

IAF SPACE OPERATIONS SYMPOSIUM (B6)
Mission Operations, Validation, Simulation and Training (3)

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OHRC IMAGING OPERATIONS FOR CHARACTERIZATION OF CHANDRAYAAN-2 LANDING
SITE

Abstract

The Chandrayaan-2 Orbiter and Lander named Vikram as an integrated module was launched from Sriharikota, the space port of India, on the 22nd of July 2019. The Lunar orbit insertion took place on 20th of August 2019 as composite module. After initial orbit raising maneuvers around the Earth, the Moon and also the calibration of the sensors and actuators, the integrated module reached 119 km*127 km lunar orbit on 1st Sep 2019. Orbit trimming maneuvers were performed in-order to achieve a perilune of around 95 km for Orbiter High Resolution Camera (OHRC) imaging operations over landing site at South Pole.

The Chandrayaan-2-Lander's mission objective was to land on the south pole of the moon, while Orbiter take scientific measurements of Moon from 100km with the help of several onboard instruments. The OHRC on-board Chandrayaan-2 Orbiter is a highest spatial resolution camera (ever flown in Moon's orbit) operating in visible panchromatic (PAN) band. OHRC's primary goal was to image the landing-site region prior to landing, for surface characterization and there by finding hazard-free zones. OHRC makes use of large focal length optics and small pixel size detector to achieve high spatial resolution. It employs time delay integration (TDI) technique to enhance signal collection and thereby achieve good signal to noise ratio (SNR) even under low illumination condition for very high spatial resolution having very less dwell time. There are four setting available i.e. 64, 128, 192 and 256 TDI stage to cater to range of signal dynamic range. Ground sampling distance (GSD) and swath of OHRC (in nadir view) are 0.25m and 3km respectively, from 100 km altitude. OHRC provides SNR of 70 @ 128 TDI at reference radiance of about 0.5 mW/(cm².sr.m) expected during the OHRC imaging over landing site. This instrument has the capability to provide stereoscopic views in consecutive orbits (by spacecraft maneuvering) for Digital Elevation Model (DEM) generation.

This paper brings out the various operations carried out on the OHRC, to acquire sufficient amount of imaging data for about 2 to 5 orbits prior to the landing operation. During OHRC operation various aspects were considered like suitable TDI stage, integrating time, Roll angle, Pitch angle for given orbit parameters and Sun elevation angle. As per mission objective, OHRC captured the landing site images,

using which DEM was generated by ground processing. Subsequently, hazard map was generated (using DEM) and uploaded to Lander in time to carry out landing operation by Vikram.