



Instrument for Analysis of Greenland's Glacier Mills

NASA's Jet Propulsion Laboratory, Pasadena, California

A new instrument is used to study the inner workings of Greenland's glacier mills by riding the currents inside a glacier's moulin. The West Greenland Moulin Explorer instrument was deployed into a tubular shaft to autonomously record temperature, pressure, 3D acceleration, and location. It is built with a slightly positive buoyancy in order to assist in recovery.

The unit is made up of several components. A 3-axis MEMS (microelectromechanical systems) accelerometer with 0.001-g resolution forms the base

of the unit. A pressure transducer is added that is capable of withstanding 500 psi (≈ 3.4 MPa), and surviving down to -40 °C. An Iridium modem sends out data every 10 minutes. The location is traced by a GPS (Global Positioning System) unit. This GPS unit is also used for recovery after the mission. Power is provided by a high-capacity lithium thionyl chloride D-sized battery. The accelerometer is housed inside a cylindrical, foot-long (≈ 30 cm) polyvinyl chloride (PVC) shell sealed at each end with acrylic. The pressure

transducer is attached to one of these lids and a MEMS accelerometer to the other, recording 100 samples per second per axis.

This work was done by Alberto E. Behar, Jaret B. Matthews, and Hung B. Tran of the Jet Propulsion Laboratory; Konrad Steffen, Dan McGrath, and Thomas Phillips of the University of Colorado Boulder; and summer students Andrew Elliot, Sean O'Hern, Colin Lutz, Sujita Martin, and Henry Wang for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1), NPO-46514

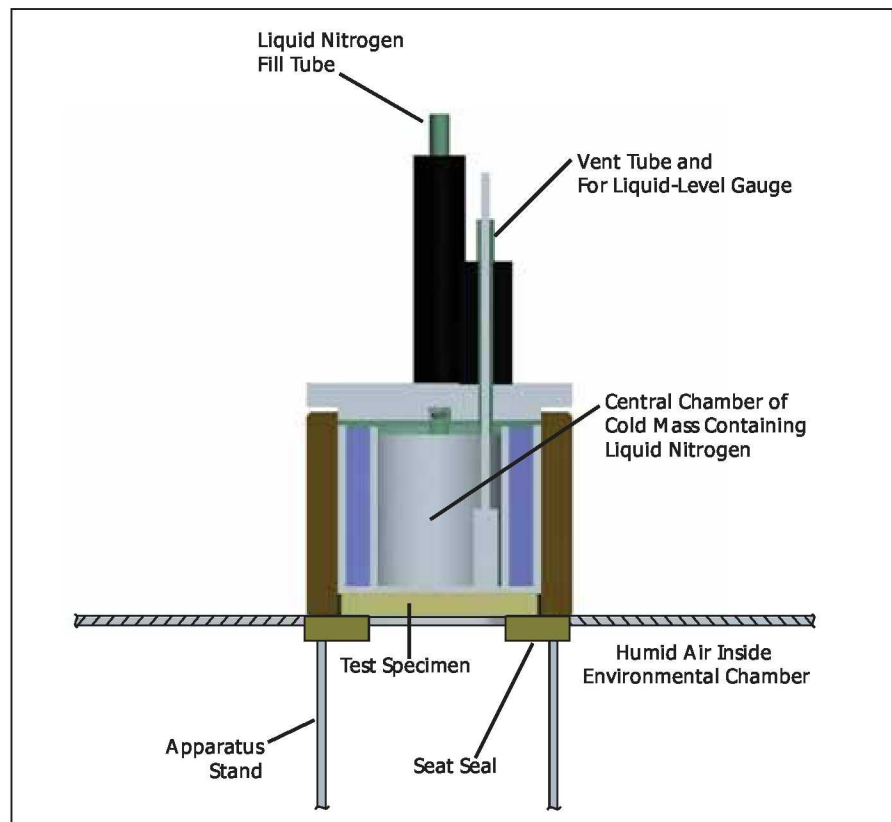
Cryogenic Moisture Apparatus

Testing for moisture uptake in materials can be performed under standardized cryogenic conditions.

John F. Kennedy Space Center, Florida

The Cryogenic Moisture Apparatus (CMA) is designed for quantifying the amount of moisture from the surrounding air that is taken up by cryogenic-tank-insulating material specimens while under typical conditions of use. More specifically, the CMA holds one face of the specimen at a desired low temperature (e.g., the typical liquid-nitrogen temperature of 77 K) while the opposite face remains exposed to humid air at ambient or near-ambient temperature. The specimen is weighed before and after exposure in the CMA. The difference between the "after" and "before" weights is determined to be the weight of moisture absorbed by the specimen.

Notwithstanding the term "cryogenic," the CMA is not limited to cryogenic applications: the low test temperature can be any temperature below ambient, and the specimen can be made of any material affected by moisture in air. The CMA is especially well suited for testing a variety of foam insulating materials, including those on the space-shuttle external cryogenic tanks, on other cryogenic vessels, and in refrigerators used for transporting foods, medicines, and other perishables. Testing is important because absorbed moisture not only adds weight but also, in combina-



The **Cryogenic Moisture Apparatus** imposes a low temperature on a central portion of the upper face of the specimen while the bottom face of the specimen is exposed to moist air at ambient or near-ambient temperature. This is a simplified view.