

Lessons Learned from the NUTSAT Mission

-The Road to Mass-production

Kuang-Han Ke
Gran Systems

04/25/2023

Satellite Development in Taiwan

- Incremental developments in its history

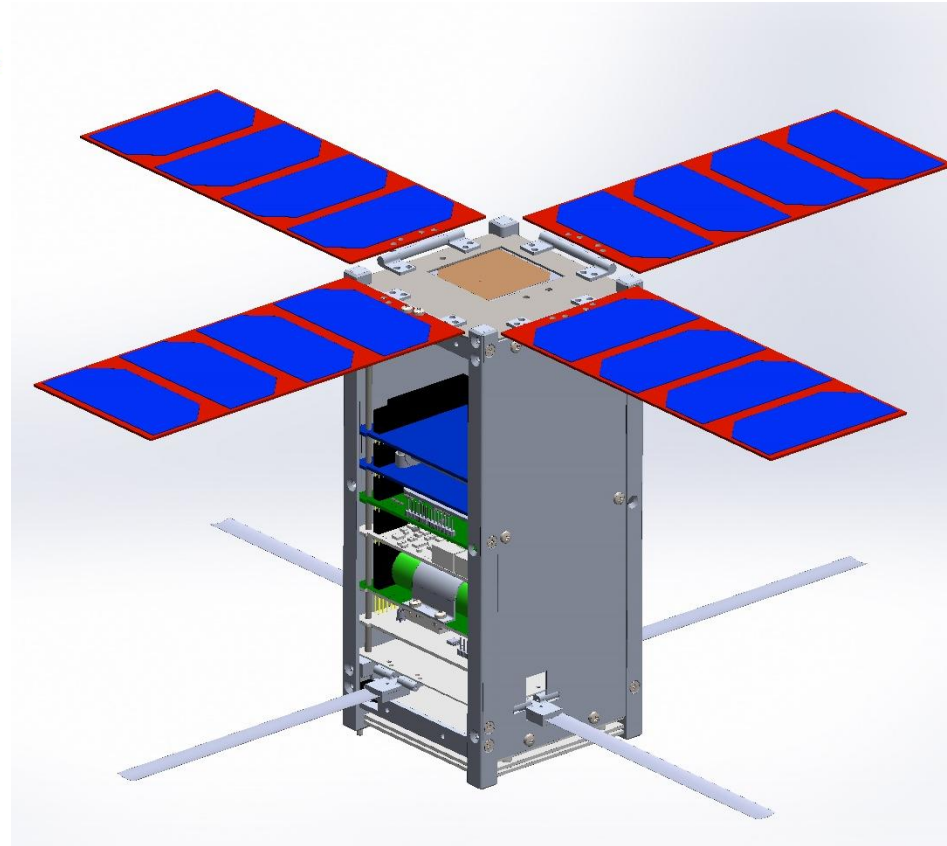
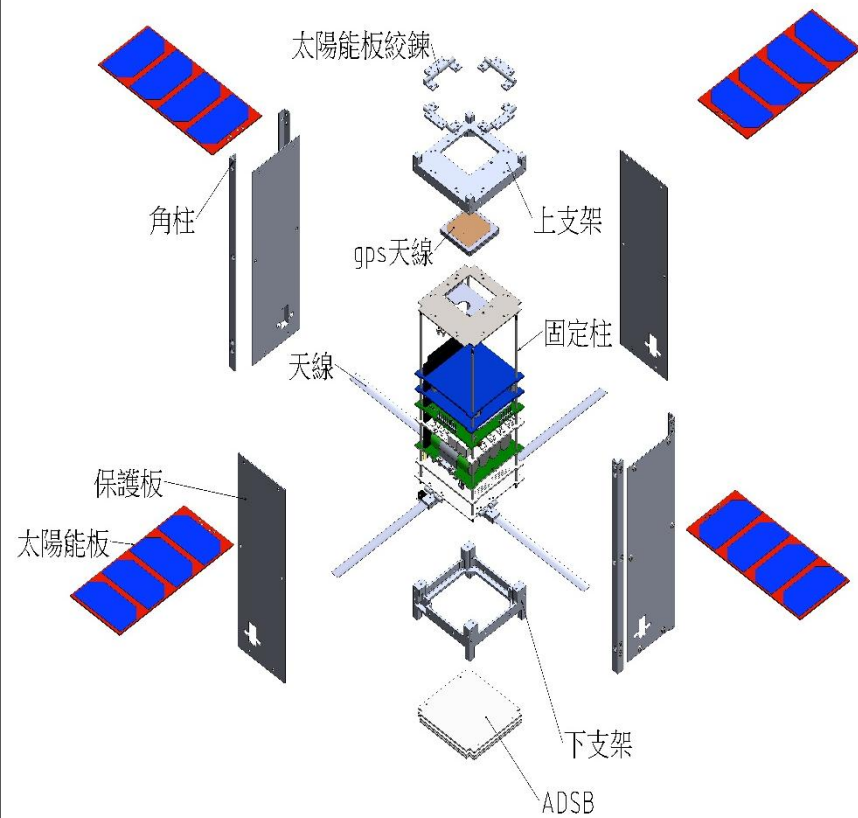


Medium to Smaller Satellites.

Taiwan Cubesat Program

- NUTSAT is one of the 3 Capstone Cubesat Programs from Taiwan, launched in November 2022 and deployed into orbit on December 29, 2022, from the ISS.
- By 2017, National Formosa University won the NUTSAT project.
- Gran Systems joined in 2018 as the local launch service provider and assisted as an **industry player** in the development process of NUTSAT.

Birth of NUTSAT



The purpose of the mission is for **technology demonstration** and **systems engineering training for aviation safety**.

Gran Systems Business Scope

Gran Systems is in the following business in
New Space, Medical Equipment, Semiconductor :

- (1) System Integration,
- (2) Angel Investment & Incubation,
- (3) Think Tank.

Experience in International Collaboration



First In-Space New Space Company In Taiwan

Initial Mission Learnings

- As the earliest in-space entrant in the space industry in Taiwan, we have access to most of the world's premier launch service providers.
- We worked on all geo-politics possible to make it to space.
- The launch services had different pricing, quality, and heritage from US, EU, India, and Japan.
- While coordinating with all related parties, we made sure that NUTSAT met all the specifications, kept all technical documentation within specification or have applied exceptions, ability to react and switch from one country to another and to launch changes.
- For first-timer, you need experienced team to help you go-through issues.

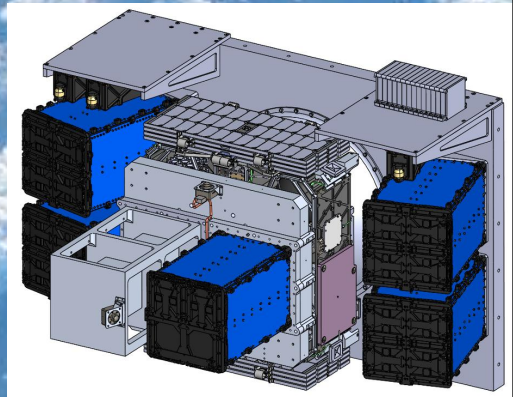
International Relationship



COVID-19 Pandemic Experience

- Due to the COVID-19 pandemic, we had to change to another launch service supplier, and went through an additional technical review process.
- Since the standards and requirements are different for each launch service provider, NUTSAT needed to be modified.
- With the extra efforts in the re-construction stage, the NUTSAT has much better performance than before and can adapt to different launch vehicles without needing much modification, when we faced unexpected reasons to switch between 10 different spacecraft.

Road of 10 Spacecrafts to Space



Source: SpaceX, Nanoracks, Northrup Grumman, Momentus

Learn and Help

- The ability to adapt to sudden changes of switching to different launch vehicles enables us to become launch transfer experts able to organize stranded launch service customer self-help group, providing services to several other cubesat teams on the same flight, to be able to smoothly transfer to their next spaceflight.

5-year Mission

- Great learning opportunity for industrial development building cubesats.
- With perseverance, this mission is overall a reasonably successful mission, achieving most of the objectives and the industrial development goals. The cubesat has been alive and receives signals daily while it is in space.

Make Something Good Out Of the Mission

- As the company participated in this full cubesat mission, we decided to **work on the productization** of several subsystems according to its accessible markets.
- These include **mass-produced test pods, cubesat structures, portions of the cubesat buses**, etc., after going through full cubesat missions to make the product robust and with space heritage.
- **Space Heritage!**

Make Something Good Out Of the Mission

- Many products are now fully mass-produced in the production facilities to serve the cubesat industry, providing the capacity of hundred-unit cubesat constellations.
- For 6U and below cubesat market, this production capacity is now >40% of current worldwide market demand, and hence the worldwide production scale requirement.
- This mass-production capacity has been available and proven since 2022, and is now offering to the market.
- When industry customers and academia training missions are thinking about the basic cubesat constellations, the industry support is ready to provide assistance today, and the resources are scalable to expand for future needs.

Systems Integration

Own Products From Taiwan to You





On NASA Website



The image shows the NASA Small Satellite Information Search interface. On the left is the NASA logo. To its right, the text reads "SMALL SATELLITE INFORMATION SEARCH". A search bar contains the text "Gran Systems" and a dropdown menu below it shows "Select Source(s)". In the top right corner, there are links for "HOME" and "ABOUT", and a search icon. At the bottom of the interface, there are sorting options: "Sort by Relevance (Descending)" and a page size of "25". A pagination bar shows page numbers 1 through 5, with "1" being the active page. Below the pagination bar, it says "Page 1 of 257 (About 6418 results)".

Mass-produced Cubesat Deployer MyPOD

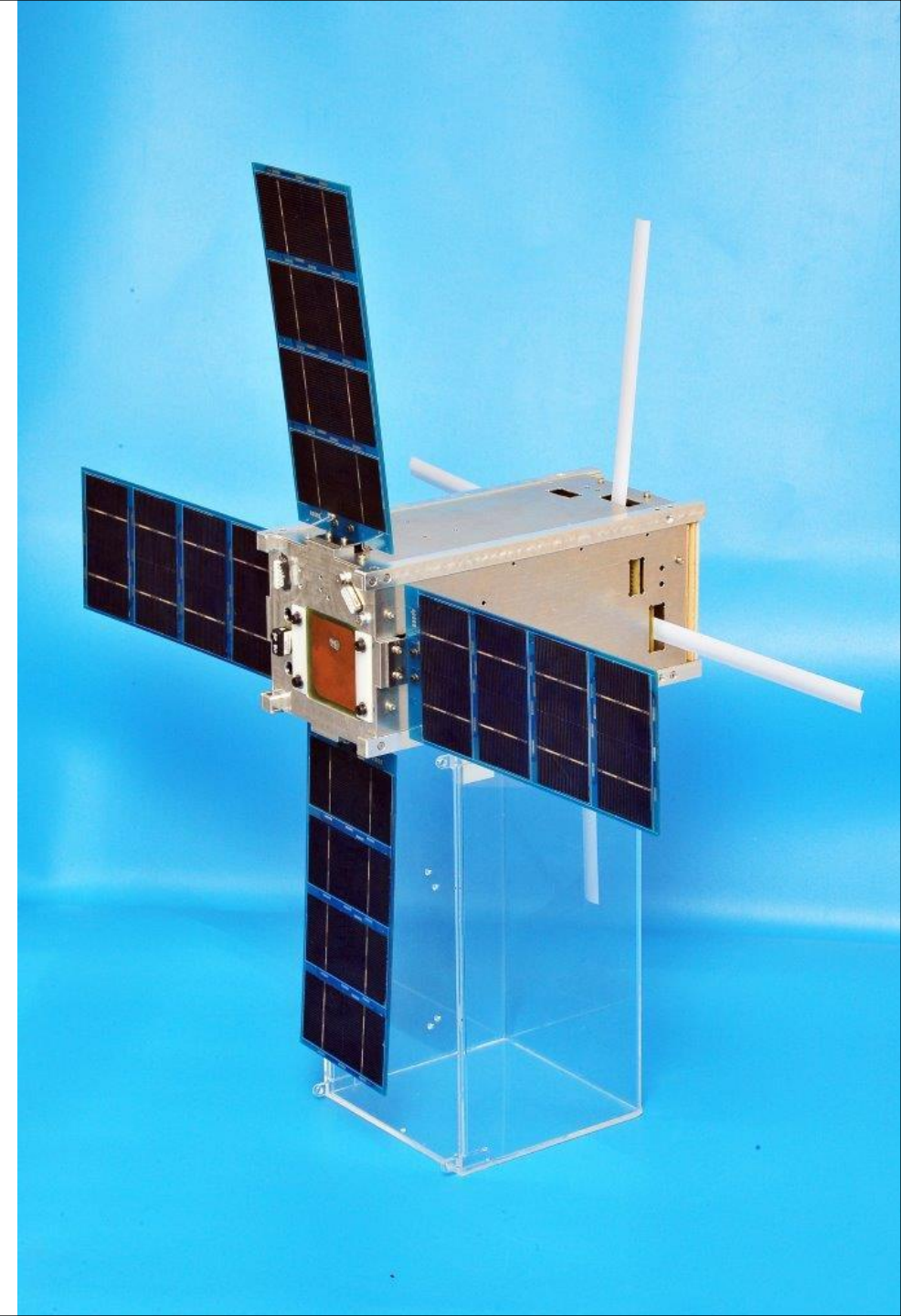
MyPOD is the first of Gran Systems' effort to provide the industry mass-produced cubesat deployers for cubesat constellations. It is currently Nanoracks NRCSD, NRCSD-E, and other rocket compatible, to maximize the size and flexibility of the cubesat deployed, taking advantage of the flight heritage of these series of cubesat deployment. MyPOD is available in 1U, 3U(+), 6U, 12U and customized versions. MyPOD is currently designed for ground testing operation, for fit check, vibration test, thermal vacuum test, drop test, shock test, and transportation to the system integration and launch sites. It is not only designed as durable and functionally reliable as other cubesat deployers in the industry, but also the first design of the industry that can withstand the brutal testing environment needed for the cubesat mission and also look good for displaying in the university department or company display.

Related Documents:

- IMAGE 1
- IMAGE 2

Supplier: [Gran Systems](#)
Source: SATSEARCH

Cubesat Buses, HW, Missions



Mass-produced Space Hardwares and Equipment

Mass-Production System House

50 ea. these 2 years

70 ea. this summer

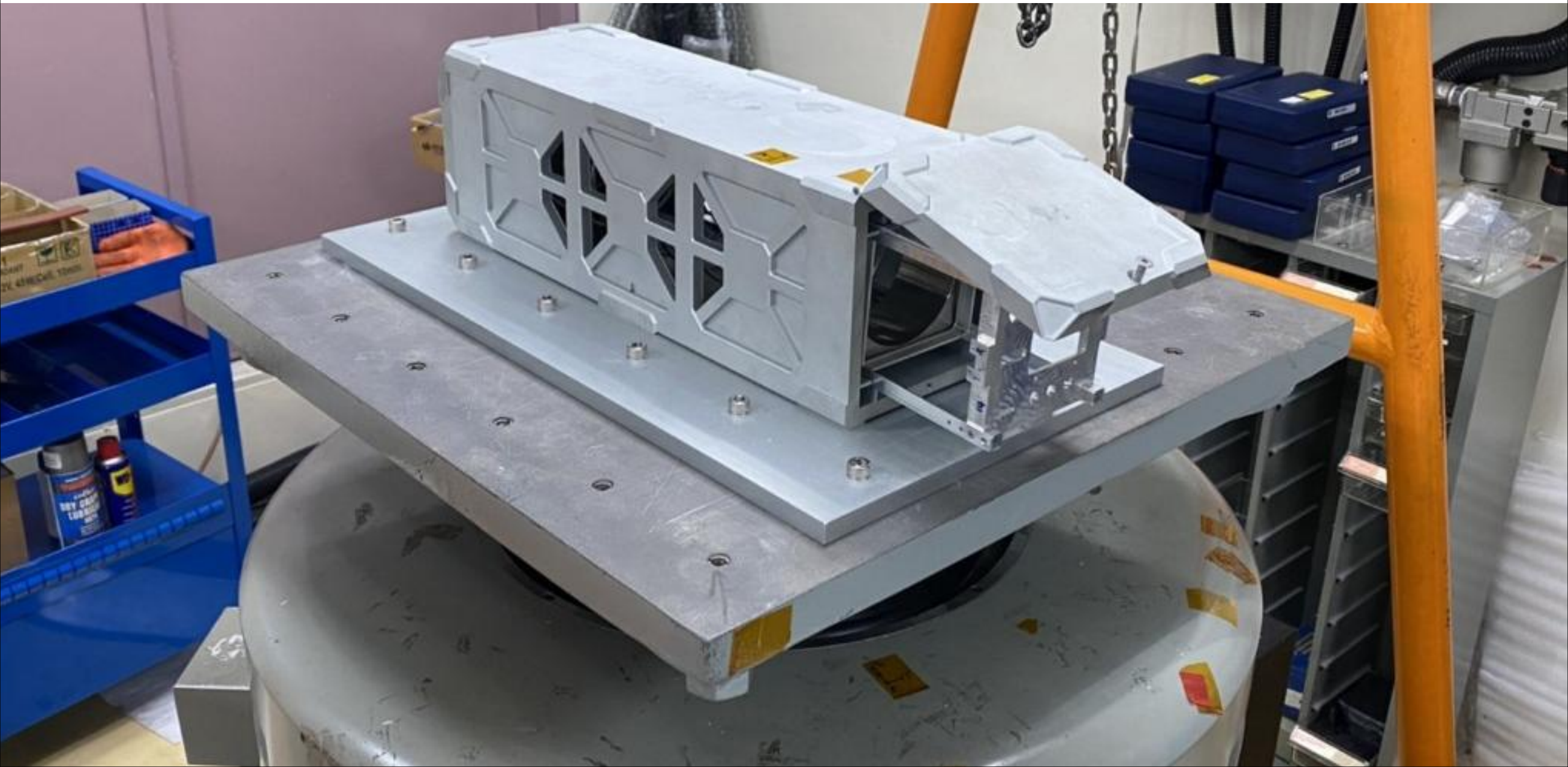
125 ea. this summer



gransystems.com

1-408-585-9948 info@gransystems.com

人類發展與太空科技進步
需要更多電子設備與加工工具



Workforce Development

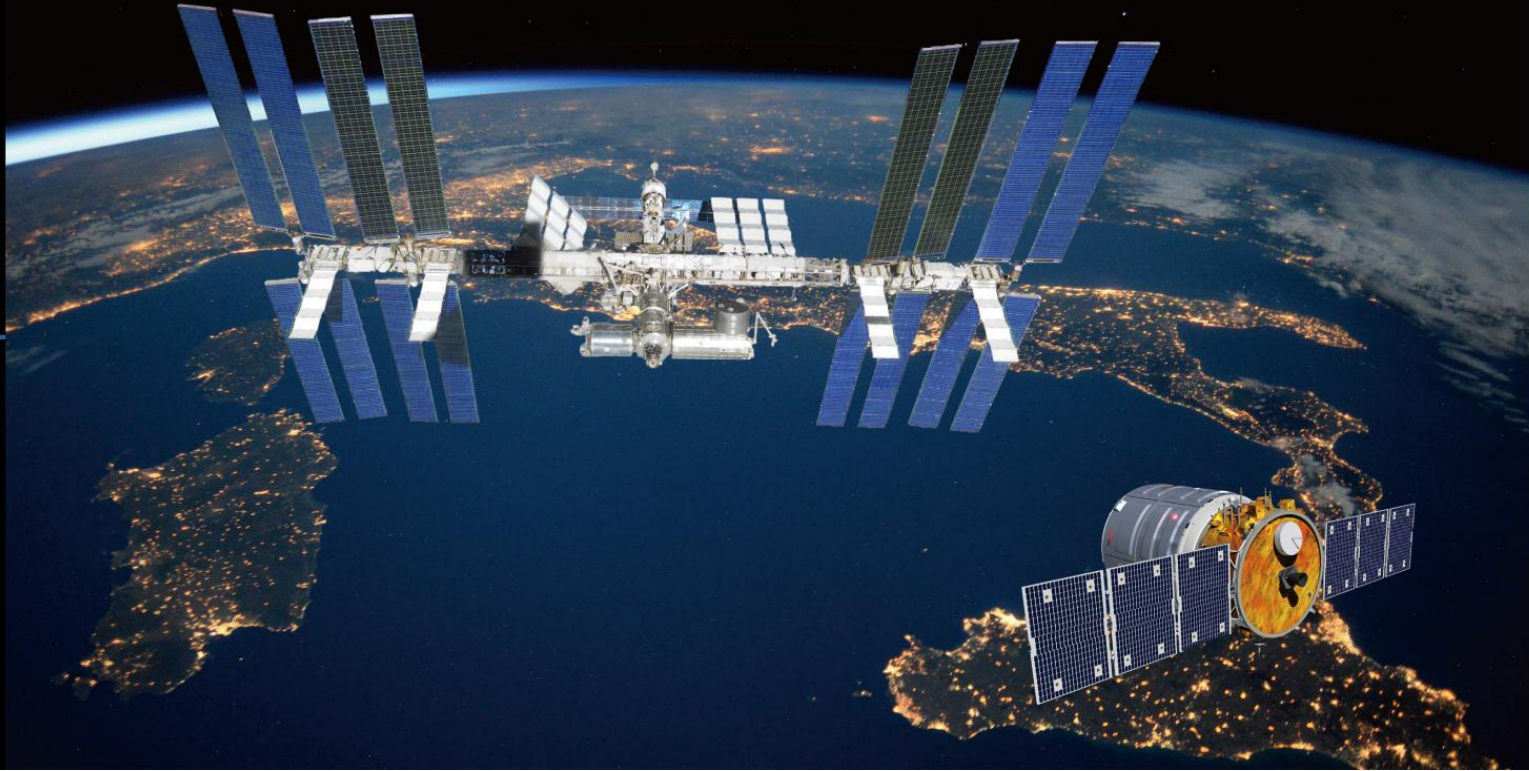


Latter Mission Learnings

- You might not succeed the first time.
- Do, learn, fix, do again, relearn, and redo.
- The best launch service providers might have its shortcomings, and you need to prepare for it.
- Many things can go wrong, and you need to fit them.
- Most of the issues were from yourselves, including communications to others.
- If you persevere, you will solve most of the problems.

Manufacturing Services

- Metals
- Ceramics: grinding & polish to a few um per pass.
- Silicon & Quartz
- Carbon Fiber
- Engineering Plastics



國際太空站 服務窗口

International Space Station Gateway

微型衛星發射服務

國際太空站科學實驗
食品 / 藥品 / 生技 / 材料 / 無重力

太空商業應用



ISS Gateway Company in Asia

Food, Biotech, Pharma, Materials, Commercialization

Source: NASA, edited Gran Systems



The Work Continues





Spaceflight => Commercial Space => Space Travel

