National Transportation Safety Board

Single Pilot Safety

Accident Causation/Decision Making and Risk Management

Aaron McCarter

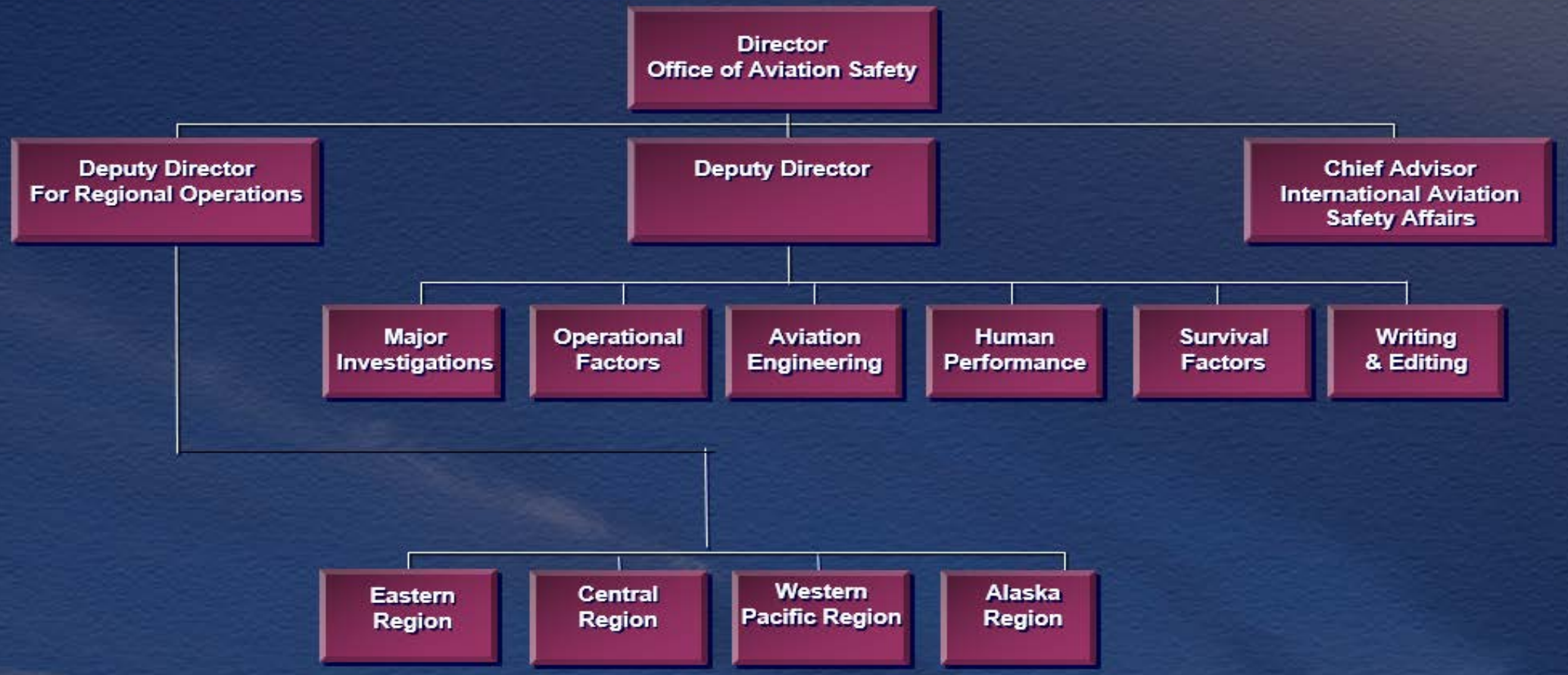
NTSB

NTSB and our Mission

- The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation -- railroad, highway, marine and pipeline -- and issuing safety recommendations aimed at preventing future accidents.

The Office of Aviation Safety

Responsible for the Safety Board's aviation accident investigations



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NTSB Structure

- The Board
  - Chairman
  - Vice Chairman
  - 4 Members with 1 Vacancy
- Multi Modal
  - Aviation
  - Railroad
  - Highway
  - Marine
  - Pipeline and Hazardous Materials

Robert Sumwalt
Chairman

T. Bella Dinh-Zarr
Member

Chris Hart
Member

Earl Weener
Member

NTSB Headquarters Support

- Operational Factors
  - Air Traffic Control, Weather
- Engineering
  - Powerplants, Structures, Systems, etc.
  - Materials, Recorders, Performance
- Human Performance & Survival Factors
- Transportation Disaster Assistance
- Writing and Editing

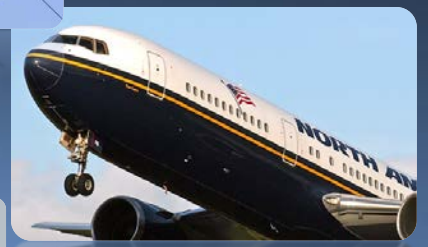
The Products of the NTSB

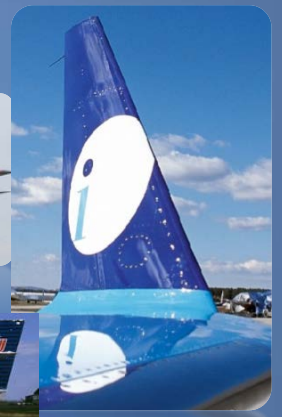
- Preliminary Report (within 5 business days)
- Factual Report (12-18 months)
- Probable Cause (1 month following the factual report)
- Safety Recommendations
  - Formal and Informal
  - The NTSB has issued over 11,600 formal recommendations in all modes of transportation, of which more than 80% have been adopted

The goal of the NTSB is Accident Prevention!

My Background

- NTSB, Air Safety Investigator
- Director of Safety
  - Haverfield Aviation: Helicopter Utility (Largest non-military MD fleet in world)
  - North American Airlines: 757/767 International (14 CFR 119.65)
- Manager of Safety/SMS/IEP
  - Compass Airlines, Independence Air, Atlantic Coast Airlines
  - Maxjet
- Consultant
  - Safety Program Development and Safety Management System (SMS) Implementation
- Commercial Pilot
  - Everything from Banner Towing, Skydiving, Checks, Cargo, Transport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What is an Accident

- Aircraft accident means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.
- Serious injury means any injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received…
  - Bone Fracture, Organ Trauma, Deep Tissue Damage
- Substantial damage means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement.

To Accident or Not to Accident

Accident

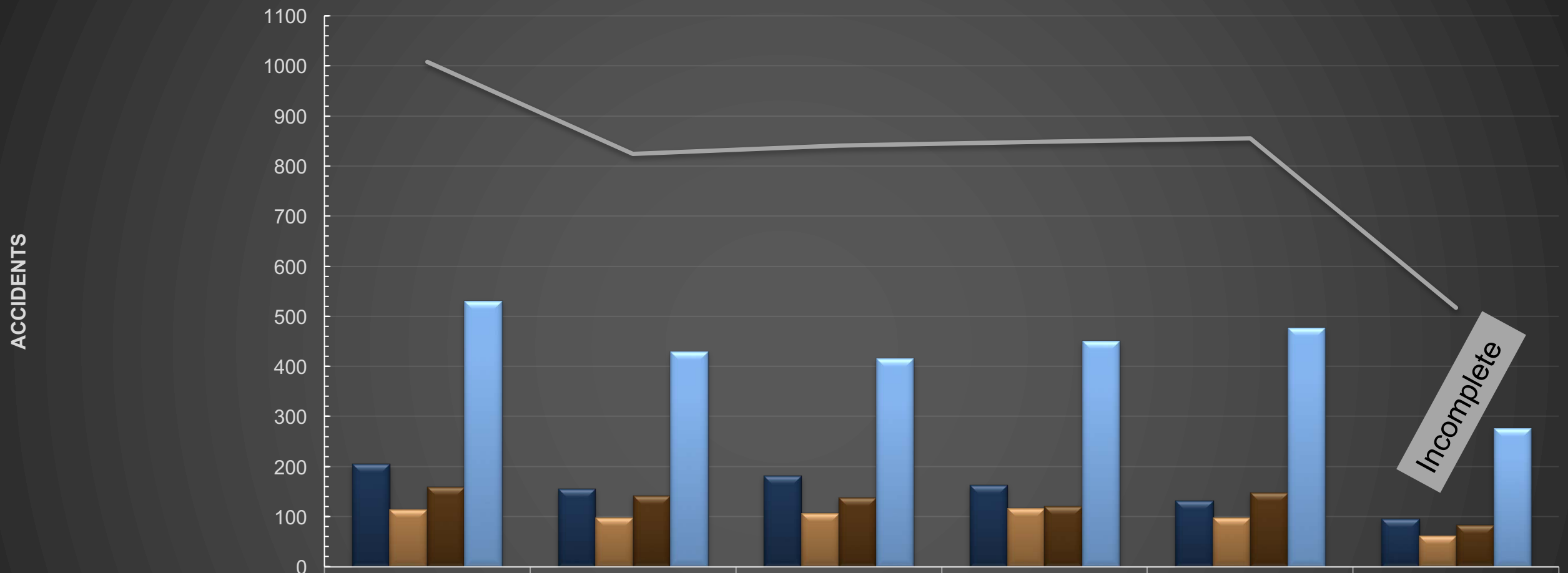
Incident

Accident

Holistic Data

- All NTSB Accident Data from 2012 to 2017*
- Single Pilot
- All “Aircraft” Types
- Part 91 and 135
- Broad Occurrence Codes & Specific Occurrence
- Fatal and Non-Fatal

Single Pilot Accidents Injury Breakdown by Year 2012-2017*



	Year 2012	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017
Fatal	205	155	181	163	132	95
Serious	114	98	107	116	98	62
Minor	159	142	138	120	148	83
None	530	429	415	450	477	277
Total Accidents (Single Pilot)	1008	824	841	849	855	517

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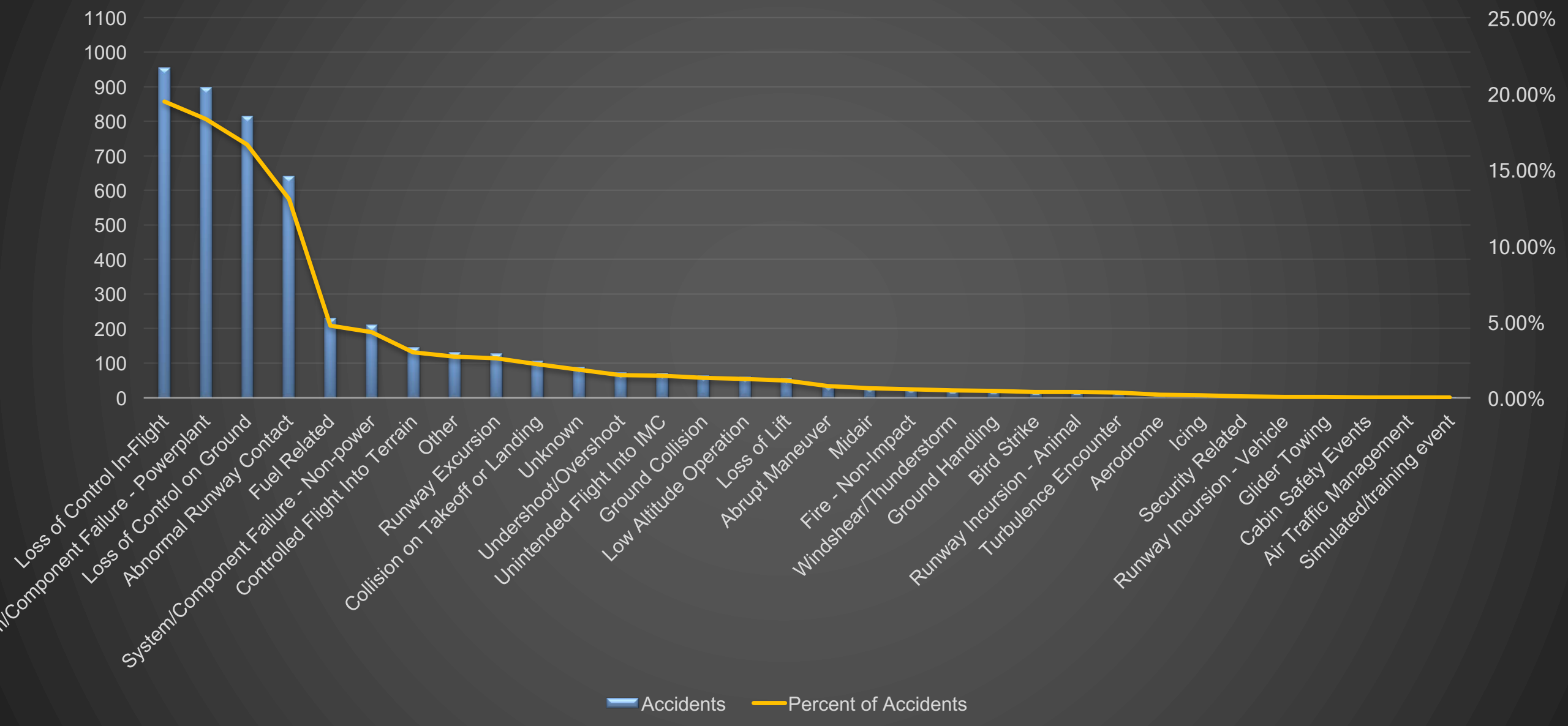
All Single Pilot Accident Data 2012-2017*



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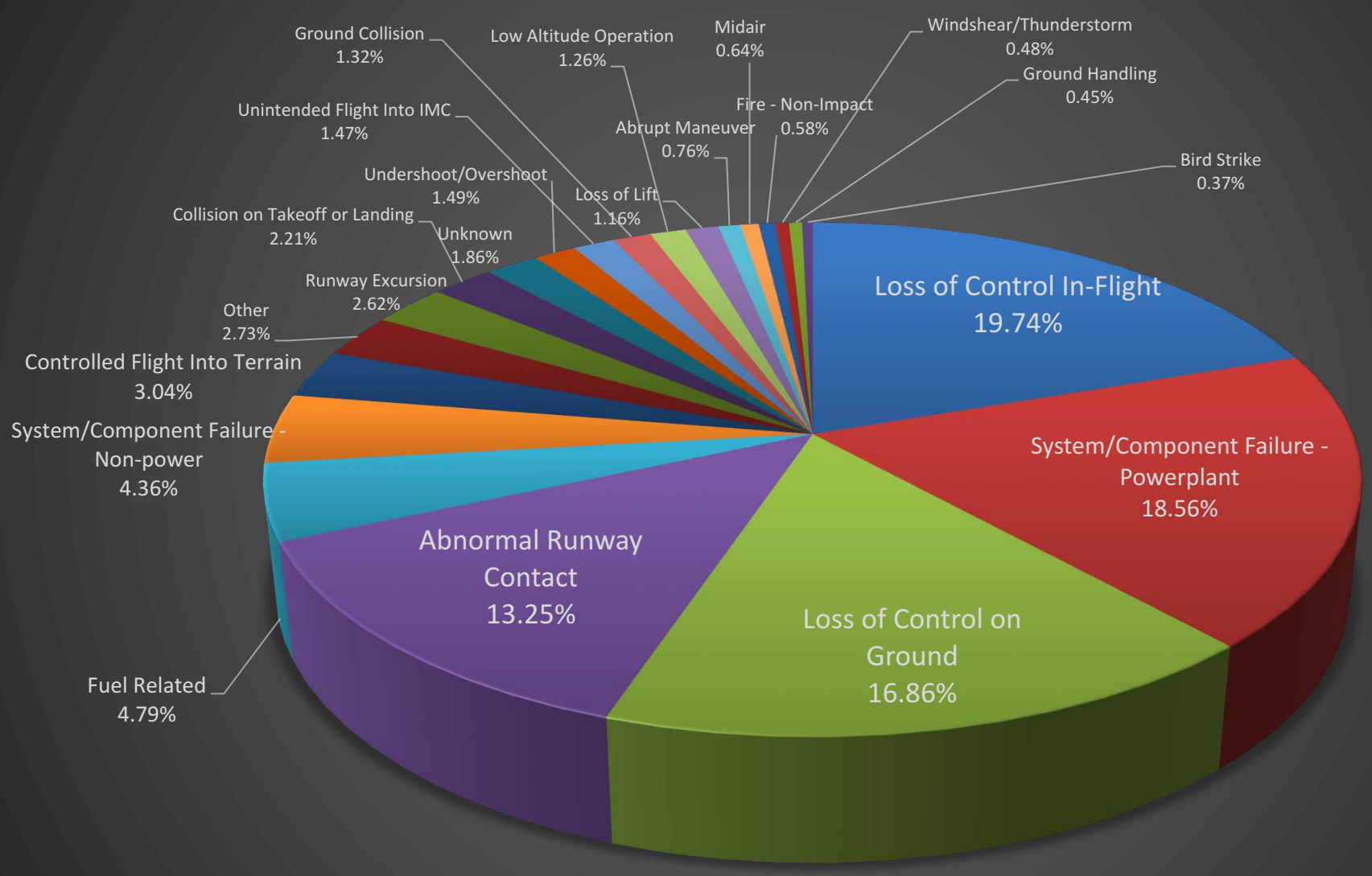
Single Pilot Accident Data by Occurrence 2012-2017*



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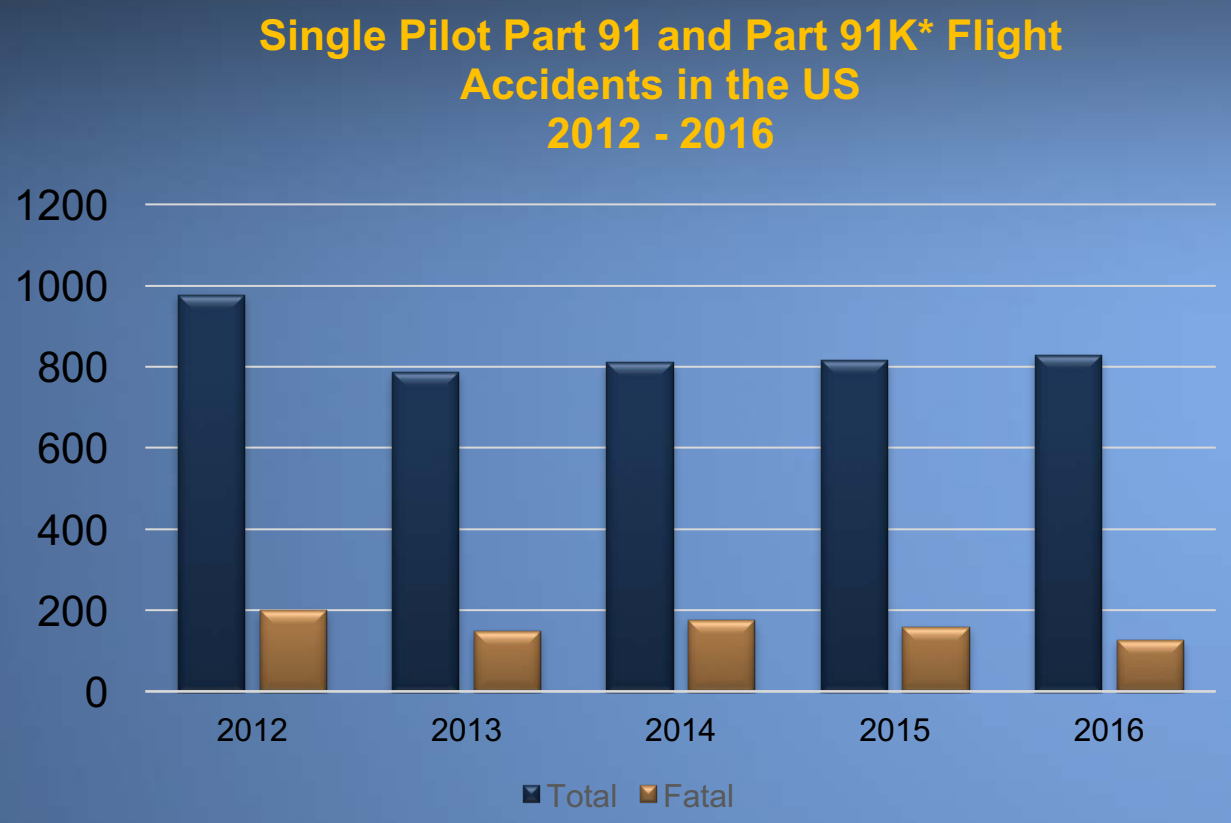
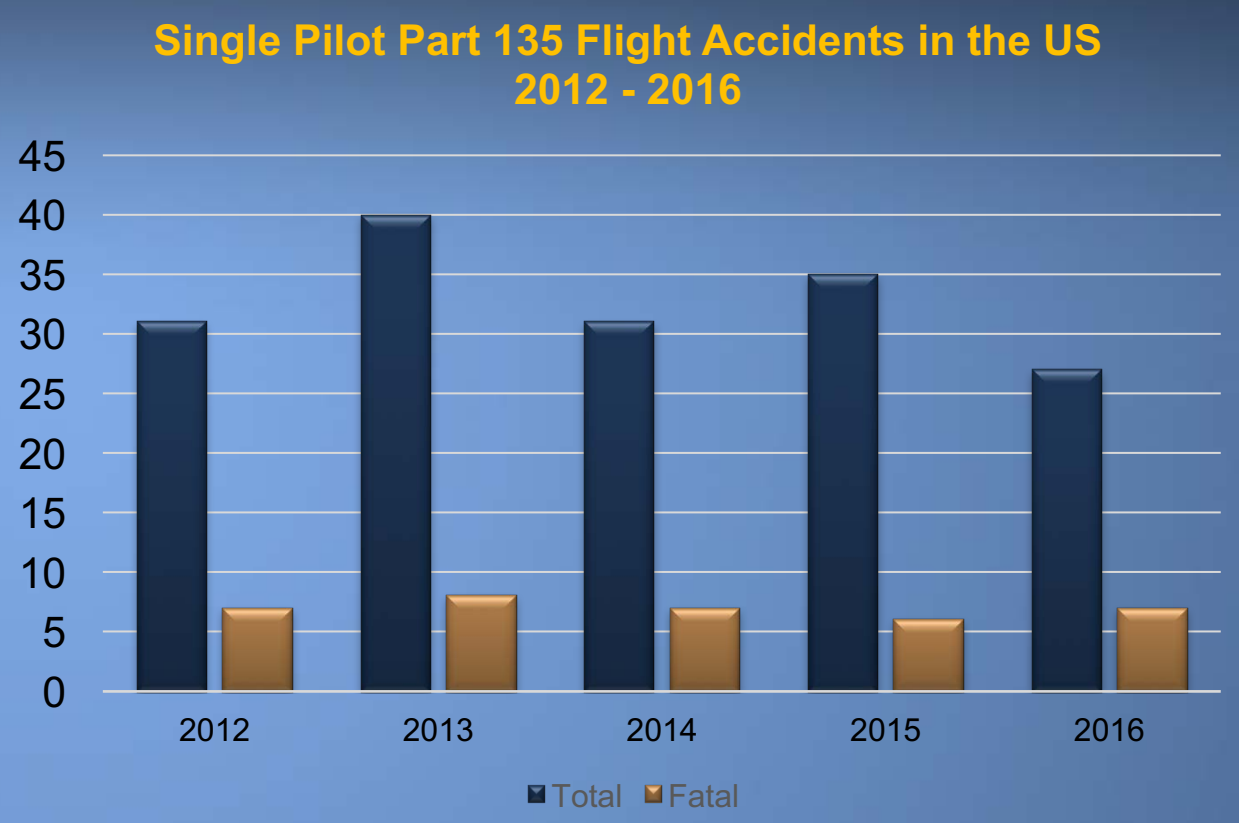
Part 91/135 Comparison





*Personal, Business, Corporate, and Positioning

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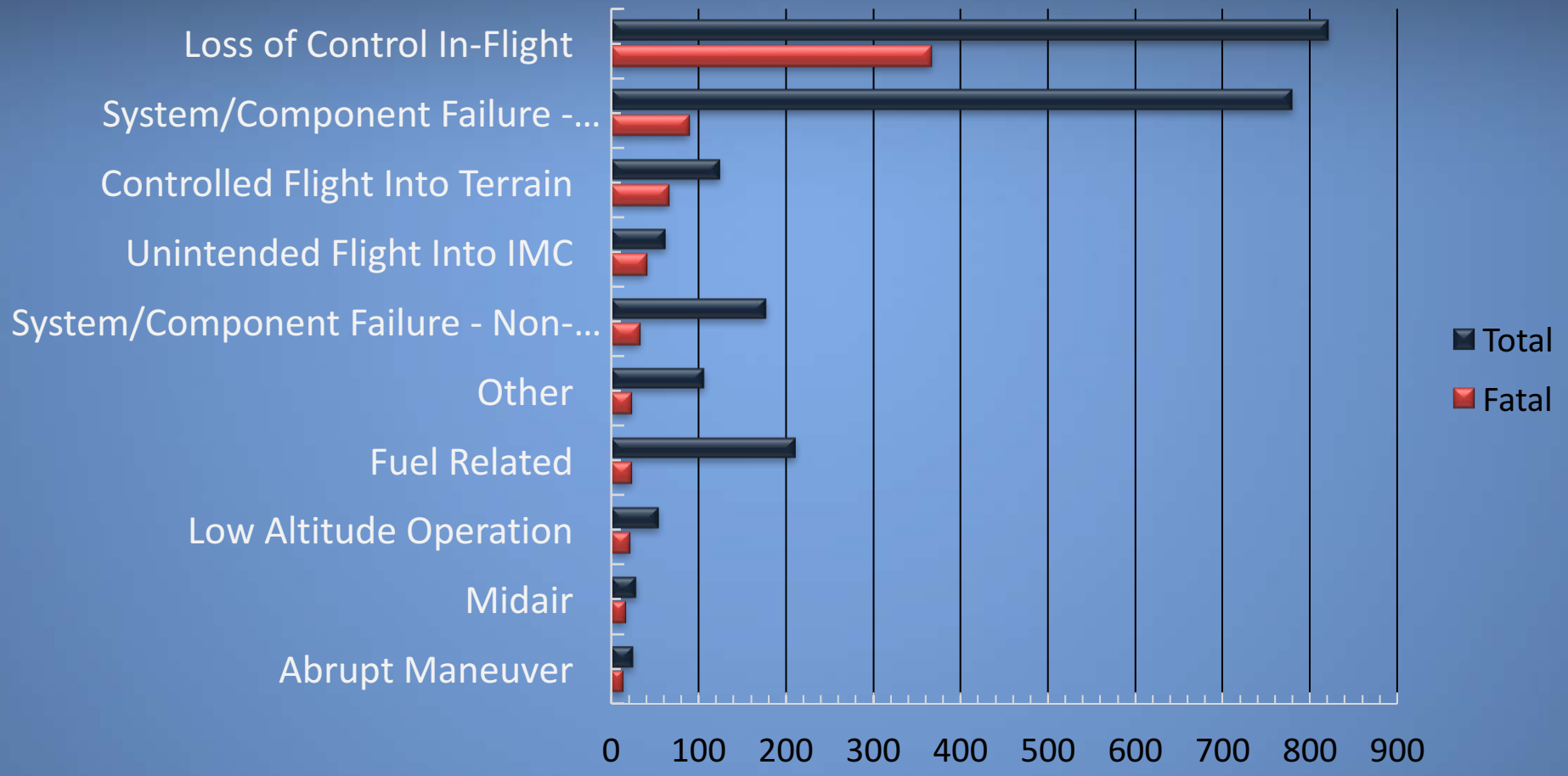
Occurrence Categories Part 91

Top 10 Occurrence Categories of Single Pilot Part 91 and Part 91K Personal, Business, Corporate, and Positioning Flight Accidents in the US, 2012 - 2016



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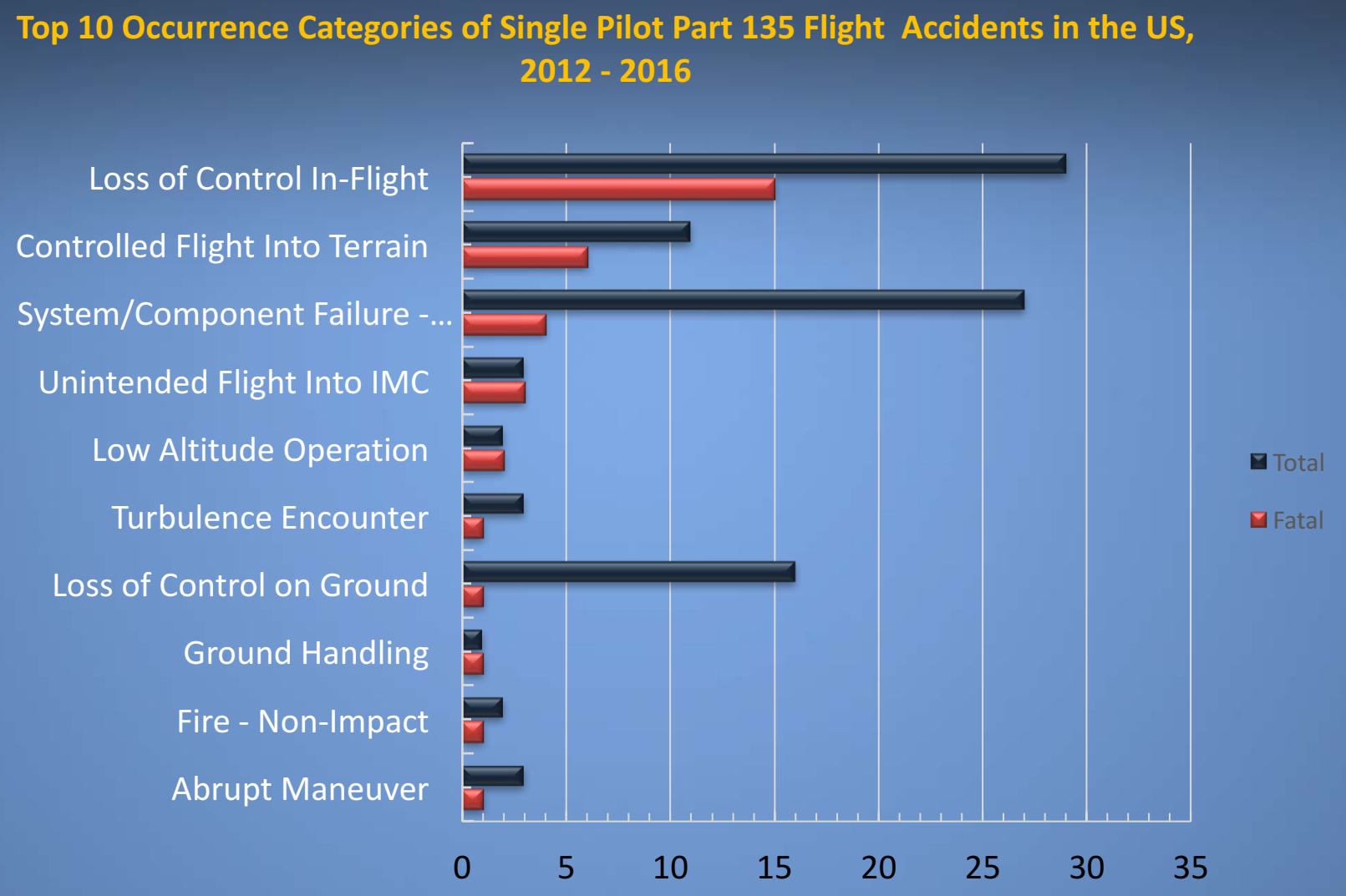
Occurrence Categories Part 135



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Drilling Down into the Cause

Finding category	Finding subcategory	Finding section	Accidents Citing	Percentage of Accidents
Aircraft			3227	79.1%
Personnel issues			3392	83.2%
Environmental issues			1920	47.1%
Organizational issues			48	1.2%
Not determined			381	9.3%

Drilling Down into the Cause-/Expanding the Aircraft Category

Finding category	Finding subcategory	Finding section	Accidents Citing	Percentage of Accidents
Aircraft	Aircraft handling/service		64	1.6%
	Aircraft oper/perf/capability	(general)	8	0.2%
		Aircraft capability	123	3.0%
		Performance/control parameters	2162	53.0%
	Aircraft power plant		350	8.6%
	Aircraft propeller/rotor		71	1.7%
	Aircraft structures		101	2.5%
	Aircraft systems		557	13.7%
	Fluids/misc hardware		373	9.1%
Personnel issues			3392	83.2%
Environmental issues			1920	47.1%
Organizational issues			48	1.2%
Not determined			381	9.3%
Grand Total			**4078**	**100.0%**

Drilling Down into the Cause-Expanding the Human Category

Finding category	Finding subcategory	Finding section	Accidents Citing Finding	Percentage of Total Accidents
Personnel Issues	Action/decision	(general	13	0.32%
		Action	**621**	**15.23%**
		Info processing/decision	**668**	**16.38%**
	Experience/knowledge	(general)	1	0.02%
		Experience/qualifications	176	4.32%
		Knowledge	30	0.74%
		Training	21	0.51%
	Physical	(general)	1	0.02%
		Alertness/Fatigue	14	0.34%
		Health/Fitness	23	0.56%
		Impairment/incapacitation	91	2.23%
		Physical characteristic	3	0.07%
		Sensory ability/limitation	9	0.22%
	Psychological	(general)	1	0.02%
		Attention/monitoring	248	6.08%
		Cognitive limitation	2	0.05%
		Mental/emotional state	12	0.29%
		Perception/orientation/illusion	112	2.75%
		Personality/attitude	20	0.49%
	Task performance	(general)	16	0.39%
		Communication (personnel)	12	0.29%
		Inspection	128	3.14%
		Maintenance	182	4.46%
		Planning/preparation	245	6.01%
		Record-keeping	4	0.10%
		Use of equip/info	**2118**	**51.94%**
		Workload management	10	0.25%
	Miscellaneous		18	0.44%

So, What Can Be Done?

Risk Identification – Identify any hazards that will affect your flight. A hazard is an object or event that could create a risk to the flight. WX, Inexperience, New Aircraft Type, New System, Airplane just get out of annual?

Risk Assessment – Each risk must be assessed in terms of its likelihood and its severity.

Risk Mitigation – Unacceptable "high" (i.e., "red") risks must be mitigated by taking action to lower likelihood and/or severity to lower levels.

RISK ASSESSMENT MATRIX

PROBABILITY \ SEVERITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low

Cessna T210M

- VFR flight - Torrance, CA to Aspen
- Solo, 13,500’ MSL , > 3 hours
- Pilot updated weather w/ FSS 4 times
  - Each update included icing AIRMET
- Night & IMC (snow) approaching Aspen
  - Pilot received IFR clearance
- While reading back flight plan info to ATC, left 180 turn, then rapid descent
- In-flight breakup

Risks/Hazards

- Single Pilot, Night, IMC (snow), Single Engine, and Mountainous
- AIRMET for icing
- “SoCal” IMC versus “Mountain” IMC
- 13,500’ MSL for > 3 hours
- “Get homeitis” (owned home in Aspen)
  - Operational Pressure.

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Pocatello
WYOMING
Casper
Cheyenne
Lake City
Fort Collins
Provo
Denver
COLORADO
Colorado Springs
UTAH
Pueblo
Durango
Accident Location
Farmington
Santa Fe
Gallup
Flagstaff
Albuquerque
Clovis
DBZ
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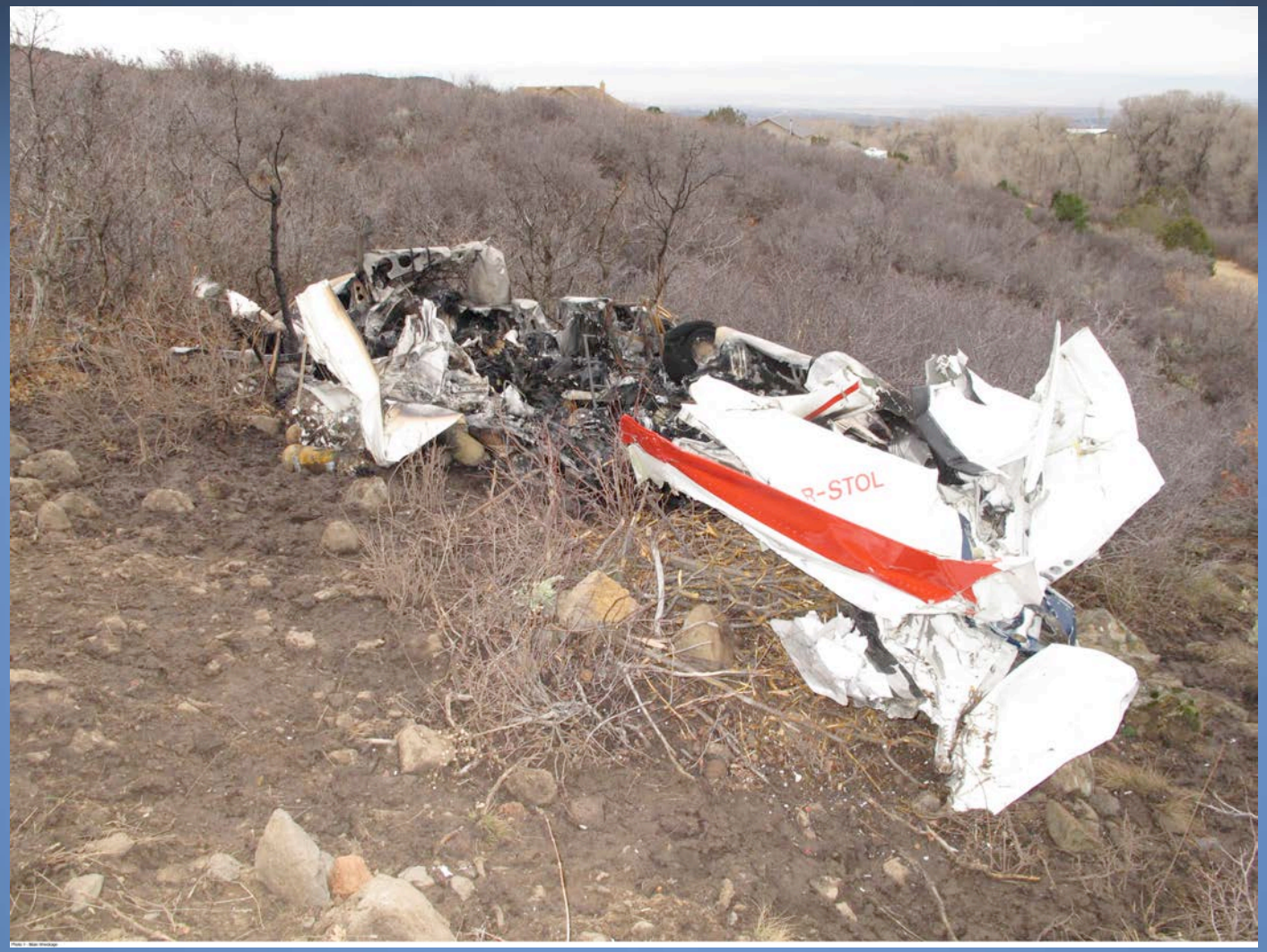

Photo 1 - Main Wreckage

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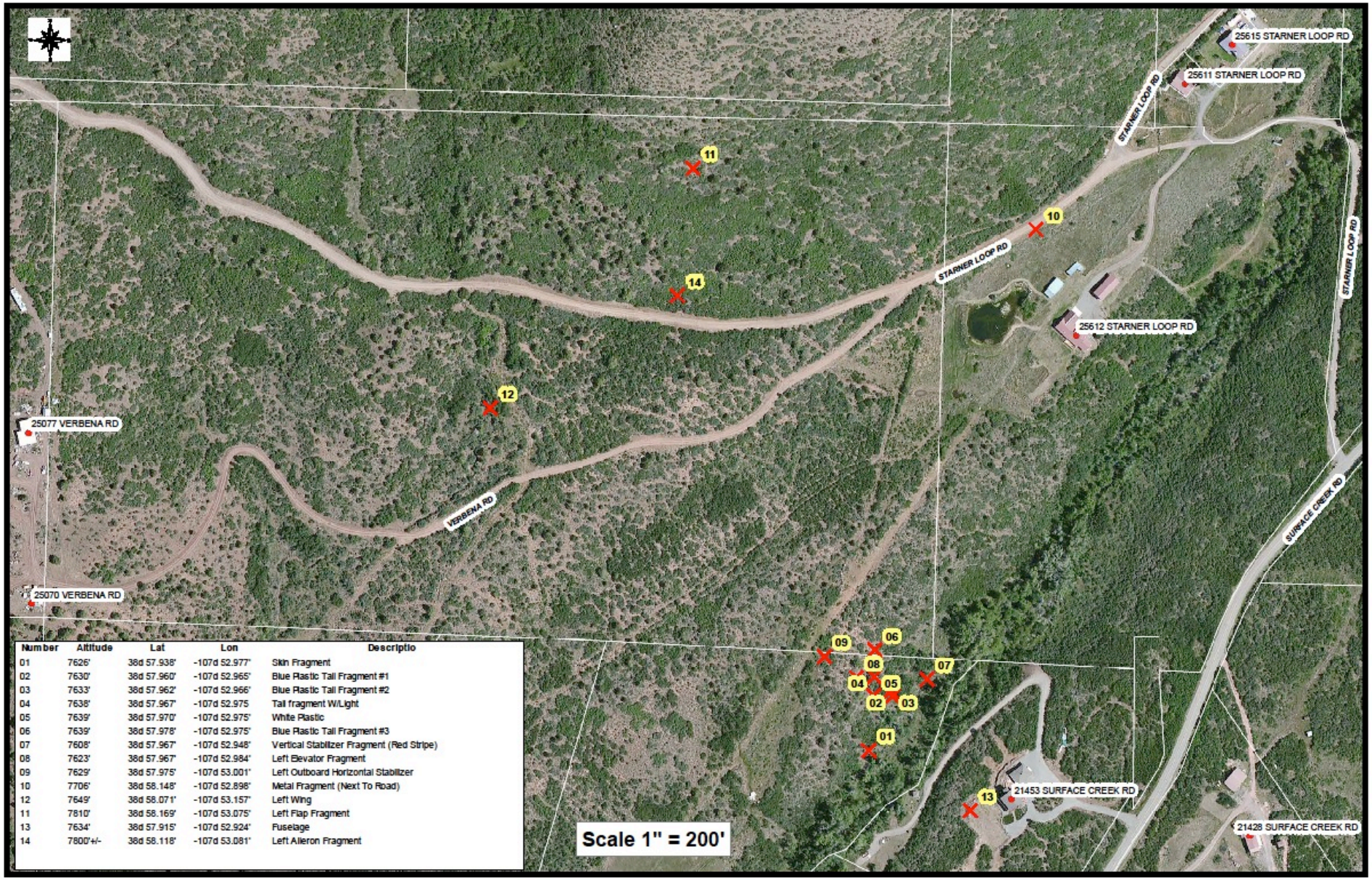

Number	Altitude	Lat	Lon	Descriptio
01	7626'	38d 57.938'	-107d 52.977'	Skin Fragment
02	7630'	38d 57.960'	-107d 52.965'	Blue Plastic Tail Fragment #1
03	7633'	38d 57.962'	-107d 52.966'	Blue Plastic Tail Fragment #2
04	7638'	38d 57.967'	-107d 52.975	Tail fragment W/Light
05	7639'	38d 57.970'	-107d 52.975'	White Plastic
06	7639'	38d 57.978'	-107d 52.975'	Blue Plastic Tail Fragment #3
07	7608'	38d 57.967'	-107d 52.948'	Vertical Stabilizer Fragment (Red Stripe)
08	7623'	38d 57.967'	-107d 52.984'	Left Elevator Fragment
09	7629'	38d 57.975'	-107d 53.001'	Left Outboard Horizontal Stabilizer
10	7706'	38d 58.148'	-107d 52.898'	Metal Fragment (Next To Road)
12	7649'	38d 58.071'	-107d 53.157'	Left Wing
11	7810'	38d 58.169'	-107d 53.075'	Left Flap Fragment
13	7634'	38d 57.915'	-107d 52.924'	Fuselage
14	7800'+/-	38d 58.118'	-107d 53.081'	Left Aileron Fragment

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Lessons Learned

- Aviate, Navigate, Communicate
  - ATC can wait
- Challenging IMC can occur quickly
  - Get the IFR clearance prior
- If in doubt, take the “pit stop”
- Know your limitations and the airplanes

Questions & Discussion

National Transportation Safety Board