FemtoSats in Zero-G ISS Experiment

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SSDS
SPACE SYSTEMS DESIGN STUDIO

Experiment Overview and Purpose

The FemtoSats in Zero-G investigation was an ISS experiment in which a handheld deployer ejected four purely mechanical FemtoSats within the ISS. Femto Satellites are centimeter-scale spacecraft that weigh less than 100 grams. The FemtoSats and deployer were made on the Additive Manufacturing Facility (AMF) onboard the ISS on August 28th, 2017, and March 29th, 2017, respectively.

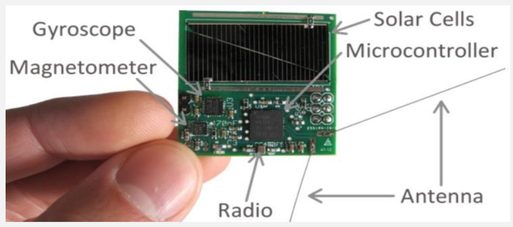

Figure 1: FemtoSat component overview

With strength in numbers, swarms of FemtoSats can collect data on spatially and temporally varying phenomena in various fields. Furthermore, large amounts of FemtoSats in a mission provide redundancy, increasing the rate of mission success. Generally, FemtoSats can be built using commercial off-the-shelf components, providing an affordable architecture for future missions.

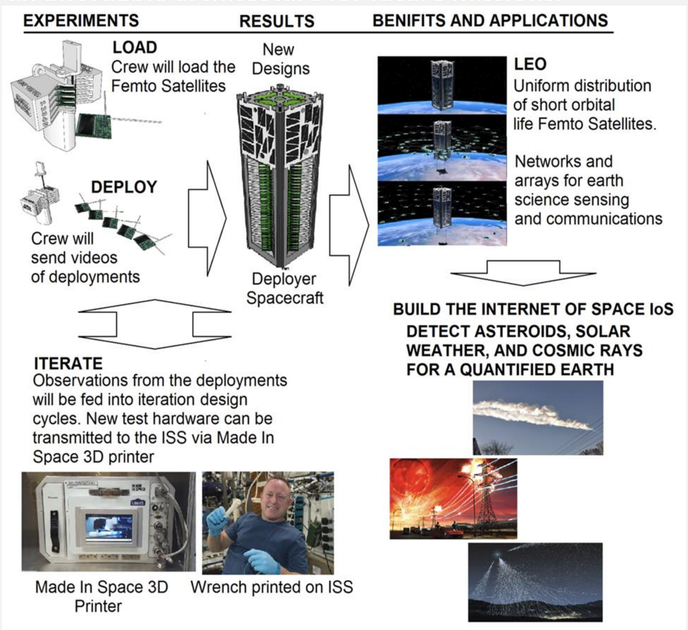

Figure 2: Roadmap for FemtoSat technology

FemtoSats have already proven to be detectable in orbit by the KickSat 2 mission and are present in the current SSDS missions of Alpha and DeSCENT

The Deployer and FemtoSats

Figure 3: Deployer being held by model astronaut gloves

The Deployer was designed with astronaut ease use at the forefront.

Four FemtoSats can be loaded into the deployer at a time. At the center back of the FemtoSat deployer there is a hole which must be aligned the with the hole on the FemtoSats one is loading.

After alignment, one can put the deployment pin into the holes and pull it when one wants to release the FemtoSats.

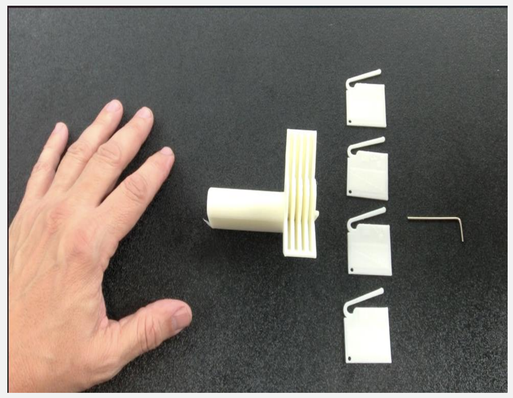

Figure 4: Deployer and FemtoSats sitting on a table

The FemtoSats themselves are 30mm by 30mm. The leg coming off the side of the FemtoSat is what contains the elastic energy used to launch them out of the deployer.

Experiment Methodology and Inquiries

The experiment lasted for about 30 minutes inside the Destiny Module of the ISS on January 25, 2018. Astronauts Norishige Kanai and Joe Acaba were the ones who carried out the experiment. The experiment contained the following inquiries:

1) Can the apparatus be printed in zero g
2) Is loading the deployer feasible in zero g
3) Can the deployer be aimed in zero g
4) Can the FemtoSats be easily recovered
5) Will the FemtoSats remain stable on deployment

Execution

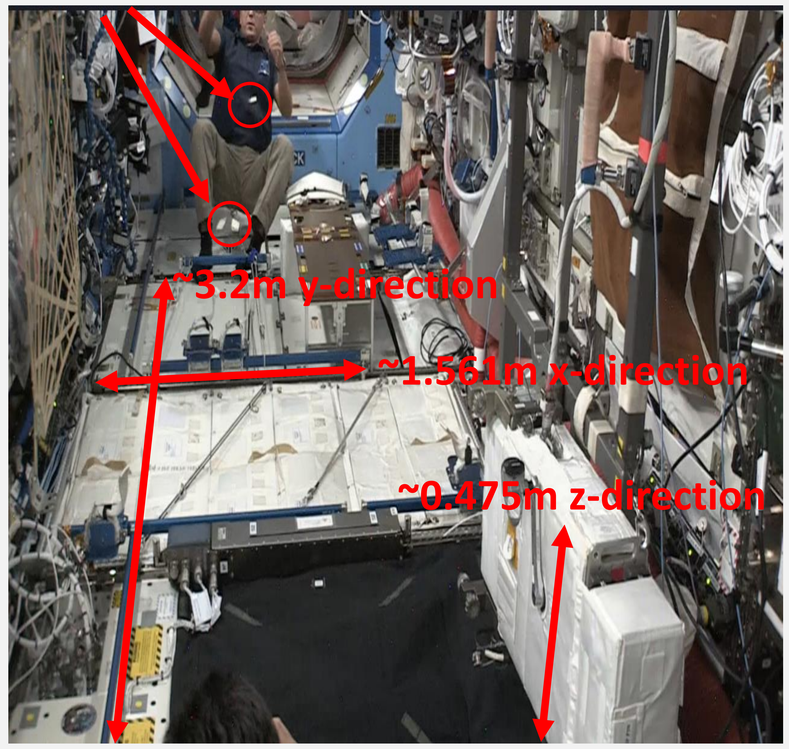

Figure 5: Astronaut collecting deployed FemtoSats in the ISS Destiny module

Experiment Video Analysis

Used the software Tracker created by Open Source Physics to plot kinematics from different astronaut deployments onboard the ISS.

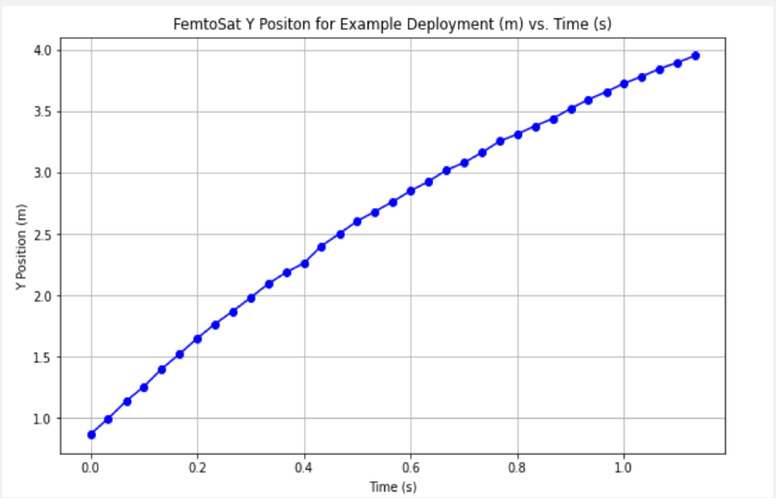

Figure 6: Example analysis of FemtoSat trajectory

Acknowledgements

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