NASA's exo-brake 'parachute' to enable safe return for small spacecraft

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Engineers pack the Technical Education Satellite (TechEdSat-5) with the Exo-Brake payload. At almost 4 square feet in cross section (0.35 square meters), the Exo-Brake is made of Mylar and is controlled by a hybrid system of mechanic struts and flexible cord. Credit: NASA Ames/Dominic Hart

NASA's "Exo-Brake" will demonstrate a critical technology leading to the potential return of science payloads to Earth from the International Space Station through the deployment of small spacecraft in early 2017.

An Exo-Brake is a tension-based, flexible braking device resembling a cross-parachute that deploys from the rear of a satellite to increase the drag. It is a de-orbit device that replaces the more complicated rocket-based systems that would normally be employed during the de-orbit phase of re-entry.

"The Exo-Brake's current design uses a hybrid system of mechanical struts and flexible cord with a control system that 'warps' the Exo-Brake – much like how the Wright brothers used warping to control the flight behavior of their first wing design," said Marcus Murbach, principal investigator and inventor of the Exobrake device.

This warping, combined with real-time simulations of the orbital trajectory, allows engineers to guide the spacecraft to a desired entry point without the use of fuel, enabling accurate landing for future payload return missions.

Engineers at NASA's Ames Research Center in California's Silicon Valley, have been testing the Exo-Brake technology as a simple design that promises to help bring small payloads back through Earth's atmosphere unharmed. The technology demonstration mission is a part

of the Technology Education (TechEdSat-5) nanosatellite that was launched Dec. 9 on Japan's H-II Transfer Vehicle from Tanegashima Space Center in Japan. The Exo-Brake will reside on the space station until its deployment in early 2017.

Since 2012, the Exo-Brake has been tested on balloons and sub-orbital rockets through the Sub-Orbital Aerodynamic Re-entry Experiments, or SOAREX, flight series. Earlier versions of the Exo-Brake and other critical systems also have been tested on orbital experiments on TechEdSat nano-satellite missions.

Two additional technologies will be demonstrated on TechEdSat-5. These include the 'Cricket' Wireless Sensor Module (WSM), which provides a unique wireless network for multiple wireless sensors, providing real time data for TechEdSat-5.

TechEdSat-5's nanosatellite bus element will also utilize the PhoneSat-5 avionics board that uses, for the first time, the versatile Intel Edison microprocessor. The new board is designed to test TechEdSat-5's unique Wi-Fi capabilities, high fidelity cameras, and contains Iridium L-band transceiver for data.

In addition to the goal of returning samples from the space station, the project seeks to develop "building blocks" for larger scale systems that might enable future small or nanosatellite missions to reach the surface of Mars and other planetary bodies in the solar system.

More information: For more information on NASA's small satellite missions, visit www.nasa.gov/smallsats

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