TechEdSat 7 and 8-NASA Mission for Earth Observation

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Objectives

The TechEdSat Nano-satellite Series uses the CubeSat standards established by the California Polytechnic State University, San Luis Obispo. With typical blocks from 1unit (1U = 10x10x10 cm) increments, the TechEdSat-7 has a 3U volume with a 30 cm length. The project uniquely pairs advanced university students with NASA researchers in a rapid design-to-flight experience lasting 1-2 school semesters.

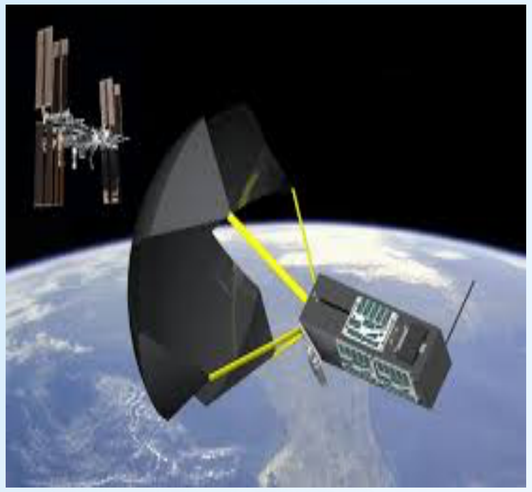
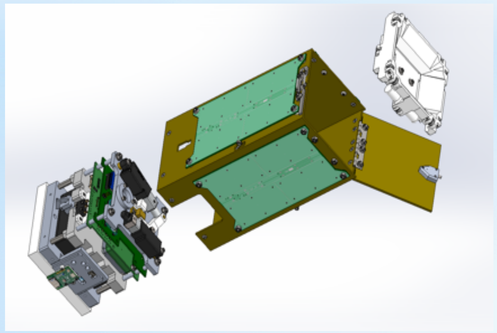


Figure 1. *TES-7 Drawing with deployed Exo-brake.*

The Series provides a platform for testing technologies for future NASA Earth and Planetary Missions, providing students with an early exposure to flight hardware development and management.

Components



TES7 satellite has two Lithium-Ion battery packs BP-955, which were certify at NASA Ames Center using the SHARP lab. Following the 36-weeks mission, the satellite will be commanded to fast re-entry into the atmosphere by utilizing the Exo-Brake.

Figure 2. TechEdSat 7 components.

Electrical Subsystem

TES7 satellite contains an electrical power subsystem (ESP), consists of: solar cells for energy conversion, lithium-ion batteries for energy storage, and EPS control electronics for power switching and telemetry gathering. TES7 has body mounted solar arrays, which cover all 4sides of the body frame. Battery packs control overcharge and over-discharge.

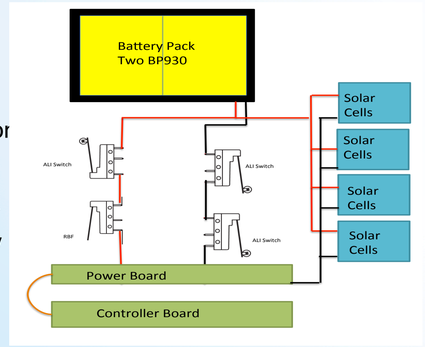


Figure 3. *Electrical Subsystem Overview.*

Structures

The new design reduced the number of failure points while allowing greater payload volume and uses same flight-tested actuators as TES-6. Additionally, the TES-7 door is places next to the NanoRacks Cubesat Deployer door to further ensure against any hang-fire concerns.

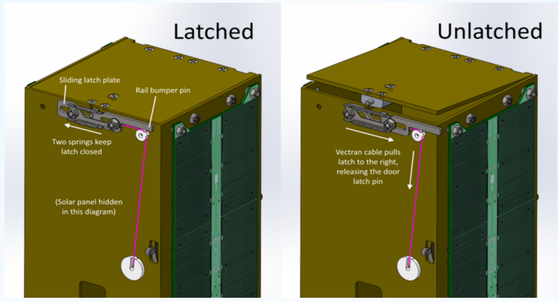


Figure 4. Simulated Picture of *Latched and Unlatched Mechanisms.*

Safety Hazard

The only potential hazard is the Li-ion batteries. Characteristics of BP955 batteries have been approved for ISS use. There are no modifications to the batteries and they are considered safe for travel. The EDSNTES satellites are powered off the entire time they are at the launch site. There is no physical access to the spacecraft while it is integrated in the dispenser at the launch site; therefore it is not possible to perform battery charging operations at the launch site.

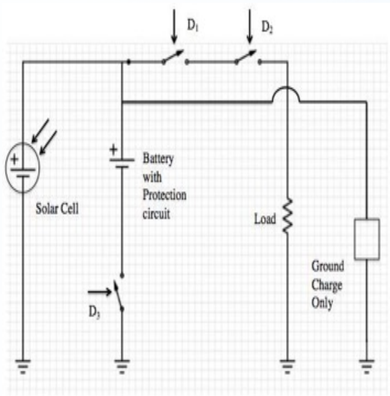


Figure 5. *NRCSD required battery protection and inhibit diagram.*

References

Project at NASA Ames Research Center, Moffett Field, California.
For more information about Ames, visit: http://www.nasa.gov/ames

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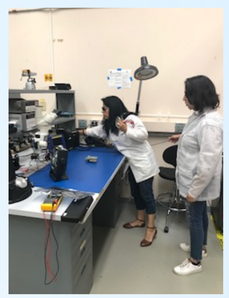
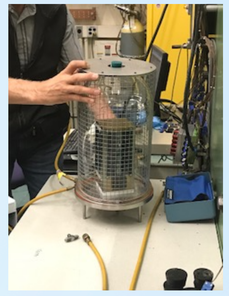
Discussion

TES-7 is a re-flight of the TES-5, 4, and 3 (3U in size), and a continuation the original 1U nanosat, TechEdSat-1 flew in 2012. With approximate mass is 2.849 kg, it has the same approach, integration, and safety regulations. TES-7 is currently scheduled to launch by Virgin Orbit on September 1, 2018. The flight experiment is intended to master the Nano-satellite communications systems, as well as control de-orbit device called “modulated Exo-Brake”. The approximate mass is 2.849 kg. After removal of the Remove before Flight (RBF) at the integration of the satellite, the TES-7 will be loaded into the deployer.





Future Work

The goal of the Technical Education Satellite (TechEdSat) is to employ a small spacecraft to evaluate, demonstrate, and validate new technologies for future missions to the surface of Mars and other planetary bodies in the solar system. TechEdSat-7 specifically will help improving low ballistic coefficient of about 1kg/m^2 for very rapid deorbit.

Acknowledgements

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