Protocol and Flight Plans

Protocol for each flight:

- Afternoon before the flight (~3PM):
  a. Determine next day's meteorology
  b. Decide on preliminary flight plan and discuss with pilots and other investigators

- Morning of the flight (7AM)
  - A. re-evaluate forecast, state of aircraft, finalize flight plan with pilots and other investigators.
  - Mid-morning (11AM) or early-afternoon (1PM): departure on that day's flight.

Within 4 hours after the return of each flight, chief scientist needs to have time series of at least the following measurements. Chief Scientist will describe and discuss these results with other investigators. All time series must have decimal time stamped (UTC) consistent with SEA 300 data acquisition system (check with John Hubbe for how to access):

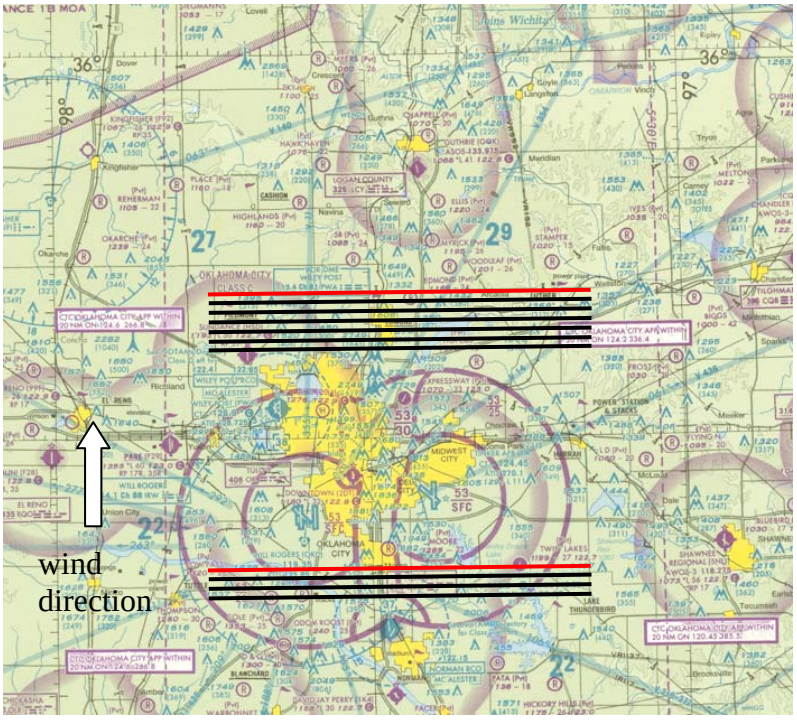
1. Altitude
2. potential temperature, equivalent potential temperature
3. Total water (liquid + vapor).
4. sulfate and organic loading from AMS
5. Scattering and aerosol absorption (from both CVI and Isokinetic inlets)
6. CO, SO2.
7. Aerosol number density.

G-1 Flight Plans:

> **Note:** We use the standard meteorological nomenclature in which wind from the north ('northerly') has a direction of 360º, easterly flow is associated with 90º, southerly flow with 180º and westerly flow from 270º. Calm conditions have a "direction" of 0º.

Stack Pattern 1. The motivation for this flight is to test instruments and to evaluate characteristic values of key measurements at different heights in both clear air and in the presence of clouds. This will be one of the first flights to be done during the campaign.

We would like to fly one stack of four (4) horizontal flight legs approximately 11 nm upwind of Will Rogers World Airport, followed by a single stack of 6 horizontal flight legs approximately



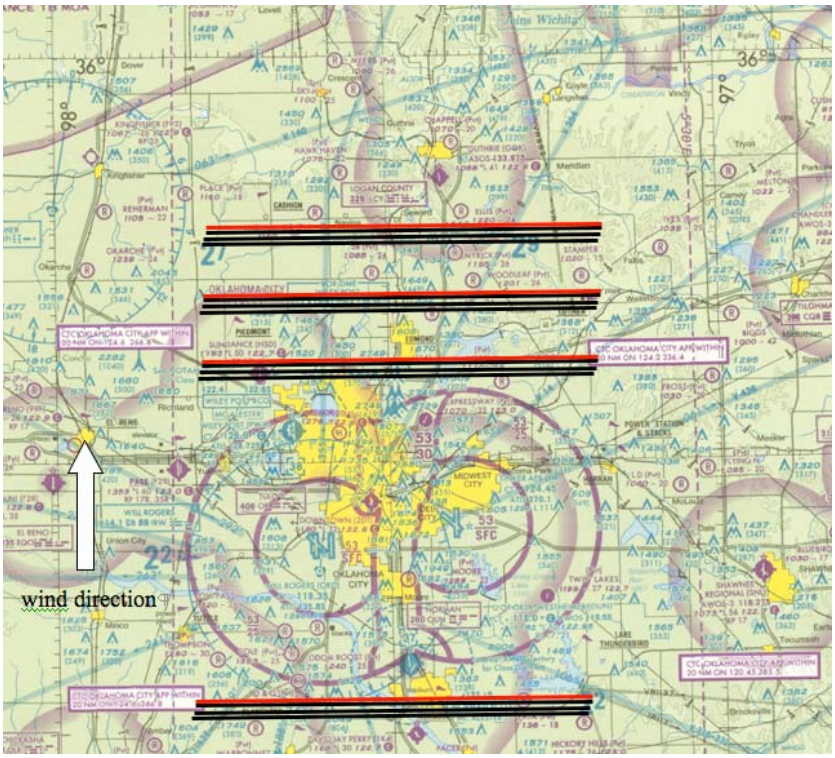
11 nm downwind of this airport. Each leg will be approximately 27 nm long.

The legs in the upwind stack will consist of 1) one transect below cloud base, 2) a transect within the cloud layer (with the AMS sampling with the CVI inlet), 3) a second identical transect within the cloud layer (with the AMS sampling with the isokinetic inlet), and 4) one transect above cloud top.

The legs in the downwind stack will consist of transects made at 1) 1500 ft AGL, 2) cloud base, 3) within cloud with the AMS sampling through isokinetic inlet, 4) within cloud with the AMS sampling through CVI inlet, 5) higher altitude within cloud with AMS sampling through CVI inlet [this leg will likely be above some cloud tops], and 6) free atmosphere.

Although we have drawn the pattern using a reference wind from the south we would like the option to rotate it to match the drift of the plume from Oklahoma City on a given day.

Stack Pattern 2. Basic OKC Flight Plan. The motivation for this flight is to characterize aerosols in regional and dirty air, below and within clouds. This is the primary flight pattern for the campaign.



This flight plan consists of one stack of three horizontal flight legs flown upwind of Oklahoma City, and a set of two or three stacks of three horizontal flight legs flown downwind of Oklahoma City. Each leg will be approximately 27 nm long. We would like to fly the first downwind stack 11 nm downwind of the Will Rogers World Airport, and fly each subsequent stack 5 to 15 nm downwind of the previous stack. The upwind stack of flight legs will be flown approximately 11 nm upwind of the Will Rogers World Airport. The pattern may be repeated, with another upwind and two or three downwind stacks.

On **cloud-free** days the 'stacks' will consist of one transect within the boundary layer, and a second transect above the boundary layer, with the remaining G-1 flight time used to make additional downwind stacks (each stack having a mid-boundary layer and above-boundary layer transect). These flights, on cloud-free days, will define control cases with which to identify the role of clouds in transporting material through the top of the mixed layer.

The King Air will perform a series of coincident level legs transects above (~29,000 ft AGL) the locations of the G-1 transects to map out the aerosol and cloud distributions at various distances downwind of Oklahoma City. These transects, like the G-1 transects, will be oriented perpendicular to the mean flow (at 850 mb) and the Oklahoma City plume. The King Air transects will be slightly longer than G-1 transects in order to locate and sample the entire horizontal width of the plume as well as regions outside of the plume. While traveling en route to the anticipated location of the coordinated G-1 pattern, the King Air will perform a "zig-zag" pattern oriented roughly perpendicular to the expected location of the Oklahoma City plume. This pattern is designed to help define the exact location of the plume and to direct the G-1 to the optimal position to sample the plume.

We have drawn the pattern using a reference wind from the south but would like the option to rotate it to match the drift of the plume from Oklahoma City on a given day.

Cloud Sampling Flight Plan: This is a generic flight plan to allow cloud sampling within a wide region centered around Ponca City. It would consist of a flight along a radial from Ponca City to cloudy regions identified from satellite pictures. As we approach region, we would request that the G-1 descend and start an upward climb to allow the scientist/pilots to identify the height of cloud base and cloud top. At the specified distance, a set of four transects would be made, each on top of the other.

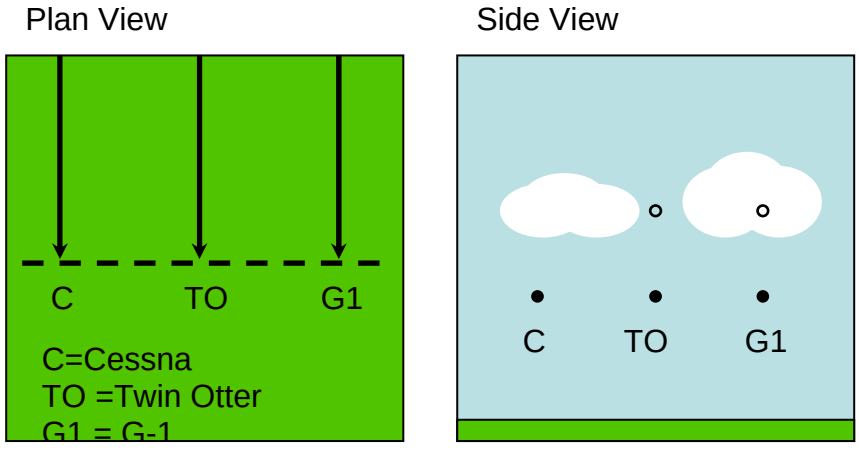
1. A low: transect at cloud base
2. A medium altitude : transect, half way between cloud top and cloud base during which our AMS would sample through the isokinetic inlet
3. A second medium altitude: transect half way between cloud top and cloud base during which our AMS would sample through the CVI inlet. And
4. A transect at cloud top

A repeat of these transects would be done, and the G-1 would then return to Ponca City.

The King Air will perform a series of coincident level legs transects above (~29,000 ft AGL) the locations of the G-1 transects

ER-2/A-Train Underflights. This flight pattern will require coordination with the ER-2 or with the overpass of the NASA A-Train satellites. The pattern would consist of a ferry flight, up to 60 nm from Ponca City, and two sets of three flight legs: one above, one or two legs within (both flown at the same altitude, one with AMS on standard inlet, one with AMS on CVI inlet), and one below the clouds. The BE-200 would fly at a single altitude (between 25,000 and 28,000 ft) over the G-1. This pattern will be coordinated with the Vance MOA if required.

Instrument Intercomparison. This pattern will involve the G-1, CIRPAS Twin Otter, and the Cessna Turbo 206. The aircraft will fly in formation at the same altitude (approximately



1500 ft AGL), but separated by a distance to be determined by the pilots in the horizontal, as indicated in the plan view and side view shown in the figure. The departure of the aircraft from Ponca City will be staggered so that the faster aircraft overtake the slower aircraft at nearly the same geographic location (this line is indicated by the broken line in the figure). The aircraft will continue for several minutes (also to be determined in consultation between the scientists and the flight crews) before turning to return to Ponca City. After turning, the Twin Otter and the G-1 will climb and fly within the clouds, again the G-1 will pass the Twin Otter. Several minutes (the exact values will be determined with consultation between the scientists and the flight crews) after passing the Twin Otter, both aircraft will then return to Ponca City. The geographic location of this fight will be determined in consultation with the flight crews.

(The Be-200 King Air will probably not participate in this intercomparison because of the different nature of the instruments on this aircraft relative to those of the Twin Otter and G-1).