SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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CHANDRAYAAN-1 MISSION, CHALLENGES AND UNIQUE FEATURES

Abstract

With the advent of technology, the space exploration studying the characteristic behaviour of planetary system got an impetus and the exploration of our nearest neighbour moon had been the natural sequence in it. Since 1959, though more than 50 lunar exploratory missions have been carried out, many critical and fundamental questions about Moon's origin, its formation and interior structure, chemical/mineralogical composition are still open. India, as one among the very few space faring nations, has chalked out its own roadmap for exploring the moon and other bodies in the solar system. As a first step toward this, Chandrayaan-1 was the first instrumented Indian mission to Moon and also the first Indian Space Research Organization (ISRO) ventured to leave Earth's gravity. This mission was aimed at high-resolution remote sensing of lunar surface. In addition, Chandrayaan-1 released a Moon Impact Probe, which explored the moon from close quarters as it descended, till impact. Chandrayaan-1 spacecraft carrying 11 scientific instruments weighed about 1380kg at the time of Launch and shaped like a cuboid with a solar panel projecting from one of its sides. The state of art subsystems of the spacecraft, some of them miniaturised, facilitate the safe and efficient functioning of its array of scientific instruments. In this paper, we discuss the challenges during various phases of the mission starting from the mission planning; spacecraft bus systems design, configuration options finalization, autonomy requirements, tradeoffs, payload design, imaging, ground segments, other facilities and Project Management challenges. All these challenges were converted into opportunities and Chandrayaan-1 Mission was successfully realized. Power management and lunar thermal environment control were the two major challenges during on orbit operations. Field Experience of Chandrayaan-1, lessons learnt for the future missions are also explained including some special post launch operations like bi-static experiment with NASA's Lunar Reconnaissance Orbiter (LRO). Chandrayaan-1 provided excellent opportunity to orient ISRO's technological resources towards realizing a viable long-term programme of planetary exploration. Realization of this mission lead to several developments of satellite technology, design, development and fabrication of a variety of experiments/payloads, set up communication, navigation and control systems for going beyond the geostationary orbit, capture of a spacecraft in an orbit around another solar system object, maintenance, observation, acquisition and transfer of data from lunar orbit to Indian Deep Space Network (IDSN) and finally establishment of a Indian Space Science Data Centre (ISSDC)