

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

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THE THERMAL ANALYSIS OF LAPAN'S IR MICRO BOLOMETER OPTICAL DESIGN

Abstract

Generally, there are several steps in designing and evaluating of a space optical system. One of them that have to consider carefully and needs pay attention a bit deeper is thermal analysis of optical design. Temperature changing in orbit can make lens to be either defocused or saturated. For that reason, the unity of thermal – optical system, without forgetting the structure modeling, is important thing in design process. After two years analysis and define Lapan's IR Micro bolometer requirements, the design of its optical has been starting since the beginning of this year. As a beginner in designing optical system, we have realized that thermal system would provide the big challenge in design process. Some requirements either came up from IR Micro bolometer itself or Lapan's micro satellite, i.e., uncooled system, light, lightweight, and low cost, have also made Lapan's micro bolometer optical design become more complicated as well. This paper describes the thermal analysis of Lapan's IR Micro bolometer optical design. Software either Thermal Desktop / Sinda Fluint or Finite Elements was used to analyze several conditions, such as orbital heating rate, heat fluxes, heat loads, and etc. Specifically for orbital heating rate, Monte Carlo approach was applied throughout the review process. From the graphs resulted, e.g., total absorbed flux of transient analysis, MLI (Multi Layer Insulation) is chosen to cover the IR Micro bolometer Aluminum box. Meanwhile, in order to address the defocused issue, an athermal optics will be applied for the IR Micro bolometer lens material since it is line with the design requirements which tend to the thermal passive system. In this case, we have two options. First, lens materials and diffractive lens will be integrated in one optic system. Meanwhile the other one, the passive heaters probably will be placed on behind the IR Micro bolometer mirror in order to keep and maintain room temperature.