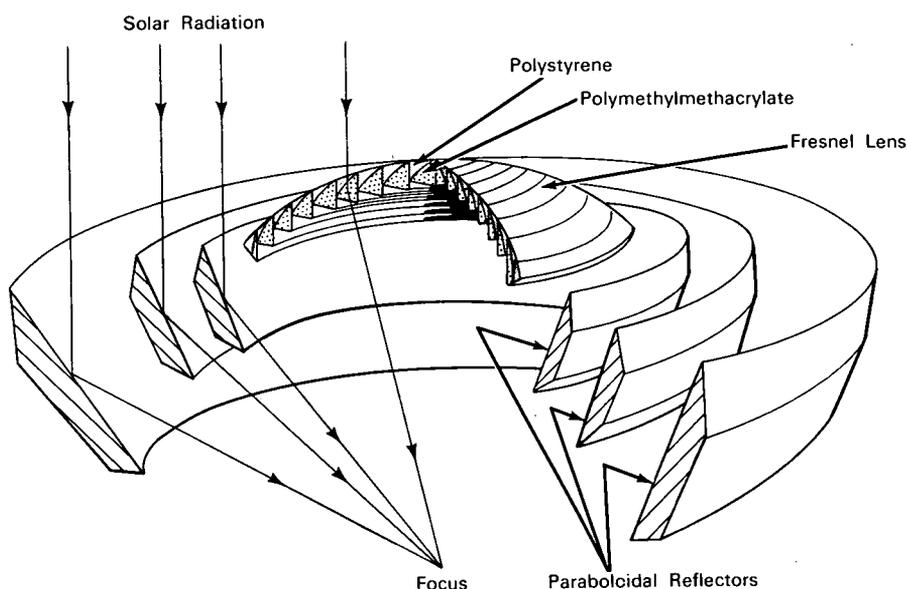


NASA TECH BRIEF



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Wide-Aperture Solar Energy Collector Is Light in Weight



The problem: To design a wide-aperture solar energy collector lens that would be relatively light in weight, free of spherical and chromatic aberration, and usable in front of an image plane occupied by large opaque components. In order to produce the maximum concentration of energy, a lens of given collecting area must have the largest possible numerical aperture, or NA (i.e., the sine of the half angle of focal point coverage). Ordinary spherical lenses cannot be made to have an NA greater than 0.5 (half angle of 30°) without serious aberrations. Conventional methods of reducing aberrations, which include the use of aspherical lenses and two materials of differing dispersive index, result in bulky lenses.

The solution: A hybrid paraboloidal reflector and Fresnel lens made of lightweight plastics.

How it's done: The Fresnel lens, designed by ray-tracing techniques, consists of polystyrene and polymethylmethacrylate in eight steps, as shown in the cross-sectional view. The lens is mounted above three paraboloidal reflector rings of cast epoxy resin with aluminized surfaces. The collector has an overall diameter of approximately 8 inches, a focal length of approximately 3.5 inches, a total numerical aperture of 0.93, and weighs only 1.2 pounds. Its loss of energy concentration due to chromatic error is essentially negligible. Undercorrection is only significant for a few narrow zones in the blue end of the spectrum, where not over 20% of the energy occurs.

Notes:

1. The collector should have application in providing a concentrated source of intense heat for experimental and industrial purposes.

(continued overleaf)

2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California, 91103
Reference: B65-10046

Patent status: NASA encourages use of this innovation. No patent action is contemplated.

Source: Beckman Instruments
under contract to Jet Propulsion Laboratory
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