DEM Thermal Model Technical Notes
XMM-OM/PENN/TC/0029.draft

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In December, 1992, a preliminary thermal analysis for the DEM was produced by Ron L. Akau, Sandia National Laboratories, Dept. 1513. A copy of this report is attached. It is intended that a more extensive mathematical thermal model be produced at a later time.

Numerous assumptions were made for this preliminary analysis, due to lack of information on the Spacecraft Platform, surrounding structures and space environment. Further clarification and information will be necessary in order to complete a more detailed thermal model of the DEM. A more detailed analysis will include nodal breakdown of the DEM at the individual module level as well as a finer nodal mesh at the exterior surfaces of the DEM. Modules will be grouped according to power cycles and interface temperatures at the module/front cover junction can be determined. Typically an exterior nodal breakdown will include nodes at the contact surfaces to the S/C platform, as well as one for each exterior side of the box.

It appears from this preliminary report that the DEM is within the range of desired minimum survival and maximum operational temperatures specified in the EID-B, 18 Feb. 1994. This analysis assumed no MLI in the cold case (power off) and unobstructed thermal radiation to space from the exterior surfaces of the box. In the hot case, the assumptions were full power (13.1 W), MLI on the five exposed surfaces and radiation and conduction downward to the platform. These are assumed to be "worst case " conditions and values could only improve as more information about the S/C and its environment becomes known. Whether MLI is finally used, will be dependant upon where the DEM is placed and its surrounding environment.

It is SNL's intent to produce a reduced thermal model for integration into the overall S/C model at a time TBD. This model can be mathematical or simply a written description of the basic geometry and thermal characteristics assumed for the calculations. Recently a reduced thermal model of a DEM type box was produced by Ron Akau for incorporation into the JUNO spacecraft model at ALENIA (Italy). Input from ALENIA was critical so that all parties used the same thermal criteria. Due to format problems between US thermal analyzers and European, it was not possible to do the integration by computer, though the "paper" model appears to be satisfactory.

Once a S/C contractor is chosen for XMM it is intended that the same type of cooperative effort be extended for the DEM. It is understood that the ESA spacecraft contractors will produce any MLI (if required) for the DEM.