

Collaborating to address
LOSS OF CONTROL IN-FLIGHT



LOSS OF CONTROL IN-FLIGHT WORKSHOP

Lima, Peru

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Module 1

UPRT Provisions: What do they say?

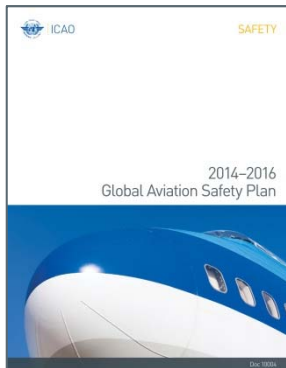
Overview

- Why do we need UPRT SARP's?
- 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

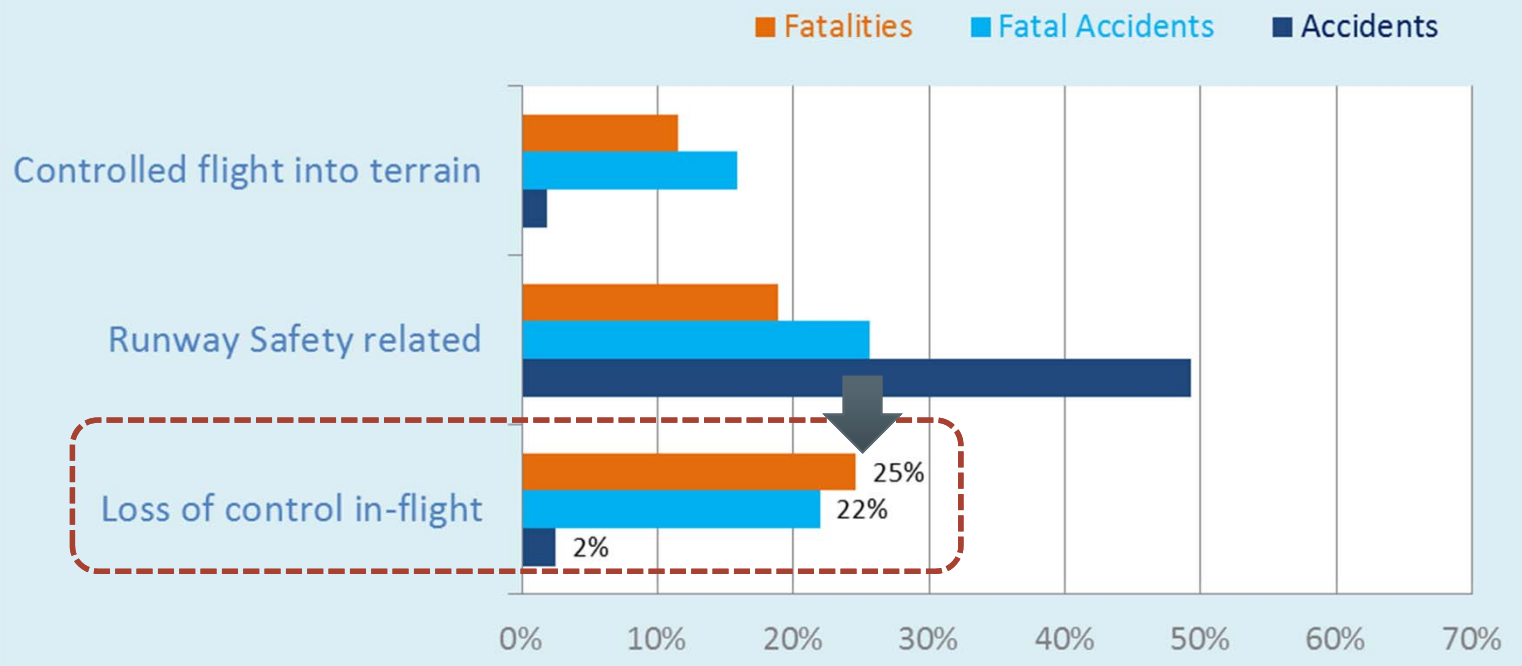
Why do we need UPRT SARPs?

- 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



Percentage of All Accidents: 2006-2013



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

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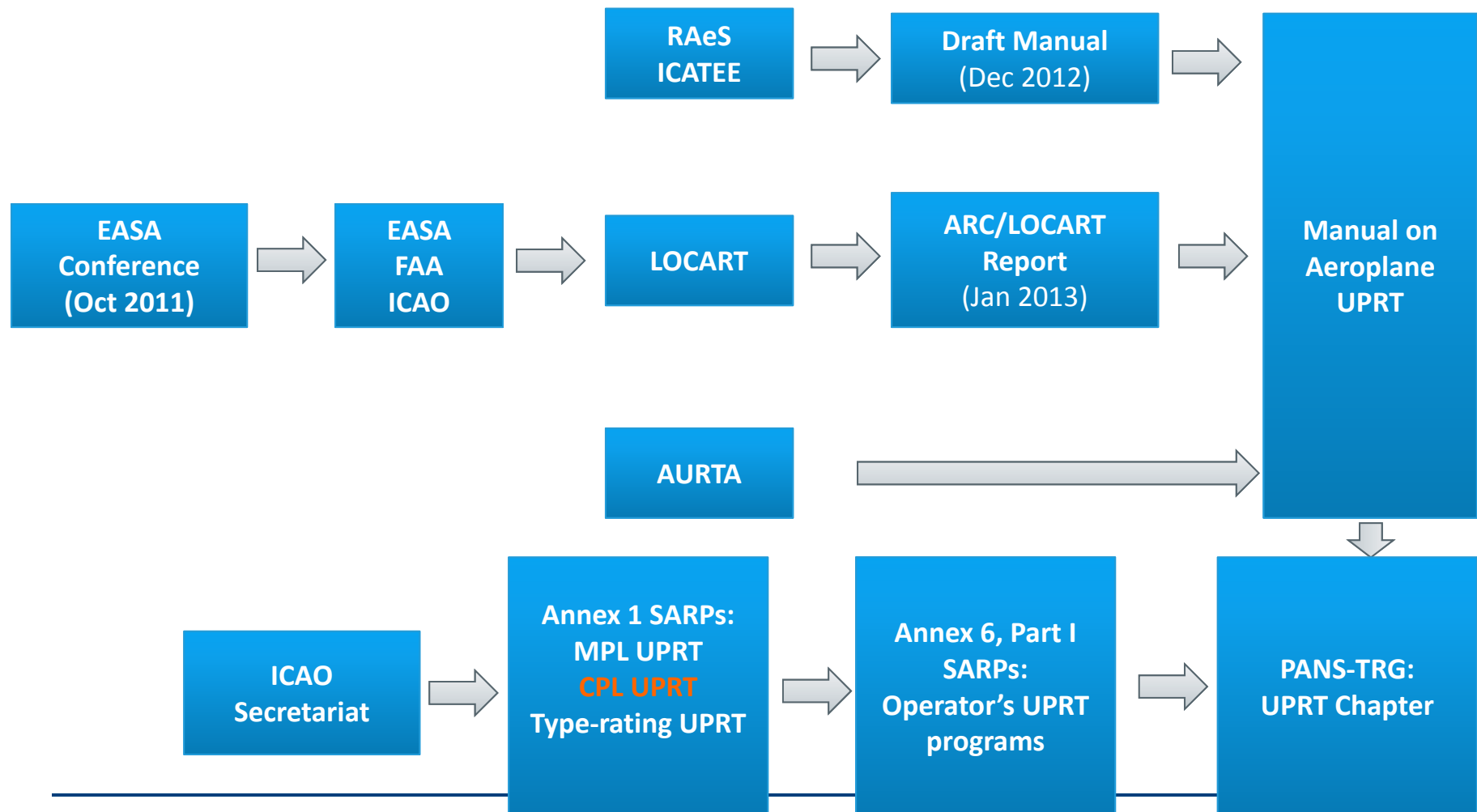
How did we proceed?

- 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

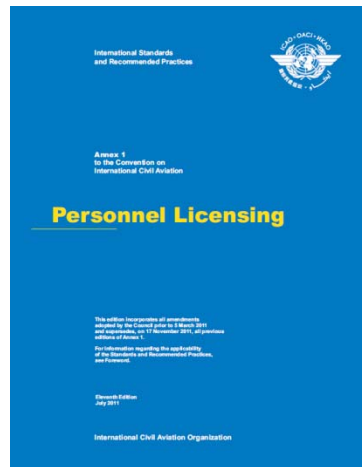
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What the SARPs say:

- Aeroplanes 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
 - **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

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What are the big changes?

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

– Licensing

- *On-Aeroplane:* MPL
CPL should be trained
- *On FSTD:* Multi-crew type rating

– Commercial air transport training programmes

- Initial (conversion)
- Recurrent

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 model upgrade

Estimated FSTD Type VII Upgrade Costs (USD)					
FSTD	Development Costs	Implementation Costs	Loss of productivity	Affected # of FSTD	Total (kUSD)
Old	24 000	72 000	23 000	381	45 340
Newer	6 500	40 000	23 000	442	30 720

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

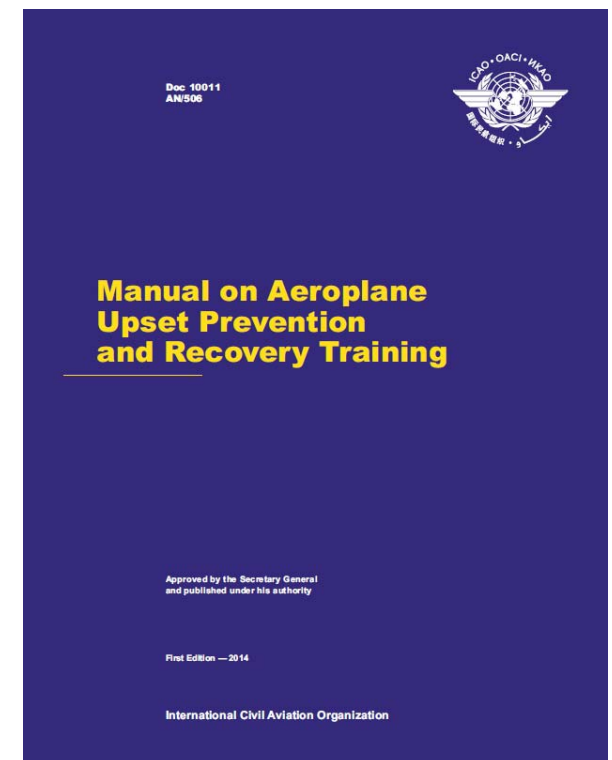
- Additional theoretical training for all pilots
- Many FSTDs will need an update to qualify for the full range of UPRT tasks
- Need to balance cost/benefits of delivery of on-aircraft UPRT:
 - SMS considerations
 - Aerobatic aircraft are recommended but not the only option
- Instructors will need further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

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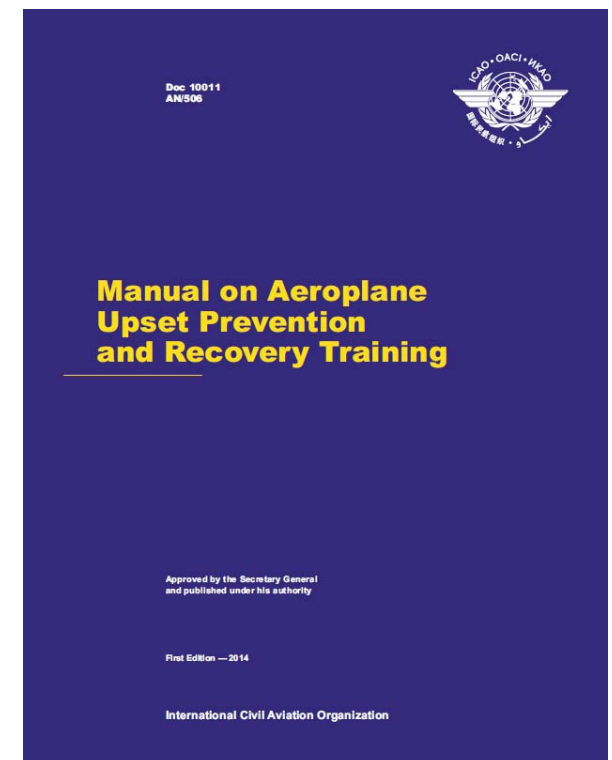
Manual on Aeroplane Upset and Recovery Training (Doc 10011)

- 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



Airplane Upset Recovery Training Aid

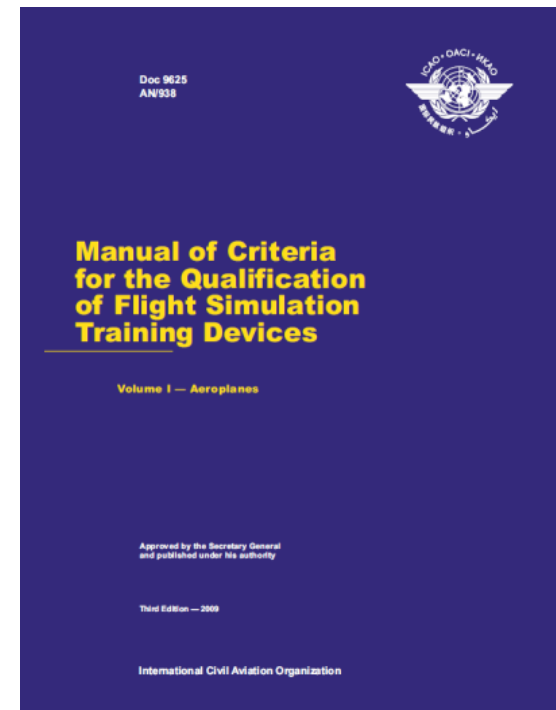
- Revision 2 to be updated
 - By OEMs and with ICAO support
 - Covering turboprop and smaller aeroplanes
 - User-friendly format
 - **Published as ICAO doc**
 - Target: end of 2015
 - Free and easily accessible



Manual of Criteria for the Qualification of FSTD

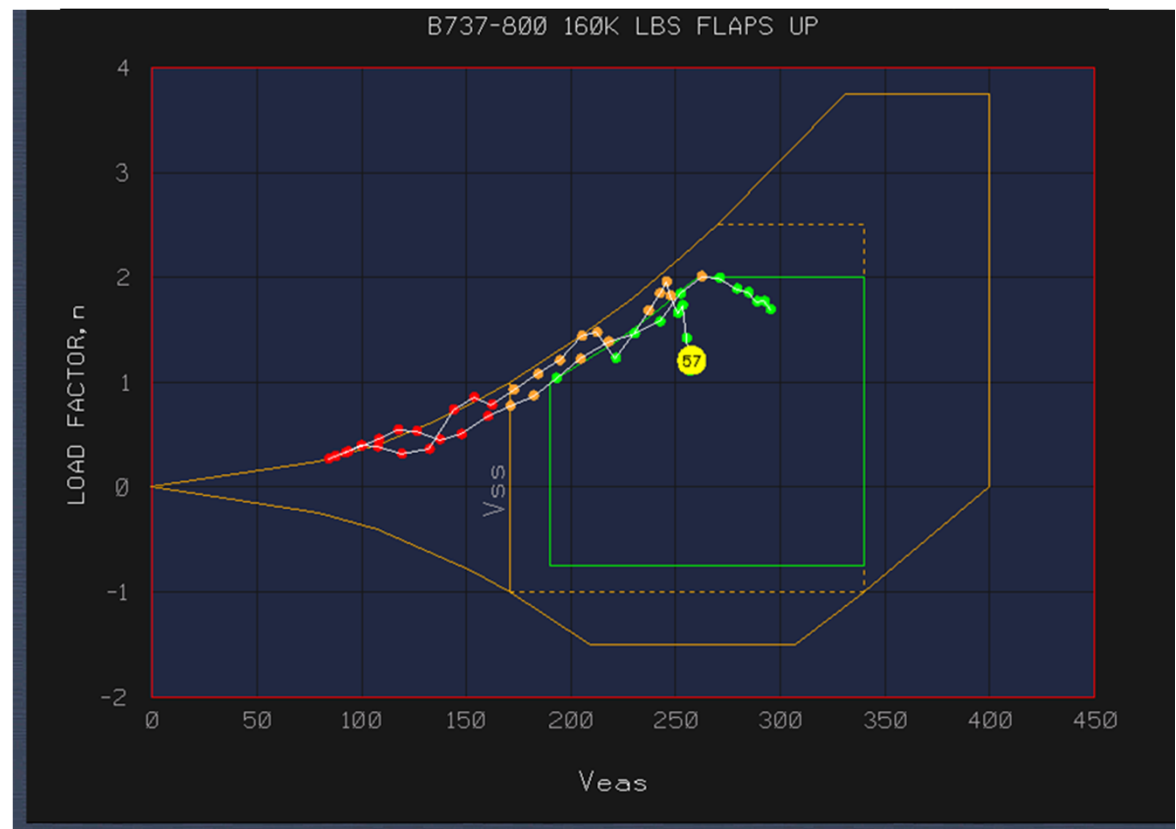
(Doc 9625)

- 4th edition (31 December 2014 unedited version – end June 2015 edited version)
- 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 V-n plot

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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 Jan, 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

– Will consider:

- Full stall simulator evaluation criteria
- **Upset prevention and recovery training**
- Enhanced Airborne Icing Modeling

← not an ICAO requirement

– NPRM conducted till January 6 2015

– Part 60 standards will be in place 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
- 2 key points: Prevention of LOC-I & no Checking

WE NEED TO GET THIS RIGHT!

Collaborating to address
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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