suspension containing charged species to be separated is loaded into a cuvette, which is machined into a top plate. The apparatus includes a lower plate, into which 20 collection cavities have been milled. Each cavity is filled with an electrophoresis buffer solution. For the collection of an electrophoretic fraction, the lower plate is rotated to move a designated collection cavity into alignment with the opening of the cuvette.

An electric field is then applied between a non-gassing electrode in the collection cavity and an electrolyte compartment, which is separated from the cuvette by a semipermeable membrane. The electrolyte is refreshed by circulation by use of a peristaltic pump. In subsequent steps, the lower plate is rotated to collect other electrophoretic fractions. Later, the collected fractions are removed from the collection cavities through ports that have threaded plugs.

The base of the apparatus contains power supplies and a computer interface. The design includes provisions for monitoring and feedback control of cavity position, electric field, and temperature. The operation of the apparatus can easily be automated, as demonstrated by use of software that has already been written for this purpose.

This work was done by Nathan Thomas, John F. Doyle, Andy Kurk, John C. Vellinger, and Paul Todd of Space Hardware Optimization Technology, Inc., for **Johnson Space Center**.

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:

Space Hardware Optimization Technology, Inc.
7200 Highway 150
Greenville, IN 47124
Phone: (812) 923-9591
E-mail: info@SHOT.com

Refer to MSC-23208, volume and number of this NASA Tech Briefs *issue, and the page number.*

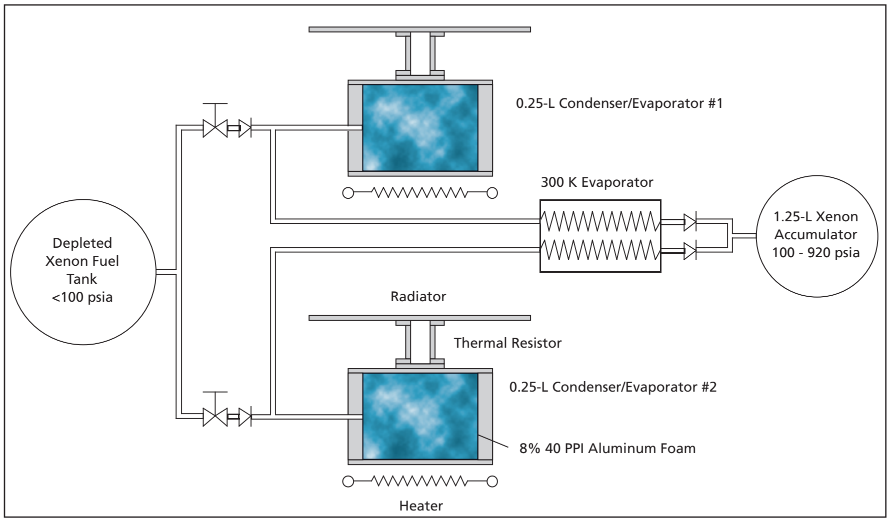
Recovering Residual Xenon Propellant for an Ion Propulsion System

Most of the otherwise unusable xenon is recovered.

NASA's Jet Propulsion Laboratory, Pasadena, California

Future nuclear-powered Ion-Propulsion-System-propelled spacecraft such as Jupiter Icy Moon Orbiter (JIMO) will carry more than 10,000 kg of xenon propellant. Typically, a small percentage of this propellant cannot be used towards the end of the mission because of the pressure drop requirements for maintaining flow. For large missions such as JIMO, this could easily translate to over 250 kg of unusable xenon.

A proposed system, the Xenon Recovery System (XRS), for recovering almost all of the xenon remaining in the tank, would include a cryopump in the form of a condenser/evaporator that would be alternatively cooled by a radiator, then heated electrically. When the pressure of the xenon in the tank falls below 0.7 MPa (100 psia), the previously isolated XRS will be brought online and the gas from the tank would enter the cryopump that is initially cooled to a temperature below saturation temperature of xenon. This causes xenon liquefaction and further cryopumping from the tank till the cryopump is full of liquid xenon. At this point, the cryopump is heated electrically by small heaters (70 to 80 W) to evaporate the liquid that is collected as high-pressure gas (<7 MPa; 1,000 psia) in an intermediate accumulator. Check valves between the tank and the XRS prevent the reverse flow of xenon during the heating cycle. The accumulator serves as the high-pressure source of xenon gas to the Xenon Feed System (XFS) downstream of the XRS. This cycle is repeated till almost all the xenon is recovered. Currently, this system is being baselined for JIMO.



A **Proposed Xenon Recovery System** promises to reduce waste of valuable cargo space on distant missions.

This work was done by Gani Ganapathi, P. Shakkottai, and Jiunn Jenq Wu of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-40613