University of Wyoming
CuPIDO 2006

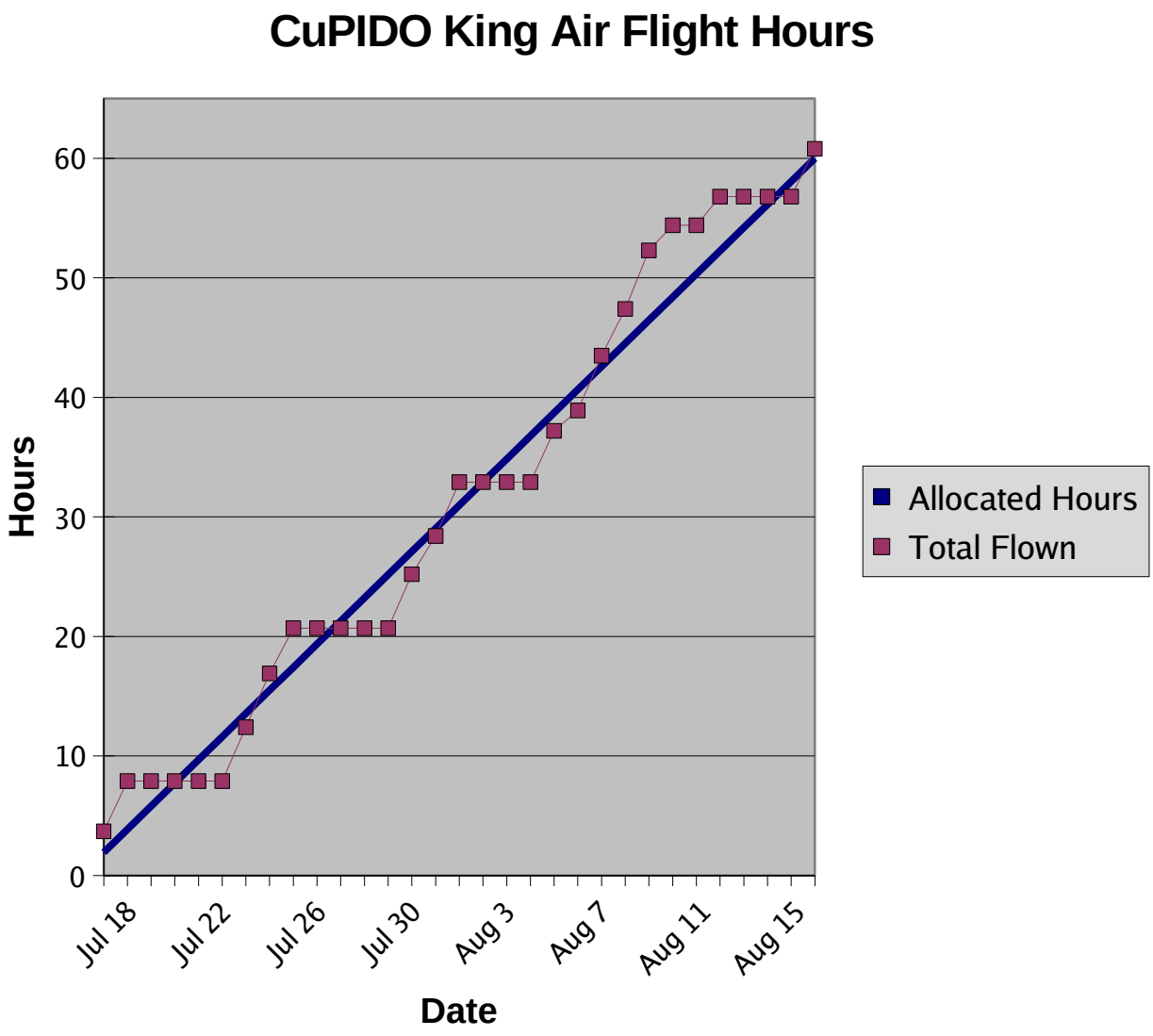
July 18 - August 17 2006

Photo courtesty of Vanda Grubisic, DRI

- Contacts
- KingAir Data
- WCR Data
- Plot of Flight Hours
- EOL Field Catalog

Date	Flight Number	Status	Times (UTC)	Hours	Notes
August 17	Flt 16	cu congestus transitioning to cb, two data system 'glitches'; 1rst aroun 1607, GPS did not recover and data system was rebooted at 1636; 2nd glitch at 1704, data looked OK, but recieved 'failure' error for LV event and HV event.	1552-1944	4.0	jfrench
August 13	Flt 15	Deep convection formed very early in flight. Subsequent pulses grew very rapidly and became electrified early, making cloud penetrations difficult to near impossible. DMT Liquid water probe not turned on, PVM fogs up on final descent	1558-1818	2.4	jfrench
August 11	Flt 14	Deep convection at take-off time. Focused on environmental study around clouds from BL to 23,000 MSL. Licor turned on late (operator error), PVM fogs up on final descent	1625-1830	2.1	jfrench
August 10	Flt 13	two growth cycles from small cu to cb, second growth cycle had extremely vigorous clouds, no known problems with data or radar.	1656-2039	4.9	jfrench
August 9	Flt 12	captured transition from small/moderate cu to cb; entire evolution on order of couple of hours; flew to 25,000 ft MSL; left early due to reports of lightning in area	1628-2016	3.9	jfrench
August 8	Flt 11	focused on cu over Bigelow/Lemmon ridge; altitudes 140, 170, 200, many repeated passes, not much ice first 2-2.5 hours (weaker echoes), PVM fogged up on final descent	1559-2032	4.6	jfrench
August 7	Flt 10	abort flight early because of rapid transition of clouds to cb and onset of lightning (reported through NLDN); no known problems with data system/instruments	1729-1901	1.7	jfrench
August	Flt 9	relatively strong, isolated cu; Data system glitch from 20:01:20 through 20:02:35, no data during this	1755-	4.3	jfrench

6		time; GPS does not recover after glitch; PVM has apparent fogging from 21:07:09 through 21:13:00	2207		
August 2	Flt 8	moderate cumulus activity, primarily 250 ns radar pulse, no known problems	1636-2059	4.5	jfrench
August 1	Flt 7	Used 250 ns pulse width entirely, radar temperature remained cool.	1705-2012	3.2	
July 31	Flt 6	Used predominantly 250 ns pulse width. Radar temperature remained within limits until the final circumnavigation pattern during which a 500 ns pulse was used.	2010-0042	4.5	
July 26	Flt 5	Radar stats - shut down for heat: 4, faults: 1, power drops: 0	1625-2008	3.8	
July 25	Flt 4	Calibration maneuvers 1651-1703. Radar stats - shut down for heat: 2, faults: 0, power drops: 0 Climbed to 23,000 feet to cool data system.	1556-2020	4.5	
July 24	Flt 3	Radar stats - shut down for heat: 2, faults: 2, power drops: 2	1600-2021	4.5	
July 19	Flt 2	Clouds didn't form until late in flight.	1600-2007	4.2	
July 18	Flt 1	Sat phone down Radar stats - shut down for heat: 1, faults: 1, power drops: 1	1610-1944	3.7	
Total Research Hours			60.8 of 60.0		


CuPIDO King Air Flight Hours
Hours
0
10
20
30
40
50
60
Jul 18
Jul 22
Jul 26
Jul 30
Aug 3
Aug 7
Aug 11
Aug 15
Date
Allocated Hours
Total Flown

CUPIDO06: 20060813a
Flight 15

Flight notes: System Scientist (4th seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Rick Damiani
System Scientist: Qu Miao
4th Seat: Jeff French

Pre-flight:
startup was uneventful

Conditions on ground 1548Z: T28/Td21, winds 090/04 kts, skies clear

Large cu already over Mt. Lemmon, sounding is wet, will hope for capping inversion to hold off deep convection. There were large cu's just west of Mt. Lemmon earlier in the AM (~0630), lots of mid-level clouds hanging around as remnants from this earlier clouds.

Flight:
Wheels up 1558 UTC (all times hereafter are in UTC)
1604: begin box at 1000 ft AGL
radar file 16-04-00 up looking 500
1607: Trad~97.5
1610: Trad~95.2
1616: Trad~100.3
1620: end box, climb to FL110
1624: series of errors on data system (bus erros, sync errors , etc…same as Aug6…nothing apparently wrong with data system…data continues recording, GPS looks OK)
1638: pen at FL110, LWC 0.5 g/m3, w 5 m/s up and 5 m/s down, already some graupel showing up at this level, T~+8C
90/270 climb to FL140
1643: pen at FL140, w~16 m/s, CLW> 2 g/m3
90/270 climb to FL170
1650: pen at FL170, LWC~1 g/3, w~5 m/s
1655: pen
turning, climbing to FL230
lightning reported in cells that we have been working, decide to do boxes around storm, hoping for a collapse of the cell and then will target new growth
1742: pen, see some new growth off left wing, will try to target that on next pass
1745: pen, w~ 15 m/s, LWC~1.2 g/m3, broad updraft
1747: climb to FL250
1753: just as ready to pen, lightning strike showed up on scope, break off pen, fly around outside of cell
1800: decide to RTB, growth too fast, too electrical

1817: wheels down

Post-flight/impressions

Impossible to work in clouds today, too much going on, a lot of stratus between 140 and 180 all the way to 230. Main cu looked very vigorous.

No known significant problems with data system/instruments

Breakers for DMT LWC did not get turned on

CUPIDO06: 20060811a
Flight 14

Flight notes: System Scientist (3rd seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Rick Damiani
System Scientist: Jeff French
4th Seat: Jason (??; grad student fr/ UA)

Pre-flight:
startup was uneventful

Conditions on ground 1617Z: T29/Td21, winds calm, skies clear

Cu started growing over mountain by 8 AM local (15Z), by takeoff there was already deep convection, cb, with some lightning. Plan is to study environment around deep convection by flying boxes at several levels from BL to ~FL230. If convection collapses and restarts we will transition into a cumulus study as well.

Since we will be out of cloud for most of flight, radar overheating a bit more of a concern. Decide to try turning of tube and vxi after ground test and restart once we are setup for box pattern.

Flight:
Wheels up 1625 UTC (all times hereafter are in UTC)
1627: start vxi and turn on radar tube, Trad~88
1630: begin box 1000 ft AGL
radar file 16-31-49 up looking, 500 ns
1638: Trad~91.6
1642: Trad~95.6
1645: AW SHOOOOT…forgot to start LICOR sample pump, turned on late
1648: end box, stopped radar, Trad~100.3, climb to FL070
1650: begin box 2, FL070; no radar, let cool
1703: end box, climb to FL100, note: there has been lightning reported in cell over Mt. Lemmon and we can see it from KingAir, box is widened on northern side to stay away from precip shafts under anvil
1706: begin box 3, FL100
radar file 17-07-04 side looking, 500 ns, 9 km range
1717: end ox, climb to FL140
radar file 17-21-11 side looking, 500 ns, 9 km range
radar file 17-23-38 dual side 250 ns
1724: glancing along cloud on upwind side
1725: stop radar as we move further from cloud
radar file 17-29-39 side/dual down 500 ns

1730: through precip shaft
radar file 17-33-52 dual side, 500 ns, try to glance upwind side of towers
1739: end box, climb to FL170
1742: start box at FL170
radar file 17-42-36 side/dual down
radar file 17-48-14 dual side 250 ns
radar file 17-53-33 side 500 ns
1757: end box, climb to FL230
1808: begin box at FL230
radar file 18-07-57 dual down, just above (and at, in some parts) stratus level, blowoff from earlier cu growth
1820 end box, RTB
1830 wheels down

Post-flight/impressions

Impossible to work in clouds today, too much going on, a lot of stratus between 140 and 180 all the way to 230. Main cu looked very vigorous.

No known significant problems with data system/instruments

Gerber PVM fogged on descent into airport and was fogged (??) on ground when data system was shut down. Likely a result of very rapid descent (>3000 ft/min) from high levels.

CUPIDO06: 20060810a
Flight 13

Flight notes: System Scientist (3rd seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Rick Damiani
System Scientist: Jeff French
4th Seat: Qu Miao

Pre-flight:
startup was uneventful

Conditions on ground 1547Z: T29/Td23, winds 130/4kts, skies clear

Some small cu just beginning to form over Mt. Lemmon

Flight:
Wheels up 1556 UTC (all times hereafter are in UTC)
1602: begin loop around mountain at 1000 ft AGL, will run radar for second half of loop using 500 ns pulse length
radar file 16-09-37 up looking, 500 ns
1610: Trad~91.4
1614: Trad~93.8
1620: Trad~98.8
1622: end box, stop radar, Trad~100.3; climb to FL100 for one pass under cu over mountain
1627: on line at FL100
radar file 16-27-47 up down, 500
1628: under/in clouds, small cu—low bases, mid-level stratus/stratocu evident from radar at ~17-18 kft
90/270
radar file 16-32-52 side looking, 500
90/270
climb to FL110
radar file 16-40-19 up/dual down, 500
1642 penetrations, top ~1000 m above us, w~3 m/s, LWC ~ 1 g/m3
90/270 climb to FL140
radar file 16-46-15 dual down, 500
1647-48: pen, one pulse below, one pulse we fly through
90/270 climb to FL160
radar file 16-51-00 dual down, 500
1651: pen, w~6-7 m/s, LWC~1.5 g/m3
90/270 climb to FL170
radar file 16-54-15 up/dual down

1655: pen, in some stratus as well, w~3 m/s, LWC~1 g/m3, much stronger echoes than all earlier penetrations, likely seeded by stratus ice at this level
90/270 climb to FL200
1701: pen, Rmax > 0 dBZ, we pen just at top of cloud, LWC~1.5 g/m3, small graupel in 2DC
90/270 climb to FL210
radar file 17-09-25 dual down 500
1710: right at top, echo all the way to ground
90/270 climb to FL215
radar file 17-13-27 dual down 500
1715: over top of cloud/turret→ appears to be anivilling some at 20-21 kft
90/270
171830: over top, just under top, appears as some new growth
90/270
1721: over top, not as high as last penetrations, but still appears to have some part that are growing
90/270
172430: over tops
90/270
172830: over/through clouds, tops right at our altitude
90/270
radar file 17-30-29 dual down
1732: over cloud, top collapsed somewhat
90/270
1735: over top of cloud
90/270
173815: through cloud, top of cloud just through our altitude
90/270
radar file 17-39-40 side/dual down
174030: in cloud, most vigorous growth at this level, w~6 m/s, LWC~1.5 g/m3
180 turn, setup for dual side, climb to FL217
radar file 17-42-11 dual side
1743: graze same cell as described above, does not look as vigorous as earlier pens
174430: graze new, more powerful looking cell (A)
180 turn, setup to pen
radar file 17-45-33 dual side/dual down
1747: pen cell (A), w~14 m/s, LWC>2 g/m3
90/270 climb to FL225
1751: pen cell (A), decaying??, w~-10/ms
175215: over top of new cell
90/270 climb to FL230
radar file 17-54-30 up/dual down, 250
1756: above growing bubble (??)
90/270
1759: pen, very vigorous cell, w~16 m/s, LWC>2 g/m3, broad updraft
90/270
radar file 18-01-12 dual side/dual down

180230: pen
180 turn, setup for grazing pass
radar file 18-04-58 dual side
pass side of several turrets
180 turn, setup for pens
radar file 18-10-18 up/dual down, 250
1813: pen, w~13 m/s, LWC>2 g/m3
180 turn, setup for grazing pass
radar file 18-14-00 dual side
1816: grazing pass
180 turn
radar file 18-17-19 up/dual down, 250
181930: pen, w~12 m/s, LWC~1.2 g/m3
90/270
182330: pen, w~8 m/s, LWC~1 g/m3
180 turn, setup for grazing pass
radar file 18-25-35 dual side 250
side pass good return
1829: break work form current cell due to lightning, will start working newer cells upwind
radar file 18-30-23 dual down, will work new cells
183320: over top, some upward motion
90/270
a few (several??) passes
1840: took pics of ice on radar wing
1843: 5 n mi. box around mountain
radar file 18-43-14 side looking, 500 ns, 9 km range
1856: end box, begin hunting for new targets
radar file 18-57-42 dual down, 500
1903: not really seeing much worth targeting at this level, descend to FL200
radar file 19-09-49 dual down 500
radar file 19-14-36 dual down 500
1916: new cell, growing vigorous, large updraft, LWC>2 g/m3
180 turn, setup to graze
radar file 19-17-10 dual side 250
pen/graze
180 turn setup to pen
192030: pen, w~ -11 m/s, mostly down, (**OOPS, no radar file…)**
180 turn
radar file 19-21-57 dual side
1923: graze pass
1924: target new cell
radar file 19-25-05 up/dual down, 250
1926 pen, w~6 m/s, LWC~1.75 g/m3
90/270
192845: pen, just at cloud top
90/270

1931: pen, just at top
180 turn
radar file 19-32-19 dual side
1933: graze bug turret over Mt. Lemmon
turn, climb to FL230
radar file 19-37-02 up/dual down 250
1939: pen w~22 m/s up and –20 m/s down **!!!!!!!!!!!!!!!!**
180 turn
radar file 19-40-40 dual side
1942 graze pass
turn
radar file 19-43-52 up/dual down
1945: pen, w~15 m/s up
radar file 19-47-28 dual side
1949 grazing pass
180 turn, to graze pass, more lightning reported in cell, decide to descend to do box at 1000 ft AGL
2015: begin box, CCW, 1000 ft AGL
radar file 20-15-16 uplooking 500 ns
2034: end box, RTB
2039: wheels down

Post-flight/impressions

Documented growth for two cycles that transitioned from cu to cb. Ended up breaking off pens because of lightning reports, both from sounding stations as well as NLDN.

No known significant problems with data system/instruments

CUPIDO06: 20060809a
Flight 12

Flight notes: System Scientist (4th seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Rick Damiani
System Scientist: Qu Miao
4th Seat: Jeff French

Pre-flight:
Conditions on ground 1619Z: T28/Td21, calm, skies clear

Small cu just beginning to form over Mt. Lemmon at time of takeoff

Flight:
Wheels up 1628 UTC (all times hereafter are in UTC)
Will do 1000 ft AGL leg today, will try to use 500 ns pulse, start radar on backside (east side of mtn) expect w/ 500 ns, can probably only get ~1/2 loop with radar
1634: begin box ~1000 ft AGL
radar file 16-41-17 up looking, 500 ns, Trad~92.7
1645: Trad~93.8
1647: Trad~95.6
1650: Trad~98.1
1653: Trad~100.3
1653: end loop, climb to FL100 for pass under cu
1659: at FL100, setup for pass under cloud
radar file 16-59-12 up/down 500
170030-1701: just under clouds/at cloud base
1702: climb to FL115, 90/270
radar file 17-05-35 up/down 500
170640: pen, tops ~500 m above us, w~3 m/s, CLWC~0.5-0.6 g/m3
90/270
radar file 17-10-59 up/dual down, 500
1712: pen 2 cells, first dying, second growing w/ w~5 m/s
90/270, climb to FL125
radar file 17-16-07 up/dual down, 500
171730: pen, clouds ~500 m above us, LWC~0.5 g/m3
180 turn, setup for dual side pass
radar file 17-20-03 dual side 500
1721: grazing pass, Refl~-17 dBZ→-20 dBZ
180 turn, setup for pass on other side of cloud
172315: grazing pass
90/270 climb to FL130

radar file 17-24-59 side/dual down (*screwup, forgot to switch mirror, was supposed to be up/dual down)*
1726: pen
90/270 climb to FL140
radar file 17-27-56 up/dual down, 500
1729: pen, detached, all down moving
1731: do box at FL140, all above clouds at this time
1742: end box
radar file 17-45-55 up/dual down
1746: pen, very little liquid water, weak w's
90/270
174945: pen 2 cells, both w~5-6 m/s, LWC~1 g/m3
90/270
1752: pen 2 cells, both growing
90/270
radar file 17-53-08 side/dual down, 500
1755: pen, w~8 m/s, LWC~1.5 g/m3
90/270 climb to FL150
radar file 17-57-15 up/dual down 500
175830: pen, tops ~1300 m above us
90/270 climb to FL160
radar file 18-00-26 up/dual down
1801: pen, tops ~1300 m above us, w~8m/s, LWC>1 g/m3
90/270 climb to FL170
radar file 18-04-18 up/dual down
1805: pen, tops ~1200 m above us
180 turn, setup for grazing pass
radar file 18-06-57 dual side, 500
1808: graze pass
180 turn
181030: graze pass
90/270 climb to FL190
radar file 18-13-43 up/dual down 500
1814: pen, w~13 m/s, LWC>2 g/m3, first graupel
180 turn, setup for dual side
radar file 18-15-48 dual side 500
1817: graze pass, max Z~10-15 dBZ
turn, climb to FL200
radar file 18-19-31 side/dual down (*screwup, forgot to switch mirror, was supposed to be up/dual down)*
1821: pen, strong ech, 3 main cores(??), Z>10 dBZ
90/270
radar file 18-24-33 dual side/dual down
1826: pen, lots of attenuation
90/270 climb to FL210
radar file 18-29-28 dual side/dual down

1831: pen, lots of big ice!
90/270 climb to FL220
radar file 18-34-04 dual side/dual down
183520: pen, w~10 m/s, LWC~0.2 g/m3
90/270
1839: pen, w~4 m/s
180 turn, setup for dual side
radar file 18-40-23 dual side
90/270 climb to FL230
radar file 18-44-53 up/dual down, 250
184630: pen, weak vertical motion, LWC~0.3 g/m3
90/270
radar file 18-48-27 dual side/dual down
1850: pen, cell appears to be dying
90/270 will target new cell to the eastern side of the line
185245: pen, mostly down w's, LWC~1 g/m3
turn, setup for box around cloud
radar file 18-54-39 dual side
1904: end box, climb to FL250
radar file 19-08-16 up/dual down
1910: pen, w~10 m/s, LWC~0.7 g/m3
90/270
1914: pen, w~14 m/s, fairly broad
90/270
radar file 19-16-04 dual side/dual down
1918: pen, w~6-7 m/s
90/270
1922: pen, w~5 m/s
180 turn, setup for grazing pass
radar file 19-23-56 dual side, 500
1929: end grazing passes, 180 turn
radar file 19-30-19 dual side/dual down
1931: pen, w~8 m/s down
180 turn, grazing pass
radar file 19-32-33 dual side
1937: fly box at FL250 around clouds
radar file 19-39-13 side looking, 500 ns, 9 km range
turn for pen
radar file 19-43-05 up/dual down
1944: pen w~9 m/s, LWC~1 g/m3
radar file 19-45-28 dual side/dual down
1947: pen w~8 /ms, LWC ~0.3 g/m3
1948: reports of lightning in the area, decide to it working these cells and RTB
2016: wheels down

Post-flight/impressions

Good flight, were able to work clouds reasonably well, quit a little early due to lightning

No known significant problems with data system/instruments

CUPIDO06: 20060808a
Flight 11

Flight notes: System Scientist (3rd seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Bart Geerts
System Scientist: Jeff French
4th Seat: Qun Miao

Pre-flight:
Radar faulted a few times during startup, rest of startup was uneventful

Conditions on ground 1551Z: T30/Td23, winds 180/3kts, skies clear

No cu evident from over mountain at time of takeoff (or before), decided to takeoff earlier today because cu blewup so quickly yesterday. As was the case yesterday, a layer of alto-cu (strato-cu??) at roughly 18 kft over most of valley and mountain all morning.

Flight:
Wheels up 1559 UTC (all times hereafter are in UTC)
1601: on climb out, we can see the formation of the very first cu over the Catalinas
1604: begin box 1, 1000 ft AGL, clockwise around mountain
radar file 26-04-44 up looking, 250 ns
1609: Trad~94.9
1617: Trad~98.8
1621: Trad~99.5
1623: end box 1, stop radar, climb to FL100 MSL to try pass under cu. Cu building along ridge roughly 290-110 magnetic (between Bigelow & Mt. Lemmon)
1629: setup for run at FL100
radar file 16-29-33 up looking, 250 ns
1631: under cloud
1633: end leg, climb to FL120
1635: at FL120
radar file 16-35-17 up/dual down 500 ns *(radar pulse remains 500 ns remainder of flight)*
1637: pen 1, CLWC~0.7-1 g/m3, w~5 m/s (?)
1638: end leg, climb to FL140
1640: at FL140
radar file 16-40-47 up/dual down, Trad~98.3
1642: Pen 1, clipping tops, LWC>1 g/m3
90/270
1645: over tops, towers collapsed a bit, we are now above everything
1647: 90/270, continue working this alt and let clouds grow through this altitude
1649: on track
radar file 16-49-37 dual down

1650-51: Pen 3, above tops, a few bubbles approaching our level
90/270
1655: pen 4, some tops just above our alt.
90/270, Trad~99.9
radar file 16-58-31 up/dual down
1659: pen 5, growing cells, ~0.3 g/m3
90/270
radar file 17-02-49 up/dual down
1704: clipped top of growing cells
90/270
1708: pen, tops to ~17kft, w~8m/s, LWC~1.5 g/m3
90/270
1713: pen, tops a bit higher, but tower looks like beginning to collapse
90/270
1717: pen, tower collapsing, almost all downward moving
90/270
radar file 17-20-52 up/dual down
1722: pen, w~7-8 m/s, CLWC~1.6-1.7 g/m3
90/270
1726: pen, tops to 17-18 kft, tower bit broader than earlier pens (??)
90/270
1731: pen, primary tower collapsing, almost all 5-6 m/s down
90/270
1735: pen, tops to 18 kft, possibly higher (??)
90/270
1740: pen, new growth, w~5 m/s, collapsing towers~-4 to –6 m/s
90/270
1745: pen, new growth tower→tops to 17 kft
90/270
1750: pen, mostly collapsing towers
90/270
1755: pen, w~10 m/s, LWC~1.5 g/m3
90/270
1759: pen, this time just clipping tops
90/270
1803: pen, tops about 200 m above us
90/270
1809: pen, tops ~ 500 m above us
90/270
radar file 18-12-00 up/dual down
1814: pen, w~8 m/s, LWC~1.9 g/m3
90/270
1818-19: pen, w~10 m/s, LWC 1.9-2 g/m3
90/270
1823: pen, clippin north side of line, cu tilted to south somewhat, w~9-10 m/s, LWC~1.9 g/m3

1825: setup for box around clouds
radar file 18-26-01 side looking, 500 ns, 9 km range
1832: finish box 1, setup to try another, upwind side of box 1 clipped cloud line
183345: start box 2
1839: end box
1841: ascend to FL150
radar file 18-42-45 up/dual down
1844: pen 1, w~10 m/s, LWC>2 g/m3
90/270, climb to FL170
radar file 18-48-14 up/dual down
1850: pen, tops to 20 kft, max w~12 m/s
90/270
1854: pen, tops to 20 kft
90/270
1858: pen, max LWC~1.8 g/m3, w~5-8 m/s, no 2D particles showing up yet
90/270
1904: pen, w~8-9 m/s
90/270
1908: pen, tops 500→600 m above us
90/270
1912: pen, just missing strongest turrets on penetration
90/270
1917: pen, missed most (all?) main turrets, on next pass will displace leg ~1 km further south
90/270
1921: pen, hit clouds a bit better (more centered) this time
90/270
1926: pen
1927: end legs at FL170, climb to FL200, should be just at tops of strongest growing turrets
radar file 19-30-25 dual down
1933: pen 1 at FL200, just through top, T~-6C, picking up a little graupel on 2DC, nothing on the 2DP
90/270
1936: pen….
90/270
radar file 19-39-18 up/dual down
1940: pen, LWC 2 g/m3, some graupel
90/270
1943: pen, LWC ~3 g/m3!!, w~18 m/s!!!!
90/270
1947: pen, still vigorous growth, w>10 m/s, LWC> 2 g/m3
90/270
1951: pen, tops to 21→22 kft
90/270
1955: pen, w~6-7 m/s, LWC>2 g/m3, graupel few mm in diameter
90/270
1958: pen, downwind side mostly glaciated, tops just above us

90/270
radar file 20-01-10 up/dual down, will target new growth on upwind side (or just over Mtn Lemmon)
2003: pen, growing, very little ice evident in growing turret
90/270
2010: pen, (a) new growth just below us
90/270
2014: pen, (a) new growth through 20 kft, just a mature stage (??)
90/270
2017: pen, (a) still very little ice evident
90/270
2021: pen (a) picking up little more ice
2022: 90/270, descend to FL170, one more pass through clouds then need to RTB
2023: pen (a) at FL170, yet a bit more ice
2024: RTB
2032: wheels down

Post-flight/impressions

Clouds did not blowup quite as fast as we might have expected. Very nice study of these cu, but unable to stay out long enough to see them punch through. Within 10 minutes of leaving, by time we landed, turret had punched through and anviled!

No known significant problems with data system/instruments

Gerber PVM fogged on descent into airport and was fogged (??) on ground when data system was shut down. Upon restarting in hangar, however, it looked fine.

CUPIDO06: 20060807a
Flight 10

Flight notes: System Scientist (3rd seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Bart Geerts
System Scientist: Jeff French
4th Seat: Qun Miao

Pre-flight:
Radar faulted a few times during startup, rest of startup was uneventful

Conditions on ground 1720Z: T33/Td20, winds 100/8kts, skies clear

Cu congestus beginning to form over mountain (20-30 minutes prior to flight??). There has been layer of alto-cu (strato-cu??) at roughly 18 kft over most of valley and mountain all morning.

Flight:
Wheels up 1729 UTC (all times hereafter are in UTC)
1734: begin box 1, 1000 ft AGL, clockwise
radar file 17-34-35 up looking, 250 ns, Trad~97.6
1743: Trad~99.9
1747: Trad~101.2
1752: Trad~102.1
1754: end box , shutdown radar, Trad~103.0, BL less bumpy than on earlier days (??), ascend to FL070 and move towards mountain by 2 nmi to set up for second leg.
1756: begin box 2, FL070
1810: end box 2, ascend to FL100; cannot do box well at this level because of clouds, getting fairly strong growth over mountain, decide to go to at least FL110 and request clearances
1817: holding at FL115, outside of cloud, awaiting clearance
radar file 18-17-36 side look, 250 ns, 6 km range
1821: being vectored around because of AT problems, decided to stop radar
1829: get clearance for FL140 to FL170 block
1831: setup for rosettes at FL140
radar file 18-31-33 up/dual down
1832: pen 1 at FL140
1836: pen 2, CLWC 1.6→1.8 g/m3, w~12-15 m/s, WCR highly attenuated
1841: pen 3, very broad updraft, w~ 10-12 m/s
1844: begin box around cu at FL140
radar file 18-44-48 side looking, 500 ns, 9 km range
1852: over last couple of minutes have been getting reports of 3 lightning flashes on north side of cloud, cloud into cb stage, decide to RTB
1901: wheels down

Post-flight/impressions

Clouds blewup fast today, we perhaps got off a little late (by ½hour?, but difficult call in the AM) clouds grew to ~18 kft very quickly, stalled for some time, but once broke through that level, quickly grew to cb stage.

Significant problems with air traffic, first time for this experiment…perhaps because of t-storms popping up, also an emergency with another aircraft may have cause some of the problems (???)

No known problems with data system/instruments

CUPIDO06: 20060806a
Flight 9

Flight notes: System Scientist (3rd seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Cory Demko
System Scientist: Jeff French
4th Seat: Qun Miao

Pre-flight:
First flight after fix of apparent inverter problem. Glenn, I, and Tom Pierce did some re-wiring for 28 VDC (and 50 amp circuit breaker) into the inverter and changed one of the two 60 Hz, 1 kV units. No apparent problems related to the new fix during this flight.

No radar faults during startup.

Conditions on ground 1750Z: T32/Td14, winds calm, skies clear

No cu over mountains, completely clear in the valley.

Plan on at least 3 circumnavs at beginning of flight, then cu penetrations, followed by three circumnavs at the end of the flight.

Flight:
Wheels up 1755 UTC (all times hereafter are in UTC)
1800: Trad~94.5, begin box 1, 1000 ft AGL, clockwise
1801: **radar file 18-01-20** up looking 500 ns
1812: Trad~101.5
1814: Trad~103.5, turn off radar for remainder of boxes
1820: end box 1, shrink box by 2 n mi., ascend to FL070
1824: start box 2, FL070
1838: end box 2, shrink box by 2 n mi., ascend to FL100
1842: start box 3 @ FL100
1851: end box 3, convection just beginning over peak, too weak to work, clouds/moisture appear to be coming in from east, will do another set of boxes at FL070 and FL100
1854: start box 4, FL070
radar file 18-54-56, 250 ns, up looking, Trad~95.8
1907: end box 4, climb to FL100 to set up for another box, stop radar file, Trad~99.9
1910: start box 5, cu just beginning to tower over mountain, cloud base ~10000 ft
1920: end box 5, setup for line across top at FL100, should be right at cloud base
1925: start leg, **radar file 19-26-09** up looking, 250 ns, try to go under biggest turret
1931: end leg
1933: set up to pass through cloud at FL110
radar file 19-33-59 up/dual down 500 ns

1940: setup for pens at FL140
1941: **radar file 19-41-??** Up/dual down 250 ns
1944: 90/270, setup for pen 2 at FL140
radar file 19-46-13 up/dual down 250 ns
1948: penetration 2 at FL140
1949: 90/270, climb to FL160
1954: pen 2 at FL160, w~+15 m/s & -7 m/s; CLWC~2 g/m3
1956: climb to FL170
radar file 19-56-59 up/dual down 250
1958: pen 1 at FL170, tops to 20 kft
2001: pen 2
******in middle of penetration display quit updating, after completed penetration we orbited for a couple of minutes while I tried to reset display, an error dialog popped up (arync? 429? Several others…) I cleared the dialog and the display began updating…all of the data looked OK (see end notes for problems noticed after processing). After verifying data system was OK, I restarted cpas to make sure clocks were synced*
radar file 20-05-50 up/dual down 250
2006: pen 3, strong vertical velocities, tops to 21 kft??
2008: climb to FL190
radar file 20-09-48 up/dual down
2010: pen 1 at FL190
2014: pen 2 at FL190
2015: climb to FL200
radar file 20-16-37 up/dual down 250
2019: pen 1 at FL200
2023: pen 2 at FL200, w~+/-6 m/s; CLW 2 g/m3 ---missed strongest core???
2026: pen 3, tops to 23 kft
2027: climb to FL210
radar file 20-28-38 up/dual down 250
2030: pen 1 at FL210, missed the most vigorous growth
2033 pen 2 at FL210
2034: climb to FL220 (couldn't make FL230…planes really doggin'), realign with environmental winds (we're off by ~90 deg. Due to directional shear from base)
radar file 20-36-12 up/dual down (??)
2040: pen 1 at FL230
2045: pen 2 at FL230 (Tom has difficulty maintaining in strong pens)
2049: descend to FL210, decide it will be easier to hold altitude in penetrations
2050: pen 1 at FL210
2054: pen 2 at FL210
2058 descend to FL150
radar file 20-58-20 up/dual down
2101: pen 1 at FL150
2104: descend to FL110
2106: over mountain at FL110
2109: end leg, setup to begin boxes, conduct these boxes counter clockwise
2112: begin box 1 at FL100

radar file 21-12-58 up looking, 250 ns
2123: end box 1, descend to FL070
2126: begin box 2 at FL070
2139: end box 2, descend to 1000 ft AGL
2141: begin box 3 at 1000 ft AGL
2202: end box, RTB
2207: wheels down

Post-flight/impressions

Strong dynamics on this day, very bumpy flights, isolated cu over the mountain…

Environmental shear (directional) between ~15 and 20 ft, caused cu towers to be titled, just enough to maintain constant growth in towers, so 'classic' new growth on upshear side, descend core/precip on downshear side

Data system glitch….this occurred between roughly 20:01:20 and 20:02:25, during this time there is no king air data (in any channels) after the recovery, we have no ashtech GPS for the remainder of the flight. This will degrade the winds for the second half of the flight (primarily the accuracy, with little effect on the precision)

Gerber PVM fogged at least once on rather fast descent (??) between 21:07:09 and 21:13:00

CUPIDO06: 20060802a
Flight 8

Flight notes: System Scientist (3rd seat)

Crew:
Pilot: Tom Drew
Flt Scientist: Rick Damiani
System Scientist: Jeff French
4th Seat: Cory Demko

Pre-flight:
Radar faulted on ground testing, took extra ~10 minutes to bring radar up so that it was not faulting. Conditions in aircraft were somewhat humid…perhaps leading to faults

Conditions on ground: T28/Td22, Press 30.03, winds calm

Some Cu around valley, some deeper convection over the mountain, but obscured by the cu/Sc around the valley

Plan on running radar primarily with 250 ns pulse if echoes are strong enough, will test 500 ns pulse affect on heating later in flight, if possible

Flight:
Wheels up 1636 UTC (all times hereafter are in UTC)
1641: begin circumnavigation at 1000 ft AGL
1641: **radar file 16-41-47** uplooking, 250, Tradar~96.1, Tout~20C, some clouds just above us
1651: Trad~98.8
1657: Trad~100.8, Tout~25C
1701: Trad~102.2, Tout~25C
1702: end circumnavigation, quit transmitting, go to FL110, will try a few pens without the radar in hopes of cooling down to upper 90s before running it again
1708: cu Pen, hdg 335 @ FL110, LWC~0.6 g/m3
1713: 90/270 setup for next pen
1715: Pen2, LWC 1.2 g/m3, FSSP conc~250 /cm3
1717: 90/270, Trad~98.8, will try running radar for next pens
1718: **radar file 17-18-01** up/dualdown, 50 gates, cloud top beyond range
1722: **radar file 17-22-16** up/dualdown, 70 gates
1727: end penetrations at FL110, climb to FL140
1730: setup @ FL140
1730: **radar file 17-30-48** up/dualdown, 70 gates
1731: cloud pen, ~2 g/m3, v~8-10 m/s
1733: 90/270 switch mirror to side
1733: cloud pen, ~1.8 g/m3, v~6 m/s
1735: stop radar file, climb to FL160, Trad 97.9 (Tradar has been dropping slowly, even though running more or less continuously, at altitude)

1738: **radar file 17-38-18** dualdown
1742: 90/270 @ FL 160
radar file: 17-42-45 up/dualdown
radar file: 17-44-43 dual side (??) – I may have screwed up and run dualdown(??)
radar file: 17-48-34 dual down
radar file: 17-55-01 up/dualdown
radar file: 17-57-26 up/dualdown
1800: climb to FL180
1801: **radar file 18-01-26** up/dualdown (made 2 penetrations)
1808: **radar file 18-08-01** dual side
1810: end at FL180, climb to FL200
1814: FL 200, **radar file 18-14-20** dual down, right at cloud top
radar file 18-18-36 dual side
radar file 18-20-39 side/dual down
1820-1830: looking for new targets
1831: **radar file 18-31-14** dual down
1832: over top of bubble
1836: over top of bubble
183845: over top of bubble
1840: things not growing as high??, descend to FL180
1841: **radar file 18-41-06** dual down, pen @ 184150
1845: **radar file 18-45-55** up dual down
radar file 18-48-10 dual side
radar file 18-50-20 up/dual down
radar file 18-53-19 up/dual down
1854: penetration, followed by mirror switch
1856: penetration 2
1858: pen 3
radar file 18-58-31 dual side
1902: climb to FL190
radar file 19-03-32 up/dual down
radar file 19-09-56 up/dual down
radar file 19-11-22 side/dual down
radar file 19-14-21 dual side
radar file 19-16-35 dual down
radar file 19-25-08 dual down
radar file 19-27-44 up/dual down
193415: mirror switch
193445: (??) pen very strong turret, v~18 m/s (!!) LWC > 2 g/m3
radar file 19-38-11 dual side
1940: climb to FL200
1941: **radar file 19-41-12** dual down
1946: descend to FL180, set up for box around mountain at "detrainment-level"
1952: **radar file 1952-21** dual down (500 ns) Trad~85.5
2003: end box @ FL180, look for new targets, Trad~88.4, Tout~-4C
200445: pen

2005: **radar file 20-05-43** dual side
2015: **radar file 20-15-06** up/dual down
2018: descend to FL110 for "statistical sampling run" over mountain
2020: clouds appear significantly weaker at this time than early in the flight, no precip at this level, max echoes < 0 dBZ
2024: end leg @ FL110, set up for box @ 1000 ft AGL
2026: **radar file 20-26-23** uplooking (500 ns) Trad~86
2044: end box on east side, continue at 1000 ft AGL to get around mtn before RTB
2051: RTB, stop radar (Trad~102.2)
2059: wheels down

Post-flight/impressions

No known instrument problems during flight

Radar still heated up on first circumnav leg around mountain, even with 250 ns pulse, however, did not seem to heat as fast as did on second circumnav leg that was run with 500 ns pulse. Outside T was cooler today than earliest flights in Cupido, if had been very hot outside, likely would have had to shut radar down before finishing first circumnav leg.

While at higher altitudes and penetrating, radar was actually cooling with time, ran 250 ns pulse almost exclusively, primarily because clouds returns were fairly strong and did not need the extra sensitivity.

Problems at beginning of flight (on ground) likely due to high humidity conditions causing radar to fault until tube heated up enough to dry out (at least that is the working hypothesis….)