HAIS Instruments
Along with the extensive modifications that made the HIAPER a unique research aircraft, NSF issued a call for proposals to build a series of highly sophisticated instruments, the HIAPER Airborne Instrumentation Solicitation (HAIS). A total of 14 HAIS instruments were built by university groups, staff from NCAR, and private industry. This instrument complement, along with additional standard aircraft instruments, form the nucleus of HIAPER’s measurement capability. The payload of a HIAPER mission typically consists of a subset of the HAIS instruments, complemented by other instruments owned and operated by university collaborators. Some of the HAIS instruments can also be flown on the NSF/NCAR C-130 aircraft.
HAIS Instruments

3-View Cloud Particle Imager (3V-CPI) :: CPI portion provides 8-bit (grayscale) images of particles, and 2D-S portion of probe provides two different (orthogonal) views of particles. ‡

Advanced Whole Air Sampler (AWAS) :: Autonomous collection of ambient air samples for subsequent analysis of trace gas chemical and/or isotopic composition. ~

Autonomous Airborne Ozone Photometer :: Quantification of ozone mixing ratios at 1 sample per second using ultraviolet absorption. Undergoing modifications to improve instrument.

Chemical Ionization Mass Spectrometer (CIMS) :: Measurements of nitric acid, pernitric acid, and sulfur dioxide in standard CIMS negative-ion mode. Measurements of organics such as methanol, acetaldehyde, acetonitrile, and acetone in CIMS positive-ion mode. ¶

Fast Ozone Instrument :: Quantification of ozone mixing ratios at 5 samples per second using chemiluminescent reaction with nitric oxide. ¶

GPS Multistatic and Occultation Instrument (GISMOS) :: Measurements of water vapor distribution in the troposphere, ocean surface roughness, and soil moisture. ¶

HIAPER Airborne Radiation Package (HARP) :: Spectrally resolved actinic flux measurements and spectroradiometric irradiance measurements. ¶

High Spectral Resolution Lidar (HSRL) :: Calibrated vertical cross sections of cloud and aerosol optical depth, backscatter cross section, and depolarization. ¶

Microwave Temperature Profiler (MTP) :: Measurements of brightness temperature at three frequencies between 55.5 and 58.8 gigahertz are used to retrieve a temperature profile above and below the aircraft’s flight altitude. ¶

Quantum Cascade Laser Spectrometer (QCLS) :: Concentration data versus time for carbon dioxide, methane, carbon monoxide (nitrous oxide optional). ¶

Small Ice Detector, Version 2 (SID-2H) :: A particle light-scattering instrument for measuring size distributions of particles in the 1 to 70μm size range and for discriminating between ice crystals and supercooled water droplets in mixed-phase clouds. *

Trace Organic Gas Analyzer (TOGA) :: In-situ measurements of oxygenated volatile organic compounds, non-methane hydrocarbons, and halocarbons. ¶

Time-of-Flight Aerosol Mass Spectrometer (ToF-AMS) :: Measurements of total PM1 mass concentrations for non-refractory (NR) species (sulfate, nitrate, ammonium, chloride, organic aerosol = OA), properties and markers for OA (estimated O:C, markers for biomass burning and urban primary OA and for secondary/aged OA size-resolved PM1 composition for NR species. ¶

Vertical Cavity Surface Emitting Laser Hygrometer (VCSEL) :: Measurements of water vapor concentration at a high rate (25Hz). ~

Contact
Head of Science & Instrumentation
Dr. Jorgen Jensen
jbj@ucar.edu
303.497.1028
www.eol.ucar.edu/aircraft-instrumentation

Request HAIS Instruments
http://www.eol.ucar.edu/requestfacilities

Availability Status
~ Operational, available on request
‡ Operational, available on special request
* Improvements being undertaken

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