Part 121 Low Altitude Events:
An Analysis of ASRS Reports

FAA InfoShare – Flight Operations

Kansas City, MO

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AVIATION SAFETY REPORTING SYSTEM

NASA Aviation Safety Reporting System (ASRS)

Program Background

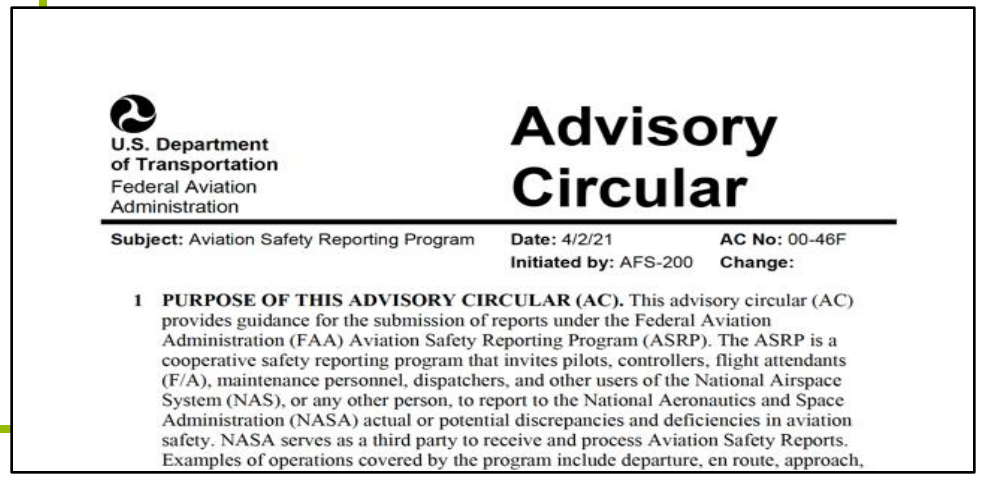
The Genesis of ASRS

The crash of TWA Flight 514, on December 1st 1974 was caused by a misunderstanding between ATC and the crew.

This accident occurred just six weeks after a United Airlines flight had narrowly escaped a similar fate.

Unfortunately, in 1974, there **was no way to share information** about United's near miss with TWA or the wider aviation community.

The FAA asked NASA to be an independent third party, creating the Aviation Safety Reporting System (ASRS) in April 1976



U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Aviation Safety Reporting Program **Date:** 4/2/21 **AC No:** 00-46F
Initiated by: AFS-200 **Change:**

1 **PURPOSE OF THIS ADVISORY CIRCULAR (AC).** This advisory circular (AC) provides guidance for the submission of reports under the Federal Aviation Administration (FAA) Aviation Safety Reporting Program (ASRP). The ASRP is a cooperative safety reporting program that invites pilots, controllers, flight attendants (F/A), maintenance personnel, dispatchers, and other users of the National Airspace System (NAS), or any other person, to report to the National Aeronautics and Space Administration (NASA) actual or potential discrepancies and deficiencies in aviation safety. NASA serves as a third party to receive and process Aviation Safety Reports. Examples of operations covered by the program include departure, en route, approach,

ASRS Mission and Legacy

For over forty-eight years, the NASA Aviation Safety Reporting System (ASRS) has received written descriptions of close-calls, hazards, violations, safety-related incidents, and successful best practices. We de-identify that information to protect anonymity.

Then:

We share that information with the wider Aviation Community

ASRS Mission and Legacy **Requires Participation**

Many carrier's Safety Management System (SMS) programs forward reports directly to ASRS. Some do not.

On-going participation from air carriers, individual pilots from those carriers, airline team members, and any concerned party continues to be vital to our safety mission.

The Importance of Participation: Part 121 Community

YOUR REPORTS – THE FOUNDATION OF ASRS

When you send your report – perhaps through the ASRS web site if your company does not automatically forward reports – you contribute to industry-wide aviation safety efforts. ASRS needs your reports to share valuable safety information with the aviation community.

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YOUR REPORTS – DRIVE CORRECTIVE ACTION

ASRS sends de-identified reports describing critical safety issues to organizations and individuals who can review the issues and take action. These Alert Messages multiply the positive impact of your safety report across the aviation industry and result in real change.

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YOUR REPORTS – PROTECTION AND ANONYMITY

The FAA offers ASRS reporters protections from certificate action and civil fines which are independent of an individual airline's SMS Event Review finding. FAA Advisory Circular 00-46F provides details of these protections. ASRS permanently separates all personal data from every report. This is returned to the reporter as the only proof of a submission. ASRS does not retain, and will never share, identifying information with anyone.

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YOUR REPORTS

Feed ASRS Safety Products

- CALLBACK
- UAS Safety In Sight e-Newsletter
- ASRS Database Online (DBOL)
- ASRS Database Report Sets
- Alert Messages

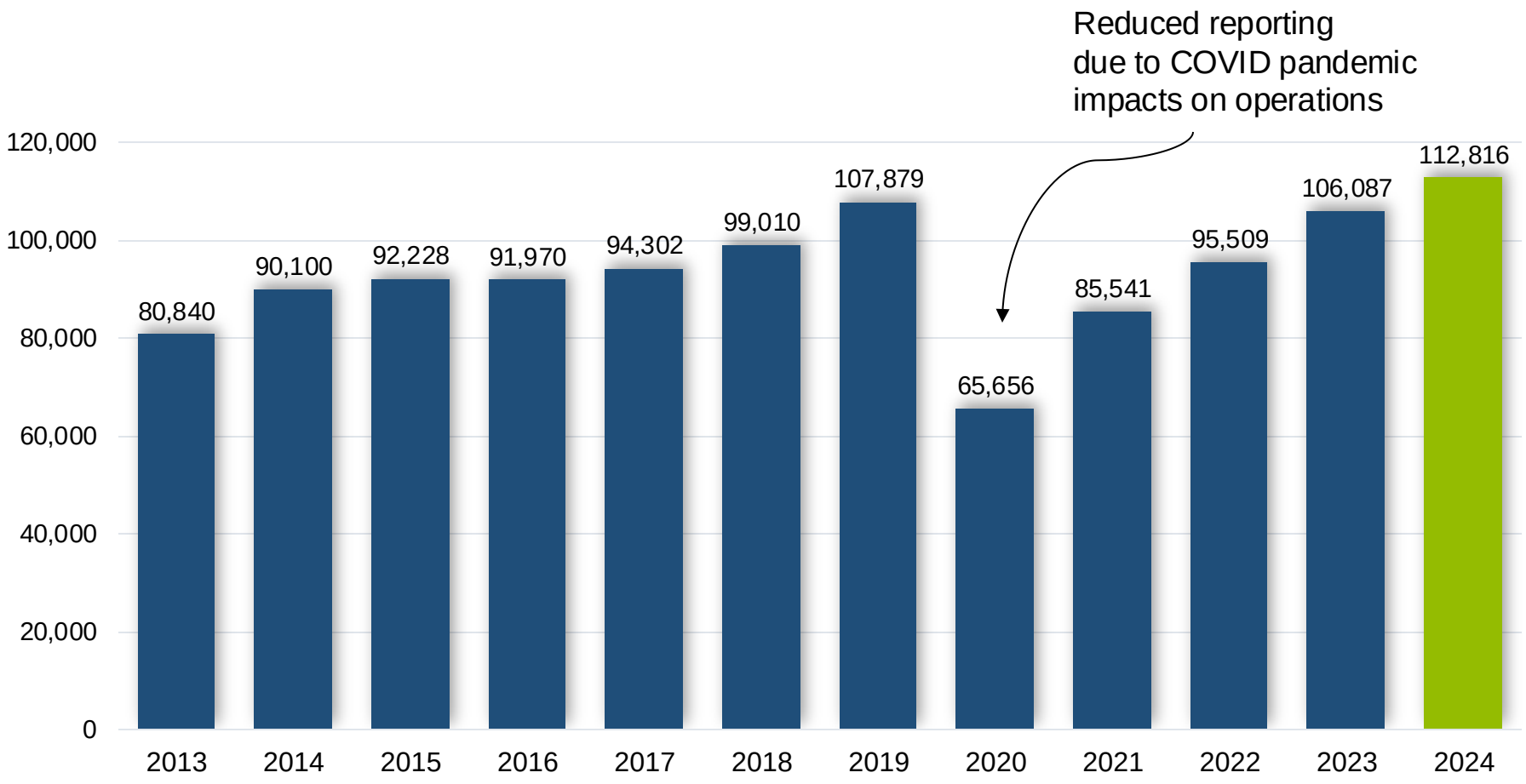
Study Background

Part 121 Low Altitude Events

Study Background

- Recently, a number of low altitude, Controlled Flight Towards Terrain (CFTT) events have occurred in which an aircraft descended well **below a safe minimum altitude or was outside of safe approach limits** while in the terminal area.
- A **qualitative analysis** of ASRS reports was conducted by ASRS Subject Matter Experts (SME).
- ASRS reports contain **rich descriptions** which can be mined to identify the **common contextual and contributing factors** that might lead to low altitude or CFTT events during terminal area operations.
- The reporters frequently offer **best practices and suggestions for preventing future occurrences.**

ASRS Report Intake Profile

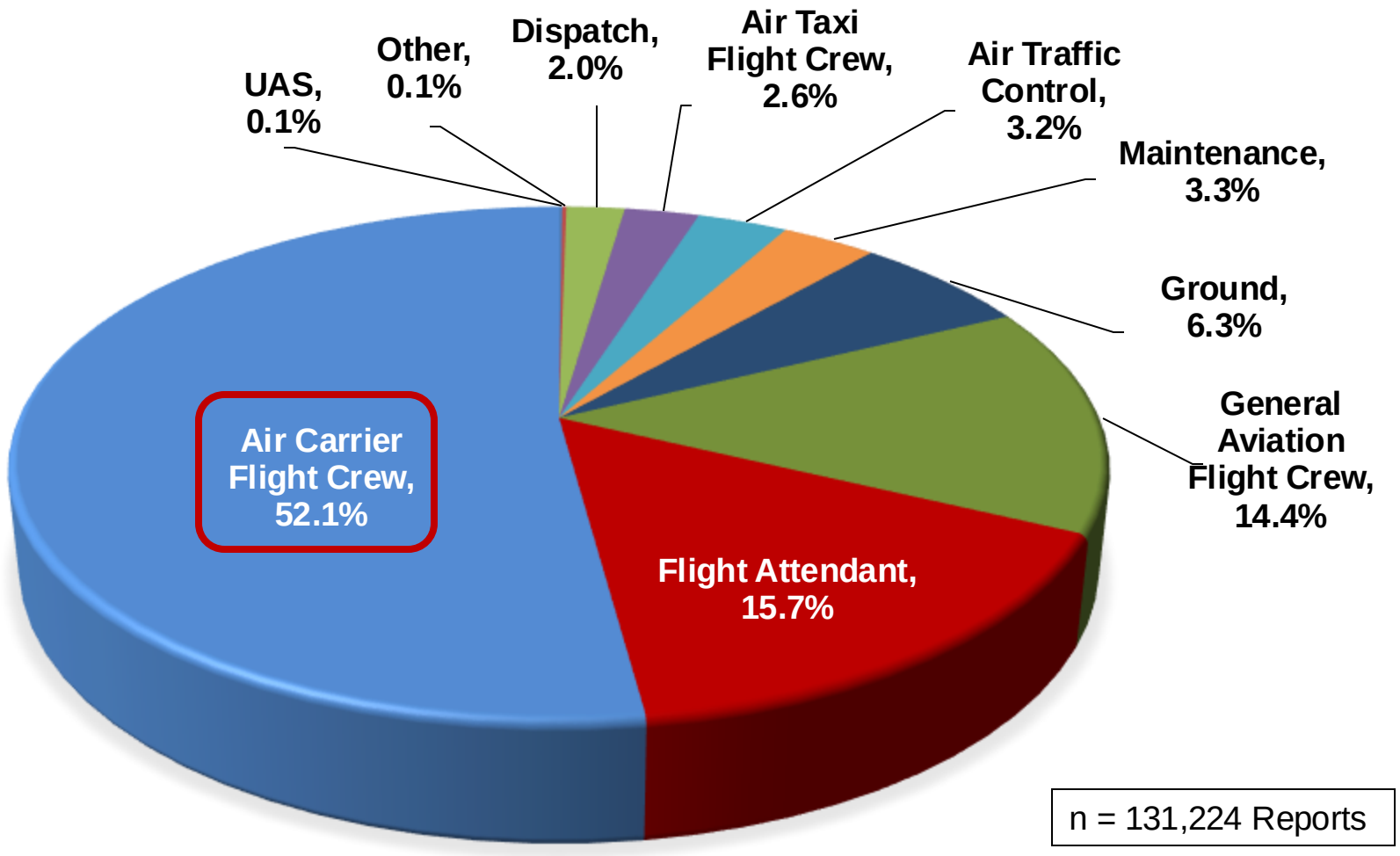


*2024 data includes reports received through October 31st.

In 2024, ASRS is forecasting a return to pre-COVID levels with over 130,000 reports

The Data: Incident Reporter Distribution

October 2023 – September 2024

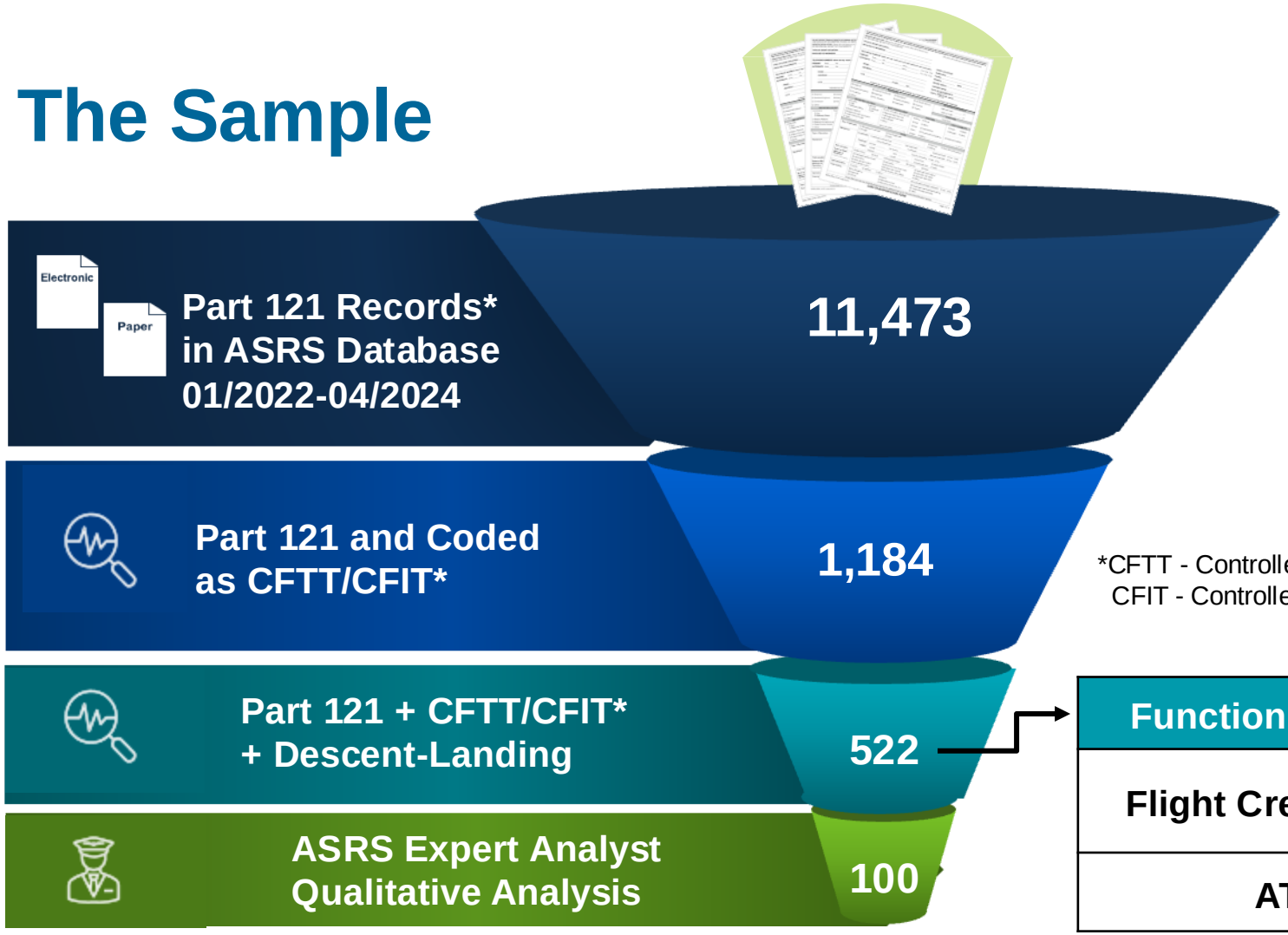


n = 131,224 Reports

Source: NASA ASRS Screening Data

The Data: Records in ASRS Database

The Sample



*CFTT - Controlled Flight Towards Terrain
CFIT - Controlled Flight Into Terrain

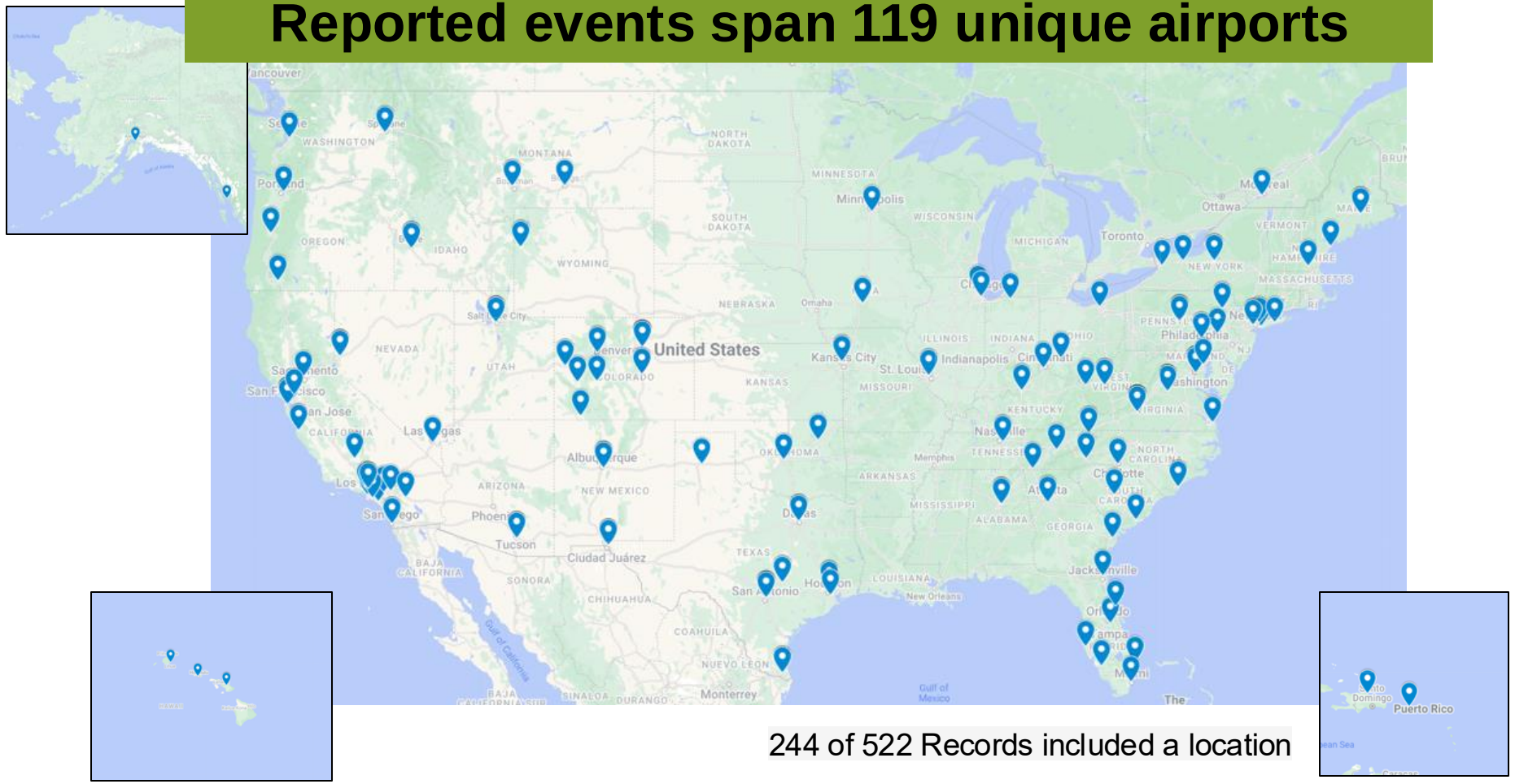
Function of Reporter	
Flight Crew	701
ATC	65

*A record may include multiple reporters

ASRS is a Voluntary, Confidential, Non-Punitive Reporting System. Please see Data Caveats in notes

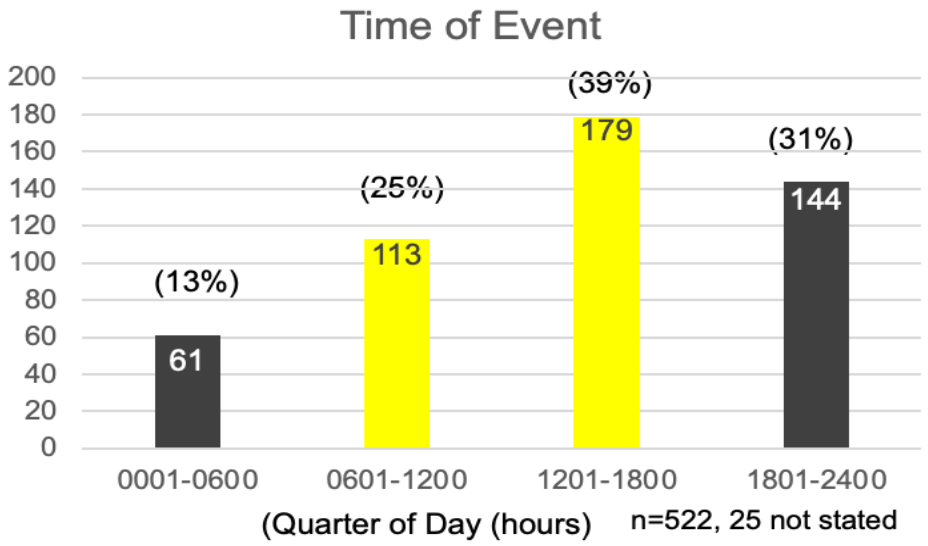
The Data: Reported Event Locations

Reported events span 119 unique airports



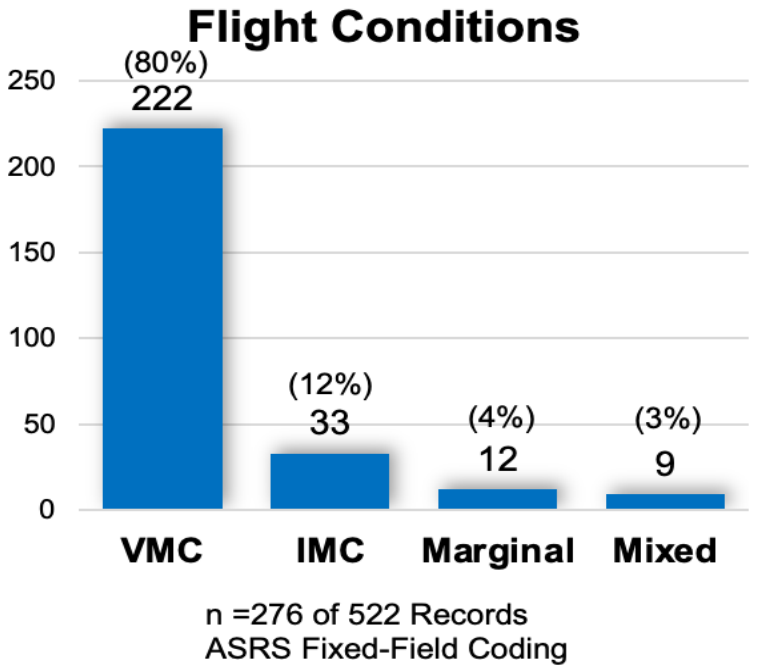
244 of 522 Records included a location

The Data: Reported Flight Conditions



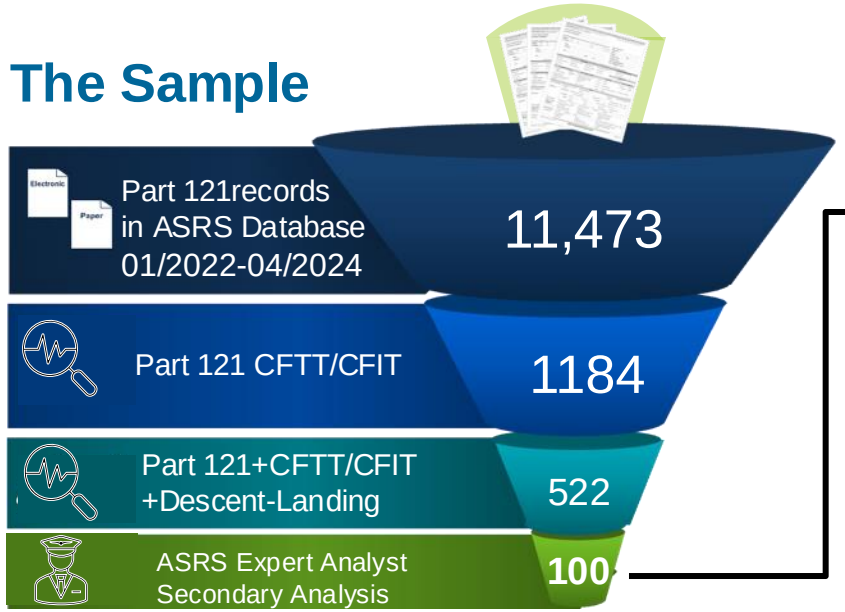
Light Conditions	Count
Dawn	2 (2%)
Dusk	7 (6%)
Night	43 (35%)
Daylight	71 (58%)
Total Reported	**123**

The majority of reported events occurred in Daylight VMC.



Qualitative Analysis of The Sample

The Sample



Secondary Analysis:
ASRS Subject Matter Expert (SME) completed a Qualitative Analysis of the 100 most recent reports:

1. Review Reports for Relevance
2. Develop Secondary Coding Schema to understand recurring themes and identify Contributing Factors
3. Complete coding and highlight Illustrative examples

Key Findings: (Secondary Coding)

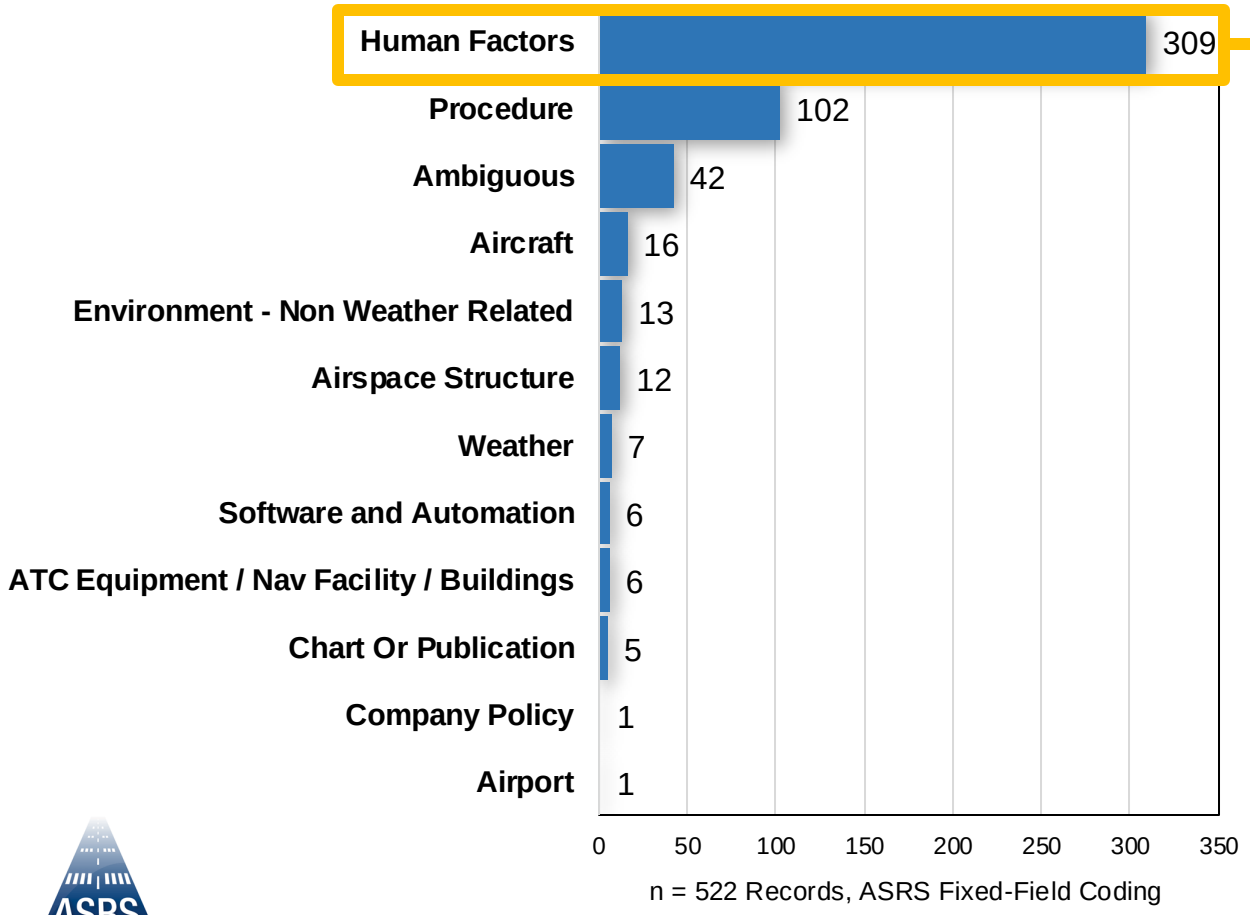
Event Attribution*	**Flight Crew**	**72**
	ATC	17
	Equipment	4
	False Alarm	9
Contributing Factors*	**Automation**	**53**
	Human Factors	**55**
	Environmental	12
Approach Type	Visual	38

n=100

*Categories are not mutually exclusive

Contributing Human Factors

Data Coded as "Primary Problem"
by ASRS Expert Analysts

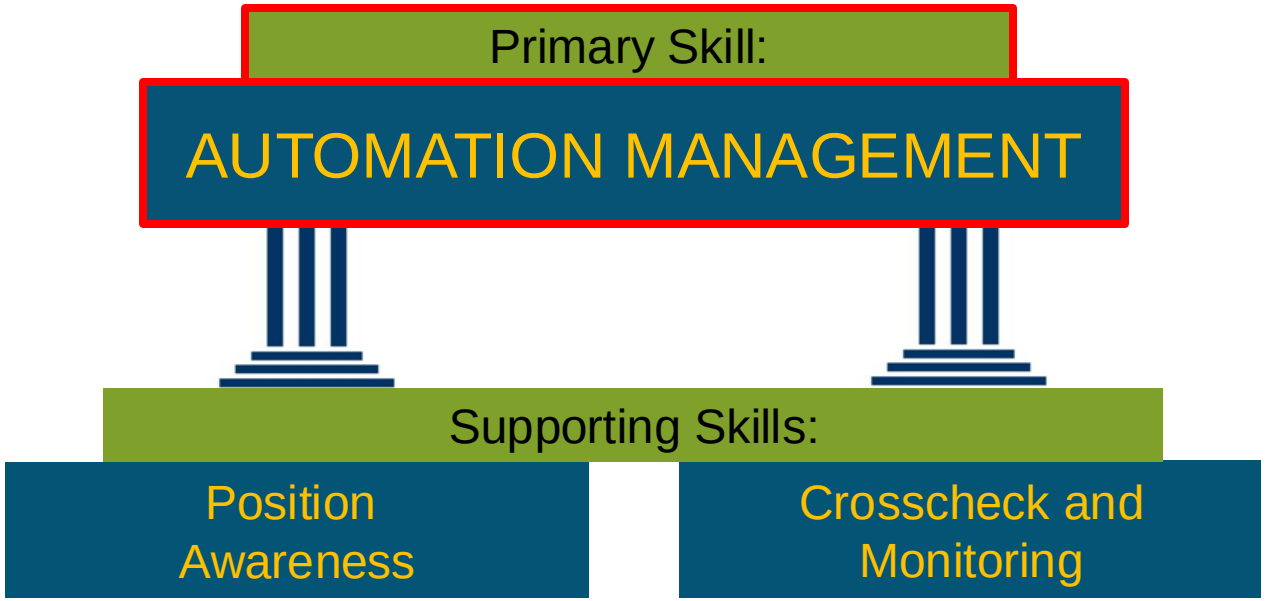


HUMAN FACTORS

- Communication Breakdown
- Time Compression
  - Workload
  - Distraction
  - Time Pressure
- Proficiency
  - Experience
  - Training
- Human-Machine Interface
- Confusion
- Training / Qualification
- Trouble Shooting
- Fatigue

N=309 records

SME Analysis: Skill Degradation



Contributing Human Factors

- Proficiency
- Communication Breakdown
- Time Compression

Breakdown in Automation Management

Incorrect Modes & Incorrect Target Altitudes

Primary Skill:

AUTOMATION MANAGEMENT

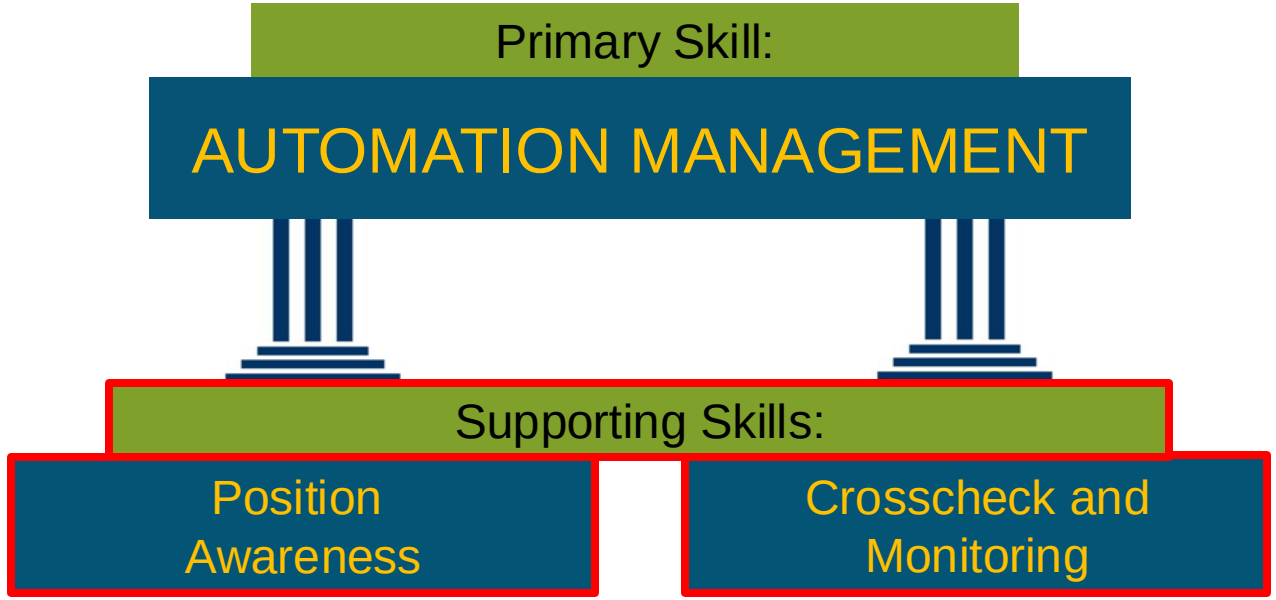
Incorrect Target Altitude or Automation Mode (or Both)

- "My first time flying with FO… I began talking him through the approach. ***3000 feet was set on the altitude, for charted height at ZZZZZ. At some point on base he set it to 2000, I didn't catch it or notice till we closed in on final***…I have no idea why he set 2000 feet, it has no logic… (2102890)

- …We set 2000 ft, went into Vertical speed mode, then hit APPROACH mode. ***On our way down, we set 3000 for the missed approach altitude without realizing we did not capture the glideslope.*** …Solution: Not setting a higher altitude, even a missed approach altitude unless more attention is paid to current position and mode." (2091566)

- "… We were cleared for the visual, and I looked at the chart to find a safe altitude to level off at***. I used 1520 at EAGAN. (This was wrong, I should have used 3000 ft).*** I went to FLCH, and realized going through 2200 ft. that 1520 was too low". (2098452)

SME Analysis: Skill Degradation



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- Proficiency
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Supporting Skill: Position Awareness

Supporting Skills:

Position Awareness

Crosscheck and Monitoring

Position is Misinterpreted or Uncertain

- "...I set 3,000 in the altitude selector. As we began to descend through 4,000 feet it became clear that we're outside of the FAF …While we were in the recovery the terrain callout was made from the GPWS. … Cause: ***Lost awareness of where I was on the approach***. We were in VMC …but ***I forgot where the aircraft was in relation to the approach***." (2092789)

- "Loss of awareness. We were on our descent down into the ZZZ airport. We were clear for the approach off of an airway. ***As the crew, we lost situational awareness as to where the minimum altitude was.*** We descended down to 14,800 to cross the IAF on the RNAV XX approach into ZZZ when we really should've been at 16,400 feet. .. Yes, ***I think we lost awareness of our surroundings*** …fix. (2100167)

Supporting Skill: Monitoring and Crosscheck

Supporting Skills:

Position Awareness

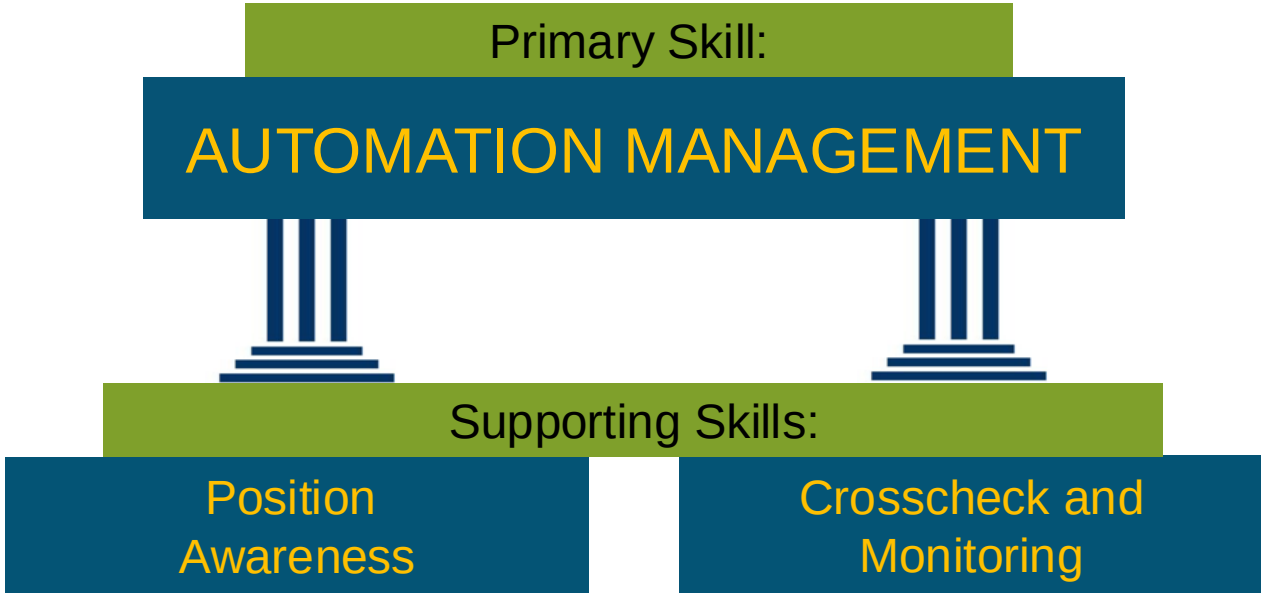
Crosscheck and Monitoring

Ineffective Crosscheck and Monitoring

- "We believe the pilot flying forgot to activate VNAV...This resulted in a caution terrain…Cause: Late runway change at destination. ***Pilot monitoring (me) failing to trap the Captain error of not re-engaging VNAV***. (2063914)

- "…the CA (PM) ***prematurely dialed in the missed altitude***... He verbalized… and I confirmed. … ***we got a ground proximity caution. … A very simple mistake that had big implications.*** The procedure is in place so we both verify the decision. ***He was too quick and I was too complacent and we both missed it..."*** (2091566)

SME Analysis: Skill Degradation



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Contributing Human Factors: Communication Breakdown

Examples of Communication Breakdown

Comm Breakdown was coded in 212 of 522 Records (41%)

ATC to Flight Crew

ATC …asked "so are you requesting to fly the transition for X?" **We didn't understand the question** and replied "transition for ILS Runway X". …I executed a go around… …I asked the FO (First Officer) to check the ATIS to see if ILSX was out of service. It was. …**All this could have been avoided had ATC suggested "localizer out of service" when they saw we were not performing as normal. …** (2097730)

Flight Crew to Flight Crew

"I could have been more assertive recommending my FO give herself some more room on the visual instead of just telling her that I thought it was really tight. Instead of telling the FO we were too low and to level off, **I could have directed her to climb ....**" (2079128)

ATC to ATC

"I was relieving the H controller, accepted the briefing, and apparently I misunderstood …. Fortunately the V controller asked about Aircraft X… However they were clearly through the final and… probably below the MVA so I climbed Aircraft X ...

Pay better attention to the briefing and aircraft on final. (2057637)

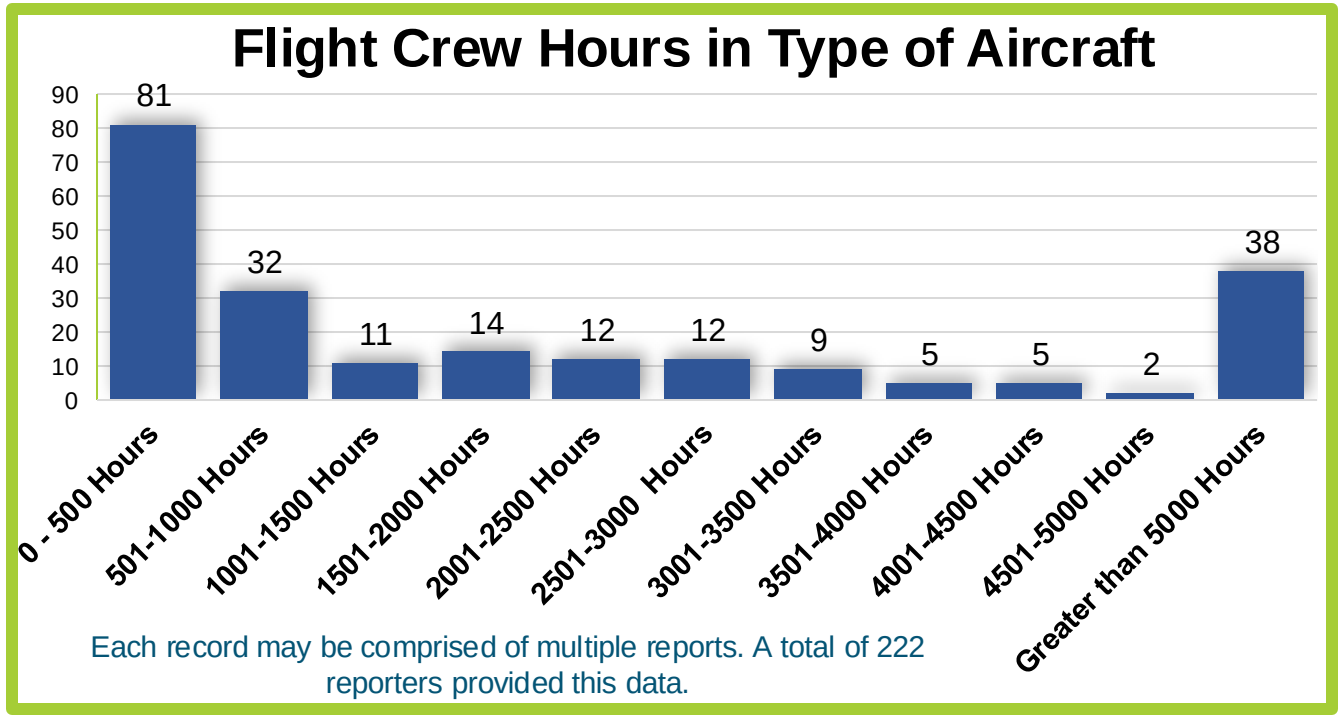
Contributing Human Factors: Proficiency

- "In the last year I have flown with **numerous pilots with very limited time, no swept wing or jet experience.** I am an airline Captain**, I have become a flight instructor.** It makes my job much tougher and **I have minimal backup**" (2102890)
- **The biggest threat was the FO being inexperienced. It was his first trip off IOE**. He set the altitude selector without communicating his actions. (2059934)
- **"Third factor is FO on probation with low time/experience…** It's humbling that making such a simple mistake can start an avalanche. (2097730)

~51% had 1,000 or less hours in type
~36% < 500 hours

Avg = 2,754 hours
Median = 990 hours

Min = 0 hours
Max = 21,000 hours



Contributing Human Factors: Time Compression

- "**Multiple maintenance issues** before the flight … increased the feeling of time pressure. **Short flight** which increased flight load. **Change of runway on approach** which increased workload" (2093496)

- **"Things went extremely fast** …I told the First Officer "I recommend you hand-fly, we are high", so he did…he's about to line up with XXR instead of XXL. ...Between focusing on the runway alignment outside and still trying to run the checklist, check in with tower, **I did not notice he was getting low.** We got the "glide slope" aural warning and he corrected. Then ***ATC also gave us a "low altitude alert***"… I tried to slow things down, not to feel rushed. …**I felt pressure to move faster ... I think it kind of set the tone for the rest of the turn.** (2069056)

Best Practices Suggested by ASRS Reporters

"Recognize when ATC instructions conflict with surrounding terrain and charted approach procedures. …***Be quick to request new instructions from ATC when you recognize that the current ones will not work.***" (2091423)

"This event is a lesson learned and will ***ensure I am confirming my flight mode annunciation modes match my intended flight requirements***." (2072756)

"A detailed briefing and planning of actions in areas of workload convergence could avoid a task saturation at the descent point". (2061199)

"With no STAR for a descent profile, ***a "hard" altitude at the IAF's would be a way to trap this potential error***". (2088730)

"Delay top of descent until you know you are clear of terrain. If not sure, ask ATC what's the MVA altitude in the area you're flying through. And **if necessary, ask for vectors** to help descending to a lower altitude for a better stabilized approach." (2087736)

"I'm realizing that some **extra monitoring and verification of actions** is going to be an absolute must when flying with some our newer, less experienced Pilots." (2061611)

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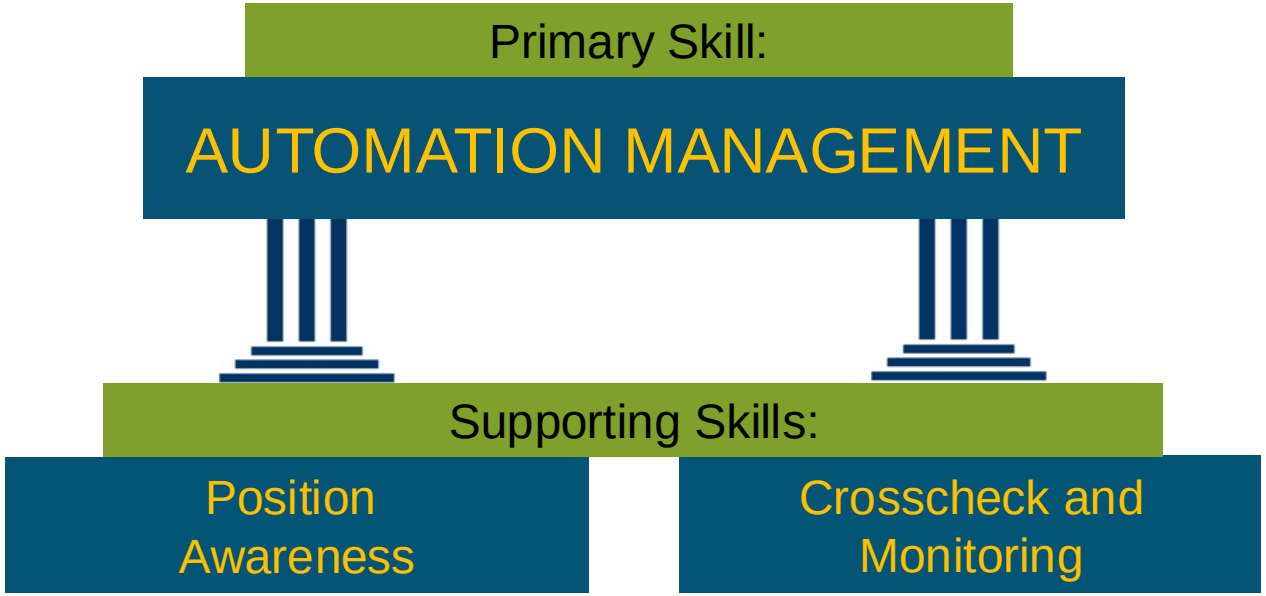

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