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Module 1 – Day 1

UPRT Provisions: **What do they say?**

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

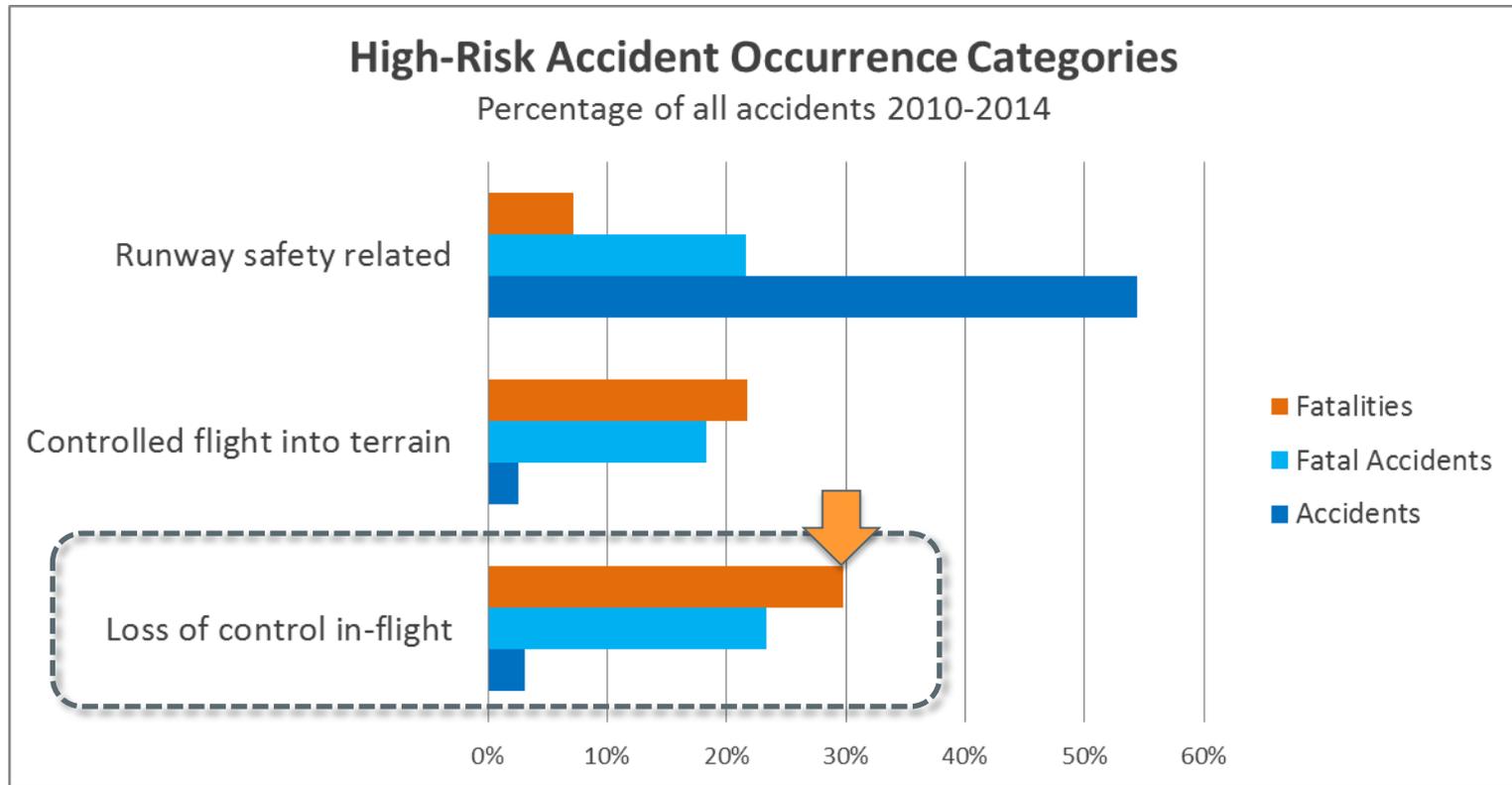
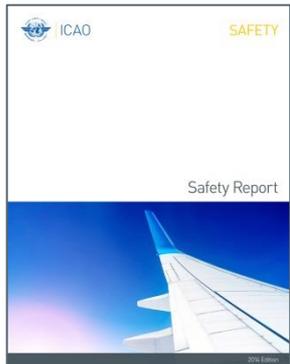
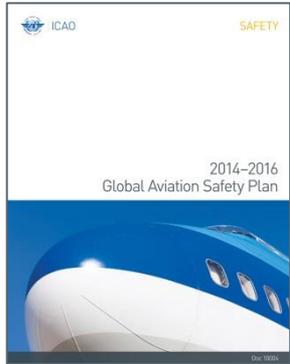
Why do we need UPRT SARPs?

- 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.**

Why do we need UPRT SARPs?

- Only **aeroplane pilots** were considered:
 - Smaller ‘loss of life’ numbers in other categories (helicopter, airship, powered-lift, glider, free balloon)
 - No expertise in helicopters and other categories
 - Other means being developed for helicopter

Top 3 Safety Priorities



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

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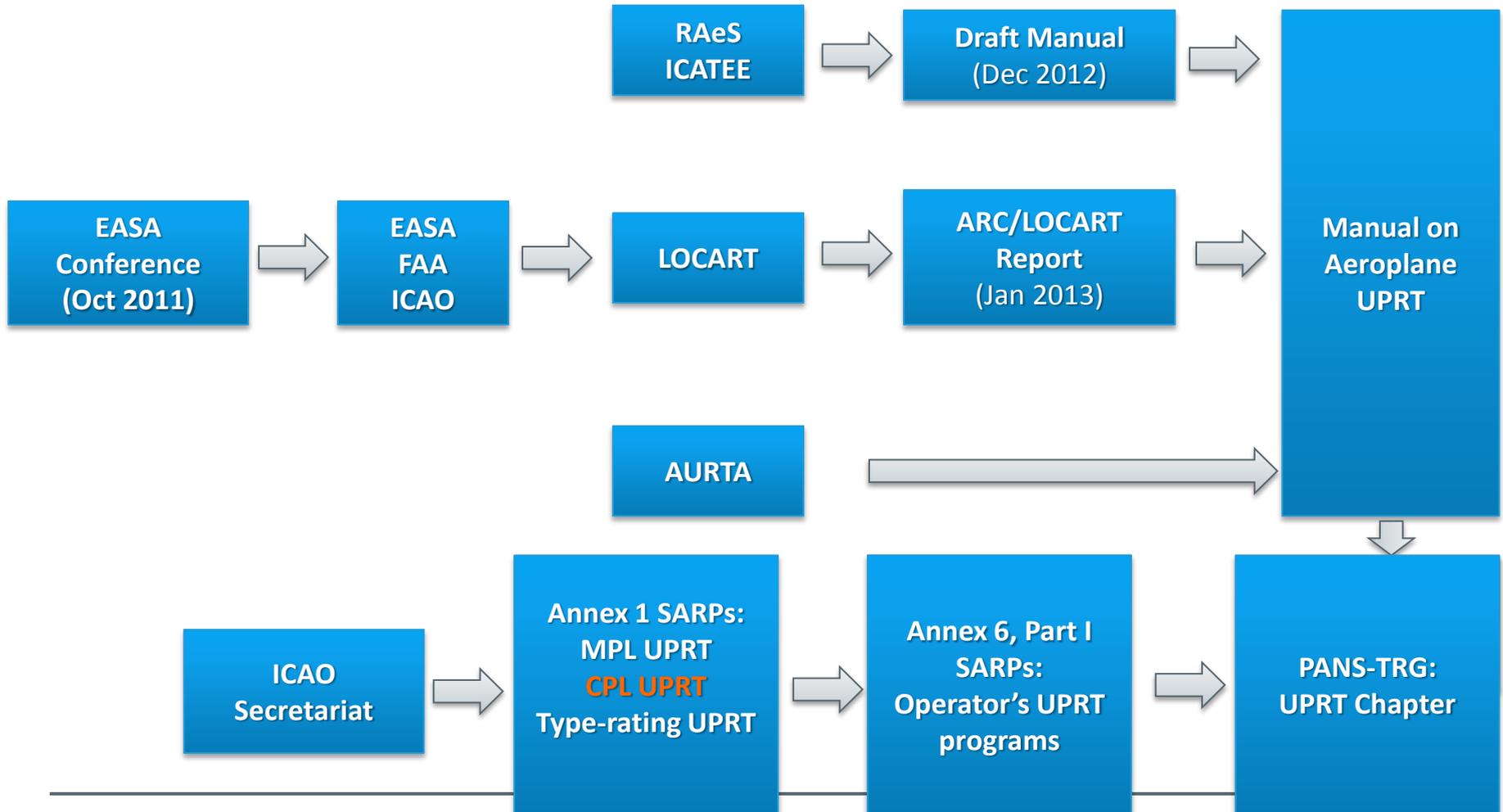
How did we proceed?

- 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*



UPRT: One Aspect of a Global Approach



- Collaborative approach:
 - Information sharing
 - Lifecycle model for pilot training
 - Implement UPRT
 - Outreach

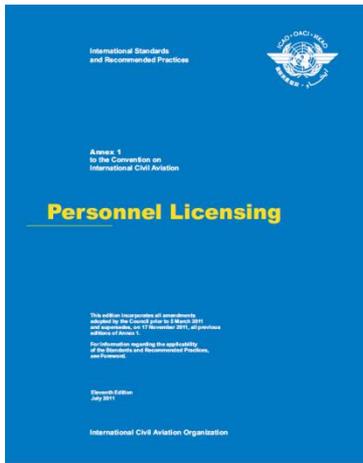
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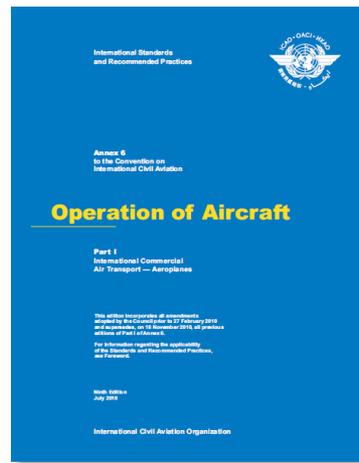
What the SARPs say:

- 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 to be conducted by an ATO (Standard)
 - CPL *should* include on-aircraft UPRT to be conducted by an ATO (RP)
 - Licensing requirements for multi-crew type-rating
 - Commercial air transport pilot training programme requirements
- Applicable: 13 Nov 2014
- Where?

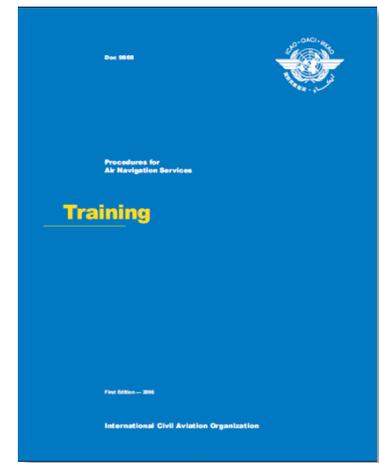
ICAO UPRT Provisions



Annex 1
UPRT requirements for MPL and the type rating of multi-crew aeroplanes + RP for CPL

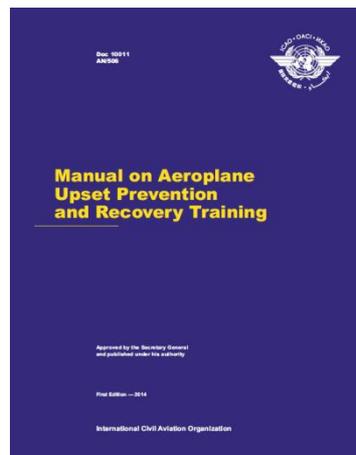
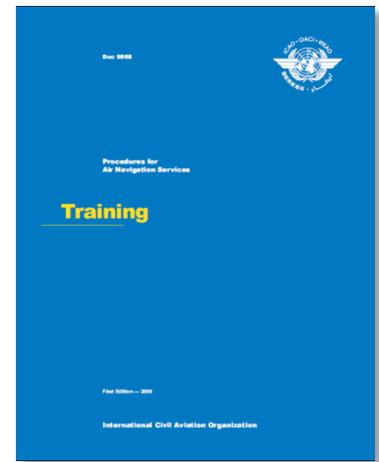
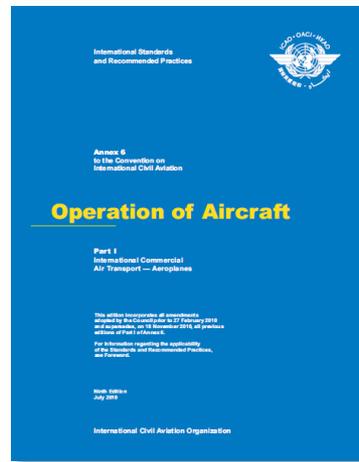
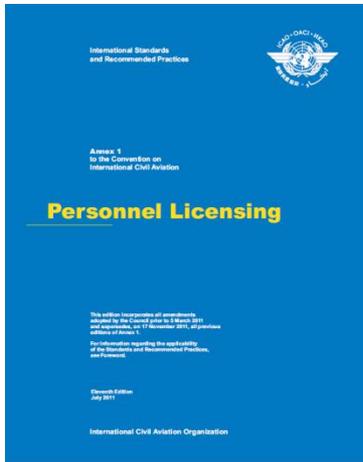


Annex 6, Part I
UPRT requirements for flight crew training



PANS-TRAINING
New Chapter to support Annex requirements

ICAO UPRT Provisions



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What are the big changes?

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

– Licensing

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

– Commercial air transport training programmes in FSTD

- Initial (conversion)
- Recurrent

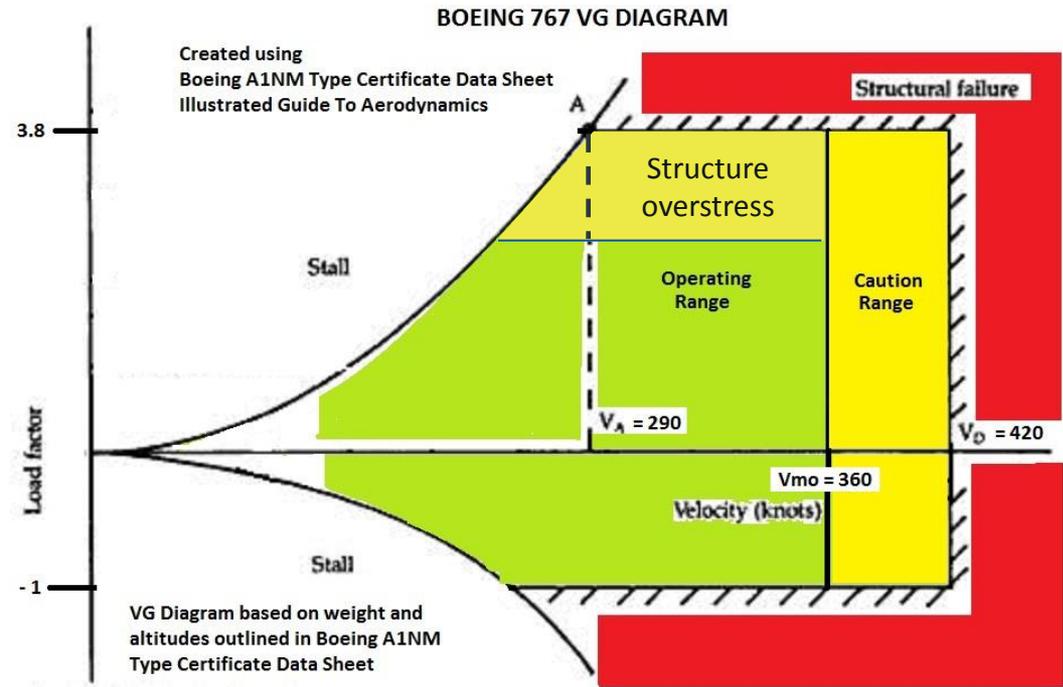
Approved UPRT by air operator or in an ATO



What are the big changes?

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

- Approach to stall
- High Altitude



What are the big changes?

2. 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?

3. UPRT is about *training, not checking*



What are the big changes?

4. Cost-benefit assessment – Personnel costs

- Of on-aircraft and FSTD UPRT
- Resources and context
 - Airline bridge training required for existing pilots

What are the big changes?

4. Cost-benefit assessment – Personnel costs

Licence/ Rating/ Training	# of individuals (Doc 9956)	Training type	Knowledge USD costs per individual	Aircraft/ FSTD USD costs per individual	Pilot salary (100,000 USD/ year)	Instructor costs (USD)	Total (m USD)	Remarks
CPL	50,000 yearly	On- aircraft	200	1000 (4 hrs)		150	67.5	Recommended practice — yearly licensing costs
MPL	300 yearly	On- aircraft					0.08	no additional costs (except type-rating)
Type-rating	100,000 yearly	FSTD	200	500	65	150	59.0	1 hour per type rating
Recurrent training	450,000 yearly	FSTD		250	32	60	84.2	30 minutes per year
Operator training	450,000	FSTD	200	2000	260	1000	882.0	4 hours once — Non recurrent — Bridge-trg
Instructor	50,000	UPRT qualif.	400	2500	500	1000	119.2	Instructor qualification — non recurrent
TOTAL							210.8 1,001.2	Recurrent Non recurrent

What are the big changes?

4. Cost-benefit assessment – FSTD Costs

- From NPRM FAA-2014-0391 (simplified/global) – includes UPRT and icing upgrade

Estimated FSTD Type VII Upgrade Costs (USD)					
FSTD	Development Costs	Implementation Costs	Loss of productivity	Affected # of FSTD	Total (m USD)
Old	24 000	72 000	23 000	381	45.4
Newer	6 500	40 000	23 000	442	30.7

What are the big changes?

5. Safety considerations for on-aeroplane training

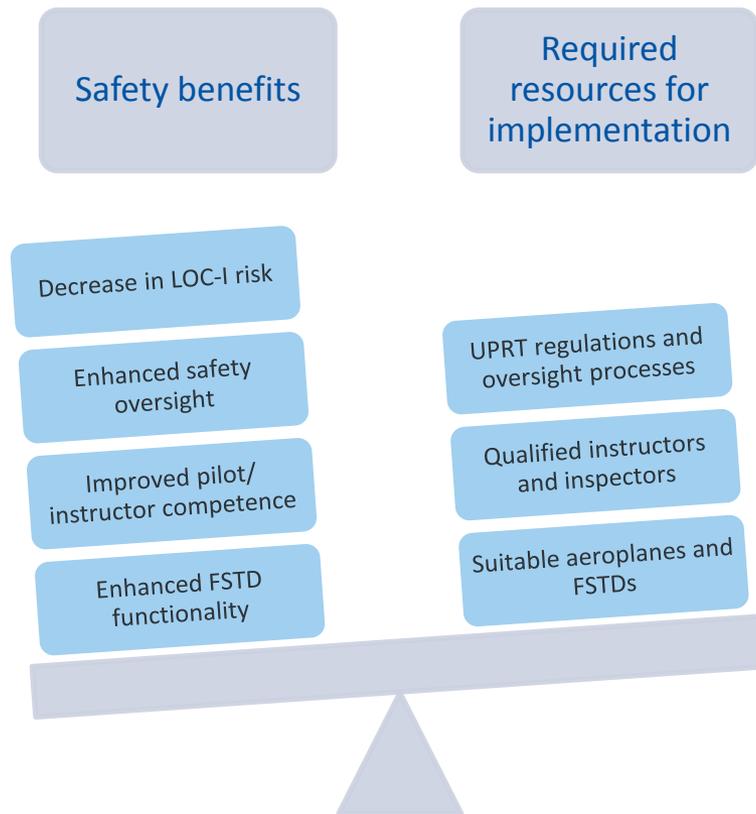
- Effective SMS
- Qualified instructors
- Aeroplane capabilities appropriate to the training tasks
- Operational control procedures

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Implications

- Optimise safety outcomes within available resources



Implications

- Additional theoretical training for all pilots
- Bridge-training for current airline 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

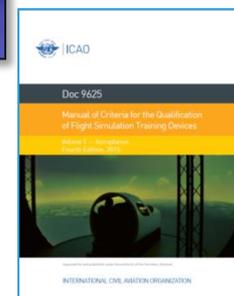
Proper authorization shall comprise: ... **the authority to act as an agent of an approved organization authorized ... to carry out flight instruction;** or a specific authorization...

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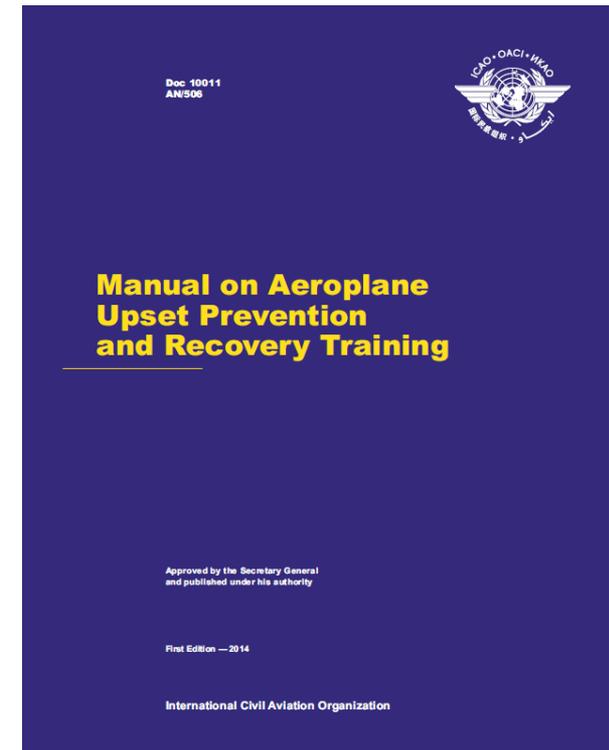
What guidance is out there?

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



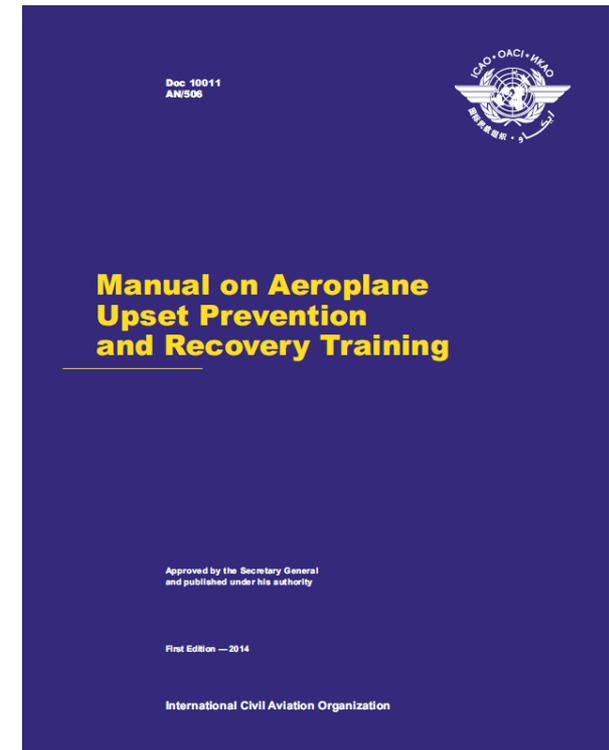
Manual on Aeroplane Upset Prevention and Recovery Training *(Doc 10011)*

- 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 Prevention 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 Prevention 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 Prevention 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 – *Practical FSTD Exercise*

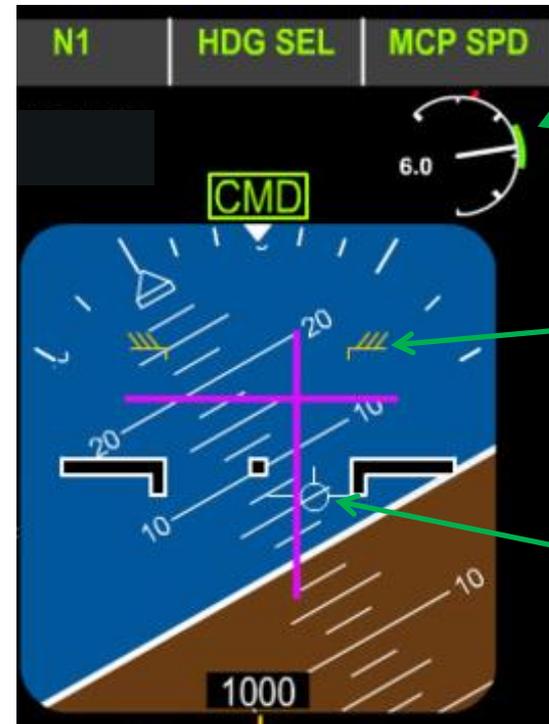
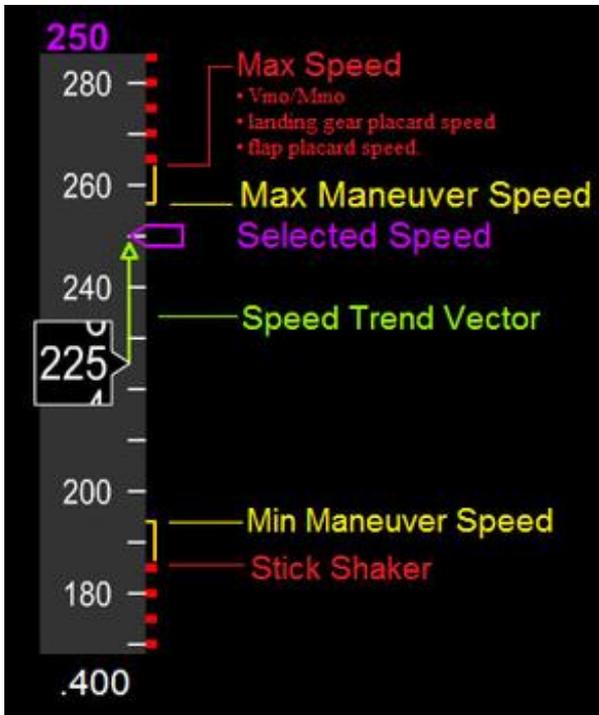
- *Objective: to experience and understand thrust availability*
- *Exercise: acceleration performance from second regime at low altitude and high altitude, e.g. 210-260 KIAS @ 5000/20000/35000ft*
- *Conditions: manual flying; max cruise thrust; ISA+10C*
- *Outcomes:*
 - *Times: 20s/50s/>6 minutes or not possible → demonstrate trading altitude for speed*
 - *Demonstrate difference between max cruise/max continuous/max rated thrust*
 - *Note pitch coupling effect differences with altitude at thrust increase*
 - *Note reduced damping at high altitude + greater effects of pitch attitude change*

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, if using scenarios not included in Doc 10011 or the Airplane Upset (Prevention and) Recovery Training Aid (Rev 2 or 3)*
- *Two videos:*
 - 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 1



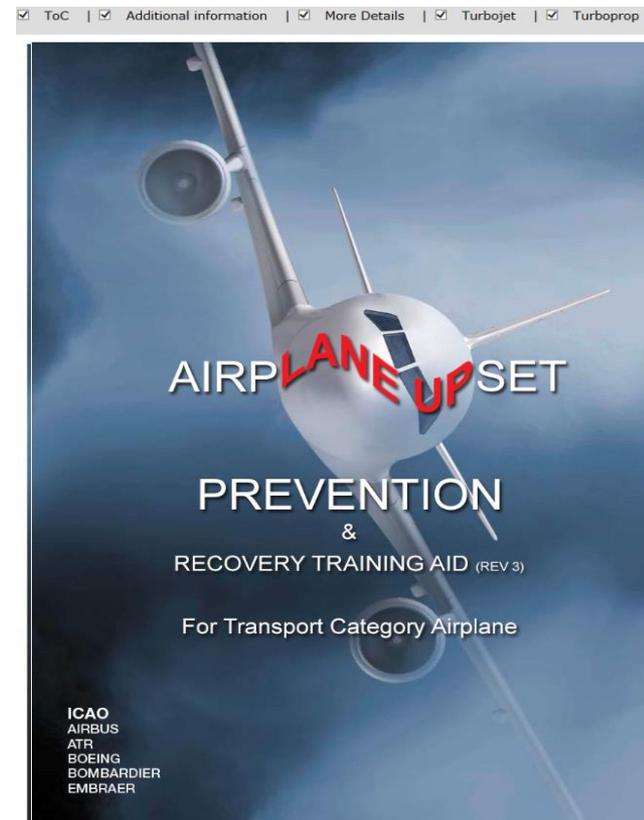
Examples of training – *FSTD Manoeuvre Exercise*

Video 2



Airplane Upset Recovery Training Aid

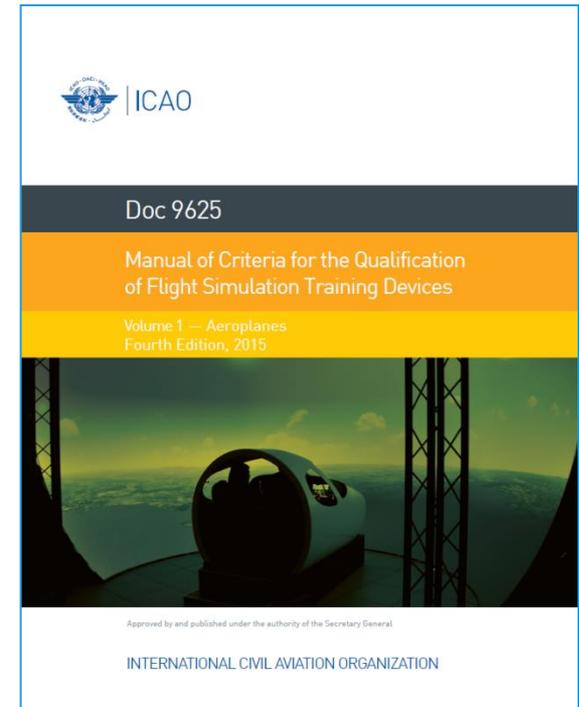
- Revision 2 being updated → Airplane Upset Prevention and Recovery Training Aid
 - By OEMs and with ICAO support
 - Covering turboprop and smaller aeroplanes
 - Free and easily accessible
 - User-friendly format
 - Published as ICAO doc
 - Target: Q1 2017



Manual of Criteria for the Qualification of FSTD

(Doc 9625)

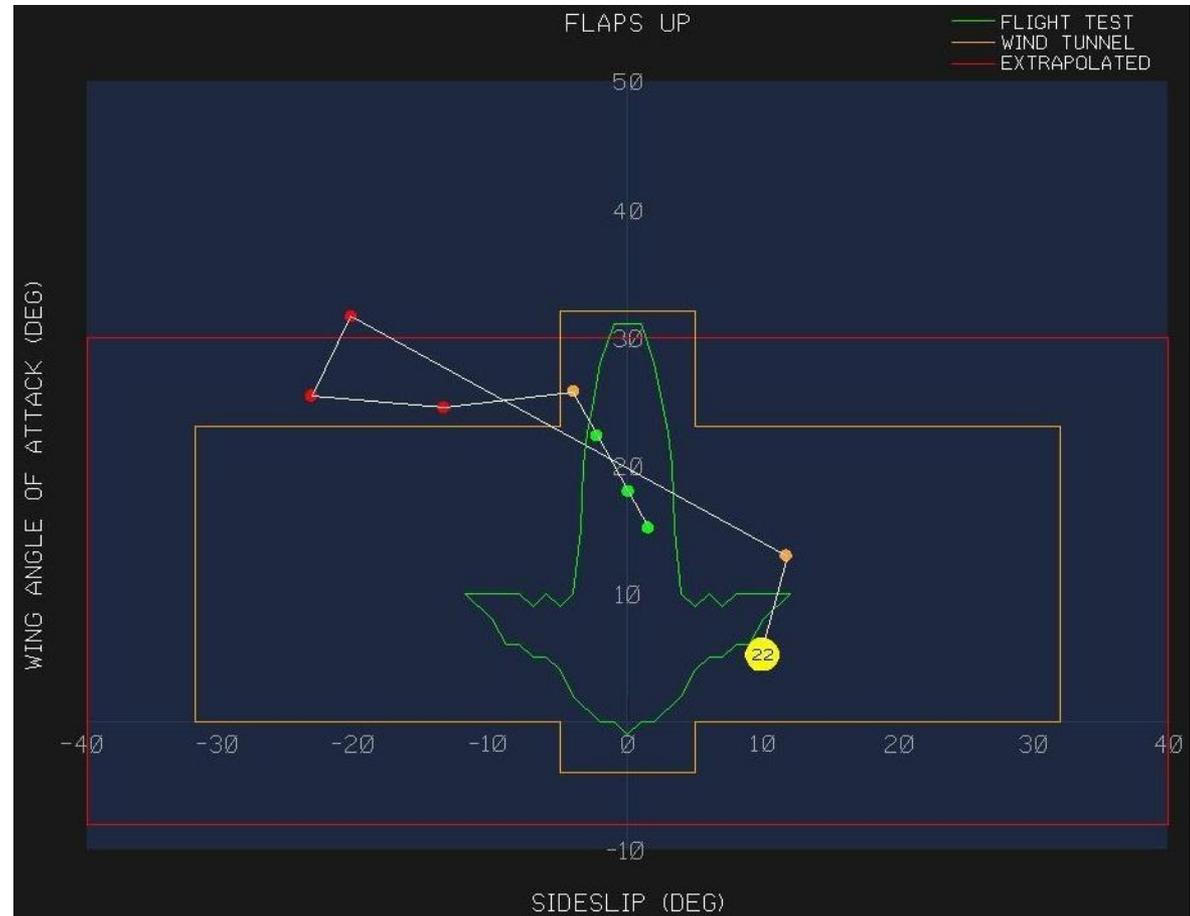
- 4th edition (August 2015)
- New attachment P has guidance for UPRT: Models and qualification tests or requirements for -
 - Aeroplane type-specific recognition cues of the first indication of the stall (stall warning, aerodynamic buffet...)
 - Aeroplane type-specific recognition cues of an impending 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:
 - IOS displays
 - Recording manoeuvres for debrief

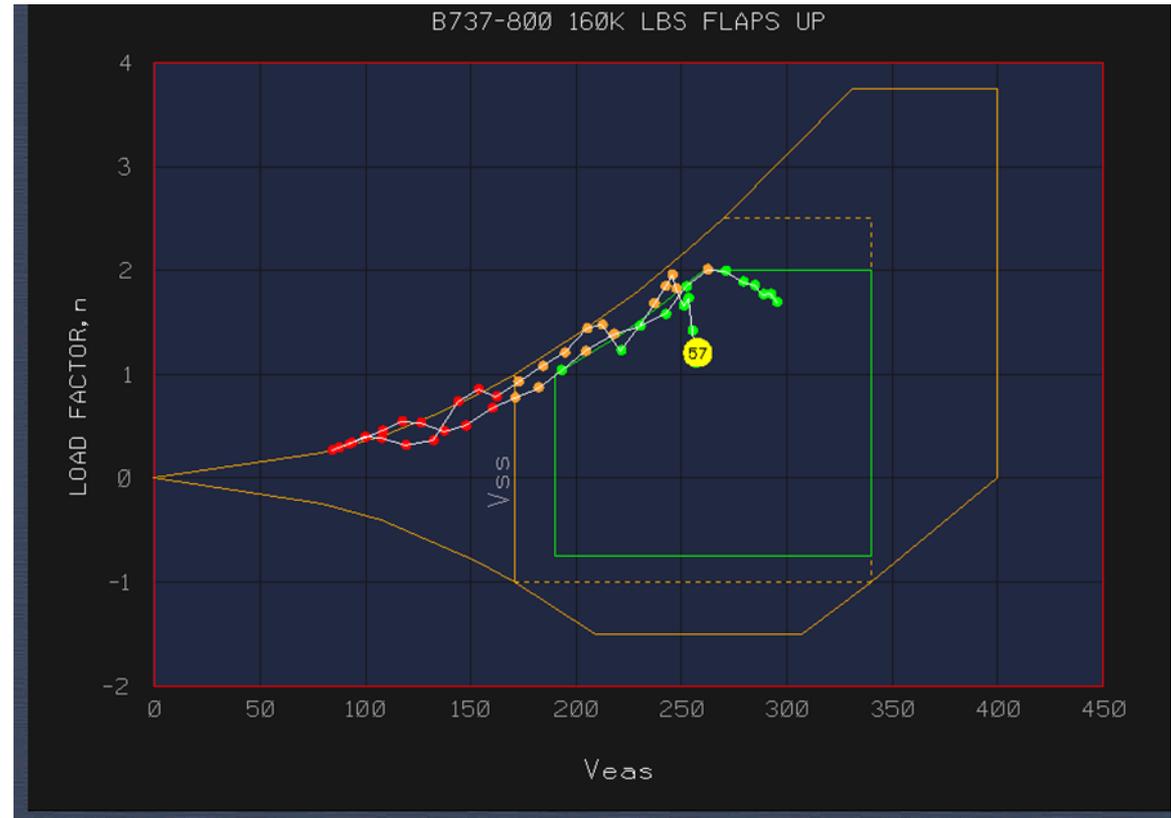


Example of alpha/beta envelope plot

Manual of Criteria for the Qualification of FSTD

(Doc 9625)

- UPRT instructor tools:
 - IOS displays
 - Recording manoeuvres for debrief



Example of V-n plot

Manual of Criteria for the Qualification of FSTD

(Doc 9625)

- UPRT instructor tools:
 - IOS



Example of instructor feedback display

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Case Study: US FAA implementation

New stall and UPRT requirements in the United States

- Congressional Direction
- Aviation Rulemaking Committee (International Harmonization)
- Public Comment
- Final Rule Publication
- Education (Public/Inspectors)

Congressional Direction

Airline Safety and FAA Extension Act of 2010 (P.L. 111-216) - 2010

- Added numerous measures (Sections) designed to improve aviation safety
- Required the FAA to establish:
 - Various multidisciplinary panels, ARCs, and/or task forces

Aviation Rulemaking Committee

- Requires a multidisciplinary panel (ARC) to study and report on methods to improve pilot familiarity with and response to stick pusher, icing, microburst and windshear events. (208)
- Report from FAA to Congress *Completed 2011*
- ARC expanded – global effort with ICAO and EASA to address LOC & upset prevention and recovery training (LOCART)

Final Rule Publication

- Requires part 121 air carriers to provide stall and upset prevention and recovery training.
 - Supplemental NPRM May, 2011 *Completed*
 - Public Comment 120 days *Completed*
 - Final rule published Nov, 2013 *Completed*
 - Effective 12 March 2019

5 Year Implementation

- Allows time for appropriate FSTD Changes
 - Part 60 NPRM
- Inspector Education
 - Necessity for standardization and consistency
- Public Education
 - Necessity for setting expectations

Rulemaking – Part 60 - FSTD

- Initiated to address simulator fidelity
 - Considers:
 - Full stall simulator evaluation criteria ← not an ICAO requirement
 - Upset prevention and recovery training
 - Enhanced Airborne Icing Modeling
 - NPRM conducted till January 6 2015
 - Part 60 standards published in March 2016 to allow time for operators to modify and evaluate FSTDs before the regulations' compliance date

Inspector Education:

- Important and needed:
 - Briefings before the release of the final rule
 - On-line training sessions with field inspectors
 - Release of inspector guidance/job aids
 - Annual Principal Operations Inspector conference
 - POI FSTD Training (Stall and Upset Training)

Public Education for aviation industry

- Press Release
 - Inform the general public
- Public Awareness:
 - Publication of the rule in the federal register
 - Release of guidance documents (job aids, advisory circulars)
- Public Interest/Industry Groups
 - Multiple industry presentations to distribute information and discuss implementation expectations

2019 FAA Requirements

Stall Prevention

- At first maneuvers based
 - Takeoff
 - Clean
 - Landing
- Incorporate Scenarios
- **Checking/Testing**

Stall Recovery

- Only maneuvers based
- Instructor led
- Hands on pilot experience through recovery

Upset Prevention

- Manually controlled slow flight;
- Manually controlled loss of reliable airspeed;
- Manually controlled instrument departure and arrival

Upset Recovery

- Nose High
- Nose Low

Take-home messages

- Effective implementation of UPRT requires considerable planning and effort by:
 - ATO's
 - airline operators
 - CAAs
- Ineffective implementation of UPRT may result in negative safety outcomes
- **U**PRT = training not checking

WE NEED TO GET THIS RIGHT!



ICAO

**North American
Central American
and Caribbean
(NACC) Office**
Mexico City

**South American
(SAM) Office**
Lima

**ICAO
Headquarters**
Montréal

**Western and
Central African
(WACAF) Office**
Dakar

**European and
North Atlantic
(EUR/NAT) Office**
Paris

**Middle East
(MID) Office**
Cairo

**Eastern and
Southern African
(ESAF) Office**
Nairobi

**Asia and Pacific
(APAC) Sub-office**
Beijing

**Asia and Pacific
(APAC) Office**
Bangkok



THANK YOU