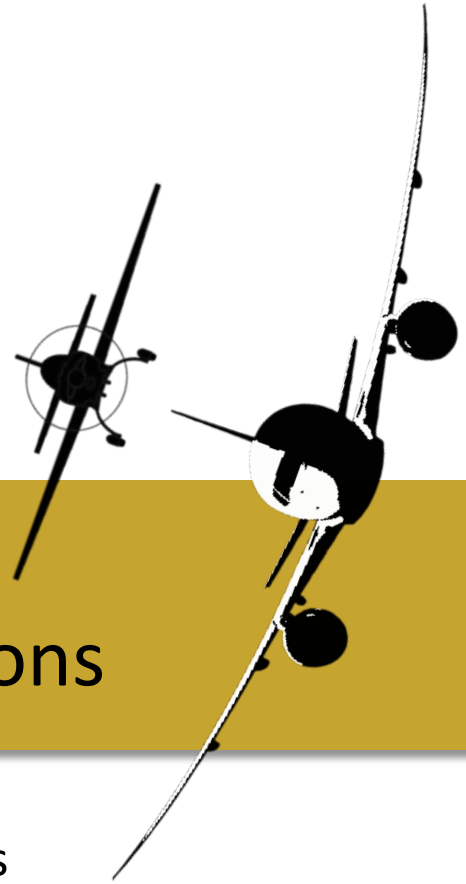


ICATEE On-Aircraft UPRT Recommendations and Considerations

Clarke “Otter” McNeace, Aviation Performance Solutions

AVIATION PERFORMANCE SOLUTIONS

I’m honored to be with you…

APStraining.com

Clarke “Otter” McNeace

Vice President of Training & Standards

- Co-Owner
- 14,000+ Flight Hours
- Part 141 Chief Flight Instructor
- 3 x Master CFI – Aerobatics
- ATP / CFI / CFII / MEI /AGI
- 4500+ Hrs All-Attitude Instruction Given
- Boeing 737 Airline Captain
- 10 Years Airline Experience
- 12 Years US Navy: F/A-18 Hornet Fighter Pilot
  - 36 Combat Missions/300 Carrier Landings
- 37 Years of General Aviation Experience
- ICATEE & FAA Stall/Stick Pusher Group Member

CAE

Swiss Re

BOMBARDIER LEADINGEDGE 2.0
Safety Standdown - *Delivered*

Outline

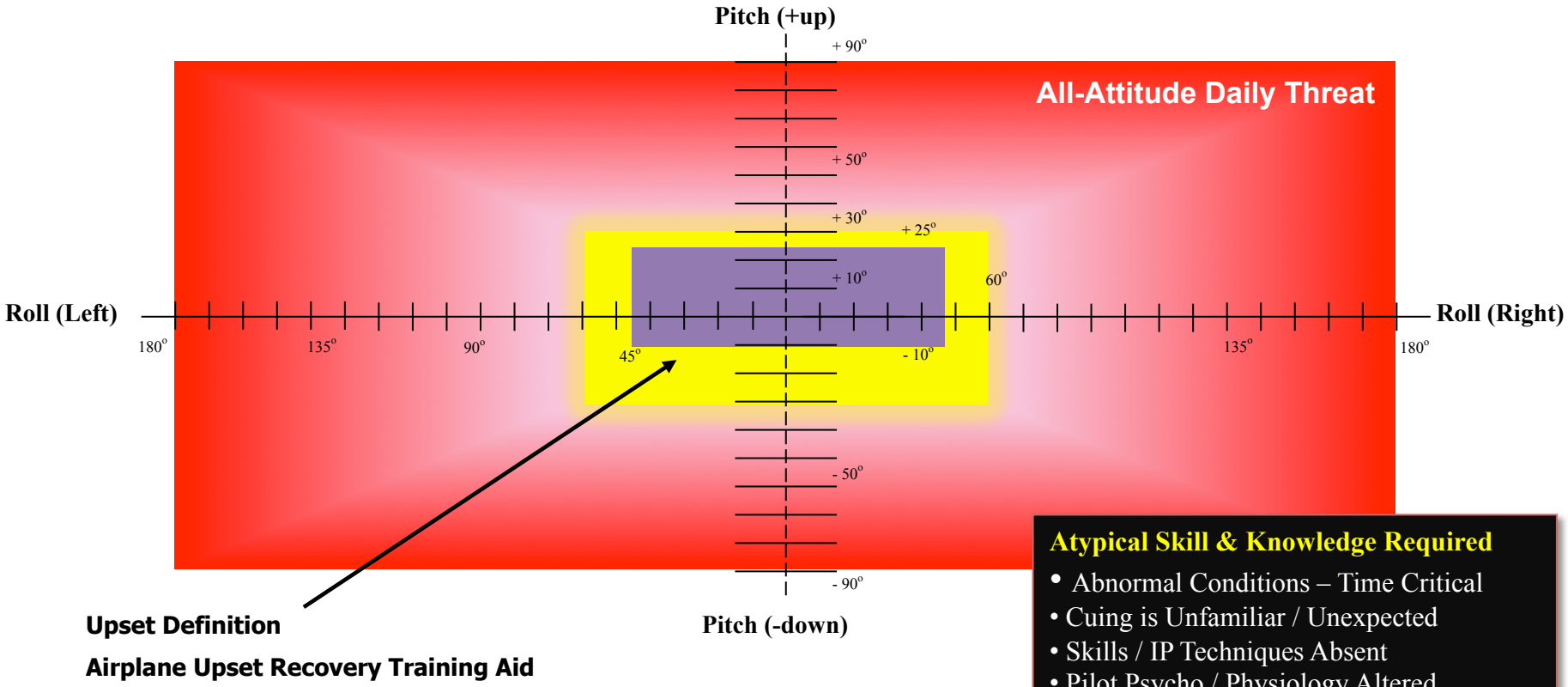
On-Aircraft Upset Prevention & Recovery Training

- Some insight into the challenges for pilots
- ICAO priorities of on-aircraft trng
- Mandatory Transferable Skills
- Margin of Safety needed


Loss of
Control is
still
happening!

Why?

All-attitude Perspective & Analogy

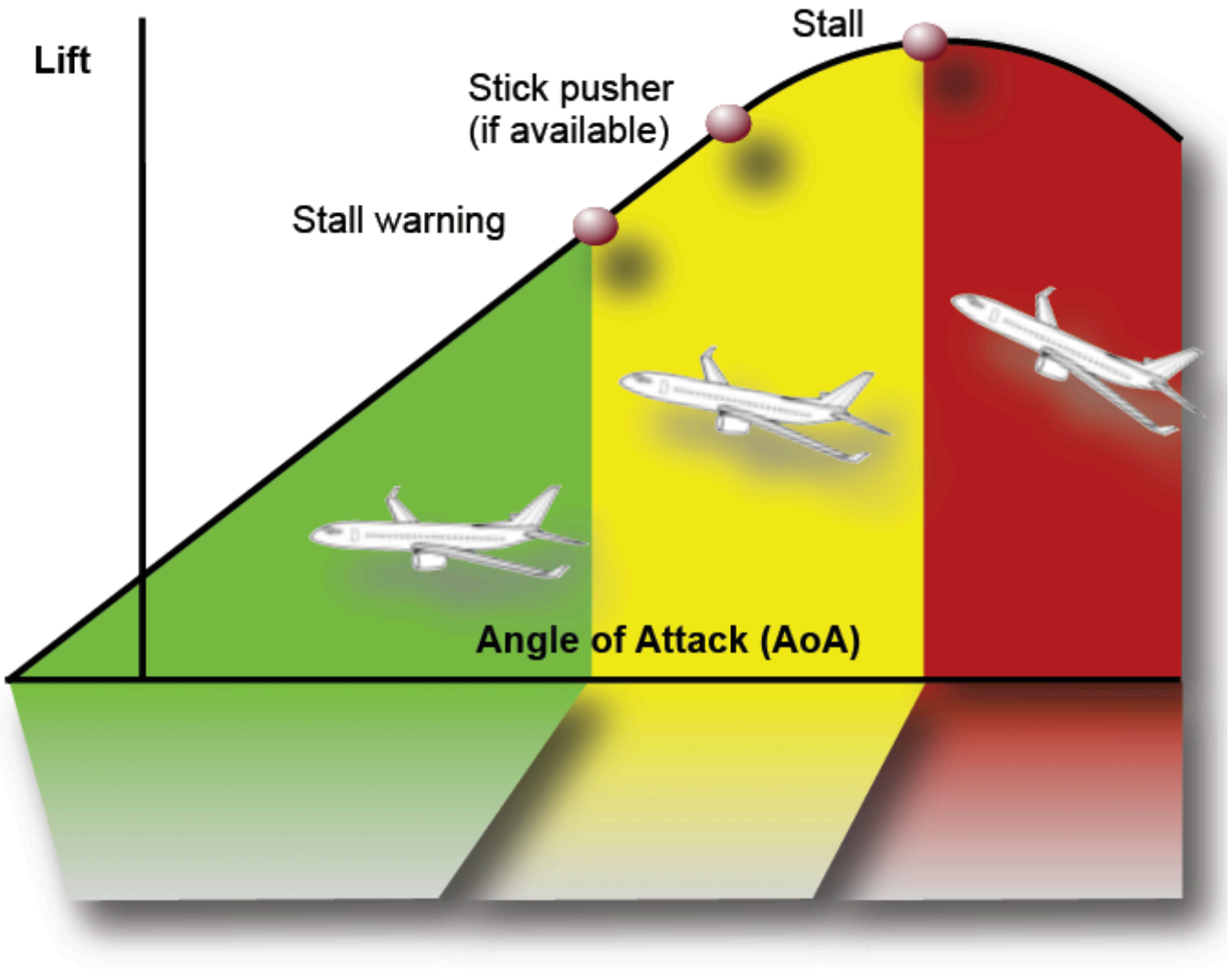


Atypical Skill & Knowledge Required

- Abnormal Conditions – Time Critical
- Cuing is Unfamiliar / Unexpected
- Skills / IP Techniques Absent
- Pilot Psycho / Physiology Altered

	100 %	All-Attitude Training (180 AOB, +/- 90 Pitch)
	11.1 %	Max Licensing Limits (60 AOB, +/-30 Pitch)
	4.9 %	Upset Definition (45 AOB, +25 & -10 Pitch)

All-Envelope Awareness



FEAR

It won’t help you get right-side up

Pre-Training Evaluation of a Corporate Pilot

Eval Scenario - TP Stall

IOS Enhancements

Simulator: Type-specific UPRT
- Type & Recurrent

Simulator: Generic ME EFIS Jet
- i.e. PL 111-216: ATP CTP – Aug 2014

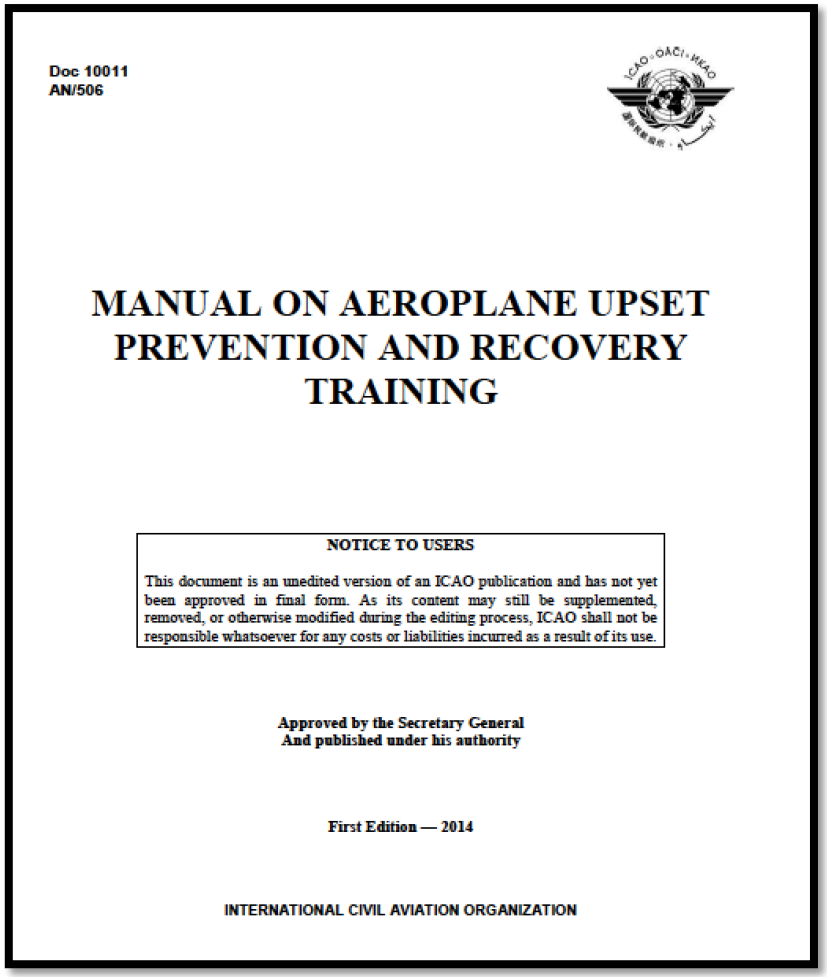
Core Skills: On-aircraft UPRT – CPL / MPL
- All-envelope All-attitude Platform Recommended
- Repetition to Proficiency: Transferrable & Positive
- Startle, Fear, Reality – Factors
- Industry-approved Techniques

UPRT-specific Academics
- Industry-approved

ICAO Manual on UPRT: Impact

Career Path of Professional Jet Pilots

ICAO Manual on AUPRT



Doc 10011
AN/506

MANUAL ON AEROPLANE UPSET PREVENTION AND RECOVERY TRAINING

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Approved by the Secretary General
And published under his authority

First Edition — 2014

INTERNATIONAL CIVIL AVIATION ORGANIZATION

tinyurl.com/icao10011

ICAO Priorities

ICAO acknowledges that:

On-Aircraft training provides experience and confidence in the psychophysiological domain of upsets that cannot be fully realized in FSTDs alone.

Human Factors Training designed to mitigate:

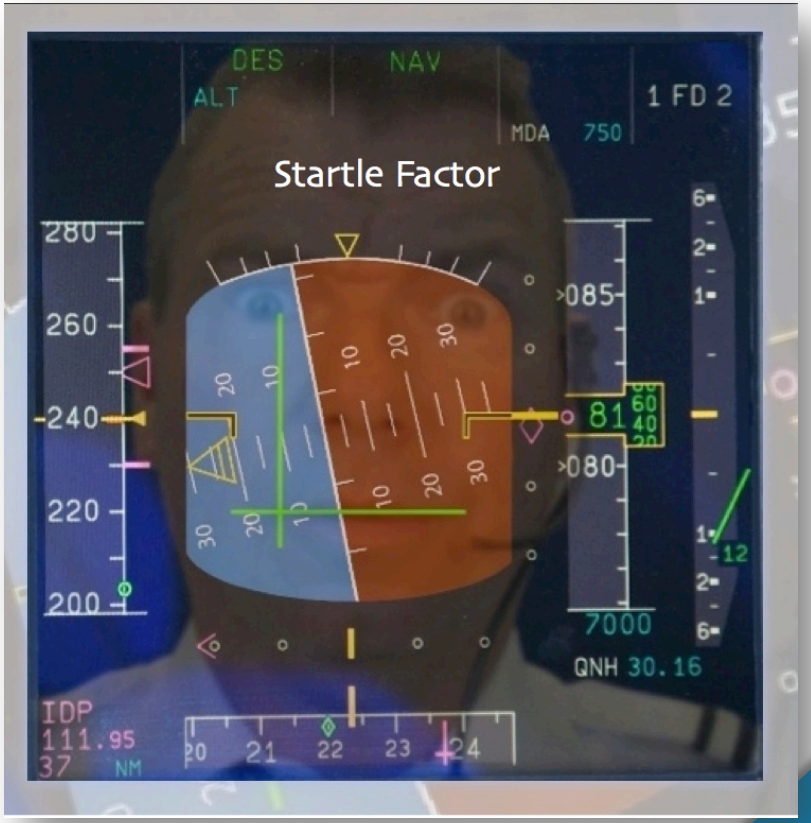
Startle/fear, disorientation, overreaction, fixation, cognitive bias

Mitigating Loss of Control In-flight

"Frightened human beings will only do what they're trained to do…."

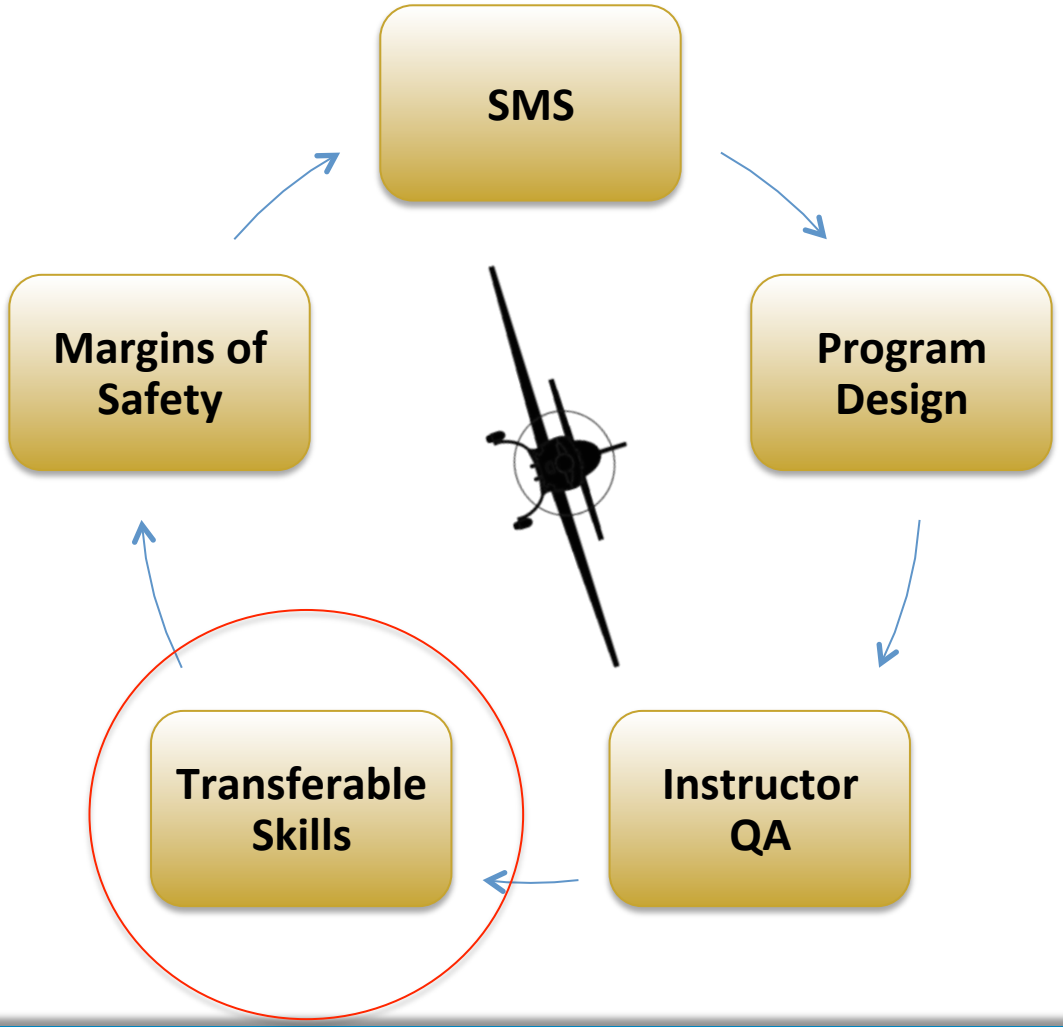
"You don't rise to the occasion. You sink to the level of your training."

Lt. Col. Dave Grossman
Marine Corps

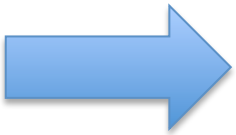


Critical Role of Simulation

On-Aircraft UPRT Framework



Light Aerobatic Aircraft



Large Transport Aircraft

So how can small aircraft apply to airliners?

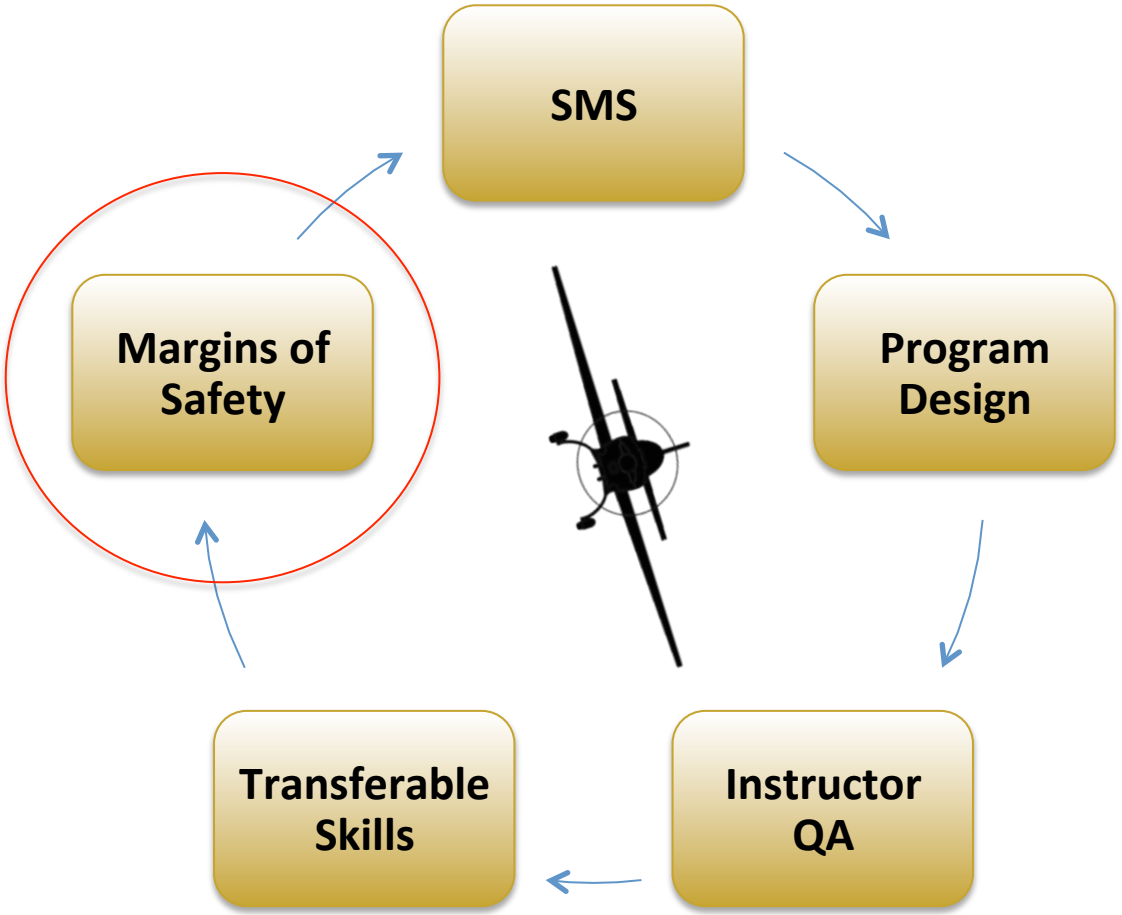
Three Areas of Application:

- Aerodynamic behavior common to all fixed wing aircraft not currently presented in existing simulators due to aeromodels or fidelity limitations.
- Essential psychological and physiological human factors impact, which cannot be fully encountered in the virtual environment.
- General strategies or techniques that can be applied broadly, which are not aircraft specific.

Transferable Skills

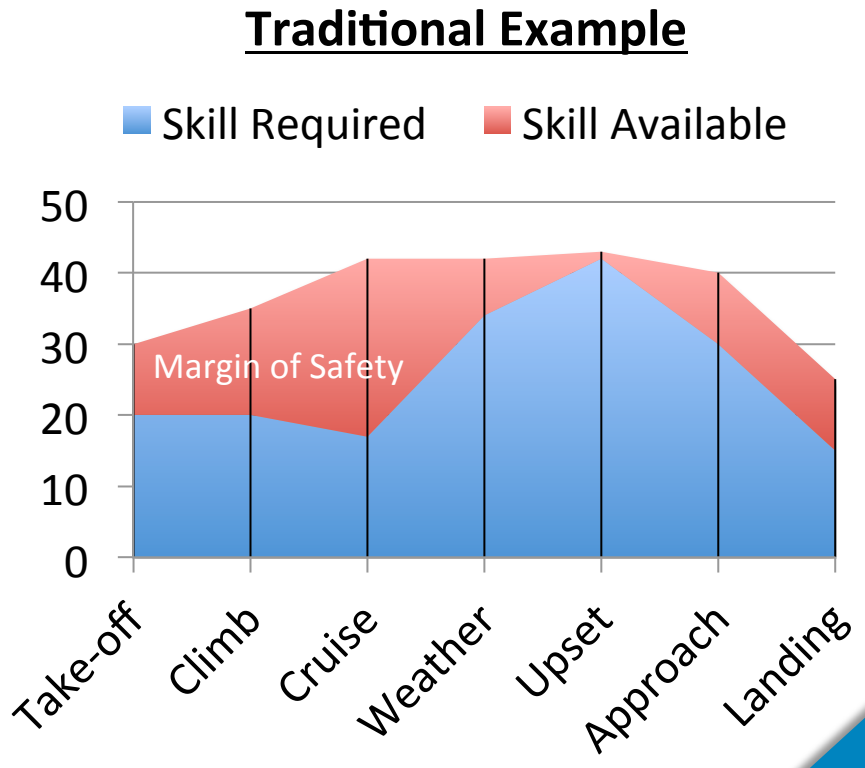
- Established Program
  - Industry-vetted
    - AURTA, Doc 10011, AC's, SIB's,
  - Aerobatics vs UPRT
  - Focused on Transfer
    - It's not about the training aircraft
- Negative Training
  - What is it?
  - Incorrect Principles
  - Not Reliably Transferable

On-Aircraft UPRT Framework



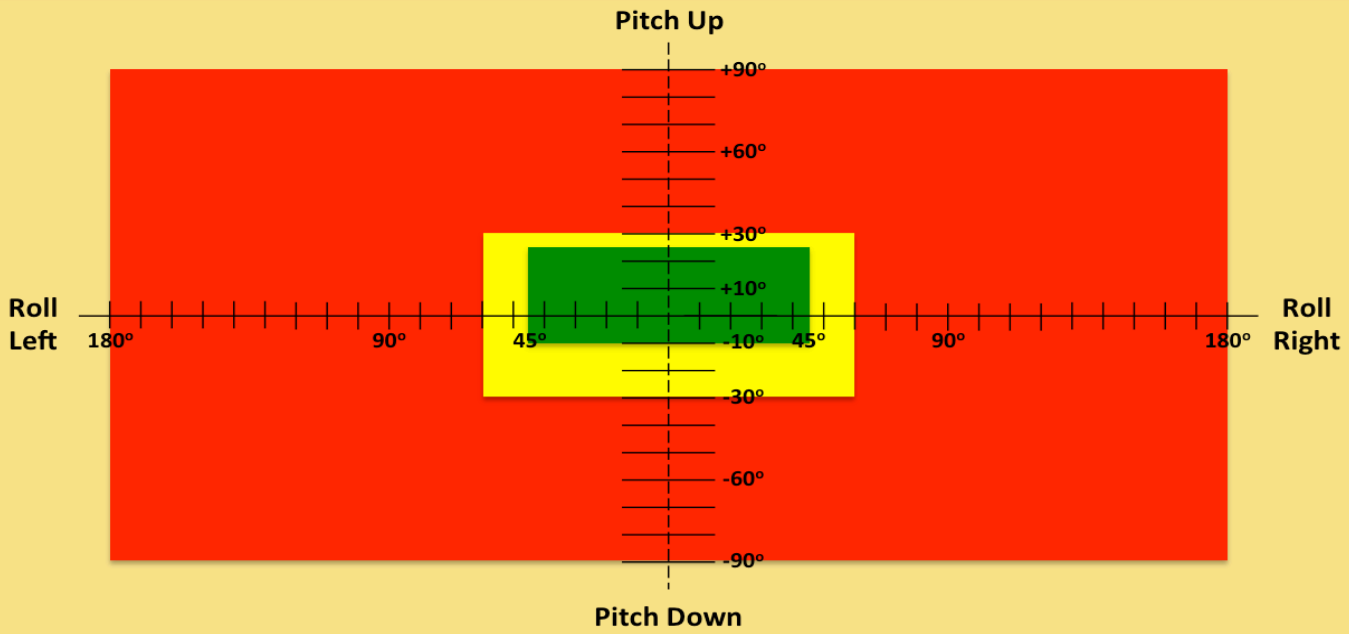
Margins of Safety

- Instructor Margins
  - Skill & Experience MUST Exceed the Curriculum Significantly
  - Currency & Fitness
- Airplane Margins
  - Must Exceed the Curriculum Significantly
  - Flight Test Limitations
  - Certification Limitations



UPRT Safety Considerations

Training & Operational Flight Envelopes



Normal Flight
Per Upset Definition
(45° AOB, Pitch +25° to -10°)
5% of Potential Flight Envelope

Commercial Licensing Training
Maximum Limits
(60° AOB, Pitch +30° to -30°)
11% of Potential Flight Envelope

Upset Prevention & Recovery Training
Potential Flight Envelope Red Zone
(180° AOB, Pitch +90° to -90°)
100% of Potential Flight Envelope

Source: Definition and Parameters for an Upset from the ICAO Manual on Aeroplane Upset Prevention and Recovery Training

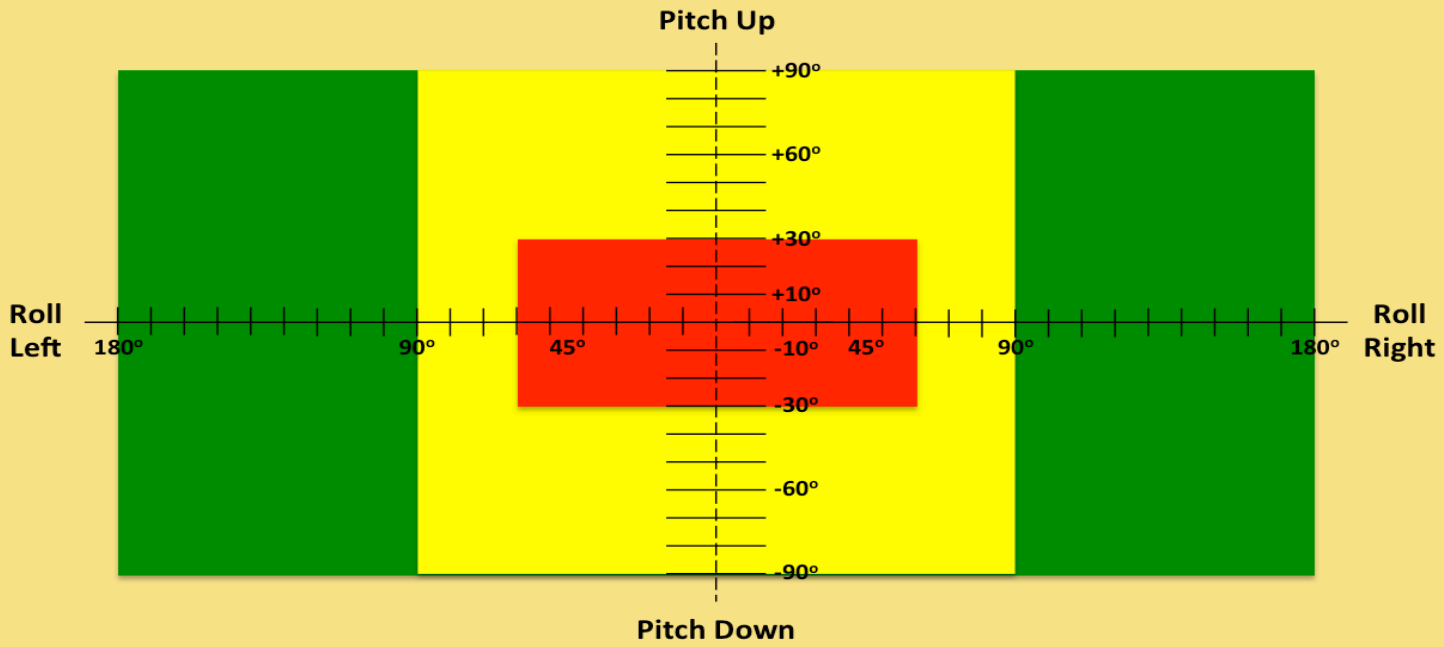
UPRT Safety Considerations

UPRT Aircraft Platform Considerations:

- We must have Safe and Legal Delivery of UPRT
- We must ask:
  - What are approved operating limitations?
  - What are design limits?
  - What is available margin of safety?
    - Pilots will make mistakes even in training

UPRT Safety Considerations

Aeroplane Operating Envelopes



Normal Category
Positive G: +3.8
Negative G: -1.52
Rolling G: +2.5
11% of Potential Flight Envelope

Utility Category
Positive G: +4.4
Negative G: -1.76
Rolling G: +2.9
50% of Potential Flight Envelope

Acrobatic Category
Positive G: +6.0
Negative G: -3.0
Rolling G: +4.0
100% of Potential Flight Envelope

Source: 14 CFR Part 23, Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

- **Normal Category** Aircraft intended for non-acrobatic operation
  - Non-acrobatic ops include:
    - Any maneuver incidental to normal operation
    - Stalls
    - Lazy Eights, Chandelles, Steep Turns (not to exceed 60 deg AOB)
  - Spins Prohibited
  - One-turn Margin of Safety

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

- **Normal Category** Design Limits

  3.8 G and -1.52 G (Flaps Up)

  Rolling Pull limit = 2.5 G

  Safety Margin = 2.5 G

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

- **Utility Category** Aircraft intended for normal operation plus limited acrobatic operation
  - Limited acrobatic ops include:
    - Spins (if approved for type acft)
    - Lazy Eights, Chandelles, Steep Turns
    - Any maneuver (not to exceed 90 deg AOB)
      - Possibly need parachutes
  - Possible only One-turn Margin of Safety

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

- **Utility Category** Design Limits

  4.4 G and -1.76 G (Flaps Up)

  Rolling Pull Limit 2.9 G

  Margin of Safety 2.9 G

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

- **Acrobatic Category** Aircraft intended for use without restriction
  - Acrobatic ops include:
    - Any maneuver (including exceeding 90 deg AOB)
      - Possibly need parachutes
    - Spins
  - Six-turn spin Margin of Safety

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

- **Acrobatic Category** Design Limits

  6.0 G and -3.0 G (Flaps Up)

  Rolling Pull Limit 4.0 G

  Margin of Safety 4.0 G

UPRT Safety Considerations

FAA 14 CFR Part 23 States (EASA CS 23):

Equipment:

- Parachutes Required: intentional maneuver +/-30 deg pitch, +60 deg AOB (except spin trng)
- G-meters: typically Acrobatic acft only
- Emergency Egress: typically Acrobatic acft only
- Dual Seatbelts: typically Acrobatic acft only

Summary of Aeroplane Limitations

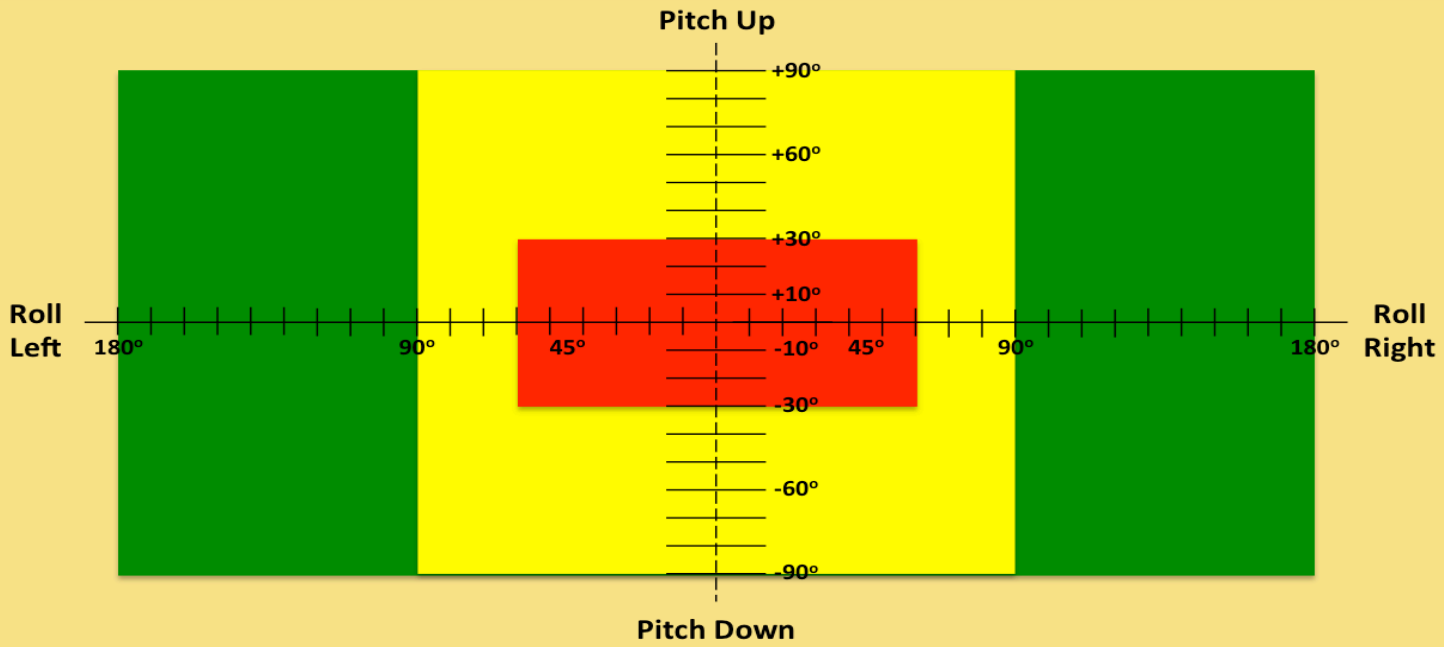
Training Aeroplane Limitations & Margins	Normal Category	Utility Category	Acrobatic Category
Intended Use	Non-Acrobatic Ops	Limited Acrobatic Ops	Without Restriction[1]
Maximum Bank Angle	60 Degrees	90 Degrees	None
Structural Design Limits[2] Flaps Up, Pulling Only	+3.8, -1.52 G	+4.4, -1.76 G	+6.0, -3.0 G
Structural Design Limits[2] Flaps Up, Rolling Pullout	+2.5 G	+2.9 G	+4.0 G
Optimum Fatigue Life Flaps Up, Pulling Only	+2.5 G	+2.9 G	+4.0 G
Intentional Spins	Never Approved	Normal or Acrobatic Limitations Could Apply	Always Approved[3]
Spin Margin of Safety	One Turn Only		Up to Six Turns
Training Equipment[4]	**Normal Category**	**Utility Category**	**Acrobatic Category**
G-meter	Atypical		Typical
Emergency Egress			
Redundant Lap Belts			

Notes to Above Table:

1. Other than those restrictions shown to be necessary as a result of required flight tests.
2. Structural design limits are lower than the values shown with flaps deployed.
3. Notwithstanding Airworthiness Directives or Supplemental Type Certificates that may affect the spins-approved status of the training aeroplane.
4. Equipment useful in the context of UPRT that typically may or may not be standard equipment.

UPRT Safety Considerations

Aeroplane Operating Envelopes



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Rolling G: +4.0
100% of Potential Flight Envelope

Source: 14 CFR Part 23, Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes

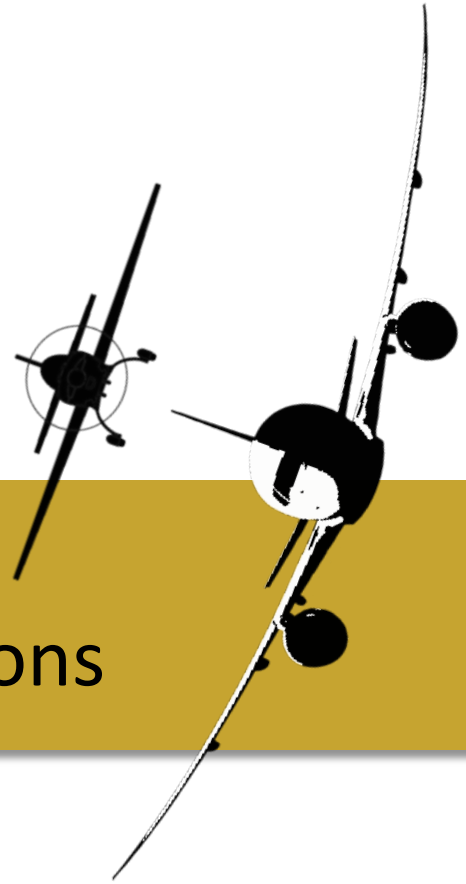
Light Twin Certification: Flight Test

- What is the certified spin margin of safety?
  - Approved for intentional spins? -No
  - Unintentional spin protection? Same as SE?
  - CS-23: No undue tendency to spin in a stall with the critical engine failed
- Are there any risks in:
  - Accelerated Stall? / Prolonged Stall? -Yes
- Margin of safety after the stall:
  - NONE

Questions

On-Aircraft Upset Prevention & Recovery Training

- Some insight into the challenges for pilots
- ICAO priorities of on-aircraft trng
- Transferable Skills mandatory
- Margin of Safety needed



ICATEE On-Aircraft UPRT Recommendations and Considerations

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