

Monitoring Volcanoes by Use of Air-Dropped Sensor Packages

Use of these packages would contribute to understanding and prediction of eruptions.

NASA's Jet Propulsion Laboratory, Pasadena, California

Sensor packages that would be dropped from airplanes have been proposed for pre-eruption monitoring of physical conditions on the flanks of awakening volcanoes. The purpose of such monitoring is to gather data that could contribute to understanding and prediction of the evolution of volcanic systems.

Each sensor package, denoted a volcano monitoring system (VMS), would include a housing with a parachute attached at its upper end and a crushable-foam impact absorber at its lower end (see figure). The housing would contain

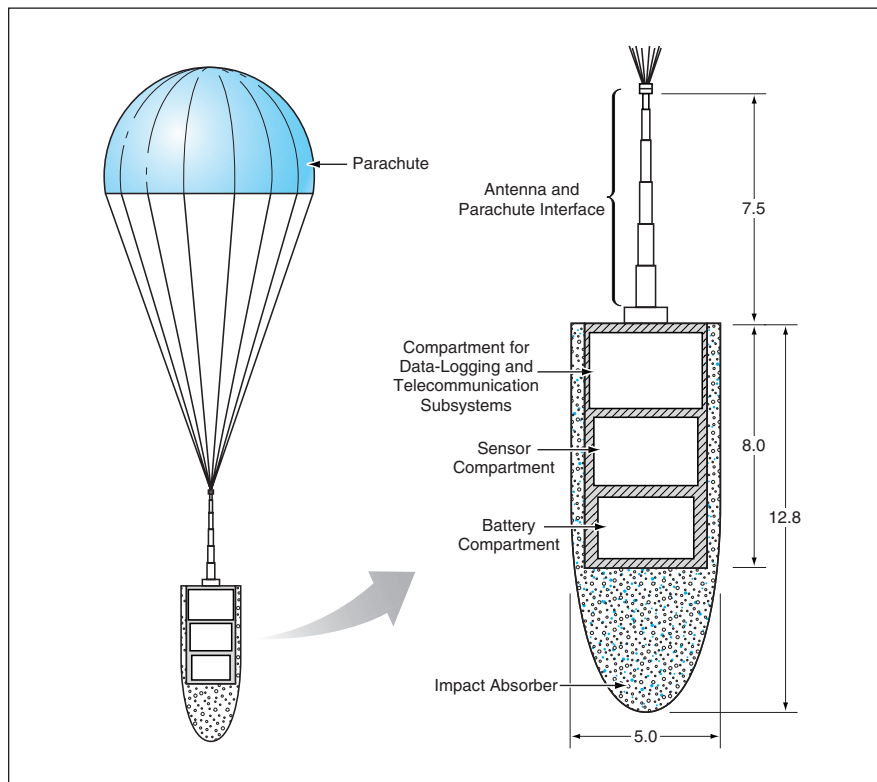
survivable low-power instrumentation that would include a Global Positioning System (GPS) receiver, an inclinometer, a seismometer, a barometer, a thermometer, and CO₂ and SO₂ analyzers. The housing would also contain battery power, control, data-logging, and telecommunication subsystems. The proposal for the development of the VMS calls for the use of commercially available sensor, power, and telecommunication equipment, so that efforts could be focused on integrating all of the equipment into a system that could survive impact

and operate thereafter for 30 days, transmitting data on the pre-eruptive state of a target volcano to a monitoring center.

In a typical scenario, VMSs would be dropped at strategically chosen locations on the flanks of a volcano once the volcano had been identified as posing a hazard from any of a variety of observations that could include eyewitness reports, scientific observations from positions on the ground, synthetic-aperture-radar scans from aircraft, and/or remote sensing from aboard spacecraft. Once dropped, the VMSs would be operated as a network of *in situ* sensors that would transmit data to a local monitoring center. This network would provide observations as part of an integrated volcano-hazard-assessment strategy that would involve both remote sensing and timely observations from the *in situ* sensors.

A similar strategy that involves the use of portable sensors (but not dropping of sensors from aircraft) is already in use in the Volcano Disaster Assistance Program (VDAP), which was developed by the U. S. Geological Survey and the U. S. Office of Foreign Disaster Assistance to respond to volcanic crises around the world. The VMSs would add a greatly needed capability that would enable VDAP response teams to deploy their volcano-monitoring equipment in a more timely manner with less risk to personnel in the field.

This work was done by Sharon Kedar, Tommaso Rivellini, Frank Webb, Brent Blaes, and Caroline Bracho of Caltech and Andrew Lockhart and Ken McGee of the USGS for NASA's Jet Propulsion Laboratory. For further information, access the Technical Support Package (TSP) free on-line at www.techbriefs.com/tsp under the Computers/Electronics category. NPO-30827



A Volcano Monitoring System would be a package of integrated instrumentation that would be dropped on the flanks of a volcano believed to be about to erupt. The dimensions shown here are in inches and are tentative.

Capacitive Sensors for Measuring Masses of Cryogenic Fluids

A single capacitance reading is linearly related to the mass of fluid in a tank.

John F. Kennedy Space Center, Florida

An effort is under way to develop capacitive sensors for measuring the masses of cryogenic fluids in tanks. These sensors are intended to function

in both microgravitational and normal gravitational settings, and should not be confused with level sensors, including capacitive ones. A sensor of this type is

conceptually simple in the sense that (1) it includes only one capacitor and (2) if properly designed, its single capacitance reading should be readily convertible to