



Large Deployable Reflectarray Antenna

NASA's Jet Propulsion Laboratory, Pasadena, California

A report discusses a 7-meter-diameter reflectarray antenna that has been conceived in a continuing effort to develop large reflectarray antennas to be deployed in outer space. Major underlying concepts were reported in three prior *NASA Tech Briefs* articles: "Inflatable Reflectarray Antennas" (NPO-20433), Vol. 23, No. 10 (October 1999), page 50; "Tape-Spring Reinforcements for Inflatable Structural Tubes" (NPO-20615), Vol. 24, No. 7 (July 2000), page 58; and "Self-Inflatable/Self-Rigidizable Reflectarray Antenna" (NPO-

30662), Vol. 28, No. 1 (January 2004), page 61. Like previous antennas in the series, the antenna now proposed would include a reflectarray membrane stretched flat on a frame of multiple inflatable booms. The membrane and booms would be rolled up and folded for compact stowage during transport. Deployment in outer space would be effected by inflating the booms to unroll and then to unfold the membrane, thereby stretching the membrane out flat to its full size. The membrane would achieve the flatness for

a Ka-band application. The report gives considerable emphasis to designing the booms to rigidify themselves upon deployment: for this purpose, the booms could be made as spring-tape-reinforced aluminum laminate tubes like those described in two of the cited prior articles.

This work was done by Houfei Fang, John Huang, and Michael Lou of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-41083

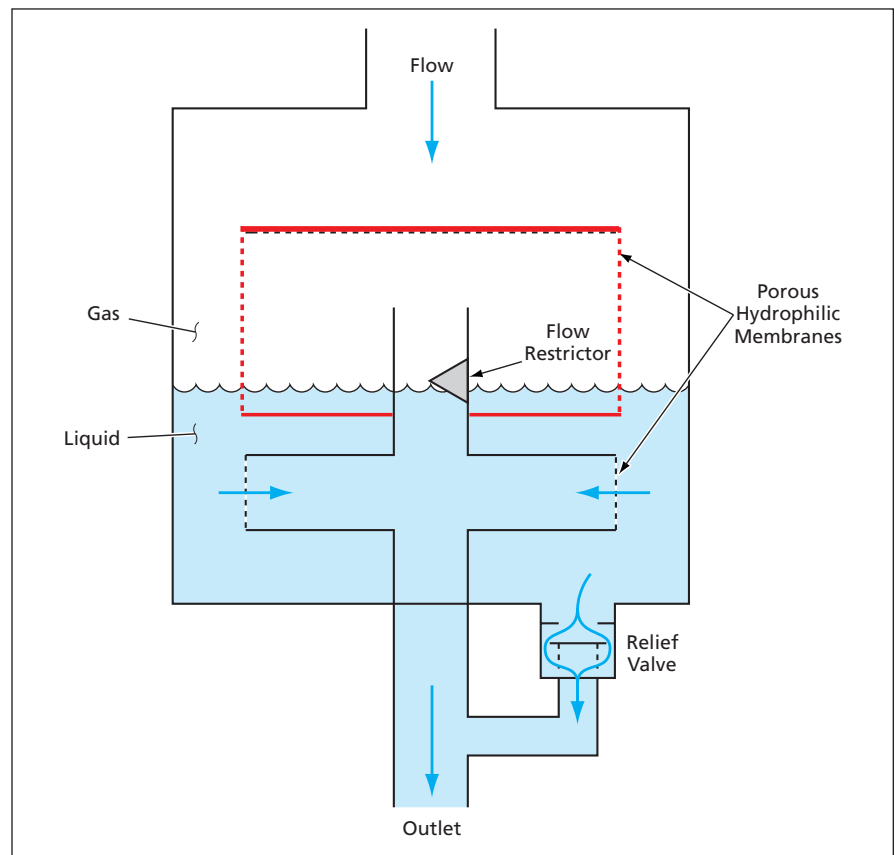
Periodically Discharging, Gas-Coalescing Filter

In effect, small bubbles would be made to coalesce into very large ones.

Marshall Space Flight Center, Alabama

A proposed device would remove bubbles of gas from a stream of liquid (typically water), accumulate the gas, and periodically release the gas, in bulk, back into the stream. The device is intended for use in a flow system (1) in which there is a requirement to supply bubble-free water to a downstream subsystem and (2) that includes a sensor and valves, just upstream of the subsystem, for sensing bubbles and diverting the flow from the subsystem until the water stream is again free of bubbles. By coalescing the gas bubbles and then periodically releasing the accumulated gas, the proposed device would not contribute to net removal of gas from the liquid stream; nevertheless, it would afford an advantage by reducing the frequency with which the diverter valves would have to be activated.

The device (see figure) would include an upper and a lower porous membrane made of a hydrophilic material. Both membranes would cover openings in a tube leading to an outlet. These membranes would allow water, but not gas bubbles, to pass through to the interior of the tube. Inside the tube, between the two membranes, there would be a flow restrictor that would play a role described below. Below both membranes there would be a relief valve.



Gas From Trapped Bubbles Would Accumulate in the head space in this vessel until the water level fell below the lower hydrophilic membrane. Then the relief valve would open, releasing the gas and water to the outlet.

Water, possibly containing bubbles, would enter from the top and would pass through either the lower membrane or both membranes, depending how much gas had been accumulated thus far. When the volume of accumulated gas was sufficient to push the top surface of the liquid below the lower porous membrane, water could no longer flow through either membrane

toward the outlet. This blockage would cause an increase in back pressure that would cause the relief valve to open. The opening of the relief valve would allow both the water and the bulk-accumulated gas to pass through to the outlet. Once the gas had been pushed out, water would once again flow through both membranes at a much lower pressure drop. The flow restrictor would

maintain enough pressure drop to keep the relief valve open until gas had been cleared from both hydrophilic membranes.

*This work was done by Donald Layne Carter and Donald W. Holder of **Marshall Space Flight Center** and Edward W. O'Connor of Hamilton Sundstrand. Further information is contained in a TSP (see page 1).
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