Technical Education Satellite 3P (TechEdSat-3P) Technical Description

The overall goal of the Technical Education Satellite 3P (TechEdSat-3P) is to employ a small spacecraft to evaluate, demonstrate, and validate two technologies for future experiments aboard small space satellites and other small payload systems. The first technology is the Exo-Brake, the goal of which is to deorbit small satellites. The second technology is use of the Iridium constellation for two-way communication with mission operations on Earth.

TechEdSat-3P will fly on the HTV-4 mission, soft stowed inside the JEM Small Satellite Orbital Deployer (J-SSOD) Satellite Install Case. The Satellite Install Case is stowed in a Common Transfer Bag (CTB) during launch. The satellite will then be transported onto the International Space Station (ISS) and integrated in the JEM Remote Manipulator System (JEMRMS).

The Japan Aerospace Exploration Agency (JAXA) will deploy the TechEdSat-3P from the JEMRMS using the J-SSOD on October 4, 2013. The J-SSOD uses a spring to "push" the TechEdSat-3P at a velocity of 5 cm/sec and at an angle of 45 degrees relative to the ISS. TechEdSat-3P will be inserted into orbit at an apogee of 437 km, perigee of 361 km, and an inclination of 51.6 degrees. There are no propellants on the satellite. The interface requirements between the J-SSOD and a satellite are developed based on the CubeSat Design Specification rev.12 published on August 1, 2009 by the California Polytechnic State University with JEM unique requirements.

Transmission will begin 40 minutes after launch from the ISS. The use of the Exo-Brake will deorbit the satellite in approximately 18 days after deployment from the ISS, thus concluding the mission.

The spacecraft contains the following systems:

Power: One Canon BP-930 battery (ISS-approved) and eight solar panels power the spacecraft. Four temperature sensors monitor the temperature of the battery, solar panels and circuit boards inside and on the spacecraft.

Control and Data Handling (C&DH): An ATMega2560 microcontroller board and a PIC32 microcontroller board are for the Iridium 9603 modules and the GPS. An AAC Microtec power board controls deployment of antenna and Exo-Brake. One temperature and pressure sensor collects upper atmosphere data and an IMU monitors the satellite's inertial state.

Communications: Two Iridium 9603 modems with two patch antennas, one StenSat amateur beacon with 12 cm antenna, and two OEM615 GPS with two patch antennas make up the communication system.

Antenna Deployment System: Passive release.

Attitude Control: Aerodynamic torque (no roll control)

Attitude Determination: IMU will provide local vector.

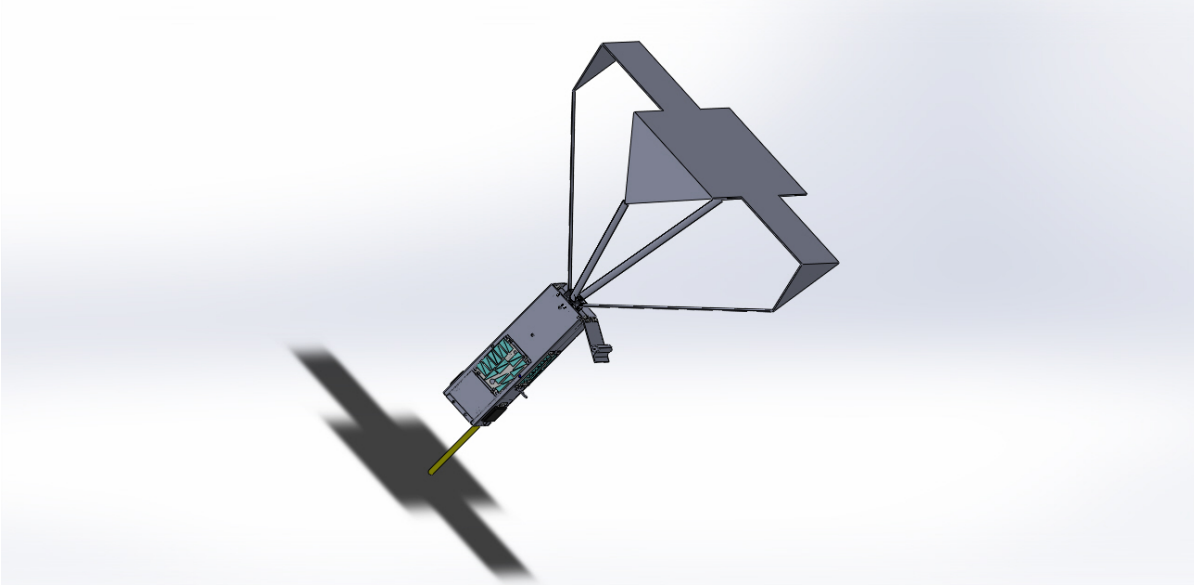

Figure 1: TechEdSat-3P Module Overview

Figure 2 below shows the deployment process of a CubeSat from the JEMRMS and unobstructed jettison cone. The Exo-Brake will also deploy forty minutes after deploying from the ISS. The launch vector and the Exo-Brake deployment will cause the spacecraft to lose altitude rapidly and deorbit in about 18 days after launch.

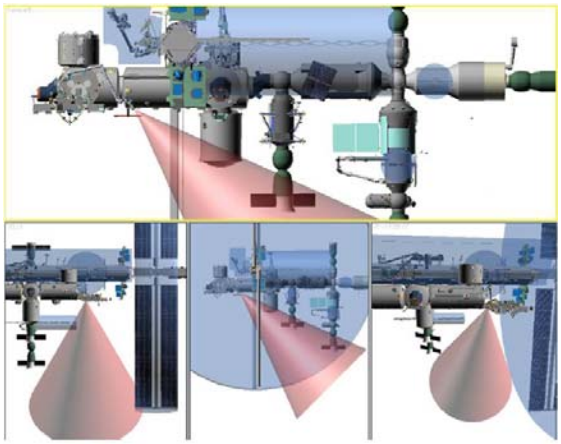

Figure 2: Deployment Vector and Clearance Cone
(ISS direction of travel right to left)