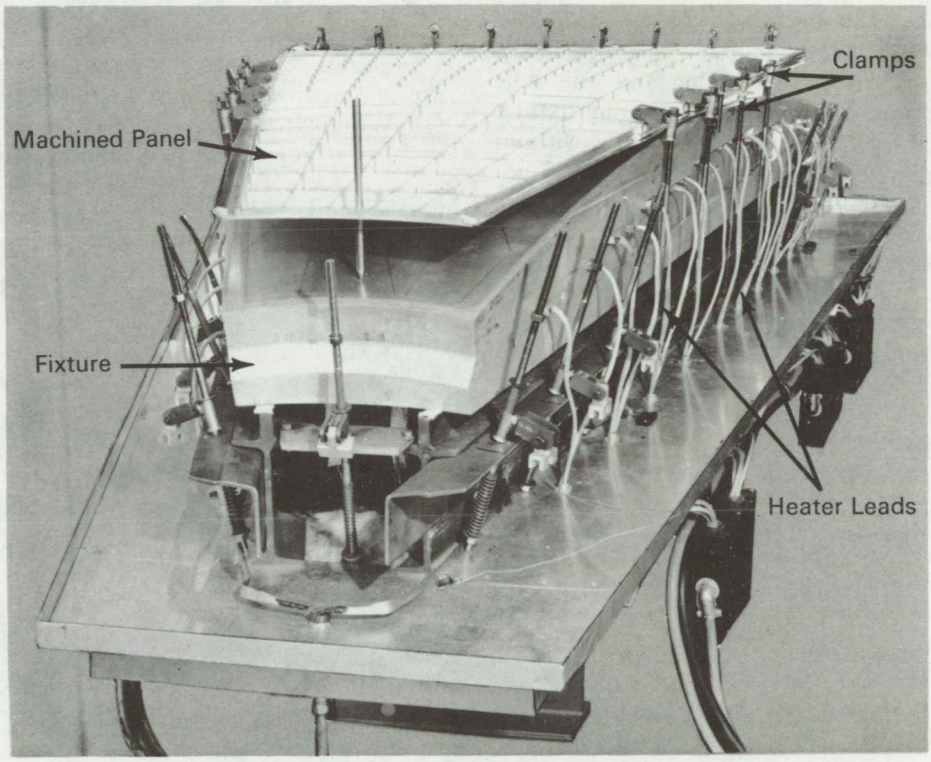
NASA TECH BRIEF

Process Sequence Produces Strong, Lightweight Reflectors of Excellent Quality



The problem:

To fabricate large compound curved surfaces for collecting and concentrating radiation. Existing methods are not satisfactory for producing rigid, lightweight sectors or panels to the dimensional and surface accuracy desired. Such accuracy with stability requires a smooth continuous surface supported by an integral network of stiffener ribs machined on the opposite side. Machining of such a network in the curved shape is extremely difficult and expensive.

The solution:

The use of several common machining and forming processes in a sequence that makes it possible to accurately fabricate lightweight sectors for assembly into large reflectors.

How it's done:

Flat plate sectors are first polished to the final surface finish on one side and the polished surface covered with protective tape. Stiffener ribs are then

(continued overleaf)

machined into the unpolished side by tape controlled milling.

The polished and machined sectors are then formed on an aluminum forming fixture that has an accurately machined and polished convex surface. The flat sector is placed on the fixture and loaded by spring loaded clamps located around the edges of the sector. The fixture, containing approximately 80 kw of resistance heaters, is heated to approximately 400°F and the clamping is increased until the sector edges are drawn close to the fixture surface. The sector-edge-to-fixture-surface joint is then sealed with high temperature silicon adhesive tape and a vacuum is drawn between the polished sector surface and the polished fixture surface. The fixture and sector are then heated to approximately 550°F and held for about one hour as atmospheric pressure forces the sector to conform to the fixture surface. The assembly is slowly cooled to approximately 200°F, the vacuum is released, and the sector removed. The edge machining and bolt hole drilling are performed on a vacuum machining fixture, which is identical to the forming fixture but without heaters. Accurate hole drilling is accomplished by positioning two adjacent sectors on the machining fixture and drilling body-fit bolt holes.

The sectors are individually cleaned, epoxy coated, and aluminized for high reflectivity prior to final assembly. An important advantage of this concept is that all polishing of the reflective surface is performed prior to the cross section machining and forming.

Notes:

1. With this concept of fabrication, integrally stiffened reflective sectors up to 25 square feet in area have been produced. Mirrors 20 feet in diameter, made of 12 such sectors, have been fabricated.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B67-10010

Patent status:

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

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