



TU-POD

A Cube Satellite (CubeSat) and Tube Satellite Dispenser Produced via 3D Printing, Successful Launch, Orbit and Dispensing of Two Tube Satellites

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Group of Astronautics for the Use of Space Systems

Introduction

The TU-POD mission originated for the need to launch TubeSats, a small picosatellite.

A number of launches have been sold along with the TubeSat kits but due to a delay in launch capability, many programs were looking for launch opportunities from ISS, including students in Mexico and Brazil.

Dr. Chantel Cappelletti, who was teaching at the Universidade de Brasilia, Brazil, from the GAUSS Team in Rome, Italy, requested that Tetonsys, LLC in Mountain Views, California designing and building a method of getting these TubeSats launched from ISS.

This was the initiative for the TU-POD mission.



Overview

- What was the needed?
- Why build a mothership?
- TU-POD mothership requirements
- What is unique about TU-POD?
- Final design/Testing/Integration
- Japanese Aerospace Exploration Agency (JAXA)
Launch
- Conclusions

What was the needed?

Provide launch for TubeSats from International Space Station (ISS) requested by GAUSS Team in Rome, Italy. Needed launches for Brazilian and Mexican student satellites.



Why build a mothership?

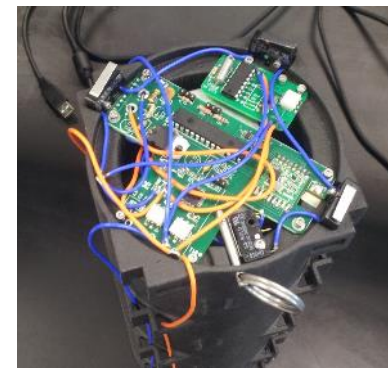
- To provide for launch opportunities for TubeSats
- What is the most practical way to launch a TubeSat?
 - Use existing CubeSat launch infrastructure.
- There was a need to combine multiple TubeSats missions due economic consideration
- Requirements by ISS for a time delay release of the TubeSats from the TU-POD to minimize re-contact risk
- Requirements to track TU-POD to confirm release of the TubeSats

TU-POD mothership requirements

- Needed something to hold the TubeSats while using the CubeSat launch infrastructure on the ISS
- Build a mothership similar in form to a 3U CubeSat that could contain TubeSats
- TubeSats 3.5” diameter x 5” long - hold two in 3U form factor
- Comply with launch requirements of JAXA from the ISS
- Required 3 day delay before releasing TubeSats from Tu-POD
- Required to have radio signal when TubeSats released

What is unique about TU-POD?

- Using 3D printing technology to create unique features
 - Special Shape for batteries and electronics
 - Unique feature for Tu-POD door release
 - Using Windform XT 2.0 from CRP USA
- 40% of the weight of AL
- Electrically conductive and machinable
- Used AL rails - JAXA requirement
- Used PocketQube electronics



Final design

- Final design includes aluminum rails to comply with JAXA requirements.
- Electronics has integrated into single board



Testing

- Final vibration and thermal vacuum testing at Morehead State University.



Final Integration

- Final assembly of TubeSats into TU-POD.



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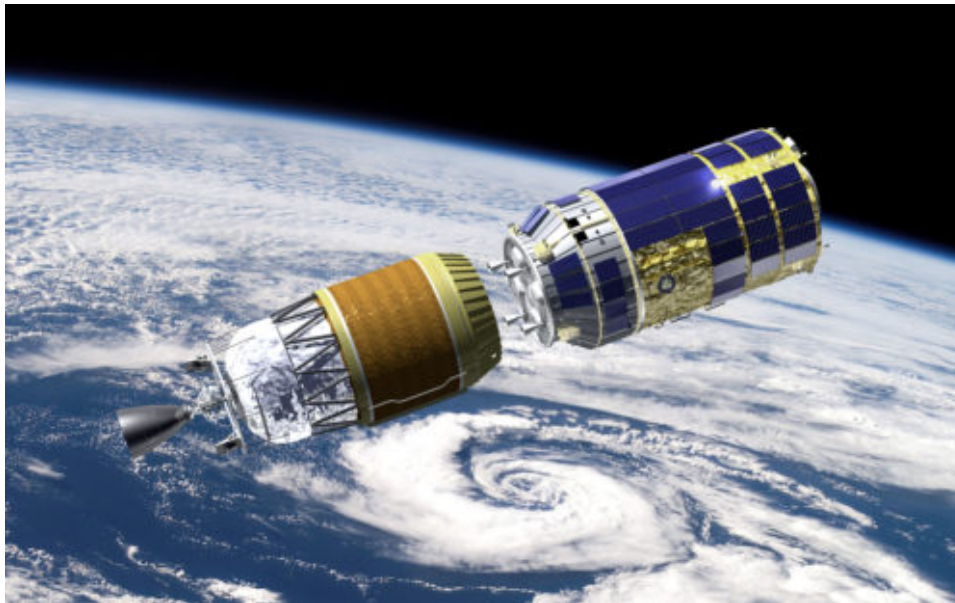


JAXA Launch

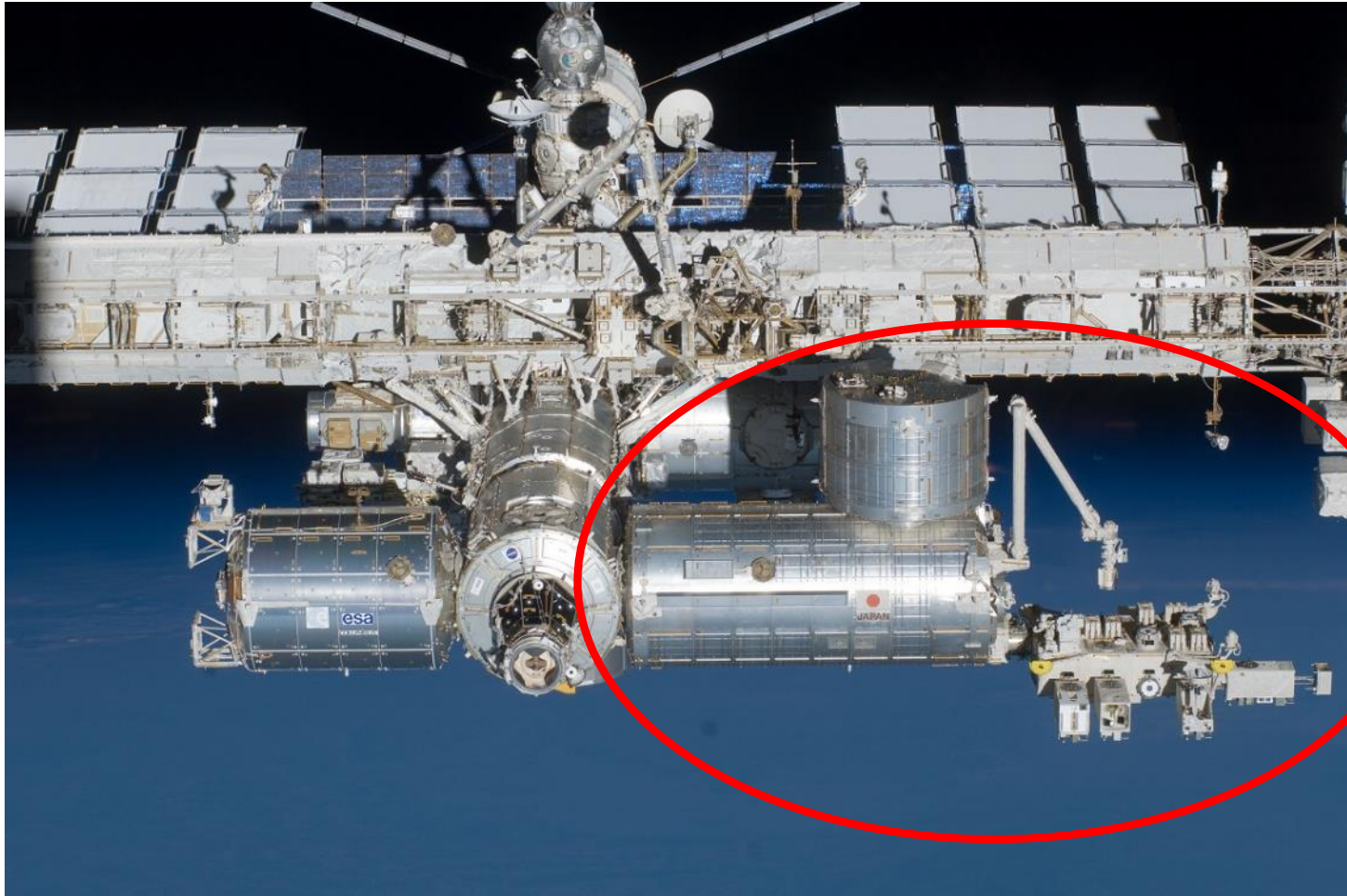
- Using the JAXA ISS resupply capsule and launch



JAXA ISS resupply capsule capture



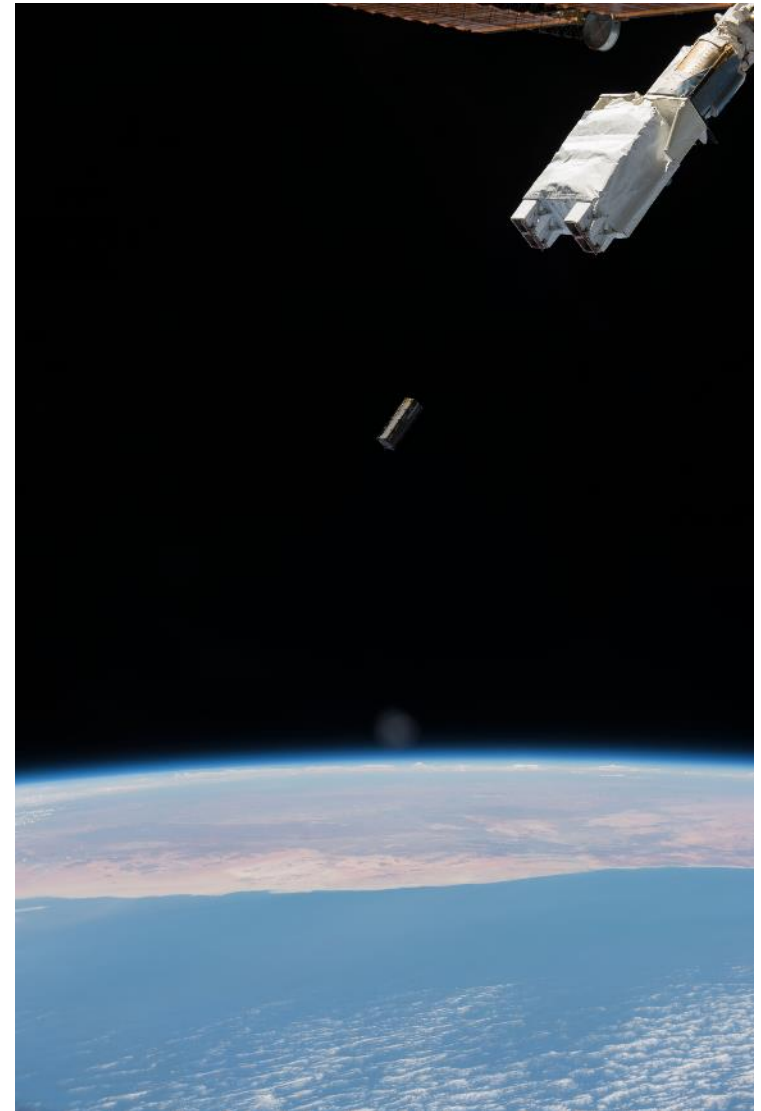
JAXA Kobe module



TU-POD Release from the JAXA Kobe module



Images from ISS



Conclusions

- First 3D printed complete satellite launched from ISS
- Qualified Windform complete satellite structure launched from JAXA platform
- Controlled release of TubeSats after three days
- The first mothership launched from ISS that released baby-satellites successfully
- All the mission requirements for TU-POD met

Thanks

Questions?

For Technical Questions Please Contact

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