



# On-Airplane UPRT

## For Instructors



## INTRODUCTION

The Camiguin Aviation On-Airplane Upset Prevention and Recovery Training program (CamAv OA UPRT) emulates established training scenarios presented in the following industry publications while at the same time introducing physiological (G-forces) and psychological (startle) elements:

- ICAO (2008). *Manual on Aeroplane Upset Prevention and Recovery Training (Doc 10011)*.
- Upset Recovery Industry Team (2008). *Aeroplane Upset Recovery Training Aid Rev. 2 (AURTA)*.
- ICAO, Airbus, ATR, Boeing, Bombardier, Embraer (2017). *Aeroplane Upset Prevention and Recovery Training Aid, Rev. 3 (AUPRTA)*.
- CAA Philippines (2018). *Philippine Civil Aviation Regulations, Parts 2, 3 and 8*.

## ON-AIRPLANE UPRT PROGRAM

CamAv OA UPRT follows a *Training-to-Proficiency* approach (ICAO Doc 10011, Sec. 1.3.6, 2.1.3) in lieu of the traditional 'checkbox-done-that' testing approach (ICAO Doc 10011, Sec. 2.2.3). The goal is to produce pilots that can deal with upset scenarios under the potentially incapacitating effects of startle and G-forces.

### Training Aircraft

CamAv OA UPRT utilizes the aerobatic-certified American Champion Super Decathlon 8KCAB and Cessna Aerobat A150K. Using aerobatic aircraft is required by regulation, ensures safety and opens up a greater range of training manoeuvres (ICAO Doc 10011, Sec. 3.3.1.2).

### Startle and G-Forces

Startle is minimized by teaching students to engage and be aware of the airplane's energy state and flightpath (AUPRTA, Rev. 3, Sec. 7.2.1). Startle can further be minimized by removing *fear-of-the-unknown*. For that purpose, students will be exposed to specific flight-envelope extremities that build confidence and trust in an airplane's aerodynamic capabilities. In addition to +G forces, pilots will experience the uncomfortable sense of 'being negative' and the physiological/psychological aspects that come with it.

### Minimizing Negative Transfer of Training

Emphasis is placed on training within the extended flight envelope of commercial airliners. However, this flight envelope might, at the discretion of the OA UPRT instructor, be exceeded to emphasize specific training elements. To minimize negative transfer of training at such times (CAAP, PCAR 2, Sec. IS 2.3.3.3, App. C) the OA UPRT instructor will discuss with students relevant points, for example:

- Most aerobatic airplanes initiate stall recovery by simply 'unloading' the controls; commercial jet airliners, however, require an additional 'forward nudge' on the stick (nose-down input) to recover.
- Aerobatic airplanes withstand G-loads such as (+6G to -5G) or higher, while commercial airliners operate within (+2.5G to -1G).
- Aerobatic airplanes are flown with more aggressive rudder inputs than commercial airliners.
- The initial procedure during upset recovery in a commercial airliner is to turn OFF the auto-throttle and auto-pilot, both of which aerobatic airplanes do not have.
- In aerobatic airplanes, pilots use their index finger to 'fly or feel' the angle of attack (AoA). In airliners, pilots utilize the digital AoA meter in conjunction with the index finger.

## ACADEMIC TRAINING

CamAv OA UPRT Academic Training focuses on the elements that are important to preventing an airplane from being upset and recovery techniques available for returning an airplane to the normal flight regime.

<i>Core Elements</i>
<b>A. Causes of Airplane Upsets</b>
<i>Environmentally-Induced Airplane Upsets</i>
<i>Systems-Anomalies-Induced Airplane Upsets</i>
<i>Pilot -Induced Airplane Upsets</i>
<i>Misuse of Airplane Automation</i>
<b>B. Flight Fundamentals for Pilots</b>
<i>Flight Dynamics</i>
<i>Energy States</i>
<i>Aerodynamic Flight Envelope</i>
<i>Aerodynamics</i>
<i>Airplane Performance</i>
<i>Icing</i>
<i>Automation</i>
<i>Engine Flameout</i>
<b>C. Recovery from Airplane Upsets</b>
<i>Situational Awareness of an Airplane Upset</i>
<i>Miscellaneous Issues Associated with Upset Recovery</i>
<i>Airplane Upset Recovery Techniques</i>
<b>- End -</b>

The following academic training modules provide classroom instructors various means to teach the previously mentioned core elements.

<i>Training Module</i>	<i>Method of Presentation</i>
<b>Training Guide to On-Airplane UPRT</b>	<i>Student Self-study and/or Classroom Discussion</i>
<b>UPRT Classroom Session</b>	<i>Instructor Briefing</i>
<b>Videos</b>	<i>Classroom Activity</i>
<b>Test Questions</b>	<i>Written Examination for the students</i>
<b>- End -</b>	

# ON-AIRPLANE UPRT EXERCISES FOR INSTRUCTORS

## *Aircraft Handling Characteristics (Objective: to introduce the aircraft and the concept of 'flying by feel')*

	<i>Trainee Mistakes</i>	<i>Instruction Notes</i>
Exercise 1: <b>Rolling, yawing, pitching</b>	Control inputs not decisive enough or too abrupt. No UP rudder causing nose to drop and an increase in airspeed.	Trainee is nervous anticipating UPRT. First time using a stick. Promote looking all sides to practice <b>spatial awareness</b> .
Exercise 2: <b>60° banking turn</b>	No nose-up nudge prior to roll. Abrupt application of rudder.	Mention commercial airliners must use <b>gentle rudder inputs</b> .
Exercise 3: <b>Rolling hands-off using rudder</b>	Rudder inputs too strong. <b>Startles</b> during steep nose-up attitudes anticipating a stall.	Point out <b>startle</b> if it happens and discuss <b>gentle rudder inputs</b> when flying airliners.
Exercise 4: <b>Experience - Simple Aileron Roll</b>	No pitch-up prior to rolling causing diving roll. Looks only ahead. <b>Indecisive</b> control inputs. Difficulty finding wings level after 360° roll.	Aileron rolls <b>build confidence</b> and <b>spatial awareness</b> and should be flown prior to stalls. Trainee should look out all sides throughout the roll.

## *Nose-High Recovery Exercises (Objective: to teach recovery from upsets that cause the aircraft to pitch up)*

	<i>Trainee Mistakes</i>	<i>Instruction Notes</i>
Exercise 1: <b>Lowering nose using PITCH</b>	Does not announce 'Nose High' and 'Auto-Pilot/Throttle OFF'. Weak, delayed control inputs. Does not realize nose is pitching up until airplane is pitched 90°.	Discuss necessity to turn auto-functions OFF. Discuss view turning to sky, in airliners ground will disappear except when looking sideways.
Exercise 2: <b>Lowering nose using ROLL</b>	Too much roll entering Spiral Dive. Too little roll, stalling the airplane.	Set up entry speed. Discuss Spiral Dive on slow recovery, stall after too early recovery.
Exercise 3: <b>Lowering nose using YAW</b>	Abrupt rudder application, stressing vertical stabilizer and leading to Spiral Dive. Indecisive rudder application losing airspeed (not really a problem).	Discuss Spiral Dive and potential for <b>rudder damage</b> on airliners. Explain that 'at the top' airplane will never stall when unloaded even at speeds far below $V_S$ .  *** Trainee will likely <b>startle</b> if airplane follows high-amplitude sinusoidal flightpath; is ok, just point out <b>startle</b> as it happens.

Exercise 4: <b>Stall Recovery</b>	Due to prior training, student is tense before/during recovery, focuses too much on <b>altitude loss</b> , possibly <b>startles</b> . Does not RELEASE, NUDGE, LEVEL, PULL. Exit speed too low, entering a <b>secondary stall</b> . Does not recognize spin onset.	Emphasize following <b>OEM stall recovery</b> . Discuss approach to stall and buffet. Teach to <b>feel the AoA</b> in the fingertips and not worry about <b>altitude loss</b> . To put him at ease, remind trainee he already recovered from a 'stall' during Exercise 3.
Exercise 5: <b>Stall with late recovery into high G</b>	Pulls early into <b>secondary stall</b> .	Ask trainee to execute ten or so stall recoveries in a row (falling-leaf). For that purpose, start at high altitude, e.g. 5,000 AGL.
Exercise 6: <b>Stall with early recovery into Secondary Stall</b>	Pulls too late having to bleed-off too much airspeed.	Encourage 'playing around', pulling & releasing with the index finger and feeling stall onset & recovery in the fingertip, respectively.  <i>*** Throughout every lesson, emphasize gaining control by: RELEASE, NUDGE, LEVEL, PULL.</i>
Exercise 7: <b>Stall with Incipient Spin</b>	Trainee <b>startles</b> and does not release resulting in developed spin.	Trainee will be nervous due to previous training to avoid spins at all cost; re-assure him/her.

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***Nose-Low Recovery Exercises (Objective: to teach recovery from upsets that cause the aircraft to pitch down)***

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	<i>Trainee Mistakes</i>	<i>Instruction Notes</i>
Exercise 1: <b>Lifting nose using PITCH</b>	Does not announce 'Nose Low' or 'Auto-Pilot/Throttle OFF'. Control inputs not decisive or too abrupt. Wings not level prior to pull-out. Slow recovery and airspeed approaching $V_{ne}$ .	Discuss if it is really necessary to turn auto-functions OFF. Explain $V_{ne}$ and G-Force. Discuss view turning to ground, in airliners the sky will likely have disappeared.
Exercise 2: <b>Banking past 60°</b>	<b>Startle</b> . Wings not rolled to level before pulling nose up. Failure to roll back the shortest route. Student 'pulls through' into a Split-S approaching $V_{ne}$ .	Causes: wake vortices, rotor clouds, systems malfunctions.  <b>CAUTION:</b> If near inverted, student might 'pull through' and inadvertently execute a high-speed Split-S.
Exercise 3: <b>Spiral Dive Recovery</b>	Startle. Wings not rolled to level prior to pulling nose up.	Discuss 2.5 G-limitation on airliners.

**Specialized Maneuvers** (Objective: teach unloading, spatial awareness & build confidence without negative transfer)

	<i>Trainee Mistakes</i>	<i>Instruction Notes</i>
Exercise 1: <b>Wing-Over</b>	Pilot does not trust airplane's aerodynamic capabilities and heavily controls it at the top without completely <b>unloading</b> .	This exercise builds trust in the airplane. Pilots should <b>unload</b> at the top, feeling the airplane fly itself around into a 180° heading change (right turn requires some rudder).
Exercise 2: <b>Half-loop, unloading at the top</b>	Trainee not looking sideways. Not <b>unloading</b> at the inverted top. Does not roll wings to level-upright prior to pulling nose up and allows the airspeed to rapidly approach $V_{ne}$ .	Emphasize the importance of <b>unloading</b> when spatially disoriented; commercial airliners have positive static control and will wind cock to a zero AoA if you let them. Discuss the importance of rolling wings to level-upright prior to pulling the nose up.
Exercise 3: <b>Spin</b>	Trainee <b>startles</b> and does not RELEASE, NUDGE, LEVEL, PULL.	Emphasize <b>OEM spin recovery</b> . Trainee will be <b>startled</b> .
Exercise 4: <b>Inverted Flight</b>	Nose drops while trying to maintain inverted horizontal level flight approaching $V_{ne}$ . Reduced cognitive ability while flying upside down.	Point out the difficulty of cognitive processes while upside down. Discuss the effect that -1 G can have on aircraft systems and the potential for malfunctions.  <b>CAUTION:</b> Student might 'pull through' and inadvertently execute a high-speed Split-S.
Exercise 5: <b>Creating lift flying sideways (Knife Edge Maneuver)</b>	Lets nose drop below horizon.	Discuss enormous loads put on vertical stabilizer and rudder.
Exercise 6: <b>Coordinated Aileron Roll</b>	Does not synchronize lift creation through all four axes.	High level of skill required for proper execution.
Exercise 7: <b>Various maneuvers:</b> <b>Reverse Cuban 8</b> <b>Hammerhead</b> <b>Immelmann</b> <b>Avalanche</b> <b>Etc.</b>	Enjoy!	At this stage, let the trainee decide what he/she wants to explore. Talented trainees may even string maneuvers together into a routine.

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