ASP VOCALS

Chief Scientist- Peter Daum
Brookhaven National Lab
631-344-7283
phdaum@bnl.gov

Deployment- One Month in the field between October 1 and December 1, 2008.

Flight hours- Between 60 and 70 research hours depending on budget.

DOE G-1 Aircraft

G-1 Specifications

Maximum gross weight	36,000 lb
Maximum operating altitude	30,000 ft Nominal
Cruise speed:	(80 - 200 m s-1)
Endurance with maximum fuel	6 hours
Crew capacity	2 pilots and 2 to 4 scientists
Cabin dimensions:	21 ft long; 7 ft wide; 6 ft high
Electrical power:	4,000 V-A at 115 VAC 60 Hz; 4,000 V-A at 230 VAC 60 Hz; 28 VDC

G-1 Standard Instruments

Parameter	Instrument
Temperature	Rosemount 102U2U/510BF Pt resistance
Dewpoint	General Eastern 1011B Cooled mirror
Pressure	Rosemount 1201F1
Vector winds	PNL Gust Probe Differential pressure/GPS
UV radiation, up- and down	Eppley Radiometer 295-385 nm
Short-wave, up- and down	Eppley Pyranometer 285-2800 nm
Long-wave irradiance, up- and down	Eppley PIR Pyrgeometer 4-50 µm

VOCALS Payload- Aerosol and Cloud Microphysics

Parameter	Instrument	Source
Aerosol Size distribution 0.1 – 3 μm	PCASP	PNNL
Aerosol size distribution 30 – 120 nm	FIMS	BNL
Aerosol concentration d> 10 nm	TSI 3010	PNNL
Aerosol concentration d> 3 nm	TSI 3025	PNNL
Cloud droplet and drizzle size distribution	DMT CAPS	BNL
Cloud liquid water content	Gerber Probe/CAPS	PNNL/BNL

VOCALS Payload- Aerosol Properties

Parameter	Instrument	Source
Aerosol composition- soluble inorganic and organic species	PILS	BNL
Aerosol composition	Aerodyne ToF-AMS (high resolution)	BNL/PNNL
CCN	DRI spectrometer or 4 x DMT CCN	Hudson/DRI Wang/BNL
Aerosol extinction and backscatter	TSI 3λ Integrating Nepehlometer	PNNL
Aerosol absorption	Photoacoustic or Photothermal	BNL or DRI

VOCALS Payload- Trace gases

Parameter	Instrument	Source
O_3	Thermo Electron 49-100	BNL
CO	UV Fluorescence	BNL
SO_2	Thermo Electron 43S modified	BNL
DMS/Organics	PTRMS	PNNL
Peroxides	Scrubber/derivitization	SUNY/Old Westbury

Objectives

Overall objective is to examine how the chemical and microphysical properties of aerosols, and their ability to act as CCN differs between remote marine air-masses and marine air-masses that have been influenced by anthropogenic aerosols, and how these differences in aerosol loading and properties influence the microphysical properties of the clouds that form in these different environments.

Scientific Questions

1. Aerosol/CCN properties

What is the importance of various sources of aerosols and aerosol precursors to aerosols that function as CCN. DMS?, Sea-salt, anthropogenic SO2? How does the importance these various sources change with distance from the coast?

What are the relationship between aerosol size, composition and CCN activity? Are they different from those found in other programs

How does this relationship vary between remote marine aerosols and aerosols that have been influenced by anthropogenic sources?

Scientific Questions

1. Aerosol/CCN properties (cont'd)

   What is the flux of DMS from the ocean surface and how does it vary as a function of ambient conditions? Are variations in DMS fluxes/concentrations correlated with the presence of DMS oxidation products in aerosols.

2. Aerosol properties and cloud microphysics

What are the effects of aerosol loading, size distribution, and composition on the microphysical properties of the clouds. Is the relationship between aerosol loading and droplet number concentration linear?

Is the spectral dispersion of the droplet size distribution a function of aerosol loading and/or aerosol composition? Is the spectral dispersion of remote marine clouds smaller than those that have been influenced by anthropogenic aerosols?

What effect does turbulence have on the fraction of aerosol particles that are activated to form cloud droplets?

3. Aerosols, cloud microphysics and drizzle

Are gradients in cloud droplet microphysics consistent with gradients in drizzle concentration? Are these gradients in microphysics associated with secular trends in aerosol loading?

Is turbulence associated with regions of drizzle?

Do newly developed parameterizations for the drizzle threshold and rate functions hold over the range of cloud properties observed over the NE Pacific?

Flight Plans

Basic flight strategy

1. Below cloud leg(s) to measure aerosol composition, size distribution, CCN spectra, vertical velocities and their variability.

2. Multiple altitude in-cloud legs to measure measure cloud microphysical properties and their variability both with respect to location and altitude.

3. Above cloud leg to characterize chemical and microphysical properties of above cloud air.

Such flights will be conducted between two navigational points about 100 km apart. Fly between these points at multiple altitudes starting with a below cloud leg, and ending with an above cloud leg. If 3 altitudes in cloud, then could fly pattern as far as 500 km offshore. Transit to pattern location could be be below-cloud; in cloud; above cloud, or some combination depending on objectives.

Other Fight Patterns

1. Extensive below cloud flights to examine aerosol size/composition/CCN relationships. As possible, such flights would be conducted in both remote regions, and in regions where aerosols have been influence by anthropogenic sources.

2. C-130 joint flights to relate aerosol/CCN/cloud microphysical properties measured in-cloud by the G-1 to cloud radiative and dynamical properties measured above cloud by the C-130.

3. As possible flights over the Ron Brown to link in-cloud measurements by the G-1 to in-situ and remotely sensed cloud properties measured on the Ron Brown.