

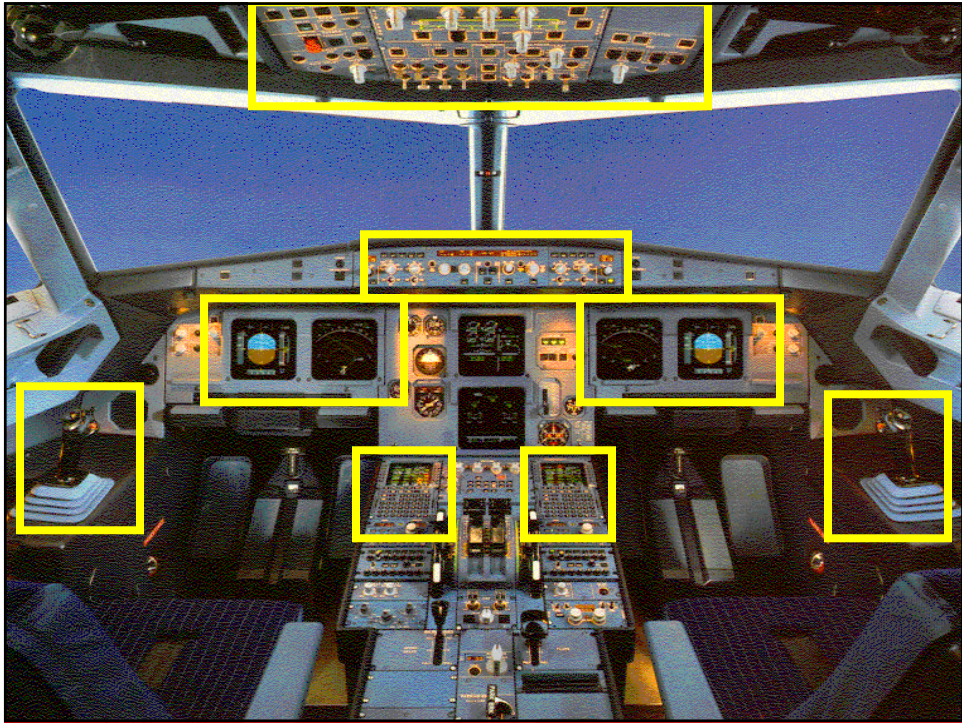
Robert Sumwalt
Vice Chairman
NTSB



Use and Training for New Bridge Technology: Lessons from the Flight Deck

May 14, 2008



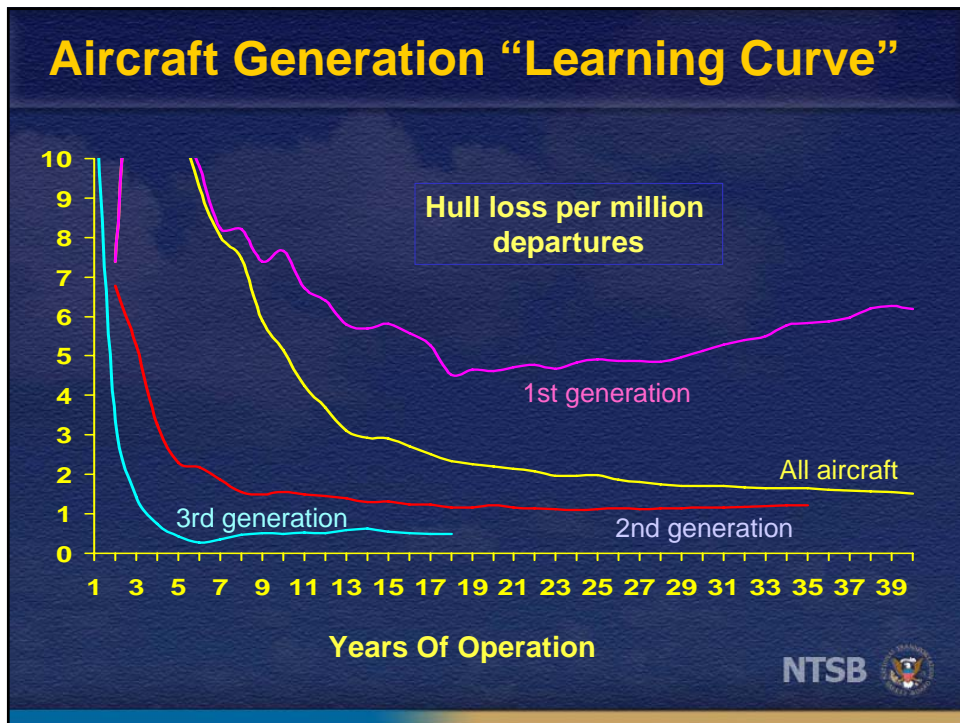


Objectives of Automation

- Increase efficiency
 - Fuel economy
 - Fewer crewmembers
 - Greater reliability
- Increase safety
 - System redundancy
 - Reduced flightcrew workload
 - Reduced response time (diagnostics)

Air Show Video





“Learning Curve”

- **Significant reduction in accident rates** with each successive generation.
- Magnitude gets **smaller with each successive generation**, but still remains highly significant.
- Accident history of automated airplanes is significantly better than all previous generations.



Pattern: Automation Errors

- Pilots do not understand what the automation is doing
- Pilots do not receive adequate feedback from automation

TRAINING

DESIGN

Human-Centered Aircraft Automation: A Concept and Guidelines”
- Dr. Charlie Billings, NASA

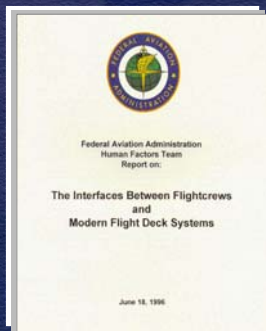




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Training Issues

FAA HF Report



- Cited lack of adequate training
- Recommended continued training - beyond the minimum required:
- Initial and recurrent training
 - Use and understanding of automation
 - Demonstrate minimum level of proficiency
 - Automation reviewed in recurrent



Dr. David Woods

“One myth about the impact of automation on human performance is...

as investment in automation increases... ↑

↓ less investment is needed in human expertise.

In fact, many sources have shown ...



... increased automation creates new knowledge and skill requirements.”



M/V Crown Princess

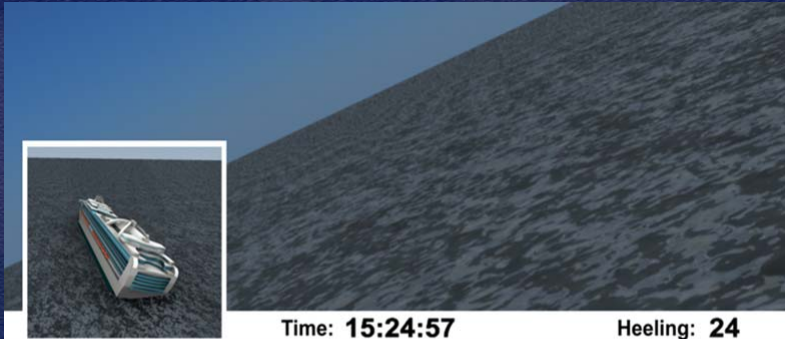


Princess Cruises

- Length: 947 ft
- Breadth: 118 ft
- Speed: 21.5 kt
- Built: Italy, 2006
- Flag: Bermuda
- Propulsion: diesel electric, twin screw
- Tonnage: 113,561
- Passengers: 3285
- Crew: 1260



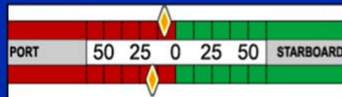
Significant Heeling Event



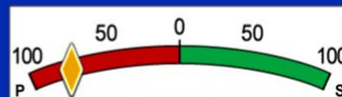
Time: 15:24:57

Heeling: 24

Command



Response



Rate of Turn



Crown Princess

Contributing to the cause of the accident:

- Captain's and staff captain's **inappropriate inputs** to the vessel's integrated navigation system...
- **Inadequate training** of crewmembers in the use of integrated navigation systems.



NTSB Recommendation

To US Coast Guard to Propose to IMO:

“In conjunction with the upcoming revisions to the Standards of Training, Certification, and Watchkeeping for Seafarers, make **training** in integrated navigation systems and integrated bridge systems **mandatory** for watchkeepers on vessels equipped with such systems.”

- NTSB Recommendation M-08-1



NTSB Recommendation

To Cruise Lines International Association

“...Recommend to your members that they voluntarily provide **initial** and **recurrent training** in integrated navigation system operation to crewmembers having watchkeeping responsibilities on vessels equipped with such systems, and include in that training a requirement for a **demonstrated level of proficiency**.”

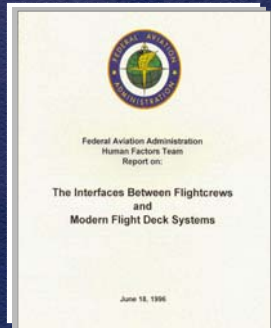
- NTSB Recommendation M-08-3



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Design Issues

FAA Automation Report



The HF Team was particularly concerned about how **information is presented**

Feedback regarding mode, status and potential errors:

- Flight deck displays
- Audio advisories



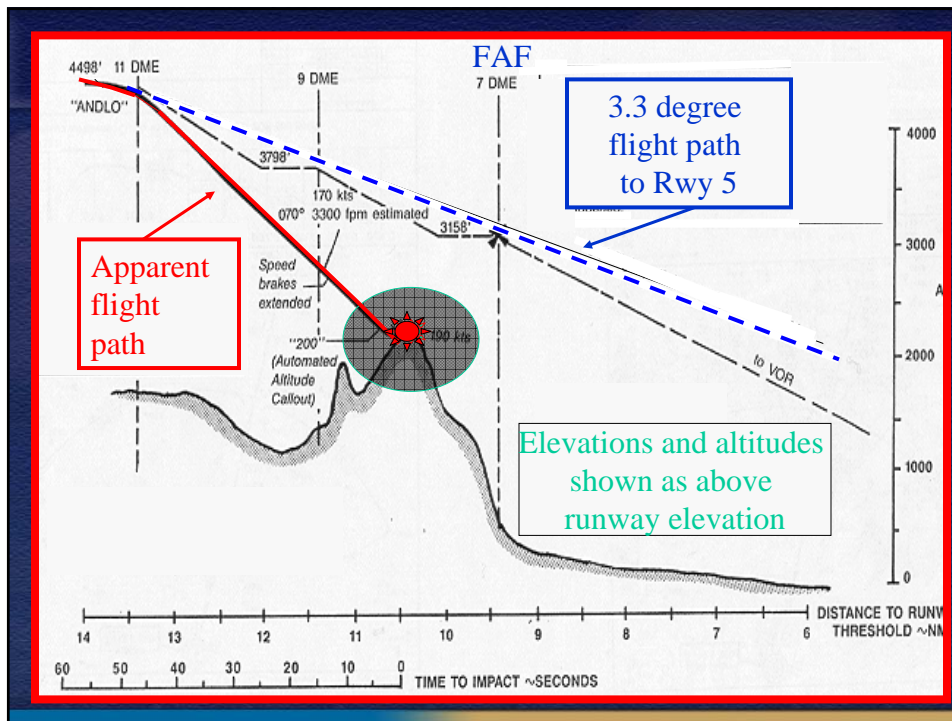
Air Inter A320 Accident

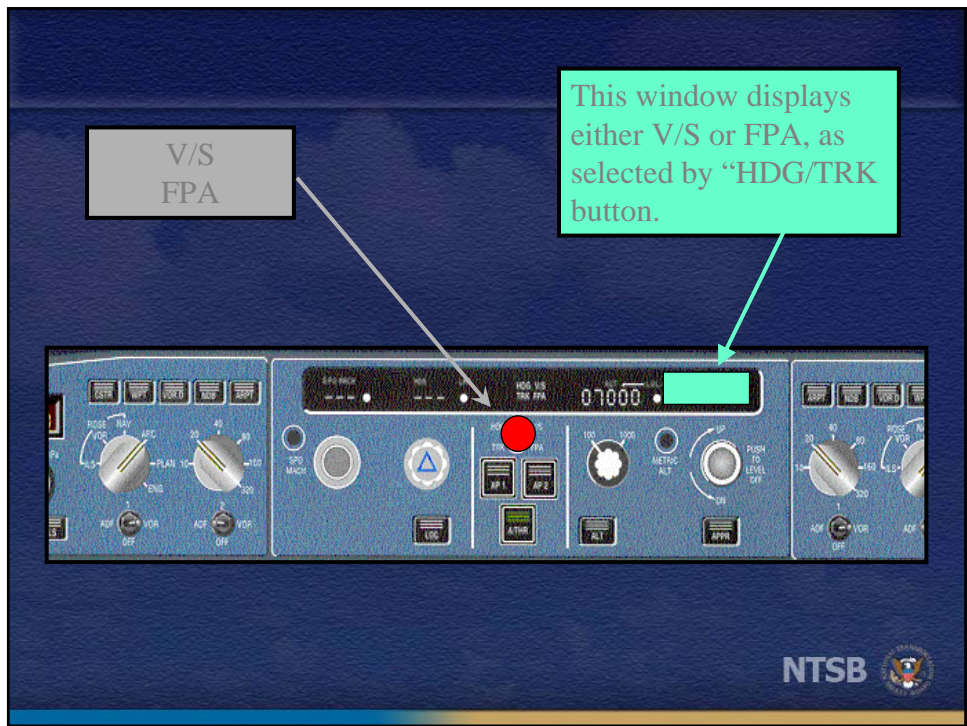


- Strasbourg, France
- January 20, 1992
- 87 fatalities



- Instrument approach
- Night
- Snowing, overcast, low visibility
- Capt 162 hrs in A320
F/O 61 hrs in A320
- Crew coordination /communications





Manufacturer Modifications



Examples:

3000

for vertical speed

3.3

for flight path angle

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Precursor Events

A320 Incident, San Diego, 1990

– Descended well below profile and MDA

A320 Incident, London Gatwick, 1989

– Almost impacted ground 3 miles short of runway

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Precursors

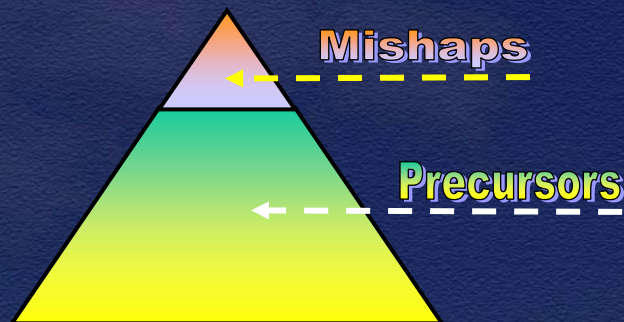
“Most accidents have many precursors that may have led one to **predict** the accident. The challenge is to...

- **identify** these precursors
- **minimize** their individual risk,
- **implement** strategies that protect against these broad classes of risk
- **assure** that specific chains of events containing these precursors cannot link up in unexpected ways that lead to an accident.”

– FAA report on the Interfaces Between Flightcrews and Modern Flight Deck Systems



Precursors



**Precursors can point to areas of vulnerability.
If used wisely, precursors can help predict accidents.**



Data is starting point of action:

- Data creates information
- Information creates knowledge
- With knowledge, we can manage risks
- When we manage risks, we are taking action.



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NTSB Conclusion

“The **systematic collection of data** on mishaps related to integrated navigation systems and integrated bridge systems will enhance the systems’ **design, procedures, and training.**”

Recommendation Issued to SAM Electronics and Sperry Marine

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GOT DATA?

