

Regional Report

at the 7th UNISEC-Global Meeting

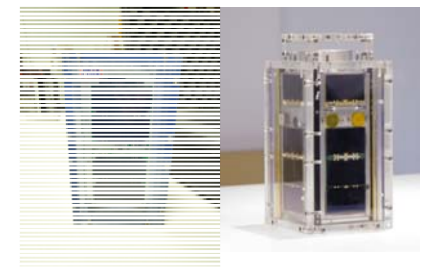
POC: Jyh-Ching Juang
UNISEC-Taiwan

Jyh-Ching Juang, Loren Chang, Kaiti Wang, and Albert Lin
(NCKU) (NCU) (TKU) (NSPO)

Past Activities

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Taiwan

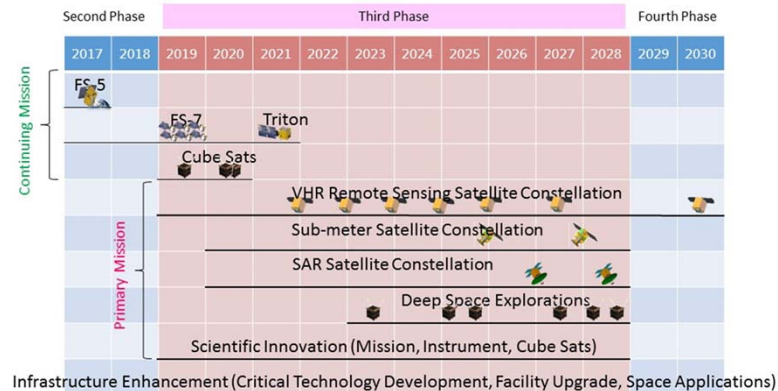
- In the past, Taiwan team universities have
 - Attended UNISEC-Global meeting 2013-2018
 - Organized MIC seminars
 - Participated in MIC
 - 2018: National Central University (Taiwan) is one of the winner team(1st place) of the 5th MIC
 - Held several CubeSat (subsystems) competitions.
 - Launched two CubeSats in space
 - 2016: PACE, National Cheng Kung University
 - 2017: PHOENIX, National Cheng Kung University



Space Activities in 2019

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Taiwan

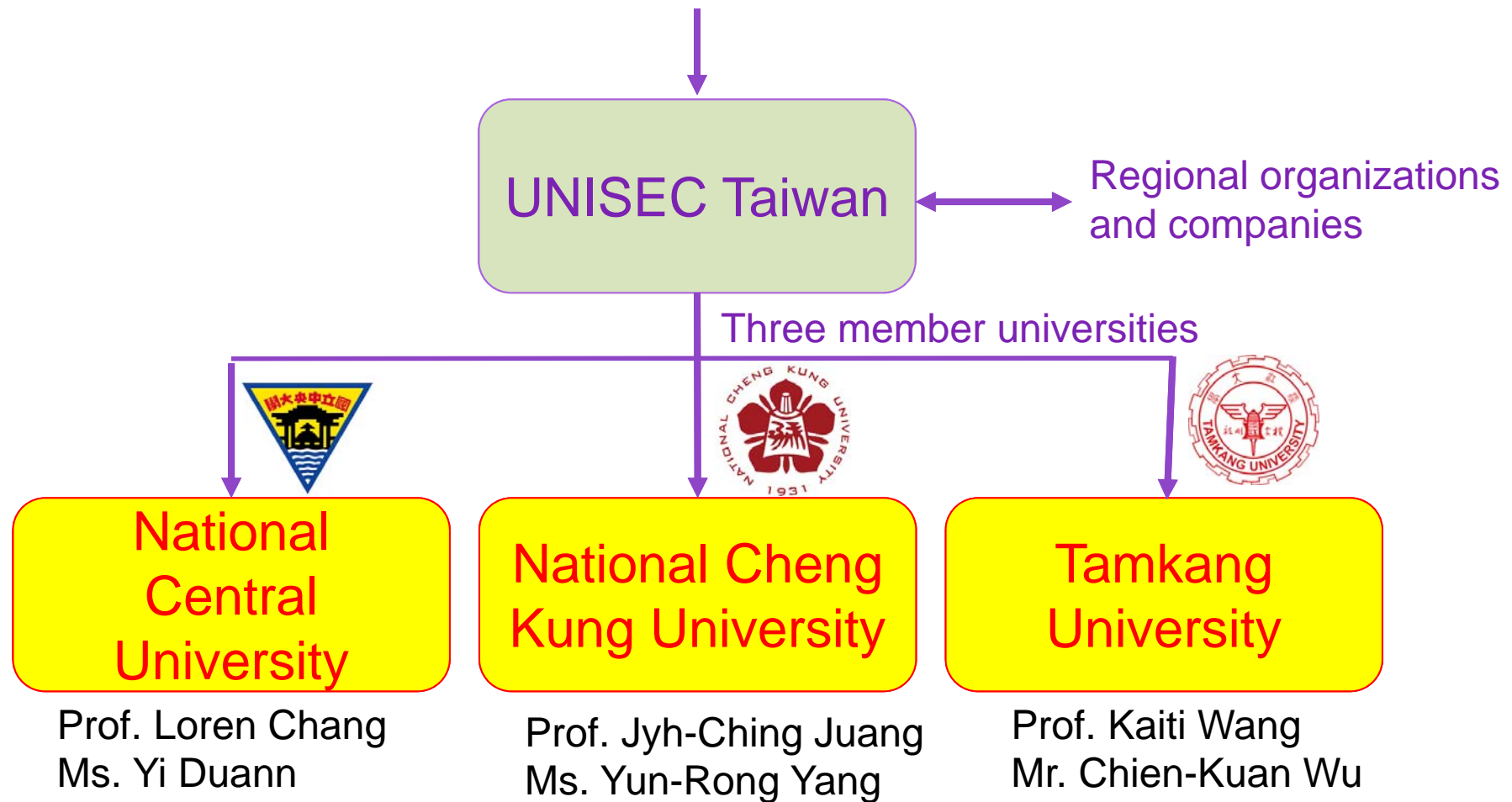
Third phase space program



CubeSats are emphasized

- NCKU has launched CubeSats
- Several universities are developing CubeSats
- Start-up space companies are positioned
- International collaborations

UNISEC
Taiwan



Tamkang University

UNISEC
Taiwan

- **Department of Aerospace Engineering**

- Founded in 1972
- Numbers of Full-Time Faculty Members: 14
- Numbers of Undergraduate Students: ~ 500
- Numbers of Master students: ~ 40
- Specialization Fields:
 - Thermo-fluid Dynamics
 - Structures and Materials
 - Dynamics and Control
 - Space Engineering and Space Sciences
- Courses related to Rockets and Space:
 - Introduction to Astronautical Engineering
 - Space Flight Mechanics
 - Rocket Propulsion
 - Aerospace Electromagnetics
- Faculty in Rockets and Space:
 - Hsiao, F. Y. - Orbit Design, Dynamics Simulation
 - Tang, J. M. - Solid fuel
 - Wang, K. - Space Observations, Space Radiation
 - Hung, C. C. - Advisor for Students' Rocket Design Team
- Student Activities: Space Technology Lab (STL) - composed by undergraduate students



<http://www.aero.tku.edu.tw>

<http://www.aero.tku.edu.tw/EINDEX.html>

TamKang University

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Taiwan

- **Space Technology Laboratory**

- Established in 2017
- People: Team members (~ 30 undergraduate students)
 - A leader (Master student)
 - A Primary Advisor (Prof. Hung)

- 6 groups:

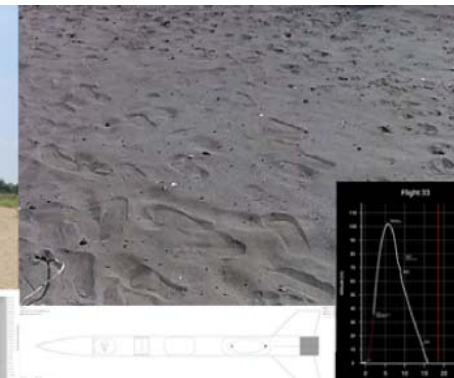
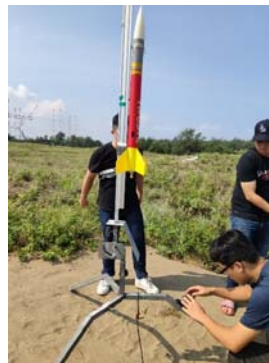
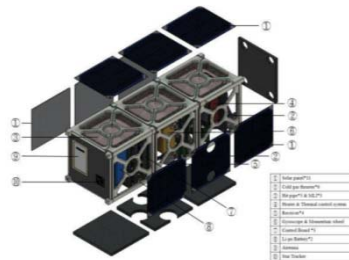
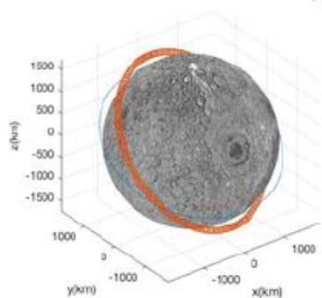
- Propulsion
- Rocket Design
- Rocket Fabrication
- Avionics
- Spacecraft and Flight Dynamics
- Space Environment and Exploration

Students design/manufacture small-rockets and make a launch test at least once a year. Up to now, they have made 3 successful launch since 2017(Advised by Profs. Hung and Tang).

Students join domestic Cubesat Mission Design Contest, and have won the 2nd place in 2017 (Advised by Profs. Hsiao and Wang.)



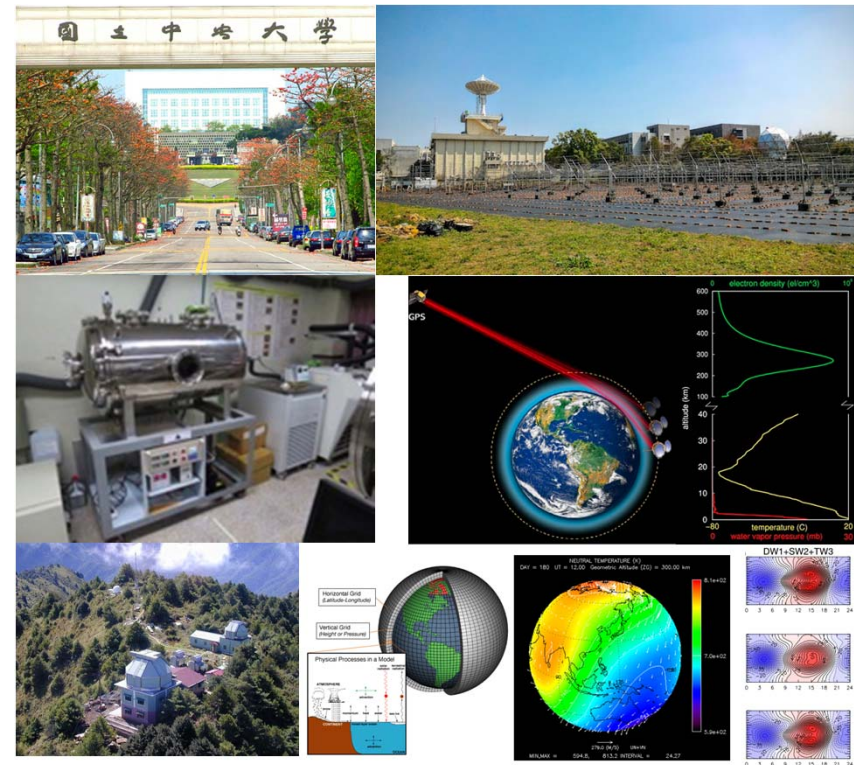
The orbits of the CubeSat and the mothership.



National Central University

UNISEC
Taiwan

- Established as follow up to 1957/1958 International Geophysical Year.
- 50 years of space science research
- 30 years of space technology development
- Multipronged space research ecosystem:
 - Satellite & sounding rocket payloads
 - Space weather & environment
 - Satellite remote sensing
 - Aerospace systems & components
- First space science & engineering department in Taiwan (2020)



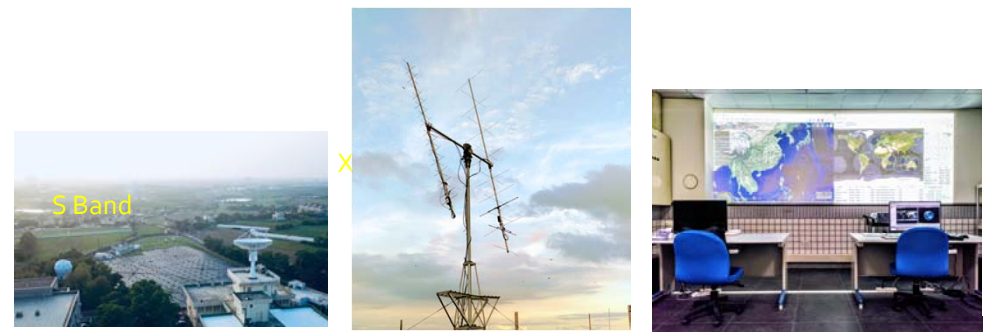
Department of Space Science & Engineering

UNISEC
Taiwan

- Formed from merger of Graduate Institute of Space Science & Engineering with Dept. of Atmospheric Sciences Space Undergraduate Division.
- Allocated student body:
 - Undergrad: 130
 - Masters: 39
 - PhD: 28
- Emphasis:
 - Space weather & environment
 - Space Systems Engineering
 - Satellite & Sounding Rocket Payloads



Environmental Testing



X band, S band, UHF Ground Stations

INSPIRE

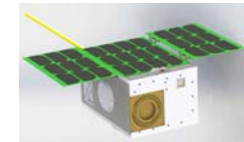
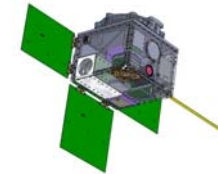
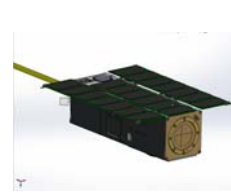
UNISEC
Taiwan

- **International Satellite Program in Research and Education.**

- Established 2015.

- **Objectives:**

- Develop constellation of small satellites for science missions and supporting ground network.
- Hands on curriculum for mission formulation, spacecraft engineering, operations, science data analysis.



Mission	Subject	Inception / Projected Launch
INSPIRESat-1	In-situ ionosphere (CIP)	2016 / 2019
IDEASSat / INSPIRESat-2	In-situ ionosphere (CIP)	2017 / 2020
OWLS / INSPIRESat-3	Solar occultation, Magnetometer	2018 / 2021
ARCADE / INSPIRESat-4	Interferometer, CIP	2018 / 2021
UVSQSat / INSPIRESat-5	Payload component test	2018 / 2020
SCION-X / INSPIRESat-6	GNSS Radio Occultation, In-situ ionosphere, Hyperspectral imager	2019 / 2022 - 2023

Institution	Country	Joined
University of Colorado at Boulder	USA	2015
Indian Institute of Space Science and Technology	India	
National Central University	Taiwan	
Laboratoire Atmosphères, Milieux, Observations Spatiales	France	2017
Nanyang Technological University	Singapore	
Sultan Quaboos University	Oman	
Kyushu Institute of Technology	Japan	
University of Alberta	Canada	2018
University of Iowa	USA	
Forschungszentrum Jülich	Germany	
Tel Aviv University	Israel	2019

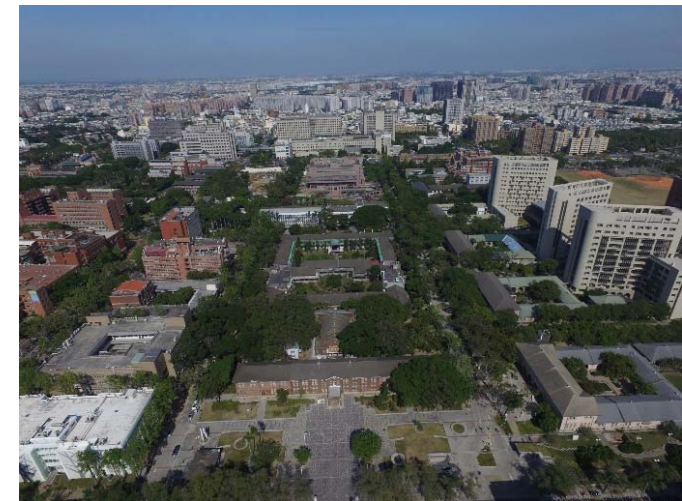
National Cheng Kung University

UNISEC
Taiwan

- Established in 1931
- Nine colleges + **College X**
 - 46 undergraduate programs
 - 98 master's degree programs
 - 55 doctoral programs
 - Personnel: 6000
 - Faculty: 1500
 - Enrollment: 20000



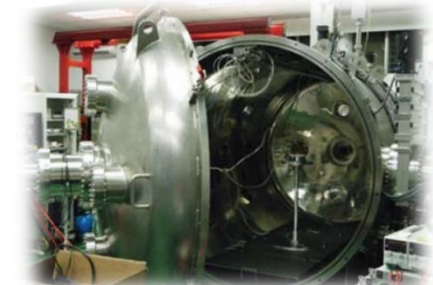
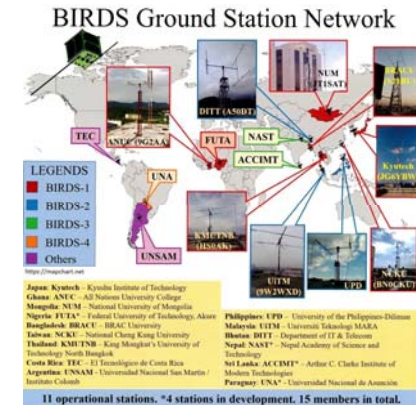
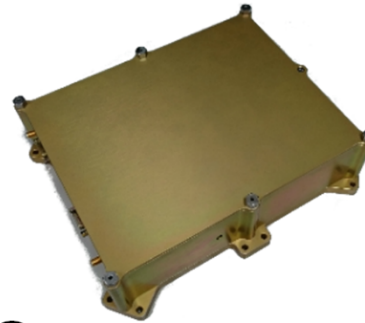
國立成功大學
National Cheng Kung University



NCKU Space Activities

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- Goal
 - Emphasis on R&D
 - Incubate human resources
 - Complement NSPO missions
- Space related activities
 - Multi-college program
 - Electric and information
 - Engineering
 - Sciences
 - Ground station of BIRDS
 - Instrument
 - Sounding rocket
 - Nano-satellites



PHOENIX CubeSat



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TEST
2015-2016

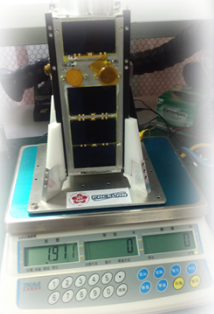


DELIVERY
2016

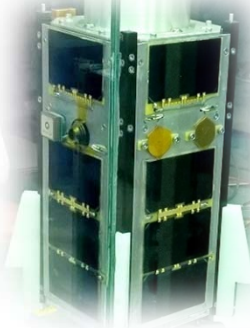
LAUNCH
2017



INTEGRATION
2014-2015



ASSEMBLY
2013-2014

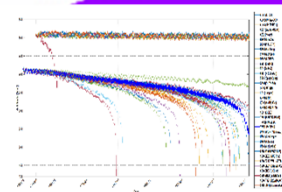


DESIGN
2012



Ω ODYSSEUS

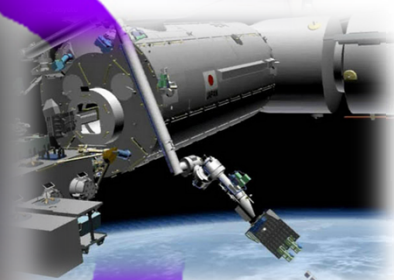
REENTRY
2019



OPERATION
2017-2019



RELEASE
2017



CONTACT
2017



By the end of 2020, university students have participated in practical space projects in Taiwan.

Training Programs

UNISEC
Taiwan

- Space Technology and Engineering Credit Program in the University System of Taiwan (UST) started in Sept. 2019.
 - Supported by NSPO.
 - More than 100 students take the courses.
 - Courses in six research areas:
 - Space Systems and Practice
 - Space Dynamics
 - Space Science and Astronomy
 - Space Remote Sensing
 - Space Mechanical Systems
 - Space Electrical Systems



Training Programs

UNISEC
Taiwan

- An interdisciplinary credit program at NCKU since 2016.
- Other lectures

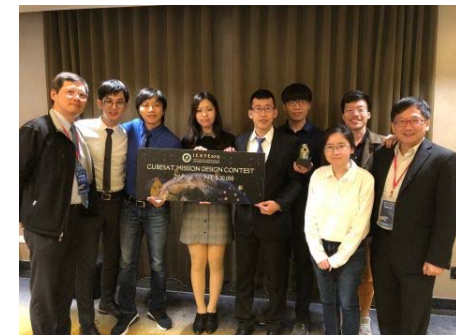


開課系所	課程名稱
物理系	太空科學與工程導論
物理系	太空科學與工程專題
物理系	天文學
地科系	天文學
物理系	天文觀測
地科系	大氣與太空測計
地科系	行星科學導論
地科系	太空中氣
地科系	空間資訊系統導論
地科系	衛星遙測概論
電漿所、物理所	天文物理
電漿所	太空物理
地科所	太空物理
電漿所	太空與天文儀器發展
地科所	衛星遙測專論
航太系	燃燒工程概論
測量系	衛星定位
航太所	火箭推進
航太所	實驗流體力學
航太所	航太工程計畫管理
民航所	現代衛星導航
電機所	電子導航

CubeSat Mission Design Contest

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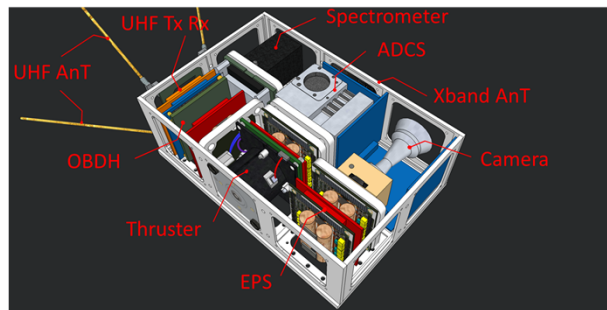
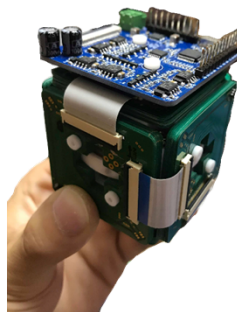
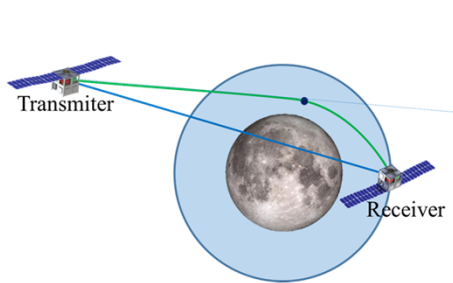
- Purpose: encourages basic and applied research related to the space science and technology to inspire more innovations and more persons participating in space programs.
- Held at iCASE 2019 (HsinChu, Nov 12-14, 2019)
- Participation: 16 teams
- More than 70 persons attended the meeting. Most are university students.



CubeSat Mission Design Contest

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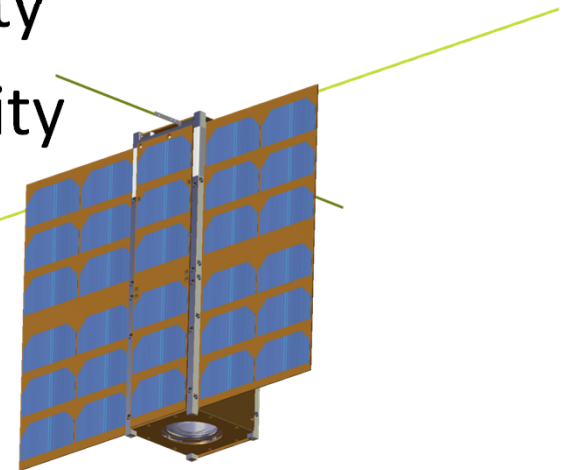
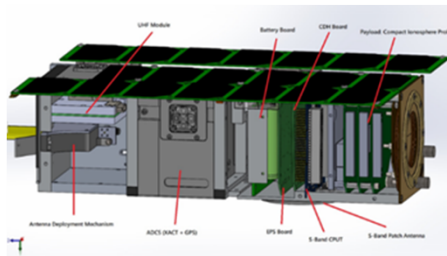
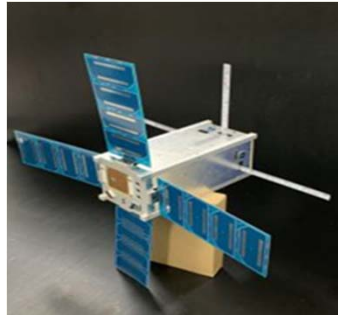
Mission ideas	
Spherical Motor	Live broadcasting of Moon landing
Atmosphere study	Re-entry and recovery system
Electron microbursts observation	Inter-satellite data-delivery service
Fisheries monitoring	Camera/altimeter to capture moon image
Artificial meteor	IPSC feasibility study
MEMS power, micro-jet thruster	Global communication network
Data collection of a hazardous asteroid	Wireless network system for secure communications
Investigate of lunar geography characteristics	Multi image super resolution image processing capability



CubeSat Programs

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- Four+ CubeSat are being designed at different universities
 - IRIS: National Cheng Kung University
 - YUSAT: MoGaMe and National Taiwan Ocean University
 - NutSat: National Formosa University
 - IDEASSat: National Central University



Sounding Rocket Programs

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- Two sounding rockets are developed at two universities
 - National Cheng Kung University
 - National Chiao-Tung University



Plan for 2020

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- UNISEC Taiwan
 - More universities
 - MIC seminars
- Space science workshop
 - Jan 2020 @NCKU
- iCASE (+ CubeSat Design Contest)
 - Nov 2020 @NSPO
- CubeSat launches
 - YUSAT
 - NutSat
 - IDEASSat
- The establishment of the UNISEC Taiwan chapter will be an important cornerstone to move further and together.