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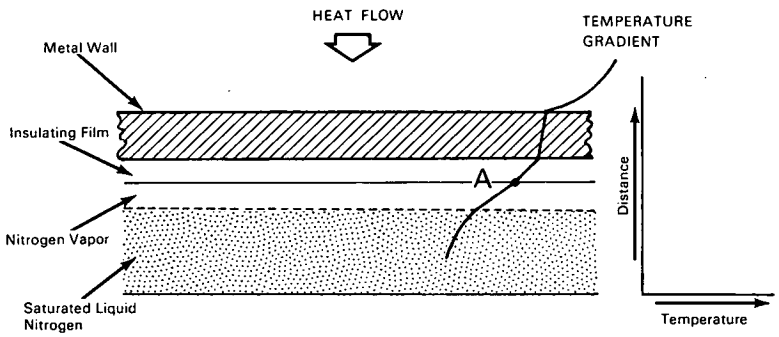
Brief 65-10240

# NASA TECH BRIEF



## Insulation Accelerates Rate of Cooling with Cryogenic Fluid




**The problem:** To increase the rate of heat transfer from the interior of a chamber to a liquid nitrogen-filled metal jacket (cryopanel). The increased rate of heat transfer will shorten the time required to lower the chamber temperature.

**The solution:** A thin film of thermal insulating material (e.g., polytetrafluoroethylene) is bonded to the surface of the metal wall facing the liquid nitrogen.

**How it's done:** As shown in the schematic illustration, heat from the chamber flows in series through the metal wall, the insulating film, a nitrogen-vapor film and the liquid nitrogen layer. Each of these layers presents a different thermal resistance to the flow of heat from the chamber into the liquid nitrogen; therefore the interface at each layer will be at a different temperature. The effect of the insulating film is to lower the temperature at point A, so that the thickness of the vapor film is less than it would be in the absence of an insulating film. The vapor film therefore has a lower thermal resistance, thus permitting an increased rate of heat transfer through the system. The combined thermal resistance of the added insulating film and the vapor film is much smaller than the thermal resistance of the vapor that would exist in the absence of the insulating film. As the insulating film approaches cryogenic temperature, its thermal conductivity changes; the thickness of this film must be an optimum for maximum heat transfer.

**Notes:**

1. In tests with a copper panel, cool-down from +50°F to −320°F was more than twice as fast with a thin film of polytetrafluoroethylene bonded to the copper surface facing the liquid-vapor nitrogen.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   P.O. Box 1537
   Houston, Texas, 77001
   Reference: B65-10240

**Patent status:** NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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