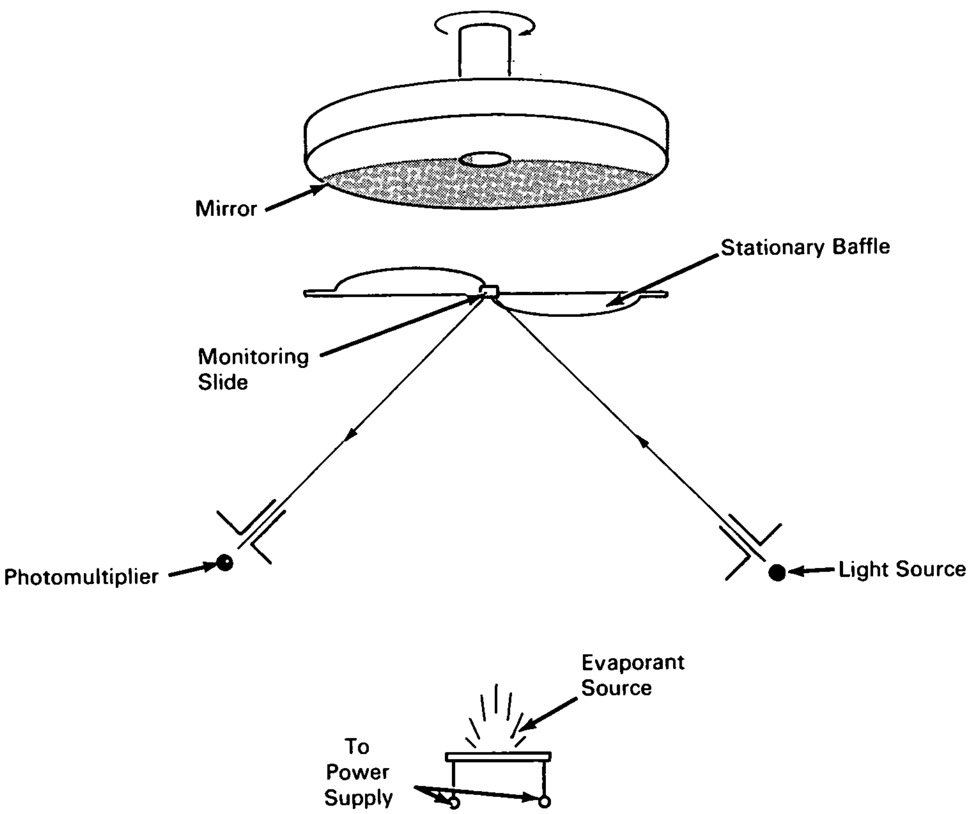
NASA TECH BRIEF

Uniform Reflective Films Deposited on Large Surfaces



The problem:

To devise a method for vacuum depositing films of uniform thickness on large substrates, using a single, small area evaporation source. In particular, there was a need to deposit a uniform overcoating of magnesium fluoride on a 39-inch-diameter aluminized paraboloidal substrate in order to obtain high reflectance in the far ultraviolet.

The solution:

Use a specially designed baffle to intercept varying amounts of the vapor stream from the evaporant source to deposit a film of uniform thickness over the surface of the substrate.

How it's done:

The baffle configuration, shown in the illustration, is designed in accordance with standard equations

(continued overleaf)

reported in the literature for baffles used in systems for altering the curvature of spherical surfaces with films of varying thickness and for simultaneously depositing films on many substrates. Although the substrate to be coated was paraboloidal, its radius of curvature at the vertex was sufficiently large (154.4 inches), so that for the purpose of designing the baffle, its surface could be considered flat, which simplified calculations considerably.

The vapor deposition is carried out in a vacuum chamber, with the baffle supported at a calculated position between the evaporant source and the surface of the substrate to be coated. To prevent bare areas, the substrate is rotated at speeds as high as 90 rpm during the deposition process. The thickness of deposit was monitored by measuring the change in reflectance of a 2-inch by 2-inch glass slide mounted on the underside of the baffle. A monochromatic light source with a wavelength of 2537 angstroms was used, and the reflected radiation was picked up by a photomultiplier microphotometer. When the reflectance reached a value previously determined to correspond to the optimum film thickness, the evaporation was stopped. Since the substrate had a hole in its center, the distortion of the baffle contour due to the presence of the monitoring slide did not affect the areas to be coated.

Notes:

1. Tests, using a fixture containing a number of 2-inch by 2-inch glass slides arranged to simulate the size and curvature of the paraboloidal substrate, indicate that a mirror coated by this method will have a reflectance as high as 82 percent at 1216 angstroms with a variation of only ±2 percent over the entire surface.

2. Further information concerning this innovation is given in NASA TN D-3357, "Uniform Vacuum Ultraviolet Reflecting Coatings on Large Surfaces" by H. Herzig, March 1966, available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Inquiries may also be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10483

Patent status:

No patent action is contemplated by NASA.

Source: (GSFC-507)