Singapore Country Report

Jonathan Hung
President

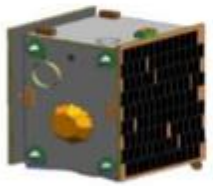
About us

- A non-profit trade association, focused on developing Singapore's space and related high technology industries.
- Serves as a neutral platform to facilitate information and communication for industry, government and academia.
- Spearheads initiatives that advances Singapore's space ecosystem
- Drives educational and outreach programs to encourage careers in space and high-technology engineering fields.

Singapore's Journey into Space

A focus on small satellite technology and platforms

April 2011



XSAT

- First Singapore made satellite
- 100 kg, 10m optical

NANYANG TECHNOLOGICAL UNIVERSITY

November 2013

VELOX-PII

- First Singapore student-built satellite
- 1U Cubesat (10x10X10cm)

NANYANG TECHNOLOGICAL UNIVERSITY

June 2014

POPSAT-HIP 1

- 3U (30x10x10cm) Cubesat
- Test high resolution optical payload and propulsion

micro space

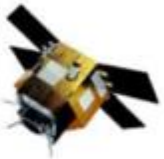
July 2014

VELOX-I

- Developed by Undergraduate Satellite Program
- Test world's first ZigBee based inter-satellite communications system

NANYANG TECHNOLOGICAL UNIVERSITY

Q4 2015 – Successful Launch



TeLEOS-1 ST Electronics

- Singapore's first commercial EO satellite

VELOX-C1 NANYANG TECHNOLOGICAL UNIVERSITY

- Tropical environmental monitoring satellite

Kent-Ridge 1 NUS

- Hyperspectral imaging satellite

Galassia NUS

- Collaboration with NUS Centre for Quantum Technologies

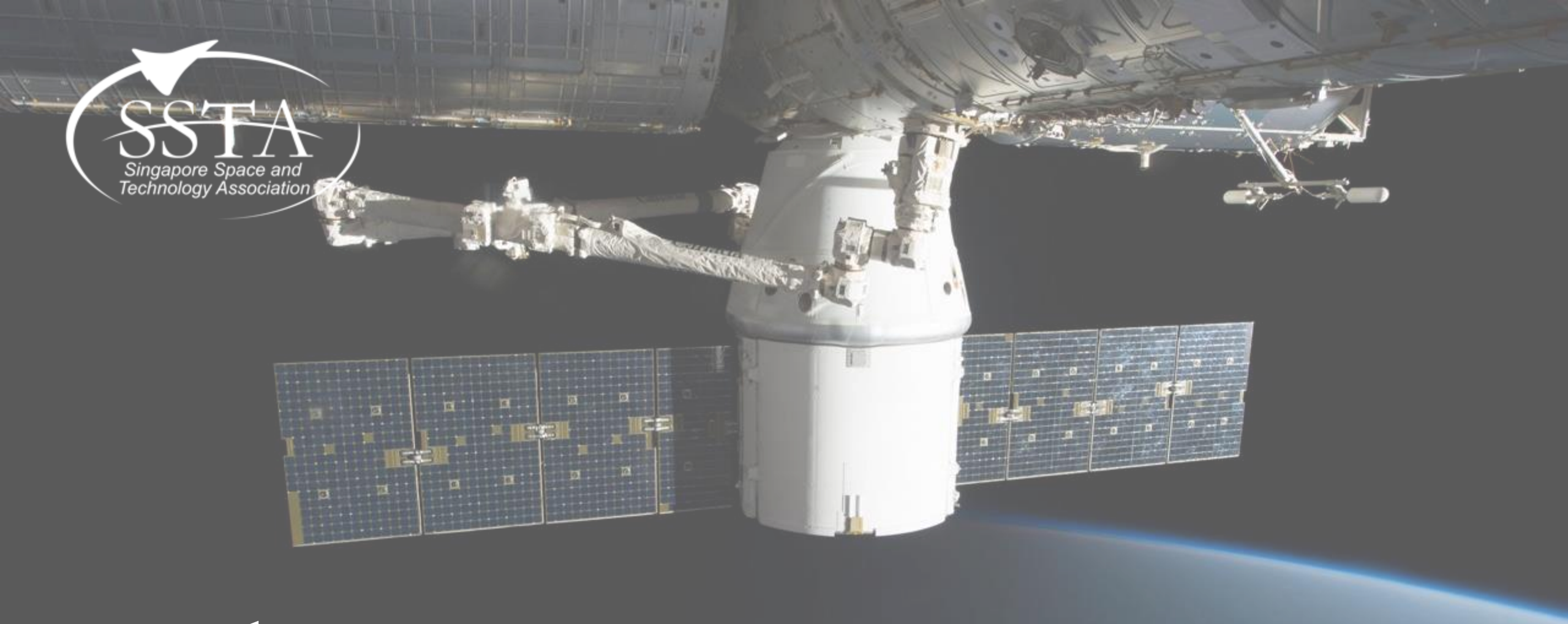
VELOX-II addvalue NANYANG TECHNOLOGICAL UNIVERSITY

- NTU collaboration with Addvalue

Athenoxat-1 micro space

- Experimental satellite for imaging

Corporate Members



Industry Programs

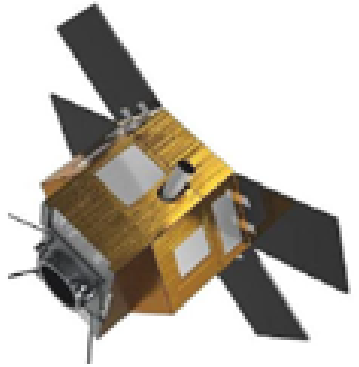
Singapore Technologies Engineering

Programmes

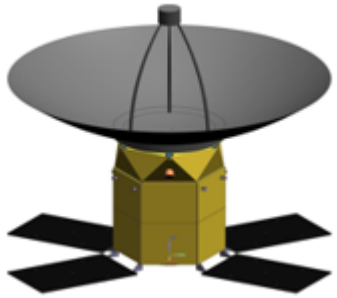
- To Provide high revisit EO data to meet government and commercial needs through acquired and locally developed satellites.

- NEO Electro-Optical (EO) Satellites

- NEO Synthetic Aperture Radar (SAR) Satellites

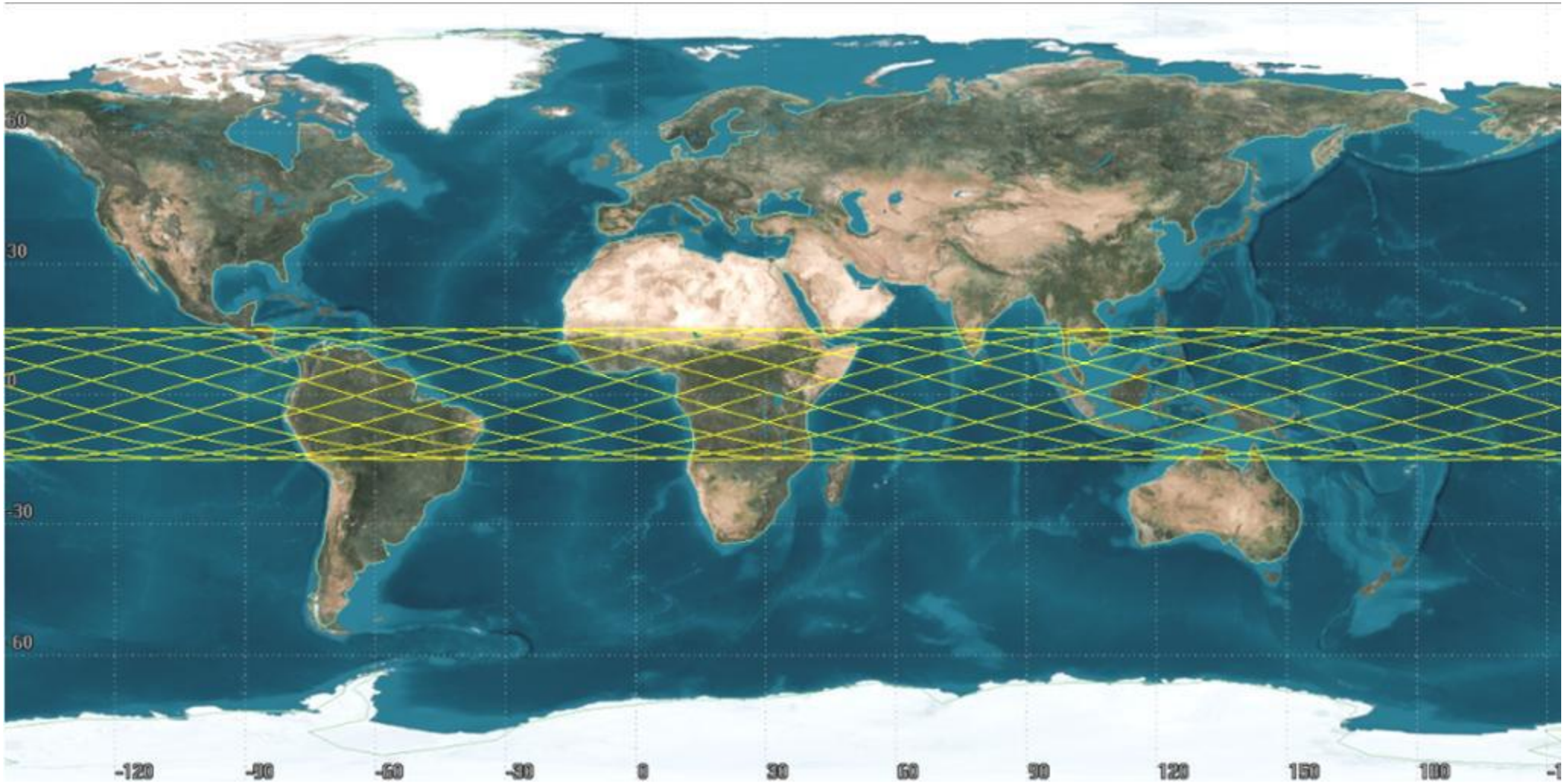


TeLEOS-1
(1m Optical)



TeLEOS-2
(1m SAR)

TeLEOS-1 NEqO Coverage




TeLEOS-1 Image, 3 October 2018
Damages by Tsunami


TeLEOS-1 Image, 3 October 2018
Landslides and Debris from Earthquake

GSTC
Global Space and Technology Convention

The St. Regis Singapore

14 & 15 FEBRUARY 2019

Supported by 24 organisations and ~ 700 delegates from all over the world.

"The satellite communications industry is an exciting and fast-growing one, with growing business and career opportunities. There are many technology innovations shaping the satellite communications industry today, including High Throughput Satellites and small satellite constellations for communications. It is therefore vital for Singapore to build up new capabilities, such as inter-satellite LEO-GEO communications, to support the growth of this industry."

- Mr Beh Kian Teik, Assistant Managing Director, Economic Development Board, Singapore

"GSTC has brought together global thought leaders, subject matter experts and end-users in the space ecosystem. It is a place to get a pulse of the fast evolving Asian space industries, to meet new business partners and uncover new opportunities.

ST Engineering is proud to have been a key partner of this home-grown convention since its inception."

- Mr Vincent Chong, President & CEO of ST Engineering

"The Global Space & Technology Convention has presented excellent opportunities for SSTL to work with current and future players shaping the Asian space developments."

- Sir Martin Sweeting, Founder and Executive Chairman, Surrey Satellite Technology Ltd

GSTC 2019 Program

Pushing The Innovation Frontier

•Global Perspectives and Developments	· Trends and New Missions · Commercial and Industry Developments
•Small Sat Innovation and Markets	· SAR Small Sats · Constellations, LEO to MEO
•Emerging Satellite Technologies in Communications	· Comms: HTS, 5G · Services: In-orbit servicing
Satellites for IoT, Earth Observation, and Cybersecurity	· Industrial IoT via LEO Constellations · EO – Agriculture, Disaster Management
Terrestrial Technology Translation for Space Applications	· Machine Learning · Predictive Analysis
Access to Capital in Space Industry	· Fundraising for Space Startups · Challenges and Risks
Miniaturisation of Space	· Small Satellites · Small Launchers

**To be finalized*

Panels at GSTC 2018

Space Agencies Dialogue

ESA (European Space Agency) · ISRO (Indian Space Research Organisation) · Glavkosmos (Launch operator for the Russian space agency) · LAPAN (Indonesian Space Agency · ANGKASA (Malaysian Space Agency) · JAXA (Japan Aerospace Exploration Agency) · Israel National Council for R&D · MBRSC (Md Bin Rashid Space Centre)

Industry Chiefs Dialogue

Seraphim Capital · Thales Alenia Space · Israel Aerospace Industries · Mitsubishi Electric Space Systems · Airbus Defence and Space · Surrey Satellite Technologies

HADR Challenge

Humanitarian Assistance and Disaster Relief

- **Students and young professionals are given the task to develop an innovative smart application**
  - Aim is to provide a significant increase in efficiency and effectiveness of humanitarian assistance and disaster relief operations.
- **App shall make use of a variety of data from space or airborne sensors as well as other sources**
  - Assuming communications over a relief area can be established through an ad-hoc network provided by satellite technology.

The challenge scenario will require teams to formulate innovative solutions in the following areas to aid in disaster management

- Robust and Reliable Communication Solutions
- Data & Information Verification and Analytics
- Mapping Solutions via Satellite Imagery
- Logistics & Telemedicine Management through Geolocation Capabilities

Supporting Partners

Airbus Defence and Space

Regional HADR Coordination Center

Singapore Civil Defence Force

Mercy Relief

SSTA
Singapore Space and Technology Association

R&D
Talent Development
& Outreach

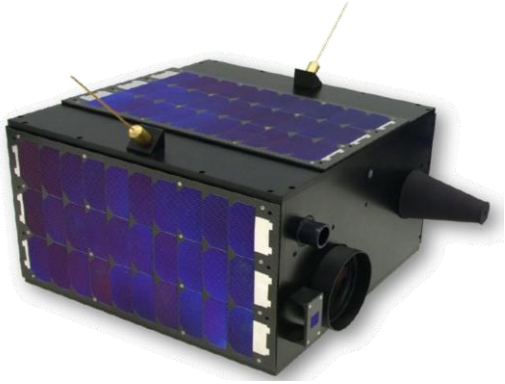
NTU Satellite Research Centre (SaRC)

	Satellites	Size	Main Mission	Launched
1	X-SAT	105KG	Imaging	20 April 2011
2	VELOX-PII	1 U	Satellite Control	21 Nov 2013
3	VELOX-I	3 U	Imaging	30 June 2014
4	VELOX-PIII	0.5U	Intra-Satellite RF communication	30 June 2014
5	VELOX-CI	135KG	GPS Radio Occultation	16 Dec 2015
6	VELOX-II	6 U	Inter-Satellite Communication	16 Dec 2015
7	AOBA VELOX-III	2 U	Thruster	19 Dec 2016
8	AOBA VELOX-IV	2 U	Thruster	End 2018
9	SPARTIUM	2 U	Space Precision Atomic-clock Timing Utility Mission	End 2018

National University of Singapore - Satellite Technology And Research (STAR) centre

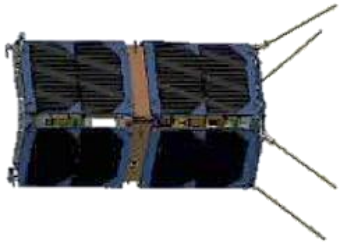
NUS previous satellites:

- KR-1 – 80kg launched in 2015
- Galassia – 2kg 3-U cubesat launched in 2015



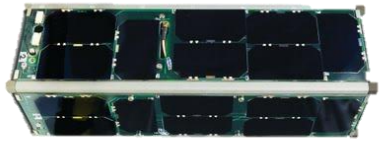
NUS Centre for Quantum Technology

- SpooQy 1 – 3U cubesat to be launched from ISS J-SSOD in 2018



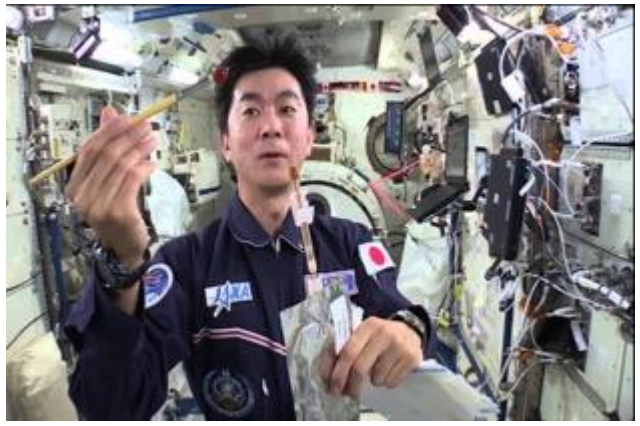
Current projects:

- Three 12 U satellites flying in formation (precise control and navigation)
- Galassia 2 – 3U satellite with multispectral camera



Try Zero-G Asia

- SSTA collaborates with the **Japan Aerospace Exploration Agency (JAXA)** to offer an educational program known as Try Zero-G Asia to students and young researchers to design space experiments.
- Students from Secondary Schools, Junior Colleges, Institute of Technical Education and Tertiary Institutions are invited to submit proposals for micro-gravity experiments.
- Selected proposals will have their experiments conducted onboard the KIBO* by a JAXA astronaut, which will be broadcasted live and transmitted to JAXA's ground station, Tsukuba Space Center in Japan.



** KIBO is the Japanese experiment module on the International Space Station (ISS)*

Past Selected Proposals

Aircraft Stability

Nanyang Polytechnic and Naval Base Secondary School

Gyroscope and Tippe Top

NUS High School

Paper Boomerang

NUS High School

The Flying Paper Plane

Hillgrove Secondary School

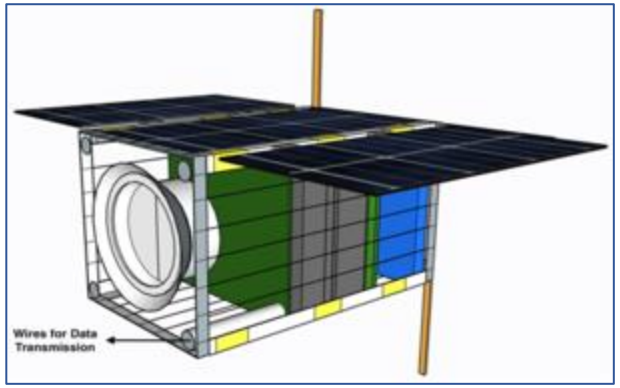
SSTA
Singapore Space and Technology Association

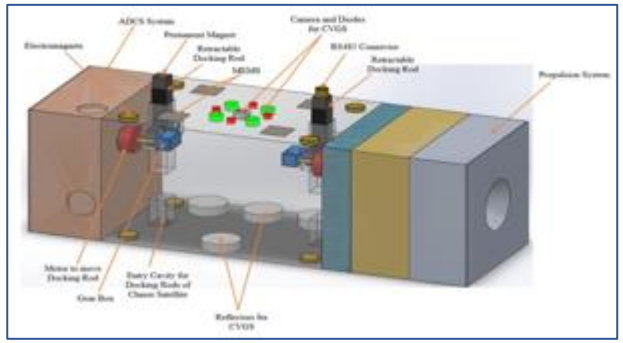
SSC Singapore Space Challenge

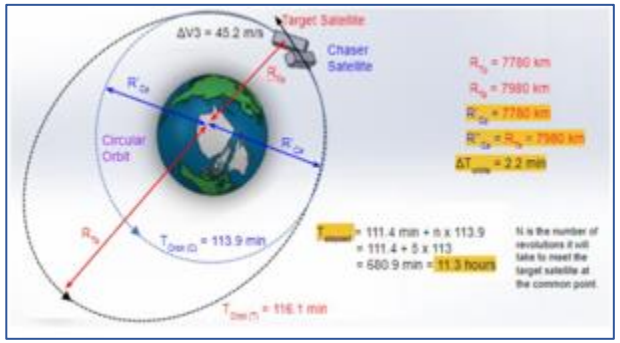
The Singapore Space Challenge (SSC) is an annual national design competition that challenges student teams to design realistic space-related, high-technology complex projects. It is organized by the Singapore Space & Technology Association.

Objectives

- Inspire interest among youths and encourage participation in space-related activities
- Educate the public on the applications and benefits of space technology in our everyday lives
- Provide a platform where students, academia and the industry can can interact to discuss and align technical concerns, research areas, and projects





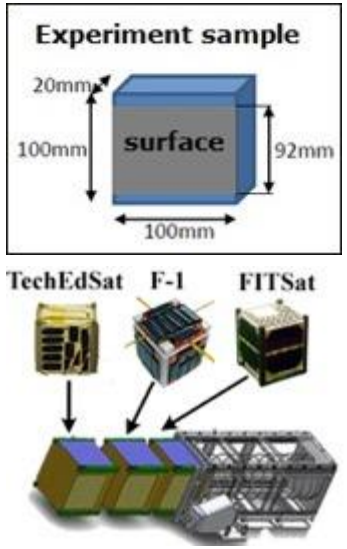


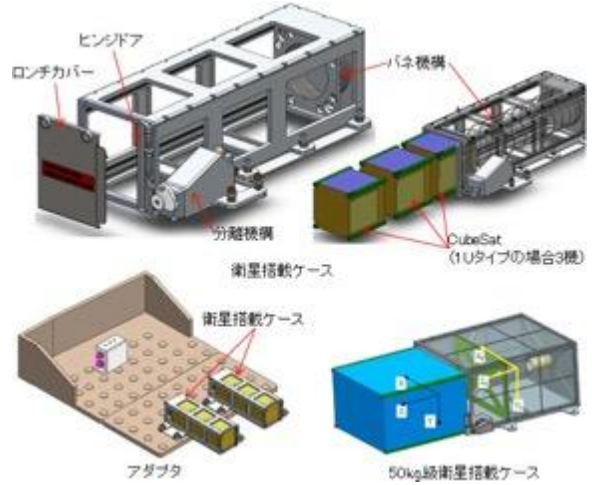
Small Satellite Launch Services

Small Satellite Orbital Deployer

SSTA provides launch services for small satellites through JAXA's Small Satellite Orbital Deployer (J-SSOD) onboard the ISS's KIBO module.

- Excellent Partnership with JAXA!
- Allows access to perform testing of materials in real space environment
- Convenient for Singapore-based companies, as launches are usually in the Asian region
- Provides a healthy launch frequency via various ISS resupply vessels
- Places less stress on payload compared to satellites launched directly from rockets



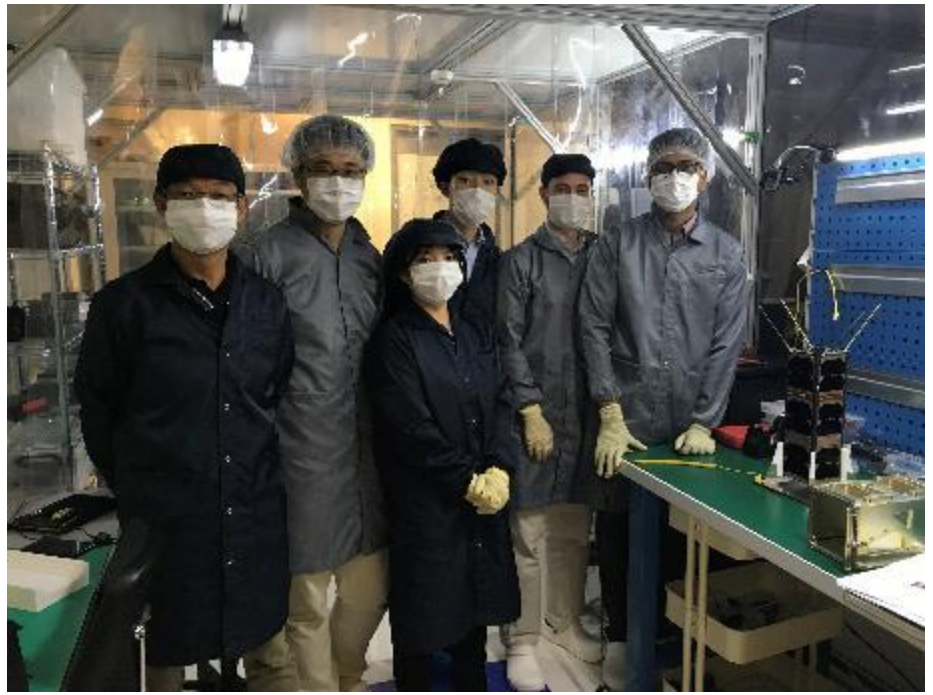


Potential users:

- Institutes of higher learning
- Research Institutes
- Startups
- Manufacturers
- Biomedical firms
- Material Science Companies

National University of Singapore
Centre for Quantum Technologies – Satellite QKD Programme

- NUS-CQT has contracted SSTA to help launch their SpooQy-1 satellite to space via JAXA's JSSOD onboard the International Space Station
- Due for deployment in 2019



Photos taken during the fit-check at NUS-CQT

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Innovation Initiatives

Advanced Space Incubator

- To spur and cultivate innovation in the space tech startup ecosystem

What the incubator brings to the table

- Access to subject matter experts
- Marketing B-B platform
- Technical consultancy on products
- Bridging funds across Asia and US
- Regional domain expertise
- Smart manufacturing solutions
- Sketch-to-Scale support
- Talent scouting
- Made-in-Singapore branding & quality

Start-up **Transcelestial Technologies** with SSTA President, DPM Teo Chee Hean, and Minister for Finance Heng Swee Keat

SSTA
Singapore Space and Technology Association

Thank You!

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Registration & Exhibition for GSTC:

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