# The Atmospheric Radiation Measurement Program Aerosol Observing Systems: Status and Planned Upgrades

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To estimate global aerosol radiative forcing and the effects of aerosols on the global climate, measurements of atmospheric aerosols are being made by Atmospheric Radiation Measurement (ARM) Program using Aerosol Observing Systems (AOS) at several locations. These include the Southern Great Plains (SGP) site; North Slope of Alaska (NSA) locale; the recent deployments of the ARM Mobile Facility (AMF) at Point Reyes, California, and Niamey, Niger; and the In-situ Aerosol Profiling (IAP) aircraft program, which provides a subset of the AOS measurements.

## Southern Great Plains Aerosol Observing Systems

### Instrument and Measurement Status

All instruments are working well and no recent problems have been reported. Aerosol scattering, absorption, aerosol hygroscopic growth, total particle number concentration, particle size distribution, and filter chemistry measurements are currently being conducted. Figure 1 shows the Aerosol Trailer which houses the AOS at the SGP Central Facility near Lamont, Oklahoma.

Recent changes (in FY2005) to the AOS include (1) moving the pumps to a shelter outside the Aerosol Trailer, (2) upgrading the light absorption measurement to three wavelengths, and (3) adding a humidified tandem differential mobility analyzer (HTDMA) system for size distribution and aerosol hygroscopic growth information. Figure 2 shows the HTDMA system in operation at the SGP Central Facility.


**Figure 1**. The Aerosol Trailer at the SGP Central Facility.

**Figure 2**. The HTDMA system that was installed in the SGP Aerosol Trailer in 2005.

### Planned Upgrades

A cloud condensation nucleus (CCN) instrument has been approved and will be added to the AOS in FY2006. A major AOS repackaging to optimize the system for thermal insulation, particle loss considerations, data acquisition, remote access/monitoring, and future expansion, will, pending approval, occur in FY2007.

## Atmospheric Radiation Measurement Program Mobile Facility Aerosol Observing Station

### Instrument and Measurement Status

All instruments are working well and no recent problems have been reported. Aerosol scattering, absorption, aerosol hygroscopic growth, total particle number concentration, and CCN concentration measurements are being conducted. One issue is corrosion, presumably from the exposure at Point Reyes and/or the transit to Niger. Some components will have to be replaced before the next deployment. Figure 3 shows the AMF during its deployment at Point Reyes, California. Figure 4 shows the AOS instruments and rack system inside the AMF Aerosol Trailer.

**Figure 3**. Trailers of the ARM Mobile Facility deployed at Point Reyes, California, in 2005. The Aerosol Trailer and aerosol sampling stack are visible at the right side of the photograph.

**Figure 4**. The AOS instrument and rack system inside the Aerosol Trailer at Point Reyes.

The only recent change to the AMF AOS was a dilution drier system installed to keep sample relative humidity low in high relative humidity conditions and to minimize dust clogging instruments and lines during dust events.

### Planned Upgrades

Although routine maintenance and expenditures for replacement parts and expendable supplies will continue, upgrades to the AMF AOS are not planned at this time.

## North Slope of Alaska Aerosol Observing Station

### Instrument and Measurement Status

The NSA AOS is located inside the National Oceanic and Atmospheric Administration (NOAA)/Earth System Research Laboratory Baseline Observatory at Point Barrow, which is adjacent to the ARM NSA site. Figure 5 shows the NOAA Observatory at Barrow, Alaska. The 10-m high aerosol sampling stack is visible on the left side of the building.

Currently, all instruments are working well. A recent problem with an analog-to-digital board was solved by replacing the board. Aerosol scattering, absorption, total particle number concentration, and filter chemistry measurements are being conducted.

**Figure 5**. The NOAA Baseline Observatory at Barrow, Alaska. The NSA AOS is housed inside this facility.

### Planned Upgrades

A major NOAA-funded upgrade to the NSA AOS will occur in summer 2006. Changes include a repackaging of the aerosol rack system, the addition of a CCN instrument, the replacement of the particle/soot absorption photometer light absorption instrument with a new three wavelength model, and potentially adding a second sampler for enhanced filter chemistry measurements.

## In-situ Aerosol Profiling Aerosol Observing Station

A major upgrade was recently performed (in late 2005 and early 2006) in the IAP program. The Cessna 172, which had performed well for the six-year period of 2000-2005, was retired, and a larger Cessna Turbo 206 (see Figure 6) aircraft was acquired. All components of the IAP AOS have been moved onto this new platform. The larger payload has permitted an improved measurement of aerosol hygroscopic growth, and flask sampling has increased from 2 to 12 flasks per flight. Figure 7 shows the new four-nephelometer Aerosol Optics rack, which permits an improved measurement of the aerosol scattering hygroscopic growth factor.

All instruments are currently working well. No recent problems reported. Aerosol scattering, absorption, aerosol hygroscopic growth, and trace gas sampling are being conducted.


**Figure 6**. The new IAP Cessna Turbo 206 aircraft.

**Figure 7**. The IAP Aerosol Optics rack for improved aerosol hygroscopic growth measurements.

### Planned Upgrades

The particle/soot absorption photometer light absorption instrument will be replaced with a smaller redesigned unit later this year. The installation of the remainder of the trace gas sampling and analysis equipment funded through the DOE Carbon Program will be installed in May 2006.

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