DICE Flight Report: June 3, 2003

Flight Type: Eureka/Trinidad Head (TH)

Flight Objectives:

1. Continue instrument, plumbing, software, communications checkout
2. Perform sounding and multiple passes by NOAA ground station at Trinidad Head
3. Perform level runs over Central Valley for instrument intercomparisons
4. Perform profile over Edwards and passes by Eddy Tower ground station

Flight Plan (UT)

15:58 Taxi
16:09 Takeoff
16:41 Level at 35 kft doing LRR maneuvers
21:20 Begin spiral descent over ocean
21:51 End descent at TH
21:51:10 – 22:05:00 TH Flyby #1
22:11:40 – 22:13:00 TH Flyby #2
22:13:00 – 22:17:20 Climb to 11.0 kft
22:17 – 22:37 Level at 11.0 kft over Central Valley
22:40 – 23:03 Level at 8.0 kft over Central Valley
23:10 – 23:39 Level at 1.0 kft AGL over Central Valley
23:39 – 23:46 Ramp profile up to 18 kft near Bakersfield
23:58 – 24:14 Spiral profile down over Edwards AFB
24:19:30 – 24:23:46 Eddy Tower Flyby #1
24:37:16 – 24:41:30 Eddy Tower Flyby #2
24:47 Land

Participating DICE Groups: Langley In Situ, Langley Lidar, PILS, Hawaii, UNH

Report

The skies over Edwards were clear and cloudless and the temperature ~83 F at takeoff. Winds were from the SW at 5m/s. Haze was evident throughout the valley, though the winds were not strong enough to mobilize surface dust.

We took off at ~9am local and flew northwest over the California Central Valley (fruit basket of America) enroute to Eureka where LRR wanted to make a series of passes over a ground-based transmitter for calibration purposes. We noted that a fairly thick haze enveloped the mountains below us though aerosol concentrations and scattering characteristics indicated the air at our flight level (35 kft) was fairly clean.

During the climb out, it became apparent that the serial interface on the APS unit in the Hawaii rack had come apart so it had to be repaired and the APS/neph data system restarted about 20 minutes into the flight. Everything else appeared to be operating normally.

LRR maneuvers occupied the first five hours of the flight and kept us at 35 kft altitude where there were few aerosols of interest. During that time, we analyzed data, played with instruments, and ate lots of junk food. At 2120 UT, LRR turned the plane over to us and we began a spiral profile over Trinidad Head (see Figure 1). Offshore, whitecaps were evident on the ocean below and, judging from windstreaks, the wind was coming from the northwest; the Coast Guard reported the near-shore winds to be from 190 at 6 m/s. DC-8 winds were from 350 at ~10 m/s when we reached the surface, but were somewhat variable depending on our position relative to shore. Sea salt aerosols were highly evident below a strong inversion that capped the MBL at 4 kft.

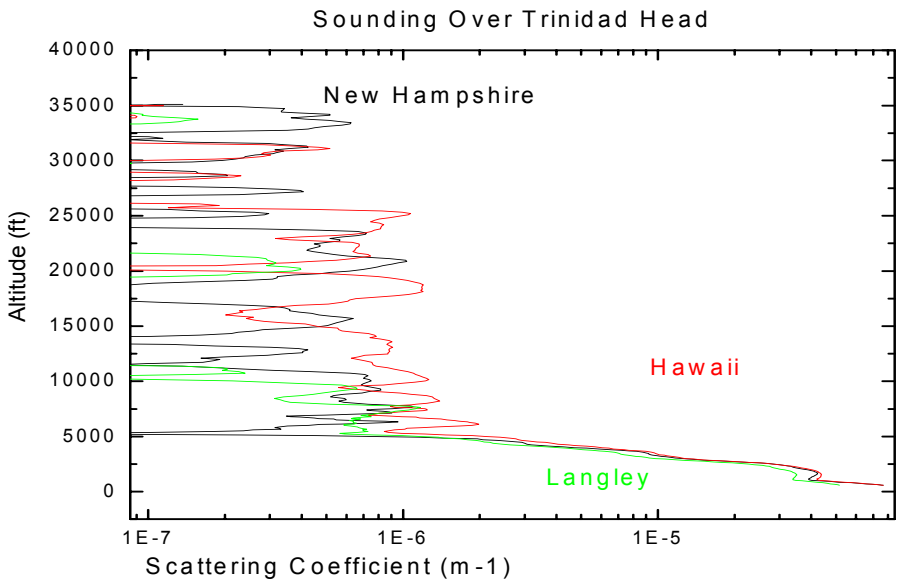

Figure 1. Nephelometer data from the vertical sounding over Trinidad Head.

On reaching 500' altitude, we set up a race track oriented along the wind vector and flew two counter clockwise loops by the NOAA station then broke off to fly a pass over the Arcata airport for a photo-op. We extended the airport approach out over the ocean, dropped down to 500' and made another pass by Trinidad Head before climbing to 11 kft to head back home.

During this and previous missions and based on APS and neph observations, we'd noted that the LaRC inlet seemed very inefficient at passing large particles. To resolve whether this was instrument or inlet related, we cross-plumbed the LaRC and UH racks so that the UH instrument complement could, if the proper valves were set, sample air from the LaRC inlet and visa versa. At the end of the last TH pass, we opened the valves between

the two racks and switched sampling instruments. Figure 2 shows aerosol scattering measurements recorded during this sampling sequence verifying there is indeed a problem with the LaRC inlet.

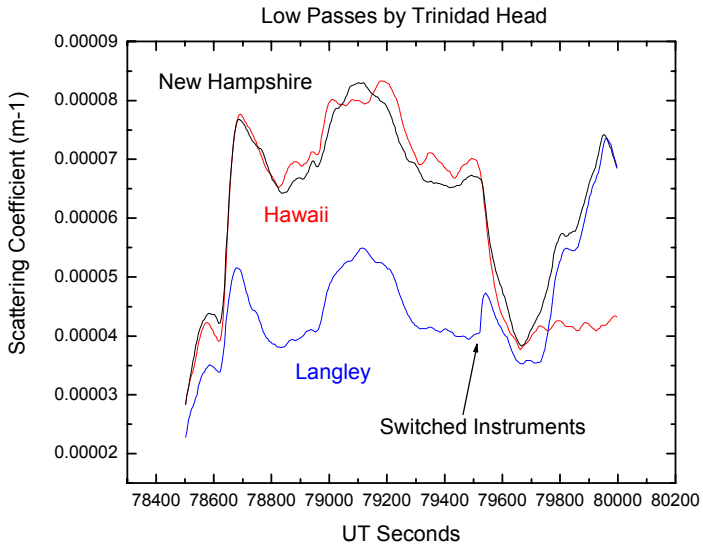

Figure 2. Nephelometer data recorded during the low passes by Trinidad Head. After ~79500 seconds, the sample flow switching valves were set to divert flow from the Langley inlet to the Hawaii instruments and visa versa.

The flight from TH took us back through the Central Valley where we flew level legs at 7 and 1 kft. Visibility was poor and our instruments indicated high loadings of both accumulation and coarse mode particles. Nitrate and sulfate aerosol concentrations were high, probably due to the high level of farming activity in the area.

We ended the mission by making a spiral profile over Edwards and two 160' passes by the ground station. Winds were from 250 at 10 to 15 m/s at when we entered the complex so there was significant coarse particle loading that should help us further evaluate the passing efficiencies of our inlets.

Post mortem:

Wednesday was spent making further refinements and characterization measurements of our systems. Hawaii's work indicated that they had been sampling 20% sub-isokinetically when they thought they were isokinetic. This could explain the large pressure differences in the inlets that were noted in the previous flight. Langley re-calibrated their flow meters and cleaned their inlet tip. No obvious reason was discovered to explain the poor transmission efficiency of the inlet to large particles, though much time was spent in speculation.