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AIRBUS

OPERATIONS TRAINING TRANSMISSION - OTT

TO: All A318,A319,A320,A321,A330,A340,A350,A380 Operators

SUBJECT: ATA 00 – Undesired Aircraft States - Training Recommendations

OUR REF.: 999.0092/18 Rev 00 dated 25-FEB-2019

APPLICABLE AIRCRAFT: This OTT is applicable to A318,A319,A320,A321,A330,A340,A350,A380

Notice: This OTT provides Operators with recommendations on training techniques or training programs. These training recommendations aim to enhance the efficiency or safety of operations. It is each Operator's responsibility to distribute the information contained in this OTT to ensure application of the training recommendations in the Operator's own training department or any training organization where their crews are trained.

1. INTRODUCTION

This OTT provides training recommendations about the prevention, the recognition and the recovery of Undesired Aircraft States. Operators and ATOs should consider these recommendations when they design their type rating and recurrent training programs.

This OTT cancels and replaces the following OTTs:

- Undesired Aircraft State – Training recommendations – Ref 999.0012/17 dated 10-FEB-2017
- Techniques for Recovery from aircraft upset – FSTD scenarios for Upset Recovery Training Ref 999.0077/16 dated 20-JUN-2016
- Use of FSTDs for Upset Recovery Training – Ref 999.0028/15 dated 10-MAR-2015.

Note: The content of this OTT is also included in the A320 Flight Crew Training Standards (FCTS) manual. As a result, the A320 FCTS is updated and the most recent version (1.1 at the date of publication of the OTT) is available on AirbusWorld. The A330, A340, A350, and A380 FCTS manuals that will be published in the coming months will include the content of this OTT.

2. GENERAL INFORMATION

2.1 DEFINITION

An Undesired Aircraft State is characterized by unintentional divergence from parameters normally experienced during operations.

Undesired aircraft states include, among others:

- Significant deviation from the intended flight path
- Significant deviation from the intended speed with or without normal flight envelope exceedance
- Excessive nose high or nose low attitudes, with or without excessive bank angles
- Excessive AOA / Stall.

Note: Recommendations for the training of unreliable airspeed indication are published in a separate OTT and FCTS chapter.

2.2 CONTENT

This OTT provides recommendations for pilot training on different undesired aircraft states. It includes some ready-made exercises that address aircraft energy management, flight path management, and system malfunctions management for the prevention and the recognition of developing undesired aircraft states. In addition, this chapter provides exercises related to recovery techniques from developed undesired aircraft states.

2.3 REGULATORY REFERENCES AND GUIDANCE MATERIALS

The content of this OTT is based on the following documents:

- The ICAO DOC 10011 “Manual on airplane upset prevention and recovery training”
- The IATA Guidance Material and Best Practices for the Implementation of Upset Prevention and Recovery Training
- The Airplane Upset Prevention and Recovery Training Aid (AUPRTA) Rev 3
- The EASA Executive Director Decision n° 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
- The FAA 14 CFR part 121 (§121.423) with Advisory Circulars (AC) 120-109A and 120-111.

3. TRAINING CONCEPT

3.1 TRAINING STRUCTURE

Pilot training should take into account three aspects of an undesired aircraft state: Prevention, recognition, and recovery.

The first part of the training should be dedicated to the **prevention** of the undesired aircraft state. The pilots should be able to identify the situations where an undesired aircraft state may develop. The competency focus should be on “Situation Awareness” (SA) and “Knowledge”.

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The second part of the training should be dedicated to the **recognition** of the undesired aircraft state. The pilots should be able to early identify an undesired aircraft state when prevention fails.

The third part of the training should be dedicated to the **recovery** from a developed undesired aircraft state. When the flight crew recognizes an undesired aircraft state, the flight crew should be able to apply the correct procedure or technique to exit the undesired aircraft state. The competency focus should be on “Flight Path Management – Manual Control” (FPM) and on “Flight Path Management – Automation” (FPA).

3.2 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.

3.3 CREDITS BETWEEN AIRBUS A3XX FBW TYPES

Credits can be granted in accordance with the published Operational Suitability Data – Flight Crew (OSD-FC).

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3.4 UNDERPINNING KNOWLEDGE

To support the acquisition of competencies to prevent, recognize and recover undesired aircraft states, the following pilot knowledge should be consolidated:

- Elements of aerodynamics. The pilots should be particularly aware of the flight envelope of the aircraft, in order to be able to keep the aircraft within the limits, and to recognize when the aircraft is reaching these limits.
- 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. The flight crew should understand the acceleration and deceleration capabilities of the aircraft depending on the altitude.
- Automated and manual flight path management that includes:
  - The control and display systems (EFIS & ECAM). The flight crew should be able to understand the indications that appear on the display units and their trend over time in order to anticipate the flying conditions.
  - The flight control systems that include flight control laws and protections.
  - The auto-flight system (Autopilot (AP), Flight Directors (FD) and Autothrust (A/THR)). The flight crew should know how to use the auto-flight system, its availability and its limits. The flight crew should review how to engage and disengage AP, FD, and A/THR.
  - The takeover techniques both from the automation and between pilots.

- 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.

4. TRAINING ITEMS

The practical training related to undesired aircraft states should include both of the following items:

- 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.).
- 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”).

5. TRAINING MEDIA

5.1 QUALIFIED FSTD

The FSTD used for the undesired aircraft states prevention and recovery training should:

- Be qualified in accordance with the most recent NAA FSTD requirements for UPRT training
- Enable the achievement of the training objectives without negative learning.

Specifically:

- Operators and ATOs under EASA regulations or mandated to comply with EASA regulations should refer to the CS-FSTD (issue 2 at the date of publication of this recommendation).
- Operators and ATOs under FAA regulations or mandated to comply with FAA regulations should refer to the FAA Part 60 (change 2 at the date of publication of this recommendation).

5.2 FSTD TRAINING ENVELOPE

Each FSTD has a training envelope. Outside its training envelope, there is a low confidence that the FSTD will respond in a similar way as the aircraft. Training outside the training envelope should be avoided since it may induce negative learning. Course designers should therefore ensure that the exercises they intend to suggest do not, by design, bring the FSTD outside of its training envelope. Instructors should also be aware of these FSTD limitations.

The exercises proposed in this OTT aim, among other things, to reduce the probability of reaching the limits of the FSTD training envelope.

5.3 UNUSUAL ATTITUDE TRAINING

To avoid negative learning, Airbus recommends that trainees do not fly the entry profile of a nose high or nose low upset, with or without excessive bank angle.

Therefore, one of the two following options are recommended:

- To perform In-Seat Instruction (ISI): The instructor takes a pilot seat and flies the entry profile before transferring the controls to the trainee, or,
- To use validated IOS functions as described in appendix 1.

5.4 STALL RECOVERY TRAINING

As a rule, stall training should focus on criteria for the identification of a stall, and recovery **at first indication of a stall** (stall warnings or stall buffet whichever occurs first). However, Operators and ATOs may decide to implement full stall training (i.e. beyond the critical angle of attack), particularly when their National Aviation Authority mandates to do so.

In terms of full stall training, Airbus still believes that any requirement for the trainee to perform a hands-on stall entry carries the risk of negative learning by developing bad habit patterns deliberately flying beyond the stall warning. Airbus remains also concerned that there is undue exposure to the risks of non-standardized stall training unless model-specific stall training is developed.

Because of these concerns, Airbus developed a training product that includes both new simulation models (initially for A3XX FBW types) and new Instructor Operating Station (IOS) functionalities called Automatic Stall Entry (ASE) and Roll-Off Function (ROF) to be integrated by training device manufacturers. For more information about this training product, refer to appendix 1.

5.5 IOS FEEDBACK FUNCTIONS

For both unusual attitude and stall training, instructors and trainees need simulator feedback functions to:

- Develop pilot awareness regarding flight parameters during developing and developed undesired aircraft states (including speed, g-load and AOA)
- Ensure that appropriate flight control inputs are applied during undesired aircraft state recoveries
- Ensure that the FSTD remains in its training envelope.

For more information on recommended IOS functions, refer to appendix 2.

5.6 USE OF MOTION

For unusual attitude training, Airbus recommends that the exercises are performed without the use of any motion system (unless otherwise specified) if there is a risk to go beyond the FSTD flight envelope. FSTD motion cues may be different from the motion cues perceived in the aircraft and this can result in negative learning. In addition, the FSTD “crash conditions” should be checked and the “crash inhibit” function should be activated if there is a risk of simulator freeze during the exercise.

5.7 ALTERNATE AND DIRECT LAW

Most unusual attitude and stall training require the aircraft to be in alternate or direct law. Airbus recommendations on how to correctly obtain alternate and direct law in an FSTD are provided in appendix 3.

6. TRAINING CONDITIONS

The proposed exercises should be run in the following conditions:

- Aircraft configuration:
  - Weight: Maximum Landing Weight (MLW)
  - CG: Mid CG.
- Weather:

- VMC and IMC (IMC at night should be preferred as being the worst case)
- No turbulence unless otherwise specified in recommended exercises.

- Altitude:
  - Low altitude definition: When an exercise or a maneuver is specified at low altitude, the aircraft should be flown between FL 100 and FL 150.
  - High altitude definition: When an exercise or a maneuver is specified at high altitude, the aircraft should be flown between FL 350 or FMS optimum flight level (whichever the higher) and the recommended max altitude.

7. TRAINING EXERCISES

The tables here below provide the recommended exercises related to undesired aircraft states prevention, recognition and recovery. (M) (S) and (D) in the column "EXERCISE" indicates the recommended teaching techniques as described in the chapter 8.2 "Teaching Recommendations".

7.1 MANUAL AND AUTOMATIC FLIGHT

Note: Head-Up Display (HUD), if installed, should be used for the following exercises.

EXERCISE	AIM	DESCRIPTION
Manual flight in normal, alternate, and direct law at low altitude. (M)	To reinforce pitch and thrust flying. To highlight flight control law characteristics including protections.	Instructor position: At the instructor station. Event: Perform flight maneuvers in normal, alternate and direct law (turn, climb, descent and go-around) with Autopilot (AP) OFF, Flight Directors (FD) OFF and Autothrust (A/THR) OFF. Set the Flight Path Vector (FPV) ON. Demonstrate normal and alternate law protections.
Manual flight in normal law at high altitude. (M)	To develop awareness of aircraft behavior near to the recommended max altitude. To highlight the importance of pitch	Instructor position: At the instructor station. Event: Adjust the aircraft weight that results in a recommended maximum altitude (REC MAX) at 2000 ft below the aircraft certified ceiling. Position the aircraft at a flight level close to this REC MAX FL and at a Mach number corresponding to the cost index. Normal law. Normal operations.

EXERCISE	AIM	DESCRIPTION
	and thrust awareness.	Set AP, FD and A/THR OFF. Set the FPV ON. Remind the flight crew that a loss of automation at high altitude may be uncommon and that minimal inputs are required to maintain the safe flight path in such a case. Perform flight maneuvers: Turn with bank angles up to 20°, perform flight level changes of 1000 ft, in climb and descent. Highlight the relationship between pitch variation and resulting vertical speed. Observe V alpha max and V alpha protection indications. Observe how the aircraft behaves at high altitude compared to how the aircraft behaves at low altitude.
Manual flight in alternate law at high altitude. (M)	To develop awareness of aircraft behavior near to the recommended max altitude.	Instructor position: At the instructor station. Event: Adjust the aircraft weight that results in a recommended maximum altitude (REC MAX) at 2000 ft below the aircraft certified ceiling. Position the aircraft at a flight level close to this REC MAX FL and at a Mach number corresponding to the cost index. Normal law. Normal operations. Set AP, FD and A/THR OFF. Set the FPV ON. Activate the alternate law. Perform flight maneuvers in alternate law as described above for the normal law. Observe V Stall Warning (VSW) indications.
Management of the auto-flight system in normal law at any altitude. (M)	To reinforce the appropriate method for engagement and disengagement of the auto-flight system. To review the effects of auto-flight system	Instructor position: At the instructor station. Event: Review of AP/FD and A/THR engagement and disengagement. Review of AP failure effects. Review of A/THR failure effects (including THR LK).

EXERCISE	AIM	DESCRIPTION
	failures.	Note: No specific altitude.

7.2 ENERGY MANAGEMENT

Note: Head-Up Display (HUD), if installed, should be used for the following exercises.

EXERCISE	AIM	DESCRIPTION
Energy management at low altitude. (M + S)	To develop awareness of acceleration and deceleration capability of the aircraft at low altitude.	Instructor position: At the instructor station. Event: Review of available engine thrust. Acceleration from VLS to VMO. Deceleration from VMO to VLS, with and without speed brakes effect.
Energy management at high altitude. (M + S)	To develop awareness of acceleration and deceleration capability of the aircraft at high altitude.	Instructor position: At the instructor station. Event: Point out the thrust required to maintain the flight level and the limited additional thrust available at MCT or TOGA. Deceleration to VLS then tentative of acceleration in level flight. Need for energy trading (descent) to recover a normal speed. Effect of speed brakes at high altitude (reduction of speed margin between VLS and VMO/MMO).

7.3 UNUSUAL AIRCRAFT ATTITUDE

Note: Head-Up Display (HUD), if installed, should NOT be used for the following exercises. Reversion to PFD is actually recommended for unusual attitude recoveries.

EXERCISE	AIM	DESCRIPTION
Unusual aircraft attitude at low altitude. Nose high. D + (M or S)	To be able to recognize an unusual aircraft attitude and to apply appropriately the “Nose High” recovery technique.	Set FFS motion to OFF. Set AP OFF, FD OFF, and A/THR OFF. Activate the alternate law. * **Option 1: With validated IOS upset function** (refer to appendix 1) Instructor position: At the instructor station. Event: Activate the IOS function “Nose Up +30° & Bank 60° (left or right)”. Ask the trainee to recognize the situation (visualization) then release the FFS for the recovery. * **Option 2: Without validated IOS upset function** Instructor position: In-seat instruction. Instructor initially as PF. Event: Speed: Alternate law max speed - 10 kt. Begin the exercise by smoothly pitching up to + 30° wings level. Passing + 20° of pitch, bank progressively to 70°. Ask the trainee to recognize the situation and apply the appropriate recovery technique.
Unusual aircraft attitude at low altitude.	To be able to recognize an unusual aircraft attitude and to appropriately apply the “Nose Low”	Set FFS motion to OFF. Set AP OFF, FD OFF, and A/THR OFF. Activate the alternate law. *

EXERCISE	AIM	DESCRIPTION
Nose low. D + (M or S)	recovery technique.	**Option 1: With validated IOS upset function** (refer to appendix 1) Instructor position: At the instructor station. Event: Activate the IOS function “Nose Down -20° & Bank 70° (left or right)”. Ask the trainee to recognize the situation (visualization) then release the FFS for the recovery. * **Option 2: Without validated IOS upset function** Instructor position: In-seat instruction. Instructor initially as PF. Event: Speed: Green dot + 10 kt. Begin the exercise by smoothly banking up to 70°. Passing 30° of bank, pitch progressively down to - 15°. Ask the trainee to recognize the situation and apply the recovery technique.
Unusual aircraft attitude at high altitude. Nose low. D + (M or S)	To be able to recognize an unusual aircraft attitude and to appropriately apply the recovery techniques.	Set **FFS motion to ON**. FFS motion should be ON in order to potentially feel the buffet associated with load factor during the recovery. Set AP OFF, FD OFF, and A/THR OFF. Activate the alternate law. * **Option 1: With validated IOS upset function** (refer to appendix 1) Instructor position: At the instructor station. Event: Activate the IOS function “Nose Down -20°& Bank 70° (left or right)”.

EXERCISE	AIM	DESCRIPTION
		Ask the trainee to recognize the situation then release the FFS for the recovery. * **Option 2: Without validated IOS upset function** Instructor position: In-seat instruction. Instructor initially as PF. Event: Begin the exercise by smoothly banking up to 70° while pitching down to -25°. Ask the trainee to recognize the situation and apply the appropriate recovery technique.

7.4 APPROACH TO STALL

Note: Head-Up Display (HUD), if installed, should not be used for the following exercises. Reversion to PFD is actually recommended for stall recoveries.

EXERCISE	AIM	DESCRIPTION
Approach to stall (impending stall) at low altitude. (M)	To be able to recognize the first indications of a stall situation and to correctly apply the stall recovery procedure.	Instructor position: At the instructor station. Event: FFS motion ON. Recommended configuration: Alternate law in clean configuration then in approach configuration in turn, then in landing configuration. Deceleration in level flight until recognition of stall indications and application of the recovery procedure.
Approach to stall (impending stall) at high altitude.	To be able to recognize the first indications of a stall situation and to correctly apply the	Instructor position: At the instructor station. Event: FFS motion ON. Light turbulence can be considered during this exercise so the trainees can identify the difference between turbulence effects and

EXERCISE	AIM	DESCRIPTION
(M)	stall recovery procedure.	stall buffet. Recommended configuration: In alternate law and in clean configuration. Recognition of first stall indications and application of the recovery procedure.

7.5 FULL STALL

If Operators or ATOs decide to implement full stall training, particularly when their Aviation Authorities mandate it, Airbus recommends to proceed as follows.

Note: Head-Up Display (HUD), if installed, should not be used for the following exercises. Reversion to PFD is actually recommended for stall recoveries.

EXERCISE	AIM	DESCRIPTION
Full stall at low altitude. (M)	To provide the pilots with the experience of the handling characteristics and dynamic cues (e.g., buffet, roll off) near and at full stall. To reinforce the proper application of the stall recovery procedure.	Set FFS motion to ON. Set AP OFF, FD OFF, and A/THR OFF. Activate the alternate or direct law (depending on the aircraft type and its configuration). * **Option 1: With ASE function** (refer to appendix 1) Instructor position: At the instructor station. Event: Perform a full stall demonstration (Use ASE “full stall demo” function) then a full stall exercise (Use ASE “full stall exercise” function), in one of the following configuration: clean, or approach configuration in turn, or in landing configuration. For the exercise, the roll-off function should be used randomly. *

EXERCISE	AIM	DESCRIPTION
		Option 2: Without ASE function Instructor position: In-seat instruction. Instructor initially as PF. Event: The instructor performs the aircraft configuration as per SOPs. Full stall exercise should be performed in one of the following configuration: Clean, or approach configuration in turn, or in landing configuration. When the aircraft is stabilized at VLS, the instructor, as PF, starts slowing down with a deceleration rate of 1 knot per second until established in deterrent buffet. At this point, the instructor hands over the aircraft to the trainee who performs the full stall recovery.
Full stall at high altitude. (M)		Same recommendations as above with aircraft in clean configuration and in alternate law.

7.6 EXERCISES MANDATED BY AVIATION AUTHORITIES

Beyond the exercises promoted by Airbus and detailed here above, some Aviation Authorities may mandate specific maneuvers classified as undesired aircraft states and for which the training could carry important risks of negative learning. The table here below provides recommendations regarding such exercises.

EXERCISE	AIM	DESCRIPTION
Bounced Landing. (M)	To apply the appropriate technique in case of high bounce at landing, as described in the	Instructor position: At the instructor station. Event: During a landing without malfunctions, the instructor announce “BOUNCE” at main landing gear touch down so for the crew to apply the technique related to

EXERCISE	AIM	DESCRIPTION
	FCTM. Part of FAA 14 CFR 121.123 requirements (Extended Envelope Training).	high bounce at touch down. Even if surprise can be part of the training, the instructor must clearly explain, before the training session, the expected reaction from the flight crew when the instructor announces “BOUNCE”. This is in order to avoid misunderstanding and negative learning.

8. EDUCATIONAL APPROACH

8.1 INSTRUCTOR COMPETENCIES

It is of significant importance that the instructors who provide undesired aircraft states prevention and recovery training in an FSTD have the specific competencies to provide this type of training. These specific competencies may not have been developed during previous instructor qualification training.

Instructors should particularly understand the capabilities and limitations of the FSTDs used for UPRT and that there may be the possibility of negative learning when there is training beyond the boundaries of the FSTD training envelope.

Operators and ATOs should therefore have a comprehensive training and standardization program in place.

The instructor theoretical training should particularly focus on all of the following aspects:

- 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 and how to provide this information to the flight crew who receive the training (Operators and ATOs

may refer to the IATA “Guidance Material and Best Practices for the Implementation of UPRT” chapter 9.3.4.).

8.2 TEACHING RECOMMENDATIONS

8.2.1 Demonstration

Some exercises are tagged “Demonstration (D)”, particularly for unusual attitude recovery. For these recovery exercises, instructors should lead and demonstrate the exercises from a pilot seat. These exercises should be maneuver-based with the assumption that prevention failed.

The instructor should:

- Carefully brief the exercise and highlight that prevention is voluntarily failed for the purpose of the exercise
- Fly into the unusual attitude and demonstrate the recovery technique
- Finally fly into the unusual attitude while the trainee is requested to stop their monitoring role by closing their eyes. In this position, the instructor transfers controls to the trainee.

8.2.2 Maneuvers

Each exercise tagged “Maneuver (M)” focuses on a single maneuver at a time, independently of any specific context. As a result, there is no need to trigger a specific event (e.g. failure, ATC order, or environmental phenomenon) to start the exercise. In this case, the instructor facilitates or explains the exercise to be performed.

8.2.3 Scenarios

The exercises tagged “Scenario (S)” should be embodied in a specific phase of a daily operational flight (e.g. departure and arrival in manual flight, cruise, etc.). In this case, the instructor triggers an event (e.g. failure, ATC order, environmental phenomenon) to start the exercises. This event causes the flight crew to discover with or without assistance how to achieve the exercises. Scenarios should be used after “D” or “M” exercises.

8.2.4 Surprise

Unanticipated scenario-based exercises should be performed during the flight crew training, in order to evaluate the flight crew’s capability to:

- Go through surprise
- Manage emotions subsequent to a startle effect
- Recognize the correct undesired aircraft state
- Correctly apply the recovery procedures or techniques.

Surprise should however be used with care not to impair the trainees confidence. Confidence is one of the two pillars of the resilience, the other being the competence. As a result, surprise should be used only when the proficiency has already be confirmed during maneuver or scenario-based training.

Best regards,

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9. APPENDIX 1: FSTD CAPABILITIES

9.1 UNUSUAL ATTITUDE RECOVERY

Some FSTDs may include predefined upset scenarios that Airbus did not evaluate. If such a predefined scenario results in an uncontrollable divergence that the flight crew is not able to immediately stop, Airbus does not recommend the use of such a scenario, because this may trigger negative learning.

Beyond the prescription of the paragraph 5.3, validated IOS functions related to unusual attitude recovery should meet the following specifications:

- Simulation should be frozen during the aircraft attitude setting
- The aircraft should be properly trimmed at the end of the attitude setting, to avoid undue accelerations at release
- The IOS should at least enable the following scenarios:
  - 1: Pitch = 40° nose up - Bank = 0°
  - 2: Pitch = 25° nose down - Bank = 0°
  - 3: Pitch = 30° nose up - Bank = 60° (right or left)
  - 4: Pitch = 20° nose down - Bank = 70° (right or left)
- These unusual attitude scenarios should be available for different flight levels: FL 050, FL 150 and FL 350* (*:for scenario 3 and 4 only).

9.2 STALL RECOVERY

9.2.1 General

Airbus has developed (initially for A3XX FBW types) a training product consisting of:

- New simulation models: Airbus has produced FSTD upgrades to be integrated by training device manufacturers. These upgrades contain enhanced aerodynamic models that provide total free play capabilities (including in the stall regime up to full stall).
- A new Instructor Operating Station (IOS) functionality called Automatic Stall Entry (ASE – See hereafter) designed by Airbus and to be integrated by training device manufacturers. This functionality provides standardized stall scenarios activation and also provides feedback to the instructor (plots on diagrams, flight controls positions….).

With this 2-piece product, Airbus defines a standardized training environment for UPRT-STALL. At the same time, by providing full stall functionality across the entire flight regime, it gives Operators and ATOs the flexibility to develop their own specific UPRT-STALL scenarios and

training program based on their regulatory requirements that would come on top of Airbus recommendations.

9.2.2 Automatic Stall Entry (ASE) Function

To prevent trainees to perform a hands-on stall entry, Airbus recommends the use of the Automatic Stall Entry Function (ASE). The objective of the ASE function is to enable the replication of a real Airbus aircraft stall without pilot intervention. ASE drives automatically the primary flight controls in order for the stall scenarios to be repeatable with the same behavior and result as on the aircraft.

The ASE function proposes two options:

- A **full stall demonstration**: During this ASE scenario, the angle of attack increases progressively, without pilot input, until a value defined as the full stall. Upon reaching this value of angle of attack, the simulation stabilizes, without freezing. The pilot has then the capability to take manual control by making an input on the primary flight controls in order to experience (体验) the recovery from the full stall.

- A **full stall exercise**: During this ASE scenario, the angle of attack increases progressively, without pilot input, until a value beyond the stall at which point the simulation freezes. Optional roll-off is also available in this scenario. The pilot has the capability to take the aircraft control at any time during the scenario. In this case, any pilot input on the primary flight controls interrupts the scenario and the simulation reverts (恢复) to a normal mode.

Note: The roll-off function enables the instructor to select the side (“right”, “wings level” or “left”) and the intensity level (from 0 to max level) of the roll-off at stall.

10. APPENDIX 2: IOS FEED-BACK FUNCTIONS

For the purpose of monitoring aircraft parameters and trainees inputs during UPRT maneuvers or scenarios, the FSTD instructor station should provide the instructor with:

- Aircraft speed
- Pitch angle
- Bank angle
- Angle of attack
- Load factor
- Aircraft altitude
- Time.

The instructor station should also provide a graphic page for the operational limits. The normal load factor (n) and airspeed (V) limits should be displayed on a V-n diagram bounded by operational load limits and operational speeds. This diagram aims at determining whether appropriate flight control inputs have been applied during recoveries. The instructor station should consequently provide a graphic page with the flight control positions.

Moreover, the FSTD training envelope should be presented on a graphic page. This display should enable course designers and instructors to confirm that the FSTD remains most of the time in its training envelope during a defined scenario. This display is not to be used by instructors to assess trainees' performance.

11. APPENDIX 3: ALTERNATE AND DIRECT LAW

11.1 GENERAL

The FSTD used for the training of the alternate and direct laws must be compatible with the following control law specifications:

	A320	A330/340	A350	A380
Law	Alternate without reduced protections	ALT 2	Alternate	ALT 2A/2B
Pitch	Similar to Normal	Similar to Normal	Similar to Normal	Similar to Normal
Roll	Direct	Direct	Similar to Normal	Direct [4]
Yaw	Alternate	Alternate	Similar to Normal	Direct [4]
Protections	Load factor	Low speed stability [1] High speed stability [2] Pitch attitude	Depends on failures [3]	Depends on failures [3]

[1] There is no low speed stability in case of failure of 2 ADRs.
[2] There is no high speed stability in case of failure of 3 ADRs.
[3] See corresponding FCOM for more details.
[4] Depending on the failure, the roll and yaw can be similar to the normal law.

There may be different options available in the FSTD for setting up the scenario. It is the responsibility of the Operators or ATOs to ensure the correct behavior and conformity of the FSTD with the above control law specifications. However, the following recommendations may be used as a guide.

11.2 HOW TO ACHIEVE ALTERNATE LAW

On A320, A330, A340 and A380, the recommended method to ensure that the alternate law is achieved is to set ADR 1 and ADR 2 to OFF on the overhead panel (in this configuration, V/S indication will still be displayed). Both CM1 and CM2 will lose normal indicated airspeed on their respective PFD. The normal indicated airspeed should be recovered by the use of AIR DATA SWITCHING CAPT on 3, or F/O on 3, for pilot handling in each part of the exercise.

For the A350, the alternate law demonstration mode of the IOS should be used (switching 2 ADRs OFF will not achieve alternate law).

11.3 HOW TO ACHIEVE DIRECT LAW

To ensure that the direct law is achieved, the instructor should set the FSTD in accordance with the following configurations:

- A320:
  - Set ADR 1 and ADR 2 to OFF on the overhead panel
  - Set the aircraft in landing configuration (flaps 3, gear down).
- A330-A340-A350-A380: Set PRIM 1, PRIM 2 and PRIM 3 to OFF on the overhead panel.