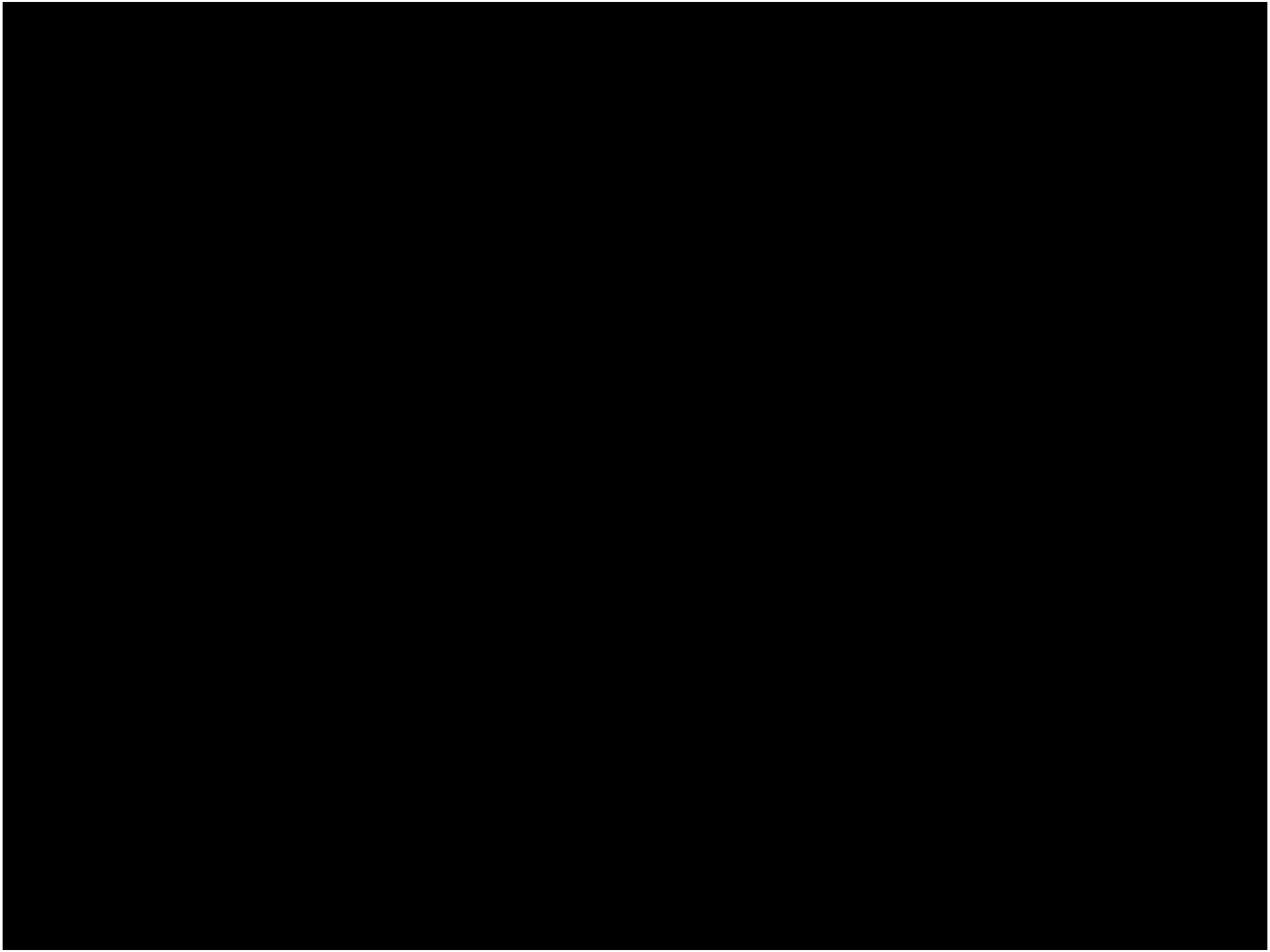


Spatial Disorientation - In flight demonstration and training A resume and opportunities for future enhancement

Colonel Malcolm G. Braithwaite OBE

Fundamentals of Aerospace Medicine
(Ed: ROY L. DeHART)

Physiological training is the main weapon against spatial disorientation at the disposal of the flight surgeon and aerospace physiologist.

Kent K. Gillingham and James W.Wolfe

(Chapter 11: Spatial Disorientation in Flight)

Fundamentals of Aerospace Medicine
(Ed: ROY L. DeHART)

Strong aeromedical and aviation training programs remain the most important defensive measure for SD.

N. Bruce Chase and Robert J. Kreutzmann
(Chapter 21: Army Aviation Medicine)

AGARD Report No.625

Orientation/Disorientation Training of Flying Personnel

A Working Group Report

Edited by

A.J. Benson

(November 1974)

Types of training

- Ground
  - Didactic lectures
  - Demonstration

Types of training

- Ground
  - Didactic lectures
  - Demonstration
- Flight Simulators

Types of training

- Ground
  - Didactic lectures
  - Demonstration
- Flight Simulators
- In flight
  - Demonstration
  - Training

Demonstration vs Training

Demonstration

The demonstration of the **limitations** of the orientation senses in flight particularly in conditions of poor visibility.

Demonstration vs Training

Training

Learning and thence demonstrating competence in handling in-flight disorientating circumstances and illusions.

Prime agencies

- U.S. Triservice Aeromedical Research Panel: Technical Working Group (TWG) for Spatial Orientation and Situation Awareness.
- Air Standardization Coordinating Committee (ASCC):
  Working Party 61 - Aeromedical Factors.
  (Project Group 117)

ASCC Working Party 61
Project Group 117 - SD

Objective

To standardize concepts, doctrines, procedures and designs to enhance aircrew effectiveness by minimizing the impact of spatial disorientation…….

….. in order to maintain the specified coalition capability requirements.


PG 117
Spatial Disorientation

UK SD Training Review Group

Demonstration

The demonstration of the **limitations** of the orientation senses in flight particularly in conditions of poor visibility.

Further reinforcement of ground-based instruction and demonstration.

Insidious onset

Fixed wing vs Rotary-wing

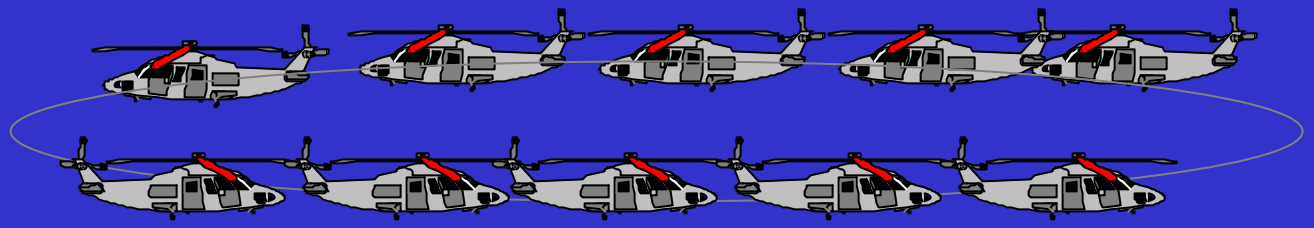
- Rotary-wing demonstration is well established.
- Fixed wing feasibility study (again !!)

SD Demonstration Sortie Procedure

- Forward flight and hover maneuvers.
- One “subject”. Eyes closed. Gives a running commentary on perception of the aircraft’s flight path.
- He/she is deprived of vision, so that the limitations (unreliability) of the non visual orientation senses, can be demonstrated.
- Two “observers”.
  (as important as being the “subject.”)

Maneuvers - forward flight

- Level turn

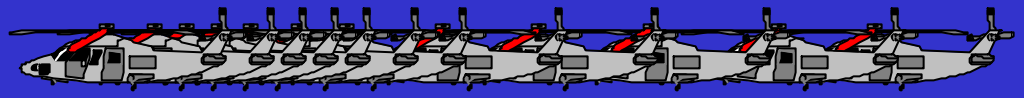


Maneuvers - forward flight

- Straight and level

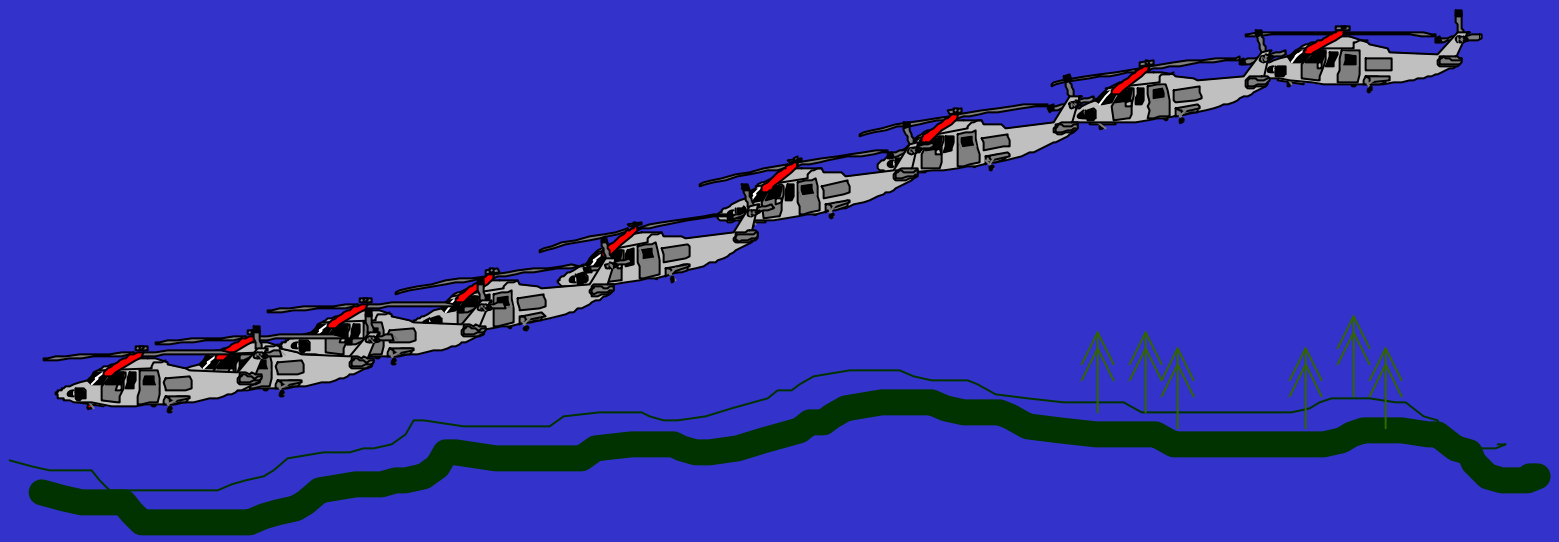
Maneuvers - forward flight

- Deceleration



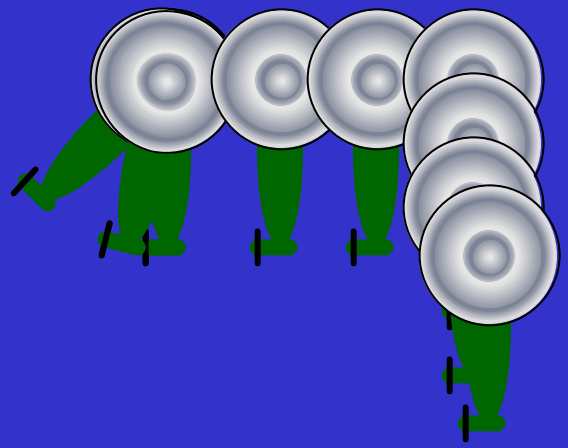
Maneuvers - forward flight

- Inadvertent descent



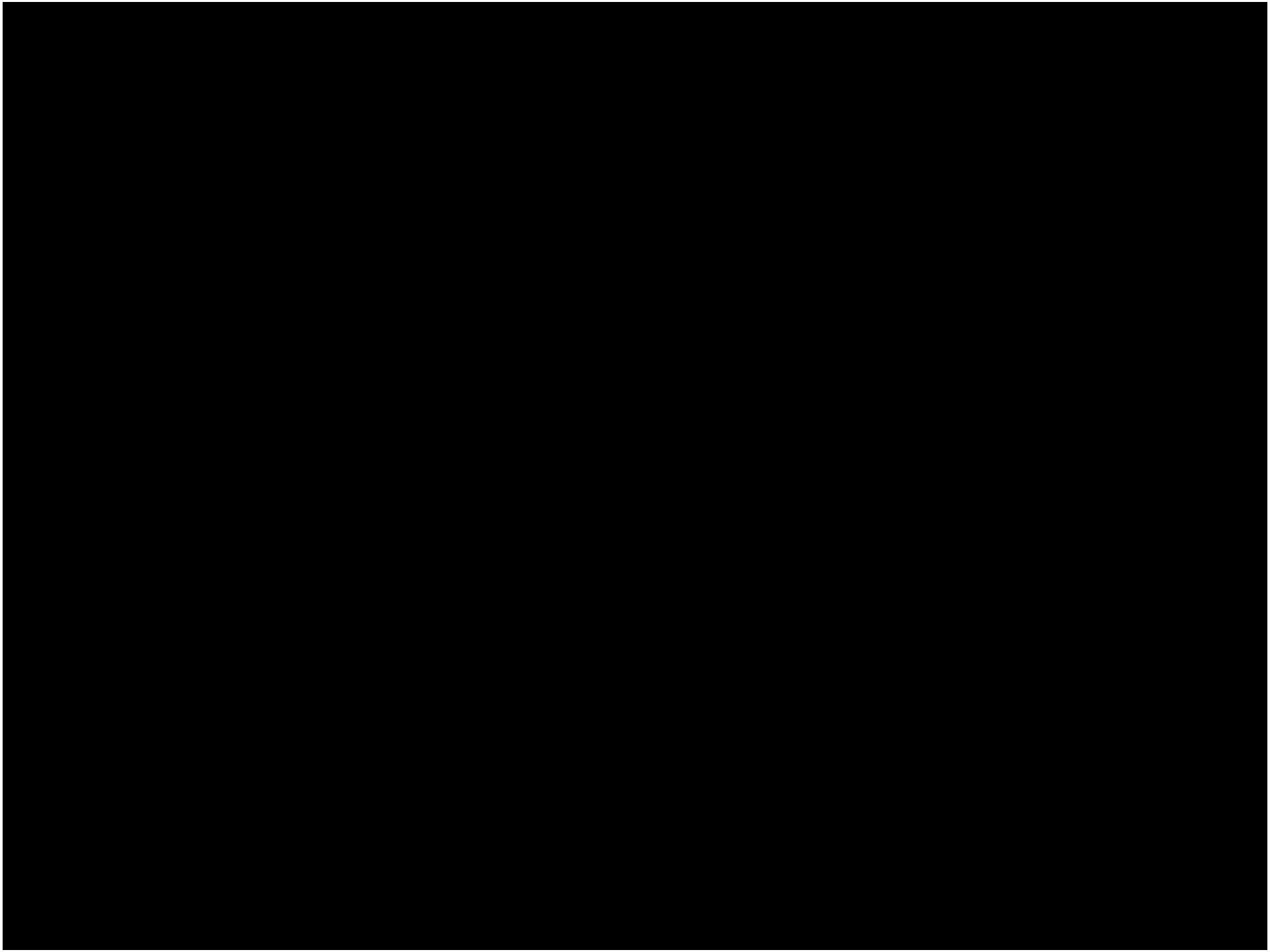
Maneuvers - hover

- A series of rotations and translations



ending in:

1. hovertaxi backwards
2. landing
3. transition to forward flight



Benefits of the SD demonstration sortie

- Reduction in the SD accident rate
  - 10 years before sortie: 0.204/10,000 hours
  - 10 years after sortie: 0.057/10,000 hours
- Cost-benefit for training
- Well accepted by aircrew
- Adaptable for use by other services

Training

Learning and thence demonstrating competence in handling in-flight disorientating circumstances and illusions.

Competent at instrument flight **PLUS:**

- inadvertent entry to IMC
- unusual attitude recovery

Flight-based training in SD Recommendations

- Establish specific training objectives
- Inadvertent entry to IMC:
  - correctly perform the procedures for inadvertent entry to IMC, i.e. immediate reversion to flight by reference to the primary flight instruments. IAS and vertical speed are to be appropriate to the aircraft type. A climb to the safety altitude is to be achieved.

Flight-based training in SD Recommendations

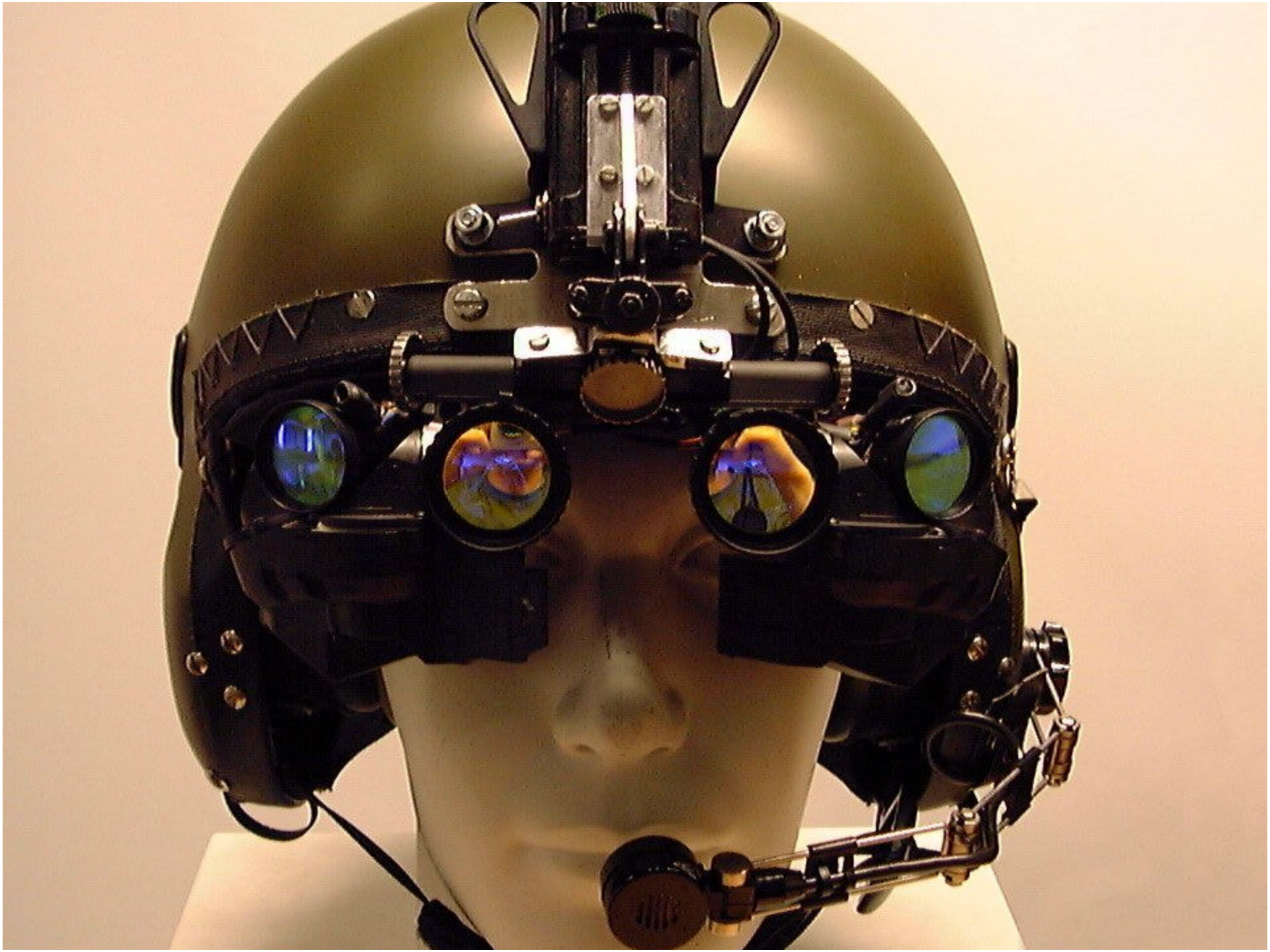
- Establish specific training objectives
- Recovery from unusual attitude (position):
  - Both the techniques to regain both proper control of the aircraft and a return to the original flight parameters are to be performed correctly. Although the precise procedures are aircraft dependent, the general principles are as follows:
    - Wings level
    - Pitch level
    - Apply appropriate power setting
    - Return to original airspeed, altitude and heading

Flight-based training in SD Recommendations

- Establish specific training objectives
- Inadvertent entry to IMC.
- Recovery from unusual attitude (position).
- Improve the training of the trainers.
  - To execute the maneuver.
  - Know what is happening to the student's physiology.
  - What the student must do to recognize and rectify.

Further enhancements to in-flight demonstration and training

- We've concentrated on "supra-threshold" maneuvers.
- Recent rotary-wing research suggests that "sub-threshold" events are more **"dangerous."**



In-flight procedures

Spatial Orientation in Flight

Kent K Gillingham

Fred H Previc

AL-TR-1993-0022

Air Force Materiel Command

Brooks Air Force Base, TX

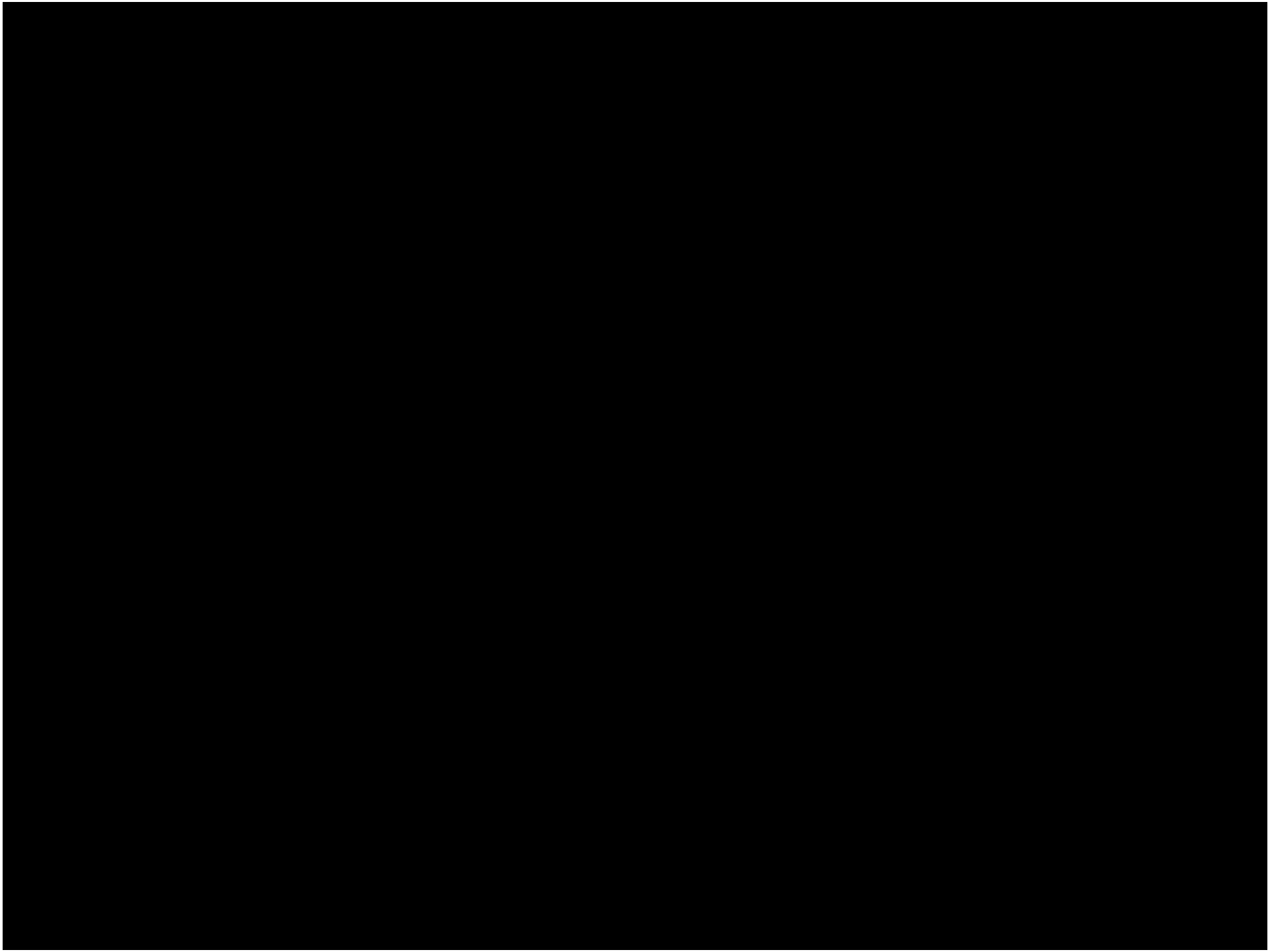
November 1993

Summary of in-flight procedures

- Minimize the likelihood of SD by frequent and systematic monitoring of the flight instruments.
- Expect to become disoriented.
- When it does occur, recognize it, and act.
- MAKE THE INSTRUMENTS READ RIGHT

“para” in flight training issues

- Pre-flight planning
- High-risk mission profiles:
  - Planned Instrument flight
  - Night flight (especially with NVDs)
  - Rotary-wing flight in snow or dust conditions
  - Carrier operations
  - Formation flight
  - In-flight refueling



Handling pilot: “Think I can make it in between there?”

Non handling pilot: “Nope”

Handling pilot: “Oh ye of little faith – look how big that is.”

Handling pilot: Oh ****

MAYDAY !!!!

Crew Resource Management (CRM)

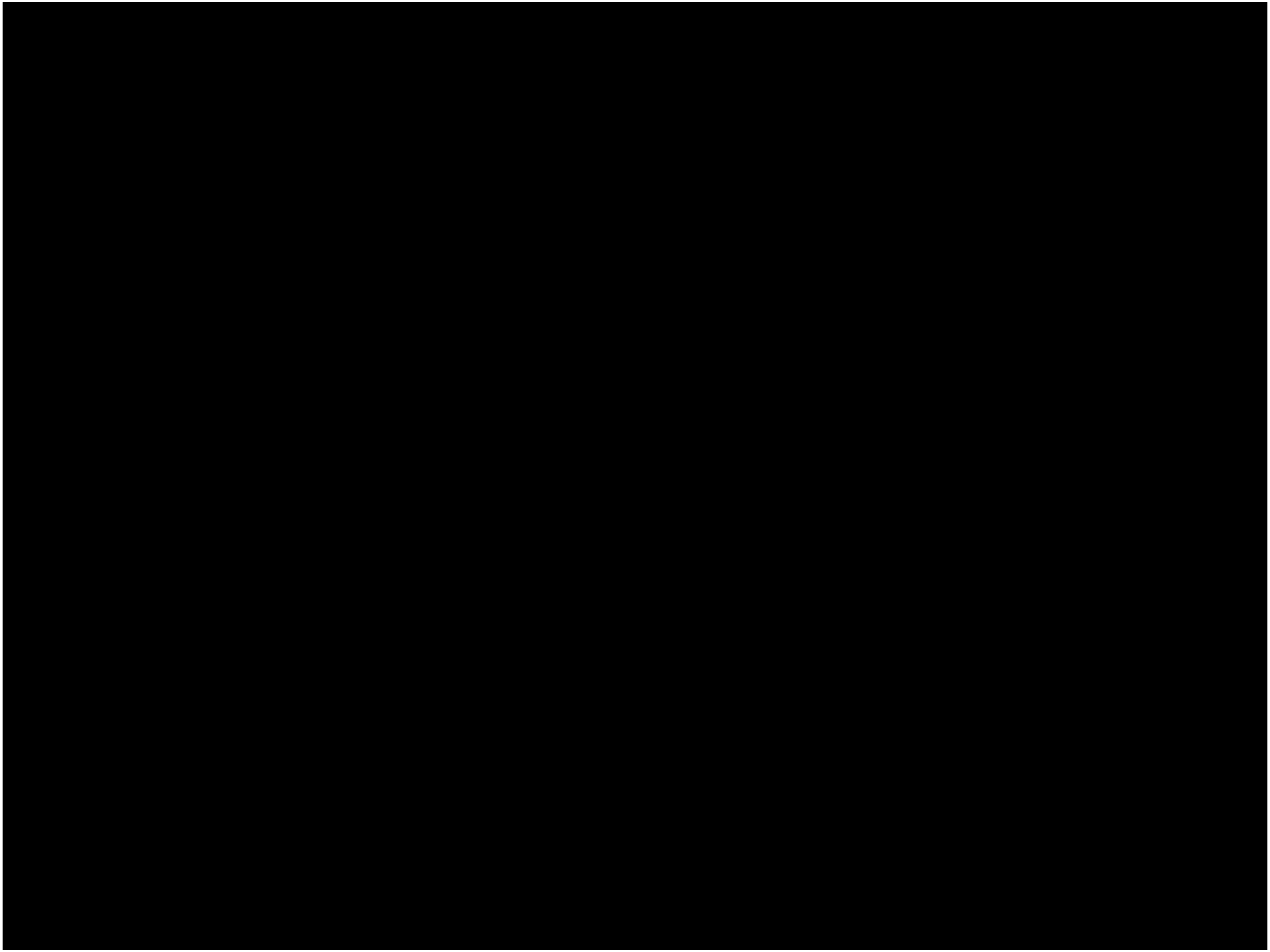
Continuation in-flight training

- **Not** the same as initial flight training.

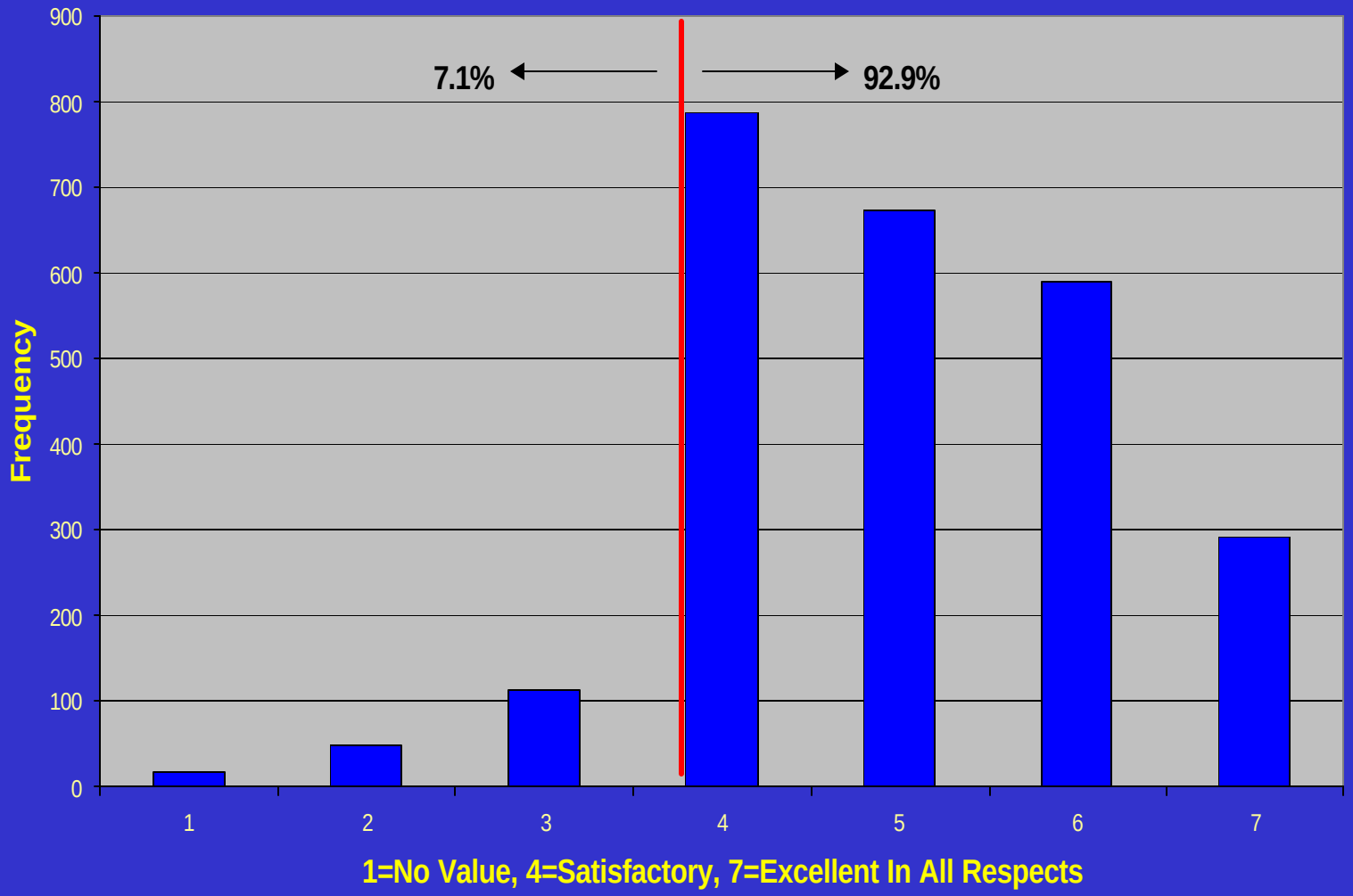
- Deployment to an **unfamiliar** area of operations.

Efficacy of in-flight demonstration and training

- User satisfaction
- Reduction in the SD accident rate.
  - Classification difficulties
- Effect on the mission.



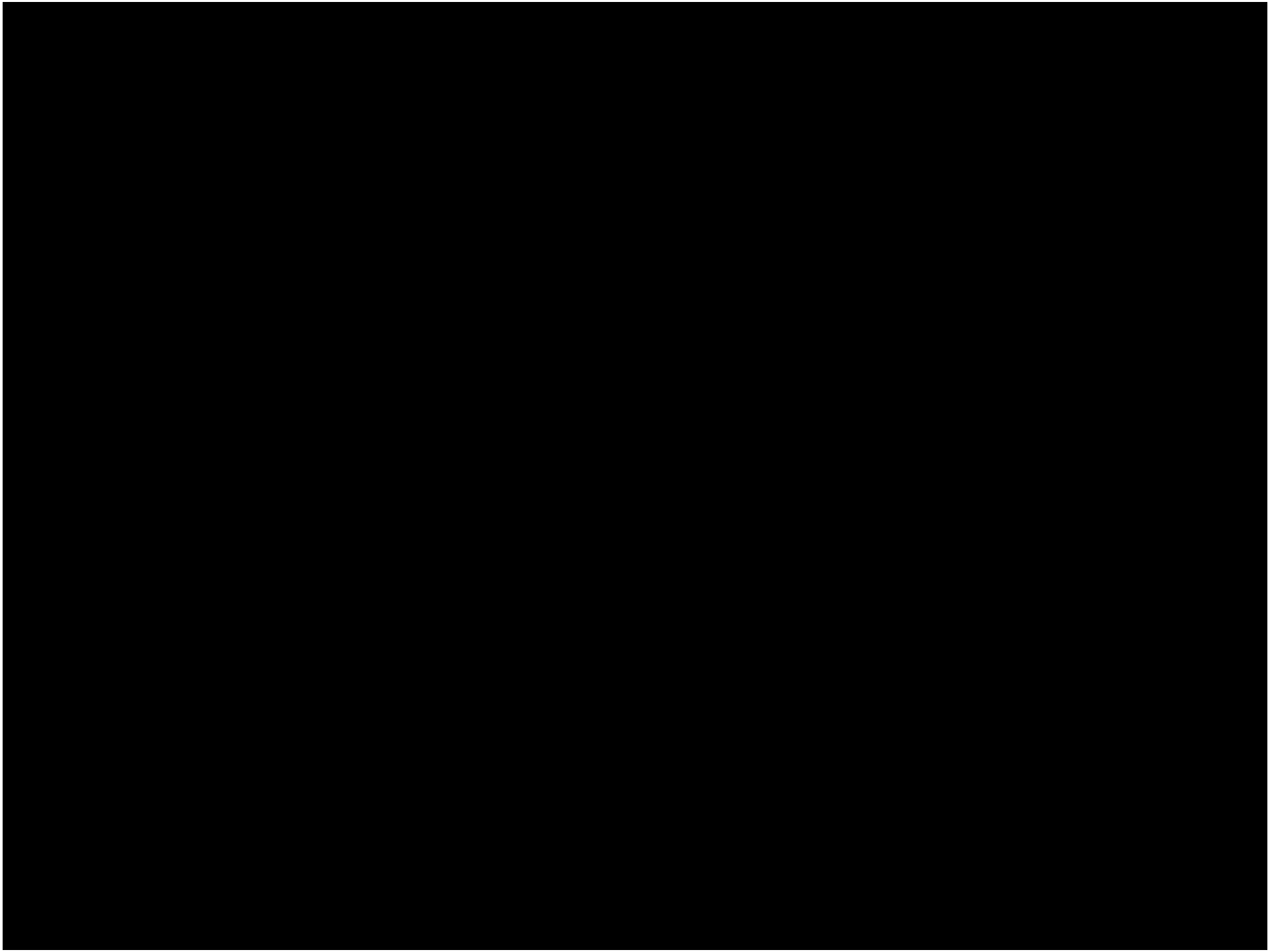
SD Training (Subjective Rating)



Results: post - SD sortie

"How well did the maneuver convince you that your non visual senses were unable to give you accurate orientation information."

Maneuver	**Rating (maximum 13)**
Level turn	11.65
Straight and level	11.57
Deceleration	11.73
Inadvertent descent	11.94
Hover (as subject)	12.31
Hover (as observer)	12.06
The sortie overall	12.22



Constraints

- Expertise
- Time
- Money
- Rx: STANDARDIZATION ??

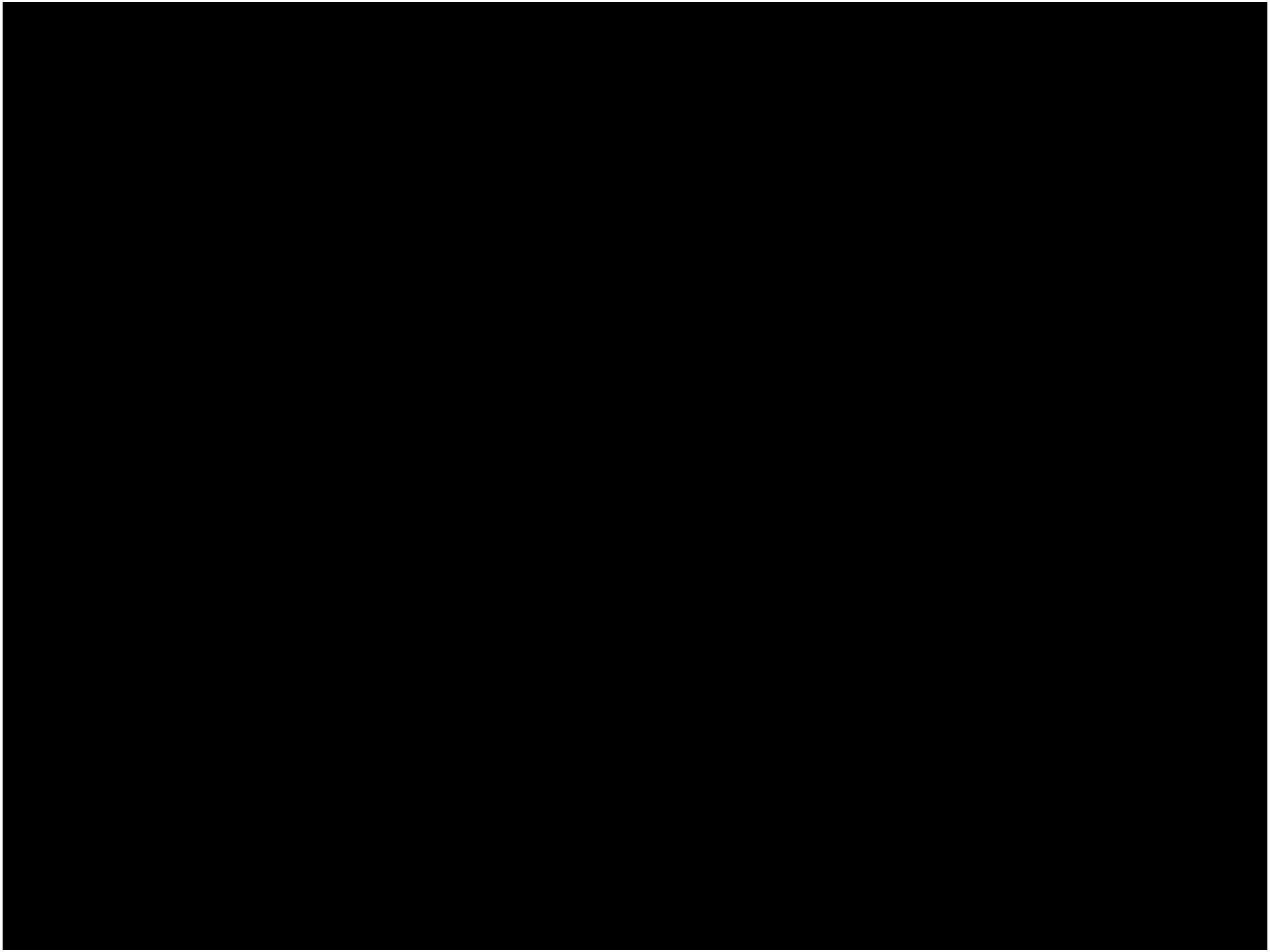
- Have I stimulated debate?

- Enhancements to in-flight demonstration and training are not the **only** control to the hazard, BUT they are:
  - more readily achieved
  - probably less costly

How to speak about men and be politically correct

"He does not get FALLING-DOWN drunk"

He becomes "accidentally" horizontal !!



Time

Op

RW Demo	Ground demo In flight **training**	FW demo
SD curricula Minimum orientation requirements	Predisposing factors to SD	Criteria for ground devices
Situation Awareness Motion Sickness project	SD Research Instruments and methodologies	SD survey Vestibular test battery