

King Air N2UW flight report for January 24, 2005

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Recollections:

Will call this one the *mouse-tail day* – to mark the fact there were rather unusual ‘tails’ off Barbuda and off Antigua, both being indicators of the unusual nature of today’s weather. In contrast with other days, when the development of the tail really only starts some distance downwind for the island, this time the deepest clouds were right over the islands and cloud depth tapered off rapidly – say within 30-50 km – to *Cu hum*. This was clearly evident as we came in for landing at ANU; unfortunately my photo memory cards were already full, so the on board video may be the best visual evidence in addition to the satellite images.. The large *Cu con* over Barbuda was penetrated on the way to ANU, pretty much into the wind direction (as judged by the tilt of the clouds). The penetration was in the middle of at least three similar formations. Later on, at a time of even greater development of the mouse-tail, MetMan made further penetrations of these clouds.

On the larger scale, the satellite VIS sequence over the morning hours shows a clear clockwise rotation about a center that was moving to the SE near perhaps 50W longitude (a guess). This feature may be a result of the depression that passed the US east coast over the past few days.

The consequence of this organization was the formation of SE-NW lines of clouds, gradually reorienting as the center of apparent rotation moved toward the SE.

Flight narrative:

King Air flight started at 8 am local, 2 hours after C130 and 2 ahead of 146. On the 9:30 Z zebra image from SPol, scattered echoes were seen, mostly in the northern semicircle, the largest cell at the N limit of coverage.

At around takeoff heard C130 talking about sampling clouds in the vicinity of RVSJ before completing the last circle, or as part of it.

King Air climbed to 070/40 at 10kft, then moved toward clouds just N of Barbuda. With that commenced the first major part of today’s flight: an hour-long study of a cell with the C130 and with the Seward Johnson.

Divided the airspace with C130 by altitude. Made first passes (1220 UTC) at 7kft, over the tops of clouds with dual-Doppler configuration. Started at about centered near 048/40 – ended up near 035/47, all the while making roughly 150-330 passes. Stayed with the cluster until 1315 UTC, with the C130 making longer passes that included the same cluster. RVSJ was initially headed in the wrong direction but turned on prompting from Bjorn and had our target in good view.



Photo on left was taken at 1300 UTC as the King Air was lined up for a penetration toward the NW at 8000'. Anvil blowing off toward the SE is seen on the right of the photo. R/V SJ was located to the left of the cloud in this photo.



This image was taken looking in the opposite direction, toward the SE, at 1310. Flight altitude was 9000'. The complex mixture of older and newer turrets in the cluster is evident. With respect to this photo the R/V SJ was toward the lower right corner.

Finished this sequence with an attempt to sample the RHI plane of RVSJ. Lined up visually by passing over the ship and taking a perpendicular to the boat. After crossing the cloud – in fact a weak portion of it, with the main rainshaft to the W – we reversed hoping for bracketing the RHI plane, but by that time, and perhaps even before that the SJ turned in order to anticipate the movement of the cell (we were talking to Bruce on the radio arranging the pass, at perhaps the bridge was making other decisions at the same time).

We headed further SE and briefly looked at a few cells, but they were weak and decided to do wind maneuvers while 146 was coming out and setting up to work with the C130.

After the maneuvers, moved toward the clouds NE of the SJ, and arranged for three fixed altitudes for the three aircraft. Clouds there were too weak, while stronger development was noted from SPol and the other aircraft at about 015/70. After some hesitation, headed there for the second major part of today's flight: a good study of a large, elongated cluster in conjunction with MetMan. The C130 sampled the same clouds at 3000 or 2500 earlier and then went on to do the circles.

King Air passes were at 7000' at first, then up to 9000' when new growth showed up. Coordination with the 146 was loose, but even so, we head (as per TCAS) several passes on nearly identical paths, at times in opposite headings. This segment of the flight was 1443-1528 UTC. MetMan continued on for some time beyond that.

In both of today's sequences, as well as on other days, the King Air penetrations were often made at an angle to the orientation of the overall line. This is a reflection of attempts to penetrate the most vigorously growing turrets as well as rain that produces NRE (nose radar echoes). In this instant, new turrets seemed to have been developing on either side (NE of SW) of the line. While these new developments could be seen from our flight altitude, the aircraft flying at lower altitudes had to use other clues, or hold fixed headings. In addition, butterfly patterns were used in a few instances for rapid returns to the same turrets.

On the way back to ANU, passed a few cells, and finally the large one over Barbuda.

One more note: I don't recall another occasion with such a prominently dark-topped boundary layer. The dark band, seen toward the far NW during the latter portion of the flight extended to 8 or 10 kft. It was not cloud, but aerosol laden. In the immediate vicinity the air was normal, hazy, not as clear as the previous day.

Observstions summary (quick one):

As emphasized in the preceding sections, the unusual winds (nearly 180° sheer is seen in the 1201 sounding from the SJ just below 2 km altitude) were one of the hallmarks of the day and have undoubtedly will be evidenced in the organization of cloud clusters. The temperature inversion at about 3.5 km, and the very(!) dry air above that level, combined to keep cloud growth to about that altitude, though vigorous turrets rose without evidence of flattening past the inversion.

Cloud droplet concentrations were in the 80-120 cm^{-3} range, updraft often reached 8-10 m s^{-1} . From penetrations near cloud tops (essentially all of the King Air passes were of that type in this flight), it seemed that there was less of a tendency for updrafts to be accompanied by rain; the more classical inverse relationship between updraft and raindrop concentrations seemed to prevail. Also, rainshafts seen from above appeared to be less

strong than on some other days. Exception was the last penetration across the mouse tail off Barbuda, but those clouds were considerably deeper than those sampled earlier in the mission. Data from the other aircraft will be more telling about rain below cloud base.

Flight notes:

1158 taxi. Cleared 070/40 at 100
1204 T/O
[cloud base: 2000 m]
1220 pass over clouds at 7000' with DD; weak returns
1231 reversed to 150 heading and down to 6000'
1233 butterfly back to last cell in line; no echo to surface
1238 5 m/s updraft, at 036/46; pointer set
1242 continuing butterfly pattern; pointer reset
1243 the same, but using visual guidance to adjust from the pointer indication
1244 the same; had a steady region of updraft with > 4 m/s
1245 at 7000'; +8 and -9 m/s
1248 up to 8000'
1249 at 8000'; noted 11 m/s updraft
1253 150 heading to pointer; roughly wind direction; will do 90/270; C130 on our right wing during the turn
1257 returned to pointer, set 1 km offset, but cancelled that plan and instead aimed at tower with large pileus around it.
1259 bumpy ride; 12 m/s; 90/270
1301 to 9000'
1303 doing SD pass by visual
130655 photo, landscape format over right wing
1309 330 heading; C130 crossed below us; SJ now also targeting this cloud
1311 036/45 still at 9000'
1315 down to 7000', under residue anvil; heading to the core
1321 passed to E side
1322 turning to line up with SJ RHI plane
1328 in cloud starboard of SJ, 070 heading, pointer set, will 90/270
1332 returned over SJ, but it turned (can see it and heard radio comment to that effect)
[cloud dissipating – heading further SE; photo card full, no more photos]
1336 up to 7000'
1342 cleared 050-090, 30-80 nm, FL 50-100
1345 7000' 075/42 new growth, 150 heading; pointer set, then 90/270. Weak WCR

echo.

1349 descent to 6000'

1350 3 cells in a row

1357 C130 to do 2500' passes. We will do Rodi maneuvers, then intercompare at 5000' in cloud.

1423 will try for fixed levels 3000' for C130, 5000' for 146 and 7000' for KA. Cleared for 360-90 sector.

Abandoning target picked for the 3-level study. It is in good location but too weak.

1440 heading to large cell at 018/80 reported by other aircraft

1443 pass on W side of cluster, new growth, UD mode

1449 150 heading under narrow anvil that extends to the SE, will reverse

1459 190 heading; diffuse target, 146 behind us

150235 360 heading, small NRE 10 nm ahead

1505 yellow NRE, pileus seen, 146 below; found 8 m/s up on N heading – this is a new spurt of growth apparently also seen by 146 lower down some minutes ago

1506 up to 9000'; 160 heading then rough 90/270 for 320 heading under anvil

1512 at pointer 4 m/s downdraft

1517 150 heading, 2 turrets; 146 on reverse of this heading

151820 at pointer, 8000', wisp of cloud above and raindrops; last pass of this sequence

1525 penetrating few tops on the way to ANU; large cluster seen NW of Barbuda

1536 crossing cluster just off Barbuda: sustained 5 m/s updraft coincident with rain

ANU tail starts with large cloud over the island and tapers rapidly to tiny Cu; will have to look at video for good record of visual appearance

1548 L/D - END of RICO flights.