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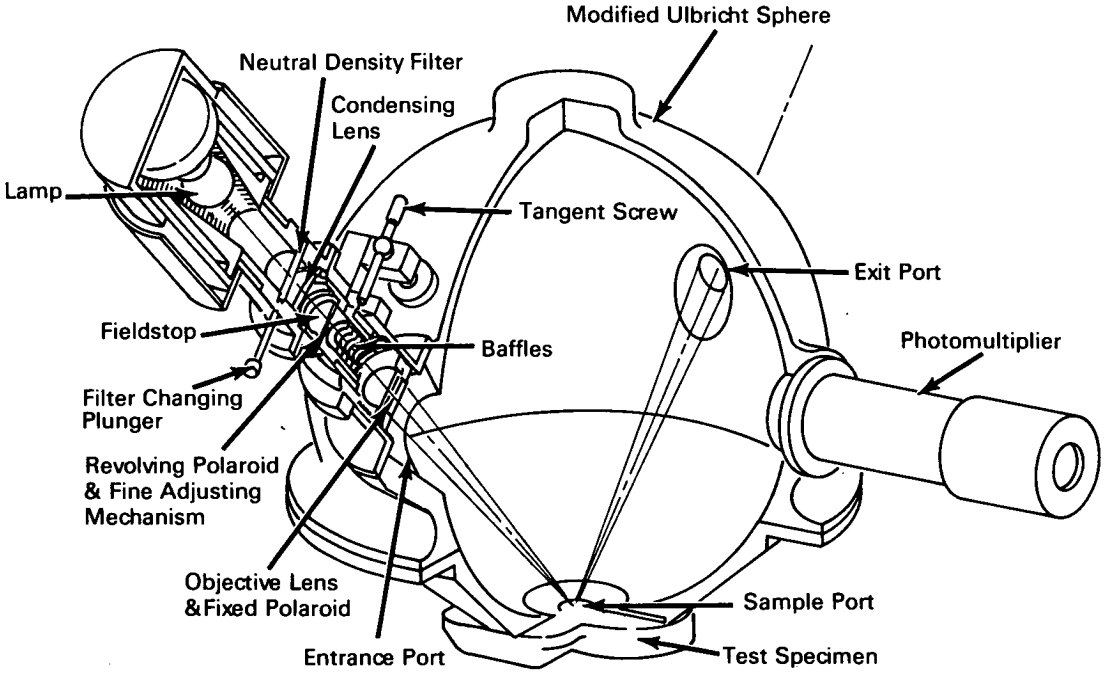
# NASA TECH BRIEF



## Special Purpose Reflectometer Uses Modified Ulbricht Sphere




**The problem:**

Navigation in space involves the seeking and identifying of spectral bodies in the presence of the ubiquitous solar radiation. This imposes rigid requirements on the surfaces of mirrors or prisms used in detectors such as star trackers and earth horizon sensors. Imperfections in optical surfaces that are normally acceptable become intolerable sources of stray solar radiation in such applications. An instrument is required that will accurately measure the degree by which an optical surface departs from the ideally flat.

**The solution:**

A modified Ulbricht sphere that accurately measures all stray radiation caused by irregularities in the reflective surface of an optical test specimen. The test specimen is so positioned between a light source and exit port that, in the case of an ideal surface, the interior wall of the sphere would remain dark. In the case of an actual test specimen all diffusely scattered radiation is collected and averaged by the reflectively treated inner wall of the sphere where it is measured by a photomultiplier tube attached to a port in the sphere wall.

**How it's done:**

The inside wall of the sphere is covered with photometer sphere paint of high reflectance (0.95 claimed by manufacturer) approximately in accordance with Lambert's law. An entrance port mounts a light source

(continued overleaf)

and related optics to direct a completely discrete ray on the surface of a test specimen mounted at a sample port in its path, where it is reflected to an exit port where it is trapped by a black lined cornucopia (not shown) mounted on the sphere so that no portion can reenter the port. The entrance and exit ports are diametrically opposite and at 45° angles to the sample port normal. Imperfections in the test specimen surface cause diffusion of the source beam to the wall of the sphere. Measurement of the amount of light reflected from the sphere wall is made by the photomultiplier and compared to the amount reflected by it from a magnesium carbonate surface of known reflectance, placed at the sample port.

**Notes:**

1. This device could find use in the fields of photometry and optical engineering in that it provides a means of measuring the reflectance of surfaces in situ.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas 77058
   Reference: B67-10109

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Mark Gorstein
of Massachusetts Institute of Technology
under contract to
Manned Spacecraft Center
(MSC-1135)