ASTRODYNAMICS SYMPOSIUM (C1)
Guidance, Navigation and Control (1) (3)

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GUIDANCE, NAVIGATION, AND CONTROL SYSTEM PERFORMANCE DURING THE LANDSAT DATA CONTINUITY MISSION LAUNCH AND COMMISSIONING

Abstract

The Landsat Data Continuity Mission (LDCM) was successfully launched and deployed from its Atlas V launch vehicle on February 11, 2013, carrying two instruments, the Operational Land Imager and Thermal Infrared Sensor. Once fully commissioned, LDCM will continue the Landsat project's continuous record of changes in Earth's surface as seen from space, originally begun in 1972. This record provides an important and unique resource for work in agriculture, geology, forestry, regional planning, education, mapping, and global change research.

The LDCM attitude control system (ACS), designed and built by Orbital Sciences Corporation in Gilbert, Arizona, makes use of coarse sun sensors, magnetometers, an inertial measurement unit, star trackers, and GPS receivers. For actuators, it uses reaction wheels, electromagnetic torque rods, and thrusters. Additionally, the ACS commands the solar array drive motors and reads back its position using potentiometers. The nominal commissioning plan for LDCM involves performing a series of tests, calibrations, and other activities over the first three months after launch. In parallel, during the first three weeks of the mission, the spacecraft team will use the propulsion system to maneuver LDCM into its final 705 km circular 98.2 deg inclination mission orbit.

This paper will discuss the chronology of the LDCM launch and commissioning. The separation and initial capture of the spacecraft will be shown, analyzing the performance of the ACS, as well as showing flight data used to estimate other key parameters such as the flexible modes and damping of the solar array. The initial performance checkout of all ACS control modes will be shown, from the initial sun acquisition mode, through LDCM's coarse pointing modes, and finally into its Earth nadir-pointing observing mode. A flight parameter error discovered upon the initial attempt to initialize the prime star tracker will be discussed, along with the corrective actions. The performance of the ACS during a series of solar, lunar, and off-nadir calibration maneuvers will be shown and analyzed. Ground calibrated

sensor parameters calculated using these calibration maneuvers will be compared with the onboard flight parameters. Additionally, the attitude and orbit performance of the spacecraft during the series of thruster maneuvers used to move LDCM into its mission orbit will be discussed. Finally, analysis of flight data will be used to discuss various other items of interest seen in the launch and commissioning period, such as the attitude and rate disturbances caused by thermal snap upon entering and exiting shadows.