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Title: The Millimeter-Wave Imaging Radiometer (MIR)

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The Millimeter-Wave Imaging Radiometer (MIR) is a new instrument being designed for studies of airborne passive microwave retrieval of tropospheric water vapor, clouds, and precipitation parameters. The MIR is a total-power cross-track scanning radiometer for use on either the NASA ER-2 (high-altitude) or DC-8 (medium altitude) aircraft. The current design includes millimeter-wave (MMW) channels at 90, 166, 183±1,3,7, and 220 GHz. An upgrade for the addition of submillimeter-wave (SMMW) channels at 325±1,3,7 and 340 GHz is planned. The nadiral spatial resolution is approximately 700 meters at mid-altitude when operated aboard the NASA ER-2.

The MIR consists of a scanhead and data acquisition system, designed for installation in the ER-2 superpod nose cone (Fig. 1). The scanhead (Fig. 2) will house the receivers (feedhorns, mixers, local oscillators, and preamplifiers), a scanning mirror, hot and cold calibration loads, and temperature sensors. All channels will have nearly identical beamwidths (3^o). The $\pm 50^o$ field-of-view will be scanned every $\sim$ 2.5 seconds. Particular attention is being given to the characterization of the hot and cold calibration loads through both laboratory bistatic scattering measurements and analytical modelling.

The data acquisition system consists of a PC/AT compatible computer with 200 MB optical WORM disk drive, a 12-bit 32-channel opto-isolated A/D converter, IF and video circuitry, and power conditioning module. Automatic offset and gain controls (AOC and AGC) provide *in situ* compensation for inevitable system offset and gain fluctuations. (Such fluctuations are expected for non-Dicke type radiometers. An optional chopper-wheel Dicke switch will be installed if necessary.) A watch-dog timer and IRIG-B time decoder are included in the PC/AT.

The high spatial resolution MMW brightness imagery will be useful for 1) verifying MMW radiative transfer models in clear air and precipitation, 2) constructing and evaluating MMW precipitation parameter (e.g., rainfall rate, particle size), cloud parameter (e.g., liquid and cirrus water content), and water vapor retrievals, 3) studying convective raincell and atmospheric gravity wave structure, and 4) evaluation of AMSU, TRMM, EOS, ESGP and joint IR-microwave retieval algorithms. Future imagery using both MMW and SMMW channels will be useful for 1) verification of SMMW radiative transfer models (particularly for cirrus clouds), 2) initial evaluation of water vapor profiling using 183 and 325 GHz channels, and 3) evaluation of cloud parameter retrieval and precipitation mapping using the SMMW channels. Most of the MIR science objectives will require complementary data from other airborne instruments (e.g., AMPR, EDOP, MTS, MAMS, weather radars, optical and infrared satellites, and radiosondes).

The MIR is a joint effort between NASA GSFC and the Georgia Tech School of Electrical Engineering. Meteorological data flights aboard the NASA ER-2 using the MIR MMW channels are tentatively scheduled for August and September 1991 during CAPE. The data will have potential impact on the design of future polar and geosynchronous passive microwave satellite missions.

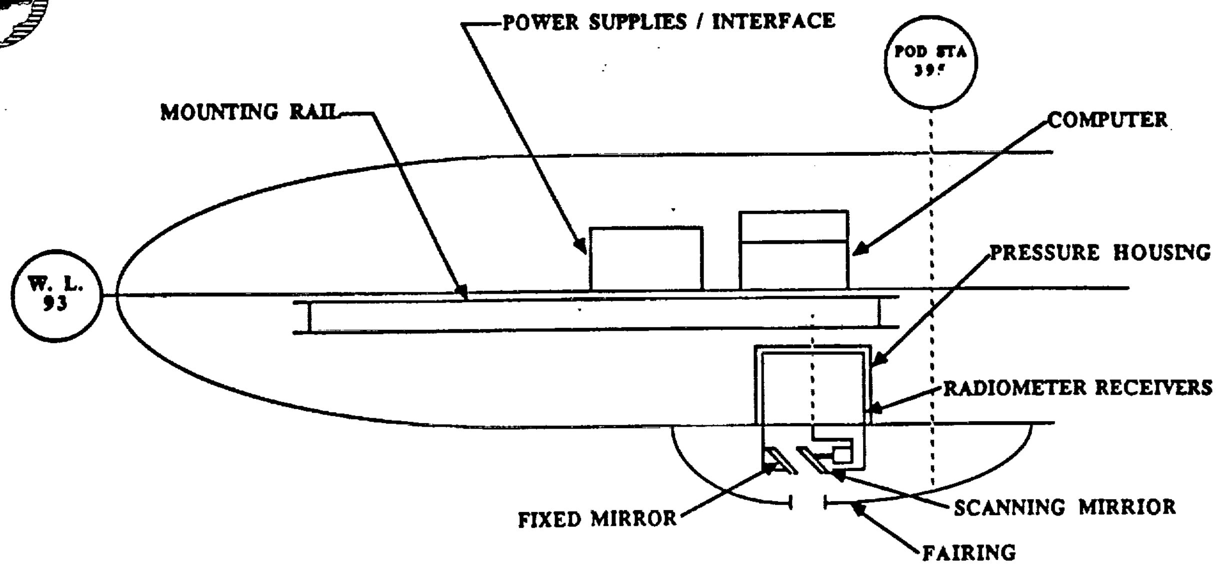

Figure 1: Location of the MIR in the ER-2 superpod nosecone.

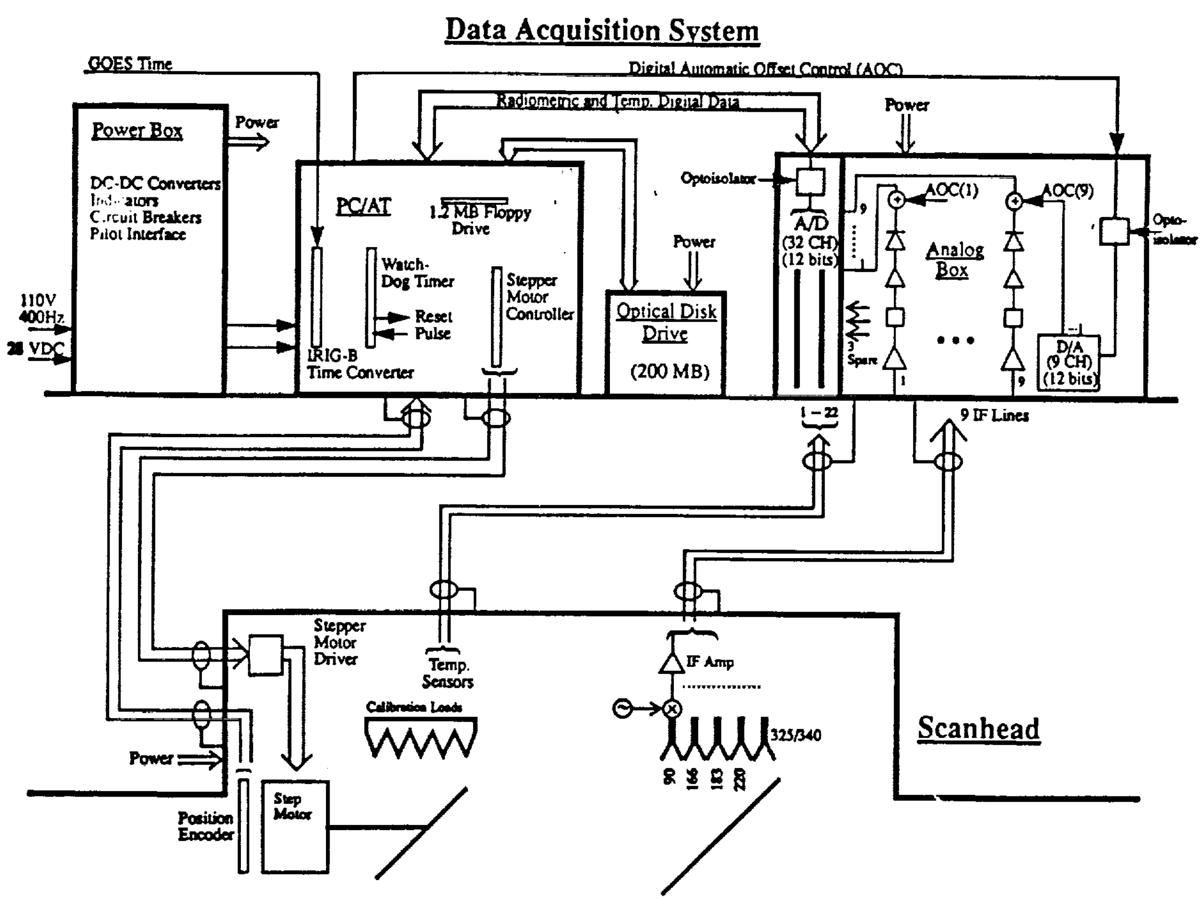

Figure 2: Block diagram of the MIR scanhead and data acquisition system.