UPRT Implementation

OEM Recommendations & Industry Experience

WATS Panel Discussion
Introduced and Moderated by Dr. Sunjoo K. Advani, IDT
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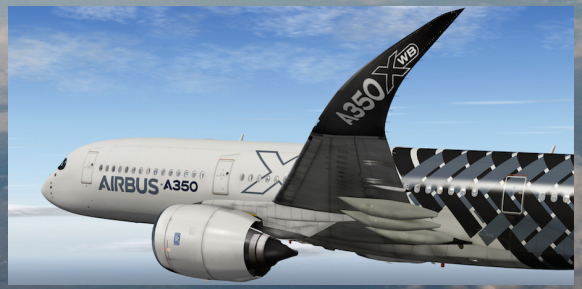


Panelists

* Capt. David Owens, Airbus
* Capt. Kip Caudrey, Boeing Flight Services
* Capt. Paul Scully, Aer Lingus
* Dr. Sunjoo Advani, Moderator

UPRT: From the Ground Up

A. How do I implement UPRT into my airline?
B. What do the regulations require, and by when?
C. What do the OEM's recommend?
D. What airline experiences can I learn from?

Could this aircraft be in a LOC-I state?

* What if…
  * Pilot is unable to command the flight path or airspeed?
    * Undesirable Aircraft State
  * Angle of attack is high?

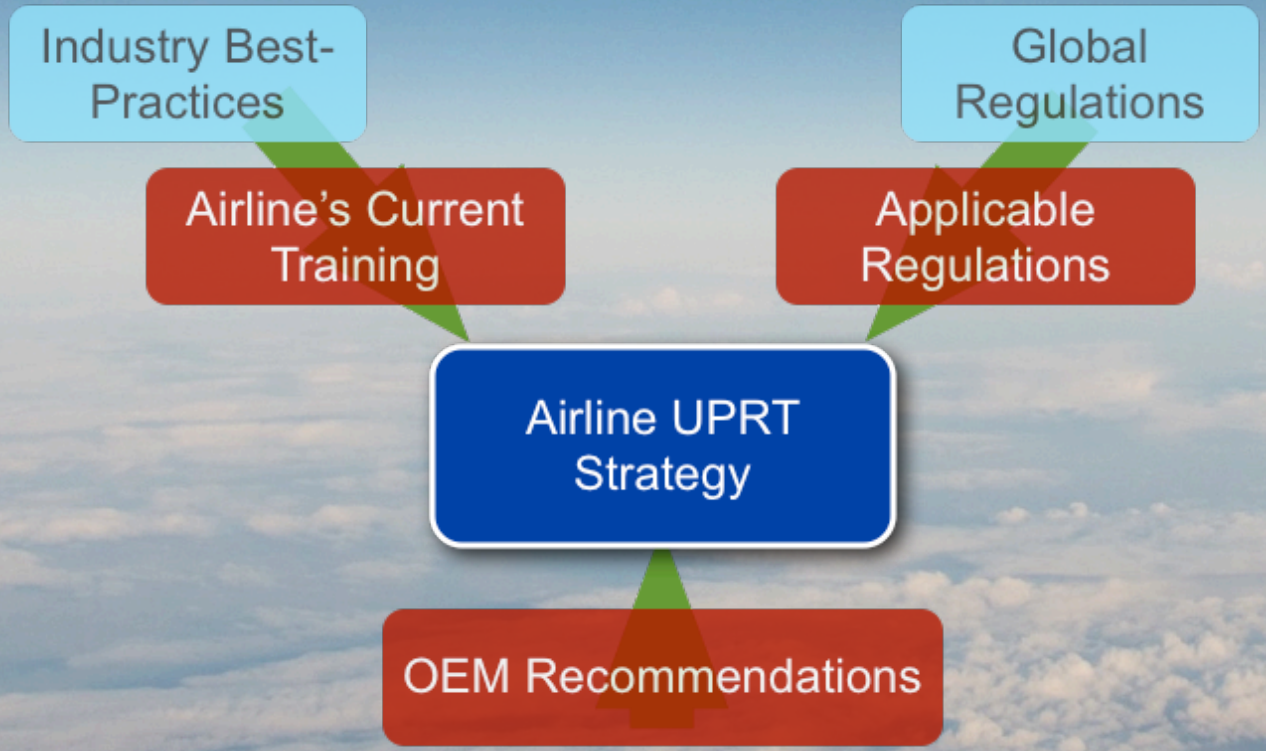
Definitions

* LOC-I Definition
* Undesired Aircraft State
* Upsets vs Stalls

A. UPRT Airline Implementation

1. Define UPRT Strategy
2. Develop UPRT Program
3. Ensure Regulatory Compliance

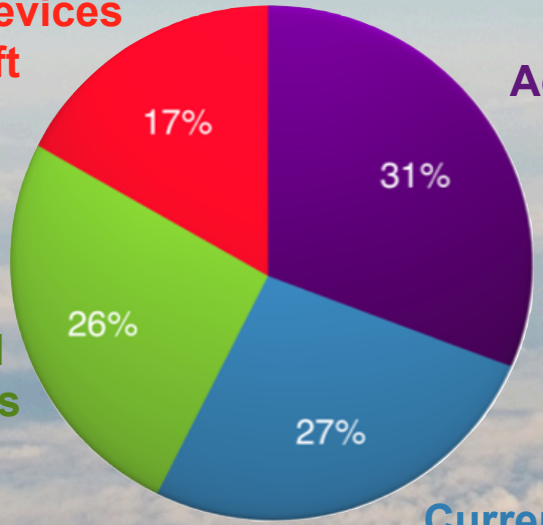
1. Develop a UPRT Strategy



2. Define the UPRT Program

* Instructors
* Cadet Training

Enhanced Training
- special devices
- on-aircraft



Academics

Enhanced Simulators

Current-Generation Simulators

ICATEE
PREVENT · AVOID · RECOVER
INTERNATIONAL COMMITTEE FOR AVIATION TRAINING IN EXTENDED ENVELOPES

3. Regulatory Compliance

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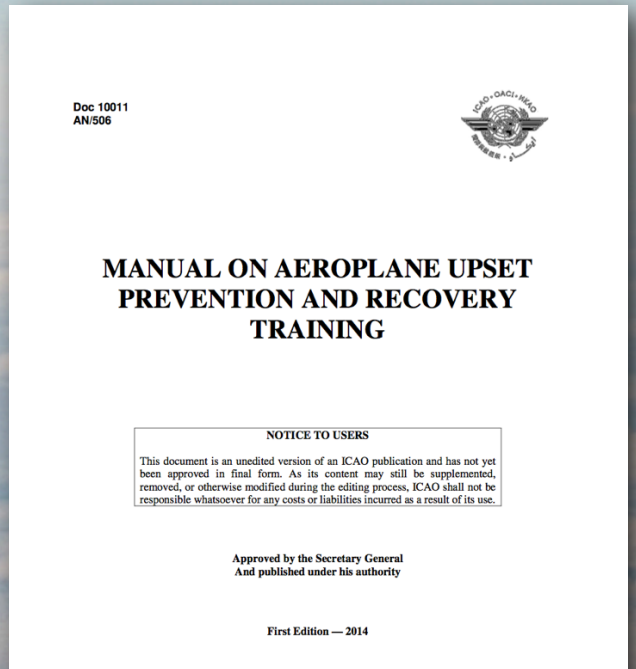

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MANUAL ON AEROPLANE UPSET PREVENTION AND RECOVERY TRAINING

NOTICE TO USERS

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Approved by the Secretary General
And published under his authority

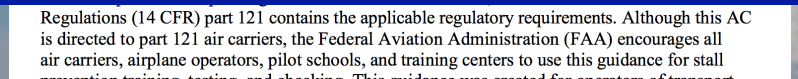
First Edition — 2014

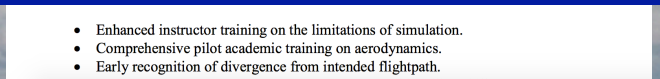
FAA Guidance

* AC 120-109A – Stall Prevention & Recovery Training
* AC 120-111 – Upset Prevention & Recovery Training

Core principles of this AC include:

- Enhanced **instructor training** on the limitations of simulation.
- Comprehensive pilot **academic training on aerodynamics**.
- **Early recognition** of divergence from intended flightpath.
- Upset **prevention** through improvements in manual handling skills.
- Training that integrates **crew resource management & monitoring**


Regulations (14 CFR) part 121 contains the applicable regulatory requirements. Although this AC is directed to part 121 air carriers, the Federal Aviation Administration (FAA) encourages all air carriers, airplane operators, pilot schools, and training centers to use this guidance for stall


- Enhanced instructor training on the limitations of simulation.
- Comprehensive pilot academic training on aerodynamics.
- Early recognition of divergence from intended flightpath.

EASA Prevention Exercises

	EASA Learning Elements - PREVENTION
A.	Aerodynamics
B.	Causes of and contributing factors to upsets
C.	Safety review of accidents and incidents relating to
D.	g-load awareness and management
E.	Energy management
F.	Flight path management
G.	Recognition
H.	System Malfunction
I.	Manual handling skills

Aer Lingus Training Modules

- Angle-of-Attack Awareness
- High-Altitude Operations
- Manual Handling

EASA Recovery Exercises

	EASA Learning Elements - RECOVERY
A.	**Recovery from developed upsets**
1	Timely and appropriate intervention
2	Recovery from Stall Events
	Take-off configuration
	Clean configuration, low-altitude
	Clean configuration, near max operating altitude
	Landing configuration
3	Recovery from nose high at various bank angles
4	Recovery from nose low at various bank angles
5	Consolidated summary of aeroplane recovery techniques

B. Regulatory Timelines

* EASA Part ORO: May 2016
* EASA Opinion (RMT 581): End 2016/Early 2017
* FCL UPRT applicable: April 2019 (subject to Commission & MS agreement)
* CS-FSTD update 1 – Q4/2017

* FAA Implementation:
  * Start date March 2019
  * completed March 2020

Academics

* Are the published materials suitable and complete, or overwhelming?
* Which areas are most deficient?

Most Significant Training Needs

* Energy Awareness
* Angle-of-Attack Awareness
* Startle Management
* *Develop UPRT skills in a step-by-step manner*

Stall Academics

* What does stall depend on?
  * ~~Airspeed?~~
  * ~~Bank angle?~~
  * ~~Load factor?~~
  * ~~Altitude?~~
  * ~~Gross Weight?~~
  * Angle-of-Attack?
  * Mach Number?
  * Configuration? (e.g. flap or slat position, ice)

FSTD Enhancements

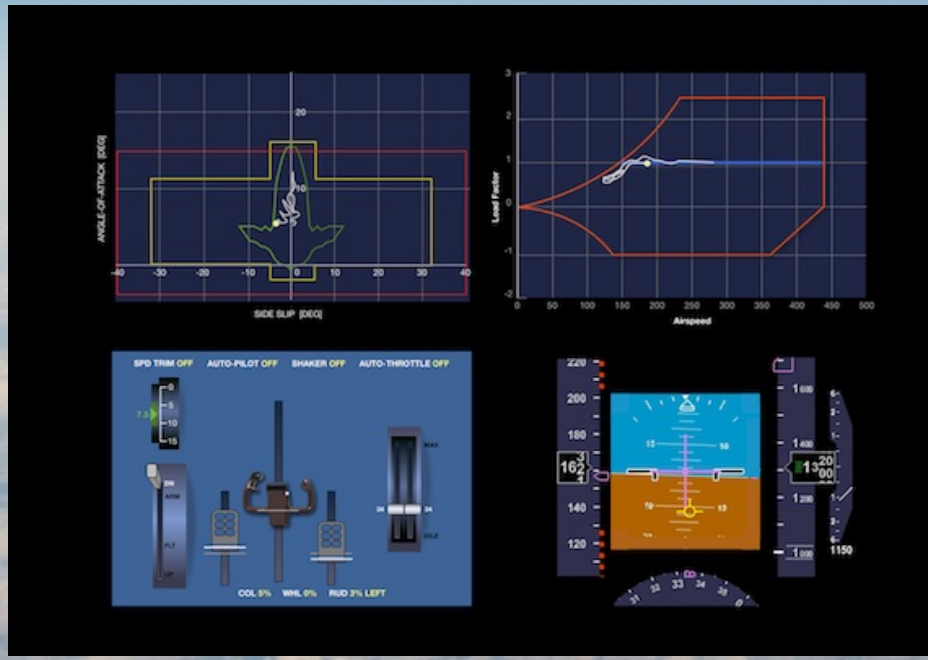
	EASA	FAA
IOS Feedback	Expected	Required
Stall Buffet Validation	Expected	Required
Stall Modelling	TBD	Required (student-flown recovery)
Icing	TBD	Required
Bounced Landing	TBD	Required
Gusty Crosswinds	TBD	Required

3. OEM Recommendations

A. Previously, “Unusual Attitude Training”

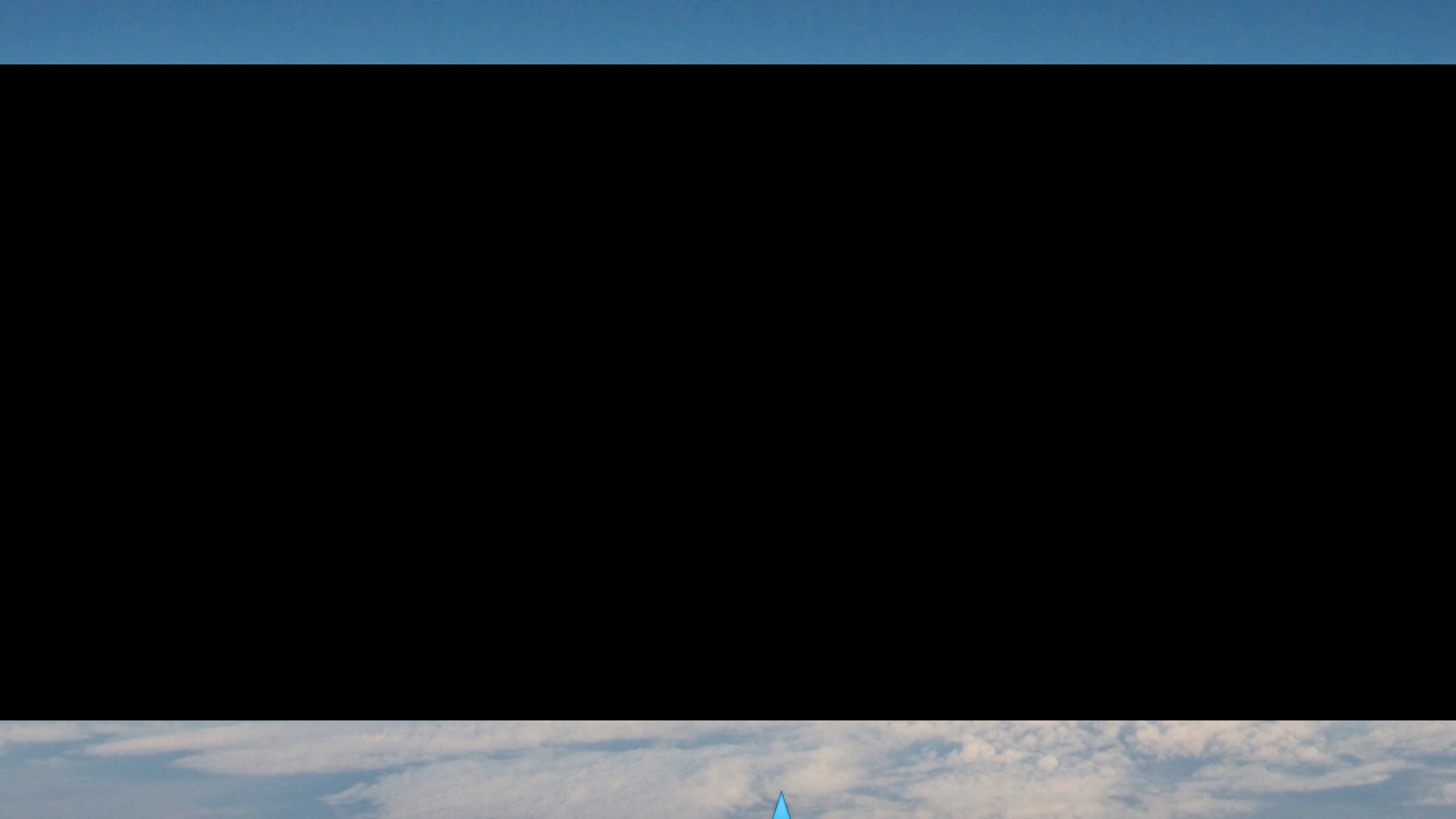
IOS Feedback

* Control Inputs
* Aircraft Response
  * Did flight model remain within fidelity limits?
  * Was the airframe overstressed?
  * Was recovery effective & safe?
  * Were undesired inputs applied?



Airbus Stall Training

on YouTube



Stall Modelling & Simulation


2000

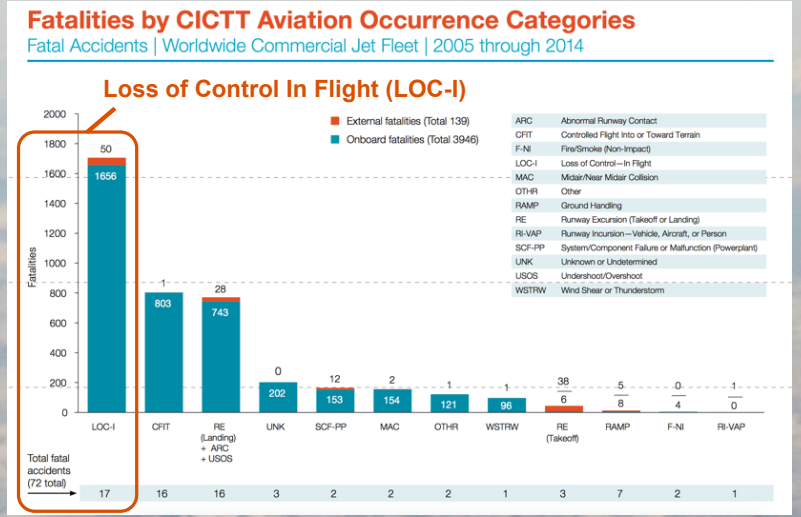

Sährle

IMPORTANT:

* **IF you train beyond CL-Max:**
  * Ensure your model is properly validated
    * **Some aircraft have roll-off; others do not**
    * **Some aircraft do not have a stall "break"**
  * Ensure your instructors are well trained
  * Ensure you have proper IOS feedback to teach recovery

Background – how we got here

* Yes, we DID train Unusual Attitudes and “Upset Recovery”, but…
  * Little attention to recognition
  * startle
  * safe recovery
* **Training failure:** Little impact on accident reduction



Background – how we got here

* 2009: Turning Point (ICATEE > LOCART > ICAO > FAA > EASA)
* **Co-operation of OEM's and Training Industry**
* Greater emphasis on:
  * Decision making (Detect, Recognize, Decide, React)
  * Manual flying skills
  * Development and maintenance of KSA's from basics to advanced

OPERATIONS TRAINING TRANSMISSION - OTT

TO: All A318, A319, A320, A321, A330, A340, A340-500, A340-600, A350, and A380 Operators

SUBJECT: Techniques for recovery from aircraft upset - FSTD scenarios for Upset Recovery Training

OUR REF: 999.0077/16 Rev 00 dated 20-Jun-2016

APPLICABLE AIRCRAFT: This OTT is applicable to A318, A319, A320, A321, A330, A340, A340-500, A340-600, A350, and A380

Notice: This OTT provides Operators with recommendations on training techniques or training programs. These training recommendations aim to enhance the efficiency or safety of operations. It is each Operator's responsibility to distribute the information contained in this OTT to ensure application of the training recommendations in the Operator's own training department or any training organization where their crews are trained.

OEM Training Recommendations

* Instructor Standardization:
  * Airline SME instructors train all instructors
* Focus on proper situation detection/type-specific protections
* Angle-of-attack awareness
* High-altitude operations

4. Valuable Airline Experiences

Developing effective UPRT programs

Aer Lingus UPRT Implementation

* Integrated training program
  * iPad eLearning course
  * Train-the-Trainer - integrated on-aircraft & simulator
  * Simulator sessions
* Close co-operation with CAA

Instructor Standardization

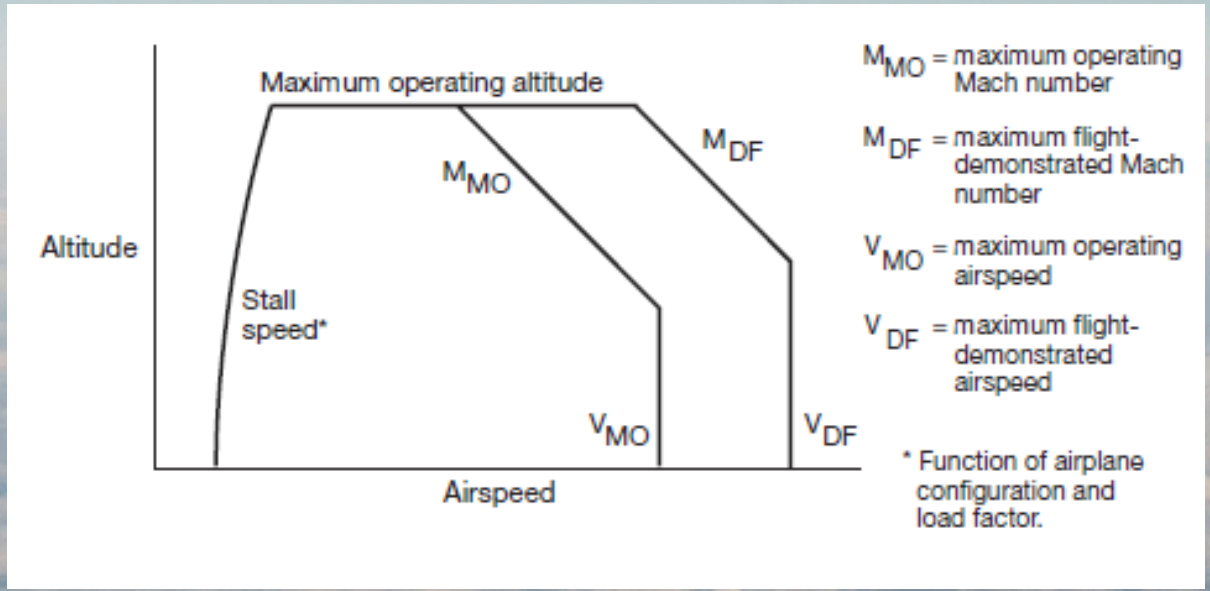
* Specialized Training for SME instructors
  * iPad/Classroom/airplane/FSTD
* Delivery to line pilots
  * iPad/briefing/FSTD

High-Altitude Operations

- Majority of flight is at high altitude
- Majority of training focuses on low altitude

Altitude & Operational Limits

* M_{MO} **decreases** with altitude
* V_{SW} **increases** with altitude



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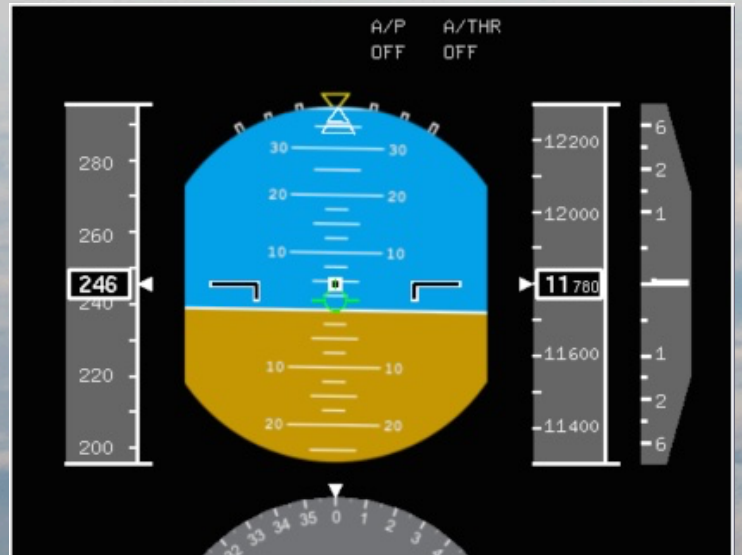
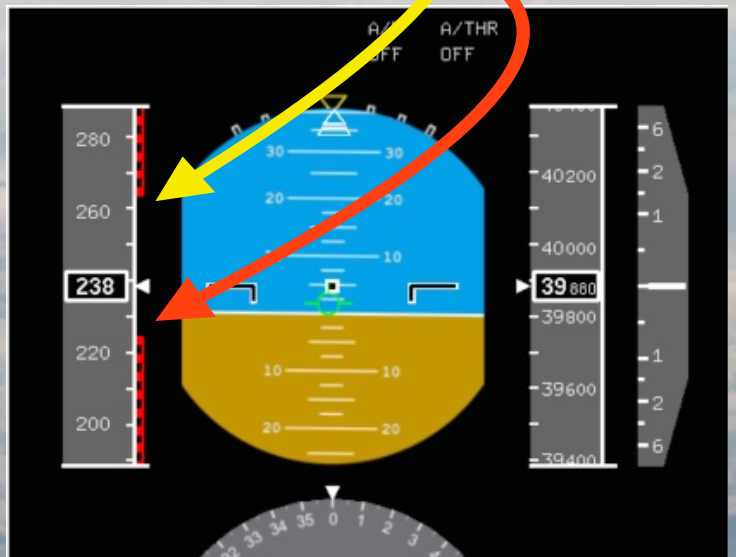
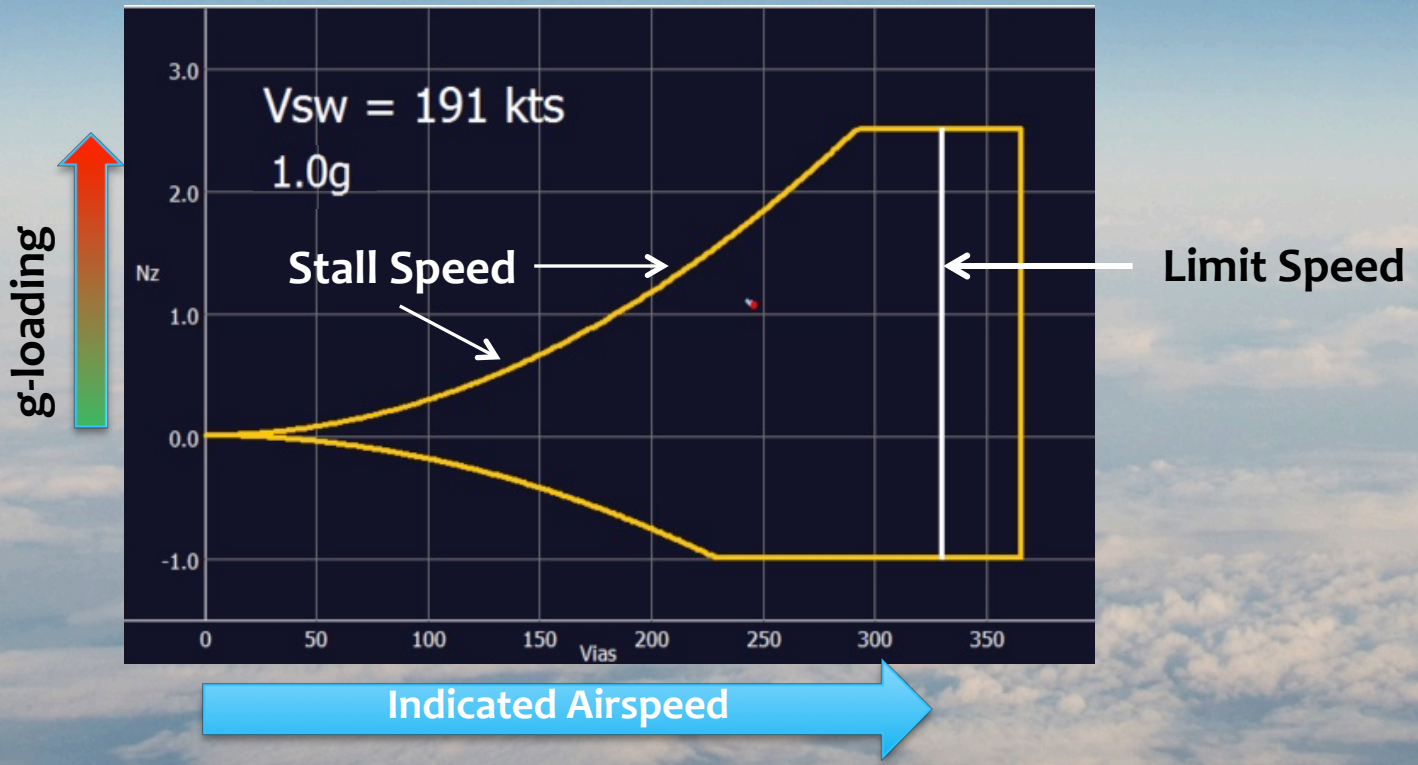
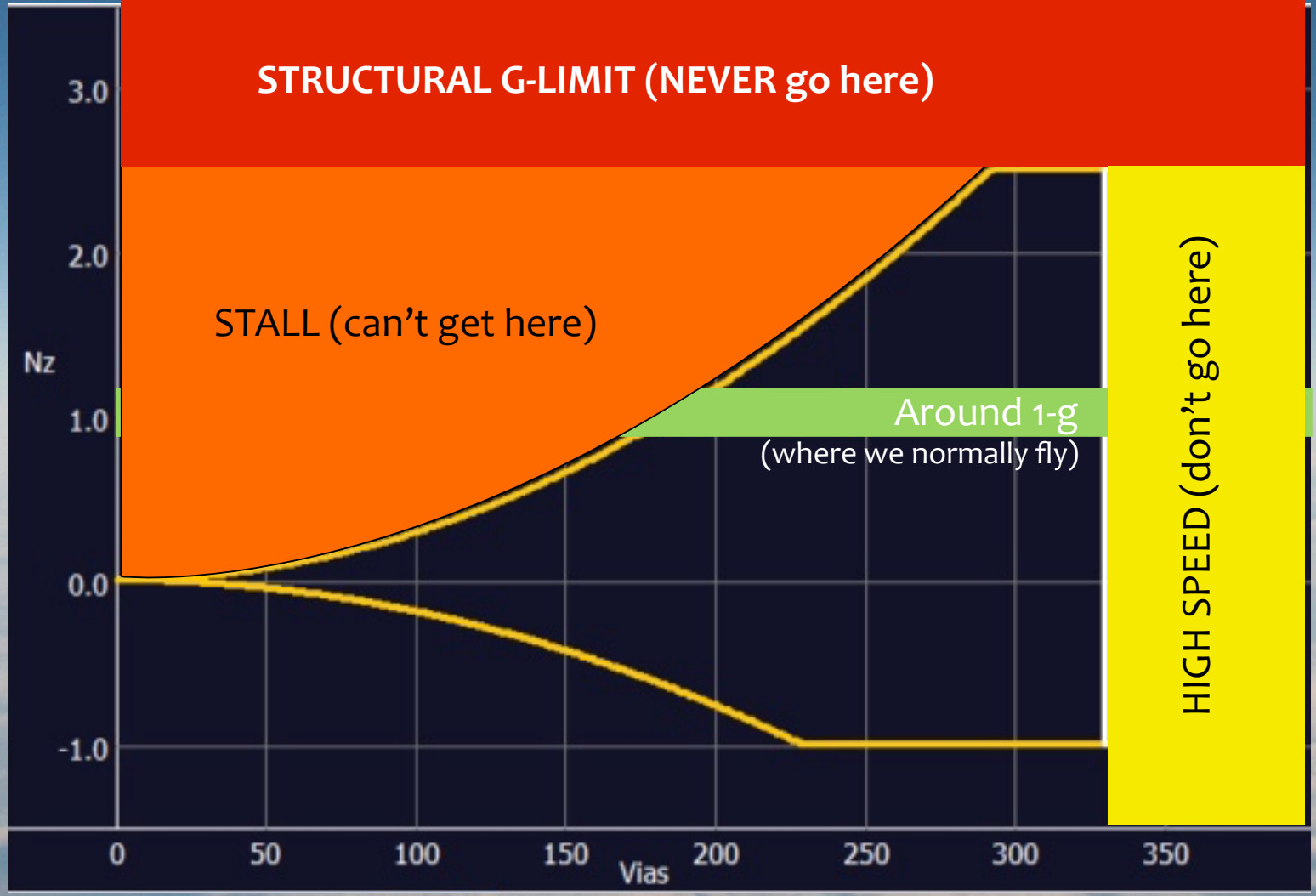
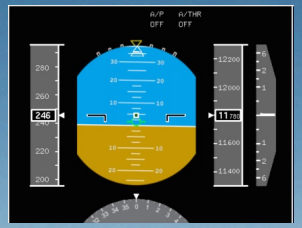


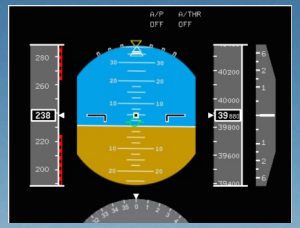


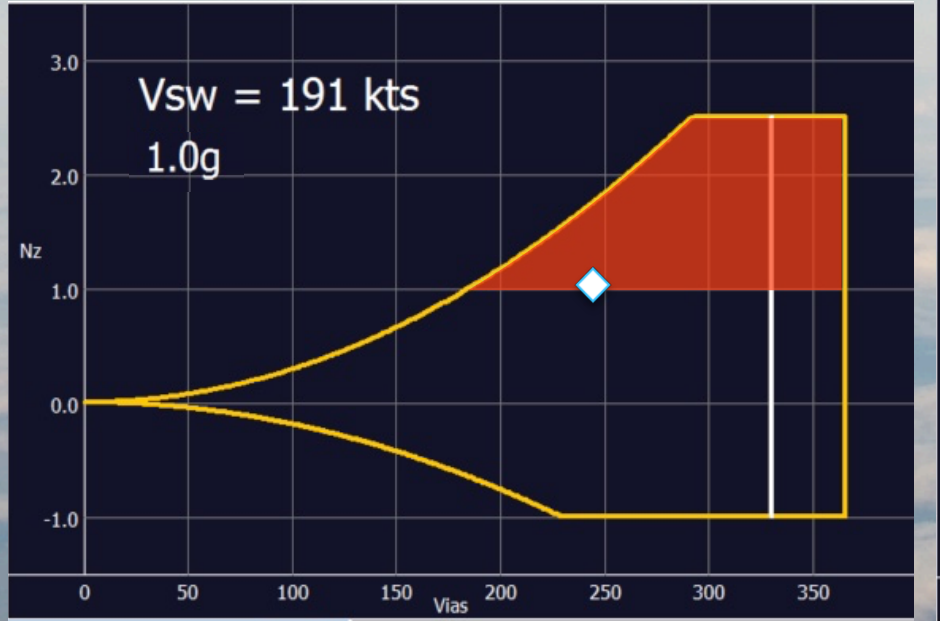
The V-g Diagram

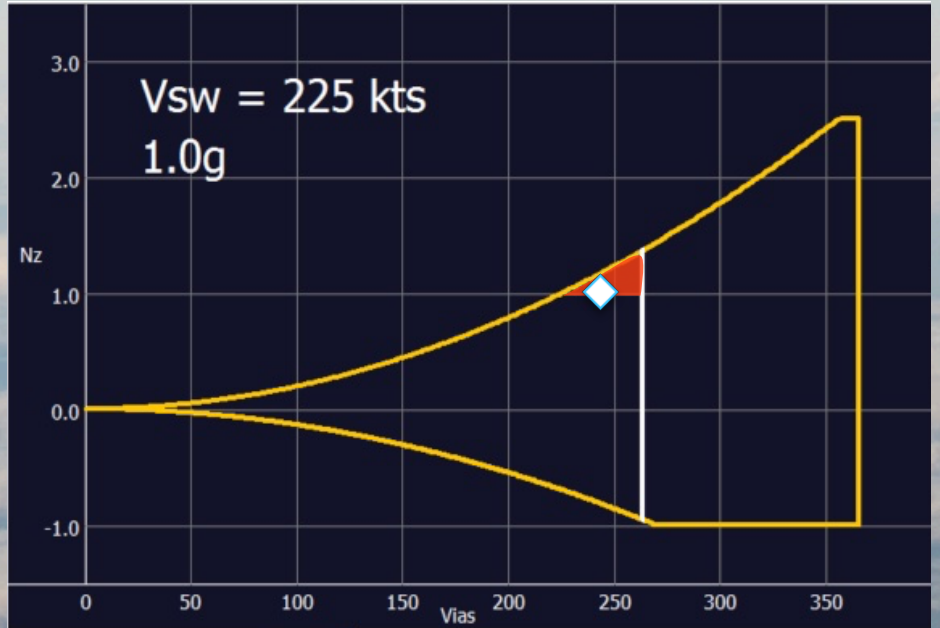



STRUCTURAL G-LIMIT (NEVER go here)
STALL (can't get here)
Around 1-g
(where we normally fly)
HIGH SPEED (don't go here)
Nz
3.0
2.0
1.0
0.0
-1.0
0
50
100
150
200
250
300
350
Vias


A/P
OFF
A/THR
OFF
246


A/P
OFF
A/THR
OFF
238


Vsw = 191 kts
1.0g
Nz
3.0
2.0
1.0
0.0
-1.0
0
50
100
150
200
250
300
350
Vias


Vsw = 225 kts
1.0g
Nz
3.0
2.0
1.0
0.0
-1.0
0
50
100
150
200
250
300
350
Vias

Take-Away

* Develop a UPRT Strategy
* **Crawl, Stand, Walk, Run** -> Awareness, Recognition, Recovery
* Train your instructors: develop confidence to deliver UPRT
* Follow OEM guidance
* Implement proper tools

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* **kip.caudrey@boeing.com** **david.owens@airbus.com**

* **UPRT.aero is intended as an industry resource on this subject matter.**

Manual Flying Skills

* Which are the main focus areas of your training regarding manual flying skills?
* Which competencies concern you?
  * Situation Awareness
  * Workload Management
  * Manual Flying

UPRT Scenarios

* OEM Recommendations
* How can we instill better LEARNING in scenarios, rather than “ticking” regulatory boxes?
* How can we as industry collectively develop better training scenarios?

Regulation

* How have you interfaced with your authorities?
* What is your approach to integration of regulation?

Standardization of Training & Instructors

* Manufacturer recommendations
* Airline implementation

- Air density decreases; airplane becomes less stable
- Margins decrease: we cannot deviate much in:
  - Airspeed (or Mach number)
  - G-loading
- Aircraft flight control and envelope protection systems usually take care of this
- System failures, atmospheric disturbances, pilot over-reaction can take us out of the safe envelope

Model Enhancements

* Type-specific warnings (Remember: Detect, Recognize, Recall, React)
  * Stall Buffet Cues
  * Changes in flying qualities
  * Stall Characteristics

What did you learn?

* How did you get started on this road?
* What did you encounter when setting up the training that you didn't expect?
* How have the pilots reacted to the UPRT courses?
* What recommendations do you have for the audience?