FAI

CIMP

COMMISSION INTERNATIONALE MÉDICO-PHYSIOLOGIQUE

FAI CIMP

President Juergen K Knueppel MD FS

- FAI Medico-Physiological Commission (CIMP)
  - (one of the oldest FAI Technical Commission; >100 years)
  - Human Factors, Medical Regulations
  - **Medical Emergency Issues**, -Anti Doping

- **Anti Doping,** TUE (waivors), ADAG
  - National Olympic Committee **Training**
  - **Select IGC AD ambassadors**

- **ICAO / EASA Oxygen: Carriage & Use Issue!**

Oxygen Delivery Systems, MWP Klaus Ohlmann, Mount Everest
8800 m, 29.000 ft – 1 Febr 2014

Ohlmann

Hypoxia and Flying

Human Factors, FAI-CIMP

Juergen K Knueppel

Basics of Hypoxia in Gen Aviation

easa Medical Expert Group Meeting

Reference: ICAO Manual of Civil Aviation Medicine (Doc 8984)

Juergen K Knueppel MD
Flight Surgeon

President FAI-CIMP
Medical Commission, World Airsports Federation

Question

- Concerning Oxygen USE?
- What are the current altitude LIMITS for glider flying?

EAS ISSUE: General Aviation (**GA**) Request to easa

a) ICAO rules "copied" into EASA regulations

1. -Carry and breathe Oxygen starting at **10.000** ft
2. -Passengers for 30 min w/o Oxygen up to **13.000** ft
3. -GA PIC assesses the use of Oxygen at **any** altitude

b) EASA deleted # 3 during the "copy" process!

c) GA - **EAS** requests to **revert** to ICAO rule

-EASA GA Safety Strategy admits this kind of move

-EAS application, arguments, suggestions under **review**

-includes risk assessment and other considerations

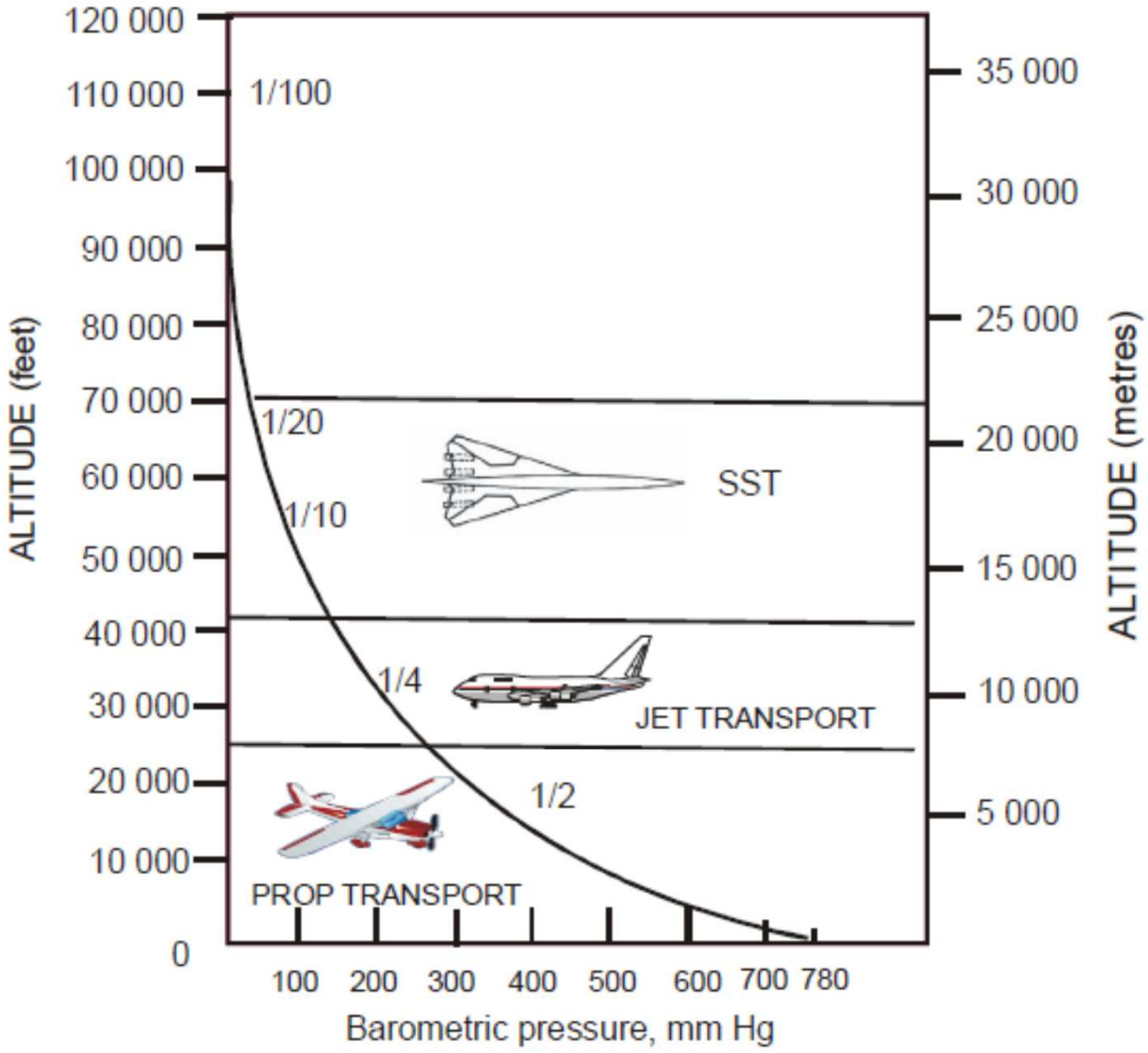
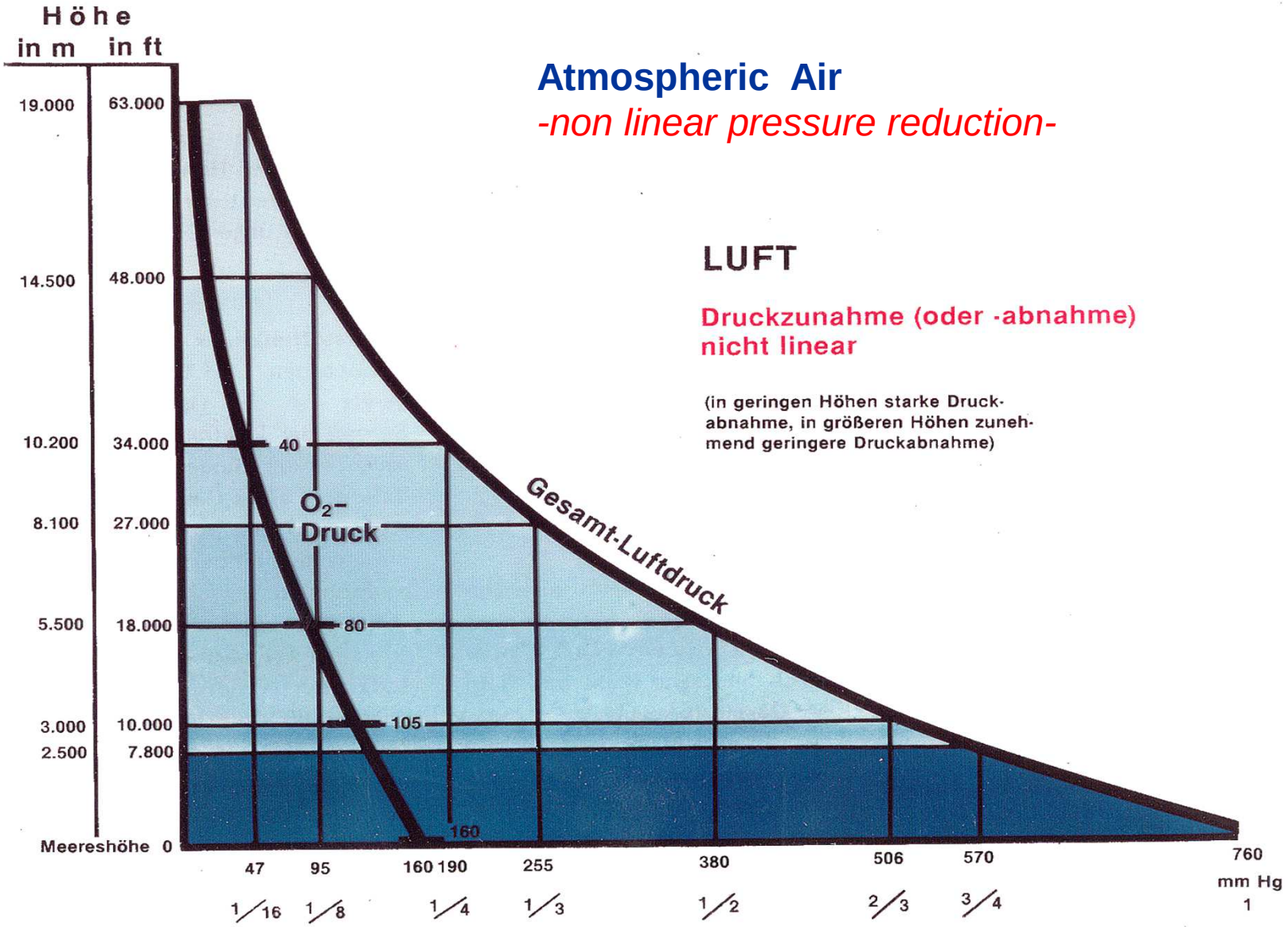


Figure II-1-3. Barometric pressure and altitude

Altitude



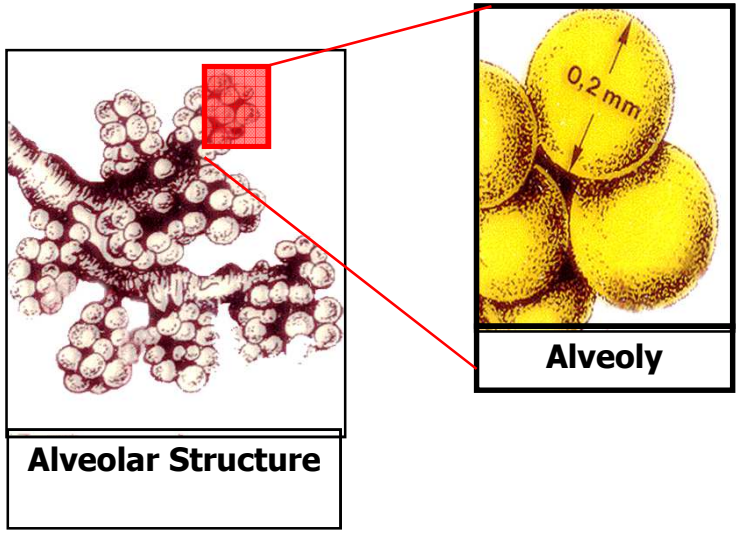
Atmospheric Air

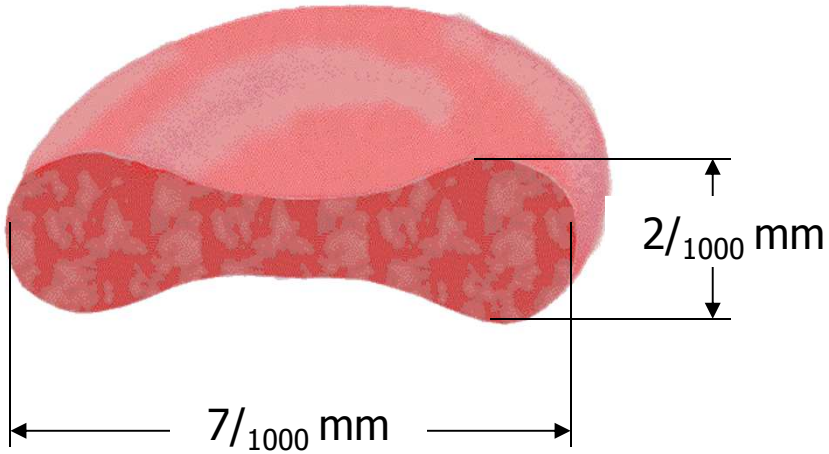
-non linear pressure reduction-

Oxygen

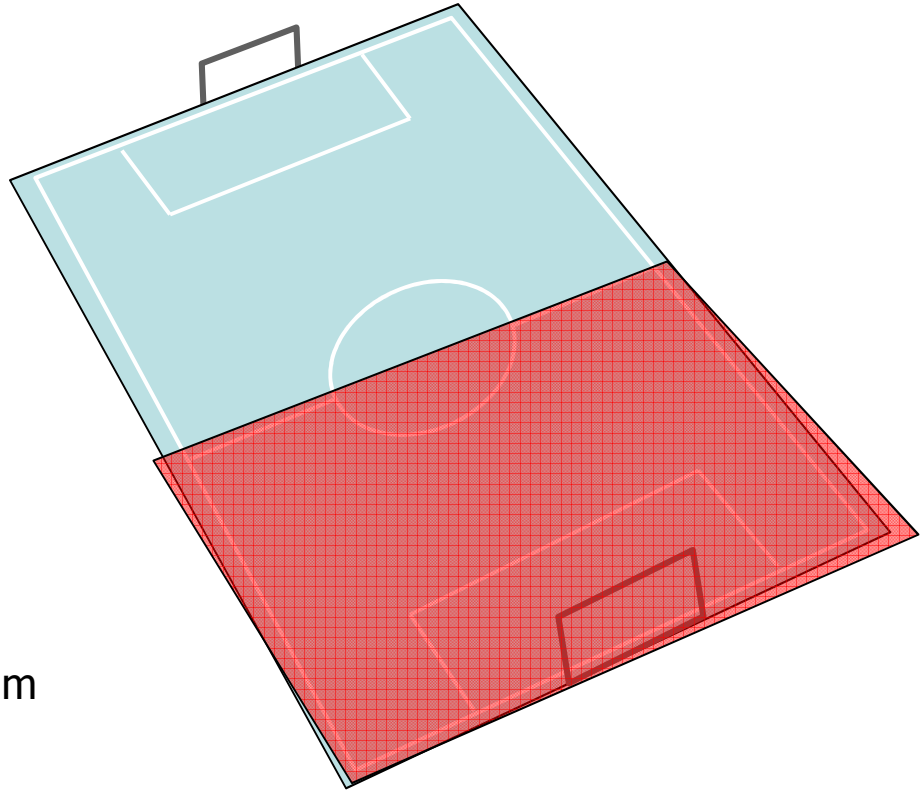
Nitrogen

Large Surfaces in the human body improve Oxygen uptake.





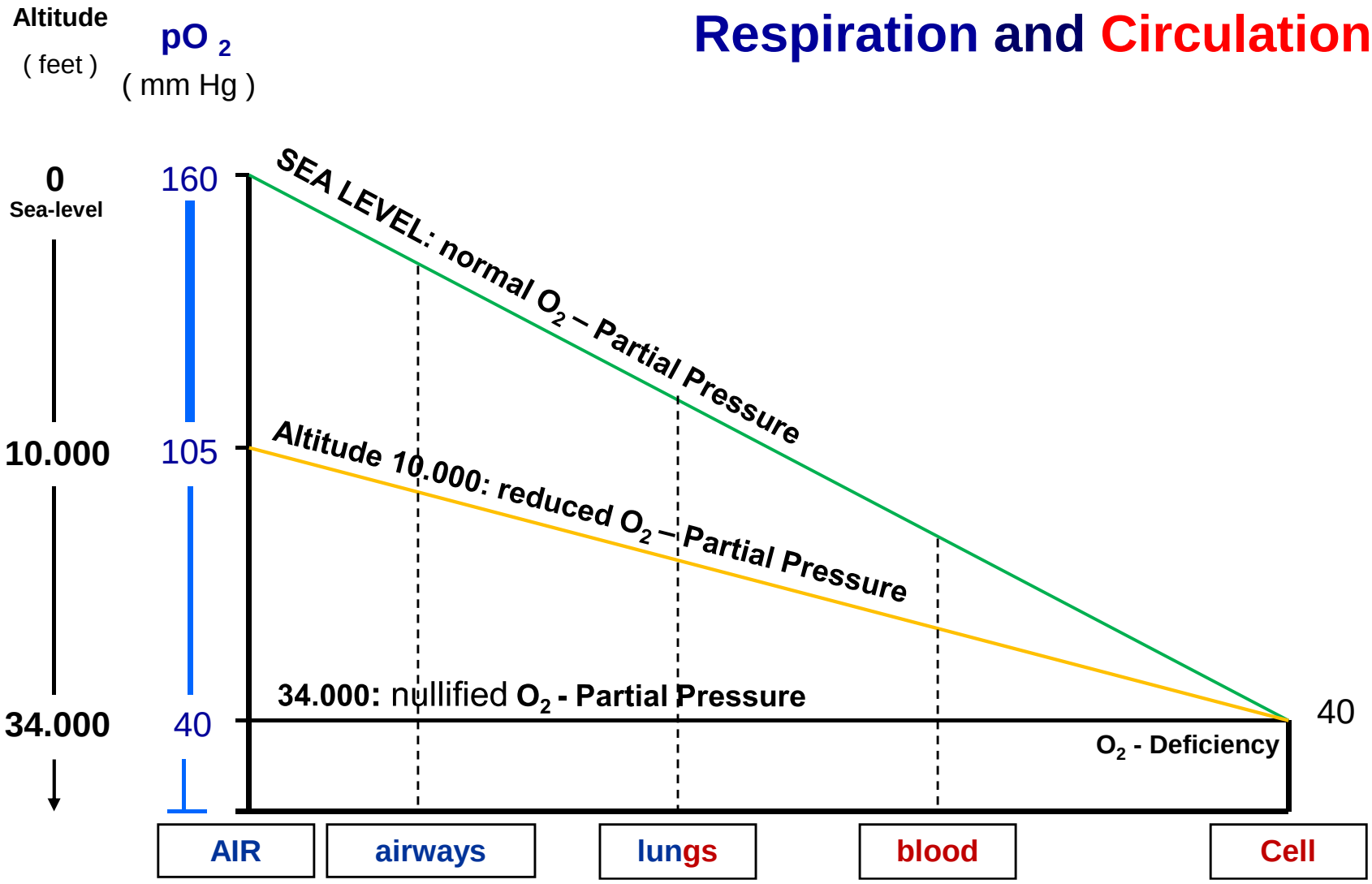
The shape of the Red Cells increases surface.



The surface of the Red Blood Cells

Size of a Socker Field

Respiration and Circulation



Effects of hypoxia at different altitudes

2 450 m (8 000 ft): blood oxygen saturation 93 %, reduced night vision

3 050 m (10 000 ft): OX Sat 89 %. *(„Zugspitze“- FL 100, IFR)*

Complex cerebral functions, begin to suffer.

3 650 m (12 000 ft): OX Sat 87 %,

arithmetical computation difficulties, short-term memory impaired

4 250 m (14 000 ft): OX Sat 83 % impaired

mental functional intellectual and emotional changes.

4 550 m (15 000 ft): OX Sat 80 %

serious impairment *(„Mont Blanc“)*

5 500 m volume of gas at sea level doubles at 18 000 ft, **1/2**

6 100 m (20 000 ft): OX Sat 65 %

TUC 10 minutes, (TUC, time of useful consciousness, until inability

7 600 m (25 000 ft): blood oxygen saturation below 60 %, TUC 2.5 minutes. DCS

*(„**Mount Everest**“)*

9 150 m (30 000 ft): TUC is approximately 30 sec

10 350 m (34 000 ft): TUC 22 sec. (100 % oxygen = 95% OX Sat)

11 300 m (37 000 ft): TUC is 18 sec, Gas Volume **1/5**

(„Airliner“)

13 700 m (45 000 ft): TUC is 15 sec, Positive-Oxygen Pressure Breathing

Table II-1-3. Signs and symptoms of hypoxia

Subjective symptoms	*Objective signs*
Breathlessness; dyspnoea	Hyperpnoea or hyperventilation
Headache	Yawning
Dizziness (giddiness)	Tremor
Nausea	Sweating
Feeling of warmth about face	Pallor
Dimness of vision	Cyanosis
Blurring of vision	Drawn, anxious facies
Double vision (diplopia)	Tachycardia
Confusion; exhilaration	Bradycardia (dangerous)
Sleepiness	Poor judgement
Faintness	Slurred speech
Weakness	Incoordination
Stupor	Unconsciousness; convulsions

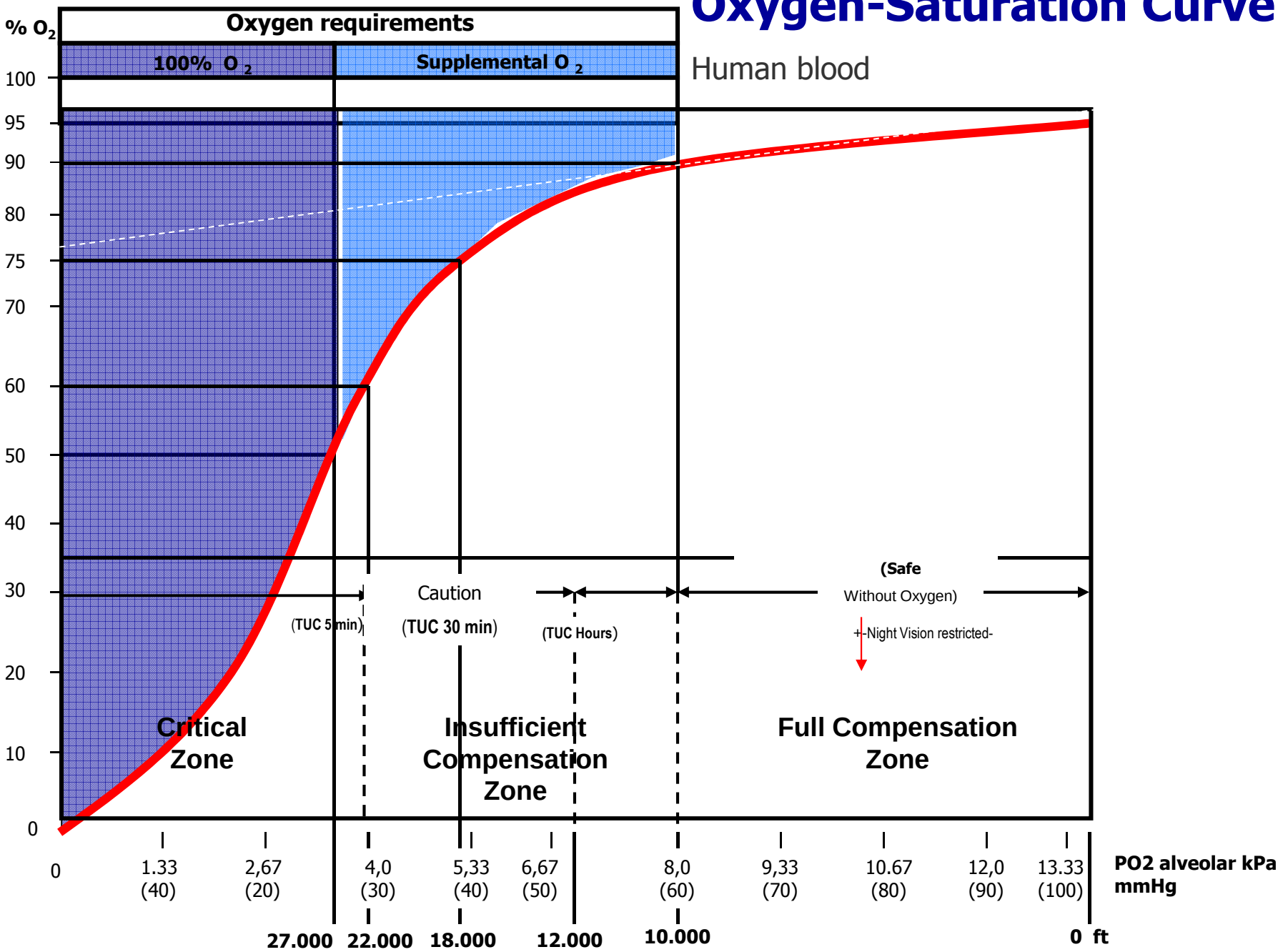
INCREASING HYPOXIA ↓

-dangerous: "**Euphoria** "/ Increased sense of **well being**

-cave **Hyperventilation**: Exhaling CO^2, Alcalization of the Blood, **Hypoxic Symptoms**

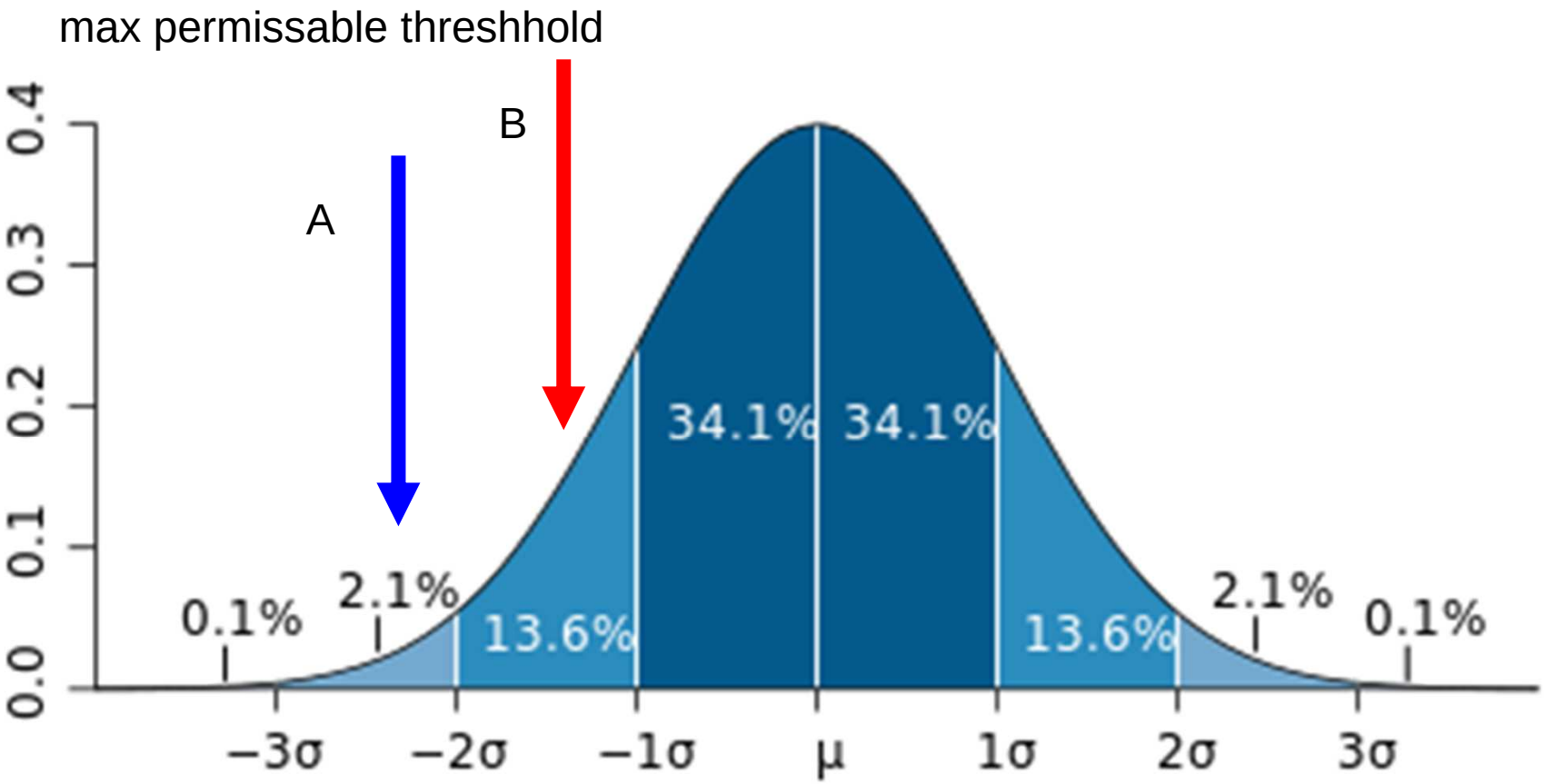
Oxygen-Saturation Curve

Human blood



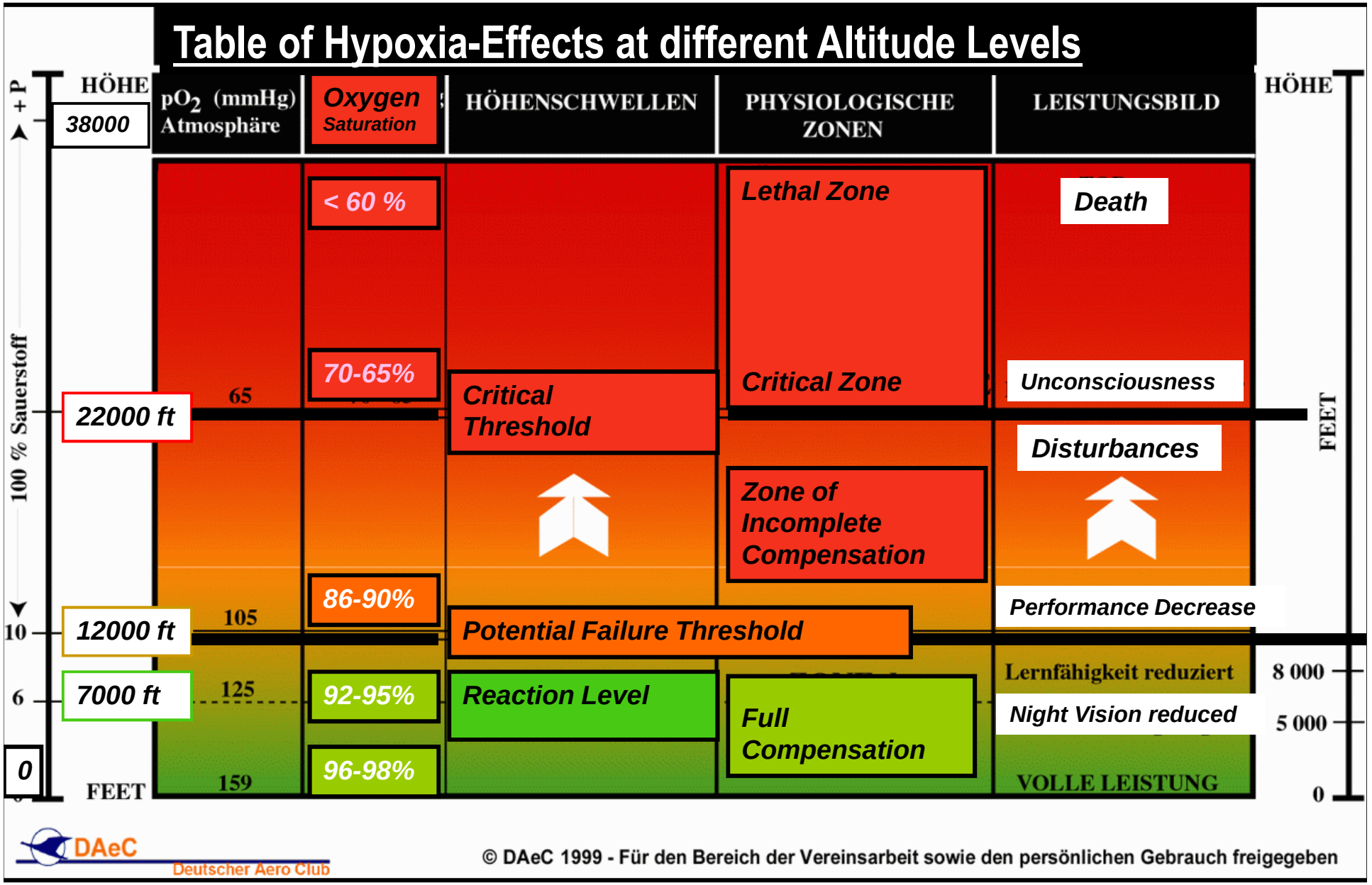
Bell Distribution Curve of Hypoxic Symptoms

Hypoxic Symptoms, Obvious Start



15.000 ft **17.000 ft** **19.000 ft**

Table of Hypoxia-Effects at different Altitude Levels



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Hypoxia

Reduced Partial Pressure of Oxygen combined with

- Hypoxic Hypoxia: ***Reduced Oxygen***

  Altitude

- Anaemic Hypoxia: ***Decreased Hemoglobin***

  Smoker

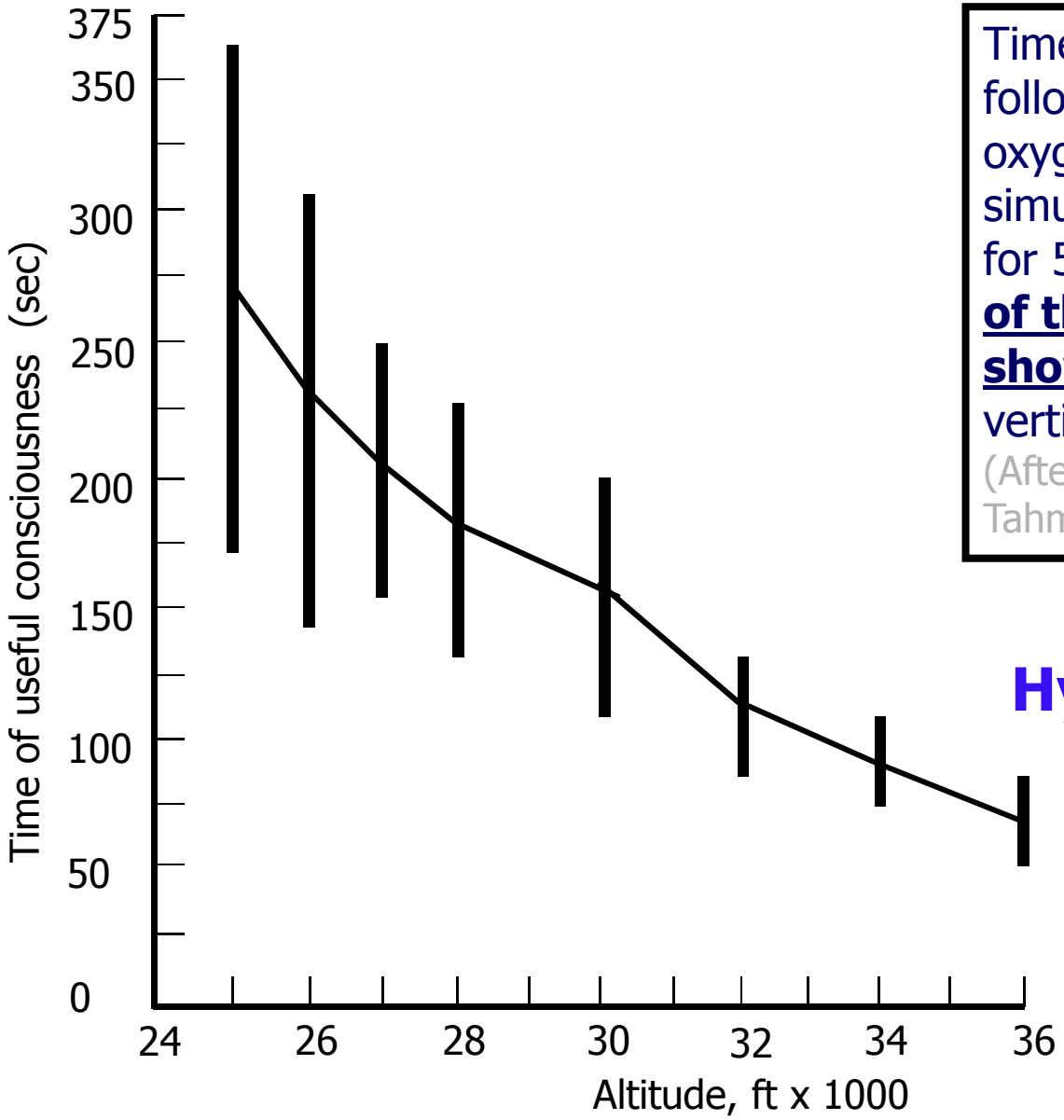
- Ischaemic Hypoxia: ***Reduced Bloodflow***

  Heart

- Histiotoxic Hypoxia: ***Tissue Poisoning***

  Hydrogen Cyanide

(Beispiele:)

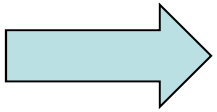


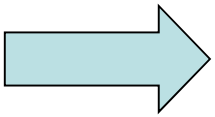
Time of useful consciousness following change from breathing oxygen to breathing air at various simulated altidutes (mean values for 50 sujects), **the magnitude of the standard devation is shown** by the length of the vertical bar through each mean.
(After Mackenzie, Riesen, Bailey Tahmisian and Crocker, 1945)

Distribution of Hypoxia symptoms at different altitudes

Provence – France, 12.000 ft

aeromednews@t-online.de

Mountaineering:  Adaptation possible

FLying:  basically **no** Adaptation !

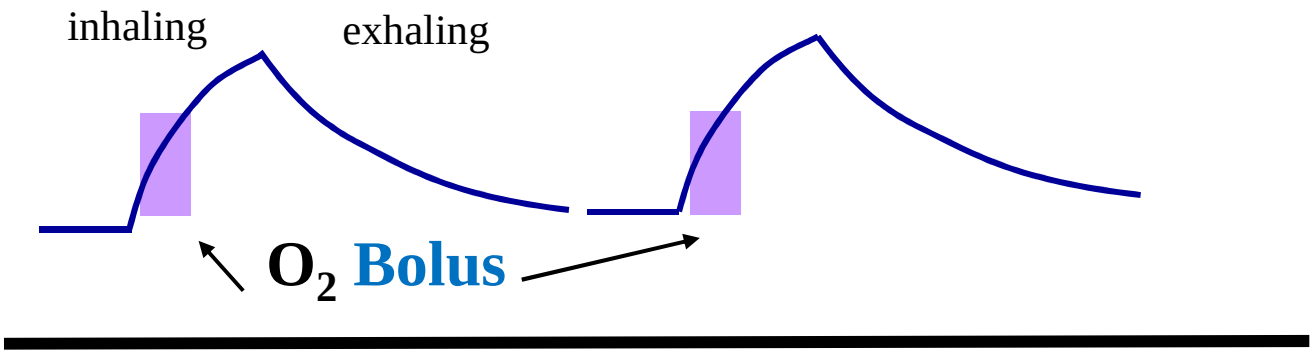
Pulsoximetry: - Nonin WristOx
- LCD Display
- 24 hours store

Electronic Oxygen Delivery System(s) (EDS)

Mountain High, USA

EDS - Principle

- O_2 on demand: = "BOLUS"
- "Bolus" (on demand)
  - altitude
  - Triggered by inhalation
  - supplied first 0.2 sec
  - O_2 ammount
- Nasal Canula

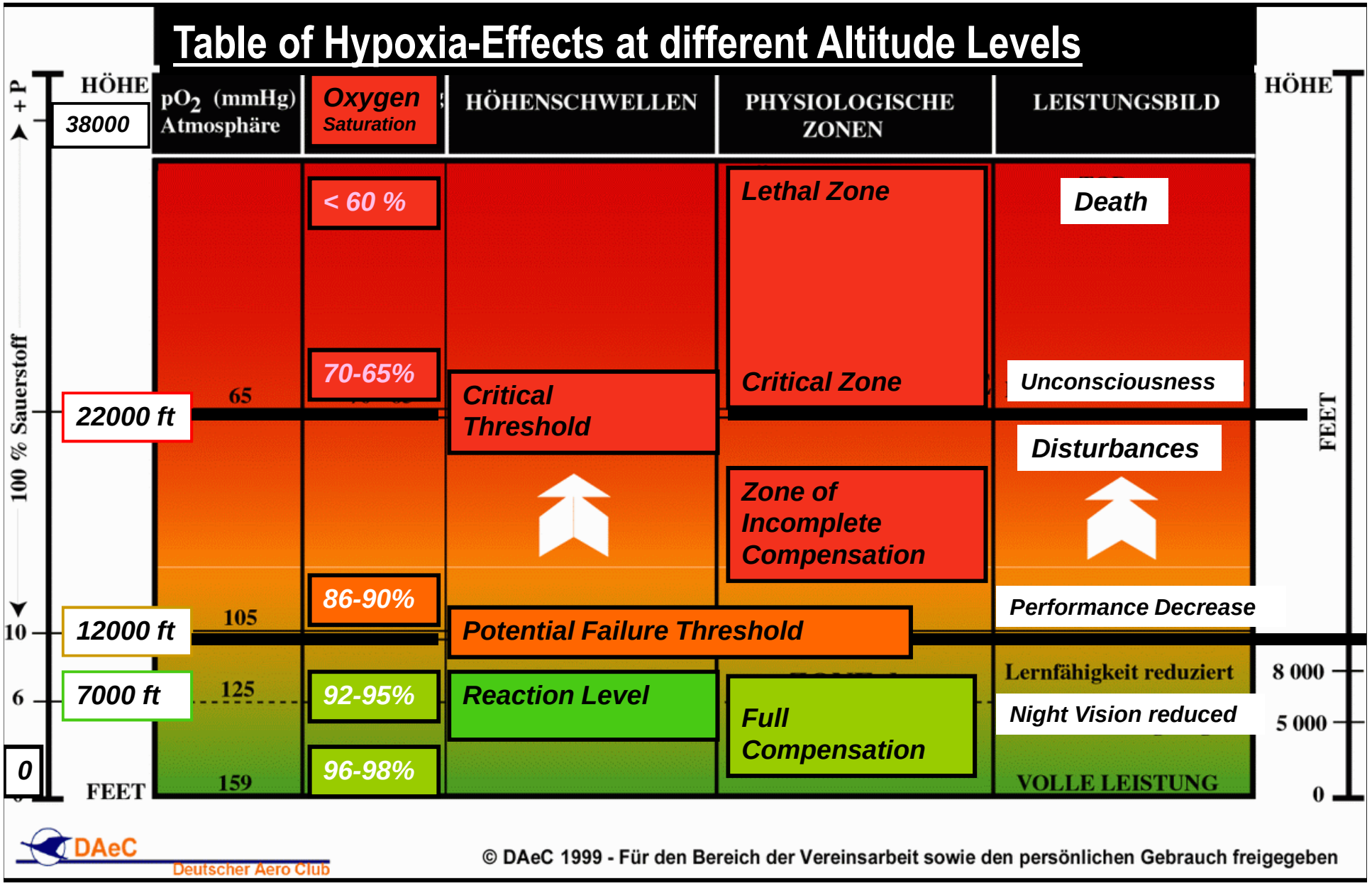


New Developments

- Small
- On board “SYSTEMs“
- Technically tested

- Puls-Oximeter
- Airlines
- Light Bottles

Table of Hypoxia-Effects at different Altitude Levels



DAeC Deutscher Aero Club

Oxygen Delivery Systems, MWP Klaus Ohlmann, Mount Everest
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Ohlmann

Roadmap for EASA GA -APPLICATION

-are there any ***known problems*** ? ***-cave overegulation*** !

-individual ***adaptation*** at elevated airfields ***–FAI-WCC***

-less stringent EASA GA are rules possible! ***-GA Strategy***

-statistical ***risk assessment***, third party risks ?

-***aeroclub guidance***, education, self control

-economical, technical, ***logistic burden*** ***-grandfather rights***

-NAC advise on ***safe operation up to 15.000 ft***

-***development-plan*** of additional GA concept

-“mandatory brief, education, ***specialist advise***“

-awareness training, ***pulse oximeter use*** ***-developments***

Roadmap for EASA GA -APPLICATION

-***less stringent*** EASA GA are rules possible!-*GA Strategy*

-are there problems ? -***cave overegulation*** ! statistical ***risk assessment***, third party risks ?

-economical, technical, ***logistic burden?*** -***grandfather rights***

-*aeroclub guidance*, education, self control

-*safe operation up to 15.000 ft*

-*plan* additional GA concept “mandatory briefs, education, *spec.t advise*“

-*pulse oximeter use -developments*

Questions / Comments . . . ?

E-Mail: aeromednews(at)t-online.de

way forward

- FAI IGC be aware of this problem

  (valid starting 2016, political level)

- Europe Airsports (EAS) ist working on it

- Application to EASA
  - (EASA General Aviation Flight Safety Strategy!)
  - Under way to revert to ICAO recs
    - dubious outcome!

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Ohlmann