



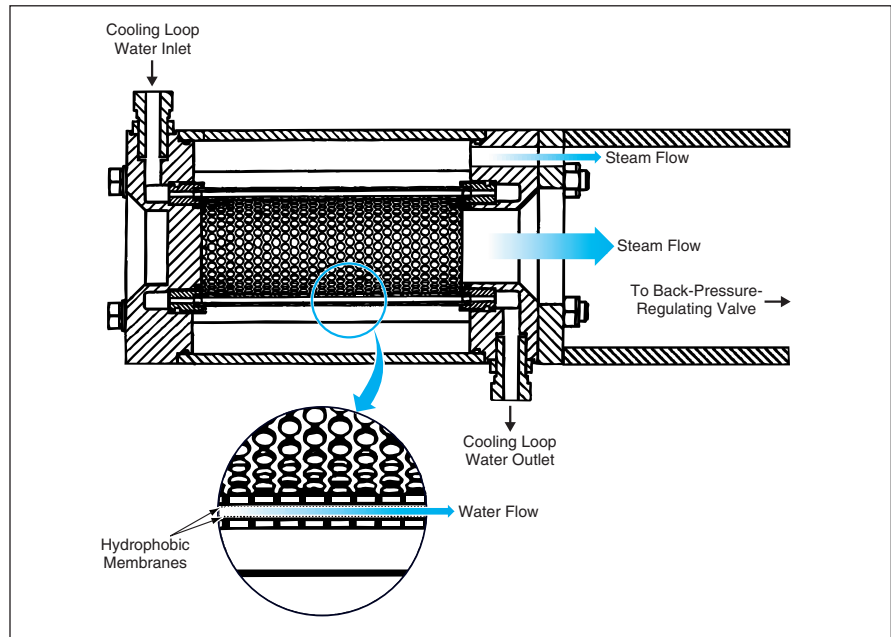
Membrane-Based Water Evaporator for a Space Suit

This design incorporates recent advances in hydrophobic micropore membranes.

Lyndon B. Johnson Space Center, Houston, Texas

A membrane-based water evaporator has been developed that is intended to serve as a heat-rejection device for a space suit. This evaporator would replace the current sublimator that is sensitive to contamination of its feedwater. The design of the membrane-based evaporator takes advantage of recent advances in hydrophobic micropore membranes to provide robust heat rejection with much less sensitivity to contamination. The low contamination sensitivity allows use of the heat transport loop as feedwater, eliminating the need for the separate feedwater system used for the sublimator.

A cross section of the evaporator is shown in the accompanying figure. The space-suit cooling loop water flows into a distribution plenum, through a narrow annulus lined on both sides with a hydrophobic membrane, into an exit plenum, and returns to the space suit. Two perforated metal tubes encase the membranes and provide structural strength. Evaporation at the membrane inner surface dissipates the waste heat from the space suit. The water vapor passes through the membrane, into a steam duct and is vented to the vacuum environment through a back-pressure



Hydrophobic Membranes provide the basis for a simple, robust device for space-suit heat rejection.

valve. The back-pressure setting can be adjusted to regulate the heat-rejection rate and the water outlet temperature.

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Compact Microscope Imaging System With Intelligent Controls

This system automates tasks that, heretofore, required the full attention of human technicians.

John H. Glenn Research Center, Cleveland, Ohio

The figure presents selected views of a compact microscope imaging system (CMIS) that includes a miniature video microscope, a Cartesian robot (a computer-controlled three-dimensional translation stage), and machine-vision and control subsystems. The CMIS was built from commercial off-the-shelf instrumentation, computer hardware and software, and custom machine-vision software. The machine-vision and control subsystems include adaptive neural networks that afford a measure of artificial intelligence.

The CMIS can perform several automated tasks with accuracy and repeata-

bility — tasks that, heretofore, have required the full attention of human technicians using relatively bulky conventional microscopes. In addition, the automation and control capabilities of the system inherently include a capability for remote control. Unlike human technicians, the CMIS is not at risk of becoming fatigued or distracted: theoretically, it can perform continuously at the level of the best human technicians. In its capabilities for remote control and for relieving human technicians of tedious routine tasks, the CMIS is expected to be especially useful in bio-

medical research, materials science, inspection of parts on industrial production lines, and space science.

The CMIS can automatically focus on and scan a microscope sample, find areas of interest, record the resulting images, and analyze images from multiple samples simultaneously. Automatic focusing is an iterative process: The translation stage is used to move the microscope along its optical axis in a succession of coarse, medium, and fine steps. A fast Fourier transform (FFT) of the image is computed at each step, and the FFT is analyzed for its spatial-fre-