

AAFEX Status Report #8 – 27 January 2009

Primary Activities: Plumbing changes; JP-8 exhaust characterization run #1—warm phase; preparation for Wednesday's early morning test; data analysis.

Weather: 30 F at 7 am, dry with mostly clear skies and slight northerly winds, switching to ENE in the afternoon with gusts to 10 mph. Temperatures warmed to near 50 F in the afternoon, then cooled to < 40 F after sunset.

Brief summaries of the days many activities:

- Robert and the AEDC crew fixed several plumbing leaks, replaced a section burned-out heated line, and moved the AFRL gas sampling lines to two unused particle probes located more toward the center of the #3 engine, all before noon (Figure 1).
- Anuj continued to analyze data from Monday's instrument intercomparison tests. Results showed that transmission line losses caused significant differences in measurements recorded at different sample locations (Figure 2).
- The 30-m box withstood engine blast during Monday's shakedown and mapping tests and its inside temperature did not exceed 100 F at any power setting. This emboldened Dave to install an EEPS, CNC and CO₂ sensor within the enclosure for the JP-8 exhaust experiment (Figures 3 and 4).
- The first JP-8 exhaust characterization test was conducted between 1 and 4 pm. All instruments worked well; the AFRL gas sampling probes were adequately centered in the core exhaust; and N₂ consumption, though high, was reduced from the previous run. Although the winds were mostly from the NE, we were able to obtain data at all power settings up to 100% of full thrust. High rates of particle nucleation were seen in the 30-m samples, even at high engine powers. Measurements recorded in the 30 m box (Figure 5) suggest that line chemistry may not be as significant a factor in promoting particle nucleation as once thought—but more analysis is needed to decide for sure. Samples drawn from the 1-m rake tips showed periodic nucleation events (Figure 6), which is something never before seen in near-field samples diluted 10-fold with dry nitrogen; the source of this effect is under investigation. Plume hits were seen in the downwind trailers during the higher thrust runs; LaRC reported seeing sulfate levels of 9 ppb at times which were well-correlated with CO₂ variations. These data will allow us to calculate the fraction of fuel-sulfur oxidized to sulfuric acid in the near-field plume.
- The second JP-8 run is scheduled for 5:30 am, Wednesday morning.



Figure 1. AEDC/MST crew finalizes changes in the 1-m sampling system.

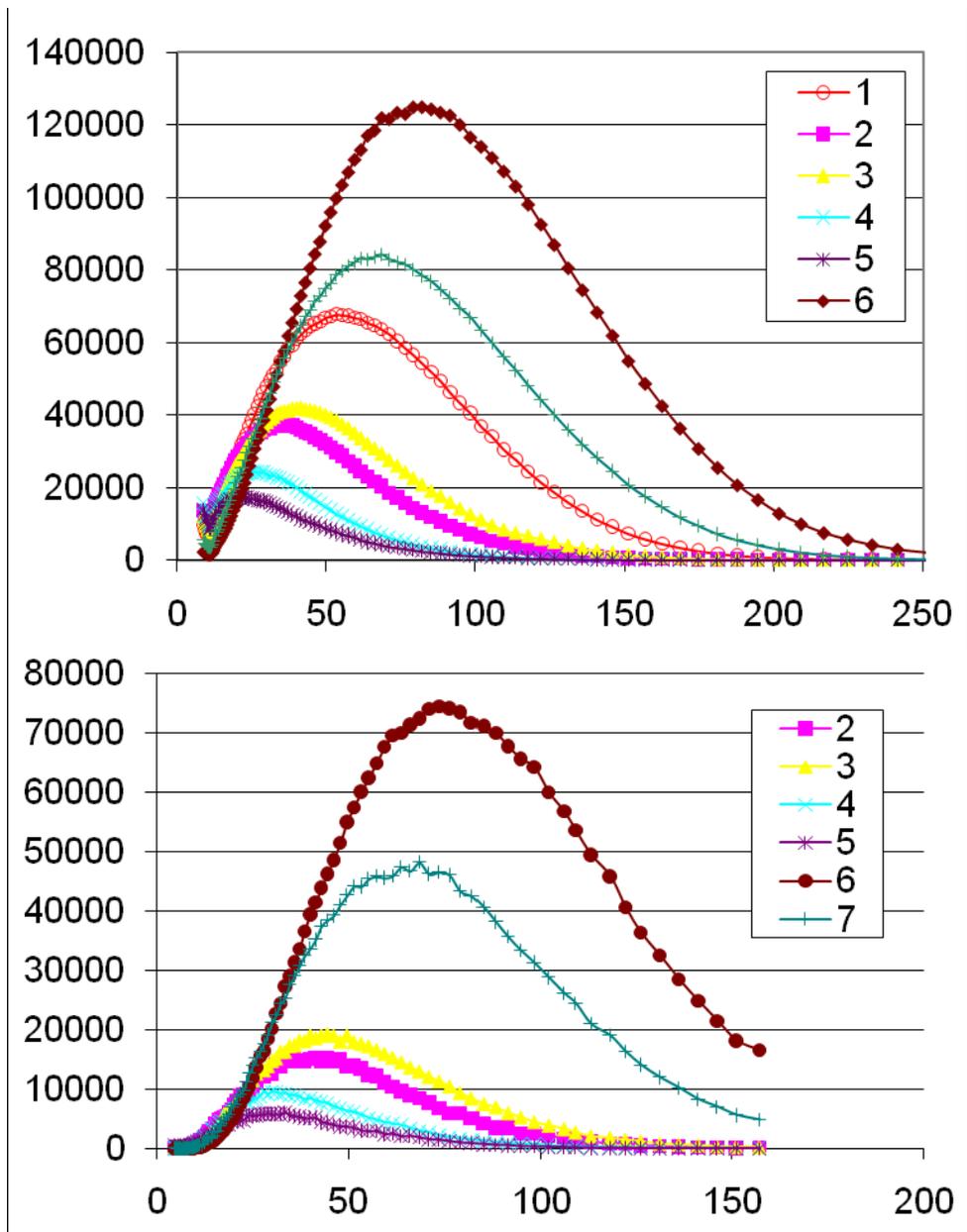


Figure 2. Results from the CAST, instrument inter-comparison tests: a comparison of size distributions recorded with essentially identical instruments sampling through different lengths/diameters of sampling tube. Without accurate corrections, these differences will be reflected in calculated emission parameters.



Figure 3. Departing from his usual modus operandi, John works while others look on.



Figure 4. Dave settles into the 30-m box in preparation for riding out the JP-8 emission characterization run.

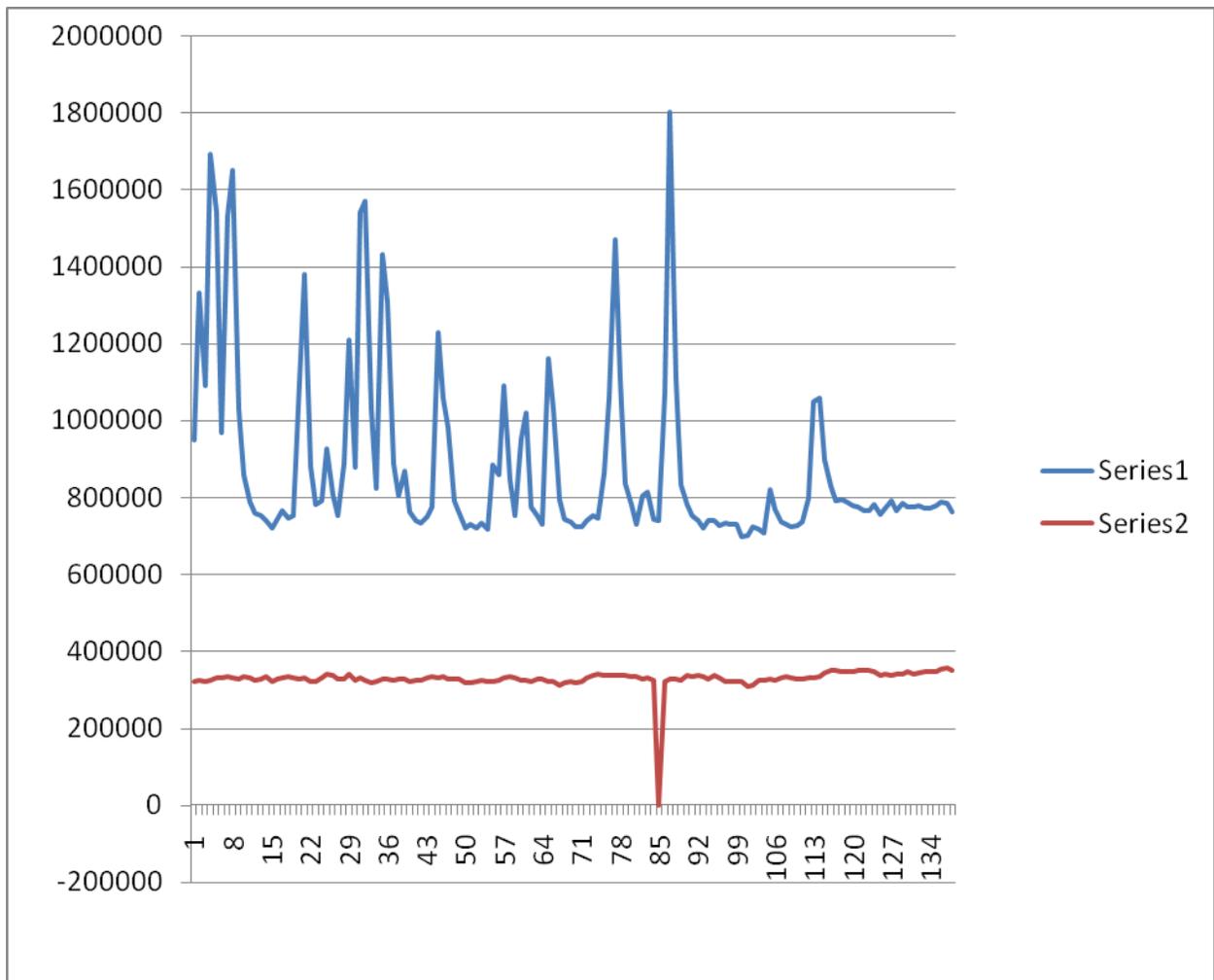


Figure 6. Time series of from particle counters without (blue) and with thermal denuders (red) on their inlets; these were recorded on 10-fold diluted samples drawn from the #3 engine rake at 45% engine power. The spikes on the top trace correspond to nucleation events occurring somewhere within the sampling system—the team is working to chase down the source of this error.