MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Vehicles – Mechanical/Thermal/Fluidic Systems (7)

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THERMAL OPTICAL ANALYSIS OF LAPAN'S IR CAMERA

Abstract

Based on our research, it is very obvious that the thermal analysis for a camera Infra Red system working on space environment is very complex due to a lot of trade-off process from the beginning. As performance of IR camera over a range of allowance temperatures is necessitated, the analysis process must be taken often. Changes of the design of LAPAN's IR camera in the beginning of 2017, either physically or technology, encouraged us to re-perform its thermal analysis. Two things that we learned from our previous research is that thermal optimization of an IR camera is an important part of opto-mechanical design, and a wide range of temperature changes in space environment will provide challenges heavier instead of in the ground, e.g., defocus problem, loose lens part, and fracture. For these reason, one of major matters of our concern as designing our IR camera is to make sure that it will capable of operating in cruel environments with extreme temperatures. Involving in two commercial soft ware, Zemax and Thermal desktop (TD) / Sinda Fluint (SF), this paper focuses on thermal optical analysis of LAPAN's IR camera. First of all, Zemax was used in passive athermalizing analysis of the optical system of LAPAN's IR camera, whereupon it was to overcome thermal defocus problem on lens mount due to temperature fluctuations in Earth orbit and to determine the proper choice of material used for lens and housing in order to avoid defocus matter as well. Iteration process was applied throughout the design procedure since we realized that the athermalization technique is a crucial factor and one of the difficulties portion in designing of an IR camera over wide temperature ranges. Furthermore, spot diagram of Zemax was also utilized to measure the tube length of the lens. Meanwhile, TD / SF was exerted to perform the common thermal analysis series, i.e., steady state, transient, and orbital heating rate using Monte Carlo approach. Our new IR camera design that brings two micro bolometer detectors with optics share in the same aparture provides more challenge actually. The utilization of black coating covering housing and tube will not only reduce stray light effect, but also is our passive thermal design strategy. All graphs resulted and measurements evidence that LAPAN's IR camera will work in the allowable temperature range in space environment, -40 degrees to 80 degrees Celsius.