



NAR Labs 國家實驗研究院
國家太空中心
National Space Organization

5th UNISEC-Global meeting

Space Education Activities and CubeSat Programs in Taiwan

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National SPace Organization (NSPO)

- Established by Ministry of Science and Technology (MOST) in 1991, National Space Organization (NSPO) has been serving as national space agency and responsible for space technology R&D in Taiwan.
- NSPO has 200+ employees and \$35M+ USD annual budget funded by MOST (as of 2017). Location: in HsinChu Science Park, Taiwan.
<https://www.nspo.narl.org.tw/>



FORMOSAT-2, -5



Remote Sensing Instrument



Mission Operation



On Board Computer

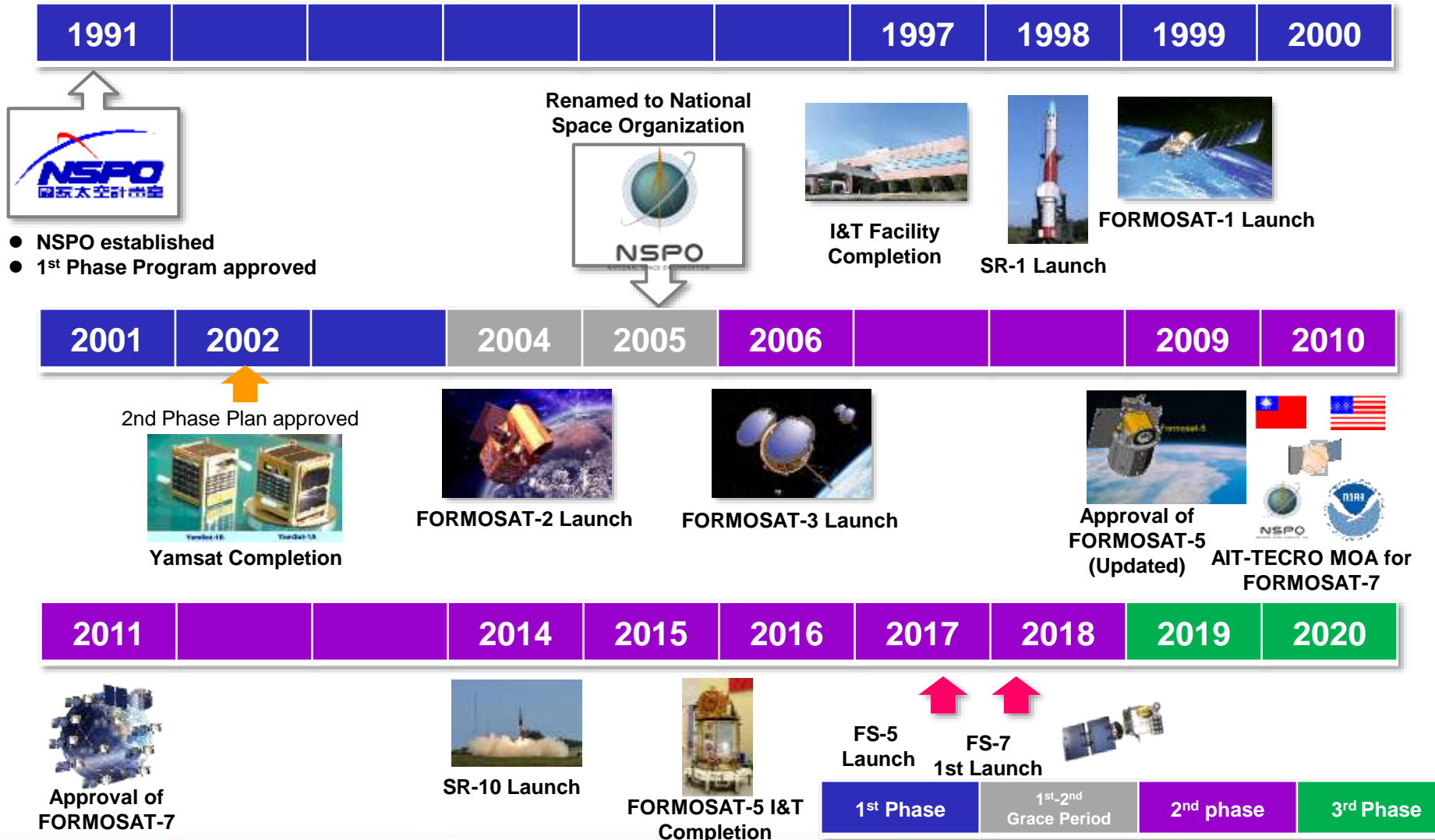


Sounding Rocket



FORMOSAT-7R

NSPO Major Milestones



NSPO CubeSats Program

- Taiwan Space Industry Development Initiative- micro-satellite development program
 - Micro/small Satellites Program,
 - CubeSats Program,
 - Sounding Rocket Program,
 - Space Industry Planning and Promotion Program.
- The time span for this CubeSats project is from 2017 to 2022 to launch at least 5 CubeSats .
- Three CubeSat contracts, called **IDEASSat**, **NutSat**, and **YUSAT**, have been issued to Taiwan's universities and domestic companies in April 2017.

NSPO CubeSat Programs (cont.)

■ CubeSat Mission :

Type	CubeSat Name	Contractor	Contract Start	CubeSat Delivery to NSPO	CubeSat Mission
3U	IDEASSat	NCU	2017/4	2019/12	ionospheric science
2U	NutSat	NFU	2017/4	2019/12	ADS-B airplane tracking
1.5U	YUSAT	MoGaMe	2017/4	2019/2	AIS/APRS tracking systems for marine and land moving objects

- ADS-B: Automatic Dependent Surveillance- Broadcast
- AIS: Automatic Identification System
- APRS: Automatic Packet Reporting System

■ Orbit preferred : orbit shape, altitude, inclination angle

- IDEASSat: circular, 450~600km, sun sync
- NutSat: circular, 450~600km, 30~50 deg, or sun sync
- YUSAT: circular, 450~600km, 30~50 deg, or sun sync

NSPO CubeSat Programs (cont.)

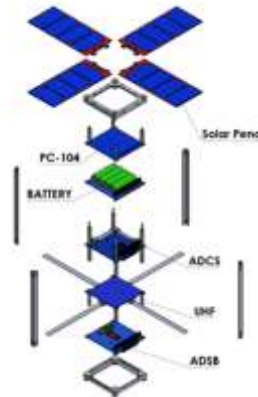
■ IDEASSat:

- There are 5 professors and about 14 students of Graduate Institute of Space Science of National Central University (NCU) involved in the project.



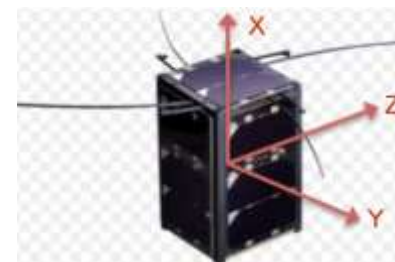
■ NutSat:

- It is the first CubeSat developed by National Formosa University (NFU), with 5 professors and about 5 students of Aeronautical Engineering Department involved.



■ YUSAT:

- There are two domestic companies, MoGaMe and LETSCOM, and one professor and students of National Ocean University involved.



Taiwan CubeSat Mission Competition

承諾 · 熱情 · 創新

- There are 8 groups submitting the papers. The competition will be held with AASRC conference at Feng Chia University on Dec 9th, 2017.



□ Paper List:

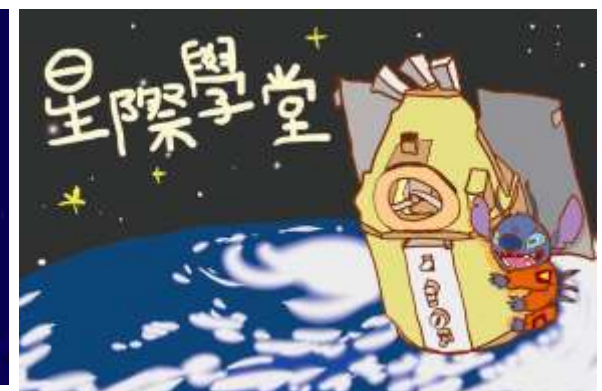
No.	Paper Title
1	Scintillation and Ionosphere Network (SCION) - A Proposed CubeSat Constellation for Space Weather Monitoring
2	SDR LTE As IoT Cubic Satellites Communication
3	An Automatic Self-Assembling CubeSat System
4	Laser Communication Experiment CubeSat (LACE)
5	Preliminary Study of Imaging the Exterior of Large Satellites by a CubeSat
6	Lunar Ionosphere Investigation by Firmament Star CubeSat
7	ICSat : The CubeSat to Test Integrated Circuit or Industrial Computers
8	INSPIRESat-1 Communication Subsystem and Engineering

Space Education

- One **space science summer campaign for senior high school** students was held by NCU with NSPO support budget this year. There are about **60** students learning how to develop satellite science instruments by hands. Some of them form a group to join the CubeSat Mission Competition.
- Meanwhile, there are a series of **satellite introduction classes** have been hold by NSPO, including satellite systems engineering, ADCS, flight software, communication and power. The attendee count has accumulated to more than 120.

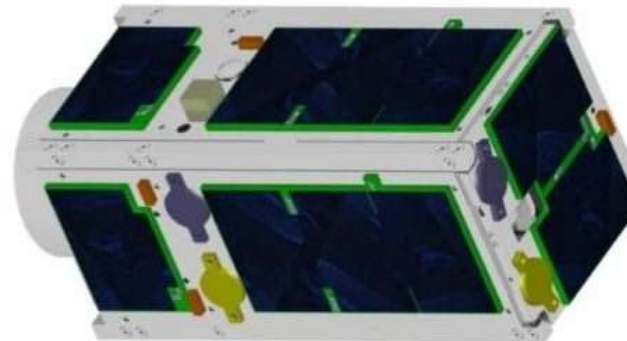
Public Space Education via Radio

- To introduce space and satellite knowledge to the public, NSPO cooperates with the student internet radio station of National Chiao Tung University, “goto&Play”, to make a radio show, “**Interstellar School**”.
- The shows contents include space people talk, space news, space knowledge, and space arts.



NCKU PHOENIX CubeSat

- NCKU has launched a 2U CubeSat named as PHOENIX as a part of the QB50 program.
- QB50 program:
 - under the support of the European Union's Seventh Framework Programme for Research and Technical Development
 - led by the von Karman Institute (VKI)
 - aim to multi-point measurements of the upper layers of the atmosphere, the mid-lower thermosphere, located between 200km and 400 km altitude, through a constellation of CubeSats.
- The PHOENIX was released from the International Space Station on **May 17, 2017** and had been successfully functional ever since.



NCKU SPACE Event

- Based on the success, NCKU has organized a NCKU SPACE event on Nov 8 and 9, 2017 to seek for further **international collaboration** and discuss potential for **space education and business**.
- The event was well attended and renowned scholars have made presentations to share their observations and research results.



Future Works

- Besides, these CubeSat projects mentioned above, NSPO will initiate **more CubeSat projects** in the following years. Meanwhile, NSPO will assist domestic CubeSat products to pass the space qualification validation and enter **international market**.
- There are some difficulties to develop microsats and CubeSats in Taiwan: **less budget** supported by government, **limited professors and students** involved in the Space area, and **low economic attraction** for domestic companies, and so on.
- There should be **more launch** activities, including sounding rockets, in Taiwan to encourage people to join the space research and satellite development.
- We hope **to join the CubeSat constellation program** and get more CubeSat development experiences and launch chances via international cooperation.