



Thomas LEPAGNOT  
Airbus Flight Safety

## Airbus support to Investigation Boards

# Content

- **Familiarization with the Airbus world**

- Immediate response to accident
- Over the duration of an investigation
- Investigation reports
- Conclusion

# Familiarization to Airbus products

- **A300 (1974)**
  - 1<sup>st</sup> Airbus into service
- **A310 & A300-600 (1983)**
  - Glass cockpit
  - FMS equipped A/C
- **A318/A319/A320/A321 (1988)**
  - Fly by wire (FBW)
  - Flight envelope protection
- **A330/A340 (1993)**
- **A380 (2007)**
- **A350 (2014)**

## A300/A310 Family



**34,6 Million** Flight Hours since EIS  
**17.3 Million** Flight Cycles since EIS

## Airbus FBW Family



**219 Million** Flight Hours since EIS  
**100 Million** Flight Cycles since EIS

# Familiarization to Airbus Civil products

**More than 28,000 Airbus aircraft take off every day ...  
An Airbus takes off every 2 seconds**



# Today Safety Context

■ Challenges:



- Growing number
- Various configurations
- Ageing fleet

- New airline business model
- Growing 2nd / 3rd hand fleet
- Increased operational pressure
- Evolution of aviation professionals

- Wider range of countries
- Variety of aviation background
- Traffic growth, congestion
- New types of operations
- Evolution of regulation
- Increased financial pressure

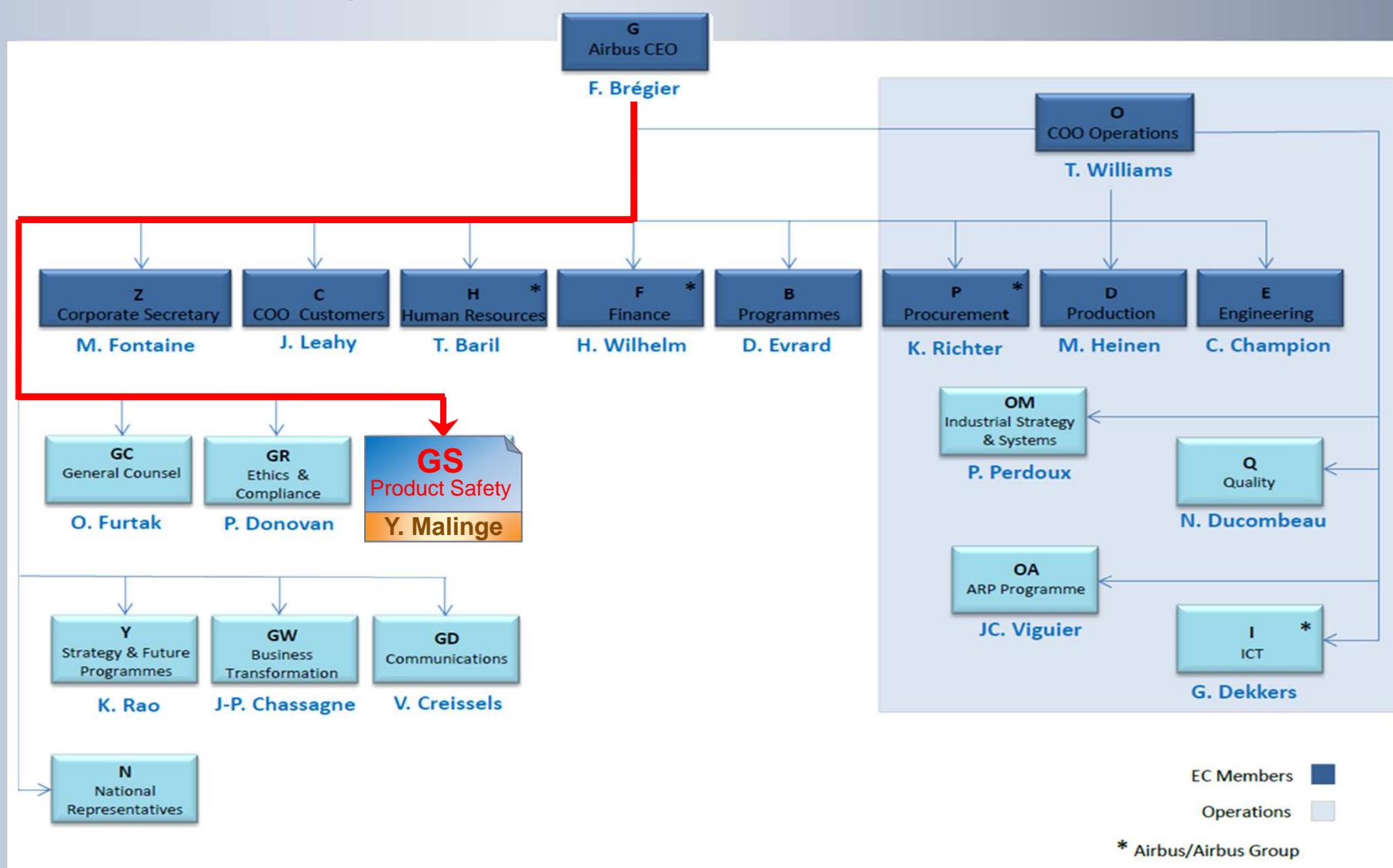
**Beyond Air Transport:**

**Communication society**

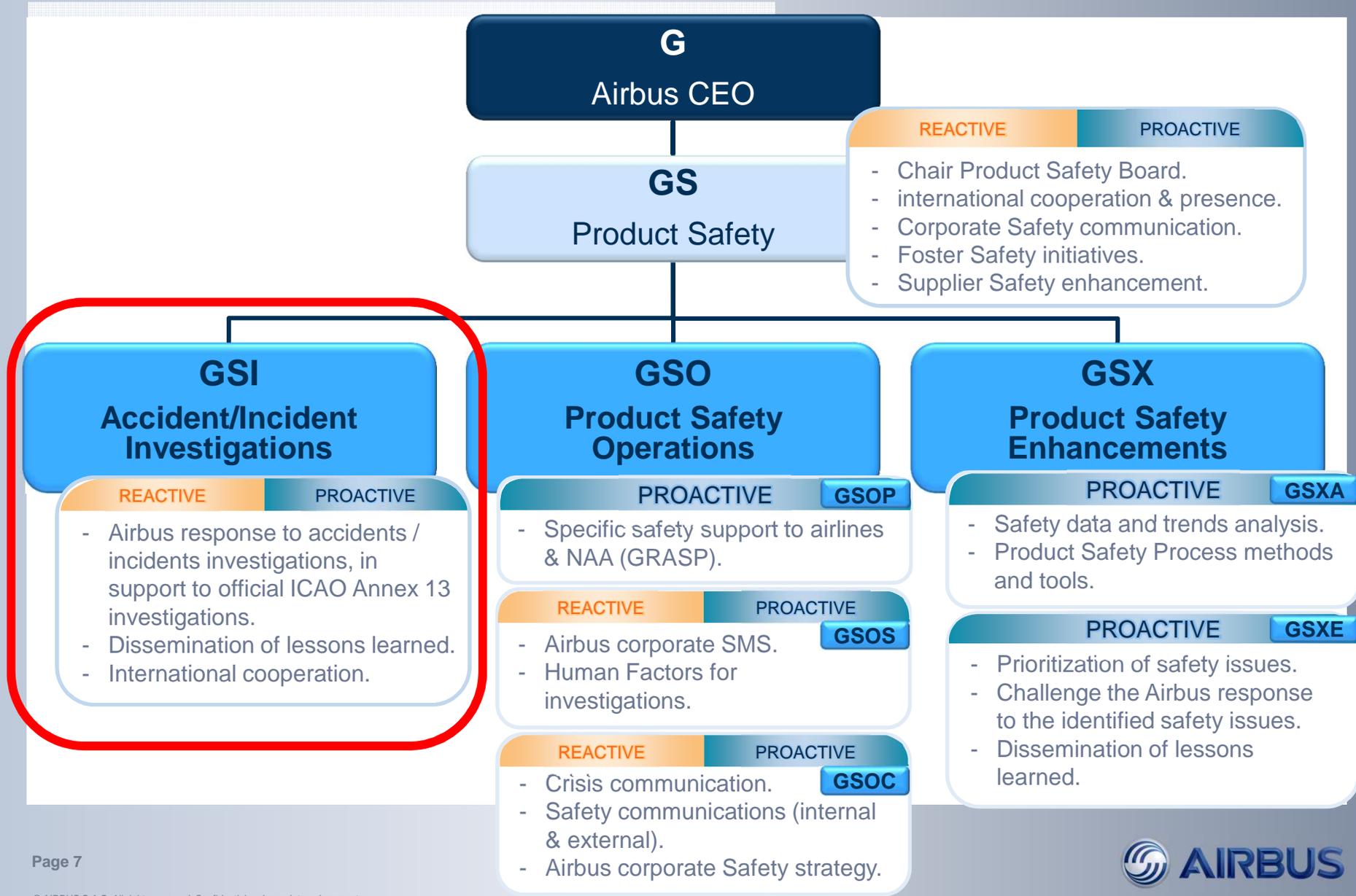
**Evolution of social risk acceptance**

**Evolution of liability stakes**

# Product safety within Airbus



# Product safety within Airbus



# Your Airbus contacts

## ■ Airbus Flight Safety Investigators

Head of Investigations



Frédéric Combes  
Head of Investigations

Accident Incident Investigators



Nicolas Bardou



Xavier Barriola



Panxika Charalambides



Denis Cadoux



Thomas Lepagnot



Jean Daney



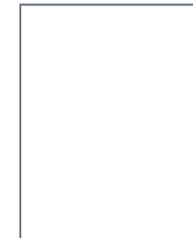
Xavier Jolivet



Thierry Thoreau



Albert Urdiroz



Q3 2015

- [account.safety@airbus.com](mailto:account.safety@airbus.com)
- Airbus Flight Safety hot line +33 (0)6 29 80 86 66

# Permanent support adapted to the context

- Airbus acts as technical advisor to the state of aircraft manufacture, in respect to the ICAO annex 13 investigation rules
  
- Airbus commits in supporting you in your duty to investigate accident and incidents:
  - In anticipation, familiarization to the Airbus world
  - In response to crisis, immediate support
  - Continuous technical and operational support over the duration of an investigation
  
- The sooner you involve us, the sooner we can assist you

# Permanent support adapted to the context

- In the frame of accident investigation, manufacturers can provide a wealth of expertise:
  - ▶ Documentation
  - ▶ Engineering tools
  - ▶ Full Flight Simulators
  - ▶ Flight Test aircraft
  - ▶ Manufacturing facilities
  - ▶ Laboratories
  - ▶ Technical & Operations Experts
  - ▶ Flight Test Pilots & Engineers
  - ▶ Support from suppliers



# Familiarization to Airbus products

- Yearly Accident Investigation Board's Investigators training:
  - To gather basic knowledge on the Airbus aircraft families
  - Last one organised in April 2015
  - The following subjects were addressed:
    - ✓ Runway Overrun Warning (ROW) / Runway Overrun Protection System (ROPS) in-service experience
    - ✓ Airbus Design enhancements
    - ✓ Operational enhancements
    - ✓ Evidence Based Training
    - ✓ Stall training
    - ✓ Telemetry visit
    - ✓ A350 Static Test Bench visit
    - ✓ A350 Flight test aircraft visit



# Familiarization to Airbus products

- You may register to *Safety first*, the Airbus safety magazine:
  - Aims at enhancing safe flight through increased knowledge and communication about safety topics
  - Source of safety information
    - ✓ For the use of flight and ground crew members who fly and maintain Airbus aircraft
    - ✓ For other selected organizations, such as Investigation Boards
  - Material obtained from multiple domains
    - ✓ Various Airbus Departments
    - ✓ Airline industry
    - ✓ Government agencies
    - ✓ Other aviation sources

# Safety first

- Includes selected information from incident and accident investigation reports, system tests and flight tests:



## Control your speed... at take-off

One of the most critical decisions that every line pilot may potentially encounter during every take-off is to continue or abort the procedure; hence the essential need to properly monitor the airspeed during this phase.



**LORRAINÉ DE BAUDIS**  
A350/A330/A340 Flight Operations Safety Enhancement

**PHILIPPE CASTAGNÉ**  
Experimental Test Pilot



A350: the flagship of a new training concept

## Learning from the evidence

In September 2014, Airbus will inaugurate its new A350 pilots Type-Rating course. The drivers for this development were both the EBT (Evidence-Based Training) principles and an analysis of natural learning mechanisms.



**CHRISTIAN NORDEN**  
Senior Director A350 Flight Operations & Training Support

**DAVID OWENS**  
Senior Director Training Policy



## Wind shear: an invisible enemy to pilots?

Weather plays a significant role in aviation safety and is regularly cited as a contributing factor in accidents or major incidents. Wind shear in the form of microbursts particularly, can be a severe hazard to aircraft during take-off, approach and landing.



**JEAN DANÉY**  
Director Flight Safety - Accident Investigation

**XAVIER LESCEU**  
Experimental Test Pilot



THE QUESTION OF PERFORMANCE

## Landing on contaminated runways

Landing performance is a function of the exact landing runway conditions at the time of landing. A simple statement for a more complex reality. Indeed, knowing what exact contamination is or remains on the runway at a given point in time is often challenging.



**ROBERT LIGNÉE**  
Experimental Flight Test Engineer

**LARS KORNSTAEDT**  
Performance Expert - Flight Operations Support

# Safety first

- Address your requests and queries to Airbus Flight Safety:
  - [account.safety@airbus.com](mailto:account.safety@airbus.com)
  
- Register *Safety first* magazine:
  - [marie-josee.escoubas@airbus.com](mailto:marie-josee.escoubas@airbus.com)



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\* Please tick the appropriate case



# Permanent support adapted to the context

- Familiarization with the Airbus world
- **Immediate response to accident**
- Over the duration of an investigation
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- Conclusion

# Response to crisis

## ■ Airbus Flight Safety hot line:

- +33 (0)6 29 80 86 66

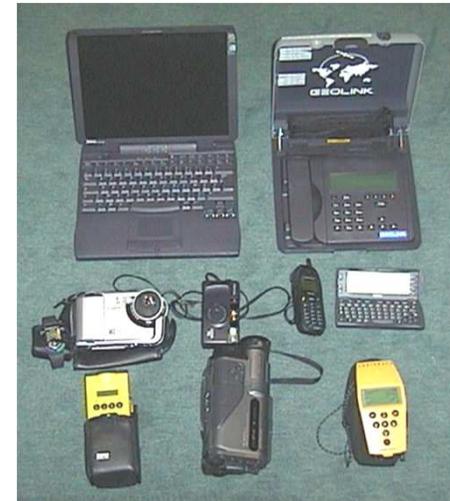
## ■ Activation of the Crisis Control Centre:

- Dedicated line to Investigation Boards
- Your Single Point of Contact within Airbus
- 24/7 availability
- Full confidentiality
- Accessible to only who needs to know



# Go-team dispatch

- **A team of experts on standby:**
  - Flight Safety
  - Systems
  - Structure
  - Engines
  - Operations
  - Recordings
  
- **Trained to investigation techniques and practices**
  
- **Investigation equipments and documentation ready**



# Immediate measures

- **Save manuals valid at the date of occurrence, e.g.**
  - Operations:
    - FCOM Flight Crew Operating Manual
    - QRH Quick Reference Handbook
    - AFM Airplane Flight Manual
    - MEL Minimum Equipment List...
  - Maintenance & engineering:
    - AMM Aircraft Maintenance Manual
    - SRM Structure Repair Manual
    - IPC Illustrated Part Catalogue
    - AWM Aircraft Wiring Manual...
- **Save manufacturing and in-service records**



# Immediate measures

## ■ Investigators safety:

- Accident sites are dangerous
- Airbus can help the IIC by providing appropriate warnings:
  - ✓ Call attention to materials, active systems, aircraft securing to avoid injury or death to persons
  - ✓ E.g., pressurized systems, oxygen bottles, hydraulic fluids, risk of fire, landing gear lockage, hot components, stressed structures...



# Immediate measures

- **Prevent loosing or disturbing evidences:**
  - E.g. Structure condition at impact / mapping, preservation of fracture surfaces, preservation of volatile materials, securing of computers memories, wheels marks on runway...

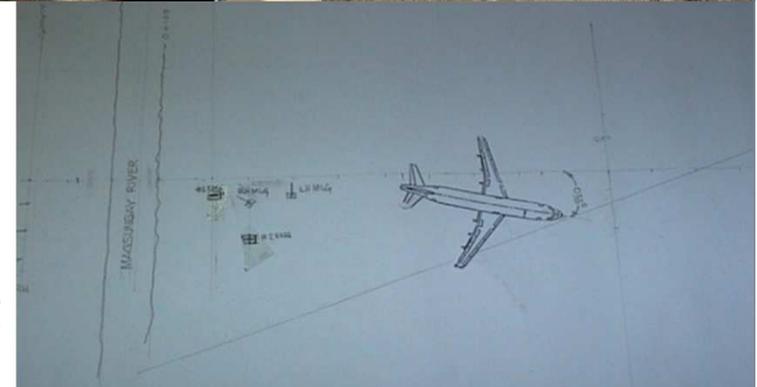


# At incident / accident site

- Retrieve DFDR & CVR
- Retrieve additional recorders
- Retrieve Non-Volatile-Memories:
  - BITE's, Post Flight Report...
- Record aircraft configuration:
  - Document conditions possibly modified upon aircraft impact, recovery...
- Anticipate on future investigation needs:
  - Contribute to mapping in order to support trajectory & performance studies
  - Quarantine equipments for future lab investigation

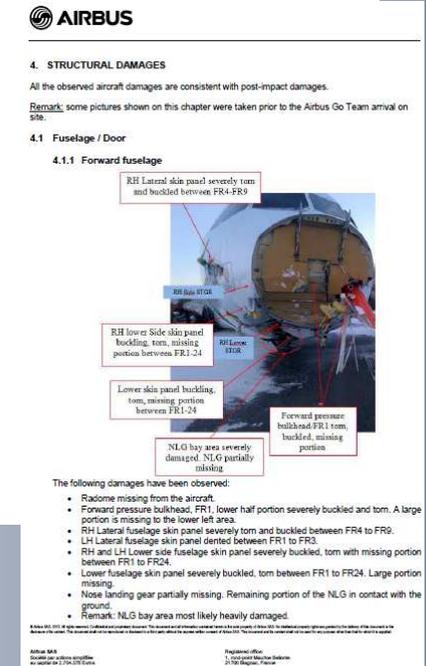
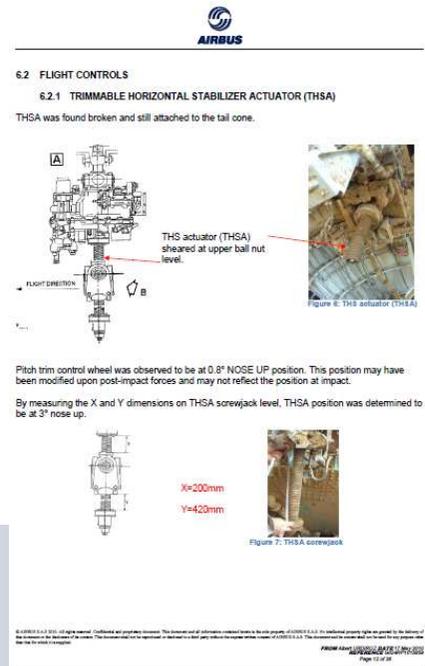
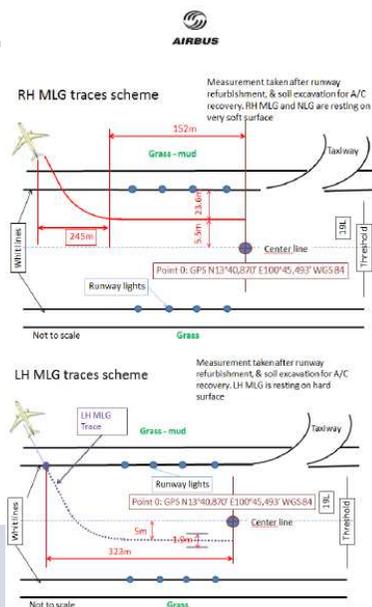


CFR Part	16 Cockpit Effects	CFR Part	19 Faults
		1123 Source: ACARSMM Identifiers: 02 22612 - MCDU(S)/CAT(S)/1(1TX)	
1128 ATA: 21200 02	VENT AVNCS SYS FAULT		
		1148 Source: CFC 1 06 21514 - PRESS CONTR 1	
1148 ATA: 21510 06	CAB PRS SYS 1 FAULT		
1256 ATA: 30310 06	ANTI ICE CAPT TAT	1256 Source: CFC6 Identifiers: 30314 - NO PHC1 DATA	
1256 ATA: 30310 06	ANTI ICE CAPT R STAT	1301 Source: CFC6 Identifiers: 30314 - NO PHC1 DATA	
1302 ATA: 30310 06	ANTI ICE STBY R STAT		



# At incident / accident site

- When on site, the Airbus Go-Team members act in full cooperation with Investigation Boards:
  - Introduce themselves and explain their field of expertise
  - Discuss the action plan
  - Act when agreed
  - Detail findings in real time
  - Document facts into an on-site report (provided to Investigation Boards).



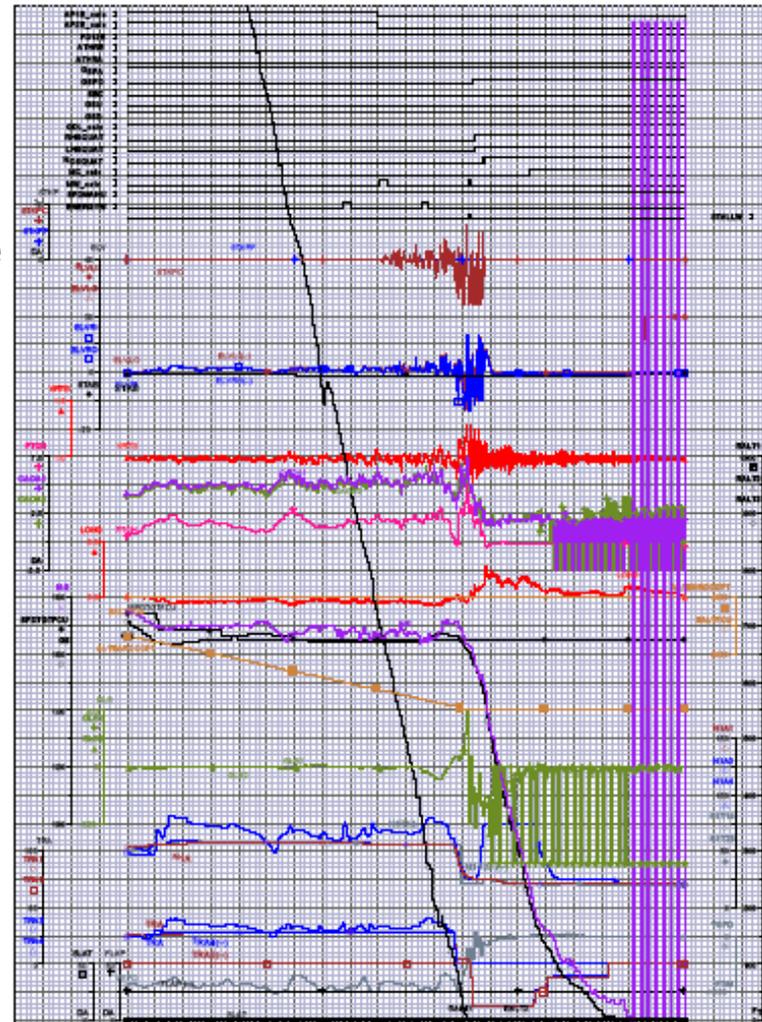
# Permanent support adapted to the context

- Familiarization with the Airbus world
- Immediate response to accident
- **Over the duration of an investigation**
  - Investigation reports
  - Conclusion

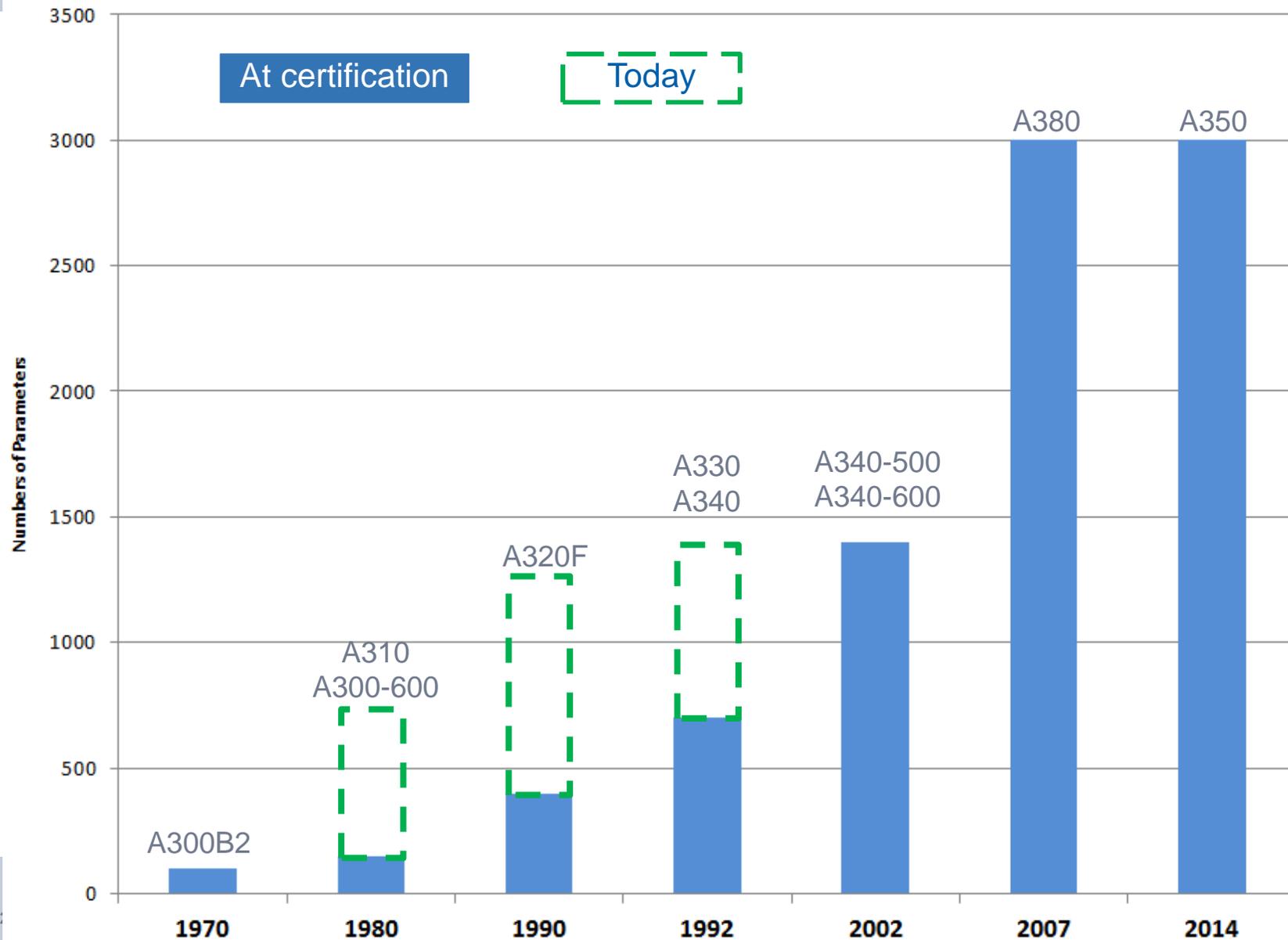
# Flight Data Recorders

## ■ Airbus supports:

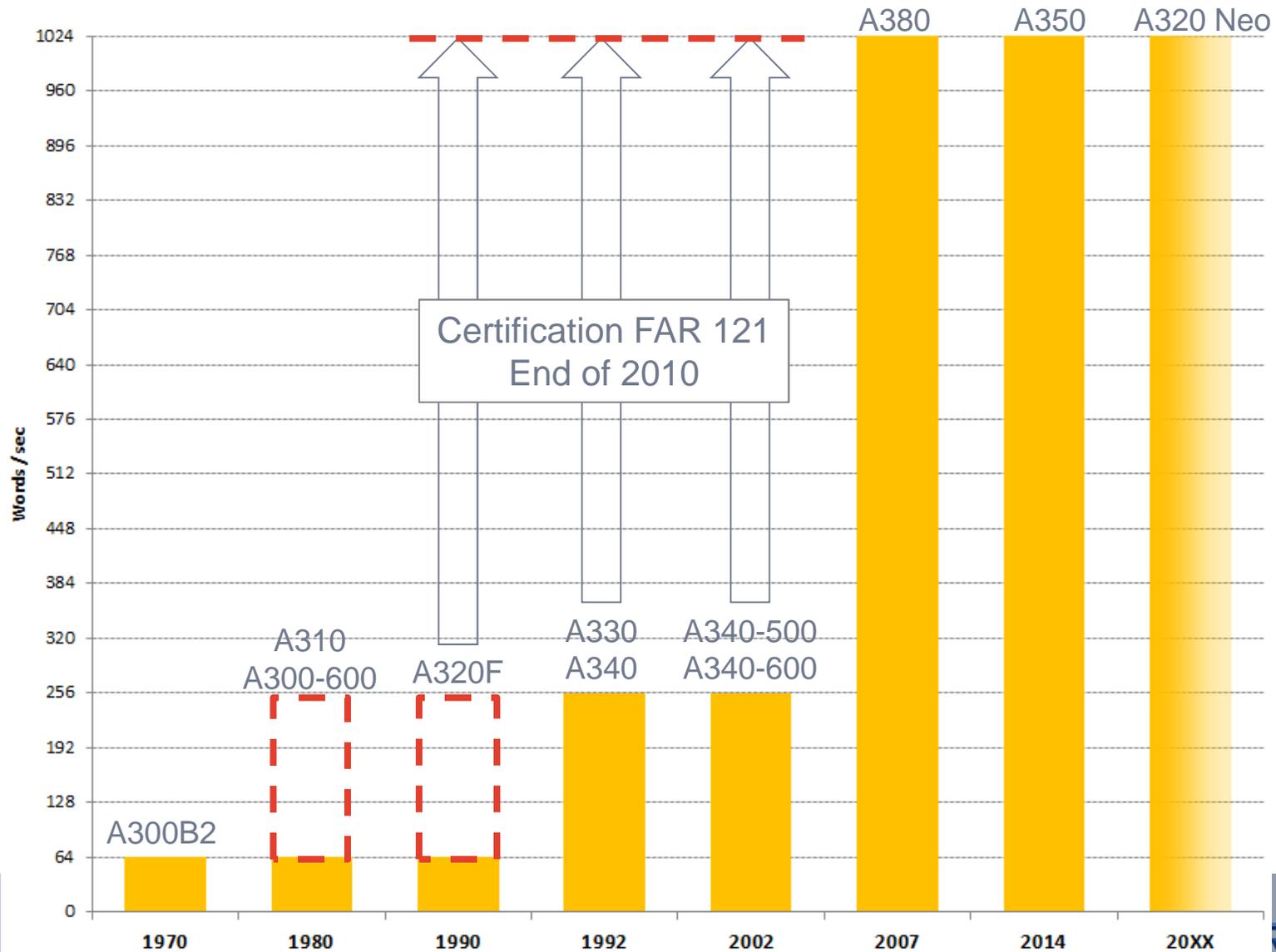
- DFDR & CVR readout
- Sharing of DFDR raw data analysis
- Operational and engineering expertise
- Accurate sequence of events
- Consistency with audio-warnings
- Synchronization of DFDR with CVR



# Evolution of numbers of parameters



# Evolution of sampling rate



# Computers BITE's, NVM's, ACARS transmissions

- Significant source of information on modern aircraft
- Complements Flight Data Recordings
- Key in recent investigations:
  - AF447
  - UPS1354
  - ...



# Examples of investigation domains

## ■ **Systems:**

- Response to inputs
- Reconfigurations
- Cockpit alerts

## ■ **Handling qualities:**

- Response to inputs
- Response to environment

## ■ Airbus has tools and expertise to review the aircraft behavior and the interface with flight crew as recorded versus the model:

- Calibrated with flight test results and certified

## ■ Airbus can also provide support in the human factor analysis

## ■ **Performance:**

- In flight
- At take-off and landing

## ■ **Structure:**

- Loads & Aeroelastics
- Structural integrity

# Simulation means

## ■ Development SIM / Full Flight SIM:



- Replay the event
- Review procedures
- Investigate human / machine interface
- Consider alternate scenarios

# Iron bird

- Allows investigating complex scenarios that cannot be simulated with FFS
- Allows accurately reproducing some failure modes down to the components



# Flight tests

- Further research and development can be supported by flight tests



# Take benefit of Airbus network

- In addition to the in-house competences, Airbus can support you in establishing cooperation with:
  - Suppliers
  - Engine manufacturers
  - Laboratories

# Permanent support adapted to the context

- Familiarization with the Airbus world
- Immediate response to accident
- Over the duration of an investigation

- **Investigation reports**

- Conclusion

# Investigation reports

- **Airbus provide investigation documents to cover these activities:**
  - Reports, submissions, presentations...
  
- **Upon agreement, Airbus inputs may appear in Final Investigation Report:**
  - Information provided in full confidentiality to the Boards involved
  - Restrictions associated with proprietary data
  
- **Airbus also supports Boards Accident / Incident Investigation:**
  - Promoting pragmatic and practical recommendations
  - Commenting the draft according to ICAO annex 13
  - Responding to safety recommendations

# Permanent support adapted to the context

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- **Conclusion**

# Conclusion

- **Immediate involvement of manufacturers is beneficial to investigation progress**
  
- **Airbus supports accident investigations:**
  - Highest level expertise:
    - ✓ Human Factor, Engineering, Operational resources
    - ✓ As needed, additional expertise is requested from suppliers
  - Tests and investigation means
  
- **Airbus completes all activities in full transparency with investigation boards**

# Conclusion

- **This cooperation with Investigation Boards promotes a comprehensive investigation which is a necessary condition to answer investigation questions**

⇒ **Early understanding of what happened:**

- Minimize speculation by giving the main facts
- Work in a more serene environment

⇒ It allows achieving our mutual goal: **Enhance flight safety**

- Learn all the lessons from investigated events
- Define effective preventive measures to prevent reoccurrence

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