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TEMPERATURE MEASUREMENT

NOTES

RODUCTION

Above balloon altitude the most common meteorological measurements are temperature and wind data provided by rocketsondes. Rocketsondes are tinely fired at several MRN (Meteorological Rocket Network) ranges. There e been several thousand of these soundings to date. Figure 1 is a typical ght from one of the Exametnet Reports.

The normal sequence of operation is a meteorological rocket (ARCAS or [Dart) is fired. Close to apogee (60 - 65 km) a rocketsonde (Figure 2) ejected. A retardation device is then opened which is used to provide bility and a reasonable fall rate to the system. Temperature information obtained from a bead thermistor and telemetered on a 1680 MHz radar link a ground station. This temperature/time history is compared to the radar cking data to give a temperature/height relationship. The retardation ce (parachute - STARUTE) is metallized to serve as a radar reflector. radar data is also used to determine wind information.

The operational sensor used in measuring the temperature is a bead rmistor (25×10^{-3} cm diameter) suspended on platinum iridium wires

(2.5×10^{-3} cm diameter). There have been several methods for mounting these. The original mount (Figure 3) was found to be too closely linked to the temperature of the mounting posts.

While the basic sensor is the bead thermistor the fact that appreciabl energy transfer occurs with the leads can be interpreted as the sensing area is not just the surface of the bead but includes some portion of the leads as well. With this in mind the heat transfer of the leads will be studied together with the bead.

GOVERNING EQUATIONS

The basic equation is the Conduction Equation

$$(1) \qquad \nabla^2 T - \frac{1}{\alpha} \frac{\partial T}{\partial t} = f(\vec{r}, t)$$

α = thermal diffusivity

A schematic of the bead thermistor and leads is shown in Figure 4. If, due to its shape and size we consider the bead itself free of temperature gradients and study the heat transfer in the leads, the bead conditions enter the equation as a boundary condition (1). An additional benefit is the heat transfer in a wire sensor is then just a change in boundary condition (1, 2).

The assumption that the radial gradient of temperature in the wire is zero makes the heat equation one dimensional