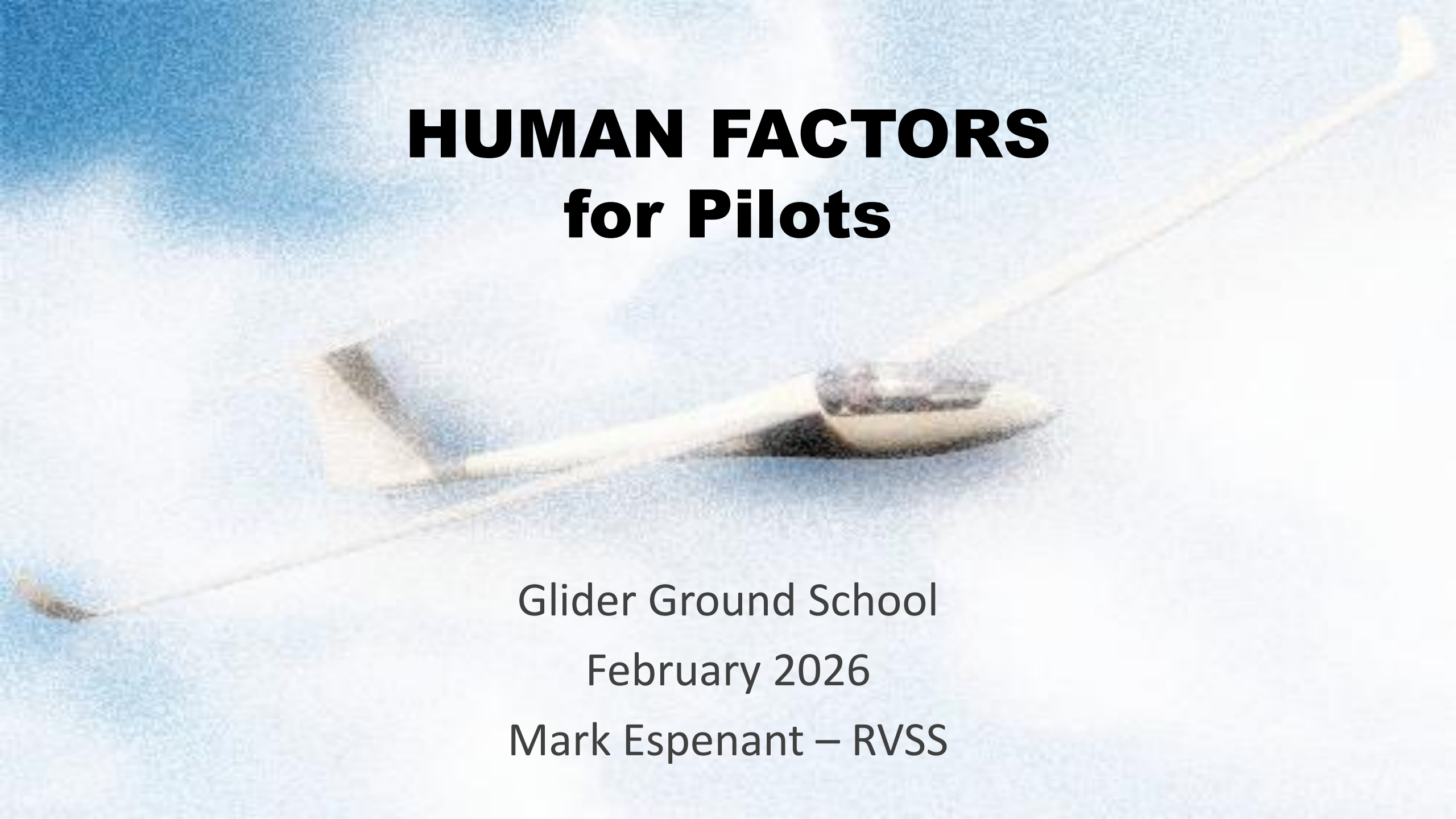


HUMAN FACTORS for Pilots

Glider Ground School

February 2026

Mark Espenant – RVSS

Who Am I?

- Started gliding in 1977 with Air Cadets
- Instructing since 1981, taught cadet glider course
- CFI of Lahr gliding club in Germany
- Have owned 13 airplanes (buying 14th in April!)
- Chief Tow Pilot and instructor with RVSS
- About 3700 hrs TT

Who are you?

- What do you do?
- Flying experience?
- Gliding Club?
- What prompted attending this course?
- What are your goals?

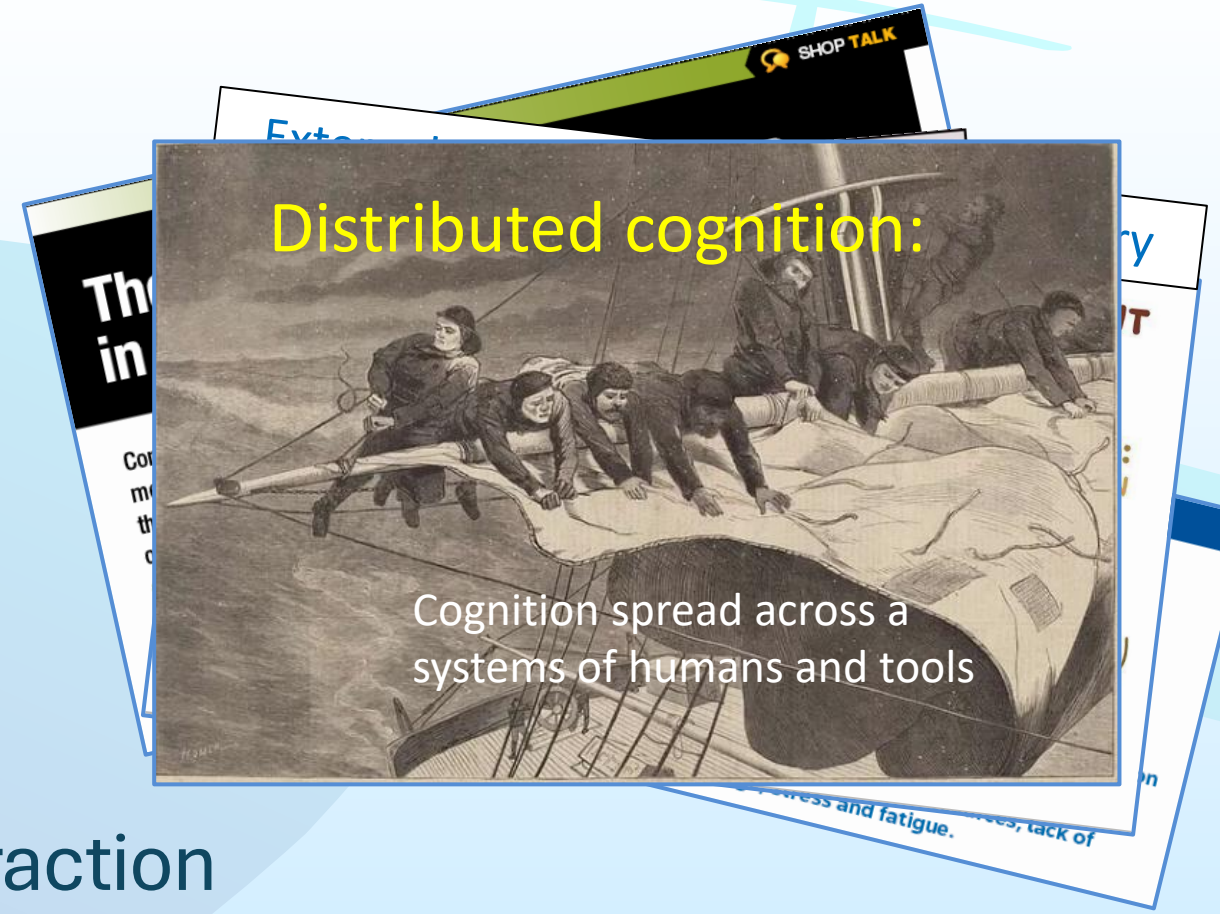
Ready to Start Learning?

Why Human Factors Matter

- 70–80% of aviation accidents involve human factors
- Gliding is uniquely vulnerable: no engine, high workload phases, teamwork
- Human factors = understanding our own limitations
- Good pilots aren’t perfect, they’re self-aware

Learning Objectives

- Improve decision-making
- Maintain situational awareness
- Manage risk and workload
- Communicate effectively
- Understand human limitations
- Reduce stress, fatigue, and distraction



Section 1 — Aeronautical Decision Making (ADM)

- ‘Human Factors’ error!!

SOAR

What Is ADM?

- Structured approach to making safe, timely decisions in flight
- Intuition alone isn’t enough — intuition is biased, emotional, and inconsistent
- Gliding requires deliberate decision-making because conditions change rapidly and options are limited
- ADM helps prevent “drift” into unsafe situations

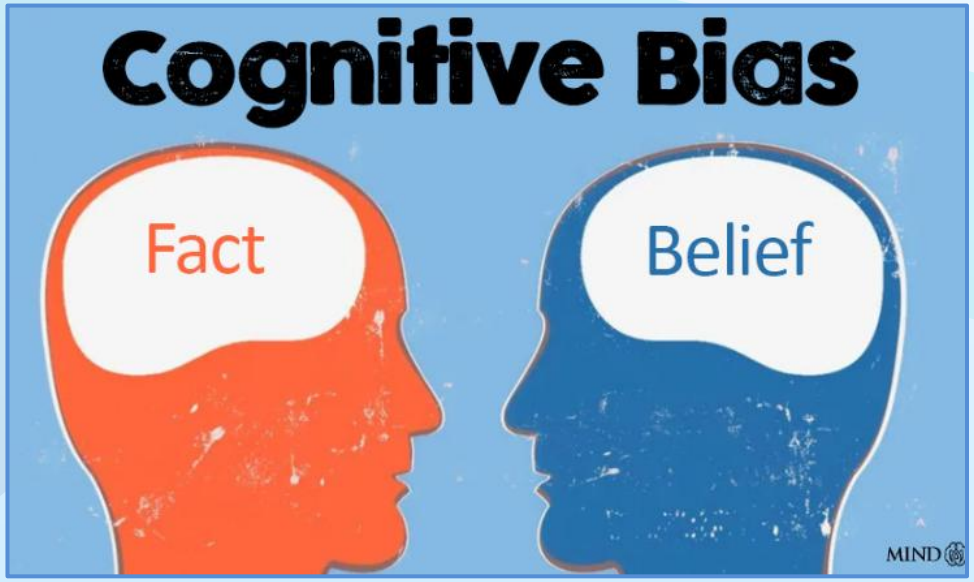
The SOAR Model

- Situation – detect a situation, notice a change, assess the impact
- Options – ‘What can I do?’ Compare and select best option
- Act – Execute the option
- Reassess – How has the situation changed? For the better?

- SOAR is continuous!!

Common Cognitive Biases

- Get-there-itis
- Confirmation bias – supports what we believe
- Overconfidence – ‘I’m so good I don’t need to plan’
- Anchoring – resisting changing the plan



Attitudes & Personality

- Hazardous attitudes – anti-authority, impulsivity, invulnerability, macho, resignation
- How personality influences flying
- Self-awareness as a safety tool – compensate for your failings ☺

Emotions & Behaviour

- Emotional states degrade performance – frustration, excitement, anxiety
- Behaviour patterns that increase risk – rushing, skipping checks, ‘pressing on’
- Strategies to regulate emotions in flight – deep breaths, pausing, verbalizing key steps, checklists

Glider-Specific ADM Case Studies

- Launch decisions – marginal crosswind
- Weather calls in flight
- Landout decisions
- Circuit judgement errors

What would YOU do?

Section 2 — Situational Awareness (SA)

What Is Situational Awareness?

- SA as a mental model – constantly updated
- Three levels:
  - Perception – What's happening around me?
  - Comprehension – What does it mean?
  - Projection – What will happen next?
- Loss of SA is subtle and often only noticed in hindsight!

Maintaining SA in Gliding

- Lookout techniques – scanning, not staring
- Traffic awareness – circuit, thermalling – concentrated near airport
- Weather cues – cloud development, wind shifts
- Airfield – towplane patterns, circuit, ground operations

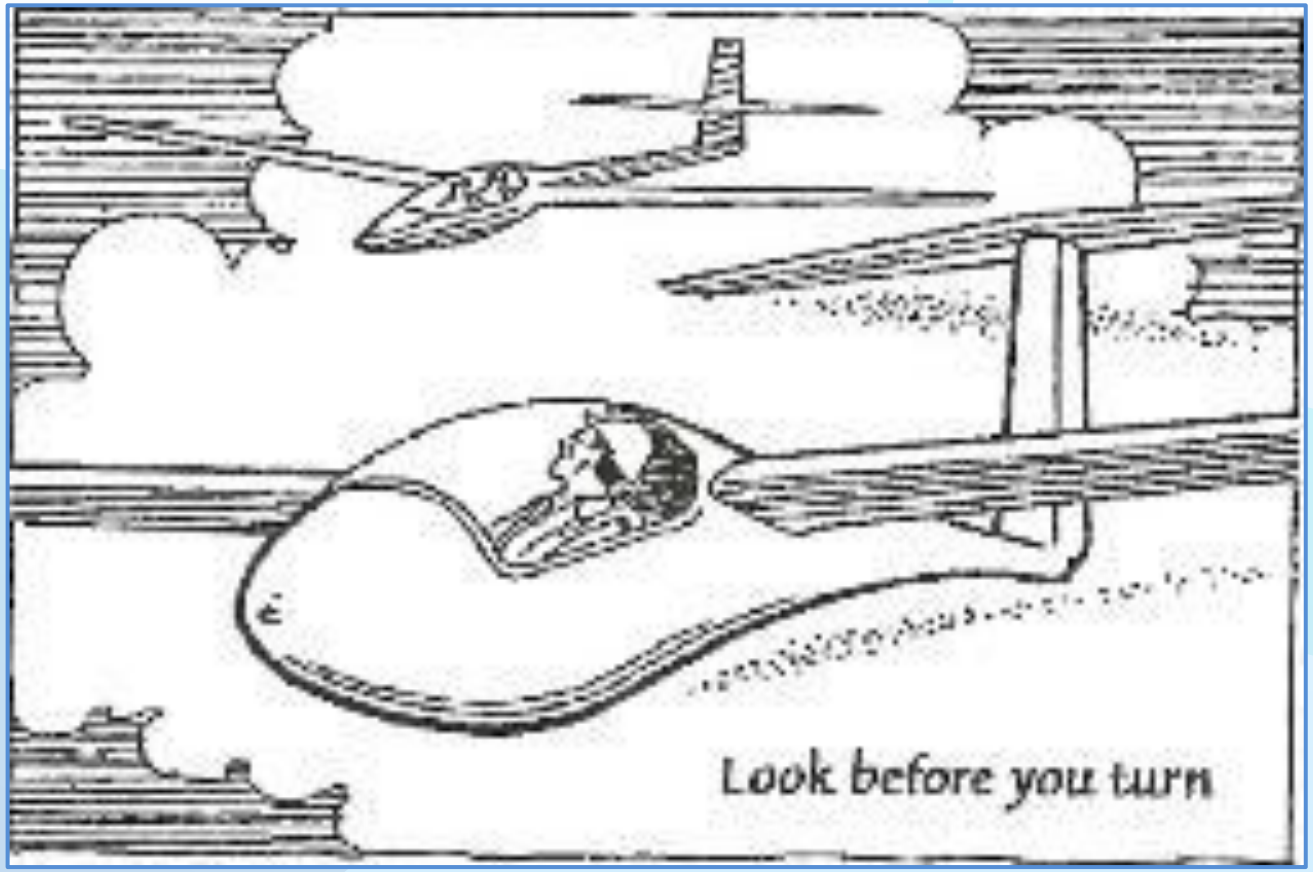
Vision & Scan Techniques

- Effective scan patterns – ‘block’ or ‘sector’
- Scanning must be deliberate and continuous
- Blind spots
- Visual illusions – false horizon, size/distance, glare

Look first!!

Lookout

- When & Where
- Collision course
- Visual scanning technique
  - Lateral
  - Vertical
  - Combination Lateral/Vertical
  - Sectored
- Empty Field Myopia



Lookout When & Where

- Circuit
- Close to airports
  - Enroute
- Thermals
- Air exercise
  - Turns
  - Below
- Cross-country

- Glider limits
  - Rear/Front seats
  - Clean canopy
- Personal limits
  - Glasses
  - Hats

‘Always, Everywhere’

Visual Scanning Techniques

Visual Scanning Techniques

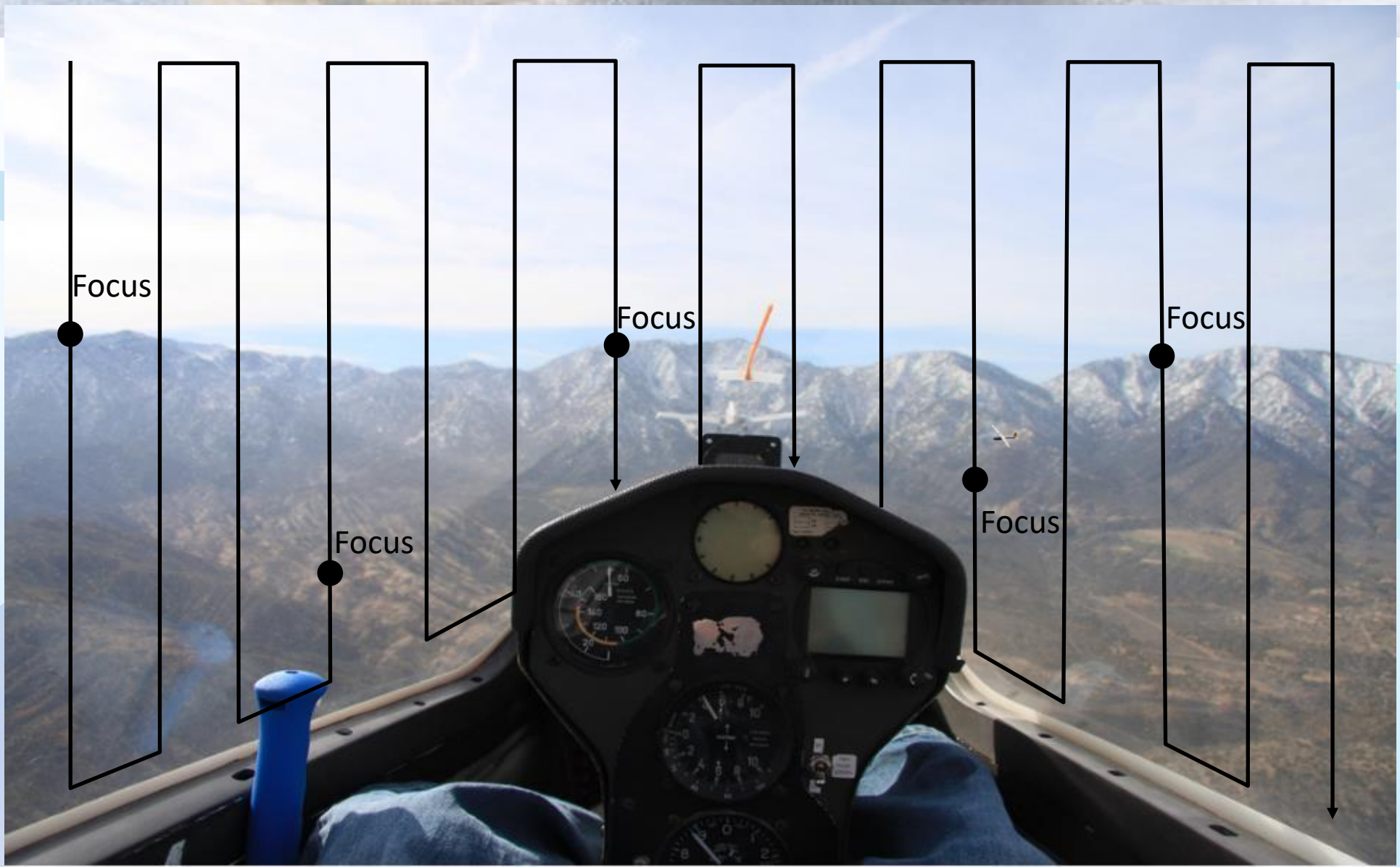
focal vs peripheral vision

Visual Scanning Techniques

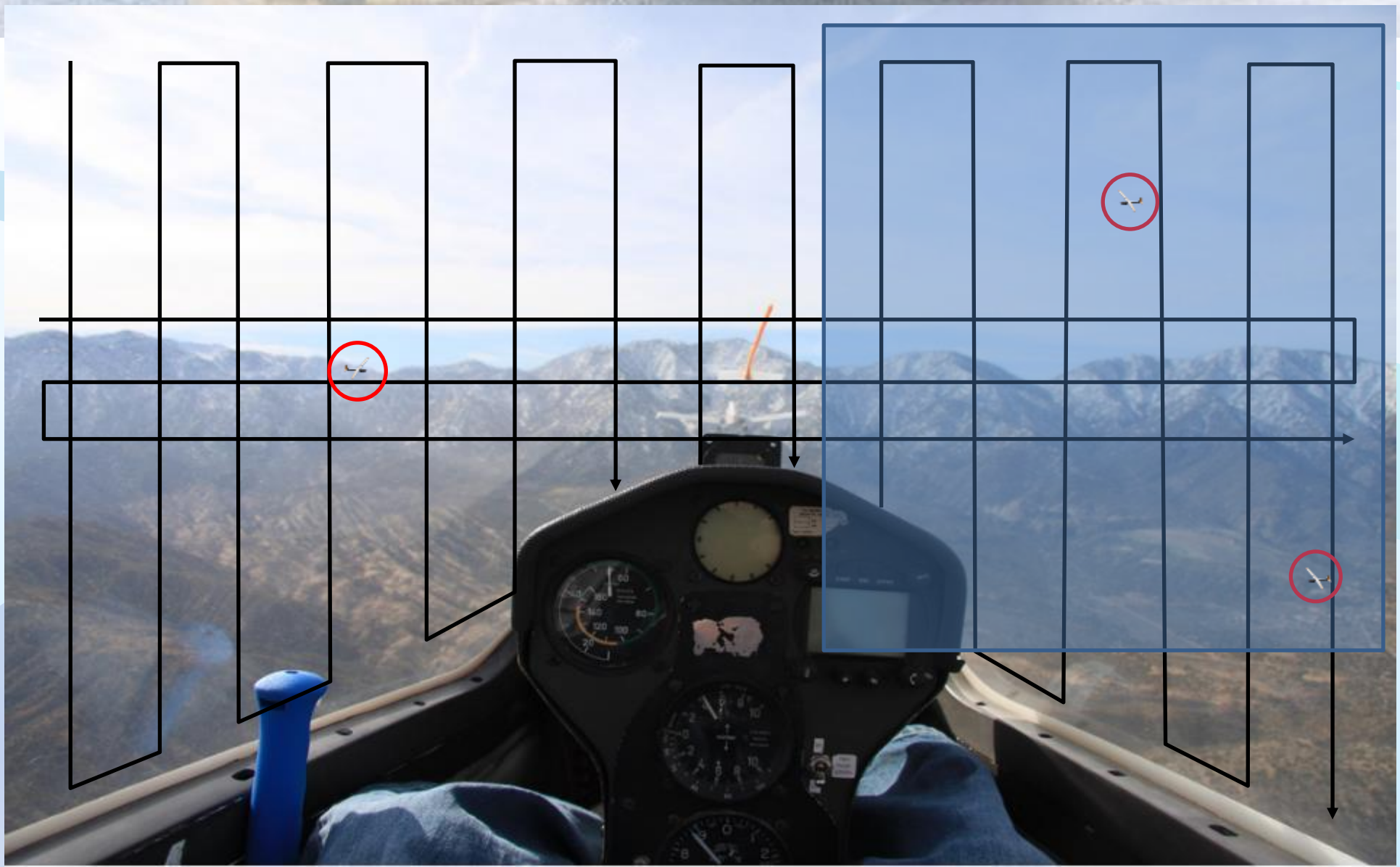
focal vs peripheral vision

Visual Scanning Techniques

Visual Scanning Techniques



Visual Scanning Techniques



Visual Scanning Techniques

- Traffic pattern
- Memorize the landing checklist
- Know the airspace
  - Different entry points
- Listen to radio transmissions
- Local thermals
- Tow plane pattern

Visual Illusion

- Sloping runway
- Sloping terrain
- Large trees on approach
- Landing in rain

Visual Illusions

Downsloping terrain on approach.	Approach terrain level with runway.	Upsloping terrain on approach.
		
Pilot incorrectly perceives approach is low.	Pilot correctly perceives approach is accurate.	Pilot incorrectly perceives approach is high.

FAMILIAR APPROACH OVER TALL TREES	UNFAMILIAR APPROACH OVER SHORT TREES
	
PILOT CORRECTLY JUDGES GLIDESLOPE AS ACCURATE	PILOT INCORRECTLY JUDGES THAT APPROACH IS HIGH

Wet Canopy

- Tendency to flare too low

Spatial Disorientation

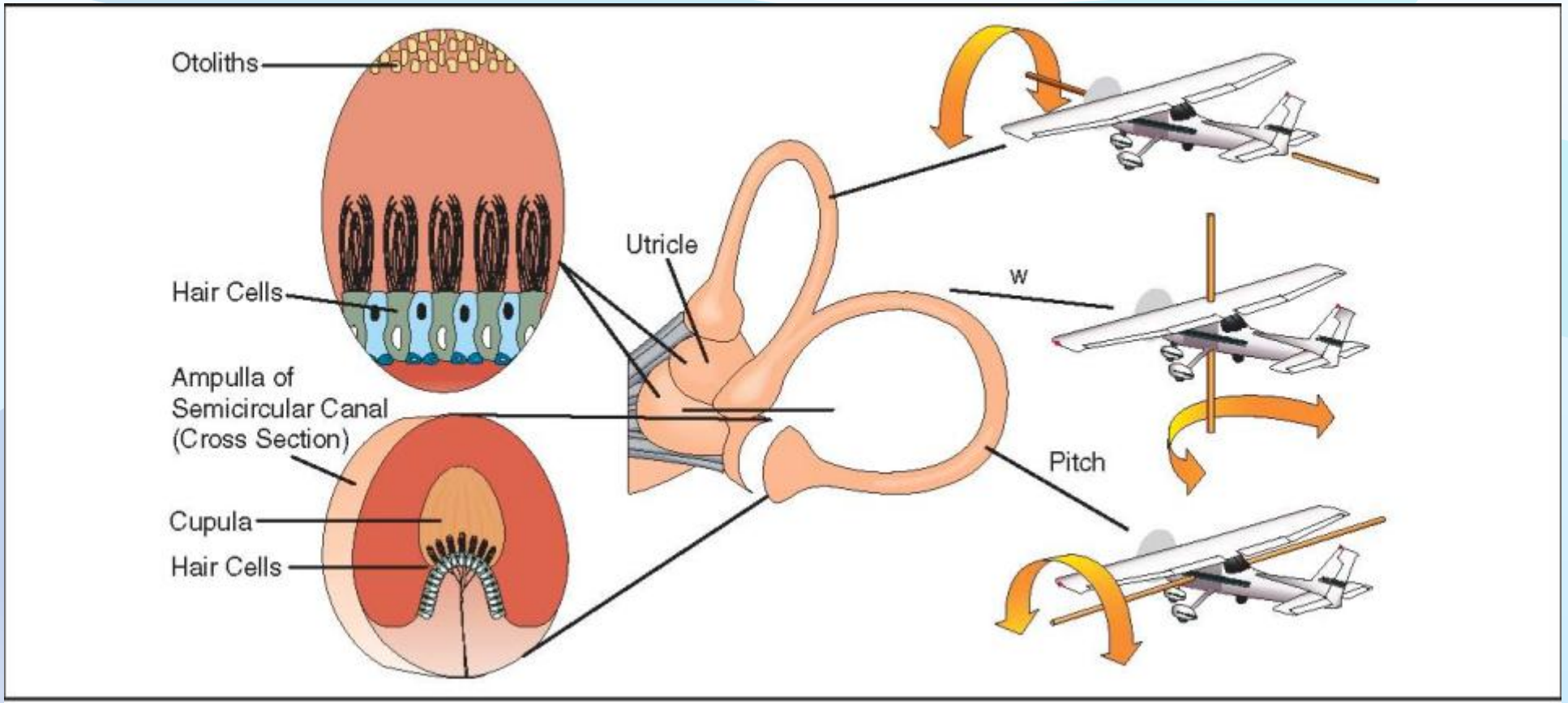
- Vestibular illusions
- Glider pilots are vulnerable in cloud, haze, or low-contrast conditions
- Prevention strategies – maintain visual reference, trust instruments

Disorientation

. Vestibular system

- Coriolis effect
- The leans
- Pitch up

➢ Spatial disorientation
➢ Vertigo



Positive & Negative “g”

- $+G_z$
  - Drain blood from head
  - Grey-out ≈ +2 g
  - Black-out ≈ +4 g
  - G-LOC ≈ +6 g
  - Push-Pull effect
- 60° bank thermalling
  - +2 G_z
  - Fatigue
  - Grey-out
- Recovery from Grey-out

$-G_z$
Negative G
“Eyeballs up”
(Footwards acceleration)

$+G_X$
Transverse A-P G
“Eyeballs in”
(Forwards acceleration)

$-G_Y$
Right lateral G
“Eyeballs right”
(Left lateral acceleration)

$+G_Y$
Left lateral G
“Eyeballs left”
(right lateral acceleration)

$-G_X$
Transverse P-A G
“Eyeballs out”
(Backwards acceleration)

$+G_Z$
Positive G
“Eyeballs down”
(Headwards acceleration)

Map & Display Interpretation Errors

- Common mistakes – misreading scale, interpretation of distances, misidentifying landmarks, over-trusting GPS
- How to crosscheck
- Using technology without over-reliance – mental map

Controls & Displays

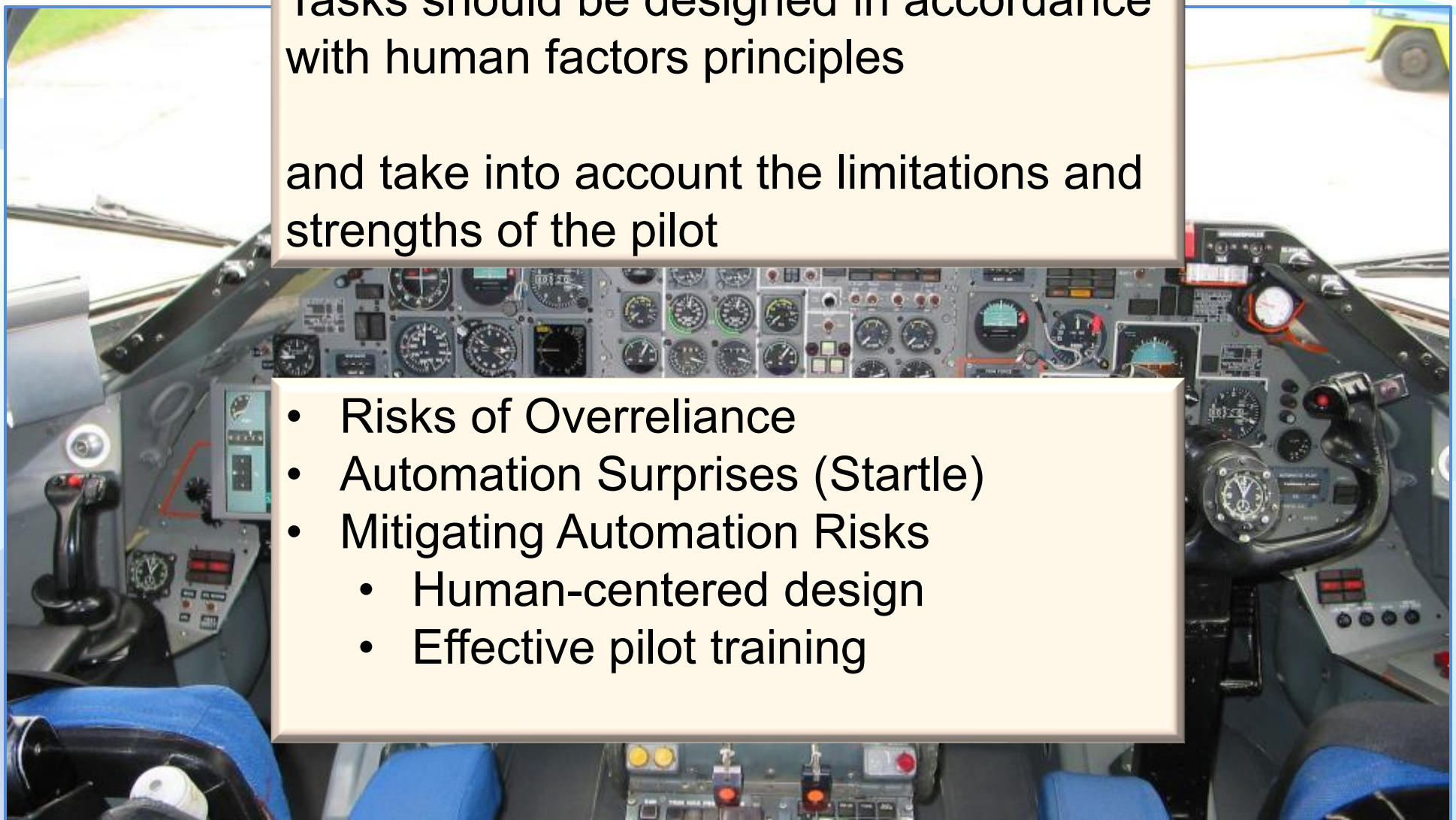
Muscle memory

Controls & Displays

Controls & Displays

Tasks should be designed in accordance with human factors principles

and take into account the limitations and strengths of the pilot



- Risks of Overreliance
- Automation Surprises (Startle)
- Mitigating Automation Risks
  - Human-centered design
  - Effective pilot training

Controls & Displays

- A student in a Blanik L-13 completed the circuit and arrived too high on final. The instructor took over control and performed a side-slip with what was thought to be the dive brakes, but were in fact the flaps.
- Human Factors include the poor ergonomic design of handles in this type of glider and the instructor's lack of experience.

SA Loss Case Studies

- Midair conflicts – poor lookout, converging thermals
- Circuit misjudgements – wind, distraction, fixation
- Airspace infringements – boundaries incl vertical, wind drift

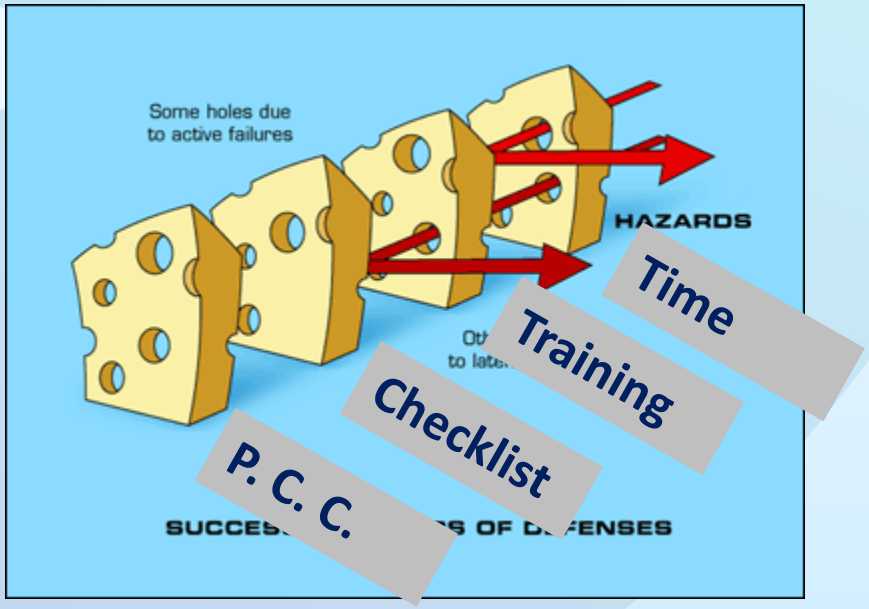
Section 3 — Risk & Workload Management

Threat and Error Management (TEM)

- Threats – Something that will hurt you or the glider – weather, traffic, terrain
- Errors
- Undesired aircraft states – low energy, off-course, low altitude (the cone!), unstable approach
- Recovery strategies – early is best – invoke ADM!

Threat & Error Management

- Error management:
  - Swiss cheese model



Threat & Error Management

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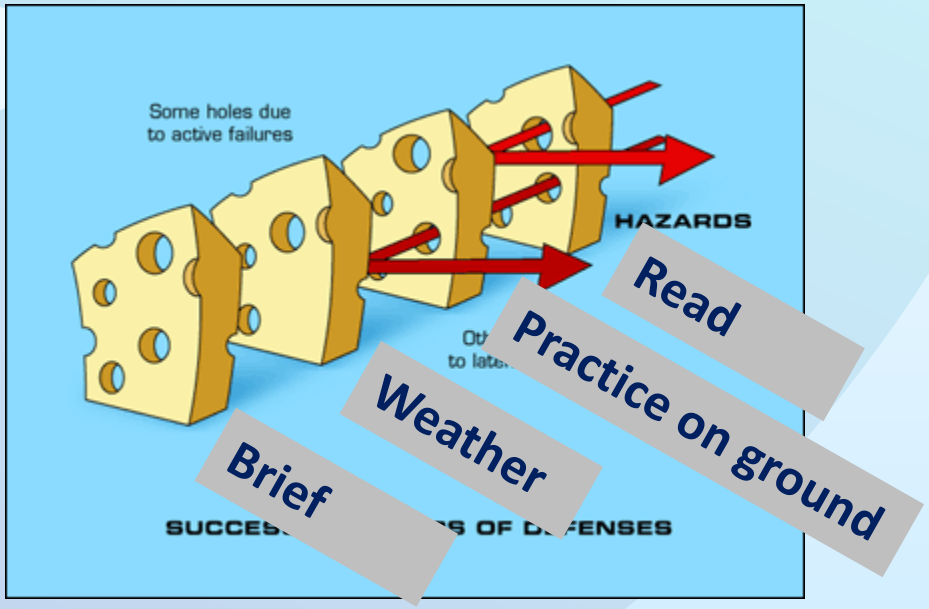
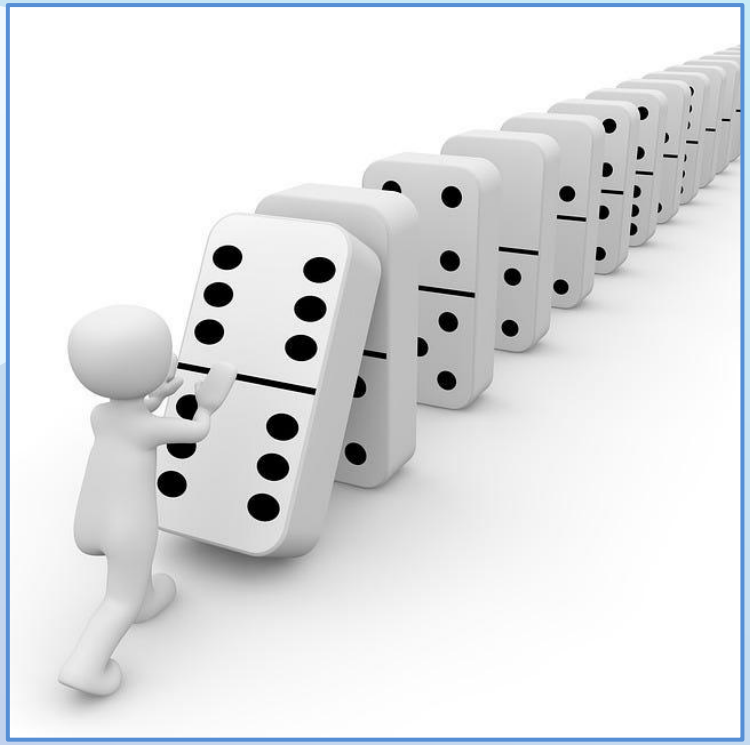
  - Swiss cheese model



Threat & Error Management

- Error management:
  - Error chain



- ❑ Ambiguity
- ❑ Fixation
- ❑ Confusion
- ❑ No one flying the glider
- ❑ No one looking out
- ❑ Use of undocumented procedure
- ❑ Violating Limitations
- ❑ Unresolved Discrepancies
- ❑ Misunderstood communications

Workload Peaks in Gliding

- Launch – rapid events, transition, high stakes
- Aerotow – position, turbulence, towplane movement
- Thermalling – traffic, lift changes/seeking, energy management
- Circuit & landing – compressed timeline, judgement critical

Anticipate need for additional attention!!

IMSAFE Checklist

- Illness
- Medication
- Stress
- Alcohol
- Fatigue
- Eating/Emotion

If in doubt, sit it out!!

Physiological Risk Factors

- Dehydration – long flights
- Hypo/hyperthermia
- Motion sickness
- Smoking – poor oxygenation
- Fitness & personal health

Medications, Alcohol, and Drugs

- Effects on cognition
- Delayed impairment – long after return to BAC = 0
- When not to fly

- 12 hrs or still u
  - TC AIM AIR 3.
- While using an
- TC policy: no c
  - TC AIM AIR 3.

Workload Management Techniques

- Prioritization – **AVIATE**, navigate, communicate
- Task shedding
- Use checklists
- Stay ahead of the glider

"Never take your aircraft to a place that your brain hasn't visited a few moments before"

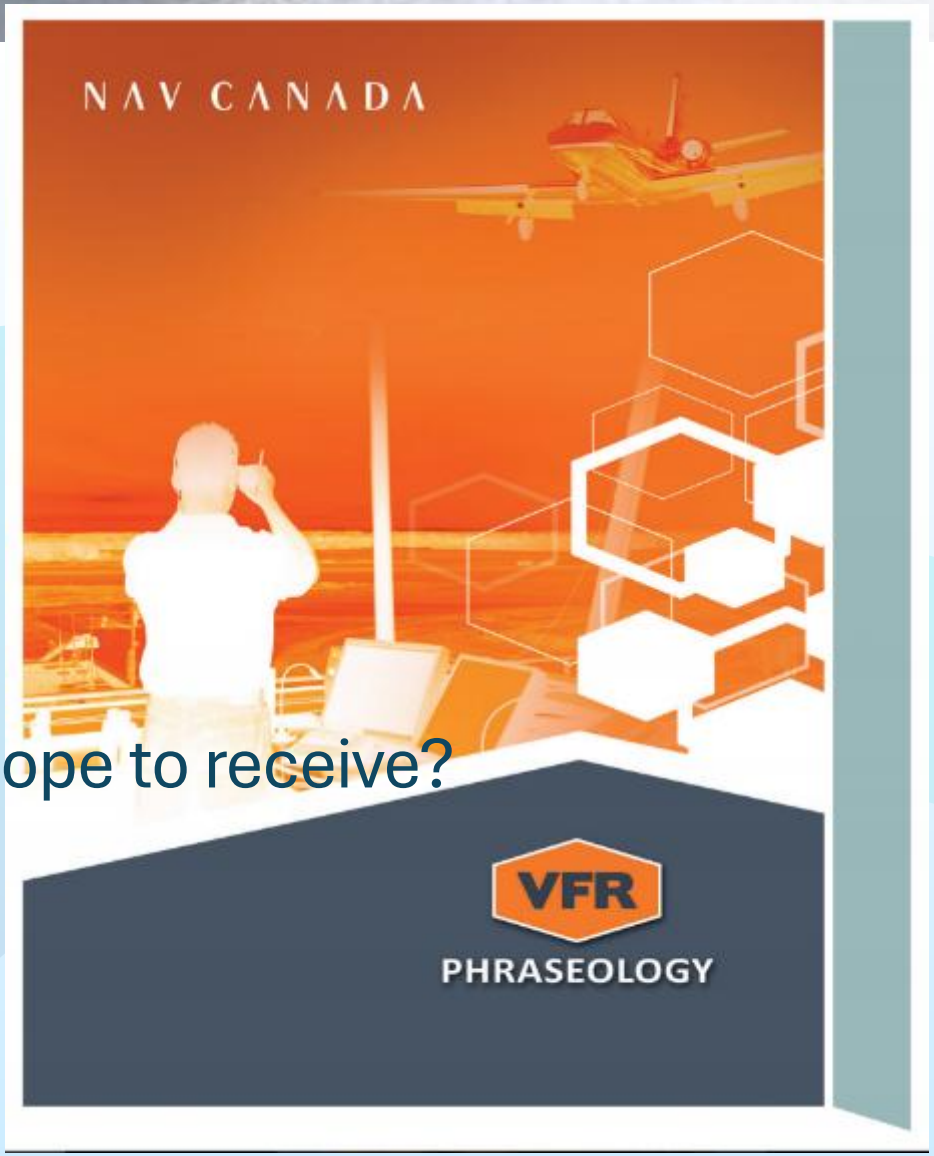
Section 4 — Communication & Crew Resource Management (CRM)

What Is CRM?

- CRM is about using all available resources — people, tools, procedures
- CRM for solo pilots – radio, FLARM, checklists, planning
- CRM as teamwork + resource use

Effective Communication

- Clear, concise, assertive
- Standard phraseology
- Radio discipline:
  - What is the purpose of this transmission?
  - What information do I need to impart and hope to receive?
  - Say it clearly and concisely



Tow Pilot & Ground Crew Coordination

- Launch communication – Standard procedures, checklists
- Signals and abort procedures
- Teamwork — safe ground ops depend on coordination
- Remember SA? That includes the ground

Checklists & Briefings

- Why checklists matter
- You gotta use them properly!
- Preflight briefings
- Postflight debriefs

Don’t let these not happen!

Peer Pressure & Organizational Culture

- How group dynamics influence decisions – sometimes bad
- Recognizing unsafe pressure
- Creating a safety positive culture

Technology as a CRM Tool

- FLARM
- GPS
- Variometers
- Avoiding overreliance

Keep your head out of the airplane!

Section 5 — Stress, Fatigue, and Distraction

Understanding Stress

- Acute vs. chronic stress
- Stress responses – narrows attention and reduces decision quality
- Stress affects ADM & SA

Recognize your own stress indicators!

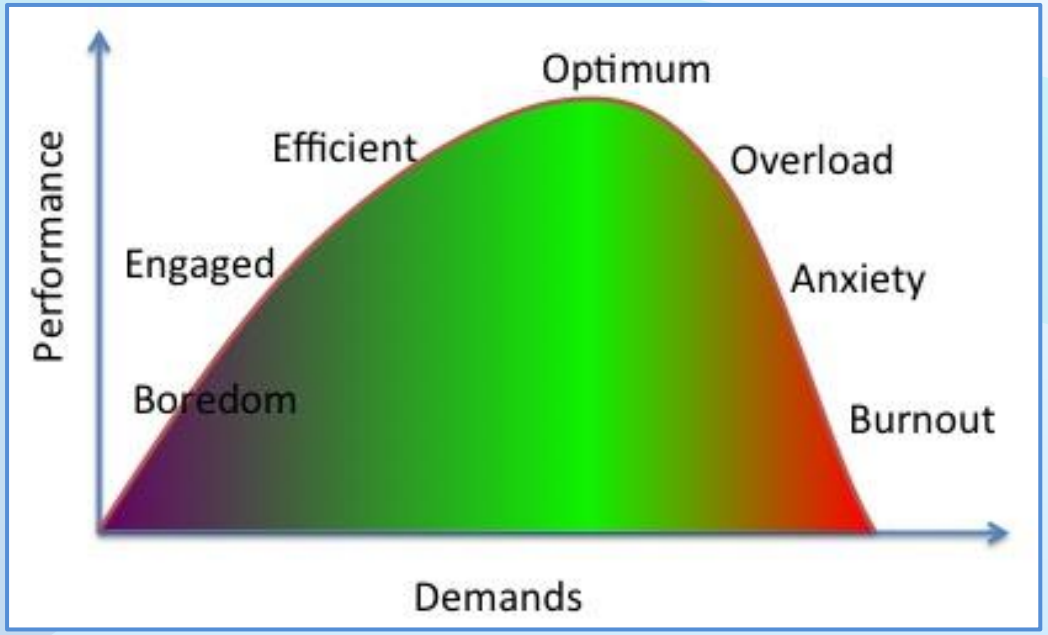
Stress

- Sources of stress:
  - Control – Lack of control over the situation
  - Unpredictability – Something unexpected occurs
  - Novelty – Starting or experiencing something new
  - Ego attack – The situation is a threat to your ego

Stress

- A little bit = OK (increase alertness)
- Too much = Not good
  - Short term → wrong decisions, panic
  - Long term → Health

- Increase pulse rate
- Increase blood pressure
- Increase rate of breathing



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Stress

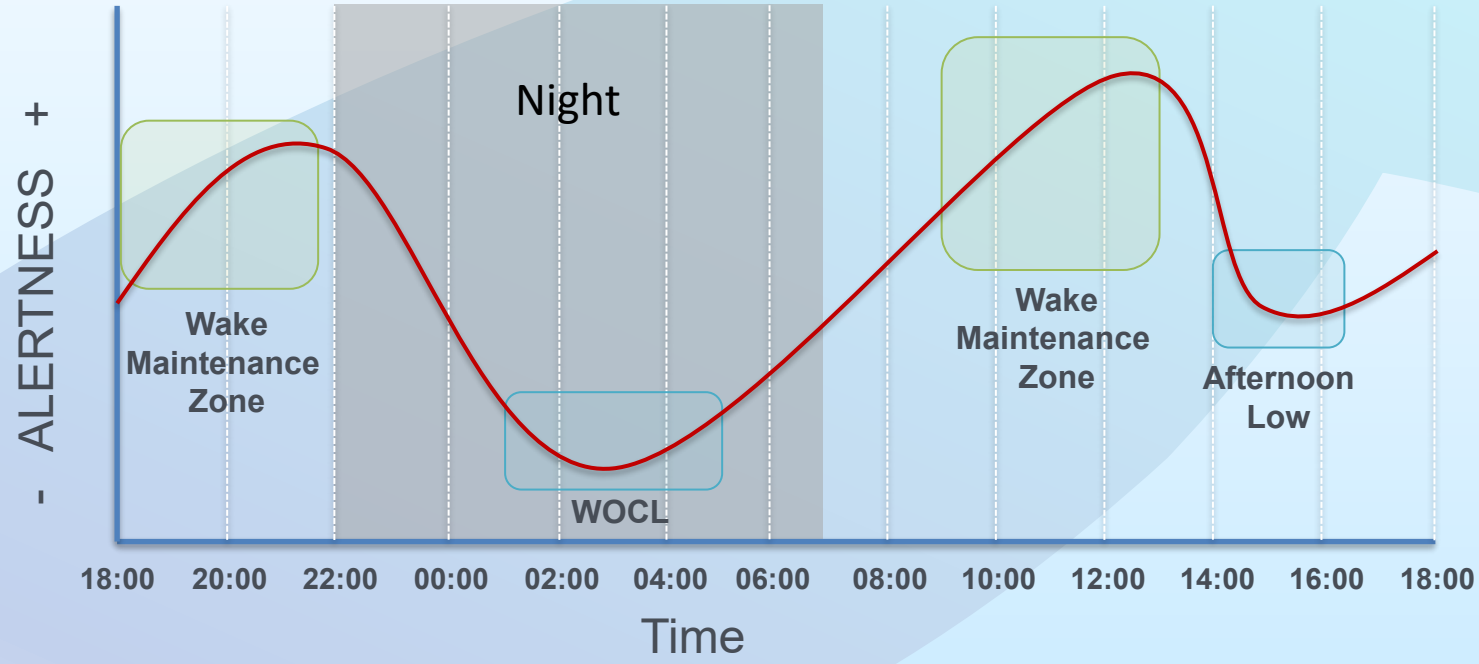
- If stressed before getting in the cockpit:
  - Wrong kind of stress? Analyse:
    - Source
    - Level
  - What can you do about it?
    - Talk to someone (friend, chief pilot)
    - Slow down (lifestyle, training), give yourself more time
    - Re-adjust goals, set boundaries
    - Be prepared (study)
    - Repetition
    - Deal with underlying factors
    - Be in shape

Fatigue Science

- Sleep cycles
- Circadian lows mid-afternoon
- Fatigue symptoms – impaired judgement, reaction time, SA
- Fatigue in long soaring flights

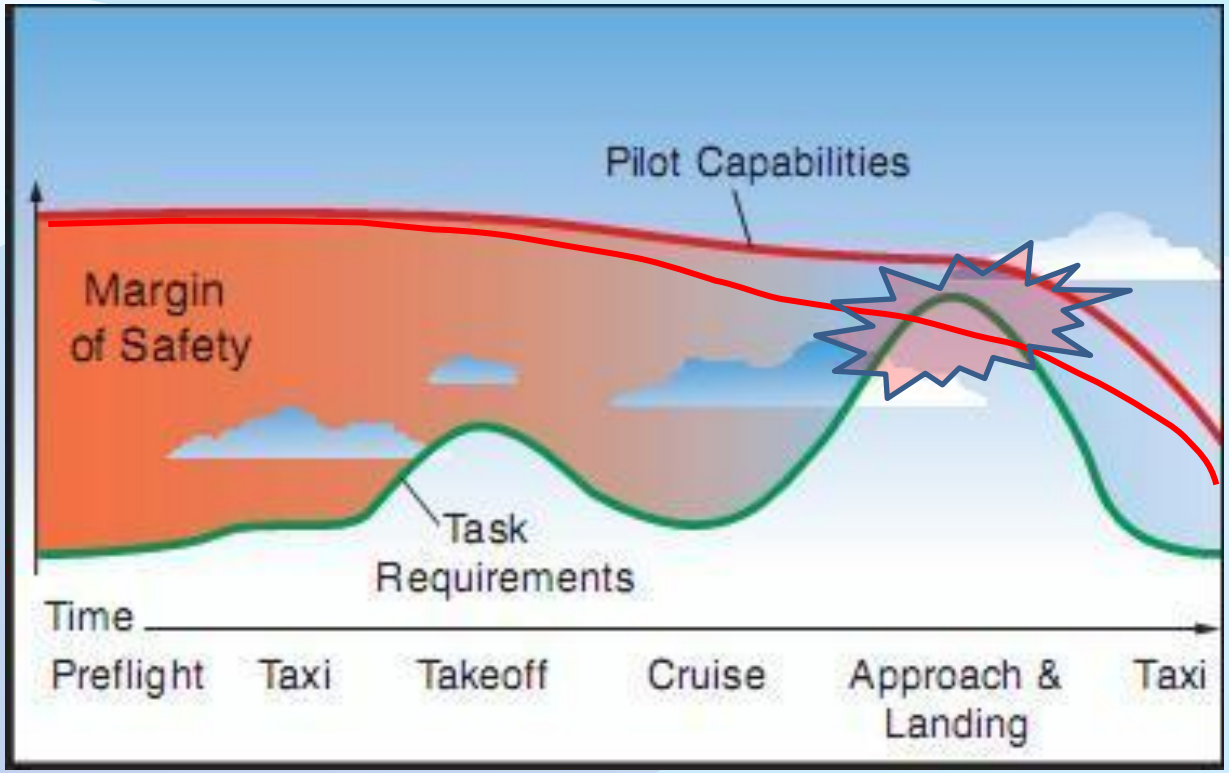
Fatigue

- Circadian Rhythm:
  - Fatigue vs time of day
  - Window of Circadian Low (WOCL) and Afternoon Low
- Returning from a cross-country inside the Afternoon Low



Fatigue

- Pilot capabilities vs mission demands
- Returning home during a competition



Distraction Management

- Types of distraction – internal, external
- How distraction leads to errors – breaking the mental model
- Strategies to stay focused – verbalizing, pausing, prioritizing
- **Restart – ‘what do I know?’**

Physiological Stressors

- Hypoxia
- Hyperventilation
- G-forces – minor in gliding, but endle
- Gas expansion
- SCUBA considerations – 12 hours m dive or flight above 8000’ ASL.

Don’t fly and dive!!

Hypoxia

- Lack of oxygen in the body tissues
  - Hypoxic
  - Anemic
  - Histotoxic
  - Stagnant

Altitude	Time of Useful Consciousness
45,000 feet MSL	9 to 15 seconds
40,000 feet MSL	15 to 20 seconds
35,000 feet MSL	30 to 60 seconds
30,000 feet MSL	1 to 2 minutes
28,000 feet MSL	2 1/2 to 3 minutes
25,000 feet MSL	3 to 5 minutes
22,000 feet MSL	5 to 10 minutes
20,000 feet MSL	30 minutes or more

Hypoxia

CARs 605.31

- On oxygen ABOVE 13,000’ ASL
- On oxygen after 30 min ABOVE 10,000’ ASL
  - Well being, euphoria
  - Headache, tingling
  - Unconsciousness
  - Death

Oxymeter

Medical Considerations

- Hearing
- Blood donation – reduces oxygenation, no flying for 48 hours
- Illness – even minor can impair performance
- Anaesthetics – no flying for at least 24 hours incl dental. General anaesthesia, on OK of doctor
- Pregnancy – generally OK to 30 weeks
- When to ground yourself

Use IMSAFE!!

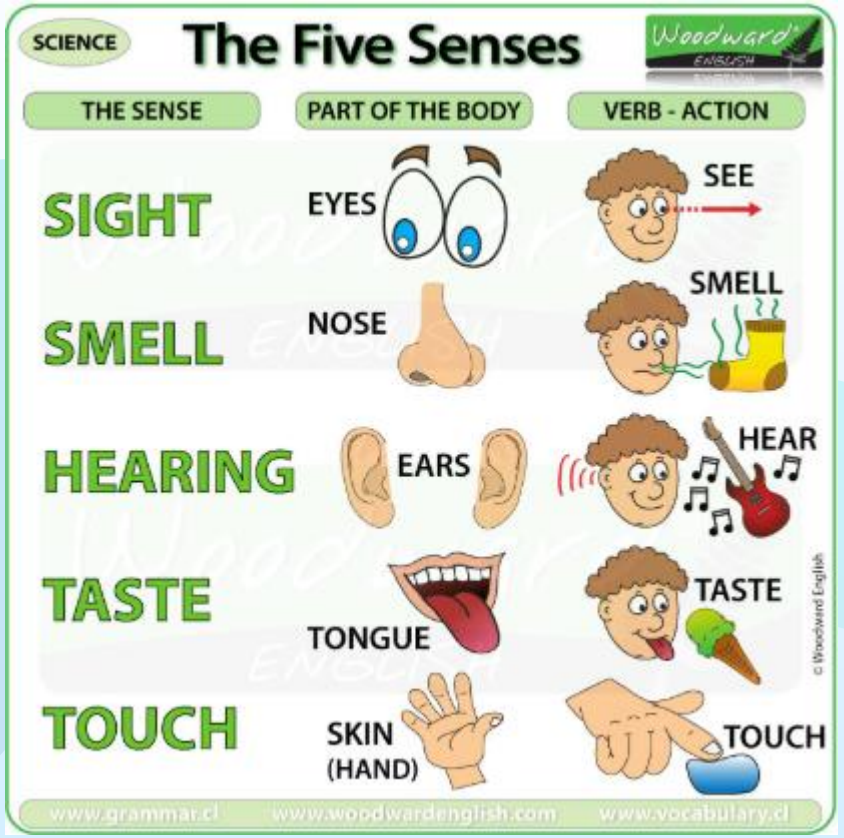
Stress & Fatigue Case Studies

- Realistic glider scenarios – illness, hot weather, multiple flights
- What went wrong
- How it could have been prevented

Section 6 — Human Limitations & Performance

The Human Body as a Sensor System

- Strengths – good at pattern recognition
- Weaknesses - poor at detecting subtle changes
- Limits of perception – senses have limits in motion and low contrast



Vision Limitations

- Night vision – poor, adaptation takes time
- Glare – reduces contrast and depth perception
- Depth perception – critical to flying!
- Colour limitations – affect map reading and display interpretation

Hearing & Communication Limits

- Noise – not so much in gliders…but relevant
- Hearing loss
- Miscommunication risks – major factor in accidents!

Confirm your understanding!

Physical Limitations

- Reach
- Strength
- Dexterity…all vary between pilots!
- Weight & balance considerations
  - Affects aircraft control
  - Max and min limits…check every flight
  - Confirm ballast in…or out!

Adjust your seat first!

Environmental Effects on Performance

- Heat – reduces cognitive performance
- Cold – reduces dexterity
- Hydration – critical for long flights
- Altitude – affects oxygenation and judgement

Temperature

- Heat stress
  - Symptoms
  - Performance
  - Prevention
- Hypothermia
  - Symptoms
  - Performance
  - Prevention

Windchill factor <-> affects people only

Motion Sickness

- Caused by sensory mismatch
- Prevention – ventilation, horizon reference, exposure
- What to do in flight

Yes, of course, Age

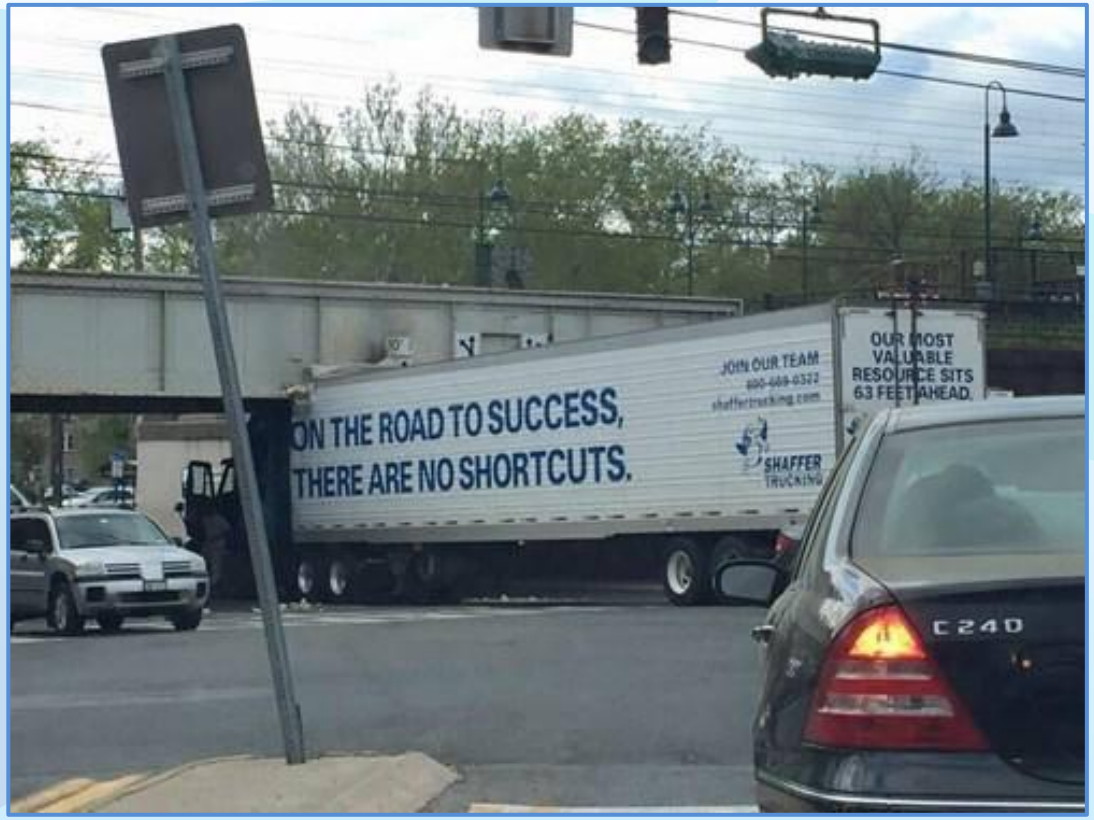
- All senses become weaker
- All physical capabilities decrease
- Cognition slows down
- Fortunately, experience overcomes these losses…for a while

Almost 49 yrs!

Section 7 — Wrap Up

- Human Factors is the study of how glider pilot's performance is influenced by their environment

Have a safe flight!



Key Takeaways

- ADM
- SA
- Risk management
- CRM
- Stress & fatigue
- Human limitations

Practical Tools for Everyday Flying

- IMSAFE
- Checklists
- Briefings
- Personal minimums
- Debriefing habits

Questions & Discussion

- Open floor
- Invite personal experiences
- Encourage safety culture