

AAFEX-II Status Report #11 – 01 April 2011

Primary Activities: Repeat JP-8 characterization; compare AAFEX and E-31 measurements on left engine; complete line loss study; disassemble test apparatus

Weather: Sunny and clear all day; 48 F at 0730 warming to 84 F at 1400. Winds very calm in the morning, then picking up with a slight northerly direction around noon.

Summary: Participants came in a bit later, as Test Run 11 was scheduled to start at 10:00 am. Designed to obtain repeat JP-8 emissions data and facilitate more direct comparisons of the AAFEX and E-31 measurements (Figure 1) on the left engine, the plan included more than 60 test points and required about 4 hours of engine run time to complete. To avoid hazardous waste disposal fees and test E-31 measurement precision at lower PM concentrations, the uncertified HRJ/JP-8 blend was to be burned in both engines during the initial third of the test.

Because of various minor problems, engines were not on and stable until ~10:30. The E-31 group immediately noted unusually low PM emissions on the left engine probes; Changlie also observed similarly low CO₂ values on the rake. Upon examining the emissions at several different positions and finding extremely low combustion tracer concentrations, Robert suggested that, because of fuel burn, the engine height may have increased since the previous test causing the core flow to pass above the primary sampling probes. After engines were shutdown at 11:05 am, Robert measured the vent tube height as 74 inches, 6 inches above its nominal elevation. With Robert manning the tap measure (Figure 2), Joe bled air from the left strut to lower the engine down to its normal height.

Engines were re-started at 11:30 am and testing resumed. During the last set of points, the left rake was translated horizontally to position the E-31 inlet probe 2.2 inches left of center and the AAFEX probes 2.2 to the right. Both groups then recorded emissions data at 100, 85, 65, 30, 7 and 4% of maximum thrust. Initial comparisons suggest that the PM number measurements at several power settings are least in the same ballpark.

Because of extreme heat in the cockpit (104 F), several test points were eliminated and the engine-run portion of AAFEX-II was officially completed at 2:45 pm.

While line-loss tests and instrument calibrations continued through the evening, the DC-8 was pulled off to the southwest corner of the ramp (Figure 3) and participants began to disassemble the test apparatus (Figure 4).

All agreed that AAFEX-II was an unqualified success and cause for celebration (Figs. 5 and 6).

Agenda for April 2, 2011

- Conduct final calibrations
- Complete line-loss study
- Tear down, pack up, and depart



Figure 1. Dave and company can barely contain their excitement as they await engine start for the final test run, a large fraction of which is devoted to addressing E-31 objectives.



Figure 2. To better align engine exhaust core flow with sampling probes, Robert measures engine height while the ground-crew Joe bleeds nitrogen from the left strut.



Figure 3. The DC-8 enjoys a well-deserved sunbath after contributing 30 hours of unflinching engine run-time to the AAFEX-II mission.



Figure 4. Reminiscent of a scene from 2001: A Space Odyssey, participants are mysteriously drawn to the monolithic right-engine sampling rake after it is unveiled from the DC-8's wing shadow.



Figure 5. AEDC, Aerodyne and NASA team members gather for an end-of-mission celebration at Speedy Joe's Fine Dining Establishment in Palmdale, where 6 pitchers of beer and 15 dinner entree items (plus tax and tip) cost the revelers a whopping \$18 each.

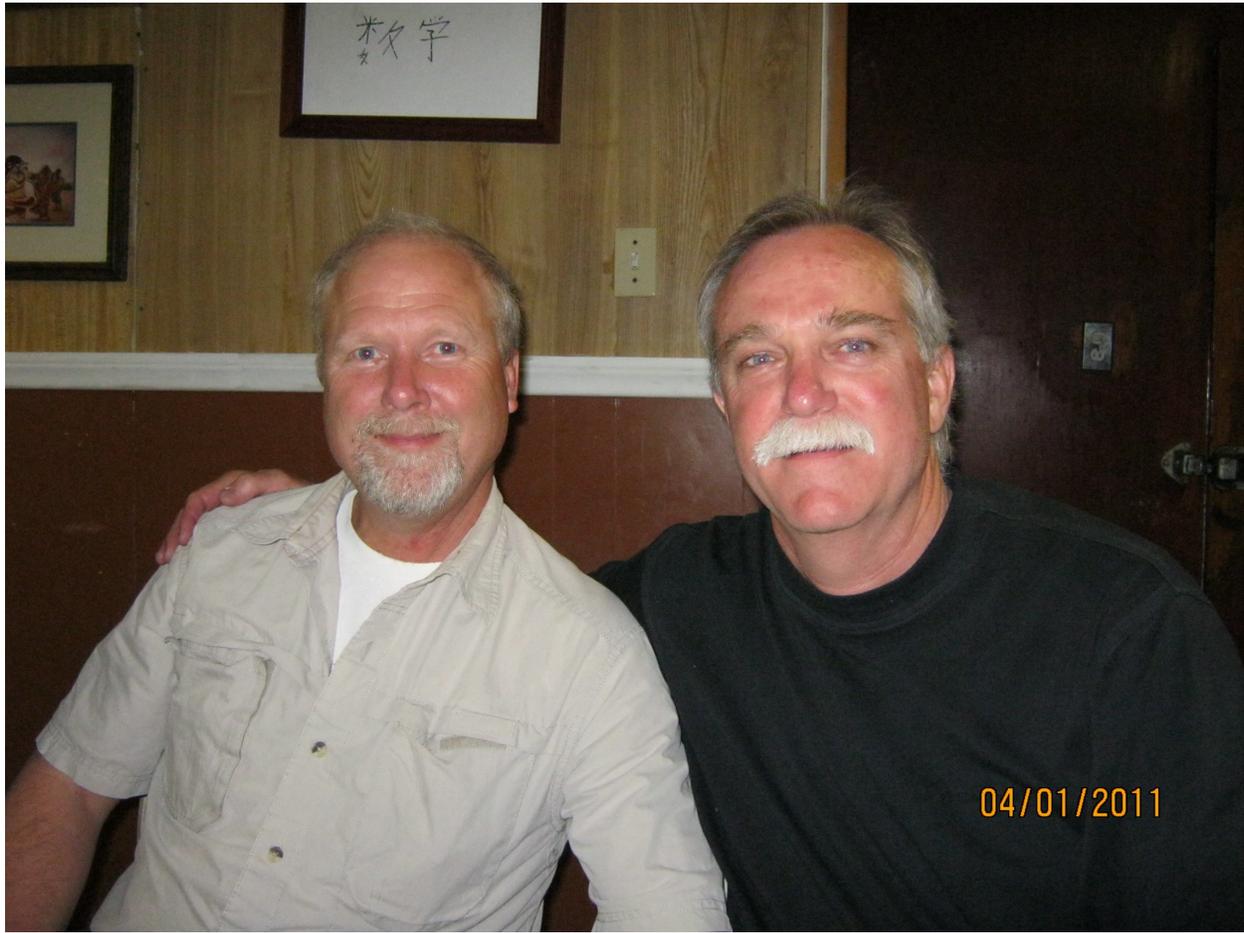


Figure 6. Fellow Montana State alumni and fly-fishing enthusiasts Berk and Bruce celebrate AAFEX-II success and 34 years of friendship.