



Ian Knowles, ICAO

III. ICAO Provisions and worldwide rules

Thanks to:

Content developers



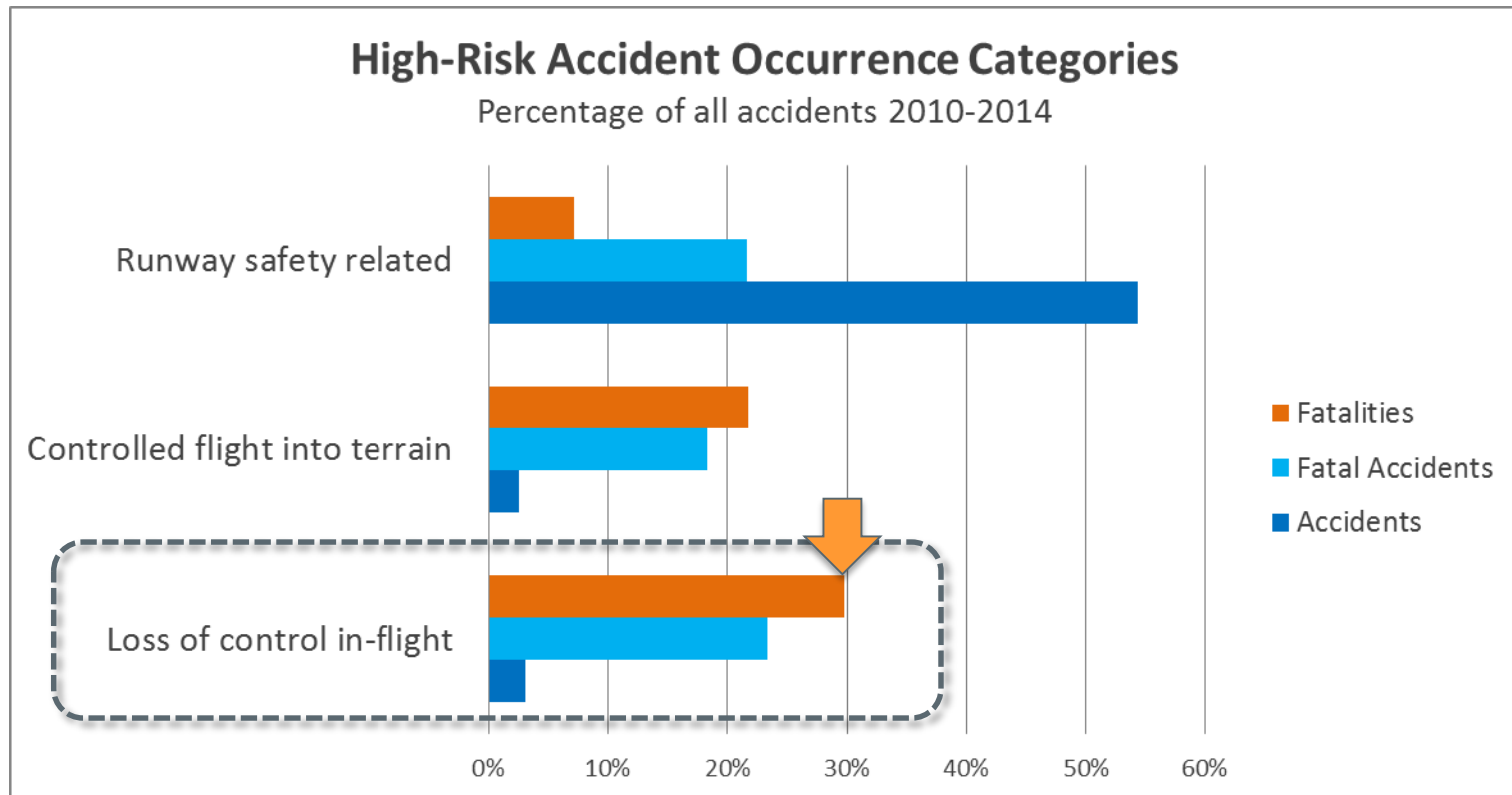
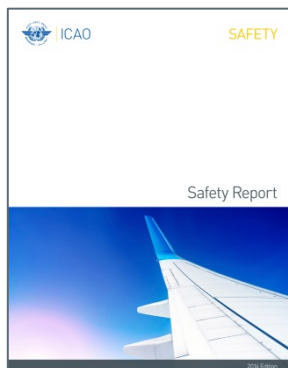
Overview

- Why do we need UPRT SARPs?
- How did we proceed?
- What do the ICAO provisions say?
- What are the big changes?
- What are the implications?
- What guidance is out there?
- Example of implementation

Why do we need UPRT SARPs?

- Mitigating loss of control in-flight accidents is an *ICAO Safety Priority*
- Upset prevention and recovery training (UPRT) for pilots is **one means to address this priority.**
- Only **aeroplane pilots** were considered

Top 3 Safety Priorities



* Accidents involving scheduled commercial air transport with maximum take-off weight exceeding 5 700 kg

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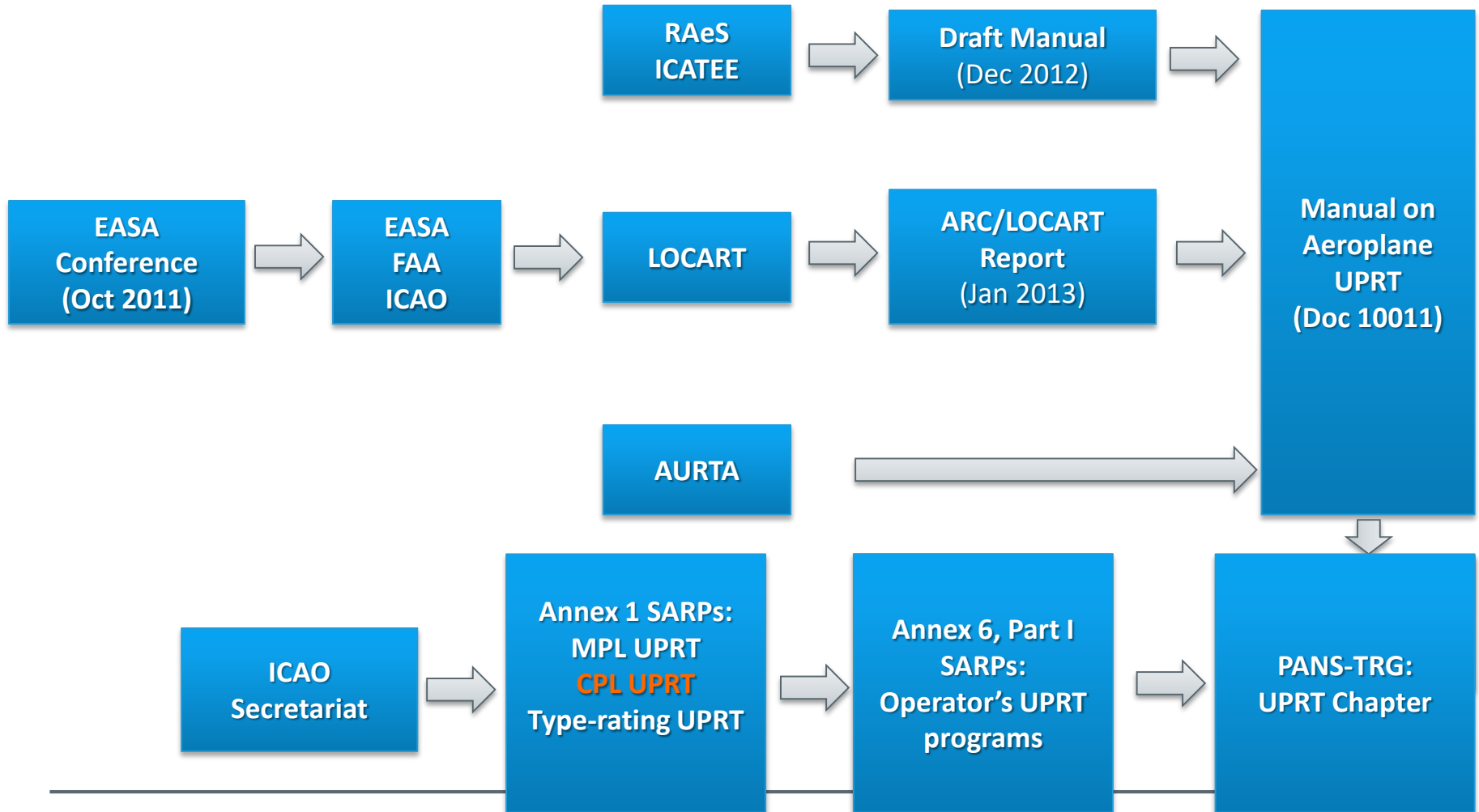
How did we proceed?

- Identified training concerns:
 - **Insufficient knowledge** of high altitude aerodynamics and upset threats
 - **Wrong emphasis** on minimizing altitude loss during recovery from approach to stall
 - **Current training** concentrated in a small domain of the operational envelope

How did we proceed?

- Process used:
 - Build on existing industry initiatives
 - RAeS's ICATEE
 - LOCART initiative
 - Existing Airplane Upset Recovery Training Aid (**AURTA**)
 - Integration of material
 - Annex and PANS-TRG amendments
 - Guidance material

How did we proceed? - *Process used*



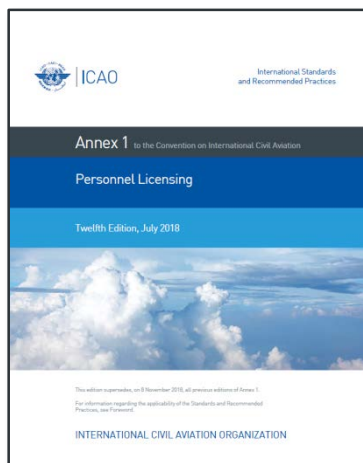
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What the SARPs say:

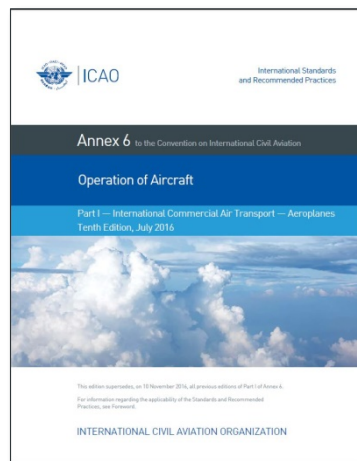
- Pilots must be trained in upset *prevention* and recovery in order to meet:
 - Licensing requirements for CPL and MPL
 - MPL *must* include on-aircraft UPRT and be conducted by an ATO
 - CPL *should* include on-aircraft UPRT and be conducted by an ATO
 - Licensing requirements for multi-crew type-rating
 - Commercial air transport pilot training programme requirements
- *Applicable:* 13 Nov 2014

ICAO UPRT Provisions



Annex 1

UPRT requirements for MPL and the type rating of multi-crew aeroplanes + RP for CPL



Annex 6

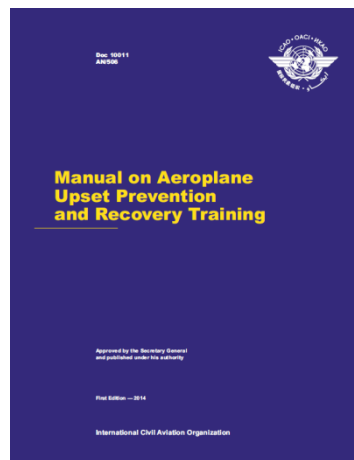
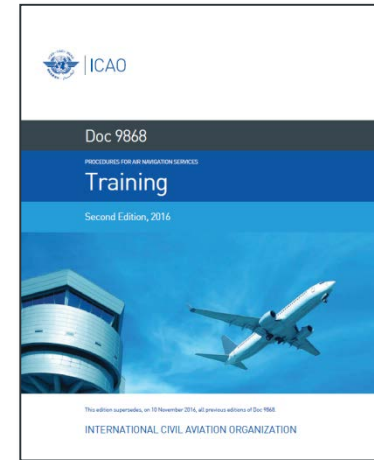
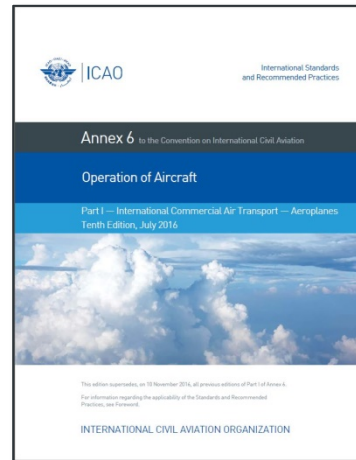
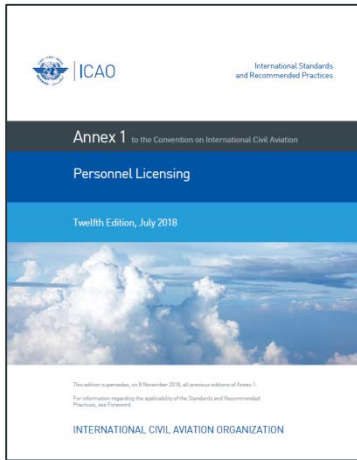
UPRT requirements for flight crew training



PANS-TRAINING

New Chapter to support Annex requirements

ICAO UPRT Provisions



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What are the big changes?

Professional pilots to be trained in upset *prevention* and recovery:

– Licensing

- *On-Aeroplane:* MPL
 - *On FSTD:* Multi-crew type rating
- CPL should be trained
- } Approved UPRT in an Approved Training Organization

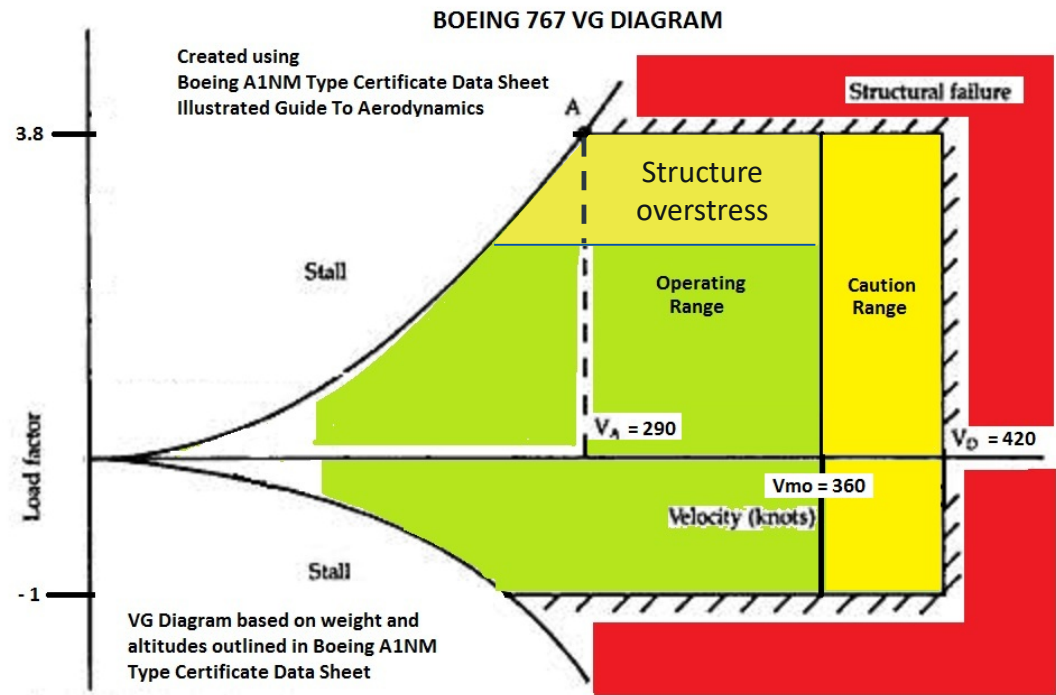
– Commercial air transport training programmes

- Initial (conversion)
- Recurrent

What are the big changes?

Pilots must be trained *throughout* the normal flight envelope (green), including the outer edges.

- Approach to stall
- High Altitude



What are the big changes?

Pilots must be trained *throughout* the normal flight envelope (green), including the outer edges.

Why not outside the envelope?

- **Potential for negative transfer of training:**
 - Out-of-envelope aircraft responses can be random
 - FSTD responses do not replicate aircraft responses faithfully
- **Globally, training benefits do not outweigh safety risks**

What are the big changes?

UPRT is about *training, not checking*



What are the big changes?

Safety considerations for on-aeroplane training

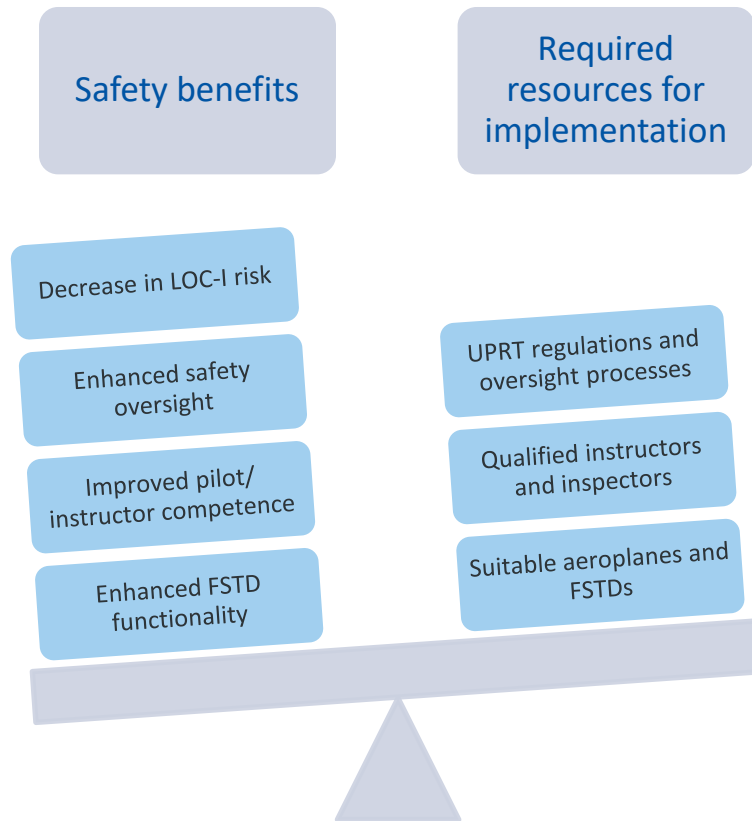
- Effective SMS
- Qualified instructors
- Aeroplane capabilities appropriate to the training tasks
- Operational control procedures

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Implications

- Optimize safety outcomes within available resources



Implications

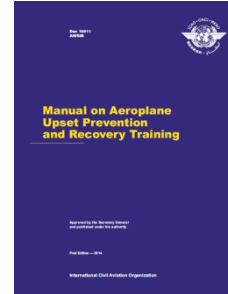
- Additional theoretical training for all pilots
- Many FSTDs will need an update to qualify for the full range of UPRT tasks
- Need to balance cost/benefits for delivery of on-aircraft UPRT:
 - SMS considerations
 - Aerobatic aircraft are recommended but not the only option
- Instructors will need further training described in PANS-Training to meet Annex 1 authorization requirements
- Bridge-training for current airline pilots

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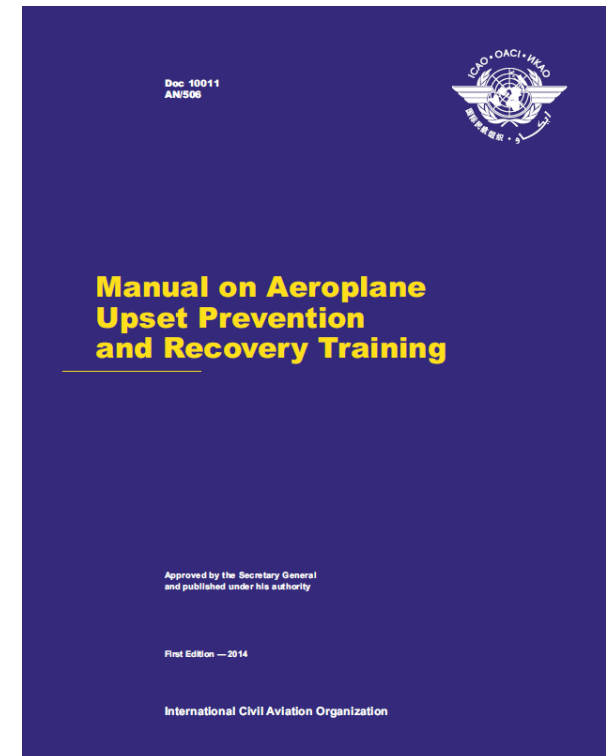
What guidance is out there?

- Manual on Aeroplane Upset and Recovery Training (Doc 10011)
- Aeroplane Upset Recovery Training Aid
- Manual of Criteria for the Qualification of FSTDs (Doc 9625)
- LOC-I Website



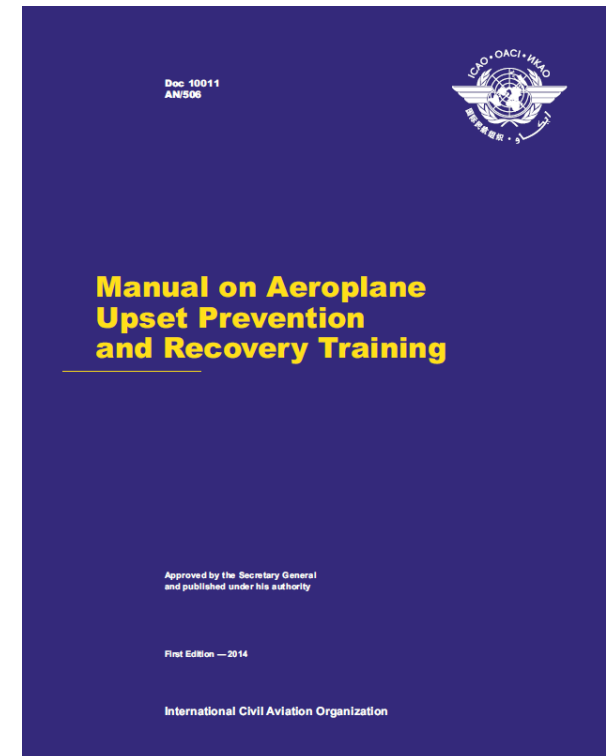
Manual on Aeroplane Upset and Recovery Training (*Doc 10011*)

- Introduction:
 - Upset defined, history & applicability
- Training programme requirements
- Training:
 - Academic training
 - On-aeroplane training
 - FSTD training
(non-type-specific and type-specific FSTD)
 - OEMs:
 - Recommendations and training scenarios
 - Upset recovery techniques



Manual on Aeroplane Upset and Recovery Training (*Doc 10011*)

- FSTD fidelity requirements for UPRT
(*see later*)
- UPRT Instructors:
 - academic, on-aeroplane, FSTD
- Regulatory oversight
- Appendix:
 - Competency-based UPRT programmes



Manual on Aeroplane Upset and Recovery Training (*Doc 10011*) – *Academic and Practical Topics*

- *Aerodynamics*
- *Causes and contributing factors of upsets*
- *Safety review of accidents & incidents relating to aeroplane upsets*
- *G-awareness*
- *Energy management*
- *Flight path management*
- *Recognition*
- *Upset prevention and recovery techniques*

Manual on Aeroplane Upset and Recovery Training (*Doc 10011*) – *Academic and Practical Topics*

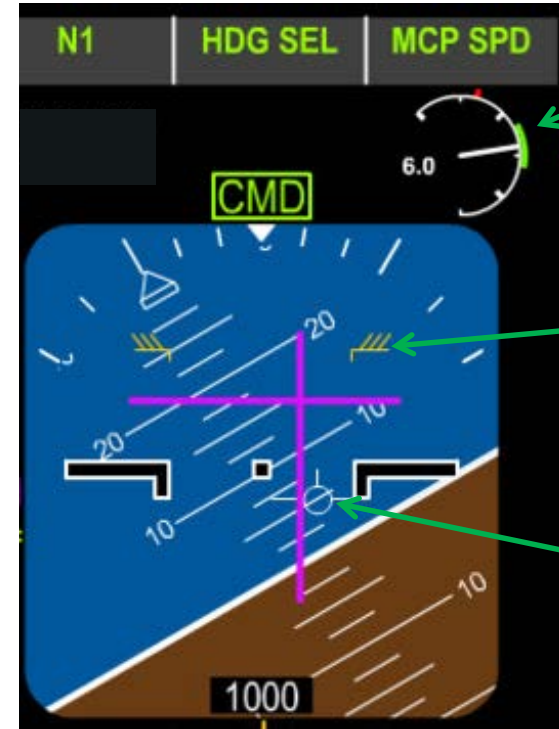
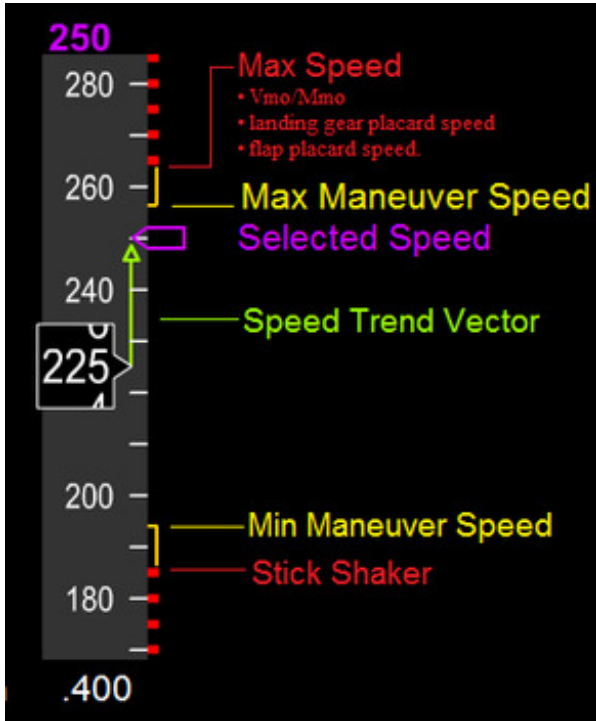
- *System malfunction*
- *Specialized training elements*
- *Human Factors:*
 - situation awareness
 - startle and stress response
 - threat and error management (TEM)

Examples of training –*FSTD Manoeuvre Exercise*

- *Any UPRT programme being considered by an ATO/airline should be submitted to the OEM for a “No-Technical Objection” statement*
- *Video:*
 - Provided by *Alaska Airlines* on B737-NG UPRT
 - Example of a UPRT exercise that airlines may wish to develop
 - Not an approved training exercise
 - Illustrates instructor interaction and inputs, as well as trainee understanding
 - Uses B-737 PFD symbols, described on next slide

Examples of training –FSTD Manoeuvre Exercise

- To help in understanding the videos, here are symbols of the B737-800 PFD for the speed tape/ADI:



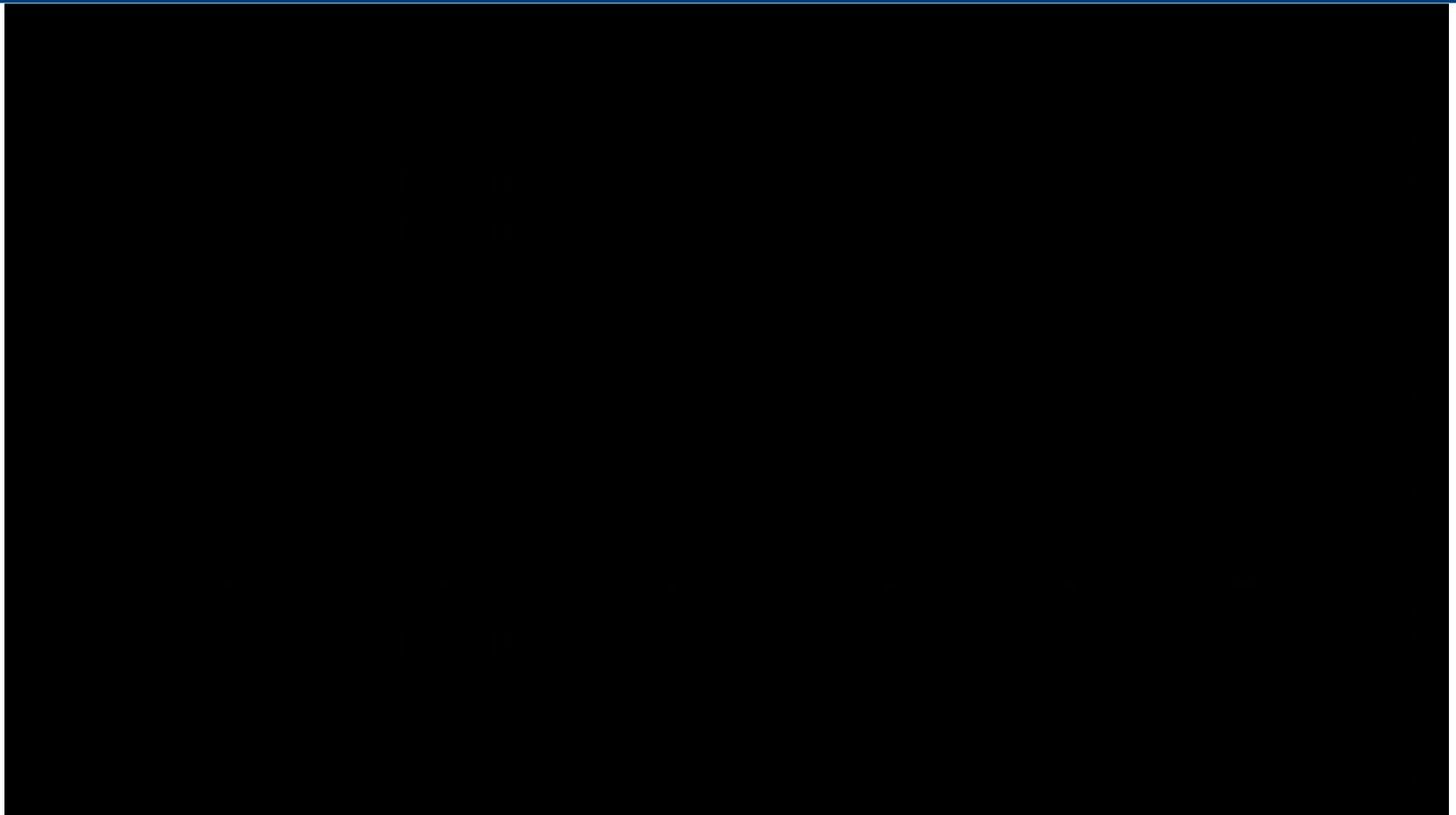
AOA (Cpt)

Pitch Limit Indicator

Flight Path Vector

Examples of training –*FSTD Manoeuvre Exercise*

Video



Airplane Upset Recovery Training Aid

- Revision 2 to be updated
 - By OEMs and with ICAO support
 - Covering turboprop and smaller aeroplanes
 - User-friendly format
 - Published as ICAO doc
 - Target: end of 2015
 - Free and easily accessible



Manual of Criteria for the Qualification of FSTD

(Doc 9625)

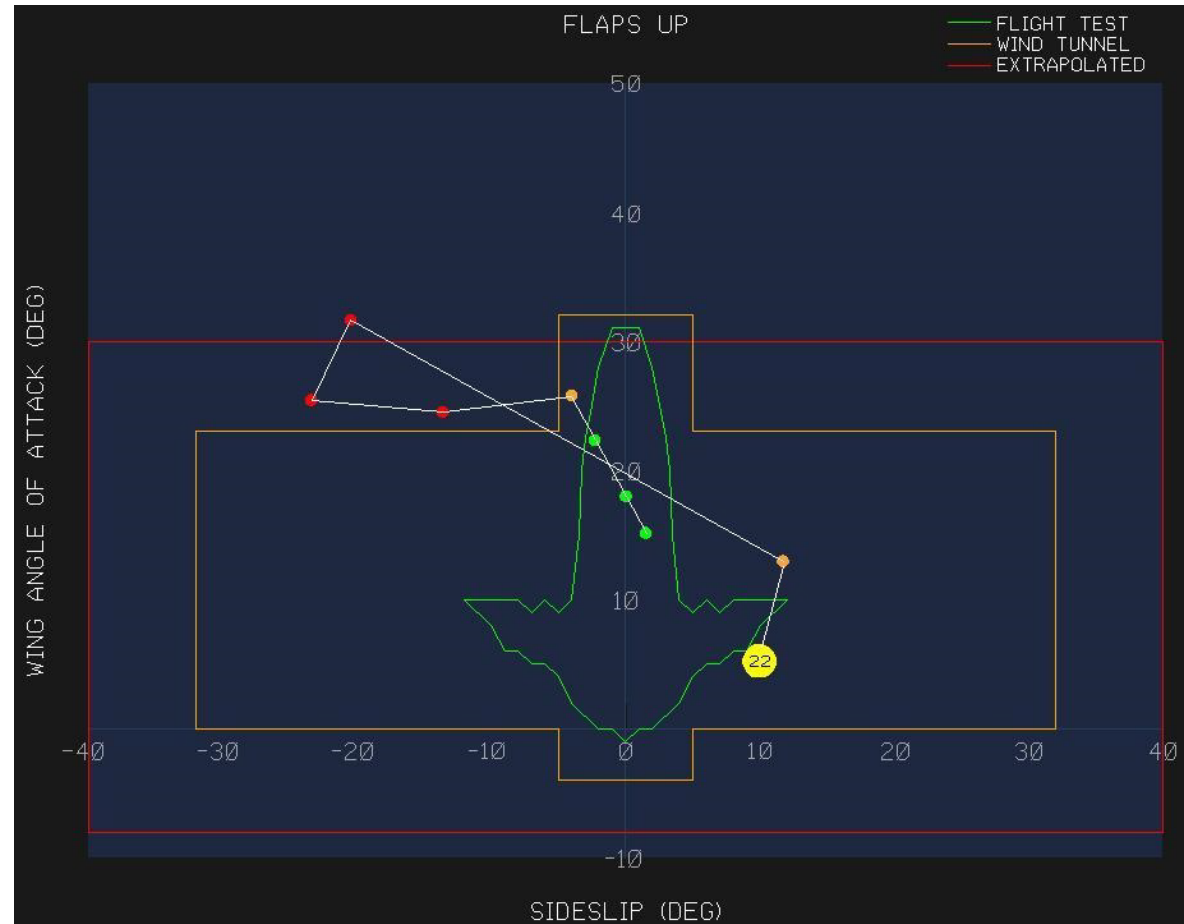
- 4th edition 2015
- New **Attachment P** has guidance for UPRT: Models and qualification tests or requirements for -
 - Aeroplane type-specific recognition cues of the first indication of the stall (stall warning, aerodynamic buffet...)
 - Aeroplane type-specific recognition cues of an impending aerodynamic stall
 - Exemplar recognition cues and handling qualities from the stall break through recovery *if prescribed by regulations*
 - Engine and airframe icing evaluation



Manual of Criteria for the Qualification of FSTD

(Doc 9625)

- UPRT instructor tools:
 - Alpha-beta cross plot
 - Recording manoeuvres for debrief

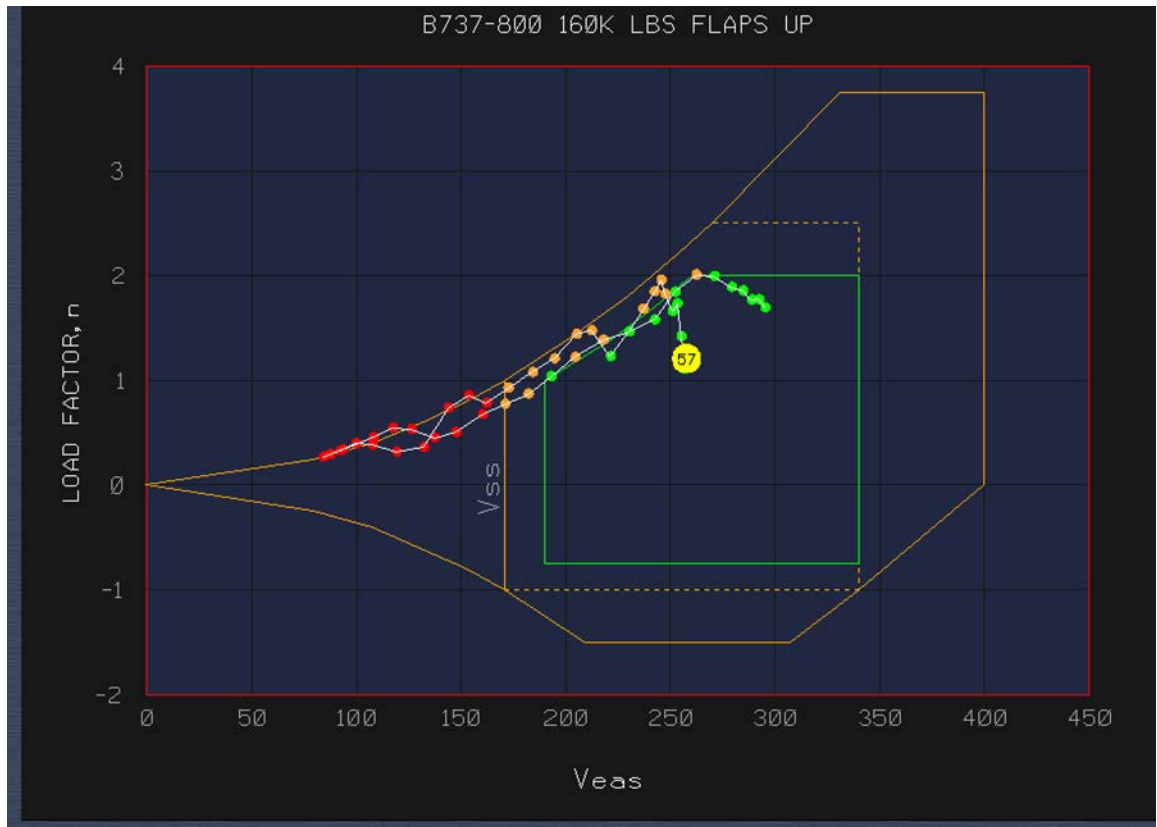


Example of alpha/beta envelope plot

Manual of Criteria for the Qualification of FSTD

(Doc 9625)

- UPRT instructor tools:
 - Load factor/speed plot
 - Recording manoeuvres for debrief



Example of V-n plot

Manual of Criteria for the Qualification of FSTD

(Doc 9625)

- UPRT instructor tools:
 - Real time display of parameters



Example of instructor feedback display

LOC-I Website



The screenshot shows the homepage of the LOC-I website. At the top is a navigation bar with links for Home, Graphs, trends analysis, Technology, Operations, Training, Events, and Contacts, along with a search box and a 'Go' button. The main banner features a large image of a Boeing 747 in flight against a blue sky with clouds. The text on the banner reads 'LOSS OF CONTROL IN-FLIGHT' and 'Loss of Control In-Flight Welcome to the airline industry's official on loss of control in-flight information and reports'. Below the banner are three columns: 'News & Events' with two paragraphs of placeholder text, 'Articles' with two articles each featuring a small image (an airplane and a world map) and placeholder text, and 'Contributors' with one paragraph of placeholder text.

Home | Graphs, trends analysis | Technology | Operations | Training | Events | Contacts Search **Go**

LOSS OF CONTROL IN-FLIGHT

Loss of Control In-Flight
Welcome to the airline industry's official on loss of control in-flight information and reports

News & Events

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Articles

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Contributors

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- EASA/FAA Implementation

FSTD REQUIREMENTS

					
APPROACH TO STALL	AERODYNAMIC STALL	UPRT MBT + SBT	ICING Engine & Airframe	CROSSWIND With Gusts	BOUNCED LANDING
<ul style="list-style-type: none"> Stall identification devices Type Specific Stall entry at 1g & Turning Flight Adds High Altitude Cruise CCA Normal, to Protections & CCA Non-Normal, to Recovery Pusher validation test * Requires accurate icing model 	<ul style="list-style-type: none"> Aerodynamic Stall modeling Stall Identification to +10 AOA Type Specific Stall entry at 1g & Turning Flight Adds High Altitude Cruise CCA Normal, to Protections & CCA Non-Normal, to Recovery Pusher validation test 	<ul style="list-style-type: none"> Maneuver Based Training (MBT) Scenario Based Training (SBT) Alpha / Beta Plots V-n Diagram Flight Controls Schematic Flight Instruments Schematic Data Recording 	<p>Representative Aerodynamic Effects</p> <ul style="list-style-type: none"> Changes in pitching moment Increase in drag Effect on stall angle of attack Effect on control effectiveness Effect on control forces Effect on stall buffet characteristics and threshold perception Effects on engine power reduction/variation, vibration, etc. 	<p>Takeoff & Landing</p> <ul style="list-style-type: none"> Evaluated by F&S Testing Crosswind at Max Demonstrated 	<p>Instructor Led / Shallow & High Bounce</p> <ul style="list-style-type: none"> Evaluated by F&S Testing Instructor May Callout Bounce
Training:	FSTD:	Training:	FSTD:	Training:	FSTD:
 	 	 	 	 	 
 	 	 	 	 	 
	 				



An FSTD used to conduct this training must be qualified for the task.



ICAO

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Lima

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Nairobi

**Asia and Pacific
(APAC) Sub-office**
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THANK YOU