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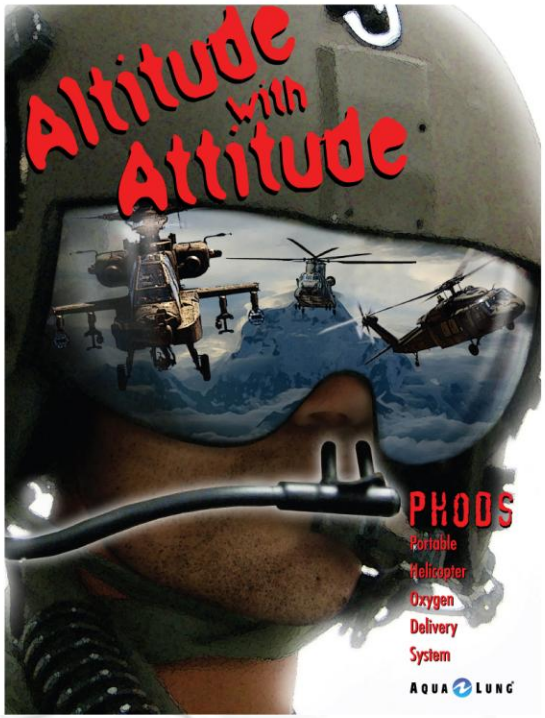

A Man-Mounted Portable Helicopter Oxygen Delivery System-One year later

SAFE Europe Symposium Brief -31 March 2010

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CEO-Aerial Machine and Tool Corporation

Briefing Objectives

- Team members
- Background of system
- PHODS system
- Testing
- Applications
- Oxygen in the field
- Companion product-PHODS Console
- Conclusion

Team Members

- Aqua Lung America
  - High pressure breathing devices and regulators
- Gentex, West
  - Helmets and Resporitory Systems
- Mountain High
  - Oxygen supply systems for civil gliders (high altitude)
- Breathing Air Systems
  - Oxygen and compressed gas

PHODS-SAFE 2008 Team Achievement Award

Background

- Operations in Afghanistan exposed and demonstrated Army Aviation needs
- No system specifically designed for helicopter flight below 18,000 ft
- Need for a robust and individual ***supplemental*** system
- Need for proper integration into today's combat gear
- Need for the automatic delivery of oxygen
- Need for a compact and efficient oxygen system

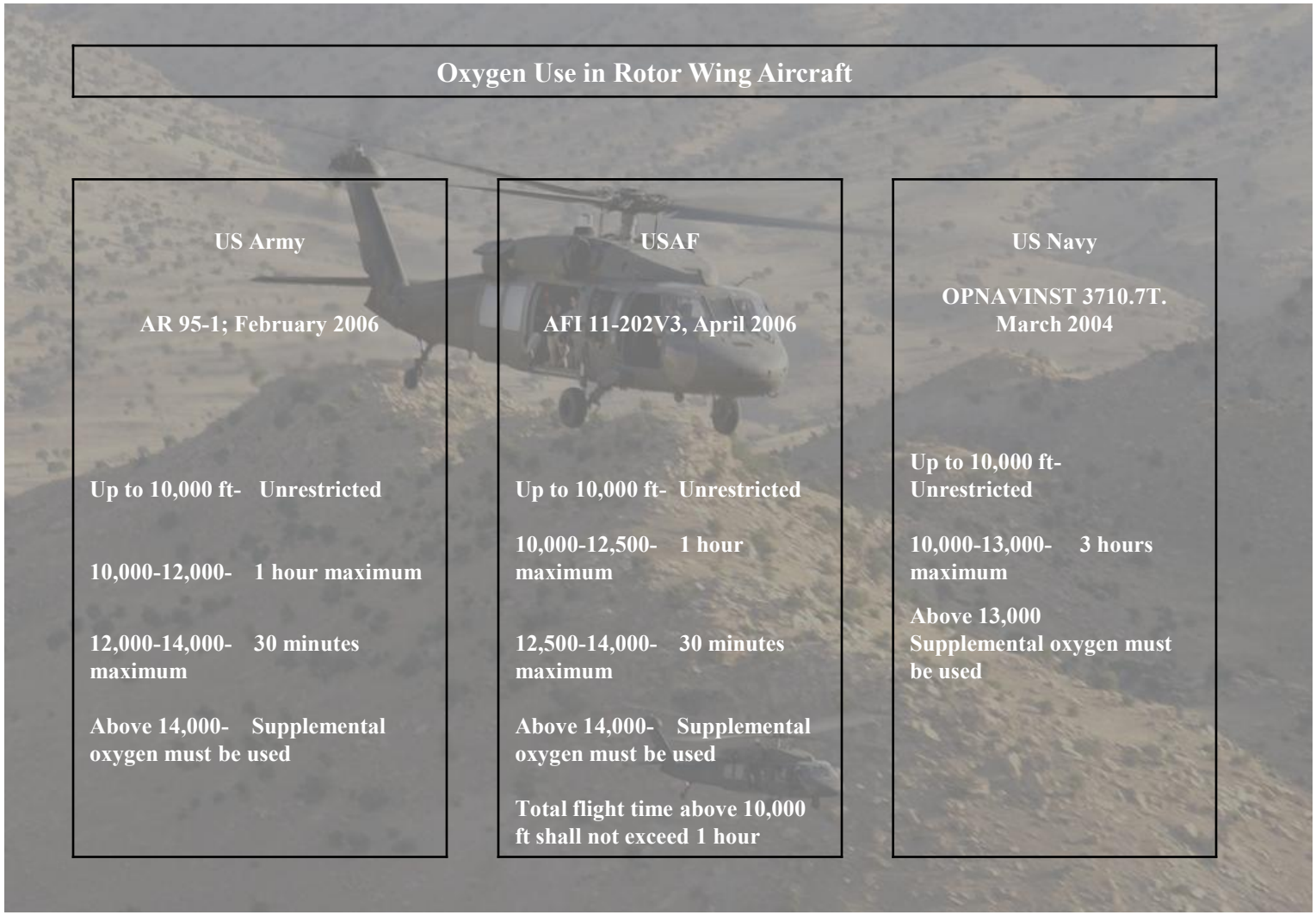
Factors


Current theater of operations
Flight @ moderate altitude (>14,000 ft)
Survival
Evasion
Escape
Mountains
Varying terrain
Varying environment
Sand
Fatigue

Portable Helicopter Oxygen Delivery System

- **Definition**:
- A light weight portable oxygen delivery system that once turned on will deliver oxygen to the user and change delivery volumes based on the altitude.
- Can be used as a primary delivery of oxygen, an emergency system and for escape & evasion at high altitudes. Secondary, but not designed for, can also be used for medical applications.

Existing U.S. DOD Regulations



Oxygen Use in Rotor Wing Aircraft

US Army

AR 95-1; February 2006

Up to 10,000 ft- Unrestricted

10,000-12,000- 1 hour maximum

12,000-14,000- 30 minutes maximum

Above 14,000- Supplemental oxygen must be used

USAF

AFI 11-202V3, April 2006

Up to 10,000 ft- Unrestricted

10,000-12,500- 1 hour maximum

12,500-14,000- 30 minutes maximum

Above 14,000- Supplemental oxygen must be used

Total flight time above 10,000 ft shall not exceed 1 hour

US Navy

OPNAVINST 3710.7T. March 2004

Up to 10,000 ft- Unrestricted

10,000-13,000- 3 hours maximum

Above 13,000 Supplemental oxygen must be used

System Overview

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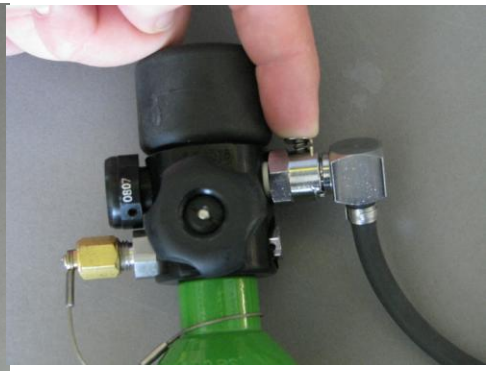
Portable Supply System



Pressure Gauge

Output Q.D.

Refill Port

ON/Off Knob

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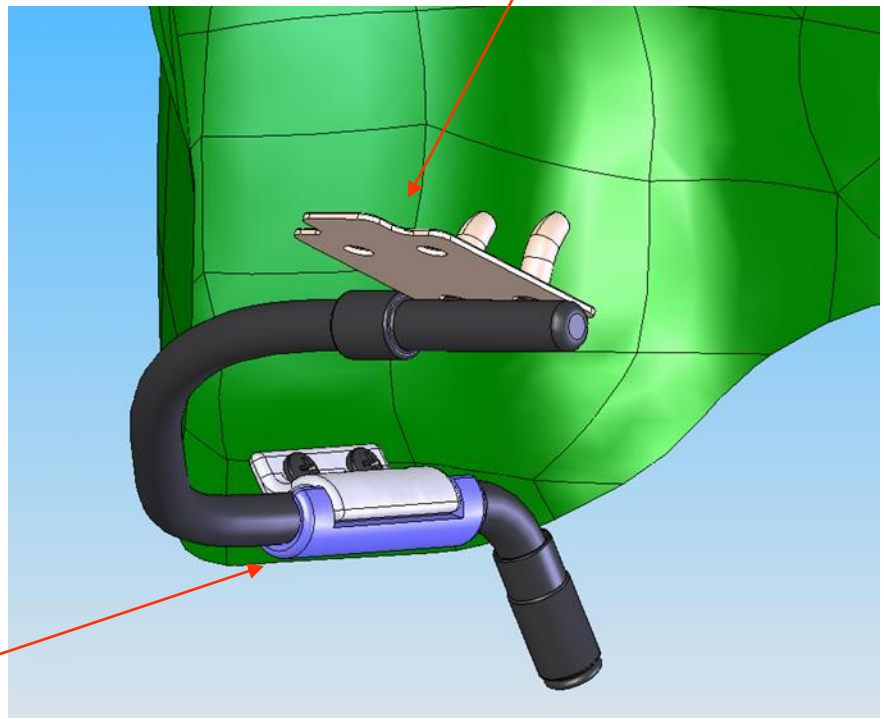
Helmet System Connections

PHODS Cannula by Gentex

Flexible boom

Removable cover

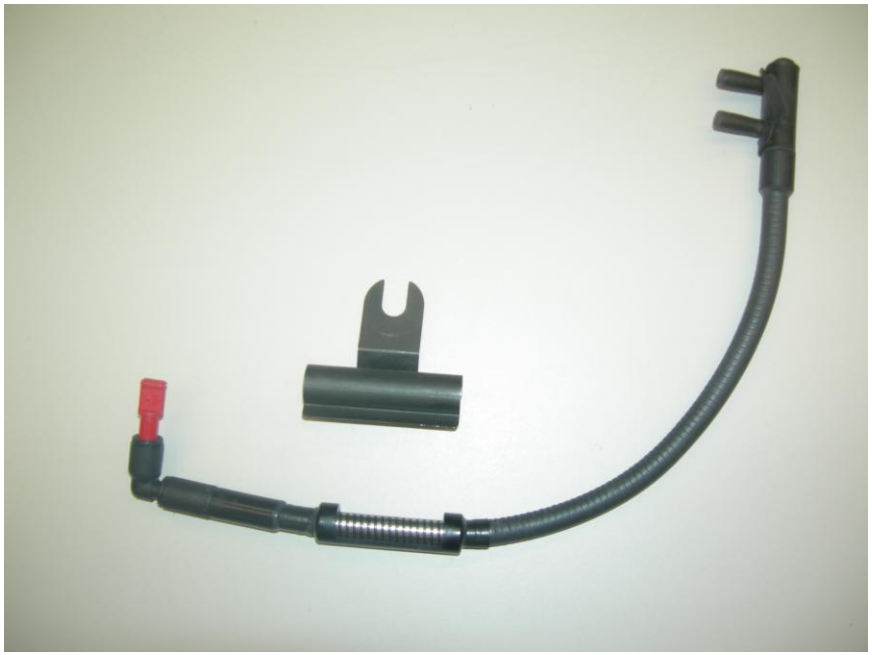


Robust clip in mount

PHODS Cannula

- Robust flexible boom
- Delivers oxygen to user via nasal passage
- Mounts on all helmets
- Attachable and removable in flight
- Removable soft rubber cover for cleaning or replacement
- Placed on right or left side of helmet
- Must breath through your nose
- Estimated duration up to 3.0 hours

AH-64 Apache Helmet Integration



Potential Integration into other helmets

Note: Mounts, cannula, or oral/nasal mask have only been tested and approved for use with Gentex helmets

Optional Oral Nasal Mask

- Based on the MBU-20 design
- Lightweight soft rubber mask
- Attachment by Maxiofacial shield clips
- Fits inside maxiofacial shield
- Standard military microphone
- Consumes more oxygen than cannula
- Estimated duration 2.0 Hours

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Oxygen Pulse Controller by Mountain High

- Commercial item from civil glider community
  - Electronic auto-profiling “Pulse Demand” regulator
  - Digital micro-computer electronics for absolute accuracy
  - Visual alarm for apnea, pinched tube and empty cylinder
  - Senses barometric pressure
  - Senses user inspiration
  - Delivers measured O2 automatically
  - Adapts to each individual that includes anticipating breathing cycles

Oxygen Pulse Controller “OPC”

OPC Modes of Operation

- Off
- On = Automatically begins delivery of oxygen on ascent through 10,000 ft msl
- F 20 = Oral nasal mask setting for increased flow
- R/M = Reserve Manual mode for increased flow available at any altitude. (Used for Inspection, Pre-breathing or Medical use)
- Automatically stops delivery at 8,000ft msl in descent

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Testing Criteria

- USASAM/FAA Altitude Chambers
  - Pilot Volunteers
  - Rest & Exercise
    - 10,000 ft
    - 15,000 ft
    - 18,000 ft
  - Effectiveness of O2 Delivery
    - Pulse Oximetry
    - Color Vision
  - Ease of Use

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Reports Issued-USAARL(U.S. Army Aeromedical Research Lab)

- USAARL #2007-14-PHODS
- USAARL #2008-04-Cannula and HGU 56/P
- USAARL #2008-13-Oro-Nasal Mask

These can be downloaded from the www.usaarl.army.mil web site.

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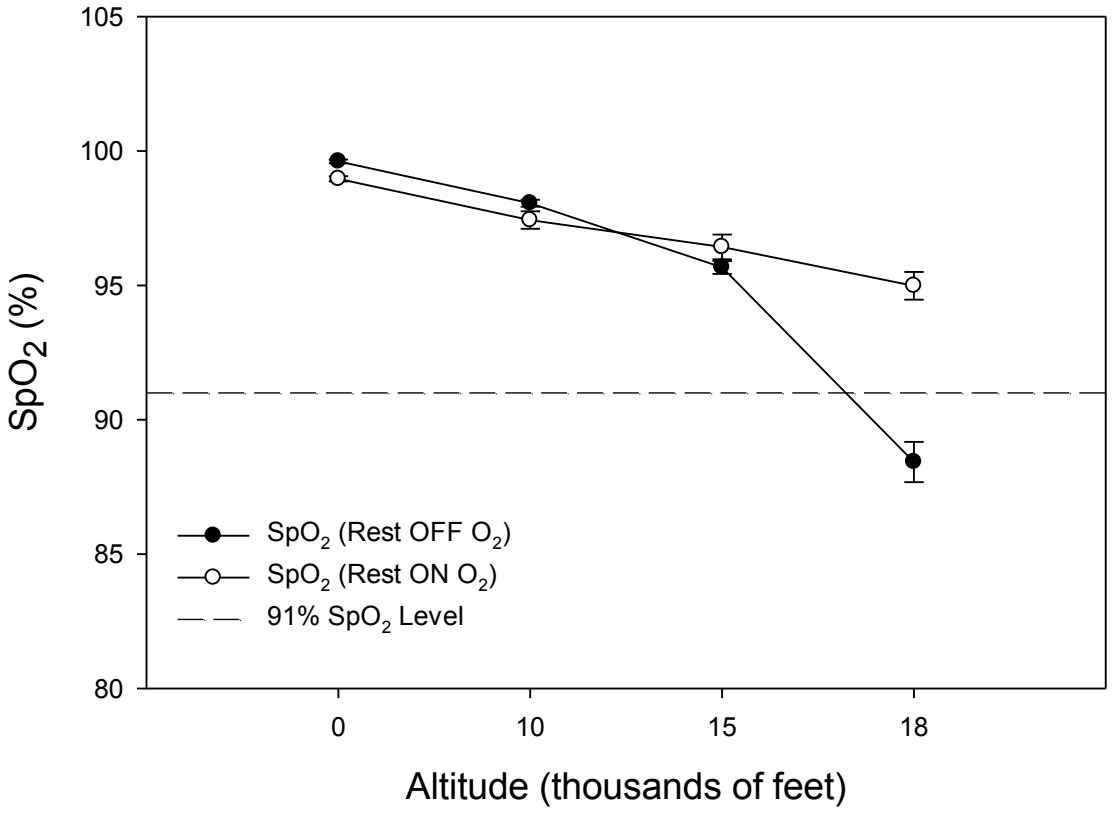
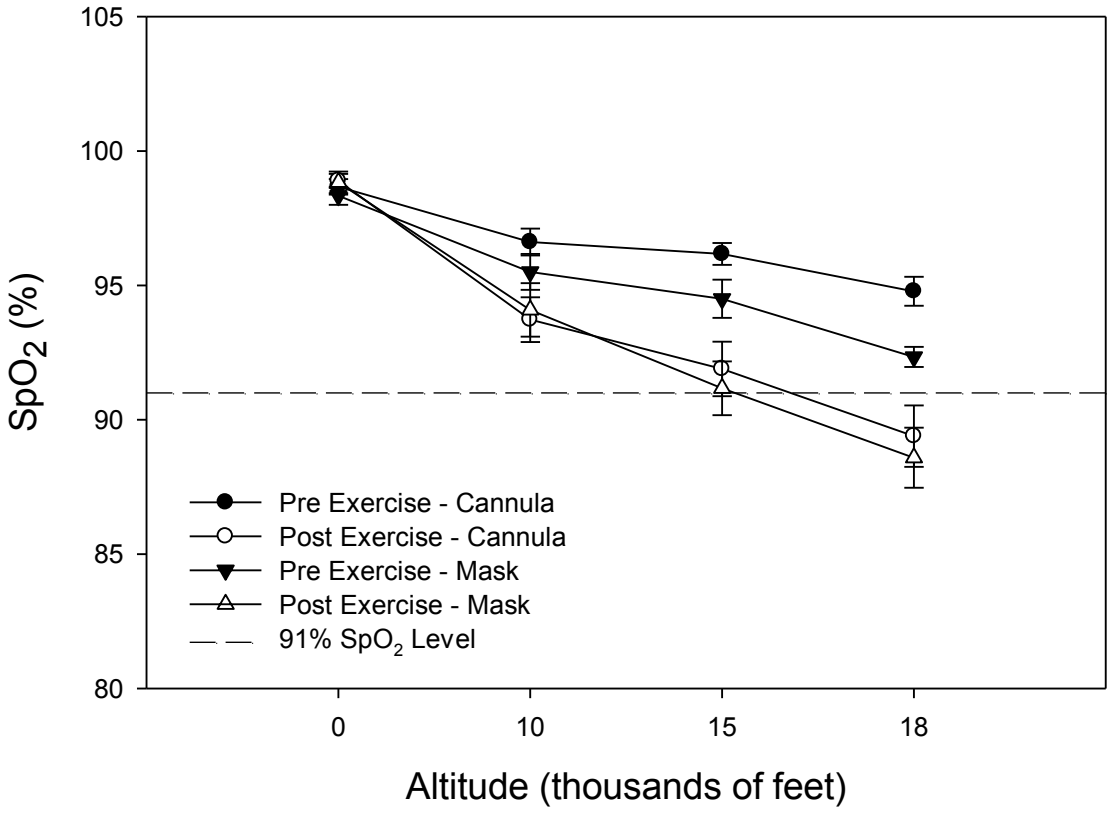
SpO2 vs Altitude



SpO2 vs Altitude

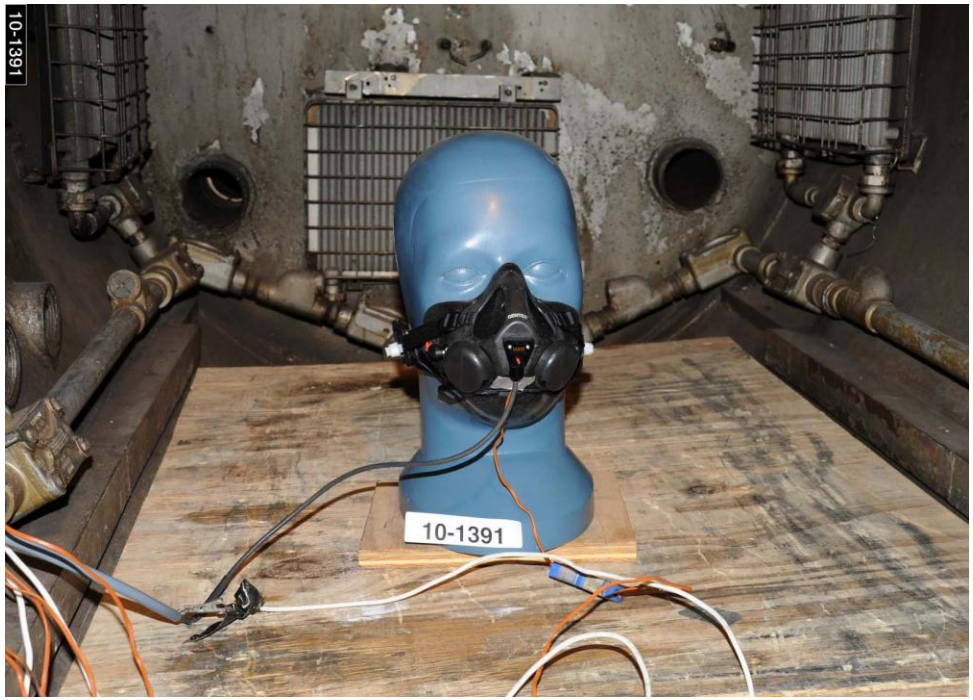


PHODS Mask testing March 2010-Dayton T. Brown Co.

PHODS MASK OFFICIAL TEST SETUP PHOTO

- Mask mounted on ANSTI head, connected to Breathing Machine by Hard Tubing.
- Breathing Machine located in insulated box positioned below head. Machine was insulated and heated to prevent freezing during -25 F portion of test.
- OPC was mounted directly on side of head. Plastic bag was to provide protection from humidity during 100% condensing humidity portion of test. OPC was not being evaluated during this test rather part of setup.
- Elastic Cord/PVC tube was used to compensate for helmet compression which occurred during initial cycles causing mask to break seal.
- Mask was tested to MIL-STD-810F, Method 520.2, Proc. III,Temperature/Altitude/Humidity,Total number of Test Cycles: 10 .Tested to 165F and -25F, 0-22,000 FT MSL, and 0-100% humidity.

PHODS Mask testing March 2010-Dayton T. Brown Co.



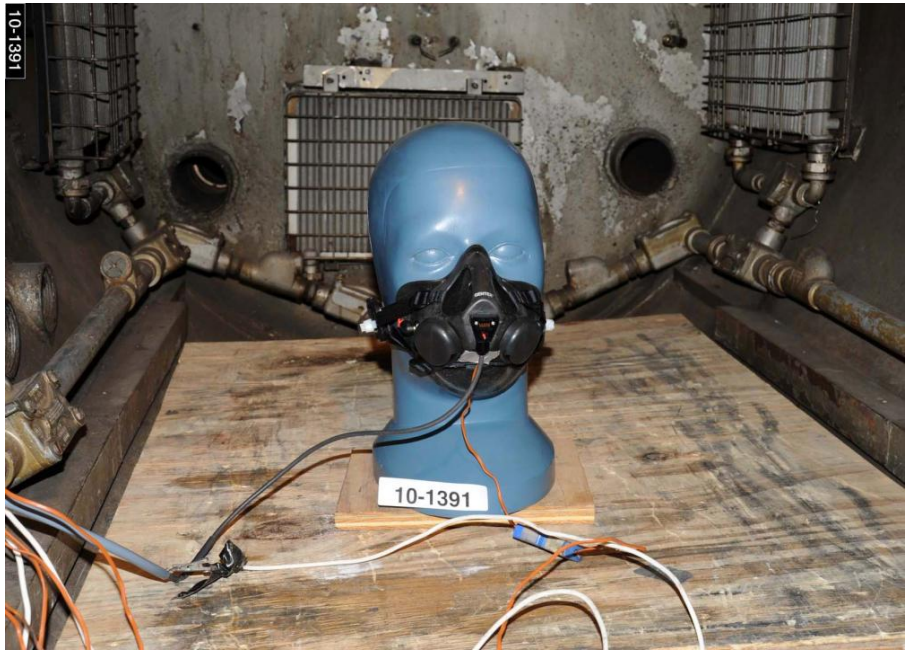
PHODS MASK OFFICIAL EXPLOSIVE ATMOSPHERE TEST SETUP

Mask Low Impedance Microphone was connected to an Aqua Lung supplied activation fixture which duplicated pilot voice transmissions while in Explosive Atmosphere.

Continued transmissions occurred from maximum test altitude of 22K MSL, to 0 MSL Sea Level.

Mask was tested to MIL-STD-810F, Method 511.4, Proc. I

PHODS Mask testing March 2010-Dayton T. Brown Co.



Additional Tests Performed

Test	Reference Test Specification
High Temperature Storage Total number of Test Cycles: 7 +85C or 185F	MIL-STD-810F, Method 501.4, Proc. I
Low Temperature Storage/ Low Pressure (Altitude) Total number of Test Cycles: 1 -54C or -65F	MIL-STD-810F, Method 500.4, Proc. I MIL-STD-810F, Method 502.4, Proc. I
Vibration – Cat. 24 (minimum int.)	MIL-STD-810F, Method 514.5, Proc. I

Fill Adapter, K-Cylinder-PHODS

102911 ADAPTER

- *CGA 540 to fit K cylinder*
- *Gauge*
- *Flow restrictor*
- *Open/close valve*
- *Bleeder valve*
- *Hand tight PHOD connector*

Mobile Oxygen Cylinder Recharge System-MOCRS

- Generates OBOGS Grade Oxygen (90+-3% Purity) using Pressure Swing Absorption molecular sieve ceramics
- Easily Transported to forward deployed ALSE locations
- Complete with cart, 2 K-cylinders, 6 position PHODS fill chamber
- Runs Automatically and requires little attention and will shut down if oxygen purity drops

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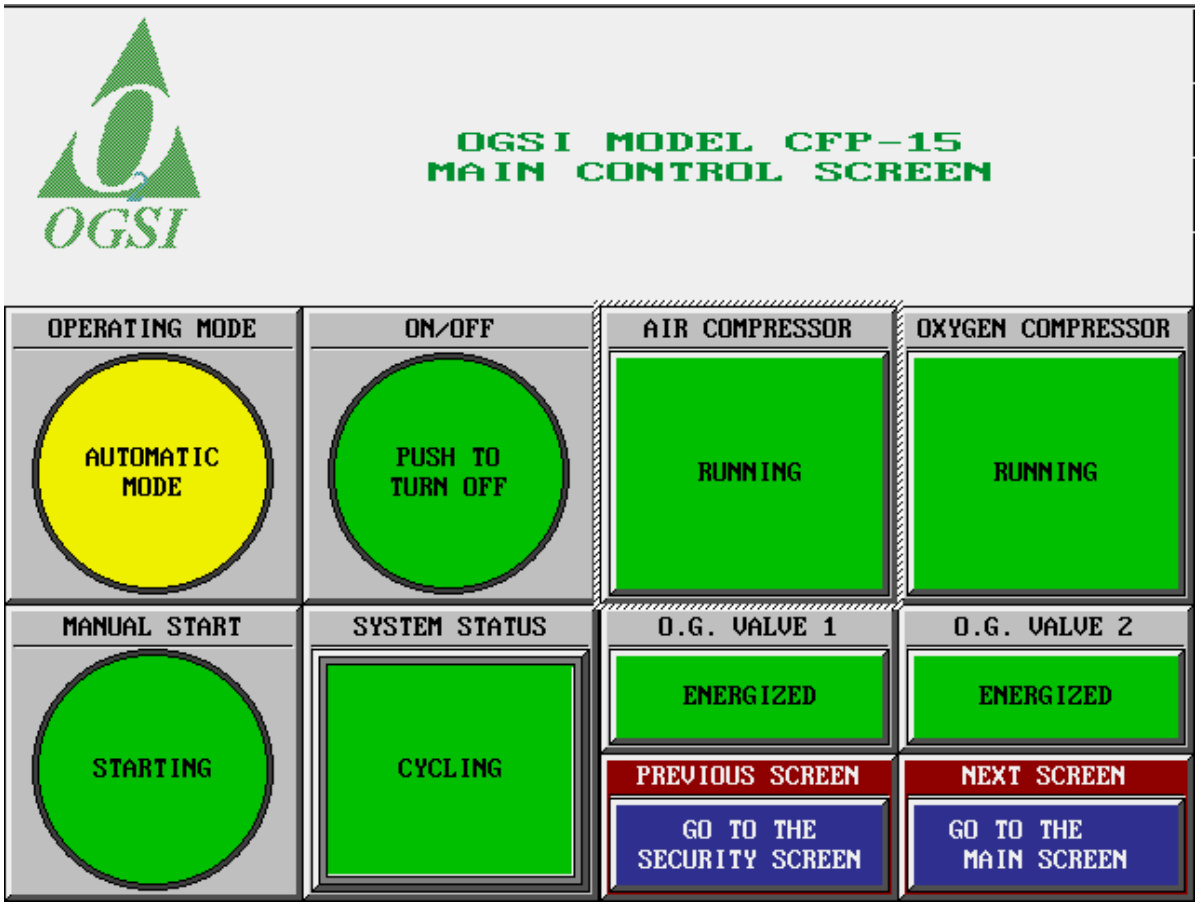
Touch screens



PHODS 16 Man Console

- 50 Cubic ft. cylinders - Ballistic protected container

Legacy System

New PHODS Console

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PHODS 16 Man Console

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Technical Training

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Support Equipment

- Provisioning spare parts kits
- Dedicated “clean” tool kit
- U.S. Army approved user training IKP training materials for fielding
- Complete technical training packing under development
- Deployable ability to generate oxygen

PHODS Current Status

- AWR Completed
- Under Contract with Army with 2000+ shipped
- Fielding underway and systems in use daily
- 16 Man O2 console 95% complete (Level III ballistic Liner)
- Oxygen Generating System fielded
- Complete logistics support in place
- User training package complete
- Maintenance package complete

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PHODS-A Year Later

The U.S. Army has successfully fielded roughly 1500 systems to the following units:

159th Avn (Ft Campbell, KY)	82nd Avn (Ft Bragg, NC)
1-52 Avn (Alaska)	160th SOAR
3 ID (Savannah, GA)	B. Co 1-168 (Ft Lewis, WA)
AASF (Reno, NV)	B. Co 1-158 (Germany)
1-228th Avn (Honduras)	2-29 Inf Regt Flight Co (Ft Benning, GA)
101st Avn (Ft Campbell, KY)	B. Co 1-168 (Pendleton, OR)
C. Co 1-171 Med (Santa Fe, NM)	A & B Co 1-207 Avn (Alaska)
4th CAB (Ft Hood, TX)	

Comments from the field

- **U.S. Army 160TH SOAR (Special Operations)**

  "*We flew PHODS last night for the first time. We actually flew with it for 7 hours and where actually using it for about 5 1/2 hours continuously. We where up as high as 13000 MSL and where pretty constant at 9500 MSL. It worked great and was not cumbersome at all. At the end of the night, I still had a half of a bottle left. It was slowly delivering oxygen at 7500 MSL and then it increased the delivery cycle and volume of oxygen as we ascended through 10000 MSL. You can actually hear the puffs of oxygen when it delivers it to the cannula. That was comforting as it let us know it was working. I had my FE check the guys in the back every 30 minutes.*"

- *"The crew members did consume slightly more oxygen than the pilots due to workload while hoisting in the snow at 12500 MSL. Overall, our guys where very happy with it and it worked really well. Much better than we expected. We will be flying it again tonight. The only thing we wish we had here is the extra cases of bottles purely for worst case contingencies. Thanks again."*

Comments from the field

3 ID

"We used on a CSAR Mission in December greatly adding to mission success."

4th CAB

"We are currently performing high altitude training using PHODS and we are requesting a system for each crewmember assigned."

PHODS Conclusion

- PHODS is an efficient and automatic supplemental oxygen delivery system that maintains blood oxygen saturation and has been sucessfully fielded to the warfighter.
- Designed specifically for helicopters
- Multiple applications
- Flexible integration for all helo applications
- Established subcomponents and proven team members
- Turn key support – maintenance, training & O2 generation

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QUESTIONS?

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