The Hashemite Kingdom of Jordan
Civil Aviation Regulatory Commission
Flight Operations Standards Department

المملكة الأردنية الهاشمية
هيئة تنظيم الطيران المدني
دائرة مقاييس العمليات الجوية

ADVISORY CIRCULAR

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A. SUBJECT:

Upset prevention and recovery training (UPRT)

B. PURPOSE:

The Chief Commissioner of Civil Aviation Regulatory Commission of Jordan (CEO) may, from time to time, issue advisory circulars(ACs) on any aspect of safety in civil aviation. This AC contains information about standards, practices and procedures acceptable to CARC. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

C. STATUS:

1. This AC provides guidance to Civil Aviation regulatory commission Approved Training Organizations(ATO) for the development and implementation of UPRT.

2. This is Amendment (2) of AC - 28 -04- 012 which was originally issued on 15 April 2019. It will remain current until it is withdrawn or superseded. This AC is under the continuous review and assessment in terms of any updating rules or procedures regarding UPRT.

D. CONTENTS:

D. REFERENCES:

1. Approved Training Organizations (ATO) Requirements.
2. ICAO Annex 1.
3. ICAO Annex 6 Part 1.
4. ICAO Doc 10011- Manual on Airplane UPRT.
5. ICAO Doc 9868 Training - Chapter 7.
6. ICAO Doc. 9625 Manual of Criteria for the Qualification of FSTDs Vol 1 (Edition 4).
7. JCAR FCL 1.
8. FAA-AC120-111 – UPRT.
9. AC AOC-39(0) 2 August 2016-Civil Aviation Authority Of Singapore

1. BACKGROUND.

a. Since 2001 there has been a noticeable rise in aeroplane accidents resulting from **loss of control in flight** (LOC-I) events. From in-depth study involving representatives from numerous civil aviation authorities, aviation accident investigative bodies, industry and professional associations, airlines, major approved training organizations and aircraft manufacturers, it was determined that the flight crew involved in LOC-I accidents had often reacted inappropriately prior to and/or during the event. It became increasingly obvious that an effective countermeasure to LOC-I dictated the need for improvements to existing training. This prompted ICAO, in 2012, to form a working committee with FAA and EASA to review and update current training to mitigate LOC-I.

b. It is now strongly recommended by ICAO that an effective UPRT curriculum must give priority to awareness training as a preventive measure to aeroplane upsets. The focus on recovery training which took precedence before is now seen to be secondary in the overall context of UPRT.

2. DEFINITIONS.

An aeroplane upset means an aeroplane in flight unintentionally exceeding the parameters normally experienced in line operations or training, normally defined by the existence of at least one of the following parameters:-

a. pitch attitude greater than 25°, nose up; or
b. pitch attitude greater than 10°, nose down; or
c. bank angle greater than 45°; or
d. within the above parameters, but flying at airspeeds inappropriate for conditions.

Note 1: *The above parameters shall be conducted annually as part of FCL 1 (PPL,CPL, ATPL, MPL, LPC) and Type Rating training provided by an ATO.*

Note 2: *These values are not set values but examples that need to be tailored to the aircraft type. Moreover, there is a new definition being considered and shall be published in the next revision of the Airplane Upset Recovery Training Aid (AURTA)*

Aeroplane upset prevention and recovery training (UPRT) means a combination of theoretical knowledge and flying training with the aim of providing flight crew with the requisite competencies to recognize and thus prevent or recover from developing or developed aeroplane upsets.

Loss of control in flight (LOC-I) means a categorization of an accident or incident resulting from a deviation from the intended flight path.

Manoeuvre-based training means training that focuses on a single event or manoeuvre in isolation.

Negative training means training which unintentionally introduces incorrect information or invalid concepts, which could actually decrease rather than increase aviation safety.

Negative transfer of training means the application and 'transfer' of what was learned in a training environment i.e. a classroom, a Flight Simulator Training Device (FSTD) to normal practice, i.e. it describes the degree to which what was learned in training is applied to actual normal practices. In this context, negative transfer of training refers to the inappropriate generalization of knowledge and skill to a situation or setting in normal practice that does not equal the training situation or setting.

On-aeroplane training means a component of a UPRT programme designed to develop skill sets in employing effective upset prevention and recovery strategies utilising only suitably capable light aeroplanes.

Scenario-based training means training encompassing one or more scenario elements, constructed to facilitate real-time assessment or training.

Startle means an uncontrollable, automatic muscle reflex, raised heart rate, blood pressure, etc., elicited by exposure to a sudden, intense event that violates a pilot's expectations.

Surprise means an unexpected event that violates a pilot's expectations and can affect the mental processes used to respond to the event.

3. INCORPORATING UPRT INTO A PILOT'S TRAINING PROGRAMME.

a. UPRT is to be incorporated into a pilot's training as part of PPL, CPL, MPL, ATPL,LPC and type-rating training provided by an ATO. ATOs are to update their pilot training programmes to incorporate UPRT and are to submit the UPRT programme and the instructor qualification programme for CARC approval.

b. This programme should also be kept up-to-date with the latest concepts, techniques and recommendations.

c. The ATOs may refer to this AC for developing and implementing UPRT.

4. SCOPE OF AN UPRT PROGRAMME.

a. The UPRT programme should include clear training objectives stating what the trainee is expected to perform, and the desired learning outcomes. The trainee should be able to demonstrate the knowledge and skill in preventing, recognizing and recovering from an aeroplane upset before being considered as having successfully completed the UPRT.

b. The UPRT programme should emphasize pilot awareness of his aeroplane performance at all times with the primary aim of preventing an aeroplane upset. Adhering to Standard Operating Procedures and employing **Threat and Error Management** (TEM) skills should be adopted as sound strategies to enhance awareness.

c. The UPRT programme should focus on achieving trainee comprehension of aerodynamics, promulgating vigilance for detection of flight path divergence and emphasizing the timely and appropriate intervention to correct the divergence. Automation and system anomalies and how they can lead to flight path deviation should also be included in the syllabus of the programme.

d. Most upsets eventually call for manual handling skills and techniques for positive recovery. Therefore the UPRT programme should include training the pilot to manually recover from an upset. Recovery techniques using automation should not be ruled out completely but emphasis should be drawn to the potential complexity associated with this option in some cases if recovery is time critical. For example, if transitioning wake turbulence, it may be best to leave the auto flight system engaged rather than disconnecting it as long as the auto flight system is performing adequately.

e. An LOC-I events to date are stall related. Consequently, recovery from the approach to high-altitude stall is considered an integral part of UPRT. Special emphasis should be drawn to the fundamental shift in the context of stall recovery, where reducing the angle of attack (AOA) is the primary action for successful recovery from the high-altitude stall. Please refer to **Appendix 1**.

f. In their research of 18 accidents and incidents resulting from pilot loss of aeroplane-state awareness, the US Commercial Aviation Safety Team (CAST), which also contributed to the ICAO-led UPRT study team, determined that 17 of them occurred when the pilots did not have visual reference (i.e. instrument meteorological conditions (IMC) or night conditions). Therefore UPRT should include training in the FSTD under visual meteorological conditions (VMC) and IMC, including day and night settings.

g. FAA, in its AC 120-111 of April 2015, has indicated that research evidence showed that in many LOC-I incidents and accidents, the pilot monitoring (PM) may have been more aware of the aeroplane state than the pilot flying (PF). Apart from active vigilance, crew interaction on the flight deck should be emphasized as a critical defence mechanism against flight path divergence.

h. Startle or surprise has been a factor in LOC-I incidents and accidents as upsets that occur in normal operations are unplanned and inadvertent, adversely impacting recognition or recovery. Exercises which include the element of startle or surprise may be added to FSTD training. However, to avoid negative training, instructors should guard against inputs which could create or evoke manoeuvres that exceed the limitations of the FSTD.

i. ATOs should adopt a holistic, competency-based approach to UPRT by incorporating both academic and practical training in the curriculum. The training elements, components and platforms that should be included are listed in **Appendix 2**. Subsequent paragraphs in this AC provide more guidance for the ATOs in their respective scope of UPRT.

5. UPRT IN (PPL,CPL, ATPL, MPL,LPC AND TYPE RATING TRAINING BY ATO.

The UPRT to be provided by an ATO as part of FCL 1 (PPL,CPL, ATPL, MPL, LPC and Type Rating training is described below.

6. Academic Training

Understanding what can lead to an aeroplane upset and how to recover if such a situation occurs is critical to UPRT. Therefore the academic training for UPRT establishes the foundation from which situational awareness, insight, knowledge, and skills are developed, and therefore should be accomplished prior to training the associated flight events in an aeroplane or FSTD. The scope of the academic training can be found in **Appendix 2**.

7. Practical Training

Practical training is for the pilot to acquire practical skills to effectively employ upset avoidance strategies and, when necessary, effectively recover the aeroplane to the originally intended flight path. The practical training 4 component may consist of two distinct subcomponents:

(a) On-aeroplane training This kind of training is to be conducted in suitably capable light aeroplanes by appropriately qualified instructors. The intent of this training is to develop the knowledge, awareness and experience of aeroplane upsets and unusual attitudes, and how to effectively analyze the event and then apply the correct recovery techniques. ATOs will be responsible for risk mitigation strategies for this type of training. Refer to **Appendix 3**.

(b) FSTD training (for multi-crew transport type aeroplanes)

i. For this type of training, the FSTD to be used must be capable of producing the correct effects in the context of UPRT. The FSTD must not be required to perform outside the limits of the **Valid Training Envelope** (VTE) of the type. Replication of the actual type-design response and flight control effects are essential characteristics to prevent negative training or negative transfer of training.

ii. FSTD training should be conducted in a Type VII full flight simulator. It should have the fidelity to meet the learning objectives of the training and preferably be (Instruction operating station) IOS equipped to run pre-programmed UPRT manoeuvres and scenarios for ease and standardization of instruction. The Manual of Criteria for the Qualification of FSTDs (ICAO Doc 9625) provides guidance on the approval of FSTD for UPRT. This is discussed further in paragraph 14.

iii. FSTD training should follow a logical progression where pilots are introduced to the aeroplane's capabilities within the operating limits prior to training at the edge of the normal flight envelope.

iv. FSTD training should include both manoeuvre-based and scenario-based training. Stakeholders are encouraged to seek guidance from the Original Equipment Manufacturer (OEM) in development of all UPRT training. Please refer to **Appendix 4**.

v. Whilst **Manoeuvre-Based Training** (MBT) focusses mainly on prevention and recovery, **Scenario-Based Training** (SBT) should develop perception and decision making skills relating to upset recognition, prevention and recovery, while providing the pilot with an opportunity to use the skills learned in manoeuvre-based training in a realistic scenario. Using evidence-based data to develop SBT is encouraged to lend realism and comparative analyses to the training. Startle can only be induced in SBT. Please refer to **Appendix 5**.

vi. Feedback applications which monitor and record operational limit exceedances in the FSTD are effective briefing tools for the instructor. They enhance debriefing where the instructor would be able point out erroneous control inputs.

8. BRIDGE TRAINING.

Many type-rated pilots within the current system might not have undergone a specific programme on UPRT. For these pilots to fully benefit from UPRT during training it would follow that they undergo a brief bridge training programme to bridge the gap in their academic and practical competencies in UPRT. It is envisaged that bridge training comprising a classroom session and one FSTD detail should be sufficient to transition these pilots into training featuring UPRT.

9. STALL AND UPRT REQUIREMENTS FOR TYPE VII5 FSTD

a. Stall manoeuvres evaluation relates to FSTD qualification in meeting the training requirements of approach to stall maneuvers. The following stall entry methods should be demonstrated in at least one of the three required flight conditions:

i. Stall entry at wings level (1g);
ii. Stall entry in turning flight of at least 25° bank angle (accelerated stall) and
iii. Stall entry in a power-on condition (required only for turboprop aeroplanes).

b. The "approach to stall" tolerances in stall characteristics tests apply up to the activation of the stall warning system or aerodynamic stall buffet, just prior to the stall break, whichever occurs first. Training recovery from the full stall should be avoided if the FSTD is not suitably qualified for the exercise.

c. For the purposes of UPRT, the instructor operating station should have adequate feedback about the aeroplane and its controls state during UPRT exercises. This should include:

i. FSTD validation envelope
ii. Flight control positions
iii. Aeroplane operational limits.

d. The FSTD should have selectable aeroplane upsets to trigger an upset condition. The instructor should be provided with appropriate guidance concerning the method utilized to drive the FSTD into an upset condition.

e. The following minimum set of upset recovery maneuvers should be available to the instructor:

i. A nose high, wings level aircraft upset;
ii. A nose low, wings level aircraft upset; and
iii. A high bank angle aircraft upset.

f. The intentional degradation of FSTD functionality to drive an aeroplane upset is generally not acceptable unless used purely as a tool for repositioning with the pilot out of the loop.

Note: *Care should be taken with flight envelope protected aeroplanes, as artificially positioning*

g. The aeroplane to a specified attitude may not be representative because the flight control law may not be correctly initialized.

h. In addition to the practical exercises in UPRT the instructor should also focus on improving the pilot monitoring skills which are almost always associated with LOC-I events.

10. INSTRUCTORS.

a. The efficacy of UPRT is dependent on the quality of the instructor. The ATOs are to ensure that their UPRT instructors are qualified through an approved instructional programme. The instructors should possess a sound knowledge of both the academic and practical aspects of UPRT.

b. The review of LOC-I incidents and accidents is beneficial to UPRT. Instructors should be familiar with the learning outcomes of these events and the pedagogical bearing it has on UPRT.

c. Instructors should understand aeroplane energy management, human factors (HF), including but not limited to spatial disorientation, somatogravic illusion (or false pitch-up sensation), startle, surprise, effects of fatigue, distraction and TEM. Understanding of these HF elements is critical to the instructor's ability to explain to his trainee the potential physiological catalysts to LOC-I.

> ***Note:*** *ATOs should consider including exercises with go-arounds from various stages of the approach as this is known to have caused somatogravic illusion (or false pitch-up sensation) and disorientation effects in actual flight. Although, current-day FSTDs cannot provide the actual aerodynamic effects of the real aeroplane the experience, it is felt, will be beneficial to the trainee.*

d. Instructors should go through the practical training of the Training Programme as regularly as required by ATOs to ensure that they are able to demonstrate the correct recovery techniques should the need arise. Please see **Appendix 6**.

11. TEMPLATES AND SCENARIOS.

1. The templates attached as Appendices have been selected from some of the reference documentation cited at the top of the AC. These templates should be used only as guidance material and are not meant to be prescriptive.
2. ATOs may design exercises which best suit their aircraft type and training rationale for UPRT. Some sample training scenarios are provided **Appendix 7** for reference.

12. APPENDIXES

APPENDIX 1
STALL RECOVERY TEMPLATE (WITH ASSOCIATED RATIONALE)

1.	Autopilot and autothrottle……..…..…..Disconnect
Rationale	While maintaining the attitude of the aeroplane, disconnect the autopilot and autothrottle. Ensure the pitch attitude does not increase when disconnecting the autopilot. This may be very important in out-of-trim situations. Manual control is essential to recovery in all situations. Leaving the autopilot or autothrottle connected may result in inadvertent changes or adjustments that may not be easily recognized or appropriate, especially during high workload situations.
2.	a) Nose down pitch control…… Apply until stall warning is eliminated b) Nose down pitch trim……..…..…..As Needed
Rationale	a) Reducing the angle of attack is crucial for recovery. This will also address autopilot-induced excessive nose up trim. b) If the control column does not provide sufficient response, pitch trim may be necessary. However, excessive use of pitch trim may aggravate the condition, or may result in loss of control or high structural loads.
3.	Bank……..…….Wings Level
Rationale	This orients the lift vector for recovery.
4.	Thrust ……..……As Needed
Rationale	During a stall recovery, maximum thrust is not always needed. A stall can occur at high thrust or at idle thrust. Therefore, the thrust is to be adjusted accordingly during the recovery. For aeroplanes with engines installed below the wing, applying maximum thrust may create a strong nose-up pitching moment if airspeed is low. For aeroplanes with engines mounted above the wings, thrust application creates a helpful pitch-down tendency. For propeller driven aeroplanes, thrust application increases the airflow around the wing, assisting in stall recovery.
5.	Speed brakes/Spoilers……..……..Retract
Rationale	This will improve lift and stall margin.
6.	Return to the desired flightpath.
Rationale	Apply gentle action for recovery to avoid secondary stalls then return to desired flightpath .

APPENDIX 2
UPSET TRAINING ELEMENTS, COMPONENTS AND PLATFORMS

Subjects and training elements	**Academic training**	**On aeroplane training – PPL(A) CPL(A)/ MPL(A)**	**Non-type specific FSTD training - MPL(A))**	**Type specific FSTD Training LPC/ATPL**	**AURTA Revision 2, references**
	For ATO	For ATO	For ATO	For ATO	
A. Aerodynamics					section 2.5
1) general aerodynamic characteristics	√	√	√		
2) advanced aerodynamics	√	√	√	√	
3) aeroplane certification and limitations	√	√	√	√	
4) aerodynamics (high and low altitudes)	√	√	√	√	
5) aeroplane performance (high and low altitudes)	√	√	√	√	
6) angle of attack (AOA) and stall awareness	√	√	√	√	
7) stick shaker activation	√	√	√	√	
i) stick pusher activation	√	√	√	√	
ii) Mach effects — if applicable to aeroplane type	√	√	√	√	nil
8) aeroplane stability	√	√	√	√	
9) control surface fundamentals	√	√	√	√	
i) trims	√	√	√	√	
10) icing and contamination effects	√	√	√	√	
11) propeller slipstream (as applicable)	√	√	√	√	
B. Causes and contributing factors of upsets					section 2.4
1) environmental	√			√	
2) pilot-induced	√			√	
3) mechanical	√			√	
C. Safety review of accidents and incidents relating to aeroplane upsets	√	√		√	
D. G-awareness					sections 2.5.3 and
1)	√			√	

positive/negative/increasing/decrea sing g-loads					2.6.2.2
2) lateral g-awareness (sideslip)	√			√	
3) G-load management	√			√	
E. Energy management					Section 2.5.2
1) kinetic energy vs. potential energy vs. 2.5.2 chemical energy (power)	√	√	√	√	
2) relationship between pitch and power and performance	√	√	√	√	
3) performance and effects of differing engines	√	√	√	√	
F. Flight path management					
1) automation inputs for guidance and control	√	√	√	√	
2) type-specific characteristics	√	√	√	√	
3) automation management	√	√	√	√	
4) manual handling skills	√	√	√	√	
G. Recognition					section 2.5.5.5-2.5.5.9
1) type-specific examples of instrumentation during developing and developed upset	√	√	√	√	
2) pitch/power/roll/yaw	√	√	√	√	
3) effective scanning (effective monitoring)	√	√	√	√	
4) stall protection systems and cues	√	√	√	√	
5) criteria for identifying stalls and upset	√	√	√	√	
H. Upset prevention and recovery techniques					section 2.6.1 sections 2.6.3.2-2.6.3.5
1) timely and appropriate intervention	√	√	√	√	
2) nose-high/wings-level recovery	√	√	√	√	
3) nose-low/wings-level recovery	√	√	√	√	
4) high bank angle recovery techniques	√	√	√	√	
5) consolidated summary of aeroplane recovery techniques	√	√	√	√	
I. System malfunction section					Section 2.4.2
1) flight control anomalies	√	√	√	√	
2) power failure (partial or full)	√	√	√	√	
3) instrument failures	√	√	√	√	
4) automation failures	√		√	√	
5) fly-by-wire protection degradations	√		√	√	
6) stall protection system failures,	√		√	√	

including icing alerting systems					
J. Specialized training elements sections					sections 2.6.3.2- 2.6.3.5 and section 3 section 2.5.5.7
1) spiral dive (graveyard spiral)	√	√	√	√	
2) slow flight		√	√	√	
3) steep turns		√	√	√	
4) recovery from approach to stall		√	√	√	
5) recovery from stall, including uncoordinated stalls (aggravating yaw)		√	√	√	
6) recovery from stick pusher activation (as applicable)	√		√	√	
7) nose-high/high-speed recovery		√	√	√	
8) nose-high/low-speed recovery		√	√	√	
9) nose-low /high-speed recovery		√	√	√	
11) high bank angle recovery		√	√	√	
12) line-oriented flight training (LOFT) or line-operational simulation (LOS)			√	√	
K. Human Factors					
1) situation awareness	√	√	√	√	√
i) human information processing	√	√	√	√	√
ii) inattention, fixation, distraction	√	√	√	√	√
iii) perceptual illusions (visual or physiological) and spatial disorientation	√	√	√	√	√
iv) instrument interpretation	√	√	√	√	√
2) startle and stress response	√	√	√	√	√
i) physiological, psychological, and cognitive effects	√	√	√	√	√
ii) management strategies	√	√	√	√	√
3) threat and error management (TEM)	√	√	√	√	√
i) TEM framework	√	√	√	√	√
ii) active monitoring, checking	√	√	√	√	√
iii) fatigue management	√	√	√	√	√
iv) workload management	√	√	√	√	√
v) crew resource management (CRM)	√	√	√	√	√

Note: Refer to the Airplane Upset Recovery Training Aid (AURTA) Revision 2 for more details. However, the AURTA generally was developed to deal with topics pertaining to swept -wing aeroplanes with more than 100 passenger seats.

Note: References made to relevant sections of AURTA may be changed in subsequent revisions.

▸The FSTD must have the correct modeling for this maneuver(6,7,8).

APPENDIX 3
UPRT TEMPLATES (FOR ON-AEROPLANE TRAINING)

On-aeroplane training applies to PPL,CPL(A), ATPL , MPL,LPC and Type rating provided by ATOs. Reference should also be made to ICAO Annex 1 as appropriate for PPL,CPL(A), ATPL , MPL,LPC and Type rating. ATOs may propose alternative training templates that can also meet the requirements. Aeroplane performance capabilities must not be exceeded (refer to OEM'S Pilot Operating Handbook or Manual).

Table 1. SLOW FLIGHT TEMPLATE (CLEAN CONFIGURATION OR WITH FLAPS AT 1ST STAGE).

Objective	To fly the aeroplane safely at 10kts above Vs0 and Vs1 without stalling	Maintain selected speed and altitude
Entry	a. From the level flight cruise, reduce speed to 10kts above stalling speed by selecting a lower power. b. Carry out gentle turns whilst maintaining the selected speed.	Adjust attitude progressively to maintain altitude. Adjust power as required to maintain speed or when turning.
Recovery	Re-select cruise power. Progressively clean up Flaps and adjust nose attitude as the aeroplane speed increases.	Flaps should be raised only when above recommended speeds to prevent inadvertent stalls.

Table 2. STALL TEMPLATE

A. Clean configuration stall in level flight and recovery
   i. Recovery at incipient stage
   ii. Recovery at fully developed stall
B. Stall with Power and/or Flaps
   i. Stall with Power, no Flaps
   ii. Stall with Flaps, no Power
   iii. Stall with Power and Flaps
   iv. Stall in Approach Configuration – recovery at incipient stage only

Objective (A & B)	To recognize the symptoms of a stall at different configurations and recover safely	
Entry	a. From the level flight, select idle power setting. b. Select power or flaps as required c. Raise nose progressively to maintain height. If simulating an approach to land, commence a descent before raising the nose slowly to simulate stretching the approach and to induce the onset of stall symptoms	a. Maintain level flight unless simulating an approach configuration b. Observe flaps limit speed c. Call out the symptoms as they appear

	d. Identify the symptoms of an approaching stall e. Identify the symptoms of a fully developed stall f. Note the speed and nose attitude differences at different configurations.	
Recovery (Standard Stall Recovery – SSR)	a. Lower nose attitude and simultaneously apply full power.9 b. Use opposite rudder to prevent further wing-drop if it occurs c. Above safe speed, roll wings level and recover to a climb	a. Raise flaps in stages. Do not exceed limit speeds b. DO NOT use ailerons to correct a wing-drop as it will lead to auto-rotation and incipient spin

Item (9) These on-aeroplane SSR actions are recommended for typical Single Engine Piston (SEP) aeroplanes used in the PPL(A), CPL(A), ATPL , MPL,LPC training and Type rating provided by ATOs . It is not intended to supersede the stall recovery actions recommended by the aeroplane manufacturers (OEM) as may be found in their respective Aeroplane Flight Manuals or Pilot Operating Handbooks.

Table 3. STALL IN A TURN & SPIRAL DIVE TEMPLATE

A. Stall in a turn (with high angles of bank)
B. Spiral dive.

Objective	A. To recognize the symptoms of a stall in a turn and recover safely B. To recognize a spiral dive and recover safely	
Entry	A. From the level flight crews, enter a steep level turn and progressively increase back pressure to induce a stall. B. From the level flight, reduce power and commence a steep descending turn with >30° bank.	A. Stall is identified as the aeroplane momentarily halting in the turn following the onset of stall symptoms. B. Observe aeroplane speed limits
Recovery	A. Apply SSR technique (refer to Table 2) B. Reduce power, roll wings level and recover from the dive.	DO NOT use ailerons to correct a wing-drop as it will lead to autorotation and incipient spin

Table 4. UNUSUAL ATTITUDE (UA) RECOVERY TEMPLATE

A. Without Bank
   i. Nose High
   ii. Nose Low
B. With Bank
   i. Nose High with Bank
   ii. Nose Low with Bank

Objective	To recognize an aeroplane upset attitude and recover safely	May also be conducted in simulated instrument Flying training
Entry	a. The aeroplane is flown by the Instructor and put at nose attitudes >25° pitch up or 10 pitch down. b. Power is set so as not to allow the aeroplane to exceed the airspeed limits during the recovery. c. Angles of bank in excess of 45° should be introduced progressively after the student has demonstrated competency in recovery without bank.	a. To create the startle effect, the student may be asked to look at the aeroplane floor whilst the Instructor sets up the upset attitude condition. b. DO NOT exceed the aeroplane limits.
Recovery	a. Apply power accordingly to correct a reducing or increasing airspeed situation. b. If nose attitude is above horizon, first pitch the aeroplane to horizon before rolling the wings level. c. If nose attitude is below horizon, roll the wings level first instead before pitching the aeroplane back to the horizon.	a. Recover the aeroplane to straight and level, and with cruise power set. b. DO NOT use ailerons to correct a wing-drop as it will lead to auto-rotation and incipient spin

APPENDIX 4
UPSET RECOVERY TEMPLATES (MULTI-CREW TRANSPORT TYPE AEROPLANE)

Aeroplane Manufacturers (OEMs) contributed to the following upset recovery templates. Although these procedures represent the latest concepts of UPRT accepted by the various safety agencies, any future recommendations by the OEMs will take precedence over the recommendations here.

Note: These techniques assume the aeroplane is not stalled. If the aeroplane is stalled, recovery from the stall must be accomplished first. Please see Appendix 1.

TABLE 1. NOSE HIGH RECOVERY TEMPLATE

Either Pilot: Recognize and confirm the developing situation. Announce: "Nose High"10	
Pilot Flying	**Pilot Monitoring**
AP: DISCONNECT"11	MONITOR airspeed and attitude throughout the recovery and ANNOUNCE any continued divergence.
A/THR: OFF	
Apply as much nose-down control input as required to obtain a nose-down pitch rate.	
THRUST: Adjust (if required)	
ROLL: Adjust (if required) not to exceed 60°	
When airspeed is sufficiently increasing: RECOVER to level flight12 *Note: Recovery to level flight may require use of pitch trim.*	

TABLE 2. NOSE LOW RECOVERY TEMPLATE

Either Pilot: Recognize and confirm the developing situation. Announce: "Nose Low"13	
Pilot Flying	**Pilot Monitoring**
AP: DISCONNECT14	MONITOR airspeed and attitude throughout the recovery and ANNOUNCE any continued divergence.
A/THR: OFF	
RECOVER from stall if required	
ROLL in the shortest direction to wings level15	
THRUST and DRAG: Adjust (if required)	
RECOVER to level flight16. *NOTE: Recovery to level flight may require use of pitch trim*	

a. 10 *If the A/P and/or A/T are responding correctly, it may not be appropriate to decrease the level of automation while assessing whether the divergence is being stopped.*

b. 11 *A large out of trim condition could be encountered when the AP is disconnected*

c. 12 *Avoid stall because of premature recovery or excessive g loading*
d. 13 *If the A/P and/or A/T are responding correctly, it may not be appropriate to decrease the level of automation while assessing whether the divergence is being stopped.*
e. 14 *A large out of trim condition could be encountered when the AP is disconnected.*
f. 15 *It may be necessary to reduce the g loading by applying forward control pressure to improve roll effectiveness.*
g. 16 *Avoid stall because of premature recovery or excessive g loading.*

APPENDIX 5
EXAMPLES OF SCENARIOS AND MANOEUVRES FOR UPSET PREVENTION AND RECOVERY TRAINING (TRAINING IN FSTD FOR MULTI-CREW TRANSPORT TYPE AEROPLANE)

These three are constructed using the philosophies and concepts of the OEM and aviation safety agencies. ATOs are encouraged to develop additional scenarios that fit their training needs.

SCENARIO 1: NOSE-HIGH ATTITUDE IN AN AEROPLANE WITH UNDER-WING MOUNTED ENGINES	
INSTRUCTOR ROLE	Implement scenarios that result in an unexpected nose-high attitude (40° or greater) with full power.
OBJECTIVE	This scenario is ONLY for aeroplanes with under-wing mounted engines. The pilot will recognize the nose-high attitude and immediately perform the upset recovery procedure. If a detectable nose-down pitch rate is not initially achievable, the pilot should demonstrate recovery by reducing the thrust to a point where a nose-down pitch rate is achieved .
EMPHASIS AREAS	• Effect of thrust on pitch moment. • Recognition and recovery. • Crew coordination. • Angle of attack (AOA) management, including available AOA indications. • Aural and visual warnings (environment and aeroplane cueing). • Surprise and startle. • Situational awareness (SA) while returning to desired flightpath after the upset recovery, including such items as heading, altitude, other aeroplane, and flight deck automation .
FSTD SETUP CONSIDERATIONS	In order to create potential onset conditions, consider use of the following: • System malfunctions resulting in erroneous pitch attitude indications; • Other system malfunctions resulting in a nose high attitude; • Realistic environmental threats destabilizing the flightpath.
SCENARIO ELEMENTS	• Upon recognizing the first indication of an upset, perform the upset recovery procedure. • The necessity for smooth, deliberate, and positive control inputs to avoid increasing load factors. • Reducing thrust, if necessary, can reduce the upward pitch moment.
COMPLETION STANDARDS	Recognizes and confirms the situation. • Initiates recovery by reducing thrust to approximately midrange until a detectable nose-down pitch rate is achieved. • Verifies the autopilot and autothrottle/autothrust are disconnected.

	• Proper recovery consists of up to full nose-down elevator and by using stabilizer trim, if required. A steady nose-down pitch rate should be achieved and it should be noted that the aeroplane would be less than 1g and the associated characteristics of such. • When approaching the horizon the pilot checks airspeed, adjusts thrust, and establishes the appropriate pitch attitude and stabilizer trim setting for level flight. • The manoeuvre is considered complete once a safe speed is achieved and the aeroplane stabilized. • Satisfactory crew coordination must be demonstrated.
COMMON PILOT ERRORS	• Fails to disengage the autopilot and autothrottle. • Fails to reduce thrust sufficiently, if necessary, to obtain nose-down pitch. • Reduces thrust excessively. • Fails to use sufficient elevator authority • Fails to use stabilizer trim when necessary
COMMON INSTRUCTORERRORS ERRORS	• Fails to notice improper control inputs. • If the FSTD training envelope was exceeded, fails to advise the pilot to prevent negative training.

SCENARIO 2: LOSS OF RELIABLE AIRSPEED	
INSTRUCTOR ROLE	Implement scenarios that result in erroneous airspeed indications.
OBJECTIVE	The pilot will recognize the airspeed discrepancy, determine airspeed data is erroneous, and apply the appropriate non-normal procedure while maintaining aeroplane control using pitch and power targets.
EMPHASIS AREAS	Recognition. • Crew coordination. • AOA management including available AOA indications. • Maintain awareness of and manage flightpath and energy. • Aural and visual warnings (environment and aeroplane cueing). • Completion of the appropriate non-normal checklist. • Surprise and startle. • Manual flying skills. • Effects of altitude on control inputs.
FSTD SETUP CONSIDERATIONS	The scenario will be conducted at or near the maximum operating altitude in instrument meteorological conditions (IMC). Use of flight simulation training device (FSTD) capabilities to induce erroneous airspeed indications may include:

	• Full or partial pitot/static blockage or icing. • Air data computer failures.
SCENARIO ELEMENTS	• During cruise, one or two airspeed indicators will malfunction. • The pilot recognizing the erroneous airspeed data indication will verbally announce the discrepancy • The pilot flying will maintain control of the aeroplane and call for the appropriate non-normal checklist. • At the conclusion of the scenario, the instructor will discuss available aeroplane AOA indications.
COMPLETION STANDARDS	The pilot flying will manage pitch and power to avoid a stall. • Satisfactory crew coordination must be demonstrated. • Correctly identifies the erroneous airspeed data. • Completes the appropriate non-normal checklist. • Verifies the autopilot and autothrottle/autothrust are disconnected. • The pilot monitoring provides the pilot flying with meaningful input (e.g., attitude and altitude deviations and trends).
COMMON PILOT ERRORS	• The importance of pitch control and AOA is not recognized. • Use of large thrust changes. • Failure to complete the appropriate non-normal checklist. • Over controlling the aeroplane, especially pitch.
COMMON INSTRUCTORERRORS ERRORS	• Fails to notice improper control inputs. • If the validated FSTD envelope was exceeded, fails to advise the pilot and stop the scenario to prevent negative training .

SCENARIO 3: SUB-THRESHOLD ROLL	
INSTRUCTOR ROLE	Implement scenarios that cause an imperceptibly slow roll rate (less than 3° per second) that result in an unexpected high bank angle.
OBJECTIVE	The pilot will recognize the high bank angle and immediately perform the upset recovery procedure
EMPHASIS AREAS	• Recognition and recovery. • Crew coordination. • AOA management. • Out-of-trim control forces at autopilot disconnect (if engaged). • Aural and visual warnings (environment and aeroplane cueing). • Surprise and startle. • Effects of multiple levels of automation. • Effects of altitude on recovery. • SA while returning to desired flightpath after the upset recovery, including such items as heading, terrain, altitude, other aeroplane, and flight deck automation.
FSTD SETUP CONSIDERATIONS	The scenario will be conducted at an altitude that will allow for a recovery. Crew distractions may be used (e.g., minor malfunctions, air traffic control (ATC) instructions, weather).

	Use of FSTD capabilities to induce a slow, imperceptible roll rate (less than 3° per second) may include: • Attitude changes, • Thrust asymmetry, • System malfunctions (e.g., surreptitious disabling of automation). • Dynamic upsets should not be implemented in a manner that disables or unrealistically reduces flight control effectiveness for the purpose of generating or attaining an upset condition.
SCENARIO ELEMENTS	• The instructor will introduce a situation which causes the aeroplane to enter an imperceptible roll resulting in an unexpected bank angle greater than 30°. • Either pilot will notice and announce the excessive bank. • The pilot flying will demonstrate the proper recovery procedure. • Disengage the autopilot and autothrottle. • If a nose high or nose low condition exists, identify the situation and apply the correct recovery. • Maintain awareness of energy management and aeroplane roll rate. • Unload (reduce AOA) as necessary and roll to wings level as the nose approaches the horizon. Recover to a slightly nose-low attitude. Check airspeed and adjust thrust and pitch as necessary. • When recovery is assured, adjust the pitch attitude to return to the intended flightpath.
COMPLETION STANDARDS	• Rolls in the shortest direction to wings level. • Returns the aeroplane to the assigned flightpath. • Satisfactory crew coordination must be demonstrated.
COMMON PILOT ERRORS	Recovery is initiated by rolling in the wrong direction, increasing the bank. • Losing situational awareness and failing to return to assigned flightpath or follow ATC instructions after recovery. • Pilot(s) slow to recognize or announce the excessive bank. • Executes improper recovery procedure. • Failure to disengage the autopilot and/or autothrottle/autothrust. • Slow to reduce angle of attack (unload). • Failure to maintain awareness of energy management.
COMMON INSTRUCTORERRORS ERRORS	• Fails to notice improper control inputs. • If the FSTD training envelope was exceeded, fails to advise the pilot and stop the scenario to prevent negative training.
MANOEUVRE 1: MANUALLY-CONTROLLED SLOW FLIGHT	
OBJECTIVE	Recognize the low energy or high drag configuration and the slow response to flight control and thrust inputs to enhance the pilot's knowledge of the low speed handling qualities prior to stall training.
EMPHASIS AREAS	Manual flying skills

FSTD SETUP CONSIDERATIONS	• Select ceiling and visibility unlimited. • The manoeuvre will be conducted in the following two scenarios: ▸ Low altitude beginning in a clean configuration, and then slowing while configuring the aeroplane for landing. This manoeuvre will be conducted at maximum landing gross weight while maintaining speed at the VREF for the configuration. ▸ High altitude in a clean configuration (e.g., near the service ceiling), near maximum gross weight while maintaining minimum speed for the configuration. • Target speeds must be below the speeds that are normal and appropriate for the various configurations. The minimum speed must avoid stick shaker. Ideally a single speed can be selected for use throughout the manoeuvre that will permit judicious Manoeuvring without stick shaker. Encountering stick shaker without executing a stall recovery could lead to negative training.
SCENARIO ELEMENTS	elevator or stabilizer), bank angle, and power setting that will allow a controlled speed reduction to establish the desired target airspeed. • Manoeuvre in straight and level flight to stabilize speed and trim. • Turn left and right, and change direction of turn, to observe changing handling characteristics. • Turns through 90° left and right, at bank angles appropriate to speed and configuration. • Climb and descend at 500 feet per minute (fpm) while in a turn.
COMPLETION STANDARDS	• Recover to appropriate airspeed for the configuration and establish the appropriate altitude and heading. • Recovery is complete when straight and level un-accelerated flight is achieved.
COMMON PILOT ERRORS	• Inadequate back-elevator pressure as power is reduced, resulting in altitude loss. • Excessive back-elevator pressure as power is reduced, resulting in a climb,

	followed by a rapid reduction in airspeed and "mushing." • Inadequate compensation for adverse yaw during turns. • Fixation on the airspeed indicator. • Failure to anticipate changes in lift as flaps are extended or retracted. • Inadequate power management. • Inability to adequately divide attention between aeroplane control and orientation.

APPENDIX 6
INSTRUCTOR TRAINING ELEMENTS

UPRT instructor training elements UPRT	***UPRT academic instructor***	***UPRT aeroplane instructor***	***UPRT FSTD instructor***
UPRT instructor training elements UPRT	√	√	√
Comprehensive knowledge of all applicable training elements (refer to Appendix 2)*			
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*	As applicable	√	√
How to do a flight risk assessment (aeroplane)	**As applicable**	√	
Recognition of trainee errors	As applicable	√	√
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	√	√	√
*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 conform to the appropriate aeroplane flight manual.			

APPENDIX 7
SAMPLE TRAINING SCENARIOS

Three scenarios were constructed using the philosophies and concepts described in this AC. They include clean configuration (high altitude), takeoff, and landing configuration impending stalls. Training providers are encouraged to develop additional scenarios that fit their training needs. The examples should be easily tailored to any transport category airplane. The examples given are not intended to be limiting in any way. They are provided as a framework for developing a training curriculum.

SCENARIO 1: CLEAN CONFIGURATION STALL PREVENTION (HIGH ALTITUDE)

INSTRUCTOR ROLE	Implement scenarios that result in an unexpected impending stall near the airplane's maximum operating altitude.
OBJECTIVE	The pilot will recognize the impending stall and immediately perform the stall recovery procedure. The pilot should demonstrate willingness to trade altitude for airspeed to accomplish an expeditious recovery.
EMPHASIS AREAS	• Recognition and recovery. • Crew coordination. • AOA management. • Out of trim control forces at autopilot disconnect (if engaged). • Aural and visual warnings (environment and airplane cuing). • Surprise. • Reduced roll stability and increased buffeting. • Climbing at a slower than normal airspeed and higher than normal vertical speed may result in leveling off at a speed below that which can be maintained at the thrust available • The role of increasing temperature and turbulence on high altitude performance. • Effects of multiple levels of automation. • Effects of altitude on recovery. • Knowledge of the aircraft's high- and low-speed buffet boundaries. • Thrust available versus thrust required to maintain altitude. • There is no predetermined value for altitude loss, maintaining altitude during recovery is not required, and the recovery will likely take several thousand feet. • Situational awareness (SA) while returning to desired flightpath after the stall recovery, including such items as heading, altitude, other aircraft, and flight deck automation.
FFS SETUP CONSIDERATIONS	This scenario will be conducted near maximum operating altitude for the specific airplane weight and temperature. Crew distractions (e.g., minor malfunctions, air traffic control (ATC) instructions, weather) and simulator capabilities may be used to induce impending stalls. Scenarios from actual events, such as climbing in vertical speed mode, which will result in the airplane leveling off at an airspeed behind the power curve can also be used.
SCENARIO ELEMENTS	□ At level flight with the autopilot on, introduce an event or reduce thrust to less than adequate for maneuvering flight.

	□ Upon recognizing the impending stall, perform the stall recovery procedure. □ The necessity for smooth, deliberate, and positive control inputs to avoid excessive load factors and secondary stalls.
COMPLETION STANDARDS	□ The pilot will perform a deliberate and smooth reduction of AOA. □ Positive recovery from the stall event is paramount. There is no predetermined value for altitude loss and maintaining altitude during recovery is not required. □ Appropriate application of thrust to accelerate and enable a positive recovery. □ Establishing the appropriate AOA takes precedence over roll control (attempting to maintain wings level) for positive recovery from the stall event. □ Intermittent secondary stall warnings, but not secondary stalls. AC AOC-39(0) - 19 - 2 August 2016 may be acceptable due to the associated recovery challenges at altitude because of the lack of aerodynamic damping. □ The maneuver is considered complete once a safe speed is achieved and the airplane stabilized. □ Satisfactory crew coordination must be demonstrated.
COMMON PILOT ERRORS	□ Recovery is attempted with thrust instead of reducing AOA. □ Not maintaining a nose down input until the impending stall cues are eliminated. □ Insufficient pitch down to allow desired energy conversion of altitude to airspeed. □ Pilot fails to promptly recover from a secondary stall. □ Reluctance to sacrifice significant altitude. □ Pilot fails to distinguish between high speed buffet and low speed stall. □ Pilot increases the load factor too quickly and gets multiple impending stalls or a stick pusher activation. □ Inappropriate use of rudder. Pilot prioritizes roll control (attempting to level the wings) before reducing AOA. □ Not disconnecting the autopilot and/or autothrottle/autothrust prior to reducing AOA.

SCENARIO 2: LANDING CONFIGURATION STALL PREVENTION

INSTRUCTOR ROLE	Implement scenarios that result in an unexpected impending stall during an approach.
OBJECTIVE	The pilot will recognize the impending stall and immediately perform the stall recovery procedure, then commence missed approach.
EMPHASIS AREAS	• Recognition and recovery. • Crew coordination. • AOA management. • Out of trim control forces at autopilot disconnect (if engaged). • Aural and visual warnings (environment and airplane cueing). • Surprise. • Reduced roll stability and increased buffeting. • Effects of multiple levels of automation. • Effects of altitude on recovery. • SA while returning to desired flightpath after the stall recovery, including such items as heading, terrain, altitude, other aircraft, and flight deck automation. • There is no predetermined value for altitude loss. Maintaining altitude is not required.
FFS SETUP CONSIDERATIONS	The scenario will be conducted during approach to landing in the landing configuration, at an altitude that will allow for a recovery. Crew distractions (e.g., minor malfunctions, ATC instructions, weather) and simulator capabilities may be used to induce impending stalls.
SCENARIO ELEMENTS	□ At 1,000 feet above ground level (AGL), reduce thrust to be inadequate to maintain a safe speed or descent angle, and results in an increase in AOA to maintain glide path. Upon recognizing the impending stall, perform the stall recovery procedure. When recovery is assured, adjust the pitch attitude to initiate a climb to comply with missed approach instructions.
COMPLETION STANDARDS	□ The pilot will perform a deliberate and smooth reduction of AOA. Positive recovery from the stall event takes precedence over minimizing altitude loss or roll control (attempting to maintain wings level before appropriate AOA is established). Appropriate application of thrust to accelerate and enable an expeditious recovery. The return of the airplane to safe flight without encountering secondary stall warnings. The maneuver is considered complete when safe speed has been achieved and the pilot initiates the missed approach. Satisfactory crew coordination must be demonstrated.
COMMON PILOT ERRORS	□ Recovery is attempted with no loss of altitude. Recovery is attempted without recognizing the importance of pitch control and AOA. Inappropriate use of rudder. Pilot prioritizes roll control(attempting to level the wings) before reducing AOA. Not disconnecting the autopilot and/or autothrottle/autothrust prior to reducing AOA. Not maintaining a nose down input until the impending stall cues are eliminated. Pilot increases the load factor too quickly and gets multiple impending stalls or a stick pusher activation. Rolling wings level prior AOA reduction. Failure to roll

	wings level after AOA reduction to improve performance. Losing SA and failing to return to assigned flightpath and complete a missed approach, or follow ATC instructions after recovery.

Other suggested scenarios include:

1. After level-off from a descent with idle thrust, the pilot either forgets to increase thrust or on airplanes equipped with autothrottle/autothrust, the autothrottle/autothrust does not increase thrust.

2. While at low altitude and maneuvering, banking at slow speeds.

3. During approach, while slowing to approach speed, the pilot does not add flaps soon enough or does not closely watch the energy trend.

4. The flight crew is instructed to climb to an altitude within the airplane's certified flight envelope, but is not possible to maintain given the weight and temperature conditions.

Capt. Haitham Misto
Chief Commissioner