AAFEX-II Status Report #3 – 23 March 2011

Primary Activities: Continue instrument setup; perform calibrations; install rakes and probes; string sample and dilution lines;

Weather: 39 F at 0700, partly cloudy with relatively light southerly winds. Temperatures near 60 F by midday w/broken clouds. Intermittent showers after 1530, with fresh winds from the south.

Summary: After a hearty breakfast featuring omelets, waffles, and biscuits w/gravy, participants departed the Embassy Suites and were on site, hard at work by 0730. Progress was unimpeded by security hassles, diversionary training classes and, for most of the day, bad weather. Here are a few highlights of the workday:

- Lack of power was the primary complaint of ARI/NASA downstream trailer dwellers Monday and Tuesday. After scoping the problem Tuesday afternoon, facility electrician Ted revisited the site around 1000 and attempted to connect the unwieldy trailer power cord into the 3-phase ground power box. Ends of the cable were corroded and stiff making Ted's job very difficult. Just as he was considering other options, Donnie came by and used his super-human strength to wrestle the cable through the box cutouts and onto the proper terminal blocks. Rick of the downstream samplin' team was particularly appreciative of Donnie's contributions and thought his efforts deserved special recognition.
- Acting on concern that one tank truck would be insufficient to supply community needs for the experiment duration, Bruce ordered two, 72-bottle platforms of N2 gas for a Monday delivery. He later calculated that at an estimated consumption rate of 300 liters/minute, the 45,000 cubic foot tank trailer would last for >100 hours, which is 3-times longer than the planned engine run time. So it goes.
- Steve and Brian (Figure 1) worked steadily on connecting the aerosol sample inlets to valve box located in the rear of the MST trailer. They also plumbed the nitrogen dilution lines, leak checked all fittings, and test-fired the pneumatic valves in the 6-port valve boxes and sample selection box. Spirits were high within the MST group as they felt they were ahead of schedule in preparing for the initial engine runs on Saturday.
- Veterans of many engine emission experiments, Chris and the AFRL group are also well along in their preparations as they have plumbed, leak-checked and drawn flow through both their particle and gas sampling systems. Edwin and Matt arrive Thursday, so the team will be at full force on Friday.
- The hardworking AESO team continued their march toward mission readiness by anchoring sampling lines and cables to the pad (Figure 2), running dilution lines and calibrating instruments. Xu, Triet and the group have completed calibrations and are ready for the line-loss and instrument comparison studies that will be conducted on Thursday and Friday.
- Robert and the AEDC crew of Brad, Roy, Gary, and Steve worked steadily on the monumental task of installing the 1-m rakes and stands. Parts needed to attach the AESO hook probe to the #2 engine stand arrived via FEDEX from AEDC, but did not mate properly

to the pre-existing threaded holes in the traversing table. The team met with Ron Wilcox and a DAOF machinist and discussed several work-arounds, one of which will be implemented on Thursday. Despite this snag, good overall progress was made in getting the rakes populated and plumbed (Figure 3).

- Rick and the Aerodyne crew made progress on several fronts. Mike and Zhenhong successfully integrated the C-TOF-AMS into the LaRC van, helped get it and NASA instrument suite plumbed to the common sampling manifold, began pumping down the AMS to prepare for taking data, then pitched in to help address E-31 and downstream-trailer issues. Eben completed plumbing the 150-m instruments, but ran into a snag when a turbo pump on his TOF-MS failed. A new pump should arrive on Thursday. Rick and Jon worked in the ARI mobile laboratory, positioning instruments and performing calibrations. Scott and Berk arrive Thursday and the team will begin integrating additional instruments into the NASA van and conducting calibrations.
- The LaRC group of Andreas, Eddie, Luke, and Bruce also made progress in mission preparation. Eddie completed connecting sample lines and signal cables to all the instruments in the EM-50 van. Andreas and Luke helped install the ARI AMS and NASA instruments in the van, then completed setting up instruments in the 150-m trailer and calibrated the CO2 and SO2 instruments placed at that location. Bruce helped plumb the N2 supply then did a lot of kibitzing and photo-taking. Moreover the team is well on-course for Saturday engine runs.
- Dave and John made steady progress in setting up the E-31 sampling system and instrument kit. The prototype sample distribution system was mounted on the trailer wall (Figure 4) and leak checked; the “Reference”, “E-31”, and “Annex-16” lines were run over to the #2 engine rake stand (Figure 5); the heated sample dilution box was placed near the test stand and plumbed; and available instruments were installed and calibrations initiated. Next up: further instrument installation and line-loss tests.
- Dave and Bruce cogitated over line-loss assessment methods and after consulting with Professor Hagan and Max, came up with the following approach. Monodisperse NaCl particles will be generated with a tube furnace and DMA set-up located inside the MST trailer; DMA output will be blow out through clean tubing to the upstream ends of the various articles (i.e., 1-m sample lines, E-31 lines, etc.) using a mini-eductor. Identical CPCs and pressure transducers will be placed at the up- and downstream ends of the test articles and data will be gathered as particle sizes are varied from 10 to 200 nm. To ensure that differences between the up and downstream measurement locations are due to wall losses not differences in instrument performance, the tests will be repeated after switching locations of the CPCs. Once this plan was agreed upon, the team went about setting up the equipment in preparation for tests to begin Thursday morning.

<u>Major tasks for Thursday</u>

- Arrival and set up of Changlie’s instruments in the AEDC trailer

- Arrival and set up of Berk's GC/MS in the LaRC van
- Line loss tests
- Instrument inter-comparisons (CO2, CPCs, SMPS)
- Readiness review meeting

Figure 1. MST Bruise-brothers Brian and Steve install sampling lines as Robert looks on.

Figure 2. Triet anchors samples lines between the AESO hook inlet probe and DB2.0 to the concrete pad.

Figure 3. Gary, Brad and the Abominable Snowman (Steve) endure rapidly changing weather conditions to mount the #2 engine sampling rake.

Figure 4. John and Dave make progress on setting up the ARP prototype sampling system in the now comfortably heated E-31 trailer.

Figure 5. That's right, John. Righty-tighty, lefty-loosey.