



USAFE - AFAFRICA

Simulator-Based Aircrew Physiological Training Reduced Oxygen Breathing Device (ROBD)

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**OVERALL BRIEFING CLASSIFICATION:
UNCLASSIFIED**



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Overview

- **Aircrew Physiological Training Requirements**
- **ROBD History and Implementation**
- **Challenges**





Aircrew Physiological Training

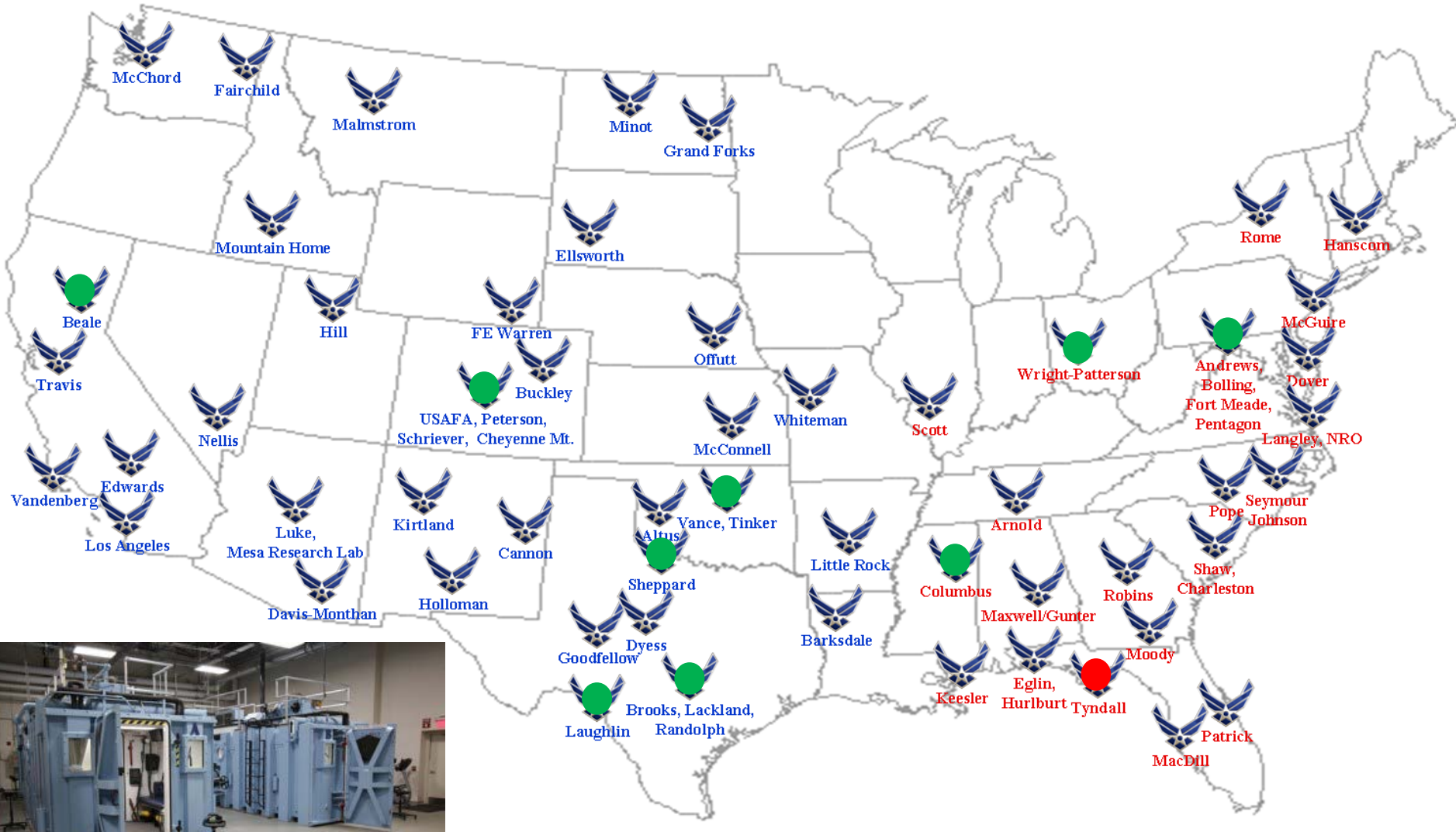
- **AFI 11-202 Vol I requirement for all aircrew to undergo physiological training**
 - **Initial – SUPT, SUNT, Enlisted Aircrew Tech School**
 - **Recurrent – Every 5 years**

 - **Historically altitude chamber-based**
 - **Aircrew grouped based on common weapon system**
 - **TTB – Tanker, Transport, Bomber**
 - **TARF – Trainer, Attack, Reconnaissance, Fighter**
 - **HELO – Helicopter Aircrew**
 - **HAP – High Altitude Parachutists – Special Ops, PJs**

 - **Human Performance academics with hypoxia in chamber**
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Hypobaric Chamber Locations





Aircrew Physiological Training

- **Course groupings not a best fit for everyone**
 - **C-130 loadmaster in same class as a B-52 pilot**
 - **RC-135 Linguist in same class as KC-135 boom**
 - **F-16 pilot in same class as T-6 IP**
 - **Oxygen panel used in chamber not used in some platforms – B-1, B-2, F-22A, F-35**
 - **Risk of Decompression Sickness and Ear/Sinus Blocks**
 - **Costs associated with TDY and man-days for travel to nearest chamber**
 - **Overall loss of realism with chamber-based symptoms vs operational effects of hypoxia**
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Real-world Application?





ROBD

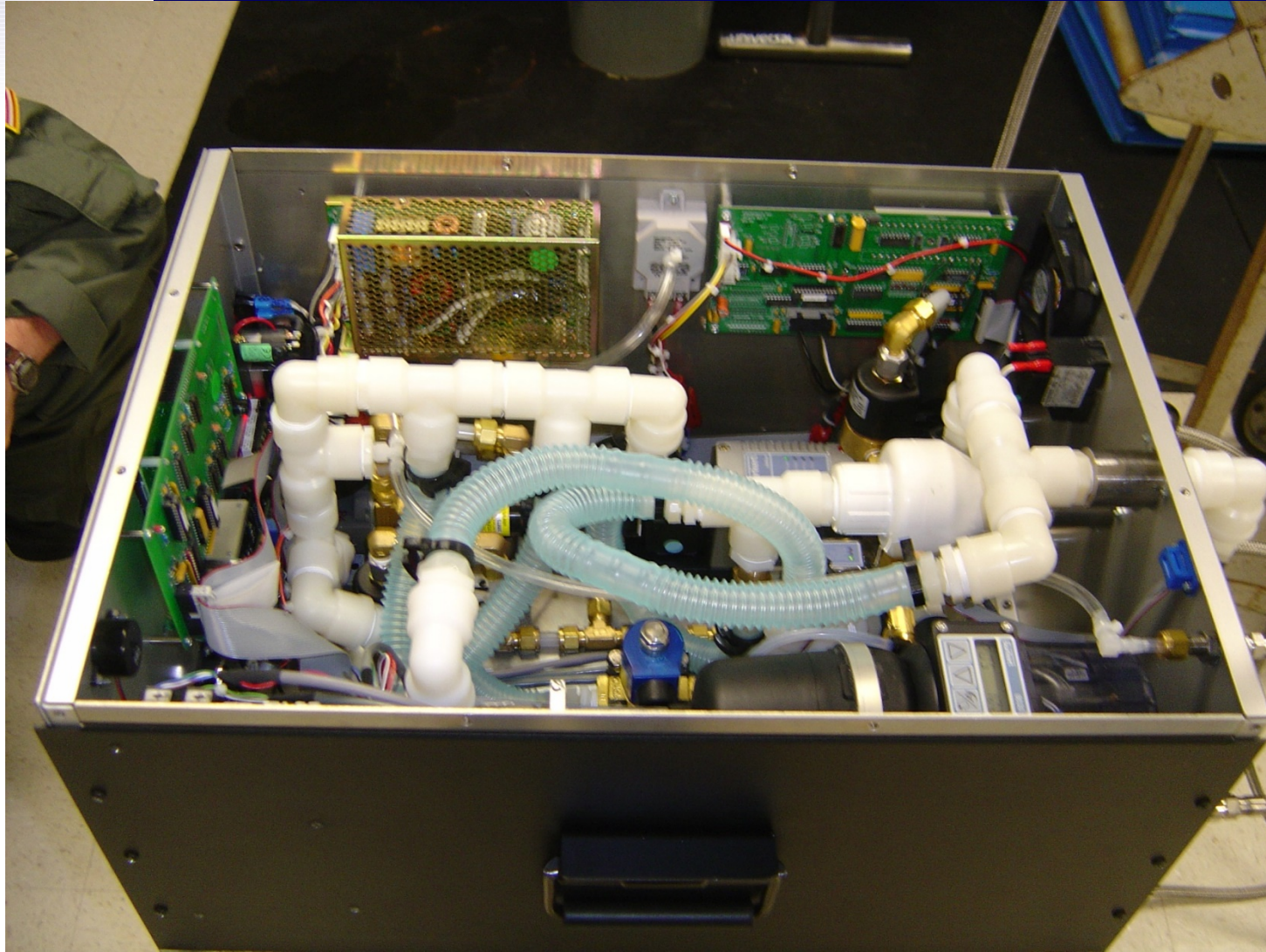




- **Hypoxia created by mixing less air with nitrogen**
 - **Decreased percentage of oxygen in mixture vs less pressure**
 - **Recovery via 100% oxygen at Emergency pressure**
 - **Components**
 - **Mixer, mass flow controllers, O₂ sensor**
 - **High pressure cylinders (3)**
 - **Pressure reduction regulators with hoses**
 - **Fitting for aircrew mask**
 - **Cost approx \$30K/unit**
 - **Annual sustainment: Gas supply, unit calibration, HFT operation**
 - **Based on environmental monitoring technology**
 - **Mass flow controllers sensitive to .0001 for gas content mixture**
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ROBD Internals





ROBD Approval

- **1999 through 2001 proof of concept**
 - **Met stringent requirements for human use**
 - **Unanimous approval during tests with F-16 pilots**
 - **USN development via CRADA with contractor**
 - **2003 brief to ACC/A3 for use in fighter sims**
 - **Approved for 15 month requirement; bombers added**
 - **AF/A3O approved**
 - **Since, added to >30 bases**

 - **Deussing, E. C., Artino, A. R., & Folga, R. V. (2011). In-flight hypoxia events in tactical jet aviation: characteristics compared to normobaric training. *Aviation, space, and environmental medicine*, 82(8), 775-781.**
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ROBD Operations

- Training system-based hypoxia recognition and recovery
- Improves realism of hypoxia experience
 - Conducted while performing mission tasks
 - Operational symptoms – effect on flight tasks, SA and CRM
 - Corrective procedures with appropriate oxygen system panel
- Reduces cost to wings for TDY/Man-days
 - Same 5-yr frequency as chamber-based training
 - Maintain 5 year requirement for physiological training





ROBD Advantages

- **No threat of DCS/AGE**
 - **Less response from Flight Medicine**
 - **No more decompression sickness or ear/sinus blocks**
 - **No restriction to flight ops post hypoxia**
 - **No 30-minute 100% O₂ pre-breathe time**
 - **Less manning required**
 - **Inside observers**
 - **Cost of maintenance**
 - **Less space than chamber**
 - **HFT (flight simulator) complement offers more realistic scenario**
 - **Can change airframe platform based on software**
 - **Gradual change in O₂ delivery mimics slow decompression**
 - **Constant monitoring with pulse oximetry**
 - **65% SpO₂ level**
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ROBD Drawbacks

- **No objective sign recognition (temperature, condensation, pressure demonstrators, cyanosis)**
- **Extended hours for large classes (15-20 minute/student)**





Challenges

- Which training system is best for training objective
 - Helmet/Mask required
 - Physiology teams access to simulator/facility
 - Add to secure locations/WTT
 - Non-read in students cannot access
 - High pressure bottle storage – HAZMAT approval
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Questions?

