Friends and Partners in Aviation Weather (FPAW)

Donald Eick
NTSB Senior Meteorologist
Please silence all cell phones or else!
Topics

• How are we doing?
• NTSB 2014 accident data
• Turbulence/Thunderstorms
• 2013 UPS Accident BHM Weather
  Recommendations
• Icing events
NTSB 2014 - Accident Statistics

- 1,287 accidents
- 261 fatal accidents
- 439 total fatalities
- Part 121 – 16 accidents, no hull loses
- Part 91 - General Aviation accounted for 95% of all fatal accidents but only 51% flight hours
  - Accident rate 6.74 per 100,000 hours (^ 6.26)
- Weather related events account for a high percentage of the accidents and one of the highest fatality rate!
Defining Fatal Accident Events

In 2008 NTSB began using the Commercial Aviation Safety Team (CAST) descriptions for classifying accidents:

• **Loss of Control (LOC) in flight/ground (~38% wx)**
  – Adverse winds
  – Spatial Disorientation
  – Thunderstorms
  – In-flight icing

• **System/component failure – Powerplant**
  – Carburetor icing major contributing cause

• **Controlled Flight Into Terrain (CFIT)**
  – Low ceilings & visibility?

• **Collision with terrain/object**

• **VFR encounter with IMC**

• **System/component failure – Non-Powerplant**
Part 91 – Weather As Cause/Factor period 2000-2011

2014 - 10 Year Average
- 1,500 accidents
- 280 fatal events
- 500 total fatalities
- ~ 435 WX related

19,441 Accidents

- 29% Accident
- 71% Wx Related

- Adverse Winds 52%
- Clouds 4%
- Precipitation 4%
- Low CIG/VIS 13%
- Density Altitude 6%
- Carburetor Icing 6%
- Structural Icing 3%
- Thunderstorms 2%
- Turbulence 3%
- Windshear 2%
- Up/Downdrafts 4%
- Whiteout 0%
- Sand/Duststorm/ Dust Devils 1%
“The best safety device in any aircraft is a well trained pilot”
Embraer EMB-505 “Phenom”, N322QS
Sept. 19, 2014

- Part 91 - NetJets corporate flight
- IFR flight plan – wx briefing
- Nashville, TN – Conroe, TX
  - Lone Star Executive Airport (KCXO)
- Landing runway 1 (5000 ft x 100 ft concrete)
- ATC broke out at minimums, touched down just past 1,000 ft mark & didn’t seem to decelerate
- Weather
  - KCXO 191341Z 00000KT 2SM +RA BR FEW005 BKN080 OVC100 23/22 A2993 RMK AO2 P0021 T02280222
- Overrun 400 ft into mud & ditch – substantial damage
Part 121 - Air Carrier Operations
Operational Control & Flight Dispatch
We can control everything in the sky, except the weather!
Part 121 – Air carrier Weather Related Cause/Factors 2000-2011

446 Accidents

- Turbulence: 71%
- Adverse Wind: 14%
- Icing: 1%
- TSTMS: 6%
- Precip: 5%
- Fog: 1%
- Windshear: 1%
- Freezing rain/sleet: 1%

Non-Wx Related: 63%
Weather Related: 37%
Turbulence has caused more serious injuries to passengers than any other class of accident.
Turbulence Classification

- Clear Air Turbulence (CAT)
- Convectively Induced Turbulence (CIT)
- Mountain Wave (MWT)
- Mechanical (LLT)
- Vortex Wake
Convective clouds – Convectively Induced Turbulence (CIT)

All thunderstorms imply the potential for severe turbulence. Severe thunderstorms imply severe-to-extreme turbulence!
Elements of an Investigation

- Define the environment
- Relate the environmental conditions to the accident
- Evaluate weather products and services
2014 NTSB Part 121 – Turbulence Events

• 3 Official Part 121 accidents:
  • DCA14CA035 – Valdosta, GA 1S/12M
    – B767 CIT encounter, 3 FA lifted off floor, 1 fractured lumbar vertebrae, 2 others FA and 10 passengers minor incurred injuries
  • CEN14CA455 – Hemphill, IL 1S/3M
    – ERJ-170 encountered wake turbc, rolled, FA seriously, along with 3 passengers injured
  • DCA14LA060 – Billings, MT 2S/9M
    – B737 encountered MTW, all FA incapacitated 2 seriously, major head wound, diversion, 9 minor injuries & infant issue
2015 NTSB Part 121 – Turbulence Events

- NTSB 9 events investigated/15 others noted with injuries over 60. Numerous flight crew incapacitation events.
- OPS15IA020 – Max NE A320 3M
- WPR15LA239 – Reno, NV E175 1S
- DCA15NA150 – Seattle, WA E175 1M
- DCA15NA149 – Salt Lake, NV E175 1M
- DCA15NA133 – Norfolk, VA B737 1M
- DCA15CA131 – McCook, NE CRJ 1S/6M
- DCA15CA136 – Newark, NJ B777 1S
- DCA15NA104 – Philadelphia, PA B737 1M
- DCA15LA067 – Honolulu, HI B767 1S/12M
Turbulence & Hail Encounter

- Delta F159 B747-400
- June 6, 2015
- Detroit – Seoul
- FL360 @ 0630Z
- Unable to get deviations around convection
- Encounters severe turbulence & hail
- Damage – radome, leading edges, engines
- Significant damage – aircraft retired from service
- Foreign Investigation
Hail Encounter – International Event

- American Airlines B787
- July 27, 2015
- Hail encounter after departing Beijing
- Aircraft 3-months old, 4 weeks of maintenance to return to service
- Damage radome, side window, leading edge
NEW DETAILS

FLIGHT POUNDED BY HAIL
DO PILOTS HAVE ENOUGH WEATHER DATA?
U.S. Investigation Hail Encounters

- Delta Airlines A320 flight #1889
- KBOS-KSLC
- Aug. 8, 2015 @ 0201Z
- Aircraft encountered SVR turbulence, hail, lightning at FL340
- Crew declared emergency & diverts to KDEN
- 3 minor injuries
- Southwest B737 also encountered SVR turbulence
- On going investigation

GLD UUA /OV GLD04447/TM 0214/FL340/TP A320/TB SEV/
RM SEV HAIL- CRACKED WINDSHIELD ZDV
AIM & AC 00-24C – “Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.”
Delta Hail Encounter
Microbursts
August 8, 2015 - Wet Microburst Tucson, Arizona
DCA15LA173 – Charlotte, NC
American Airlines A321
August 15, 2015

- On going investigation
- Part 121 night flight
- ATL-CLT
- Final approach encountered LLWS
- During go-around struck approach lights and tail struck runway
- Substantial damage
- No injuries
DCA13MA081 - Bagram, Afghanistan
National Air Cargo, B747-400
April 29, 2013

• Part 121- Supplemental cargo flight
• Carrying heavy Army equipment
• Crashed on takeoff
• Witnesses reported steep pitch-up, before descending into ground
• No weather issues identified
• Fatal 7
DCA13MA133 – Birmingham, AL
UPS Flight 1354, A300
August 14, 2013

- Part 121 – scheduled cargo flight
- IFR flight plan SDF-BHM
- Dark nighttime conditions prevailed
- Aircraft crashed on approach at 0447 CDT
- VFR conditions existed over airport, with LIFR ceilings along approach path
- Fatal 2
• NTSB Probable Cause –
  – Crew’s continuation of an unstabilized non-precision approach & their failure to monitor the aircraft’s altitude during the approach, which led to an inadvertent below the MAA and subsequent into terrain.
  – Contributing – flight crew’s expectation that they would break out of the clouds at 1,000 ft due to incomplete weather information
First Officer: “it wouldn't happen to be actual”

Captain “…got the runway…”

Autopilot off
First sound of impact
“too low, terrain”

Estimated cloud base

4:47:28 CDT

DA = 1200 ft

Distance north of KBHM runway 18 threshold, nmi

Altitude, ft. MSL

Distance north of Birmingham runway 18 threshold, nm

TERRAIN

IMTOY

AP : VERT SPEED
V/ S : - 1500 fpm
NTSB Recommendations:

• Require annual update to Dispatch Resource Management (DRM) that includes pilot/dispatch interface
• FAA require remarks section of METAR to be provided to dispatchers & pilots
• FAA expand guidance in 7110.65 “ATC” – to further define pertinent METAR remarks
Stationary front over the area producing LIFR to IFR conditions across the region – AIRMET issued

UPS LIDO System – limitations; strips off METAR remarks, “SPECI” or “AMD”, unable to access UA, WA, CWA/MIS, AWW, other local obs

NWS AWC site also noted stripping

Lack of standardization s in ATC disseminate METAR remarks

NOTAM – primary runway closed 0500 local
METAR KBHM 140753Z 00000KT 9SM OVC008 23/22 A2996
   RMK AO2 CIG 007V011 SLP137 T02330217=
SPECI KBHM 140848Z 33003KT 10SM OVC010 23/22 A2997
   RMK AO2 CIG 006V013=
METAR KBHM 140853Z 00000KT 10SM BKN010 OVC075 23/22 A2997
   RMK AO2 CIG 006V013 SLP138  T02330217 52000=
SPECI KBHM 140904Z 00000KT 10SM SCT010 BKN075 23/22 A2996
   RMK AO2=
TAF AMD KBHM 140647Z 1407/1506 VRB03KT P6SM BKN004
- Dispatcher reviewed LOC RWY 18 approach
- Chart indicated “NA” at night
- Chart error caught & FDC NOTAM had corrected “NA” error, UPS dispatcher not aware of the correction
- Primary runway closed until 0500 local (accident 0447 CDT)
UPS – Birmingham, AL
Recommendations

• Lack of standardization in ATC providing “other pertinent remarks from the weather observation” on ATIS broadcast
• Pertinent Remarks – defined in FMH-1

ATC Specialist Vikki Cole struck by lightning while monitoring traffic Newcastal Airport, DE July 2008
12.7 Remarks

- Clarify present Wx in main body – VC, DSNT, LTG DSNT W
- Movement clouds/Wx -“TS MOV NE”
- Volcanic Ash
- Funnel Cloud/Tornado/Waterspout
- Peak Wind
- Wind Shift/Frontal Passage – WSHFT/FROPA
- Tower/Surface visibility differences
- Variable prevailing visibility
- Sector visibility
FMH-1 Coding of Remarks

Remarks...

- Type/Frequency/Location of Lightning - example (FREQ LTGICCGCC OVHD)
- Beginning/End of precip/Thunderstorms
- TS location/movement (TS W MOV NE)
- Hail size (GR)
- Virga
- Variable ceiling/sky coverage; CIG 4V6
- Obscurations
- Significant Cloud Types - specifically (TCU, CB, CBMAM, ACC, SCSL, ACSL, CCSL, ROTOR)
Remarks....

- Pressure Rising/Falling Rapidly \((PRESRR/PRESFR)\)
- Sea Level Pressure \((SLD)\)
- Aircraft Mishap
- No SPECI reports
- Snow increasing rapidly – snowfall rate/total on ground – example: \(SNINCR 1/5\)
- Other significant info for station \((FIRST/LAST reports of the day, runway condition, fog dispersion ops, etc.)\)

- What about all those numbers?
Additive & Automated maintenance Data

- Precip data – hourly, 3- and 6-hr, 24-hr (Prrrr)
- Snow depth (4/ssss)
  - Note - not on runway, that’s NOTAM requirement
- Cloud types (8CCC)
- T/TD data – hourly, 6-hr max/min, 24-hr (Tsttttstttt)
- Pressure tendency (5appp)
- Sensor status (PWINO, PNO, TSNO, FZRANO)
- Maintenance indicator ($)

- Nice to know but required to broadcast?
One more thing, NTSB PIREP issues:

- Several pilots operating were interviewed regarding the Wx conditions encountered
- FedEx aircraft landed immediately after the accident on runway 06 at 0507 CDT
- Broke out of overcast layer close at minimums ~300 ft agl, never advised ATC or made any PIREP of lower than report conditions
- ASOS never reported the lower cloud layer experienced by UPS/FedEx
RECENT ICING RELATED EVENTS UNDER INVESTIGATION
In the 5 year period between 2010-2014 there have been 52 icing accidents with 78 fatalities.

Part 121 – 2

EMB145 – Dayton, OH

EMB145 – Memphis, TN

Part 135 – 8

Part 91 - 42
DEN14FA058 – Memphis, TN
Trans State Airlines EMB-145
Feb. 5, 2014

- Part 121 – IFR flight
- HOU-MEM
- Night IMC at MEM
- 1st approached missed, on 2nd approach 20-40 ft agl wing dropped & aircraft rolled right contacting runway
- On ramp all leading edges had significant mixed ice buildup
DEN14FA058 – Memphis, TN
Trans State Airlines EMB-145
Feb. 5, 2014

- METAR/TAF expected LIFR BR
- TAF tempo –FZDZ
- No AIRMET/SIGMET
- CWSU closed during period, no prior advisories
- CIP expected 50-70% of LGT icing below 3,000 ft
DCA15MA027 – Gathersburg, MD
Embraer EMB-500, N100EQ
December 8, 2014

• Part 91 IFR business flight
• Chapel Hill, VA – Gaithersburg, MD
• Crashed on approach
• Fatal 3 aircraft, family 3 on ground
• Very light intensity echoes associated with snow squall
• Numerous reports LGT-MDT icing below 5,000 ft
• No advisories current for icing
KLGA 151600Z 02009KT 1/4SM R04/3000V4500FT SN FZFG VV009
M03/M04 A3012 RMK AO2 P0001
3 inches new snow at time of accident
Landing runway 13 – quartering right crosswind/slight tailwind in moderate snow
MOST WEATHER RELATED ACCIDENTS AND INCIDENTS ARE PREVENTABLE!

Questions?

eickd@ntsb.gov