Electronic Oxygen Delivery System(s) (EO$_2$DS)

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EDS

- Problem
- Function of EDS
- USE of EDS
- Remarks
THE PROBLEM

• General Rule: Oxygen should be used by pilots starting at 10,000 ft.

• If you have to rely on Gaseous Oxygen (GOX) in Gas-Bottles, the amount of Oxygen is often very limited.

• At Altitudes between 10,000 and 20,000 ft pilots don’t like to wear Oxygen Masks.
Electronic $O_2$ Delivery System (EDS)

Built for Use in General Aviation
- AC without pressurized cabin
- Light AC
- Gliders (Mountain Wave Flying)
- Mountain Climbers

Price: 1000$

(1. Mountain High, Salt Lake City, Utah;
2. Spiegelberg, Hamburg)

initially developed for patients with chronic respiratory diseases ("OXYMIZER, OXYTIMER")
Basic Flight Physiology:

Partial Oxygen Pressure must be sufficient to provide adequate O₂ supply to the body

- At Sea Level: 160 hpa O₂, HbO-Saturation: 98%
- At 10,000 ft: 110 hpa O₂, HbO-Saturation: < 90%
- At 18,000 ft: 80 hpa O₂, HbO-Saturation: < 75%

Course of O² Saturation with EDS at 25,000 feet:

- Altitude Chamber
- 100% O₂ from start
- 2 min without O₂
- 2 minutes hypoxic, EDS with a Bolus of 58 ml

*Threshold*

*Time in Minutes*

*Hb O₂ (%)*

- Start Hypoxia
- EDS

*Graphical representation of oxygen saturation changes with altitude and EDS intervention.*
EDS - Principle

- $O_2$ on demand: "BOLUS"
- "Bolus"
  - depends on altitude level
  - is triggered electronically
  - is delivered in first 0.2 sec
  - amount varies in length
- Inhaling strictly through the Nasal Cannula
1. Requirements
   EDS with Electrical Power
   $O_2$ Bottles
   Reduction Valve
   OXYGEN tubes
   Nasal Cannula

2. EDS safety issues
   ALARMS
   VISUAL DISPLAYS
   TEMPERATURE & HUMIDITY
   VIBRATION AND SHOCK
Electronic $O_2$ Delivery System (EDS)

**CALCULATION:**

$O_2$ requirements at 18,000 ft (50% ATM)

- Breath of 400 ml contains at S.L. 80 ml $O_2$ (20%)
- Requires at 18,000 ft 180 ml $O_2$ (40%)

(Net min + 80 ml $O_2$ required)

- EDS provides at 18,000
  - EDS (MH) BOLUS only 42 ml $O_2$
  - First 0.2 sec of inhalation
  - (Includes a margin of safety)
Electronic $O_2$ Delivery System (EDS)

- **Bolus provided**
  - at 18,000 ft 42 ml
  - at 25,000 ft 58 ml

- **Endurance at 18,000 ft for 1 Person**

  *Constant Flow System* to *EDS System*

  - $O_2$ use / h 144.0 ltr 49.2 ltr
  - 2 ltr Bottle/200 bar 2.5 h 8.0 h
**Electronic O₂ Delivery System (EDS)**

- **SAFETY ASPECTS:**
  - Audio-Alarm, Warning Light if no O₂ supply

- **FAA RULE:**
  - Use only up to 18,000 ft
  - (mask and constant flow, if higher)

- **“Attention“:**
  - Use for medical purposes
    - only, if no additional O₂ required on ground.
  - Beware of Anemia!
EDS used in Gliders
Wave Flying
10,000 ft to 18,000 ft
EDS
Optional other Options

- Unpressurized AC, above 10,000 ft
  PILOTS
  LOADMASTERS

- High Altitude Parachute Drops
  PARACHUTERS
  LOADMASTERS

- Patients in AeroMedEvac Flights
- Class 4 Patients on AirTransport
Rugged Helicopter version
(System-Spiegelberg)
• on Helicopters
  >10,000 ft up to 15,000 ft
• Concept German CH 53
  • for Pilots, more comfort
  • for Loadmasters
  • “one“ size $O_2$ BOLUS
The EDS System could serve

**AeroMedEvac Patients & Airline Passengers with risks**

- who fly in pressurized AC, not over 8000 ft
- when $O_2$ saturation on the ground is sufficient,

**if there are only limited resources available.**
New Developments

- Smaller systems
- On board “SYSTEMS”
- Technical Certification
  
- Pulsoximetry
- Use on Airlines
- Light Plastic Bottles
**EDS Summary:**

1. *New Technology*
   - O₂ electronically delivered
   - Inhalation sensed

2. *Economical O₂ -Use*
   - Small bottle, more O₂
   - Altitude dependent

3. *Comfort*
   - Nasal cannula
   - No communication problems
   - Possibility to drink and eat

4. *Improvement of Pilot O₂ Compliance*
Producer:
Electronic Oxygen Delivery Systems

1. Fa Spiegelberg
   (GmbH&Co. KG)
   Tempowerkring 4
   D-21079 Hamburg

2. Mountain High
   Salt Lake City
   Utah / USA