National Aeronautics and
Space Administration

Strategies for Improving Safety Learning

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Learning from All Operations

FLIGHT SAFETY FOUNDATION

POC for the FSF LAO initiative:

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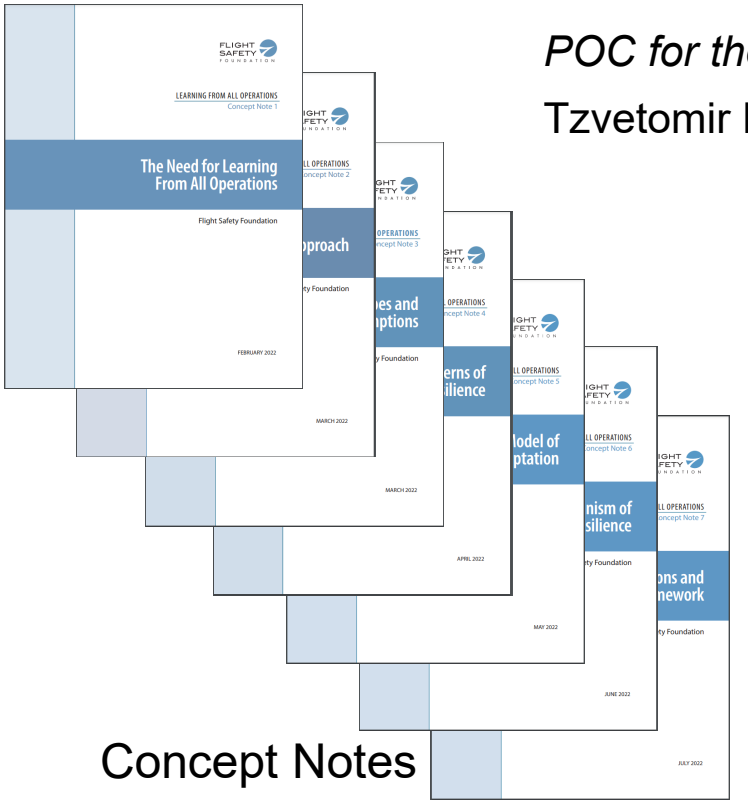
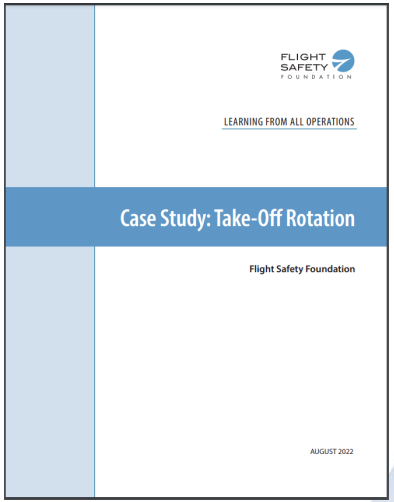
White paper



Concept Notes



Case Study

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

Expanding learning opportunities

- Build upon or complement existing approaches to collect, analyze, manage, & disseminate safety data
  - Observations of work
  - Event investigation
  - Surveys & audits
  - Expanded use of system data
- What are the learning principles that help us get the most out of those safety data?

How do we turn safety *data* into safety *learning*?

Incorporate learning from success & failure in debriefs

After-Event Reviews: Drawing Lessons From Successful and Failed Experience (Ellis & Davidi, 2005).

- Soldiers' navigation performance improved more when debriefed on failures and successes compared with only failures
- Before the study, soldiers' mental models of failed events were richer than for successful events, but this gap closed after the study

Image credit: US Army (2008). Public Domain

What Can You Do?

- Structured debriefs could include…
  - What was planned and expected to happen?
  - What actually happened?
  - What surprised us?
  - What went well and why?
  - What else could we have done?
  - What did we learn that would help others?

Use of stories to support learning

Reading Stories Activates Neural Representations of Visual and Motor Experiences (Speer et al., 2009).

- Recorded brain activity using functional magnetic resonance imaging (fMRI) while participants read short narratives
- The same brain regions activate when people perform, observe, imagine, or read about real-world activities

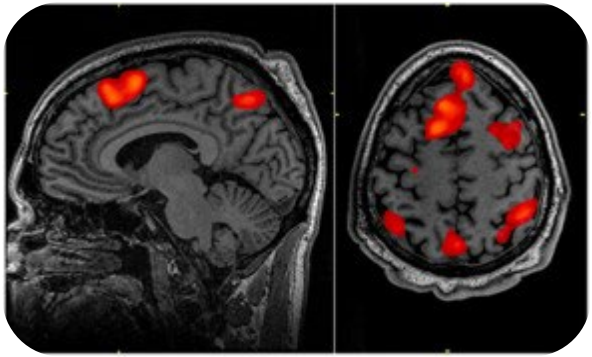


Image credit: John Graner (2010). Public Domain

What Can You Do?

- Use of stories in lessons learned
  - Enrich anomaly reporting and resolution processes
  - Learning experiences can be frequent, interactive, reflective, and designed to build expert decision-making and professional judgement
  - Improve how an organization builds and maintains collective memory, deep knowledge, and a larger repertoire of decision-making strategies

Getting the most out of learning opportunities

- "*What* are you learning?" vs. "*How* are you learning?"
- "Cognitively active" learning is generally superior to "cognitively passive" learning in educational settings (Stanger-Hall, 2012)

Passive Learning

- I previewed the material ahead of time
- I came to class
- I read the assigned text

Active Learning

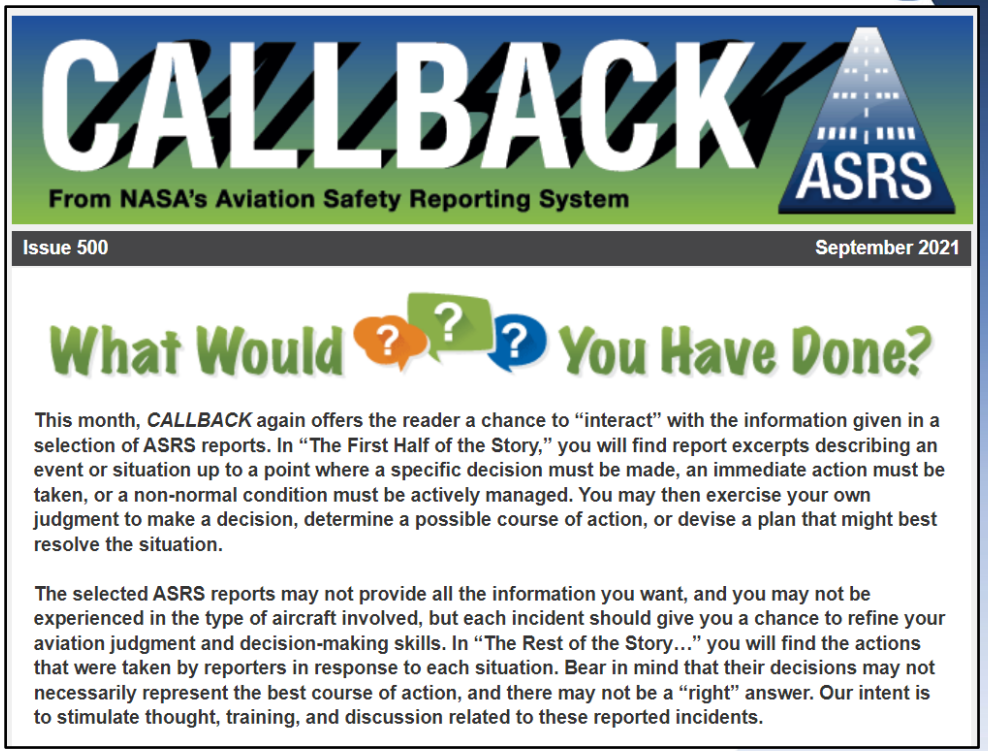
- I asked myself "how does this work?" and "why does it work this way?"
- I wrote my own study questions
- I fit all the facts into the bigger picture
- I closed my notes and tested how much I remembered

- Implications for
  - How we should collect, organize, and share knowledge
  - Assumptions about operators learning from on-the-job experiences

What does it mean to be an active learner?

Factors that impact individual learning

- Motivation (Weiner, 1966)
- Prior knowledge (Cohen, 1981)
- Rehearsal and practice (Craik & Lockhart, 1972)
- Elaboration (e.g., Yogo & Fujihara, 2008; McLeod et al., 2010)
- Spacing out your practice (e.g., Ebbinghaus, 1885)
- Organizing information (e.g., Bellezza, 1981)
- Sleep (e.g., Abel & Bauml, 2013)



CALLBACK

From NASA's Aviation Safety Reporting System

ASRS

Issue 500 September 2021

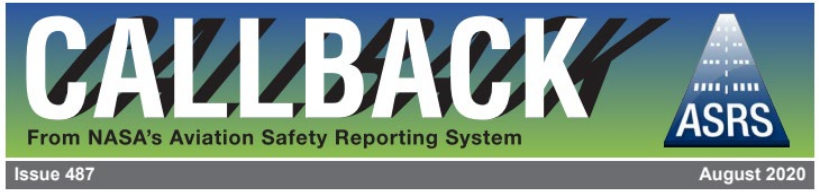
What Would You Have Done?

This month, *CALLBACK* again offers the reader a chance to "interact" with the information given in a selection of ASRS reports. In "The First Half of the Story," you will find report excerpts describing an event or situation up to a point where a specific decision must be made, an immediate action must be taken, or a non-normal condition must be actively managed. You may then exercise your own judgment to make a decision, determine a possible course of action, or devise a plan that might best resolve the situation.

The selected ASRS reports may not provide all the information you want, and you may not be experienced in the type of aircraft involved, but each incident should give you a chance to refine your aviation judgment and decision-making skills. In "The Rest of the Story…" you will find the actions that were taken by reporters in response to each situation. Bear in mind that their decisions may not necessarily represent the best course of action, and there may not be a "right" answer. Our intent is to stimulate thought, training, and discussion related to these reported incidents.

Learn more:
https://asrs.arc.nasa.gov/publications/callback.html

Leverage active learning

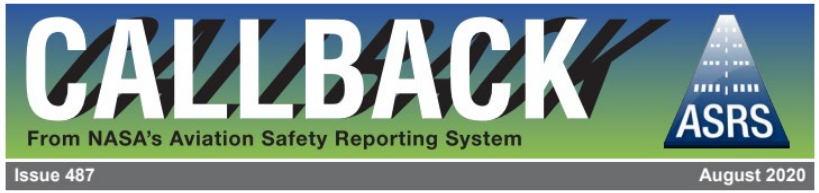


The First Half of the Story…

I was Pilot Flying and set thrust for takeoff, pressed the TOGA button to engage takeoff thrust, and noticed the right thrust [lever] did not fully advance. I called, "Check thrust." The Captain noticed that the Number 2 Engine would not achieve takeoff thrust.

What Would You Have Done?

Leverage active learning



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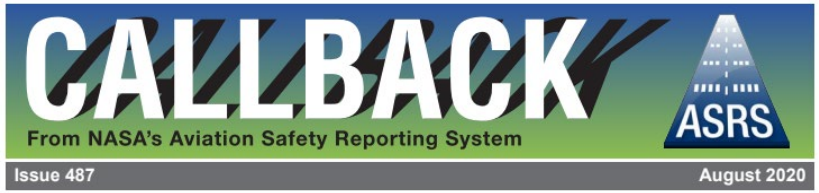
What Would You Have Done?

The Rest of the Story…

[The Captain] called, "100 knots," but I noticed he was heads down at the engine gauges, and I called, "V1." I achieved Vr, and he called for a rejected takeoff. I said, "Negative, we are past V1." He pushed the thrust levers to full thrust, and we rotated without incident. I disconnected autothrottles and was able to achieve climb thrust for the climb to cruise altitude. At cruise, the Captain called Maintenance Control to discuss the issue, and they told us that the aircraft [recently] had a similar incident.... We continued the flight without incident and debriefed the situation at cruise. We talked about the fact that we were at such a light weight and the speeds V1 and Vr came so much earlier than normal.

Leverage active learning



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What Else Could You Ask…

…after reading the rest of the story?

- How does your solution compare with what the event crew did?
- What else could the event crew have done?
- Of all the solutions you came up with, which do you think would have worked best? Why?
- What do you think were the "learning moments" or "teachable moments" in this situation?
- What could you take from this situation to add to your own "strategy toolbox"?
- Does this situation remind you of one that you have personally experienced? What do you think contributed to *your* situation working out successfully or unsuccessfully?

Key Take-Aways

- Learning from All Operations expands our understanding of what constitutes a safety-relevant event
- Expanding opportunities for collection, analysis, and dissemination of safety data also expands opportunities for safety learning
- Learning strategies discussed include debriefing successes, leveraging stories, and employing active learning
- Applying established principles of learning can help to make the most of safety learning opportunities
  - Individuals can apply these principles to reinforce learning from their own and others' experiences
  - Organizations can apply these principles through policies that help preserve, reinforce, extend, and expand good practices

Thank you!

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