

Push to Unload

Are we doing it right?

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11 Sep 24





Aerobatic Flying



Motion Sickness

Loss of Control in Flight : UPSET



Doc 10011
AN/506



MANUAL ON AEROPLANE UPSET PREVENTION AND RECOVERY TRAINING

NOTICE TO USERS

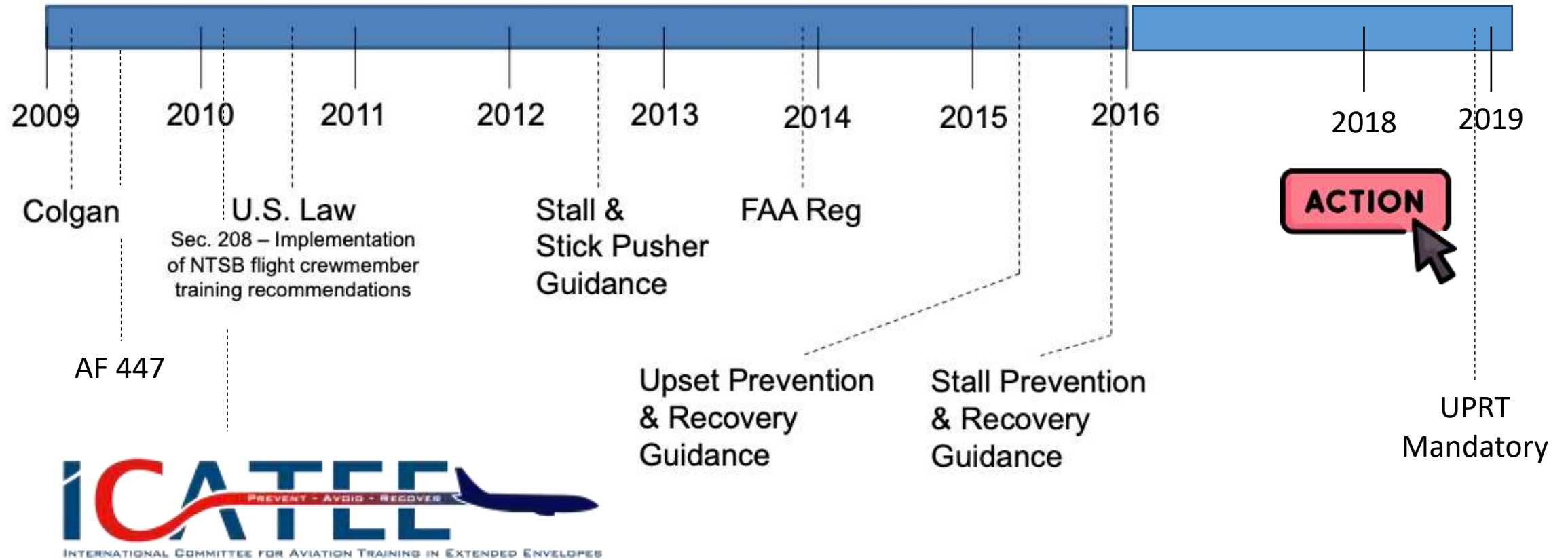
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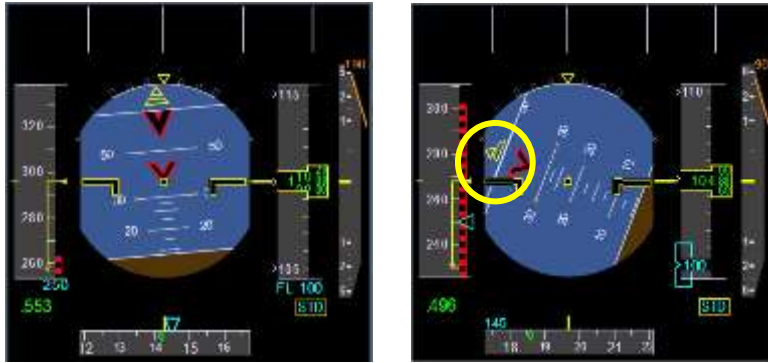
First Edition — 2014

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Loss of Control in Flight: UPSET



Training Guidelines



PUSH TO UNLOAD

Thrust and Drag

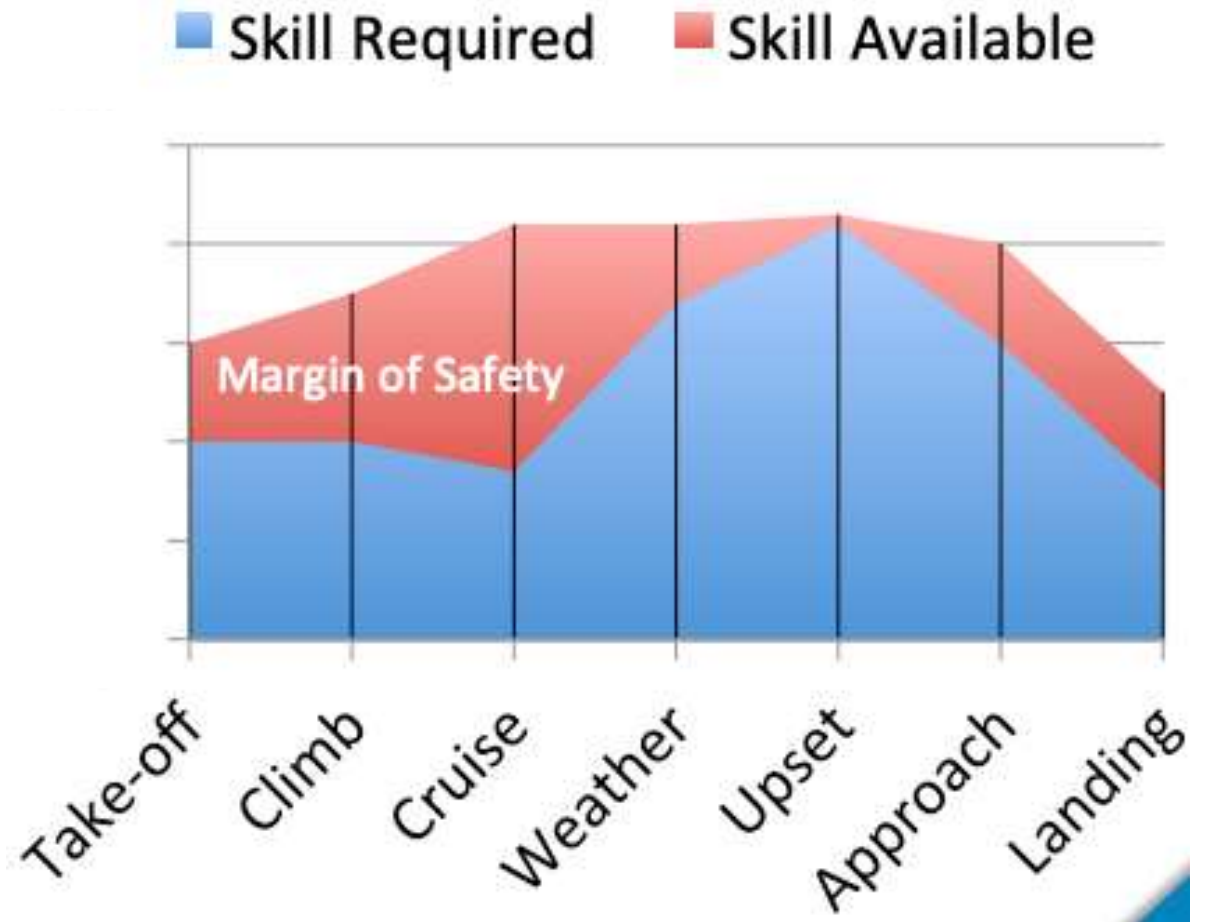
ROLL

STABILIZE



Instructor Margins

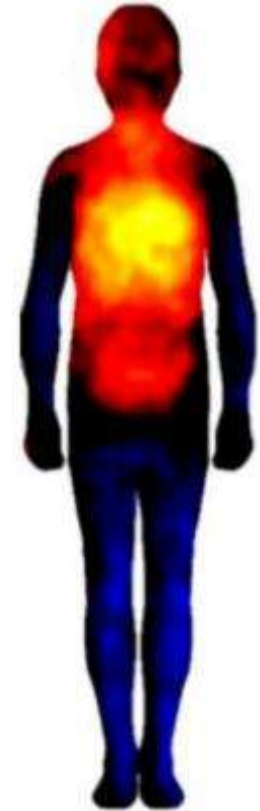
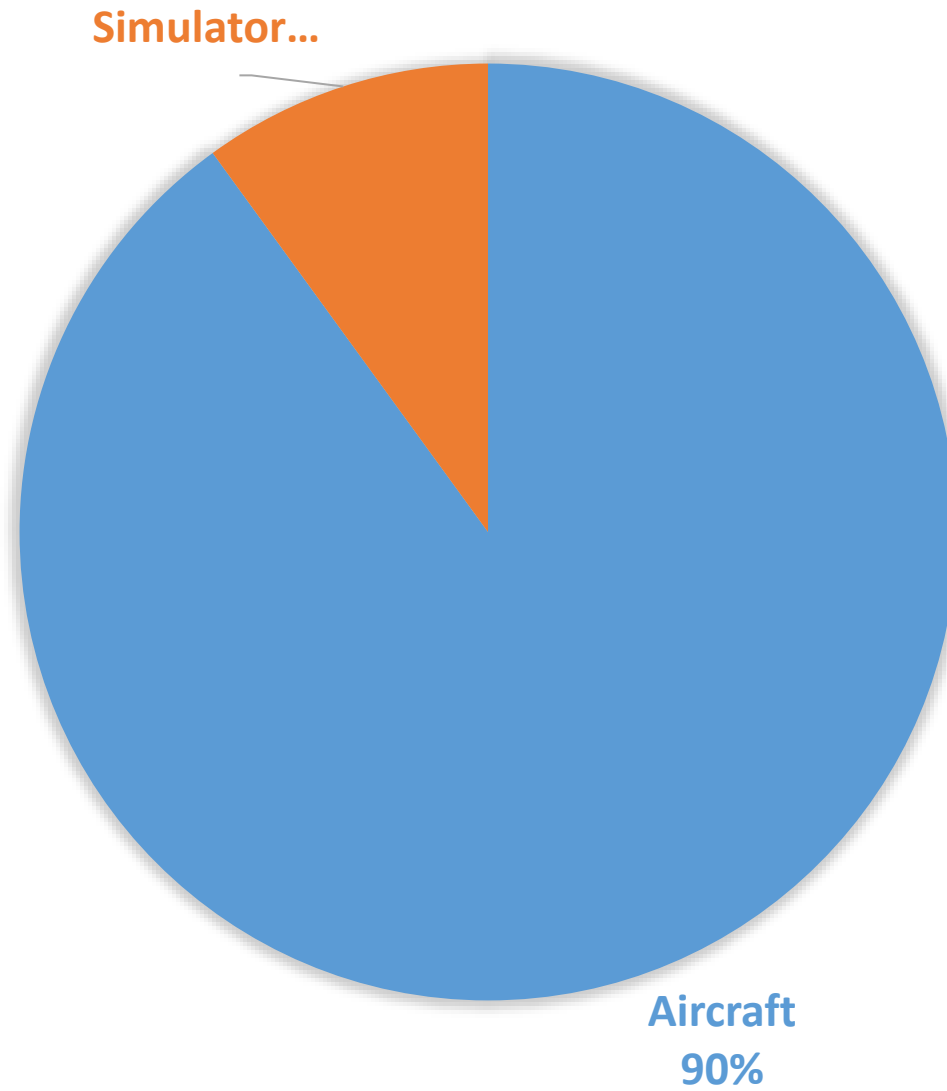
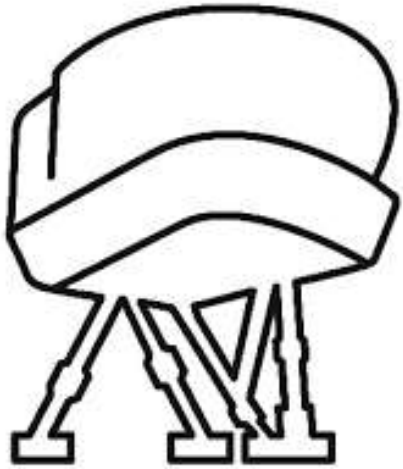
- Skills & Experience MUST Exceed the Curriculum
- Currency & Fitness



G – Load Effects



Body Sensations

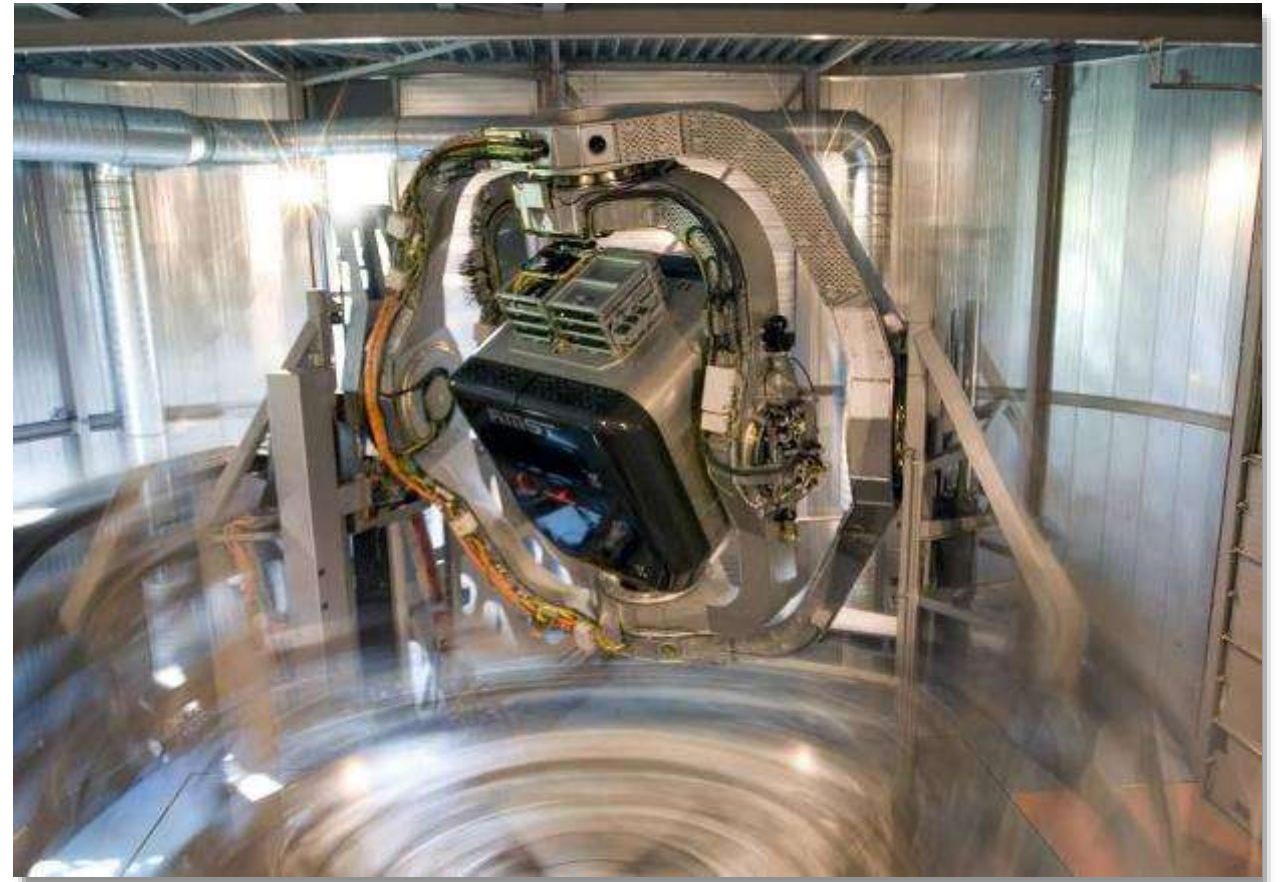


Advanced UPRT Instructor Qualification

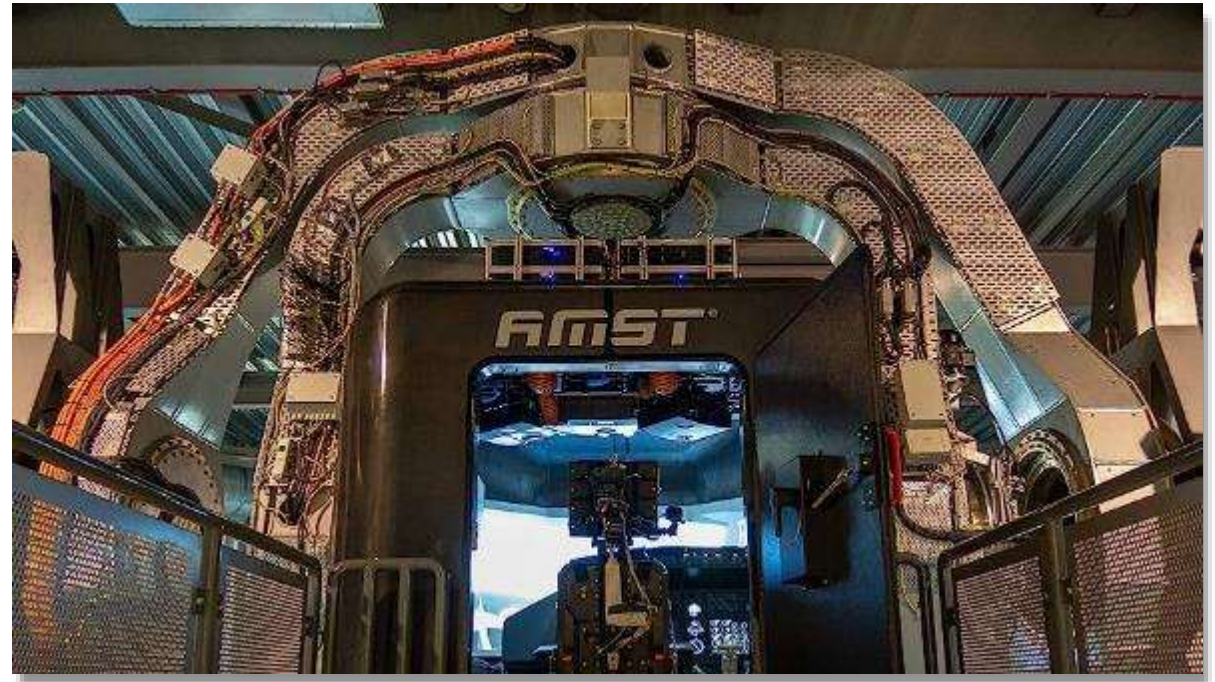


DESDEMONA

motion simulation for your proficiency



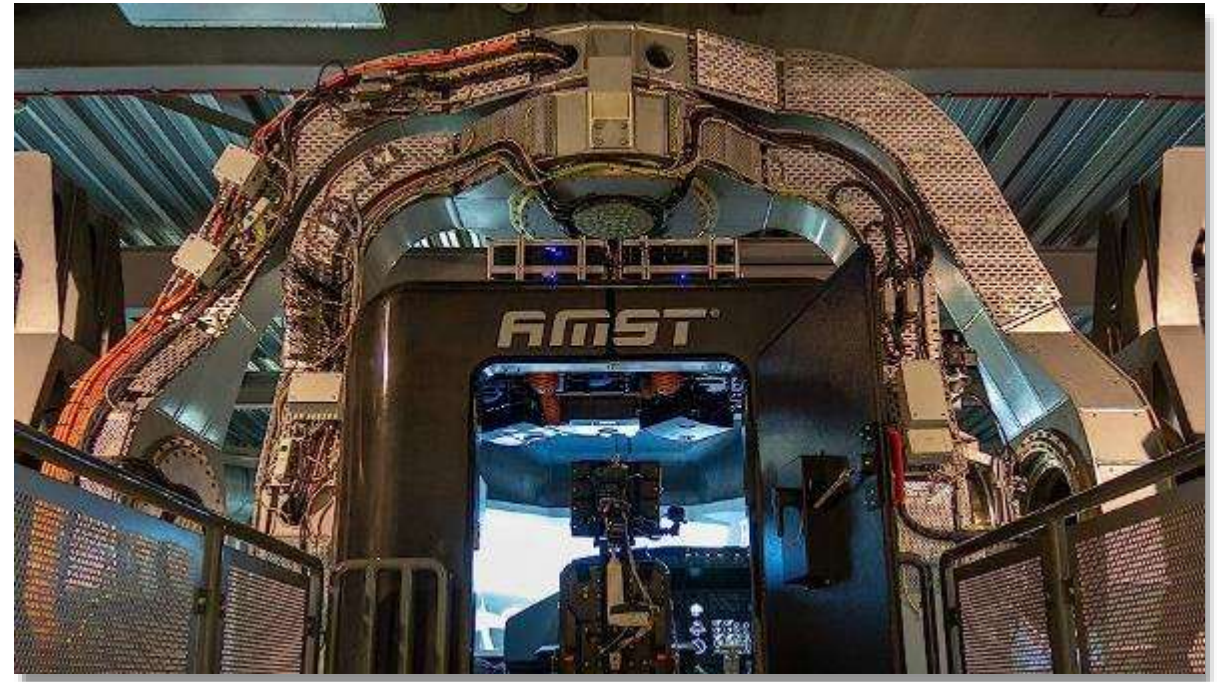
Sustained 3-g Forces



Unique Elements

Sustained 3-g Forces

Extended Envelope Trg

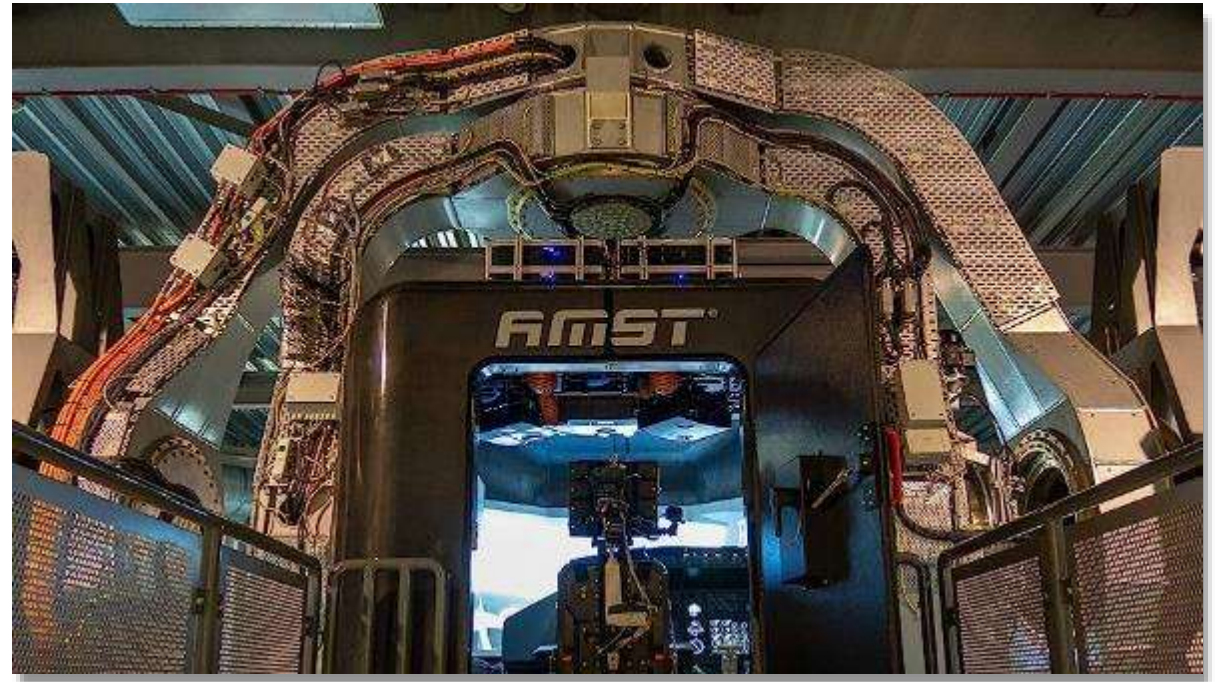


Unique Elements

Sustained 3-g Forces

Extended Envelope Trg

Deep Stall Trg



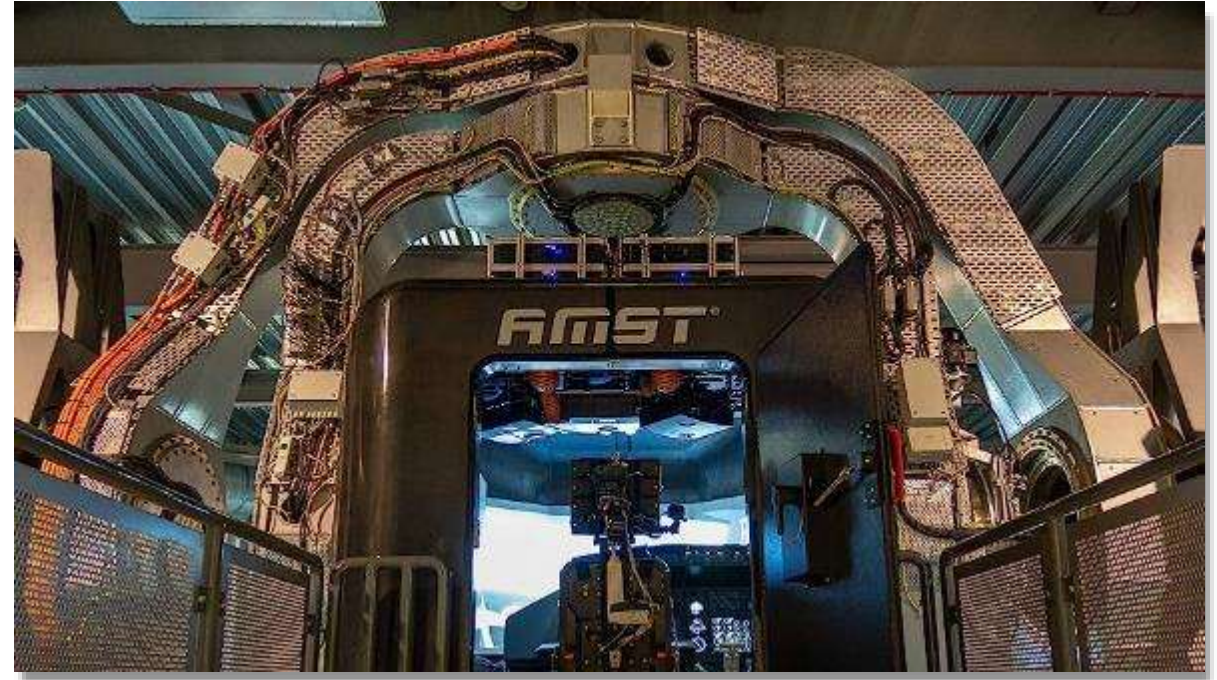
Unique Elements

Sustained 3-g Forces

Extended Envelope Trg

Deep Stall Trg

Spatial Disorientation



Unique Elements

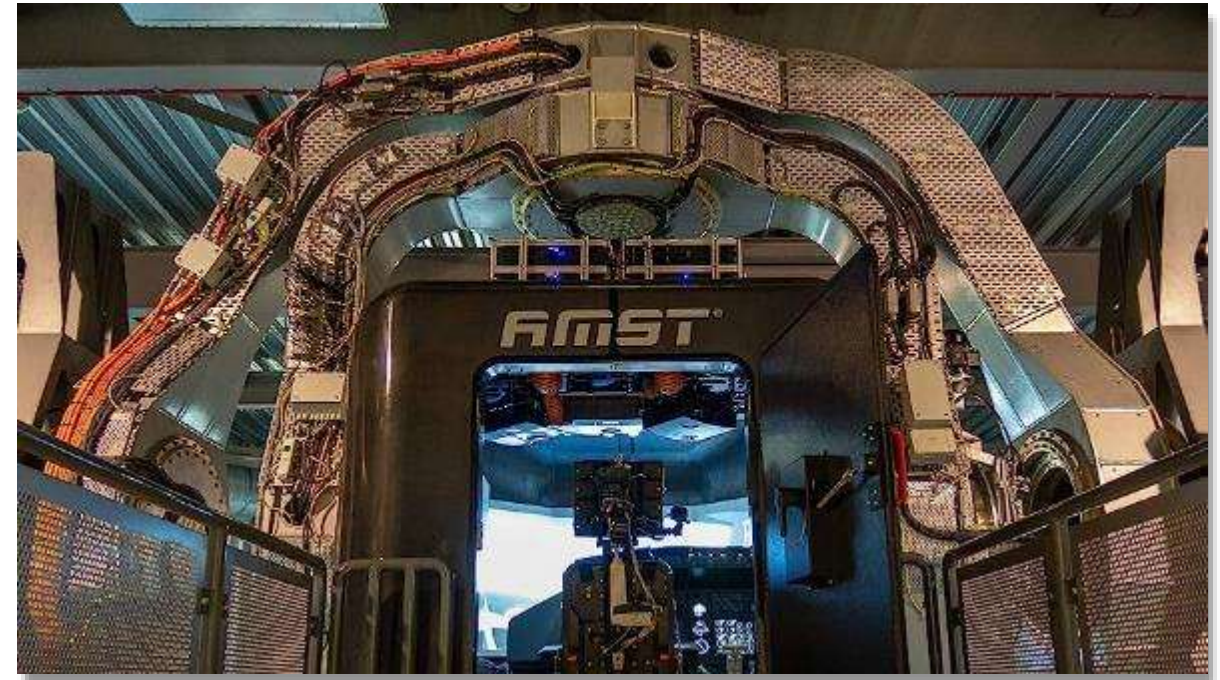
Sustained 3-g Forces

Extended Envelope Trg

Deep Stall Trg

Spatial Disorientation

**Psychological & Physiological
Human Factors Experience**



Unique Elements

Sustained 3-g Forces

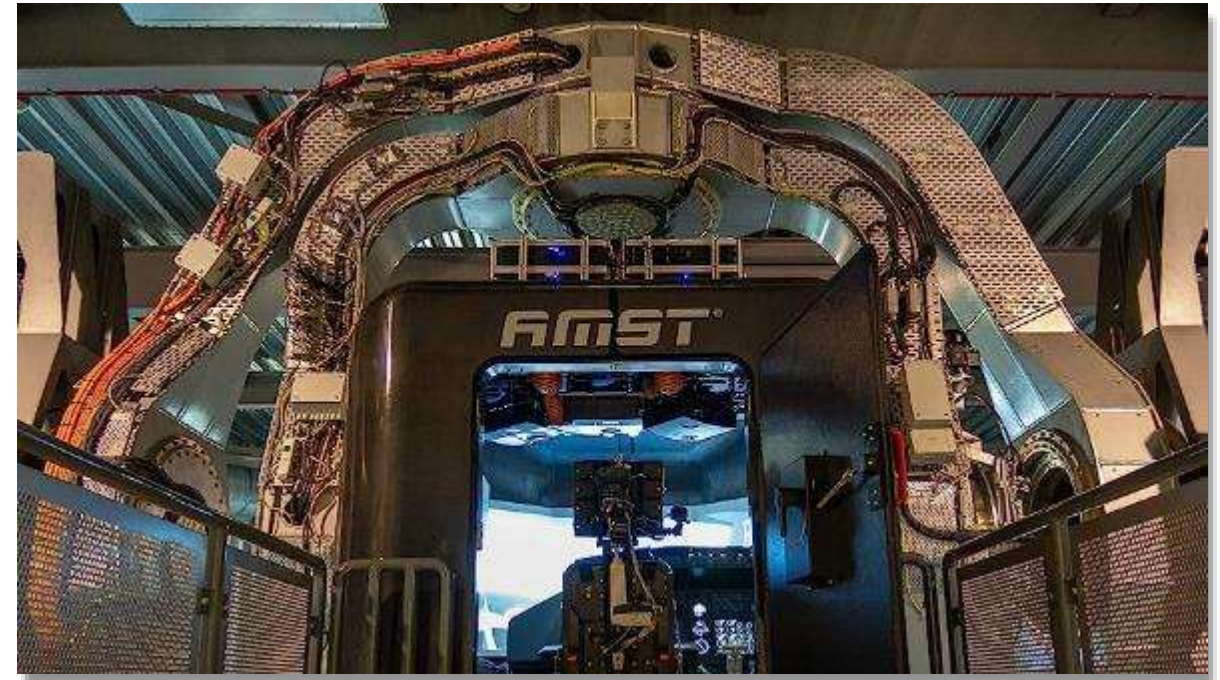
Extended Envelope Trg

Deep Stall Trg

Spatial Disorientation

**Psychological & Physiological
Human Factors Experience**

General Strategies & Techniques





Austrian 



FO Thomas Reisner, SFI Embraer E195



Austrian 

CPT. Dr. Robert Ahornegger, Technical Pilot E190 , Advanced UPRT Instructor



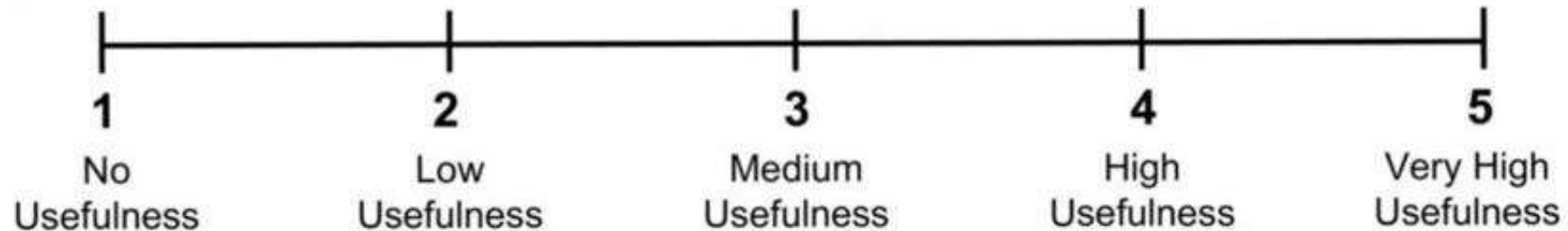
UPRT – Challenge or just another training task?



- 160 Responses
- Age 30 to >60
- Major part aging 50 – 59 years
- 96,6 % ATPL
- 62 % TRE / Check Airmen
- 96,9% Transport Category Aircraft
- Average > 13.000 flight hrs

Experts

On-Aircraft UPRT experience is



Ø=4,1

of value instructing UPRT in FFS

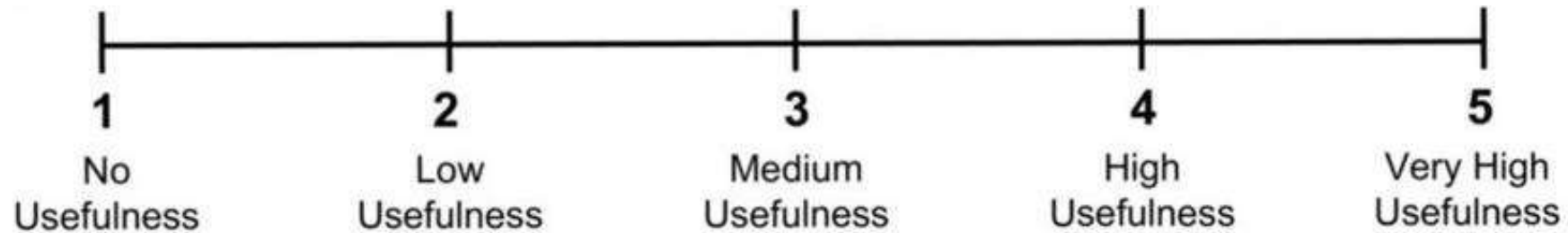
Ø=4,1

of value for Upset scenarios as pilot in FFS

Ø=4,0

of value in a real-life Upset scenario

G – Forces are rated important



$\sigma=4,4$

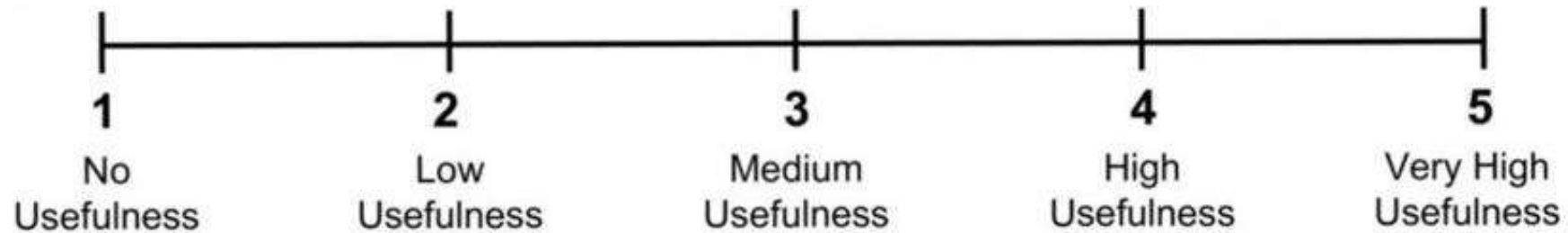
for Upset Recovery Training

$\sigma=4,0$

for Stall Recovery Training

Preliminary Survey Results

Instructors judge



Ø=3,8

They can pass on-a/c UPRT experience to students

Ø=4,0

On a/c UPRT as important for airline pilots

Preliminary Survey Results

Feel of G-forces: Instructors highlighted the importance of experiencing realistic G-forces during different maneuvers.

Envelope expansion: On-aircraft training allows pilots to experience real high pitch and bank values, expanding their operational envelope.

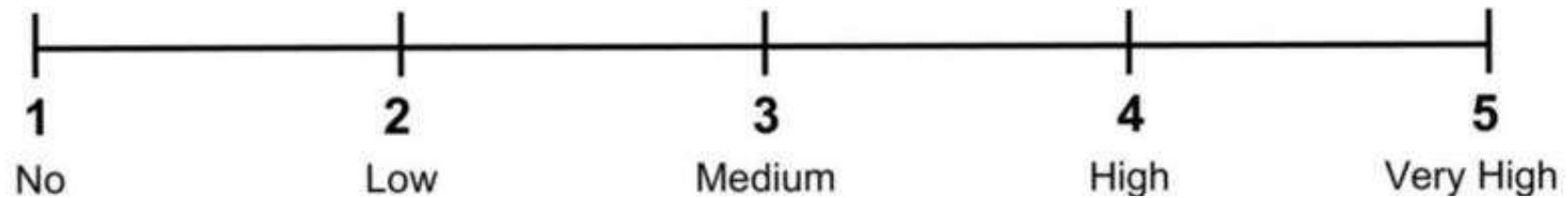
Limited applicability for recovery technique training:
On-aircraft UPRT is seen more as a tool to teach human limitations rather than to train specific recovery techniques.

FFS : rated medium suitable for UPRT

Real-world clues: While simulators are advanced, on-aircraft training provides real-world clues and experiences that simulators may not replicate accurately.

G-load experience: (0.5g, 2g, 2.5g) on small aircraft are considered helpful for normal flight crews.

Line Pilot knowledge



∅=2,9

on human performance limits during UPRT

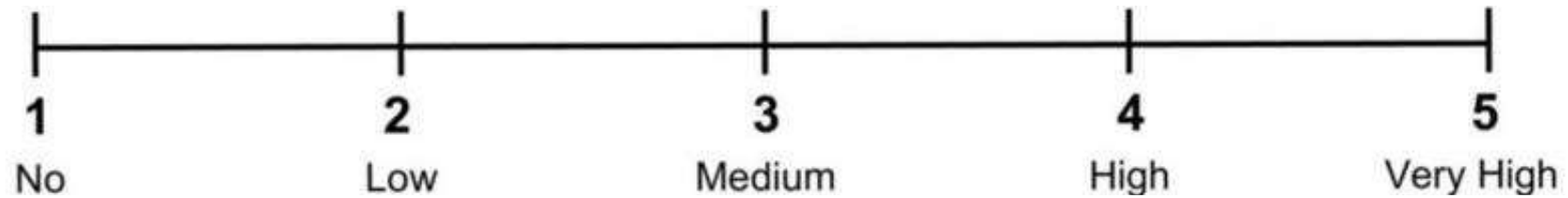
∅=3,2

of principles of flight (AOA, v-n diagram, FFS limitations)

∅=3,5

of aircraft protection systems

Instructors judge



Ø=2,9

Readiness for real-life upset scenarios

Ø=3,2

Benefit of g-load indication

Ø=3,9

Benefit of AoA indication

Preliminary Survey Results

IP judge **positive** about UPRT on FFS....

Structured Upset/Stall recovery procedures

Aircraft-specific procedures: Training focuses on specific procedures tailored to the aircraft type.

Demonstration of aircraft performance limits: Simulators demonstrate aircraft performance limits and built-in protections, enhancing pilots' understanding of aircraft capabilities.

Phrasing and automated reactions: Training emphasizes phrasing and automated reactions during UPRT events, such as "push to unload" and "roll, stabilize."

Thomas Reisner, University of Applied Science Graz, Austria

Preliminary Survey Results

IP judge **positive** about UPRT on FFS....

Safety and repetition: Training in simulators is safe and allows for repetition, improving pilots' proficiency

Briefing and facilitated repetitions: Training includes thorough briefing followed by facilitated repetitions to reinforce learning.

Development of awareness: Training in simulators develops awareness regarding UPRT and enhances pilots' skills.

Preliminary Survey Results

IP judge **negative** about UPRT on FFS....

1g situation / lack of g-forces: Simulators always maintain a 1g situation, which doesn't accurately replicate real flight conditions and impacts the training experience.

Missing real environments: FFS lack real environments and fail to simulate spatial disorientation.

Missing startle and surprise: Simulators fail to replicate startle and surprise effects, which are crucial in real-world upset scenarios.

Potential threat from poor recovery: Simulators may not adequately simulate the potential damage or injury resulting from poor or overcontrolled recoveries.

Thomas Reisner, University of Applied Science Graz, Austria

Preliminary Survey Results

IP judge **negative** about UPRT on FFS....

Unrealistic behavior beyond approved limits: Simulators may behave unrealistically beyond approved limits, impacting the effectiveness of training.

Awareness reduction: The absence of g-loads leads to a reduction in awareness and understanding of the situation.

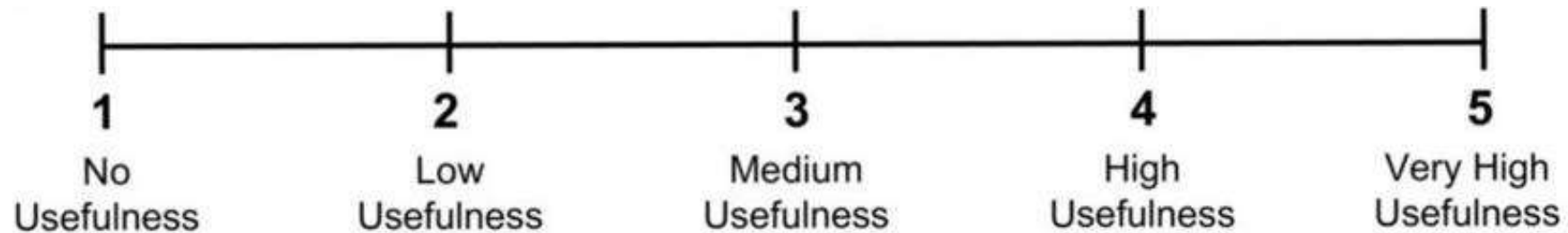
Need for realism: The absence of g-load simulation in simulators is seen as a significant limitation, and using real aerobatic aircraft alongside simulators is suggested to provide comprehensive UPRT.



DESDEMONA

motion simulation for your proficiency

17 DESDEMONA Instructors



Ø=4,5

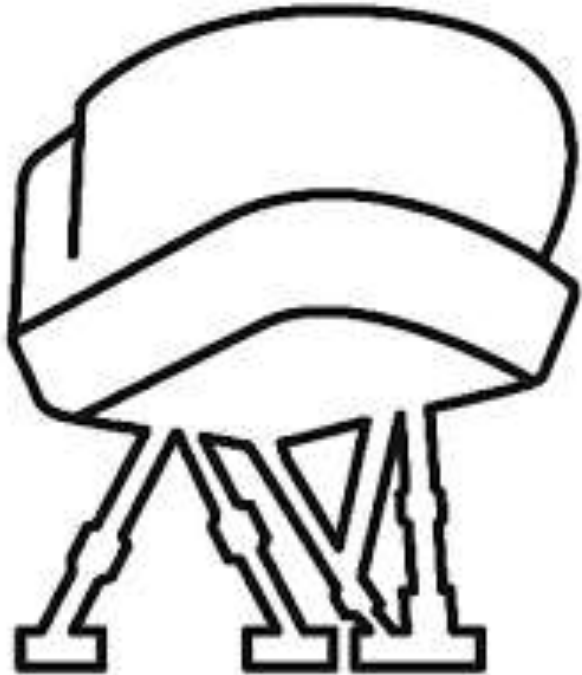
Improves understanding and teaching

Ø=4,6

Spatial Disorientation, HF, aerodynamics (AoA)

Ø=4,3

Correct recovery training



Advanced Spatial Disorientation (ASD) Training



Fixed and rotary wing

**Flight models for
trainer & fighter aircraft (similar PC-7/F-16)
light helicopter (similar AS 350)**

**Demonstrates and familiarises pilots with the
potentially disastrous effects of Spatial Disorientation**

**Pitch-up sensations after take-off
(somatogravic – vestibular)**

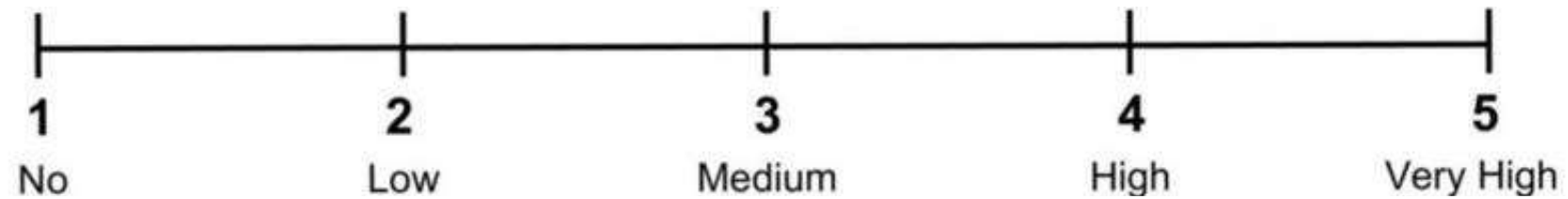
Human factors research and development tool

Advanced Spatial Disorientation (ASD) Training



- **10 Pilots**
- **60 % Cpt 40% FO**
- **100% Commercial Transport**
- **40 % Instructors**

Assessment on human performance & limitations.....



Ø=3,1

Before Spatial Disorientation - Training

Ø=4,5

After Spatial Disorientation - Training

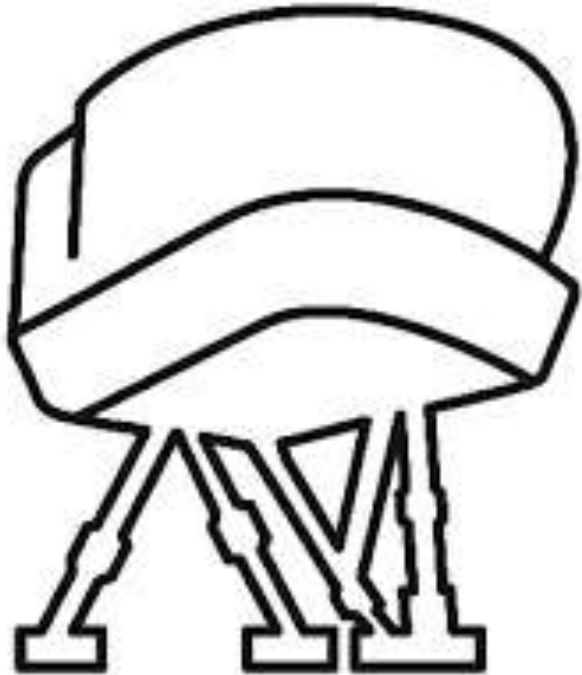
Preliminary Survey Results

IP judge **positive** about Advanced Spatial Disorientation Simulator....

Illusions are experienced iso just reading or being told

UPRT: enhanced understanding

Experiencing both illusions (visual as well as vestibular): enhanced impression concerning certain impacts in daily airline operations. Especially effects during a high energy Go-Around



V-n- Diagram



AMST
BUILDING CONFIDENCE.

In pilot's field of view

Speed Tape Indications



V-n Diagramm



FMST
BUILDING CONFIDENCE.



- **Envelope adjusts to**
 - Flap setting
 - Altitude
- **Immediate Feedback**
- **„Push to Unload“**
- **Effects of turbulence (overstressing)**
- **History visible (20 sec)**
- **Margins to limits**

Did the training increase the understanding of the

- V-n-diagramm: **4.6**
- Maneuvering speed: **4.2**
- Increased g-load in turns: **4.6**
- Importance of „push to unload“ : **4.6**
- Threat of entering a secondary stall during recovery: **4.2**
- Threat of overstressing the aircraft during recovery: **4.4**
- Limits of FFSs: **4.6**



FPM a Team Effort

Operators – ATOs only complying with minimum regulatory UPRT requirements

Instructors only feel medium qualified to deliver competent UPRT

g- loads experience judged as highly valuable / essential

FFS are regarded to be limited valuable for UPRT

A/C / DESDEMONA / ASD highly valuable for Instructor / pilot qualification

PM Duties missing

Recommendations

Improve Instructor Qualification → Competencies (theoretical & practical)

Instructor Pilots to be exposed to extended envelope

Instructor Pilots regular recurrent advanced UPRT

Enhanced Training Devices to be used for Instructor Qualification

FFS update to enhance Upset Scenarios

PM Duties to be included to SOPs to make UPRT a Team – Effort

Push-to-Unload to be changed changed to „Release – to – Unload“

Additional Flight Crew Training



Hybrid Instructor Qualification



Aircraft

DESDEMONA

Advanced Spatial Disorientation
Trainer

Is



\$A£€T¥

OUR #1
PRIORITY ?



Christof Kemeny



„ You don't rise to the
occasion,

you sink to the level of
your training“

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