When the airline industry was at the crossroads of resilience and compliance - and took the wrong turn.

The B737 Max disaster as an example of missed opportunities for a safer world of aviation

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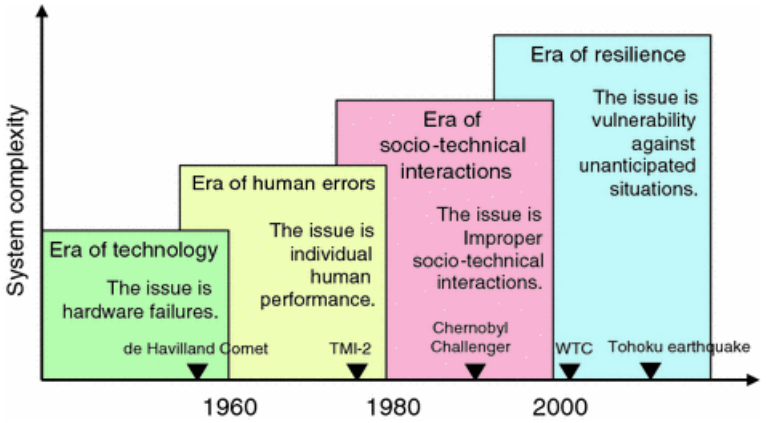
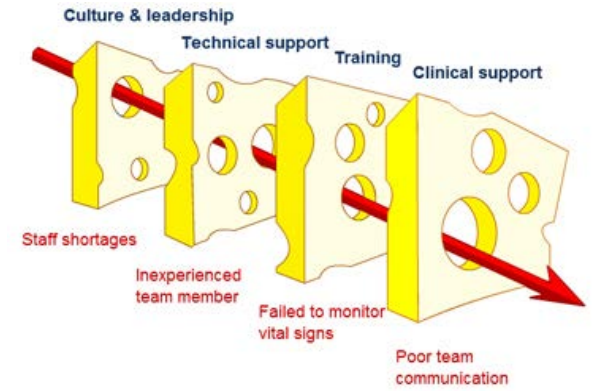
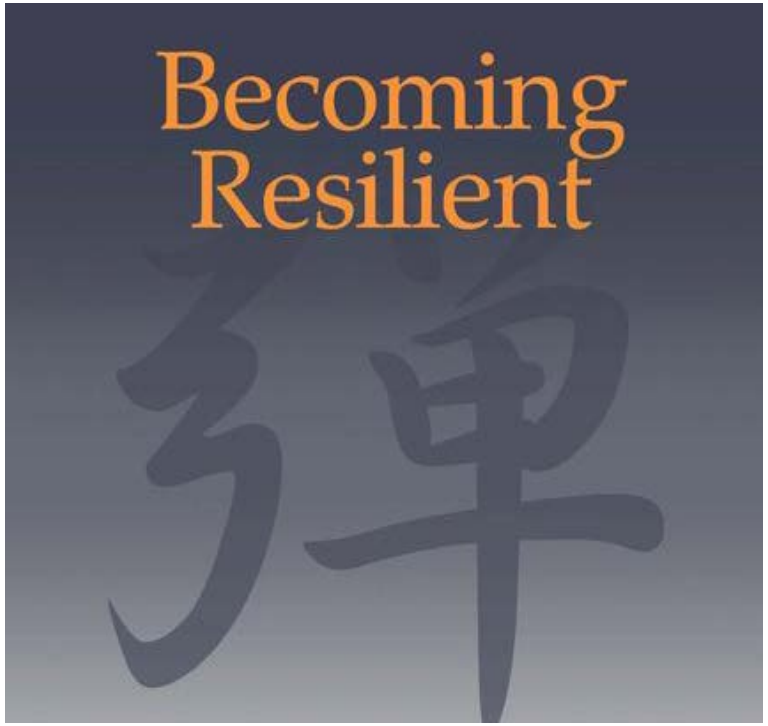
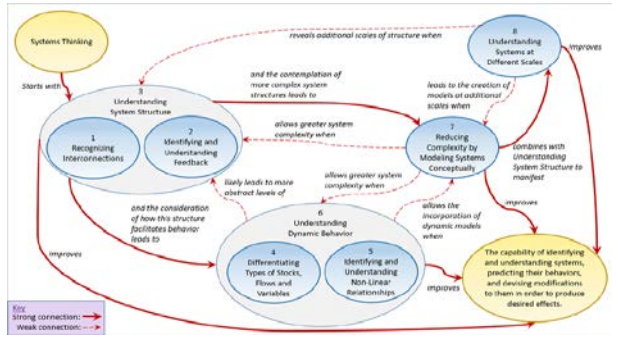
ATQP/EBT Manager
TRE B737

The 2000´s promises



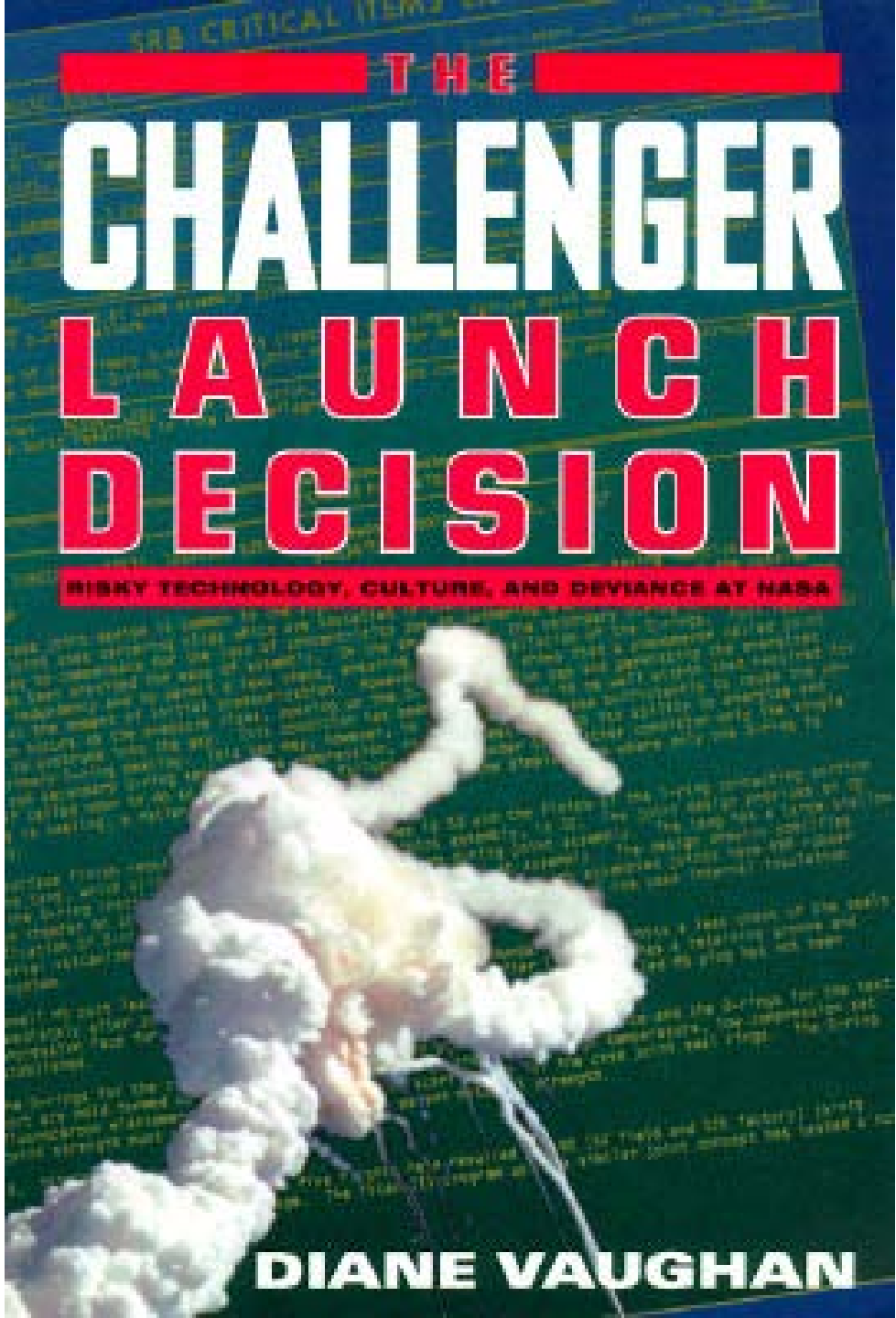






1996 Diane Vaughan explained us what happened 1986

- Culture of Production
- Normalization of Deviance
- Structural Secrecy



The regulator and the organisation

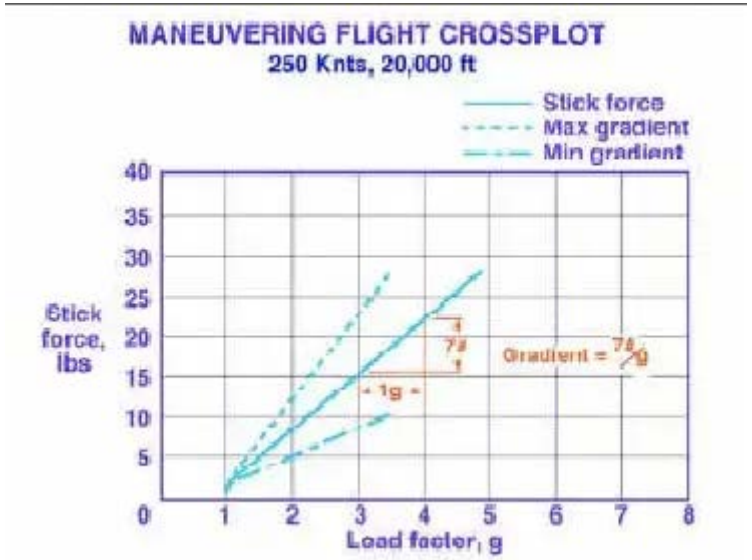
- Instead of direct rule making of what, when and how to do or train
- the organisation sets up ist own rules and procedures to keep/improve safety standards
- however in a well document way of processes how „safety“ is managed

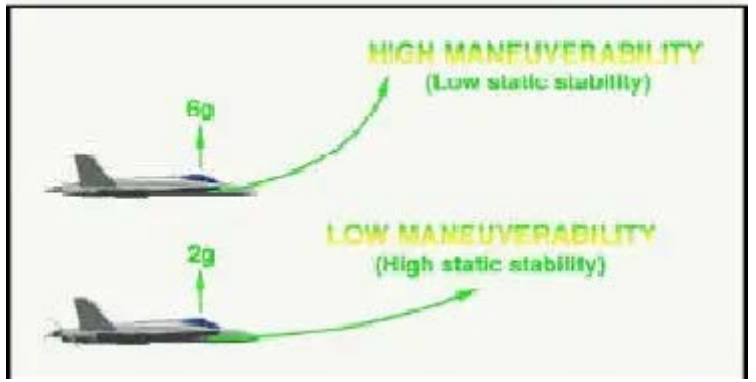
Responsibility for Safety is handed over to the organisation

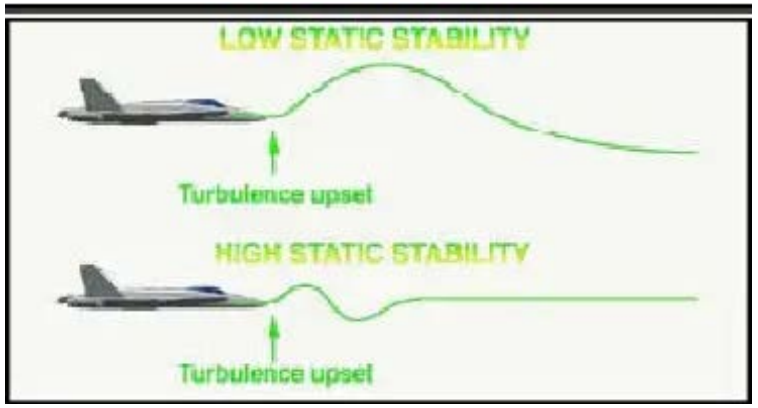
Quality Management Systems & SMS

Something alike happened in Seattle

One of the biggest problems & the fix







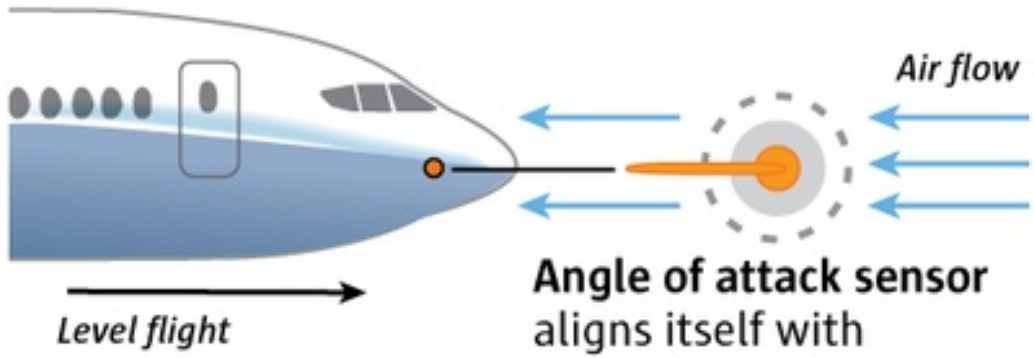
Flight testing during certification requires a “Wind Up Turn”

Elevator forces were simulated by stabilizer inputs

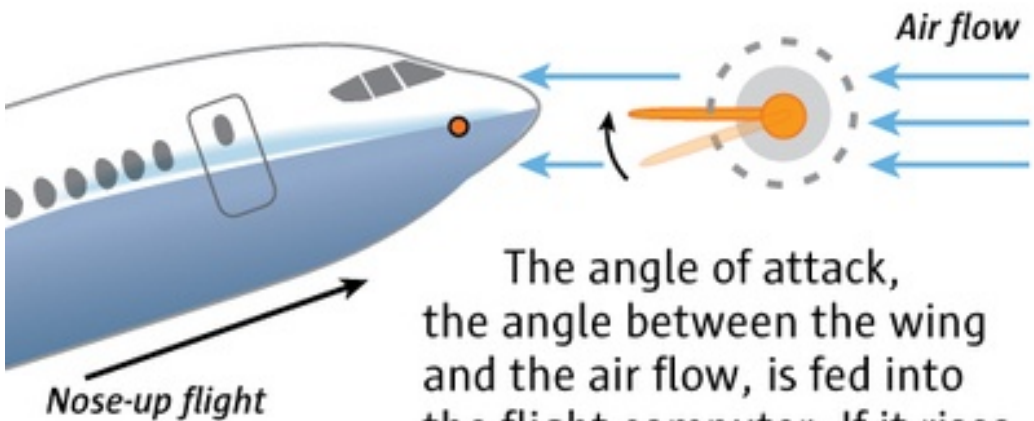
MCAS works when:

- High G-forces
- High Angle of Attack
- High Speed

How the new MAX flight-control system operates to prevent a stall



Angle of attack sensor aligns itself with oncoming air flow.



The angle of attack, the angle between the wing and the air flow, is fed into the flight computer. If it rises too high, suggesting an approaching stall, the MCAS system activates.

MCAS (Maneuvering Characteristics Augmentation System)

The MCAS system automatically swivels the horizontal tail to move the nose down. In the Lion Air crash, the angle of attack sensor fed false information to the flight computer.

Horizontal tail

Sources: Boeing, FAA, Indonesia National Transportation Safety Committee, Leeham.net, and The Air Current.

Reporting by **DOMINIC GATES**,
Graphic by **MARK NOWLIN / THE SEATTLE TIMES**

How MCAS risk was categorized:

Likelihood \ Severity	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low	Medium	High	High	High
Probable B	Low	Medium	High	High	High
Remote C	Low	Medium	Medium	High	High
Extremely Remote D	Low	Low	Medium	Medium	High
Extremely Improbable E	Low	Low	Low	Medium	High* / Medium

*Risk is high when there is a single point or common cause failure.

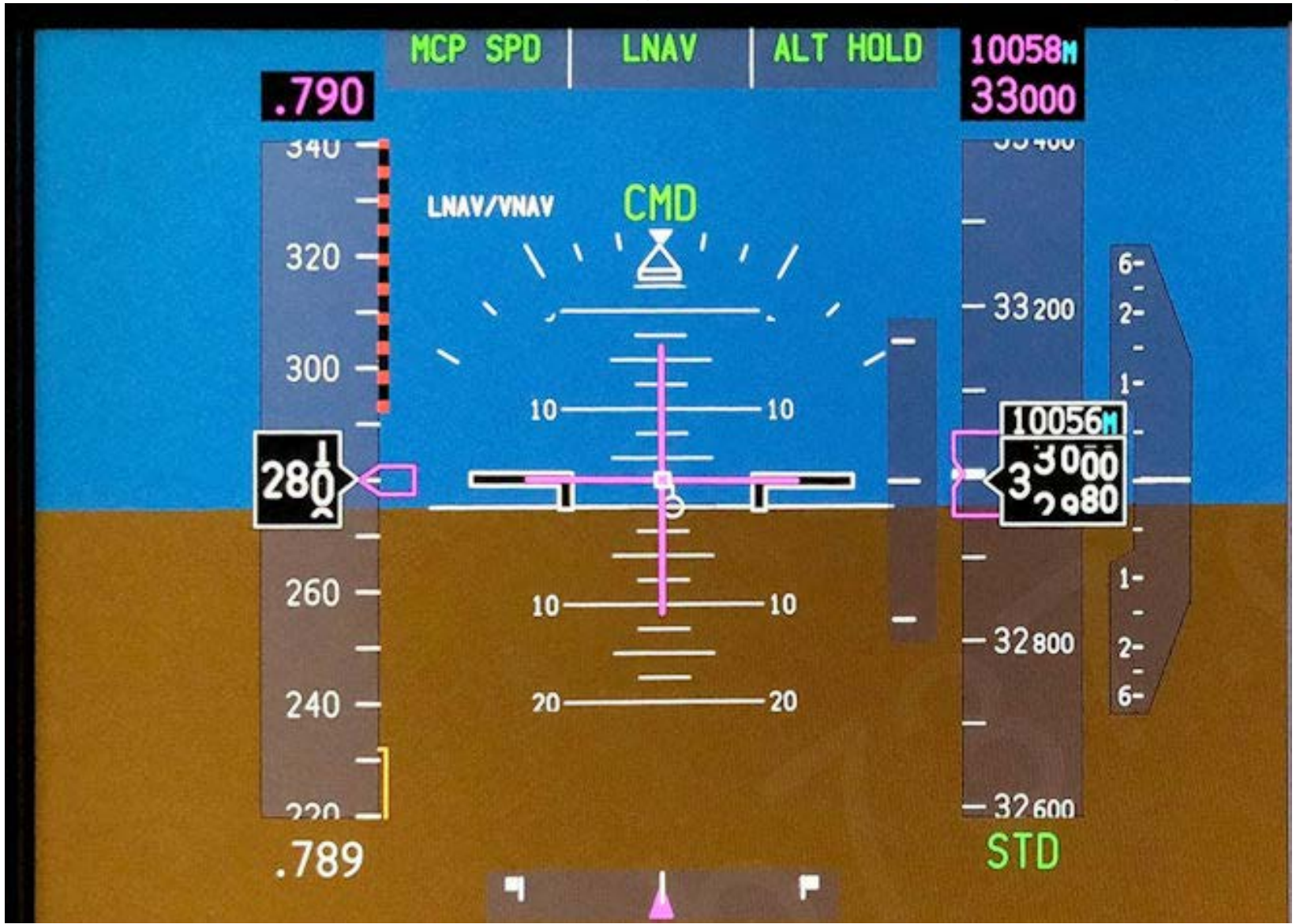
Max time for pilot´s intervention is 3 sec

More problems – more fixing

- Flight characteristics during slow flight
- MCAS had to work at low speeds and low G-forces
- Without falling out of grandfather rights for certification
- Pressure from Management (Boeing and FAA) rose

  - ➢Culture of Production
  - ➢Normalization of Deviance
  - ➢Structural Secrecy

Inside the Cockpits of both flights



…and now everything culminates

- Boeings pressure to catch up with Airbus orderbook
- An overstretched, old design
- Certification rules not coping with todays technologies
- Certification process drained by resources
- Licensing authorities unable to oversight novel airline training
- Airline training ticking of requirements
- Pilots not able to react on unconceivable situations

So in the end…

- All involved parties/agents complied to the procedures
  - Even the pilots looked for checklists during the last moment

- 20 years ago Mrs Vaughan gave us a starting point for what to do
- The concepts of resilience are around for 15 years
- But here no real signs for resilient behavior are present –

what happened to the concept of resilient organizations?