



Capt. Christian Norden

- Airbus Director Flight Operations & Training Policy.
- TRI/TRE on A320, A330, A340 and A350
- Pilot, Examiner and Manager for a European operator for 30 years
- Joined Airbus in 2007
- Airbus representative in IATA EBT development group since 2009
- Led the creation of the new A350 Flight Crew Training program
- Airbus representative in EASA EBT rulemaking since 2015
- He holds an LL.D. degree.

A large Airbus A350-900 aircraft is parked on a tarmac. The aircraft is white with a blue tail fin featuring the Airbus logo and the text 'A350'. The sun is low in the sky, creating a bright reflection on the wet surface of the tarmac. The sky is blue with scattered white clouds.

EASA EBT Workshop
1 February 2017

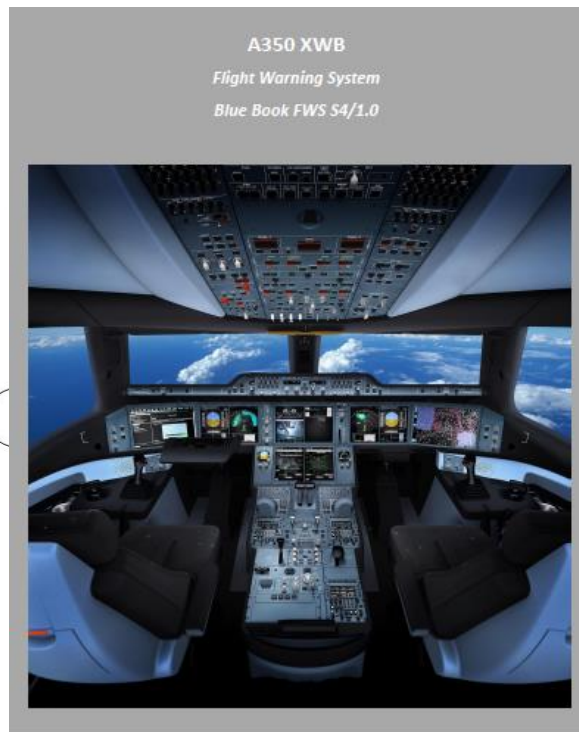
Malfunction Clustering

The role of the manufacturer

Presented by Christian Norden

Number of possible
warning/cautions and emergency
procedures presented by today's
Flight Warning computers?

**Several hundreds to several
thousands!**



Malfunctions

**Managing the
training of
malfunctions**

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-COMPLEX AEROPLANES	PRACTICAL TRAINING		MPL/TYPE
	OTD	FTD	
Manoeuvres/Procedures			<p>A mandatory minimum of 3 abnormal shall be selected from 3.4.0 to 3.4.14 inclusive</p>
3.4.0 Engine (if necessary propeller)	P----->	----->	
3.4.1 Pressurisation and air-conditioning	P----->	----->	
3.4.2 Pitot/static system	P----->	----->	
3.4.3 Fuel system	P----->	----->	

❑ CONCEPT BACKGROUND

- Created in the 90's to support mixed fleet flying concept
- Today it is part of the Operational Suitability process.

❑ METHODOLOGY

- Four different malfunction characteristics
- Combination of **malfunction characteristics**
- Classification

❑ MALFUNCTION CHARACTERISTICS

+ PROCEDURE

characteristic refers to the existence of a **series of actions**.

+ COGNITIVE

refers to the application of **mental abilities** such as knowledge, judgment, evaluation, reasoning, comprehension or problem solving.

+ WORKLOAD

characteristic refers to the **actual amount of work** for the crew


+ HANDLING

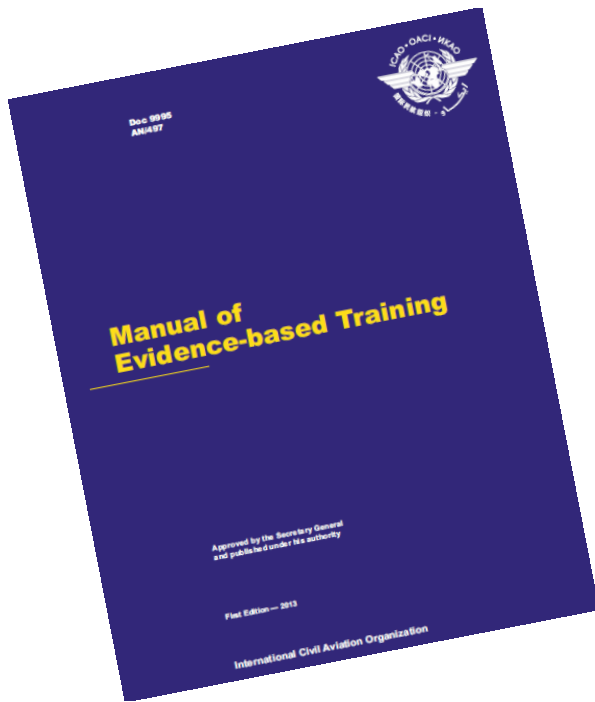
characteristic refers to the **modification** of the aircraft handling

Class of Equivalence Concept

CLASS OF EQUIVALENCE	PROCEDURE	COGNITIVE	WORKLOAD	HANDLING
0	No	No	No	No
1	Yes	No	No	No
2	Yes/No*	Yes	No	No
3	Yes/No*	Yes/No*	Yes	No
4	Yes/No*	Yes/No*	No	Yes
5	Yes	Yes	Yes	Yes

Program design
uses Class of
Equivalence
principles

 CLASS OF EQUIVALENCE ALERT		EWD ALERT COLOR (Select: R/A/G/C/W or No EWD Warning)	EQUIVALENCE CLASS	Procedure (Select: Y/N)	Cognitive (Select: Y/N)	Workload (Select: Y/N)	Handling / Maneuver (Select: Y/N)
ATA	ALERT TITLE						
ATA 28 - FUEL	FUEL - CTR TK L+R PMPs FAULT	A	2	Y	Y	N	N
ATA 31 - INDICATING / RECORDING SYSTEMS	FWS - AUDIO FUNCTION LOST	A	2	Y	Y	N	N
ATA 32 - LANDING GEAR	L/G DOORS NOT CLOSED	A	2	Y	Y	N	N



ICAO DOC 9995
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Introduced the principle of 5
classes **of malfunctions**

Malfunction characteristics is
linked **to crew performance**

ICAO

Malfunction Characteristics and crew performance

- ❑ **“Immediacy”**: System malfunctions requiring immediate and urgent crew intervention or decision (e.g. malfunctions with memory items)
- ❑ **“Complexity”**: System malfunctions requiring recovery procedures with multiple options to analyse and/or multiple decision paths to apply.
- ❑ **“Degradation of aircraft control”**: System malfunctions resulting in significant degradation of flight controls in combination with abnormal handling characteristics
- ❑ **“Loss of instrumentation”**: System malfunctions that require monitoring and management of the flight path using degraded or alternative displays
- ❑ **“Management of consequences”**: System malfunctions affecting significantly the flight crew



European Aviation Safety Agency

EMIT 0599

‘Display based and competency-based training’



European Aviation Safety Agency

RMT.0599

'Evidence-based and competency-based training'

❑ **At least one** malfunction for **each characteristic** shall be included at the frequency determined by the Baseline Programme.

❑ **Demonstrated competency** in the management of one malfunction is considered **equivalent** to demonstrated competency in the management of other malfunctions with the **same characteristics**.

EASA

Malfunction Equivalency application



European Aviation Safety Agency

RMT.0599

'Evidence-based and competency-based training'

Malfunction clustering may be undertaken in **consultation with the aircraft OEM.**

The objective of this consultation is to review the operator analysis regarding the OEM **operational certification** (e.g. OSD) documents and to the **general OEM operation and training policy.**

EASA

Malfunction Equivalency work with OEM

A photograph of an Airbus A350-900 aircraft on a tarmac. The aircraft is white with a blue tail fin featuring the Airbus logo and the text 'A350-900'. The aircraft is parked on a wet surface, and its reflection is clearly visible in the water. The sky is blue with scattered white clouds, and the sun is visible in the upper center, creating a bright glow and reflecting on the water.

EASA EBT Workshop
1 February 2017

Malfunction Clustering - EBT in initial type rating

Presented by Christian Norden

☐ EBT 2008 - 2013



- ☐ Competence Driven
- ☐ Develop Resilience
- ☐ Driven by Evidence
- ☐ Develop Instructional Style

☐ A350 Type Rating 2011 - 2014



- ☐ Competence Driven
- ☐ Develop Resilience
- ☐ Driven by Evidence
- ☐ Develop Instructional Style
- ☐ Observe Appendix 9 Part FCL

Fulfil Appendix 9 PART FCL Performance Standard

3.3	Normal operation of systems and controls engineer's panel	P→	→	→	→			
	Normal and abnormal operations of following systems:						M	A mandatory minimum of 3 abnormal shall be selected from 3.4.0 to 3.4.14 inclusive
3.4.0	Engine (if necessary propeller)	P→	→	→	→			
3.4.1	Pressurisation and air-conditioning	P→	→	→	→			
3.4.2	Pitot/static system	P→	→	→	→			
3.4.3	Fuel system	P→	→	→	→			
3.4.4	Electrical system	P→	→	→	→			

Height	
Generally	± 100 feet
Starting a go-around at decision height	+ 50 feet/- 0 feet
Minimum descent height/altitude	+ 50 feet/- 0 feet
Tracking	
on radio aids	± 5°
Precision approach	
	half scale deflection, azimuth and glide path
Heading	
all engines operating	± 5°
with simulated engine failure	± 10°
Speed	
all engines operating	± 5 knots
with simulated engine failure	+ 10 knots

How to assess?

PART FCL Flight Test Tolerance: "Demonstrate Airmanship"

A350 Type rating

Had to comply with today's training standard

Normal operations

Abnormal operations

Contextual operations

Background task

A350

Training Objective Analysis

Normal operations

A350

Flight dispatch preparation

Access to the aircraft

- FLP007 Perform PAX door opening from outside
- FLP008 Perform PAX door closing from outside
- FLP009 Perform PAX door arming and disarming from inside
- FLP010 Perform PAX door closing from inside
- FLP011 Perform PAX door opening from inside
- FLP012 Perform routine access to the cockpit
- FLP013 Perform normal exit from the cockpit

Landing

Taxi-in & arrival/engine shutdown

Post flight operations

Flight close

Go around

Diversion

ective

Normal operations

Abnormal operations

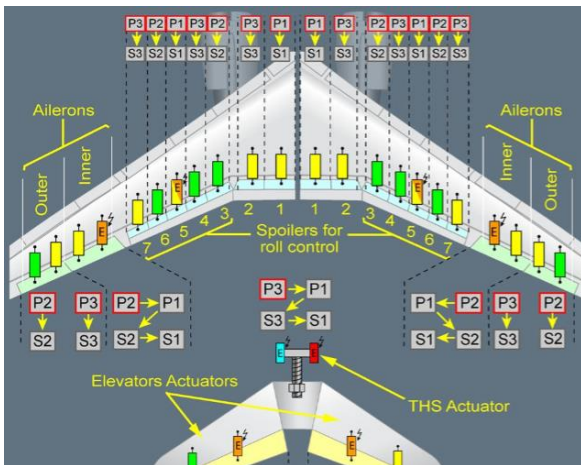
Contextual operations

Background task

A350

Training Objective
Analysis

Total **306** training objectives for the
Standard Transition Course



Technical Knowledge

> 30h past conventional CBT (e.g. A320, A380)

19h SKM A350

System Knowledge Modules (SKM)
are Quick User Guides for initial knowledge base

Novelties A350 training

A new style of
knowledge
acquisition

Quick
user
Guide



ACE



“Airbus Cockpit Experience “

- Part Task Trainer
- Difference Level C

ACE

- Cockpit Simulator on Laptop or Tablet
- ACE is used from Day 1 throughout the whole course - also for preparation of e.g. FFS sessions
- System Knowledge modules and ACE modules are intermixed
- “Learning by Discovery”
- Includes SOP training

Training Tools

Innovative Solutions



Training Tools

New APT+

Shift content from **FFS** to **APT+**

Shift content

More training
than FFS



Start with Manual Flying



More training
time in the FFS

Scenario Based Training



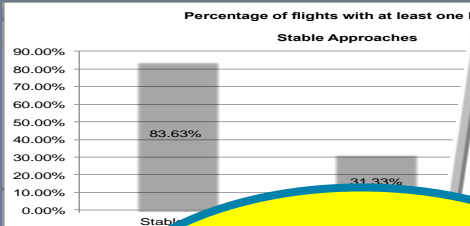
Surprise as a training element



Training Tools

Better use of FFS
capabilities

Evidence Driven



1008	Speed Above VLE
1009	Speed Above VLE
1016	Speed Above VLO Extension
1017	Speed Above VFE
1025	Speed Above Recommended Turbulence Speed
1028	Speed Low
1032	Speed High in Climb (below 1000ft)
1038	Speed Low in Climb (100ft - 1500ft)
1100	Pitch High at Take Off
1101	Pitch Rate High at Take Off
1102	Pitch Rate Low at Take Off
1103	Pitch High in Climb

A

Adverse weather

Automation management

Competencies non-technical (CRM)

Compliance

Error management

Go-Around management

Manual aircraft control

Mismanaged aircraft state

Monitoring & cross-checking

Unstable approach

ATC

Engine failure

Fire and smoke management

Loss of communications

Managing loading, fuel, performance errors

Navigation

Operations or type specific

Pilot incapacitation

Traffic

Upset recovery

Windshear recovery

programme

995

Use of Data

A review

Application of Procedures

Communication

Flight Path Management - Automation

Flight Path management – Manual
Control

Leadership and Teamwork

Problem Solving and Decision Making

Situation Awareness

Workload Management

Knowledge *)


Competencies drive training

- Design
- Execution
- Assessment

Performance Indicators define the desired outcome

6 APPENDIX 2 - AIRBUS PILOT COMPETENCIES AND ITS INDICATORS

Competency	Competency Description	Performance Indicators
Application of Procedures	Identifies and applies procedures in accordance with published operating instructions and applicable regulations, using the appropriate knowledge.	<ul style="list-style-type: none">- Follows SOP's unless a higher degree of safety dictates otherwise- Identifies and applies all operating instructions in a timely manner- Correctly uses aircraft systems, controls and instruments- Safely manages the aircraft to achieve effective and efficient operation, concerning fuel, environment, passenger comfort and punctuality- Identifies the source of operating instructions
Communication	Demonstrates effective oral, non-verbal and written communication in the cockpit and with other personnel.	<ul style="list-style-type: none">- Knows what, how, where, when, how much and with whom he or she needs to communicate- Ensures the recipient is ready and able to receive the information- Conveys messages and information clearly, accurately, timely and adequately- Confirms that the recipient correctly understands important information



Pilot Training

☐ Remedial

Session type
(select none)

Session date

Trainee's details

Customer
Lastname
Firstname
Position
Course Number
Course Type
From/To

Competencies	1	2	3	4	5	N/D	Competent
Application of procedures							Not yet Competent
Communication							
Flight path management - Automation							
Flight path management - Manual							
Knowledge							
Leadership and teamwork							Instructor's name
Problem solving and decision making							Name
Situation awareness							
Workload management							Code

Free text

Validate

Save without validation

Unprotect

☐ I confirm that all the required manoeuvres and exercises for this session are either completed or listed in the free text box

☐ I confirm that the reporting has been presented to the trainee and validated in his/her presence

Note - Any misinterpretation of exercises will be notified to the next instructor

Competencies

Are drivers of the
A350 training
design and
conduct

EXAMPLE: “LEADERSHIP AND TEAMWORK”

- Assessment

*“How often and how many performance indicators for **Leadership and Teamwork** has the pilot demonstrated?”*

GRADE	HOW WELL	HOW OFTEN	HOW MANY	OUTCOME
1	Not Standard	Rarely	Few	Unacceptable reduction in safety margin
2	Marginally (still not standard)	Occasionally	Some	Reduction in safety margin or effectiveness
3	Standard	Regularly	Many	Safe
4	Above standard	Regularly	Most	Safe and effective
5	Exemplary standard	Always	All	Safe, effective and efficient

Grading

Performance Indicators drive the result

EXAMPLE: “LEADERSHIP AND TEAMWORK”

- Assessment a grade « 2 » using the Performance Indicators:

Understands and agrees with the crew's roles and objectives

GRADE	HOW WELL	HOW OFTEN	HOW MANY	OUTCOME
2	Marginally (still not standard)	Occasionally	Some	Reduction in safety margin or effectiveness

Gives and receives both criticism and praises well, and admits mistakes

Confidently says and does what is important for safety

Demonstrates empathy, respect and tolerance for other people

Involves others in planning and allocates activities fairly and appropriately to abilities

Grading

Performance Indicators drive the result

Demonstrated competency in the management of one malfunction is considered equivalent to demonstrated competency in the management of other malfunctions with the same characteristics.

Grading non-technical skills compared to technical skills requires thorough instructor standardization!

Day1	Day 2	Day 3	Day 4	Day 5
CREW registration SYSTEM KNOWLEDGE & PTT	SYSTEM KNOWLEDGE & PTT	SYSTEM KNOWLEDGE & PTT	SYSTEM KNOWLEDGE & PTT	SYSTEM KNOWLEDGE & PTT
Day 6	Day 7	Day 8	Day 9	Day 10
SYSTEM KNOWLEDGE & PTT + SYSTEM TEST	SOP PTT	FFS 1	APT+ 1	APT+ 2
Day 11	Day 12	Day 13	Day 14	Day 15
APT+ 3	FFS 2	FFS 3	FFS 4	APT+ 4
Day 16	Day 17	Day 18	Day 19	Day 20
APT+ 5	APT+ 6	FFS 5	FFS 6	FFS 7
Day 21	Day 22	Day 23		
FFS 8	FFS 9	SKILL TEST		

Footprint

Driven by trainees
needs



A350 Flight Crew Training added EBT elements to the Type Rating Training

October
2014

February
2017

- **Very positive feedback** from the start
- Noticeable: **very steep learning curve esp. in short courses**
- **More competent crews** with fewer remedials
- **Instructor standardization** for **Competency** based training an ongoing challenge

Lessons learned

By Airbus after 2 ½
years A350
training



European Aviation Safety Agency

RMT.0599

'Evidence-based and competency-based training'

February
2017

December
2017

EBT TYPE RATING

Airbus will share with EASA its experience in the development and conduct of the A350 type rating training.

RMT 0599

**Lessons learned
from Airbus A350
Type rating**

