Learning from what goes well

ICAO ANW
August 29, 2023

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Why learn from what goes well?
A thought experiment

- Human error has been implicated in 70% to 80% of accidents in civil and military aviation (Weigmann & Shappell, 2003).

Holbrook, J. (2018, April). *Human performance contributions to safety in commercial aviation* [PowerPoint presentation]. NASA Ames Research Center, Moffett Field, CA.

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- World-wide jet data from 2007-2016 (Boeing, 2016)
  - 244 million departures
  - 388 accidents

Outcome

	Not Accident	Accident	
No	?	?	?
Yes	20%	80%	?
	?	388	244,000,000

Attributed to Human Intervention

- Human error implicated in 80% of accidents.

- Pilots manage malfunctions on 20% of normal flights.

- 388 accidents over 244M departures.

Outcome

Attributed to Human Intervention

	Not Accident	Accident	
No	?	78	?
Yes	20%	310	?
	?	388	244,000,000

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Attributed to Human Intervention

	Not Accident	Accident	
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Yes	20%	310	?
	243,999,612	388	244,000,000

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Attributed to Human Intervention		Not Accident	Accident	
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	Yes	48,799,922	310	?
		243,999,612	388	244,000,000

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Outcome

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No	195,199,690	78	195,199,768
Yes	48,799,922	310	48,800,232
	243,999,612	388	244,000,000

Attributed to Human Intervention

When we characterize safety only in terms of errors and failures, we ignore the vast majority of human impacts on the system.

A Couple of Problems with our Assumptions

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Wrong! 100% of accidents are due to human limitations!

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Wrong! 100% of accidents are due to human limitations!

And 100% of successful operations are due to human capabilities!

A Couple of Problems with our Assumptions

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Wrong! 100% of accidents are due to human limitations and 100% of successful operations are due to human capabilities!

- Pilots intervene to manage aircraft malfunctions on 20% of normal flights (PARC/CAST, 2013).

Pilots intervene in various ways on 100% of flights!

How do we think about safety?

Traditional Thinking ("Safety-I")	
Focused on ensuring that "as few things as possible go wrong"	
Humans are a source of errors and hazards: Control and correct	
Variability is a threat—minimize it	
Focus on incident rates	
Focus on what we don't want: injuries and incidents	
Procedures are complete and correct	
Systems are well designed, work as designed, and are well maintained	

See Hollnagel, Wears, & Braithwaite (2015)

How do we think about safety?

Traditional Thinking ("Safety-I")	"Safety-II" Thinking*
Focused on ensuring that "as few things as possible go wrong"	Focused on ensuring that "as many things as possible go right"
Humans are a source of errors and hazards: Control and correct	Humans are a source of flexibility and resilience: Learn and adapt
Variability is a threat—minimize it	Variability is normal—manage it
Focus on incident rates	Focus on learning
Focus on what we don't want: injuries and incidents	Focus on what we do want: how safety is created; how problems are solved
Procedures are complete and correct	Procedures are under-specified and must be interpreted and adapted
Systems are well designed, work as designed, and are well maintained	Systems are complex and will degrade; there will always be flaws and glitches

See Hollnagel, Wears, & Braithwaite (2015)

Responding to Mishap Findings

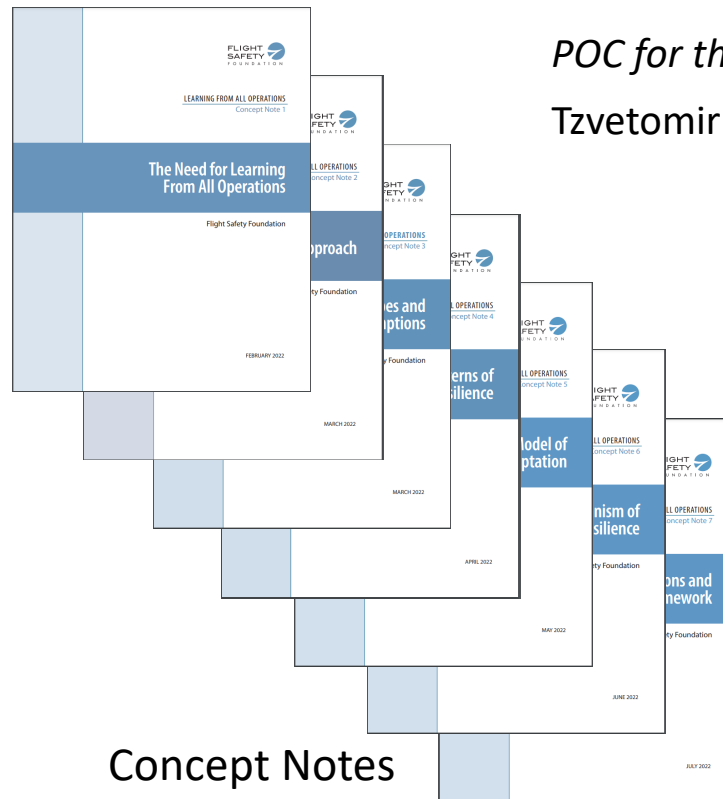| Finding from Mishap Analysis	Traditional Risk Mgmt. Response (Safety-I)	RE/HRO/Safety-II Response
• People had concerns but did not speak up.	• Encourage workers to speak up (e.g., "if you see something, say something").	• Change meeting format: ask open-ended questions, leader speaks last. • Encourage cross-checks and promote cross-role understanding.
• No one noticed the emerging problem.	• Attribute to complacency or loss of situation awareness. • Encourage workers to be careful and pay attention.	• Look for evidence of dismissing problems, prioritizing authority over expertise, simplified root-cause analyses. • Implement structured pre-mission briefs focused on reinforcing awareness of risks and contingencies.
• There was a failure in responding to the unexpected.	• Create rules that specify what the correct response should be.	• Build tangible experience with uncertain and unpredicted events. • Develop drills and simulations to practice noticing subtle cues and responding to surprise.
• Mishap was a recurring anomaly.	• Create more documentation of incidents and lessons learned. • Require workers to review and study them.	• Expand analysis methods and breadth of learning opportunities. • Identify similar events in which things went well, and ask, "what can we learn from our success?"

Impacts of systematically limiting data (by thinking only in terms of "safety I")

➢ Human performance includes both desired and undesired actions – actions that promote safety, as well as actions that can reduce safety.

➢ When our safety thinking systematically restricts the data we collect and analyze, it
- Restricts our opportunities to learn, and it
- Affects our policies and decision making.
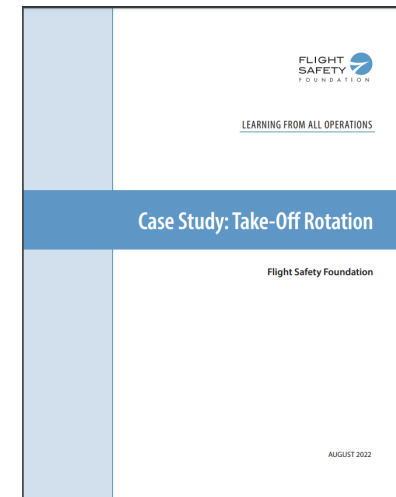
Learning from All Operations

POC for the FSF LAO initiative:

Tzvetomir Blajev (blajev@flightsafety.org)

White paper   Concept Notes   Case Study

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

Human Contributions to Safety (HC2S) Initiative

System-Wide Safety (SWS) Project Focus:

Transformational changes in aviation to make flight more efficient and accessible will require new technologies, policies, and procedures. Enabling these changes to be done safely at every step is the goal of the SWS project.

Human Contributions to Safety (HC2S) Initiative Focus:

People represent the primary source of safety in aviation, through their capability to anticipate, monitor for, respond to, and learn from expected and unexpected change. Understanding and measuring this capability so that it can be integrated into the design of technologies, policies, and procedures is the goal of the HC2S initiative.

How to "Change the Narrative..."

...that people are the safety problem

IMPLICATIONS

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

- Designs intended to replace humans often fail to acknowledge or understand the capabilities that humans routinely contribute to safety, and therefore fail (or don't have the data/knowledge) to design that into the system

- Designs that leverage a "safety pilot" who will only intervene to "save the day" in rare failure events fail to consider how our cognitive systems work and how they evolved to work. Such designs are setting up the safety pilot to fail.

How to "Change the Narrative…"

…that people are the safety problem

PROPOSED SOLUTION

- In today's aerospace industry, *data talks*
- When the only data that are available are about human failure, then data-driven designs only consider that humans fail
- To change the narrative, we need new data and new ways to examine data
  - Specifically, data on how (and the processes by which) humans *contribute* to safety

IMPACTS

- Safer system designs
- Increased organizational awareness
- Improved operational learning/training
- System safety that is robust to future changes

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Human Contributions to Safety (HC2S) Initiative

Expand the range of safety-relevant events to include not only rare safety failures but frequent safety successes

- Create a data testbed to enable exploration of methods and metrics for pilot contributions to safety and mission success – *learning from what goes well*

- Develop methods and metrics for learning from *all that happens*
  - Structured observation
  - Self reports
  - System data
- Learn from simulations and operations

Thank you!

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August 29, 2023

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