NGST Systems Engineering Report

Thermal Subsystem 06

Title:	
Effect on OTA Temperature of Adding Redundant Sun Facing Layer/Loss of Sun Facing Layer	
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References:	

Description

A parametric thermal analysis was conducted to examine the overall effect of incorporating a redundant sun side layer into the NASA NGST Yardstick baseline six layer shield. This second layer would be optically treated to perform as the sun side layer in case the sun side layer failed to deploy or was severely damaged during the mission. The incorporation of such a second layer would somewhat degrade thermal performance due to the redundant layer's increased emittance but would probably preserve the mission in the event of a catastrophic loss of the primary sun side layer. Without a redundant layer, the loss of the sun side layer would expose the very high α/ε ratio VDA second layer. Temperatures of this layer could rise to well over 265 C and would seriously jeopardize the mission. More probably then a complete loss would be the development of a large tear in the primary layer directly exposing the second layer's VDA coating

The redundant sun side layer was modeled by taking the baseline six layer yardstick TSS model changing the optical properties on shade layer two to match the EOL properties on the sun side layer. After the temperature results were computed, the model was then modified by removing shade layer one leaving the other five layers with the redundant second layer facing the sun.

Results Summary

Table 1 lists the results of the parametric thermal study. Two parametric cases were analyzed and are compared to the EOL baseline results. The first case examined the primary mirror's average temperature if the second layer was optically treated on one side like the sun facing layer. The second case examined the primary mirror's temperature if the primary sun side layer was lost but the redundant second layer remained. This basically reduces the shield to a five layer system. Results indicate that although there is degraded performance due to the incorporation of the redundant layer, it is effective in preserving shield thermal performance if the first layer is lost. A redundant second layer should only be considered after the failure mechanisms for the first layer are fully understood. The addition of a redundant layer combined with other degradation mechanism could raise the primary mirror's temperature to unacceptable levels.

Table 1 Impact of using redundant sun–side layer on primary mirror temperature

Primary mirror temperatures (K)	Baseline 6 layer	6 layer with redundant sun–side layer	5 layer (loss of primary sun side layer)
Minimum	31	32	33
Mean	***42***	***44***	***46***
Maximum	53	55	58