

Design and Mechanical Analysis of Deployment Mechanism for LPEX experiment onboard MOM-2 Mission

Janmejaya Kumar*, P.Kalyan Reddy, Sanjeev Mishra, Chandan Kumar, K. Durga Prasad, Nirbhay K. Upadhyay, S. A. Haider, Varun Sheel , Anil Bhardwaj

*Corresponding Author: janmejaya@prl.res.in

Langmuire probe (LP) and electric field (EF) experiment (LPEX) is an instrument being developed to be flown on board Indian Mars Orbiter Mission-2 (MOM-2). LPEX aims to measure the electron density and electric field along the spacecraft path in Mars orbit. The experiment necessitates the LP and EF sensors to be placed away from the spacecraft body which demands the development of a boom and deployment mechanism. In this paper, I will present preliminary model of LPEX boom and deployment mechanism, its design aspects and simulation results.

LPEX Boom Deployment mechanism is integrated by Hinge, boom, latching system, HDRM and microswitch. In this mechanism 1 m or 1.5 m carbon fiber boom with 50mm spherical (two hemi sphere) LP sensor and two identical EF sensors will be deployed once the spacecraft reaches the Mars orbit. No power source is used for deployment. In this mechanism two torsional springs (in parallel) have been used. Deployment is accomplished by releasing the stored energy by the springs. Initially, during launch, the boom will be in stowed condition with the help of Frangibolt Actuator and will be deployed into at desired point of time in the orbit of Mars. Only a small power is required for frangibolt operation and microswitch function. Structural, thermal and Modal analysis is done for the designed mechanism. Here, the most critical and important part of the design is choice of the torsional spring because any small change in leg length, pitch and angle between legs of torsional spring will have worst effect on deployment mechanism. Both torsional springs are planned to be made up of Beryllium copper alloy. Base/Deck and fork will be made of aluminium alloy. A lock mechanism is used which will lock the deployed configuration. Also a micro switch is used at the base/deck to ensure the successful deployment. Various design aspects and preliminary results from mechanical analysis of LPEX design will be presented.