Weather and Flight Testing

Edwards 412th

SCOTT WILEY
METEOROLOGIST
FLIGHT INSTRUCTOR
Flight Testing Weather Hazards

- Aircraft and Mission Dependent
- Turbulence
- Icing
- Thunderstorms
- Winds/Windshear
- IFR CIGS/VSBY
- Unknown Weather Hazards???
- Aircraft configuration susceptible
ICING

=WORST: SLD ICING
→ Supercooled Large Droplets
→ Freezing Rain FZRA
→ Freezing Drizzle FZDZ
→ Ice pellets PL
Lessons learned

→ De-ice boots/hot wings overwhelmed by SLD icing BEWARE RUNBACK
→ Roll excitations and tailplane stalls are incidenceous and hints are:
  → Sloppy controls, ice on antenna, wipers but not on windshield or massive amount of ice
FIG. 7. Map of the terrain, low level flow through passes and canyons, and convergence zones for patterns when the southeasterly flow reaches the valley areas west of the mountains (Adapted from DeMarraias et al. 1965).
FIG. 6. Map of the terrain, low level flow through passes and canyons, and convergence zones for patterns when the westerly sea breeze flow pushes into the deserts (Adapted from DeMarrais et al. 1965).
Shearline thermals
Shearline wave hybrid
CLEAR AIR TURBULENCE-CAT

- CAT has catastrophic effects on aircraft
- Mountain wave flight into the rotor
- Aircraft landed safely, program cancelled
February 17, 1986

Scott,
This picture was taken
at Inyokern Feb 17, 1986, 4:30 PST
It was a good wave day!!

Regards, Bill Harris
ADDs winds FL240

Wind speed (kts) at 24,000 ft MSL (400 mb)

Analysis valid 2300 UTC Tue 27 Nov 2007
ADDs winds FL300

Wind speed (kts) at 30,000 ft MSL (300 mb)

Analysis valid 2300 UTC Tue 27 Nov 2007
ADDs winds FL360

Wind speed (kts) at 36,000 ft MSL (225 mb)

Analysis valid 2300 UTC Tue 27 Nov 2007
Turbulence AIRMETs (green) and SIGMETs (red)

chart created at 2255 UTC Tue 27 Nov 2007
AIRMETs valid until 0300z/28th, SIGMETs expire at or before 0215z/28th
200mb/FL350
Water vapor satellite picture
Water vapor in the US
3 hours later...
AIRMETs

AUS45 KKCI 272220 AAC
LCT WA 272220 AMD
AIRMET TANGO UPDT 6 FOR TURB VALID UNTIL 280300
AIRMET TURB...ID MT WY UT CO AZ NM...UPDT
ROM 50WSW YXC TO 50NNW ISN TO BFF TO GLD TO 50W LBL TO TCC TO
10S SJN TO DTA TO 50WSW YXC
IOD TURB BLW FL180. CONDS ENDG 00-03Z.

AUS45 KKCI 272220 AAC
LCT WA 272220 AMD
AIRMET TANGO UPDT 6 FOR TURB VALID UNTIL 280300
AIRMET TURB...NV UT CO AZ NM CA AND CSTL WTRS
ROM GLD TO 50W LBL TO TXO TO 20SSW INW TO 40NNE BZA TO 20S MZB
TO 200SW MZB TO 140SSW SNS TO ILC TO HBU TO GLD
IOD TURB BTN FL250 AND FL410. CONDS CONTGB BYD 03Z THRU 09Z.

AUS45 KKCI 272220 AAC
LCT WA 272220 AMD
AIRMET TANGO UPDT 6 FOR TURB VALID UNTIL 280300
AIRMET TURB...ID MT WY NV UT CO WA OR CA AND CSTL WTRS
ROM 50NNW ISN TO 70NW RAP TO BFF TO GLD TO HBU TO ILC TO 140SSW
NS TO 20ESE FOT TO 140W TOU TO BLI TO 30S GEG TO BOI TO PIH TO
10NE HVR TO 50NNW ISN
IOD TURB BTN FL180 AND FL390. CONDS CONTGB BYD 03Z ENDG NE PTN AND
AR NW PTN 06-09Z. CONDS CONTGB RMNDR THRU 09Z.

SIGMETs

SIGMET NOVEMBER 1 VALID UNTIL 280115
SIGMET
10 NM
ROM 30ESE CYS TO 20E LVS TO 50NW ABQ TO CHE TO 30ESE CYS
CNL SEV TURB BLW FL180. RPRTD BY ACFT. CONDS CONTGB BYD 0115Z.

SIGMET OSCAR 1 VALID UNTIL 280215
SIGMET
IV CA
ROM ELY TO ILC TO 30N EHF TO CZQ TO 60S FMG TO ELY
CNL SEV TURB BTN FL280 AND FL380. RPRTD BY ACFT. CONDS CONTGB BYD
215Z.
Figure 1

ASK 21 Two Seat Glider

Manufactured in Germany by A Schleicher. Wing span 17m  Max AUW = 1320 lbs
Wreckage of GBP

Cockpit and tail structures were relatively undamaged until impact with the ground.
Tip area affected by arcing, right wing only

Composite view of structural layout
Right aileron bellcrank mounting bracket showing melted end and heat effects.

Sketch of bracket attachment to spar:
Two upper bolts, one lower.

Lower bolt failure.

Details of centre push rod from right wing
Rod is normally a tube of 16mm diameter, 1mm wall thickness.
Southeast of a super cell TS near the tropopause.
Super Cell TS diagram

AVOID DOWNSTREAM AREAS OF TS BY 1NM FOR EACH KNOT OF WIND AT YOUR FL... 100KTS=100NM

FL500

FL400

FL300

FL200

FL100

WS020/29010KT

09025G45KT

SEV TURB

EXTREME TURB

SEVERE THUNDERSTORM

MOD ICG

SEV ICG

COLD AIR

32 F

WARM MOIST AIR

TS ANVIL

32 F

GR
Thunderstorms

• TS contain every known aviation weather hazard!
• FAR 121.419 “Escaping from severe weather situations ...inadvertent encounters...Operating in or near TS, GR, TURB, FC, ICG, etc.”
• Supercells, Severe TS, and Microbursts must be avoided!
• Southwest of TS
• Looking Northeast
• Building tower in foreground
• Multicellular storm
• Flanking line under wing extending south
Low Level Wind Shear (LLWS)

- LLWS is a sudden change in wind speed and/or direction below 2000 feet AGL
- TAF LLWS ...
- VRB004KT P6SM SKC... WS010/15030

- Decoded: Wind shear is forecast to occur at 1000 feet AGL due to winds of 150 degrees at 30 knots.
- Since winds are light and variable at the surface pilots could encounter a 26 knot headwind loss when descending through 1000 feet AGL.
OUTFLOW from TS or MB

- PARENT TS/CB/AC
- TURBULENT EDDIES
- COLD AIR OUTFLOW
- STRONG WIND SHEAR BOUNDARY
- OUTFLOW BOUNDARY - GUST FRONT/MICROBURST

MILES FROM THE OUTFLOW BOUNDARY

6,000 feet

3,000 feet
“No wind” microburst diagram

Stationary Microburst

Contact Stage

Outburst Stage

Cushion Stage

Extremely high winds

Cold Air

Cushion
DFW MICROBURST

➢ Wet or Dry Microbursts
  ➢ Wet - TS or SHRA common Midwest-Eastern US
  ➢ Dry - BLDU, ring shaped dust whirls, VIRGA common Desert Southwest-Rockies KEDW
➢ Pilot must recognize and avoid
  ➢ 90 seconds to impact
➢ Danger is tailwind and not the downdraft
➢ For every knot of tailwind there is a 1-2% loss of lift on the wing ex.-50KTS=no lift!
➢ Strong ones are not survivable by any aircraft
Microburst footprint
LIFT - Lots of Increased Flight Time

Types:
- Thermal
- Ridge
- Mountain wave, pressure wave
- Shear-line, Sea breeze fronts
- Dynamic Soaring
- Combo: Thermal/shearline waves
- Other: Lift is where you find it!
Thermals

- Solar powered
- Hot air rises / cold air sinks
- Adiabatic superadiabatic process
  - Defn: no heat added/subtracted
  - "Parcel" theory
  - Atmospheric Soundings RAOB
  - ATMOSPHERIC LAYERS
    - PRANDTL
    - ECKMAN
    - FREE GEOSTROPHIC

New Thermal Column Forming at Ground
Average AV Thermal
Latest Bak40 analysis is valid at 20:00 UTC.
Latest Op40 analysis is valid at 20:00 UTC.

For up-to-date information about the status of RUC runs, see the RUC forum (new window).
(You can subscribe to this forum to get email copies of new posts.)

Op40 1h Forecast, 16-Oct-2007 21:00:00 (5.0nm/112° from PHX)

CAPE 0
Cln 0
PW 18
TT 50
KI 29
LI 1
SI 1
SW 120
LCL 734

wind (kts)

Pressure (mb)

716mb (2.9 km)
9383 ft

SkewT-log P

NOAA / ESRL / GSD

Load Soundings | Get text | 10mb scale | SkewT/Teph. | Wind scale: 40/100

| PHX(F3) 2300 16Oct07 | PHX(F2) 2200 16Oct07 | PHX(F1) 2100 16Oct07 | PHX(A) 2000 16Oct07 |