Delivering UPRT

Airline perspective

SCOPE

- Training framework
- UPRT Program
- Competency-Based-Training approach.
- Importance of Flight Path Management Skills
- Using Data and technology to enhance training

TRAINING FRAMEWORK

- Developing the SMEs

Learning from UPRT providers

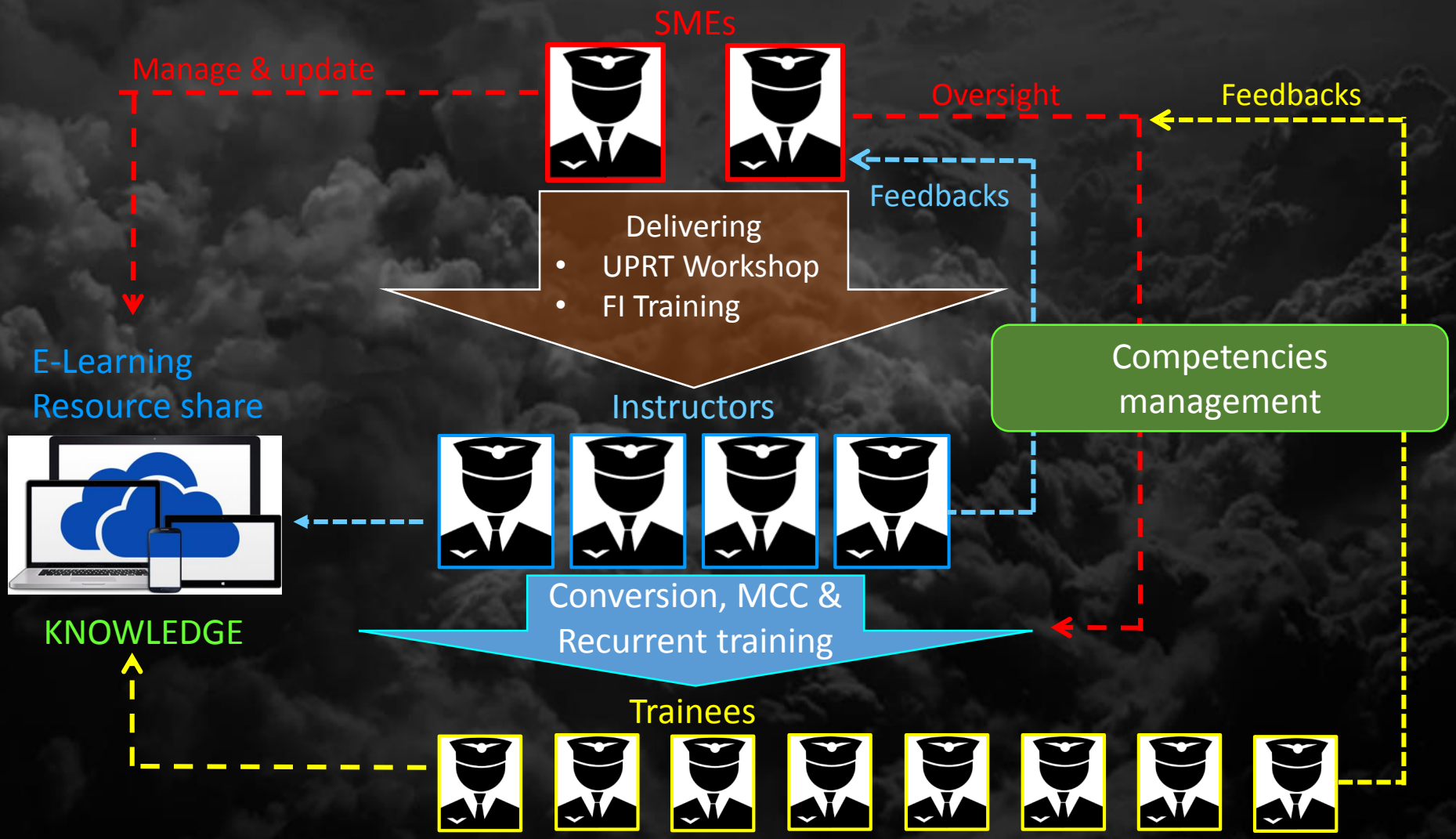
Learning from forums

Participation in UPRT workshop

Tapping experience from flying instructors with High AOA training background.

TRAINING FRAMEWORK

- Instructional program



UPRT PROGRAM

In compliance with CAAS AC AOC-39

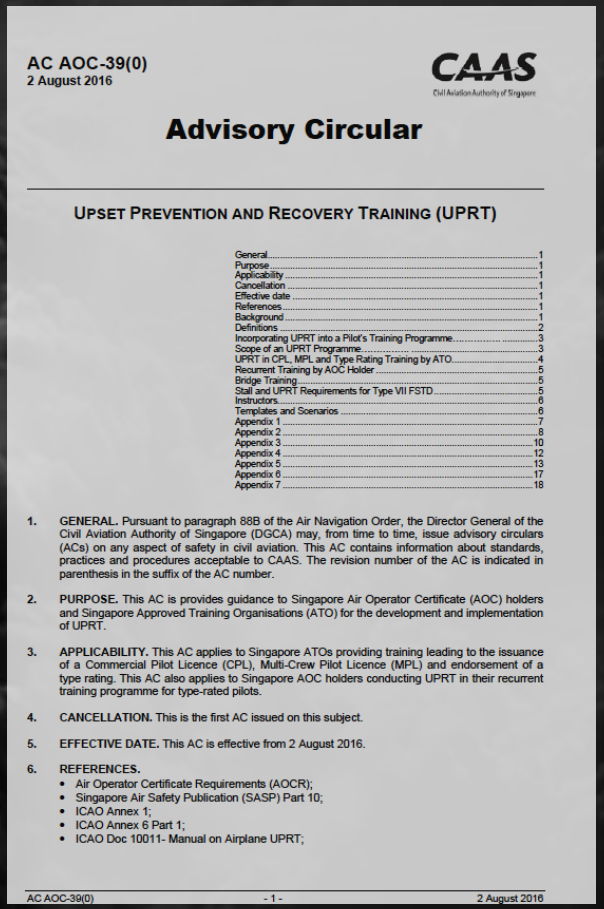
UPRT is incorporate in:

1. Type conversion & Recurrent Training Syllabus.

2. Academic Syllabus.

3. Instructor Training.

4. FSTD Requirements.



AC AOC-39(0)
2 August 2016

CAAS
Civil Aviation Authority of Singapore

Advisory Circular

UPSET PREVENTION AND RECOVERY TRAINING (UPRT)

1. **GENERAL.** Pursuant to paragraph 88B of the Air Navigation Order, the Director General of the Civil Aviation Authority of Singapore (DGCA) may, from time to time, issue advisory circulars (ACs) on any aspect of safety in civil aviation. This AC contains information about standards, practices and procedures acceptable to CAAS. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

2. **PURPOSE.** This AC is provides guidance to Singapore Air Operator Certificate (AOC) holders and Singapore Approved Training Organisations (ATO) for the development and implementation of UPRT.

3. **APPLICABILITY.** This AC applies to Singapore ATOs providing training leading to the issuance of a Commercial Pilot Licence (CPL), Multi-Crew Pilot Licence (MPL) and endorsement of a type rating. This AC also applies to Singapore AOC holders conducting UPRT in their recurrent training programme for type-rated pilots.

4. **CANCELLATION.** This is the first AC issued on this subject.

5. **EFFECTIVE DATE.** This AC is effective from 2 August 2016.

6. **REFERENCES.**
   - Air Operator Certificate Requirements (AOCR);
   - Singapore Air Safety Publication (SASP) Part 10;
   - ICAO Annex 1;
   - ICAO Annex 6 Part 1;
   - ICAO Doc 10011- Manual on Airplane UPRT;

UPRT PROGRAM

In compliance with CAAS AC AOC-39

1a. Type Conversion syllabus follows OEM.

1b. Recurrent Syllabus (6 in total over 3 years).

I. Recurrent 1 and 4 incorporates UPRT.

II. Program includes academic refresher, DOC 10011, AC AOC-39 and OEM exercises.

III. Maneuver Based and Scenario based Training (LOFT).

UPRT PROGRAM

In compliance with CAAS AC AOC-39

2. Academic Syllabus
   a. E-Learning incorporated with all elements from
      I. DOC 10011/CAAS AC AOC-309
      II. AURTA Rev 3

   b. E-Learning required for ab-initio, MPL, MCC bridging course and recurrent training.

UPRT PROGRAM

In compliance with CAAS AC AOC-39

3. SIA UPRT Instructor Training (Since May 2015)

   SIA UPRT INSTRUCTOR QUALIFICATION TRAINING/REFRESHER COURSE (Dec 2016)

   15.4 Instructors should go through the practical training of the Training Programme as regularly as required by the AOC holder or ATO to ensure that they are able to demonstrate the correct recovery techniques should the need arise. Please see Appendix 6.

APPENDIX 6
INSTRUCTOR TRAINING ELEMENTS

UPRT instructor training elements UPRT	*UPRT academic instructor*	*UPRT aeroplane instructor*	*UPRT FSTD instructor*
Comprehensive knowledge of all applicable training elements (refer to Appendix 2)*	√	√	√
Training platforms (aeroplanes and devices)			
1) limitations of training platform		√	√
2) operation of IOS and debriefing tools			√
Review of LOC-I accidents/incidents	√	√	√
Energy management factors*	√	√	√
Disorientation	√	√	√

UPRT PROGRAM

Instructor Qualification - CAAS

AC AOC-39(0) 2 August 2016
- Appendix 2 & 6

APPENDIX 2
UPSET TRAINING ELEMENTS, COMPONENTS AND PLATFORMS

Subjects					
H. Upset prevention and recovery techniques					section 2.6.1
1) timely and appropriate intervention	√	√	√	√	
2) nose-high/wings-level recovery	√	√	√	√	sections 2.6.3.2-2.6.3.5
3) nose-low/wings-level recovery	√	√	√	√	
4) high bank angle recovery techniques	√	√	√	√	
5) consolidated summary of aeroplane recovery techniques	√	√	√	√	
I. System malfunction section					section 2.4.2
1) flight control anomalies	√	√	√	√	
2) power failure (partial or full)	√	√	√	√	
3) instrument failures	√	√	√	√	
4) automation failures	√		√	√	
5) fly-by-wire protection degradations	√		√	√	
6) stall protection system failures, including icing alerting systems	√		√	√	
J. Specialized training elements section					sections 2.6.3.2-2.6.3.5 and section 3
1) spiral dive (graveyard spiral)		√	√[6]	√	
2) slow flight		√	√	√	
3) steep turns		√	√	√	
4) recovery from approach to stall			√	√	
5) recovery from stall, including uncoordinated stalls (aggravating		√	√[7]	√[8]	section 2.5.5.7
6) recovery from stick pusher activation (if applicable)	√		√	√	
7) nose-high/high-speed recovery			√	√	
8) nose-high/low-speed rec		√	√	√	
9) nose-low /high-speed re very		√	√	√	
10) nose-low/low-speed re ery		√	√	√	
11) high bank angle re ery		√	√	√	
12) line-oriented flight train (LOFT) or line-operational sim tion (LOS)			√	√	
K. Human Factors					section 2.5.5.11.10
1) situation awa ne					
i) human inf mation processing	√		√	√	
ii) in ntion, distraction	√		√	√	
iii) ce al illusions (visual or physio al) and spatial disorie ation	√		√	√	
iv) instrume terpretation	√	√	√	√	
2) startle and stress response					
i) physiological, psych ical and cognitive effects	√	√	√	√	
ii) management strategies		√	√	√	
3) threat and error management (TEM)					
i) TEM framework	√	√	√	√	
ii) active monitoring, checking		√	√	√	
iii) fatigue management	√	√	√	√	
iv) workload management	√	√	√	√	
v) crew resource management (CRM)	√	√	√	√	

Note: Refer to the Airplane Upset Recovery Training Aid (AURTA) Revision 2 for more details. However, the AURTA generally was developed to deal with topics pertaining to swept-wing aeroplanes with more than 100 passenger seats.

Note: References made to relevant sections of AURTA may be changed in subsequent revisions.

Foundation Knowledge & skills

APPENDIX 6
INSTRUCTOR TRAINING ELEMENTS

UPRT instructor training elements UPRT	*UPRT academic instructor*	*UPRT aeroplane instructor*	*UPRT FSTD instructor*
Comprehensive knowledge of all applicable training elements (refer to Appendix 2)*	√	√	√
Training platforms (aeroplanes and devices)			
1) limitations of training platform		√	√
2) operation of IOS and debriefing tools			√
Review of LOC-I accidents/incidents		√	√
Energy management factors*	√	√	√
Disorientation	√	√	√
Workload management	√	√	√
Distraction	√	√	√
OEM recommendations*	√		√
UPRT recognition and recovery strategies*	√	√	√
How to do a flight risk assessment (aeroplane)	As applicable	√	
Recognition of trainee errors	√	√	√
Intervention strategies		√	
Aeroplane type-specific characteristics*	√	√	√
Operating environment	√	√	√
How to induce the startle factor		√	√
Value and benefits of demonstration	√	√	√
How to assess pilot performance using core competencies if conducting CBT	√	√	√

*OEMs may at some point develop differing guidance regarding procedures to address these areas of training which may deviate from the material provided herein. In all cases, whenever type-specific UPRT is being conducted, training organisations should provide procedural training which conforms to the appropriate aeroplane flight manual.

Instructional Knowledge &skills

COMPETENCY-BASED-TRAINING

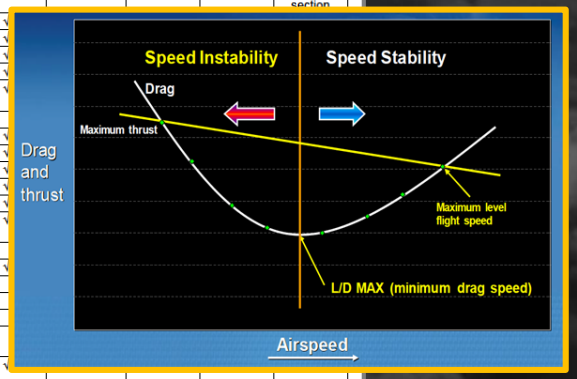
- CBT approach in UPRT

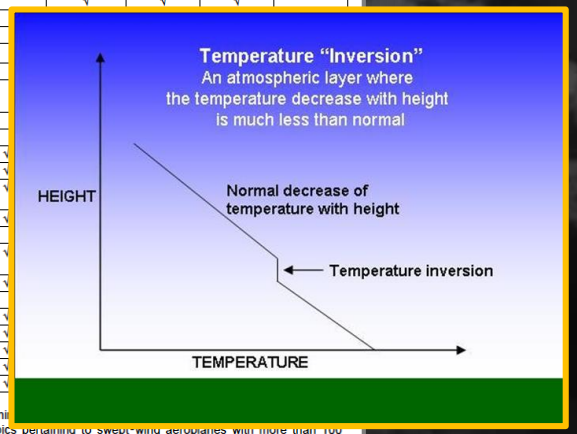
Foundation knowledge – *Operationalizing* it to enhance other competencies.

H. *Upset prevention and recovery techniques*
1) timely and appropriate intervention
2) nose-high/wings-level recovery
3) nose-low/wings-level recovery
4) high bank angle recovery techniques
5) consolidated summary of aeroplane recovery techniques
I. *System malfunction* section
1) flight control anomalies
2) power failure (partial or full)
3) instrument failures
4) automation failures
5) fly-by-wire protection degradations
6) stall protection system failures, including icing alerting systems
J. *Specialized training elements* sections
1) spiral dive (graveyard spiral)
2) slow flight
3) steep turns
4) recovery from approach to stall
5) recovery from stall, including uncoordinated stalls (aggravating yaw)
6) recovery from stick pusher activation (as applicable)
7) nose-high/high-speed recovery
8) nose-high/low-speed recovery
9) nose-low /high-speed recovery
10) nose-low/low-speed recovery
11) high bank angle recovery
12) line-oriented flight training (LOFT) or line-operational simulation (LOS)
K. *Human Factors*
1) situation awareness
i) human information processing
ii) inattention, fixation, distraction
iii) perceptual illusions (visual or physiological) and spatial disorientation
iv) instrument interpretation
2) startle and stress response
i) physiological, psychological, and cognitive effects
ii) management strategies
3) threat and error management (TEM)
i) TEM framework
ii) active monitoring, checking
iii) fatigue management
iv) workload management
v) crew resource management (CRM)

Note: Refer to the Airplane Upset Recovery Traini
AURTA generally was developed to deal with topics pertaining to swept-wing aeroplanes with more than 100 passenger seats.

Note: References made to relevant sections of AURTA may be changed in subsequent revisions.





- ✓ Situational Awareness
- ✓ Application of procedures
- ✓ Leadership & Teamwork
- ✓ Problem solving & Decision Making
- ✓ Workload Management
- ✓ Communication
- ✓ Flight Path Management – Manual
- ✓ Flight Path Management – Automation

COMPETENCY-BASED-TRAINING

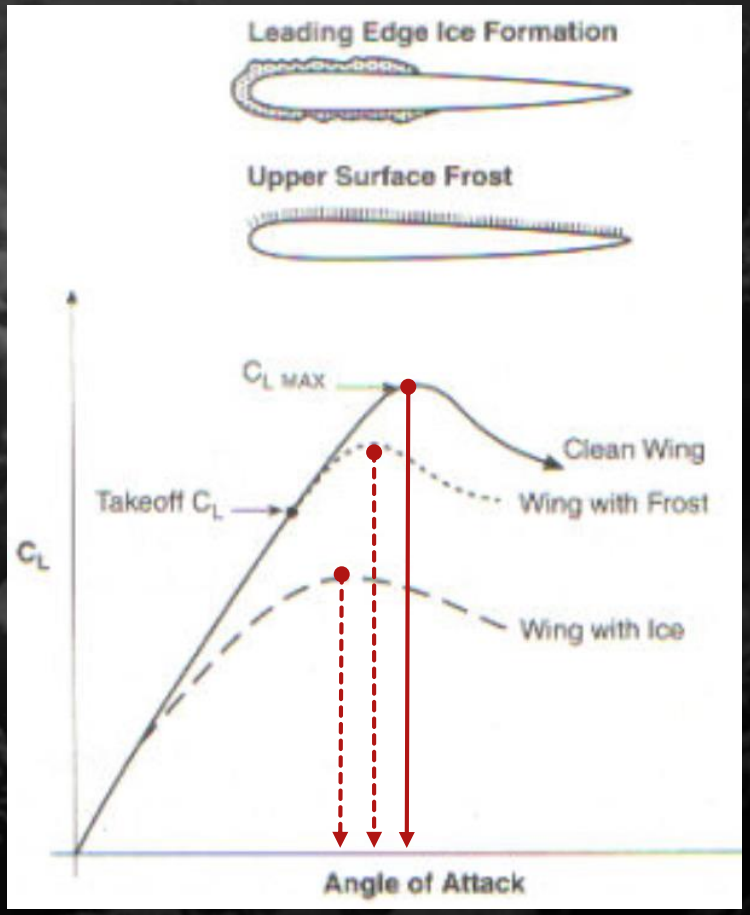
Some methods of enhancement includes:

- ✓ Facilitated discussion on UPRT related incident or accident cases.
- ✓ Checking of understanding on the application of procedures.
- ✓ Development of analytical skills in problem solving and decision making process through scenario-based training.
- ✓ Demonstration on how errors can lead to fatal accident. Threat & Error Management skills.
- ✓ Usage of rich media to enhance learning experience.

COMPETENCY-BASED-TRAINING

- Curriculum examples - Icing

- Ice accumulation increases aircraft weight / drag
- Airplane may exhibit stall onset characteristics before stick shaker activation



Effect: Stall occurs at **lower AOA**

COMPETENCY-BASED-TRAINING

- Curriculum examples - Icing

Icing

- Automation response during icing encounters
  - Autopilot and Auto-throttles can mask the effects of airframe icing
  - Autopilot can trim the airplane up to a stall thus masking heavy control forces
  - Pilots have been surprised when the autopilot disconnected just prior to a stall

Automation - To maintain level flight, AOA increases due drag and weight. Thrust increases to maintain speed.

✓ In-flight icing - Serious Hazard - stalls at much higher speeds and lower angles of attack. If stalled, the airplane can roll / pitch uncontrollably.

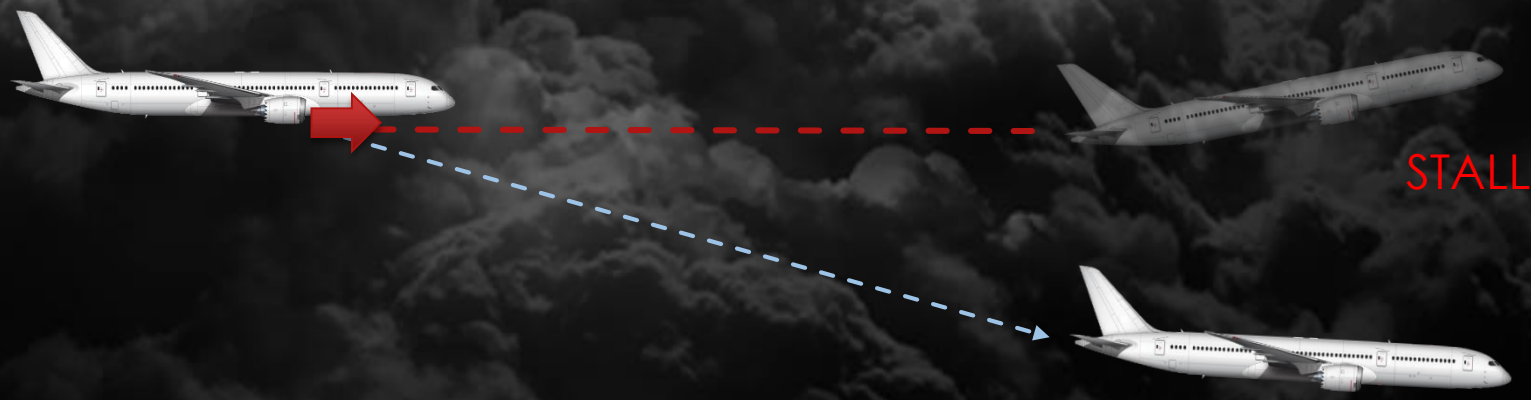
COMPETENCY-BASED-TRAINING

- Curriculum examples - Icing

- Automation response in cruise,
  - Attempts to maintain altitude and airspeed
  - Thrust will increase to maximum limited thrust setting.

If no action taken by pilots, (WAI and EAI usage)

Airspeed continues to deteriorate - the only option is to **descend.**



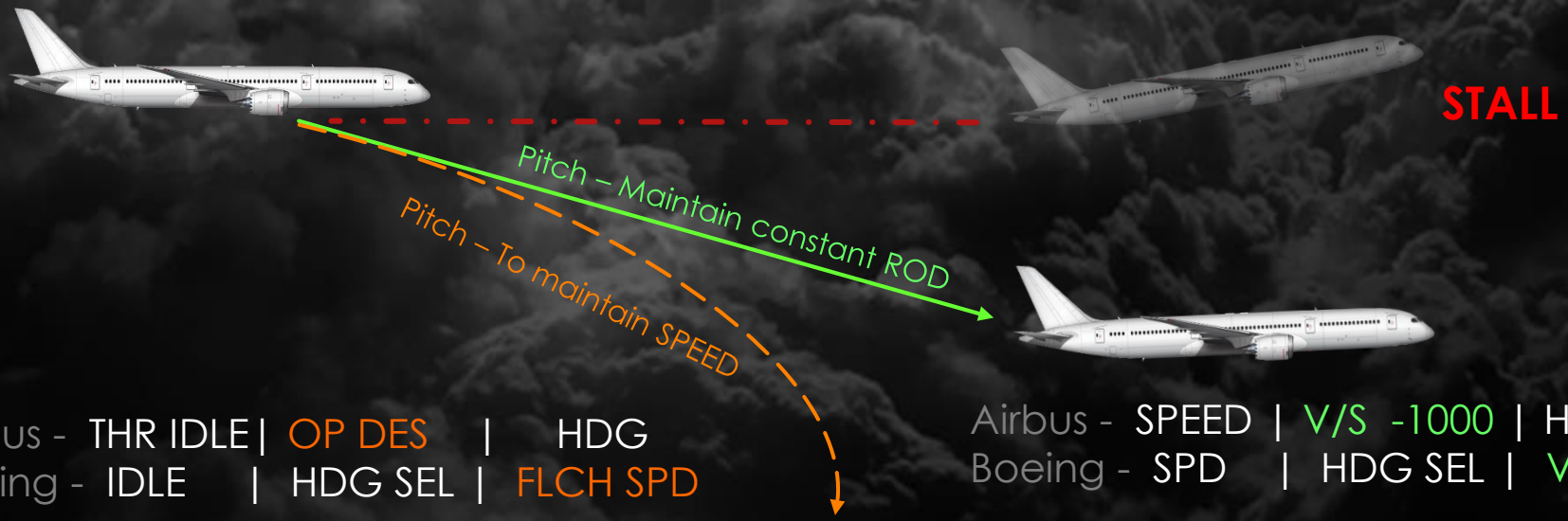
COMPETENCY-BASED-TRAINING

- Curriculum examples - Icing

Automation response in High Altitude flight.

Pilot must take action before excessive airspeed loss:

- ✓ Recognise and response to severe icing condition. (WAI and EAI usage)
- ✓ If necessary, increase the airspeed by initiating a descent.
- ✓ Engage an automation which maintains the throttles at maximum thrust.



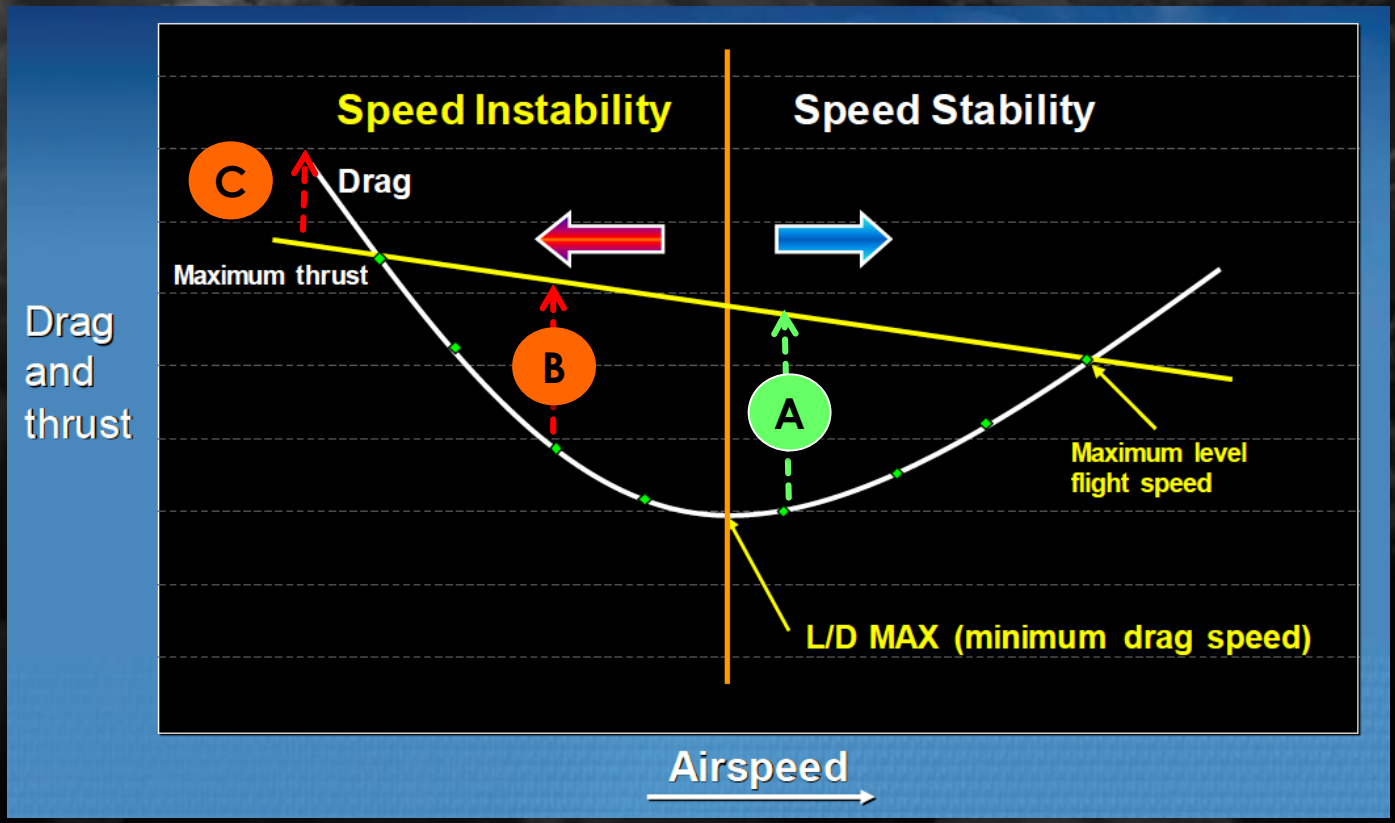
If the aircraft is not responding quickly enough you must take over manually

COMPETENCY-BASED-TRAINING

- Curriculum examples – High Altitude performance

L/D Max

- The lowest point on the total drag curve – also known as V_{md} (minimum drag speed)



COMPETENCY-BASED-TRAINING

- Curriculum examples – High Altitude performance

L/D Max

- When would an aircraft likely decelerate below L/D max speed?

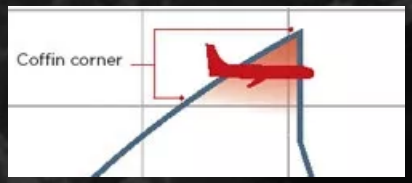
Threats

- ATC -Close in altitude constraint
- Operational pressure – Expedite climb to higher than planned Flight Level.

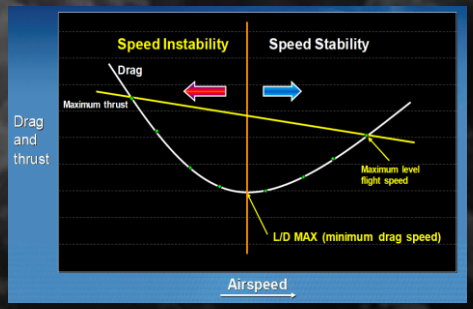
Pilot reaction

- Max angle climb speed (Boeing)
- Green dot speed (Airbus)

V_S increases with ALTITUDE



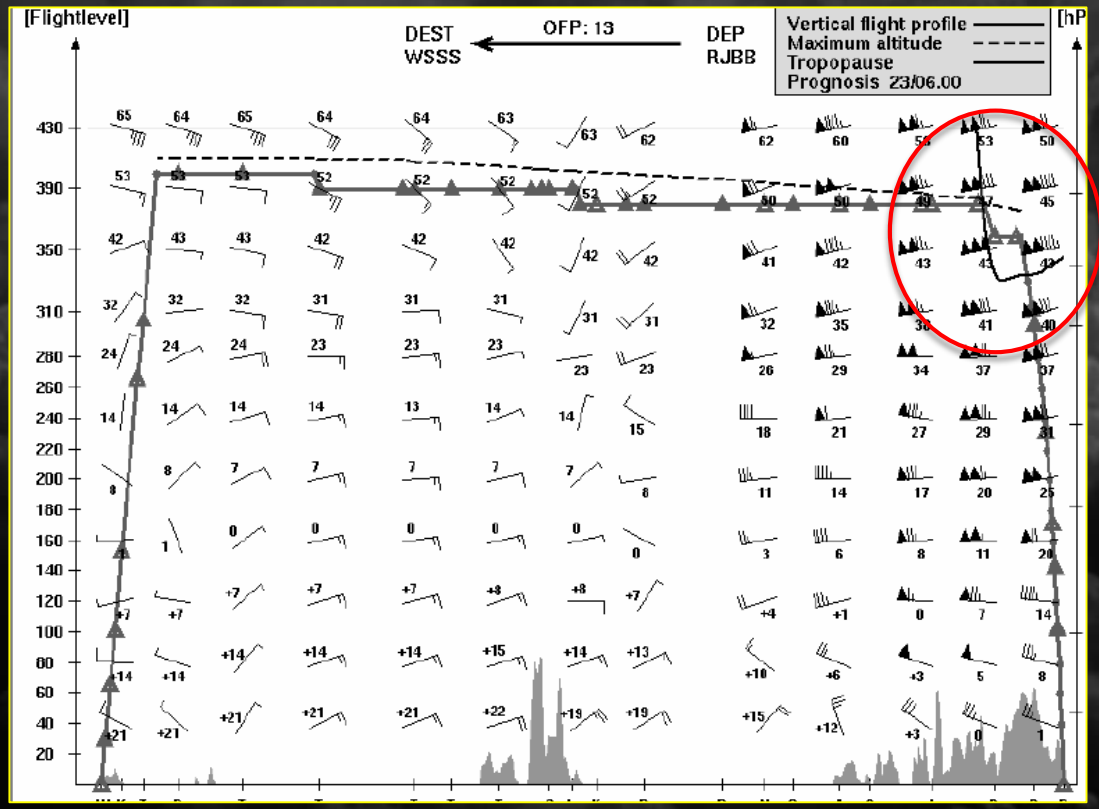
SPEED



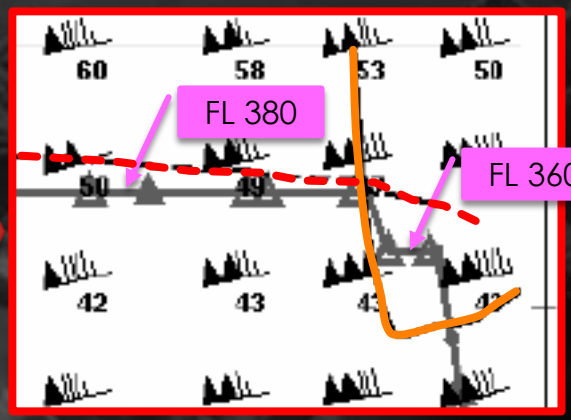
COMPETENCY-BASED-TRAINING

- Curriculum examples – High Altitude performance

Typical Optimum vs. Maximum Altitude



Vertical Profile - Wind



Tropopause

Max. Altitude

Thermal inversion at Tropopause

As part of climb strategy, crew must be cognizant of the environmental changes at high altitude that may affect the aircraft performance.

COMPETENCY-BASED-TRAINING

- Curriculum examples – Vortex wake encounter
  - Pilot startle reaction with disconnection of Autopilot. (Airbus)
  - Compared with autopilot remained engaged

With either little or no input, an airplane encountering wake turbulence, will be expelled from the vortex.
Resulting upset is often the result of crew over reaction to the wake.

COMPETENCY-BASED-TRAINING

- Instructor competencies

  - Are your instructors trained to differentiate the needs for different type of training?

COMPETENCY-BASED-TRAINING

- Example – Stall & Upset recovery exercises

Manoeuvre-Based Training

Key competencies

- ✓ Application of procedures
- ✓ Flight Path Management
- ✓ Communication

Timely corrective action is crucial in ensuring a safe recovery

COMPETENCY-BASED-TRAINING

- Example – LOFT exercises

Scenario-Based Training

Key competencies

- ✓ Situational Awareness
- ✓ Problem solving & decision making
- ✓ Communication

Early recognition and timely preventive measures are crucial in ensuring a safe outcome.

COMPETENCY-BASED-TRAINING

- Example – Recurrent training (LOFT)

Tailored Scenario-Based Training

Evidence-based

Event-based

FLIGHT PATH MANAGEMENT SKILLS

Concerns:

- Failure to recognise a developing situation.
- Pilot Monitoring (PM) not actively involved in problem solving and decision making process.
- Too much reliance on aircraft's protection features.

  "Don't worry, aircraft won't stall"

FLIGHT PATH MANAGEMENT SKILLS

Focus areas

- ✓ Develop resilience
- ✓ Pilot monitoring Skills
- ✓ Risk attitude in daily operations
- ✓ Importance of good practices.

  Team, PF & PM roles

DATA AND TECHNOLOGY

- Using data analytics to create insight.
- Aircraft or Simulator data sources.
- Tools to aid instructor in conduct of training & assessment.
- Push media technology to raise awareness.

END OF PRESENTATION