Preliminary Squawk List for Flight 1844, flown on Friday, 13 Dec 2000, 2110 to 2310 UTC

Project IMPROVE test flight

(Instruments not mentioned as having a problem are believed to have worked satisfactorily)

FLIGHT CONDITIONS

Flight over the coastal waters of Washington State just west of Neah Bay in Warning Area 237 A. Localized overcast stratocumulus with varying base heights embedded in post-frontal very cold northwest flow sampled via one each 100 m (300 feet) descent and ascent. Top temperature about –7° C, base about –3° C. A few ice crystals were encountered, but it was mainly precipitation free. No precip seen reaching the ground in possible "haze-like" virga below cloud. Overcast cirrostratus above the stratocumulus thickened to altostratus during the flight. Lowest ice particles from emanating from the higher layer estimated at *or above* 20, 000 feet ASL during flight, and therefore not practical to reach in the limited time available. Few targets, therefore, for the two imaging probes (2-DP and HVPS).

OVERALL ASSESSMENT

Disappointing overall due to:

- Catastrophic failure of alternator required shutdown of all power to back of plane just as we were nearing the top of stratocumulus deck following the only ascent from cloud base. This was the second such shutdown during the flight; the first having occurred enroute to the Warning Area. This required the power to the instruments to be shutdown at this point and no further measurements were made. (The problem has been taken care of as of this (Monday) a. m.)
- Unsettling prop-sync problem that caused a very noticeable, high frequency vibration that made Tom's laptop hard to read because of prop-out-of-sync induced "jitters" he told me. It was also unsettling back in the bubble where the "jitters" due to this problem were very noticeable on the metal ring that I hang on to while in the bubble. The prop sync problem was eliminated about 15 min into the flight (it began on take off and was eerily reminiscent of the last KWAJEX flight). However, the problem returned later in the flight last half hour or so) and seemed to have continued the rest of the way. Status or whether action is required unknown at this time.

- the FAA controller would not allow us to proceed through the non-warning area "slot" between the north and south warning areas located off the Washington and Oregon coasts. The slot extends west-southwestward from Hoquiam/Ocean Shores.
  This is a corridor that we have used on dozens of occasions in the late 1980s into the early '90s whilst doing cumulus studies (e.g., Brad Baker, Kevin Perry eras.) Thus, we were unable to fly to Warning Area 237-D, or even 237 B which is diagonal and southwest of the one we flew in as were *a priori* assigned to us.
- the minimal convection, precipitation and only moderate LWCs (<0.6 g m-3) did not allow as good a test of the cloud imaging probes as has been hoped,
- DMT still very noisy.
- 2-DP not working.

HIGHLIGHTS

- HVPS worked with its new software by Tom for the first time but few particles seen due to low ice particle concentrations.
- FSSP-100 and J-W exhibited almost exactly the same LWCs in cloud. The HVPS display software worked during the flight.
- The vexious noise spikes in tstatr data were, thanks to Grant, finally removed!

PARTICULARS INSTRUMENT PROBLEMS

1. GPS /WINDS/TURBULENCE/AIRSPEED

GPS tans-vector system (recently discontinued by Trimble). Data OK; apparently a characteristic of a low resolution part of this system is to report a new lat-long every 3-15 seconds. Another channel, Grant has discovered, reports position updates at 10 Hz frequency! Jack apparently wired our part for only the low res output. Grant is looking into recording the hi-res output from the Trimble. This should allow for winds to be updated at the same frequency.

MRI turbulence meter: removed from aircraft and cannot be repaired. R. I. P.
Will not be mentioned again in these reports.

Winds: Our own winds, using the GPS data, and Shadin heading, continue to differ from the Shadin winds, the latter usually having what appear to be fairly reliable winds. For example, a wind maneuver performed by the pilots immediately prior to cloud penetrations resulted in a 10 kt wind from the northwest, close to the 12 kt wind NW wind at this time indicated by the Shadin.

Grant has made progress in this matter (I have examined some old flights and found the winds are beginning to look much better re the Shadin using his equations). More progress is expected in the next flight when the new calculations are effected in real time in the aircraft data system.

The Shadin Air Computer winds: generally yielded reasonable-appearing winds in straight line flight except that they are limited to discrete values such as 2.6, 5.1, 7.4, etc, rather than a continuum of values. Due to the limitations of the GPS system described above, these winds are necessarily constant over several to more than 10 seconds.

BAT: Not working yet.

2. STATE PARAMETERS

Rosemount temperature sensor: The Rosemount-derived static temperature continues 5-15˚C higher than both the reverse flow temperature (tstatr) and the Shadin Air Computer static temperature. It has been suggested that this is due to a problem with the wiring and/or the Rosemount sensing head. Implementing a calibration is confounded by a Rosemount temperature dependency on TAS and time —the magnitude of the temperature discrepancy INCREASED on this flight from the beginning to the end of the flight. No progress yet in solving this problem. It is doubtful to me that this can ever be solved outside of having a Rosemount engineer look at our instrumentation set up. I recommend this.

Reverse flow temperature sensor: The large spikes (electrical noise) in the data have been virtually eliminated! These were not easily excised and Grant should be given HUGE accolades for tracking down and eliminating this 20 year old or more problem.

Ophir hygrometer: The large spikes (electrical noise) in the Ophir dewpoint temperatures have been virtually eliminated! Good agreement between the two instruments only occurred during the last third of the flight; previous to that, the chilled mirror dp was several degrees lower (in dry air) than was the Ophir dewpoint, a bit of a reversal of the normal situations like this we've experienced. It is not known why there was a discreapncy during the first two-thirds of the flight since they were both cleaned prior to the flight according to Don.

3. CLOUD PHYSICS

PVM-100: The usual, numerous noise spikes are still present. Again many seem to be random, but they are also triggered when the probe

is first beginning to sense LWC and at the end of cloud penetrations as the LWC recedes rapidly to zero, a property that Grant pointed out in SAFARI I believe.

However, PVM-100 LWCs, when not impacted by noise spikes, were about 65% of those of the FSSP-100 derived LWCs, perhaps even a bit lower relative to the FSSP-100 than on the previous flight. It is not clear which one is correct. Further has taken place checking the adiabaticity of LWC values. The FSSP-100 peak values are superadiabatic (read "impossible".) In any event, this probe needs to be cleaned and calibrated (using Hermann's disk method).

FSSP-100: Looked good but should be calibrated with the DMT micropositioner due to the continuing lack of agreement with the PVM to help determine which is the more correct. Still possible that droplet concentrations are somewhat higher (peaks over 200 cm^{-3}) than they should be on this flight. These seem high given the meteorological situation of long fetch northwesterly flow. However, adding credibility to the FSSP-100 measurement is the J-W hot wire meter which indicated almost exactly the same LWCs in both the descent and ascent legs.

Johnson-Williams hot wire: Almost too-good-to-be-true agreement with FSSP-100 derived LWCs. The two traces are indistinguishable. However, crap, I have just seen that given cloud base temperature/pressure (-3° C at 907 mb) and top temperature/pressure (-7.8 at 842 mb), they are BOTH superadiabatic in their maxima by about 0.1 to 0.2 tenths g m^{-3}. It is now (i.e., at 1642 LST 18 Dec) that the PVM-100 has the correct LWC. Hence it is even more urgent that calibrations be performed on the FSSP-100 and PVM-100.

DMT hot wire: No change, still very noisy in and out of cloud. This is a rather different behavior than we saw in the last few SAFARI flight wherein the noise disappeared as the LWC signal became significant. It is doubtful that reliable LWCs can be rescued from this instrument.

2-D precip probe: No improvement, no useable data obtained though cleaned and aligned according to Don prior to the flight. Still imaging furiously in clear air and no cloud particles were imaged though a few were imaged by the HVPS. I don't believe it can be repaired here.

1-D cloud probe: No improvement; no useable data obtained. Several channels record particles and adjacent size channels do not making holes in spectrum exactly as was the case in flight 1843. The spectrum obtained is subject to question. Don believes that

because the probe is now installed in the 32-channel pod for the FSSP-300 and because the 1-D has only 15 channels that there may be a “card” problem. Thus, the probe may not work in this pod without a considerable wiring effort or getting a new “card” (?)

CPI: Not installed, being repaired at SPEC.

2-D cloud probe: Not installed, being repaired at DMT.

Radar: Apparently has a weak transmitter; the cause is being investigated by Grant.

4. RADIATION

pyrup: Large, random noise spikes.