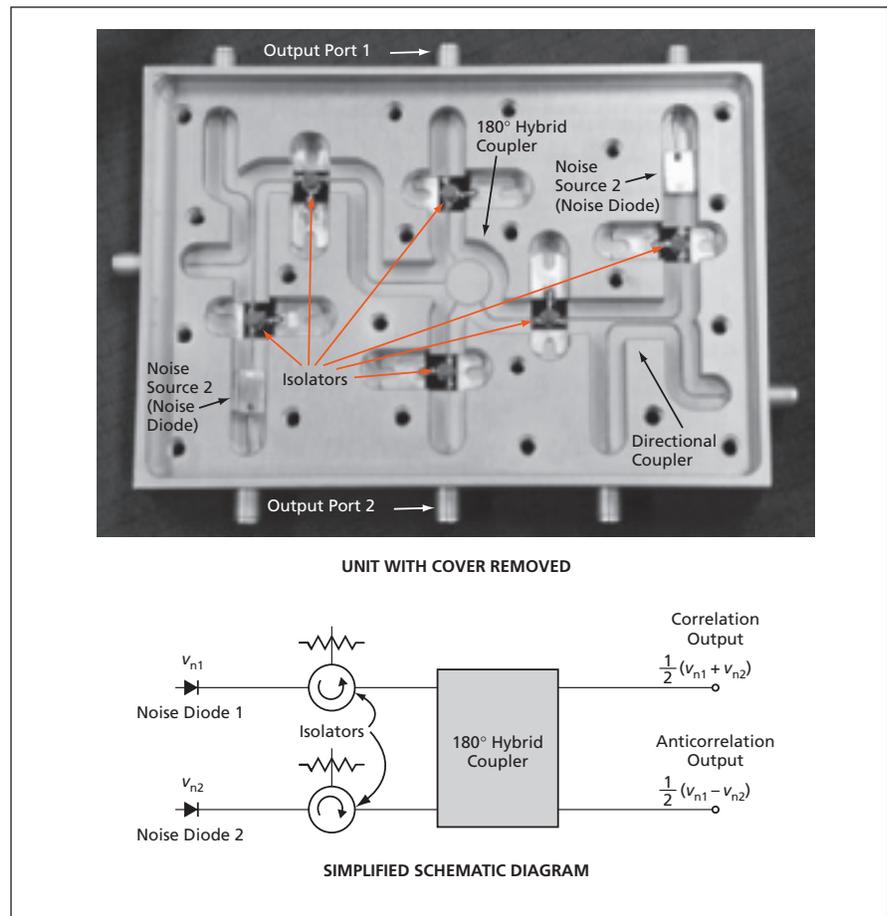


processed to estimate and correct for the decorrelation effect.

Typical prior correlated-noise sources suitable for this purpose consist of multiple units connected by coaxial cables; as such, they tend to be too bulky and heavy to be incorporated into flight instrumentation assemblies. In contrast, the present correlated-noise source is a single unit (see figure) that is relatively compact and can easily be integrated into a flight instrumentation assembly. The unit includes directional couplers for sampling noise-diode outputs and injection of test signals. This source provides both correlated (sum) and anticorrelated (difference) signal components at the output ports. The source can be operated in four modes: (1) both noise diodes on, (2) both noise diodes off, (3) noise diode 1 on with noise diode 2 off, and (4) noise diode 2 on with noise diode 1 off. Measurements of the resulting combinations of correlated and anticorrelated signal components provide the data needed for calibration.

This work was done by Jeffrey R. Piepmeier and Edward J. Kim of Goddard Space Flight Center. Further information is contained in a TSP (see page 1).

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Goddard Space Flight Center, (301) 286-7351. Refer to GSC-14745-1.



This **Correlated-Noise Source** includes noise diodes and microstrip components in a single, integral housing. Adherence to geometric tolerances of circuit layout, with special attention to considerations of symmetry, is essential for proper operation.

Hybrid Deployable Foam Antennas and Reflectors

Compressed foam structures would be expanded to full size and shape.

NASA's Jet Propulsion Laboratory, Pasadena, California

Hybrid deployable radio antennas and reflectors of a proposed type would feature rigid narrower apertures plus wider adjoining apertures comprising reflective surfaces supported by open-cell polymeric foam structures (see figure). The open-cell foam structure of such an antenna would be compressed for compact stowage during transport. To initiate deployment of the antenna, the foam structure would simply be released from its stowage mechanical restraint. The elasticity of the foam would drive the expansion of the foam structure to its full size and shape.

There are several alternatives for fabricating a reflective surface supported by a polymeric foam structure. One approach would be to coat the foam with a metal. Another approach would be to attach a metal film or a metal-coated polymeric

membrane to the foam. Yet another approach would be to attach a metal mesh to the foam.

The hybrid antenna design and deployment concept as proposed offers significant advantages over other concepts for deployable antennas:

- In the unlikely event of failure to deploy, the rigid narrow portion of the antenna would still function, providing a minimum level of assured performance. In contrast, most other concepts for deploying a large antenna from compact stowage are of an "all or nothing" nature: the antenna is not useful at all until and unless it is fully deployed.
- Stowage and deployment would not depend on complex mechanisms or actuators, nor would it involve the use of in-

flatable structures. Therefore, relative to antennas deployed by use of mechanisms, actuators, or inflation systems, this antenna could be lighter, cheaper, amenable to stowage in a smaller volume, and more reliable.

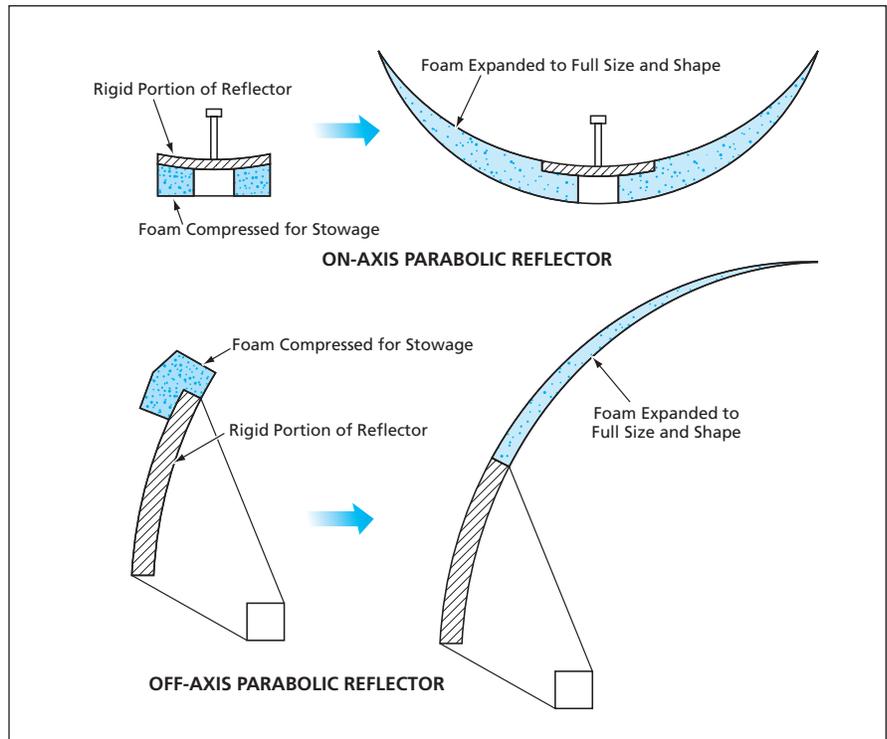
An open-cell polymeric (e.g., polyurethane) foam offers several advantages for use as a compressible/expandable structural material to support a large antenna or reflector aperture. A few of these advantages are the following:

- The open cellular structure is amenable to compression to a very small volume — typically to 1/20 of its full size in one dimension.
- At a temperature above its glass-transition temperature (T_g), the foam strongly damps vibrations. Even at a temperature below T_g , the damping

should exceed that of other materials.

- In its macroscopic mechanical properties, an open-cell foam is isotropic. This isotropy facilitates computational modeling of antenna structures.
- Through chemical formulation, the T_g of an open-cell polyurethane foam can be set at a desired value between about -100 and about 0 °C. Depending on the application, it may or may not be necessary to rigidify a foam structure after deployment. If rigidification is necessary, then the T_g of the foam can be tailored to exceed the temperature of the deployment environment, in conjunction with providing a heater to elasticize the foam for deployment. Once deployed, the foam would become rigidified by cooling to below T_g .
- Techniques for molding or machining polymeric foams (especially including open-cell polyurethane foams) to desired sizes and shapes are well developed.

This work was done by Tommaso Rivellini, Paul Willis, Richard Hodges, and Suzanne Spitz of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-30819



These On- and Off-Axis Parabolic Reflectors are two examples of antenna reflectors that would include rigid narrow apertures and adjoining deployable foam-supported wider apertures.

Coating MCPs With AlN and GaN

Emission of electrons is increased.

Goddard Space Flight Center, Greenbelt, Maryland

A development effort underway at the time of reporting the information for this article is devoted to increasing the sensitivity of microchannel plates (MCPs) as detectors of photons and ions by coating the MCPs with nitrides of elements in period III of the periodic table. Conventional MCPs are relatively insensitive to slowly moving, large-mass ions — for example, ions of biomolecules under analysis in mass spectrometers. The idea underlying this development is to coat an MCP to reduce its work function (decrease its electron affinity) in order to increase both (1) the emission of electrons in response to impingement of low-energy, large-mass ions and (2) the multiplying effect of secondary electron emission.

Of particular interest as coating materials having appropriately low or even negative electron affinities are gallium nitride, aluminum nitride, and ternary alloys of general composition $Al_xGa_{1-x}N$ (where $0 < x < 1$). These materials exhibit attractively high degrees of chemical, mechanical, and thermal stability plus

acceptably high resistance to sputtering. The electron-excitation cross sections of these materials are expected to exceed those of several other materials (including diamond) that are, variously, in use or under development for the same purpose. Moreover, by doping these materials with silicon, one can render them partly electrically conductive, thereby suppressing the undesired accumulation of electric charge that could otherwise occur during bombardment by ions.

For experiments, thin films of AlN and GaN — both undoped and doped with Si — were deposited on commercial MCPs by radio-frequency molecular-beam epitaxy (also known as plasma-assisted molecular-beam epitaxy) at temperatures < 200 °C. This deposition technique is particularly suitable because (1) MCPs cannot withstand the higher deposition-substrate temperatures used to decompose constituent compounds in some other deposition techniques and (2) in this technique, the constituent Al, Ga, and N are sup-

plied in elemental form, so that there is no need for thermal decomposition at the substrate surface. The nitride films thus formed were, variously, amorphous or polycrystalline. The nitride films were coated with surface layers of gold < 100 Å thick.

The MCPs were tested in a standard configuration in which the output stage of a first MCP was coupled to the input stage of a second MCP. Each pair of MCPs was mounted in a standard holder that included front and back contact rings and an anode for collecting the output electrons of the second MCP. The MCP pairs were biased at potentials between 1.7 and 1.9 kV, and count rates measured after preamplification and discrimination. To enable a direct comparison, in one pair, the second MCP was uncoated while the first MCP was coated over half its surface. The coated and uncoated sides of the half-coated MCP were exposed to fluxes of argon ions at kinetic energies of 1.0 and 0.5 keV. At 1.0 keV, the count rate for the coated side was about 2.3 times greater than