The NetLander ATMIS Temperature and Wind Sensors

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An improved understanding of the near-surface weather and climate on Mars is essential because this will be the working environment for future robotic and manned missions. Existing measurements and models show that the near surface winds and temperatures vary over a wide range of spatial and temporal scales. The NetLanders will provide the first opportunity to measure these properties from a network of 4 stations.

Mars Pathfinder observations showed that temperatures must be measured at several heights within 1 to 2-m of the surface to resolve the large vertical temperature gradients, which change from super-adiabatic during the day to strongly stable at night. Absolute accuracies of ± 2 K and relative accuracies better than ± 0.1 K are needed for temperatures between ~170 and 300 K. Viking Lander measurements show that surface wind speeds are usually between 1 and 10 m/s, but Mars Pathfinder detected dust devil wind speeds as high as 60 m/s. To characterize these winds, accuracies of ~10% in wind speed and direction are needed over this range.

The NASA Jet Propulsion Laboratory will provide the atmospheric temperature and wind sensors for the NetLander ATMIS experiment. The temperature sensors will be mounted at ~25, 50, and 90 cm above the deck of each NetLander on the ATMIS/ELF boom to resolve the near-surface vertical temperature gradients. Like Viking, Mars Pathfinder, and the Mars Polar Lander, ATMIS will use thin-wire (75-μm diameter) chromel-constantan (type E) thermocouples (TC's). These TC's will be supported byY-shaped, fiberglass supports. Each bracket includes 3 TC's that are wired in parallel for redundancy (Figure 1).

The horizontal wind velocity will be monitored by a directional, constant over-temperature hot-wire anemometer located at the top of the ATMIS/ELF boom. This sensor is based on the MPL MVACS design (Figure 1). In this design, the hot wire is heated to 100 °C above the ambient atmospheric temperature, and the wind speed is determined by measuring the power needed to maintain the hot wire at this temperature. The wind direction is determined by an array of TC's that surround the hot wire and detect the azimuth of the heated plume that forms downstream of the hot wire (Figure 2).

This presentation will describe these sensors and their data products.

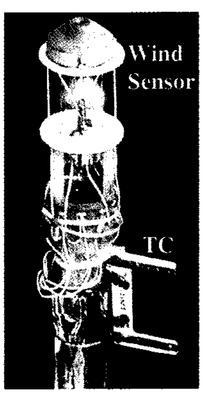

Figure 1: The MPL MVACS wind and temperature sensors. This design was extensively tested in the Mars Aeolian Wind Tunnel at NASA Ames and in Mars simulation chambers at JPL as part of the MVACS flight qualification process.

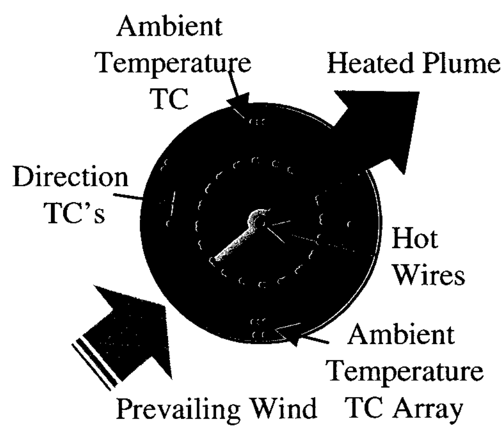

Figure 2: Top view of wind sensor, showing placement of central hot wires, surrounding direction TC's and the ambient temperature TC's. Principle of operation also shown. As the wind blows across the hot wires, the heated plume is detected by the direction TC that is downwind. One of the 2 ambient temperature TC arrays is always upwind.