

Miniaturized Aerosol, cloud, and radiometric Instruments for light weight Autonomous UAVs

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Abstract for ESTO Conference, June 2006, Maryland

The Maldives Air Campaign (See Abstract by Ramanathan et al, 2006 in this session) demonstrated a novel application of stacked AUAVs for atmospheric science research. This presentation will focus on the development of new miniaturized instruments and their integration with UAVs.

Aerosol, cloud, radiometric instruments, and an integrated data acquisition system have been miniaturized with a total payload weight and power less than 5 kg and 50 W, respectively. The AUAV payload is mission-specific and is outfitted to perform a particular set of measurements. These measurements include aerosol concentration, aerosol size distribution, aerosol absorption, cloud drop size distribution, cloud condensation nuclei, solar radiation fluxes (visible and broadband), atmospheric turbulence, temperature, pressure, and relative humidity. The data collected during the MAC campaign has been validated using standard calibration routines in conjunction with comparisons to ground-based instruments in both laboratory and in situ (in aircraft) settings. All instruments have been thoroughly tested and calibrated prior to deployment.

Much of the instrument suite includes commercially-available instruments that have been repackaged or redesigned to minimize weight and volume. An aerosol inlet was designed to minimize sample biases in aerosol number and size distributions. The radiometric sensors perform well during straight and level portions of the flight as the autopilot maintains a level platform (pitch and roll) to within a degree. An integrated data acquisition system connects to the instruments via an interface that supplies power and distributes the data signals to the computer. A single-board computer samples 16 channels of analog-to-digital (A/D), reads/controls up to six instruments via standard serial communication, and stores the data to a compact flash card. Several integrated circuits are embedded into the interface to increase its functionality as the central data system, including a GPS for time stamping and spatial coordination.