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In its first on-orbit demonstration 300 miles above the Earth, Boeing's [NYSE: BA] Orbital Express system autonomously transferred propellant fuel and a battery from one spacecraft to another, marking industry firsts for the revolutionary system.

During the fuel transfer demonstration, the Boeing Autonomous Space Transport Robotic Operations (ASTRO) servicing spacecraft successfully transferred hydrazine propellant with Ball Aerospace's NextSat, a prototypical modular next-generation serviceable client spacecraft.

The ASTRO vehicle also used a robotic arm to transfer a battery to NextSat. It marked the first time that a spacecraft autonomously transferred hardware to another spacecraft using a robotic arm.

The landmark tests are the first in a series of planned demonstrations during a three-month mission to validate the system's functionality.

"The Orbital Express team is accomplishing things that have never been done before in space," said George Mueller, president of Boeing Advanced Systems. "These achievements are the first steps toward developing a system that will extend the life and operation of various types of spacecraft."

Orbital Express, launched to orbit on a United Launch Alliance Atlas V rocket on March 8, is a Defense Advanced Research Projects Agency-led effort consisting of the Boeing ASTRO servicing spacecraft and the NextSat serviceable client spacecraft.

"Boeing believes autonomous on-orbit servicing and rendezvous proximity operations can be a vital element to enable a more operationally responsive space," said Alex Lopez, vice president of Boeing Advanced Network and Space Systems.

Through pre-demonstration system checks, the team verified the spacecraft's ability to stay connected and hold a firm seal during transfer operations.

ASTRO's fluid transfer system supports typical client spacecraft configurations using either a pressure-fed (ullage recompression) or transfer pump system.

In the ullage recompression demonstration, ASTRO transferred approximately 31.97 lbm (pounds mass) of hydrazine to NextSat, satisfying the objective of 32 lbm. In the transfer pump demonstration, ASTRO transferred 2.2 lbm more than the 17 lbm target. The team then conducted a pump fluid transfer from NextSat back to ASTRO.

The team also performed an autonomous transfer of hardware between the two spacecraft. Using its robotic manipulator arm, ASTRO placed a battery on NextSat. The battery was successfully integrated into NextSat's power system following the transfer.

The demonstrations occurred at the lowest levels of spacecraft autonomy, which required several ground-based "approval to proceed" (ATP) confirmations. The team initiated ATPs to closely monitor and evaluate the operations. Future demonstrations will require fewer ATPs, allowing Orbital Express to conduct flight activities with increased autonomy. At the highest autonomy levels, no ATPs are required.

Orbital Express team members include NASA, Ball Aerospace, Northrop Grumman Space Technology,

MacDonald, Dettwiler and Associates Ltd., the Charles Stark Draper Laboratory Inc., and Starsys Research.

Orbital Express mission information and demonstration updates can be found at:

<http://www.boeing.com/orbitalexpress>.

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