the incoherent subtraction process as a coherent propagation. Thus, for systems utilizing both positive and negative polarity feeds, this approximation allows both surface and alignment errors to be assessed without the use of additional hardware or laser metrology. Knowledge of the antenna surface profile allows errors to be corrected at a given surface temperature and observing angle. In addition to imperfections of the antenna surface figure, the misalignment of multiple antennas operating in unison can reduce or degrade the signal-to-noise ratio of the received or broadcast signals. This technique also has application to the alignment of antenna array configurations.

This work was done by Bruce Dean of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15977-1

Helium-Cooled Black Shroud for Subscale Cryogenic Testing

A sheet metal and honeycomb design allows a space-like thermal environment to be maintained around a test item.

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This shroud provides a deep-space simulating environment for testing scaled-down models of passively cooling systems for spaceflight optics and instruments. It is used inside a liquid-nitrogen-cooled vacuum chamber, and it is cooled by liquid helium to 5 K. It has an inside geometry of approximately 1.6 m diameter by 0.45 m tall. The inside surfaces of its top and sidewalls have a thermal absorptivity greater than 0.96. The bottom wall has a large central opening that is easily customized to allow a specific test item to extend through it. This enables testing of scale models of realistic passive cooling configurations that feature a very large temperature drop between the deep-space-facing cooled side and the Sun/Earth-facing warm side.

This shroud has an innovative thermal closeout of the bottom wall, so that a test sample can have a hot (room temperature) side outside of the shroud, and a cold side inside the shroud. The combination of this closeout and the very black walls keeps radiated heat from the sample's warm end from entering the shroud, reflecting off the walls and heating the sample's cold end.

The shroud includes 12 vertical rectangular sheet-copper side panels that are oriented in a circular pattern. Using tabs bent off from their edges, these side panels are bolted to each other and to a steel support ring on which they rest. The removable shroud top is a large copper sheet that rests on, and is bolted to, the support ring when the shroud is closed. The support ring stands on four fiberglass tube legs, which isolate it thermally from the vacuum chamber bottom. The insides of the cooper top and side panels are completely covered with 25-mm-thick aluminum honeycomb panels. This honeycomb is painted black before it is epoxied to the copper surfaces. A spiral-shaped copper tube, clamped at many different locations to the outside of the top copper plate, serves as part of the liquid helium cooling loop.

Another copper tube, plumbed in a series to the top plate's tube, is clamped to the sidewall tabs where they are bolted to the support ring. Flowing liquid helium through these tubes cools the entire shroud to 5 K. The entire shroud is wrapped loosely in a layer of double-aluminized Kapton. The support ring's inner diameter is the largest possible hole through which the test item can extend into the shroud.

Twelve custom-sized trapezoidal copper sheets extend inward from the support ring to within a few millimeters of the test item. Attached to the inner edge of each of these sheets is a custom-shaped strip of Kapton, which is aluminum-coated on the warm-facing (outer) side, and has thin Dacron netting attached to its cold-facing side. This Kapton rests against the test item, but the Dacron keeps it from making significant thermal contact. The result is a non-contact, radiatively reflective thermal closeout with essentially no gap through which radiation can pass. In this way, the part of the test item outside the shroud can be heated to relatively high temperatures without any radiative heat leaking to the inside.

This work was done by James Tuttle, Michael Jackson, Michael DiPirro, and John Francis for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15968-1