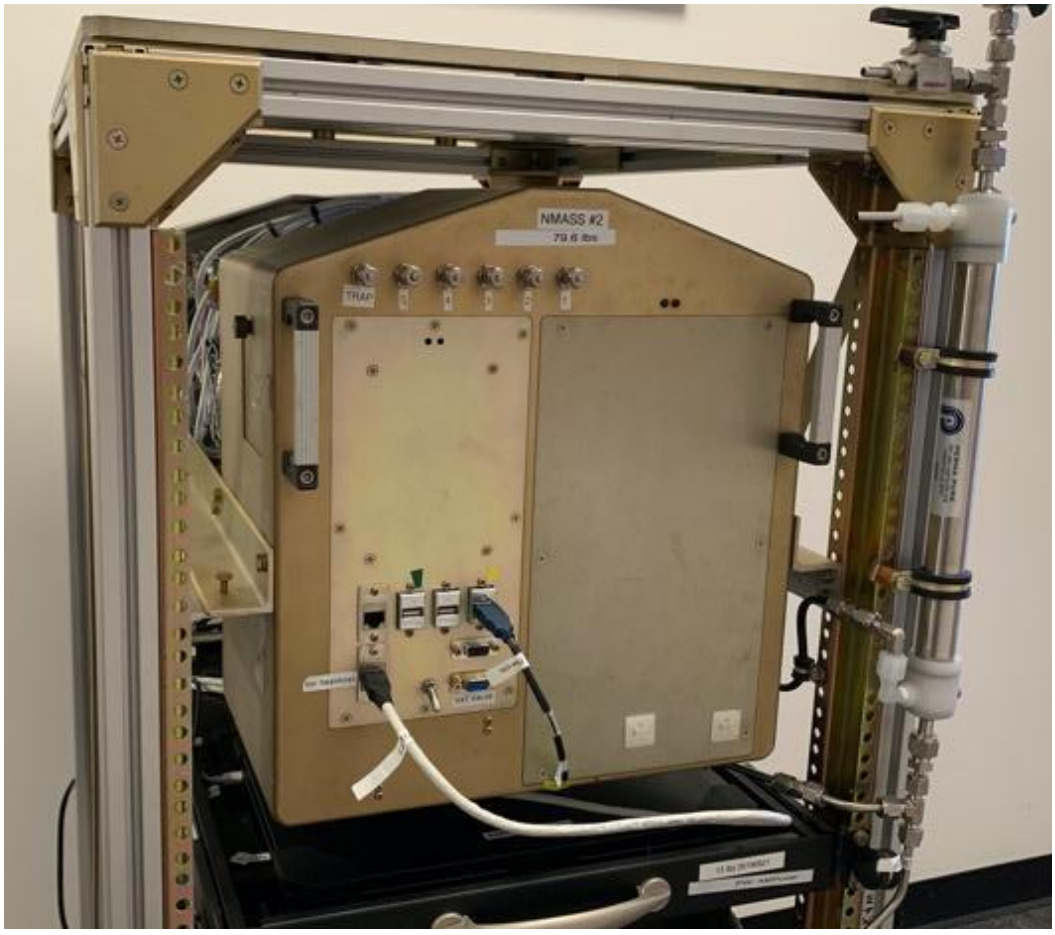
Aerosol Microphysical Properties (AMP) on ACCLIP

The Aerosol Microphysical Properties (AMP) instrument package operated by NOAA's Chemical Sciences Laboratory consists of two instruments mounted in a rack in the fuselage of the G-V aircraft. The two instruments are the Nucleation-Mode Aerosol Size Spectrometer, or NMASS, and the Ultra-High Sensitivity Aerosol Spectrometer, or UHSAS. Together, these instruments measure the concentration of aerosol particles as a function of their size from a diameter of ~3 nm to ~1000 nm. Both instruments measure continuously, proving one-second time resolution over this broad size range.

The NMASS counts particles in five different size categories by condensing a vapor of perfluorotributylamine, a non-toxic, non-flammable heat transfer fluid, onto nanometer-sized particles. The resulting droplets are detected by five separate laser diode particle counters. The internal pressure within the NMASS instrument is controlled so that the particle sizing does not change even as the G-V changes altitude. The NMASS measures particles with diameters from 3-60 nm in only five size categories, but at ~1s time resolution.



NMASS instrument in G-V rack.

The UHSAS measures the size and concentration of particles with diameters from ~60-1000 nm. A continuous air sample is accelerated through a nozzle into the center of the beam of a near-infrared laser. As individual particles traverse the laser beam, they scatter light, which is collected by two mirror systems and focused onto detectors. The amount of detected light can be directly related to the size of the particles. A 100-bin histogram of particle concentrations as a function of their size is generated every one second, although time averaging may be needed when particle concentrations are low.

UHSAS instrument in G-V rack.

The AMP instruments sample from a secondary diffuser mounted within a HIAPER Modular Inlet (HIMIL) attached on the top center of the G-V fuselage. Particles sizes measured by the AMP instruments are sampled and transmitted with high efficiency by the HIMIL. The sample flow is dried to <20% relative humidity prior to measurement.

Data from the AMP instruments provide a continuous aerosol size distribution from 3-1000 nm at dry conditions. Using data from other instruments, such as the High-Resolution Time-of-Flight Aerosol Mass Spectrometer, the water uptake of the particles can be estimated, and the ambient physical and optical properties of the aerosol can be calculated. This information can be used to determine the particle surface area available for heterogeneous chemical reactions and, with additional information from the Single-Particle Soot Photometer (SP2) in the same rack, the scattering and absorption of sunlight by the particles can be calculated. The AMP instruments also help identify which particles have been formed locally from gas-phase condensation, and which have been transported from other sources.