CONTACT DYNAMICS TESTING OF AUTOMATED THREE POINT DOCKING MECHANISM

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Statement of technical details of the capability being described

TRW has conducted an extensive Contact Dynamics Test Program (CDTP) of the Three Point Docking Mechanism (TPDM). The CDTP tested the ability of the TPDM latches to capture and automatically dock to target spacecraft. The target selected was the Hubble Space Telescope (HST). Mock ups of the TPDM with its three latches and the docking interface of the HST were constructed at the Marshal Space Flight Center (MSFC) in Huntsville, Alabama for use in the tests. The tests were performed at the Flat Floor and Six Degree of Freedom (6-DOF) facilities at MSFC.

History of the origins and evolution of the capability

The CDT took place in four stages. The first stage included tests of one and two TPDM latches on the Flat Floor Facility. These tests results were used to validate the tests which were to be performed on the 6-DOF simulator. Following the flat floor tests, single latch docking simulations were performed in the 6-DOF facility and compared to the Flat Floor results. After these tests, the 6-DOF facility was enhanced to improve its fidelity and the single latch tests were repeated. After verifying the single latch results, the full 3 latch tests were conducted.

The level of maturity of the capability

The 6-DOF test facility has been validated and is fully functional. The 3 latch tests examined numerous design parameters and docking conditions to evaluate the design of the TPDM and its latches, and to validate the ability of the TPDM to capture a target spacecraft.

Test experience and/or experimental results

The 3 latch tests validated the docking capability of the TPDM and several design decisions were made based on test results. Data recorded from these tests included numerical data of positions, velocities, accelerations, sensor states, and latch positions and video tapes of the actual test runs.

Source/sponsorship and current funding estimates

The contact dynamics tests were supported by the MSFC Orbital Maneuvering Vehicle contract. Currently TRW is performing IRAD to conduct automated docking using a three point docking mechanism.