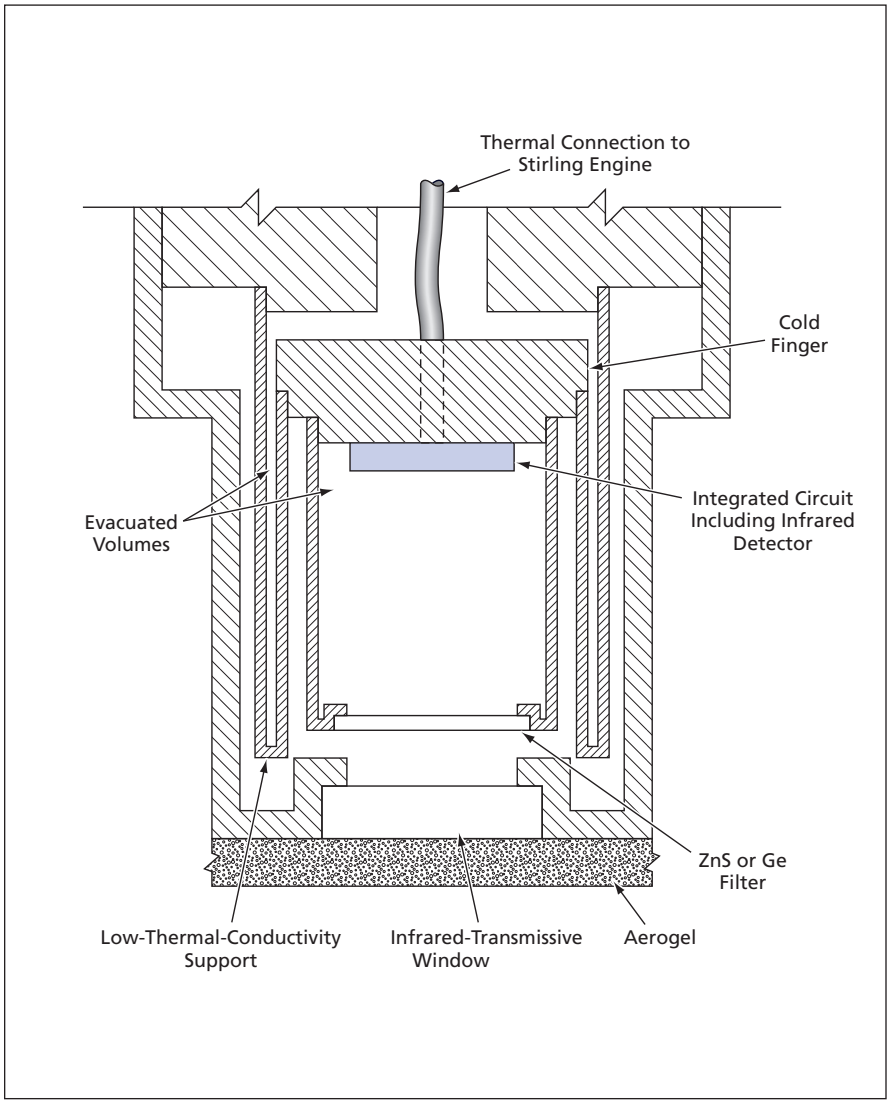
Infrared Imaging System for Studying Brain Function

This would be an alternative to large, expensive, immobile fMRI systems.

NASA's Jet Propulsion Laboratory, Pasadena, California

A proposed special-purpose infrared imaging system would be a compact, portable, less-expensive alternative to functional magnetic resonance imaging (fMRI) systems heretofore used to study brain function. Whereas a typical fMRI system fills a large room, and must be magnetically isolated, this system would fit into a bicycle helmet.

The system would include an assembly that would be mounted inside the padding in a modified bicycle helmet or other suitable headgear. The assembly would include newly designed infrared photodetectors and data-acquisition circuits on integrated-circuit chips on low-thermal-conductivity supports in evacuated housings (see figure) arranged in multiple rows and columns that would define image coordinates. Each housing would be spring-loaded against the wearer's head. The chips would be cooled by a small Stirling Engine mounted contiguous to, but thermally isolated from, the portions of the assembly in thermal contact with the wearer's head. Flexible wires or cables for transmitting data from the aforementioned chips would be routed to an integrated, multichannel transmitter and thence through the top of the assembly to a patch antenna on the outside of the helmet.



Each Sensor would contain an infrared-detector integrated-circuit chip mounted on a cold finger on a low-thermal-conductivity support in a vacuum.

The multiple streams of data from the infrared-detector chips would be sent to a remote site, where they would be processed, by software, into a three-dimensional display of evoked potentials that would represent firing neuronal bundles and thereby indicate locations of neuronal activity associated with mental or physical activity. The 3D images will be analogous to current fMRI images. The data would also be made available, in real-time, for comparison with data in local or internationally accessible relational databases that already exist in universities and research centers.

Hence, this system could be used in research on, and for the diagnosis of response from the wearer's brain to physiological, psychological, and environmental changes in real time. The images would also be stored in a relational database for comparison with corresponding responses previously observed in other subjects.

This work was done by Frederick Mintz, Philip Moynihan, and Sarath Gunapala of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Innovative Technology Assets Management
JPL
Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-2240
E-mail: iaoffice@jpl.nasa.gov

Refer to NPO-43932, volume and number of this NASA Tech Briefs *issue, and the page number.*