The
NAUTILUS DRYDOCKS, LLC
Exceptional Products For The World of R/C Submarines
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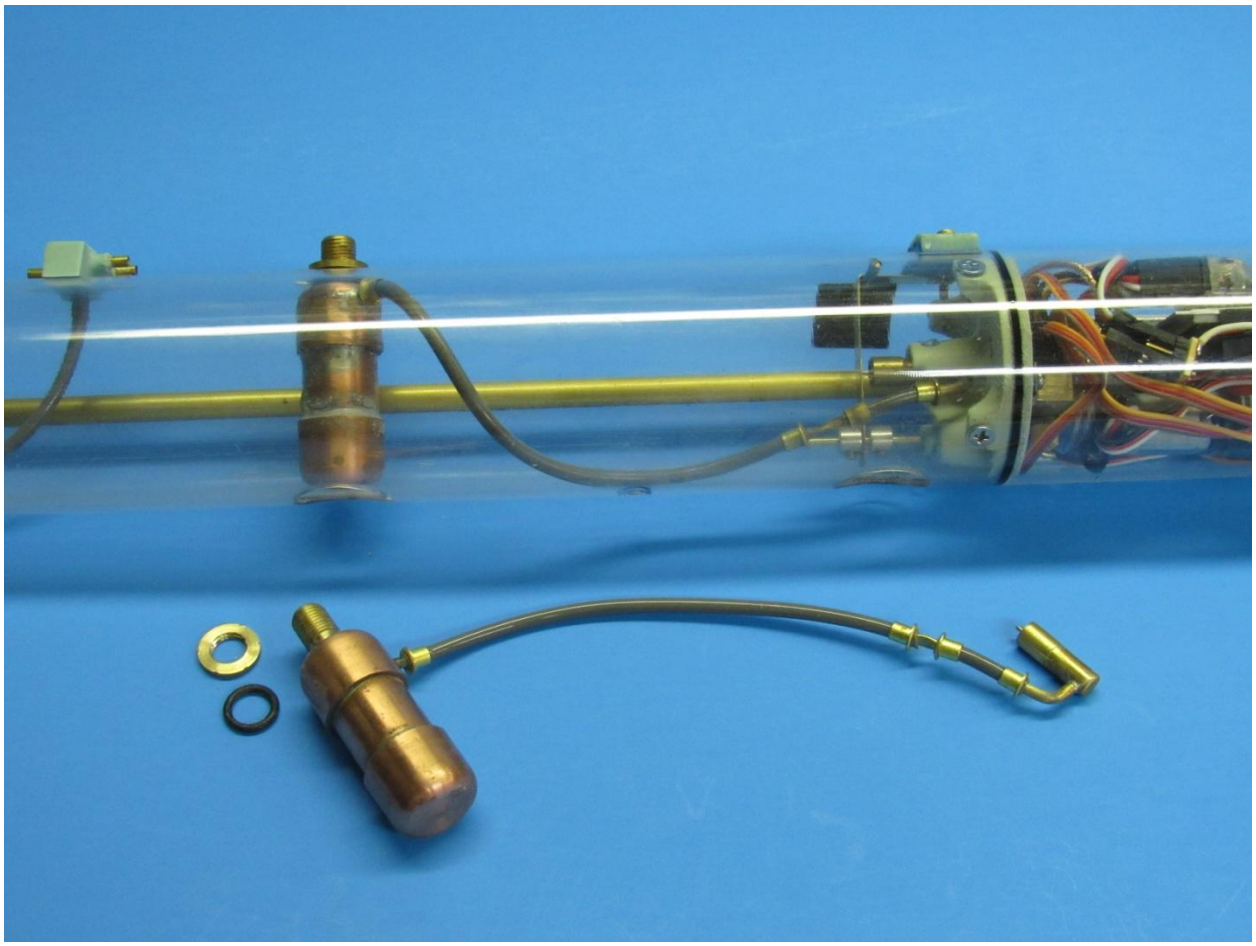
GAS BALLASTS BLOW DEVICE

BB-001-BBD



WARNING – wear eye-protection any time you charge or vent the gas ballast blow device.

The gas ballast blow device (GBB) is specifically designed to be retrofitted to our line of statically diving SubDrivers (SD).

The SD is a system comprising a clear Lexan cylinder that houses the Control, Ballast, and Propulsion sub-systems.

The GBB enhances the performance of the ballast sub-system by providing a means of emptying the ballast tank in an emergency situation. The device is not intended to be a primary means of ballast water ejection when employed aboard our line SD's as the provided bottle is of small size – this to minimize the loss of floodable volume within the ballast tank by the device components.

The GBB provides the means to contain and release, via your r/c command, or that of the on board fail-safe device, a quantity of gaseous propellant into the ballast tank to blow the ballast tank dry, surfacing your r/c model submarine. However, though intended as an emergency back-up to a primary means of ballast water discharge, the device has utility as the prime means of discharging ballast water in systems employing relatively small ballast tanks.

Caution ***– only use 'air-brush propellant' to charge the device, typically a mixture of methane-butane, that assumes a liquid state when at a pressure greater than 70-psi at room temperature.***

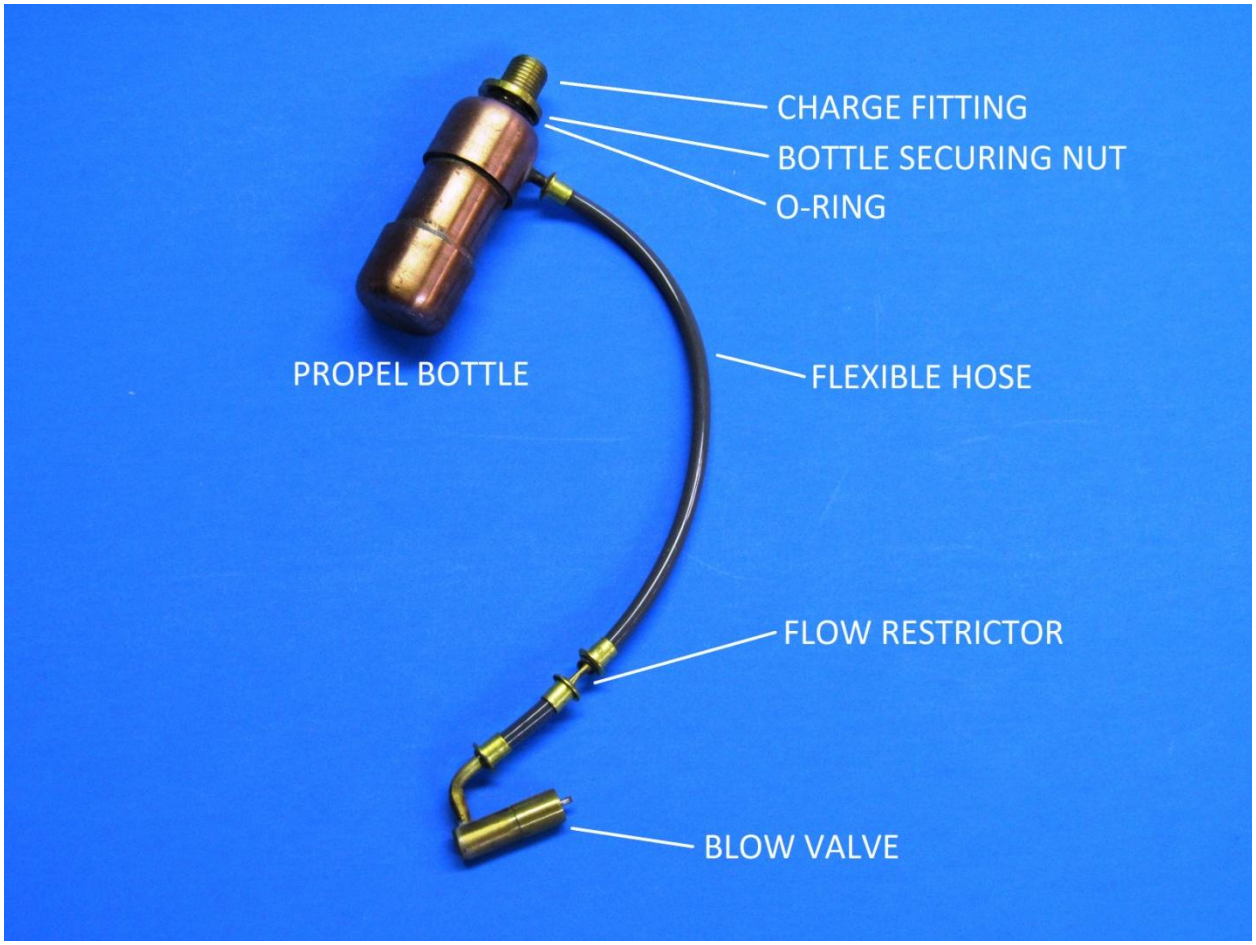
A full charge of typical air-brush propellant within the propel bottle will displace approximately 25 ounces of water at one-atmosphere. If, for example, the ballast tank holds 15 ounces of water, it would be reasonable to expect only two complete blows from this device. Of course, a larger propellant bottle will provide a correspondingly larger number of blows per charge.

Warning ***– never charge the device with CO2 or other high-energy pressurized liquid-gas propellants as the flexible hose elements will burst.***

This device is sized to provide a one-time discharge of ballast water from a large ballast tank when activated in a fail-safe situation – a situation where the principle means of ballast water management has either failed, is surface-air

dependant, or cannot overcome the ambient water pressure where the sunken model submarine came to rest -- This product is intended to be a back-up, not the principle means of ballast water discharge.

GAS BALLAST BLOW DEVICE PART NOMENCLATURE AND DISCRIPTION



A copper ***Propel bottle*** stores a charge of liquid propellant. At the top of this bottle is soldered a standard Schrader valve which serves as a ***charge fitting***, used to transfer Propel from propellant can to bottle. The threaded shank of the charge fitting also serves as the securing point from which the bottle is suspended within the SD ballast tank. The bottle made fast and watertight with an ***o-ring*** between bottle and top of cylinder, and ***bottle securing nut*** driven down onto the charge fitting thread from atop the cylinder.

A soldered nipple, projecting near the top of the propel bottle, makes up to a length of ***flexible hose***. The hose serves two functions: to direct propel gas to the blow valve, and to act as a safety-valve in the event the pressure in the device exceeds 500-psi – the burst pressure of the flexible hose. A pinched brass tube ***flow restrictor*** reduces the flow-rate of propel gas, in order to prevent too quick a discharge of gas once the blow valve is opened.

The ***blow valve*** is a modified Schrader valve. When the valve stem is depressed propel gas is released into the ballast tank, forcing ballast water out through open flood-drain holes in the bottom of the ballast tank.

WHAT YOU'LL NEED TO CHARGE THE DEVICE

There are several air-brush type propellants on the market today. The ones suitable for this application are identified as cans with a male thread that will make up to a Paacshe 3B valve. An example is the Paacshe propellant, seen here:

http://www.paascheairbrush.com/products/Compressors/pressure-cans/n-12

You will need to acquire a 3B valve – this is the interface-charging fitting that makes up to the propellant can and outputs to a standard air-chuck charge fitting.

http://www.paascheairbrush.com/products/airbrushes-airbrush-parts-and-accessories/airbrush-accessories/other-accessories/3B

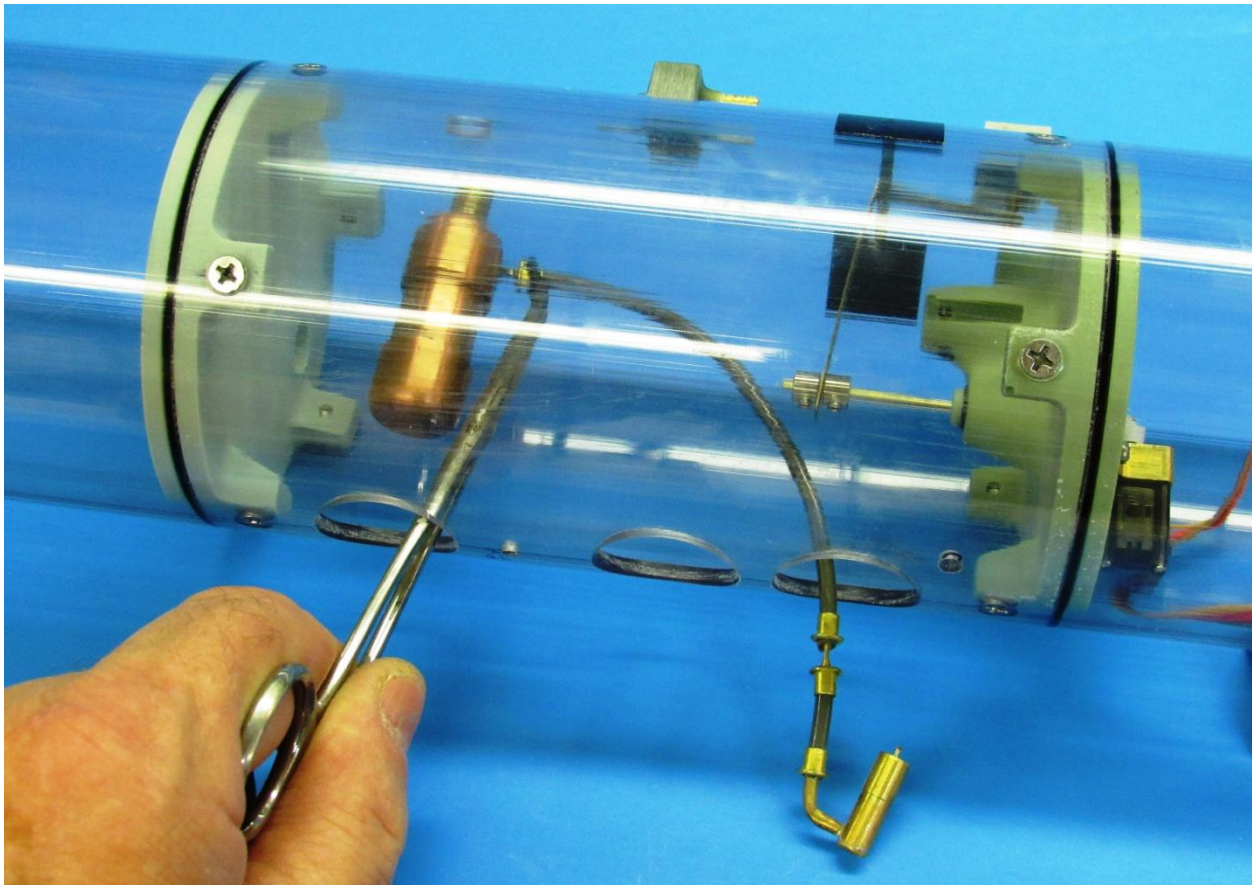
You can find the air-chuck fitting at just about any automotive parts store.

The air-chuck female threads make up to the output side of the 3B valve. Use Teflon-tape to insure a gas-tight seal along the threaded union. It's the air-chuck

that interfaces with the GBB charge fitting; the point where liquefied gas transfers from can to propel bottle.

TYPICAL GAS BALLAST BLOW DEVICE INSTALATION

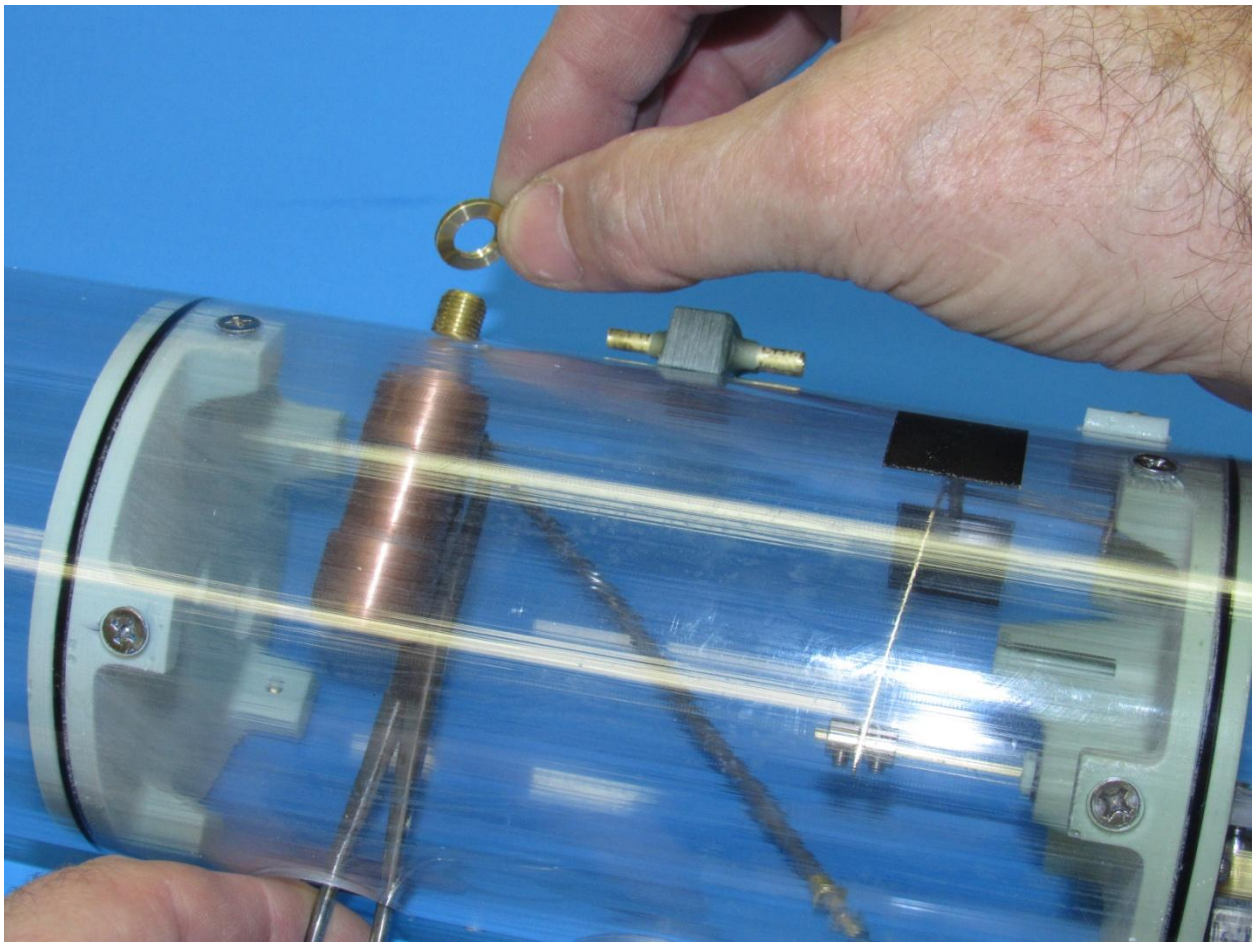
Installing the GBB within the SD's ballast tank is a quick operation as the sub-system is designed specifically for retro-fit of the device.



Remove the propel bottle securing nut and set it aside. Insure that the sealing o-ring remains atop the bottle.

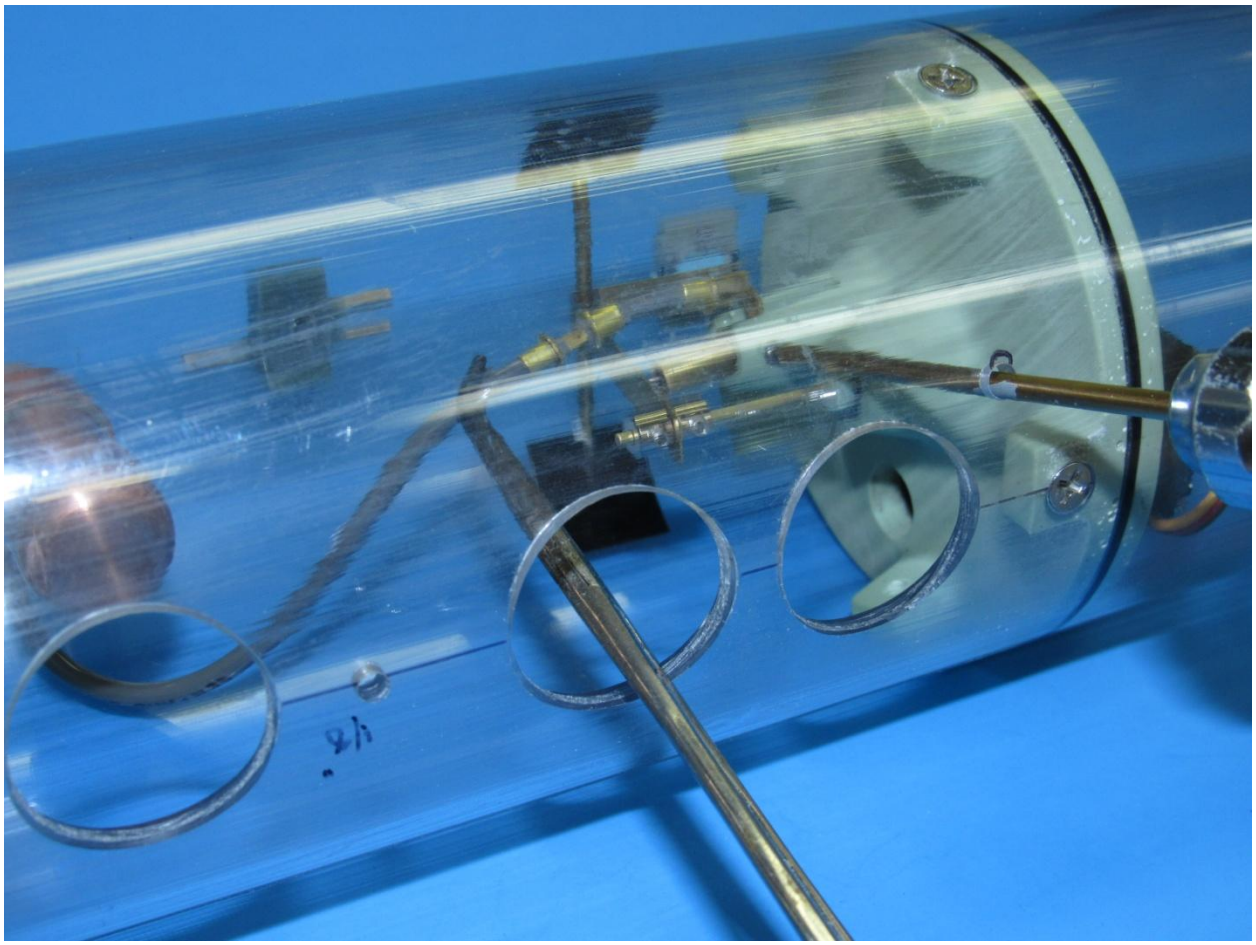
Your SD cylinder, as provided, has a 5/16" hole atop the ballast tank. That hole covered by a piece of electrician's tape. Remove the tape. This hole accommodates the threaded shank of the bottles charge fitting. With the aid of a hemostat (or long-nose pliers) insert the bottle within the ballast tank through

one of the open flood-drain holes located at the bottom of the ballast tank. Drive the charge fitting neck up into and through the 5/16” hole.



Screw down the securing nut a few threads to keep the bottle from falling down into the ballast tank. Remove the hemostat and push on the bottom of the bottle with a finger as you hand tighten the securing nut. Don’t use any tool to wrench down on the nut or you’ll unseat the sealing o-ring. Hand-tight only!

You'll note that the devices blow valve is accommodated in the SD by a slide-in-place foundation built into the after ballast bulkhead – a feature present in all our statically diving type SD's from 2" diameter up. This foundation permits adjustment of the blow valves position in relation to the ballast linkage arm -- an adjustment made as you integrate the GBB to work in concert with the SD's normal SAS type ballast blow mechanism. Once adjusted as to position, the blow valve is made fast with a set-screw set within the bulkhead foundation.



With the bottle now secured firmly to the top of the ballast tank, use the hemostat to grab and position the blow valve into the after ballast bulkhead blow-valve foundation. With the ballast sub-system servo in neutral, set the stem of the blow valve approximately 3/32” aft of the ballast linkage arm and secure the blow valve in place by ***gently*** tightening the 4-40 X 1/8” securing set-screw – the hex-wrench accessing that set-screw through a hole near the bottom of the ballast tank.

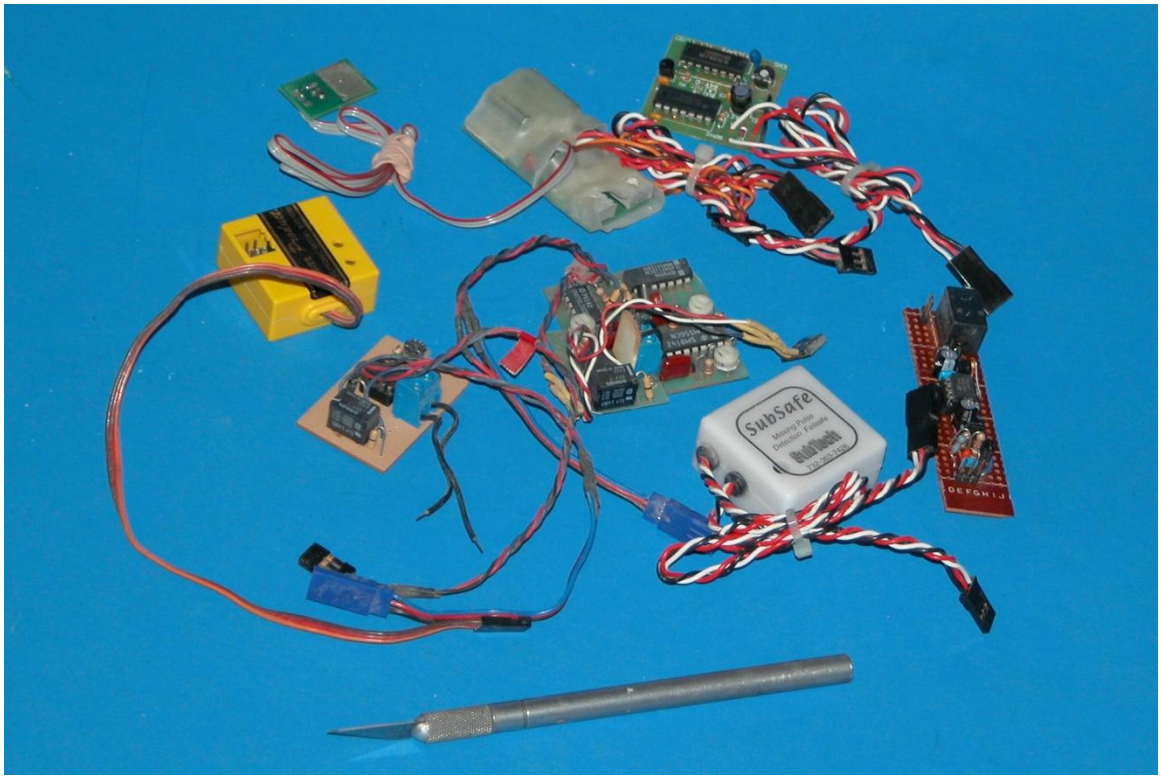
(If the blow valve will not reach far enough forward to achieve the 3/32” stand-off distance to the linkage arm, glue a shim of suitable thickness to the back-side of the linkage arm to achieve the 3/32” stand-off distance between linkage arm and blow valve stem).

THE FAIL-SAFE DEVICE – A MUST-HAVE The question, when dealing with r/c model submarines is always, “if the submerged submarine looses the transmitted signal, how will it know to blow its tank to surface?”

A fail-safe circuit -- more properly called a missing pulse detector – is a device placed between the receiver ch-4 port and the ballast sub-system servo. This device autonomously works to position the servo to the ‘blow’ position if the transmitted signal is lost or becomes unintelligible. Specifically, The fail-safe monitors the pulse-train coming from the receiver – if that pulse-train should stop, the fail-safe circuit will (after a suitable time delay in most units) generate a pulse-train of pulses of appropriate width to position the ballast servo to a pre-determined position, that ‘fail-safe’ position instigating a blow of the ballast sub-system, that command rescinded once the transmitted signal is regained.

It goes without saying that the inclusion of a fail-safe device in boats operating in deep water – that device overseeing the operation of the ballast sub-system, even if you are not in the loop -- is not an option. It’s a necessity!

Below is only a sample of the many types of fail-safe devices that have been available over the years.



Fail-safe devices used to be bulky affairs, but today are little larger than a fat postage stamp!

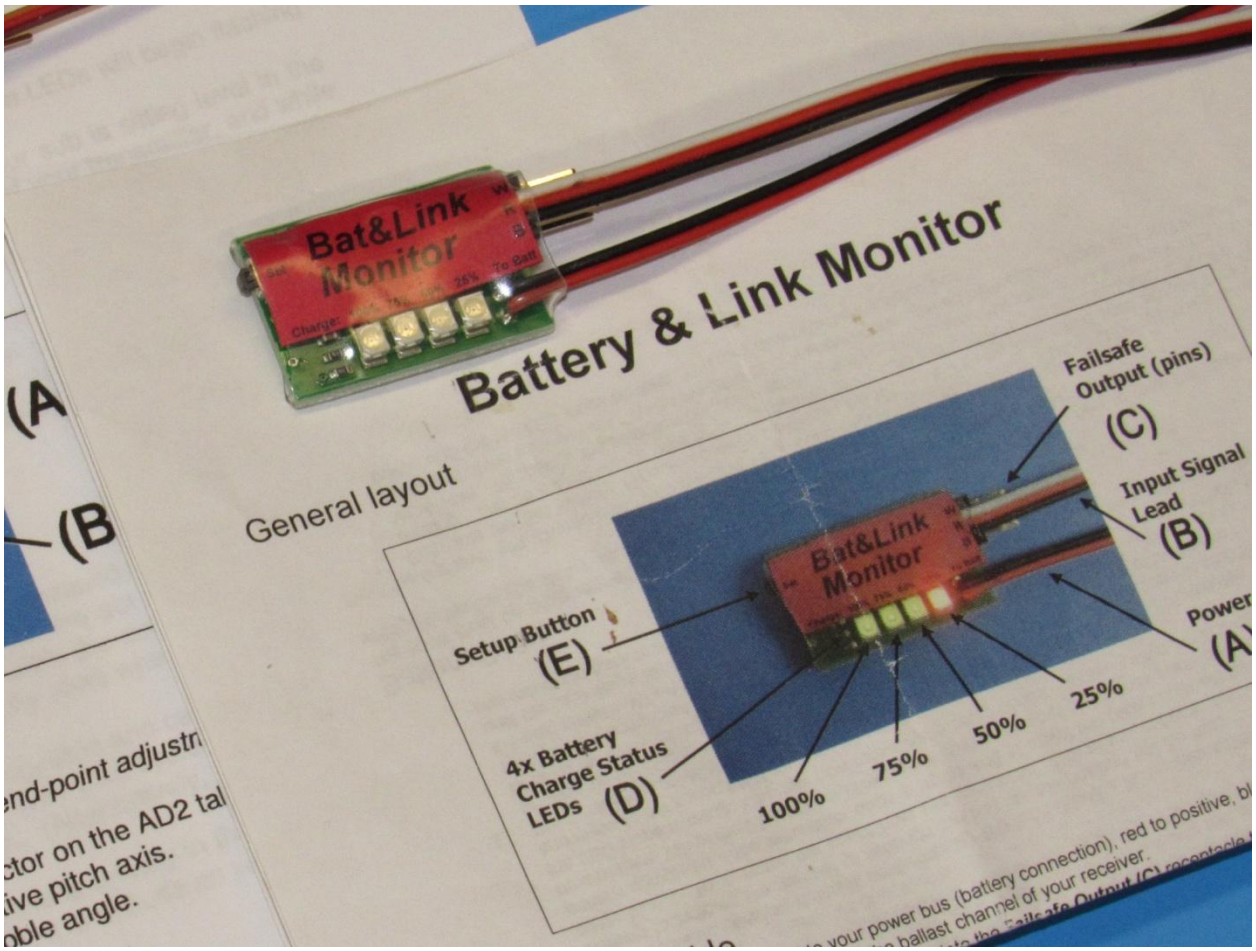
The KML Battery Link Monitor (BLM) – the cream of the crop, and highly recommended -- not only provides the loss-of-signal fail-safe function, but will also blow the ballast tank should the system voltage drop to a pre-set value. That last feature very important as it will protect the voltage sensitive Lithium type batteries used these days from damage: When the voltage drops to the critical value, the BLM automatically blows ballast and won't permit a vent until the battery is replaced or recharged.

The BLM, and other fine devices needed by the r/c submariner can be found here:

https://www.rc-submarine.com/

If your receiver has the ability to position its attached servo(s) to specific positions (consult your receiver manual) on loss-of-signal, then a dedicated fail-safe device can be omitted. However, the receiver will not protect Lithium batteries from a

low-voltage condition. So, if you are using a Lithium type battery you should protect it with the BLM.



A very simple arrangement: The ballast sub-system servo gets the output of the fail-safe device (in this example, the BLM); the input side of the fail-safe device connected to the receivers ch-4 port. And that's all there is to it. In normal operation the servo is slaved to the transmitters commands. However, should the signal be lost -- say, the model went too deep -- the fail-safe detects that situation, generates a pre-set pulse-width chain, which directs the servo to open the blow valve. The blow valve remains open until the radio link with the receiver is restored -- the model submarine has risen to a depth where its receiver can once again detect the transmitted signal.

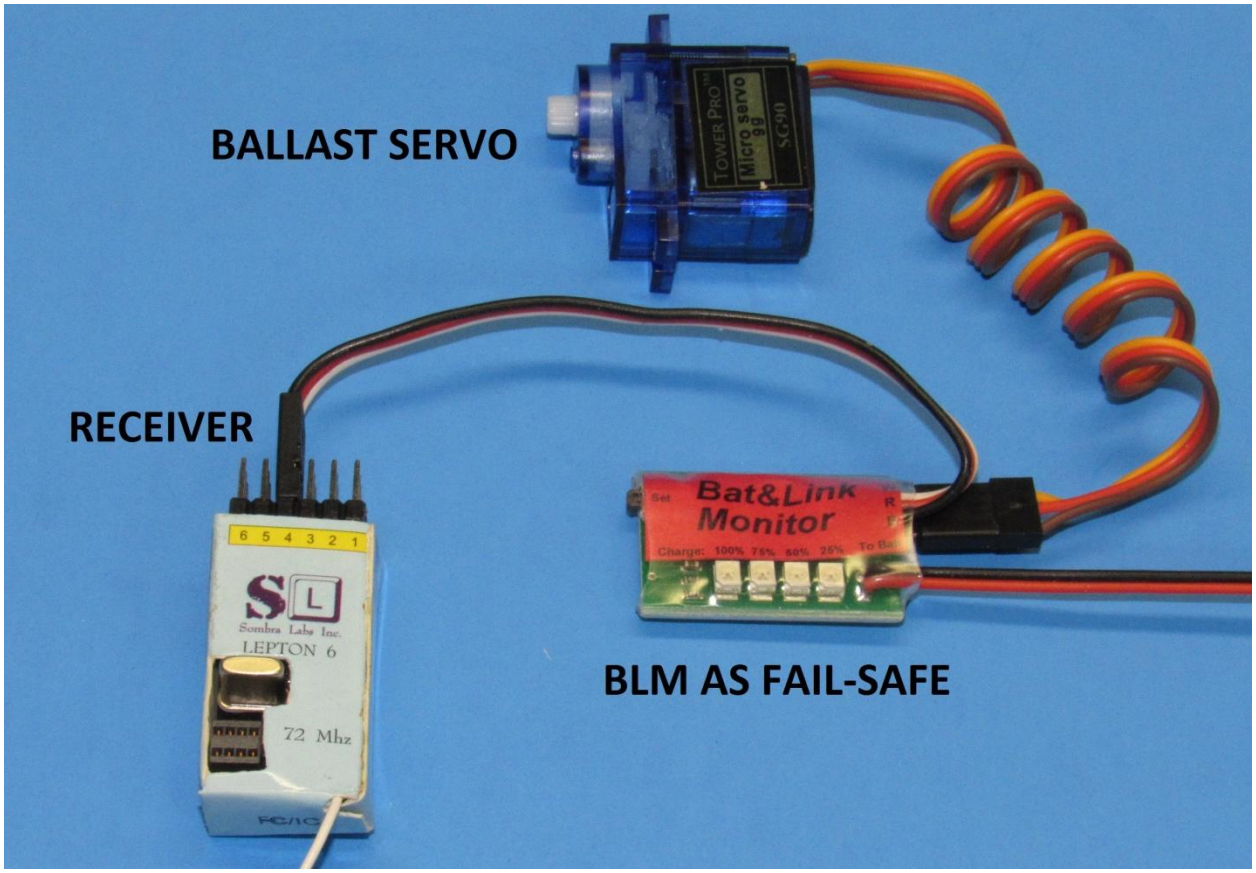
(An under-appreciated feature of the BLM is that its operating current comes straight from the system battery, not the receiver bus. Should the BEC or receiver

fail the BLM will still function, and also provide the operating current needed by the ballast sub-system servo to operate. The failure-tree of this device has few branches.

INTEGRATING THE GAS BALLAST BLOW DEVICE

GAS BALLAST BLOW AS PRINCIPLE MEANS OF BALLAST WATER DISCHARGE I recommend you use the ch-4 stick on your transmitter for control of the ballast sub-system – that's the left stick, left-right motion (in airplane parlance, the 'rudder' channel).

Configure the transmitter (servo 'reverse' switch for basic, dumb transmitters; or menu selection for fancy-assed computer transmitters) so that center stick commands the ballast tank vent valve closed and the blow valve closed; the vent valve is open and the blow valve closed when the stick is placed to the extreme left; and the vent valve closed, and the blow valve open when the stick is placed to the extreme right.



If your transmitter has a three position toggle-switch it can be used as the means of controlling the ballast sub-system remotely. However, insure that the toggle is a spring-return-to-neutral or, invariably, you'll forget that you went to 'blow' and the LPB will run continuously even though the ballast tank has been long dry and the model cruising happily on the surface. The spring return (which is the case for the ch-4 stick) insures operation only as long as you consciously hold the stick/switch to the blow or vent position.

OK, simple enough.

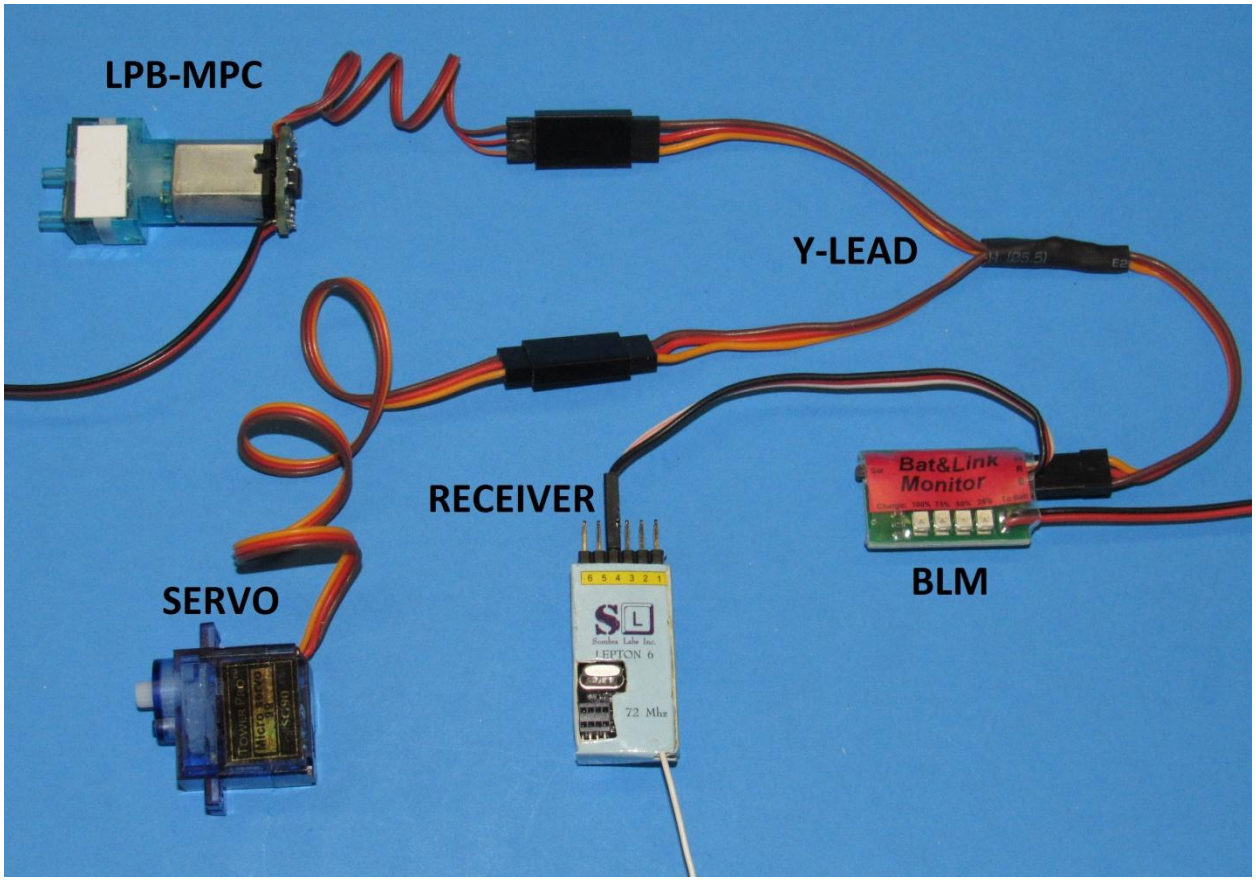
GAS BALLAST BLOW AS SECONDARY MEANS OF BALLAST WATER DISCHARGE But, if the objective is to use the GBB as a secondary means of expelling ballast water, you have to rig things so that no gas is released during normal (transmitter directed) operation of the ballast sub-system. In this mode you only want a gas 'blow' during the fail-safe command issued shortly after loss-of-signal.

This is achieved by the ballast sub-system linkage moving a short distance, not enough to engage the blow valve actuating stem, during normal blow; and a greater distance, enough to engage the valve stem of the blow valve actuating stem, during fail-safe operation.

Most fail-safe devices permit you to set the degree of servo motion when the device goes to the loss-of-signal, 'blow' mode. And you either program that loss-of-signal servo position into the fail-safe device directly through analog potentiometer, or a 'set'-button during the fail-safe device set-up routine

How? ...

… You read the frig’n instructions that came with the fail-safe device! That’s how.



The above bread-board device layout represents a SAS type primary ballast sub-system. The only engagement the GBB has is through the linkage operated by the ballast servo, that linkage engaging the gas ballast device blow valve when the servo is over-positioned by the fail-safe device upon loss-of-signal. Normal transmitted commands do not over-position the servo, so no discharge of gas occurs during the 'blow' command.

Your fail-safe device instructions will tell you how to set for maximum servo throw when loss-of-signal occurs.

PRE-MISSION, MISSION, AND POST-MISSION CHECKS AND OPERATIONS

As with all aspects of r/c submarining planning, preparation, care, and exactness are pre-requisites to a successful day's fun at the pool or lake. The care and feeding of your GBB is no exception.

***Warning** – never charge the device with CO2 or other high-energy pressurized liquid-gas propellants as the flexible hose elements will burst.*

When not in use the bottle charge fitting core valve is loosened to vent off any unused propellant. This is done with a tire-valve core-valve tool available at just about any automotive supply store.

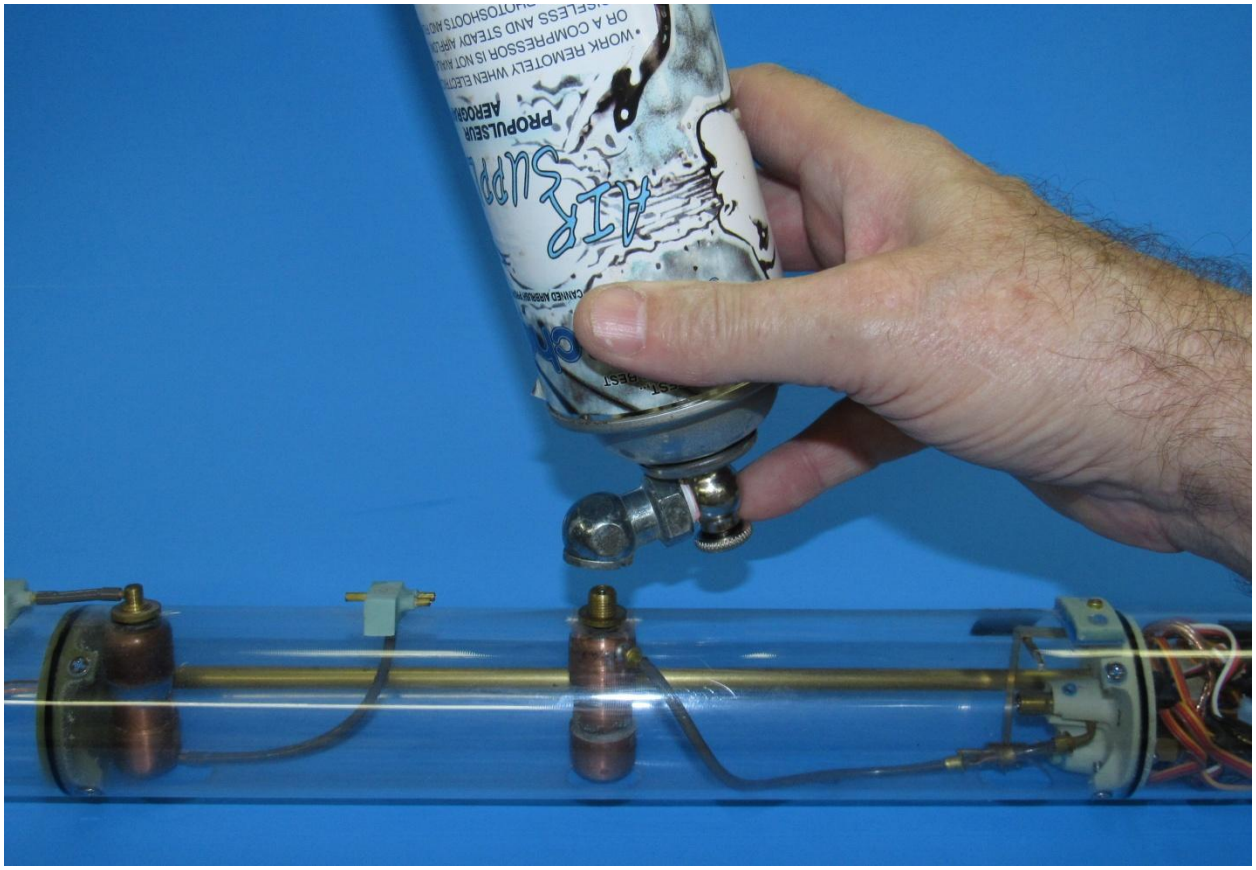
***Caution** – only use 'air-brush propellant' to charge the device, typically a mixture of methane-butane, that assumes a liquid state when at a pressure greater than 70-psi at room temperature.*

PRE-MISSION During your pre-mission checks and tasks, as your ready the r/c model submarine for use, tighten the charge fitting core-valve.

WARNING – wear eye-protection any time you charge or vent the gas ballast blow device.

Charge the bottle with one shot of propellant and check for proper operation via the transmitter, and then check for correct function of the fail-safe by turning off the transmitter and wait for the pre-set delay to time out. If gas is heard escaping into the ballast tank, turn the transmitter back on and observe that the gas discharge is secured. Go through the securing protocol of system and transmitter. Vent the bottle. Insure that you put the propellant can and its charge fitting in your field-box.

Complete the other pre-mission checks and operations. Verify that everything's in good working order. Only then do you pack your field box, grab your stuff and load up the car for a day's fun at the pool or lake.



MISSION At The boating site tighten the bottle charge fitting valve and charge the bottle at the lake/pool shortly before placing the model in the water.

A full charge of propellant is achieved after ‘chilling’ the bottle. This is done by completing an initial charge, then quickly venting off the charge by unseating the charge fitting core-valve stem. This will greatly reduce the ‘energy’ of the bottle as compared to the ambient temperature liquefied propellant to be loaded into the bottle. This bottle chilling permits much more propellant to be introduced on the second charge.

If it’s a warm day and you don’t plan on immediately putting the model in the water, vent off the bottle. If not, there is a high likelihood you and people around you will be entertained by a very loud retort as the flexible hose elements of the GBB device explode!

Nice work, idiot!

So, after changing your underwear, you'll be stuck with the task of replacing the burst flexible hose.

When not in use, vent the bottle!

After placing the model into the water perform a close-to-shore submerge-surface cycle two times; the first using the normal blow sub-system, the second cycle performed by the fail-safe-circuit (you simply turn off the transmitter and patiently wait for the model to surface as the gas does the job of blowing the ballast tank dry). Yank the successfully tested model submarine out of the water and recharge the bottle. Proceed with normal operations.

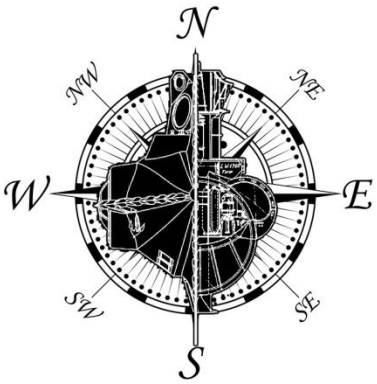
Keep count of how many times the gas ballast blow system is used. Experience will tell you when to bring the model back for a re-charge of the bottle.

At the end of the session at the lake/pool, vent the bottle and pack things up for the trip back home.

POST-MISSION Back at the shop visually inspect the bottle, flexible hose, restrictor, and blow valve. If all is in order, complete all other post-mission tasks, and then put the SD and model submarine into safe storage or display– a secure and dry space.

David D Merriman lll

For the Nautilus Drydocks



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