

Surface Supplied Air Diving

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South Carolina
Aquarium

South Carolina Aquarium Dive Operations

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It is the mission of the South Carolina Aquarium (SCA) Dive Team to provide excellence in animal care and husbandry, to actively support both the educational and conservation endeavors of the SCA, and to provide a memorable, positive guest experience to all those who visit our facility.

Prerequisite and Schedule

- Prerequisites
 - > **Reserve Air Supply Systems**
 - > **Guardian FFM**
- Power Point and Quiz
- 1 Topside Tending Evaluation by DSO
- 1 Dive
 - > **Guardian FFM removal**
 - > **Reserve Air Supply System Ascent**
- 1 Emergency Response – Rescue Cinch Use
- Emergency procedures
 - > **Cinch Collar**
 - > **Spine Board**

Why Surface Supplied Air?

- Surface Supplied Air diving is the typical diving method used in all exhibits except for the GOT
- Due to small spaces, delicate acrylic, and rockwork, it is best to minimize equipment on the diver

Exhibits Dove on Surface Supply

- Carolina Seas
- Rocky Reef
- Ocean Floor Transect
 - > **Snapper Banks**
 - > **Blackfish Banks**
- Sea Turtle Exhibit
- Salt Marsh
- Shark Shallows

Carolina Seas

Exhibit Specifications

- 14' deep exhibit
- 14,000 gallons saltwater
- Temperature 76°-79°F

Approved Dive Ops

- Aquarium Care and Husbandry
- Staff Training and Emergency Drills
- Event Dives

NAVY No Decompression Limits - UNLIMITED

Carolina Seas cont.

- Clean acrylic first and then the rockwork
- Watch kicking too much (really shouldn't have to kick at all) because of pieces getting broken off.
- Do not touch light fixtures!
- **Exhibit Hazards:** Overhead Crossbar and Dive Platform

Rocky Reef

Exhibit Specifications

- 5' deep exhibit
- 4,000 gallons saltwater
- Temperature 76°-79°F

Approved Dive Ops

- Aquarium Care and Husbandry
- Staff Training and Emergency Drills
- Event Dives

Navy No Decompression Limits - UNLIMITED

Rocky Reef cont.

- Enter exhibit from top middle
 - > Rockwork is set up like steps
- Smooth Gravel on bottom of exhibit at the end of the dive
- Lionfish, scorpionfish, and eels may be in the exhibit -be careful around them
- **Exhibit Hazards:** Tank Crossbars
 - > Do not go behind the rockwork on the left side

Ocean Floor Transect

(Snapper Banks/Blackfish Banks)

Exhibit Specifications

- 5' deep exhibit
- 11,000 gallons saltwater
- Temperature 76°-79°F

Approved Dive Ops

- Aquarium Care and Husbandry
- Staff Training and Emergency Drills
- Event Dives

Navy No Decompression Limits - UNLIMITED

Ocean Floor Transect

Snapper Banks

- Rockwork in center is natural stairs
- Careful not to corner the fish
- Smooth Gravel at end of the dive
- Lionfish, scorpionfish, and eels may be in the exhibit - be careful around them
- **Exhibit Hazards:** Overhead crossbars

Blackfish Banks

- Enter in center of exhibit where there is no rockwork
- Smooth Gravel at end of the dive
- Lionfish, scorpionfish, and eels may be in the exhibit - be careful around them
- **Exhibit Hazards:** Overhead crossbars

Sea Turtle Exhibit

Exhibit Specifications

- 8' deep exhibit
- 4,000 gallons saltwater
- Temperature 76°-79°F

Approved Dive Ops

- Aquarium Care and Husbandry
- Staff Training and Emergency Drills
- Event Dives

Navy No Decompression Limits - UNLIMITED

Sea Turtle Exhibit cont.

- Diver should always enter/exit the tank from the feeding platform near Jellies Exhibit
- Careful not to scare fish when getting in and out of exhibit i.e. mahi mahi or needlefish
- Possible Dangers:
 - > **Scorpionfish**
 - > **Lionfish**
 - > **Turtles (Can be removed if too interactive)**
- Look for loose rockwork and remove as needed

Saltmarsh

Exhibit Specifications

- 3' deep exhibit
- 18,000 gallons saltwater
- Temperature 73°-79°F

Approved Dive Ops

- Aquarium Care and Husbandry
- Staff Training and Emergency Drills
- Event Dives

Navy No Decompression Limits - UNLIMITED

Saltmarsh

- Enter carefully over acrylic
- Blue Crabs may bite
- Stingrays may have barbs
- Acrylic cleaning and walls of stingray pool only
- Don't clean rockwork

Shark Shallows

Exhibit Specifications

- 6' deep exhibit
- 20,000 gallons saltwater
- Temperature 76°-80°F

Approved Dive Ops

- Aquarium Care and Husbandry
- Staff Training and Emergency Drills
- Event Dives

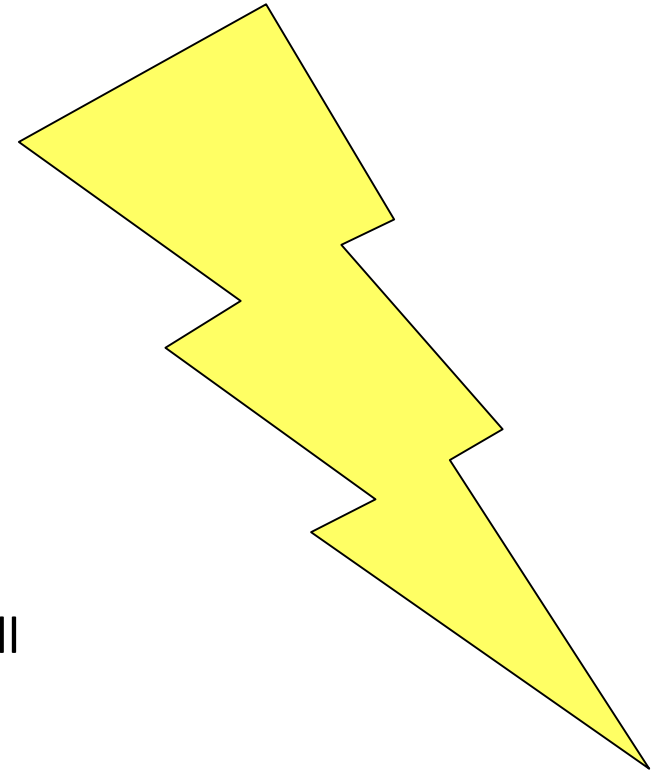
Navy No Decompression Limits - UNLIMITED

Shark Shallows

- Enter carefully over walls on public side
- Stingrays may have barbs
- 1-2 Divers take 6ft deep end
- Remaining Diver(s) take rocks & walls
- Dive Team should stay on one end of the tank & shift as a unit to the opposite end when ready
- Be very wary of crisscrossing umbilicals, which can trap an animal
- Check your blindspots often as it's easy to box in and overstress a shark

Thunder Warning

- For outdoor exhibits, all diving must stop in the presences of thunder or lightening
- This is regardless of cloud position & wind direction
 - Exhibits include:**
 - > **Shark Shallows**
 - > **Salt Marsh**
- Indoor Exhibits are grounded and diving can still be conducted during thunder/lightening



Surface Supplied Staffing

- Surface Supplied Diving requires minimum Team of 4
- **1 Diver in Exhibit**
 - > DPIC - (paid Dive Staff; *topside role in building*)
 - > Standby Diver - (spare gear setup; *topside role at site*)
 - > Tender - (feeds Comm Line & Monitors Air; *topside role at site*)
 - > Solo Diver - (FFM w/ Comms; *in-water*)
- **2–4 Divers in Exhibit**
 - > DPIC - (paid Dive Staff; *topside role in building*)
 - > Tender - (feeds Comm Line & Monitors Air; *topside role at site*)
 - > 2-4 Divers - (FFM w/ Comms; *in-water*)

Surface Supply Carts

- There are 2 Carts for Surface Supply Dive Operations
 - > Air Cart
 - > Gear Cart



Air Cart



- The Air Cart combines 2 cylinders into a single air source, utilizing a high pressure manifold system
 - > Up to 4 Divers can be supported off this manifold
- There is also a battery operated Communication Box
- The Dive Log & Emergency Check Sheet clipboard is usually clipped to the Air Cart

Gear Cart

- The Gear Cart holds Emergency O2 & Birex
- There are 3 webbing straps to help transport the Diver Umbilicals from Compressor Room to Exhibit
- Guardian FFM's & Spare Airs can go either on the Gear Cart or Air Cart for transport



Diver Responsibilities

- Assist in bringing a cart to Exhibit
- Load Weight Harness
- Ensure Spare Air is above 2500psi
- Attach Spare Air to Harness
- Function Test all Equipment
- Ensure Emergency Checklist is complete by Tender before entering exhibit
- Assist in returning a cart back to Compressor Room

Standby Diver Responsibilities

- Assist in bringing a cart to Exhibit
- Enter Exhibit in response to In-water Emergency
- A redundant setup should be set such that the Standby Diver only has to Don Weight Harness & FFM before entering tank:
 - > Weight Harness Loaded
 - > Umbilical attached
 - > Air & Comms On
 - > Full Unit Staged near Entry-Way
- Function Test all Equipment
- Assist in returning a cart back to Compressor Room

Tender Responsibilities

- Bring a cart to Exhibit
- Emergency check sheet completion
- Paper dive log completion
- Cart Assembly
- Function Test Comms (Diver-Diver & Tender-Divers)
- Monitor intermediate pressure (145-155 psi)
- Monitor cylinder pressure (>500psi)
- Monitor divers
- Alert security when dive is completed
- Cart breakdown
- Return a cart back to Compressor Room

Gear Needed From Compressor Room

- **Radio** (*near Dive Locker*)

- **Keys** (*near Dive Locker*)

- Air Cart

- Gear Cart

Check for presence of:

- > Emergency O2
- > Birex

- Umbilicals

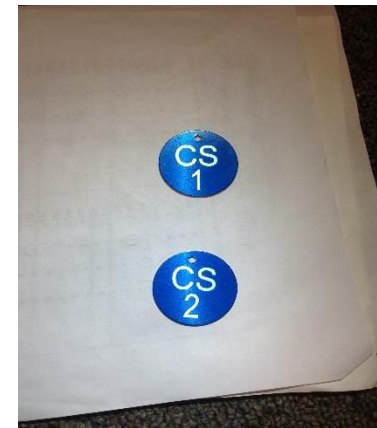
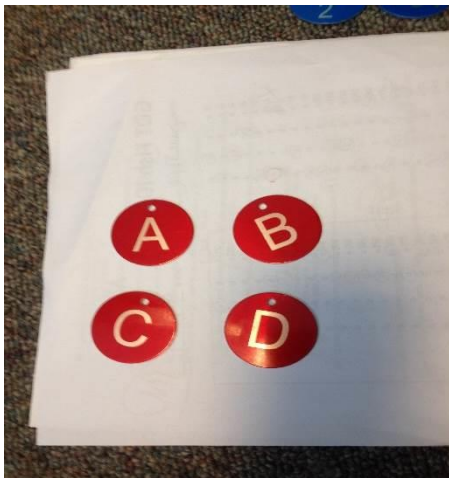
- Guardian FFMs

- Spare Airs



Choosing an Umbilical

- 5 Umbilical's dedicated for general use
- These will have round red tags and be coded A/B/C/D/E
- 2 Umbilical's dedicated for use in Carolina Seas
- These will have round blue tags and be coded CS1/CS2



Choosing a Guardian FFM

Numbers 1–5 FFM's dedicated for general use

- 2 “CS” FFM's dedicated for use in Carolina Seas



Choosing a Spare Air

- 6 Spare Air's dedicated for general use
- Cylinder & Holster are labeled with numbers **3-8**
- 2 Spare Air's dedicated for use in Carolina Seas
- Holsters are marked with Blue Stripes
- Cylinder & Holster are labeled with **CS 1 & CS2**



Transporting to Exhibit

- *Check Tank Pressure before leaving 3rd Floor*
- Be loud & attentive in public areas
 - > “Excuse me! Right behind you!”
 - > “Come see us dive in 15 mins at *[exhibit]*”
- **Go SLOW**
 - > Go Single File
 - > These carts are heavy and don’t stop quickly
 - > Be mindful of kids darting in front of you
 - > Be mindful of the Diver’s heels, whose wheeling the front cart
 - > Stay at least 10 ft apart; it’s like driving a car.

Pre-Dive

- Fill Out Emergency Check Sheet before Cart Setup
 - > Notify Security (All exhibits)
 - *Check Dive Alarms (Carolina Seas)*
 - > Must have radio available (All exhibits)
 - > Confirm Emergency Oxygen Kit is present
 - > Backboards available at all exhibits
 - > Confirm First Aid Kit is present (All exhibits)
 - > Cinch Collar for extractions (Carolina Seas)
- Fill out Dive Log
- Begin Cart Setup Last

Emergency Check Sheet

**Ensure that you visually locate each item on the Checklist.*

DATE	Exhibit	Tender	Security	Alarms	1st Aid	Radio	Cinch	Spineboard	Oxygen

Dive Log

Date	Diver 1 / (Surface Int)	Diver 2 / (Surface Int)	Diver 3 / (Surface Int)	Time In	Time Out	Bottom Time	PSI In	PSI Out	Standby	Tender	Table/ computer	Task	Exhibit	DPIC
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Safety Notification

- In Carolina Seas check alarms with Security (Channel 1) as you are getting in the exhibit and let them know when you are out of the water.
- In all other exhibits that we use Surface Supply, we still call Security (Channel 1) and let them know when we are getting in and out of the water.

Emergency Skills

- Reserve Air Supply System Use
- Emergency Ascent
 - > **Carolina Seas and Sea Turtle Exhibit are too deep to stand up and be out of the water**
 - > **Be aware of overhead hazards in Carolina Seas! (Dive platform and support bar)**
- Diver Extraction
 - > **Cinch Collar in Carolina Seas**
 - > **Spine Board available at all exhibits**

Cart Setup Procedures Outline

1. Connect Yoke-Whips to Cylinders
2. Connect Umbilical to Cart
3. Secure Umbilical to Cart
4. Connect Umbilical to Communications Box
5. Connect Guardian Mask to Umbilical
6. Power On Communications Box
7. Slowly Pressurize & Check all Gauges
8. Divers Equip Mask & Secure Umbilical
9. Function Test Air & Communications

Connect Whips to Cylinders

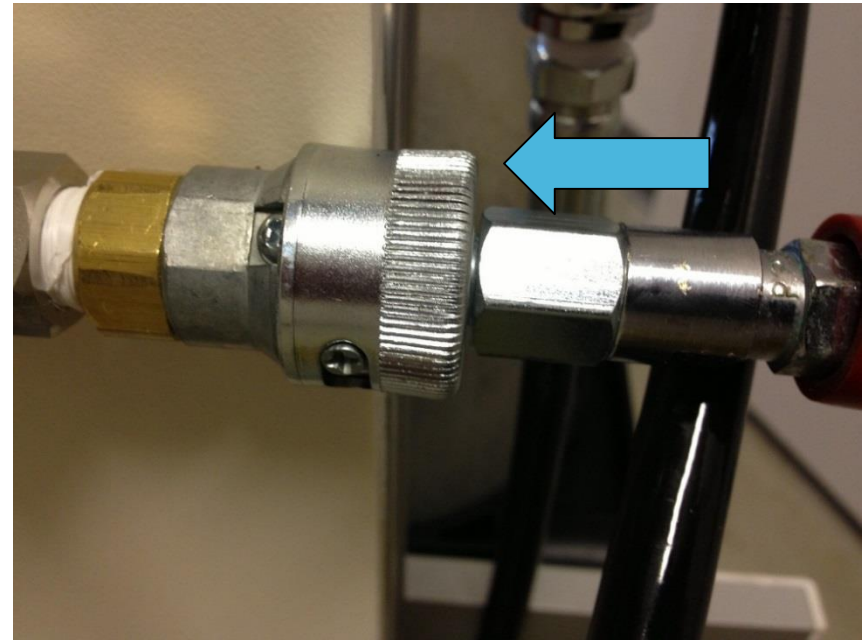


- Air Cart is designed to hold two cylinders
- Connect whips to cylinders
- Close Bleeder valves on whip
 - > *Do not pressurize yet!*

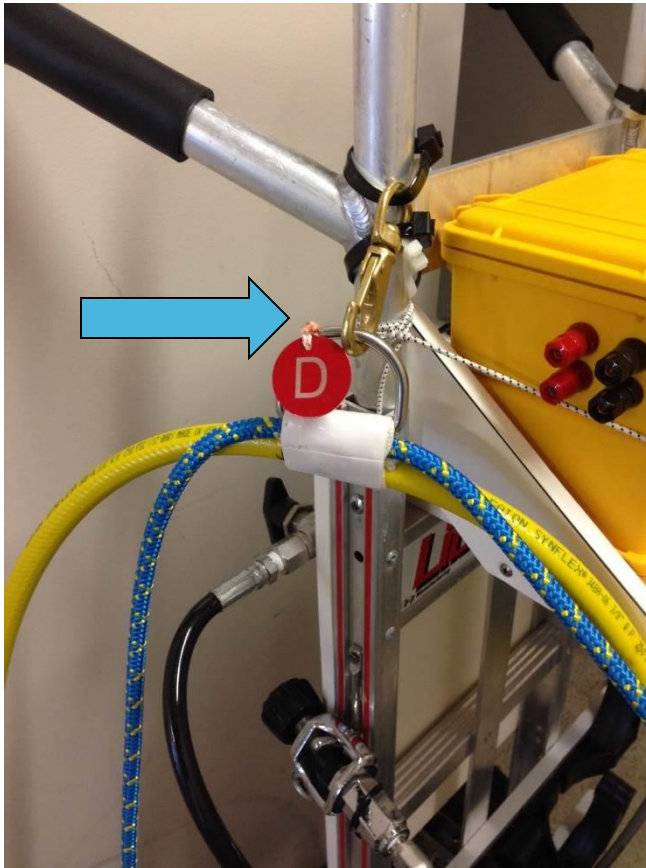
Connect: Umbilical to Cart

Connect Regulator hoses to quick connect

- To release you must rotate the female connection (see arrow)



Secure: Umbilical to Cart



- The umbilical needs to be clipped to the cart to eliminate tension when the diver stretches the umbilical

Connect: Umbilical to Communications box

Banana plugs are color coordinated

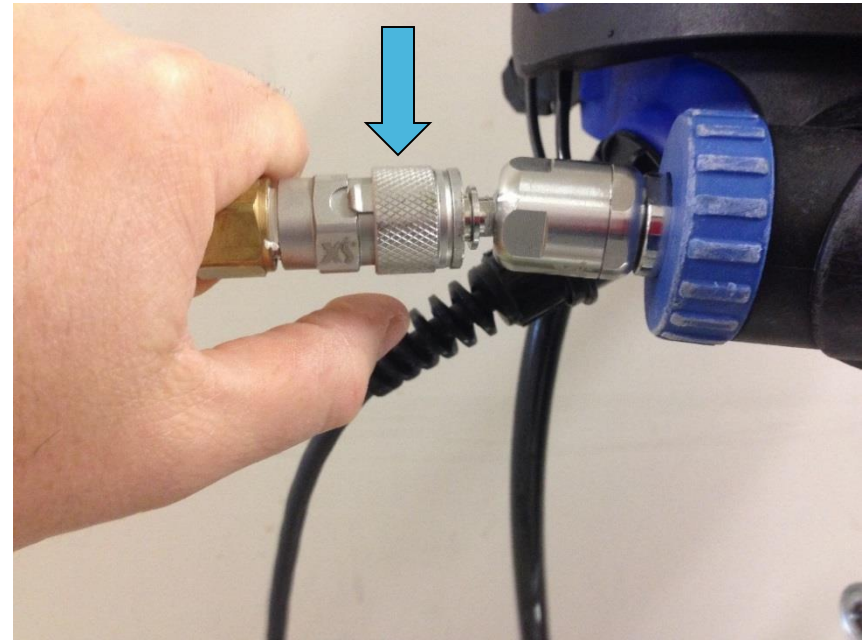
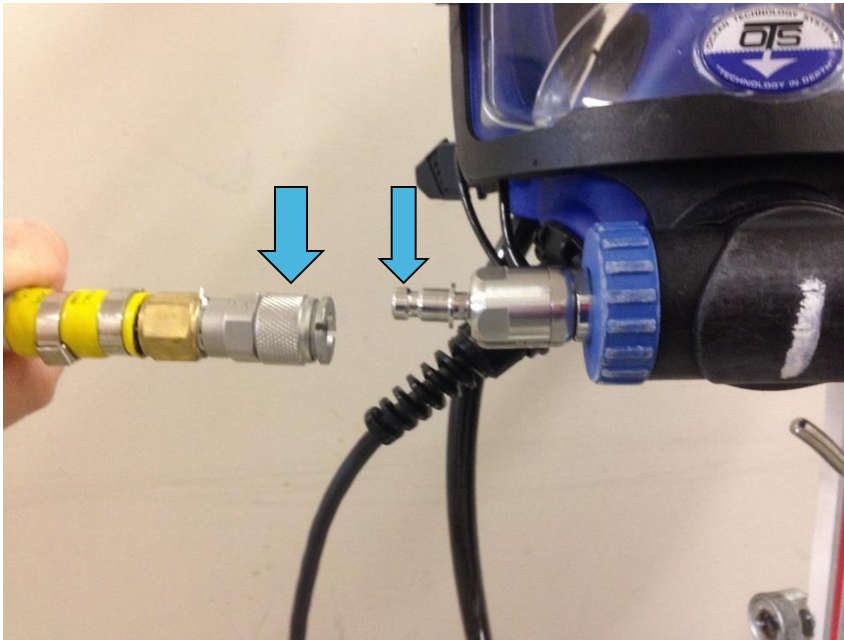
- The second diver is plugged into the back of the first set of plugs.
 - > *Note plugs don't fully insert*



Umbilical air connected to mask

Quick Connects should push together easily

- There is a locking mechanism that needs to be rotated into place



Umbilical communications connected to mask



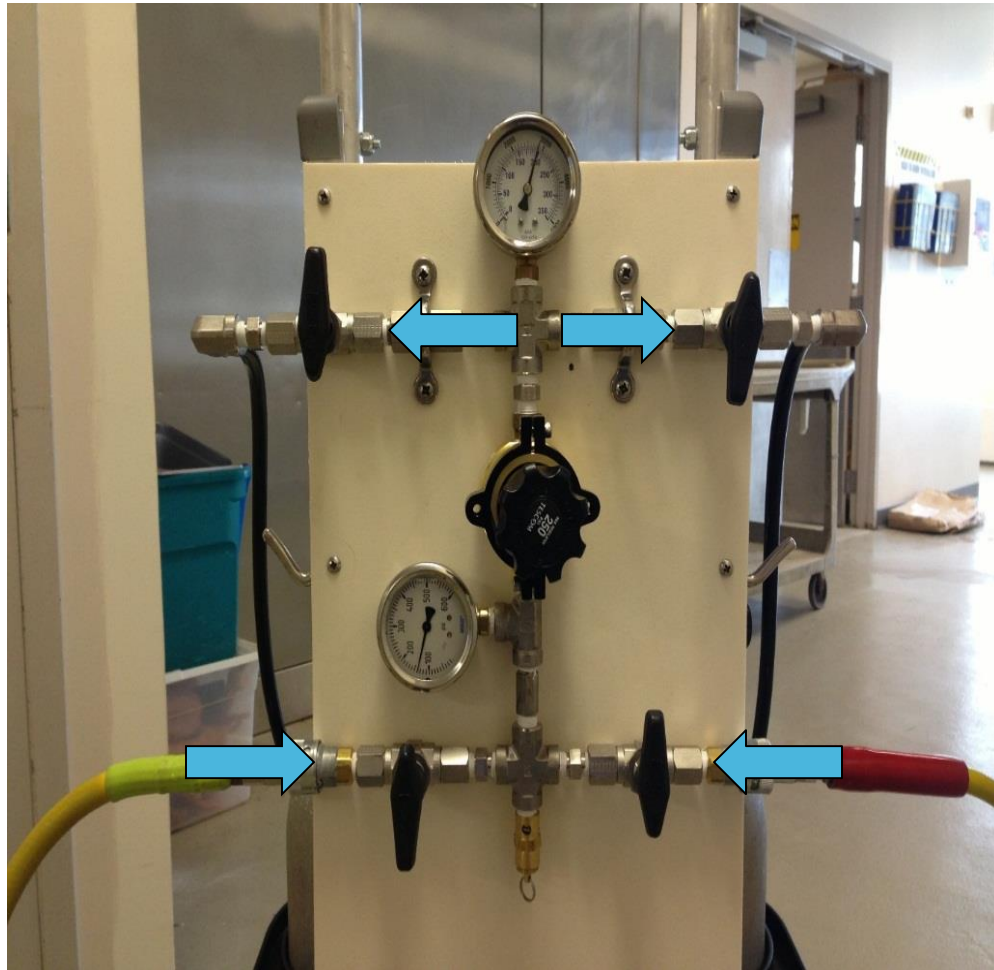
- Guardian FFM's use hardwire comms.
- The Hi-Use connection on the umbilical attaches to the Hi-Use connection on the mask

Communication Box on Cart



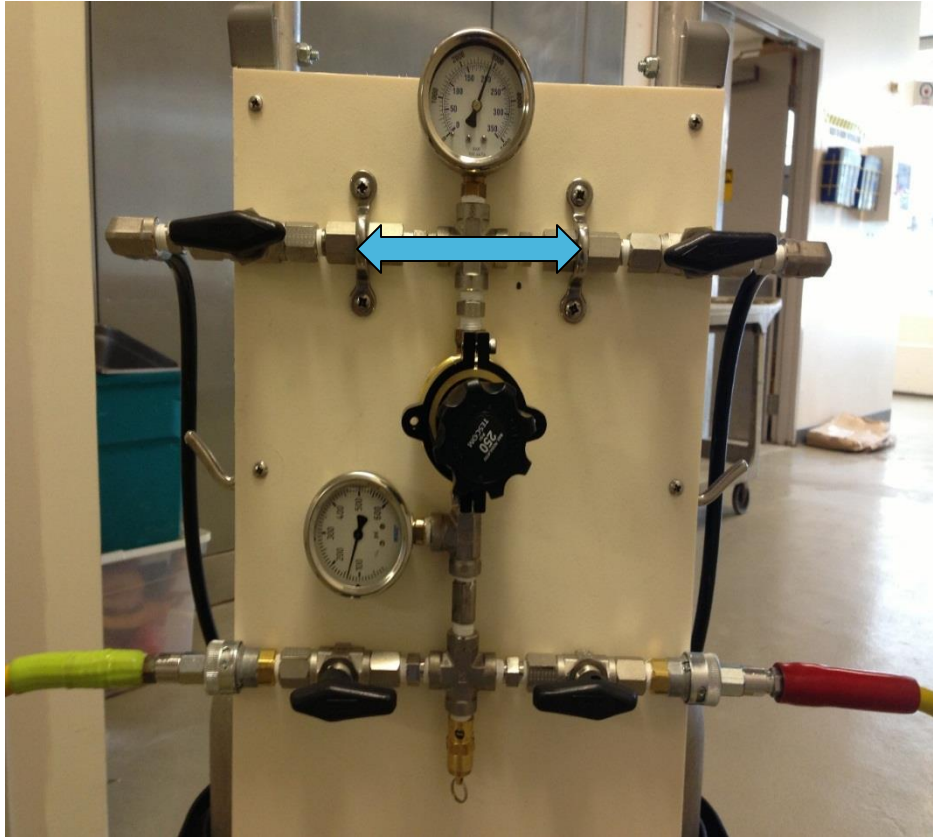
- Turn Power ON
 - > Note steady Green Light is on in Lower Left Corner.
- Turn Speaker ON
- Volume to diver and tender can be controlled
 - > **Warning: Diver to Tender Volume also controls Diver to Diver; Don't adjust past ½'s of full volume without checking in**
- To speak to the diver the yellow "Push to Talk" button must be pressed and held during transmission

Pressurize the Cart



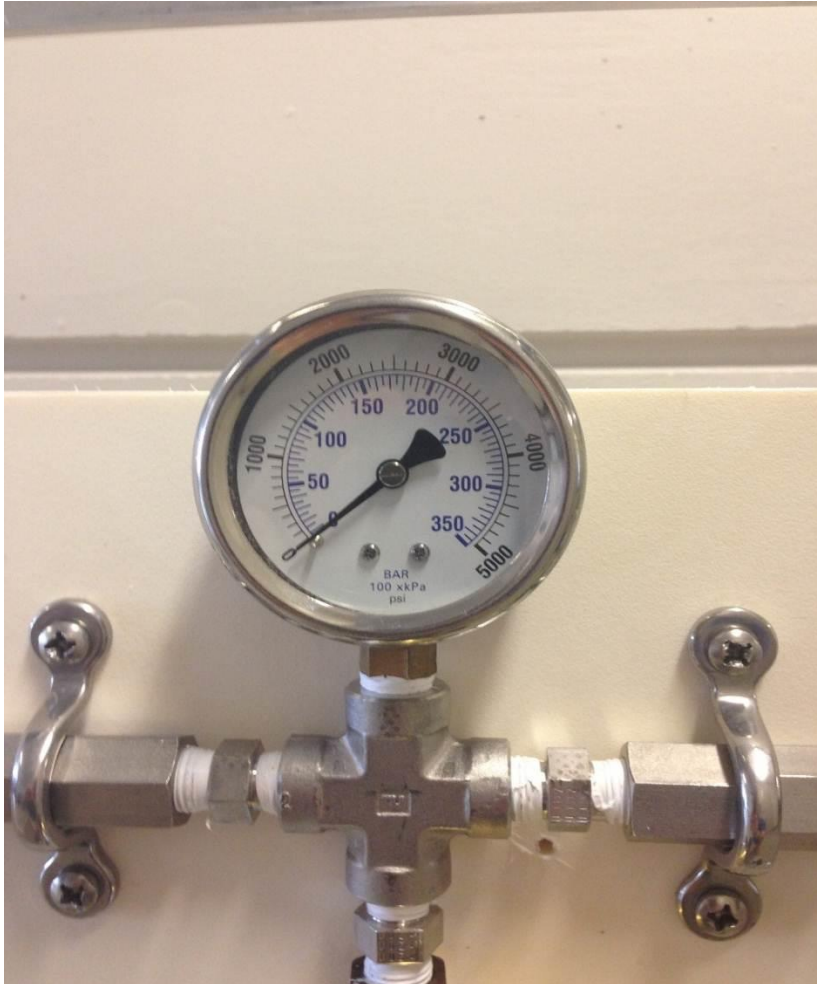
- Close all $\frac{1}{4}$ turn valves
- Handle perpendicular to piping is closed
- Turn on cylinders slowly

Open High Pressure Valves



- Open top $\frac{1}{4}$ turn valves ***SLOWLY***
- Handle parallel to piping is open

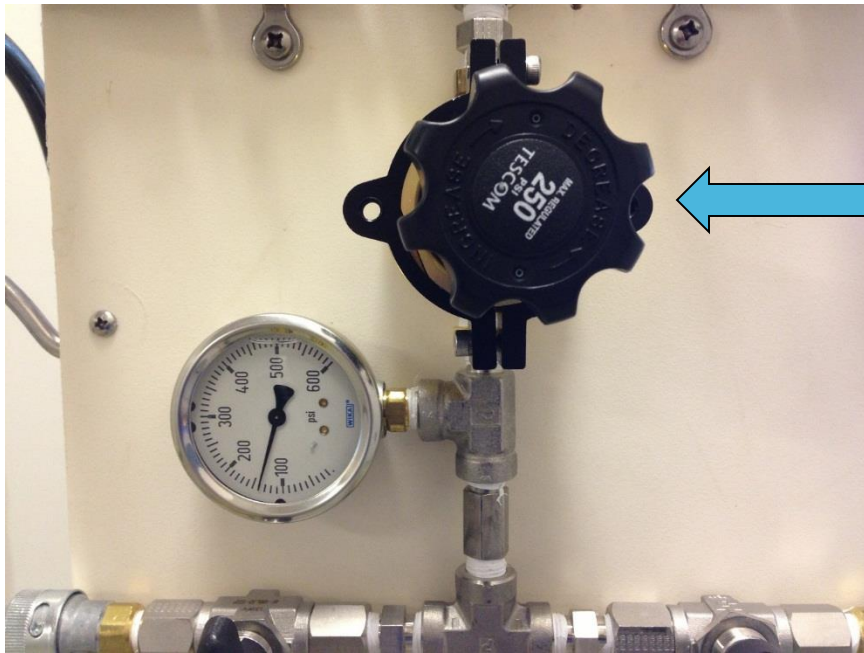
Check Cylinder Pressure



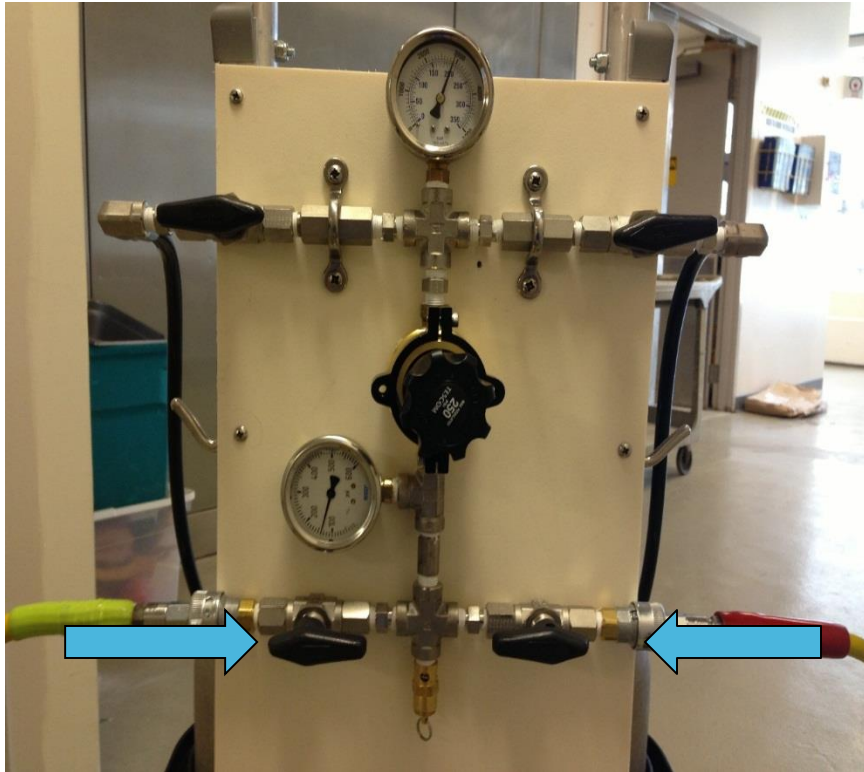
- Pressure on top gauge is from the cylinders
 - > HP120's are 3400psi max
 - > All other air cylinders are 3000psi max

Intermediate Pressure

- Check intermediate pressure at lower gauge
- IP should be 145-155 psi
- The Tescom regulator can be adjusted if IP is not correct
 - > *Contact DSO prior to adjusting*
 - > The Tescom shouldn't ever need adjusting in it's service life



Pressurize the Regulators



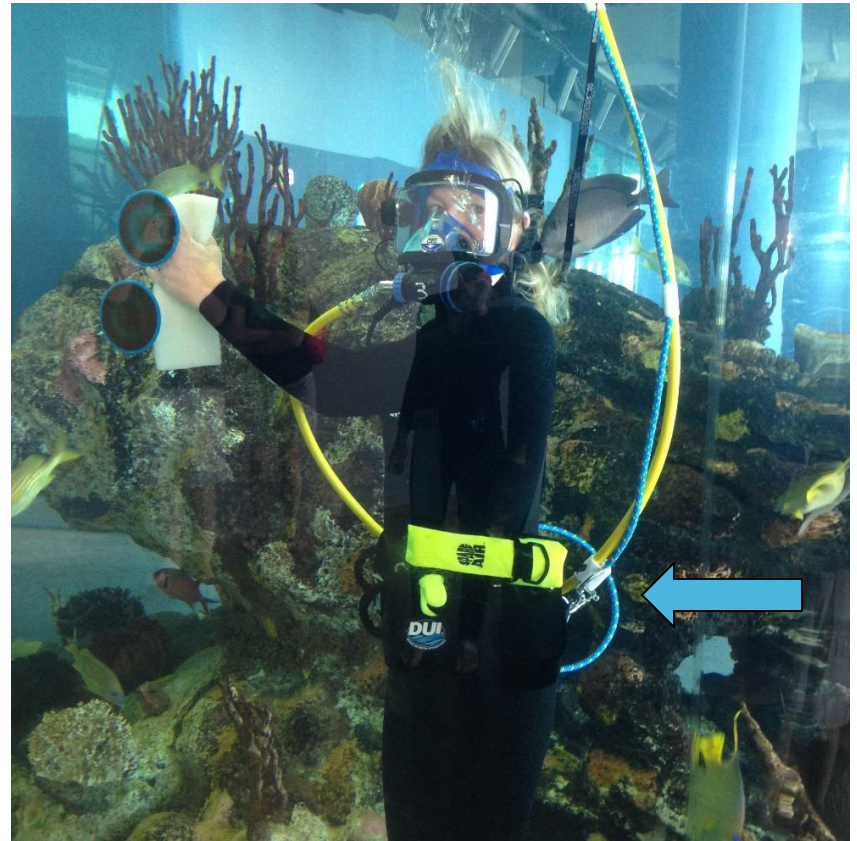
- Open lower $\frac{1}{4}$ turn valves ***SLOWLY***

Low Air Pressure

- Surface Supplied air pressure should never go below **500 psi**.
- Tender is responsible for monitoring air pressure on the air cart and alerting divers when air pressure is low
- Verbal communication or a signal of 5 pulls on the tether line should be used to alert the diver to surface

Gear Attachment / Communication

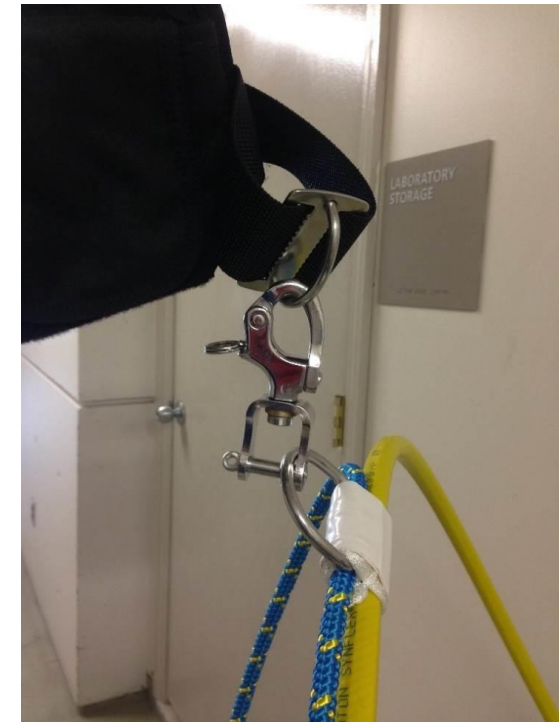
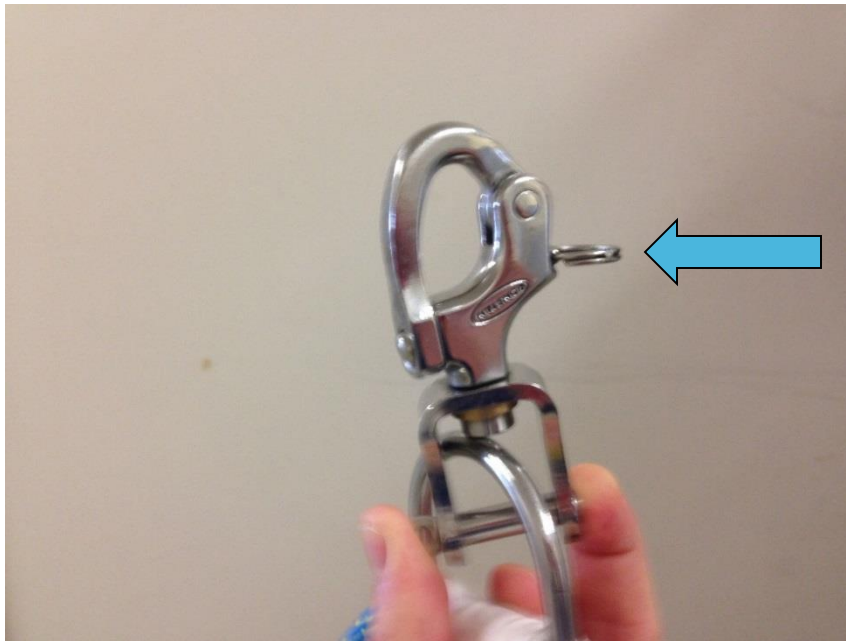
- Umbilical must be clipped to the diver's harness.
- For clean hose deployment: Cart end should come from divers Left Side



Umbilical Attachment to Diver

Lockable clip, pull loop/pin and apply tension to latch to release

- Clip to D ring at back of Weight Harness



Function Test

- Tender will help Prep & Equip Divers
- Function test Guardians are breathing
- Function Test Communications works
 - > **Divers to Tender**
 - > **Tender to Divers**
 - > **Diver to Diver**
 - *One-way communication working doesn't mean they're all working*

Diver Gear Considerations

- Plan on adding extra weight to your normal diving weight
- Never use a wetsuit in one exhibit and then go to another exhibit (cross contamination)
- Each exhibit should have it's own wetsuits and weights
- Fins are not worn in tanks other than the GOT
- Always make sure equipment is disinfected after use

Loading the Weight Harness



Weight Release



- Pull Handle on one or both sides of harness straight forward
- Continue pulling until Pocket detaches from harness
 - > Handle will be attached to pocket
- Drop Handle & Pocket

RASS Attachment

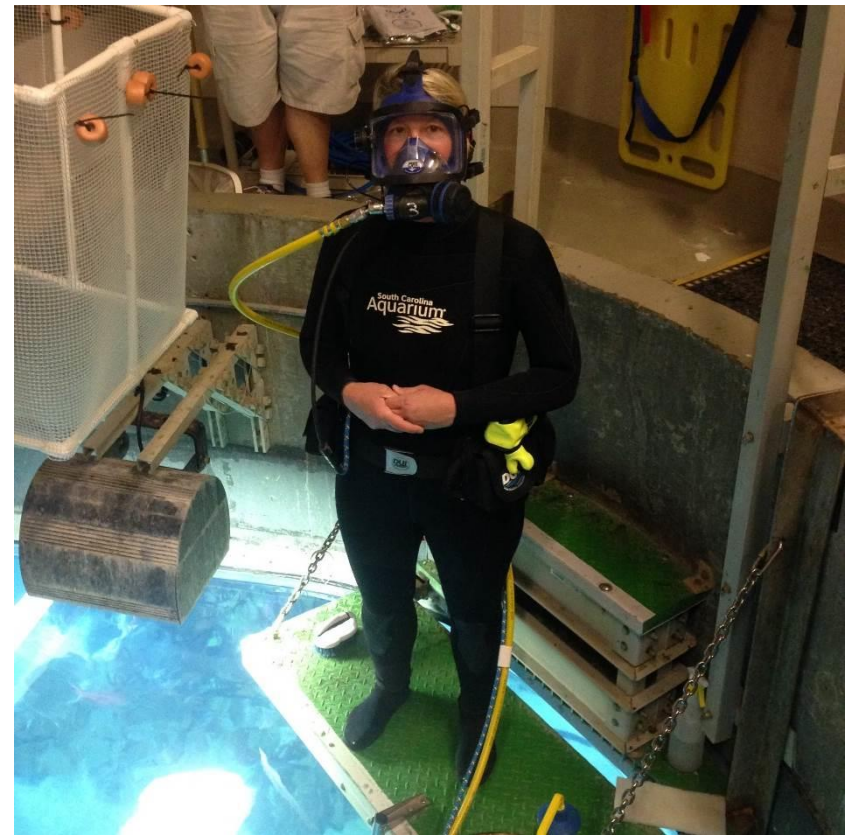
- Attach to Weight Harness on Diver's Left Side



Pre-dive Checks

Don Mask and Breath

- Do Communications Test



Dive-Dive-Dive!



Surface Cart Breakdown

- Turn off Cylinder(s)
- Open bleeder valve(s) on whip(s)
- Purge or breath down FFM Regulators
 - > **Make sure IP Gauge = 0**
- Disconnect Umilicals & FFM's at Quick Connects
- Close all ¼ turn valves

Guardian FFM Disinfect Procedure

- Rinse Guardian FFM with freshwater
- Spray with Birex
- Wait for 10 minutes
- Rinse in freshwater
- Thoroughly drain all water from Guardian
 - > This takes about 1 minute of rotating and parting the skirt
- Hang on Gear Cart for Transport



Umbilical Disinfect procedure

- Coil & Secure Umbilicals
- Hold the Cart end of the umbilical out of Rinse Buckets
 - > *Failure to do so allows water inside umbilical and promotes mildew in the Diver's breathing source.*
- The rest of the umbilical should be Disinfected for 10 minutes, then Freshwater Rinsed



Cylinder & Spare Air Rinse

- Cylinders should be hosed down if they had a significant amount of splash/spray/drip on them
- Spare Air's should be soaked for 10 minutes in Fresh Water
 - > Remove the mouthpiece cover on the Spare Air to allow thorough rinsing
 - > Birex if they were used
 - > When storing, Holster Cover should be undone to prevent mildew growth on the purge



Dive Cart Disinfect Procedure

- Spray carts wheels off with fresh water
- Return all carts to Compressor Room
- Unload & Hang all FFM's, Spare Air's, & Umbilicals

