

STORRM



The Sensor Test for Orion Relative Navigation Risk Mitigation (STORRM) is a next generation docking camera and navigation system that was demonstrated aboard the STS-134 mission to the International Space Station (ISS) in May 2011.



**Ball Aerospace
& Technologies Corp.**

..... Agility to innovate. Strength to deliver.

Overview

During the STS-134 mission, the Space Shuttle crew undocked from the ISS and then re- rendezvoused with the station on an Orion Multi-Purpose Crew Vehicle-like approach. The STORRM system met or exceeded the required accuracy and range capability necessary to meet crew safety, mass, volume and power requirements for a wide variety of future NASA missions.

Data collected during the mission will be used to update algorithms to improve the sensor performance in support of the Orion Multi-Purpose Crew Vehicle Flight Test Program, which aims to send humans into deep space and, eventually, Mars.

Ball Aerospace's Role

Ball designed and built the Vision Navigation Sensor (VNS) and the high definition docking camera to support the STORRM Development Test Objective (DTO) for the STS-134 mission.

These cross-cutting sensor technologies are applicable for future commercial or government uses, including orbital debris control, in-space servicing, autonomous rendezvous and docking, formation flying, landing and small body proximity operations.

The innovative VNS provides eye-safe flash lidar and high-rate 3-D imaging to target a vehicle from very long range to docking by calculating direct and bearing measurements up to six degrees of freedom. In comparison, the Space Shuttle's sensors can only calculate up to three degrees of freedom.

Quick Facts

- STORRM's sensors provided real-time 3-D images to the crew with a resolution up to 16 times higher than the Space Shuttle's sensors.
- This next generation system provided data from as far away as three miles (three times the range of the Shuttle docking system) and less than six feet.
- STORRM's sensors are up to five times lighter and use five times less power than the current system.

The docking camera demonstrates autonomous and astronaut-guided docking from the vehicle or ground station.

During the mission, STORRM's VNS performed better than expected by providing continuous measurements from as far away as 3.5 miles to within 6 feet of ISS—three times the range capability of the current relative navigation sensor. The next generation sensor technology also provided exceptional 3-D images of the target.

Under direction of the Orion Project Office, the STORRM DTO was a cooperative effort between teams from Ball, NASA Johnson Space Center, Lockheed Martin, and NASA Langley Research Center. Ball is under contract to Lockheed Martin.



STS-134 crew at Ball Aerospace in June 2010 for training on the STORRM system

