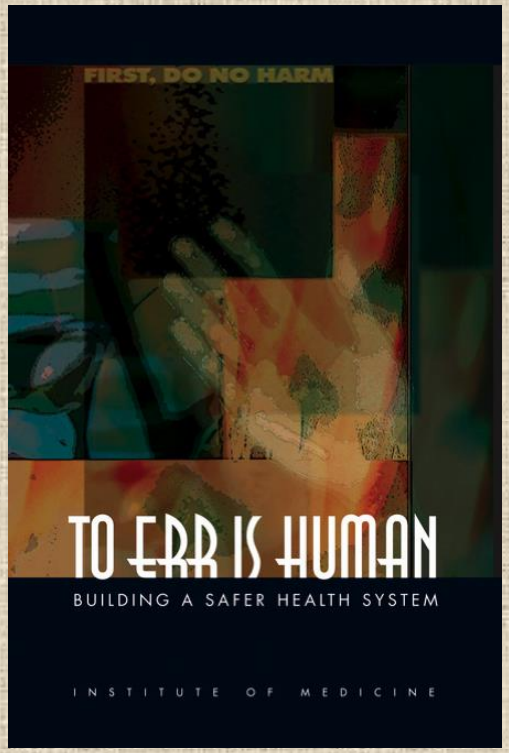
Flying into trouble?

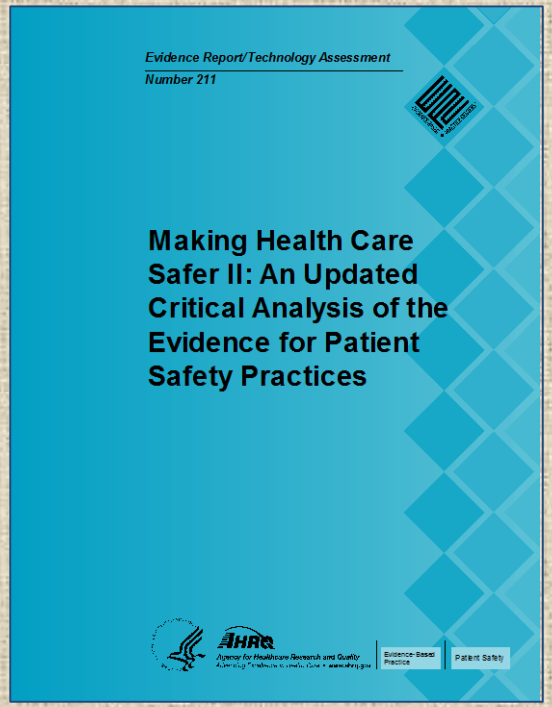
Mr Richard Flint

Intstitute of Medicine 1999



- 44000 to 98000 deaths per year
- A jumbo jet crashing each day

Reports

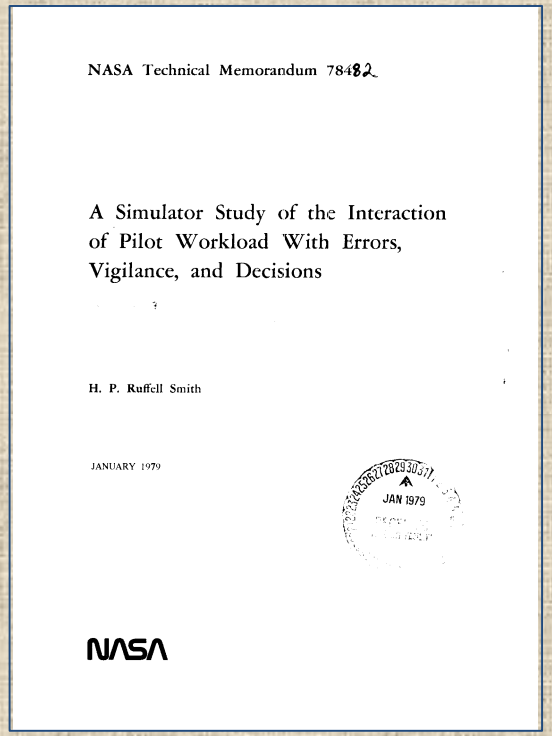


- Checklist
- Audit
- Integrating operating room displays
- Beta blockers
- Retained items in surgery
- US for central line insertion

Flying in the 1950s

Flying in the 1970s

Pilots are not god



NASA Technical Memorandum 78482

A Simulator Study of the Interaction of Pilot Workload With Errors, Vigilance, and Decisions

H. P. Ruffell Smith

JANUARY 1979

NASA

- Commissioned a NASA simulator
- 20 three-man crews
- Simulated a transatlantic flight from NY
- Difficulties resulted from poor teamwork

Whenever you solve a problem, you usually create one. You can only hope that the one you created is less critical than the one you eliminated.

Earl Weiner

Airbus A330 203

- Fly by wire
- Flight envelope
- Flight modes
  - Normal
  - Alternate 1
  - Alternate 2

Pilots

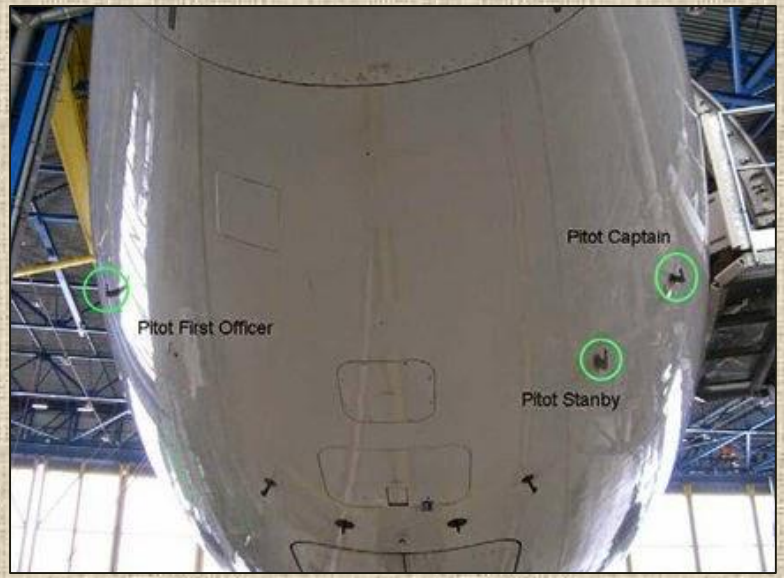
Captain Marc Dubois (58yo)
Air France 1988
10,988 hours

David Robert (37yo)
Air France 1998
6,547 hours

Pierre-Cedric Bonin (32yo)
Air France 2003
2,936 hours


Air France 447
31st May 2009
729pm
Paris
Rio de Janeiro - State of Rio de Janeiro
10 h 50 min
North Atlantic Ocean
South Atlantic Ocean
South Pacific Ocean
Gulf of Mexico
Caribbean Sea
Gulf of Guinea
United States
Mexico
Cuba
Puerto Rico
Guatemala
Nicaragua
Venezuela
Colombia
Ecuador
Peru
Brazil
Bolivia
Paraguay
Chile
Argentina
Uruguay
Guyana
Suriname
United Kingdom
Ireland
Denmark
Germany
Poland
Belarus
Ukraine
France
Austria
Romania
Italy
Spain
Portugal
Greece
Turkey
Morocco
Algeria
Tunisia
Libya
Egypt
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Burkina Faso
Guinea
Ghana
Nigeria
South Sudan
Gabon
DR Congo
Tanzania
Angola
Zambia
Namibia
Zimbabwe
Botswana
South Africa
Google


AIRBUS A330-200


Pitot Captain
Pitot First Officer
Pitot Stanby

Electronic calvary charge of warnings

ACARS Messages

Time of Reception	ACARS Message	Interpretation
02:10:10	AUTO FLT AP OFF	Warning: Autopilot has disengaged
02:10:16	AUTO FLT REAC W/S DET FAULT	Warning: Reactive wind shear detection system is inoperative
02:10:23	F/CTL ALTN LAW	Warning: Flight Control has switched to alternate law
02:10:29	FLAG ON CAPT PFD SPD LIMIT	Warning: Speed limit in airspeed tape of Captain's PFD is no longer available
02:10:41	FLAG ON F/O PFD SPD LIMIT	Warning: Speed limit in airspeed tape of First Officer's PFD is no longer available
02:10:47	AUTO FLT A/THR OFF	Warning: Autothrottle has disengaged.
02:10:54	NAV TCAS FAULT	Warning: TCAS is inoperative
02:11:00	FLAG ON CAPT PFD FD	Warning: Flight Director on Captain's PFD is inoperative, flagged by red
02:11:15	FLAG ON F/O PFD FD	Warning: Flight Director on First Officer's PFD is inoperative, flagged by red
02:11:21	F/CTL RUD TRV LIM FAULT	Warning: Rudder travel limiter error, rudder-deflection-limit calculation is no longer possible
02:11:27	MAINTENANCE STATUS EFCS 2	Warning: Maintenance Status of Electronic Flight Control System #2
02:11:42	MAINTENANCE STATUS EFCS 1	Warning: Maintenance Status of Electronic Flight Control System #2
02:11:49	AFS PROBE-PITOT 1X2/2X3/1X3 (9DA),HARD	Failure: Automatic Flight System, failure of pitot tubes
02:11:55	EFCS1 X2,EFCS2X FCPC2 (2CE2)/WRG:ADIRU1 BUS ADR1-2 TO FCPC2,HARD	Failure: Electric Flight Control System #1-#2, Flight Control Primary Computer #2, ADIRU #1, comm. Air Data Reference #1-#2 to FCPC #2 have failed
02:12:10	FLAG ON CAPT PFD FPV	Warning: Flight Path Vector removed from Captain's PFD, flagged by red
02:12:16	FLAG ON F/O PFD FPV	Warning: Flight Path Vector removed from First Officer's PFD, flagged by red
02:12:51	NAV ADR DISAGREE	Warning: ADIRU units disagree on flight parameters
02:13:08	SIS 1 ISIS(22FN-10FC) SPEED OR MACH FUNCTION,HARD	Failure: ISIS #1, Speed or Mach function have failed
02:13:14	IR2 1,EFCS1X,IR1,IR3 ADIRU2 (1FP2),HARD	Failure: Inertial Reference (IR) #2 #1 #3, EFCS #1 have failed
02:13:45	F/CTL PRIM 1 FAULT	Warning: Primary Flight Control Computer #1 is no longer functional
02:13:51	F/CTL SEC 1 FAULT	Warning: Secondary Flight Control Computer #1 is no longer functional
02:14:14	MAINTENANCE STATUS ADR 2	Warning: Maintenance status Air Data Reference #2
02:14:20	AFS 1 FMGEC1(1CA1),INTERMITTENT	Failure: Automatic Flight System #1, Flight Management Guidance and Envelope Computer #1 are no longer operative
02:14:26	ADVISORY CABIN VERTICAL SPEED	Warning: Cabin pressure changes at a rate of 1800 feet/minute or greater for 5 seconds.

Response

2:10:06 Bonin takes control. Climbs steeply. Stall warning!

2:10:16 Robert recognises loss of speed indicators

2:10:27 Robert recognises climbing and calls for Bonin to level.

2:10:38 Stall warning stops. Plane under control

Response

2:10:55 Pitot functioning

2:11:21 Plane reaches maximum altitude. Starts to fall with nose up

2:11:37 “Left seat taking control”

Response

2:10:55 Pitot functioning

2:11:21 Plane reaches maximum altitude. Starts to fall with nose up

2:11:37 “Left seat taking control”

Response

2:11:43 Captain on deck
"We have lost control of the plane"

2:11:47 Stall warning ceases. Falling at 35000ft

2:12:15. Recognise falling. Robert pushes nose down. No response

Response

2:13:40 Pass through 10000ft

(Robert) “Climb…climb…climb…climb”

(Bonin) “But I’ve had the stick back the whole time”

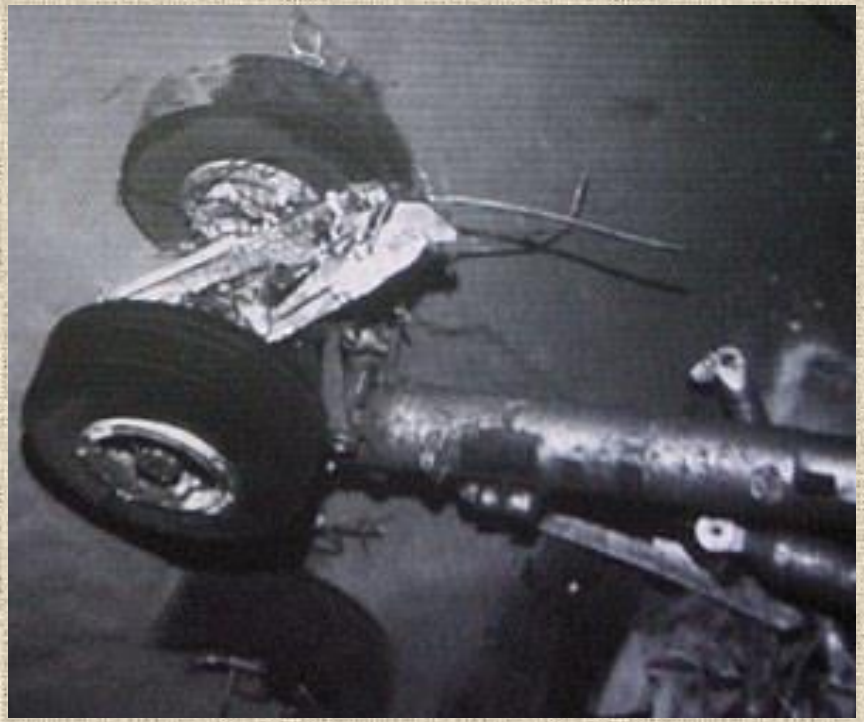
(Dubois)” No, no, no…”

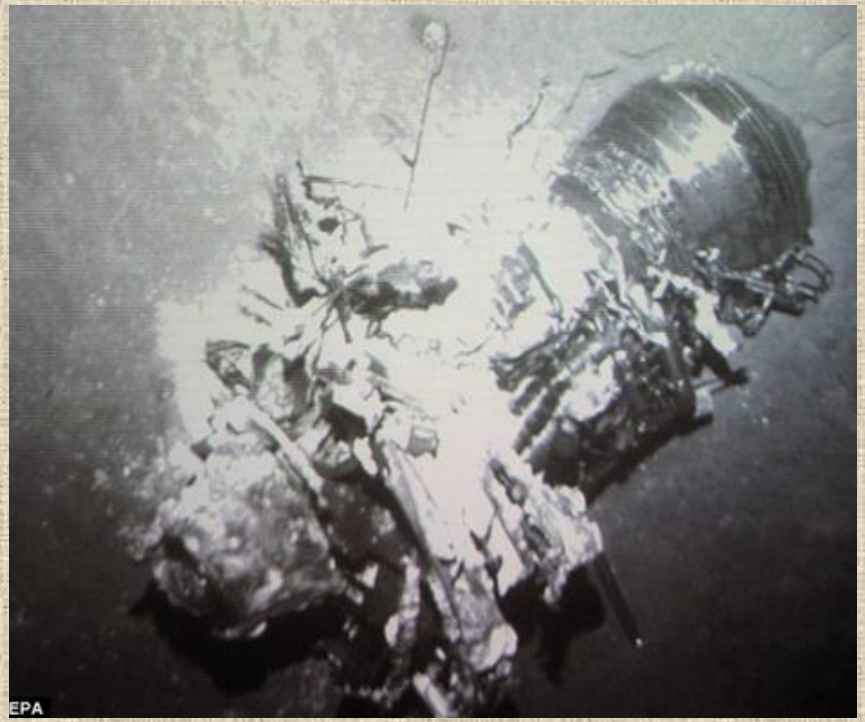
2:14:23 “Damn it, we’re going to crash…This can’t be happening”

2:14:25 (Bonin) “But what’s happening”

BEA Graphic Of Aircraft Attitude Just Prior To Impact

2:14:28





What can we learn

“Processes reduce workload when it is low, but increase it when workload is high.”

What can we learn

"It takes an airplane to bring out the worst in a pilot"

What can we learn

Professionalism must be maintained

What can we learn

Exotic devices create exotic problems

Summary

- Process of surgical safety is borrowing from ideas developed in the airline industry
- Automation in this industry has not alleviated all risk
- When process fail, salvage is difficult
- Salvage will depend on how the doctor reacts
- Staff must always be vigilant (doctors need to doctor)
- Don’t rely on the process