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# CCSDS/ESA STANDARD TEST STATION FOR CHECKOUT OPERATIONS OF CHANDRAYAAN-1, W2M AND HYLAS MISSIONS

**Abstract**

Chandrayaan-1 Spacecraft, first Indian mission to moon carrying science instruments from ISRO as well as instruments from NASA and ESA uses CCSDS based Telecommand, Telemetry to ensure compatibility with internationally available Deep Space Network (DSN) stations. W2M and Hylas missions whose mainframe systems were realized by ISRO follow ESA standards for compatibility with international ground stations. This paper highlights the methodology used for design of a test station for verification of CCSDS capabilities of onboard systems of Chandrayaan-1, W2M and Hylas Spacecrafts. The test station was developed using modular approach where CCSDS capabilities are designed as new modules and integrated to automated checkout software system within the design framework of an in-house developed Checkout Command Language (CCL) used for various other ISRO missions. The test engineer can write and execute the procedures using the same well-known operator interface. Selection of configurable CCSDS options across various missions and choice of parameters for a particular mission made possible through enhanced capabilities of CCL instructions. Command operation procedure (COP) services, authentication and encryption features of W2M/Hylas were verified successfully using augmented capabilities of existing instructions in CCL and telemetry processing schemes. Large software patches for a German payload SIR-2 and calibration coefficients for the accelerometer onboard Chandrayaan-1 Spacecraft were successfully uploaded and verified through effective use of a new CCL instruction. Star Sensor and Lunar Laser Ranging Instrument space packets were successfully processed by using established processing schemes with new database definitions. The test station supported successful evaluation of onboard flight and design verification models during various phases of assembly, integration and testing activities of these missions. The test station is configured around Compaq Alpha UNIX platform running automated checkout software system supported by Windows-2000 based customized CORTEX equipment. The software is being ported to open Linux platform for checkout operations of ISRO/CNES SARAL mission, Chandrayaan-2 and other CCSDS compatible missions.