Technical Education Satellite 4 (TechEdSat-4) Technical Description

The overall goal of the Technical Education Satellite 4 (TechEdSat-4) 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-4 will fly on the ORB-2 mission, hard stowed inside the Nanoracks Cubesat Deployer (NRCSD). 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-4 from the JEMRMS using the NRCSD in fall 2013. The NRCSD uses a spring to "push" the TechEdSat-4 at a velocity of 5 cm/sec and at an angle of 45 degrees relative to the ISS. TechEdSat-4 will be inserted into orbit at an apogee of 413 km, perigee of 381 km, and an inclination of 51.6 degrees. There are no propellants on the satellite. The interface requirements between the NRCSD 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 20 days after deployment from the ISS, thus concluding the mission.

The spacecraft contains the following systems:

Power: Two Canon BP-930 battery (ISS-approved) and eight solar panels power the spacecraft. One 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 UofI microcontroller board and a PIC32 microcontroller board are for the Iridium 9602 modules and the GPS. An SJSU 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 9602 modems with two patch antennas and one OEM615 GPS with two patch antennas make up the communication system.

Attitude Control: Aerodynamic torque (no roll control)

Attitude Determination: IMU will provide local vector.

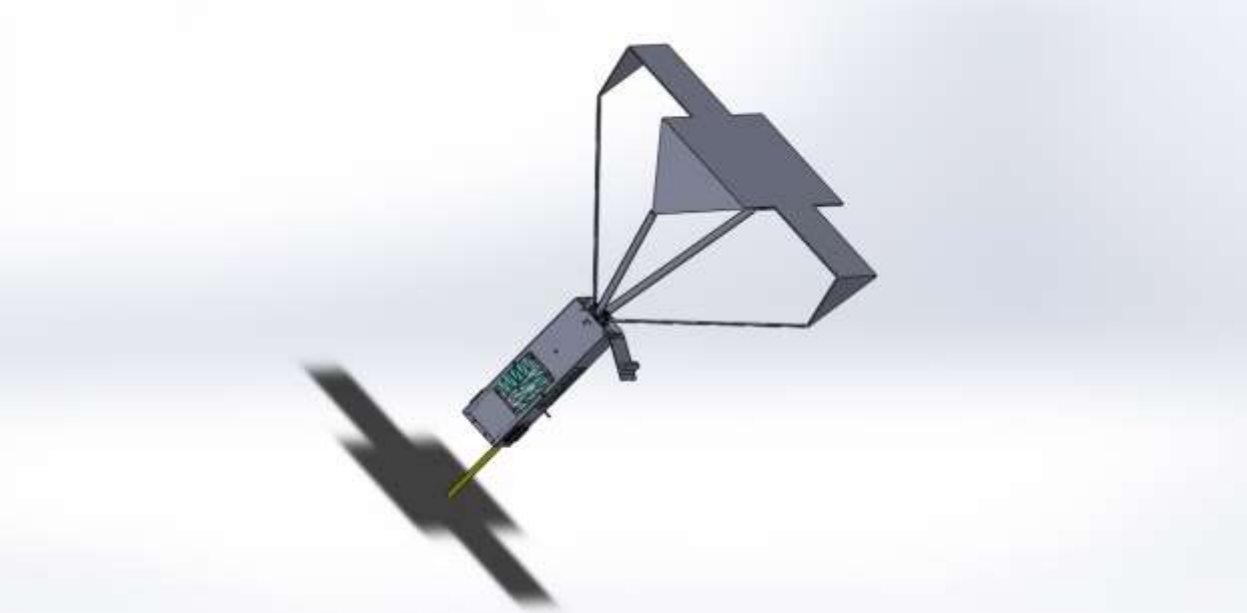

Figure 1: TechEdSat-4 Overview

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 20 days after launch.

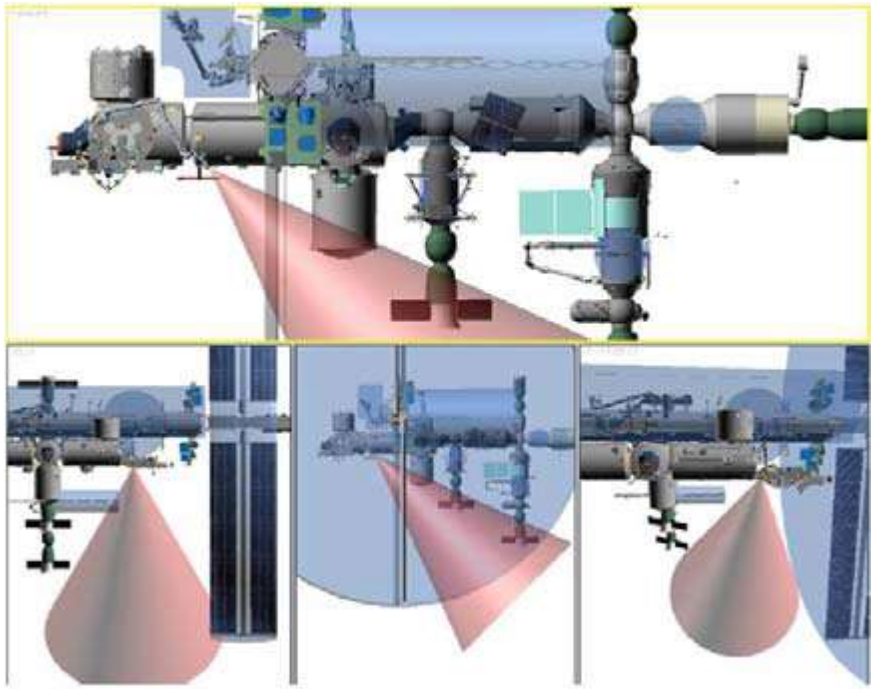

Figure 2: Deployment Vector and Clearance Cone
(ISS direction of travel right to left)