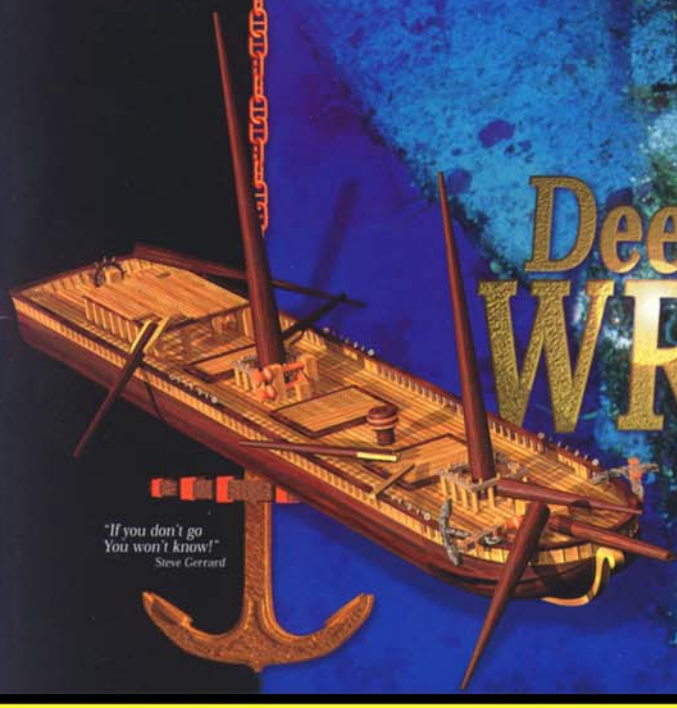
ADVANCED DIVER MAGAZINE

Advanced Openwater to Technical Explorer

- Sidemount Rig•
- Wreck / Carrie Lee•
- Oxygen Enriched Trimix•
- HID Technology•
- Halcyon Rebreather•
- Wreck / Fantastico•
- Wreck / S-16 U.S. Submarine•
- Cave / Sabak-Ha•
- Extreme Depth / 735ft. Dive•
- Advanced Dive Planning•
- Wreck / St. James•



Deep WRECKS

"If you don't go You won't know!"
Steve Gerrard

Fall•Issue 3•1999
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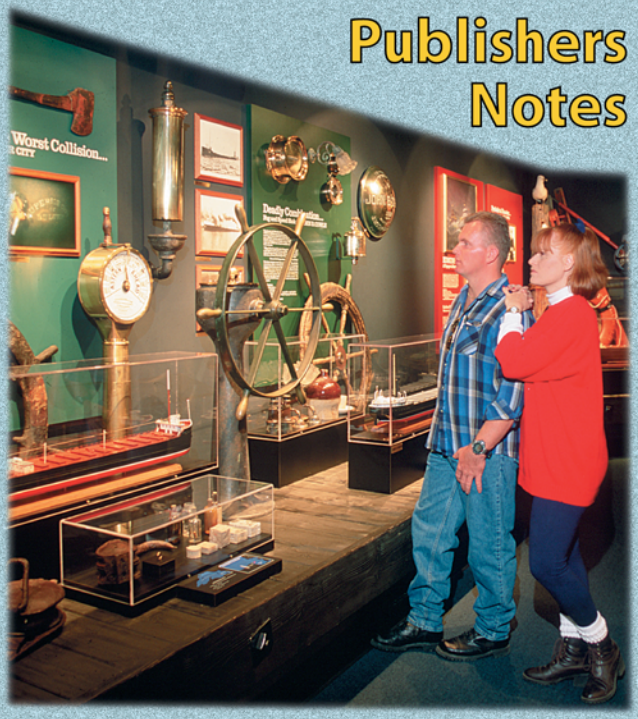

I was visiting a dive buddy of mine the other day, Larry Borden. He's kind of a local spearfishing legend, a true Billy-the-Kid, double barrel speargun toting, eagle-eyed reef invader. Easily any grouper's worst nightmare. I actually think Larrys been diving since the separation of the supercontinent Pangaea formed the worlds oceans.

Viewing some of his old dive videos of how it used to be with giant schools of jacks, millions of snapper and a seemingly endless supply of grouper. I got the feeling that maybe I missed the boat. What could there be left that has not already been explored, fished out, or raped of its artifacts? Is there something that's new, unexplored, and untouched from the previous generations of divers?

What do we have today that previous generations didn't? The answer is advanced technology and high performance equipment to go deeper, stay longer and decompress safer.

Less than 1% of the oceans are shallower than 130 feet. Imagine all the new and exciting discoveries awaiting in the next 2% that we can now explore.

Steve Gerrard once said, "If you don't go, you won't know."

Curt Bowen
Publisher

GET PUBLISHED!

Advanced Diver Magazine is constantly searching the globe for new discoveries made by divers like yourself. Historical or interesting shipwrecks, unexplored caves or ongoing exploration projects, diving techniques, scientific research projects, underwater archeology, etc... No writing or artistic skill required, the staff at ADM will assist your publishing needs. Submit your ideas or discoveries to:
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Cover: Bow of the Carrie Lee, Grand Cayman. Photo by Nancy Romanice
3D Illustration of the Saint James, Lake Erie. Illustration by Curt Bowen

Backdrop Photo: Steve May

SIDEMOUNT DIVING

The ultimate side mount rig has to be more than just a side mount harness. Considerations must be made to insure the entire system-harness, air cells, d-rings, regulators, hoses, SPG's, cams, and pockets are set to withstand the toughest of challenges. If any aspect of the system is not tested to the utmost, it will most likely fail in one of the innumerable pitfalls of exploration and expedition-style diving. The TransPac II is designed as an exploration/expedition harness. The only one of its kind. I have tested it in remote areas and thousands of feet back in caves, with multiple scenarios of hiking, climbing and rappelling with equipment-up to eight hours of walking, wading, crawling and diving. I have tested the harness in every possible environment. It does back mount as well as it does side mount. It's the Hummer of diving harnesses.

Flexibility is the key when putting together a system fit for expedition diving. When traveling to remote areas you never know what to expect, and unforeseen problems often arise in even the best-planned trips. This concern has lead to what I feel is the first true expedition rig for diving.

The regulators need to be a matched set with a left and right configuration. I travel with four identical regulators, two for back mount and two that double for side mount and stage bottles. The side mount regulators have short SPG's, these work well for double duty on primary and stage bottles. I prefer the short hoses because they lay flat and can be easily read by flexing the hose up, when released these relax back to the flat position. One key point is to eliminate any excess hoses and hose length to keep everything streamlined. Each regulator has an inflator hose; these are 15" in length. One connects to the BC power inflator and the other to my dry suit if needed. Left bottle routes behind the neck and fastens to a right shoulder d-ring.

Sidemount Cylinder Configuration

A.	Large Carabiner	D.	Cam Strap Positioning Strap
B.	Right Cylinder Second Stage	E.	Dry Suit Inflator Hose
C.	Left Cylinder Second Stage	F.	Low Pressure Inflator Hose

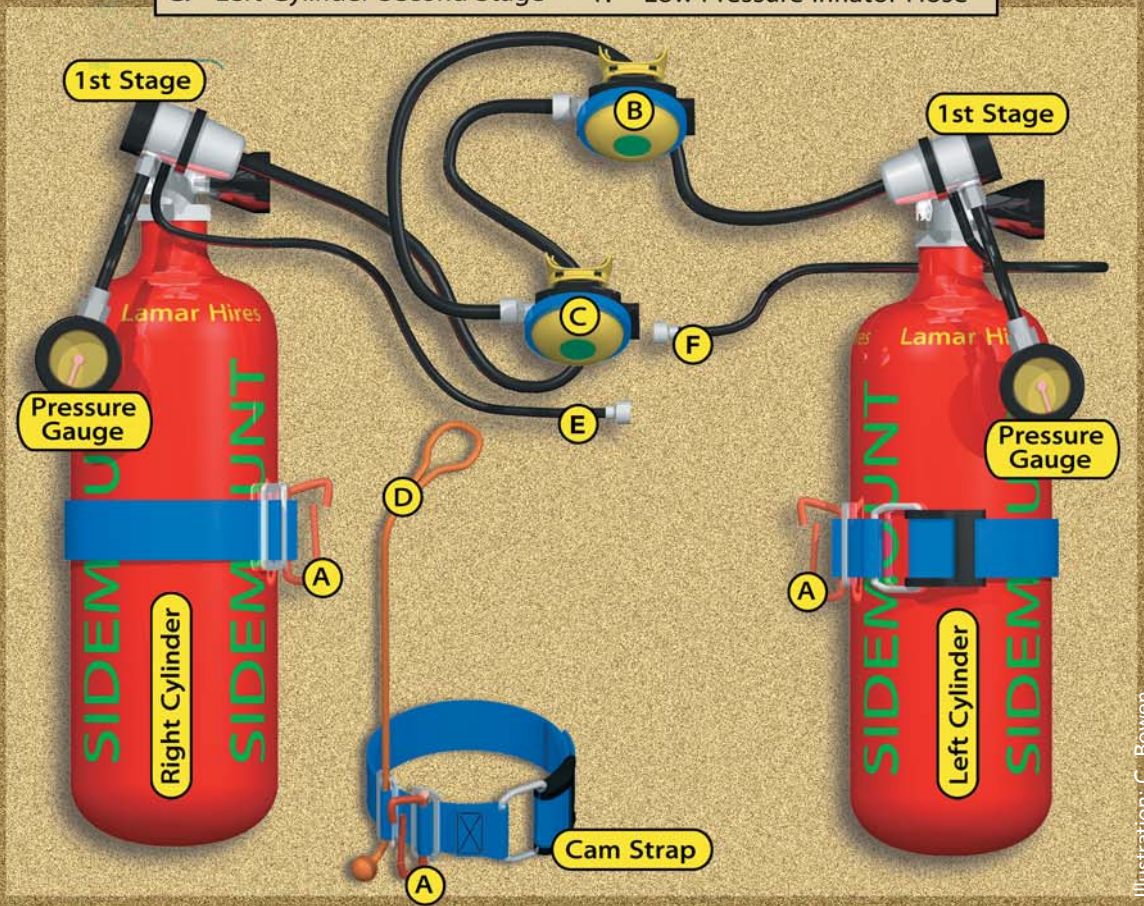


Illustration: C. Bowen

The 32" hose goes on the right bottle and the second stage rests in a neck strap.

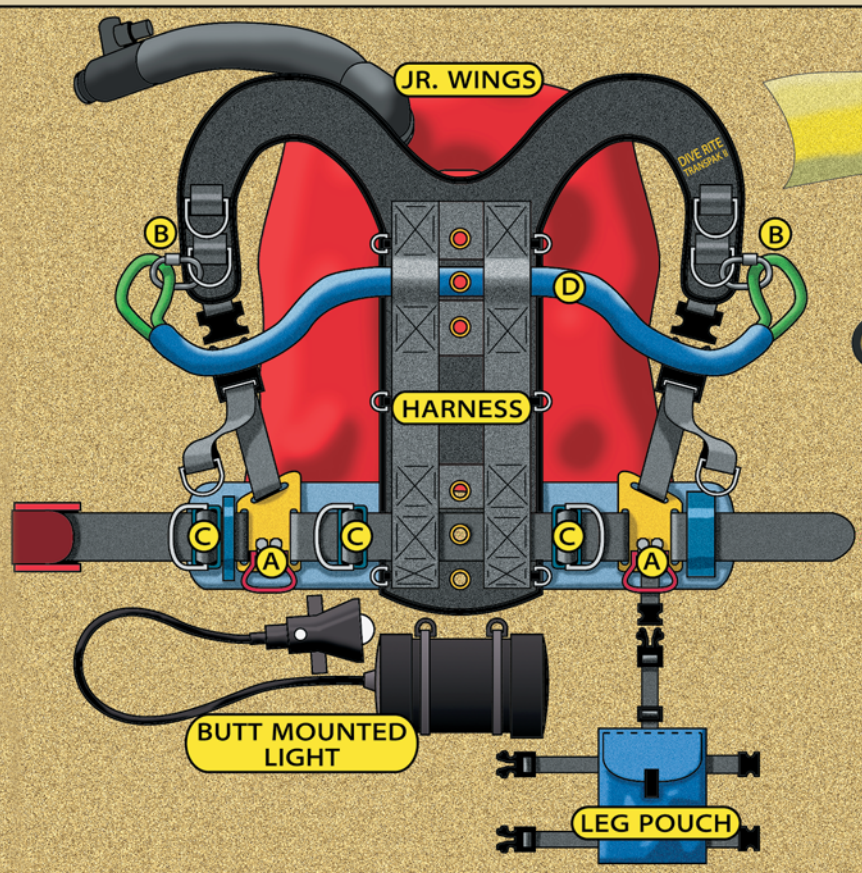
The cylinders attach to the harness with a medium size carabiner secured to a standard cylinder cam band with a 2-inch belt slide. This attachment carries the bulk of the cylinder weight. A 90 degree bent d-ring mounted on a stainless plate, that ties the waist to the shoulder, is the point of attachment for the cylinder. This type of connection is very strong and distributes the weight on the harness. The caribiner keeps the travel of the bottle to a minimum as the buoyancy characteristics of the bottle change when the bottle pressure drops. The rope leash attached to the cylinder cam band has a loop on one end that goes over the neck of the cylinder to control height adjustment of the cam bands when changing cylinders.

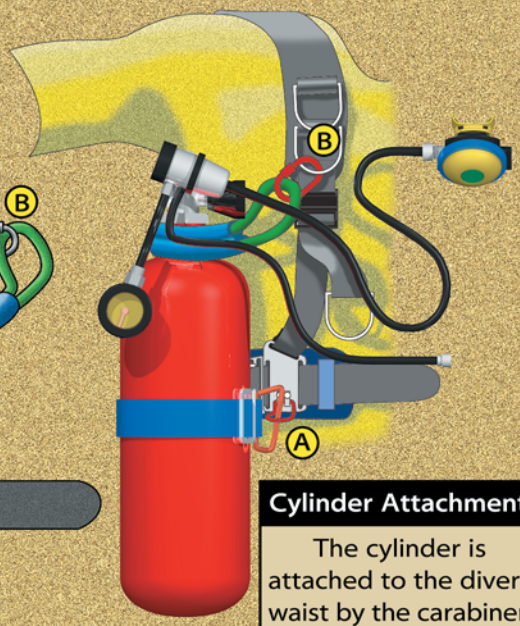
The stainless plates are the pivot point to balance the load and secure the bottles. The bungie that runs though the upper cylinder cam band slots fastens to the harness with medium stainless quick links. The bungie strap goes over the necks of the cylinders to keep them close to the body under the arms. This is one of the primary differences in configuring cylinders

Continued on Page 15

Sidemount Harness Configuration

A. Carabiner Harness Attachment Ring	C. D-Rings for Reels, Lights etc.
B. Bungie Shoulder Attachment	D. Bungie





Cylinder Attachment

The cylinder is attached to the divers waist by the carabiner. The cylinder valve and first stage is held tight against the divers side by the bungie.

GRAND CAYMAN CARRIE LEE WRECK DIVETECH

Resting on the edge of the abyss at 260 fsw, the Carrie Lee looks ready to steam off of her sandy slope into the trench below. This 150' freighter carried supplies between Grand Cayman and the sister islands until 1985 when she capsized and later sank becoming one of the most spectacular deep wrecks the islands have to offer.

Carrie Lee was making way to Cayman Brac with a load of containers when she was caught in severe weather. Fighting the storm with no cargo in her hold and stacks of containers on her deck, she lost stability and capsized while the storm pushed her back towards Grand Cayman. For two weeks, attempts were made to tow her back to port and right her, but they were unsuccessful, and the Carrie Lee sank in 110 fsw just over the edge of the wall. Two subsequent storms moved her to where she rests today. The first moved her down the sloping bottom to 220 fsw where she sat for 12 years until Hurricane Mitch passed through the islands in October 1998. Five days of intense surge from Mitch moved the Carrie Lee to the edge of the trench where she now sits, her bow jutting out over the edge of the wall pointing to blue water.

Descending to the wreck at the wheel-house, Extended Range divers using air can see the majority of the wreck without exceeding 200 fsw. Trimix divers can also plan their dive to start by going over the wall to 300 fsw and make their ascent up the wall to find the Carrie Lee waiting for you. Either way you will see an

Above: Divers exploring the pilot house of the Carrie Lee.
Left: The bow sits, poised ready to slide over the wall and into the abyss below.

Photos: Nancy Romanica

also have complete state-of-the-art equipment rental and deco tanks as well as experienced technical guides and a complete blending station for any mix that a diver could want.

Conditions in Cayman allow for year-round diving on the Carrie Lee. Extended Range air dives are typically made with a 20 to 25 minute bottom time and use 36% and 80% Nitrox for decompression, with a maximum depth of 200 fsw.

Trimix profiles range from 150 to 300 fsw for 15 to 35 minute bottom times based on the divers' preference. Trimix gasses are blended for a maximum pO2 of 1.4 and an END of 130 fsw.

Divetech offers a full range of dive locations and instruction that can fit any divers experience level.

Left: Divers decompressing in the tropical cobalt blue waters Below: The ships name, anchor and deck winch on the ships bow.

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abundance of life on the wreck. Long rope sponges stream from the wheelhouse. Tube and vase sponges crowd the wreck filtering the nutrient-rich current that washes its deck. Every other space is covered with soft corals, hydroids and encrusting sponges of yellow, pink, red and green. Barracuda and schools of snapper and jacks lay claim to the ship now. While tiny bursts of rich tropical color swarm through the rigging and sponges, and green morays lurk in the crevices.

In 1997, Divetech of Grand Cayman installed a permanent mooring to the wreck. Divetech is the island's only technical diving facility and makes several trips a week to the Carrie Lee on their 34' custom technical dive boat. The boat is fully equipped with decompression stations, emergency oxygen, backup decompression gasses, a surface/support diver and has plenty of room for doubles and stage bottles. They

HE 17% O2 25% N2 57%

OXYGEN ENRICHED TRIMIX

Ever since Benke et al. (1935) concluded that compressed air at depths greater than 66 fsw (20 m) exerted narcosis characteristics, divers have been limiting depths, attempting to acclimate to narcosis, or looked to alternative gas mixtures. Research continued throughout the years by a wide array scientists from Shilling and Willgrube (1937), Case and Haldane (1941), Kiessling and Maag (1962), Fowler and Ackles (1972) to name only a few. The research is not new and the conclusion is old news. Nitrogen at a PN2 of 3.18 to 4.0 begins to exert narcotic properties resulting in decrements in reasoning ability, reaction time, and manual dexterity.

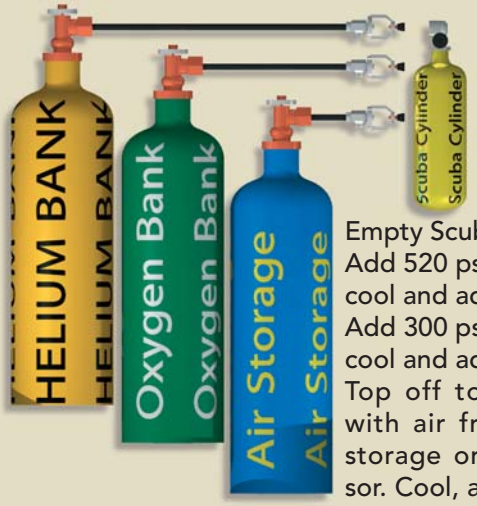
On the other hand, partial pressures of oxygen in excess of that encountered at normal atmospheric conditions may be toxic to the body. Once again it's old news. So what's new? Many agencies, civilian and government, are reducing PO2 limits below the traditional NOAA standard of 1.6. Most would agree, including the USN and OSHA, that a PO2 of 1.4 or less should be the upper limit. Oxygen breathing may result in generation of a greater quantity of free radicals or superoxides. Oxygen may inactivate cell enzymes, coenzyme A, and damage DNA and lipid membranes and has long been linked to accelerated cataract growth and decreased visual acuity in patients undergoing Hyperbaric Oxygen Therapy.

In recent years, the traditional approach to reducing PN2's and PO2's within the divers gas mix (open circuit) for depths exceeding 100 fsw (30 m) has been some form of oxygen enriched air. An example would be a 27% oxygen enriched air dive to 150 fsw (46 msw). For this dive our PO2 still remains around 1.5 with our PN2 over 4.0. Under many circumstances, the use of oxygen

Mixing Procedures

MIX:
25% Oxygen
17% helium at an ending pressure of 3000 psig.

Empty Scuba Cylinder
Add 520 psi helium, cool and adjust.
Top off cylinder to 3000 psi with stored 36% nitrox. Cool, analyze and adjust to proper 25% oxygen mix.



Empty Scuba Cylinder
Add 520 psi Helium, cool and adjust.
Add 300 psi Oxygen, cool and adjust.
Top off to 3000 psi with air from either storage or compressor. Cool, analyze and adjust to 25% oxygen.

OXYGEN ENRICHED TRIMIX

Depth	PO2/END	O2%	He%	N2%	Ending PSI	HE to Add	O2 to Add	Air to Add
150	1.4/100	25%	17%	57%	3000	520 psi	300 psi	2180 psi

WARNING: Advanced Diver Magazine does not recommend gas mixing by anyone not properly trained with blending procedures. This article is presented for informational purposes only and not intended to replace proper training.

enriched air at depths exceeding 100 fsw (30 msw) and certainly 130 fsw (40 msw) do not produce the desired result of a significant reduction of nitrogen or oxygen partial pressures.

The alternative gas mix for these moderate depths is helitrox. Helitrox is an oxygen enriched tri-mix that reduces both PO2's and PN2's to within acceptable limits for midrange dives. By producing a gas mix with a close to normoxic FO2 and a reduced FN2, we can reduce our exposure to oxygen and the hazards of narcosis. For moderate depths between 90 fsw (27 msw) and 150 fsw (46 msw) we can dive a gas mix with 17 % helium and 25% oxygen that will keep our PO2 limits to near 1.4 or less and keep our PN2's below the narcosis threshold of 3.2. The 17% helium within the mix only slightly alters our traditional air NDL's while significantly minimizing the risk associated with nitrogen and oxygen allowing the advanced recreational diver to dive within NDL's and allowing the technical diver an alternative to using oxygen enriched air as a decompression/travel/bailout gas.

The obvious main benefit with helitrox or a target best mix helium base at the mid range depth level is the avoidance of narcosis as well as the reduction of oxygen exposure. Commercial and Navy divers have known this for many years as evidenced in their use of heliox. But is it worth the drawbacks associated with helium?

First lets look at the cost factor. Helium cost between 23 cents to 30 cents per cubic foot. A typical helitrox fill will use around 13 cubic feet of helium. Even if we triple the price to include the oxygen in a 25% oxygen and 17% helium fill we are still at $12. This would not seem to be a deterrent to diving with a clear head. Helium does have a higher thermal conductivity than nitrogen, however, when used in relatively small amounts such as helitrox the thermal conductivity is minimal.

The descent rate for the RGBM NDL's used within this article is 30 fpm. The danger in descending too fast is that the inert gas uptake may exceed what is planned for the schedule, which can increase your risk to DCI. The ascent rate for the NDL's is also 30 fpm to the first stop. Ascent is a part of your mandatory decompression and ascending too fast wil result in inadequate decompression. The advantage of a slow ascent is that minimizes phase separation, minimizes bubble expansion, and permits greater desaturation from bubbles when compared to faster rates. When using helitrox or a targeted oxygen enriched tri-mix, ascent rate becomes vital as helium desaturates 2.65 times faster than nitrogen. The helium base diver must certainly closely monitor ascent rates, descent rates, bottom and depth. Is this really any different than air diving?

There are many applications for mid range helium base mixes. But the greatest benefit may be for the recreational technical nitrox diver to have a mix with quantitative benefits. Jim Bowden and Tim O'Leary recently had the privilege of teaching the NAUI Helitrox course in Cavalaire France on wrecks in the 150 fsw (46 msw) range. Candidates found themselves diving wrecks where they had dived many times previously on air or nitrox and now remembering details of the wrecks that they had once "overlooked."

Mixing oxygen enriched tri-mix or helitrox should only be done by a trained technician but the process is fairly straightforward. For the 25% oxygen and 17% helium helitrox the technician need only put 520 psi of helium in a eighty cubic foot cylinder and then "stack" to 3000 psi with a 36% oxygen enriched air. This further minimizes risk by never exposing equipment to 100% oxygen. The technician may also set the PO2 at 1.4 and the END at 100 fsw (30 msw) and mix by the partial pressure blending method.

OXYGEN ENRICHED TRIMIX

DEPTH	PO2/END	O2%	HE%	N2%	Cylinder PSI	HE to Add	O2 to Add	Air to Add
130	1.4/100	28.3	7.2	64.5	3000	230	359	2611
140	1.4/100	26.7	12.6	60.7	3000	377	317	2306
150	1.4/100	25.2	17.3	57.4	3000	520	300	2180
160	1.4/100	23.9	21.6	54.4	3000	649	284	2067
170	1.4/100	22.8	25.5	51.8	3000	764	270	1966
180	1.4/100	21.7	29.0	49.3	3000	869	257	1873

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HID
HIGH INTENSITY DISCHARGE

By: Curt Bowen

The hottest new product to hit the technical dive arena are handheld HID arc lights. The HID stands for High Intensity Discharge and while arc lamps have been around longer than light bulbs, new technology has made them safe and efficient. The first hand held HID lights were introduced about 4 years ago. These systems utilized automotive HID components, with large separate ballasts and high power requirements. The first company to use this latest technology for handheld lights was Sartek Industries, since then many others have followed their lead. The new technology produces high luminescence (it's bright), high color temperature (solar quality light, color 5000°K), and high efficiency (uses very little power). The light produced by a HID arc lamp is a very cool, brilliant white light which makes it ideal for video and photography.

The HID arc lamp differs from standard incandescent lamps in the fact that it does not contain a filament. Incandescent lamps produce light by passing an electrical current through a filament (a wire in a vacuum). This causes the wire to heat up to the point of glowing, the more current the brighter the light. One of the problems with incandescents is that most of the energy they give off is in the form of heat. In order for an incandescent to produce a white light the filament must be overdriven with current, thus producing excess heat. Forcing a filament to produce that much light makes it very fragile and all it takes is a slight bump and you're in the dark. HID arc lamps are discharge lamps, that is, the light is produced by electrically exciting a mixture of gases inside a glass tube (like a fluorescent or neon sign). This system produces much less heat and more usable light. I have tested this by leaving my HID lit, in its plastic handle, out of the water for nine hours, without any damage. Don't try that with your incandescent light. HIDs are also much less susceptible to shock and vibration (no filament to break). If you manage to hit it hard enough to knock it out, just turn the switch off for 10 seconds then on again (this resets the electronics). HIDs typically produce four to six times the light output of an equivalent wattage incandescent. That means a 18 watt HID

looks as bright as a 75-110 watt incandescent light. If that wasn't enough to sell you on an HID, the burn times are longer also.

Battery	Useable Battery Power	Burn Time 50 Watt Incandescent	Burn Time 100 Watt Incandescent	Burn Time 18 Watt HID
12V 7AH	54 watts	1 hour	30 min.	3 hours
12V 14 AH	108 watts	2 hours	1 hour	6 hours
Note: An 18 watt HID bulb has the equivalent brightness of a 75-110 watt incandescent bulb.				

(Useable batter power is calculated at 65% of the battery's theoretical wattage value)

I have been diving with HIDs for a couple of years now and have found that when you enter a wreck or a cave with an HID, other divers start checking their lights, thinking their batteries are dying. Inevitably divers who see the HID in an actual dive environment are ready to trade their worldly possessions (and spouses, children, etc.) to own an HID. While initially it may seem expensive, a full system HID (light-head, reflector, battery, charger) is priced about the same as a top quality incandescent (about $950 retail). In water with a large amount of particulate matter, the HID manages to punch through and illuminate the area in the distance rather than the particles in front of you. The whiteness of the light brings out the true colors of an object rather than casting a yellow haze like an incandescent. This ability to illuminate distant objects is a great tool, whether diving for lobsters in the north-east or cave diving in Florida.

I can't go back, I admit it I'm spoiled. The days of carrying monster sized video canister lights the size of small stage cylinders are over. The HID light gives the security of knowing that I'll have all the light I need, when I need it.

Sartek Industries' HID-18 light, will retro-fit to any 12vdc battery pack (that will save some money!) and with wetmate connectors, the system gives you the flexibility to change battery packs or add light-heads at any time, even underwater. If you need more light than that they also have available 21, 24, 50 and soon a 90 watt HID as well as video reflectors that change your handheld light into a video or photography light. If you get the opportunity to try an HID you won't be disappointed. It may just give you a new perspective on the underwater world.

Manufacturers of HID light systems:

Sartek Industries: 516•924•0441 www.sarind.com
Dive Rite: 904•752•1087 www.Dive-Rite.com

METHOX!

New Technology or just Wasted Gas

Bubba Beauregard thinks he's sitting on a goldmine. In a run-down dive shop deep in the Florida Everglades this onetime pig farmer has accomplished what many tech divers have been attempting for years: to create an inexpensive and (allegedly) safe breathing mixture, from a plentiful natural source. The gas is called METHOX and it is already creating quite a stink in the technical diving community. Stories of incredible bottom times, minuscule decompression obligations, and virtually unlimited maximum depth allowances prompted the editors of Advanced Diver to head down to the Everglades and find out the real story. What we discovered changed our view of tech diving forever.

Bubba's dive shop is a converted barn deep in pig farming territory. You could not have chosen a more unlikely place for such an incredible discovery to occur. Behind the barn, covered in brown reeds and duckweed, is a retention pond, or in pig farming terms: the fecal lagoon, whose final depth has not yet been recorded and which is reported to have a cave system that webs out for several miles.

We found Bubba to be a quiet and unassuming man, as most geniuses are, and what he lacked in teeth and personal hygiene, he seems to have made up for with down-home friendliness. He relayed the story of his fantastic breakthrough to us over home made collared greens and sweet potato pie. The following is an account of that discovery, in his words.

"My ancestors been living on this land since the Indian War. We been farming pigs here for more than a hundred years, and each pig we raised done gone through about 5 pounds of manure a day and every bit of that manure went into that fecal lagoon. I'd guess there must be a million pounds of dung down there."

"My son, he's a little slow, when he was just a cub he'd always be playin in that damn lagoon. Drive his momma wild comin home every night covered in pig droppings, smelling like a damn ham hock gone bad in the sun for a week."

"One day he up and fell in the lagoon and that boy sank, luckily Gary Walker, a local redneck and wannabe superhero, was chewin the fat with the boys and saw the cub fall in. When they came out they were covered in pig dung from head to toe, but their eyes were as big as flapjacks."

What they had witnessed inside the fecal lagoon was nothing short of fantastic. A thick, brown haze covered the top 30 feet of water but below, the water cleared and Walker could see that the lagoon went on for a long time. "We felt real small," Walker would later tell us, "really small."

At that moment Beauregard knew he was onto something big. That morning he made the first dive of his career into the fecal lagoon, and two weeks later he achieved instructor status and acquired permits to open Fecal Lagoon to public diving.

"We dove as deep as we could on air, but needed more," Beauregard explained. "And it all came together when we hired the Mexican fellas to work the farm." Unbeknownst to Beauregard, the migrant workers had placed their Porta John in close contact to the intake valve of his air compressor, the results were immediate.

"I'll tell you what," Beauregard said, "The air comin outta that thing smelled like a Tijuanna outhouse, but we used it anyway. And I'll tell you what, that day I made it to 350 feet."

It was unbelievable, like magic, divers from Bubba's Dive Team kept going deeper and deeper, ignoring the rational physics that had limited them, and they were making it back.

Beauregard claims that members of his dive team have gone as deep as 700' on the new mixture with no ill effects (other than

perhaps bad breath). When we asked him about decompression, he gave us a confused look and changed the subject.

The methox bandwagon is now in full swing in south Florida. Beauregard has even gained the blessing of the PNDN (Pay Now Dive Now) certification agency to begin teaching classes in methox. When Advanced Diver reached Joe Profit, head of the PNDN, he sang the praises of methox. "It's unbelievable," he said, "It will change technical diving as we know it."

Not everyone is sold on methox. At a recent technical diving conference in Ft. Lauderdale, Fl, the head of a major certification agency spoke out on the dangers of the new gas, calling it "Fart Oil," and "A real danger to the already suspect oral hygiene of the technical diving community." And while we must keep a watchful eye on any new breathing mixture, it is hard to argue with the results.

Profit sees methox as a marketing giant waiting to erupt, already in the works are methox t-shirts, methox specific tanks, and most recently, engineers for the PNDN have been laying plans for a methox rebreather. A simple concept that works off the diver's own natural gas supply. Bottom times may vary depending on what the diver ate the night before.

ADM's dive team did not get to dive the Fecal Lagoon on our visit, unfortunately each of us got violently ill our first day there, but Beauregard assures us that it will pass in time. We are all very excited to dive the new gas and hopefully explore the outer reaches of Fecal Lagoon.

Sidemount Diving
Continued from Page 7

for side mount verses stage/ travel gas.

The preferred air cell is the TrekWing. This air cell is shorter than most and fits very well inside the harness. This is one of the major changes over earlier side mount setups. The rear of the cell is held in place and can not balloon behind your back as easily. The bottom of the air cell is just above the waist cummerbund so most of the lift potential is available. A bungie cord strap fastens the left and right hand slide release buckles of the air cell together. This keeps the air cell from taking on the appearance of a set of wings on the diver's back.

Lights and reels can be mounted on multiple d-rings on the harness. Primary canister lights should be butt mounted on the lowest 1" d-rings and hang below the buttocks. All accessory items should be placed on d-rings behind the cylinders to keep everything streamlined.

Side mounting adds a few new wrinkles to diving. For one, the diver must manage multiple cylinder gas supplies and regulator hoses up front and personal rather than the traditional over the shoulders. Connecting the bottles to the harness takes practice and dexterity; remember it's easier to lift a bottle that is totally submerged in water rather than all or even some of its dry weight. Also, those new to side mount will find new wear points on equipment. The elbow dump on the BC becomes the highest point on your back, exposed it can be ripped off the air cell. I recommend a simple elbow instead of the rapid exhaust common on most air cells and a shorter corrugated hose on it as well, twelve inches is optimal. A leg pocket is the best way to carry any needed extras. Waist pockets are very difficult to reach when bottles are on your side.

While each new expedition presents its own unique challenges, the side mount rig described above is versatile enough to handle a majority of applications. It offers flexibility, a streamlined profile, and above all, safety and convenience to vital components of your expedition dive system.

Lamar Hires is the President of Dive Rite and a pioneer in sidemount cave exploration.

ADVANCED GADGETS

Sartek Industries BQL-50 Watt Back Up Quartz Light Head

Announcing the introduction of the BQL-50 Backup Quartz Light. The BQL-50 is a 50-watt test tube style light with a built in Wet Mate connector. The BQL-50 allows you to change light heads underwater. Simply install a Wet Mate cord on your existing battery pack and light head and you're ready.

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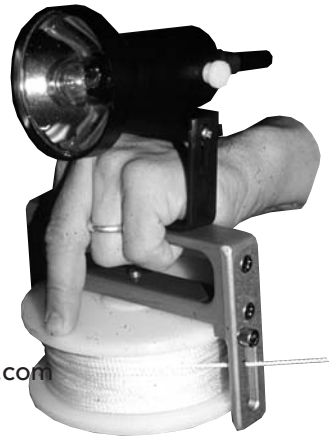
Extreme Exposure's Pathfinder line of jam proof reels



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	Diameter	Line Length
Primary Reel	5"	Approximately 400'
Exploration Reel	5"	Approximately 800'

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Ocean Technology Systems Buddy Phone

The XT-100 Buddy Phone transceiver has been specifically designed as an underwater acoustic telephone for the sport diver. It provides clear, moderate-range communications. With an optional surface station, diver-to-surface and/or surface-to-diver communications are available.

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Drager Mini Pressure Gauge

Originally designed for the new DragerRay rebreather. Its small but easy to read pressure gauge has standard size fittings for most high pressure hoses. Coupled with a 6 inch HP hose it makes a prefect stage cylinder pressure gauge. Reads from 0 to 5000 psi.

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HALCYON REBREATHER

PVR-BASC

The first new rebreather operating system design in three decades. Respiratory coupled & intuitive. Rebreather manufacturers are often fond of pointing out that the underlying technology found within rebreather design is older than SCUBA itself. To be sure, some of the first air recirculation techniques originated in the late 1800s with the often-cited Fleuss mask of 1879. However, in many ways current rebreather designs are still in their infancy. Today's diver must weigh a range of variables before they consider the use of rebreather technology for non-task-specific diving.

The Halcyon Advantage

The production of the Halcyon Rebreather came out of a careful study of available rebreather designs. Their choice of a Semi Closed, Passive Addition rebreather has paid off with the best safety record in the rebreather industry and the only unit to earn penetration records in deep cave diving. Halcyon allows the diver to focus on the dive objectives instead of on the operation of the rebreather unit. As a result of their design innovation, Halcyon sets the standard for exploration around the world. Halcyon Rebreathers can be found in the hands of leading explorers on nearly every continent.

The Halcyon's unique PVR-BASC operating system is the only rebreather technology that gives constant intuitive proper operation feedback to the diver just as in conventional scuba—through the mouthpiece. Conventional scuba informs the diver of changes in operation via breathing ability/effort. All other rebreathers available to the civilian market today require electronic monitoring systems to inform the diver of proper function.

Unlike most of the other popular semi-closed rebreathers, the Halcyon adds gas based on the diver's metabolic needs and not on some best guess calculation. As a result, the Halcyon offers high efficiency without the most common disadvantages found in rebreather design. It will allow more than 100 minutes at 300 feet deep on a single 80 ft2 drive bottle.

Unlike closed circuit rebreathers, the Halcyon does not rely on debatable electronic controls to mix a diver's breathing gas. Halcyon gas additions are delivered from a dependable premixed source and controlled by a diver's respiratory demands.

Here is how it works

1. Halcyon diver interface

The "mouthpiece" serves multiple purposes other than the obvious. The one way flow of the loop gas is directed by the largest mushroom valves of any rebreather in the field today. A unique mouthbite and chin rest compliment the rugged design and prove to be very comforting on long dives.

2. Halcyon/Scubapro bailout

Halcyon utilized inner valve components from Scubapro to create a reliable low profile performance regulator for bailout and gas switch periods of the dive. Single-hand rotation of spool valve selector allows diver immediate access to "back-gas." This unique design allows modular substitution of a selection of other brand regulators. To date, APEKS, Oceanic, and Sherwood regulators have been adapted for use with the Halcyon Rebreather.

3. Water trap system

Flooding from occasion mismanagement of the mouthpiece and moderate loop leakage can be eliminated by Halcyon's unique water trap system. Gas flow is redirected up and over a sump where liquids drop out and gas flows over.

4. Water trap pump

Five feet of Gates 33HB hose act as a reservoir downstream of a unique one-way valve mechanism allowing water to flow in the hose and gas to flow both directions for ascent equalization. A hand pump is attached to the exit end of the hose and full control is isolated by a turn stainless steel "Whitey" valve. Audible detection (gurgling) of liquid circulating in the loop alerts the diver to pump the trap dry.

5. Major bellows

The counterweighted bellows affords an absolute minimum work of breathing when measured where it counts, in the lungs. Measuring the WOB at the mouth (many rebreather stats) is not applicable to the true parameters effecting long exposure rebreather divers. The inherent pneumatic force of the bellows is perfectly matched with the counterweight opposing the divers lung centroid. Gas flows in and out of the bellows at the corresponding rate of inspiration / expiration. A depth proportion adjusted amount of each bellows exhaust stroke moves through a redundant non-return valve into the minor bellows or exhaust bellows.

6. Minor bellows

Depth variable discharge gas proportioning is accomplished by reducing the actual size and shape of the exhaust bellows. This function initiates gas addition timing relative to diver RMV and gas addition volume relative to depth and RMV. The location upstream of the scrubber further increases efficiency of the scrubber by eliminating discharge gas prior to CO2 removal, yet another wasteful design feature oversight of all other commercially available SCR's

7. Depth compensators

Enclosed single ATA (adjustable as option for preloading) filled bellows attached to control rods which retract with depth, in turn reducing volume and shape of minor bellows while increasing proportionately recycled loop gas volume. This design represents the true genius of the Halcyon gas management advantage over all other SCR's.

8. Discharge control valve

The ambient pressure balanced DCV is the final mechanism controlling discharge of exhaust gas. The simple valve design is field serviceable and has a open flow failure mode, not a life threatening closed circuit hypoxic mode.

9. Gas insulated scrubber

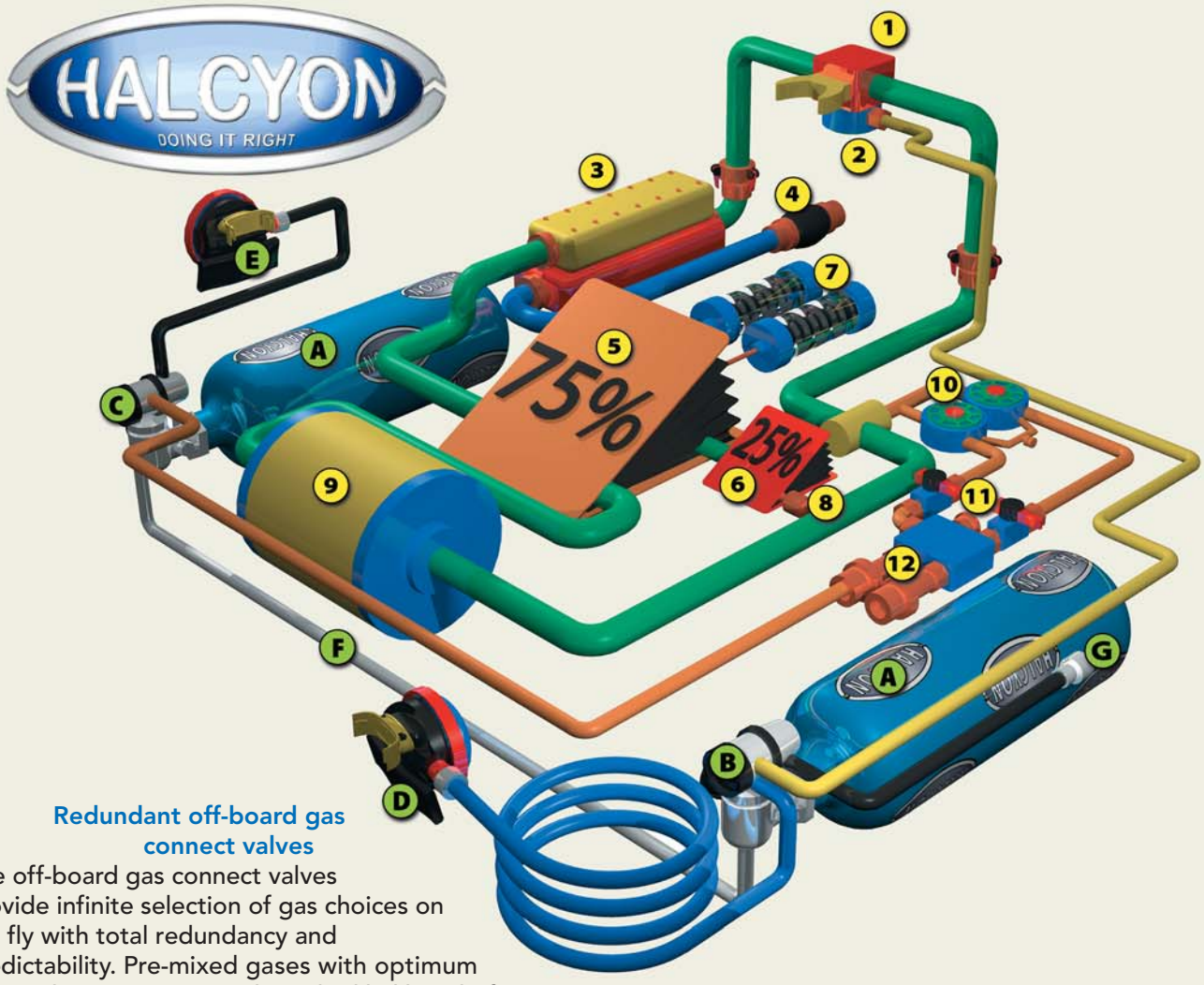
Less than 3% of the scrubber media housing actually come in direct contact with the ambient environment. A substantial gas chamber surrounds the other 97% of the housing which in turn is enclosed by the watertight outer housing. Standard sizes of 4 and 6 pound provide 6 to 10+ hours respectively in moderate water temperatures. The Halcyon scrubber is by far the easiest and most predictable canister to load due to the fact the media housing is completely removable without tools.

10. Halcyon/Scubapro gas addition system

Redundant RMV drive gas addition respiratory coupled making the entire machine intuitive to operate more like conventional OC SCUBA than any other operating system. New gas addition is triggered on the inhalation stroke in sequence with the final exhaust component being discharged keeping the loop FiO2 and buoyancy of the unit near perfection. Either regulator will suffice this requirement and both combined allow adequate gas addition for balancing even the most rapid descents.

11. Gas addition regulator isolation valves

Manual isolation of either or both gas addition regulators allowing diver full control and verification of proper operating system condition-all with one hand. Periodic verification of the complete function of the gas addition system is verifiable on the fly simply by turning each regulator off and monitoring the subsequent reduction in bellows travel (the diver can sense the length of the stroke while breathing, which perpetually reduces with each breathe while gas addition is terminated, eventually ceasing altogether, this "alarm" feature instructs the diver to switch to OC bailout while resolving the gas addition failure). Other rebreather systems require electronic monitoring of this potentially fatal and insidious mechanical failure and lack any means by which to test during the dive.



12. Redundant off-board gas connect valves

The off-board gas connect valves provide infinite selection of gas choices on the fly with total redundancy and predictability. Pre-mixed gases with optimum Po2 and inert content reduce the likelihood of hyperoxia/hypoxia, potentially due to a series of land based and pre-dive detectable human errors.

Conventional Back gas set

DIR rebreather diving incorporates an entire set of DIR gear appropriate for the actual dive mission. The rebreather is simply a gas extension tool to increase performance and efficiency.

A. Bottom Gas Mixture

B. Right post back-gas regulator

Long hose primary OC, wing inflation (warm water, separate Argon supply for cold), and main gas supply to rebreather OC bailout

C. Left post back-gas regulator

Necklace (back-up) OC, SPG, and back-gas rebreather supply

D. Primary OC regulator

The long hose regulator remains in the conventional wrap position with loop tucked under canister light and second staged clipped off to top right D-ring with break-away o-ring rigging.

E. Back-up OC regulator

Conventional DIR necklace regulator worn in conjunction with entire system.

F. Extended Isolator Manifold

Custom fabricated isolator manifold, specific to exact back-gas bottles used.

G. LP inflator hose

Typical DIR warm-water setup would run this hose behind the neck to the wing inflator.

It should be obvious by now that the entire PVR-BASC operating system was designed to reduce/eliminate the failure prone reliance and task loading associated with electronically controlled operating systems while increasing rebreather performance to more than 10 times the best expected of conventional OC scuba.

PH: 954•462•5570
WEB: www.halcyon.net

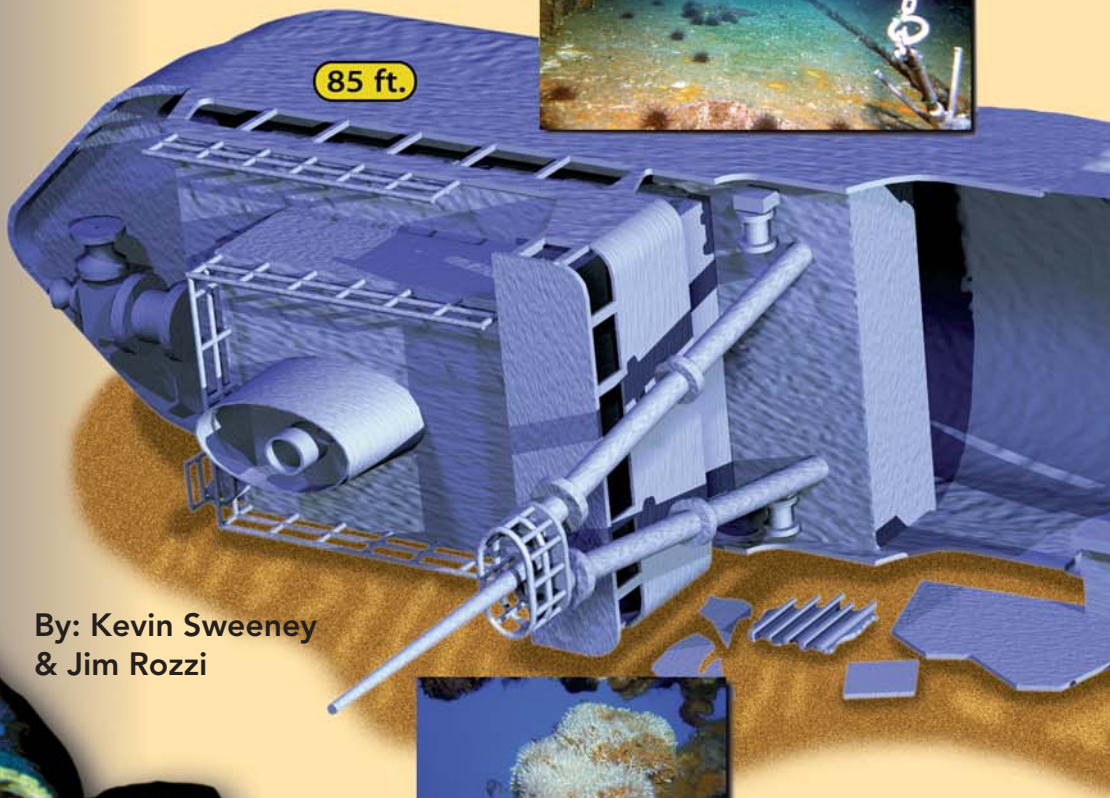
Illustration: C. Bowen

FANTASTICO

NAPLES FLORIDA

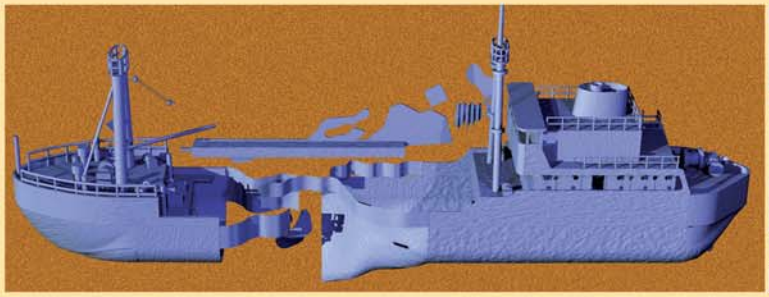
In the early hours of Saturday, March 13, 1993 a Spring storm of tremendous strength crashed into Florida's West Coast. Labeled the "No Name Storm" it brought with it near hurricane force winds and tidal surges as high as 12 feet. The storm caused more than 500 million dollars in damages to properties along Florida's Gulf Coast and killed at least 26 people.

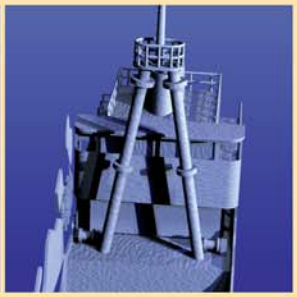
That same Saturday morning the 200 foot Honduran freighter Fantastico was chugging through the gulf bound for Tampa with a full load of phosphate. While rough seas had been forecast, the strength of the storm had been grossly underestimated and just after dawn, the crew of the Fantastico found themselves floundering in 30 foot waves and winds over 70 miles per hour. Not long after, approximately 57 miles Northwest of Naples, Florida, the Fantastico succumbed to the wicked conditions, and sank. Of the ten men who crewed her, three were rescued by the Coast Guard as they clung to an overturned



By: Kevin Sweeney & Jim Rozzi

Photos: Dawson Cochran, Kevin Sweeney, Lorraine Sommer
Illustrations: Curt Bowen





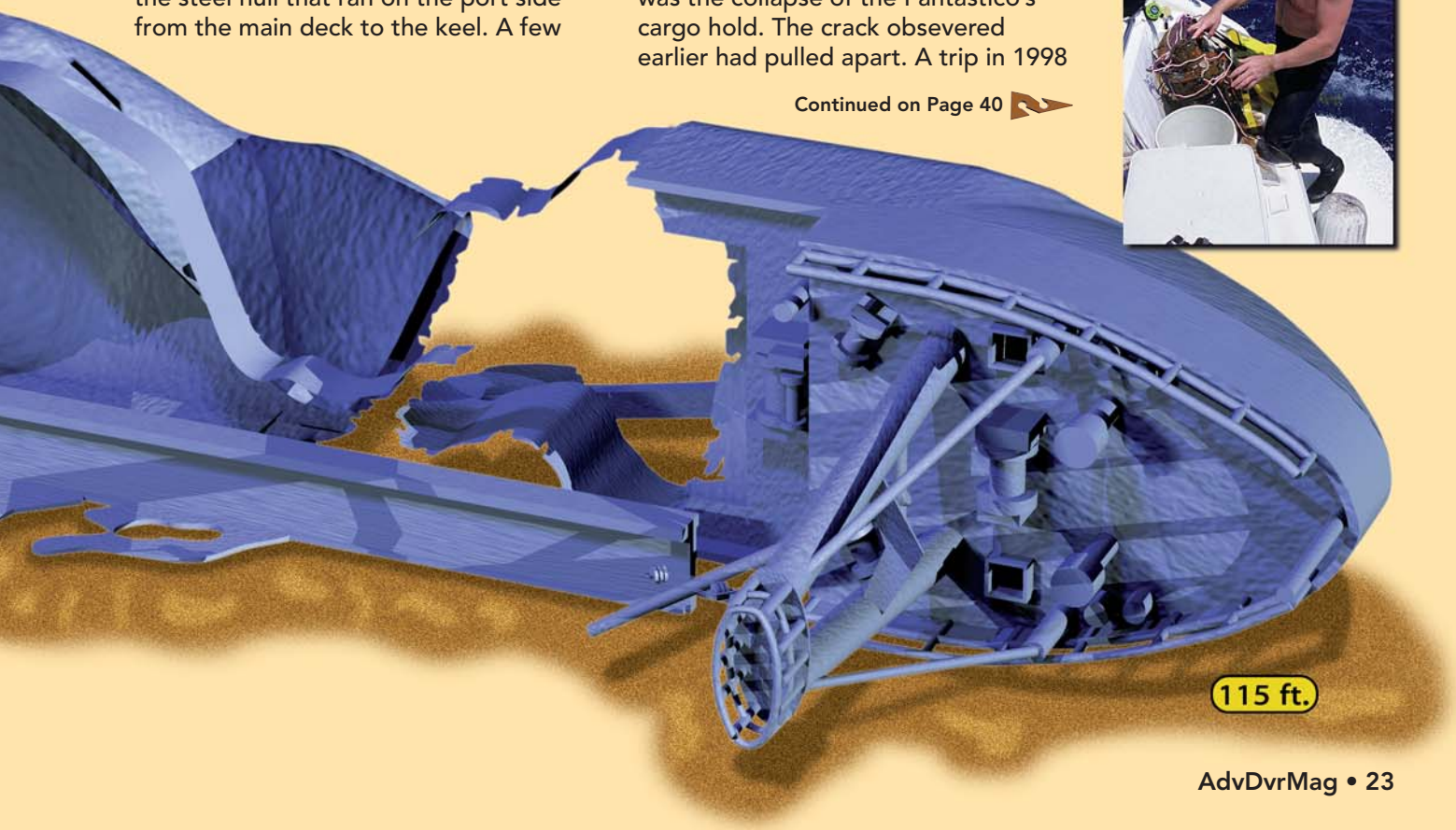
lifeboat, three bodies were later recovered, and four were never found.

Fantastico now rests in the sand of the Gulf of Mexico in 115 feet of water with the top of the wreck coming up to 80 feet. When first dove in 1994, she was found lying on her starboard side with the bow pointing north. Oil was still seeping from the wreck and her booms and masts were still rigged with steel cable. Four inch manila line floated toward the surface and clouds of shimmering baitfish darted all over her. The anchor was still housed and, at the stern, schools of snapper swam around the single propeller. Her pilothouse and machinery rooms were accessible. A stretcher and first aid kit were found lying in the sand nearby. The ship's load line certificate, issued July 13, 1992, was found in the pilothouse. The only evidence of damage was a crack in the steel hull that ran on the port side from the main deck to the keel. A few barracudas circled high above the wreck and the name Fantastico was still clearly made out, painted in bold, black letters on the ship's port bow.

Dives in 1995 and 1996 disclosed an ever-increasing colonization by marine life. Sea urchins and small soft corals were attached to the length of the hull. Schools of amberjack and spadefish swam around the wreck in large numbers, inquisitively checking out divers. A nurse shark slept on the bottom inside the cargo hold. Free-swimming blacktip and bull sharks circled at distances of 30 to 40 feet, and the first three or four jewfish were spotted.

Dives to the wreck in September of 1997 saw cobia, Spanish Mackerel, permit, and several more jewfish. The most dramatic observation of this trip was the collapse of the Fantastico's cargo hold. The crack obsevered earlier had pulled apart. A trip in 1998

Continued on Page 40



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Equipment for Underwater Exploration

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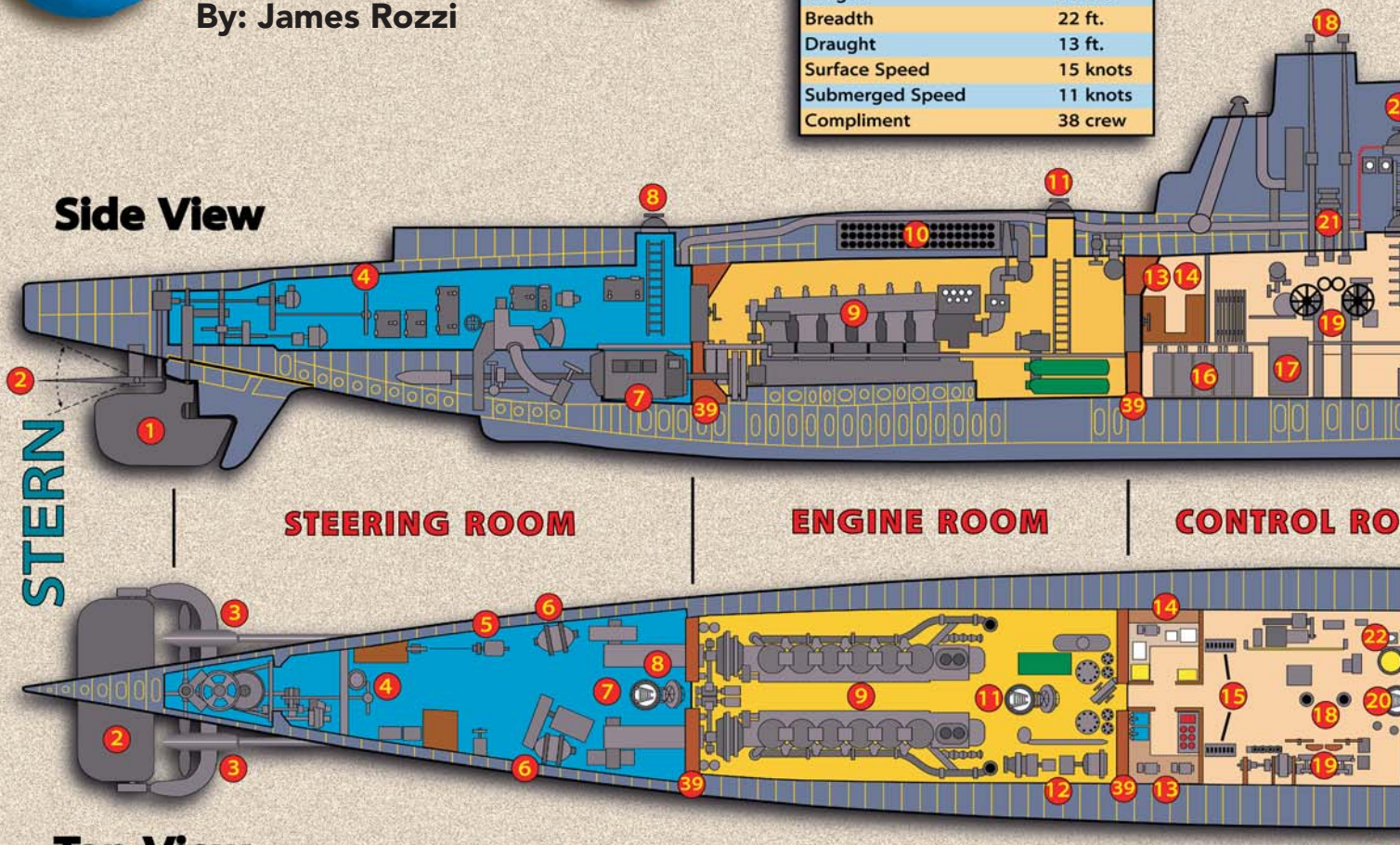
S-16 WW-I U.S. SUBMARINE

By: James Rozzi

U.S. Submarine S-16	
Surface Displacement	876 Tons
Submerged Displacement	1092 Tons
Length	231 ft.
Breadth	22 ft.
Draught	13 ft.
Surface Speed	15 knots
Submerged Speed	11 knots
Compliment	38 crew



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29. Mess Tables
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35. Torpedo Rm. Hatch
36. Torpedoes
37. Torpedo Tubes
38. Bow Diving Gear
39. Bulk Head W/Door

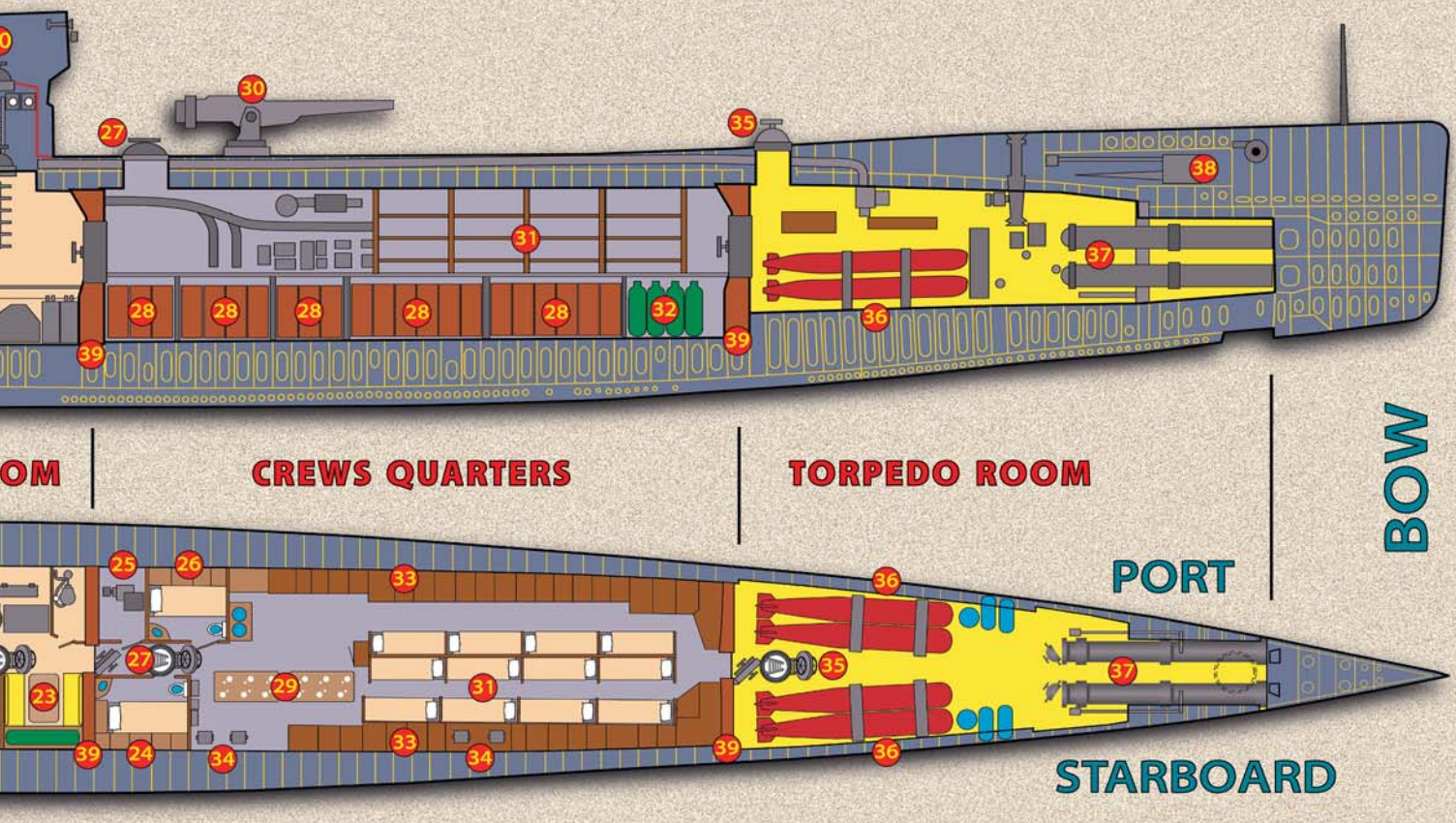
Illustration: C. Bowen

March 19th, 1918 the S-16 submarine was constructed by the Torpedo Boat Company of Bridgeport Connecticut. Launched on December 23rd, 1919 and commissioned on December 17th,1920. She would serve under Lt. Commander Andrew C. Bennett and left New London, Connecticut on May 31st, 1921. Sailing through the Panama canal the S-16 traveled to California, Hawaii, Guam, the Philippine Islands and reached her new base at Cavite, Luzon on December 1st, 1921. For the next several years she would be placed on many active duties and patrolled the waters off China, Japan and the Philippines.

November 3rd, 1924 the S-16 was ordered back to the U.S. and for the next 12 years she was to patrol the California coast, Hawaii and the Panama canal. May 22nd, 1935 the S-16 was decommissioned and sent to Philadelphia for dry dock.

With the involvement of the United States in WW-II the S-16 was recommissioned on December 2nd, 1940. During World War two she would patrol the eastern coast of the United States with voyages to Bermuda, St. Thomas and the Panama Canal zones. During the last stages of WW-II the S-16 was again decommissioned on October 4th, 1944 and struck from the Navy list.

April 3rd, 1945 in calm seas just off Key West, Florida the S-16 was towed to her final resting place. With all hatches open the scuttle plugs were pulled and water rushed in, filling the inside compartments as the U.S. sailors scrambled up through the hatchways towards safety. With a blast of air from the open hatches the U.S. WW-I submarine S-16 dipped below the waves and to her final resting place.



Submarine Wrecks in U.S. Waters

German Submarines

Submarine	Depth	Location
U-1105	85 fsw	Potomac River
U-85	100 fsw	Oregon Inlet, NC
U-701	110 fsw	Cape Hatteras, NC
U-352	120 fsw	Morehead City, NC
U-853	130 fsw	Block Island, RI
U-2513	215 fsw	Dry Tortugas
U-869	230 fsw	NJ
UC-97	250 fsw	Lake Michigan
U-140	267 fsw	Virginia Coast

United States Submarines

Submarine	Depth	Location
S-37	35 fsw	San Diego, CA
Blenny	70 fsw	Ocean City, MD
G-2	75 fsw	Connecticut
G-1	100 fsw	Newport, RI
L-8	110 fsw	Rhode Island
S-49	125 fsw	Patuxent River, MD
Tarpon	140 fsw	Hatteras, NC
Dragonet	150 fsw	Chesapeake Bay
S-21	160 fsw	Maine Coast
Bass	160 fsw	Block Island, RI
S-5	170 fsw	NJ
Spikefish	260 fsw	Block Island, RI

Today the S-16 sets upright with a slight 20 degree tilt to her starboard side in 265 feet of water, 17 miles from Key West. Currents from the Gulf Stream flow over her hull and can make diving the sub very difficult to impossible. She is still in very good condition with little coral growth. Large amberjack and Barracuda circle above the submarine. Snapper and grouper hide within her water vents and hatches and an occasional shark can be seen darting in and out of view.

Interesting parts of the wreck include the conning tower, two large props and rudders. The large stern hatch into the steering room allows penetration with a set of doubles, all others would require the removal of scuba equipment and possible a no mount system. Extreme caution should be taken as submarines are designed with tight cramped spaces in mind. Visibility will quickly be reduced to a few inches because of the percolation of rust from the walls. Multiple wires, pipes and grates are potential snag problems.

Divers: James Rozzi, Jim Webber and Curt Bowen.
Special Thanks to Capt. Billy Deans

Hal Watts FORTY FATHOM GROTTO

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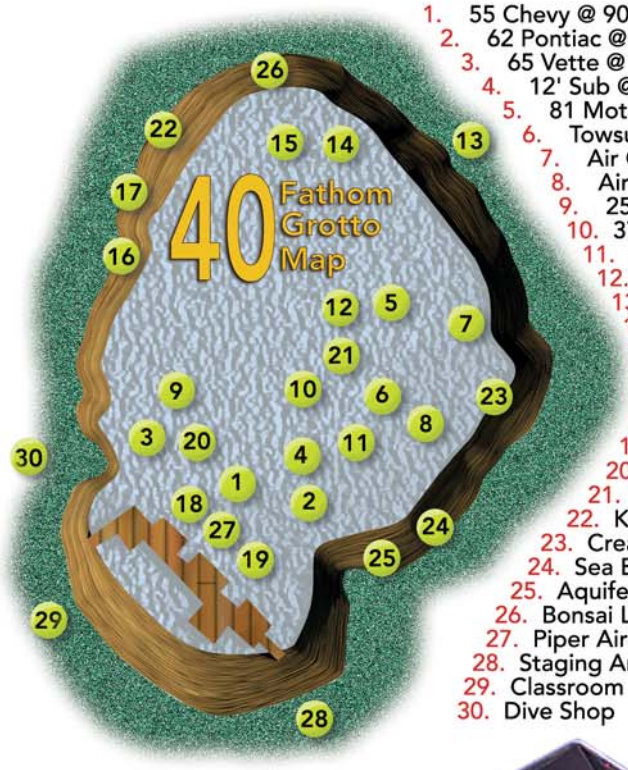

1. 55 Chevy @ 90ft.
2. 62 Pontiac @ 100ft.
3. 65 Vette @ 110ft.
4. 12' Sub @ 80ft.
5. 81 Motor Cycle @ 40ft.
6. Towsub @ 60ft.
7. Air Chamber @ 35ft.
8. Air Chamber @ 32ft.
9. 25' Cabin Cruiser @ 110ft.
10. 37 Chevy @ 140ft.
11. Falcon/Nova @ 150ft.
12. Chevy Van @ 150ft.
13. 28 Chrysler @ 200ft.
14. 53 Dodge @ 175ft.
15. 64 Corvair @ 187ft.
16. 62 Olds @ 200ft.
17. VW Bug @ 210ft.
18. 8 x 16 Platform @ 15ft.
19. 8 x 16 Platform @ 30ft.
20. 8 x 16 Platform @ 40ft.
21. 8 x 16 Platform @ 60ft.
22. KeyHole Cave @ 236ft.
23. Creature Cave @ 55ft.
24. Sea Biscuit Cave @ 50ft.
25. Aquifer Entry Cave @ 100ft.
26. Bonsai Line @ 240ft.
27. Piper Airplane @ 90ft.
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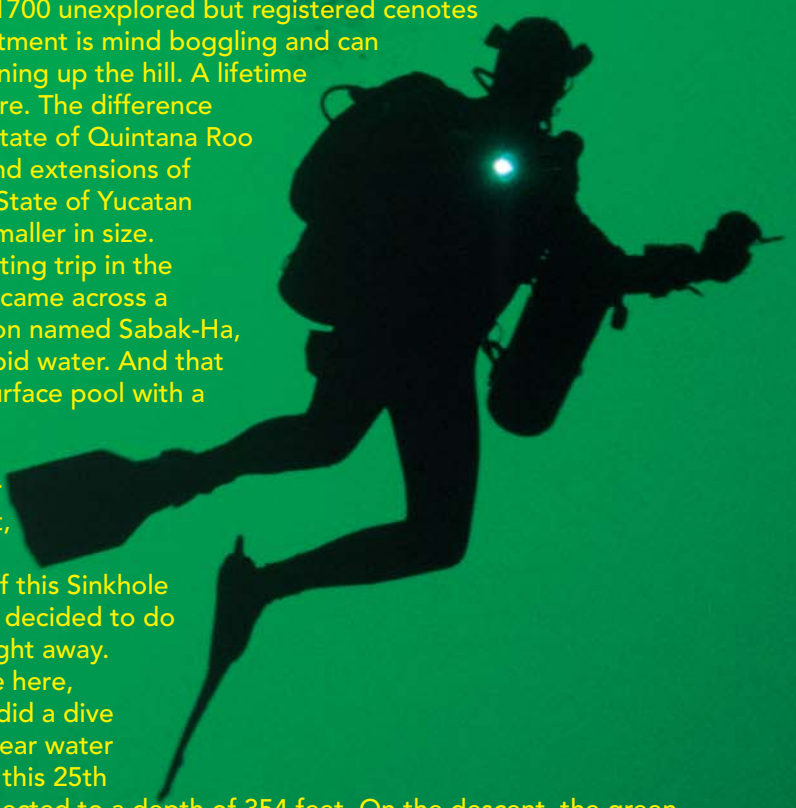
SABAK-HA

By: Andreas W. Matthes

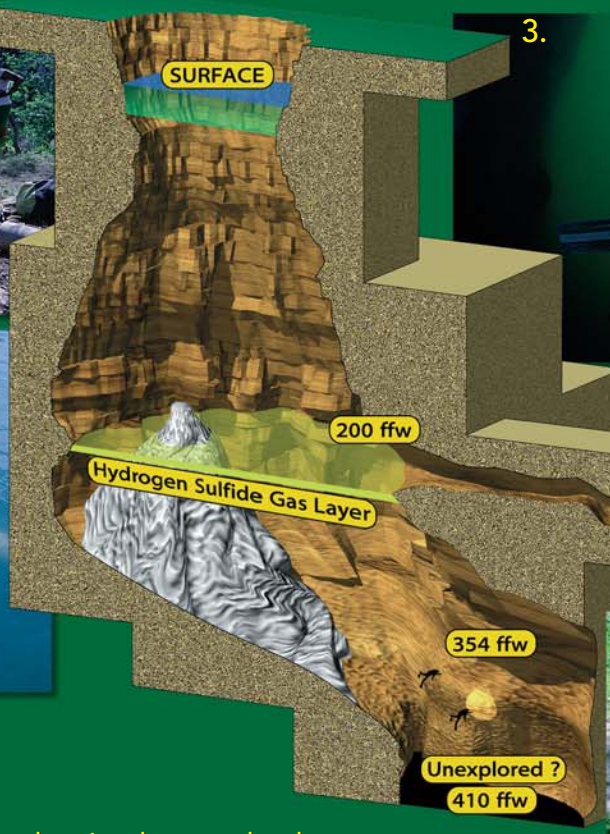
Looking for new places to dive, new underwater caves to explore can become an obsessive pursuit. It harkens back to the very beginnings of man when people gathered in caves to protect themselves from mother nature. No place yet discovered on earth is better suited for this quest than Central America. The Swiss cheese-like limestone rock of the Yucatan peninsula in Mexico is one of the prime areas of underwater cave formation. In the State of Yucatan you will find yourself in an area full of unexplored cenotes and only a few people who are exploring them. The sheer number of over 1700 unexplored but registered cenotes kept by the Ecology Department is mind boggling and can give one the feeling on running up the hill. A lifetime of exploration is waiting here. The difference between the caves of the State of Quintana Roo and Yucatan is the depth and extensions of these cave systems. In the State of Yucatan the caves are deeper but smaller in size.

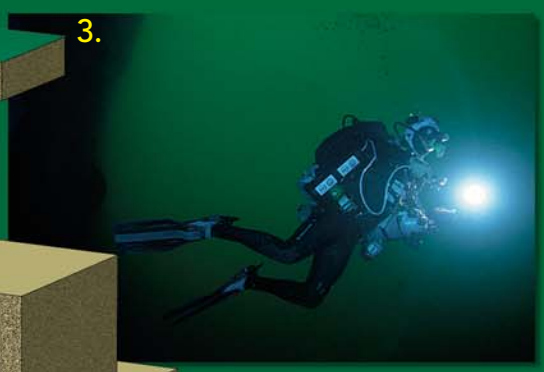


While on a cenote scouting trip in the Yucatan, Daniel Dens and I came across a huge, water-filled depression named Sabak-Ha, which in English means turbid water. And that is what you looking at. A surface pool with a diameter of about 100 feet filled with green, uninviting water. The ground to water level drop is around 40 feet, as is usually found in this region. The immense size of this Sinkhole made it look so deep that I decided to do my first dive on trimix straight away. A week before my first dive here, Memo de Anda of Cancun did a dive to 180 feet and reported clear water but no bottom in sight. On this 25th of September I went unexpected to a depth of 354 feet. On the descent, the green algae bloom gave way to crystal clear water below 35 feet. The huge size of this sinkhole was breath-taking, I felt like an ant in the midst of a full bathtub. At a depth of 210 feet, I found a hydrogen sulfide layer with 20-25 feet of visibility trapped in the halocline, the interface between fresh water above and brackish saltwater below. At 290 feet the Talus Cone came into view, the breakdown of what was once the ceiling of this large dome. At 210 feet, the diameter of this immense hole is about 250 feet across, filled with clear water and circular in shape. At 354 feet I hit my turnaround pressure, maximum depth and planned bottom time. When I tied off the exploration guideline on a rock I could not see the final bottom and neither the walls that should enclose this cave. My interest into Sabak-Ha was awakening.

On the 16&17th of November 1998, Kashi de Cleer and I returned to Sabak-Ha to have a closer look at the walls of this sinkhole. Upon our investigation we came across a horizontal cave passage at a depth of 180-200 feet which extended 423 feet horizontally into the bedrock, the exploration was halted by a terminal break down. A cloud of millions of little cave shrimps was greeting us at the entrance and further into the cave we found one of the largest populations of blind cave fish we have ever seen in a single location and at that depth. We counted 13 blind cave fish while entering the passage with one sweep of the eye and named the passage Blind Cave Fish Cafi.

Photos: Roberto Hashimoto
Illustration: C. Bowen





Photos:
Left Page
Exploration Diver at 170 ffw, Silhouetted against the green algae layer.

Right Page
1. An array of dive cylinders and mixes needed for a deep exploration dive.
2. Andreas Matthes resting on the surface.
3. Andreas Matthes at 145 ffw.
4. Diver making last minute preparations on his equipment.

On the 20th of May 1999, Ronald Rumm and I returned to see what the bottom was doing. We were descending to a depth of 356 feet and found ourselves swimming horizontally on top of a huge breakdown, entering a giant, deep cavern or cave passage into what we named the Black Abyss. I tied the end of our exploration guideline on to the wall which was on our right. Below us was a black void, a huge crack that went into the inky darkness and out of sight. In front we could not see a wall, neither could we see a wall to our left. We felt very little.

On the 16th of August, a new cave passage was found. The entrance of the cave passage is on the opposite side of the Blind Cave Fish Cafi passage, at a depth of 211 feet and it extends into the bedrock horizontally for 403 feet. The shallowest part of the passage is right at the end of the exploration guideline at 186 feet where the passage splits up into two small leads. Close to the end of the guideline a side passage was established that is still continuing but will be passable only in side mount gear configuration. Close to the cave entrance are two leads that are going off to the left and right, which remain unexplored. The cave passage has been named Passaje de Sacrificios (Passage of Sacrifices) due to the fact that after the completion of the dive, one complete stage bottle including regulator was lost and is now resting on the bottom at a estimated depth of 280-350 feet. Exploration continues.

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EXTREME DEPTH

Bjarte Vestol 735ft/225m

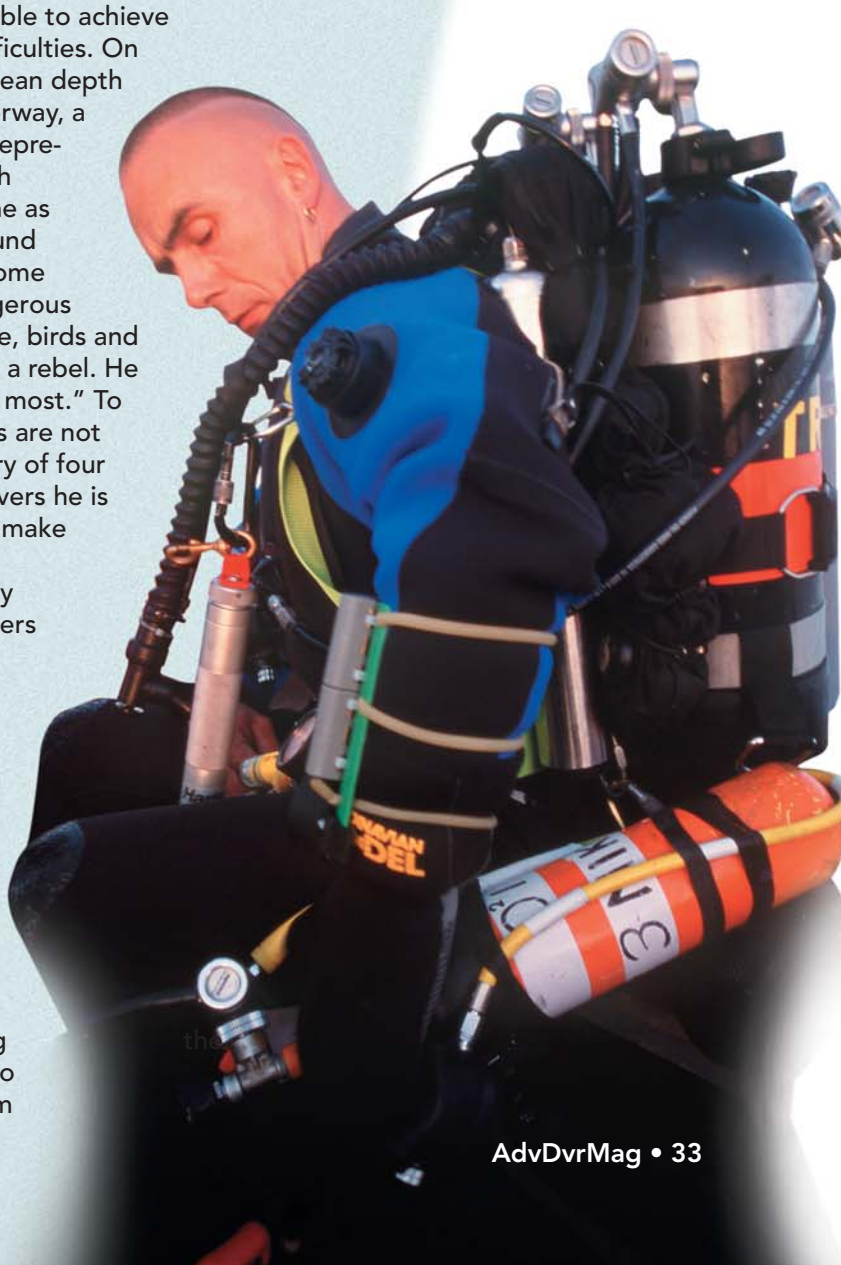
Text By: Bjarte Vestol
& Jim Bowden

In 1993, Sheck Exley chronicled thirteen sub 500 ft / 152 m dives. Of these only one dive had been made in the open ocean to that depth, Jim King dove to 643 ft / 196 m in Deans Blue Hole in the Bahamas. By 1998, when I reported on deep technical dives, the number of sub-500 ft dives had grown to over 37. One additional, though difficult to confirm ocean dive was reported to 685 ft / 208 m by a diver known as Thoctaricles in the Mediterranean Sea. Obviously the more difficult conditions confronting the diver in the open ocean-currents, cold, sea state, access logistics and so on, have made progress somewhat slower in this area.

That which is difficult to do or considered impossible to achieve only waits for the right individual to overcome the difficulties. On May 28, 1999 Bjarte Vestol (right) accomplished an ocean depth record with a dive to 225 m / 738 ft. Bjarte is from Norway, a country which together with its thousands of islands represents a coastline of about 55,000 km. Norway has high mountains and deep valleys and is split by fjords, some as deep as 1200 meters. The same irregular terrain is found under the sea. Bjarte is a climber and adventurer of some renown. Like so many who involve themselves in dangerous activities, he is a sensitive individual who enjoys nature, birds and his family. His wife Siri says, "Some people see him as a rebel. He goes his own way and he often thinks differently than most." To me he fits in with those rare people whose adventures are not intended to kill time but to make time live. In a country of four and a half million people and 10,000 or so certified divers he is one of a few utilizing trimix and technical methods to make his deep excursions safer and successful.

The dive was made in the southern part of Norway outside Kristiansand. Bjarte used two Uwatec computers to confirm his depth. One gauge read 218 m / 715 ft and the other 225 m / 738 ft. The total dive time including decompression was 178 minutes. The bottom time was six minutes indicating a very rapid descent. Bjarte spent one hour at 9 m / 30 ft in a chamber after exiting the water. The water temperature was 5-7 degrees Celsius. (41 to 44 F). Visibility ranged from good to very bad at depth. What follows, in his words, are the details of his dive.

"I had to have my last training dive on Wednesday the 26th, just two days before the planned dive to 225 meters because my new suit was delayed. Then I had to make a lot of adjustments like increasing filling speed of the inflator, weights and balance. I also decided in the last days to use a heliair 12% deco from



Photos: Hans Petter Haraldsen

120 m / 393 ft to 80 m / 263 ft to improve safety and shorten decompression."

"NTD (Norsk Teknisk Dykkekrets) arrived on Thursday, the day before the main dive. They brought with them two fast boats and a pressure chamber. The chamber was placed on shore. NTD did a very good job with organization and support divers."

"The dive was done in an area where scuba diving is prohibited because of U-boats and ferryboat traffic. So we had to do it very early in the morning. I was quite nervous and stressed the days before because of all the work in the last moment and I had little sleep. In the back of my mind I thought that even the best equipment can have its limits. In the cold water the regulators would freeze sooner or later. The lamps could break (ed, Sheck had a light implode violently on one of his dives). It would be easy to drift away from the bottom line in the current. I also knew the dive site was a dumping place for ammunition and shells from the Second World War, and the fishermen had lost some nets down there."

"We got up at 0230 in the night the diving day. I felt much better when I started dressing. In the speed boat on the way to the dive site I felt very calm and I knew I could go very deep that day. I knew I had a very proper training and some of the best diving equipment available. I also knew the team around me was very professional. I had built a good self confidence. The ocean was very calm, just like a mirror. The sun rose at half past 3 and it was a beautiful morning."

"I jumped in the water together with the deepest support diver and descended after some minutes. I had full control all the way down. The gas shifts were perfect and it was the fastest descent I have ever done. I have never consumed so little transport and bottom gas before, not even on the 146 meter dive. The whole dive was almost too easy that day. The decompression went as planned. I almost emptied my first deco gas, the 12 % heliair, but had a backup for it. A little bit worse was the argon for the suit. It had just a few liters left. I was also a little bit cold at the end of the dive because of a little leak in one arm. Safety divers waited for me at 80 meters and 40 meters, both followed me to the surface. At the end of the 3 meter stop the support divers took off most of my equipment but when I surfaced, I had to climb a ladder into the rubber boat with both of my 15 liters on my back. The rig was made very tight around me because I wanted good balance and I had no connections on the webbing because of safety. Support divers undressed me in the boat while it was running full speed to shore. They put me in the chamber for one hour at 9 meters on O2. I had no problem with DCS after this dive, but I was quite exhausted the rest of the day."

Photos: Hans Petter Haraldsen

PREPARATION DIVES:

#1 TRIMIX TRAINING DIVE 5 APRIL 99

Depth: 479ft. / 146m. Total dive time: 106 min.

I had a lot of problems during this dive. It was badly organized. I had problems getting support divers, I had to abort the dive at 30 m because the hose to the suit came off. In the second attempt I hooked in a spare deco bottle at 60 m which ripped my regulators out of my mouth and I lost half of my transport gas.

#2 TRIMIX DIVE 9 APRIL 99

Depth 535ft./163m. Total dive time: 133 min.

Minor problems: I almost lost one of the computers. I had to stop around 60 m to strap it on. I lost speed and concentration, but managed to go on and turned around at 163 m. One of my support divers lost half of his bottom gas and met me at 60 m instead of 80 m as planned. This gave me the lesson that you cannot trust anybody else but yourself in an emergency. The sea on the surface was quite rough and caused a lot of trouble disconnecting the equipment and getting back into the boat.

#3 TRIMIX DIVE 23 APRIL 99

Depth: 528ft./161m. Total dive time: 139 min.

This time somebody had stolen my bottom line and I had to make a new one in a hurry. I was quite pissed and that is not the best preparation for my mind. The dive went very well but I forgot to change batteries in my reserve lamp. My main lamp ran out after about 50 minutes and since this dive was done late in the evening, I had problems reading my instruments the last hour of deco.

#4 TRIMIX DIVE 29 APRIL 99

Depth: 561ft./171m. Total dive time: 147 min.

Problems: A leaky mask caused some trouble and slowed me down. Rough seas and some current on the surface caused a lot of stress for my boatman and the support diver.

#5 TRIMIX DIVE 14 MAY 99

Depth: 590ft/180m. Total dive time: 149 min.

This dive went very well but I felt I could go faster with more training. I felt a little pain in my right shoulder. Was it DCS or just a muscle stretch?

#6 TRIMIX DIVE 20 MAY 99

Depth: 515ft./157m. Total dive time: 132 min.

No problems.

#7 TRIMIX DIVE 26 MAY 99

Depth: 524ft./160m. Total dive time: 136 min.

No problems

MAIN DIVE:

On the main dive I felt my brain was crystal clear all the way from surface to the bottom and up, and I did not feel any abnormal signs in my body.

After the main dive I had to walk about 160ft./50m from the pier up a hill to the pressure chamber. I then felt a little bit dizzy. This disappeared when I sat down in the chamber but I think this was because of the long breathing I had on pure O2 at 20ft./6m and 10ft./3 meters and all the way from the surface to the chamber? In the water I had 5 minutes breathing on my transport gas (16% heliair) every 20 min. After the chamber I felt OK but I was quite exhausted.

Bjarte's future plans are to dive a steamer which collided with another ship and sank one hundred years ago to a depth of 624ft./190m.

DIVE PROFILE / BOUNCE DIVE TO 722 ft / 220 m

DEPTH	MIX	PPO_2	END
260 ft / 80 m	Tx 16 O_2 / 24 HE	1.43 ppO_2	190 ft / 58 m
738 ft / 225 m	Tx 6.5 O_2 / 69 HE	1.48 ppO_2	200 ft / 61 m
430 ft /132 m	Tx 6.5 O_2 / 69 HE	0.91 ppO_2	110 ft / 34 m
400 ft /120 m	Tx 12 O_2 / 43 HE	1.55 ppO_2	210 ft / 64 m
290 ft / 87 m	Tx 12 O_2 / 43 HE	1.15 ppO_2	150 ft / 45 m
260 ft / 80 m	Tx 16 O_2 / 24 HE	1.43 ppO_2	190 ft / 58 m
210 ft / 63 m	Tx 16 O_2 / 24 HE	1.16 ppO_2	150 ft / 45 m
170 ft / 51 m	Tx 16 O_2 / 24 HE	0.97 ppO_2	120 ft / 36 m
150 ft / 45 m	Tx 16 O_2 / 24 HE	0.87 ppO_2	105 ft / 32 m
120 ft / 36 m	EANx 30% O_2	1.37 ppO_2	102 ft / 31 m
110 ft / 33 m	EANx 30% O_2	1.28 ppO_2	92 ft / 28 m
100 ft / 30 m	EANx 30% O_2	1.19 ppO_2	82 ft / 25 m
90 ft / 27 m	EANx 30% O_2	1.10 ppO_2	75 ft / 23 m
80 ft / 24 m	EANx 30% O_2	1.01 ppO_2	65 ft / 20 m
70 ft / 21 m	EANx 50% O_2	1.54 ppO_2	33 ft / 10 m
60 ft / 18 m	EANx 50% O_2	1.39 ppO_2	26 ft / 8 m
50 ft / 15 m	EANx 50% O_2	1.24 ppO_2	20 ft / 6 m
40 ft / 12 m	EANx 50% O_2	1.09 ppO_2	13 ft / 4 m
30 ft / 9 m	EANx 50% O_2	0.94 ppO_2	7 ft / 2 m
20 ft / 6 m	100% O2	1.59 ppO_2	0 m
10 ft / 3 m	100% O2	1.29 ppO_2	0 m

TOTAL DECO TIME: 151 minutes.
DIVE RUN TIME: 177 minutes.
CNS Total: 116.6%
OTU's: 241

WARNING!
Deep diving is extremely dangerous and can cause serious injury or even death.

43 cuft / 1219.0 liters of Tx 16 O_2 / 24 HE
119 cuft / 3379.4 liters of Tx 6.5 O_2 / 69 HE
28 cuft / 779.7 liters of Tx 12 O_2 / 43 HE
32 cuft / 889.5 liters of 30.0%
65 cuft / 1825.2 liters of 50.0%
50 cuft / 1409.2 liters of 100.0%
336 cuft / 9502.0 liters total

The actual decompression times on this schedule have been left out for safety reasons. If you have not been properly trained in mixed-gas decompression diving by an internationally recognized technical certification agency and/or don't have a firm handle on decompression planning and mixed-gas diving,

DO NOT ATTEMPT ANY TYPE OF MIXED GAS DECOMPRESSION DIVING!

ADVANCED NITROX DIVE PLANNING

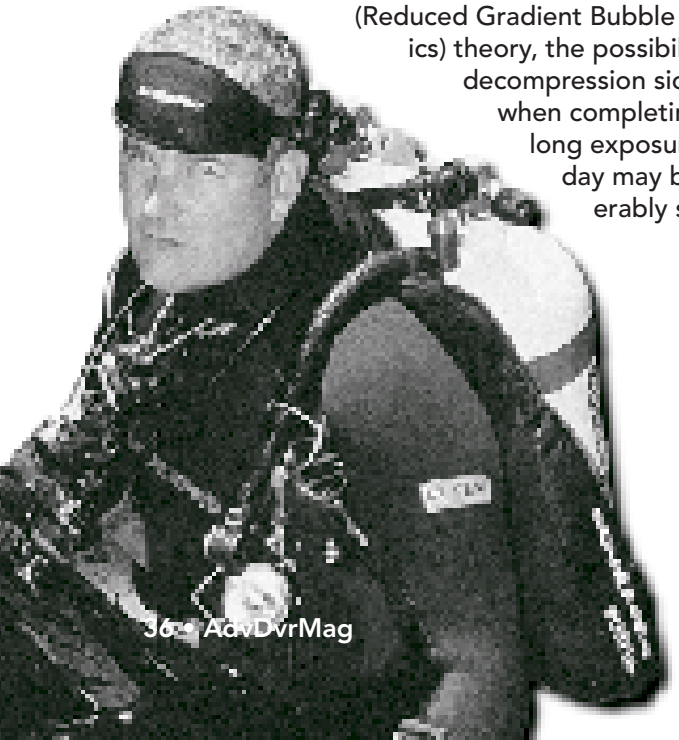
By: Curt Bowen

Recreational dive planning is basic and most of the time taken haphazardly. Advanced dive planning that requires longer bottom times, decompression, and different breathing mixtures is imperative and if not planned completely could result in serious injury or even death.

Since the introduction of nitrox within the recreational diving community divers are now capable of prolonged bottom times for depths above 130 feet. With proper mixtures divers can easily extend bottom times to over 100 minutes with minimal decompression obligations. These long bottom times are extremely useful when exploring caves, conducting wreck surveys or completeing tedious scientific research.

As recreational divers we were all taught to take our bottom times quite seriously. Never exceed NDL's, get to the surface, let your body release the residual nitrogen, then go back down and do the whole thing over again, but the common thought on this long-practiced method is changing. According to the RGBM (Reduced Gradient Bubble Mechanics) theory, the possibility of decompression sickness when completing one long exposure dive a day may be considerably safer than completing multiple short dives to the same depth.

One long exposure dive a day may be considerably safer than completing multiple short dives to the same depth.



Part one of this two part article will cover proper dive planning for such extended nitrox dives. Part two will cover the basics for diving below recreational limits of 130 feet using helium based gases. (see article on page 10 for Oxygen Enriched Trimix)

Four basic pieces of information are vital to the planning of extended range nitrox dives: geographic location, maximum depth, bottom time planned, and predicted environmental conditions.

Geographic location plans should include the basics such as travel requirements, airline weight and chemical (sodalime) restrictions, gas supplies available on site, passport or foreign government permits or restrictions, etc... It can be a tremendous hastle wasting valuable vacation, or expedition time in an airport or customs office.

The pre-determination of maximum depth and desired bottom times is vital in planning the amount of equipment needed, proper bottom gases, decompression mixtures and their volumes.

Environmental conditions are often the most difficult to plan for, but even basic research into the location where the dive will take place can add a margin of safety. Accurately predicted environmental conditions will determine additional equipment that may be required for harsh conditions such as strong currents, extreme cold, poor visibility or a combination of all.

Once determining the maximum depth, the best mix can be calculated. In many locations around the world the best mix and decompression mixes may be impossible to obtain because of the lack of available oxygen supplies, again, proper planning can prepare you for such setbacks. It is always better to know beforehand, than to find out after you have arrived on site.

Best Mix

The formula to calculate the best mix for any particular nitrox dive is to divide the partial pressure of oxygen (PO^2) by the absolute pressure (p). A recommended maximum partial pressure of 1.4 PO^2 for normal diving operations should be adhered to. A 1.6 PO^2 is tolerable for decompression stops only. Warning: Extremely long dives using even a 1.4 PO^2 and decompression gases can exceed oxygen toxicity limits. See table to the right for O^2 toxicity Time limits.

Best Mix Formula:

$$FO^2 = PO^2 / p$$

Example: The best mix for a 115 fsw dive with a PO^2 of 1.4 ata is (Eanx 31%).

FO^2 = 1.4 ata / (115 fsw / 33)+1
FO^2 = 1.4 / 4.48
FO^2 = Eanx 31.25% or rounded down to 31% oxygen

Maximum Operating Depth (MOD)

With the toxicity properties of oxygen at higher partial pressures a diver must know the maximum operating depth for each of their diving mixtures. The MOD of a nitrox mixture is determined by dividing the partial pressure of oxygen (PO^2) by the fraction of oxygen (FO^2).

Max Operating Depth

Eanx Percent

	1.	1.5	1.
2	32	1 3	155
2	2	13/	1
3	21	132	1 3
31	1	12	13/
32	11	121	132
33	/	11/	12/
3	2	112	122
35		1	11/
3	5	1	113
3/	1	1	1
3		/	1 5
3	5	3	1 2
	2		
5	5		/2
			55
/	33	3/	2
	2	2	33
	1	22	25
1	13	1	1

MOD Formula:

$$p = PO^2 / FO^2$$

Example: The MOD for a nitrox mixture of Eanx 33% oxygen at 1.4 ata is 107 fsw.

p = 1.4 ata / 0.33
p = 4.24
p = (4.24 ata -1) x 33
p = 107 fsw

When planning a desired bottom time, divers must take into account a myriad of factors. This is the accumulation of all the planning discussed earlier: conditions, time needed (in survey, exploration, etc.), decompression obligation, O2 exposure and gas consumption all play major roles in allowable bottom time.

Oxygen Exposure Time Limits

T	Single Exposure	24 Hour Exposure
1.	5 min	5 min
1.5	12 min	min
1.	15 min	min
1.3	1 min	21 min
1.2	21 min	2 min
1.1	2 min	2/ min
1.	3 min	3 min
.	3 min	3 min
.	5 min	5 min
./	5/ min	5/ min
.	/2 min	/2 min

In decompression diving, we do not have the luxury of being able to go directly to the surface, thus it is imperative to carry enough breathing gas for all phases of the dive. To help us accomplish this, we can use the Surface Consumption Rate (SCR) formula to determine our gas consumption. SCR is the amount of breathing mixture that a diver consumes at sea level in one minute. To calculate this correctly a diver must know precisely how much gas they consume at a steady depth during a specific amount of time. Multiple calculations should be made for consumption at rest and under specific workloads as consumption increases under duress. Environmental conditions (cold, currents, visibility) can also cause major fluctuations in gas consumption so be sure to use it as an approximation. Rounding numbers is OK.

SCR Formula:

$$SCR = \frac{\text{Air Pressure in psi}}{\text{Time}} \div \frac{\text{Depth}}{33} + 1$$

Example: A diver uses an aluminum 80 ft^3 with a service pressure of 3000 psi for a dive to 66 feet for 5 minutes, 500 psi of breathing gas is consumed.

$$SCR = \frac{500}{\text{5 minutes}} \div \frac{66}{33} + 1$$

The diver's Surface Consumption Rate is 33 psi per minute.

While SCR must be calculated in psi, to make the figure universal to any cylinder we must convert it to volume (ft^3). On any given technical dive, numerous cylinders of various volumes are commonly used, thus SCR must be converted to cubic feet per minute to be useful.

Cylinder Capacity Chart

Manufacturer	Material	Cubic Feet	Service Pressure	Surface Area	Diameter	Length Inches	Weight Lbs.	Buoyancy Full Lbs.	Buoyancy Empty Lbs.
Lexan	Aluminum	77.	3	3 .75	7.25	2 .1	2 .	-1.	+ .1
MS	S l	5	2	2 .23	7.	2 .	31.	- .7	n ut l
F r/Sa r	S l	5.1	2	27.7	. 2	23.	37.	- .5	-1.2
MS	S l		2	2 .	.	2 .	3 .	-7.7	n ut l
Lexan	Aluminum	.	33	33.	.	2 .2	.2	-3.3	+3.5
r ss St l	S l	. .1	35	3 .	7.25	23.	33.	-7.5	n ut l
r ss St l	S l	1	2	23. 7	.	2 .2	.	-5.3	-2.5
MS	S l	112	2	21. 2	.	2 .	1.	- .	-1
r ss St l	S l	12	35	2 .1	7.25	27.	3 .	- .	−1
r ss St l	S l	12	2	2 .	.	2 .	52.	-7.	-2
H s r/ ush r	S l	12	31	2 .5	. 3	25.	55.	-2 .	- 7. 2
MS	S l	125	2	21.12	.	2 .	5.	- .5	n ut l
MS	S l	131	2	1 .32	.	3 .7	7.	1 .3	+ .75
H s r/ ush r	S l	1	31	22.7	. 3	2 .	3.	-2 .	- .
H s r/ ush r	S l	1		23.15	. 3	31.3	7.	- 2.3	- .

PSI to FT^3 Conversion Formula:

$$\left(\frac{\text{Cylinder Volume}}{\text{Service Pressure}}\right) \times \text{SCR psi per minute}$$

Example:

Using the SCR formula on the previous page we determined that the divers SCR was 33 psi per minute.

$$\left(\frac{80}{3000}\right) \times 33$$

$$.026 \times 33$$

Answer is 0.88 ft^3 per minute surface consumption rate. This calculation can now be used for all cylinder sizes.

The above chart provides the actual cubic feet and service pressure for a variety of cylinder sizes.

Volume of gas in a cylinder

Used to calculate the volume in a cylinder at any pressure. This is used to determine if enough gas is available to complete extended bottom times or required decompression. Failure to correctly calculate needed volumes for each section of a dive could result in an out of gas emergency and/or the inability to finish required decompression.

Volume Formula:

$$\text{psi in cylinder} \times \left(\frac{\text{Cylinder Volume}}{\text{Service Pressure}}\right)$$

Example:

A diver is planning a dive that will require 38 ft^3 of decompression gas. He is using a OMS steel 47 with a service pressure of 2640 psi, the cylinder currently has 2200 psi, will this be enough volume to safely complete the dive?

$$2200 \text{ psi} \times \left(\frac{47}{2640}\right)$$

$$2200 \text{ psi} \times .017$$

Answer is 37.4 ft^3 in the cylinder available, the diver would not have sufficent gas to complete the decompression!

Dive Planning in Action

A perfect example of proper dive planning in action can on ADM's recent trip to the Fantastico wreck off of Naples, Florida (the expedition is detailed on page 21).

Contacting boat Captain Jim Rozzi for the basic details gave us valuable information on the maximum depth (115 ft), expected weather and sea conditions, and a short briefing on the size, type and condition of the wreck.

Survey work on the wreck would require an extended bottom time, we planned for a fairly conservative 80 minutes at depth plus required decompression.

Calculating the best mix at a PO^2 of 1.4 at 115 feet gave us a nitrox mixture of 31%. The MOD of 31% at 1.4 PO^2 is 116 feet. The oxygen exposure time limit at 1.4 PO^2 is 150 minutes for a single exposure.

Using the Abyss decompression software we calculated the required decompression times, determined our decompression gas and ensured that our CNS oxygen toxicity limit was well below 100%.

Over the years I have determined that my personal SCR under a minor work load is .65 ft^3 per minute and my DSCR (decompression surface consumption rate) is 0.4 ft^3, thus a dive to 115 feet for 80 minutes would require a volume of 233.2 ft^3. Using my double OMS steel 125's at 2640 psi I calculated I would have 275 ft^3 available. For safety I decided to place a extra stage tank (aluminum 80 ft^3) containing 31% on the wreck in the case of an emergency.

Decompression obligations according to Abyss software would be, 12 minutes on 31% from 50 feet to 30 feet and 46 minutes on 100% oxygen at 20 and 10 feet. 46 minutes at 20 feet using a DSCR of 0.4 ft^3 would require 29.4 ft^3 oxygen. Using an OMS Steel 46 with a service pressure of 2640 filled to 2200 psi would provide 38.3 ft^3 oxygen.

Down to my local dive shop (Scuba Quest), mixed tanks, purchased a few extra odds and ends. Packed all my basic diving equipment, gathered my extra wreck survey equipment, grabbed some artifact collecting tools, snagged my camera gear. Packed it neatly into a giant (home depot) dive box. Tossed the box, doubles and stage cylinders into the back of my truck. Threw in some extra clothes, county music CDs, some cold cokes and my beautiful wife along with all her stuff in the front cab and I'm off for another exciting dive adventure. Diving is easy, getting ready is the hard part!

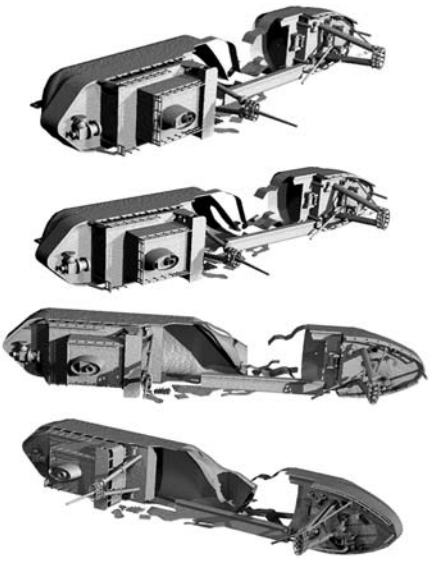
Fantastico Wreck
Continued from Page 23

was met with bad visibility, but even in poor conditions an increased collapse was evident. The resident jewfish population was also observed as growing larger at this time.

On Sunday, August 29, 1999, as Hurricane Dennis threatened the Eastern United States, Advanced Diver Magazine's Dive Team visited the Fantastico to see what changes had occurred in the past year. The cargo area was found flattened and twisted. The port bow was still intact and the anchor remained housed in the hawse pipe. Port and starboard running lights were found hanging in the anchor locker. Manila line was coiled in the chain locker. The propeller was still in position, however the stern seemed to be twisted away from the bow section and had moved more to the starboard.

A commercial fishing net lay over a portion of the wreck with its large lead sinkers still attached. A porthole with glass intact was found attached to a wooden door in one of the many machinery spaces. Monofilament fishing lines are now on much of the wreck, presenting a real entanglement hazard for divers. A pair of African pompano with long streamer fins gliding behind them were viewed cruising the area. Schools of amberjack and barracudas circled the waters overhead. Large, black grouper were seen hiding beneath metal sheets on the bottom, but the most prominent of all species viewed on the wreck were the jewfish, formally known as Epinephelus Itajara. Over forty were counted on this trip to the Fantastico.

These giants of the deep are the largest members of the grouper family attaining lengths to eight feet and weighing up to 700 pounds. They are indigenous to tropical waters throughout the



Southern US and Caribbean, but the largest concentrations of Jewfish are found on Florida's Southwest coast from Sarasota to Naples. Jewfish were once prized by fisherman because of their tender, white meat, but were hunted to near extinction in the1980's and in 1987 were granted protected status under the Endangered Species Act. In the past few years, the results of this legislation have proved to be a major success, and with the greater number of divers in the water today, encounters with jewfish are becoming more commonplace. While jewfish will take up residence on natural limestone or rock bottom, their favorite lairs are shipwrecks, and their increased numbers have presented wreck divers with the interesting dilemma of how best to deal with them.

These "gentle giants" are normally docile creatures, but they can be unpredictable and extreme caution should be taken when encountering multiple large jewfish. They can become very aggressive if provoked, cornered or presented with freshly speared fish. When agitated, a jewfish will produce a loud, thunderous booming noise to warn potential predators or unwary divers of their displeasure. If they continue to feel threatened, jewfish have been known to charge divers with incredibly quick bursts of speed. The skin of the jewfish is very rough, like sandpaper, and can cause serious injury just by rubbing against a diver. The best advice is to slowly swim away from their immediate vicinity, usually if you leave them alone, they will do the same.

It was a breathtaking sight upon descending onto the Fantastico and seeing so many jewfish. They hung together in tight schools and became visibly agitated and territorial as the dive team moved in. While we attempted to keep our distance, several large fish became curious and followed us along the entire length of the ship. Two jewfish even followed some of the divers into the wreck when they penetrated the pilot house. This could easily have become an emergency situation if the large fish felt cornered, but patience and gentle movements on the diver's part helped the team avoid any dangerous encounters.

On the trip back to the dock we discussed the significant changes that had taken place on the Fantastico. It was amazing how much structural deterioration the wreck had sustained in the short eight years since its sinking, but dominating the conversation, and our memories of the trip were the jewfish. Their presence on the Fantastico had produced an unexpected and breathtaking excitement that few fish can match.

Dive team:
Curt Bowen•Dawson Cochran, Rusty Farst•Leroy McNeal
James Rozzi•Kevin Sweeney
Jim Webber.

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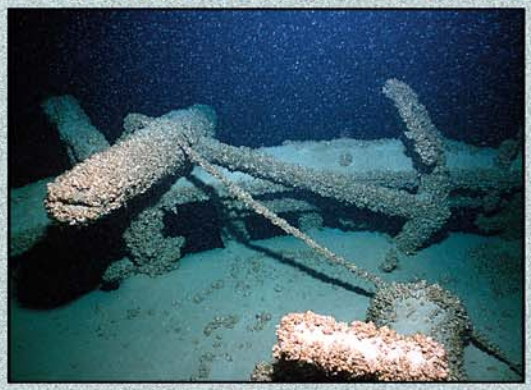
Lake Erie's Mystery Schooner X



By: Chris Laughrey

The Great Lakes, North America's vast inland sea, formed eons ago when massive glaciers gripped the continent in the frigid hand of the ice ages. These vast ice sheets, up to 2000 feet thick, deepened and enlarged the river valleys of a previous era as they carved and scoured the earth beneath them creating the Great Lakes basins. The glaciers finally released their icy grasp on the lakes region about 10,000 years ago, but below the surface, at depths beyond the thermocline, the waters of the inland sea remain perpetually cold and dark, a boreal memory of an ancient time. Literally thousands of shipwrecks lie entombed in these glacial depths today and technical divers find Great Lakes wreck diving a challenging and rewarding pursuit.

Lake Erie is the shallowest of the Great Lakes with an average depth of only 62 feet. The eastern third of the lake, however, contains a deep basin with depths up to 210 feet. Erie's East Basin is separated from the shallow water to the west by a long, submerged ridge of sand and gravel left behind by the retreating glaciers. The deep waters between this ridge and the east end of the lake, an area of only 2,500 square miles, hold over 400 shipwrecks! Sailing vessels and steamships cohabited the lake throughout the 19th century, thus wrecks of every kind abound: sloops, schooners, brigs, and barks; hybrid barkentines and brigantines; sidewheel and propeller-driven steamers; iron-hulled freighters and enormous railroad ferries. There are many fascinating dives in the East Basin, but one wreck in particular stands out among them all and that is the Mystery Schooner X, recently identified as the schooner St. James.

The St. James is a completely intact 19th century Great Lakes schooner resting upright in 170 ffw with both masts standing. The wreck is located about 7 miles southwest of Longpoint, Ontario. She is a magnificent sight, one that few wreck divers get to see in a lifetime. The ship is 125 feet in length. The two masts tower 80 feet above the lake bottom. Divers typically descend along the foremast and their first view of the ship's bow area reveals a large wooden windlass and huge wooden anchors on each forward rail. The starboard anchor rests neatly in place while the flukes of the port anchor lie on the deck, its big oak stock lying askew over the bow rail. Several spars are scattered about. Swimming forward over the rail and dropping down to about 160 ffw in front of the bow, divers can study the fascinating "figurehead" that is in place on the bow stem. At first sight it looks like a carved ram's head. In reality it is a "fiddlehead," a common ornamental carving on a sailing ship's bow that resembles the curved scroll at the head of a violin. The fiddlehead is flanked on top by a

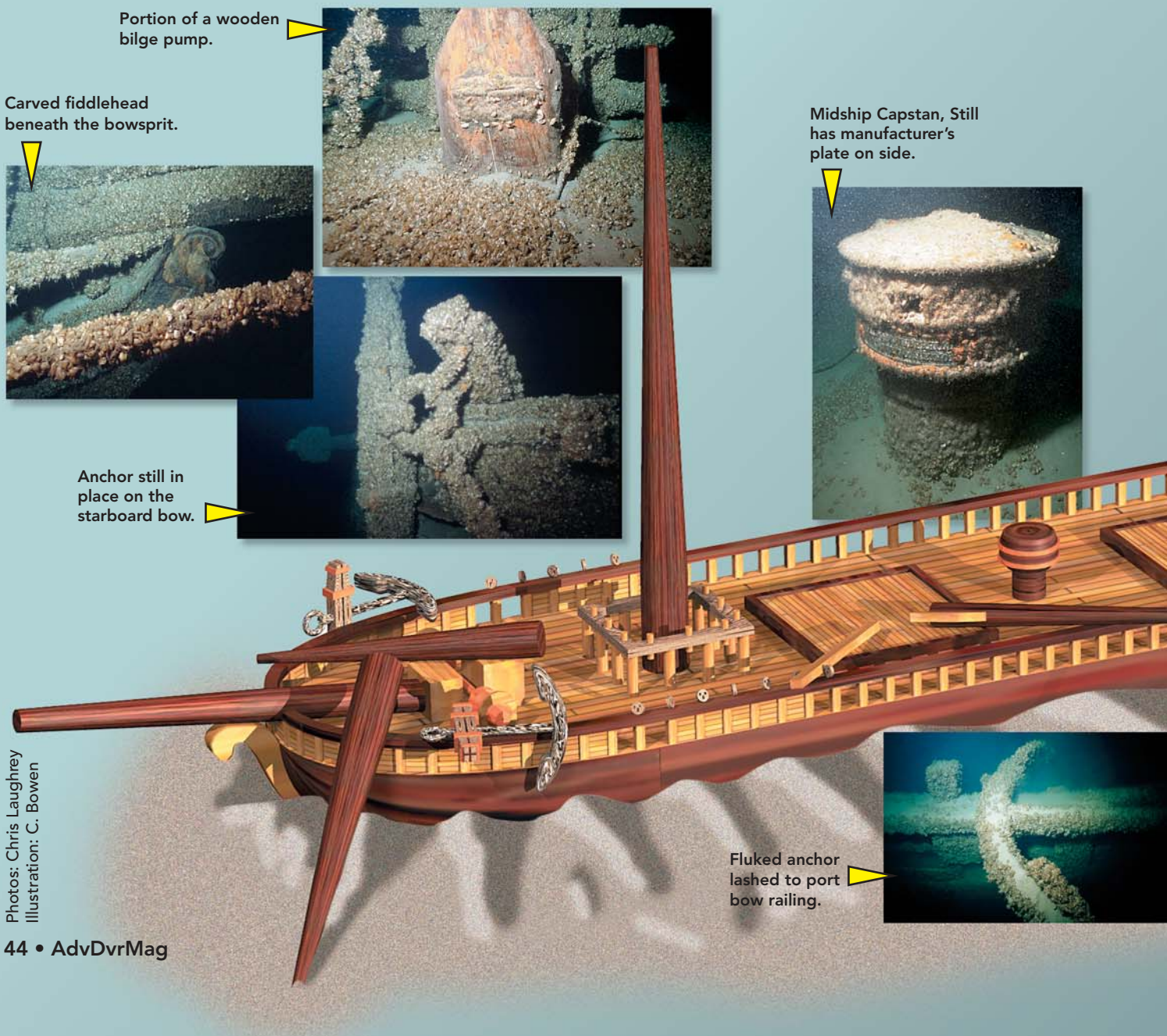
Saint James

Photos: Chris Laughrey

long, thick bowsprit that points outward towards the dim depths of the lake floor.

Ducking under the bow stem and swimming back along the schooner's rail to the foremast, divers can examine the deadeyes once used to set up the vessel's shrouds. Wooden belaying pins stand empty and erect behind the deadeyes. Swimming back onto the deck, divers can explore around the forward cargo hatch. The schooner's hold contains a cargo of mud-covered grain. Behind the hatch is a large wooden capstan. Swimming aft, divers encounter another smaller wooden windlass in front of the mainmast. Part of a boom and its gooseneck are still attached to the mainmast. More spars lie across the deck and rail behind the mainmast and more deadeyes and belaying pins adorn the intact railing adjacent to the mast.

The stern of Schooner X offers her greatest surprise, the main cabin roof is still attached and the ship's wheel remains mounted in place in the aft cockpit. Most cabin roofs popped off of sailing vessels as they sunk on the Great Lakes. These roofs, in fact, often served as life rafts for crew swept off a foundering ship's deck. The main cabin itself as well as the cockpit is filled with mud and silt, which obscures any artifacts that might lie within. One of the lifeboat davits is still in place off the stern on the port side. The ship's large rudder is visible above the muddy bottom. Divers can also look over two bilge pumps in

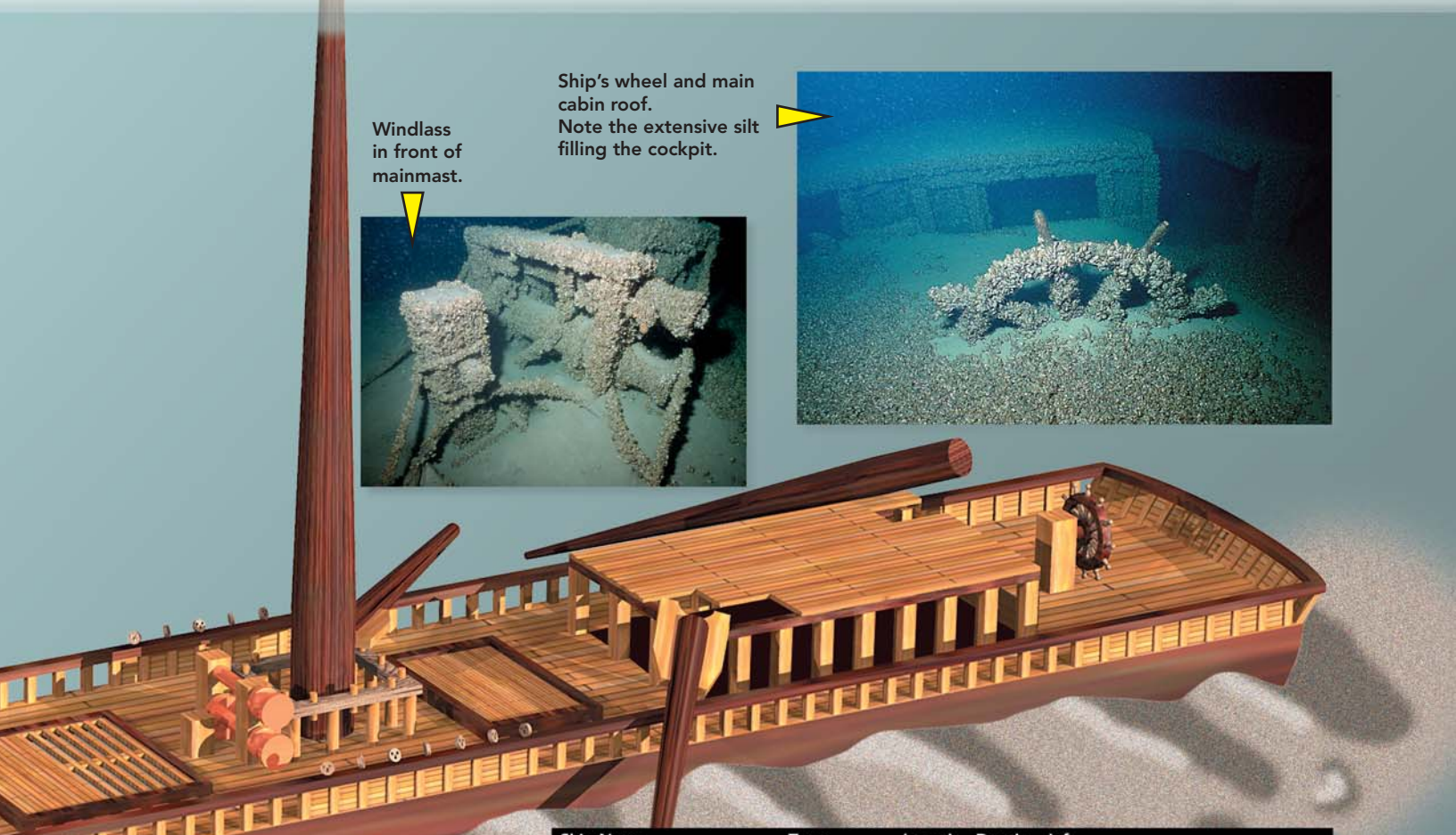


Photos: Chris Laughrey
Illustration: C. Bowen

the aft part of the ship. One is wooden.

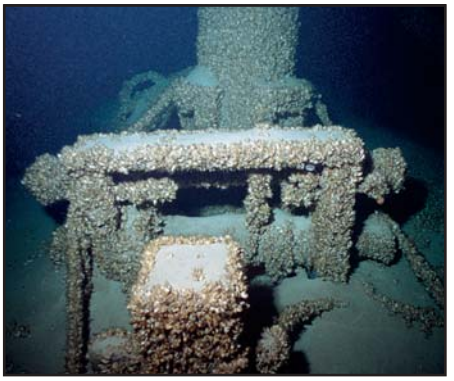
Schooner X was originally discovered in 1984 by Gary Kozak, a side scanning sonar expert and Lake Erie wreck hunting pioneer. Gary's sonar image of the schooner clearly shows her two upright masts. He was searching for the wooden steamer Dean Richmond, however, and never dove the wreck. Canadian wreck diver Dan Lindsey and several of his colleagues obtained the location from Kozak and began a long series of explorations on the ship. The Ontario-based Save-Our Ships (SOS), an active and effective Great Lakes wreck preservation and conservation organization, became involved in efforts to identify Mystery Schooner X as it was known in 1994. There have now been four formal expeditions to try to identify this very special wreck: in 1994 with the research vessel Edwin Link and submersible from Florida; in 1995 and 1996 with noted underwater explorer Joe MacInnis from the Canadian Navy research vessel Cormar with submersible; and in 1997 by the Canadian Geological Survey and Eco Nova. The latter expedition allowed geologists Steve Blasco and Darren Keyes to study sedimentation patterns around the wreck. This work complimented their research into the sedimentology of the Long Point area. None of these expeditions discovered the identity of the mysterious schooner.

During the summer of 1997, Dan Lindsey, John Veber, and Ray Stewart, all Ontario divers, found the



Ship Name	Type	Length	Depth	Info
Annabelle Wilson	2 Masted Schooner	?	50 ft.	Sank in a storm, lies scattered
SK Martin	Wooden Steamer	152'	55 ft.	Loaded with coal, sank in a storm
CB Benson	Wooden Schooner	137'	75 ft.	Sank in a storm, all hands lost
Wilma	Fishing Tug	?	75 ft.	Hit ice in 1936, sunk upright
Passaic	Wood Steam Barge	198'	84 ft.	Sank 1891 in rough seas
Carlingford	3 Masted Schooner	154'	95 ft.	Sank after a collision in 1881
Brunswick	Iron Steamer	236'	115 ft.	Sank after a collision
Dean Richmond	Twin Screw Steamer	238'	115 ft.	Sank in 1893, All hands lost
Washington Irving	Two Masted Schooner	?	120 ft.	Good condition, little history known
Acme	Arched Steamer	190'	130 ft.	Good condition, sits upright
John J. Boland	Steel Steamer	258'	135 ft.	Lies on starboard side, intact
Atlantic	Side Wheel Steamer	267'	155 ft.	Sank in a collision in 1852. Loss of over 250 passengers & crew
Arches	Arched Steamer	?	155 ft.	Sits upright with 30' arches.
Crows Nest	2 Masted Schooner	?	164 ft.	One of the oldest wrecks
Tug Boat Smith	Steam Tug	120'	167 ft.	Intact with ships wheel & telegraph
Persian	Wood Steamer	?	205 ft.	Fire destroyed wreck before sinking

tonnage numbers 226 76/100 carved into the hatch combing. Further research by these divers and others led to the identification of the shipwreck as the schooner St. James. The discovery of the schooner's name only deepened the mystery. Little information is available about the ship. She was built in Milan, Ohio in 1856. The ship was last seen when she left Toledo, Ohio on October 23, 1870 with a crew of seven under the command of Captain James Burrill. The St. James was never seen again. Twelve days after her departure from Toledo, the Buffalo (NY) Courier reported that the vessel had not been heard from at either Toledo or her destination, Port Colborne, Ontario. The schooner had, "gone missing." One newspaper article speculated that she sank in a squall. Others wonder if she didn't just spring a leak and sink slowly before being able to reach the relative safety of Long Point Bay. The fact that the ship is in such good condition and the lifeboat is gone supports the latter hypothesis, but what became of the crew? Lindsey and his cohorts continue their research. You can follow it at Lindsey's website: http://members.home.net/longpoint/mystery.htm.



Very few divers got to visit the St. James before the 1999 season. Our small group of technical divers started diving the wreck in 1996 with Captain Doug Embler out of Erie, Pennsylvania. Doug recently took a break from chartering, but several other operators run to the wreck. Captain Jim Herbert of Osprey Charters in Barcelona, NY frequently visits the schooner. Jim runs an excellent boat and has any gas mix you need available for technical dives. You can reach Jim through his website, www.osprey-dive.com. In Ontario, Days Off Dive Charters runs to the St. James from Port Dover. Contact Ed Mclaughlin at mcl@execulink.com. With more divers visiting the wreck than in past years it is important to remain cognizant of the schooner's remarkable heritage and fragile condition. Artifact collecting is strictly illegal.

The Mystery Schooner St. James is a wreck diver's dream. Tall, stately, and ghostly, she lies silent in the deepest part of Lake Erie beckoning you down with her enigmatic charm. Intact, well-preserved wooden shipwrecks are hard to find. This one is well worth the visit.

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By now, every experienced diver should be familiar with the benefits of using nitrox. The accelerated decompression times, and safety factors that nitrox offers have brought it to the forefront of the technical diving comunity. Longer bottom times and shorter surface intervals have grabbed the attention of the mainstream dive industry and what once was feared is now embraced and courses are being taught by every recognized dive training institution in the world. But just as we are getting used to the term "Enriched Air" and the hassles of partial pressure filling, along comes Underwater Breathing Systems, Inc. with a safe, versatile, and cost effective membrane filling system that just may change the way we look at nitrox.

Membranes are not a new idea, but in the past they were not a viable option for scuba diving because of their extremely high cost, and bulk. The new systems manufactured by Underwater breathing Systems however, have the potential to make membranes the norm in nitrox filling rather than the exception.

For those uneducated in the ways of the membrane, the concept is a simple one. Instead of adding a percentage of pure oxygen to a tank then topping off with air, as in partial pressure filling, a membrane system consists of a canister attached to the intake valve of a compressor that actually filters out the nitrogen (along with hydrocarbons and other contaminants) as the tank is being filled. Thousands of tiny, hollow, hair-like fibers contained within the canister remove the nitrogen particles from the air at a highly manageable rate (Normally within 1/2% accuracy in the final mixture). Thus, when breathing a nitrox mixture produced by a membrane you are not breathing "enriched air," but rather denitrogenated air, or DNAx. The gas is then fed to a standard, oil lubricated compressor for storage in nitrox banks or filled as needed into scuba cylinders.

Operating a membrane system is much simpler than learning partial pressure filling, and no gas blending course is required. Determining the proper gas ratio is easily accomplished by setting a needle valve to the desired percentage, removing the guesswork and mathematical calculations associated with partial pressure fillling. The operator monitors the rate by watching an O2 sensor. Need 36%? simply adjust the needle until the oxygen sensor lays steady at 36%, then open the cylinder, or bank and let the filling

Illustration: C. Bowen

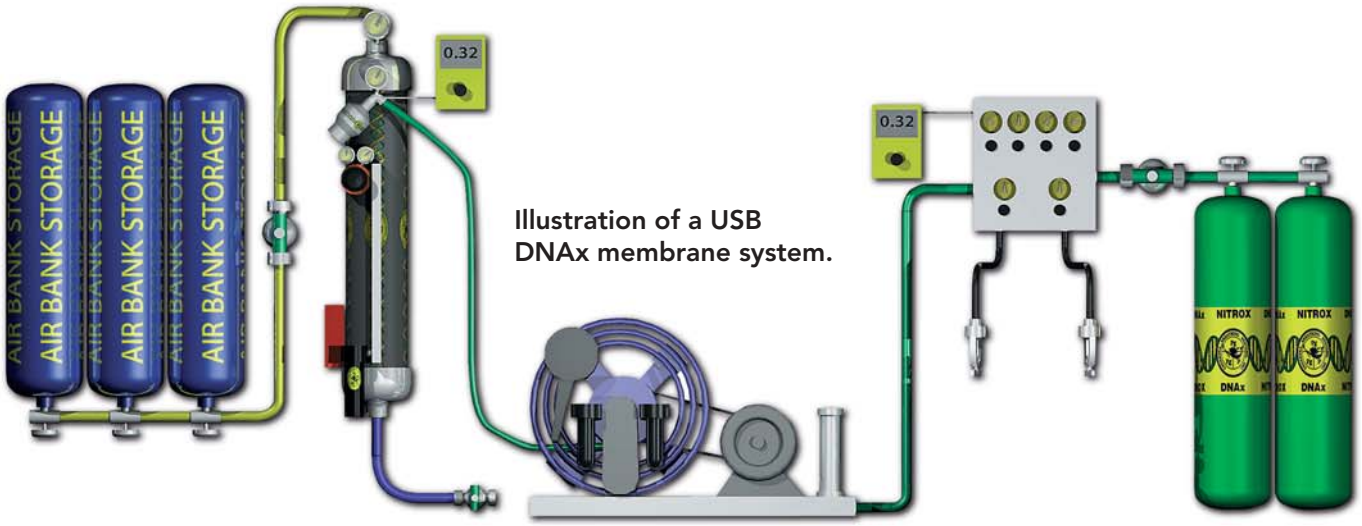


Illustration of a USB DNAx membrane system.

begin. Changing the mix is as easy as adjusting the valve needle. This absolute ease of use also cuts down on training time needed to qualify operators on the membrane. The average training course on the machine is one hour.

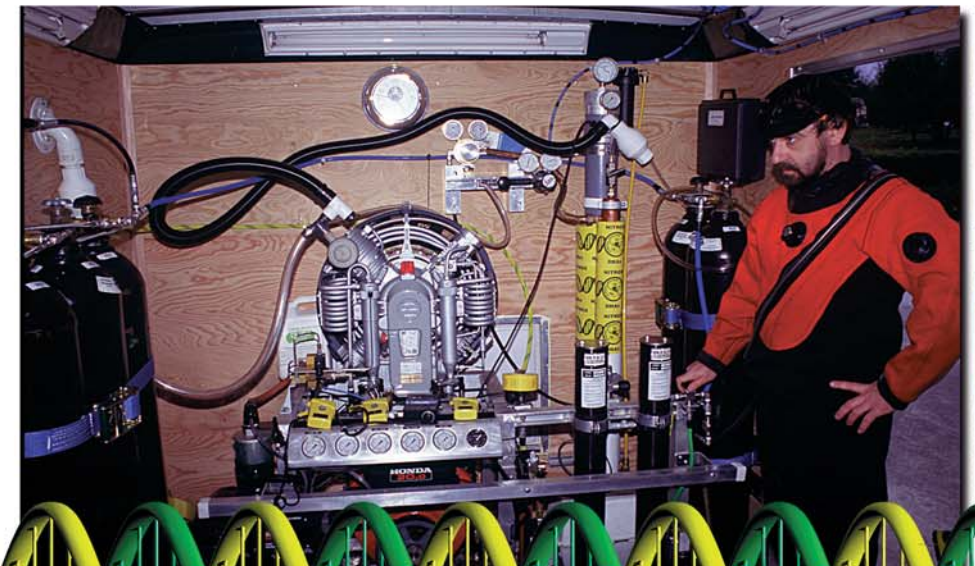
One of the most significant advantages of the membrane is that it produces gas mixtures of 21% up to 40% from simple air. This eliminates the need for O2 cleaning of equipment, and most importantly, removes the hassle and danger of storing and handling large oxygen bank cylinders. In this regard the membrane saves time, money and adds a significant safety factor to the fill station over the partial pressure method.

Maintenence of the membrane is minimal, with just one filter change (about $40) required four times per year. The system operates on Grade E air and uses 220V at 10 Amps. It can be connected to any existing oil lubricated compressor without major modifications. Life of the system is estimated to be 20 years.

Its compact size and relatively light weight make the membrane an excellent solution for remote area diving and liveaboard vessels. It is mobile enough to take into the field, thus making it feasible for expedition diving.

Pictured below is Mike Zee of Lake Superior Dive Tours who employs a USB DNAx continuous membrane for nitrox filling. The fill station is located inside his custom-built, 14'x7' dive trailer, which really showcases the mobility of the membrane system. The rig that Zee uses is attached to a K14cfm Bauer compressor powered by a 20 horsepower Honda 8,000 watt electrical generator. Wherever Zee's diving adventures may take him, he has a potentially unlimited amount of nitrox at his disposal thanks to the membrane system.

Underwater Breathing Systems Inc., offers two models of nitrox membrane systems the USB 250 DNAx which pumps 24 cfm @ 40% O2, and the USB 230 DNAx that pumps a more conservative 14 cfm @ 40% O2. Trimix systems are also available.



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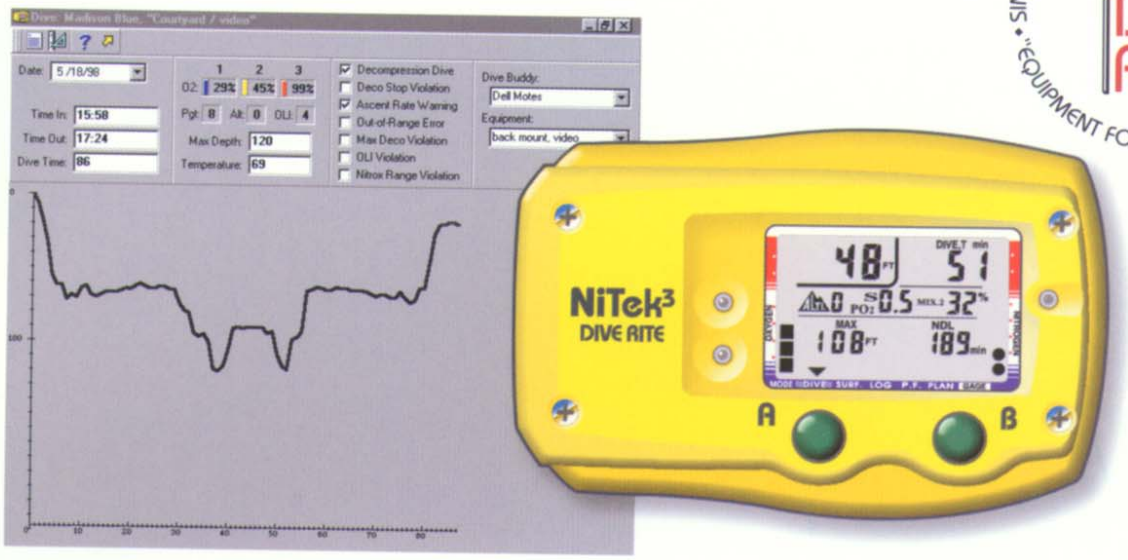

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