Testing involved a small, metal Dewar tank composed of an inner and outer shell. The annular region was filled with perlite. Displacement sensors were connected at two locations on the outside of the outer shell. With the perlite not compacted, the inner tank was thermally cycled and the difference in the two displacements was measured as the inner tank warmed and pressed on the perlite.

The perlite was then compacted by hand in two areas while the inner tank was cold in order to mechanically couple the inner and outer shells. When the inner tank was allowed to warm and expand, it deformed the outer tank into an elliptical shape, and the displacement sensors detected different motions for the fluffy and compacted perlite. In any location where the perlite was still fluffy and not compacted, there was no deformation. In areas where the perlite was packed more solidly, the sensors detected a slight deflection. By running these checks between cycles, it becomes a simple matter to identify areas of perlite compaction, and replace it before it can cause damage to the outer shell.

This work was done by Robert Youngquist of Kennedy Space Center. Further information is contained in a TSP (see page 1). KSC-13214

Using Thin-Film Thermometers as Heaters in Thermal Control Applications

NASA's Jet Propulsion Laboratory, Pasadena, California

A cryogenic sensor maintains calibration at ≈4.2 K to better than 2 mK (<0.5 percent resistance repeatability) after being heated to ≈40 K with ≈0.5 W power. The sensor withstands 4 W power dissipation when immersed in liquid nitrogen with verified resistance reproducibility of, at worst, 1 percent. The sensor maintains calibration to 0.1 percent after being heated with 1-W power at ≈77 K for a period of 48 hours.

When operated with a readout scheme that is capable of mitigating the self-heating calibration errors, this and similar sensors can be used for precision (mK stability) temperature control without the need of separate heaters and associated wiring/cabling.

This work was done by Hyung J. Cho, Konstantin Penanen, Kalyani G. Sukhatme, and Warren A. Holmes of Caltech, and Scott Courts of Lake Shore Cryotronics for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-46882

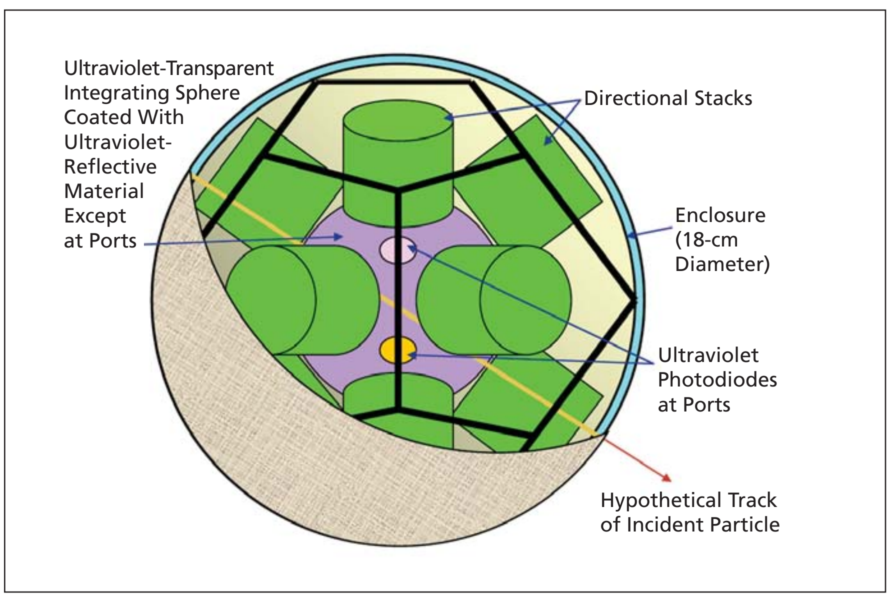
Directional Spherical Cherenkov Detector

Incident particles could be sorted by direction, speed, and electric charge.

John H. Glenn Research Center, Cleveland, Ohio

A proposed radiation-detecting apparatus would provide information on the kinetic energies, directions, and electric charges of highly energetic incident subatomic particles. The apparatus was originally intended for use in measuring properties of cosmic rays in outer space, but could also be adapted to terrestrial uses — for example, radiation dosimetry aboard high-altitude aircraft and in proton radiation therapy for treatment of tumors.

The apparatus (see figure) would include a spherical Cherenkov detector surrounded by stacks of pairs of detectors. Each such pair and stack would be used in identifying incident particles and would respond to particles incident within a solid-angle range that, in conjunction with the number of such stacks, would define the angular resolution of the apparatus. The number of stacks and the number of pairs of detectors in each stack may be unlimited.



A **Spherical Cherenkov Detector** would be combined with directional/triggering detector stacks.

The detectors in each stack would typically have areas >1 cm^2 and could be made, variously, from compensated silicon or from such wide-bandgap semiconductors as semi-insulating silicon carbide. Sheets of tungsten, lead, nickel, iron, and/or alloys thereof, serving as energy-moderating materials, could be inserted between detectors to enable discrimination of particles by energy. A scintillation counter could be used as a