Squawk List for Flight 1845, flown on Thursday, 21 Dec 2000,
2140 21 (Dec) to 0016 (22 Dec) 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 in Warning Areas 237 B and A and slightly beyond near and over coast. Weakly developed post-frontal convection partially embedded in two chaotic layers of stratocumulus encountered offshore. Frontal band clouds sampled enroute to coast. Considerable drizzle and ice particle concentrations (though very light precipitation actually reached the ground) were encountered. These provided targets for the newly installed PMS 2-DC probe, back from repair at DMT. The PMS 2-DP was removed to make way for the 2-DC. The CPI, back from repair at SPEC Inc., was also installed prior to the flight.

OVERALL ASSESSMENT

- Aircraft performed well; no power problems in the back, prop-sync problem cured.
- Navy squelched their P-3 flight leaving all warning areas to the Convair, but then the lack of a military presence did not allow test of coordination between the Convair and the military.
- We ARE allowed to work the offshore region south of the warning areas (this assurance from Ken and Larry.)
- Serious imaging probe problems; CPI did not image particles even when the probe appeared to be working; 2-DC also did not image particles for unknown reasons.
- LWCs vary in degree of agreement with one another. For example, FSSP-100 derived LWC was often higher than all of the other LWCs, but not always.

HIGHLIGHTS

- HVPS worked well and imaged many thousands of particles successfully
- The 35 GHz radar’s signal was vastly strengthened as evidenced by the strong ground return.

PARTICULARS ON INSTRUMENT PROBLEMS

1. GPS /WINDS/TURBULENCE/AIRSPEED GROUP

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.

Winds: Our own winds, using the GPS data, and Shadin heading, continue to differ at times from the Shadin winds, the latter usually having what appear to be fairly reliable winds. However, there was near identical agreement between the pilot derived winds, Shadin winds, and Tom's winds in maneuvers over Quillayute. However, on the return leg to PAE, "our" winds were too high and from the wrong direction. Thus, while some improvement was noted, we are not finished with this problem.

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.

Rosemount TAS: Correction to account for altitude-pressure change has resulted in much more accurate TAS from the Rosemount, as previously noted. However, unnoticed til now is that after the correction was implemented (following flight 1842), the trace became noisy. What appear to be frequent "drop-outs" of Rosemount TAS that have caused this noise continue. Looks like a loose connection somewhere, but why should this problem begin with only changes to software???

2. STATE PARAMETERS

Rosemount temperature sensor: No change. The Rosemount-derived static temperature continues 5-15˚ C higher than either the reverse flow temperature (tstatr) and the Shadin Air Computer static temperature (shadin_stemp). 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 changes with time all other things constant. No progress yet in solving this problem.

Reverse Flow Temperature: Magnitude of noise vastly reduced, but there are still periods of significant noise that produce spurious temperature offsets from the real temperature that must be excised prior to any analysis.

Chilled Mirror Dewpoint Temperature: It has always suffered from once-in-awhile noise spikes that produce spurious temperatures. However, on this flight, numerous noise spikes occurred between 2257 and 2316 UTC.

3. CLOUD PHYSICS

PVM-100: The probe was calibrated with the Gerber disk prior to the flight.
The usual, numerous noise spikes were not only present, but were more numerous than usual. They affect all three PVM channels, lwc, effective radius, and surface area. However, they do not affect all three channels simultaneously. Many noise spikes 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.

The PVM-100 LWC, when not impacted by noise spikes, were almost exactly the same as those of derived from the FSSP-100. No values on this flight, due to the considerably warmer cloud bases on this flight compared with the previous flight, were superadiabatic. Thus, there appears for the moment to have been an improvement in the PVM and/or FSSP 100 performance.

However, the ratio of LWCs (FSSP/PVM) alternated during the flight. The FSSP was much higher than the PVM in the first cloud sampled shortly after takeoff (2154-2156 UTC), then exhibited extremely good correspondence with the FSSP LWC between 2202-2226 UTC, followed by a period when the FSSP LWC was less than half that of the PVM. These kinds of differences occurred again later in the flight. There is no obvious explanation for them at present.

FSSP-100: The FSSP-100 was calibrated with the DMT micropositioner and good results were achieved; that is, the 40 micron test “particle” was split between channels 12 and 13. (A perfect test would put the test “particle” completely in Channel 13.) It is still possible that droplet concentrations are somewhat higher (peaks over 200 cm^{-3} were again recorded), but in the defense of such observations, there was an offshore component of the winds along the entire Oregon and Washington coasts. Those winds may very well have brought

continental and higher CCN concentrations into the clouds that we sampled.

Johnson-Williams hot wire: Very low re FSSP-100 in first cloud penetration just after takeoff—similar in behavior to the PVM LWC in this first cloud. The two traces (FSSP LWC, J-W) are indistinguishable thereafter til 2217 UTC then the J-W LWC is exceedingly high relative to the FSSP LWC.

DMT hot wire: No change. Still noisy in and out of cloud. Less noise on this flight whilst in cloud. And in these latter circumstances, the DMT LWCs are in good agreement with the FSSP-100.

2-D precip probe: Not working properly, but was replaced by the 2-DC (see above).

1-D cloud probe: No improvement; no useable data obtained since spectra impacted by several "holes" making the whole thing dubious. Several channels record particles and adjacent size channels record very few making holes in the 1-DC spectrum. 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" (?) It appears that action was not able to be taken on this item prior to flight 1845.

CPI: Would not image; several crashes, several re-starts of probe done in an effort to get it to image. Later diagnosis on Friday between Don and Peter Marsley (sp?) at SPEC concluded that the camera needed to be replaced. SPEC agreed to ship a camera out for short-term use on Tuesday, December 26, 2000. However, the camera is not likely to be installed until after the first of the year due to lack of personnel.

35 GHz Radar: Very strong ground signal, signal strength vastly improved over the previous flight. However, only very light precipitation found in "flyable" regions; not clear whether radar "saw" any of this. No data being recorded as yet; waiting for digitizer card.

4. RADIATION

pyrup: Large, random noise spikes.