What Do People Do?

Swedish Coast Guard
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Human Systems integration division

System Wide Safety

A quick thought experiment

- Human error has been implicated in up to 80% of accidents in civil and military aviation[1]

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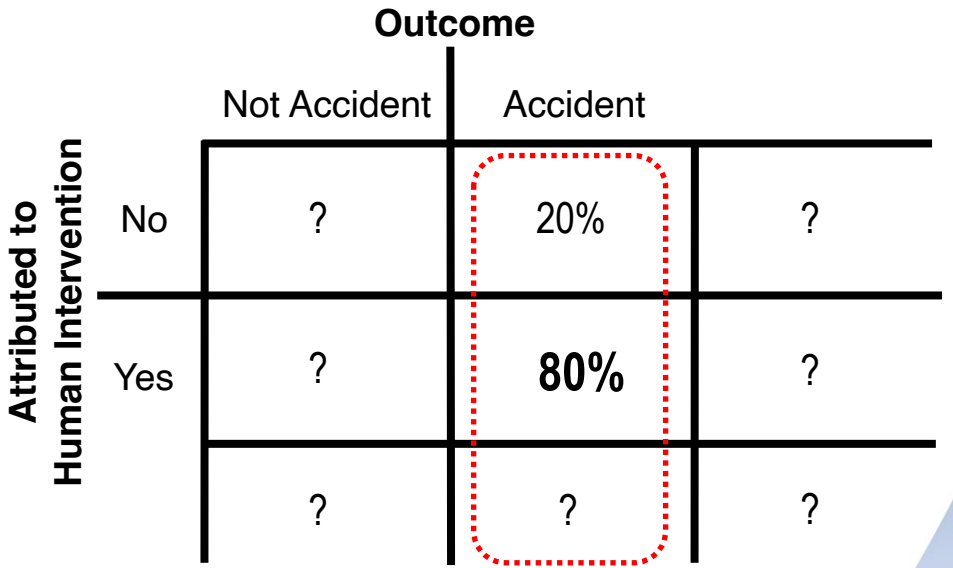

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Attributed to Human Intervention	Outcome: Not Accident	Outcome: Accident	
No	80%	20%	?
Yes	**20%**	**80%**	?
	?	?	?

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- World-wide jet data from 2007-2016[3]
  - 244 million departures
  - 388 accidents

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Yes	**20%**	**80%**	?
	243,999,612	**388**	**244,000,000**

(1) Weigmann & Shappell, 2003; (2) PARC/CAST, 2013; (3) Boeing, 2017

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Attributed to Human Intervention	Outcome: Not Accident	Outcome: Accident	
No	195,199,690	78	195,199,768
Yes	48,799,922	310	48,800,232
	243,999,612	388	244,000,000

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Pilots *Produce* Safety Far More Often than They *Reduce* It

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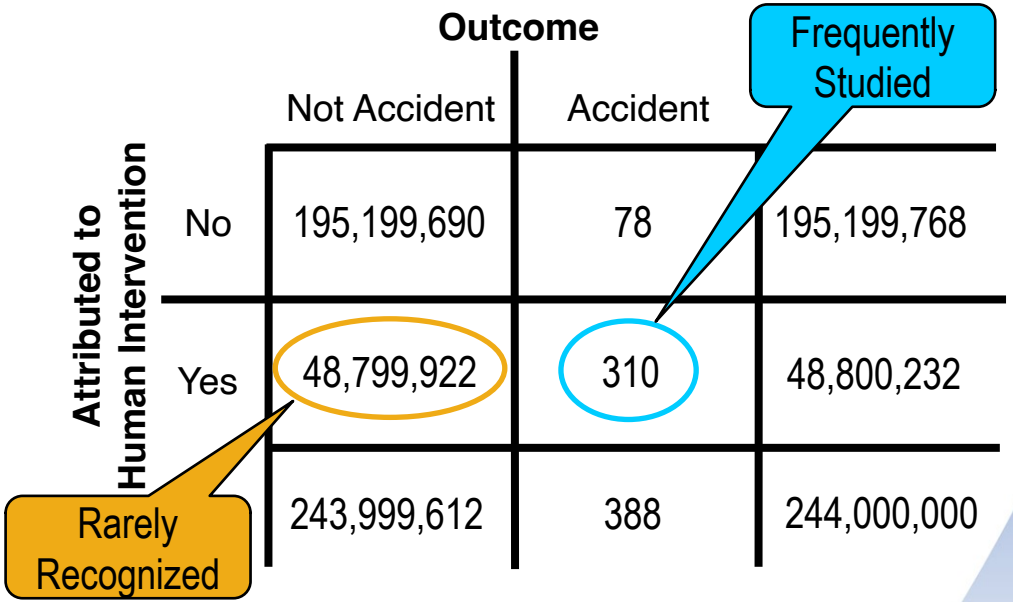

Learn more: Holbrook, J. (2021). Exploring methods to collect and analyze data on human contributions to aviation safety. In *Proceedings of the 2021 International Symposium on Aviation Psychology.* https://aviation-psychology.org/wp-content/uploads/2021/05/ISAP_2021_Proceedings_FINAL.pdf *(1) Weigmann & Shappell, 2003; (2) PARC/CAST, 2013; (3) Boeing, 2017*

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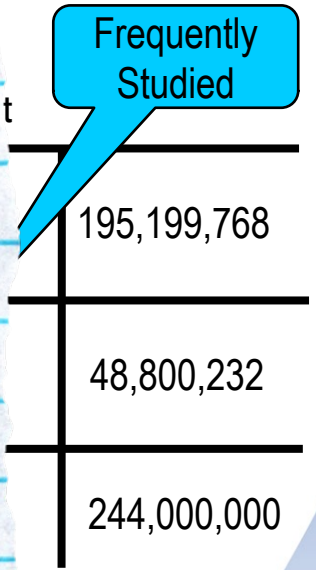

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Revisiting Our Assumptions on Human Performance

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  Pilots intervene in various ways on 100% of flights!

Revisiting Our Assumptions on Human Performance

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$$\frac{\text{(All non-accidents) } 243{,}999{,}612}{388 \text{ (All accidents)}} = 628{,}865$$

Human capabilities keep flights safe more than **628,865** times for every time that a human limitation contributes to an accident!

This estimate is more indicative of operational realities!

To Err is Human…

- Claybrook & Kildare (*Science*, 2018)
  - "… humans are inherently bad at monitoring semi-autonomous systems and are readily distracted."
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- "To fast forward to the safest possible operational state … network operators will be interested in the path that realizes full machine autonomy as quickly as possible." (Uber, 2016)
  - *Note*: Accordingly, it's a *safety imperative* to get those error-prone humans out of the safety loop!

Consequences of Focusing on Human Error

- Designs intended to “protect” the system from “error-prone” humans can design *out* the capability for humans to effectively intervene/adapt, which is a far more common behavior than error.

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- Automation levels are only increasing
  - Until automation designers acknowledge and consider that pilots can intervene to *cause* safety, every increase in automation adds to the risk of
    - Isolating the pilot from the aircraft
    - Limiting the pilot’s adaptive capacity and capability

Where Do We Start?

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  - Specifically, data on how (and the processes by which) humans *contribute* to safety
  - Approaches that can be implemented today

Approaches that Have Been Implemented

- **American Airlines** – Learning & Improvement Team (LIT)
- **Japan Airlines** – Resilience Operation Monitoring (ROM)
- **Southwest Airlines** – Safety & Learning Advancement Team (SLAT)
- **Delta Air Lines** – Integrating Learning From All Operations into the Components of a Safety Management System
- **Cathay Pacific** – Operational Learning Review (OLR)

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  - Approaches that can be implemented today
- Changing the narrative that people are the safety problem

Benefits of Learning from All Operations

- Safer system designs
- Increased organizational awareness
- More frequent opportunities for operational learning/training
- System safety that is robust to future changes
- Resilience

Key Take-Aways

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  - We ignore the vast majority of human impacts on the system
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- When we characterize safety only in terms of errors and failures
  - We ignore the vast majority of human impacts on the system
  - We restrict opportunities to learn
  - Our design decisions and safety policies are affected
- When we *systematically* restrict opportunities to learn, not only do we learn less and less often, but we can draw misleading conclusions

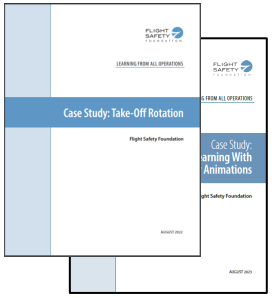
Key Take-Aways

- Learning from all operations is critical to informing system designs, policies, and procedures that effectively preserve the capability for humans to intervene/adapt to sustain safe operations.
  - https://ntrs.nasa.gov/api/citations/20190033462/downloads/20190033462.pdf

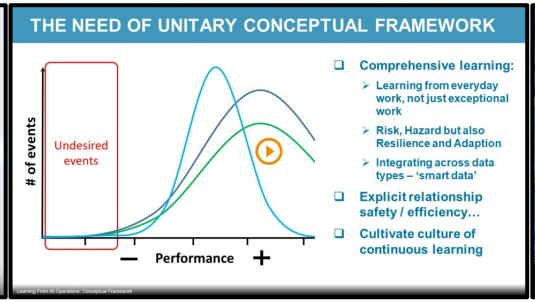
Learning from All Operations: Resources

Publications

FLIGHT SAFETY FOUNDATION



https://flightsafety.org/toolkits-resources/learning-from-all-operations/



https://nescacademy.nasa.gov/video/15d835918c84470bbf3177d0c4db65961d

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  - https://ntrs.nasa.gov/api/citations/20190033462/downloads/20190033462.pdf
- We can “change the conversation” that people are the safety problem
  - by demonstrating practical and sound new approaches to data collection and analysis, and to learning,
  - and by expanding our understanding and definition of what constitutes a “safety event.” (how about a “learning event”?)

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Thank you!

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