Human Factors and Risk Management

It's Not Rocket Science!

Current as of: 3.14159 (Pi Day) 2019

Bottom Line Up Front

Human Factors considerations are a critical part of Risk Management, but they are often overlooked or ignored!

- 80 percent of NASA Class A/B mishap findings between 2007 and 2017 involved Human Factors

- 90 percent of AFRC's FY16 aviation ground mishaps and close calls involved Human Factors
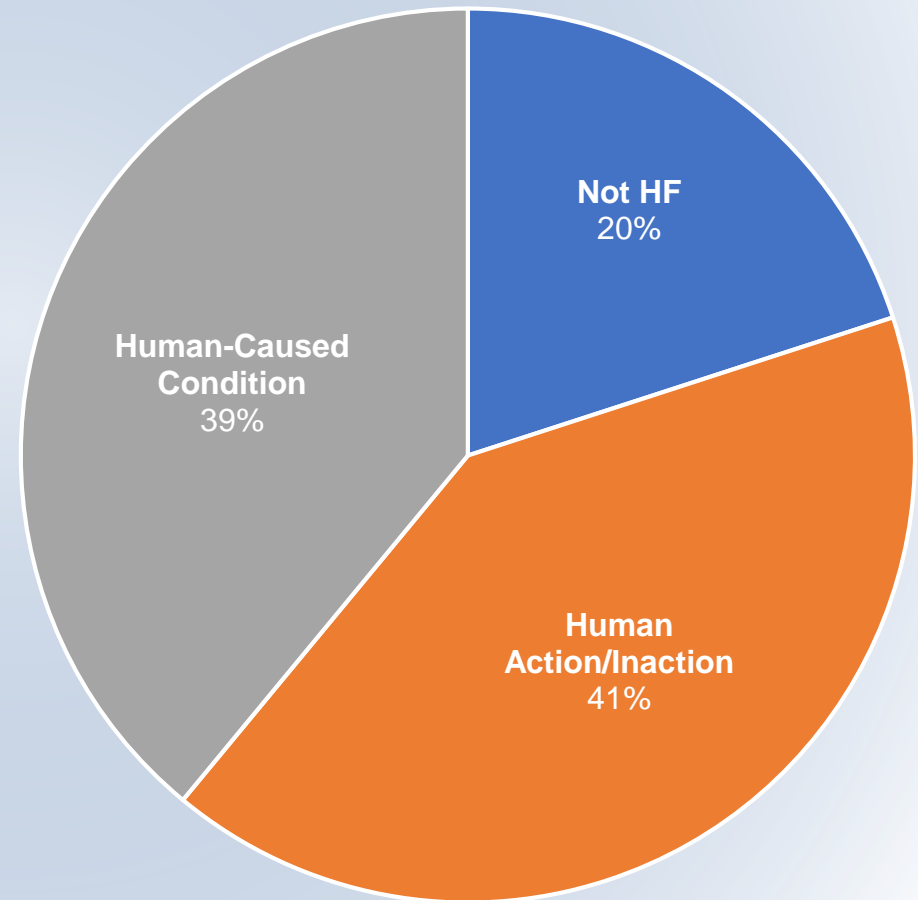
Not HF
20%

Human-Caused Condition
39%

Human Action/Inaction
41%

Setting the Stage

- **We tend to use good Risk Management practices in many areas of our personal and professional lives**

We fasten our seatbelts and buy insurance before we drive our cars.

We wear PPE when required.

We don't leave our children unattended when they're swimming in the ocean!

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- **Doing so can lead to potentially unsafe conditions or actions that can cause close calls and/or mishaps**

Fairchild   B-52
Crash June 1994

- Over-Confidence
- Rule Violation
- Supervision Failure
- Other Cultural Issues

Costa Concordia
Wreck March 2012
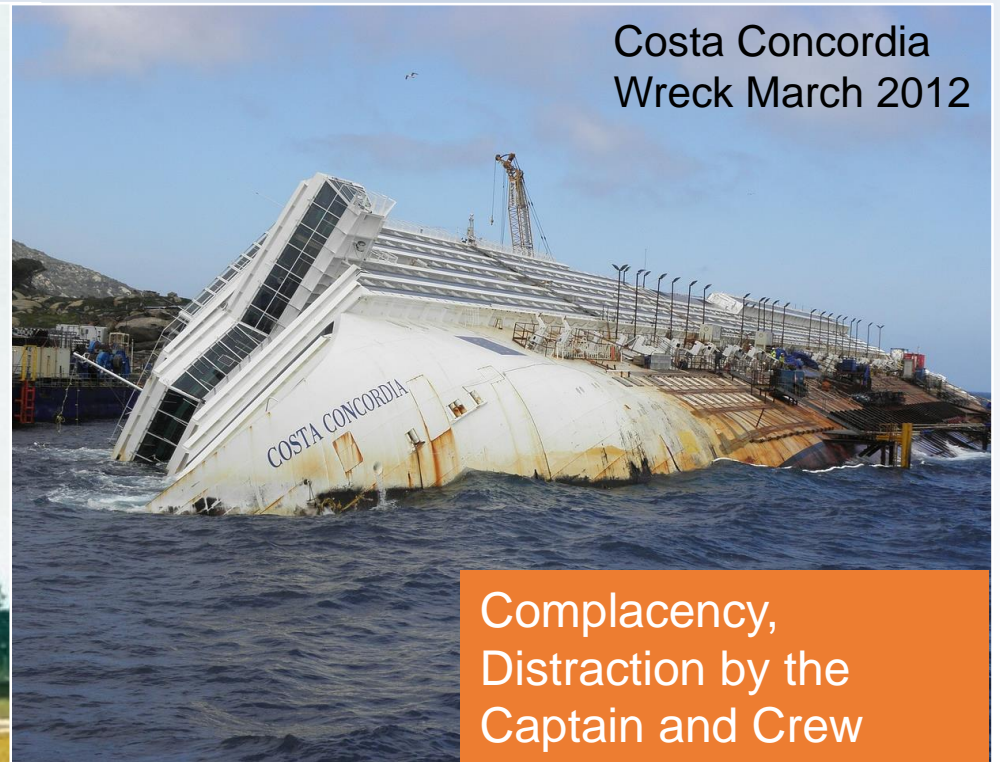
Complacency, Distraction by the Captain and Crew

Human Factors Basics

- **Humans normally try to achieve success, but**
  - □ Inattention/poor decision-making can lead to injury, damage, or mission failure

- **NASA's Human Factors Analysis and Classification System, or NASAHFACS, lists four tiers of active error and latent failure sources**
  - □ Acts (decision, skill-based and perceptual errors, plus violations)
  - □ Preconditions (environmental, operator condition, and personnel factors)
  - □ Supervision (inadequate, inappropriate operations, failure to correct unsafe situations, and supervisory violations)
  - □ Organizational influences (resource management, processes and climate)

- **Mitigation plans are needed to eliminate/reduce error sources; considerations should include:**
  - □ Physical systems design (producibility, reparability, maintainability)
  - □ Process design, development, and control (procedures, checklists)
  - □ Increased training and automation (to take the human out of the loop)
  - □ Conducting peer reviews to identify items and areas prone to errors

Human Factors Basics (Continued)

- **Identify the sources of possible "incorrect actions" or "errors"**
  - □ Trap and remove errors that could cause damage or injury

- **Remove source(s), block paths to occurrence**

- **If elimination is not practical, then develop a mitigation strategy to reduce the outcome's severity to something acceptable**
  - □ Develop mitigations that contain or alter the error's propagation path

- **When incorrect actions/errors occur:**
  - □ Stop the activity immediately and move to a safe condition
  - □ Do not continue until you understand why the actions/errors occurred

Applying Human Factors principles can reduce risk and promote safety.

Examples: Effective Application of Human Factors Principles

Astronaut Launch Duty Day

- **Issue:** Astronauts were awake 20 hours prior to docking at ISS on launch day. This left them highly fatigued prior to demanding docking task.

- **Solution:** Add 3-hour nap to schedule before launch so astronauts are alert.

Construction crew daily safety brief

- **Problem:** None. Supervisor is giving detailed briefing on day's work plan, asking each team member about potential safety risks, and ensuring that all members understand their respective responsibilities.

Expedition 51 launch to ISS April 20, 2017

Prepping to pour concrete at AFRC

Examples: When Human Factors are Overlooked/Ignored

Airman Killed Trying to Open Hangar Door

- Issue: Door was open about 10 inches. Airman tried to reach through opening to push the OPEN button on the other side of the door, but inadvertently pushed the CLOSE button. He was crushed.

- Assessment: Airman didn't consider safety risk and violated procedure for opening door (could have walked around to enter the hangar). Supervision tacitly condoned "cutting corners."

DOD Satellite Close Call During Move (Launch Delayed)

- Issue: Containerized satellite slid off tilt-bed truck inadvertently onto factory floor.

- Assessment: Crews failed to secure the container to the truck before releasing winch. Poor Crew coordination and adherence to procedures.

Virgin Galactic Space-Ship Two Mishap – October 2014 (One Death)

- Event: Spacecraft destroyed on ascent after copilot unlocked feather lever

- Some of the Human Factors related findings: Human Factors were not emphasized during design, hazard analysis, procedure development, or simulator training. Also, crew had very little high-performance aircraft time.

Examples: ER-2 Inadvertent Hatch Opening

Type D mishap: $12,000 Damage (January 2013)

- **What happened?** Hatch latch opened during landing rollout, allowing hatch to impinge upon adjoining pod structure (it jammed in the open position)

- **Investigation analysis:** Hatch determined to be only partially locked and observations by ground crew and mobile pilot failed to identify this condition

- **Human Factors issues (latch design, checklist criteria/usage)**
  - Hatch installed 14 Jan; flight was on 29 Jan (2-week period between activities)
  - Locked indications were not easy to verify and mobile pilot could not see hatch
  - Final inspection/preflight did not call for verification of hatch security

- Mobile pilot did not have a specific preflight checklist item to verify hatch security

- **Other Lessons Learned**
  - Potential environmental risks associated with the latch design were not mitigated (detents, locking cues, etc.)
  - Established processes and controls (checklists/ procedures) were not adequate to ensure repeatable results
  - Training was not standardized and did not take into account differences between different latches

Responsibilities

Managers and Supervisors

- Increase Human Factors awareness training in our orgs and emphasize risk reduction and mitigation for all activities (not just the big ones)

- Have all teams conduct detailed 'pre-activity' briefings to discuss risks and other human factors considerations

- Encourage our employees to look for potential failure modes in processes and systems and develop mitigation strategies

- Identify tasks and processes susceptible to employee fatigue and ensure employees have adequate rest periods

- When close calls or mishaps occur, identify the Human Factors present and find out why the decisions and/or actions involved were taken

- Set high standards, but do not expect error-free performance

- Value employee risk reduction/mitigation efforts and accept that these efforts may impact schedule and cost to the activity

Responsibilities (Continued)

Employees

- Accept that we may not be the best judge of our own performance state

- Monitor our peers during risky activities, look for changes in behavior, like fatigue, and ask them to do the same for us (be a good wingman)

- Take personal responsibility to ensure we stay trained and proficient in all areas required by our jobs and to speak up if we aren't!

- Accept that management decisions could unknowingly increase risk and to speak up if we see that happening

- Admit when our human performance state is below the requirements of the task at hand and call 'knock it off' if needed!

- Apply these principles to our activities outside of work too, so we can make it back to work safely and in one piece tomorrow!

Responsibilities (Continued)

Everyone

- Recognize that our environment is continually changing and we are all susceptible to hazards – if we see something, say something!

- Review procedures and processes with an understanding that they were developed under a set of human performance assumptions that may have changed

- Always remember that risk reduction/mitigation is a team responsibility

- Demand honest feedback from ourselves and teammates (conduct thorough end-of-shift or event debriefs)

- Be relentless in our pursuit of excellence!

NASA AERONAUTICS BOOK SERIES

Breaking the Mishap Chain

Human Factors Lessons Learned from Aerospace Accidents and Incidents in Research, Flight Test, and Development

Peter W. Merlin, Gregg A. Bendrick, and Dwight A. Holland

For more info go to…
https://www.nasa.gov/connect/ebooks/
break_mishap_chain_detail.html

Bottom Line

Human Factors considerations are a critical part of Risk Management. It is up to all of us to make sure they are not overlooked or ignored.

Questions?