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MARS ORBITER MISSION: DESIGN APPROACH TO AUTOMATE THE PLANNING AND SCHEDULING OF PAYLOADS OPERATIONS

Abstract

Mars has always captivated the scientific community of all the leading space exploring nations because of its expected life survivability climatic conditions. The Mars exploration started as early as 1960 with flyby missions. In 1971, Mariner 9 became the first artificial satellite to orbit around Mars. India launched, Mars Orbiter Mission (MOM), its maiden mission to Mars on November 5, 2013. On 24th September 2014, India became the fourth country after USSR, NASA and ESA to having orbited its spacecraft around Mars. The spacecraft carries five indigenously developed payloads. Of the five payloads on board MOM; MSM (Methane Sensor for Mars), MCC (Mars Colour Camera) TIS (Thermal Infrared Imaging Spectrometer) are developed by SAC (Space Application Centre), Ahmadabad; LAP(Layman Alpha Photometer) is developed by LEOS (Laboratory for Electro-Optics Systems),Bengaluru, and MENCA(Mars Exospheric Neutral Composition Analyser) is developed by SPL (Space Physics Laboratory), Thiruvanathapuram. Every payload on MOM has specific operational requirements in terms of attitude, altitude, duration of operation and periodic configuration updates. The payload operations also have to be carried out in conjunction with other spacecraft operations which require extensive planning, clash resolving among various operations and merging of feasible operations. A comprehensive software was designed and developed to schedule various operations like payload operations; Delta-Differential One Way Ranging (DDOR) operations; momentum dumping; SSR (Solid State Recorder) record and playback operations; SADA (Solar Array Drive Assembly) offsetting for proper power generation etc. after resolving the clash, and scheduling as per the defined priorities. The clash resolved operation plan is provided to CSG (Command Sequence Generator) to translate the inputs into the commands for up-linking to the spacecraft. The feedback, from the PIs (Principal Investigators) on the collected scientific data, was taken to maximize the science goals of the payloads. The paper briefly describes the planning aspects; design, development, testing and validation of software developed to operate the payloads in such a way so as to get maximum science return.