
SIDE STICK PRIORITY
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ALT
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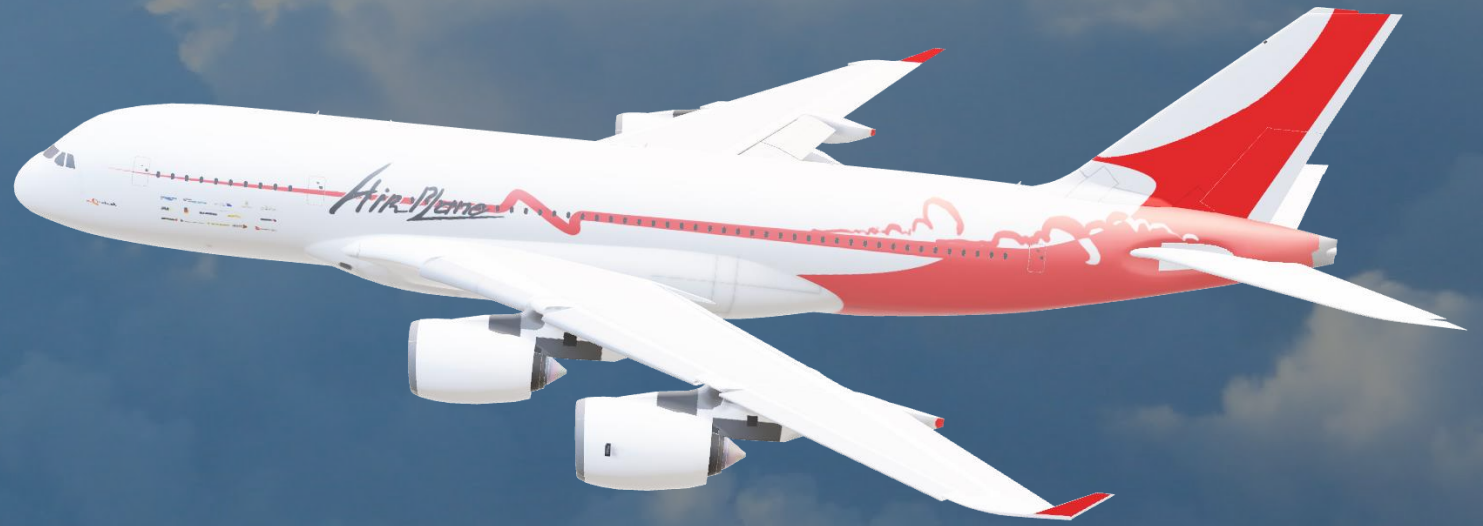
What IT can learn from Aviation



History

1891 Otto Lilienthal

1903 Wright Brothers

1907 Karl Jatho

WW I 1st Mass production

WW II first Phraseology for aviation radio

1977 Teneriffa accident

WW II Z3 (Konrad Zuse)

Turing Bomb (decryption Enigma)

Computers for Manhattan Project

1962 AGC (Apollo Project)

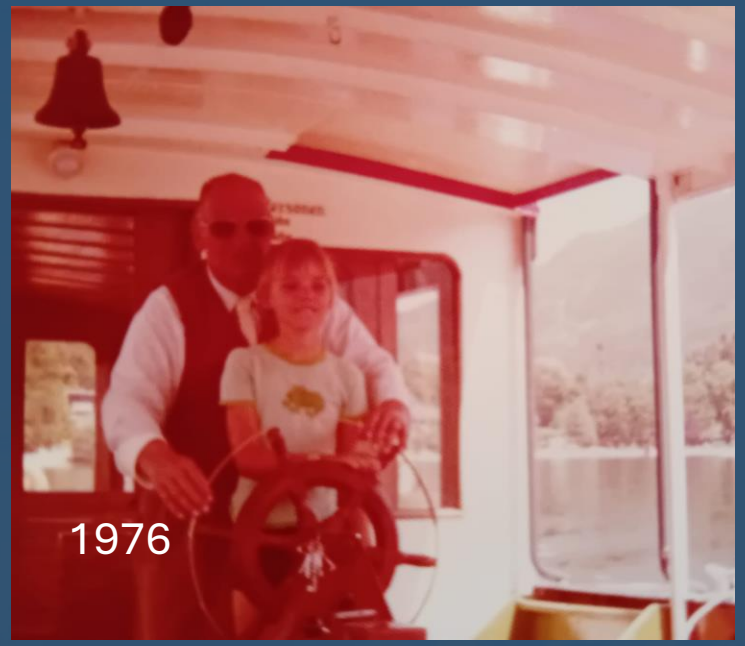
1982 Commodore C64

1984 Apple Macintosh

Your Pilots today

Uwe Küchler (Pilot Flying)

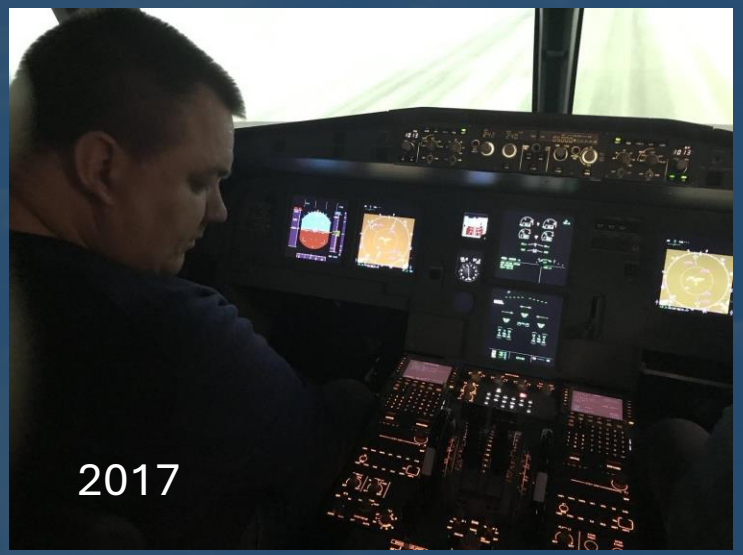
- Generation C64
- More than 40 years of IT experience
- 1997-2000 employee of Oracle Germany
- Since then: IT-Consultant, DBA and Developer, Tutor, Manager
- Recently: Senior Consultant @ AWS
- Author and Blogger (oraculix.de)
- Since 1998 Private Pilot (PPL)
  - 12 Plane Types, 600 Flights



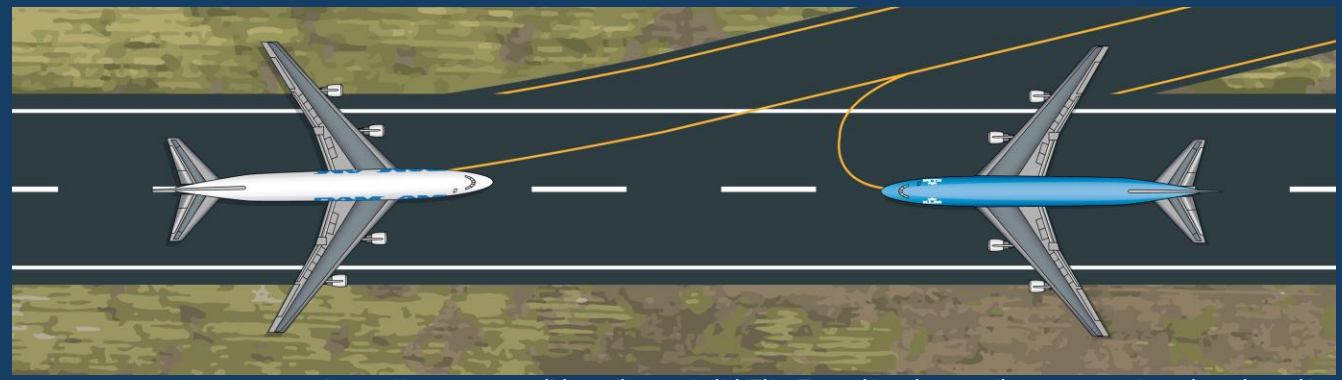
Your Pilots today

(Pilot Monitoring) Christian Hädrich

- Generation „Golf“ (X)
- More than 35 years IT experience
- 28 years as IT Consultant
- Aviation Enthusiast

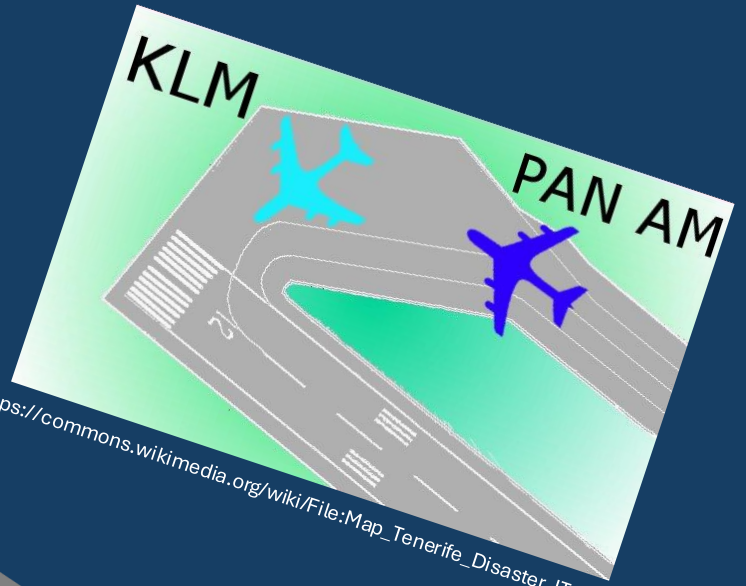


Teneriffa 1977

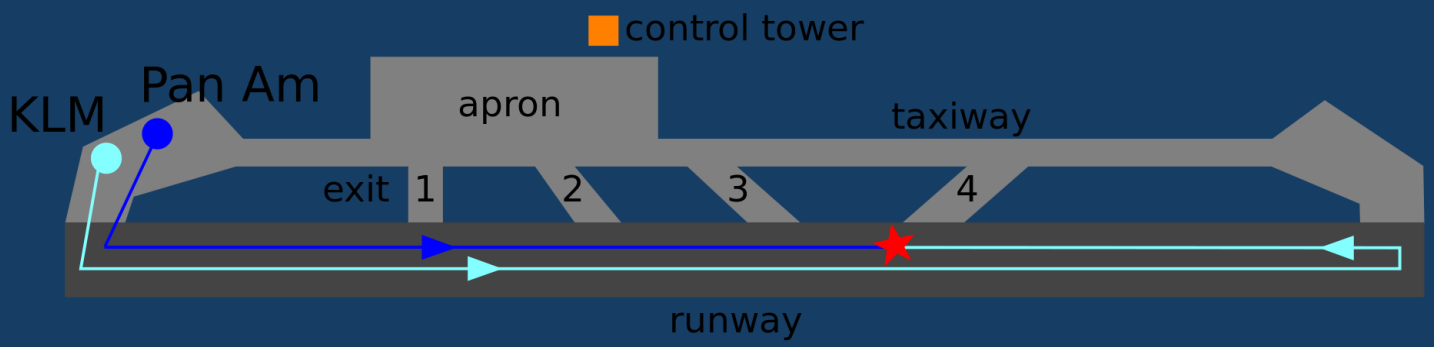


https://commons.wikimedia.org/wiki/File:Tenerife-airport-disaster-crash-animation.gif

https://commons.wikimedia.org/wiki/File:Tenerife747s.png



https://commons.wikimedia.org/wiki/File:Map_Tenerife_Disaster_IT_parking.jpg



Crew Communication

„super“-competent, dominating Captain

„Wait a minute, we don´t have an ATC clearance.“

“No, I know that, go ahead, ask.“

…

„Is he not clear, then?“

„What yo you say?“

„Yup?“

„Is he not clear, that Pan American?“

„**Oh, yes** (emphatic) …“

https://upload.wikimedia.org/wikipedia/en/a/a2/KLM_Magazine_that_contains_Captain_Jacob_Veldhuyzen_Van_Zanten.jpg

https://tenerifecrash.fandom.com/wiki/Klaas_Meurs?file=Klaas.jpg

Radio Communication

Special problems in aviation radio:

- Sometimes weak Communication
  - Interference
  - Shadowing
  - Background noise
- Many participants on one frequency
  - Requires concentration
  - Impossible to speak at the same time

Risk of misunderstandings or loss of information.

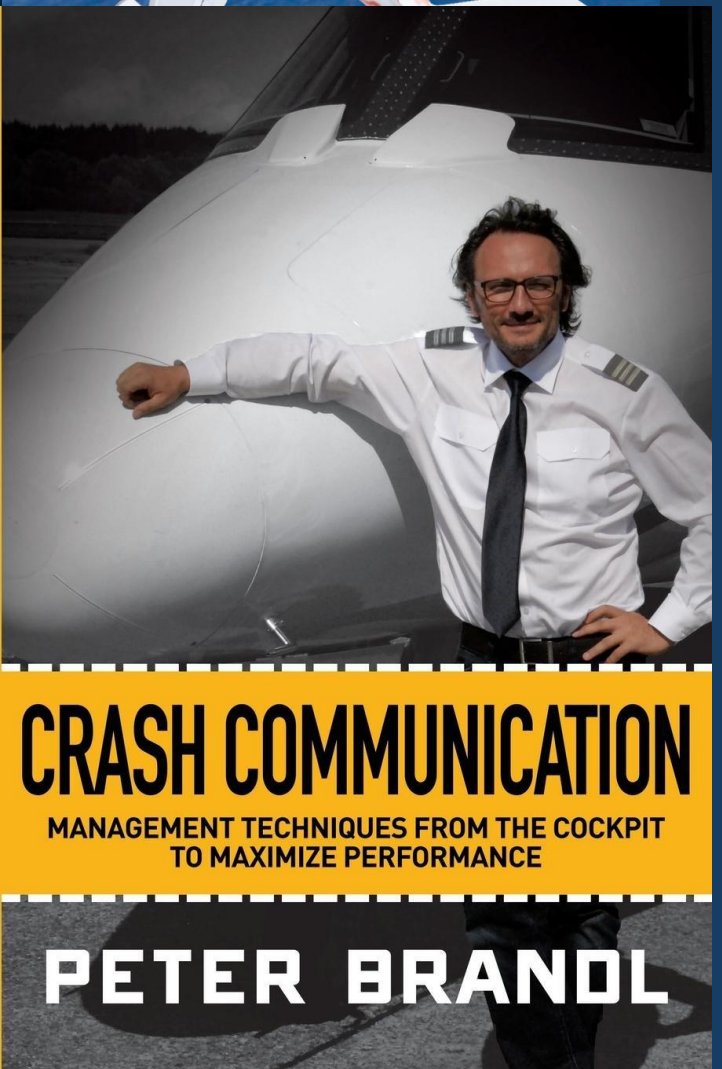
→ Counteract with clear rules

Chain of reasons …

- Dominant Captain
- Pressure because of max. Flight time
- Communication overlap
- Language (PanAm didn‘t ask for wait until KLM takeoff)
- Unclear Wording (departure / takeoff)

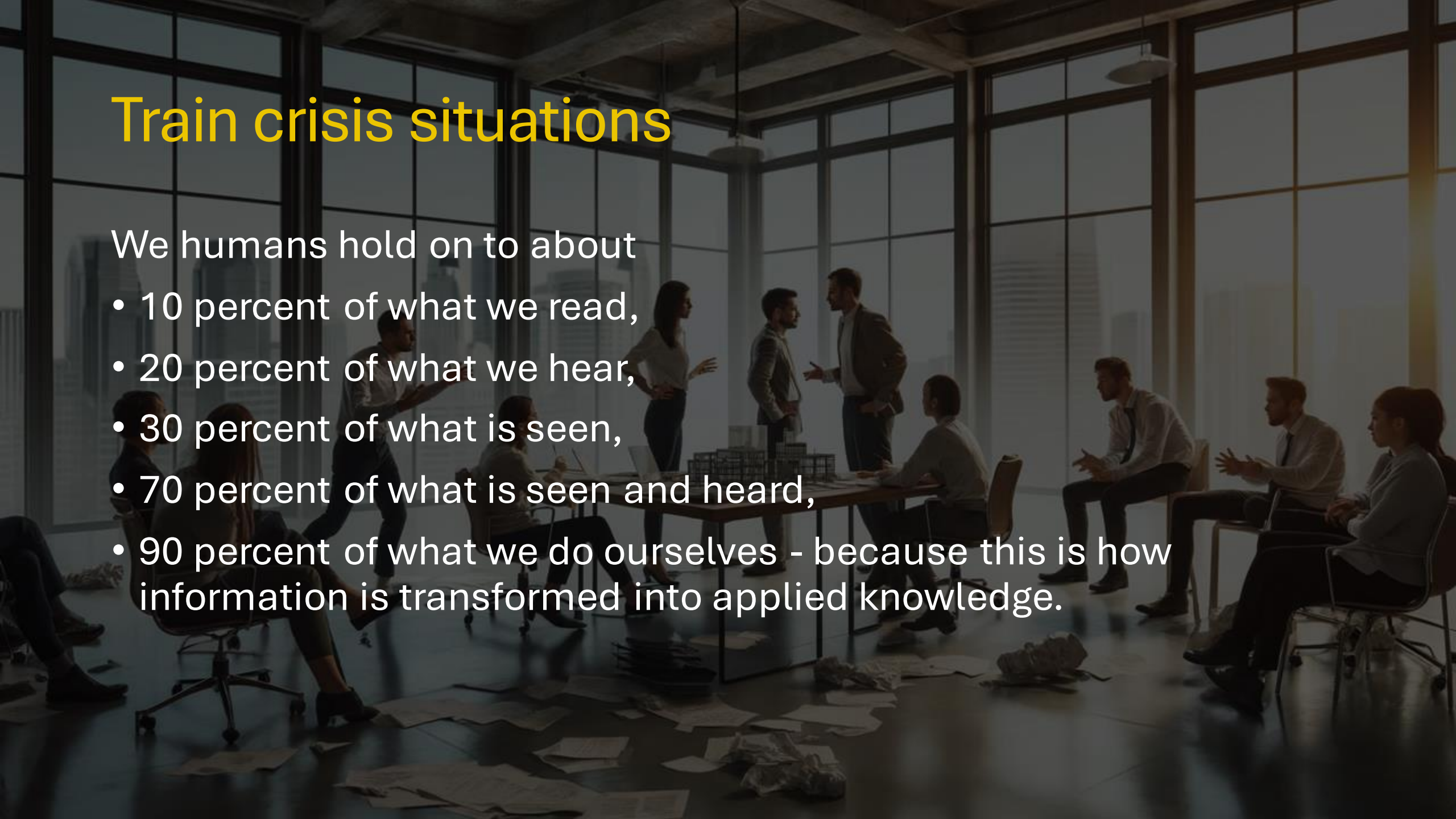
Communication - example aircraft radio

- Clear phraseology (fixed word combinations and sequences)
  - Facilitates understanding on both sides
  - Helps concentration because information is firmly structured.
- Instructions and important information are "read back" (repeated)
- If in doubt, ask again ("say again [after ...]")
  - No unnecessary shyness
  - Prevent mistakes!



Crew Resource Management (CRM)

- Training for aircraft crews designed to improve interpersonal skills in order to prevent flight accidents caused by human error.
- This involves cooperation, situational awareness, leadership behavior and decision-making as well as the associated communication.
- For example, dividing up tasks and agreeing who will take on which tasks.
- Mandatory part of airline training (but not worldwide).



Train crisis situations

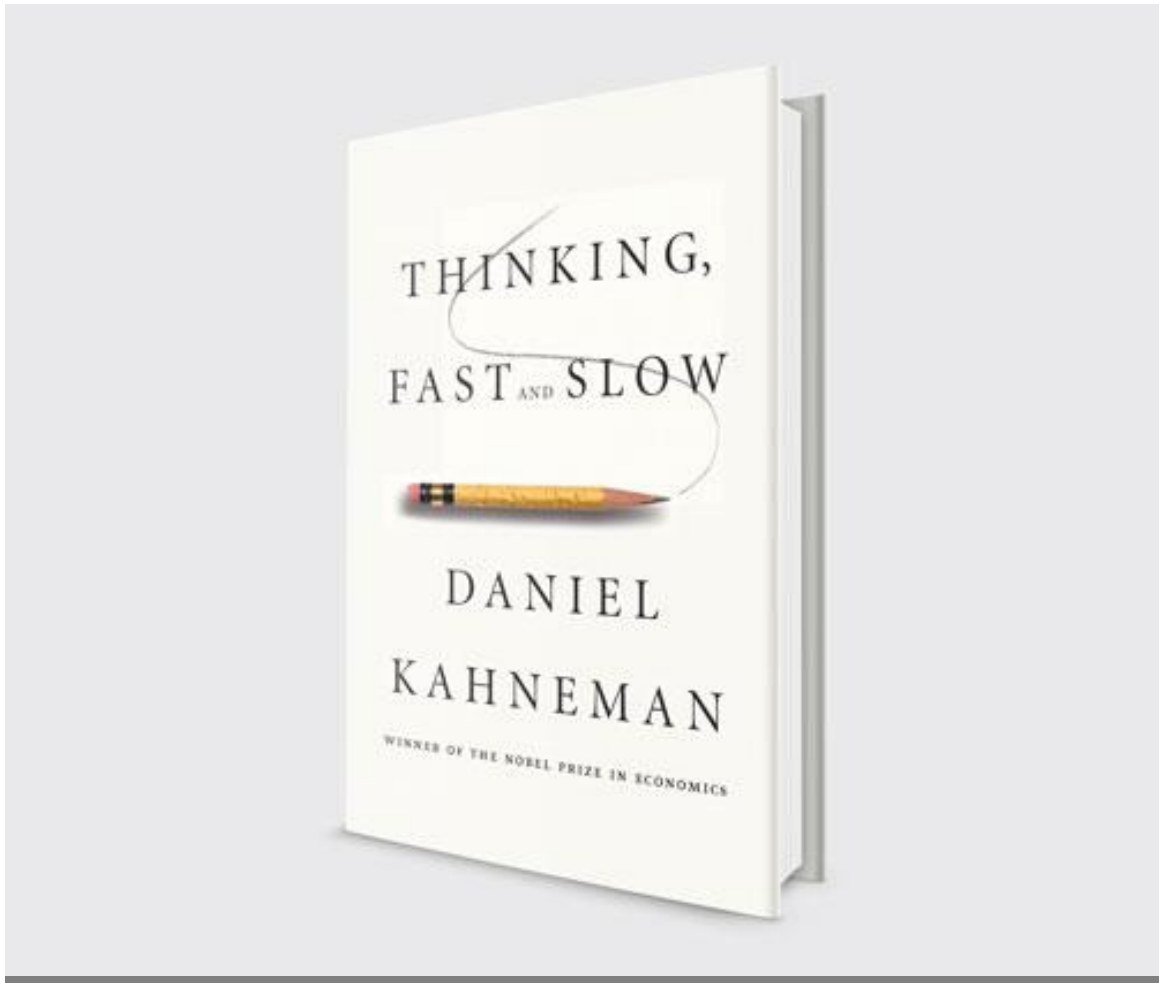
We humans hold on to about

- 10 percent of what we read,
- 20 percent of what we hear,
- 30 percent of what is seen,
- 70 percent of what is seen and heard,
- 90 percent of what we do ourselves - because this is how information is transformed into applied knowledge.

„What is thought is not said
What is said is not heard
What is heard is not understood
What is understood is not believed
What is believed is not yet advocated
What is advocated is not yet acted on
What is acted on is not yet completed“

(Konrad Lorenz)

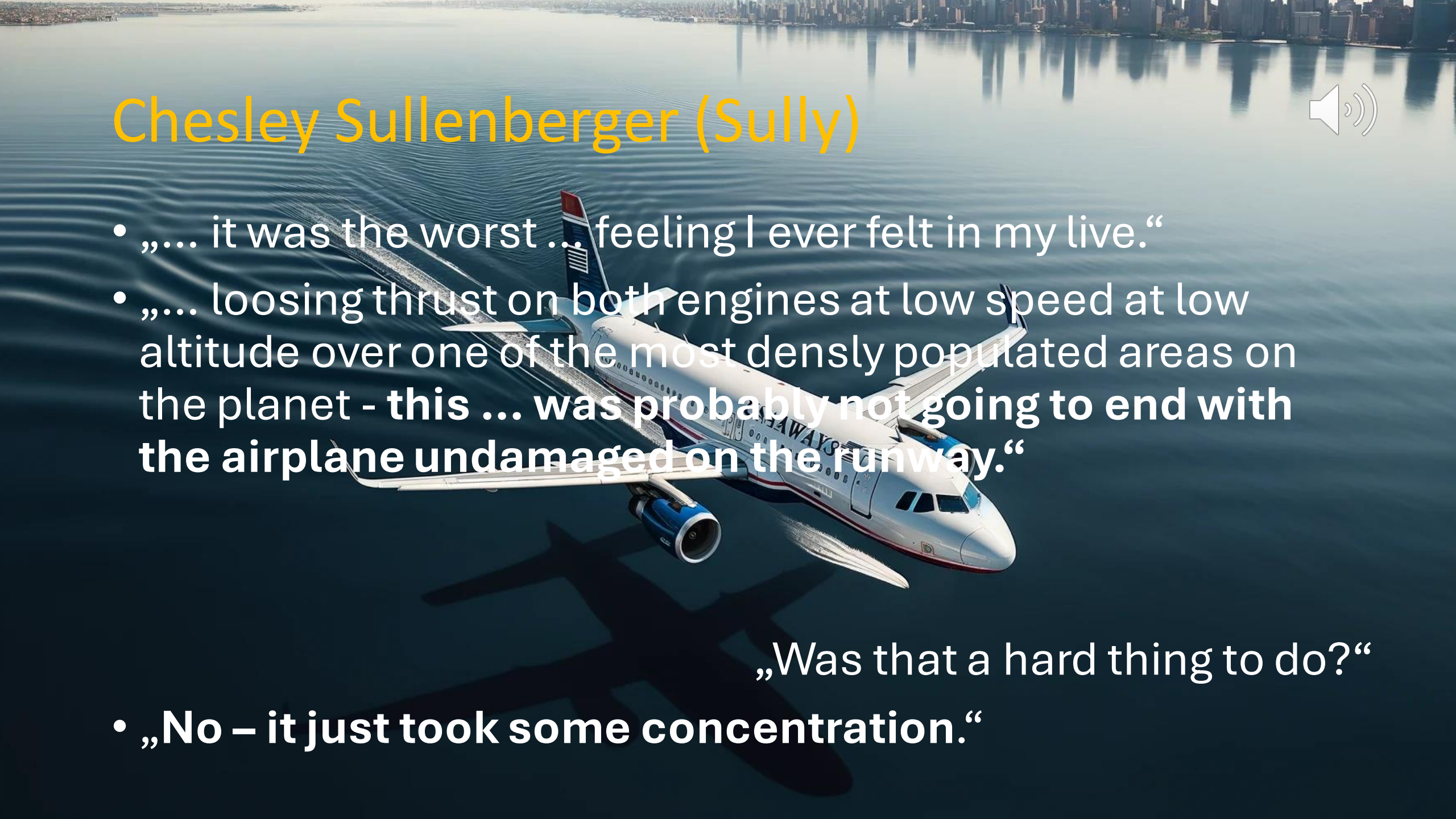
https://m.media-amazon.com/images/S/amzn-author-media-prod/u5bqpd1erkokht2vl0jl3iqmfb._SX450_CR0%2C0%2C450%2C450_.jpg



https://friedmanstrategy.com/wp-content/uploads/2013/02/FSG_ThinkFastSlow.jpg

Thinking, fast & slow

Chesley Sullenberger (Sully)



- „… it was the worst … feeling I ever felt in my live.“
- „… loosing thrust on both engines at low speed at low altitude over one of the most densly populated areas on the planet - **this … was probably not going to end with the airplane undamaged on the runway.**“

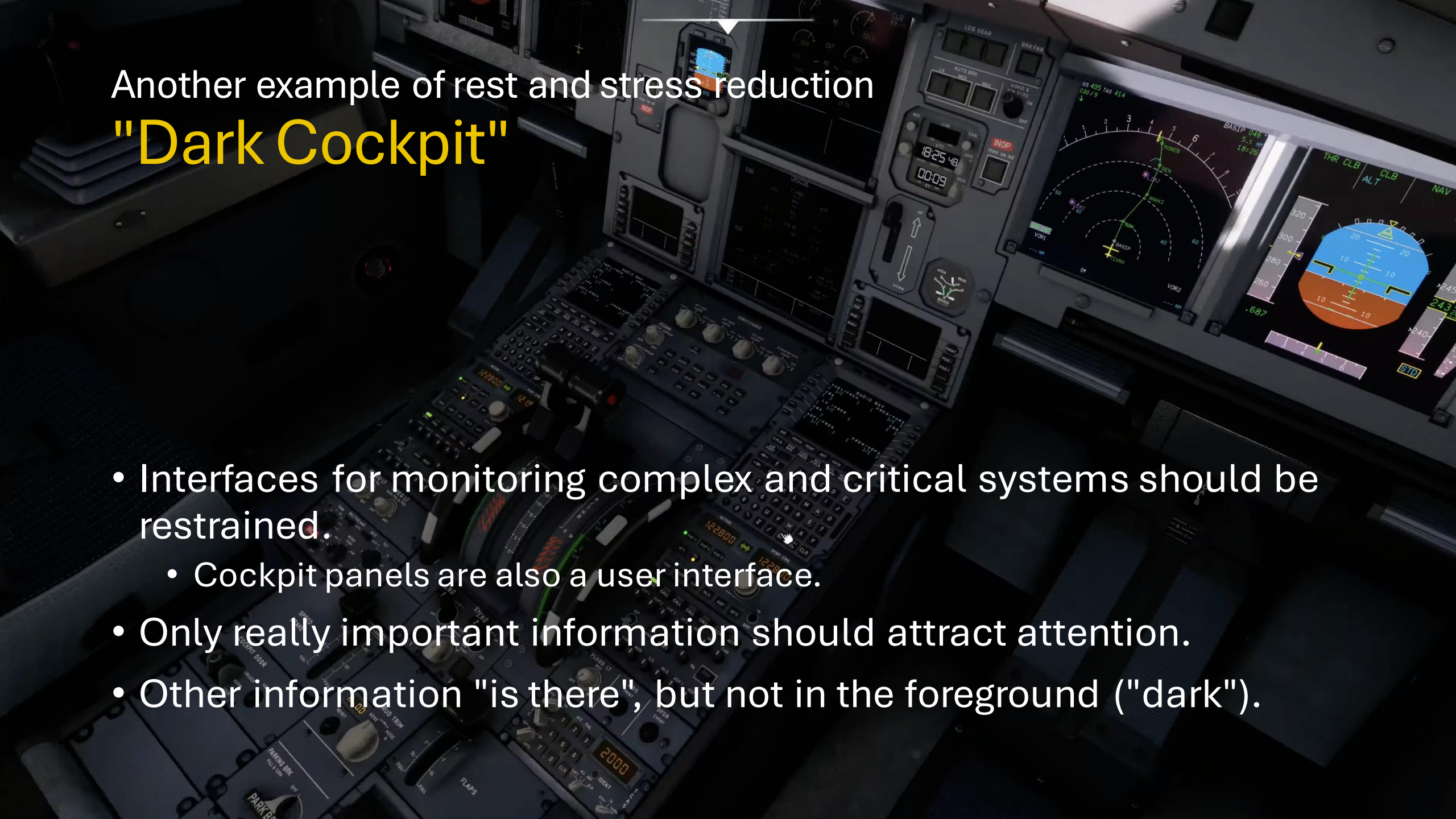
„Was that a hard thing to do?“

- „**No – it just took some concentration.**“

Communication:

Quiet to whom quiet is due!

- Not communicating can sometimes be more helpful if the actions are clear.
  - Example: US Airways Flight 1549, landing in the Hudson River
- External interventions ("What is the status?") can delay crisis reactions!



Another example of rest and stress reduction

"Dark Cockpit"

- Interfaces for monitoring complex and critical systems should be restrained.
  - Cockpit panels are also a user interface.
- Only really important information should attract attention.
- Other information "is there", but not in the foreground ("dark").

AirFrance Crash in Atlantic Ocean

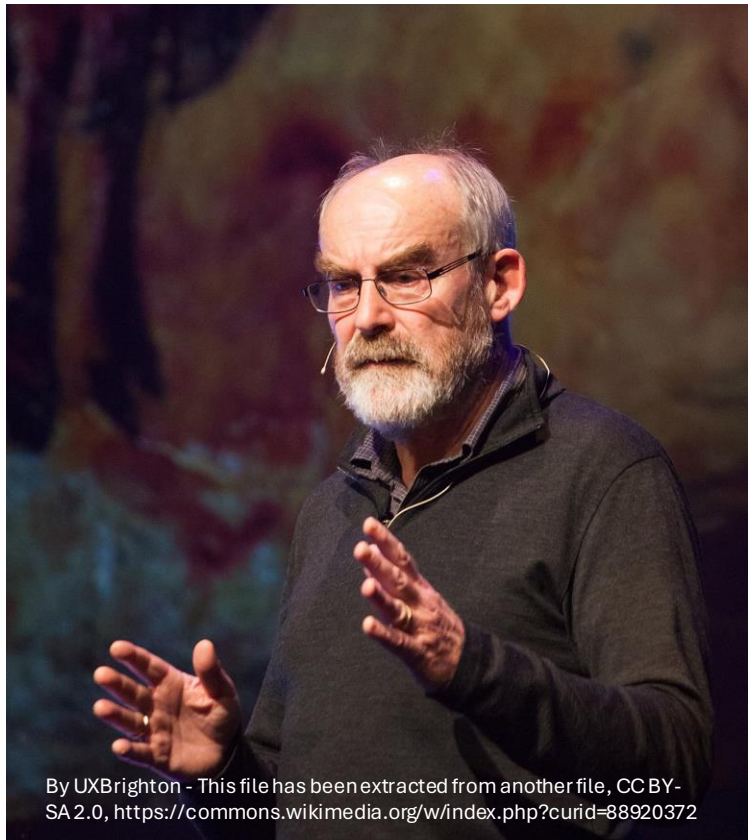
What had happened?

- Probably tired
- Pitot-Probe freeze
  - Autopilot auto-switch-off
  - Wrong speed and altitude information
- Complex Situation
  - Stall in high altitude
- Over-Reaction
- Stress
- Unclear tasks
  - Double input

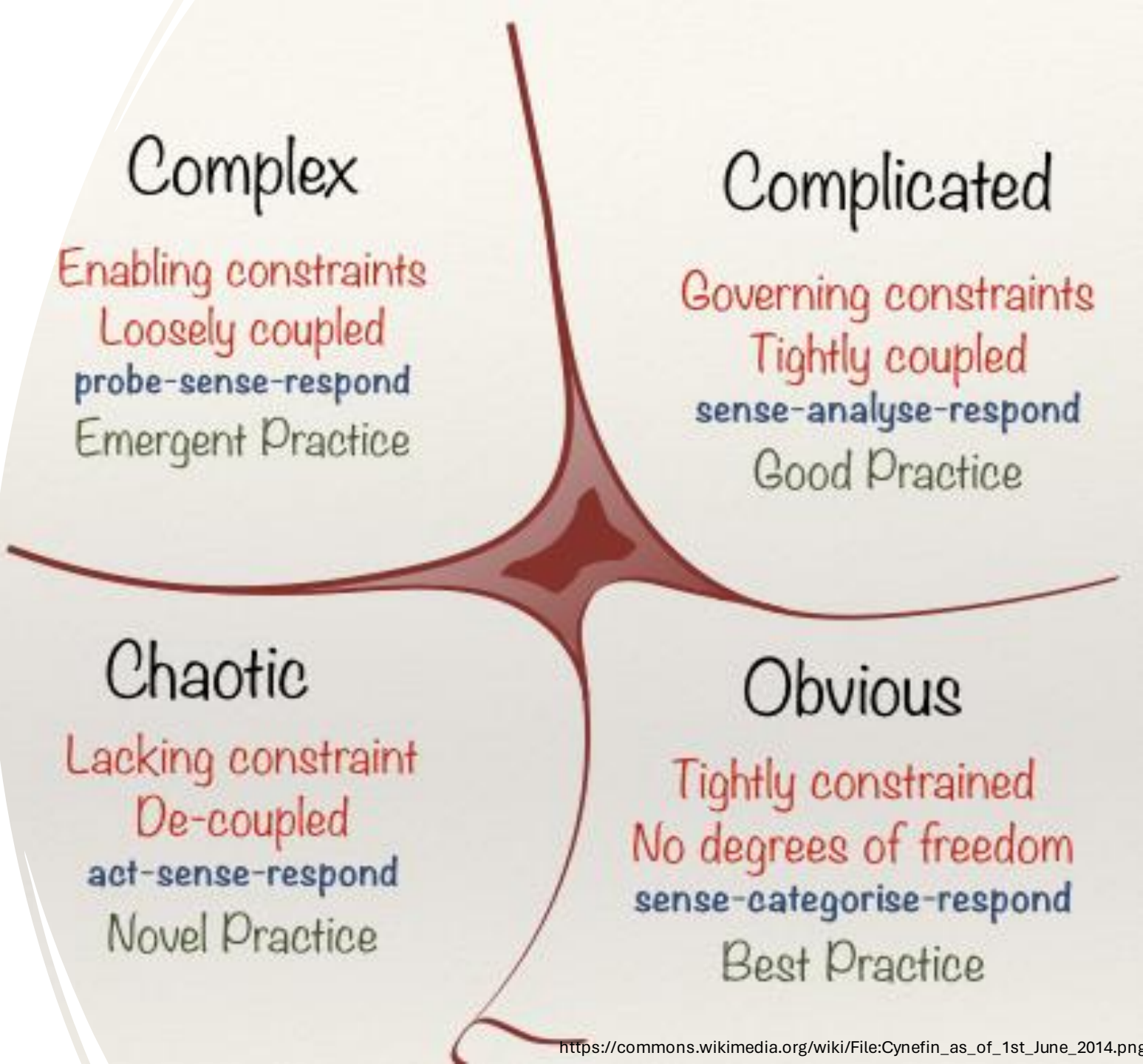
Situation awareness

Cynefin

Dave Snowdon

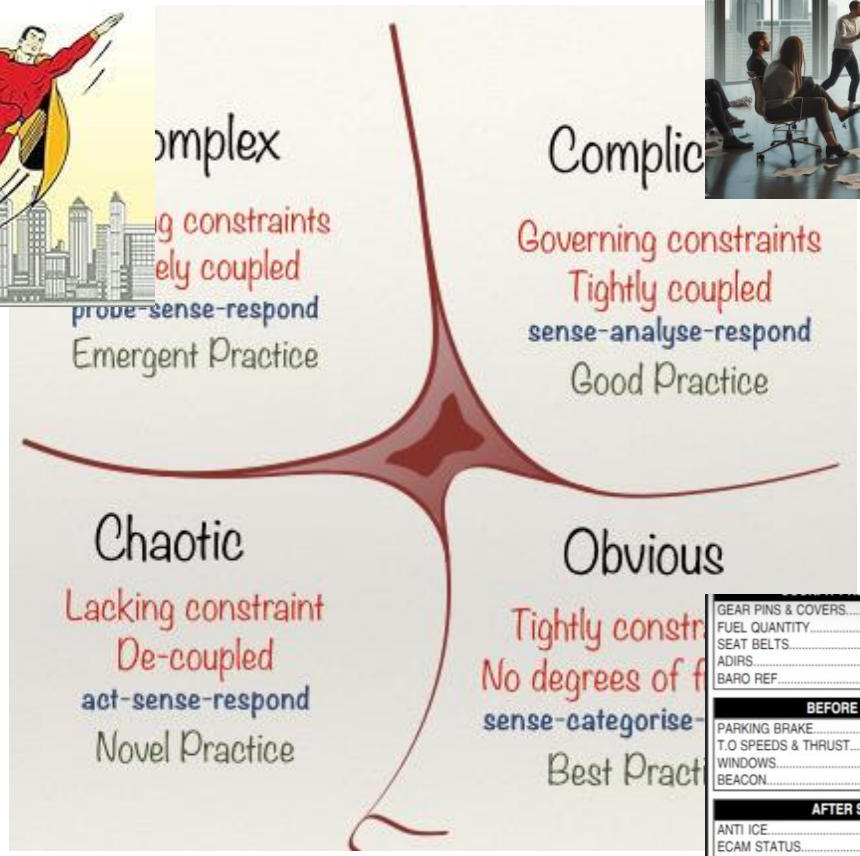


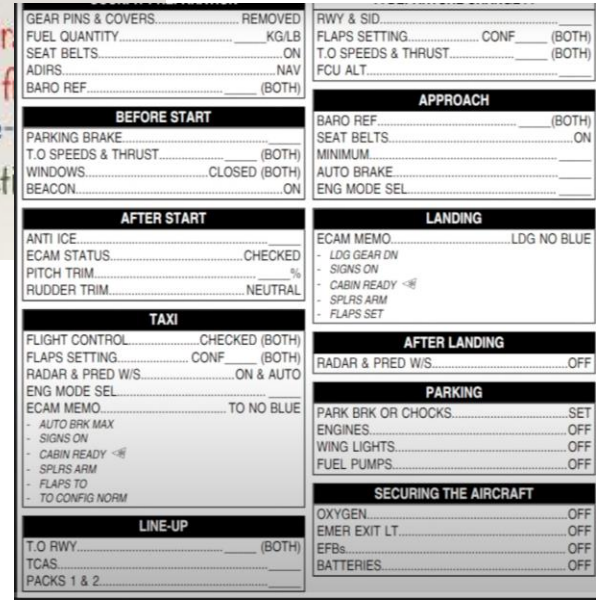
By UXBrighton - This file has been extracted from another file, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=88920372



https://commons.wikimedia.org/wiki/File:Cynefin_as_of_1st_June_2014.png

Situation awareness





GEAR PINS & COVERS	REMOVED
FUEL QUANTITY	____KG/LB
SEAT BELTS	ON
ADIRS	NAV
BARO REF	____ (BOTH)

BEFORE START

PARKING BRAKE	____
T.O SPEEDS & THRUST	____ (BOTH)
WINDOWS	CLOSED (BOTH)
BEACON	ON

AFTER START

ANTI ICE	____
ECAM STATUS	CHECKED
PITCH TRIM	____ %
RUDDER TRIM	NEUTRAL

TAXI

FLIGHT CONTROL	CHECKED (BOTH)
FLAPS SETTING	CONF____ (BOTH)
RADAR & PRED W/S	ON & AUTO
ENG MODE SEL	____
ECAM MEMO	TO NO BLUE
- *AUTO BRK MAX*	
- *SIGNS ON*	
- *CABIN READY*	
- *SPLRS ARM*	
- *FLAPS TO*	
- *TO CONFIG NORM*	

LINE-UP

T.O RWY	____ (BOTH)
TCAS	____
PACKS 1 & 2	____
RWY & SID	____
FLAPS SETTING	CONF____ (BOTH)
T.O SPEEDS & THRUST	____ (BOTH)
FCU ALT	____

APPROACH

BARO REF	____(BOTH)
SEAT BELTS	ON
MINIMUM	____
AUTO BRAKE	____
ENG MODE SEL	____

LANDING

ECAM MEMO	LDG NO BLUE
- *LDG GEAR DN*	
- *SIGNS ON*	
- *CABIN READY*	
- *SPLRS ARM*	
- *FLAPS SET*	

AFTER LANDING

RADAR & PRED W/S	OFF

PARKING

PARK BRK OR CHOCKS	SET
ENGINES	OFF
WING LIGHTS	OFF
FUEL PUMPS	OFF

SECURING THE AIRCRAFT

OXYGEN	OFF
EMER EXIT LT	OFF
EFBs	OFF
BATTERIES	OFF

"You don't live long enough to make all the mistakes yourself."

Eleanor Roosevelt

Error culture

- Self-awareness
- Learning from the mistakes of others
- Reducing the probability of errors
- Four-eyes principle
- Flat hierarchy

Study on error culture in aviation and intensive care medicine

Question	Cockpit	Others
I sometimes make mistakes at work	100%	33%
Is it made easy for me to discuss/report mistakes?	74%	56%
Error analysis is carried out system-wide	97%	45%
When I am exhausted, I can still act efficiently in critical situations	26%	60%
Juniors should not question the decisions of seniors	6%	45%

JB et al.: „Error, stress, and teamwork in medicine and aviation: cross sectional surveys “, BMJ 2000:320/7237/745

Learning from others

Anonymous problem reports

- Common practice in the USA for decades
  - Formerly by letter post
  - Today via online portal
- There is also such a portal in the EU
- Airlines usually have their own reporting systems
  - Part of the quality standards
  - Integration into the reporting process at EU level

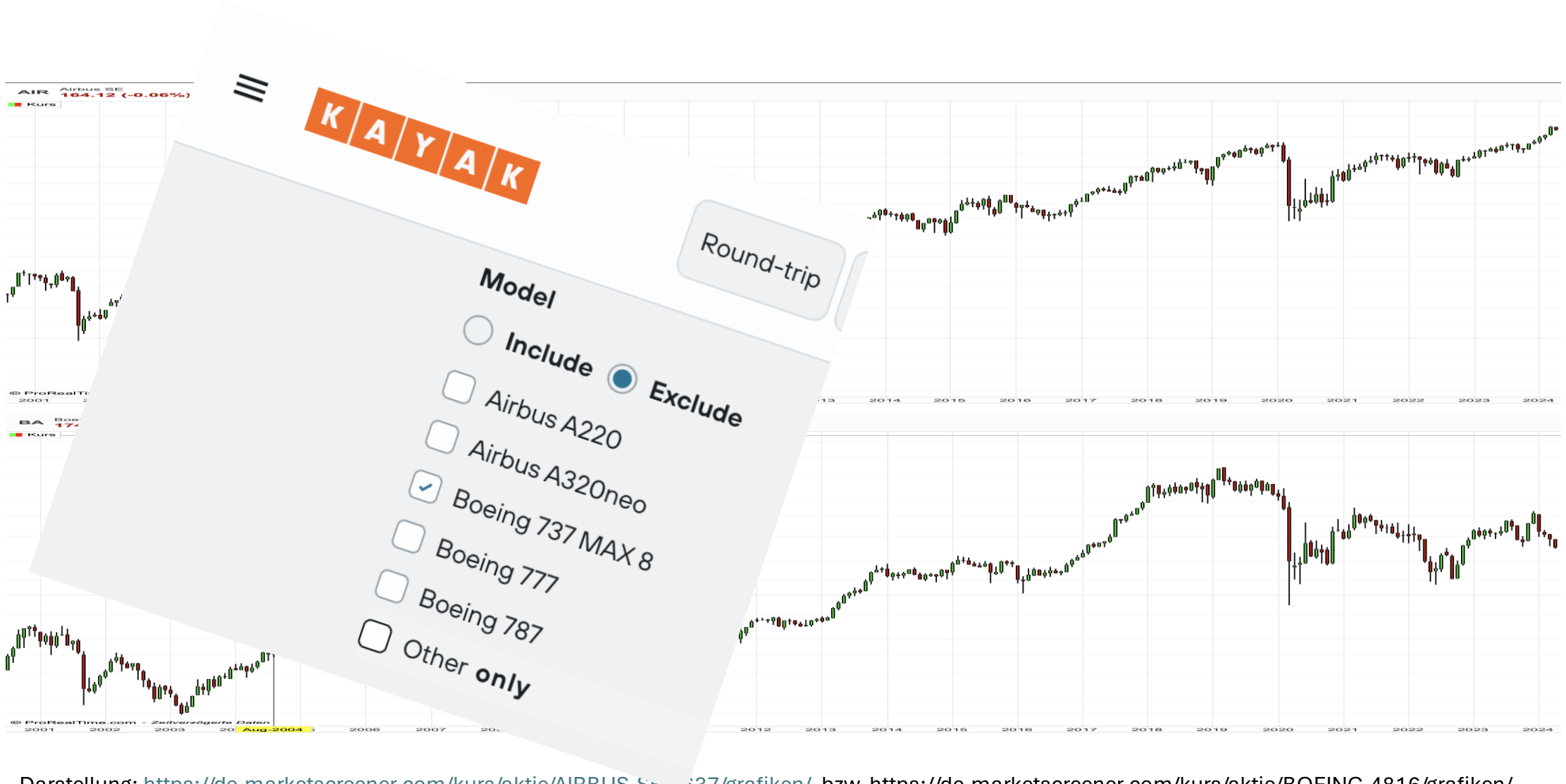
You don't fall over your mistakes. You always fall over your enemies, who exploit these mistakes.

Kurt Tucholsky

Blaming culture

- Leads to fear of making mistakes
  - Such fears lead to a standstill and
  - Prevent innovation
  - Prevents the development of the individual and therefore the team / organization
- Leads to mistakes being covered up
  - And thus potentially to unnecessarily dangerous situations!
- Poisons the working atmosphere
  - Career through "sawing at the chair" instead of performance?
  - "I'd rather do nothing, then I won't do anything wrong"
  - Focus on blame instead of solutions

Boeing and Airbus



Darstellung: https://de.marketscreener.com/kurs/aktie/AIRBUS-SE-[illegible]37/grafiken/. bzw. https://de.marketscreener.com/kurs/aktie/BOEING-4816/grafiken/

“When people say I changed the culture of Boeing, that was the intent, so that it’s run like a business rather than a great engineering firm. It is a great engineering firm, but people invest in a company because they want to make money.”

Harry Stonecipher

https://www.chicagotribune.com/**2004/02/29**/so-why-does-harry-stonecipher-think-he-can-turn-around-boeing/

Organize Methods, Standards and Processes

- Define Company- and/or Team-wide Methods and Standards
- Train upfront
- Minimize Start-Up- and Run-out-Curves
- Regular (automated) checks
- Constant Enhancement (or redefinition)
- Create (and use) Checklists
- Exercise emergency situations (Restore, Resource unavailable …)

Work as a Team

- Cut-Down Tasks (closed-loop)
  - … close and document
- Fly (Work) / Monitor
  - … and probably take control
- Everybody should be able to handle every task
  - Remember: let the „unexperienced“ do the work
- Daily rebalance work
- Trust team-members
  - Fit for work?

Communication

- Clear Communication
- Confirm Communication
  - Repeat
  - Write-Down Meeting results
- Minimize Communication
  - Is this important for everybody?
  - Prepare Meetings (avoid blah blah)
- Ensure everybody is heard
  - Team-lead or scrum-master active pull
  - Team Methods (e.g. Liberating Structures / agile / Lean Management / …)
- Reduce clutter („dark cockpit“)

“Healthy“ Error culture

- Shift from blame to collaborative solutions
  - "This could also happen to me" section in internal communication (e.g. forum)
  - Learn from mistakes (Establish process)
  - Anonymous reporting in larger organizations
- Manager Feedback from Team (e.g. use Retro)
- External Help and Team-Training
- … more ideas … ?

“De-Briefing“ / Key Takeaways

- Establish a culture of learning from mistakes w/o repercussions
- Accept feedback and critique from your peers
- Communicate clearly; ask; repeat, where needed.
- Have standard operation procedures and/or checklists for complicated tasks
- Practice such procedures and/or emergency situations

Linklist I

- The Ultimate Apollo Guidance Computer Talk
  https://media.ccc.de/v/34c3-9064-the_ultimate_apollo_guidance_computer_talk
- AeroNewsGermany / AeroSimGermany
  https://www.youtube.com/@AeroNewsGermany https://www.youtube.com/@aerosimgermany3126
- Teneriffa 1977 Accident
  https://www.youtube.com/watch?v=2d9B9RN5quA
- Peter Brandl (CRM for Managers)
  https://peterbrandl.com
- Daniel Kahneman: Thinking Fast & Slow
  https://en.wikipedia.org/wiki/Thinking,_Fast_and_Slow
- Landing on Hudson River
  https://www.youtube.com/watch?v=Cv_48qFhoO4
- What happened to AF447?
  https://www.youtube.com/watch?v=e5AGHEUxLME

Linklist II

- Boeing Problems
  https://www.youtube.com/watch?v=Q8oCilY4szc
- Study: "Error, stress, and teamwork in medicine and aviation: cross sectional surveys“
  http://www.bmj.com/content/320/7237/745
- “The impact of aviation-based teamwork training on the attitudes of health-care professionals”
  http://www.journalacs.org/article/S1072-7515(04)01175-5/abstract?cc=y=
- FAA Aviation Safety Reporting System (ASRS):
  https://asrs.arc.nasa.gov/
- NTSB Aviation Accident Database:
  http://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx
- EU Incident Reporting System:
  http://www.aviationreporting.eu

Linklist III

- Video: “The Need for Checklists (wrt Performance)” by Brendan Gregg: https://youtu.be/zxCWXNigDpA?t=547
- Performance Checklists ("USE" Method by Brendan Gregg): http://www.brendangregg.com/USEmethod/use-linux.html
- “Standard Operating Procedure” in der Wikipedia: https://de.wikipedia.org/wiki/Standard_Operating_Procedure
- Video: A340 in-flight engine failure: https://youtu.be/rEf35NtlBLg
- Spectacular Approach to Tromsø https://youtu.be/UmszD0D7DVU
- What happend to MH370? https://www.youtube.com/watch?v=Y5K9HBiJpuk