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Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards. (5)

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LESSONS LEARNT DURING DEVELOPMENT OF INDIAN METEOROLOGICAL ELECTRO-OPTICAL PAYLOADS

Abstract

India has been developing and deploying meteorological EO (Electro-Optical) instruments for GEO (Geosynchronous) platform since early nineties of last century. So far, there have been 7 missions in orbit comprising of 11 meteorological payloads working in wavelength bands spanning from Visible wavelengths to Long-Wave Infra-Red (LWIR) wavelength. As can be expected of any complex space system, the design team faced many technical problems both during the development of these instruments as well as during the in-orbit operations. While many of these problems were simple in nature, there were a few instances of anomalous behavior where the root cause of an anomaly was a complex interplay of factors contributed by diverse disciplines like electronics, thermal engineering, material science and structural engineering. Understanding these anomalies, involved detailed interdisciplinary analysis and simulation. These efforts turned out to be excellent learning opportunities for future missions. This paper brings out these efforts put in while solving anomalies and lessons learnt from them.

Anomalies observed In-orbit: First two meteorological payloads initially showed stripes in IR image and then severe degradation in image quality. Another mission showed scan mechanism showing erratic behavior depending upon position of scan mirror. Causes of anomalies were well understood and corrective actions were taken, which made next missions outlive their designated mission life of 15 years.

Anomalies observed and resolved during realization: One initial mission showed few anomalies during Payload development which was interaction of in-situ calibration stimuli and video signal, excessive

background for LWIR camera, excessive noise in IR image data during thermal-vacuum test etc. There were a couple of instances where Opto-mechanical interfaces were improved to acquire more deterministic and compliant joints to prevent bi-metallic deformation under the influence of thermal load. Various techniques were analyzed and used to mitigate deformations of large scan mirror and powered telescope mirrors. Paper attempts to bring out lessons learnt while solving performance anomalies.