Demonstration Mission for a Lunar CubeSat

11:50 - 12:05 Jorge Ruben Casir Ricano, Kyushu Institute of Technology、Space Robotics Laboratory

(Day3-12) BIRDS-X Satellite Project “Dragonfly”

12:05 - 12:20 Yudai Etsunaga, Kyushu Institution Of Technology

(Day3-13) BIRDS-X Satellite Project “Dragonfly” Telecommunication Subsystem

12:20 - 12:40 Essien Ewang, National Space Research and Development Agency/Centre for Satellite Technology DevelopmentCSTD)

(Day3-14) Space Activities Towards the Realisation of an Indigenous Satellite into Space in Nigeria.

12:40 - 13:40 Lunch

13:30 -13:45 Hery Steven Mindarno, Kyushu Institute of Technology

(Day3-15) The Development of Surya Satellite-1: Pioneering Indonesia Nanosatellite

13:45 - 14:00 Ezra Fielding, Kyushu Institute of Technology

(Day3-16) Towards a Standardized COTS-based Payload Interface Board for Nanosatellites

14:00 - 14:20 Femi Ishola, Phemotron Systems LLC Japan

(Day3-17) Concept and Mission Development of the AI-MotherBox-1 CubeSats Formation

14:20 - 14:40 Yu-Sheng Liu, National Cheng Kung University

(Day3-18) LaptopSat- A new concept of CubeSat

14:40 - 15:00 Mark Angelo Cabrera Purio, Adamson University

(Day3-19) Nurturing the Next Generation of Filipino Space Engineers: Capacity Building Initiatives

15:00 - 15:10 Yukihisa Otani, Kyushu Institute of Technology (Remote)

(Day3-20) How to record the satellite development for the next project

15:10 - 15:20 Fatimah Zaharah binti Ali, Universiti Teknologi MARA (UiTM) (Remote)
(Day3-21) ASEAN MULTINATION COLLABORATION PROJECT: CRAFTING INDIGENOUS SPACE PROGRAM IN MALAYSIA

15:20 - 15:40 Coffee Break

15:40 – 15:55 Shota Kubo, kyushu Institute of Technology
(Day3-22) Demonstration of onboard orbit determination using Genetic Algorithm
15:55 - 16:10 Reynel Josue Galindo Rosales, Kyushu Institute of Technology
(Day3-23) Scalability of Peltier Element based Thermal Vacuum Test System
16:10 - 16:25 Arturo Benjamin Hurtado-Perez, Centro de Desarrollo Aeroespacial、Instituto Politecnico Nacional
(Day3-24) Multi-Objective Topological Optimization Method for Satellite Structural Design
16:25 - 16:40 Daniel Lemuel Sanchez-Cabadas, Centro de Desarrollo Aeroespacial、Instituto Politecnico Nacional
(Day3-25) SMD-QFP-Based Parallel On-BoardComputer For Small Satellites
16:40 - 16:55 Tasuku Matsui, Kyusyu Institude of Technology
(Day3-26) Automatic visual inspection and report generation system of vibration test for CubeSat
16:55 - 17:15 Asia Saeed Kajo Habila, Institute of Space Research and Aerospace
(Day3-27) Estimation of the Attitude Disturbance Torque in the Low Earth Orbit to Enhance Satellite Control and Preserve Its Mission

Name: Nobuhiro Funabiki
Affiliation: ArkEdge Space Inc.
Title: Development of 6U Standard Bus for Mass Production of Multiple Types of CubeSats

Abstract:

The system design with high customizability and the reduction of development cost by design standardization are significant to use CubeSats for a variety of applications. This presentation introduces the design overview of 6U CubeSat bus of ArkEdge Space, and its points for improvement toward high usability.

Name: Toshihiro Obata
Affiliation: Synspective Inc.
Title: Synspective's SAR satellite constellation and solutions

Abstract:

Synspective is the company that will build more than 30 SAR (Synthetic Aperture Radar) satellite constellation to provide SAR images and solutions.

We will present our current status of our satellites on-orbit, manufacturing / testing of multiple satellites, and our new factory preparations. We will also present our solutions to provide useful information to customers with our SAR images as well as other information.

We will share with you our future plan, issues, and any possibility to collaborate with all.

Name: Fernando Aguado
Affiliation: University of Vigo
Title: Spanish Contribution to the Atlantic Constellation

Abstract:

The Atlantic Constellation project, spearheaded by the Spanish and Portuguese Space Agencies, marks a significant leap in space exploration and technology. The initiative's goal is to deploy a network of satellites enhancing Earth observation and telecommunications across the Atlantic region. Utilizing cutting-edge satellite technology, the project aims to boost data connectivity, monitor environmental changes, and aid in disaster management. The collaboration between Spain and Portugal highlights their joint commitment to innovation in space technology, driving scientific research and development. This endeavor not only bolsters the space capabilities of the involved nations but also contributes to global efforts in understanding and safeguarding our planet.

Name: Michael Pham
Affiliation: Cal Poly Pomona | Bronco Space

Title: Lessons Learned from 4 University CubeSats on 4 Back to Back SpaceX Transporter Launches

Abstract:

The Bronco Space Institute for Collaborative Orbital Networks lab at Cal Poly Pomona has recently completed four unique CubeSat missions on four consecutive SpaceX Transporter Rideshare missions. These satellites (BroncoSat-1, Pleiades - Yearling, Pleiades - Yearling 2, and Pleiades - Squared) were all dreamed, designed, and built by an undergraduate student team over the course of three academic years at Cal Poly Pomona.

Throughout these three years, Bronco Space was able to reduce the cost and lead time from concept to delivery from $120,000 USD and 10 months for BroncoSat-1 to only $6,000 USD and 1 week for Pleiades - Squared. Our experiences developing these satellites has lead us to create and open source the PROVES CubeSat Kit.

PROVES (the Pleiades Rapid Orbital Verification Experimental System) is a very low-cost entry point into the CubeSat community and the space industry through an open-source 1U CubeSat kit designed for mass manufacturing. This kit is a derivative of the PyCubed architecture from Stanford university, but expands it to be more accessible and encompass all the needs of a CubeSat with a structure, EPS, solar panels, flight computer, and communications system. With a $1000 USD cost of materials, the PROVES kit seeks to significantly lower the barrier to entry for academic teams looking to fly a CubeSat. With the rapidly growing New Space Industry, it's crucial to educate the future workforce with hands-on experience. However, student-focused teams struggle to get off the ground, and very few become sustainable programs across multiple generations of students.?

The PROVES CubeSat kit seeks to tackle these issues and offer a pathway for academic teams to gain valuable experiences from building, testing, and flying a small satellite. By designing a radically low-cost architecture, we seek to ensure a functional satellite is not out of reach for any student team, and for those who have the means, it is possible to acquire the kits in quantity to engage as many students as possible. By offering the core designs as open-source resources, we also hope to create a self-sustaining community that uses the PROVES architecture as a pathway to orbit.?

We seek to present lessons learned from this process, and provide insight on best practices that other university teams may use to accelerate their own CubeSat development and gain greater success as a thriving CubeSat community.

Name: Daniel Rockberger
Affiliation: NSLComm
Title: Beetlesat Constellation design considerations

Abstract:

The Beetlesat LEO constellation is a communication constellation of 264 satellites that are in the range of 200kg.

The constellation still is based on a Lean design and cost to enable a low capex for the entire constellation. This lean approach leads to many design considerations that are unique.

Name: Cesar Bernal Franco
Affiliation: DHV
Title: DHV's Innovations: Advanced SmallSat Power Systems

Abstract:
DHV, an innovative Spanish company headquartered in the picturesque city of Malaga, is at the forefront of the rapidly evolving new space sector.
Our specialization lies in delivering cutting-edge power systems and solar arrays meticulously crafted to meet the unique requirements of SmallSat and CubeSat applications, missions and customers across the globe.
At DHV, our team of over 150 highly motivated and exceptionally skilled engineers shares a common mission: to provide exceptional customer-focused solutions in the service-oriented new space environment.
The presentation at the 6th IWLS will explore DHV's transformative contributions to the new space sector, offering a glimpse into the future of SmallSat and CubeSat power systems. It will encompass three pivotal facets that define DHV:
1-Innovative Product Line: We will introduce our diverse family of products and technologies, meticulously designed to usher in the new space era with efficient and dependable power solutions.
2-Lean Design Principles: DHV's unwavering commitment to lean design principles ensures that our power systems are not only cutting-edge but also cost-effective, perfectly tailored to the distinct needs of the SmallSat and CubeSat market.
3-MAIV (Mass Manufacturing, Assembly, Integration, and Validation) for Constellations: Discover how our MAIV processes and automatization have been meticulously honed to address the unique demands of satellite constellations, guaranteeing reliability and performance at scale.

Name: Masanobu Tsuji
Affiliation: ArkEdge Space Inc.
Title: Store & Forward mission on AE's CubeSat constellation

Abstract:

RWASAT-1 was deployed in November 2019 and OPTIMAL-1 was deployed in January 2023 from International Space Station (ISS)/ Japanese Experimental Module (JEM, Kibo). These two CubeSats carried Store and Forward (S&F) module on board. S&F modules collected ground data such like temperature and CO2 density from IoT sensor devices in remote areas, stored the data on the memory of the module and downlinked the data over a ground station in Japan. In this presentation I will report the function of S&F and the result of experiments in Rwanda, Chile and Japan. S&F is expected to apply to many applications. For agriculture and fishery, collecting soil moisture data and sea surface temperature are useful. For disaster prevention, it can be used for early warning of flood and wildfire. For environment management, monitoring toxic gas of volcanos is thought. For logistic applications, tracking positions of containers is useful. Some of these applications need only to collect data once a day or less than that. But if we can collect data more frequently with a satellite constellation, we can expand applications in the future. Moreover, I will introduce the AE's ground station to downlink S&F data, newly installed at Makinohara, Japan.

Name: Marco Schmidt
Affiliation: University of Wuerzburg
Title: 5G communication in space - the UWE-5 project

Abstract:

Low Earth Orbit (LEO) satellite constellations have become a revolutionary technology in the field of satellite communications. These constellations consist of a large number of small satellites orbiting the Earth at low altitude and offer significant advantages over conventional satellite systems. Unlike geostationary satellites, the signal propagation delay on the communications link is comparatively small. On the other hand, LEO satellites move very fast relative to the Earth's surface and provide limited ground coverage.

In this work, first an overview of current developments in the field of LEO satellite constellations is given. Both the overall architecture and the communication hardware are discussed. Commercially operated constellations such as Starlink or OneWeb show how global coverage can also be reliably achieved with LEO satellites.

Furthermore, the small satellite project of the University of W?rzburg is presented in this work. While four satellites have already been successfully launched into orbit, the fifth mission will deal with the integration of the satellite link into a 5G network. For this purpose, a novel communication payload will be developed within the UWE-5 project.

Name: Tuomas Tikka
Affiliation: Kuva Space
Title: Hyperfield - Hyperspectral satellite constellation for improving life on Earth

Abstract:

Climate change is already strongly changing our environment and global food security is beginning to falter. Kuva Space's upcoming hyperfield constellation will provide global, daily and actionable real-time insights on ecological and man-made assets through spaceborne hyperspectral imaging and AI. This novel small satellite-based solution enables creating a constellation of tens of satellites highly cost-efficiently, providing affordable insights even for developing countries. The industries served by the solution include carbon and environment, insurance and finance, and safety and security.

The first generation satellite for the constellation is currently being developed in an ESA InCubed project jointly by Kuva Space and VTT Technical Research Centre of Finland. The 6U CubeSat carries a novel in-orbit tunable high-resolution hyperspectral imager covering visual to near-infrared wavelengths. The next generation satellites will also cover short-wave infrared wavelengths by including additional imaging channels. The imager technology concept has already been successfully demonstrated in the company's Reaktor Hello World mission launched in 2018.

The Hyperfield constellation development is a turning point for Kuva Space as it transforms from providing single satellite missions to realizing a large constellation of hyperspectral satellites and services.

In this presentation, we will present the hyperfield constellation, including the satellite design and our considerations for efficient serial production and testing. Hyperspectral data applications enabled by the eventual service will be showcased to provide insights to the added value of frequent spaceborne hyperspectral imaging and analytics.

Name: Tomoaki Yasuda
Affiliation: ArkEdge Space Inc.
Title: VDES Satellite Constellations Enabling Maritime Digitalization

Abstract:

The VHF Data Exchange System (VDES), has been proposed to replace the currently used Automatic Identification System (AIS) in ship navigation and maritime traffic management. VDES offers, in addition to the traditional AIS functionality, medium-speed bidirectional digital communication tailored for vessels and maritime applications. Furthermore, by integrating a satellite constellation, it enables real-time global coordination for vessel safety and security, as well as offshore operations.

In this presentation, it will be introduced the background and use cases for the proposal of VDES, and also provided an explanation of the development status of the satellite VDES constellation system, which leverages the expertise in the design and operation of ultra-small artificial satellites.

Name: MIGUEL MUNOZ MARTINEZ
Affiliation: STARTICAL
Title: STARTICAL, A CONSTELLATION DESIGNED FOR AIR TRAFFIC MANAGEMENT

Abstract:

Air traffic Communications, Navigation and Surveillance systems are key in the provision of safe and efficient air traffic management. These systems have traditionally been ground-based which means that in remote and oceanic areas there is a lack of Communication and Surveillance which is severely affecting the airspace capacity and flight efficiency. This translates in higher separation minima compared to continental areas and the pre-establishment of air routes.

Satellite constellations can extend CNS services to provide a global coverage which is key to reduce separation of aircraft in oceanic and remote areas increasing efficiency and capacity while reinforcing the required level of safety. Additionally, it can serve as backup for continental areas.

Name: Toshihiro Shibukawa
Affiliation: ArkEdge Space, Inc.
Title: Conceptual Studies on Lunar Navigation and Communication Systems

Abstract:

Represented by NASA's Artemis missions, there is an international movement on lunar exploration, and needs for communication and navigation infrastructure in the lunar environment is demanded. ArkEdge Space is now working with JAXA on conceptual studies and prototype developments related to Lunar Navigation Satellite System (LNSS) and communication relay satellite systems. ArkEdge Space is planning to realize these systems based on micro-satellites, and conceptual studies on the architecture of these systems will be presented.

Name: Yung-Fu TSAI

Affiliation: Taiwan Space Agency

Title: A Mission Design for GNSS-RO/R Constellation in Taiwan

Abstract:

In a GNSS reflectometry (GNSS-R) mission, the reflected signals can be processed to form delay Doppler maps (DDMs) so that the various geophysical parameters of Earth's surface, such as roughness, ocean wind speed, and soil moisture can be retrieved. Currently Triton is the operational GNSS-R mission in Taiwan which carries TASA in-house built GNSS-R receiver. In addition to the reflectometry, the operational FORMOSAT-7 (FS-7) GNSS-R radio occultation (GNSS-RO) mission is exploited to profile the ionosphere and atmosphere to better understand the space weather and weather prediction. Therefore, the GNSS-RO/R mission is the next step of the GNSS remote sensing mission in Taiwan as expected. A mission conceptual design of the GNSS-RO/R mission to collect atmospheric and ocean surface roughness soundings simultaneously for the enhancement of severe weather prediction would be introduced in this paper.

Name: Yanina Hallak
Affiliation: UARX Space
Title: Benefits of Constellation Deployment using an Orbital Transfer Vehicle

Abstract:

Using an orbital transfer vehicle (OTV) to deploy constellations offers several advantages in space missions. One of the key benefits is the precision it provides in placing satellites in optimal orbits, allowing for more efficient utilization of their capabilities. Moreover, this approach reduces the constraints typically imposed on satellite design by launch vehicle capabilities, offering greater payload size and weight flexibility. OTVs are highly versatile, capable of carrying multiple payloads on a single mission, enhancing cost-efficiency.

Additionally, OTVs provide flexible mission planning, enabling the deployment of satellites as needed and reducing wait times for suitable launch opportunities. They offer controlled, precise separation of satellites in target orbits, minimizing the risk of collisions or interference with other space assets. Lastly, they can be a contingency plan, ensuring successful constellation deployment during launch vehicle anomalies. In a rapidly evolving space industry, OTVs have become indispensable tools for many satellite missions, underlining their importance for space agencies, satellite operators, and commercial launch providers.

Name: Takayuki Kawai
Affiliation: Space One Co., Ltd.
Title: Space One, New Launch Services Provider for Small Satellites

Abstract:

Space One is the new Japanese Launch Services Provider who is planning to launch the first flight next year. Our rocket “KAIROS” has the capability of 150Kg to SSO or 250Kg to LEO. So we are looking forward to contributing to small satellite customers just not by launching satellites, but also launching satellite with minimum process to launch.

This lecture gives the information about the first flight preparation status and future manifest of KAIROS rocket.

Name: Pablo Gallego Sanmiguel
Affiliation: PLD Space
Title: Successful MIURA 1 Maiden Launch and Next !

Abstract:

PLD Space Consolidates its Leadership in the European Space Race.

The excellent results of the MIURA 1 test flight provide the Spanish company with "complete technological know-how" in space rocket development.

From MIURA 1 to MIURA 5 more than a thousand points of improvement of subsystems have been compiled, accelerating the development of the orbital vehicle, and reducing its technological risk.

The MIURA 5 value proposition has generated 320 million euros worth of commercial interest since January.

The analysis of the data collected by the Spanish company PLD Space after the launch of their MIURA 1 rocket shows that the mission has been "a complete success". 100% of the main objectives have been achieved and all the technologies developed by the company have been validated in flight. This is a milestone that positions PLD Space as the only European private company with launch capability in Europe today.

Name: Tomohiro Maki
Affiliation: Mitsubishi Heavy Industries, Ltd. Space Systems
Title: Launch of constellations

Abstract:

As more and more private companies and start-ups enter the space business, the need to launch small satellites is increasing, and a shortage of launchers is becoming an issue. MHI, together with JAXA, is developing a large flagship launch vehicle ; H3 rocket, and is considering how to solve the shortage of small satellite launch opportunities with the H3. In addition to batch transportation of mega constellation satellites, MHI hopes to create transportation opportunities by implementing ride-sharing, in which excess launch capacity is used as a launch opportunity for small satellites. In the future, we would like to aim to provide dedicated launches for small satellite rideshare customers. Constellation/rideshare launches, which require the management of various interfaces, present different issues than large satellite launches, such as dealing with complex logistics, satellite safety reviews and Space Activities Act applications for large number of satellites. In addition, it is necessary to discuss how to consider satellite/launch vehicle compatibility verification for satellites of the same design and launch heritage.

Name: Thomas Pfister
Affiliation: GomSpace A/S

Title: Towards Next Generation Cubesat Platforms

Abstract:

Since the start in 2007, GomSpace have strived towards standard products and standard platforms. Up to now, size has been the main discriminating factor when it comes to cubesats. For GomSpace, the first standard platform was a 3U cubesat built on our GOMX-3 mission and the second standard was the 6U platform based on GOMX-4, the dual satellite mission launch in 2018. Since then, the market has moved towards bigger platforms and today 8U, 12U and 16U are popular sizes.

GomSpace's strategy for the next generation of CubeSat platforms represents a change in the evolution of small satellite technology, since our 3rd generation platform is designed to be size agnostic, accommodating CubeSats ranging from 6U to 16U. This approach allows us to provide a comprehensive solution for a wide range of missions. At the heart of this strategy lies the avionics core, featuring cutting-edge technology to enhance the performance and capabilities of CubeSats across various sizes. The avionics core comprises:

1. On-Board Computer: The 3rd generation platform boasts a state-of-the-art on-board computer, called HP-OBC, designed to be a versatile and easy to use payload interface and at the same time handle data processing, onboard autonomy, and other mission-critical tasks.
2. Power System: Our 3rd generation CubeSat platform incorporates a redesigned power system, named P80. This system is small enough to fit even 6U cubesats, but powerful enough to handle 16U satellites or even microsatellites with power levels up to 300W.
3. Enhanced Communication Systems: Communication is vital for any satellite mission. GomSpace's 3rd generation platform features a suite of communication systems, referred to as NanoCom Link, specifically designed for S-band and X-band ground links. These communication systems provide robust and high-speed data transfer capabilities, enabling more comprehensive data collection, faster response times, and increased overall mission effectiveness.

Incorporating these advanced avionics components into a size agnostic 3rd generation CubeSat platform underscores GomSpace's commitment to further enhancing the capabilities of CubeSats for a wide range of applications, with a particular focus on advancing signal intelligence missions in space.

The selected strategy for the next generation platforms is based on our experience from delivering 16 satellites, of various sizes, to the same customer and for the same type of mission. The presentation during the conference will elaborate on lessons learnt from this program.

Name: Joseph Casas, (Joe)
Affiliation: NASA MSFC
Title: "Leaner" Collaborative Space Exploration Opportunities: Small Spacecraft Missions

Abstract:

Space exploration for purposes of scientific research, technology development, societal benefits and economic expansion has changed over the past 60 years. Domestic and international partnerships have been successful in exploration throughout history. Collaboration examples highlight the importance for both domestic and international cooperation in a few large space exploration activities which are usually complex technically, lengthy in schedule, costly in nature and programmatically more difficult to manage. However, a trend today is a growing focus in the use of small space exploration collaborative activities and missions. Small spacecraft missions which typically use higher risk approaches, require lower cost, and provide shorter development to flight timeframes usually provide enhanced opportunities for innovation creation, technology insertion demonstration, work force skills development and increased collaborative mission opportunities among partnering organizations. These “ leaner” missions potentially allow organizations and countries to share mutually benefitting innovation, skills and resources while increasing the overall success and research output of missions. One such international small exploration collaborative mission is the NASA Brazil Scintillation Prediction Observations Research Task (SPORT) mission. Many lessons learned and opportunities for knowledge and skills improvement can be gained by these collaborative small spacecraft missions. Effective communications; shared and clear common objectives; impacts of uncontrollable world events, and mutual trust are key factors to realizing the full success of the mission and the collaboration.

Name: Alim Rustem Aslan
Affiliation: Istanbul Technical University
Title: Challenges in Operating and developing CubeSats for various missions

Abstract:

developing leansatelites depends on available capabilities and time to launch. Software is very critical and generaly overlooked. Operations of developed lensats naturally depend on their robustness along with a number of factors. The presentation will bring up issues and experiences based on developed, operated and being developed lensats by ITU-SSDTL.

Name: Kota Kakihara
Affiliation: ArkEdge Space Inc.
Title: Start-up Company's Activities Related to Lean Satellites in Lunar and Deep Space Missions

Abstract:

ArkEdge Space is engaged in businesses related to deep space probes using micro/nano satellites. The company aims to develop ultra-small and cost-efficient deep space probes and use them to expand the scope of human activities. Based on the technological base cultivated in the business of mass-producing Earth-orbiting satellites, the company expects to contribute to cost reduction and efficiency improvement in deep space exploration and open up a new phase in future deep space exploration by developing technologies for the necessary parts for deep space probes.

Name: Willem Herman Steyn
Affiliation: University of Stellenbosch
Title: Attitude and Orbit Control Systems for Lean Satellite Constellations

Abstract:

An AOCS for lean satellite constellations has special requirements regarding volume, power and redundancy. The presentation will highlight these requirements focusing on the attitude controllers, estimators, orbit determination and the sensors plus actuators. The physical properties of the AOCS hardware required and some practical in-orbit performance results will be presented.

Name: Nori Ait-Mohammed
Affiliation: European Space Agency
Title: ESA IOD CubeSat Missions: Current Status and Future Potential

Abstract:

Over the last decade, ESA's CubeSat Systems Unit (TEC-SPC) has built up a centre of expertise within the Agency and European ecosystem with a wide experience on CubeSat projects and lessons learned. The unit has become the focal point for all CubeSat related matters. It supports its own projects but also requests from all over the Agency (Earth Observation, Operations, Exploration, Telecommunication, Navigation) as CubeSats have now become recognized throughout the Agency beyond the domains of technology demonstration and education. A new era focusing on deep space missions, close-proximity operations and constellations is now awaiting us. This presentation will provide an overview of TEC-SPC's current activities and prospects.

Name: Jose Rodrigo Cordova-Alarcon
Affiliation: Kyushu Institute of Technology
Title: Lean satellite design approach of the 3U CubeSat CURTIS towards a mass-producible platform

Abstract:

In this session we will describe the design and our integration experiences of the 3U CubeSat CURTIS developed at Kyushu Institute of Technology, Japan. Its design features a slot-based structural platform and flexible subsystems interface based on a back-plane board aiming towards a mass-producible platform. CURTIS is conceived as a technology demonstration satellite to conduct in-orbit thermal exchange experiments using surface-coated graphite materials for their use in space applications, demonstrate a highly integrated BUS comprised of an OBC, EPS, and UHF transceiver in a single board and mid-resolution imaging by an in-vehicle analog camera, enclosed in a 1U unit volume. The 2U BUS consists of an onboard computer and an electric power system with flight heritage developed by Kyutech, UHF, an S-band transceiver, magnetic-based active attitude control, and payload control boards. The launch is scheduled for February 2024 and deployed from the International Space Station Japanese Experiment Module KiboCUBE. Its operations will be conducted by the Kyutech ground station in the UHF band and a ground station network in the S-band frequency. The experiences gathered during the design, integration, and testing will serve as a reference to design mass-producible constellations.

Name: Paolo Marzioli
Affiliation: Sapienza University of Rome

Title: The S5Lab actions on shared telemetry systems through Internet-of-Things devices: advances in the research on WildTrackCube-SIMBA, CORAL and the new lean satellite missions

Abstract:

Internet-of-Things can be considered the result of the technology advances of the last decades and of the miniaturization of microcomputers and electronics obtained since the late '90s.

Within nano-satellite missions, important results and demonstrations have been provided by overcoming numerous technology challenges, including efforts on the LoRa-based TinyGS network and by the results and follow-ups of KITSUNE (developed at Kyushu Institute of Technology, Japan) and its ground station terminals deployed worldwide.

The Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) research group at Sapienza University of Rome has developed between 2019 and 2021 the WildTrackCube-SIMBA mission, developed together with Machakos University and University of Nairobi and coordinated by the Italian Space Agency, who is providing demonstrations for wildlife tracking through IoT modules with a 1U CubeSat in Sun-Synchronous Orbit (SSO). Within October 2023, the SIMBA team has managed to optimize the functionalities of the wildlife tracking LoRa transmitters and the operations for satellite uplink. Experimental test campaigns have been run, both in Italy and in Kenya, to verify the potential of the demonstrated system. New mission scenarios, such as a satellite mission follow-up and new mission profiles, have been conceived and are under study.

Furthermore, a new 2U CubeSat mission named CORAL, developed with Thales Alenia Space Italia and Telespazio and coordinated by the European Space Agency, has been assembled and it is under qualification for a launch opportunity from the ISS in Q3 2024. Such mission will extend the SIMBA telemetry system mission scenario to distributed telemetry among small satellites, achieving contact not only with ground terminals, but also with other satellites equipped with similar IoT transmission devices. Such concept will be soon applicable, if the demonstration is successful, to lean satellite constellations for more reliable telemetry links and architectures. Finally, S5Lab is working on two new missions, the first satellite missions for Panama and Dominican Republic (developed in collaboration with IILA, the Italian-Latin-American Organization), that are considering to equip IoT devices for the first in-orbit demonstrations of the two Caribbean area countries.

This presentation will give an overview on the advances over shared telemetry systems for IoT-equipped CubeSats, with particular focus on the experience of S5Lab related to the implementation of SIMBA, CORAL and new mission profiles. With respect to the presentation of the last Lean Satellite Workshop (January 2023), the presentation will focus on the SIMBA on-field testing campaign occurred in fall 2023, the updates from CORAL and the new mission profiles (including the two new 1U CubeSats) with details on mission segments, performance analyses, completed tests and regulatory topics.

Name: Kei Sano
Affiliation: Kyushu Institute of Technology
Title: VERTECS: 6U satellite for astrophysical science

Abstract:

Visible Extragalactic background RadiaTion Exploration by CubeSat (VERTECS) is a 6U satellite to study star formation history from the cosmic creation by observing visible extragalactic background light. VERTECS is equipped with a wide-field telescope system optimized for the observation of extragalactic background light. Design of the bus system is based on heritage of nano satellites developed by Kyushu Institute of Technology in combination with a high-precision attitude control system required for the astronomical observation. VERTECS is being developed under JAXA-SMASH (Small Satellite Rush) program in collaboration of several institutes and companies. The program started in December 2022 and we plan to develop the satellite in 2 years.

Name: Frederick A Slane
Affiliation: Space Infrastructure Foundaiton
Title: The Evolving Role of Lean Satellites Within an Open Space Architecture

Abstract:

An open reference architecture for space has been developed to support the international standards development organizations: ISO (ISO TC20/SC14 and ISO TC20/SC13) and CCSDS (the Consultative Committee for Space Data Systems). By design this reference architecture includes decomposition from systems to component and material levels. By design this reference architecture includes all aspects of the space domain.

This presentation explores the role of lean spacecraft under the reference architecture. Specifically, lean and small spacecraft potentially provide capabilities which may be additive (two or more lean spacecraft working together); non-commutative (linking two or more space capabilities together dependent on the order of connection to achieve a different function, including with larger, more complex space systems); or, non-associative (functioning in different order to achieve different results). The viewpoints of operations, components and interfaces as operators within the reference architecture are explored.

Possible applications for LEO, GEO and Lunar are given.

Name: Mengu Cho
Affiliation: Kyushu Institute of Technology
Title: Overview of Lean Satellite Related Standards

Abstract:
The overview and the status of lean satellite related international standards are presented.

The standard presented are the following,

1. ISO-19683 Design Qualification and Acceptance Tests of Small Spacecraft and Units
2. ISO-TS-20991 Requirements for Small Spacecraft
3. ISO/DIS-17981 CubeSat Interface

Day1-13 → Day2-16

Name: Hirokazu Masui
Affiliation: Kyushu Institute of Technology
Title: Improvement of Structure Design and Testing Methods for Mass Production-Oriented Nano-Satellites

Abstract:
Kyushu Institute of Technology is working on the development of satellite structures for mass production and the improvement of testing methods. For the CubeSat structure, the number of parts has been reduced from the conventional frame structure, and a "slot structure" has been developed to facilitate the installation and removal of the internal circuit boards. For an efficient environmental test methods, we are developing a simple method using an impact hammer to measure resonance frequency instead of using a shaker. In this presentation, we will introduce the above two approaches.

Name: Karen Wendy Vidaurre Torrez
Affiliation: Universidad Catolica Boliviana "San Pablo" Sede La Paz
Title: Enhancing 1U CubeSat Capabilities through image On-Board Classification Testing with a Stratospheric Balloon

Abstract:

On-board classification using deep learning represents an attractive feature for new satellites, enabling autonomous data analysis and decision-making in space. This groundbreaking capability holds the potential to significantly reduce reliance on Earth-based data processing, while also refining data management for operations such as remote sensing and enhancing resource allocation for establishing the link between the space and ground segments. Furthermore, on-board classification in nanosatellites is constrained by the computational and energy resource limitations. In this manner, this work presents a framework to conduct early tests for on-board image classification using a stratospheric balloon, tailored for a 1U CubeSat, which, notably, aims to become Bolivia's pioneering self-developed satellite. This framework was developed using the NUCLEO-F446RE STM32 board and the Arducam 5MP OV5642 camera as its main components. In addition to the preliminary implementation and test for on-board classification payload, the design of the Attitude Determination and Control System (ADCS) is also presented. Our research has meticulously elaborated the roadmap in the comprehensive and thorough early stage testing process, which included the evaluation of several commercial off-the-shelf (COTS) components.

Name: Esteban Fretes
Affiliation: Paraguayan Space Agency
Title: Lean Satellite development in Paraguay - Guaranisat-2

Abstract:

The BIRDS-4 program (Kyushu Institute of Technology) and the project “Paraguay to Space”?Phase 1, which comprised the design, integration, testing, launch, and operation of the country's first satellite, GuaraniSat-1, provided significant lessons learned, and the first batch of students specialized in space systems engineering returned home with the capabilities to carry out the development of the space sector in their own country in accordance with BIRDS' objectives. In its second phase, the “Paraguay to Space” project aims to duplicate and adopt the entire process of satellite development by designing the second Paraguayan satellite, hereafter GuaraniSat-2, as well as imparting Project Based Learning (PBL) activities to future generations, therefore strengthening the nation's space-capacity. Guaranisat-2 will be designed and implemented in Paraguay by young professionals and students. This presentation focuses on the general technical aspects of the satellite bus system and the related missions, as well as the social and cultural significance of space technologies for the nation, along with the prospects, difficulties, and challenges of implementing a project of this nature in Paraguay.

Name: Alexander Kaloyanides
Affiliation: Loyola Marymount University
Title: Retractable Solar Sail for Attitude Control and Orbital Adjusting of LeanSat Satellites

Abstract:

The idea of solar sailing as an effective propulsion system is based on the theory of light, behaving as particles without mass, transferring their momentum onto a thin, highly reflective object, with a large enough surface area to accelerate through space. While the dream has been around for centuries, only recently has solar sailing technology been harnessed as a one-directional propulsion system, with the exceptions of JAXA's IKAROS and JPL's NEA Scout Satellite, respectively using photon reflectance and an active mass translator (the latter was never tested), using the momentum and the physics of solar sailing to create new attitude controlling systems. In furthering the study, the proposed ESCAPE CubeSat Satellite uses a more direct method of manipulating it's sail as an attitude controlling mechanism through an active pressure translator; altering the geometric shape of the sail to shift the center of pressure and mass alignment. The mathematic results suggest a more controlled, efficient, and effective system that is capable of achieving a quicker response, along with having a higher fault maneuverability tolerance compared to its predecessors.

Name: Michela Boscia
Affiliation: Sapienza University of Rome

Title: Best practices and lessons learned from standardization of CubeSat bus and AIV loops at Sapienza S5Lab: from WildTrackCube-SIMBA to CORAL with innovative technologies and new-era perspectives

Abstract:

CubeSats offer immense versatility and cost-efficiency, making space exploration more accessible. Within the New Space Economy, CubeSats have provided an entry point for startups, universities, and even established space agencies to rapidly develop and deploy missions, now progressively opening the perspective of large constellations based on the CubeSat form factor for various mission purposes.

In this framework, the Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) has launched 5 different CubeSats since 2017, and a new satellite, Coral, is under development and will be launched from ISS in Q3 2024. With the last four satellites, launched between 2018 and 2022, based on the same bus architecture, S5Lab have gained experience in standardizing the architecture of a satellite. Thanks to the participation in the "Lean Sat" study groups, the S5Lab research team is helping in generalizing the obtained results from the Assembly, Integration and Verification activities.

In particular, the experience gained with WildTrackCube-SIMBA, aimed at performing Internet-of-Things data relay with wildlife collars in Kenya, allowed to gather a series of lessons learned on the AIV practices that are modifying the manufacturing and verification loop for the upcoming qualification of CORAL.

Such guidelines and lessons learned are applicable to vibration testing, where coupling between the deployer mechanisms and the proto-flight model satellites invalidates the traditional ECSS requirements, to thermal vacuum testing, where the definition of the thermal reference points is not univocal, to functional and mission testing, where the specifications and test success criteria can be often misleading.

Such effort, besides being reflected on CORAL, is part of a PhD course research coordinated by the Italian Space Agency, which is at the moment working on leaning and adapting ECSS quality and AIV standards for easier access to space when applying the European space standards. Furthermore, such activities are considering innovative approaches to AIV, including the application of digital twin, Augmented and Virtual Reality (AR/VR), and, in compliance with the studies made by the Lean Satellite community, to lean down the structural testing activities for speeding up the complete system-level AIV loop for CubeSats.

This presentation will describe in detail the lessons learned on AIV from the manufacturing, assembly and testing of the four last CubeSats manufactured at S5Lab (1KUNS-PF, LEDSAT, WildTrackCube-SIMBA, GreenCube), by highlighting the gathered lessons learned and their application on the CORAL case. Furthermore, the future perspectives for the collaboration within the ECSS study groups, with the Italian Space Agency, and within AR/VR and innovative technologies will be given.

Name: Daisuke nakayama
Affiliation: Kyushu Institute of Technology, IoT Network Innovation Research Center
Title: S-band and X-band communication sub-system on VERTECS project

Abstract:

A 6U CubeSat "VERTECS" is under developing in collaboration of Kyutech, ISAS and several institute.

It's astronomical nano-satellite designed to reveal star formation history by observing visible extragalactic background light.

This mission requires more capability of downlink and attitude control system.

In order to make it possible, we chose S-band command and telemetry system and X-band high speed mission downlink system.

In this session, we discuss about initial design and result.

Name: MUHAMMAD HASIF BIN AZAMI
Affiliation: Universiti Teknologi MARA
Title: Optimizing Single-Board Computers/Computer-on-Modules for Deep Learning in CubeSat Applications: Hardware and Software Considerations

Abstract:

The rapid advancement of deep learning technologies has paved the way for the integration of deep learning (DL) algorithms into small satellite platforms such as CubeSats. Single-board computers (SBCs) and computer-on-modules (COMs) have emerged as crucial components in these miniaturized systems, providing compact, versatile, and cost-effective computing solutions. This study focuses on evaluating SBCs and COMs for deep learning applications within CubeSat platforms, particularly selecting an operating system (OS) with a space-use heritage. SBCs and COMs are characterized by their integrated components, including flash memory, random access memory (RAM), central processing unit (CPU), and graphical processing unit (GPU). The choice of the OS is pivotal in enabling the installation of image-processing libraries for deep learning tasks. Notably, open-source OS options such as Linux, which have a track record of use in onboard spacecraft and launch vehicle processors, are preferred for their source code and space heritage availability. Several prominent SBCs, including the Raspberry Pi, Nvidia Jetson, and Radxa development boards, are examined in this study. A comprehensive market study is conducted to identify the most suitable CubeSat platform, considering the specific requirements and space environment tolerance of the mission. The Nvidia Jetson series stands out due to its GPU availability, providing significant advantages for deep learning workloads. This research aims to provide a comprehensive overview of the critical factors and considerations in selecting SBCs and COMs for deep learning applications in CubeSat platforms. The findings offer valuable insights into the choice of hardware and software components, with the goal of optimizing the performance and capabilities of CubeSats in space missions that leverage deep learning technologies.

Name: Juan Jose Rojas Hernandez
Affiliation: Instituto Tecnol?gico de Costa Rica
Title: An integrated instrument for power system testing of constellations

Abstract:

Lean satellites have enabled access to space for non-space-faring nations due to its low cost and non-traditional, risk-taking philosophy. In most cases, indigenous capacity development is the underlying objective of the missions.

It has been demonstrated that the Electrical Power System (EPS) is responsible for almost half of the catastrophic failures during the first 30 days upon release into orbit. The equipment used to test conventional satellite power systems is expensive and inadequate for testing Lean Satellites' power systems because it is not sized for these low power applications. To improve the reliability of Lean Satellite space missions, this work showcases the progress in the development in the development of an integrated and modular test system designed to be used as a solar array simulator, battery charger and discharger or electronic load as needed. This system provides a complete solution to the testing needs of power systems in Lean Satellite constellations, both in the initial and intermediate phases of development when verifying the functionality at device and subsystem level, and in the final phases when performing long duration tests to the satellite flight model.

Name: MOUMNI Fahd
Affiliation: MicroOrbiter Inc.
Title: Study Case for Public-Private Partnership in Lean Satellite Development

Abstract:

Public-Private partnerships are believed to be the trigger to catalyze the space industry. In this regards, MicroOrbiter Inc.(Startup) and the Kyushu Institute of Technology LaSEINE laboratory (University) have joined hands together to develop the MicroOrbiter-1 satellite project (also known as MO-1). As the nature of both organizations is different, efficient management strategies have to be found to merge both ways of working into one. What are the strategies to highlight for a Lean Satellite development between a Startup and a University? How to take decisions, review the systems and communicate ? Which general lessons can be learned? This work aims to address these questionments by analyzing the case of the MO-1 Project. Still in current development, the Project already teaches ways of collaborating between multinational members and various profiles, it spots the light on data sharing while respecting policies of each institution, and it also identifies benefits and limitations of this kind of partnership.

Name: Carlos Alberto Lopez-Balcazar
Affiliation: Centro de Desarrollo Aeroespacial, Instituto Politecnico Nacional
Title: Free Web-Based Link Budget Calculator For satellite RF and Optical Communications

Abstract:

The design of satellite communications systems is always under vertiginous development due to both the exponential increase of very reliable and demandant services as well as by the constrictions of satellite services imposed by small satellites standards. Moreover, with the introduction of novel communications systems based on Free Space Optical (FSO) links due to their better performance, despite the unique set of challenges regarding its implementation. These advancements require tools that provide the greatest control in the conception and design of the transmission systems, because satellite links are particularly prone to losses. In this work, we propose an open-source web-based application that allow to perform link budget calculations for both radio and optical satellite systems which aims to be flexible, simple, user-friendly, largely compatible, and mainly, abode to standardised and documented models for provide reliability and accuracy.

Name: Fabian Ramirez-Lopez
Affiliation: Centro de Desarrollo Aeroespacial, Instituto Politecnico Nacional
Title: Logic Layer for a Low-Cost Mobile Earth Station Based on LPWAN Principles for Satellite Communications

Abstract:

The great success of small satellites has led to saturation of the low Earth orbit, demanding new capacities in different sectors, and in particular, in the transmission of payload data and ground telemetry. The development of typical ground stations required to meet these demands can be complicated and expensive for countries and entities with little or no experience and budget, making it difficult for them to immerse themselves in the space field. One possible solution is the development of miniaturized, low cost, complexity and mass mobile ground stations that allow them to be both accessible and relocatable, depending on the needs of the satellite operator, as well as allowing the deployment of ground station networks with low human resources. . and economic. In order to grant maximum flexibility in the ground sector, the proposed mobile land station consists of a radio frequency transceiver that allows establishing a satellite data upload and download link, a central processing unit and an information storage memory, as well as a transceiver that allows this data to be retransmitted to a fixed exchange through low power network protocols (LPWAN), taking advantage of the currently deployed physical infrastructure of different LPWAN technologies, such as LoRa?. This paper presents the development of the logical layer of said ground station, which is capable of receiving and interpreting the data from the satellite, which are recoded in the station through the LoRaWAN protocol for retransmission in said infrastructure, with the purpose of in order to respect the design principles of the mobile land station.

Name: NECMI CIHAN ORGER
Affiliation: Kyushu Institute of Technology
Title: Overview of LEOPARD 3U CubeSat: A Technology Demonstration Mission for a Lunar CubeSat

Abstract:

LEOPARD (Light intensity Experiment with On-orbit Positioning and satellite Ranging Demonstration) satellite is a 3-unit (3U) research CubeSat with multiple missions. These missions could be listed as monitoring of horizon light scattering with a multispectral camera, onboard processing of Earth-origin one-way radio ranging signal (OPERA), single event latch-up (SEL) detection, total ionization dose measurement for onboard commercial-off-the-shelf components, solar panel deployment demonstration with shape memory alloy and ambient magnetic field measurements. First, the multispectral camera payload will be observing light scattering by atmospheric molecules and aerosol particles that is caused by Rayleigh scattering when the Sun is below the horizon line. While the lunar mission plans to monitor the horizon within various wavelengths such as UV, visible and NIR, the technology demonstration mission will utilize observations at visible and NIR wavelengths at low Earth orbit (LEO). Second, OPERA mission aims to demonstrate the positioning technology for deep space missions. Multiple mobile ground stations will transmit S-band signals to the satellite, and the satellite orbit with its velocity vectors and range will be calculated by onboard processing. Third, SEL mission will demonstrate protection capability from single event effects during mission lifetime while another payload will determine which COTS components are suitable for space by measuring TID effects. Finally, a heater mechanism will deploy solar panels assembled with shape memory alloy while multiple magnetometers on the deployed panels will measure the geomagnetic field. Currently, the LEOPARD engineering model is under development, and the operation is expected to be in the second half of 2024.

Name: Jorge Ruben Casir Ricano
Affiliation: Kyushu Institute of Technology, Space Robotics Laboratory
Title: BIRDS-X Satellite Project “Dragonfly”

Abstract:

BIRDS-X satellite project is a 2U CubeSat named Dragonfly based on the BIRDS Open-Source Bus design. The satellite is dedicated to amateur radio communication. It has external dimensions of 100 × 100 × 227 mm and is being developed at the Kyushu Institute of Technology (Kyutech) by a multinational team of students from different backgrounds and levels of education. The project aims to bring diversity to the space sector and democratize space usage while following a lean satellite approach. This paper presents a general overview of the satellite subsystems and their four main missions. The first mission is a global Automated Packet Reporting System (APRS), the second is a Ground Terminal (GT) competition, and the third is the development and on-orbit validation of a new low-cost UHF transceiver designed by one of the team members. The fourth mission is a volcano monitoring task, using the satellite as a platform to store and forward volcanic data using the APRS protocol.

Name: Yudai Etsunaga
Affiliation: Kyushu Institution Of Technology
Title: BIRDS-X Satellite Project “Dragonfly” Telecommunication Subsystem

Abstract:

This paper introduces the Telecommunication system in the development framework of Dragonfly, a 2U CubeSat part of the BIRDS-X project based on the BIRDS Open Source design and being developed at the Kyushu Institute of Technology. The telecommunication subsystem of BIRDS-X is essential for facilitating contact between the satellite and its ground station. It comprises two UHF Transceivers, seven APRS VHF transceivers, and two antenna panels, all installed on the satellite. The main task of the UHF transceivers is to manage command uplink and telemetry/mission data downlink. One of the two UHF Transceivers in Dragonfly is a new development using COTS components. The APRS VHF transceiver's main contribution is to the Amateur Radio Community by allowing anyone to communicate with the satellite through APRS. Additionally, this paper presents several communication tests performed on the satellite's engineering model (EM).

Name: Essien Ewang
Affiliation: National Space Research and Development Agency(NASRDA)/Centre for Satellite Technology Development(CSTD)
Title: Space Activities Towards the Realisation of an Indigenous Satellite into Space in Nigeria.

Abstract:

The National Space Research and Development Agency (NASRDA) is tasked with leading space activities for the realisation of an indigenous satellite in space. The mandate is to vigorously pursue space capacity building and improvement of the quality of life of mankind through space-related research and development (R&D) and capacity building in science, technology, space law, and governance for sustainable national development in Nigeria. Through strategic cooperation with foreign experts, various activities have been initiated and completed. This is achieved through cutting-edge research, development and innovation in the design, construction, testing and launch of the satellite for various applications. This shows that six (6) successful satellites of various sizes have been launched. These include earth observation satellites (NigeriSat-1, NigeriaSat-2, Nigeria Sat-X and NigeriEduSat-1). The communications satellite missions (NigComSat-1 and NigComSat-1R). All of these missions were initiated and executed by the Agency’s engineers and scientists through strategic collaborations. This paper presents NASRDA's progress in developing its first independent indigenous satellite and discusses the plan to accomplish this through a lean satellite deployment strategy.

Keyword: Space Activities, Indigenous Satellite, Lean Satellite, and NASRDA

Name: Hery Steven Mindarno
Affiliation: Kyushu Institute of Technology
Title: The Development of Surya Satellite-1: Pioneering Indonesia Nanosatellite
Abstract:

Surya Satellite-1 (SS-1) is the awardee of the 3rd Round KiboCUBE Program, a collaboration program between the United Nations Office of Outer Space Affairs (UNOOSA) and Japan Aerospace Exploration Agency (JAXA) to grant a launch slot to a 1U CubeSat program. This CubeSat is the first Indonesian student CubeSat to reach Earth orbit. SS-1 brings an amateur radio Automatic Packet Reporting System (APRS) payload with an independently developed CubeSat bus and structure. The project's mission is APRS beaconing, APRS digipeating, and capacity building for Indonesian students. Manufacturing most subsystem modules and structures in-house makes this project challenging in parts procurement and the Assembly, Integration, and Test (AIT) process. The Flight Model (FM) of SS-1 has qualified through the Japanese Experiment Module (JEM)-Small Satellite Orbital Deployer (J-SSOD) Interface Control Document (ICD) requirements and verifications of JAXA. Moreover, SS-1 underwent the vacuum chamber, thermal cycle, and vibration test to ensure survivability in the launch and space environment. During its progression, SS-1 received manufacturing, test facilities, and ground system development support from government research institutions, satellite operators, and the amateur satellite community. As a result, SS-1 is a benchmark model on how academics, industry, and government can cooperate and create a breakthrough in national satellite projects at the most affordable scale. SS-1 launched and docked at the International Space Station (ISS) on November 26th, 2022, and became the first Indonesian satellite deployed from the ISS on January 6th, 2023. SS-1 is presently orbiting at around 400 km altitude and 51.4° inclination. The Author(s) will describe some of the team's experiences, particularly in the space systems engineering approach, in ensuring a space-qualified design is developed for the successful launch and operation of SS-1.

Name: Ezra Fielding
Affiliation: Kyushu Institute of Technology
Title: Towards a Standardized COTS-based Payload Interface Board for Nanosatellites

Abstract:

The VERTECS 6U Astronomical Nanosatellite is set to produce a large amount of data each day with its high-resolution imaging sensor capturing an extensive portion of the night sky. Modern nanosatellites are moving towards more data intensive missions as the supporting technologies develop and mature. To support VERTECS and similar missions, a Commercial Off-the-shelf (COTS)-based standardized payload interface was developed centered around the Raspberry Pi Compute Module 4. This interface board paves the way for future missions with high data requirements and will support the adoption and implementation of machine learning applications in orbit.

Name: Femi Ishola
Affiliation: Phemotron Systems LLC Japan
Title: Concept and Mission Development of the AI-MotherBox-1 CubeSats Formation

Abstract:

We present the introduction, concept, and mission development of the AI-MotherBox-1 CubeSats formation. The AI-MotherBox-1 is Phemotron Systems' flagship innovative space platform, a 12U-sized primary satellite flying together with two 3U-size slave satellites in Low Earth Orbit. The mother platform is been designed to incorporate the world's first robust CubeSat artificial intelligence engine, ADS-B sensors, and laser communication system. The formation will demonstrate fully autonomous flight operation. The swarm inter-CubeSats communications operation will be at X-band, fail-safe contingency at UHF. The mother platform will feature our innovative “OptoX Engine”, a versatile, cross-platform, and functional high-throughput (10Gbps) laser communication data downlink capability. The system will have the ability to receive, and store mission data and TT&C downlink from orbiting CubeSats and then forward them to OGS using laser communication at the next available pass, a sort of “on-orbit cloud storage” service for CubeSats. This presentation will discuss our activities in the early phase of mission development, partners, and stakeholders. The AI-MotherBox-1 mission possesses the potential to revolutionize the way we utilize low-cost platforms to achieve huge mission returns. Exploiting the power of space-borne artificial intelligence systems, the mission will provide us with turnkey space situational awareness with valuable insights on global air traffic safety, the Earth’s climate and environment, and a useful tool to respond to natural disasters and other emergencies.

Name: Yu-Sheng Liu
Affiliation: National Cheng Kung University
Title: LaptopSat- A new concept of CubeSat

Abstract:

CubeSats and the CubeSat standard have reshaped space development over the past two decades. In recent years, there has been a trend towards flattened satellite configurations to achieve improved performance to some extent. This paper introduces a new CubeSat concept named "LaptopSat," which leverages a flattened CubeSat design to further extend the performance potential of CubeSats.

The concept of LaptopSat will be introduced in this paper, alongside the presentation of existing LaptopSat models. The performance of LaptopSat will be analyzed, and implementation methods will be proposed. Furthermore, potential satellite missions and application scenarios will be suggested.

This study has revealed that the utilization of the LaptopSat concept in CubeSat design offers significant advantages of high integration, simple structure, and ease of integration and testing. Furthermore, improvements have been observed in power, drag, and thermal control performance, albeit with control performance remaining stable or decreasing. Additionally, the research indicates that launching LaptopSat can be accomplished using existing systems or slightly modified satellite and Poly Picosatellite Orbital Deployer (P-POD) .

These characteristics make LaptopSat highly suitable for employment in missions involving constellations, communication, and Very Low Earth Orbit (VLEO). This innovation holds the potential to evolve into a novel nanosatellite standard in the future.

Name: Mark Angelo Cabrera Purio
Affiliation: Adamson University
Title: Nurturing the Next Generation of Filipino Space Engineers: Capacity Building Initiatives

Abstract:

In alignment with Session-9: Students and Young Engineers, this presentation zeroes in the extensive capacity-building initiatives embarked of our new space engineers subsequent to their transformative education in Japan. Commissioned by the STAMIN4Space Program and the Department of Science and Technology (DOST), the mandate was to translate acquired knowledge into substantial contributions for the development of future Filipino space engineers. Over the past six months, having returned as part of a limited cadre of space engineers in the Philippines, we recognize an augmented responsibility to disseminate our expertise and kindle the enthusiasm for space engineering among the emerging generation. Our initiatives encompass a broad spectrum, ranging from organizing impactful space-related webinars and assuming roles as distinguished resource speakers to conducting informal classes on CubeSat development and integrating a specialized space engineering track into the Electronics Engineering curriculum. A significant milestone among these efforts is the establishment of STARLab ? the Space Technologies and Applications Research Laboratory, strategically positioned with the generous backing of Adamson University. Serving as a central hub for space engineering education, ground station operations, and remote sensing applications, STARLab epitomizes our dedication to creating an environment conducive to advanced space engineering studies. This presentation endeavors to provide a comprehensive account of our multifaceted endeavors, with the overarching objective of shaping the next generation of Filipino space engineers, contributing substantially to the growth of the Philippines' space endeavors, and fostering a dynamic community of space enthusiasts and professionals.

Name: Yukihisa Otani
Affiliation: Kyushu Institute of Technology
Title: How to record the satellite development for the next project

Abstract:

In recent years, the educational program based on the CubeSat development has been conducted. The students graduate and leave the project every year. Therefore, it is essential to keep the satellite development record to convey the know-how, technology, lessons learned, and the project management method to the next generation. However, most of the students tend to dislike making the documents. The material for the periodic meeting is helpful to keep the experiences of the previous projects, but common understanding in the project is likely to be omitted in these documents. As a result of these things, the students in the next project waste the time to solve the same problems that appear before. This presentation suggests a method to keep the development record for the next satellite project based on the experiences through the activity to clarify the satellite development processes.

Name: Fatimah Zaharah binti Ali
Affiliation: Universiti Teknologi MARA (UiTM)

Title: ASEAN MULTINATION COLLABORATION PROJECT: CRAFTING INDIGENOUS SPACE PROGRAM IN MALAYSIA

Abstract:

The launching of the first Malaysian Nanosatellite, UiTMSAT-1, in 2018 to space sparks the indigenous space program in the country. It has made Universiti Teknologi MARA (UiTM), a Malaysian member of the BIRDS program, inspire other space enthusiasts and entities to expose and emerge the space activities and potentialities for the advancement of national space technologies. UiTMSAT-1 development was under the collaboration project of Joint Global Multi-Nation BIRDS-2 with Kyushu Institute of Technology (Kyutech), Japan, in which other developing countries such as Bhutan and the Philippines were involved. In sustaining and spreading the BIRDS program's satellite technologies, Kyutech encourages all BIRDS countries to develop their second nanosatellite locally. In the recent progress, the research team from UiTM managed to secure funding from the Malaysian Ministry of Science, Technology, and Innovation (MOSTI) for a project of 1U-sized nanosatellite development. The nanosatellite's primary mission is to capture images of the Earth using an improved ground-resolution camera payload onboard. Interestingly, the nanosatellite project is a multination collaboration project between Malaysia, the Philippines, Thailand, and Japan. The project was officially kicked off in February 2021, and the launch of the nanosatellite will be in the end of 2023. The project will be utilizing local experts from UiTM and existing facilities in the country while supported by students and researchers from the University of Perpetual Help System DALTA (UPHSD), Philippines, and King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand. The flight model integration and launching preparation will be conducted in Kyutech, Japan. Other entities such as space agencies, ministries, industries, and NGOs will get involved in the project by providing required capacities such as space policy, governance, and management. With the project's implementation, it will be the surge to bring up the space field in developing the technological advances in Malaysia and other developing countries in ASEAN while opening the eyes of many potential entities for a space-related collaboration project. Be- sides, it will allow the involved partners to utilize data from the nanosatellite, hence introducing the platform for data sharing and strengthening the bridge and linkage of collaboration.

Name: Shota Kubo
Affiliation: kyushu Institute of Technology
Title: Demonstration of onboard orbit determination using Genetic Algorithm

Abstract:

In recent years, deep space exploration using microsatellites has become more active. Kyushu Institute of Technology is planning to develop the lunar exploration satellite “HORYU-6.” It is planned to be equipped with “OPERA (Onboard Processing of Earth-origin one-way Radio ranging signal)” as its orbit determination system. Current orbit determination requires a large antenna to receive weak radio waves from the satellite, and there are very few facilities equipped with this antenna. It aims to realize a new orbit determination method using several meter-sized antennas that can be installed at universities, and if the technology can be realized, the options we can choose will be increased for space exploration. Therefore, the technology demonstration experiment satellite “LEOPARD” is currently being developed as a precursor to the installation of “OPERA" on “HORYU-6”. By realizing the technology of “OPERA” with “LEOPARD”, we can also expect the development of an orbit determination system for “HORYU-6”. In this research, we built an orbit determination system "OPERA" using genetic algorithms, and incorporated it into "LEOPARD", verifying whether orbit determination can be performed normally in low Earth orbit, The accuracy of this process will be evaluated.

Name: Reynel Josue Galindo Rosales
Affiliation: Kyushu Institute of Technology
Title: Scalability of Peltier Element based Thermal Vacuum Test System

Abstract:

The growing demand for cost-effective satellite solutions has led to the rapid proliferation of lean satellites. As we need to ensure the reliability and performance of lean satellites while reducing the cost of conventional testing methods, research has been done for the use of thermoelectric elements in the Thermal Vacuum Systems used for the testing of lean satellites. The thermoelectric elements used in this research are commercial off-the-shelf (COTS) Peltier devices. These can be connected in parallel to provide more cooling power compared to its previous iterations. This presentation shows the increased performance of the Thermal Vacuum Chamber by including more Peltier elements than the previous design and the possible scalability of these systems.

Name: Arturo Benjamin Hurtado-Perez
Affiliation: Centro de Desarrollo Aeroespacial, Instituto Politecnico Nacional
Title: Multi-Objective Topological Optimization Method for Satellite Structural Design

Abstract:

Artifitial Satellites are important devices for a modern connected society, as they provide valuable data worldwide. Despite being known as useful communication, observation and strategic tools, their launch costs are prohibitively high, thus limiting sustancially the oportunities for developing countries, public institutions and enthusiasts to research and exploit orbital resources. As the launching costs are proportional to the mass of the object, an interesting way of reducing them consists in reducing mass. In this work, we focus on mass reduction by optimizing the structure of small satellites. Structural topology optimization consists in optimizing mechanical properties of the structure while reducing the mass required, thus mechanically outperforming the previous design. In many fields as in the aerospace one, multi-objective optimization is required, as it is necesary to optimize simultaneously several objective functions. In this field, the Soft-kill Bidirectional Evolutionary Structural Optimization method (SBESO) is nowadays broadly used for topological optimization when using the discrete approach. However, SBESO has the feature of getting stuck in local extreme. In this work, we propose to hibrydize the classical SBESO method with an Evolutionary Algorithm to overcome some of its weaknesses.

Name: Daniel Lemuel Sanchez-Cabadas
Affiliation: Centro de Desarrollo Aeroespacial, Instituto Politecnico Nacional
Title: SMD-QFP-Based Parallel On-BoardComputer For Small Satellites

Abstract:

Systems intended to be implemented in space environments, such as ”Lean satellites”, require efficient energy management and adequate processing capabilities for their operational and functional management. Within the range of subsystems necessary to operate a satellite, is the on-board computing, responsible for the control of all the basic satellite modules, through specific functions stored in the form of algorithms, in the memory unit of the controller used for the management of each subsystem. In this work, it is proposed to implement a partially decentralized distributed system, consisting of 8-bit microcontrollers interconnected through a hybrid bus topology, this in order to maximize the data processing capabilities of a predetermined mission, while reducing its mass by contemplating SMD QFP versions of the mentioned microcontrolers, while considering contained power consumption for 3U or larger CubeSats, increasing the processing capacity and responsiveness of the distributed on-board computer.

Name: Tasuku Matsui
Affiliation: Kyusyu Institude of Technology
Title: Automatic visual inspection and report generation system of vibration test for CubeSat

Abstract:

In recent years, small satellite constellations have grown exponentially in popularity and use due to several aspects and benefits such as risk management, faster development time, automation, and less cost per satellite than bigger ones. The testing time and cost for constellations can be considered higher due to the large number of satellites that must be tested before launch, and some companies currently use more than a thousand satellites. Therefore, this generates a complicated situation with the management of human resources, leading to increased time and money consumption as well as human error. This paper focuses on the development of an automatic visual inspection system that is required after the vibration testing of a CubeSat. It introduces the conceptual study, design, and testing of a prototype of the previously mentioned system for a 2U CubeSat, which can detect anomalies such as torque mark shifts on the screws of the satellite, as well as cracks on fragile components such as the solar cells by using an image subtraction method and then generating an automatic report, this system aims to reduce documentation work leading to a minimized testing period.

Name: Asia Saeed Kajo Habila
Affiliation: Institute of Space Research and Aerospace (ISRA)
Title: Estimation of the Attitude Disturbance Torque in the Low Earth Orbit to Enhance Satellite Control and Preserve Its Mission

Abstract:

The attitude determination and control subsystem (ADCS) is one of the essential satellite subsystems and contributes to its mission success. It prevents satellites from freely spinning in space by determining their attitude and controlling their orientation. However, for small satellites in Low Earth Orbit (LEO), the ADCS faces many challenges that negatively affect their control accuracy and may lead to mission failure. Especially for satellite missions that require precise control, such as fine pointing for high- or low-resolution payloads and point antennas toward their targets. Furthermore, it is crucial to guarantee the efficient operation of satellite constellations and maintain exact control over the positions of individual satellites in relation to one another. The space environment is considering a challenge for small satellites in LEO due to their small moment of inertia. There are various attitude disturbance torques that represent it, such as gravity gradient, solar radiation, aerodynamic, and magnetic moment torques. This paper presents the effect of the disturbance torque on the satellite and how to accurately estimate it on the ground or online in the orbit to accurately control the satellite. The paper also presents a new identification methodology to determine which kind of attitude disturbance is acting on the satellite with the magnitudes identified. This, in turn, will improve the satellite's estimated state and control and ultimately preserve its mission.

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