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C3Or4C-04: Cryogenic Thermal Margins: Key to IR Sensor Success

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Thermal margins are critical to the development, the production, the test, and ultimately the performance of thermal subsystems. And, the subset of thermal subsystems that are cryogenic are even more reliant on thermal margins for success. Thermal uncertainty margins cover the inherent uncertainty, due to both design and analysis limitations, of predicting performance in space. They are not equivalent to sensitivity analyses that focus on the impact on performance of individual design and analysis parameters and assumptions. Thermal margins cover all the areas of uncertainty in the design. These include areas that are inherently nearly impossible to eliminate uncertainty such as: thermal interstitial joints (workmanship influenced), orbit environments (transient), surface properties (vary with individual surfaces), thermophysical properties (vary with individual material lots), MLI (empirical ranges), etc. These areas often have empirically derived ranges. At British/Ball Aerospace, cryogenic margin is based on the MIL-STD philosophy and this section will cover that in more detail. It is critical to not only establish, but track margins throughout a program, from pre-proposal to on-orbit. Examples will be provided that show the tracking of margin on several actual Ball programs.

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