

**The Meteorological Measurement System
on the NASA ER-2 Aircraft**

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Abstract

A Meteorological Measurement System (MMS) was designed for the high-altitude ER-2 aircraft (NASA 706). Through dedicated instrumentation installed on the aircraft and repeated calibrations, the MMS provides accurate in-situ measurements of free-stream pressure, temperature, and the wind vector. The MMS experiment has participated in two major high-altitude scientific expeditions, the Stratosphere-Troposphere Exchange Project (STEP) based in northern Australia and the Airborne Antarctic Ozone Experiment (AAOE) based in southern Chile.

Key MMS subsystems are described. The MMS consists of a dedicated inertial navigation system (INS), a radome differential pressure system, a data acquisition system, and air data instrumentation.

The MMS incorporates a high-resolution INS (Litton LTN-72RH model), which is specially configured and is updated at 25 Hz. The differential pressure system, consisting of two sets of pressure ports and transducers, is installed in the ER-2 radome to provide sensitive measurements of the airflow angles (angle of attack and angle of sideslip). The data acquisition system was designed to meet aircraft requirements of compactness and light weight (2 cu. ft, 50 lb) and for MMS requirements to sample, control, process, and store 45 parameters (some redundant) at a sampling rate up to 10 Hz. The MMS data are stored both in a tape recorder (20 MB) and a hermetically-sealed winchester hard disc (10 MB). Special and redundant instrumentation for temperature and pressure measurements were also installed on the aircraft.

The operational software was written in MC68000 assembly language to facilitate preflight checkout, inflight sampling (currently operating at a 5-Hz sampling rate), quick postflight download, and operating utilities. The software package must accommodate various modes of MMS data: analog and digital, serial and parallel, synchronous and asynchronous. The application software was developed in FORTRAN for data conversion, processing, analysis, diagnostics, and graphic presentation.