NTSB | National Transportation Safety Board

NTSB Review of Low Ceiling/Visibility Accidents

Donald Eick
NTSB Senior Meteorologist
Operational Factors (AS-30)

NTSB – Who We Are & Mission

Independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, highway and transit, marine, pipeline, and commercial space.

- We determine the probable cause of the accidents we investigate and issue safety recommendations aimed at preventing future accidents.
- We conduct transportation safety studies and coordinate the resources of the federal government and other organizations to assist victims and their family members who have been impacted by major transportation disasters.

mariners' certification appeals.

Reports – Timeframes & Scope

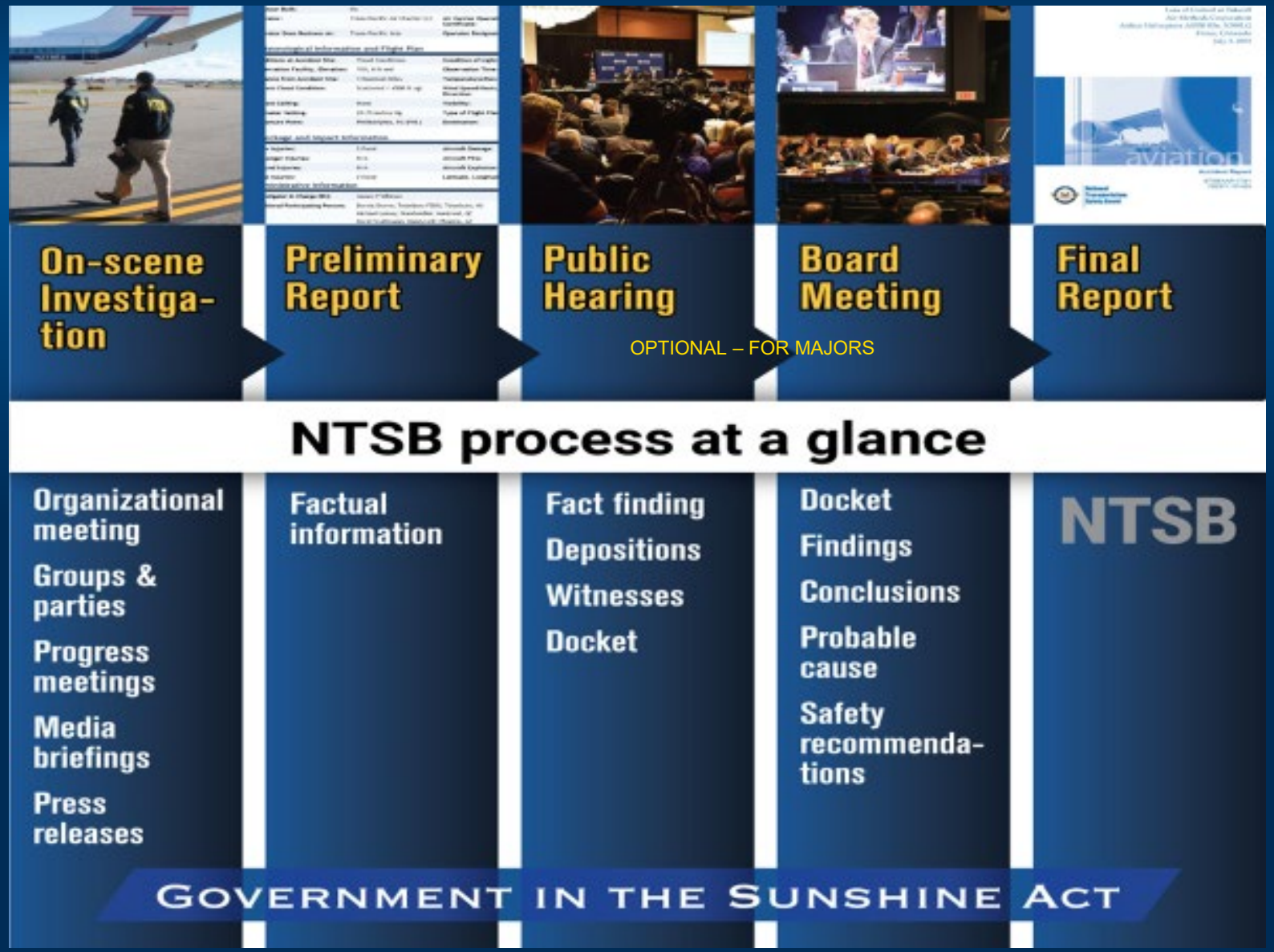
- Notification (14 CFR Part 830)
- Launch
- Preliminary Report (*within 10 business days*)
- Factual Report (*6-18 months*)
- Probable Cause *(~1 month after factual report*)
- Safety Recommendations

What We Examine…

Man-Machine-Environment

- Operational Factors
  - Air Traffic Control, Weather, etc.
- Aviation Engineering
  - Powerplants, Structures, Systems, etc.
- Human Performance & Survival Factors

NTSB



Find them at www.ntsb.gov

..and in our Docket

NTSB

2020 U.S. Civil Aviation Accide

1,139[1] U.S. Civil Aviation Accidents

210 Fatal Accidents

349 Total Fatalities

- Part 91 – General Aviation

  1,085 accidents (95%), 205 fatal events (97%) with total fatalities 332 (94%).

- Part 135 – Commuter/On-Demand

  45 accidents (4%), 7 fatal events (3%) with total fatalities of 26 (6%).

- Part 121 – Air Carrier

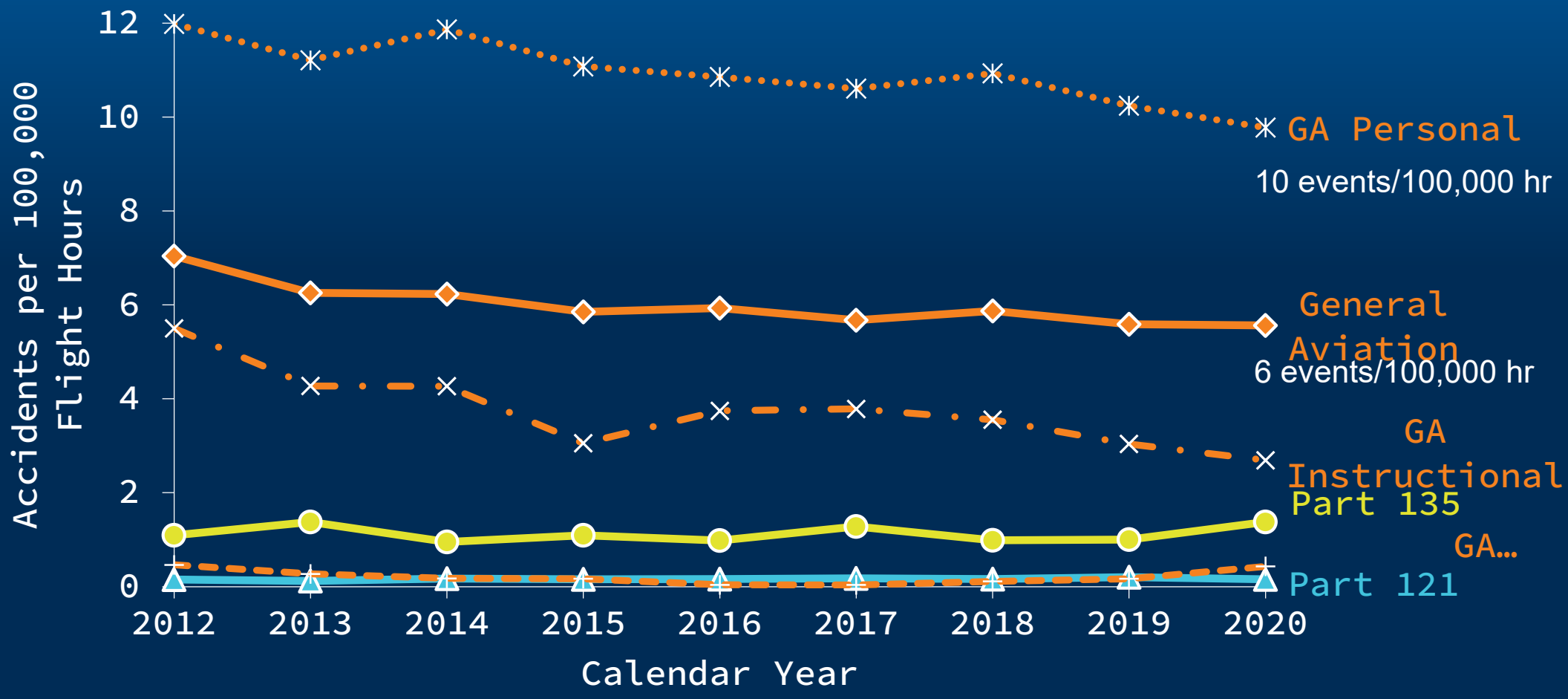
  14 accidents (1%), 0 fatal events (7 Wx related; 6 turbulence, 1 adverse winds)

Accidents rate 0.310 per 100,000 departures

Footnote 1 – Accident totals do not necessarily sum to total US Civil Aviation because of collisions with multiple aircraft

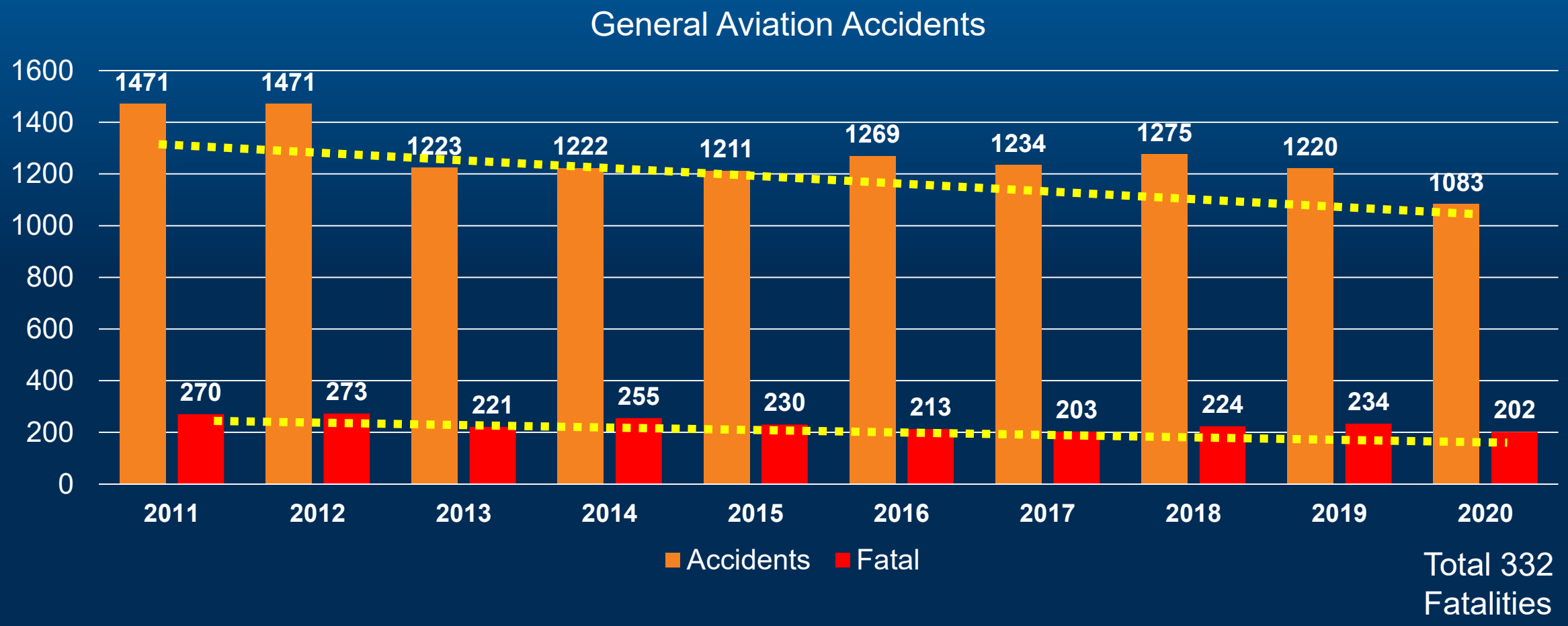
NTSB

US Civil Aviation Accident Rates: 2012-2020



NTSB

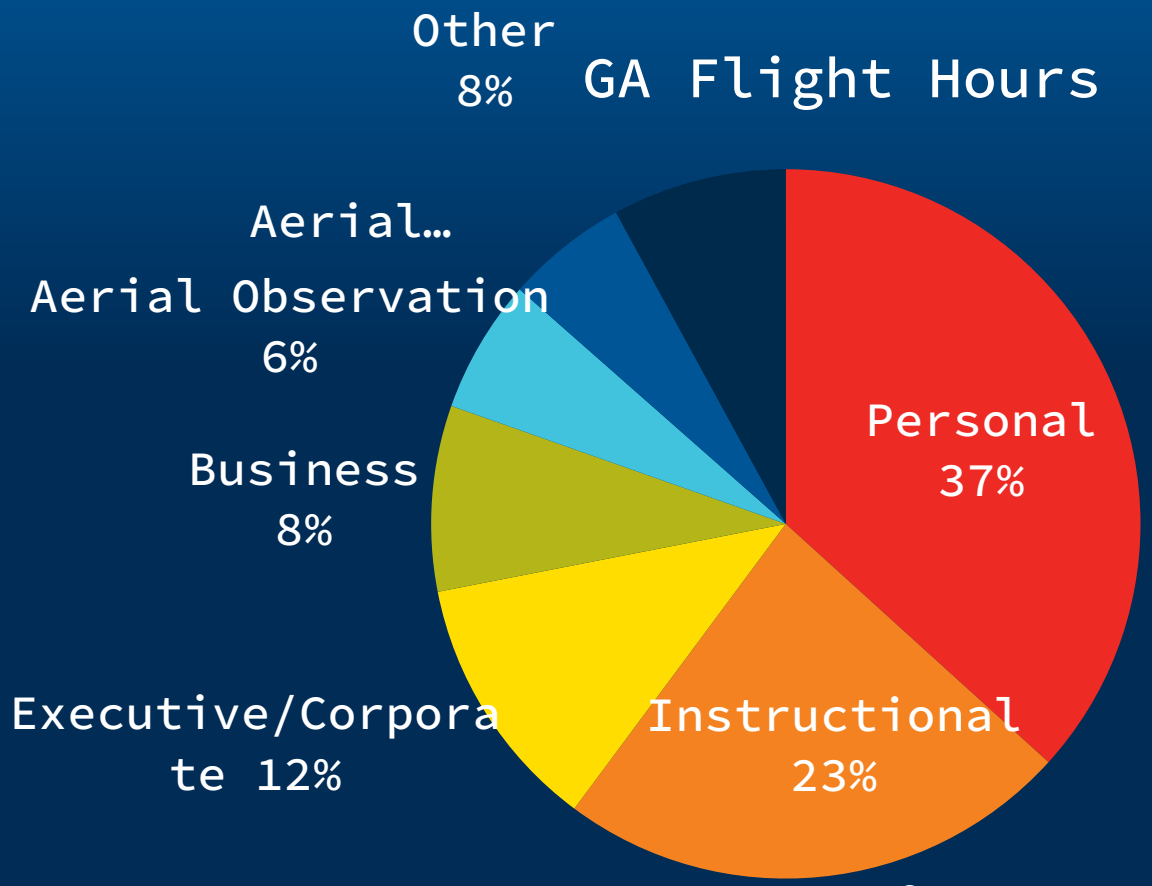
NTSB General Aviation Accidents and Fatal Events: 2011-2020

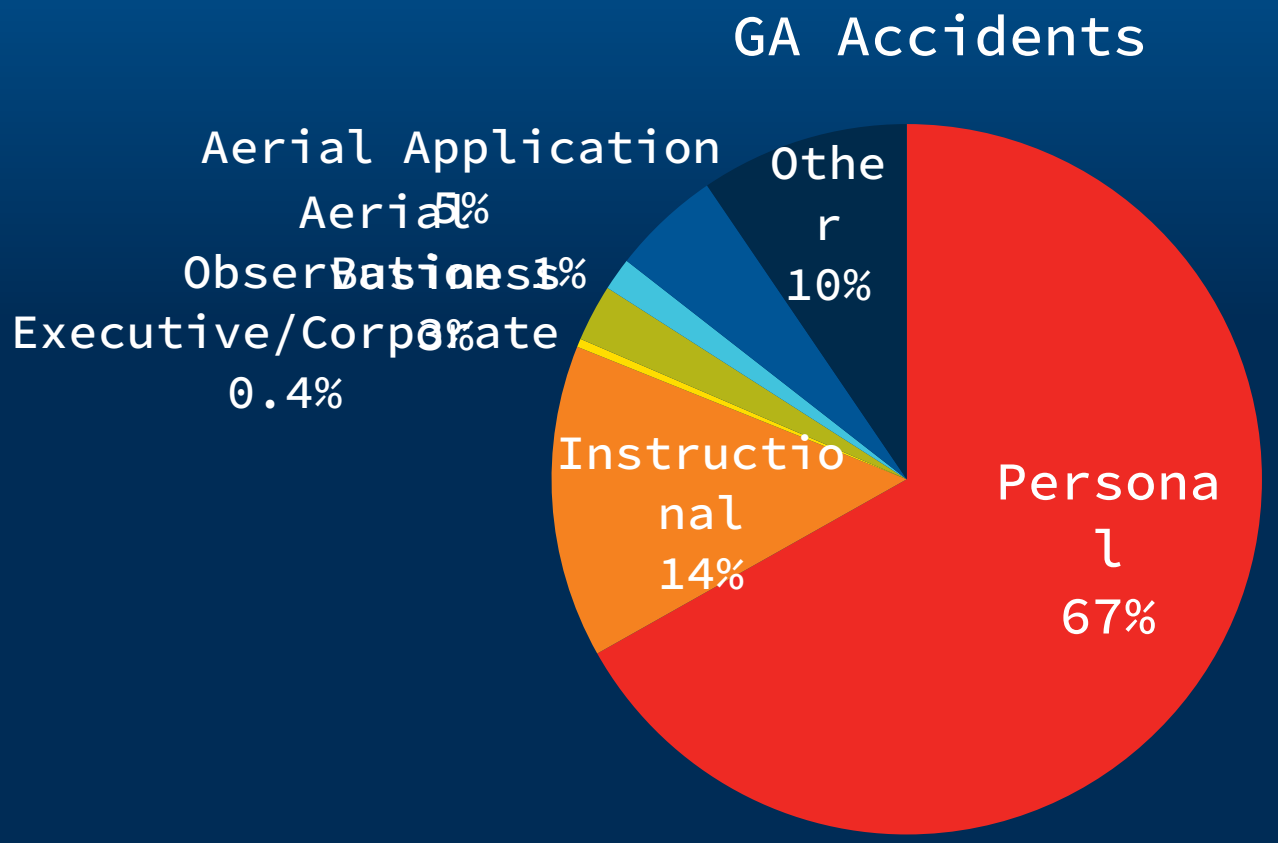


Total 332 Fatalities

NTSB

General Aviation Flight Hours and Accidents by Purpose of Flight: 2012-2020

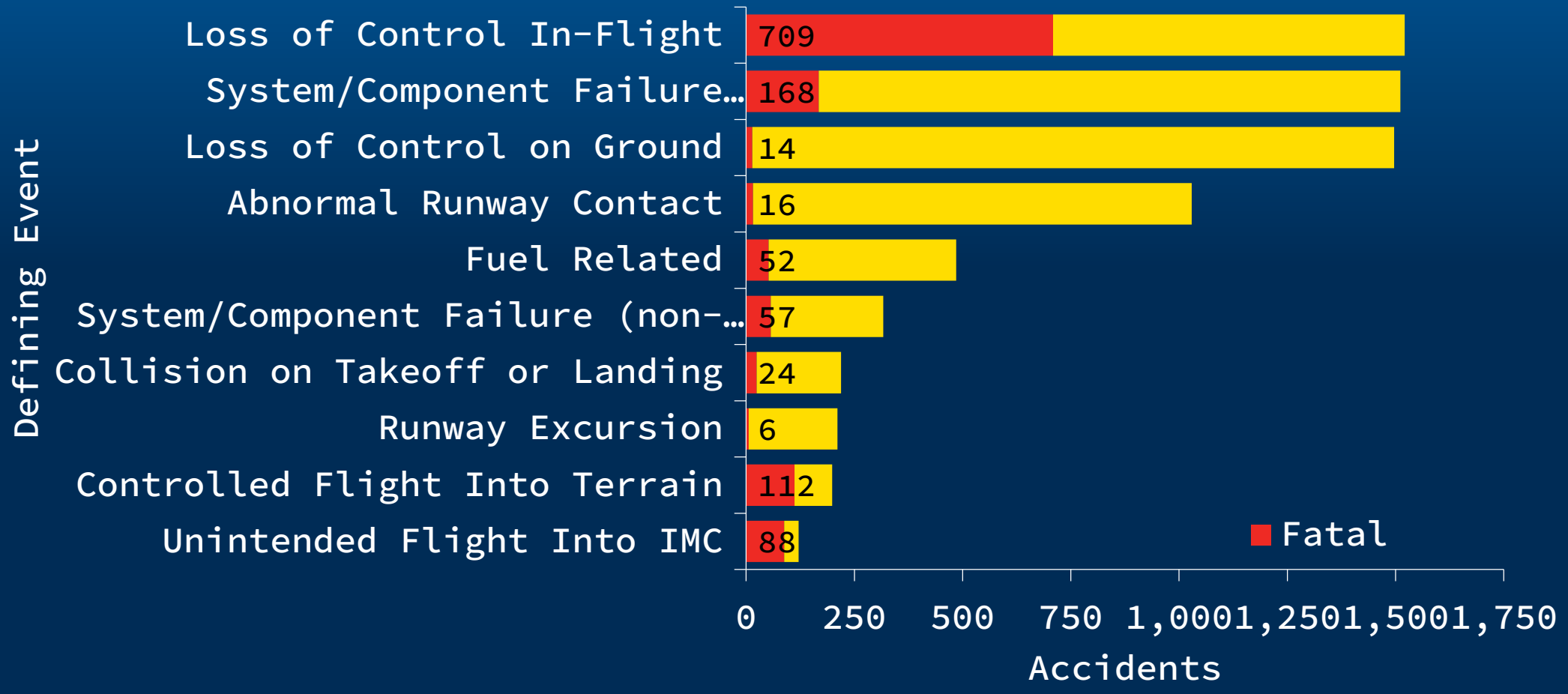




Source: FAA

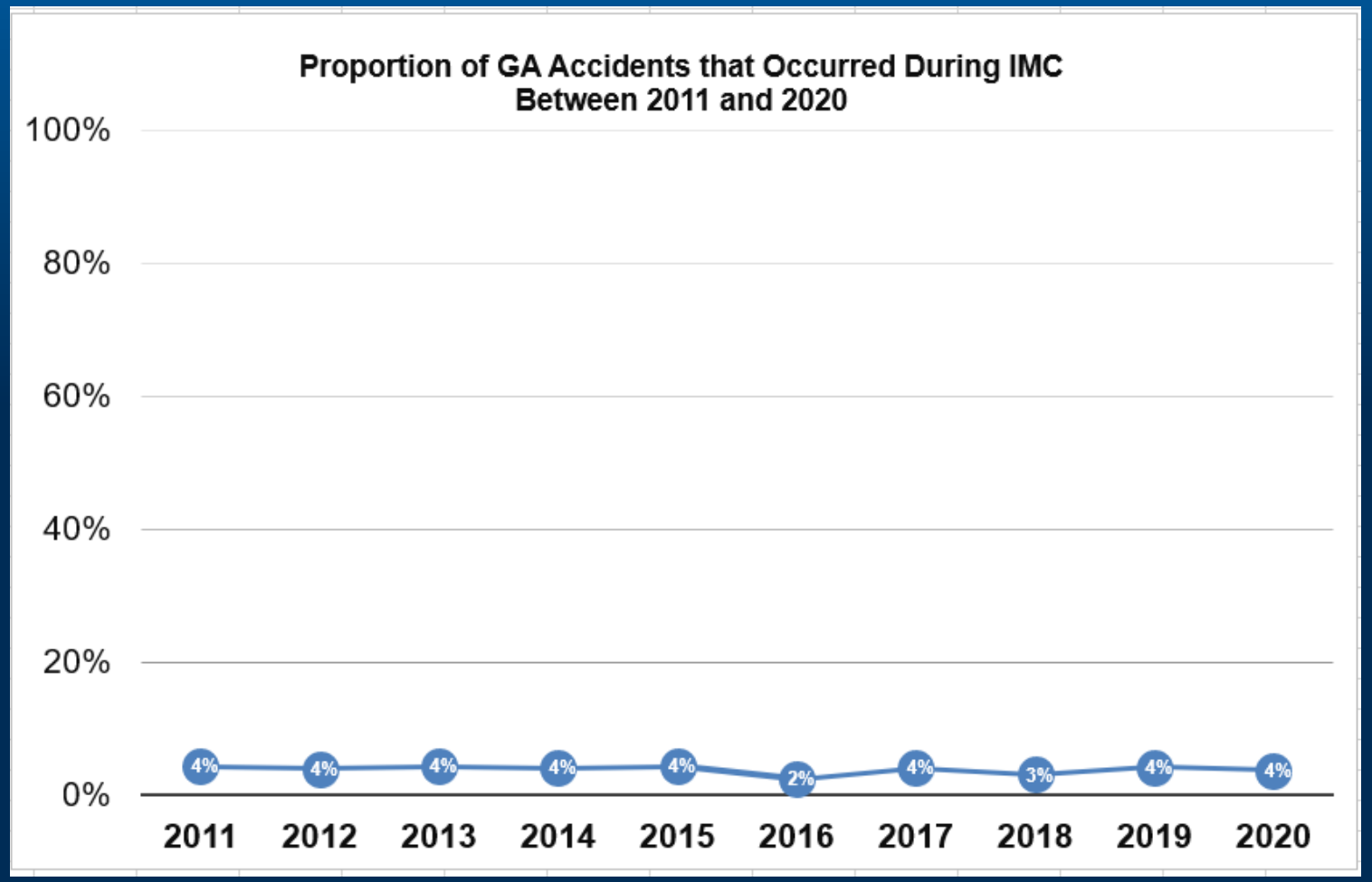
NTSB

Top 10 GA Personal Flying Accident Categories: 2012–2021



NTSB

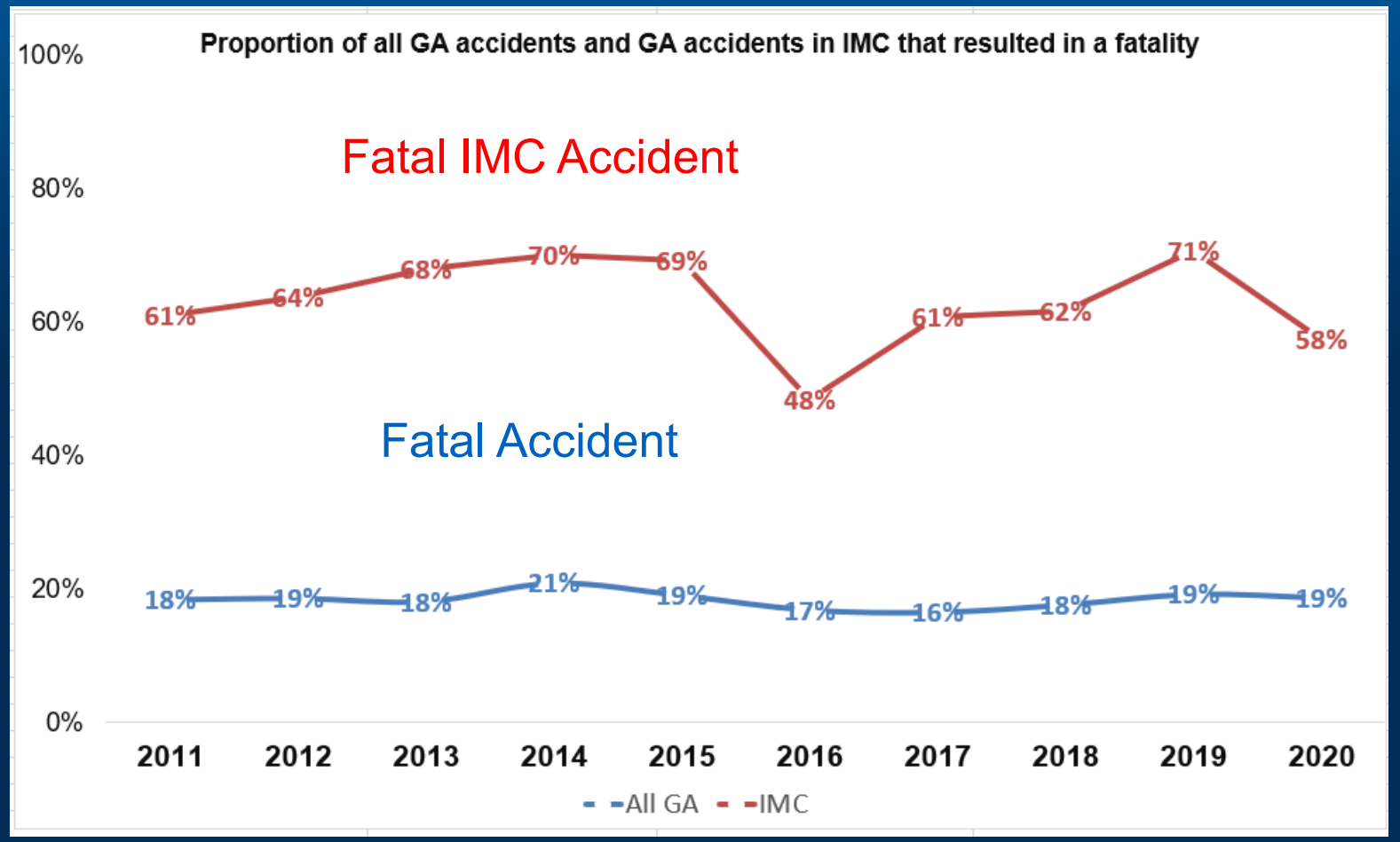
Proportion of GA accidents with IMC cited: 2011–2020



Period from 2011-2020 the proportion of GA accidents that occurred during IMC ranged from 2% to 4%.

NTSB

Proportion of all GA accidents in IMC and fatalities

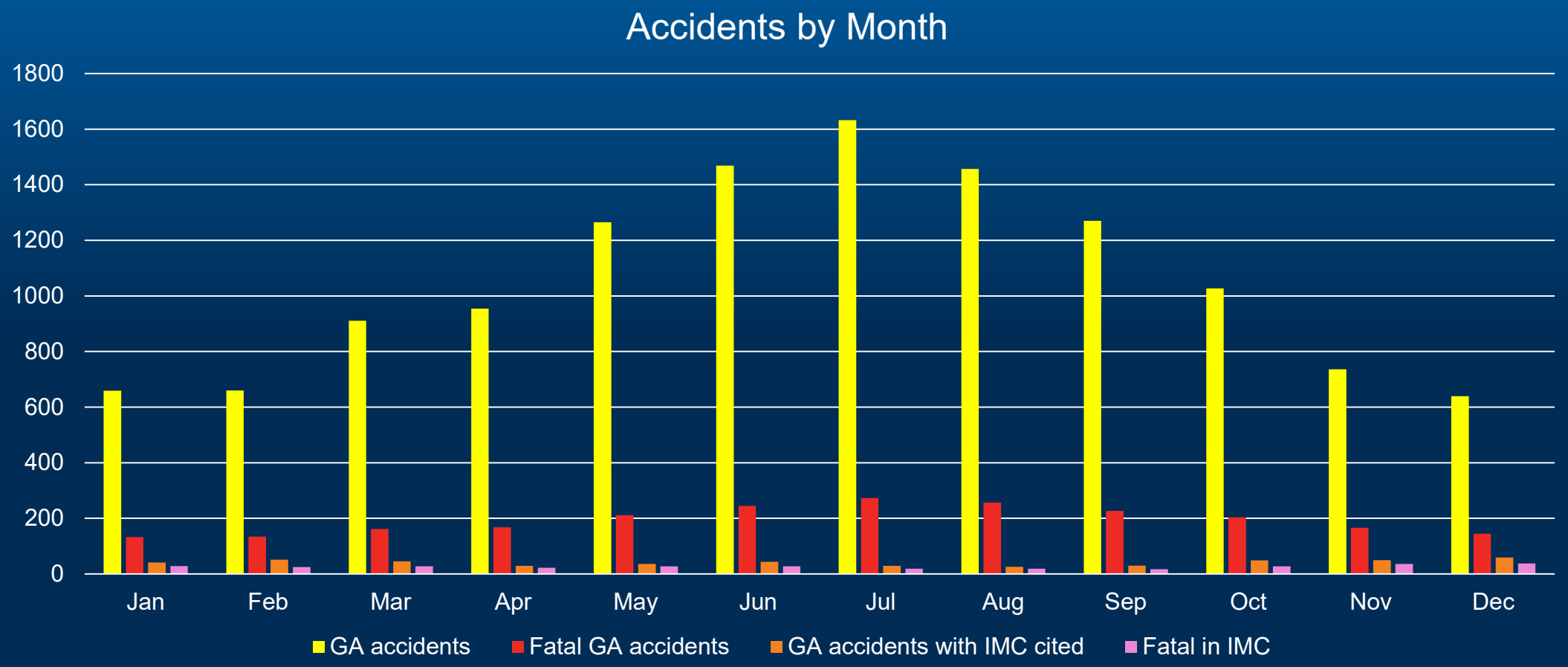


Period 2011-2020 the proportion of GA accidents that resulted in a fatality average 18%.

Of the 489 accidents listed with IMC, 312 were fatal or 64% on average.

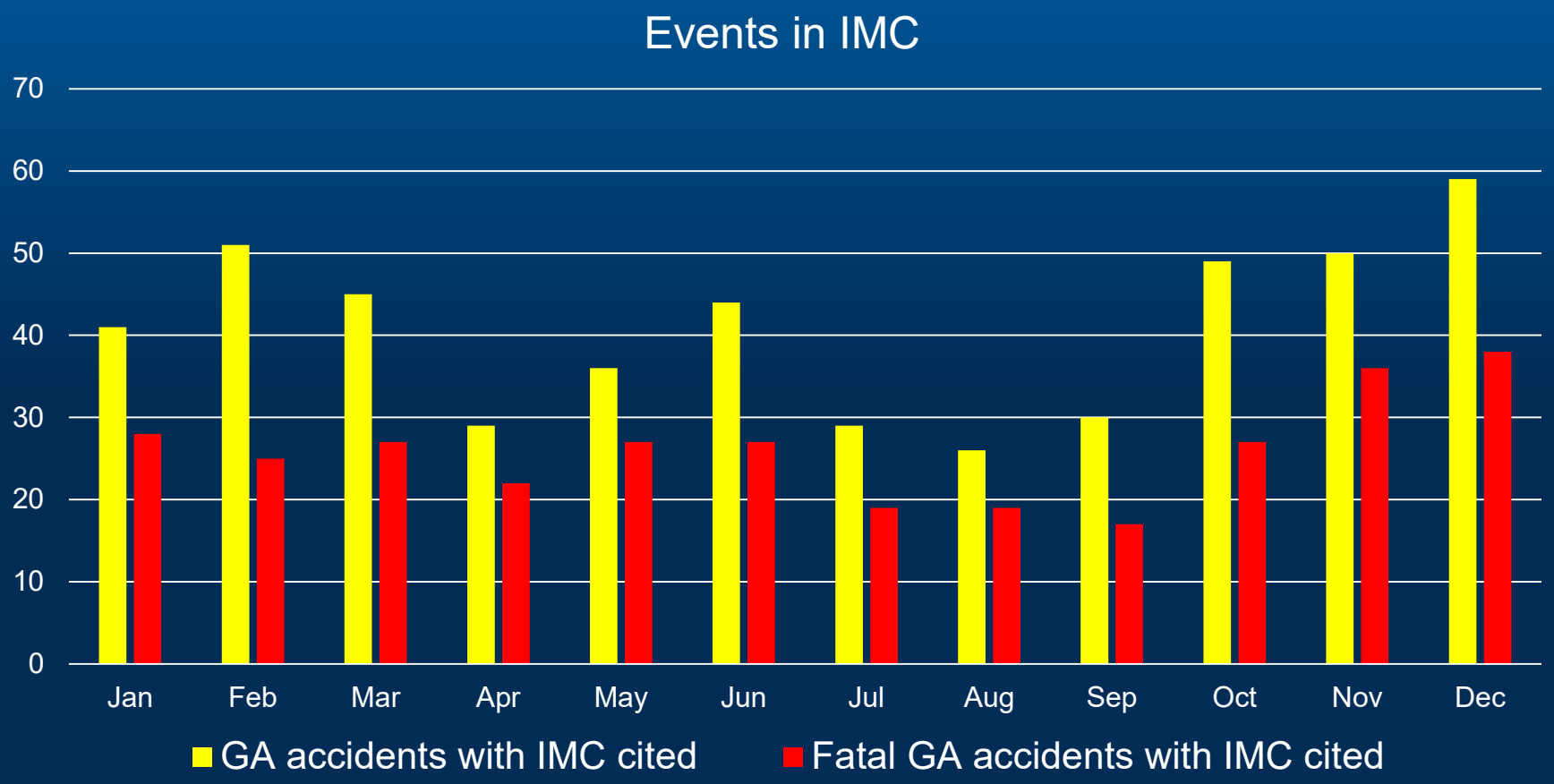
NTSB

GA Accidents by Month and Fatality Rates in IMC: 2011-2020



NTSB

GA Monthly Accidents with IMC and Fatal Events: 2011–2020



Total events in IMC; 489 accidents with 312 fatal events, 64% fatality rate

NTSB

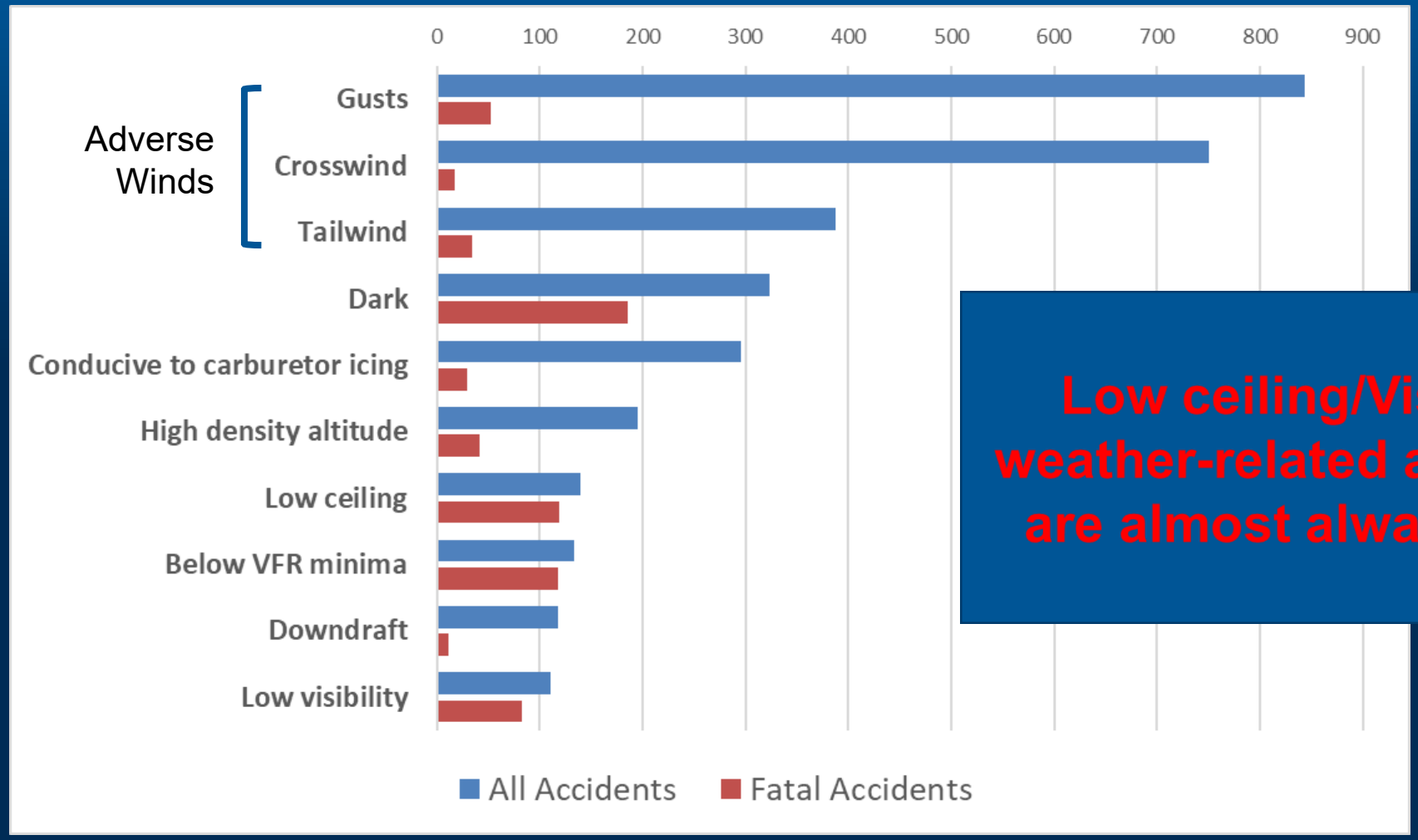
Part 91 Weather-Related Accidents 2008-2020

	Weather-Related	Non Weather-Related	Total Events	Weather-Related Percentage
Accidents	**3,637**	**12,108**	**15,745**	**23%**
Fatal Accidents	**823**	**2,027**	**2,850**	**27%**

D.Eick/E.Emery NTSB 2022

- Average 1,312 accidents annually with average 262 fatal events
  - Weather-related accidents ~300 accidents
  - Fatal weather-related accidents ~64 accidents

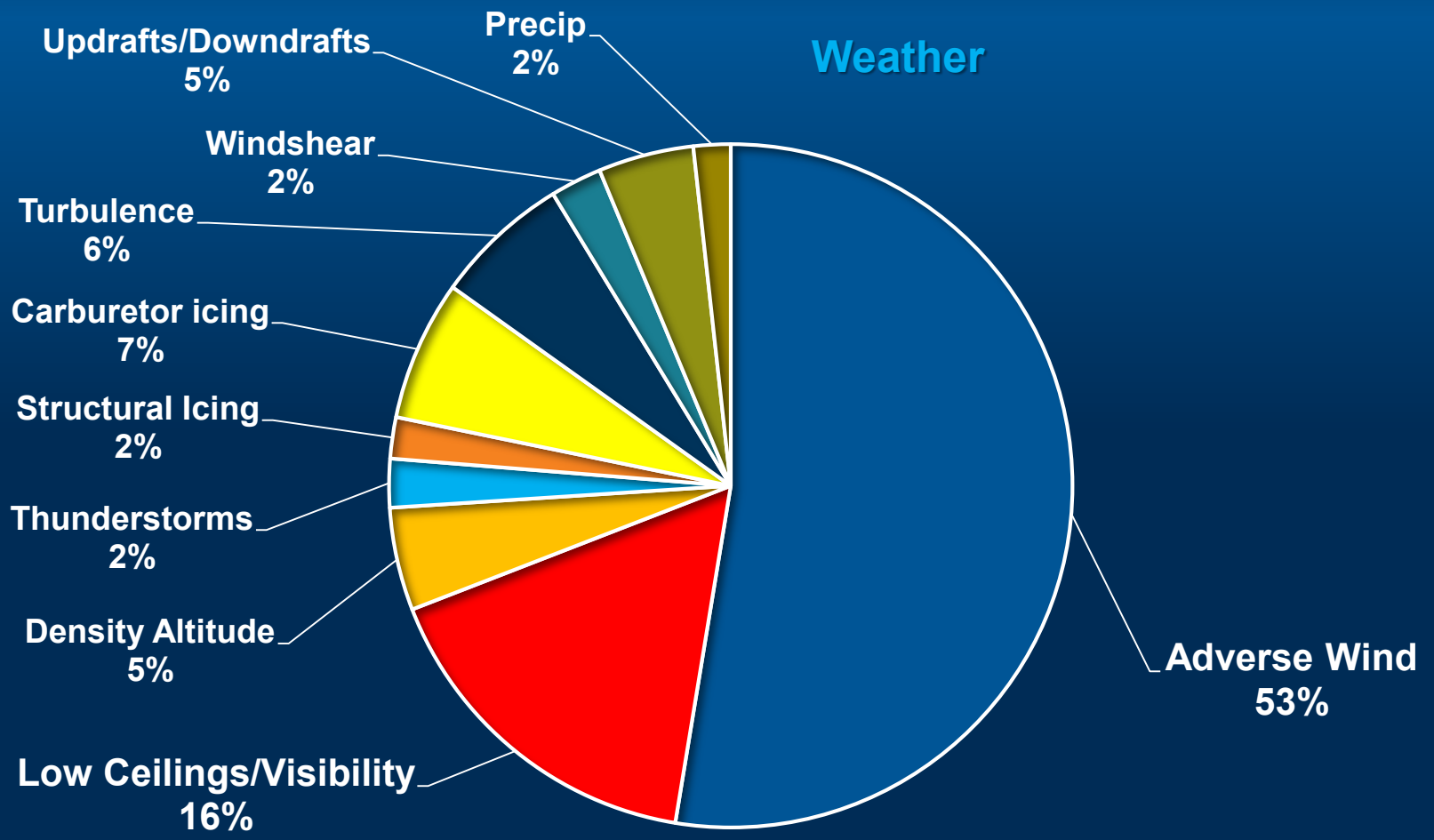
Part 91 – 10 Most Frequent Weather-Related Findings: 2008–2020

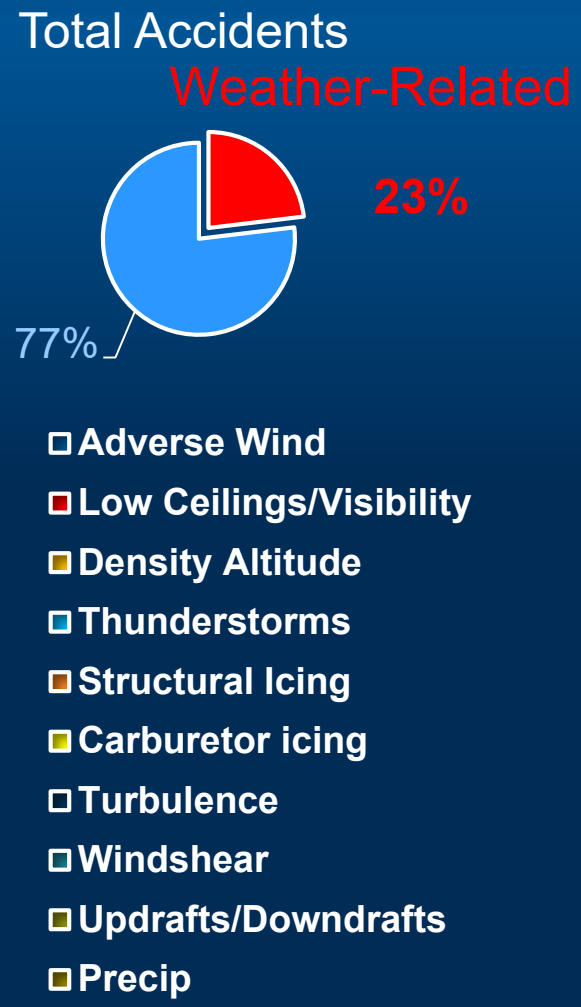


Low ceiling/Visibility weather-related accidents are almost always fatal!

NTSB

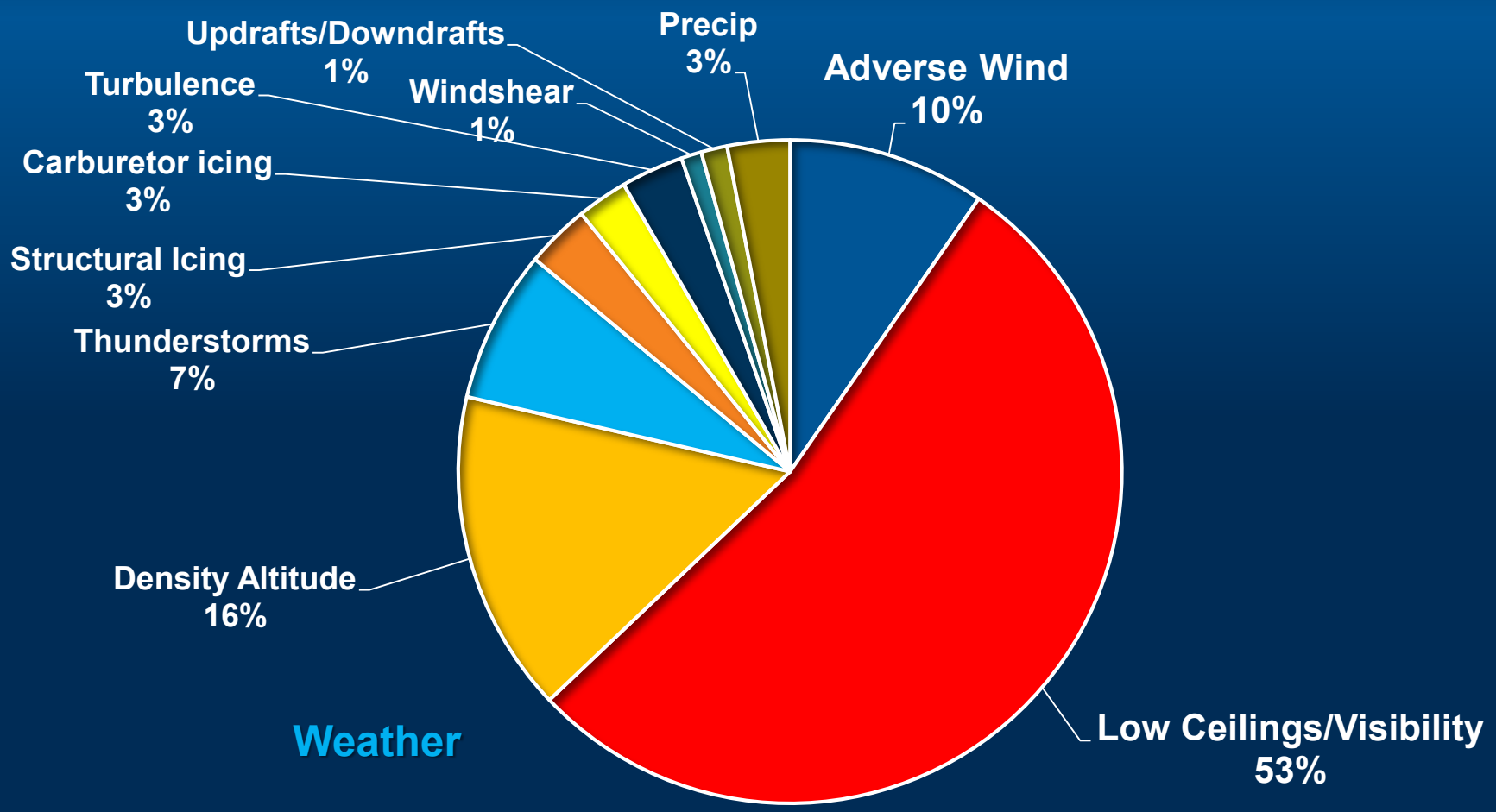
Part 91 – Environmental Factor
Accidents: 2008–2020

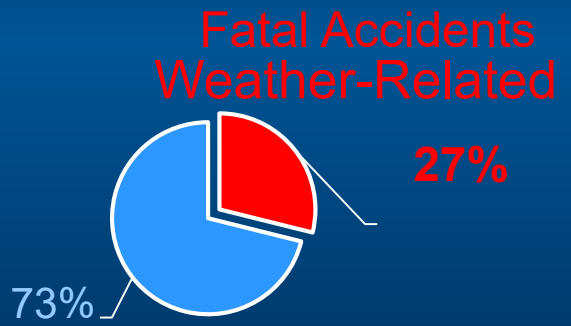




NTSB

Part 91– Fatal Environmental Factor Accidents: 2008–2020

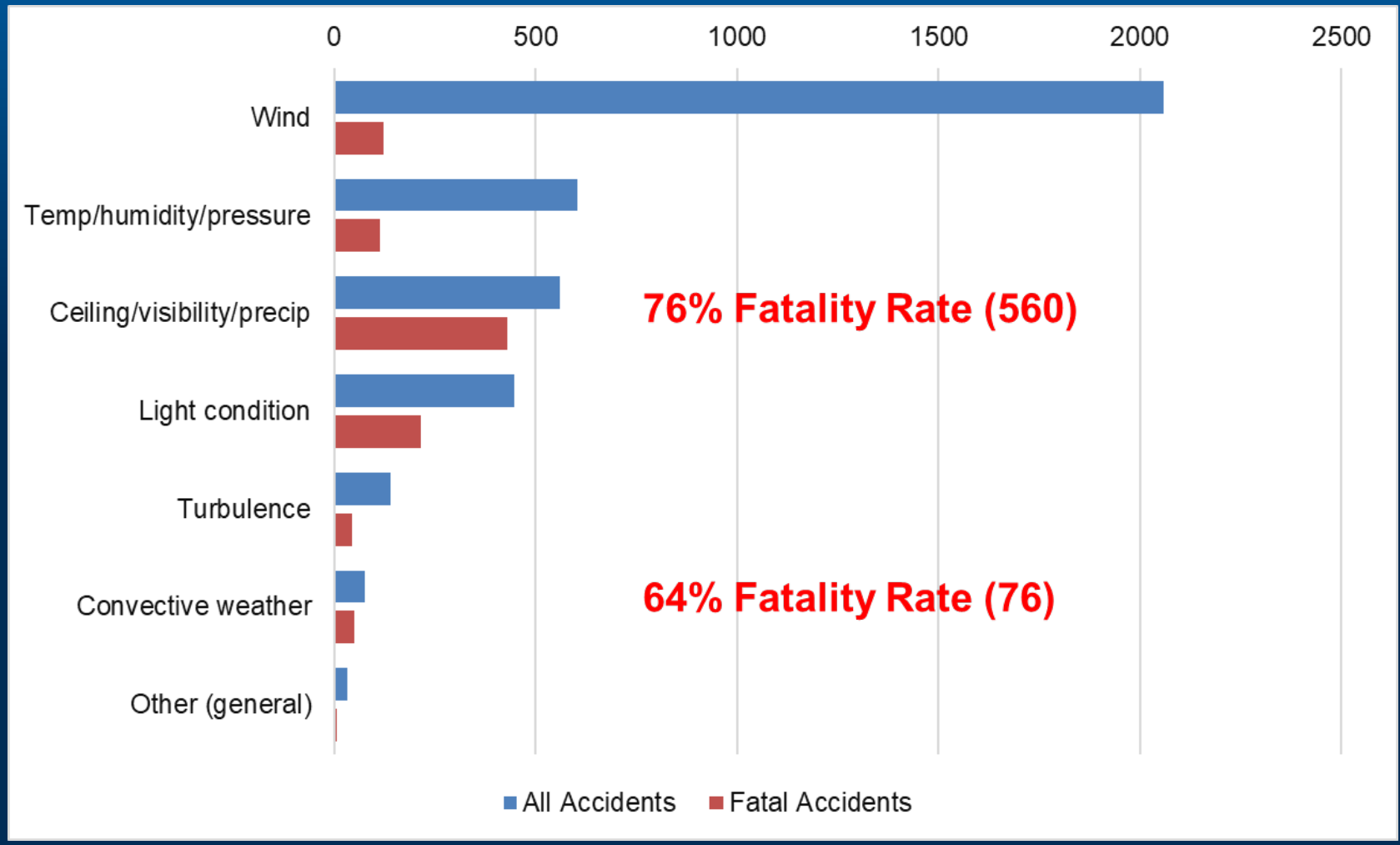




- Adverse Wind
- Low Ceilings/Visibility
- Density Altitude
- Thunderstorms
- Structural Icing
- Carburetor icing
- Turbulence
- Windshear
- Updrafts/Downdrafts
- Precip

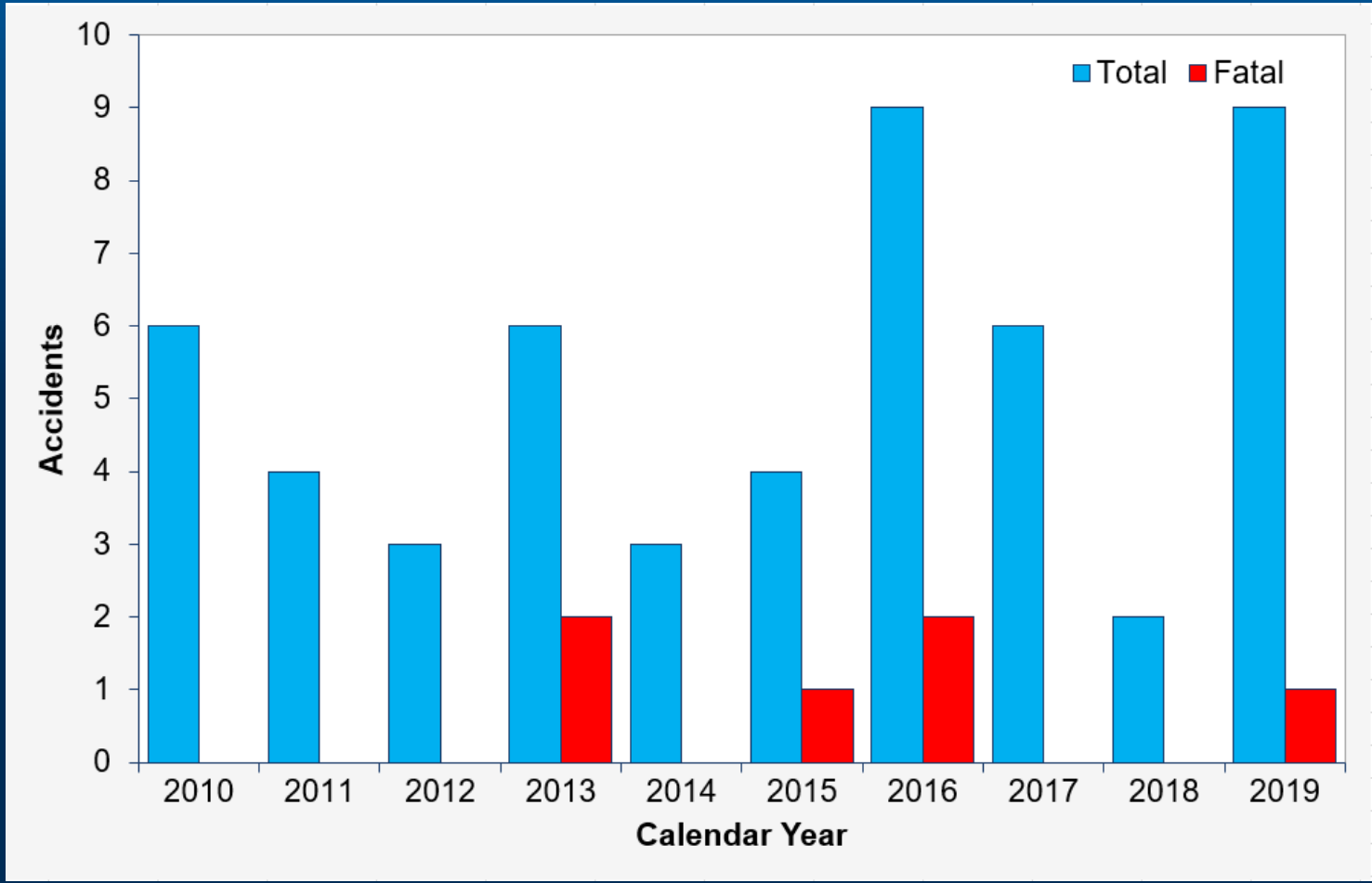
NTSB

Part 91 Accidents by Weather-Related Findings: 2008–2020



NTSB

Scheduled Part 135 Accidents: 2010–2019



52 accidents with 6 fatal events

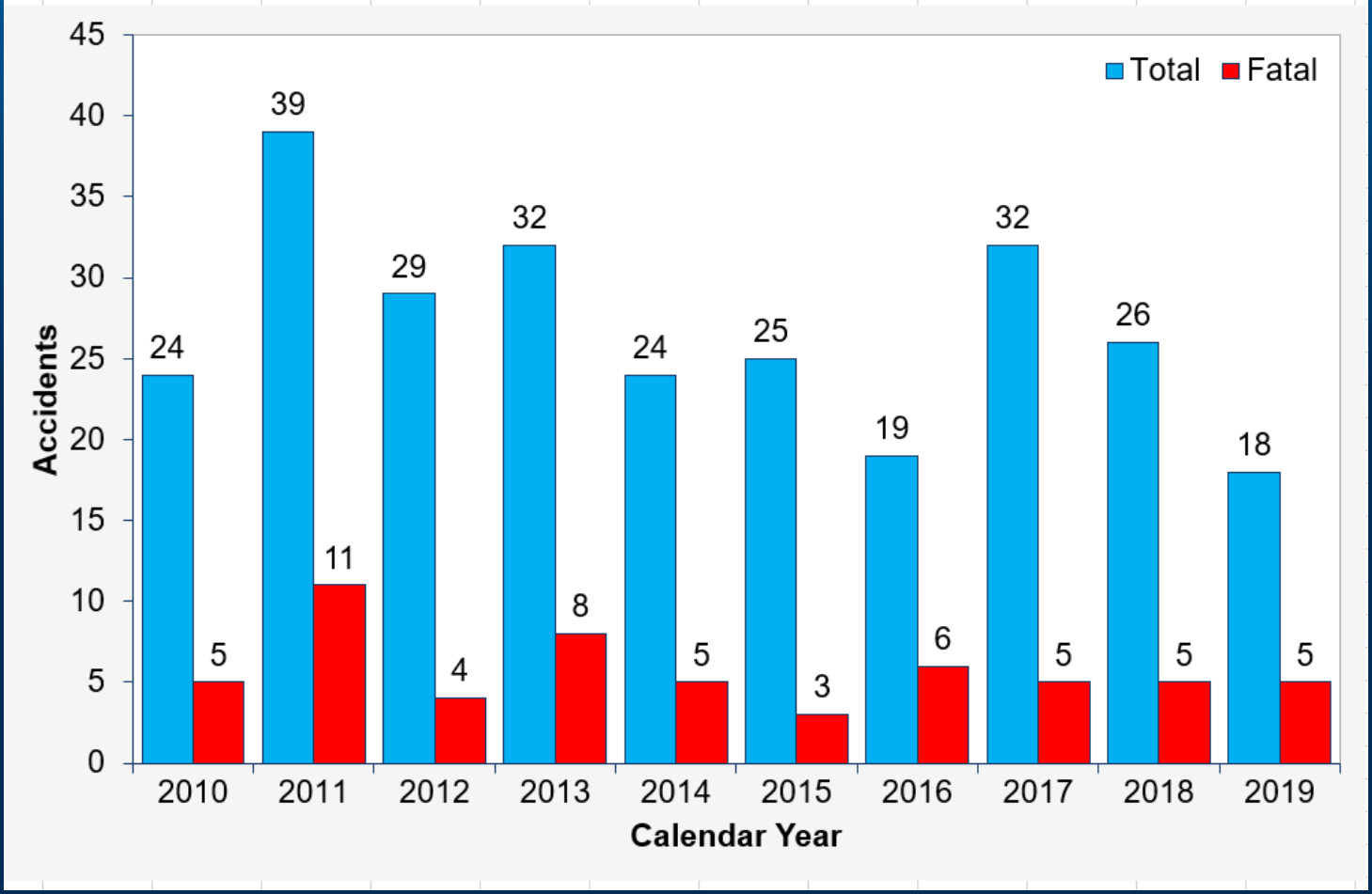
Defining Events in 2019:

- Loss of Control on Ground
- Loss of Control in-Flight
- Runway Excursion
- Undershoot/Overshoot
- Ground Collision
- Bird Strike
- Other

*Majority of events occurred in Alaska (7)

NTSB

Non-Scheduled Part 135 Fixed-Wing: 2010-2019



268 accidents with 57 fatal events

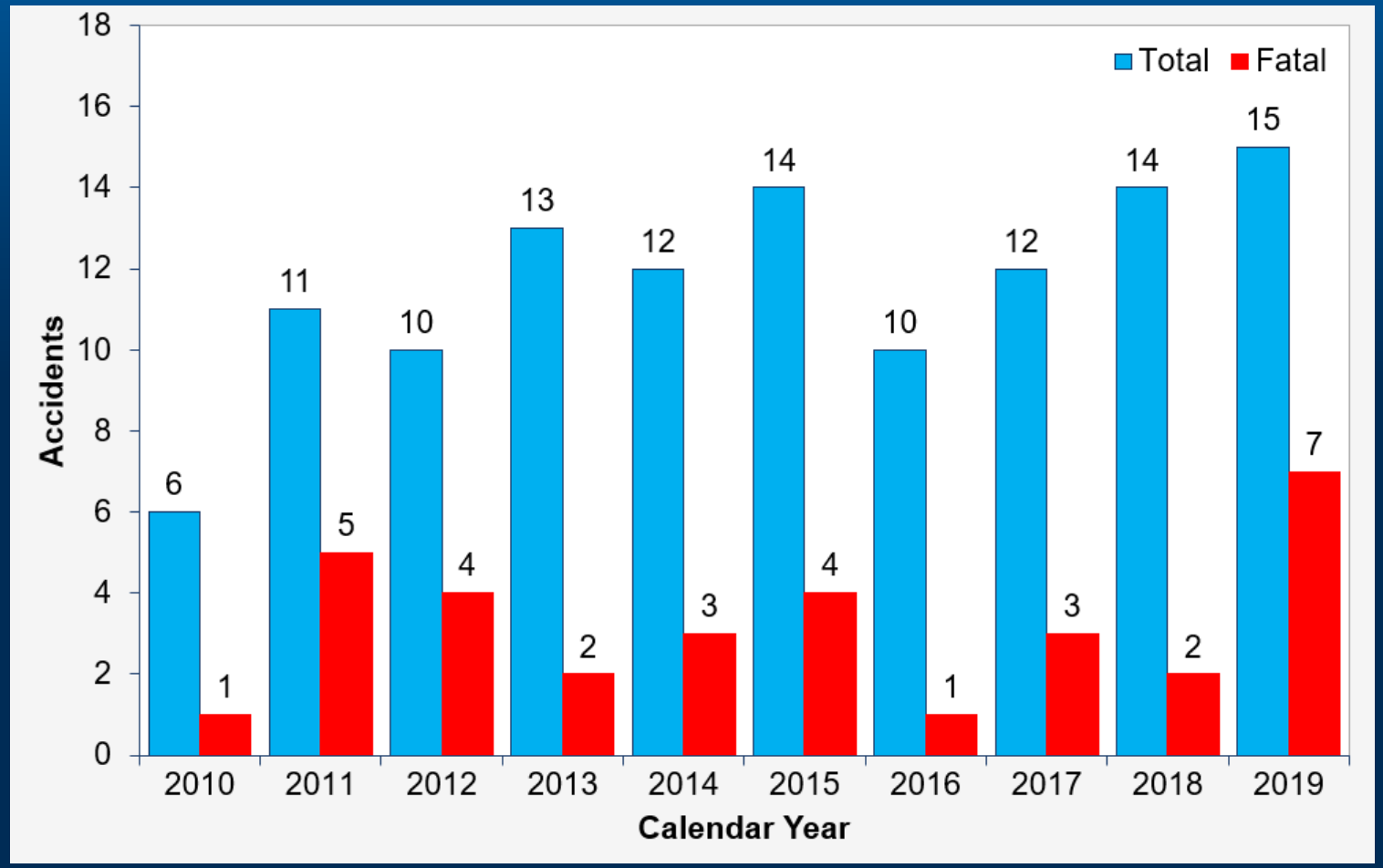
Defining Events in 2019:

- System/Component Failure-Powerplant
- Loss of Control In-Flight
- Midair
- System/Component Failure
- Runway Excursion
- Ground Collision
- Turbulence Encounter
- Ground Handling
- Other

* Split between lower 48 and Alaska (7)

NTSB

Non-Scheduled Part 135 Helicopter Accidents: 2010-2019

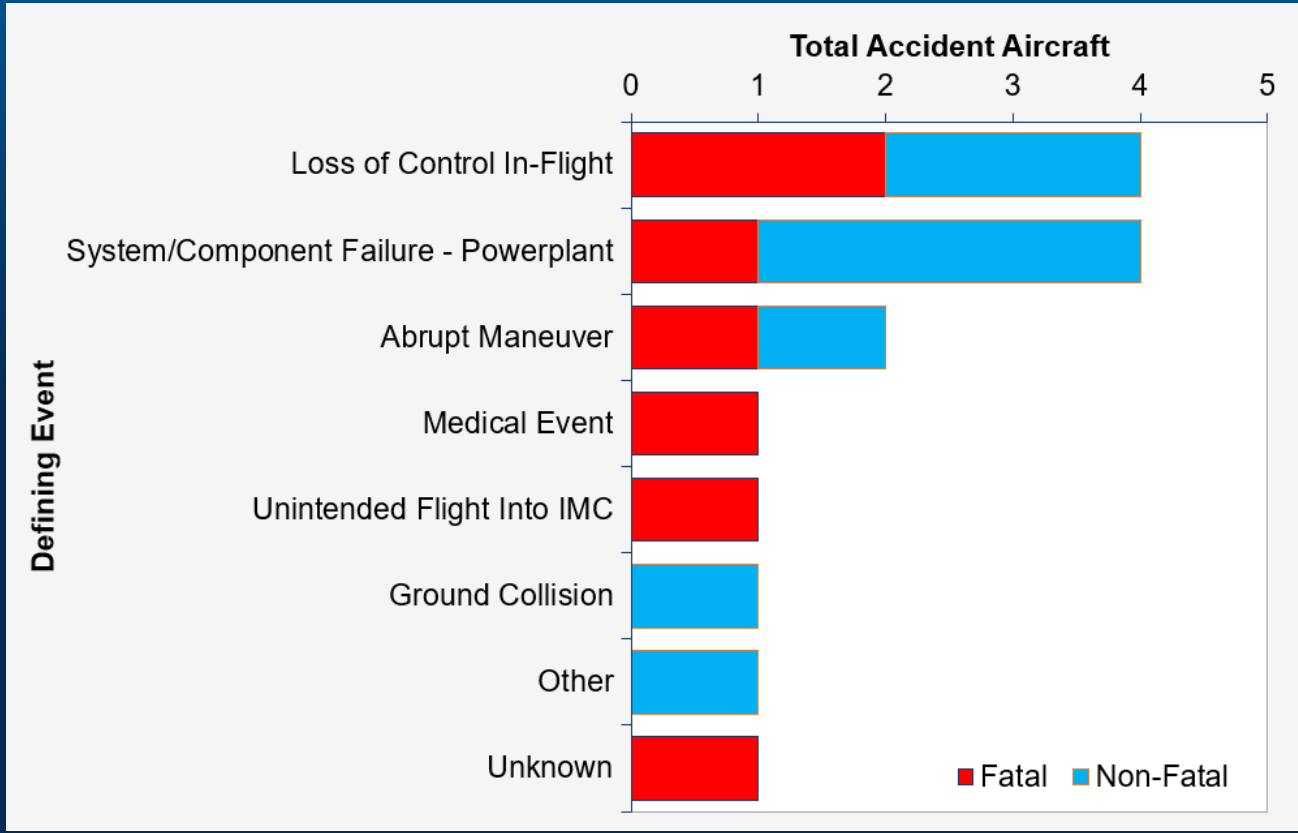


117 accidents with 32 fatal events

- Majority of the 2019 accidents occurred over CONUS (10), with (3) Hawaii and (2) in Alaska.

NTSB

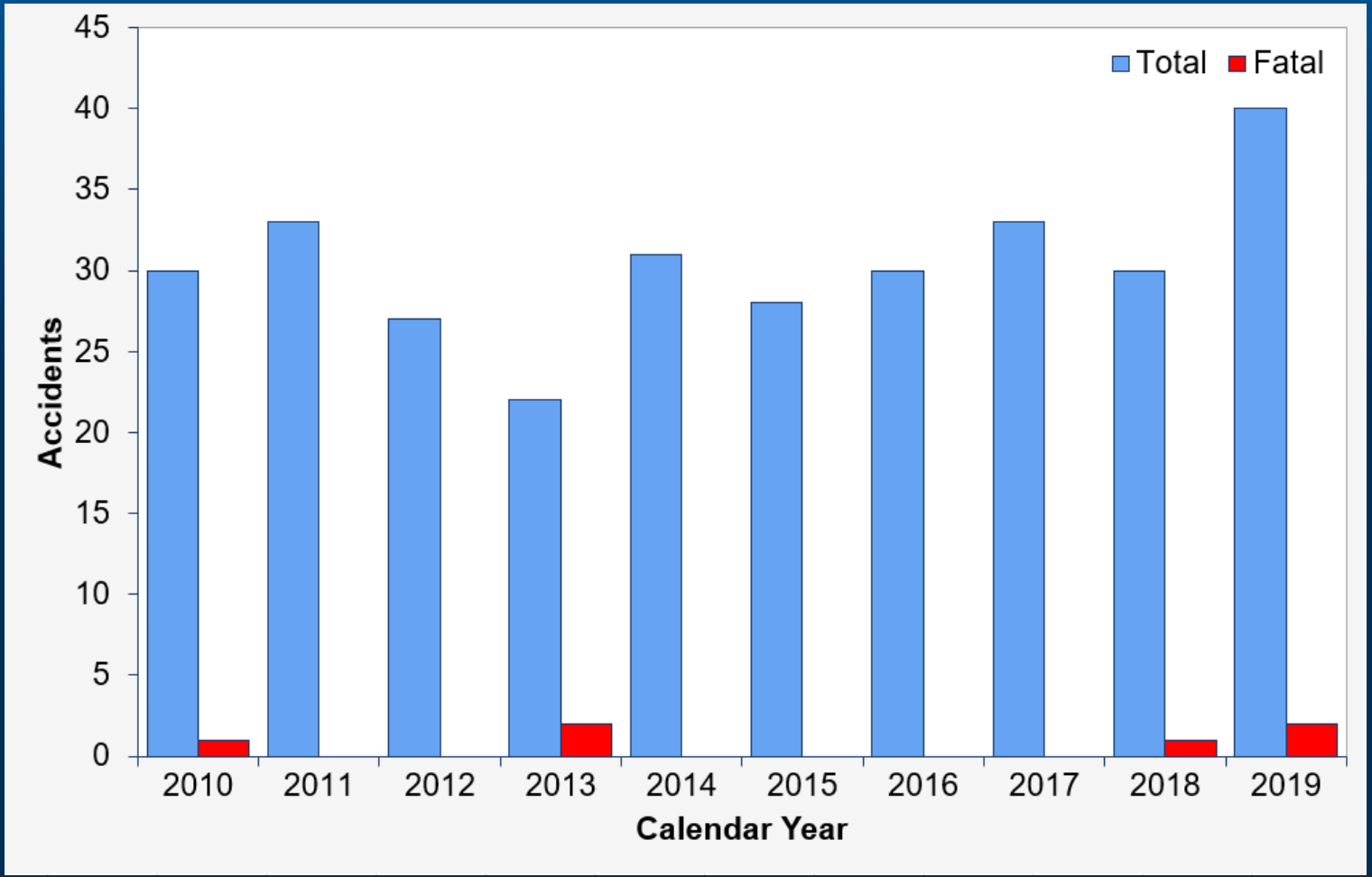
Part 135 Helicopter Defining Events: 2019



NTSB case	Location	Event	Fatalities
CEN19FA185	Brainerd, MN	HEMS LOC-I in IMC	(2)
CEN19FA095	Galliano, LA	GMEX LOC-I in IMC	(2)
CEN19FA072	Zaleski, OH	HEMS LOC-I in IMC	(3)
WPR19FA123	Kailua, HI	Upset/Turbc	(3)
ANC20MA010	Kekaha, HI	CFIT in IMC	(7)

*Half of fatal events occurred in IMC conditions

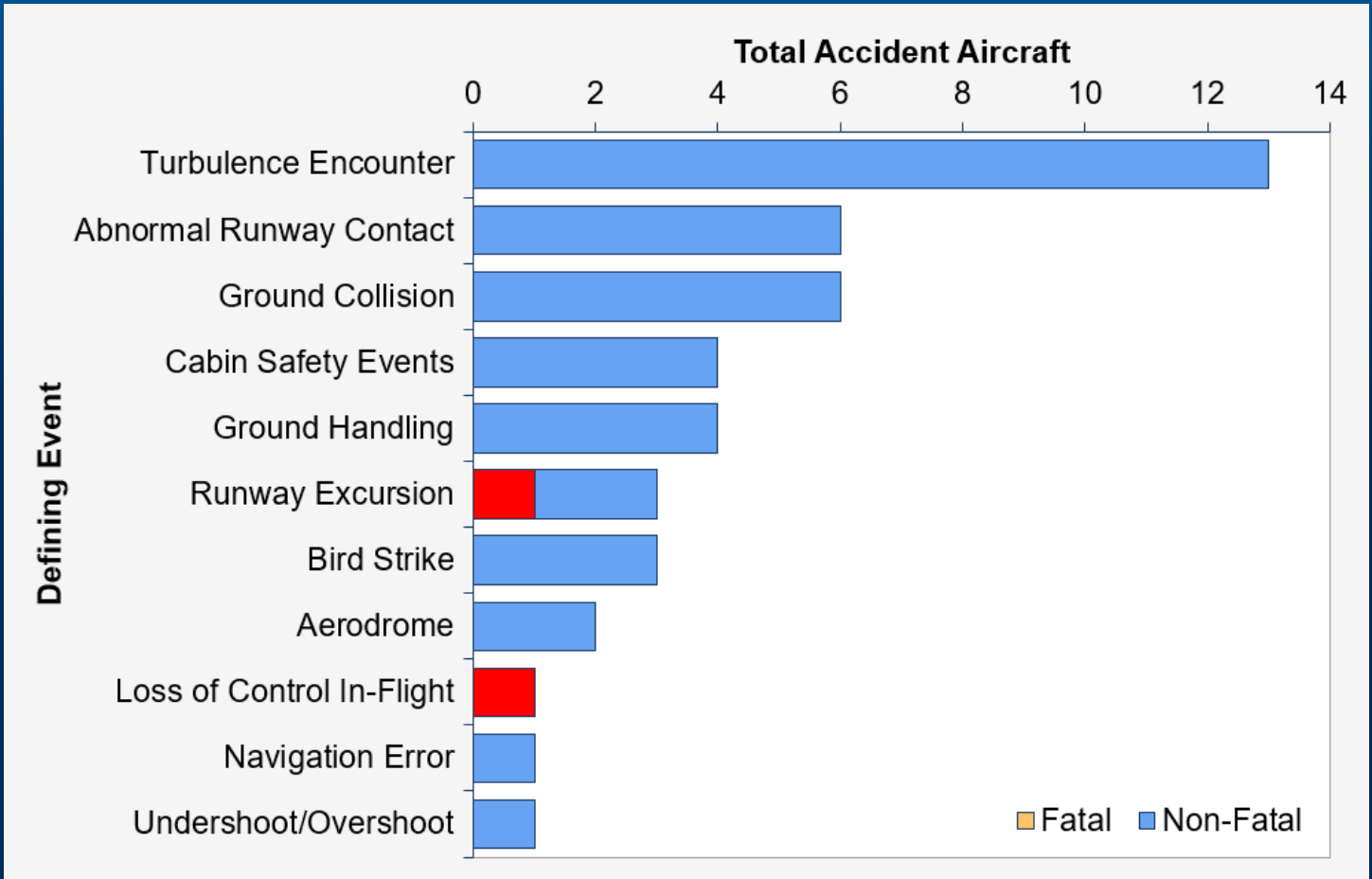
Part 121 Accidents: 2010-2019



Between 2010-2019 there were 304 Part 121 accidents, with 6 fatal events.

NTSB

Part 121 Defining Events: 2019



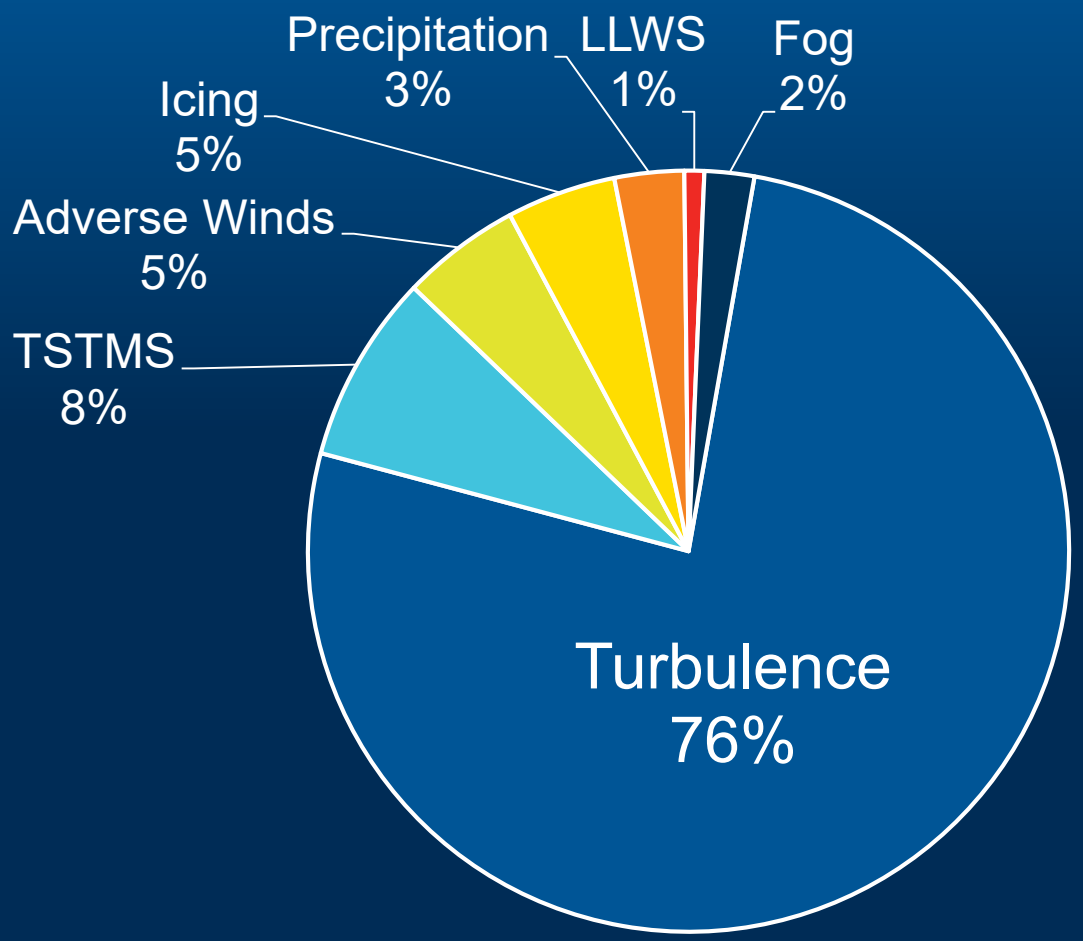
42 Accidents recorded in 2019, with 2 fatal events:

DCA19MA086 – Trinity, TX (3); LOC-I IMC due to spatial disorientation

DCA20MA002 – Unalaska, AK (1); Runway Excursion on landing/tailwind

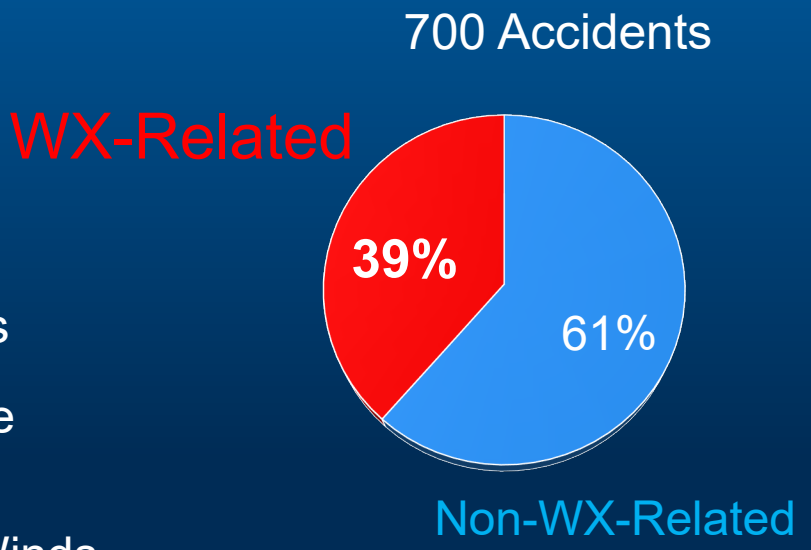
NTSB

Part 121 Air Carrier Weather-Related Accidents: 2000-2020



Weather Factors

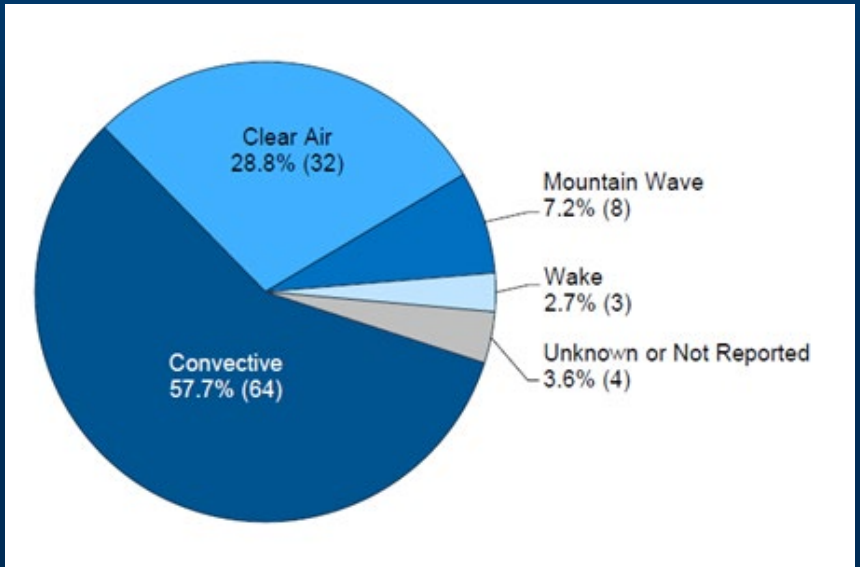
- Turbulence
- TSTMS
- Adverse Winds
- Icing
- Precipitation
- LLWS
- Fog



NTSB

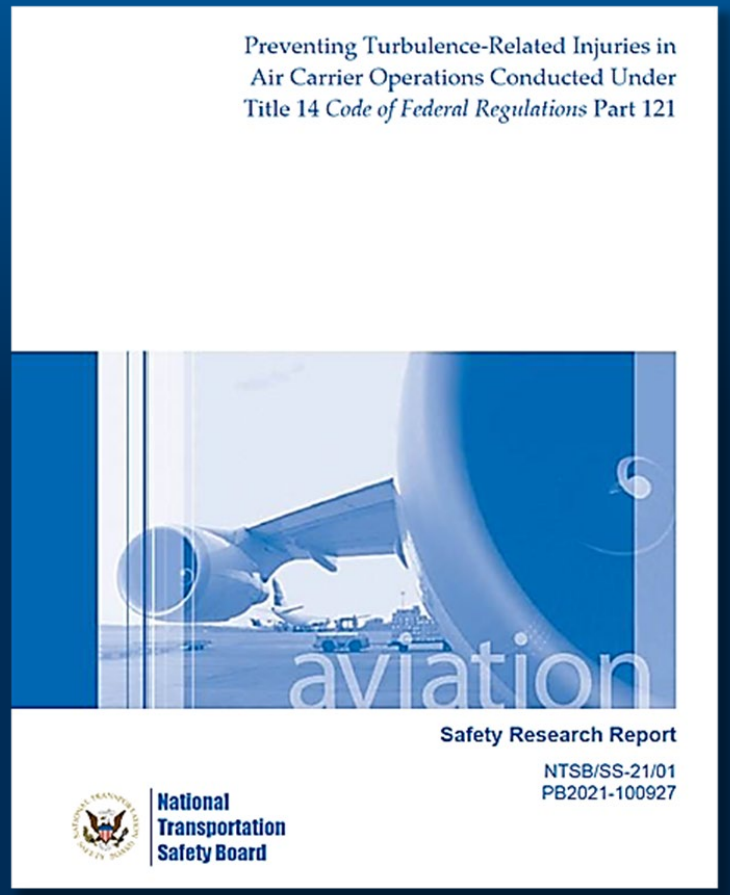
Turbulence

#1 Defining event for Part 121 Accidents
Turbulence



NTSB

NTSB Part 121 Turbulence Safety Research Report



- Review of Part 121 turbulence events between 2009–2018
- Case study of 10 turbulence related accidents in 2019–2020
- Stakeholder interviews
  - FAA, Air Traffic Control
  - Air Carriers, Pilot, Dispatcher & Flight Attendant Unions
  - NWS, NCAR, and other commercial WX vendors
- Result issued 21 safety recommendations to the FAA, NWS, and air carriers

NTSB would like to recognize NCAR's and the FAA's assistance and efforts in reducing turbulence related events!

NTSB

Part 121 – Accidents/Incidents in Instrument Meteorological Condition (IMC), 2015-2020

NTSB Case	Location	Date	Aircraft	Defining Event
• DCA20LA013	– Chicago, IL	Nov.11, 2019	EMB145	Runway Excursion
• DCA19MA143	– Jacksonville, FL	May 3, 2019	B737	Runway Excursion
• DCA19FA089	– Presque Isle, ME	March 4, 2019	EMB145	Wrong Surface
• DCA19MA086	– Trinity Bay, TX	Feb. 23, 2019	B767	Loss of Control Inflight
• DCA19IA036	– Burbank, CA	Dec. 6, 2018	B737	Runway Excursion
• DCA15FA085	– New York, NY	March 5, 2015	MD-88	Runway Excursion

DCA20LA013 – Chicago, IL
Envoy Air EMB145
November 11, 2019 @ 0743 CST (1243Z)

- American Eagle flight from Greensboro, NC to Chicago, IL
- FICON 5/5/5 1/8IN WET SN
- Experienced a right main landing gear collapse after departing runway 10L while landing.
- No injuries to 41 passengers & crew, aircraft substantial damage.
- Instrument meteorological conditions (IMC) prevailed, with quartering crosswind 18-24 KT, tailwind component of 3-5 KT
- Runway excursion

METAR KORD 111340Z 35018G28KT 3/4SM R10L/3500V5000FT –SN BLSN VV011 M05/M06 A3021 RMK A02 PK WND 35028/1331 P0001 T10501061 $

NTSB

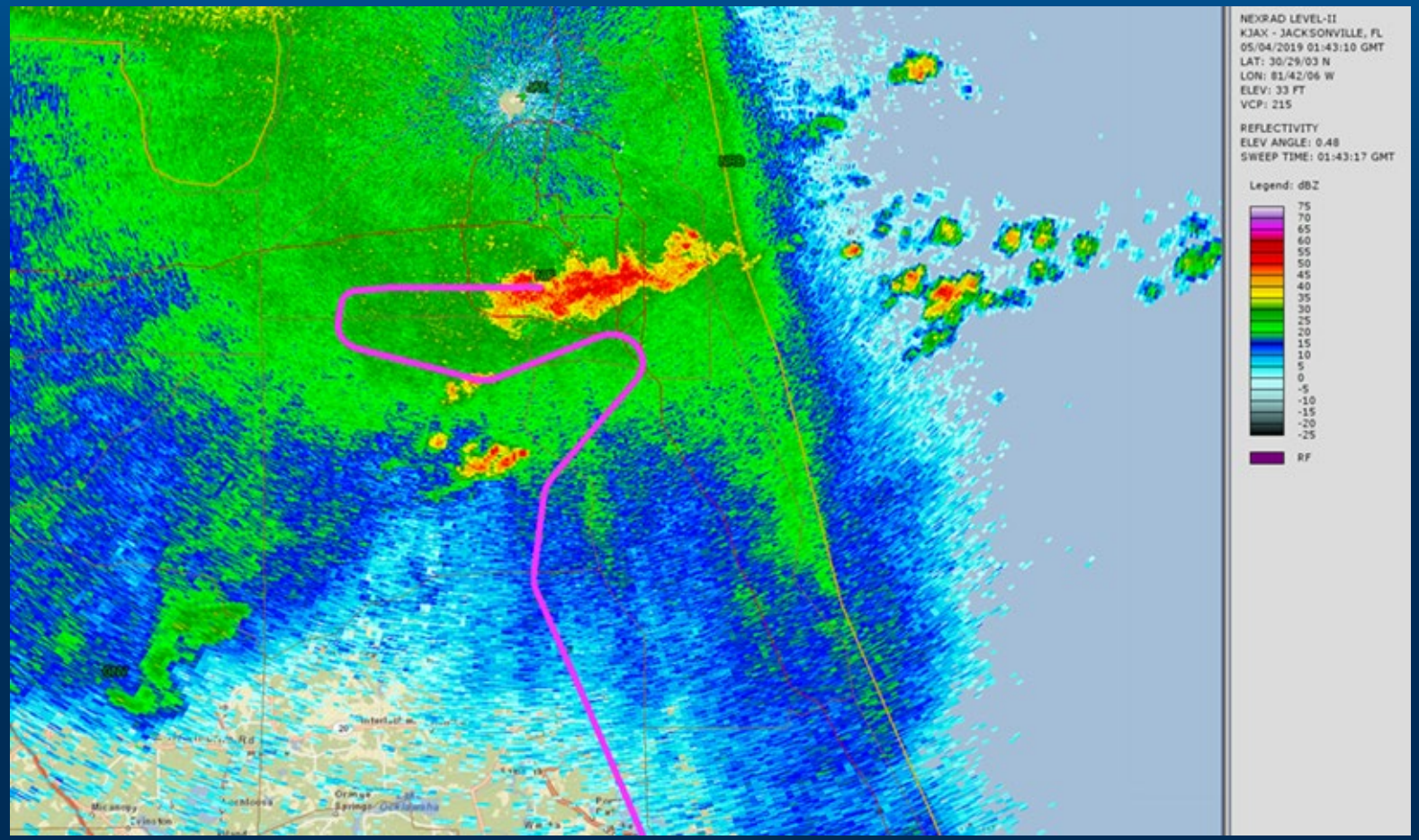
DCA19MA143 – Jacksonville, FL
Miami Air International B737 run
May 3, 2019 @ 2142 EDT (0142Z Ma

- Military charter Guantanamo Bay, Cuba to Naval Air Station Jacksonville (NIP)
- Night IFR–MVFR conditions prevailed in thunderstorms
- RNAV (nonprecision)
- Overran runway 10 due to hydroplaning caused by heavy rainfall on the ungrooved runway
- 21 passengers minor injured, 3 pets died in cargo hold, aircraft substantial damage (scrapped)

SPECI KNIP 040140Z 23010G16KT 3SM +TSRA BR SCT008 BKN018CB OVC030 24/22 A2999
RMK A02 TSB04 FRQ LTGIC OHD TS OHD MOV E T1 SET P0052

NTSB

DCA19MA143 – Jacksonville, FL



Reflectivities 40-55dBZ along track

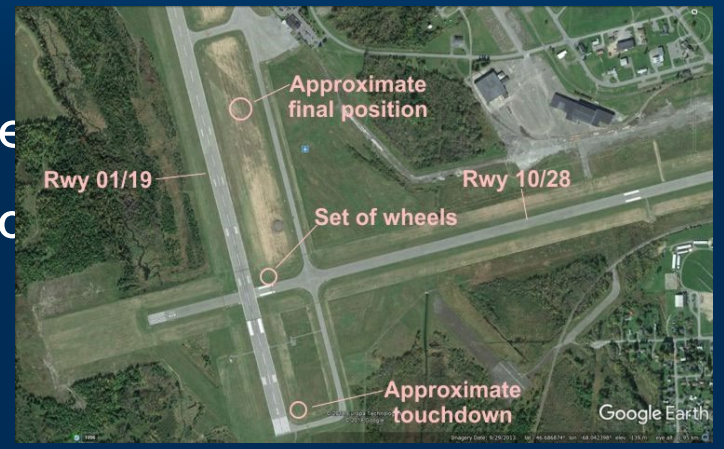
714 Lightning flashes within 20”

Convective SIGMET current for Area TS moving little, with tops above FL450

NTSB

DCA19FA089 – Presque Isle, ME
CommutAir EMB-145
March 4, 2019 @ 1129 EST (1629

- Scheduled flight EWR-PQI
- IMC prevailed in winter storm
- 1st missed approach; runway not positively identifie
- 2nd approach landed between runway and taxiway in mc
- No injuries, substantial damage to aircraft
- Official Probable Cause not issued at this time

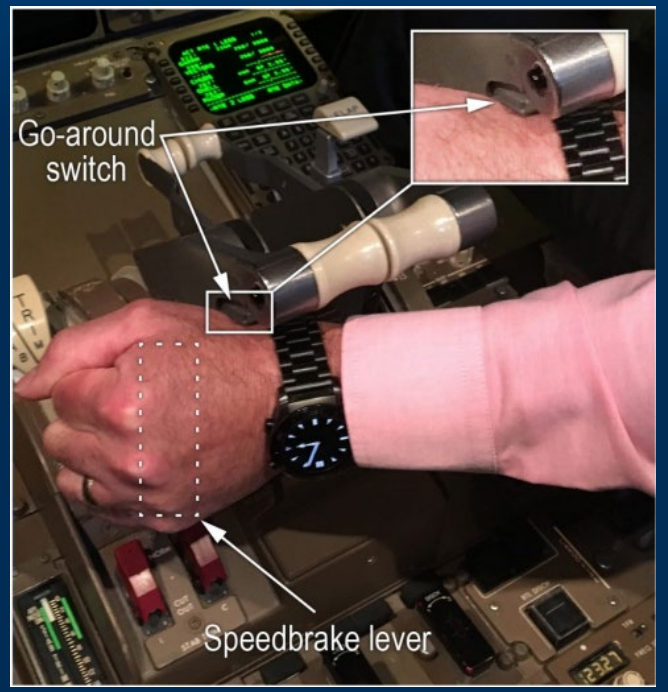


SPECI KPQI 041618Z AUTO 06004KT 1/2SM SN FZFG M03/M04 A2968 RMK AO2 P0000 FZRANO RVRNO=

NTSB

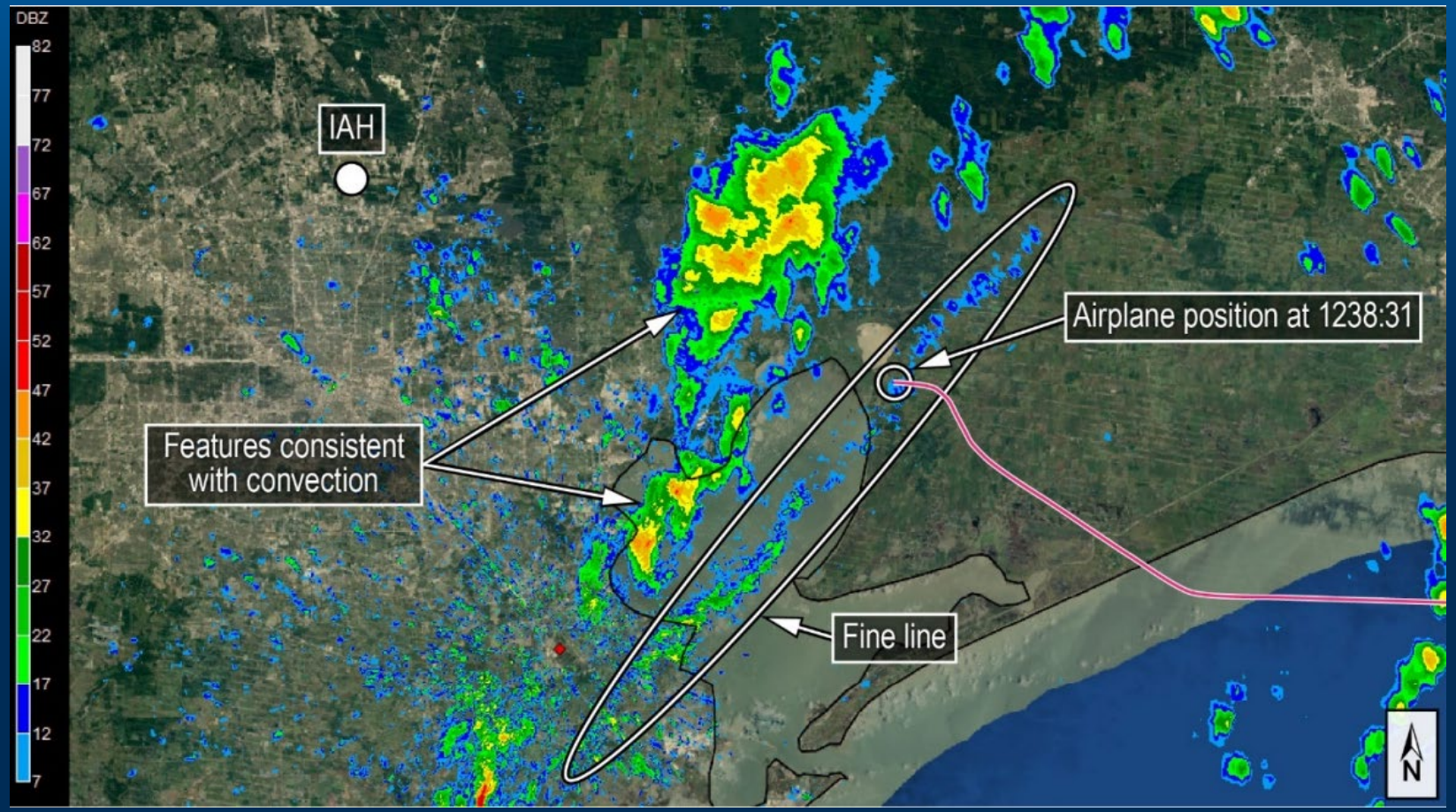
DCA19MA086 – Trinity Bay, TX
Atlas Air (Amazon) B767 cargo flight
February 23, 2019 @ 1239 CST

- Part 121 cargo flight MIA-HOU
- Penetrating leading edge of cold front associated with windshear & IMC at 6,300 ft
- Encountering turbulence, flying pilot (FO) inadvertently activated aircraft's go-around mode
- Aircraft pitched up, FO experienced spatial disorientation & pushed nose-down control inputs, that put the aircraft in a steep descent from which the crew did not recover (32-seconds)
- Captain's delayed awareness of and ineffective response
- Fatal 3



NTSB

DCA19MA016 – Trinity Bay, TX

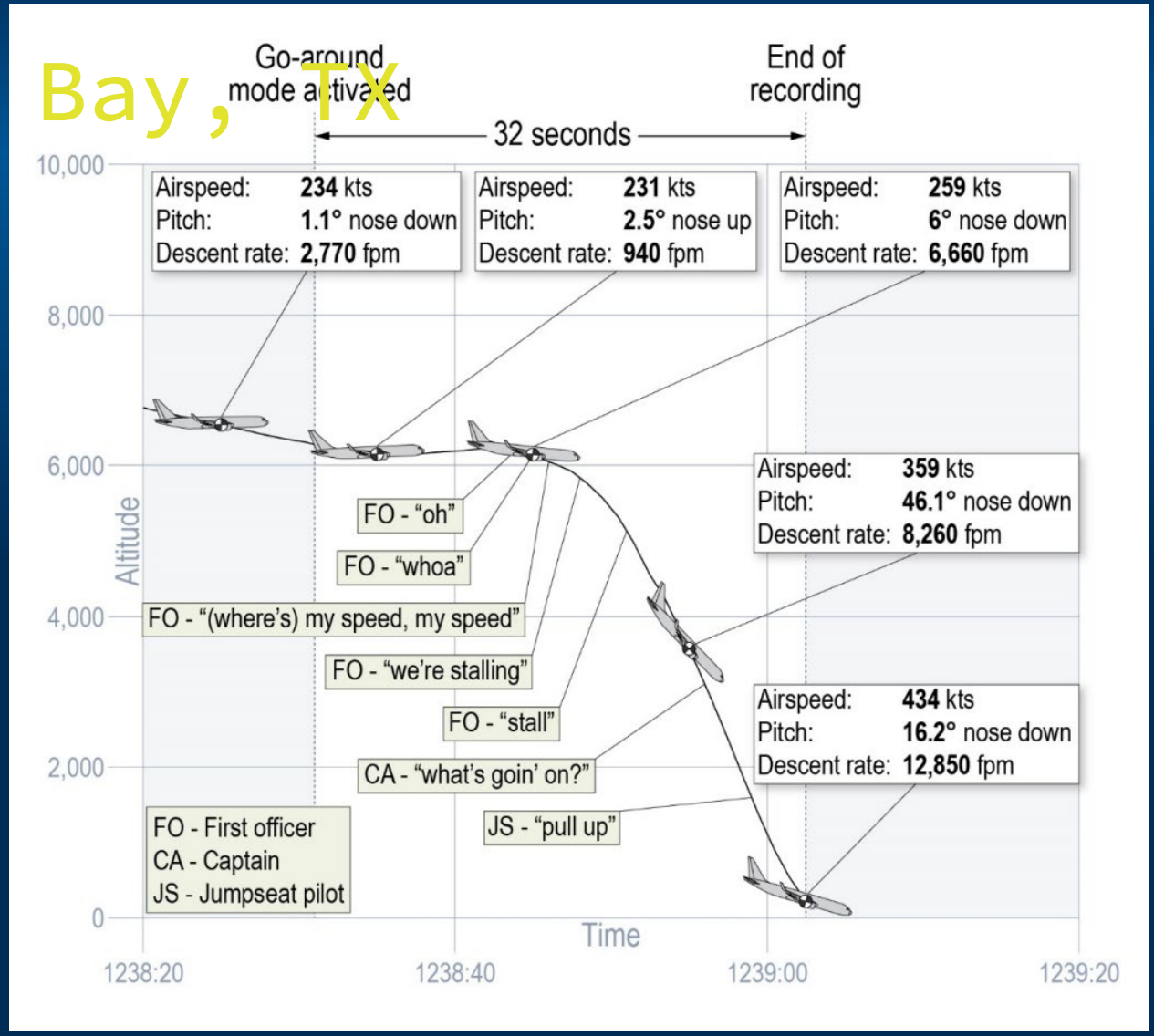


- At 1238 CST flight encountered fine line ahead of a cold front and associated convection.
- Aircraft in the immediately vicinity behind the flight, reported IMC & moderate chop over the upset location.

DCA19MA016 – Trinity Bay, TX

Aircraft was in IMC conditions at the time of the Go-around mode activation through 3,000 ft when they broke out of the overcast clouds.

Attempted recovery too low to recover.



NTSB

DCA19IA036 – Burbank, CA
Southwest Airlines B737 Runway Ex
December 6, 2018 @ 0905 PST (1705

- SWA flight 278 OAK-BUR
- IFR conditions prevailed, heavy rain and a tailwind conditions
- Controller advised of moderate-heavy precip over the field, winds 290° at 9 KT, cleared to land runway 08 (only precision ILS approach runway @ 5800 ft x 150 ft)
- Overran the runway into the Emergency Materials Arresting System (EMAS) at the departure end of the runway preventing aircraft hitting end of runway barrier or entering roadway off the airport and possible injuries
- No injuries to 117 passengers or crew, minor damage to aircraft, $1 million damages (EMAS)

METAR KBUR 061705Z 28013KT 1 1/4SM +RA BR SCT004 BKN013 OVC020 08/08 A2991 RMK A02 SLP013

NTSB

NTSB

DCA15FA085 – New York, NY

Runway excursion during landing, Delta M
March 5, 2015 @ 1102 EST

- Scheduled flight ATL-LGA
- IMC conditions prevailed in snow and freezing fog, 7" of snow on ground (4" new)
- Braking action good with ¼" wet snow with snowbanks up to a foot, runways not treated
- Landing LGA runway 13 departed left side of runway & impacted embankment
- Excessive reverse thrust (over EPR 1.3 limit) used – limiting rudder effectiveness

METAR KLGA 051600Z 02009KT 1/4SM R04/3000V4500FT SN FZFG VV009 M03/M04 A3012 RMK P001

- Minor injuries 29 passengers, substantial damage to aircraft

1-MIN DATA 1602Z 010@10KT – RWY 13 CROSSWIND 10KT, 2KT TAILWIND

NTSB

NTSB Summary

- IMC conditions impact all flight categories (Part 91, 135, and 121 operations) but are more evident in Part 91 and 135 flights (helicopter operations highest risk)
- IMC occurred in about 4% of all Part 91 accidents
- The proportion of Part 91 accidents that resulted in a fatality was 18%; while fatal IMC accidents averaged 64%
- Seasonal peak in Part 91 low/ceiling accidents noted in December, favor cold season October through March, while peak accidents typically peak in July.
- Low ceilings/visibility conditions is the highest weather cause of fatal weather-related accidents and account for 53% of weather-related fatalities
- A large portion of the low ceiling/visibility accidents, the pilot failed to obtain or received an inadequate preflight weather briefing


NATIONAL TRANSPORTATION
SAFETY BOARD
E PLURIBUS UNUM