Naval Sea Systems Command

NAVSEA PANAMA CITY Coastal Systems Station

*The leader in littoral warfare*

# Basic Operation of the Open-Circuit Self-Contained Breathing Apparatus (SCBA)

**SCOTT Air-Pack 4.5**

# SCBA Issues

- SCBA Upgrades, Changes and Options
- Technical and Operational Information
- Carbon Fiber vs. Fiberglass
- Flash Hood Interface

# SCBA Upgrades, Changes and Options

- Cricket Alarm
- Exhalation Valve
- 4 Strap Head Harness
- Black Harness Material
- Spectacle Kit
- Carbon Fiber Cylinder

## OBA Con

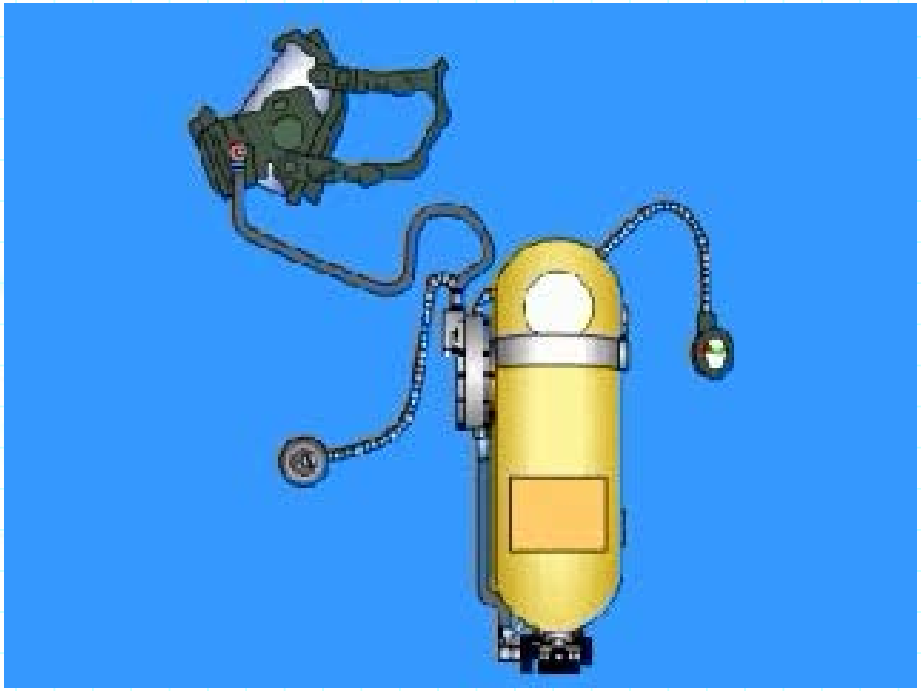
- Chemical canister stowage/cost/disposal
- Nearly 100% O2 delivered to face piece
- No positive pressure
- Deflation of breathing bag

## SCBA Pro

- Positive pressure maintained
- NIOSH and NFPA approved as required by OPNAV
- Compatible with equipment used by most contemporary FF orgs
- In conjunction with BACS, can recharge in **60 sec while user is still breathing on system**

- SCBA: cylinder-fed, open circuit, provides breathable **air** to fire fighter
- Replacement for A-4 OBA

# Principles of Operation



# SCBA Components and Component Parts

# Air Cylinder and Valve Assembly

Cylinder

- Holds 4500 psi compressed air
- Fully wrapped composite construction
- Breathing quality air (Grade D) **not oxygen**
- Only durations of 30 and 45 minutes are used by Navy
- Stored in lockers throughout ship on SCBA backpack and as spares
- **15 year service life, requires hydrostatic testing every 3 years**
- Label contains manufacturer's name, date of manufacture, hydrostatic test information and DOT exemption number


SCOTT
45 MINUTE
TC-3FCM-310 BAR
DOT-E 7277-4500
ALT 708- 752
1272107
12 98
59943
14.9
438 MIN
7500

# Air Cylinder and Valve Assembly (Cont'd.)

## DOT Exemptions:

| | Fiberglass | Carbon Fiber |
|---|---|---|
| Luxfer | E9634 | E10915 |
| SCI | E7277 | E10945 |

# Air Cylinder and Valve Assembly (Cont'd.)

Valve

- Located at neck of cylinder
- Open and back off ¼ turn
- Connection: CGA-347 (standard for breathing air in the pressure range of 3000-5000 psi)
- Burst disc: actuates when pressure inside air cylinder reaches about 7200 psi

# Air Cylinder and Valve Assembly (Cont'd.)

Pressure Indicator

- Located on valve assembly at neck of cylinder
- Provides continuous indication of air cylinder pressure
- Does not require calibration (shall *not* have “No Cal Required” sticker)

# Air Cylinder and Valve Assembly (Cont'd.)

Cylinder Hang Plate

- Located on valve assembly at neck of cylinder
- Provides mechanism for securing air cylinder to SCBA backpack

# Backpack and Harness Assembly

Backpack

- Corrosion resistant wire frame and cylinder hook (mates to cylinder hang plate)

# Backpack and Harness Assembly (Cont'd.)

Cylinder Band and Latch Assembly

- Adjustable band and latch that secures air cylinder to backpack
- Fine adjustment can be made using vernier adjustment *while toggle lever is open* (proper adjustment = not able to turn with finger pressure when latched)

# Backpack and Harness Assembly (Cont'd.)

Harness Assembly

- Consists of two adjustable shoulder straps and an adjustable waist strap with pads
- Waist belt has quick-release buckle and adjusters and houses holder for second stage regulator
- Shoulder straps have pull up, push-to-release adjusters for quick adjustment
- Flame and heat resistant Kevlar

# Backpack and Harness Assembly (Cont'd.)

Remote Pressure Indicator

- Located in front on right side shoulder strap
- When air cylinder valve is open, provides continuous remote indication of air cylinder pressure
- Face is fully luminescent
- Does not require calibration (shall *not* have “ No cal Required” sticker)

# Backpack and Harness Assembly (Cont'd.)

Bell Alarm (Cricket Alarm)

- Located in front on left side shoulder strap
- When air cylinder pressure is at 23-27% of capacity, will provide a steady dinging sound to audibly alert the user of the situation

# Backpack and Harness Assembly (Cont'd.)

High Pressure Hose

- Located between cylinder valve and First-Stage regulator (“pressure reducer”)
- Delivers air at cylinder pressure to the First-Stage regulator
- Hose is attached to air cylinder valve by the coupling nut. The high pressure seal is made by the coupling nut o-ring. ***Before disconnecting the coupling nut, ensure all air is bled from the high pressure hose. Air left in the hose may cause the o-ring to dislodge, resulting in inability to make a seal.***

# First-Stage Regulator (Pressure Reducer)

# First-Stage Regulator (Pressure Reducer) (Cont'd.)

First-Stage Regulator

- Mounted to the left of the air cylinder
- Reduces cylinder pressure to about 100 psi
- Uses a redundant dual path reducing system; secondary path automatically supplies air if primary path fails

# First-Stage Regulator (Pressure Reducer) (Cont'd.)

Pressure Relief Valve

- Located on the side of the First-Stage regulator
- Reseatable relief valve; actuates above 185 psi

# First-Stage Regulator (Pressure Reducer) (Cont'd.)

Quick Charge Assembly

- Located adjacent to the waist strap on the left side of the wearer
- Air cylinder refillable without removing the air cylinder and while continuing to breathe on the SCBA

# Second-Stage Regulator (EZ-Flow Regulator)

Low Pressure Hose

- Located between pressure reducer and second stage regulator
- Provides pressure of ~100 psig to second stage regulator

# Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

Regulator

- Located at the end of the low pressure hose and connects to the face piece
- Demand regulator maintains a positive pressure in the face piece at all times
- If face piece or seal is broken, air will flow freely from regulator

# Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

Purge Valve

- Red knob located on the left side of regulator (as viewed when wearing)
- Purge valve manually overrides the Second-Stage regulator
- Provides a constant flow of air to the face piece
- ***Used for emergencies only; exit space immediately if breathing with purge valve***
- Can also be used to clear fogging in face piece
- Rotate handle ccw (away from wearer) to open

# Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

Air Saver Switch

- Black button on top of regulator
- Stops air flow from the Second-Stage regulator
- Press and release to actuate
- Inhale sharply to disengage

# Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

Removal Lever

- Black tab on right side of regulator
- Used to“unlock” Second-Stage regulator from face piece in order to remove it
- To use, push tab away face and hold while turning

# Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

"Vibralert" Alarm Assembly

- Housed within the Second-Stage regulator
- Alarm will sound when 20-25% of cylinder air remains
- Alarm will also activate to indicate a problem in the First-Stage regulator

# Face Piece

# Face Piece

Face Seal

- Available in three sizes: small (green), large (black), and Xlarge (red)
- Made of a blend of natural and synthetic rubber

# Face Piece (Cont'd.)

Lens

- Single, replaceable, wide angle, clear lens
- Made of polycarbonate with a silicone-based coating to resist abrasion and chemical attack

# Face Piece (Cont'd.)

Head Harness

- Connected to the face piece by quick adjusting buckles and snap retainers
- Made of synthetic rubber

# Face Piece (Cont'd.)

Voice Amplifier

- Located in a mounting bracket over the right side voicemitter
- Powered by one 9-volt battery

# SCBA Donning Procedure

# SCBA Donning Procedure (Cont'd.)

- Inspect SCBA: quick visual inspection for any obvious damage that would preclude safe and proper use of the SCBA

# SCBA Donning Procedure (Cont'd.)

| | |
|---|---|
| Inspect Face piece: | rubber deterioration, cracks, tears, holes, tackiness |
| Inspect Head Harness: | breaks; missing straps; loss of elasticity; buckles |
| deformed, or missing; | corroded, damaged strap serrations worn |
| Inspect Lens: | cracks, scratches, loss of tightness to face piece, regulator inlet coupling deformed or damaged |

# SCBA Donning Procedure (Cont'd.)

Inspect Backpack: cuts, tears, abrasions, signs of chemical or heat damage, inoperative buckles, damage to wire frame

# SCBA Donning Procedure (Cont'd.)

| | |
|---|---|
| Inspect Cylinder: | minimum pressure allowed is 4000 psi; check cylinder for charring, dents, gouges or cuts that may have penetrated fiberglass or carbon fiber |

# SCBA Donning Procedure (Cont'd.)

Inspect Hoses: cuts, cracks, abrasions, bulges, wrinkles, loose or inoperative connections

# SCBA Donning Procedure (Cont'd.)

EZ-Flow Regulator

- Check casing for damage, dirt or debris
- Actuate purge valve, air saver switch and removal lever
- Check sealing gasket

# SCBA Donning Procedure (Cont'd.)

Don SCBA (coat method or over-the head)

- Most of the weight (85%) should be carried on the waist/hips
- Check all straps for correct adjustment

# SCBA Donning Procedure (Cont'd.)

Don Face Piece

- Spread face piece straps from inside with thumbs
- Place chin in chin cup
- Pull harness over head and smooth straps
- Ensure all hair is away from seal
- Tighten neck straps first, then temple straps

# SCBA Donning Procedure (Cont'd.)

Perform Negative Pressure Check

- Place hand over face piece opening for second stage regulator
- Inhale and hold your breath
- Listen/feel for inward air leakage
- Adjust face piece as needed until seal is maintained

# SCBA Donning Procedure (Cont'd.)

Open Air Cylinder Valve

- First depress air saver switch
- Ensure purge valve is closed,
- Open cylinder valve, close ¼ turn, and listen for Vibralert to sound during initial equalization *(the bell alarm may or may not sound at this time)*

# SCBA Donning Procedure (Cont'd.)

To Begin Operation (“go on air”)

- Attach Second-Stage regulator to face piece lock in place
- Inhale sharply to begin flow of air
- Breathe with purge valve open to experience breathing in free flowing air
- Close the purge valve, press air saver switch and disconnect regulator from face piece
- *Wait to engage the air saver switch until just prior to pulling the regulator away from the mask*

# Breathing Air Replenishment

# Breathing Air Replenishment

Air Cylinder Change-out

- Assume leaning rest position
- Assistant closes air cylinder valve
- Wearer bleeds system through purge valve and stows regulator in waist clip
- Assistant disconnects air cylinder coupling nut, unsnaps toggle latch & lever and locking tab and removes cylinder **(Grasp cylinder valve securely while doing this!!!)**

# Breathing Air Replenishment (Cont'd.)

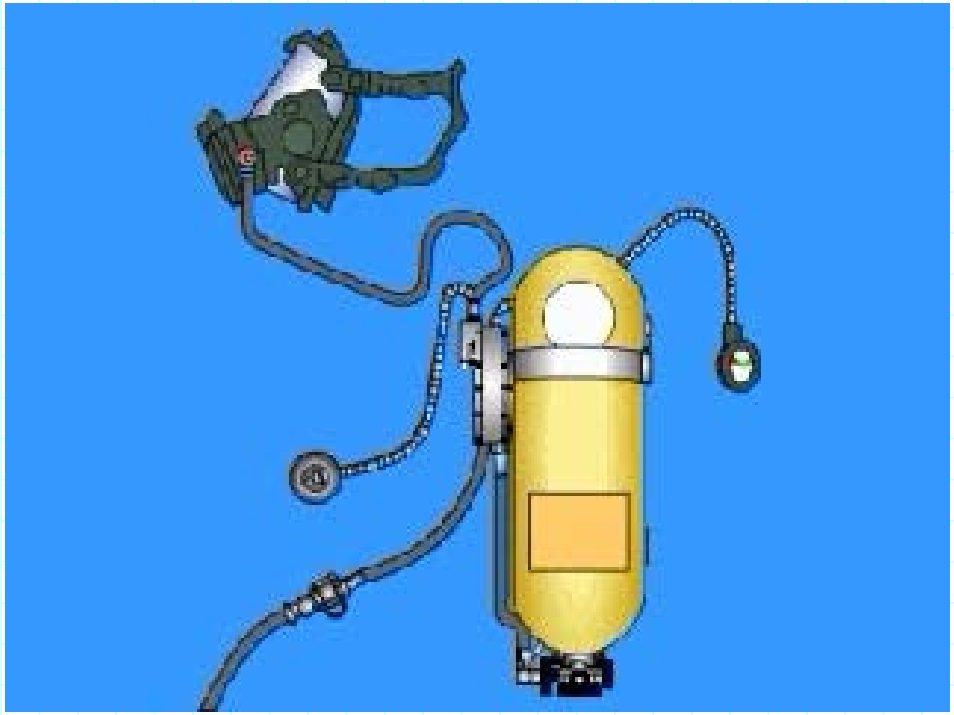
Air Cylinder Change-out (Cont'd.)

- Assistant obtains full cylinder and announces cylinder pressure to wearer
- Assistant replaces full cylinder on backpack **making sure it is secure**
- The cylinder may easily be installed by running the cylinder *up* through the bottom of the cylinder band
- Check coupling nut o-ring
- Attach hose
- Open air cylinder valve (back ¼ turn)
- Check for leaks
- Verify air pressure on remote indicator

# Breathing Air Replenishment (Cont'd.)

Quick Charge

- BACS operator will:
  - * inspect cylinder and backpack
  - * remove dust cap from quick charge couplings and inspect couplings for dirt or damage
  - * grasp hose below coupling and push couplings together until QDs click
- Air flow starts automatically; monitor pressure increase on remote gauge
- Air flow stops automatically when cylinder is full



# Breathing Air Replenishment (Cont'd.)

Quick Charge

- BACS operator will:
  - disengage quick charge coupling
  - reinstall dust caps on both couplings
  - ensure quick charge hose is attached firmly to harness before dismissing SCBA wearer

# SCBA Doffing Procedure

- Ensure purge valve is closed, press air saver switch
- Disconnect regulator from face piece
- Close air cylinder valve
- Bleed air from system through purge valve and stow Regulator in waist clip
- Doff SCBA using coat method **(Do not hold by the hoses)**
- Perform MRC R-1 and R-2 after each use (R-1 refers to M-1 which is in-depth inspection of unit. Read/perform M-1 with students.)

# SCBA Doffing Procedure (Cont'd.)

- Mix 2 tablespoons of Wescodyne G in a pail containing 1.5 gallons of water not to exceed temperature of 110°F
- Prepare two more buckets containing 2 gallons of fresh water each. Temperature should not exceed 110°F
- Agitate each face piece for 15 seconds with a total immersion time of 2 minutes in the bucket containing Wescodyne
- Agitate each face piece for 15 seconds in each of the buckets containing the fresh water rinse