Upset Prevention and Recovery Training

COSCAP-SA webinar – 13th of July 2022

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Webinar Objective

To share Airbus experience regarding the **design** and **implementation** of Upset Prevention and Recovery Training.

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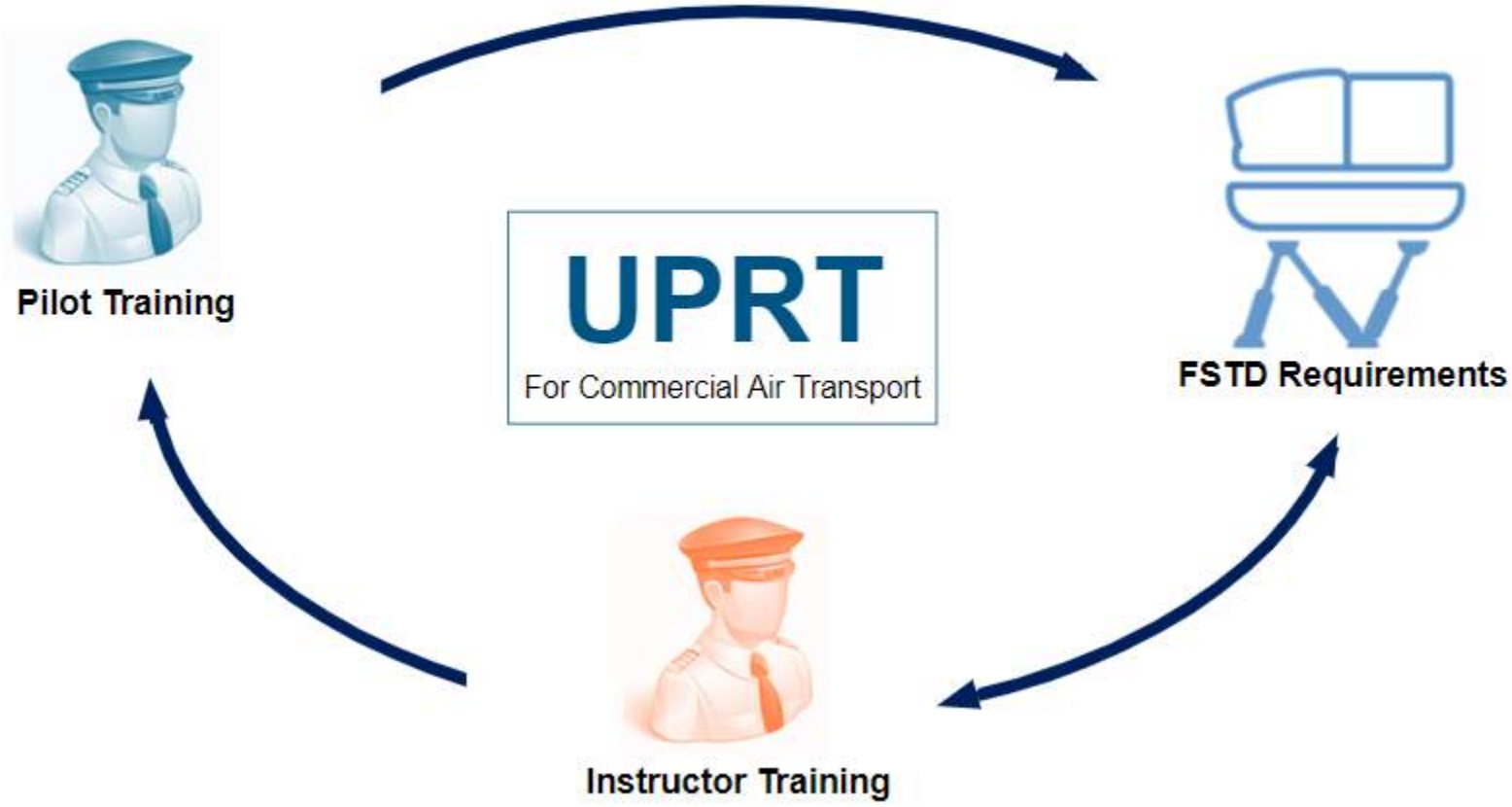
Webinar Architecture



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UPRT Rule Making

2009 (ICATEE)

2011 (ARC)

2012 (LOCART)

2014
Doc 10011
Manual on
aeroplane upset
prevention and
recovery training

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2015
Guidance Material and
Best Practices for the
Implementation of Upset
Prevention and Recovery
Training

2015
Advisory Circular 120-
109A on Stall Prevention
and Recovery Training
-
Advisory Circular 120-
111 on Upset Prevention
and Recovery Training

2015
ED 2015-012-R
amending the
Acceptable Means of
Compliance and
Guidance Material to
Part-Definitions and
Part-ORO of Regulation
(EU) No 965/2012

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2017
Revision 03 of the
Airplane Upset
Prevention and
Recovery Training Aid

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2018
14 CFR 121.423
Pilot: Extended
Envelope Training

2018
EU 2018/1974
(Aircrew)
Amendment to Part
FCL

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AURTA: 1998 / AURTA REV 1: 2004 / AURTA REV 2: 2008

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UPRT Concept

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About Upset

‘Aeroplane upset’ refers to an **undesired aircraft state** characterised by unintentional divergences from parameters normally experienced during operations. An aeroplane upset may involve pitch and/or bank angle divergences as well as inappropriate airspeeds for the conditions.

About UPRT

Aeroplane upset prevention and recovery training (UPRT) refers to training consisting of:

- Airplane upset **prevention** training: a combination of **theoretical knowledge and flying training** with the aim of providing flight crew with the required competencies to prevent aeroplane upsets
- Airplane upset **recovery** training: a combination of **theoretical knowledge and flying training** with the aim of providing flight crew with the required competencies to recover from aeroplane upsets.

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Training Toward Resilience

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Pilot Training

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Guidance Material

ICAO ANNEX 6 - For operation of aircraft in international commercial air transport
FLIGHT CREW MEMBER TRAINING PROGRAMMES
Should include UPRT

ICAO PANS-TRG Doc 9868
UPRT

ICAO Doc 10011

EASA – Training Content

AMC1 ORO.FC.220&230 Operator conversion training and checking & recurrent training and checking

ICAO

A.	Aerodynamics
B.	Causes of and contributing factors to upsets
C.	Safety review of accidents and incidents relating to aeroplane upsets
D.	g-load awareness
E.	Energy management
F.	Flight path management
G.	Recognition
H	Upset prevention and recovery techniques
I.	System malfunction
J	Specialized training elements
K	Human Factors

EASA (Air Ops)

Upset prevention training

A.	Aerodynamics
B.	Causes of and contributing factors to upsets
C.	Safety review of accidents and incidents relating to aeroplane upsets
D.	g-load awareness and management
E.	Energy management
F.	Flight path management
G.	Recognition
H.	System malfunction (including immediate handling and subsequent operational considerations, as applicable)

Upset recovery training

A.	Recovery from developed upsets

CRM training

Human Factors

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EASA – Training Frequency

Pilot
Recurrent Training Programme

EASA
European Aviation Safety Agency

Upset **PREVENTION** training

- Recurrent training programme should include upset **prevention elements at least every 12 calendar months**, such that **all the elements** are covered over a period not exceeding **3 years**.

Upset **RECOVERY** training

- Be completed from **each seat in which a pilot's duties require** him/her **to operate**.
- Recurrent training programme should include the recovery elements for the, such that **all the exercises** are covered over a period not exceeding **3 years**.

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Airbus Recommendations

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A320

FLIGHT CREW TRAINING

STANDARDS

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Airbus Recommendations

AEROPLANE UPSET:
An undesired aeroplane state (UAS) characterized by unintentional divergences from parameters normally experienced during operations.

FCTS Chapter 7.2: Undesired Aircraft States Prevention and Recovery Training:

Managing potential causes of flight path divergence.

- 70 % Prevention and,
- 30 % Recognition and Recovery.

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Airbus Recommendations – Theoretical Training

- Elements of aerodynamics
- Causes and contributing factors of undesired aircraft states
- Examples of incidents related to undesired aircraft states
- G-load awareness and management
- Aircraft energy management including thrust settings
- Automated and manual flight path management
- Elements of active monitoring and associated observable behaviors
- Aircraft stall protection systems and stall cues
- Procedures and techniques for the recovery of undesired aircraft states.

As a minimum…

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Airbus Recommendation – Practical Training

Undesired aircraft state **PREVENTION**:

- Understanding of the flight control laws principles and protections
- Exploration of the normal flight envelope (low and high speeds, low and high altitudes), with a specific emphasis on angle of attack awareness
- Energy management at low and high altitude
- Manual handling skills reinforcement in normal and reconfiguration flight control laws at low and high altitude
- Reminder of AP/FD and A/THR specificities (engagement and disengagement, operating limits, mode reversions, etc.).

Airbus Recommendation – Practical Training

Undesired aircraft state **RECOGNITION and RECOVERY:**

- Recovery from unusual aircraft attitude at low and high altitude
- Approach to stall at low and high altitude
- Understanding of the Flight Path vector (FPV) and when to use or not to use it during recovery
- Full stall at low and high altitude (when mandated by the National Aviation Authority or decided so by the operator)
- Bounced landing (when mandated by the National Aviation Authority, part of the FAA 14 CFR 121.123 “extended envelope training”).

Cross-Credits for Pilot Training

- **Recommended frequency for recurrent training:** Unless otherwise mandated by National Aviation Authorities, all elements related to the training of undesired aircraft states should be performed over a period that does not exceed **three years**.
- **Credits between airbus A3XX FBW types:** Credits can be granted in accordance with the published Operational Suitability Data (OSD-FC).

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Full credits for FSTD training

No credit at OEM level

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Airbus ATO – Initial Implementation

Pilot Training

ACADEMIC TRAINING

05h00

FSTD TRAINING

06h30

01h30 **04h00** **01h00**

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Airbus ATO – Theoretical Training

- Prevention Ground Training contents 8 Modules as follows:
  - Module A: Aerodynamics
  - Module B: Causes of and contributing factors to upsets
  - Module C: Safety Review of accidents and incidents relating to aeroplane upsets
  - Module D: G-Load awareness and management
  - Module E: Energy management
  - Module F: Flight Path Management
  - Module G: Recognition
  - Module H: System Malfunction

- Recovery Ground Training contents 1 Module as follows:
  - Module A: Recovery from developed Upsets

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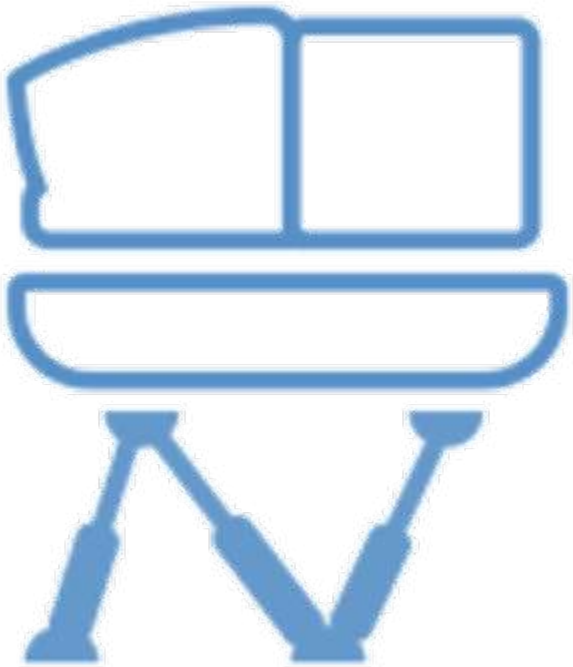
Airbus ATO – FTSD Training



- **Prevention Training contents 8 Modules as follows:**
  - **Module A: Aerodynamics**
  - **Module B: Causes of and contributing factors to upsets**
  - **Module C: Safety Review of accidents and incidents relating to aeroplane upsets**
  - **Module D: G-Load awareness and management**
  - **Module E: Energy management**
  - **Module F: Flight Path Management**
  - **Module G: Recognition**
  - **Module H: System Malfunction**

- **Recovery Training contents 1 Module as follows:**
  - **Module A: Recovery from developed Upsets**

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Training Device Requirements

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Qualified FSTD

- FSTD requirements for UPRT are included in the **EASA CS-FSTD**.
- Both EASA Part-FCL (Licensing) and Part ORO (AIR-OPS) refer to the CS-FSTD for UPRT training.
- As a rule, an **FFS qualified according to the CS-FSTD** is required for UPRT practical training.

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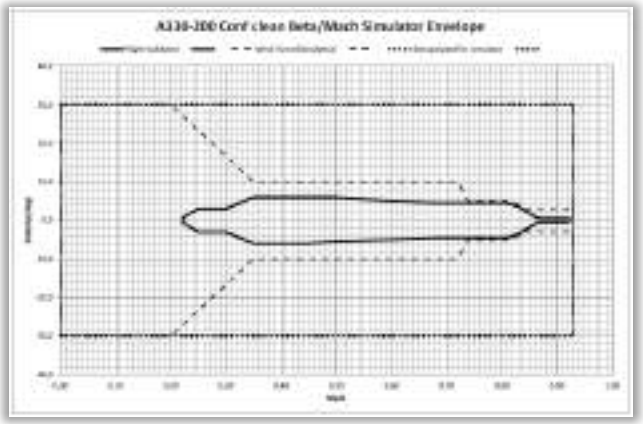
FSTD Validation Envelope

FSTD validation envelope is defined by the CS-FSTD by the following three subdivisions :

- **Flight-test-validated** region: validated with flight test data,
- **Wind tunnel and/or analytical** region: wind tunnel testing or use of other reliable predictive methods,
- **Extrapolated** region: to ensure operational continuity.



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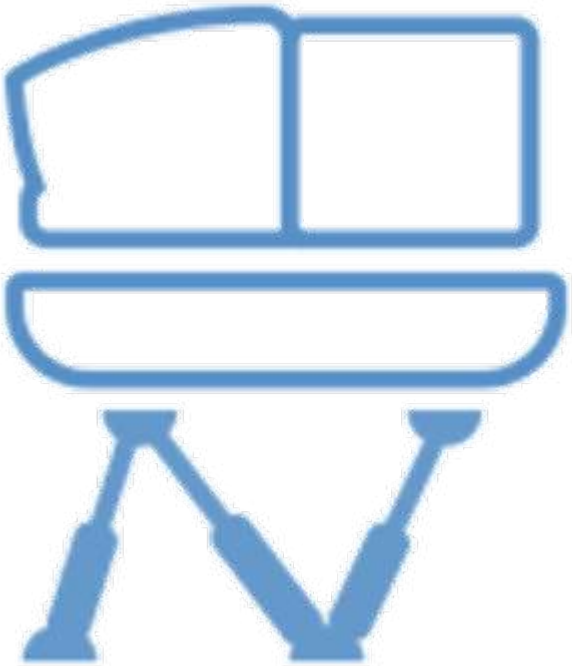
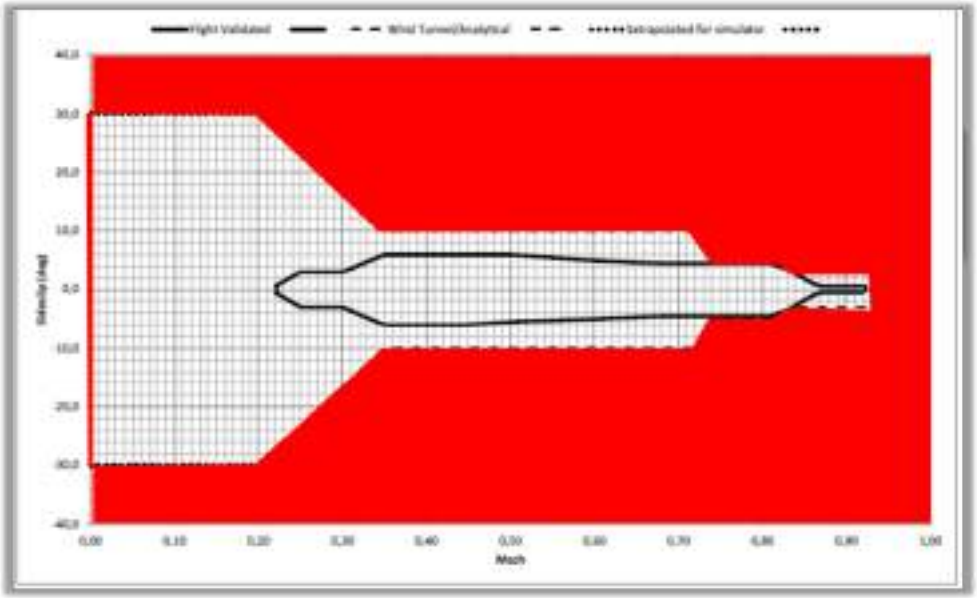
FSTD Training Envelope





FSTD Training Envelope or Valid Training Envelope (VTE): High and moderate confidence regions of the FSTD validation envelope.

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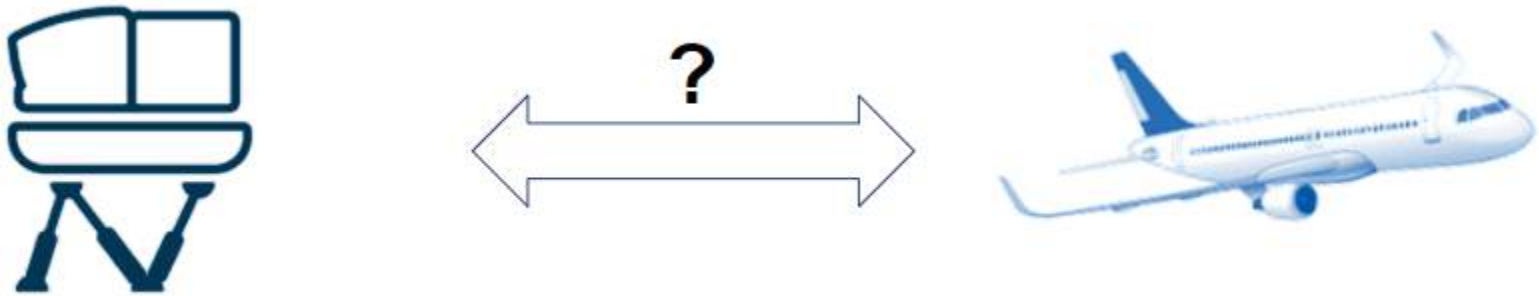
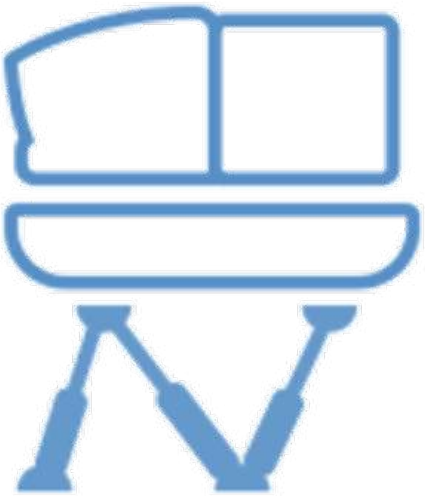
Effective FSTD Training



- Extended aerodynamic envelope
- Post stall aerodynamic model
- G-load
- Appropriate high altitude performance, including stall
- Appropriate buffet models.

FSTD Requirements



- IOS feedback mechanism in real time: FSTD Training envelope - Controls input - Operational limit,
- Aerodynamics model,
- Motion system,
- Stall event limited to Approach-to-stall.

- Upset scenarios
- Post-stall training: Optional - only if Extended FSTD Training Envelope available

FAA: Post stall training is mandatory

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Airbus Recommendations

OEM Recommendations for the use of FSTDs in UPRT are provided in the FCTS (7.2.5)

- Compliance with CS-FSTD issue 2 (EASA) or FAA part 60 (Change 2)
- **Respect of the valid training envelope** (FSTD training envelope)
- Avoidance of negative training during unusual attitude training (use of In-seat instruction or **specific IOS functions**)
- **Avoidance of negative training during approach to stall and/or full stall training.**

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Airbus FSTD Specifications

FSTD data package

- SimPack delivered by Airbus
- Integrated by the training device manufacturer:
  - ✓ Fully compliant with FAA Part 60 Change 2
  - ✓ Total free play capabilities (stall regime)
  - ✓ Enhanced aerodynamics model (full stall)
  - ✓ Stall Buffet
  - ✓ Roll Off

IOS Functions

- Developed by the Training Device Manufacturer
- New IOS pages
  - ✓ UPRT and Stall scenarios
  - ✓ Provides feedbacks to instructor (plots on diagrams, flight controls positions, etc…).

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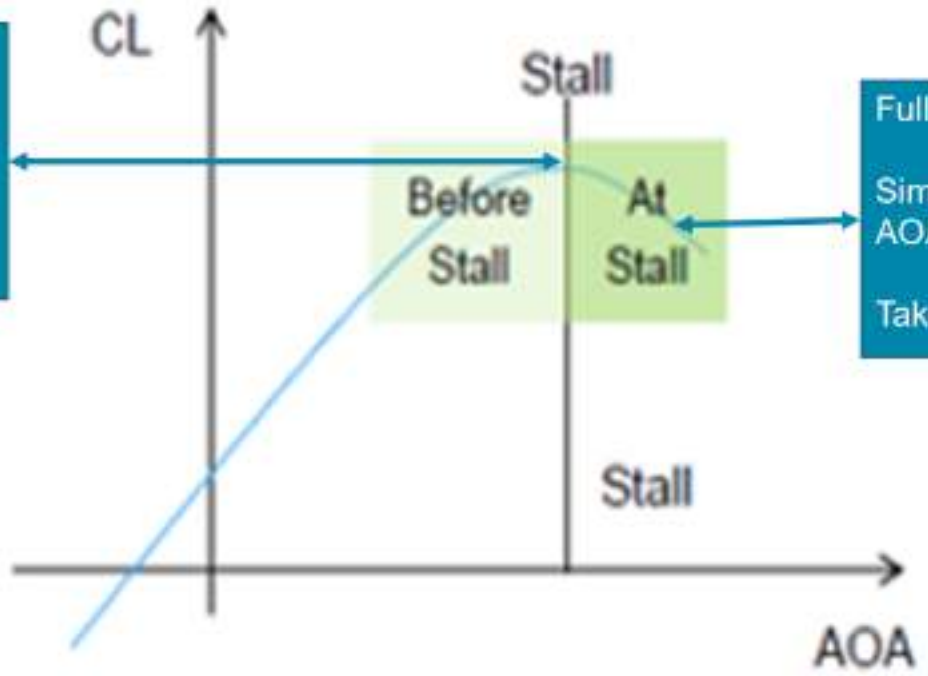
Automatic Stall Entry

Stall demonstration

Simulation stabilize at stall AOA

Take over at any time



Full stall demonstration

Simulation freeze at stall AOA + X degrees

Take over at any time

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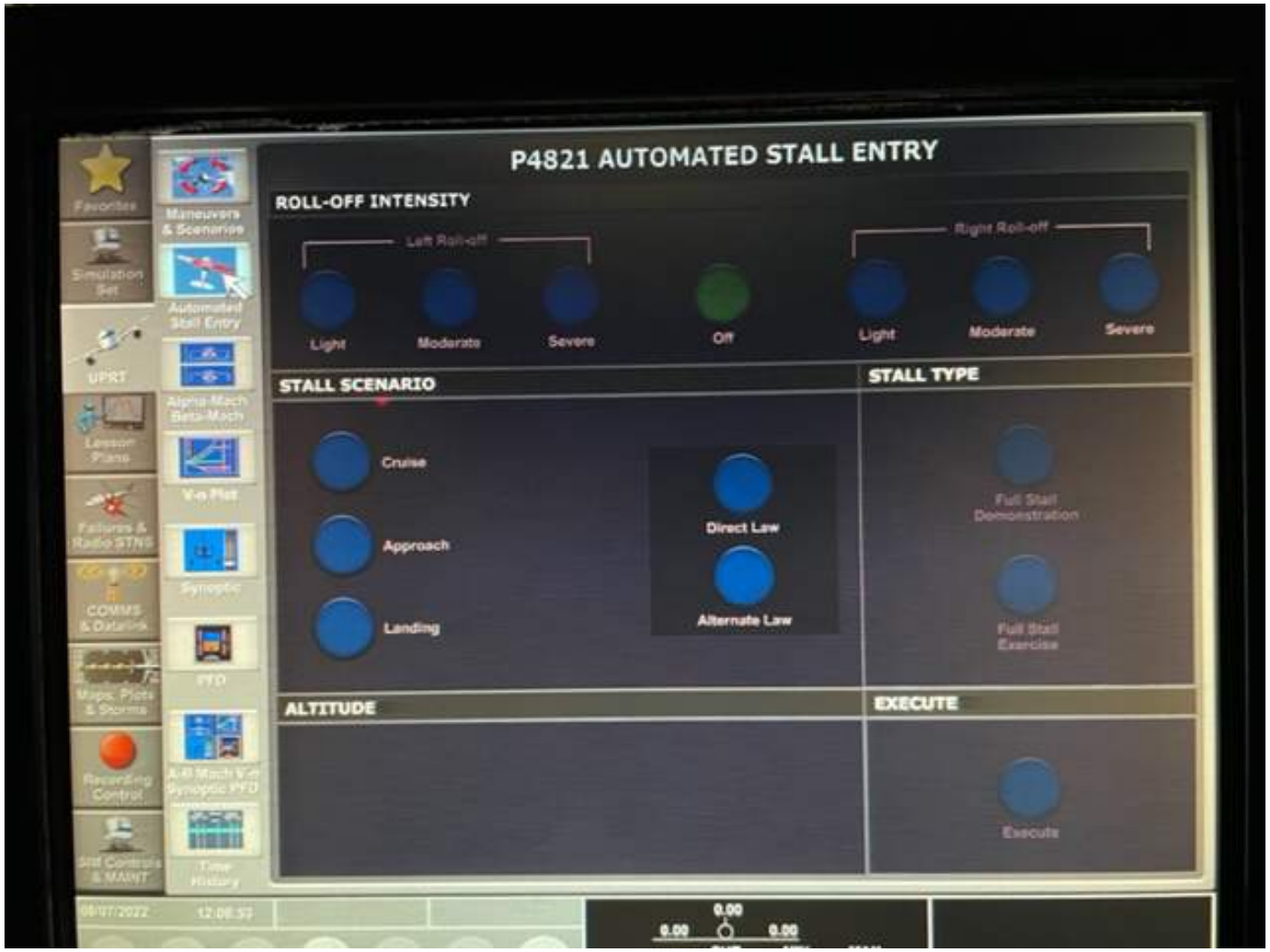
IOS: Automatic Stall Entry



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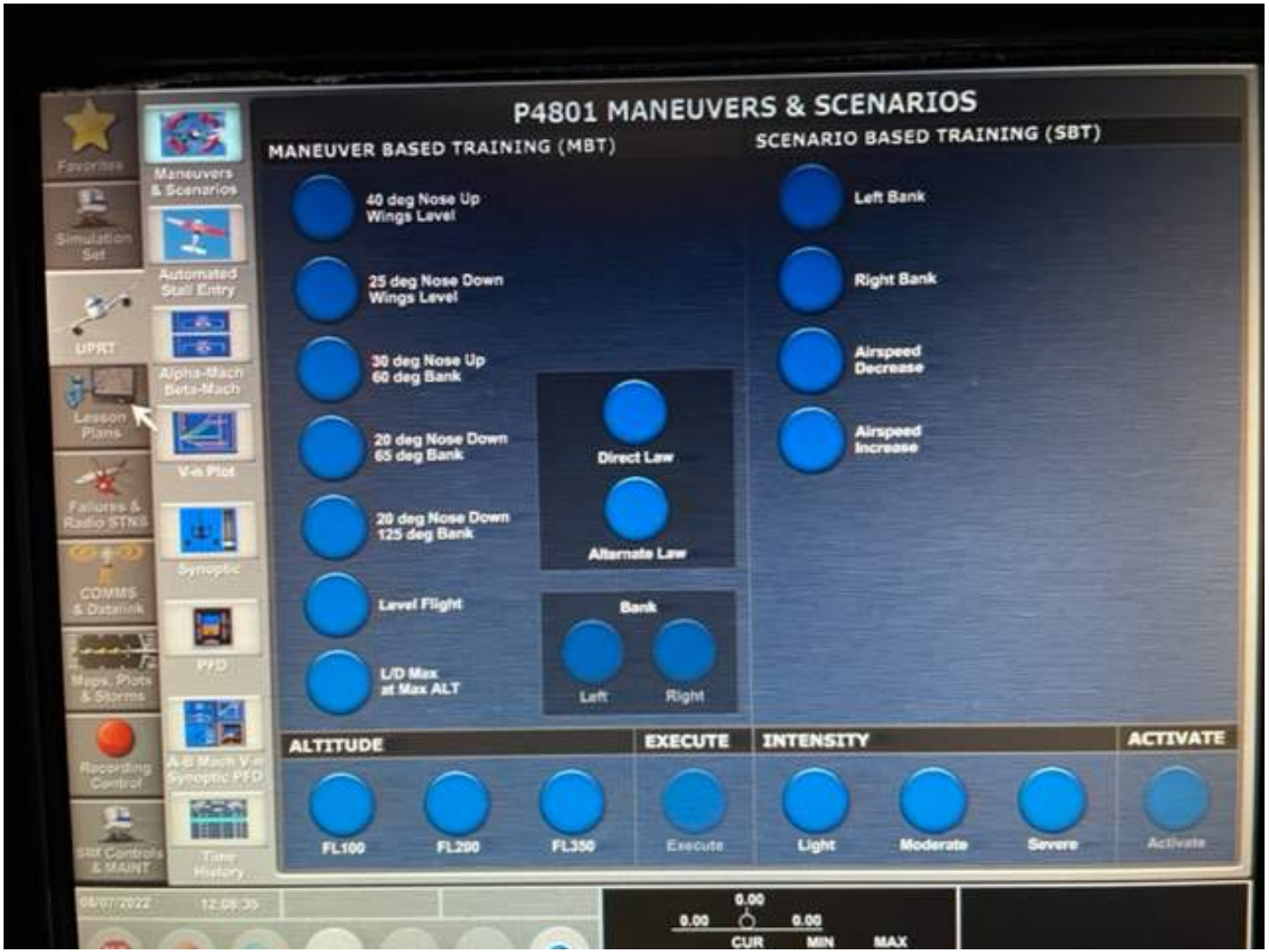
IOS: Upset Scenario



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IOS: Composite Feed-Back

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Airbus ATO Policy

IOS feedback mechanism in real time
Aerodynamics model
Motion system

Stall event limited to Approach-to-stall.

Mandatory

Upset scenarios

If not available -> ISI

Post-stall training only if qualified accordingly.Required an Extended FSTD Training Envelope

Mandatory to conduct full stall

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Instructor Training

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UPRT - Instructor Training

GM5 ORO.FC.220&230 Operator conversion training and checking & recurrent training and checking

PERSONNEL PROVIDING FSTD UPSET PREVENTION AND RECOVERY TRAINING (UPRT)

It is of paramount importance that personnel providing UPRT in FSTDs have the specific competence to deliver such training, which may not have been demonstrated during previous instructor qualification training. Operators should, therefore, have a comprehensive training and standardisation programme in place, and may need to provide FSTD instructors with additional training to ensure such instructors have and maintain complete knowledge and understanding of the UPRT operating environment, and skill sets.

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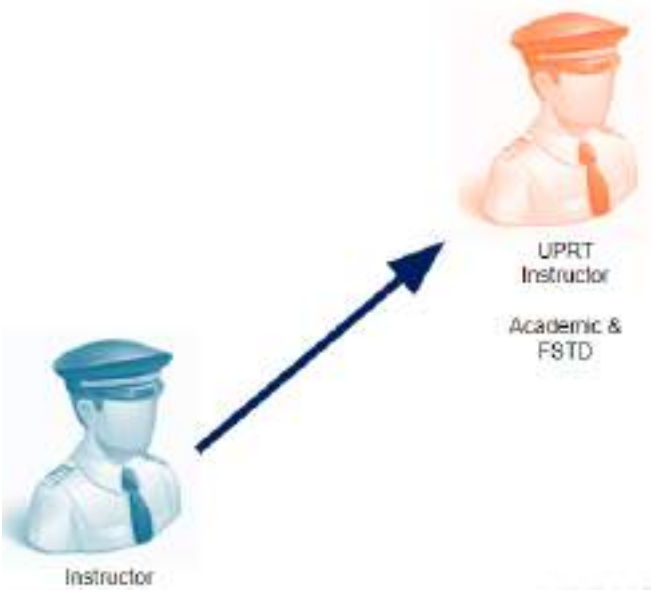
UPRT - Instructor Training

UPRT instructor training elements	*UPRT academic instructor*	*UPRT FSTD instructor*
Comprehensive knowledge of all applicable training elements (refer to Table 2-1)*	•	•
Training platforms (aeroplanes and devices)		
1)limitations of training platform		•
2)operation of IOS and debriefing tools		•
Review of LOC-I accidents/incidents	•	•
Energy management factors*	•	•
Disorientation	•	•
Workload management	•	•
Distraction	•	•
OEM recommendations*	•	•*
UPRT recognition and recovery strategies*	•	•
Recognition of trainee errors	•	•
Intervention strategies		
Aeroplane type - specific characteristics*	•	•
Operating environment	•	•
How to induce the startle factor		•
Value and benefits of demonstration	•	•
How to assess pilot performance using core competencies if conducting CBT (refer to the appendix)	•	•

* OEMs may at some point develop differing guidance regarding procedures to address these areas of training which may deviate from the material provided herein. In all cases, whenever type-specific UPRT is being conducted, training organizations should provide procedural training which conforms to the appropriate aeroplane flight manual.



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Instructor Training - Objectives

(vi) UPRT

Instructors should have the specific competence to provide UPRT during the type rating training course, including the ability to demonstrate knowledge and understanding of the type-specific upset recovery procedures and of the recommendations that are developed by the original equipment manufacturers (OEMs). Therefore, during the TRI training course, the student instructor should:

(A) be able to apply the correct upset recovery techniques for the specific aeroplane type;

(B) understand the importance of applying type-specific OEM procedures for recovery manoeuvres;

(C) be able to distinguish between the applicable SOPs and OEM recommendations (if available);

(D) understand the capabilities and limitations of the FSTDs that are used for UPRT;

(E) ensure that the training remains within the FSTD training envelope to avoid the risk of negative transfer of training;

(F) understand and be able to use the IOS of the FSTD in the context of providing effective UPRT;

(G) understand and be able to use the available FSTD instructor tools to provide accurate feedback on pilot performance;

(H) understand the importance of adhering to the FSTD UPRT scenarios that are validated by the training programme developer; and

(I) understand the missing critical human factor aspects due to the limitations of the FSTD, and convey this to the student pilot(s) receiving the training.

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Airbus Recommendations

- The **principles** of flight applicable to UPRT:
  - Influence of the Angle of Attack (AOA), critical AOA
  - Lift/drag ratio, speed stability zone of the thrust curve
  - Factors affecting the critical angle of attack that includes the Mach effect
  - Static and dynamic stability, pilot-induced oscillations
  - High speed flight, critical Mach number.
- The **capabilities and limitations** of the FSTD
- The **missing critical human factor aspects** due to the limitations of the FSTD.

UPRT - Airbus Stand-Alone Instructor Course

Pre-requisites:

- UPRT theoretical training for pilots successfully completed
- UPRT FFS session for pilots successfully completed

Ground phase:

1 day ground training:

- ✓ ½ day e-training
- ✓ ½ day classroom training

The ground training is a combination of a self-study course, classroom lecture & facilitator-led discussions.

Simulator phase:

1 day practical training:

- ✓ 1 FFS session: conduct a UPRT FFS session under supervision

Session briefing under supervision, with tutorials, followed by the FFS session under supervision & supervised de-briefing.

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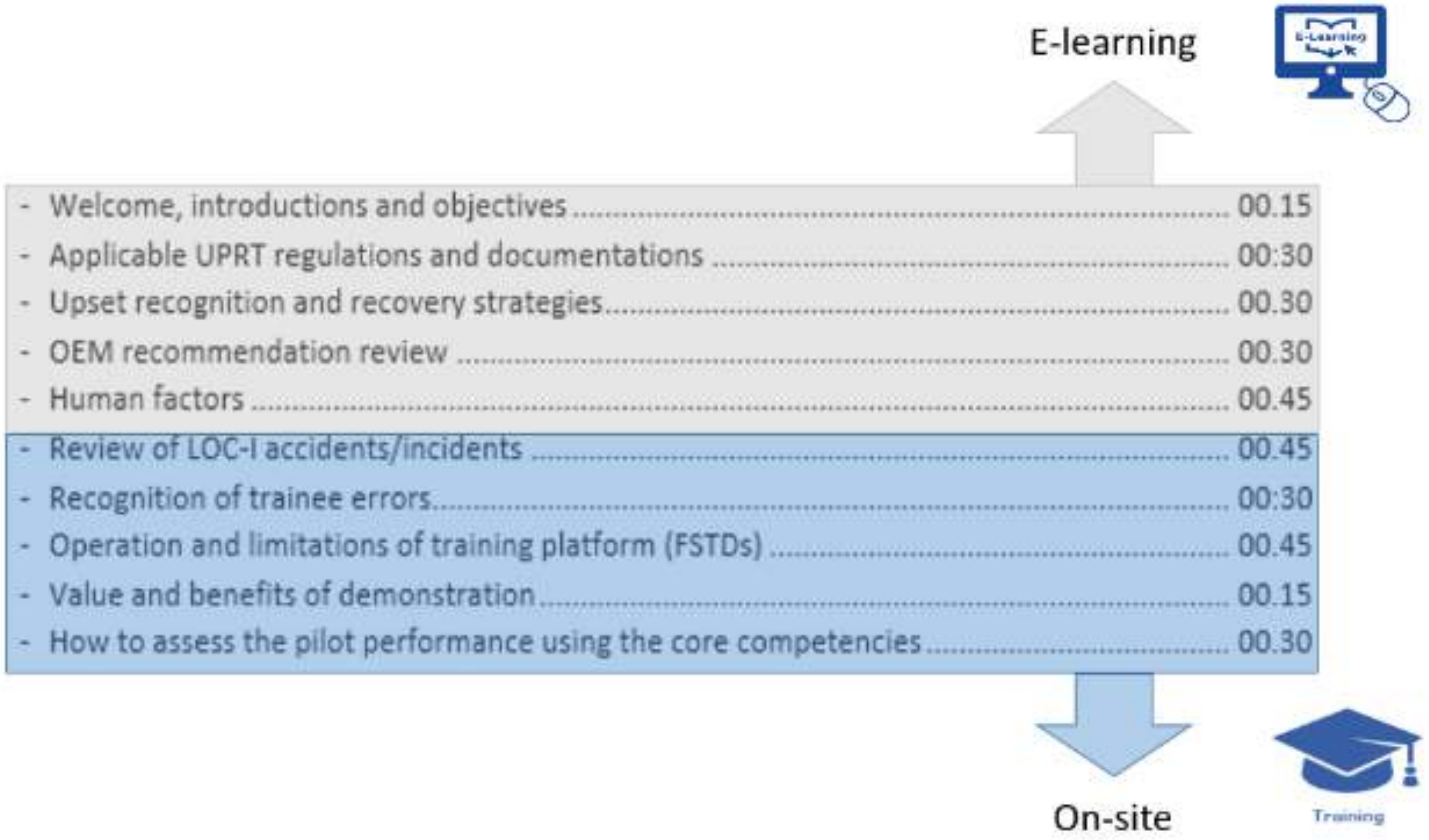
UPRT – Instructor Theoretical Training



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UPRT – Instructor Practical Training

Simulator phase: customer UPRT training under supervision.

- Session 1 (for 2 candidates)
  - Introduction by the UPRT tutor 00.20
  - Session briefing by one instructor candidate 01.00
  - FFS session (customer training under supervision) 04.00
  - Debriefing by one instructor candidate* using debriefing station 01.00
  - General debriefing by the UPRT tutor, questions and answers 00.30

* The instructor candidate that has not briefed the session.

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Implementation

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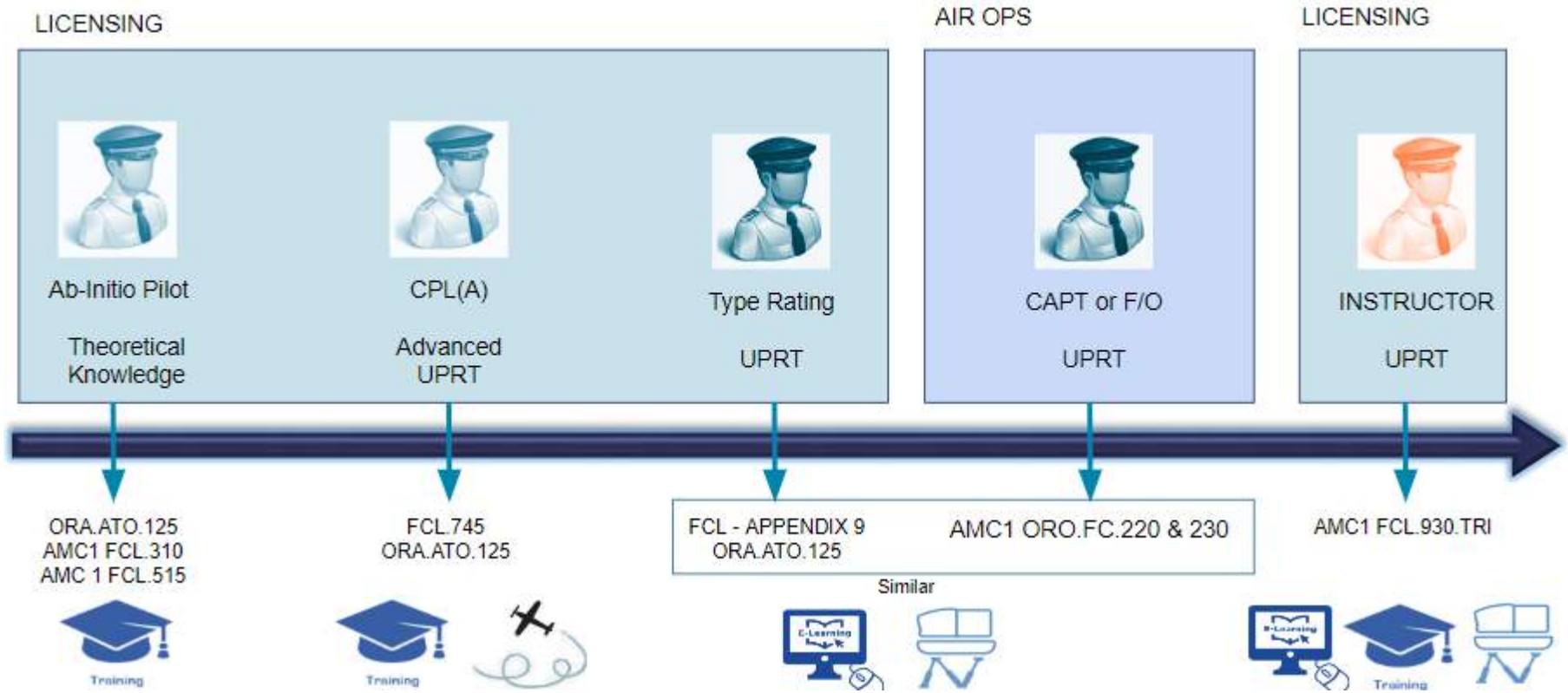
EASA – UPRT Implementation Overview



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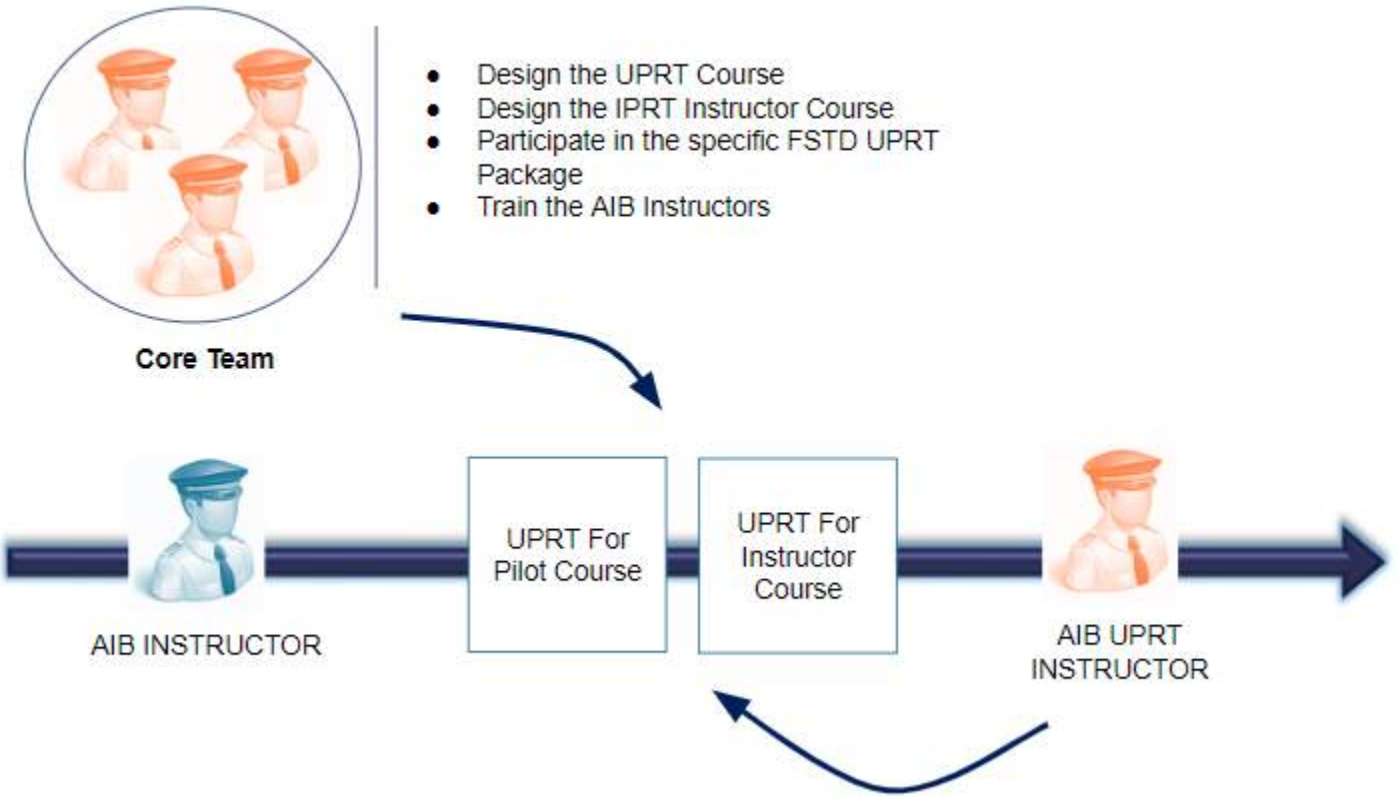
Airbus ATO – UPRT Implementation



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Additional Documentation

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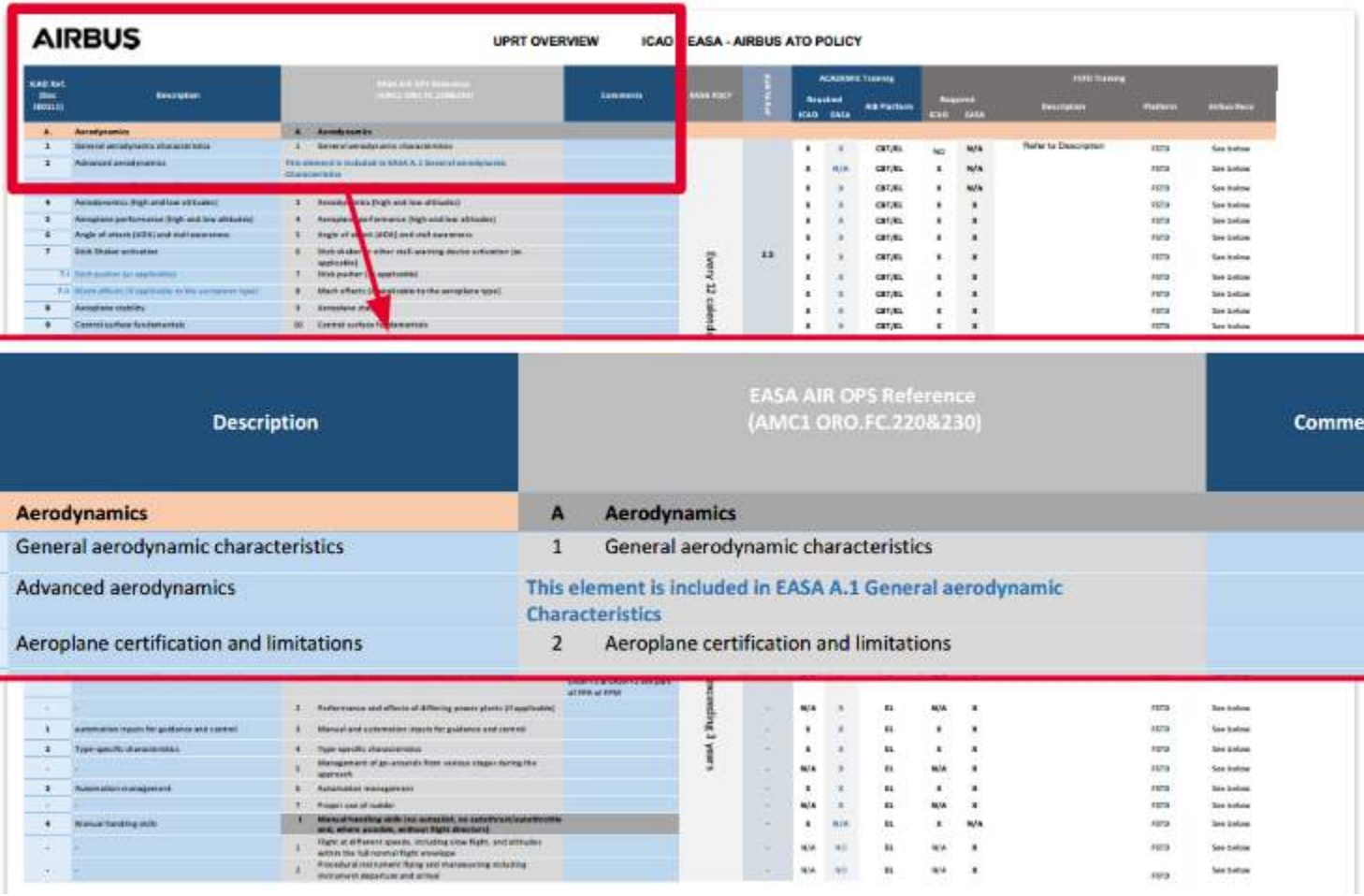
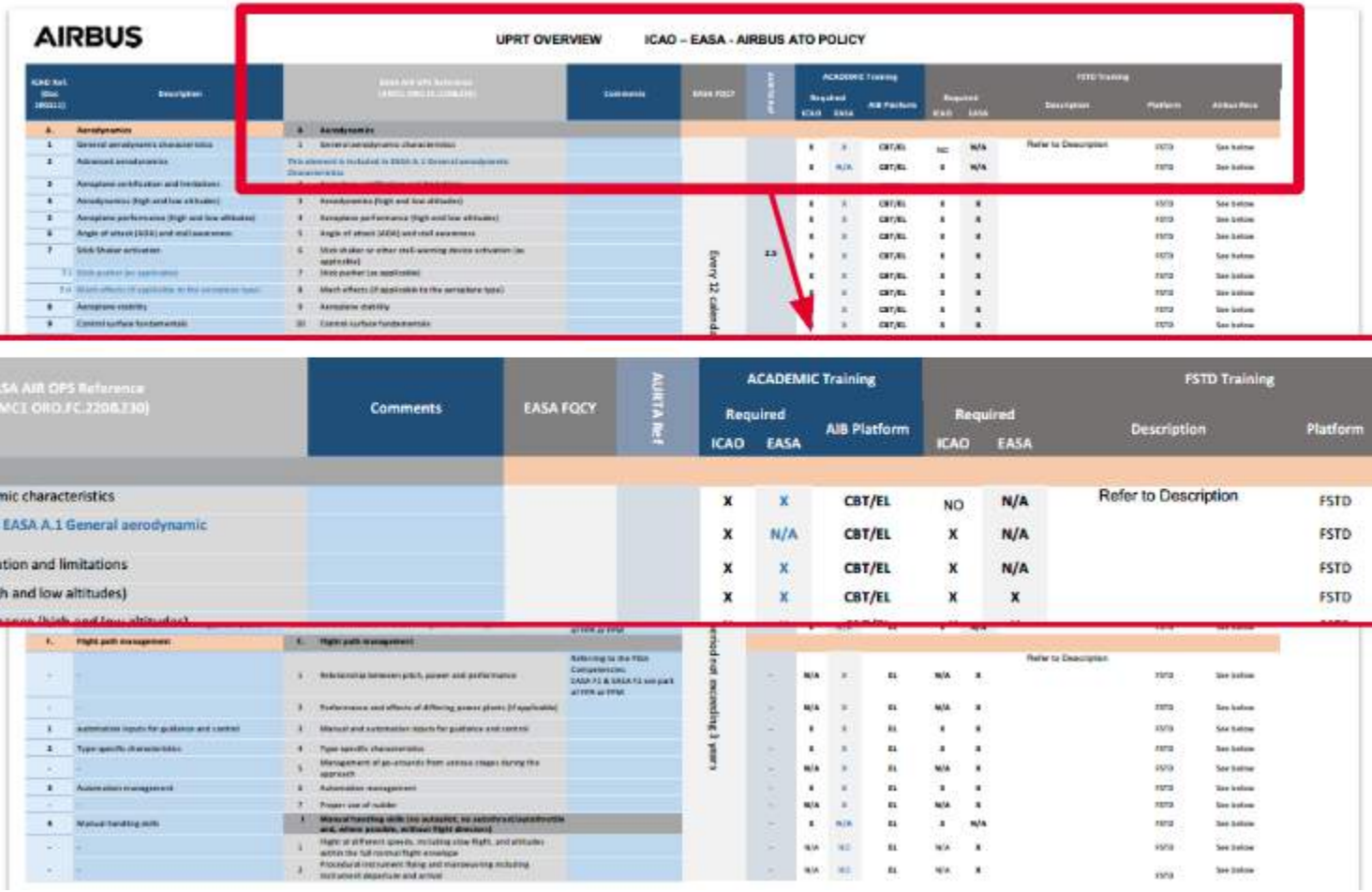
UPRT OVERVIEW ICAO – EASA - AIRBUS ATO POLICY

ICAO Ref. (Doc 10011)	Description	EASA AIR OPS Reference (AMC1 ORO.FC.220&230)		Comments	EASA FQCV	AMC1 FCL.930	ACADEMIC Training			FSTD Training				
							Required ICAO	Required EASA	AIB Platform	Required ICAO	Required EASA	Description	Platform	Airbus Reco
A.	**Aerodynamics**	A	**Aerodynamics**											
1	General aerodynamic characteristics	1	General aerodynamic characteristics		Every 12 calendar months, such that all the elements are covered over a period not exceeding 3 years		X	X	CBT/EL	NO	N/A	Refer to Description	FSTD	See below
2	Advanced aerodynamics	This element is included in EASA A.1 General aerodynamic Characteristics					X	N/A	CBT/EL	X	N/A		FSTD	See below
3	Aeroplane certification and limitations	2	Aeroplane certification and limitations				X	X	CBT/EL	X	N/A		FSTD	See below
4	Aerodynamics (high and low altitudes)	3	Aerodynamics (high and low altitudes)				X	X	CBT/EL	X	X		FSTD	See below
5	Aeroplane performance (high and low altitudes)	4	Aeroplane performance (high and low altitudes)				X	X	CBT/EL	X	X		FSTD	See below
6	Angle of attack (AOA) and stall awareness	5	Angle of attack (AOA) and stall awareness				X	X	CBT/EL	X	X		FSTD	See below
7	Stick Shaker activation	6	Stick shaker or other stall-warning device activation (as applicable)			2.5	X	X	CBT/EL	X	X		FSTD	See below
7.1	Stick pusher (as applicable)	7	Stick pusher (as applicable)				X	X	CBT/EL	X	X		FSTD	See below
7.2	Mach effects (if applicable to the aeroplane type)	8	Mach effects (if applicable to the aeroplane type)				X	X	CBT/EL	X	X		FSTD	See below
8	Aeroplane stability	9	Aeroplane stability				X	X	CBT/EL	X	X		FSTD	See below
9	Control surface fundamentals	10	Control surface fundamentals				X	X	CBT/EL	X	X		FSTD	See below
9.1	Use of trims	11	Use of trims				X	X	CBT/EL	X	X		FSTD	See below
10	Icing and contamination effects	12	Icing and contamination effects					X	CBT/EL		X		FSTD	See below
11	Propeller slipstream (as applicable)	13	Propeller slipstream (as applicable)			-	X	X	CBT/EL	X	X		FSTD	See below
B.	**Causes of and contributing factors to upsets**	B	**Causes of and contributing factors to upsets**											
1	Environmental	1	Environmental				X	X	EL	X	N/A	Refer to Description	FSTD	See below
2	Pilot-induced	2	Pilot-induced			2.4	X	X	EL	X	N/A		FSTD	See below
3	Mechanical (aeroplane systems)	3	Mechanical (aeroplane systems)				X	X	EL	X	N/A		FSTD	See below
C.	**Safety review of accidents and incidents relating to aeroplane upsets**	C	**Safety review of accidents and incidents relating to aeroplane upsets**				X	N/A	EL	X	N/A			
		1	Safety review of accidents and incidents relating to aeroplane upsets				N/A	X	EL	N/A	N/A	Refer to Description	FSTD	See below
D.	**G-Awareness**	D	**g-load awareness and management**											
1	Positive/negative/increasing/decreasing g-loads	1	Positive/negative/increasing/decreasing g-loads				X	X	EL	X	X	Refer to Description	FSTD*	See below
2	Lateral g awareness (sideslip)	2	Lateral g awareness (sideslip)			2.5.3 & 2.6.2.2	X	X	EL	X	X		FSTD*	See below
3	g-load management	3	g-load management				X	X	EL	X	X		FSTD*	See below
E.	**Energy management**	E.	**Energy management**											
1	Kinetic energy vs potential energy vs chemical energy (power)	1	Kinetic energy vs potential energy vs chemical energy (power)	Referring to the Pilot Competencies: ICAO E1 is part of SAW ICAO E2 & ICAO E3 are part of FPA or FPM			X	X	EL	X	X	Refer to Description	FSTD	See below
2	Relationship between pitch, power and performance	This element is included in EASA F. Flight Path Management				2.5.2	X	N/A	EL	X	N/A		FSTD	See below
3	Performance and effects of differing power plants	This element is included in EASA F. Flight Path Management					X	N/A	EL	X	N/A		FSTD	See below
F.	**Flight path management**	F.	**Flight path management**											
-	-	1	Relationship between pitch, power and performance	Referring to the Pilot Competencies: EASA F1 & EASA F2 are part of FPA or FPM		-	N/A	X	EL	N/A	X	Refer to Description	FSTD	See below
-	-	2	Performance and effects of differing power plants (if applicable)			-	N/A	X	EL	N/A	X		FSTD	See below
1	automation inputs for guidance and control	3	Manual and automation inputs for guidance and control			-	X	X	EL	X	X		FSTD	See below
2	Type-specific characteristics	4	Type-specific characteristics			-	X	X	EL	X	X		FSTD	See below
-	-	5	Management of go-arounds from various stages during the approach			-	N/A	X	EL	N/A	X		FSTD	See below
3	Automation management	6	Automation management			-	X	X	EL	X	X		FSTD	See below
-	-	7	Proper use of rudder			-	N/A	X	EL	N/A	X		FSTD	See below
4	Manual handling skills	I	**Manual handling skills (no autopilot, no autothrust/autothrottle and, where possible, without flight directors)**			-	X	N/A	EL	X	N/A		FSTD	See below
-	-	1	Flight at different speeds, including slow flight, and altitudes within the full normal flight envelope			-	N/A	NO	EL	N/A	X		FSTD	See below
-	-	2	Procedural instrument flying and manoeuvring including instrument departure and arrival			-	N/A	NO	EL	N/A	X		FSTD	See below



ICAO Ref. (Doc 100111)	Description	EASA AIR OPS Reference (AMC1 ORO.FC.220&230)		Comments
A.	**Aerodynamics**	**A**	**Aerodynamics**	
1	General aerodynamic characteristics	1	General aerodynamic characteristics	
2	Advanced aerodynamics	**This element is included in EASA A.1 General aerodynamic Characteristics**		
3	Aeroplane certification and limitations	2	Aeroplane certification and limitations	



EASA AIR OPS Reference (AMC1 ORO.FC.220&230)	Comments	EASA FQCY	AUR TA Ref	ACADEMIC Training Required ICAO	ACADEMIC Training Required EASA	AIB Platform	FSTD Training Required ICAO	FSTD Training Required EASA	Description	Platform	Airbus Reco
A Aerodynamics											
1 General aerodynamic characteristics				X	X	CBT/EL	NO	N/A	Refer to Description	FSTD	See below
This element is included in EASA A.1 General aerodynamic Characteristics				X	N/A	CBT/EL	X	N/A		FSTD	See below
2 Aeroplane certification and limitations				X	X	CBT/EL	X	N/A		FSTD	See below
3 Aerodynamics (high and low altitudes)				X	X	CBT/EL	X	X		FSTD	See below

ICAO Training element	Description	Example of Airbus scenario elements
A. Aerodynamics	Trainees should be knowledgeable about aerodynamic effects at both high and low altitudes. The FSTD training should be accomplished at both high altitude (within 1 500 m [5 000 ft] of the service ceiling of the aeroplane) and at low altitude (below 3 000 m [10 000 ft] above mean sea level) to reinforce the academic training described in 3.2. High-altitude training should be conducted at normal operational cruise altitudes. Trainees should also be trained with respect to the handling effects of operating at low speeds and high Mach, including: i) demonstration of Mach tuck and Mach buffet (if applicable to the aeroplane type); ii) understanding of the change in aeroplane stability at high altitude; iii) recognition of high speed/Mach buffet (as applicable to the aeroplane type) and low speed buffet; iv) the altitude necessary to effectively recover from a stall event at high altitudes; and v) awareness of control surface effectiveness at low and high speeds. Trainees should apply their aerodynamic knowledge by including the following in FSTD training: i) practice in manoeuvring the simulated aeroplane at high altitude at various speeds and automation levels — the pilot will apply the aerodynamic principles acquired in the academic training to prevent an upset; ii) trainees should be aware of the AOA from available data shown on the flight deck and demonstrate the use of those data to prevent an upset or recover from one; iii) practice of speed controlled by elevator inputs or speed controlled by thrust, and understanding of aeroplane energy	A1: Relation pitch, AOA, flight path. Aircraft flight envelope exploration. A2: PFD limitations reminder (speed, pitch, bank) A3: Aircraft maneuvering capability at same calibrated airspeed at low and hi altitude A4: Acceleration capability at low and high altitude, backside of power curve at recommended max altitude. A5: Angle of Attack awareness at different calibrated airspeed A6: Approach to stall at low and high altitude A7: Not applicable on Airbus types A8: High-speed buffet (Mach effect) at high altitude following a sudden increase of AOA from cruise AOA. A9: Aircraft stability in pitch and roll in normal law. Static stability when out of normal envelope A10: Observation of turn coordination and yaw damping in normal law A11: Use of pitch trim in direct law (direct law demonstration or during a failure leading to direct law) A12: Effect of icing on engines/airframe (limited effect of airframe icing – FSTD effect to be checked) A13: Not applicable. Theoretical Content: At least the content from AUPRTA (AURTA REV 3) chapter 6.4
	To fully understand the concepts discussed in academic training, trainees should be trained in the following: i) acceleration between two speeds of which the aeroplane is capable at low, medium and high altitude (e.g. 200–250 KIAS at low altitude, medium and high altitude with corresponding Mach numbers at high altitude);	Theoretical Content: At least the content from AUPRTA (AURTA REV 3) chapter 6.1, 6.2 and 6.3

ICAO Training element	Description	Example of Airbus scenario elements
A. Aerodynamics	Trainees should be knowledgeable about aerodynamic effects at both high and low altitudes. The FSTD training should be accomplished at both high altitude (within 1 500 m [5 000 ft] of the service ceiling of the aeroplane) and at low altitude (below 3 000 m [10 000 ft] above mean sea level) to reinforce the academic training described in 3.2. High-altitude training should be conducted at normal operational cruise altitudes. Trainees should also be trained with respect to the handling effects of operating at low speeds and high Mach, including: i) demonstration of Mach tuck and Mach buffet (if applicable to the aeroplane type); ii) understanding of the change in aeroplane stability at high altitude; iii) recognition of high speed/Mach buffet (as applicable to the aeroplane type) and low speed buffet; iv) the altitude necessary to effectively recover from a stall event at high altitudes; and v) awareness of control surface effectiveness at low and high speeds. Trainees should apply their aerodynamic knowledge by including the following in FSTD training: i) practice in manoeuvring the simulated aeroplane at high altitude at various speeds and automation levels — the pilot will apply the aerodynamic principles acquired in the academic training to prevent an upset; ii) trainees should be aware of the AOA from available data shown on the flight deck and demonstrate the use of those data to prevent an upset or recover from one; iii) practice of speed controlled by elevator inputs or speed controlled by thrust, and understanding of aeroplane energy	A1: Relation pitch, AOA, flight path. Aircraft flight envelope exploration. A2: PFD limitations reminder (speed, pitch, bank) A3: Aircraft maneuvering capability at same calibrated airspeed at low and hi altitude A4: Acceleration capability at low and high altitude, backside of power curve at recommended max altitude. A5: Angle of Attack awareness at different calibrated airspeed A6: Approach to stall at low and high altitude A7: Not applicable on Airbus types A8: High-speed buffet (Mach effect) at high altitude following a sudden increase of AOA from cruise AOA. A9: Aircraft stability in pitch and roll in normal law. Static stability when out of normal envelope A10: Observation of turn coordination and yaw damping in normal law A11: Use of pitch trim in direct law (direct law demonstration or during a failure leading to direct law) A12: Effect of icing on engines/airframe (limited effect of airframe icing – FSTD effect to be checked) A13: Not applicable. Theoretical Content: At least the content from AUPRTA (AURTA REV 3) chapter 6.4

AIRBUS

Thank you