Aviation Safety Seminar

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Understanding the Physiological Hazards Inherent in Piloting Aircraft

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Medical conditions which could create or lead to a dangerous situations in flight.

- Epilepsy
- Cardiac diseases
- Diabetes
- Serious mental illness
- Alcohol and drug abuse

Medical conditions which could cause difficulty when flying.

- Bronchitis
- Asthma
- Sinus disease
- Ear disease
- Defective sight without corrective glasses
- Migraine
- Kidney stones
- Neuroses
- Hypertension
- Advanced pregnancy
- Any condition that may require long term treatment

Situational Awareness

Situational Awareness

- The key to success in flying is the pilot, his training, his ability, and his aggressiveness with a little bit of luck thrown in. The pilot must have a clear three-dimensional sense of awareness and feel time, distance and relative motion. Analyzing multiple complex time and space oriented problems correctly is the key to making correct decisions by matching what is perceived to reality.

Aircraft Complexity


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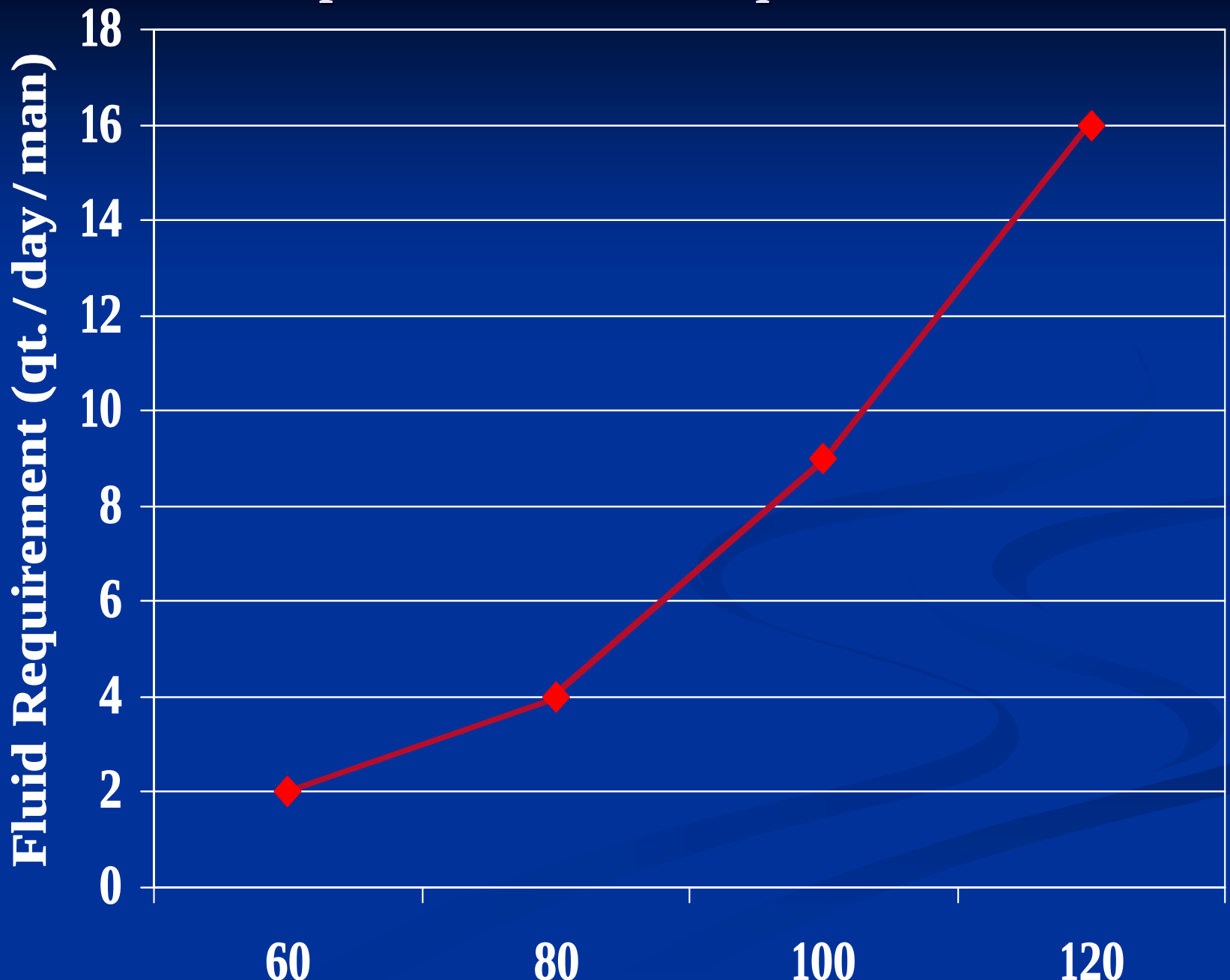
Hostile Environment

- Temperature extremes
- Dehydration
- G-Forces
- Psychological stress
- Hypoxia
- Chronic sun exposure

Normal Water Losses

- Urine: 1.5 quarts per day
- Respirations and Sweating: 1-2 quarts per day
- Cold diuresis
- Diuretic diuresis: caffeine, alcohol, anti-hypertensive drugs

Temperature vs. Fluid Requirement



Signs and Symptoms of Dehydration in Man

- Thirst
- Vague discomfort
- Economy of movement
- Anorexia
- Nausea
- Flushed skin
- Sleepiness
- Increased resting pulse rate
- Increased temperature

G-Forces

- Level flight
- 30 Degree Bank
- 45 Degree Bank
- 60 Degree Bank

- One G
- 1.2 G’s
- 1.4 G’s
- 2.0 G’s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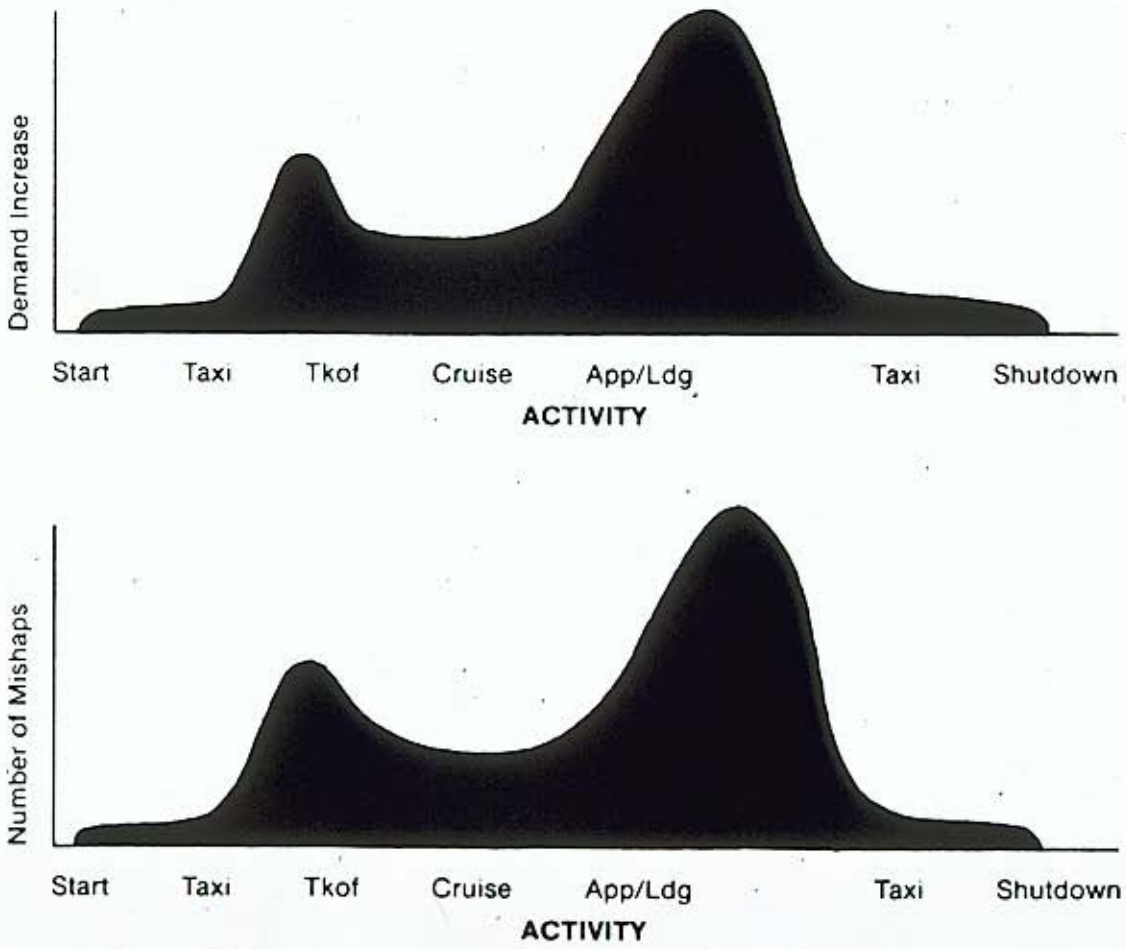
Indications of Positive Stress

- Situational awareness
- Hyperalertness
- Controlled excitement (no highs or lows)
- Realistic challenge

Indications of Negative Stress

- Insomnia
- Tunnel vision
- Carelessness
- Impulsive behavior
- Inability to concentrate
- Diarrhea
- Indigestion
- Loss of appetite
- Sweating
- Pounding of heart
- Anxiety
- Tense muscles
- Irritable
- Hyperventilation

Figure 3-3
Pilot Workload During Different Phases of Flight



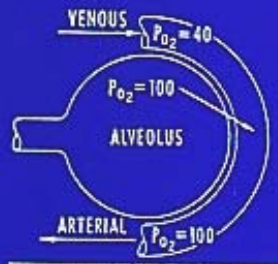
Source Richardson, J. (1978) "CFIT: A Human Factors Problem." *Aerospace Safety*, 2, 3.

Physical vs. Psychological Stress

Hypoxia

Oxygen deficiency in the body tissues sufficient to cause such functional impairment as poor judgment, euphoria, mental confusion, and eventual loss of consciousness.

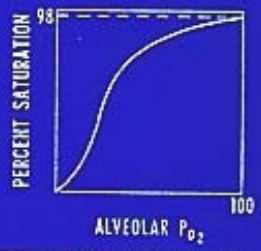
EXAMPLES OF ALVEOLAR OXYGENATION AT VARIOUS ALTITUDES WITHOUT SUPPLEMENTAL OXYGEN

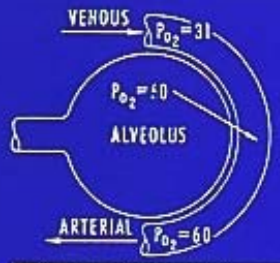


SEA LEVEL

ALVEOLUS P_{O_2} = 100 mm Hg
PRESSURE GRADIENT = 60 mm Hg
ARTERIAL PERCENT SATURATION = 98%

EXAMPLE 1

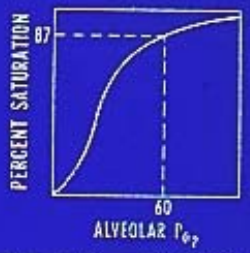


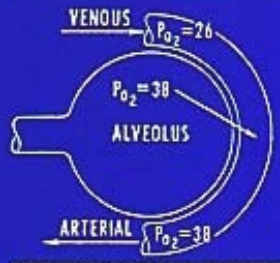


10,000 FEET (3048 m)

ALVEOLUS P_{O_2} = 60 mm Hg
PRESSURE GRADIENT = 29 mm Hg
ARTERIAL PERCENT SATURATION = 87%

EXAMPLE 2

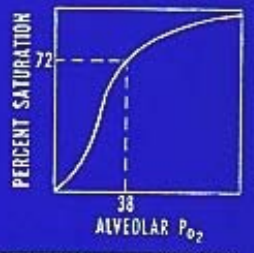


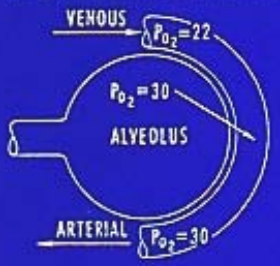


FLIGHT LEVEL 180

ALVEOLUS P_{O_2} = 38 mm Hg
PRESSURE GRADIENT = 12 mm Hg
ARTERIAL PERCENT SATURATION = 72%

EXAMPLE 3

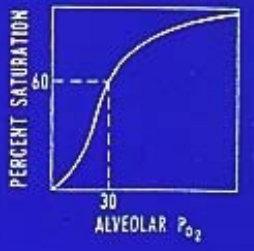




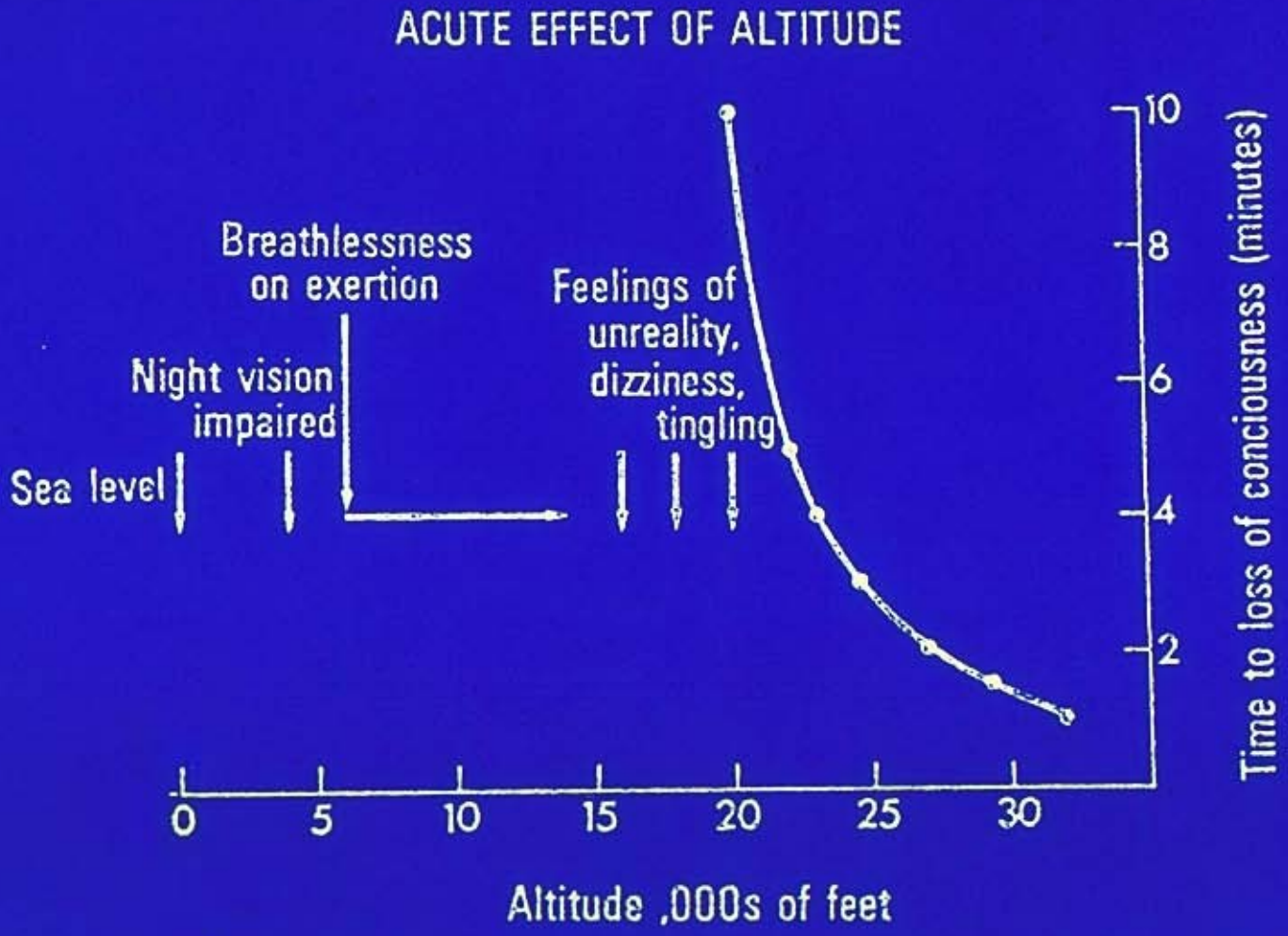
FLIGHT LEVEL 220

ALVEOLUS P_{O_2} = 30 mm Hg
PRESSURE GRADIENT = 8 mm Hg
ARTERIAL PERCENT SATURATION = 60%

EXAMPLE 4



PHYSIOLOGIC EFFECTS OF SUDDEN EXPOSURE TO ALTITUDE

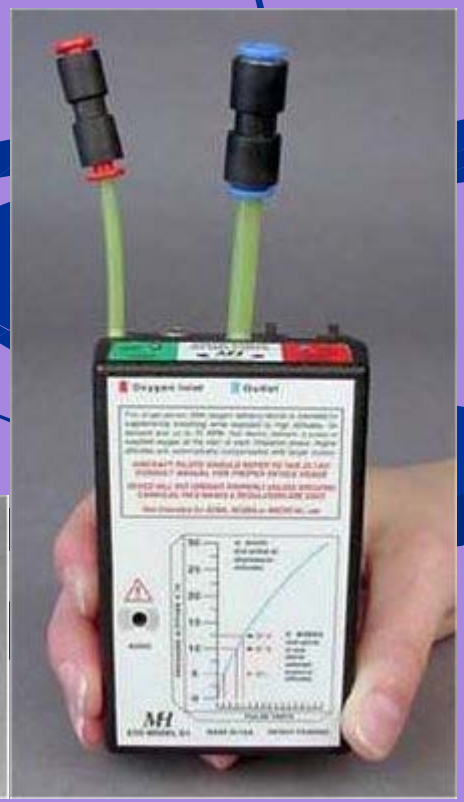


NELSON FLOW METER

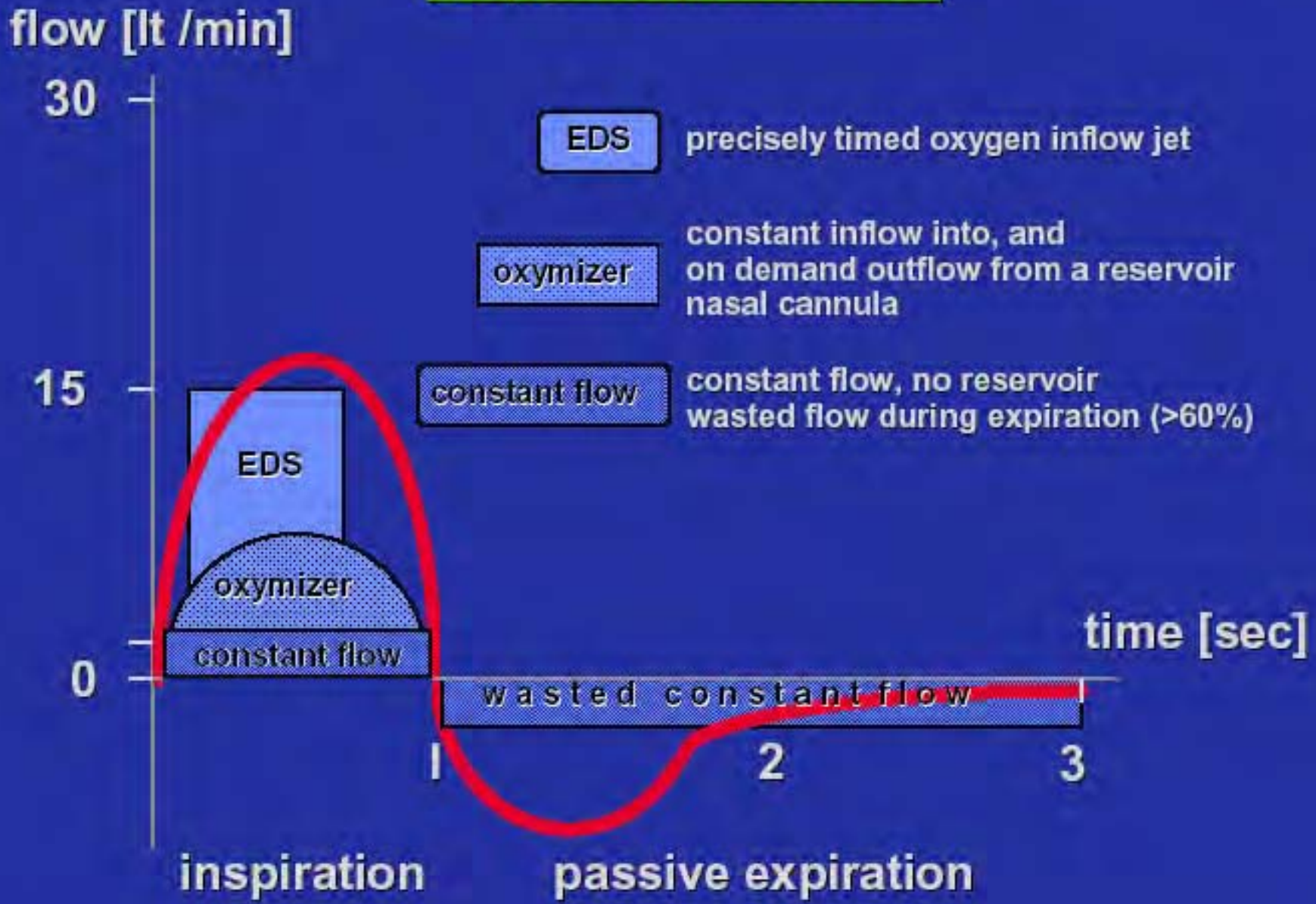
- **NELSON VS AEROX FLOW METERS**
- **Fragile Plastic** — **More Robust Case**
- **Damaged by Over tightening**
- **Case Tends to Leak from Use & Abuse**

Pulse Ox - Values

THE NEW



Single breath flow curve with oxygen supplementation



Potentially Serious Skin Cancers Resulting from Chronic Sun Exposure

Minimizing Sun Damage

- Appropriate dress
- Sunblock (SPF 30 or higher)
- Sunglasses
- U-V blocking
- Yearly A-B-C-D check of moles

Hostile Environment

- Temperature extremes
- Dehydration
- G-Forces
- Psychological stress
- Hypoxia
- Chronic sun exposure

Fatigue

- Physical, Mental, Jet lag
- Low humidity, Noise
- Annoyances, Delays, Pre-flight preparations
- Mild Hypoxia

Hazards of Smoking

- Cancer, Heart disease, Stroke, Peripheral Vascular disease, Emphysema, etc.
- Carbon Monoxide aggressively attaches to the hemoglobin molecule in the red blood cell.
- Non-smokers 1-3% Carbon Monoxide in the blood.
- Smokers 4-10% Carbon Monoxide in the blood.
- Passive smokers up to 5% Carbon Monoxide in the blood.
- 5% Carbon Monoxide at 5000 feet is equivalent to 10,000 physiologically.

Physical Conditioning

- “Pilot in poor physical condition is more subject to error and poor judgment.”
- “Pilots in good physical condition more apt to be mentally alert and have a greater capacity for arduous mental work.”

- Ross McFarland 1953. “Human Factors in Air Transportation”

Vision

- Deteriorates with age
- More noticeable at night
- Glasses can easily correct to 20/20 vision
- Tri-focals not progressive lenses may be best
- Corrective eye surgery may be risky for pilots
- Visual deterioration in various visual functions such as visual acuity, brightness thresholds, and reaction to visual stimuli occurs with carbon monoxide levels greater than 5%.

Questions