- The spray nozzles must be sized to atomize the oil and to ensure that the rate of flow of sprayed oil does not exceed the rate at which the venturi action can empty the tank.
- The vacuum pump must produce a hard vacuum against the venturi tube and continue to work when it ingests some oil and water.
- Fittings must be made vacuum tight (by use of O-rings) to prevent leakage of air into the system.

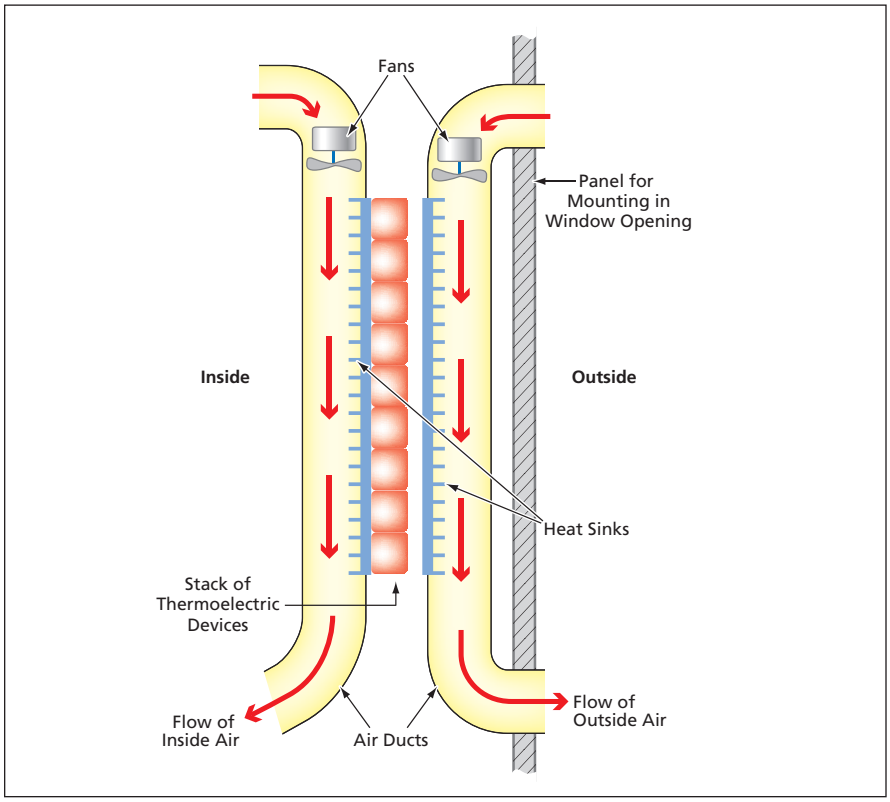
The system is fully automatic, and can be allowed to remain in operation with very little monitoring. It is capable of reducing the air content of the oil from 11 to less than 1 volume percent in about 4 hours and to keep the water content below 100 parts per million.

This work was done by Christopher W. Anderson of Lockheed Martin Space Operations for **Kennedy Space Center**. *Further information is contained in a TSP (see page 1).*
KSC-12528

Solar-Powered Cooler and Heater for an Automobile Interior

Thermoelectric devices and fans would run on solar power.

Marshall Space Flight Center, Alabama



An **Assembly Mounted in a Window Opening** of an automobile would include thermoelectric devices that would transfer heat between interior and exterior circulating airflows. The thermoelectric devices and the fans in the assembly would be powered by a solar photovoltaic panel mounted on the roof.

The apparatus would include a solar photovoltaic panel mounted on the roof and a panellike assembly mounted in a window opening. The window-mounted assembly (see figure) would include a stack of thermoelectric devices sandwiched between two heat sinks. A fan would circulate interior air over one heat sink. Another fan would circulate exterior air over the other heat sink. The fans and the thermoelectric devices would be powered by the solar photovoltaic panel. By means of a double-pole, double-throw switch, the panel voltage fed to the thermoelectric stack would be set to the desired polarity: For cooling operation, the chosen polarity would be one in which the thermoelectric devices transport heat from the inside heat sink to the outside one; for heating operation, the opposite polarity would be chosen.

Because thermoelectric devices are more efficient in heating than in cooling, this apparatus would be more effective as a heater than as a cooler. However, if the apparatus were to include means to circulate air between the outside and the inside without opening the windows, then its effectiveness as a cooler in a hot, sunny location would be increased.

This work was done by Richard T. Howard of **Marshall Space Flight Center**. *Further information is contained in a TSP (see page 1).*

This invention has been patented by NASA (U.S. Patent No.6,662,572). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-31751-1.