

ARM Aerial Facility G-1 Research Aircraft

FACT SHEET



The Gulfstream-159 (G-1) twin turboprop aircraft, owned by Battelle Memorial Institute since 1988 and operated by the Pacific Northwest National Laboratory for the U.S. Department of Energy (DOE), serves as an airborne atmospheric research laboratory for DOE and other users. The aircraft can measure a wide range of radiative, aerosol, and cloud properties, as well as collect gas-phase measurements. It is capable of taking measurements at altitudes approaching 25,000 feet (7.5 kilometers) over ranges of up to 1,500 nautical miles (2,800 kilometers). The G-1 operates at a wide range of air speeds that enables both relatively slow sampling and rapid deployment to field sites all over the world. All racks and pylons holding instruments have been fully certified by the Federal Aviation Administration enhancing safety and making it easier to obtain clearance to operate in foreign countries.



Instrumentation and Measurements

The aircraft can accommodate external probes to measure aerosol and cloud properties, zenith and nadir pointing radiometers, and internal sampling devices that cover a wide range of measurement needs. The G-1 has sufficient cabin volume, electrical power, and payload capacity, and possesses flight characteristics to accommodate a large variety of instrument systems and equipment configurations. Many instruments are provided by the ARM Aerial Facility (AAF), but other organizations may contribute instrumentation for campaigns.



A sample of the available instrumentation and measurement capabilities is as follows; see the AAF website, www.arm.gov/sites/aaf, for a complete list:

Aerosol

External probes measure an aerosol size distribution at 1Hz from 0.06 to greater than 10 microns, for example:

- Ultra-High Sensitivity Spectrometer (UHSAS): Size Distribution 0.06 to 0.7 microns
- Cloud Aerosol Precipitation Spectrometer with CAS D-POL (CAPSD): Size distribution 0.6 to greater than 10 microns
- Passive Cavity Aerosol Spectrometer: Size distribution from 0.1 to 3 microns

Internal instrumentation measures aerosol composition and concentration, for example:

- Single Particle Soot Spectrometer (SP2): Soot Spectrometry

- Dual-Column Cloud Condensation Nuclei Counter (Dual CCNc): CCN concentration at two specified supersaturations
- Palas Universal Fluid Ultrafine CPC: Total Aerosol Concentration (>0.0025 microns)

Gas Phase

- Trace Gas System: Concentration of SO₂, CO, O₃, NO, NO₂, and NO_y
- Cavity Ring Down (CRD): Concentration of CO₂, CH₄, and H₂O.

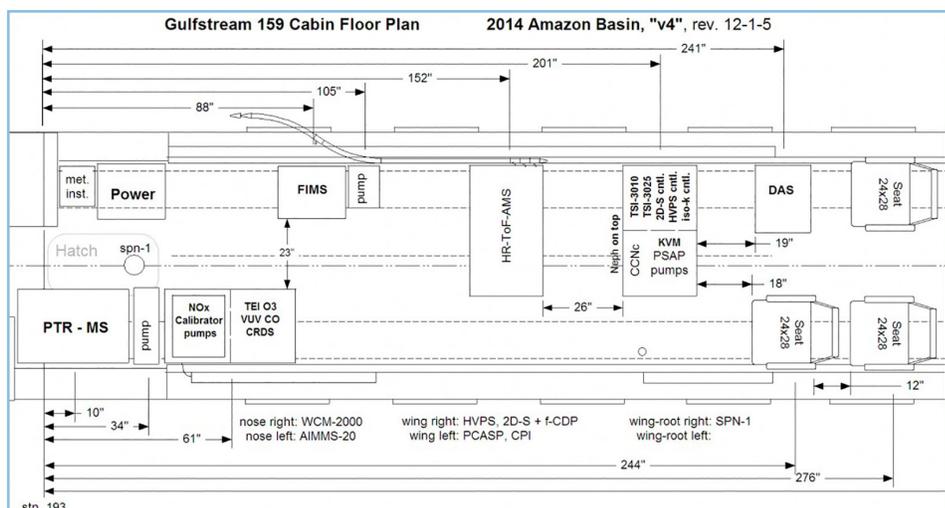
Cloud Properties

External probes measure cloud particle size distribution at 1Hz from 2 to 19,200 microns, for example:

- Fast Cloud Droplet Probe: Size Distribution 2 to 50 microns
- 2-Dimensional Stereo Probe (2D-S): Size distribution from 10 to 3,000 microns
- High Volume Precipitation Spectrometer Version 3 (HVPS-3): Size distribution from 150 to 19,200 microns

Cabin Configuration

The aircraft's 165 square feet of interior space is configured for maximum utility. Internal removable instrumentation racks enable rapid reconfiguration for customized deployments. Inlets and sensors are mounted on aluminum inserts that replace selected windows, as well as on pylons and other fuselage locations. An onboard data acquisition system accommodates a wide range of analog and digital inputs. Acquired data are processed for in-flight display. This flying



laboratory is equipped with a Gigabit local area network that provides rapid remote access to every instrument via a laptop located at every seat. In addition a data acquisition system capable of recording at speeds up to 200Hz monitors and records a vast array of aircraft and meteorology state parameters.

Aircraft Technical Information

- Length: 63.75 feet (19.44 meters)
- Wingspan: 78.33 feet (23.88 meters)
- Height: 23.33 feet (7.11 meters)
- Cabin space: 165 square feet (15.33 square meters)
- Maximum altitude: 25,000 feet (7.5 kilometers)
- Maximum gross weight: 36,000 pounds (16,330 kilograms)
- Endurance with typical payload fuel: 4-5 hours
- Crew capacity: 2 pilots, 1-5 scientists
- Cabin payload: 4,200 pounds (1,905 kilograms)
- Research Power: 500A @ 28 VDC; 77A @ 110 VAC, 60 Hz, 1-phase.

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www.arm.gov/sites/aaf