

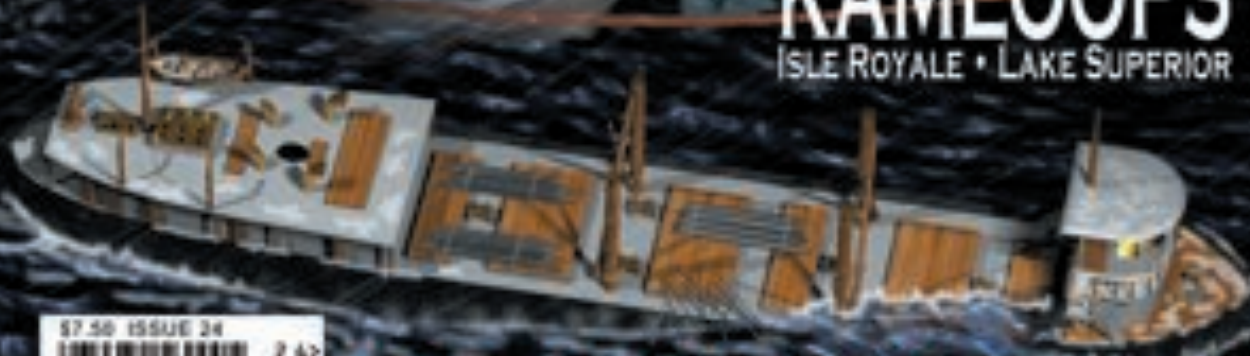
ADVANCED DIVER MAGAZINE

ISSUE 24 / 2006

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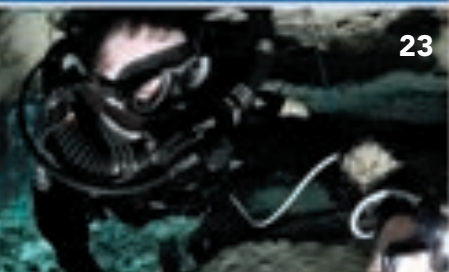
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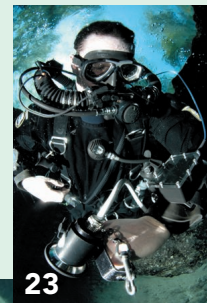
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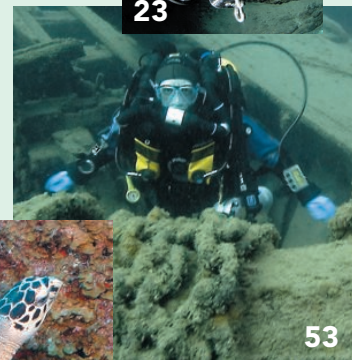
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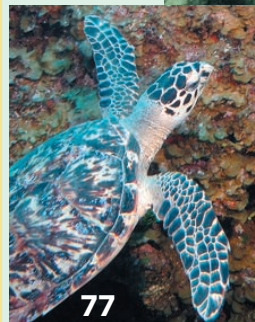
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Cover: Kija Blue CCR explorers John Zuanna and Richard Harris return from a deep exploration dive to over 350 feet.

Photo by Richard Harris

Illustration: Wreck of the Kamloops by Curt Bowen



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Publisher's Notes

Another year is coming to a close, and the cooler weather is moving across the northern hemisphere. 2006 has brought many new adventures, discoveries, and acquaintances.

To start the year, I conducted my typical 12-day Yucatan cave expedition, where we discovered and documented over 60 unexplored cave systems. Then I was off to the Bahamas to join Brian Kakuk for another week of cave discoveries, and the retrieval of some significant archaeological specimens for the Bahamian government. Next, it was off to the other side of the planet to join Ron Benson on a 10-day CCR-only filming project to shoot the best wrecks of Truk Lagoon.

I returned to the USA just in time to head off to the Dominican Republic with Pirate's Cove Dive Center for another week of CCR cave and deep wall exploration. After a short break, I found myself in Grand Bahamas doing a HD video shoot with dolphins and sharks for a possible upcoming documentary with UNEXSO's dive center. The heat of August brought me to the Canadian border for another wreck diving expedition in Lake Superior's Isle Royal.

All this along with the typical dive conference traveling, rebreather review courses, spending as much time as possible at home with my family; and, of course, my real job that pays my house payment: 48 hours a week working for the Sarasota County Fire Department. I almost forgot the most important job — organizing, designing, and writing the magazine you are holding in your hand. Not much time is left over for sleep. I think I live by the saying, "There is plenty of time to sleep when you're dead."

My schedule for 2007 has already started to fill up with some awesome destinations and expeditions. I have my cameras cleaned, charged, and ready to rock!

Curt Bowen
Publisher ADM



Publisher..... Curt Bowen
Co-Publisher..... Linda Bowen

Copy Editor..... Victoria Leigh
Chief Staff Writer.... John Rawlings
Web Master..... Jakub Rehacek
Chatter Master..... Savannah Bowen

ADM Staff Photojournalist

Mel Clark • Richard Harris
Tom Isgar • John Rawlings
Tamara Thomen

Contributing Writers / Photographers

Thaddius Bedford	Kevin Denlay	Rusty Farst
Jill Heinerth	Brett Hemphill	Dr. Thomas Iliffe
Brian Kakuk	Cass Lawson	Gavin Newman
Eric Osking	Jim Rozzi	Wes Skiles
Dr. Bruce Wienke		

Editorial Contributors & Dive Assistants

CJ Bahnsen • Ron Benson • Jack & Karen Bowen
John Campbell • Craig Challen • Rich & Doris Chupak
Erik Foreman • Paul Hosie • James Kelderman
Matt Kriesel • Steve James • Chris Limon • Warren Lo
Keith Meverden • Bruce Partridge • Ginny Rawlings
Ken Smith • Kim Smith • Dos Winkel • John Zuanna

Contact Information:

Write..... Advanced Diver Magazine
327 Snapdragon Loop
Bradenton, FL 34212 USA

Phone..... 941-748-3483 (DIVE)
E-Mail..... AdvDvrMag@aol.com
C.Bowen..... Eanx@aol.com

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An underwater scene with two divers swimming through a coral reef. The water is clear blue, and the coral is various shades of brown and orange. The title 'BONAIRE' is written in large, yellow, 3D-style letters across the middle of the image.

BONAIRE

Dive Into The Adventure

Text and Photography by Cass Lawson

There is a fine line between genius and insanity. I know, because I've just spent a week on Bonaire crossing the line so many times that I almost erased it. So what, you may ask, is genius and what is insanity? Modesty prevents me from claiming the genius taxonomy, but the insanity is definitely within my jurisdiction.

I had heard a lot about the diving in Bonaire, some good and some bad. When I had the opportunity not only to dive but also to explore the options available other than diving, I signed up for the 2006 Dive into Adventure Bonaire (DIAB), organized by Bonaire Tourism

and their PR company in New York. Before I decided to go to Bonaire, I made some enquiries about what technical diving and rebreather facilities were available on the island, as I like to dive with my trusty Evolution rebreather. I was pleasantly surprised to find that this little diving-paradise island is equipped to help and supply the most ardent of tech and rebreather divers.

I took the scenic route to Bonaire, as I did an overnight stay in Jamaica — mainly to get a fix of jerk goat and to buy some Blue Mountain coffee — then I flew into the pleasantly named and newly refurbished Flamingo International Airport (code BON). There were no problems at the airport despite my plethora of bags, and I was taken off to my apartment at the Sand Dollar

Resort that was to be home for the week. First job was to get the air conditioning on, and unpack the shorts and tee shirts. Then head off to the dive shop to meet Walt Stark of Rec Tek Diving, who had the two 13 cu ft bottles for my Evolution and Sofnolime for the scrubber unit. This is genius. I'm soon ready to go diving. Excellent.

For those of you who know (genius) and those who don't (not so genius), most of the diving is from the shore in Bonaire, so I take my trusty Evolution down to the local pier at Bonaire Dive and Adventure — not to be confused with Dive Into Adventure Bonaire (insanity). After talking with one of the local dive masters, I take a giant stride into Bonairean waters. Mmmm, 80°F warm water and about 80 feet of visibility, a gentle slope to 35 feet, healthy coral (genius) myriad fish (genius), no bubbles from my rebreather (genius) — all is well until I hit 55 feet, and one of the audible warnings (genius) on my Evolution makes me check my handset. There appears to be something wrong with my scrubber unit, and I decide to abort the dive. When I get back on shore, I check the unit and see that I have not connected a cable (insanity), but the rebreather had warned me in time.

In all, I dived nine of the sites on the mainland of Bonaire. By taking one of the small boats belonging to the dive shop, I managed to visit Klein Bonaire, the small island that lies less than a mile from the dive shop. I hate to generalize, but most of the diving is easy, relaxed, full of healthy corals, an amazing variety of fish, and, topographically, it is visually stunning. The fish and coral are due to the incredibly well run National Marine Park (genius). At this point, I must mention that before you're allowed to dive anywhere on the island, you must purchase a \$25 entry medallion that allows you to dive anywhere in the Marine Park. It seems a lot, but this is valid for one year. I guess the Tourism Board wants you to return (genius). Most of the dive sites are readily accessible from the roadside: just collect a map of the island, and follow the coast road until you come to a yellow stone with the name of the dive site you're after. Park up and get ready to dive. Now, an insanity note: there is still an element of thievery on the island, so do not leave anything in the vehicle. When I was there, sunglasses and a watch were stolen. If all you leave in the vehicle are old sandals and sweaty tee shirts, you won't be disappointed on your return; they should still be there. The only problem I had with the shore diving was that some of the entries involved walking over slippery rocks. Not too difficult, if you're using an 80 cu ft cylinder. But when you're carrying a large camera rig, I found that I tended to be off balance a bit. Perhaps that's just old age on my part, though. All in all, the diving is excellent; and, if you happen to be a photographer, then you will be in a little slice of diving heaven.

What about other activities for possible non-divers? Like Aruba, Bonaire has winds that are strong enough to support wind surfing as well as the infinitely more exciting Kite Surfing, where

you are strapped into a harness, attached to a 12-meter kite by long straps and a handle. Once you get the hang of the equipment, it can be exhilarating. A strangely described "kayak in the mangroves" proved better than its title. A hike up Mount Brandaris, all 790 feet of it, was greeted with less enthusiasm by me (and more thoughts of insanity); although, those who went said it was great. Yes, well, I'll wait until the escalator is installed. On a more interesting level to me was the abundance of good restaurants, my favorites being the City Café, Garden Café, Casablanca, The Ribs Factory, and the food at Sand Dollar was pretty fair as well.

The key question is always: Will I return to Bonaire? I guess that the answer will be yes, but I will arrange my diving differently. I will dive more on the wild east side with Larry Baillie, and do some of the deeper dives with Walt Stark.

I started with a quote, so let's end with another, slightly butchered one: "So long, Bonaire, and thanks for all the fish."

*Attributed to Oscar Levant.

From the title of Douglas Adams' book, *So Long, and Thanks for All the Fish*, a sequel to *The Hitchhikers Guide to the Galaxy*.





Tech diving in Bonaire — Walt Stark and Rec Tek Scuba

Walt “the Gas Man” Stark was my savior on Bonaire. You want gas? Call Walt. Nitrox, tri-mix, heliox, pure oxygen for your rebreather — Walt has it all; and he can deliver, if necessary.

Now why do you want to dive deep on Bonaire? Well, there is the wreck of the *Hilma Hooker* in 100 feet of water. I did a 75-minute dive on it, mostly below 85 feet, on my Evolution rebreather, exploring the hull and penetrating it a certain amount to get some images. There is also the wreck of the *Windjammer*, at about 200 feet. I can’t tell you much about this wreck, but here goes: the wreck’s correct name is the *Mairi Bhan*, which is Gaelic for “Bonnie Mary.” She was commissioned in 1874 in Glasgow by Paul MacIntyre as a 1315-ton iron clipper to carry handcrafted goods from New Delhi to London. She sank in 1912 on her way to Marseilles after she was caught in a bad storm while riding the trade winds off the Venezuelan coast. The captain tried to make for the lee side of Bonaire, but was blown off course. Apparently, cargo shifted in the holds, some caught fire, and down went *Mairi*. Walt can arrange diving here.

Want deeper? Well, at a dive site called Red Slave on the west coast of Bonaire, near the southern tip of the island, divers have wondered what was at the end of the chain, so Walt decided to find out. Buddied with Bob Killorin, they located the chain, and followed it down and down and down to 300 feet. Knowing they did not have the correct gasses, they surfaced and mixed gas for 450 feet. Again, they followed the chain until it finally ended in an anchor at 400 feet. Other exploration in this area has determined that there are numerous anchors nearby dating back to the 1700 - 1800’s. And if you want more, Walt acted as a safety diver when Helmut Meyer made the deepest (recorded) dive on Bonaire — 499 feet (152 meters) — using his Inspiration in December 2005.

For rebreather divers, Walt has a few Drager Dolphins, and he recently made a purchase of his first Evolution from Silent Diving Systems. If you want to take your rebreather, let Walt know in advance, and he will reserve tanks for you. He also has supplies of Sofnolime. Isn’t life great?

Enough said? Yes. Is there enough gas? Oh, yes. www.rectekscuba.com.

Bonair Larry's Wild Side Diving

If you want to have some serious fun diving, then you must contact Larry Baillie of Larry's Wild Side Diving. He, along with his dive master, will take you to the livelier east coast of Bonaire to dive. As this side of the island faces the Atlantic Ocean, the seas are considerably more lumpy, and thus the ride becomes slightly wild. To combat these conditions, Larry spent some time with the designers at Zodiac Boats to develop a different type of rigid inflatable boat. It is a Zodiac Hurricane 920 with two 225 Yamaha 4-stroke engines; however, the great feature of the boat is that part of the inflatable hull can be removed on each side, and an aluminum ladder installed to make entry onto the boat easier in the more turbulent waters of the eastern side of Bonaire.

The boat comfortably seats twelve. Although when I was on it there were only five of us, so there was plenty of space. In reality, Larry likes to restrict the number of divers to nine. The boat is equipped with oxygen, surface marker buoys for each diver, and a first aid kit. We met Larry at the Sorobon fishing docks, at the southern end of Lac Bay, just a short drive from where we were staying. The access here allows a short journey to the livelier side of Bonaire diving. After leaving the harbor area, the big Yamaha engines growled into action, and planed us over the not-so-lumpy water until we reached our dive site.

A change to Bonaire boat diving here: there are no mooring buoys, so Larry allows us to put on our fins, (we donned most of our gear in the harbor and on the way out). James, our dive master, enters the water first. We follow, using backward rolls, as Larry points to each of us in turn and says, "Go!" No messing about, off you go. James signals us to descend, and we drift into the dark blue waters following James to begin our dive. The current was insufficient to call it a drift dive, but this is unusual. We followed the current as Larry and the Zodiac trailed us using the surface marker buoy attached to James to use as a guide. Now, to be honest, it wasn't the most exciting dive in the world as we did not see the usual large pelagics -- still lots of fish and healthy coral -- but the east side is far better known for the large pelagics that we expected to see. I guess, like us, the big beasts must have been on vacation. On one dive, a few months before I was there, a dive group encountered 57 eagle rays. Now, let's assume that the "fiddler's constant" had been applied, and deduct 10%, that's still a lot of eagle rays. It is on this side of the island that sharks are more prevalent as well as rays, large tuna, amberjacks, and other big critters.

So, enjoy the beach diving, but please call Larry and take a trip on his great boat, and dive with the big beasts. www.larryswildsidediving.com

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An underwater photograph showing several divers swimming in clear blue water. A large, dark, textured rock formation or reef structure dominates the right side of the frame. The lighting is bright, suggesting a shallow depth.

Anatomy of a “Hit”

ADM Staff Writer
John Rawlings
takes a DCS Type II Hit

Photography by Ginny Rawlings and John Campbell

When it happened, I was stunned...the hit was completely unexpected because the dives had been so uneventful and simple - recreational level dives like we have done literally thousands of times before. The sudden numbness in my right arm had caught my attention...the near paralysis of my legs captured and held it. I knew what had happened, but didn't know why. All I knew was that in a single moment my entire world had changed, and not for the better....


Earlier, upon surfacing from our second dive, I saw some blood on the stern near the dive ladder. Glancing upward, I saw another diver on the deck while the crew was obviously treating a bloody wound on her leg. I later found that her leg had been smashed between the ladder and the hull due to the rough seas, lacerating it severely. Seeing her in obvious need of medical attention, I struggled to get my camera system up to the Divemaster, literally tore my fins off, and heaved myself up the ladder. Little did I suspect that my exertions were to give the unfortunate crew a second medical disaster in addition to the one with which they were already dealing.

My right arm had been pulled severely several times while on the down line, again while handing my camera up, and finally when hurriedly yanking myself up the ladder. Removing my gear, I placed my camera system into the camera tank, and attempted to stay out of the way of the crew as they performed first aid on the injured diver. Physically, I felt great for around 15 minutes...until, suddenly, I felt what I would describe as a “nerve pinch” directly behind my right shoulder blade. I attributed this to the over-extension of my right arm and shoulder, so I had no real concern. However, less than a minute after that first twinge, my entire right arm turned completely numb. I could move my arm freely, but the numbness was total. It was as though I were watching someone else's arm move rather than my

it
could
happen
to
you!



Photo by Ginny Rawlings



own. I knew that something was drastically wrong, despite the fact that the dive had been uneventful, and both of my computers had cleared me long before I ascended.

Feeling my arm with my other hand, I sat down to consider what might be happening. Within moments, I realized that my legs had suddenly become extremely weak - I could only move them slightly, and then only through great strength of will. Realizing that I was undergoing a Type II DCS hit, I immediately beckoned my best friend, Sparky, and the Divemaster to my side. I told them that I had a Type II "hit" occurring, and needed O₂ immediately. Within a couple of minutes, I was breathing from the on board O₂ bottle, and we were heading into the harbor, radioing in for the chamber to be ready. Sparky stayed at my side, concern flooding over his face, doing whatever he could to help while keeping me from falling over as the boat churned through the waves.

Once ashore, it took two strong men – one on each side – to assist me to the waiting van. At this point, I was stumbling like a drunk and my legs felt as weak as a kitten...being strong as a bull one second, and unable to walk without help the next is a HUGE mental shock! Fortunately, the chamber was only minutes away, and they were awaiting our arrival. Even after this short time, I could feel the benefits of the oxygen that had been administered as first aid, and some of the strength had returned to my legs while the numbness in my arm had partially dissipated. Following evaluation by the chamber physician, I was in their small two-man chamber within an hour or so after the onset of symptoms. The quick response of everyone involved has undoubtedly had much to do with the success of my recovery. Even though O₂ had alleviated some of my symptoms prior to my chamber ride, that relief would have been only temporary - especially with a Type II hit. Somehow, I had managed to get a shower of nitrogen bubbles into my spine, and they were wreaking havoc with my nervous system.

The Diver's Alert Network (DAN) was contacted immediately, and from that point onward my DAN insurance and their team of experts kicked in. I was given an extended US Navy Table 6 treatment - 6 1/2 hours at both 60 feet and 30 feet, breathing O₂ for 20 minutes at a time with 5 minute air breaks. Unusually for me, I found myself in the grip of claustrophobia while in the chamber, possibly caused by the extreme difficulty I had in drawing breaths from the oxygen mask – simply breathing in and out involved a great deal of work while on the mask, and I could feel my claustrophobia increasing as I waited impatiently for each air break. To experience claustrophobia like this for the first time (I've never felt it before, even when in zero visibility or inside tight spaces) was quite alarming...at one point, if I could have gnawed my way through the wall of the chamber with my teeth, I would have gladly done so!



At 60 feet within the chamber, my symptoms were completely alleviated. There was no numbness or weakness of any kind and my body worked well. The tender had me drinking water constantly, and I was able to urinate easily at 60 feet without discomfort. However, upon being brought up to 30 feet, I could feel a subtle tingling begin to grow in my legs. Shortly after reaching 30 feet, I felt a strong urge to urinate, but to my dismay found that I couldn't do it...something had changed. Entering the chamber, my symptoms were a "pinch" in my right shoulder blade, numb right arm, and weak legs - leaving the chamber my symptoms were partial numbness and tingling in both legs (from about my navel downward), some difficulty in walking, and a complete inability to urinate! While I was in the chamber, both the Divemaster and the chamber physician examined my two computers and saw no indication of any factor that would point to a specific cause. Later, DAN would state that I had been diving "aggressively" and had a lot of nitrogen within my system. But there was no obvious explanation as to why that nitrogen had entered my nervous system, and done the damage that it did.

Following my chamber run, the chamber physician advised me to return to my room and take it easy - he would reevaluate me the following afternoon. I explained that I was having difficulty in urinating, and asked for a catheter since it had become quite painful. Perhaps it was the language barrier between us, but I don't think that my desperation got through to him. He again simply advised me to return to my room, relax, drink lots of water, and things would probably "open up" later that night.

They didn't.

In one of the longest nights of my life, I hobbled back and forth to the bathroom all night long...each time praying that I could unload the by now extraordinarily painful amount of urine my body had created. The damage done to my nervous system ensured that the "floodgates" would simply not open, and I literally cried tears of frustration. My best friend watched each of my painful trips - wanting to do something to help; yet knowing there was absolutely nothing he could do. His night was pretty damn bad as well.

DAN was contacted again the following morning with an update. Alarmed, they immediately dispatched an air ambulance Lear Jet with a paramedic and an RN on board. They also urged me to get to the local clinic for catheterization, and the Divemaster, Patrick Jenkins, immediately drove me to have this done. It would be impossible to explain the utter relief it was to have a catheter thrust in and unload the painful

pressure I had carried all night...it was incredible, and the answer to a prayer. Patrick handled the logistics, getting us to the airstrip in time to watch as the Lear Jet touched down. Soon, along with Sparky and all of our gear, I was in the air to Miami under the care of an RN and a paramedic. Upon arrival, we were met and cleared by a customs agent (pre-arranged by DAN), and then quickly transported by ambulance to Mercy Hospital.

After being routed through the emergency room at Mercy Hospital, I was introduced to Dr. Ivan Montoya and his staff. Dr. Montoya is one of the leading experts in hyperbaric medicine in North America, and specializes in Type II DCS. It didn't take long for me to understand why he and his team are so well respected in the hyperbaric community. Over the next several days, I was struck by his and his team's professionalism and caring as I did three additional Table 6 treatments in a huge chamber capable of holding multiple patients, as well as four Table 2 treatments (2 hours each at 30 feet while breathing pure O2) in a small one-man chamber made of clear Plexiglas. Other doctors at Mercy Hospital took care of other aspects of my treatment. They, too, displayed high levels of professionalism. Each hyperbaric treatment showed noticeable improvement, and a sense of optimism pervaded both team and patient. I will be eternally grateful for the care I received, and that DAN chose to evacuate me into their hands.

A complete MRI series was done on my spine, neck, and skull - all showed nothing irregular. Believe it or not, the MRI was one of the most difficult things for me to do - try lying completely and utterly motionless on a rock-hard table for a solid hour, if you wonder why! Another aspect of the treatment was physical therapy - a thera-





pist assisting me daily in walking through the corridors of the hospital. I kidded him that I had learned to walk again years ago while recovering in a US Army hospital, and compared to THAT this was far easier! Still, the persistent tingling and sensitivity in my legs was troubling...and that catheter was still there....

I had called my wife, Ginny, upon arrival in Miami, telling her that I was doing fine and not to worry. Later, she spoke with Dr. Montoya and Sparky, subsequently flying all night from Seattle to be at my bedside the following morning. She took a hotel room nearby that Sparky had arranged for her. DAN paid for the hotel once I became an outpatient, which happened after four days of treatment. By that time, the numbness had mostly disappeared, I was walking fairly well...AND I could finally urinate on my own!!!! Following my chamber treatment on day six, I was able to walk a full mile. After my day seven treatment, I walked slightly over two miles and could have done more. Between walks, my wife and I swam in the hotel pool and I could feel the strength returning rapidly to my legs each day.

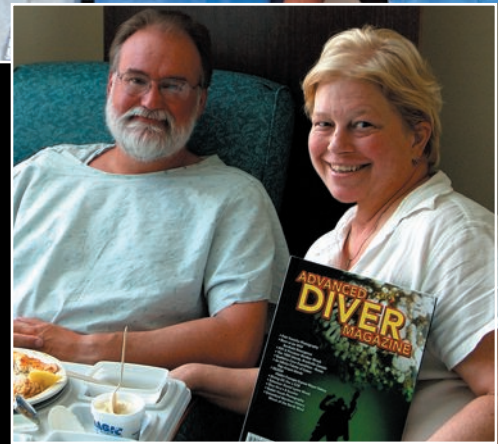
On day eight, I did a Table 2 treatment at 6:30 AM followed by another Table 2 treatment at 1:00 PM. At that point, Dr. Montoya told me that I had had a "remarkable" recovery, pronounced me basically "fit," and told me that any remaining symptoms would probably disappear with time. I was told to wait at least six months before returning to diving, and to honestly

evaluate myself before doing so. I was not cleared to fly until 72 hours following my last chamber treatment, so Ginny and I were not able to fly home for three more days. If I had to put a number to it, I would say that at that time I was about at 95% compared to how I was before the hit, the most noticeable of the residual symptoms being extreme sensitivity to temperature in the skin on my legs.

Dr. Montoya was uncertain as to why I took a DCS hit...perhaps it was the jarring that my right arm and shoulder took...perhaps the extra exertion that occurred when I exited the water...perhaps I was slightly dehydrated...perhaps I didn't sleep as well as I should have the night before...perhaps it was a "left-over" from my long bout with illness the previous month...or perhaps it is simply because I'm now in my 50's and my system may not be able to take what it used to. Upon my return home, my doctor immediately ordered an echo-cardiogram to determine if I had a Patent Foramen Ovali (PFO), which is one of the suspected "culprits" in Type II cases such as mine. The results show that I do, in fact, have a PFO, albeit a small one. The discovery of this PFO would seem to indicate that it was most likely the extra exertion coupled with the extreme amount of nitrogen I had accumulated that caused the advent of my DCS hit. While it is my intention to return to diving once my six-month hiatus is over, when I do my style of diving will be better adapted to my changed realities.

I write these words almost as a pressure release, but also in the hope that this article will force at least some of you, the readers of ADM, to evaluate your diving and your planning. I know that some of you have no diving medical coverage whatsoever, while there are others that feel that you will always be in a position to do everything correctly, and therefore DCS will never happen to you. Situations can change in the blink of an eye, sometimes from things that you cannot control or things of which you are unaware. It behooves you to be prepared to deal with the results. Those of you that DON'T have dive insurance from DAN or another reputable carrier NEED to get it! I'm living proof that sometimes, even if you supposedly do everything right, you CAN take a hit! In my case, that hit involved my spinal cord, an air evacuation, a hospital stay, and multiple chamber treatments. I absolutely shudder to think about how much everything would have cost my family had I not been adequately insured. As it was, the costs were something that I didn't even have to think about, other than out of my personal curiosity.

Take care of yourselves....



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GUADALUPE ISLAND

A brush with White Death

**Text by C.J. Bahnsen
Photography by Shark Diver and Chris Limon**

"Peter Benchley is on the *Horizon*," our dive ops manager, Tracy Andrew, announced as she disembarked from the panga boat and climbed aboard our 85-foot charter dive vessel, the *Ocean Odyssey*. I was among the 16 shark divers and 10 crewmembers who stood bunched and excited on the afterdeck upon hearing the news. With overeager impatience, I asked, "Did you talk to him?"

It was November of 2004. Our vessel sat anchored in the northeast leeward side of Isle de Guadalupe, some 300 yards off an area known as "Shark Heaven." The *Horizon*, sister boat of the *Odyssey*, was anchored not far off, also loaded with shark divers, led by eco tour operator, Paul "Doc" Anes. I was signed on with Patric Douglas, youthful swarthy-tanned CEO of Absolute Adventures-Shark Diver, for a five-day live-aboard package. Tracy had been tooling around on a panga with the shipboard shark researcher, Mauricio Hoyos Padilla, who was tracking acoustic transmitter signals from tagged sharks with a hydrophone. When they motored past the *Horizon*, there was Peter Benchley and his wife Wendy among the dive party. "We just waved a 'Hello' to him," Tracy said to my disappointment.

Guadalupe breaks open the sea 160 miles offshore of Baja California Norte. Cinder cones, geological folds, and vermilion striations of lava rock are evidence of the island's volcanic birthing. It is a rugged, 22-hour, stomach-churning steam for 220 miles due south from San Diego Harbor to get there. The bio-diverse island hosts an excess of big game fish, especially yellowfin tuna and yellowtail, which attracts sport fishermen. In 1998, long-range fishing boats out of San Diego began reporting great whites making shock-and-awe attacks on their catch. Word spread like chum.

Guadalupe represents an aqua Eden for shark divers. Unlike South Africa, Australia, and the Farallon Islands, visibility is often crystalline, well over 100 feet on the best days. Provided you chum the water, white sharks are almost guaranteed to show up everyday during the season.

It burned me that I was never able to get close enough to speak with Benchley during the four days we were both at Guadalupe, being that our vessels remained about 600 feet apart. So when I returned to my bungalow in Orange County, I sought him out via his publisher. A week later an errant email arrived from Benchley, inviting me to phone his East Coast residence on January 28, 2005.

"In South Africa, they do most of the cage diving off these monster seal colonies," he told me, when I asked how his first trip to Guadalupe rated against other shark sites. "The sharks are all over you there, fifteen to twenty at a time in a given day. I've been to South Australia half a dozen times, and I've always had pretty bad luck there. On one trip, we saw only one shark in eight days. Guadalupe was certainly better than my experiences in Australia. There were more great whites there, and they were much less shy. To have about three or four sharks around the clock for four straight days was top of the scale."

I also saw sharks regularly during those same days. Although Benchley and I were on separate boats under different eco-operators, the drill was essentially the same on the *Odyssey* and her sister vessel. Each one-hour dive rotation consisted of dropping into one of two 10' x 20' cages deployed over the stern, four divers per cage.

Unlike everyone else on the *Odyssey*, I was not a certified diver at the time. Non-certs are allowed on these dives since you don't go below ten feet, and breathing is done with a hookah. *Odyssey* divers were each cinched in a 60-pound weight harness so we wouldn't be bobbing around like loose corks. The water temp here averages 60-62 degrees during high shark season (September through early December), which constitutes coldwater diving. And because you're standing immobile in a cage rather than swimming, your core body temp drops. "I don't like coldwater diving," said Benchley, who wore a 40-pound harness and considered the water temp "marginal for a wetsuit."

On my first dive, I was bordering on sensory overload as I wrestled into a borrowed 7mm wetsuit, then the head-shrinking hood, boots, and gloves. The whole getup felt like a black python had me in a goodnight squeeze. There was so much to think about, like the rules Tracy had laid down at first dive meeting: "Never stick any part of your body outside the cage, and never make any sudden movements that might trigger a predator-prey reaction," she admonished.

Tracy would monitor us from the dive platform. Another sharky would man a push-pole during rotations. "If a shark were to come in too close to the cages, we push it off," Tracy said. "It doesn't harm the shark. We just give them a little extra nudge to keep them from entering the cage, because sharks don't have a reverse mode."





Patric and crew had been tossing five-gallon buckets of tuna parts, hang bait, and powdered chum—made from dried fish and blood meal—over both gunwales. I thrust the reg in my mouth, threw my legs into the lurching cage, and KER-PLOOSH!

When the bubbles cleared, I was standing on the cage floor. I got tossed around a bit, trying to fight the currents until I realized the idea was to stay loose, knees bent in a boxer's stance. Visibility was at 25 feet, well shy of the usual 80-plus feet. A plankton bloom was turning the blue water green and dusky, caused by deepwater upwelling that comes from the submarine canyons here.

Standing in the cage weighted to negative buoyancy felt like being on the moon at one-third gravity, only the hazy green cosmos was inverted, plunging between my neoprene boots, streaked by cornflower blues. Depths quickly nose-dive to over 1,300 feet moving out from the island.

We waited. Ten, twenty, thirty-five minutes went by. No sharks. Then I felt a shoulder tap, and Alan was pointing down to our left. At first I saw nothing; until part of the sea separated from itself, becoming a grey-green plasmatic specter that took on form. The preternatural girth of the animal—nine feet or so—reduced me to an awed simpleton.

No mere "Shark Week" could have prepared me for the overreaching immensity of my first *carcharodon carcharias* rising from below...3,000 pounds and 15 feet of shark nearing our titanium-reinforced aluminum cage. Solar vines shimmered off the great white's back like lightning flashes as the titanic fish moved with eons of evolved efficiency. Even at first sighting, I knew the design could not be improved on. Not as a cruising killing machine.

Her beauty was so overwhelming as to take away my fear. At that moment, I understood why Benchley loved sharks and why—through conservation work, TV appearances, lectures, and nonfiction books like *Shark Trouble*—he spent the latter part of his life trying to defang the empire of terror he had created with *Jaws*, which he had meant as fiction, not as an excuse to go out and headhunt sharks.

The low viz, along with a great white's notorious ability to change hues—different combinations of blue, silver, charcoal grey, sea green, and bronze—allowed the sharks to manifest like a haunting: near the surface a ways off one moment, right under the cage floor the next. The animals seemed to assemble from phantasmal mist, as if teleported from the deep. "It was very eerie," Benchley said about this phenomenon. "You'd turn around and there would be one right there. Doc Anes, a real character who ran the operation, told us, 'Remember, it isn't the shark you see that's going to get you, it's the one you don't see that does.' "



Benchley nearly lived those words. "I had my hand out to touch a shark passing the cage. Well, there was another shark following close behind that I didn't see at all. Had she wanted to, she could have easily had a hand or an arm for lunch," he said.

It turned out the female great white that cage-stormed my team was "Scarboard," named so because of the singular scars on her right flank. Scarboard is almost always observed with an escort school of pilot fish. She is one of over 70 adult and sub-adult great whites photo-documented in these waters by Pflieger Institute for Environmental Research (PIER), headquartered in Oceanside, California. Young male whites, averaging 11-14 feet, first appear in early July, while larger adult females begin showing up around September. The largest shark observed by scientists and eco tour operators was 16 feet, but local fishermen have reported sharks as large as 20 feet.

The great whites we saw averaged between 11 and 15 feet...until our last dive rotation on the third day as the yolky sun waned over Mount Augusta, Guadalupe's razorback 4,257-foot peak. The sea had turned docile blue overnight as the winds died. We weren't bullied by currents in the cage, and viz was 60 feet and improving. My consciousness was spilling into the big blue when a 14-foot female materialized from below the *Odyssey's* hull. She passed close enough for a pectoral fin to rattle the cage bars. As she receded, another great white — also a female — eclipsed my mask window. She swam beneath the cage and ghosted away.

Both sharks were hidden, but you could feel them out there. Movement erupted from the starboard. The new shark was a giantess, moving under the panga boat that had returned with Mauricio, lingering alongside it. I would have rebuked her size as some freak underwater refraction, except her body ran the length of the panga. That would make her at least 18 feet, and about two tons. Mauricio, who observed the shark from above, corroborated this later.

The queen beast glided on pectoral wings, moving to the hang bait that floated just below the surface off starboard, mouth toward us as it yawned open. The upper lip crinkled back, revealing bloody gums then a bony ridge filled with layers of serrate teeth like broken razorblades. The cavernous passage to her gullet waited. She tore the bait from the line with an easy swipe of her head, and continued toward us fronting a slack-jawed grin. She moved in along the cage, taking a good look inside. Her right eye landed on me like a dual judgment from God and Old Scratch. I was looking into an omnipotent black hole that slung me back 11 million years.

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SHEARWATER GF

CCR Mixed Gas Computer
Oxygen Controller
PPO² Monitor

by Curt Bowen

The first thing you notice about the Shearwater GF dive computer is the simple menu system that makes configuration easy. Within an hour, most users will be comfortable with it.

The Shearwater GF dive computer is the latest product of Shearwater Research Inc. Bruce Partridge, after a career in computer consulting, got involved with rebreather controllers in the late '90s when he bought one of the early CCR 2000 rebreathers. He started Shearwater Research Inc., and produced rebreather controllers for the KISS and Megalodon. Now Shearwater has introduced its first dive computer, the Shearwater GF. The GF has all of the features that you expect on a modern technical diving computer, including support for open-circuit and closed-circuit, multiple gases including trimix, gas entry and switching during a dive, and no lockout.

It adds simplicity, long battery life, and powerful sensor monitoring.

Since open-circuit (OC) and closed-circuit (CC) diving use different gases and different criteria for gas switching, the GF





uses two gas sets for OC and CC, like the radio stations in your car that are either AM or FM.

Enter your OC gases in OC mode and your CC gases in CC mode, and the computer has all it needs to know to predict your dive plan. When you switch from one mode to the other, the gas set switches automatically. Within each gas set, the GF will make automatic predictions about when to switch gases.

Automatic decisions about when to switch gases for the time-to-surface prediction means that it is very easy to set up your CC and OC gases. There is no need to enter a depth or a PPO2 to set the switch depth. There is no need to keep track of which gases are turned on and off in which mode.

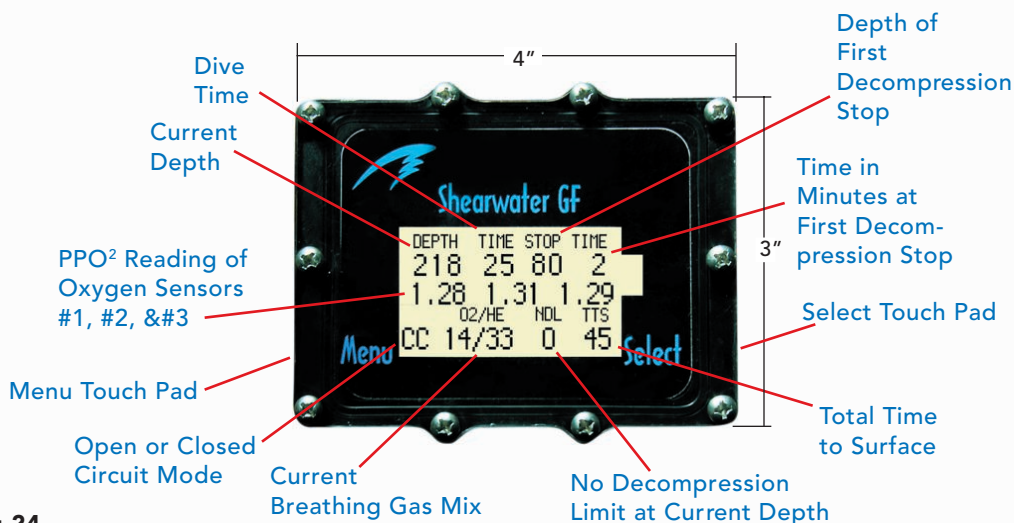
Of course, gases can be entered and changed during the dive to accommodate changing conditions.

The user is still responsible for telling the computer about actual gas switches.

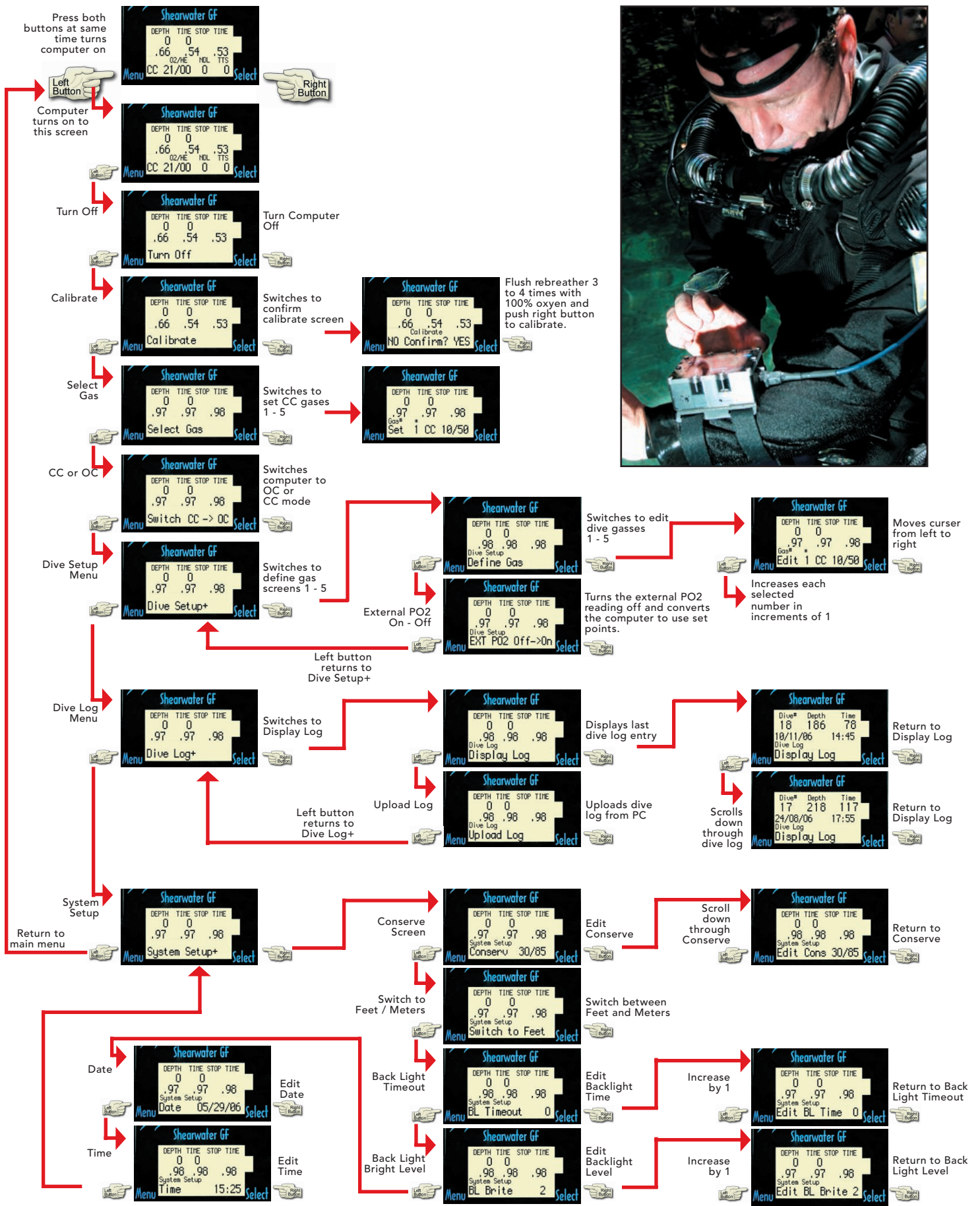
The GF has three operating modes. It can be in OC or CC, and in CC it can use predefined setpoints or external sensor monitoring.

In OC mode, the PPO2 used for decompression is calculated from the FO2 of the gas, and the depth.

In CC mode there are two ways of calculating the PPO2. The first is with setpoints. You adjust the two setpoints to be the same as what you use on your



Shearwater GF Closed Circuit Screen Sequence Chart



rebreather. During the dive you can switch between them to match the rebreather controller.

The GF also allows you to configure switching of your setpoint at specific depths. So you can set it to automatically switch up from .7 to 1.3 at 50 feet, for example. Then you can set it to switch back to .7 at 9 feet. Since most CC diving is done with a single diluent, the computer will match the dive with no user intervention.

The second way of calculating PPO2 is with external monitoring. This is where the GF really shines. It can monitor all three sensors in a rebreather, and calculate PPO2 based on voting logic and average PPO2. It also provides backup monitoring for all three of the rebreather's sensors.

If the GF is only connected to one sensor, the two unused sensors will not display, and it will function like other single sensor computers.

As an aid to analyzing sensor function, the GF can switch the display from PPO2 to millivolts at any time.

The GF uses a system of conservatism called Gradient Factors. Gradient Factors were described by Erik Baker and published for public use. They provide a way of adjusting the decompression profile to provide deep stops in a structured and concise way.

The menu system is easy to use and understand. In addition to being simple, it changes function from surface operation to diving operation. The "Turn Off" selection disappears if it is wet, and the "Calibrate" selection disappears if you are diving. Underwater, only the options that are needed are displayed. For example, bailing out from CC to OC only takes 4 button pushes.

The power consumption is so efficient that even with the backlight on all the time, you only need to change the battery once a year.

Shearwater Research Inc. also offers a heads-up display (HUD) that can be used with the GF or on its own. The HUD displays the PPO2 with three LEDs, which allows it to display the PPO2 faster. It also adds some alarm functionality with LED brightness and light density.

Adaptors are available to attach the GF and the HUD to many different rebreathers including the KISS, Inspiration, Megalodon, and others.

Overall, the GF is a welcome addition to the choice of technical dive computers. It offers significant new features in monitoring O2 sensors that are not found in competitive products.

www.rebreather.ca



Shearwater GF currently have adaptors for the following CCR Units.

- KISS Sport
- KISS Classic
- Inspiration
- Megalodon
- COPIS



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A diver is seen from a high angle, looking down into a dark cave passage. The diver is wearing a black wetsuit, a mask, and a regulator. The cave walls are dark and textured. The lighting is dramatic, with a bright blue light source at the end of the passage. Overlaid on the right side of the image is large, yellow, serif text that reads "CCCR SIDEMOUNT".

CCCR SIDEMOUNT

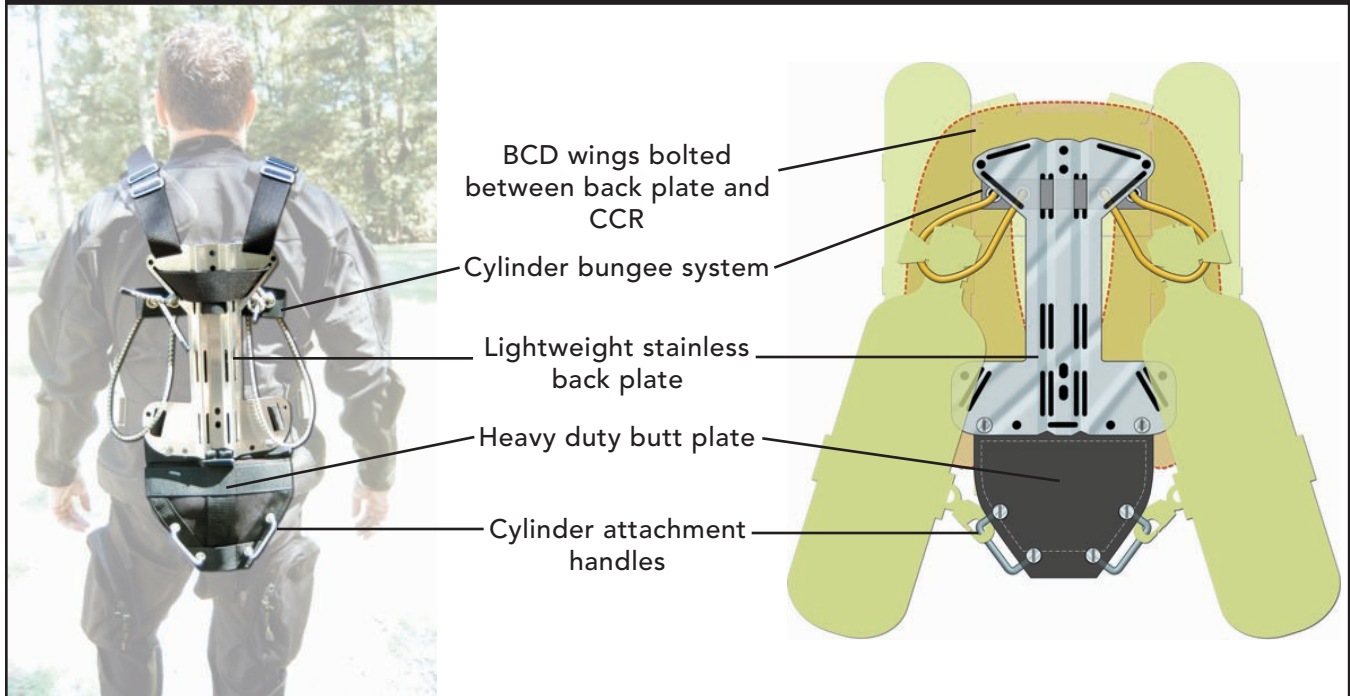
STAGE CONFIGURATION FOR EXPLORATION

Text and Photography by Curt Bowen

Following the rule of thirds for cave diving, or calculating the amount of decompression gas required to safely conduct extended range dives while using open circuit scuba was somewhat simple. Turn the dive at 2/3rd your starting pressure, bring an aluminum 80 of 50% and a 40 cu ft of oxygen, and that would get you through most standard extended range dives.

But now there is a new guy on the block who is using a system that allows him to push way past where open circuit used to restrict him. Closed circuit rebreathers are definitely the answer to extending what was once a dive that would require multiple cylinder stages, hundreds if not thousands of cubic feet of gas, and multiple set-up dives to explore the furthest reaches of the most famous cave systems or extreme deep wrecks. Now, we can dive three to five hours at any depth, mix our decompression gases by the best ppo₂, and carry it all in two small 19 cu ft bottles.

ARMADILLO CCR SIDEMOUNT DIVE HARNESS



While these systems solved the required gas supplies, best mix calculations, and reduced decompression times, they opened up a whole new can of worms to be dealt with.

As long as everything on these sometimes complex systems works without a flaw, we are in dive heaven. But what if we should have to bail off our new-fangled miracle machine, and find ourselves in a place much further and deeper than we ever would on a normal open circuit dive? How do we save our pansy-assed Starbucks-coffee-drinking butts now? We must revert back to the old school of open circuit bailout.

With our backs cluttered with this specialized fancy carbon-dioxide-scrubbing, oxygen-monitoring, LED-illuminating machine that looks like it just came out of a mission from Mars movie. We find ourselves with no place to pack on those heavy primeval steel tubular things we used to call tanks, and brag that we had the biggest of, amongst other things.

Yes, we can snap these 48-pound medieval tanks of torture onto our counterlung, dive-light, reel-cluttered chest, and attempt to swim through the cave or high current wreck like a child's kite in the wind. It also brings on a whole new meaning for

Bailout Stage Cylinder Attachment

1. Attach stage cylinder's cam clip onto the sidemount butt plate handle.

2. Retrieve the bungee and stretch it over and around the stage cylinder on/off valve.

3. Allow the stage cylinder to rest under arm pit. Repeat the same process for the other stage.

4. Once horizontal under water the bungee should pull the neck of each stage snug into the divers armpit.





The Evolution of the CCR Harness

fitting through any restriction, such as a small opening like a ship's cargo hold or the main tunnel in Wakulla Springs. Any hole less than the size of a small compact car now has become a major restriction. Don't even think about reaching your dry suit inflator, or retrieving your backup decompression tables around those bulky tanks without first boning up on your yoga courses.

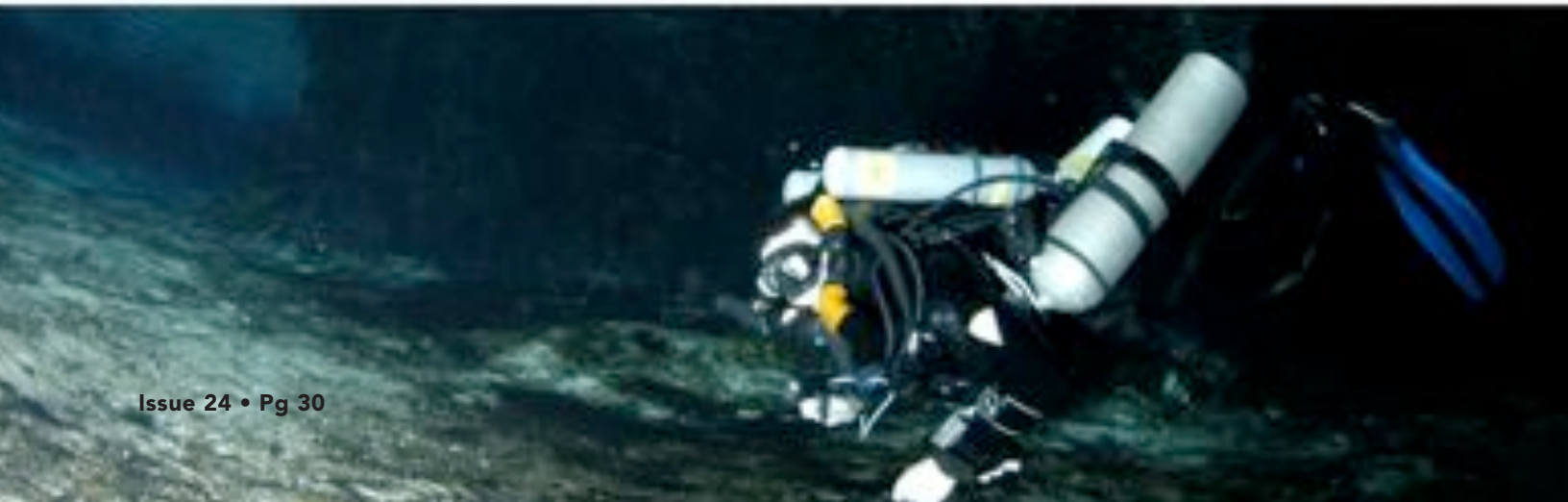
Open circuit sidemount diving is by far the most compact, streamlined method of diving, beyond free diving, that was ever created. It allows the diver to fit through restrictions barely higher than their chest, and glide through high flow caves and currents with the ease of an Olympic swimmer.

It would be only natural to marry the two ideologies of diving together into one complete system. Out of the two arose a unique piece of equipment that provides the diver with a streamlined method of carrying the required open circuit bailout gas without cluttering up their chest and restricting movement and access to vital rebreather life support equipment.

Adapting the basic bits and pieces used on an open circuit sidemount harness to the back-mounted rebreather harness, we have simply solved the problem. The diver can now easily attach two large bailout cylinders onto the special butt attachment location, and bungee its valves tight under their armpits. Moving these cylinders into this location provides the rebreather explorer the maximum streamlined configuration, and allows the diver full access to all equipment on his/her chest and waist. Tucking the cylinder valves up under the diver's armpits also greatly reduces the amount of drag, and minimizes the potential for snag problems. This system also allows the diver to easily remove and attach the stage cylinders, if needed, in the case of an emergency such as a buddy's rebreather failure.

Commercially available CCR sidemount systems are available through Golem Gear and Diverite.

www.golemgear.com
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photo by William Graham



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ADM Featured Photographer

Dos Winkel

underwater and wildlife photographer

Dos Winkel's love of nature was instilled from birth. Growing up in a small village on the Dutch coast, with sand dunes in front of his house, Dos knew the Latin and Dutch names of many local plants and shells by the age of ten. He began photography soon after.





"Nature itself is intrinsically art; and, to me, photography is an art. The challenge of nature photography is in beautifully capturing unique moments in time. Not easy. One's best picture is never taken. Only at the end of a career can one say, 'This is my best picture.' "

Dos Winkel started underwater photography in 1983. During a course he was giving (he is an orthopaedic physical therapist) on the Caribbean island of Aruba, Dos was irresistibly drawn to the magnificence of the coral reefs and their inhabitants. He was "lost" forever!

"Among the many destinations that I visit, Papua New Guinea, Raja Ampat in Papua (formerly Irian Jaya), the Galapagos Islands, and the temperate waters of South Australia are my favourites for underwater photography."

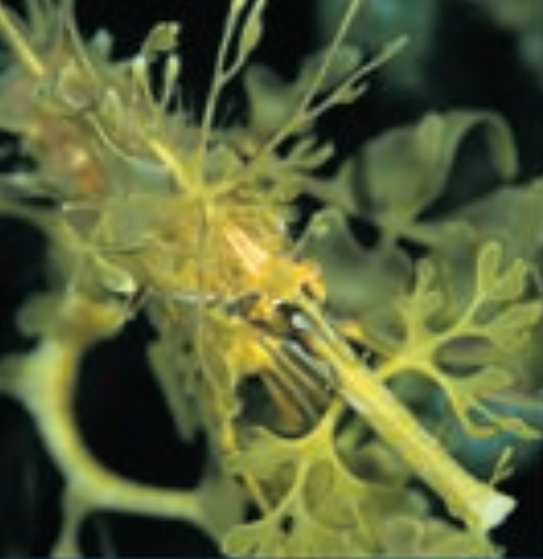
For top-side photography, Dos and his wife Bertie, also a professional photographer, have made over one hundred trips to Africa, mainly to the Ivory Coast, Mali, Burkina Faso, the eastern countries such as Kenya, Sudan, Uganda, Tanzania, and to the southern countries of Madagascar, South Africa, and Namibia. He loves to explore the rainforests of the Amazon countries like French Guyana, Brazil, Venezuela, and Peru to photograph the spectacular wildlife.

"I don't only take pictures in tropical seas with coral reefs, but also under water in rain forests, in mangrove forests, swamps, and in high altitude lakes like Lago Titicaca in the Andes. Recently, during one of the twelve television documentaries that were made about my expeditions, I photographed almost extinct, unique, prehistoric-looking frogs in this lake. Another thrilling adventure was photographing the incredible Leafy and Weedy Sea Dragons of Kangaroo Island (South Australia) and the rare Australian Sea Lions."

Dos's latest book, *ANOTHER WORLD: Colors, Textures, and Patterns of the Deep*, is for sale in over 50 countries worldwide, in seven languages. The publisher in the U.S. is Prestel Publishing, ISBN: 3-7913-3435-2. This book shows real art from the sea. His work is shown in museums, art galleries, and huge outdoor exhibitions.

In May 2007, another fascinating book will come out, *FACES of the DEEP*, with over 100 close-up portraits of marine animals.





Dos's photographs have been published in magazines such as Tauchen, Unterwasser, Fotografie Draussen, Naturfoto, Terra (Germany), National Geographic, Voyager, Asian Diver, Ocean Realm, Oceans Illustrated, AQVA, Terre Sauvage, BBC Wildlife, etc. Dos Winkel has won many awards in national and international photography contests, including the first prize in the portfolio category of the prestigious *Under Water Photographer of the Year Competition, DIVE SIGHTS 2001*.

Dos and Bertie have travelled together since 1969, visiting the remotest places on earth, not only to capture spectacular nature, but also to record the tribal people of the area — 50% of whom do not exist anymore...! With his wife, he recently published a breathtaking coffee table book about adorned tribal faces featuring tribes from Amazonia, Africa, India, Asia, and Oceania. Titled *Vanishing Beauty*, Prestel Publishing, ISBN 3-7913-3743-2, it will be available in the U.S. in January 2007.

Other published books:

- Watercolours Bonaire
- Islandcolours Bonaire
- Naturecolours Curaçao
- The Nature of Saba
- Eye on Aruba Bonaire Curaçao, History, Culture, and Nature
- Eye on St.Maarten Saba St. Eustatius, History, Culture, and Nature

www.dos-bertie-winkel.com

"There's nothing like an expert eye to bring a subject to life. And when it comes to coral reefs, they don't come more expert than underwater photographer Dos Winkel"
BBC Wildlife Magazine

"Dos Winkel concentrates on coral reefs around the world and shows a dazzling array of mountains, crevasses and caverns – each of which may be only millimeters in size."
The British Journal of Photography

"The underwater images of Dos Winkel reveal themselves as the work of a man who has found his nirvana in the visual rhythms of the coral reef."
The Daily Telegraph





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ALL HANDS LOST

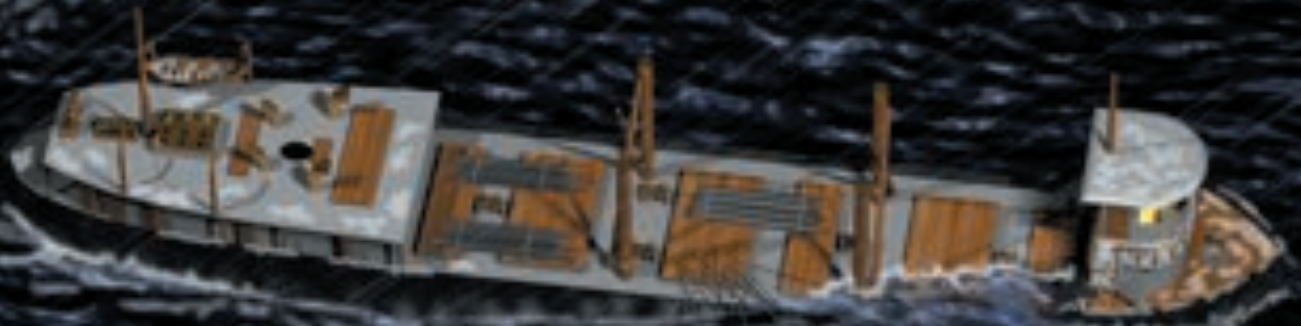


Illustration: Curt Bowen

KAMLOOPS ISLE ROYALE • LAKE SUPERIOR

Text by Curt Bowen Photography by Curt Bowen and Mel Clark

Captain William Brian, wet and frozen from the brutal storm, gripped the wooden wheel, his knuckles sharp and white against the battered red of his hands. Near gale force winds smashed wave after wave across the decks of his ship, the *Kamloops*. The 250-foot, 2,226-ton, iron cargo ship was in a battle for her life, and all aboard knew that only his skill, and the grace of God, stood between them and the ravenous waters of Lake Superior.

Rounding the northern tip of Isle Royale, the vessel had a straight shot towards the protective port of Thunder Bay, only a few hours ahead. First Mate Henry Genest's eyes strained towards the bow of the ship, always on the watch for rocks or other vessels to appear through the driving sleet and snow.

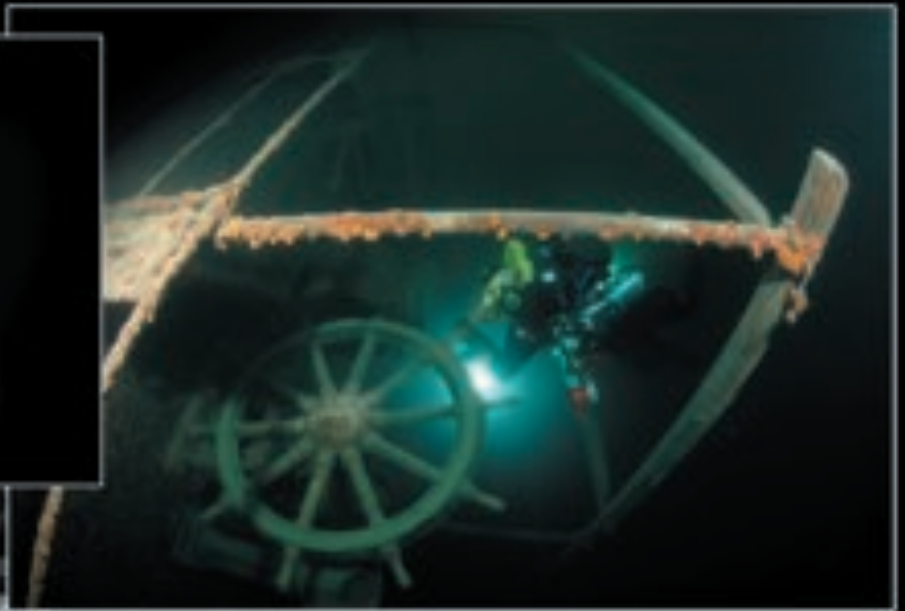
With the wind and waves approaching from the starboard stern, Captain Brian reached over and shifted the ship's telegraph into the full ahead position. Chief Engineer Jac Hawman, bracing himself against the engine's boiler, acknowledged the change in engine power. Loud and urgent, he shouted for more coal to be shoveled into the burners. Covered in black coal dust and sweat, the two ship's firemen, Andy Brown and Harry Wilson, worked with a will to stoke the engines, fighting

to keep upright as the ship lurched from port to starboard. Above the engine room, the remaining 17 crewmembers could do nothing but pray, braced against their bunks and trying not to be thrown onto the deck. Anything not bolted or tied down was rolling around on the ship's floors.

Seasoned from many years of lake travel, Captain Brian knew the dangers of Lake Superior's shallow shoals, shipping congestion, and severe storms. This would be the last crossing for the 1927 season. Intentionally pushing the ship's engines hard, he well knew they needed to make the protection of the harbor before nightfall.

Thirty-foot waves pounded the ship's stern as the winds increased beyond gale force. The temperature had dropped to 20 degrees below zero. A high load of metal poles and fence wire strapped to the deck was collecting ice. It was impossible to chip free due to the severe weather, and the added weight was slowing the vessel's forward progress.

Suddenly, all pressure within the steam engine was lost. The Chief Engineer quickly shifted the engine room telegraph into "finished with engines," indicating to the



Depth 210'

KAMLOOPS

1924 - Dec 10th, 1927

Size: length 250' x beam 42' • 2,226 tons

List of Cargo

- A** cargo hold: Wooden crates of candy Life Savers
- B** cargo hold: Farm machinery, plow disks, tooth paste
- C** cargo hold: Wheel barrels, tractor seats
- D** cargo hold: Boxes of matches, tar paper, tooth paste
- E** cargo hold: Wooden crates of leather shoes
- F** cargo hold: Coal bunker
- G** cargo hold: Coal bunker



Captain that, for some reason, the engines had lost all power. The crew scrambled to ascertain what caused the power loss, so quick and without warning, and at such a desperate time.

Now at the mercy of the building waves and the blinding snowstorm, the ship was pushed off course towards the southwest. Captain Brian knew the dangers of Isle Royale's rocky shoals, and ordered all available hands to assist with the engines. Long blasts of the foghorn called out for assistance from any ship within range of the *Kamloops* position. None would answer.

Darkness fell as the crew labored frantically deep inside the engine room. Captain Brian ordered both bow anchors to be dropped in a desperate attempt to prevent the ship from smashing onto a shallow shoal. Due to the deep water of the lake and the 30-foot waves, the ship's anchors would not hold the helpless ship in position, but dragged slowly along the lake bottom. Continued long blasts on the ship's foghorn desperately called out for assistance.

The night was black as coal; nothing could be seen beyond the frozen railings except blinding snow. The wind continued to blast the ship as freezing water smashed over the pilothouse and midship. The increased weight from the ice gathering on the ship's decking was causing the ship to list to starboard. All aboard knew that their only chance for survival was to stay on board. Abandoning a ship in such extreme weather conditions would be suicide. Could she ride out the storm? Were the anchors holding position? When would the storm break?

The hours felt like days as they persevered, hungry and exhausted, fighting the elements and their fear. And without heat inside the ship, the extreme cold was taking its toll on the desperate crew.

Thoughts of wives, children, and loved ones, prayers and new promises swept through the minds of all the crew. If only God would provide safe passage through this nightmare, what better husbands, wives, and Christians they would all be.

Suddenly, the ship jarred hard to port knocking anyone standing to the deck. The intense sound of grinding metal on rock echoed throughout the innards of the *Kamloops*. Wave after wave continued to grind the ship alongside the rocks. With the ship listing ever harder to starboard, the Captain ordered abandon ship.

Pitch-blackness, crashing ice-cold waves, and staggering winds met the frantic crew as they hastened towards the only two lifeboats aboard the doomed ship. Due to the starboard list, only the port lifeboat could be launched. Cold hands worked to loosen the dogs holding the lifeboat tight to deck. As she swung free and into the darkness, only God knows how many crew made it into the lifeboat — and how many were swept into the churning, bitter cold water.

As the anchors grabbed at the rock, Captain Brian held fast to the ship's wheel in an attempt to hold the bow straight into the waves. Just a few minutes, if he could hold her



position for just a little time, it would give the lifeboats and his crew a better chance for escape and survival.

Some of the crew chose not to abandon ship, taking the chance that she would not sink but would beach herself onto shallow rocks. Maybe even a few had made peace with their maker, and either lay in their bunks or sat at their workstations. Waiting for the inevitable, silently saying their last goodbyes to their loved ones.

Ripping free from the rocky shoal, the ship pitched hard to port and back into deeper water. The small lifeboat and its occupants were lost into the blackness. Water rushed into the ship's holds as the weight of the cargo and ice-covered decks pushed her deeper into the waves. Bands that were meant to hold the pipe and wire fencing onto the decking snapped as the ship listed harder to starboard, spewing cargo and anything loose into the encroaching water.



Top photo: **Historical photo of the cargo freighter Kamloops.**

Above left: **CCR Inspiration diver Pat Berry examines the Kamloops lifeboat.**

Left: **Mel Clark poses beside the stern telegraph.**

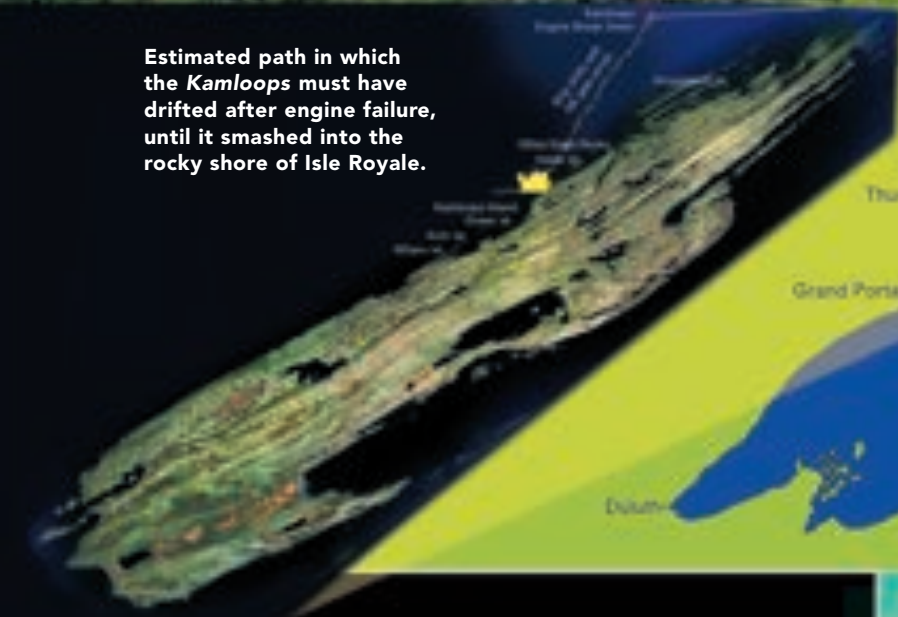
Below left: **Thousands of rolls of Lifesaver candies are located within the first cargo hold just aft the pilothouse.**

Bottom right: **Debris from the cargo holds and stacks of pipe strapped to the deck of the Kamloops is spilled onto the lake floor.**





Estimated path in which the *Kamloops* must have drifted after engine failure, until it smashed into the rocky shore of Isle Royale.



One last tug from the anchors swung the ship's stern. Within a hundred feet of the rocky cliffs of Isle Royale's northern shore, the chains pulled the bow deeper into the oncoming waves. Within seconds, a wall of freezing water slammed across the bow, splintering the pilothouse from its cabins, and taking the good Captain from his ship's helm. The lake swallowed the entire ship, and so fast did she go down into those icy depths that only some few bits of floating cargo marked her descent.

The single lifeboat, with its water-drenched passengers, clinging for life in total darkness, still fought against Lake Superior's death grip. The turmoil and battering that these few survivors had just undergone was not yet sufficient to win their lives away from the night, the storm, and the lake. Isle Royale's rocky shore loomed overhead in the darkness, the enormous waves crashing hard onto its snow and ice covered shoreline. Like a toy, the wooden lifeboat was tossed about in the waves, and then brutally smashed onto the rocks.

Could the frozen, battered men ask for another miracle? Could they survive the beaching, and make the hard scramble climb up the 20-foot cliffs with yet enough life and strength to find some kind — any kind — of shelter?

Photo: Ron Benson, CCR Dive Instructor and owner of Going Under Dive Center, descends the *Kamloops* bow mooring buoy line.





It has been said that Lake Superior never gives up her dead. Eight of the crew were able to make it to shore, only to be exposed to the harshest cold conditions Mother Nature could deliver. Gale force winds and temperatures dropping to 30 degrees below zero, quickly sealed the fate of the remaining crew. One by one, they succumbed to the elements and simply froze to death.

The newspaper told the tale in a simple, terrible headline: "All Hands Lost."

Diving the Kamloops

Isle Royale is one of the islands of the Great Lakes, located high in the northwest corner of Lake Superior. It is part of a wilderness archipelago, an unspoiled land of forests, cold and beautiful waters, primitive vistas, and opportunities for hunting the historic shipwrecks of the Great Lakes.

Even though Isle Royale is located within the United States, with all the modern amenities that this implies, visiting and getting to the shipwrecks can be rather demanding. It lies within the state of Michigan; but is, in fact, closer to the Canadian coastline – roughly 22 miles to Thunder Bay, Ontario, while the Keweenaw Peninsula of Michigan is about 56 miles away. It is a minimum of two to five hours by boat to the U.S. or Canadian main land.

Ron Benson, closed circuit rebreather instructor and owner of Going Under Dive Center, located in Maple Grove, Minnesota, a suburb of Minneapolis, invited me to join his CCR dive team for a week of Lake Superior wreck enjoyment. Being a southern Florida boy with thin warm blood, I

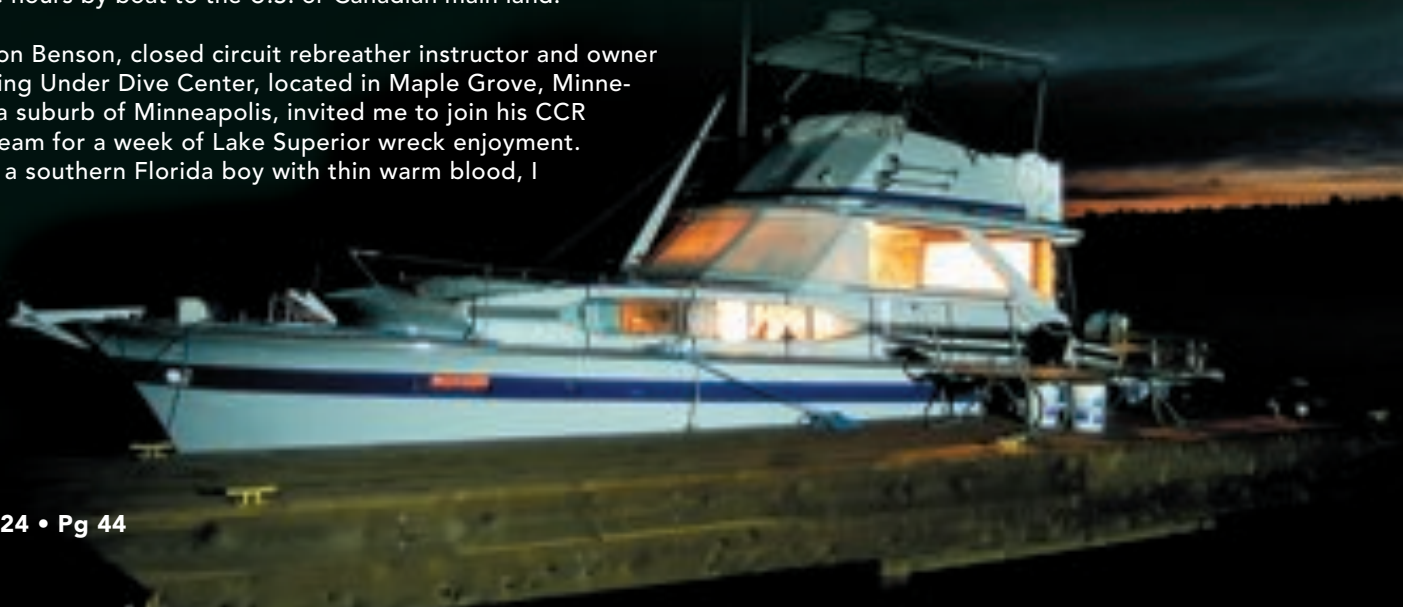
Top of page: Lighthouse located on the southwestern tip of Isle Royale.

Top left: Close-up shot of the lighthouse.

Top middle: The vessel *Deep Thought* prepares for another trip to Isle Royale.

Above: CCR diver Matt Kriesel suited up for another deep dive on the *Loops*.

Below: Sun sets as the dive team docks for the night on Isle Royale.



quickly accepted the challenge. How cold could it really be, anyway? Heck, I worked in the frozen food section of the grocery store when I was younger. OK, much younger.

The main objective for the trip would be to explore and photograph the wreck of the *Kamloops*, one of Ron's favorite wrecks, along with a quick visit and overview of some of the other north shore Isle Royale wrecks such as the *America*, the *Congdon*, the *Chisholm*, and the *Emperor*.

Ron and local diver Matt Kriesel picked up Mel Clark, Erik Foreman, both from the Pacific Northwest's Seattle, Washington, area and me at the Minneapolis airport. Complete with a small trailer full of food supplies, a couple buckets of scrubber material, and about 40 small 19 cubic foot rebreather bottles containing oxygen and a diluent of trimix 15/60, our team of five divers would be set for a whole week of shallow and deep wreck exploration. Not to mention three nice-sized bottles of Crown Royal and a bottle of Parrot Bay coconut rum, my choice, to keep us warm at night on the boat. After a five-hour drive north, we found ourselves in a small Indian village with a giant casino called Grand Portage. With no time to squander at the tables, we loaded Ron's 42-foot dive vessel, *Deep Thought* with supplies, rebreathers, and extra warm clothing for me. Three hours later we arrived at the State Park's Ranger Station for a quick but mandatory check-in, a speech on how to keep the local wildlife happy, and our last look at a modern toilet and shower.

Exiting the protective harbor of the Ranger Station, Ron cruised along the island's north shore for another four hours until we finally reached our destination, the wreck site of the *Kamloops*. Two buoys marked the location of the wreck, one on the ship's stern and the other on the bow. What I found particularly impressive was that the stern buoy was located less than 150 feet from the 30-foot rocky cliffs and jagged rocks of the island. Impressive, because the depth on the stern (closest to shore) of the *Kamloops* is over 200 feet deep and slopes downward, away from shore, to a depth at the bow of 265 feet.

Since this would be my first cold water dive in the northwest of Lake Superior, Ron thought it would be best to break me in by doing a somewhat shallow dive on the *Kamloops* stern. Suiting up in my extra warm Weezle Extreme Plus undergarment, Dive Rite's 905 drysuit, extra thick hood and a pair of wet gloves, I donned my KISS classic rebreather, a 40 cubic foot stage of oxygen, and an aluminum 80 air for emergency bailout. Standing on the dive platform with Mel Clark, Ron handed me my underwater camera housing and strobes; and with a giant stride step backwards, we entered the water. Brisk, was my first thought about the 50 degree water. But not so bad, I said to myself as we swam to the descent line. Dumping the air from my wings, I followed the 1-inch polypropylene stern ascent line as it dropped straight into the darkness below.

Right: CCR dive instructor Mel Clark suits up for another exploration dive to determine how the *Kamloops* sank that frozen night of December 10th, 1927.



At a shallow depth of around 25 feet, I met face to face with the true beast of Lake Superior's ice water chambers: water temperature a mere six degrees above freezing, 365 days a year. The 50-degree heated top water was just a warm disguise. Ron assured me that this balmy surface water has in past reached all the way down to 50 feet, but not today.

Dropping down the line, we reached the stern of the *Kamloops*. Lying on her port side, the starboard stern cabins came into view first. Immersed in the constantly frigid waters of the lake, the wood of the cabin doors appeared to be in amazingly good shape. Slipping over the top of the cabins and towards the stern, we encountered a large wooden ship's wheel and binnacle. From this point, we penetrated through the skylight windows and into the engine room. The engine room contained a multitude of catwalks, large boilers, and some human remains that are believed to be those of the ship's engineer. Exiting the engine room, we explored the stern deck that contained a large winch and stern telegraph. I noticed that the telegraph was truly in the "Finished with Engines" position. Over the stern railing and under the ship's rudder, I noted that the ship did not receive any damage to the stern rudder or prop. This lack of damage would indicate that the stern section of the ship never struck the shore during the sinking. Twenty-two minutes of bottom time had passed, and it was time to pay the piper with 45 minutes of decompression. Not much decompression, unless you're immersed in 38 degree water! By the time I reached the balmy 50-degree water at 25 feet, my hands were frozen and screaming in pain as I tried to grasp the ascent line. A lesson learned for a Florida boy: use dry gloves in such harsh conditions. It just so happens that Ron had brought a pair for me on the boat. I wondered why he was smiling when I was putting on my wet gloves....

Additional dives by the team over the next few days revealed the contents of many of the cargo holds. Items such as crates of leather shoes, boxes of matches, rolls of roofing paper, wheelbarrows, tractor parts, plow disks, boxes of toothpaste, wooden barrels, coal, and crates of candy Life Savers. What is believed to be the starboard lifeboat can be located on the lake bottom, just below the stern cabins. The lake bottom is covered with the pipes and mesh wire that were strapped onto the ship's

deck, and that were probably one of the main factors in the ship's sinking.

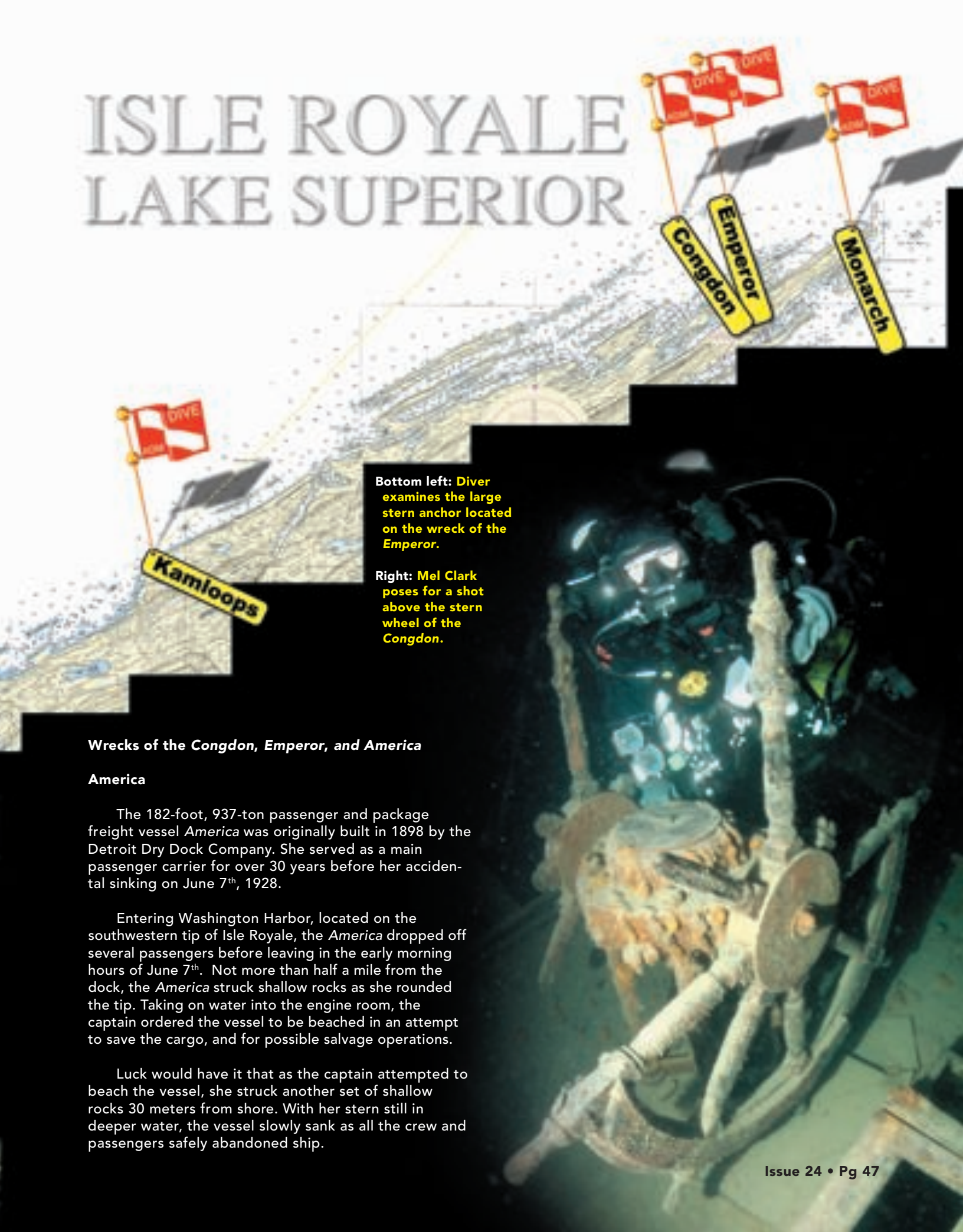
One of the mysteries behind the sinking of the *Kamloops* is the lack of any major damage ever discovered to its haul. To date, only minor damage could be discovered along the ship's starboard bottom. One of our team's goals was to explore the bottom of the wreck, in the hope of finding added clues to its sinking.

CCR divers Mel Clark and Erik Foremen descended onto the ship's bow, which is buried halfway into the lake bottom. Examining the bottom of the ship at the lake floor level, they searched for any telltale signs of collision with the rocky shoal. At first, only small amounts of minimal damage could be seen as they made their way towards the stern. Suddenly, the lake floor dropped down another ten feet creating a swim-through all the way under the ship. Entering this small, dark tunnel and going under the ship, the team discovered a three-foot by six-foot long hole in the port, folded forwards like a ripped piece of paper. Exiting on the deck side of the wreck, they noted the location of the damage just below the port rub rail, under just aft the second cargo hold. This damage would indicate where the ship had struck the shallow shoal towards the northeast of its current position, and the speed with which it would have filled with water and sank.

The Captain was correct with his order to abandon ship. Sadly, though, as with hundreds of ships before the *Kamloops*, the gales of Lake Superior and its icy waters came alive and reached out for prey like a starving sea monster, stealing the life from all hands.



ISLE ROYALE LAKE SUPERIOR



Bottom left: Diver examines the large stern anchor located on the wreck of the Emperor.

Right: Mel Clark poses for a shot above the stern wheel of the Congdon.

Wrecks of the Congdon, Emperor, and America

America

The 182-foot, 937-ton passenger and package freight vessel *America* was originally built in 1898 by the Detroit Dry Dock Company. She served as a main passenger carrier for over 30 years before her accidental sinking on June 7th, 1928.

Entering Washington Harbor, located on the southwestern tip of Isle Royale, the *America* dropped off several passengers before leaving in the early morning hours of June 7th. Not more than half a mile from the dock, the *America* struck shallow rocks as she rounded the tip. Taking on water into the engine room, the captain ordered the vessel to be beached in an attempt to save the cargo, and for possible salvage operations.

Luck would have it that as the captain attempted to beach the vessel, she struck another set of shallow rocks 30 meters from shore. With her stern still in deeper water, the vessel slowly sank as all the crew and passengers safely abandoned ship.



Above: CCR Instructor Mel Clark descends onto the wreckage of the *Congdon*.

Below: Mel examines the stern ship's wheel

Below right: A multitude of giant winches were used to load and unload the ship's cargo.



Today, the ship's bow sits in less than two feet of water while her rudder and prop are in 85 feet. She is considered Isle Royale's easiest — and most frequently dived — shipwreck because of her shallow depths and protective cover from most storms. Almost all of her artifacts have been taken, but her wooden decks, cabins, and stern section are interesting to visit.

If the weather is rough on Lake Superior, the *America* is an excellent dive for what would be an otherwise wasted no-dive day.

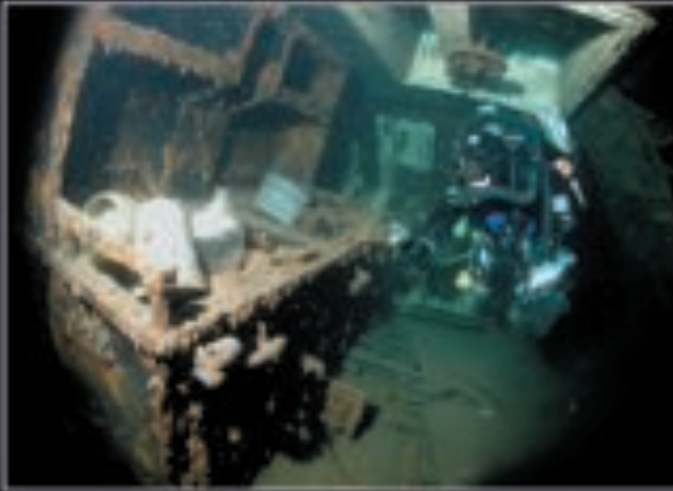
Chester A. Congdon

A massive 532-foot, 6371-ton steel bulk freighter, the *Chester A. Congdon* was built in 1907 by the Holmes Steamship Company.

On November 7th, 1918, the *Congdon* was headed out of Fort William with over 400,000 bushels of wheat when she ran aground on the shallow shoal in thick fog. Attempts to salvage the ship were hindered by several weeks of bad weather. Before a crew could arrive, the ship had split just aft of the bow and the stern lay in deep water.

Today, none of the wreckage can be seen on the lake's surface. The bow sits upright in 50 feet of water, while the stern is on a very steep slope with depths ranging from 185 feet at her stern up to 80 feet where she had split apart on the rocks.

The stern cabins are in remarkably good condition. The engine room can be explored by dropping down through the skylight. Inside, you will find a massive boiler, steam engine, and miscellaneous equipment.



Above left: Ron Benson, CCR Instructor and owner of Going Under Dive Center, gazes into the *Emperor's* firemen's cabin.

Left: Ron searches through the *Emperor's* ship's galley. Note the large stove on the left, and a glass container still holding some type of liquid.

Above: A massive ship's horn may have called for assistance the night the *Emperor* slammed into the rocky shoals of Isle Royale.

Below: A grisly reminder of the tragedies of Lake Superior's early shipping days. Human long bones and a lonely shoe remain on Lake Superior's rocky bottom, just a few hundred feet from the *Emperor's* stern.

Emperor

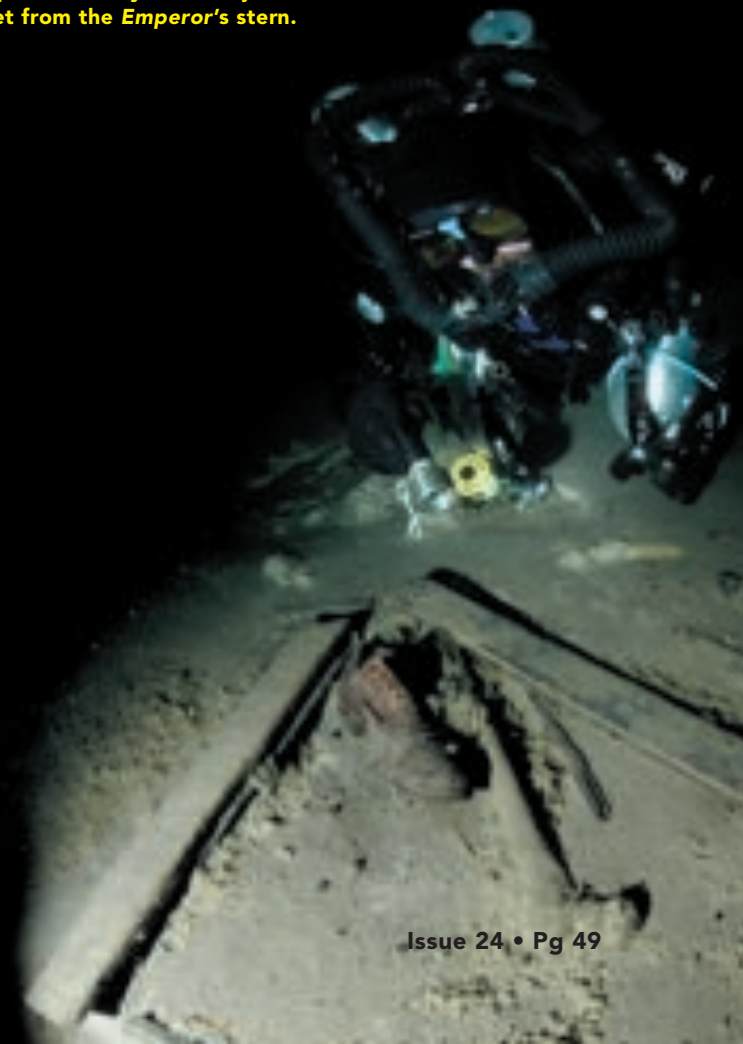
The second largest Isle Royale shipwreck, the 525-foot, 7031-ton steel bulk iron ore freighter *Emperor* was built in 1910 by the Collingwood Company.

On June 3rd, 1947, the *Emperor* was loaded with 10,429 tons of bulk iron ore when she cleared Port Arthur and headed for Ashtabula, Ohio. Weather was calm, with a light wind and excellent visibility.

Captain Eldon Walkinshaw had the watch until midnight when the first mate, James Morrey, took over. Morrey had coordinated the previous day's activities of unloading and loading the vessel. Tired from a whole day's work, he accidentally fell asleep at the helm.

Shortly after 4:15 a.m. on June 4th, the *Emperor* slammed full speed into Canoe Rocks, just a few hundred yards from the wreck of the *Congdon*. As the ship began to sink, the captain gave the order to abandon ship.

Two lifeboats were launched from the sides of the ship. The starboard lifeboat was able to hold 10 sailors; but as the port lifeboat attempted to make its escape, it was pulled under by the suction of the sinking ship. When released from





the ship's suction, it surfaced upside down. Only a few of the sailors who had been inside the lifeboat were still clinging to its sides.

Twenty one sailors were rescued from the freezing water by a U.S. Coast Guard vessel that was in the vicinity repairing navigation lights. Twelve sailors perished, either by drowning as the ship sank or by freezing to death in the icy waters.

Today, the wreck sits on a steep rocky shoal with the stern section as the main point of interest in 185 feet of water. Descending the mooring buoy, the midship of the wreck comes into view around 80 feet. Swimming towards the stern, you will pass several cargo holds with missing hatch covers. At a depth of 150 feet, the stern cabins and engine room come into view. Exploring the starboard cabins, you will first see the fireman's bunk cabin. More towards the stern, the cabins are crushed downwards like an accordion. Rounding the stern rail, you will find a large winch and a large anchor still strapped to the decking. Descending over the rail and down towards the floor, the large rudder comes into view. Examining the prop, you can see the immense force that the *Emperor* must have endured — all the prop blades have been sheared off at the hub.

Swimming along the rocky bottom, away from the starboard stern, at 185 feet you can locate the evidence of loss of life on the wreckage. Human long bones and a lone shoe lie silent on the lake floor.

Returning to the wreck, the engine room makes an enjoyable excursion along with the port cabins and ship's galley.

Left: Thousands of stars fill the nights sky as the sun sets under the horizon.

Left Photos top to bottom: Different sections of the *Emperor*.

Below: The massive force in which the *Emperor* slammed into the rocky shoal sheared off all the massive propeller blades.



Diving Lake Superior

Known as one of the coldest freshwater lakes in the world, diving Lake Superior can be both exciting due to the pristine condition of the shipwrecks and their remarkable maritime history, and extremely challenging because of the near-freezing water temperatures and extreme depths. Just beyond the reach of open circuit scuba, hundreds of shipwrecks are held captive by the great lake they call Gitchigumi, eluding our discovery and ability to visit.

Introducing the advantages of minimum gas volumes, warm breathing gas, and reduced weight that

closed circuit rebreathers offer, we will no doubt extend our ability to explore — not only in the ice water chambers of Lake Superior but across the whole planet.

Going Under Dive Center's owner, and one of the world's leading CCR instructors, Ron Benson offers specialized rebreather expeditions and resort travel to a multitude of remote world dive locations. For a complete list of dive destinations and how you can become involved, visit Going Under Dive Center's web site at www.goingunder.net. Without a doubt, it will be one of the most exciting and memorable dive trips of a lifetime.

Left: Many shipwrecks clutter the shallows and deep-water walls of Isle Royale. Divers pose for a shot on the massive props of the wreck Chisholm.

Below: CCR Diver and explorer Eric Foremen prepares for another dive using his KISS Classic rebreather.



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Warren Lo Photography

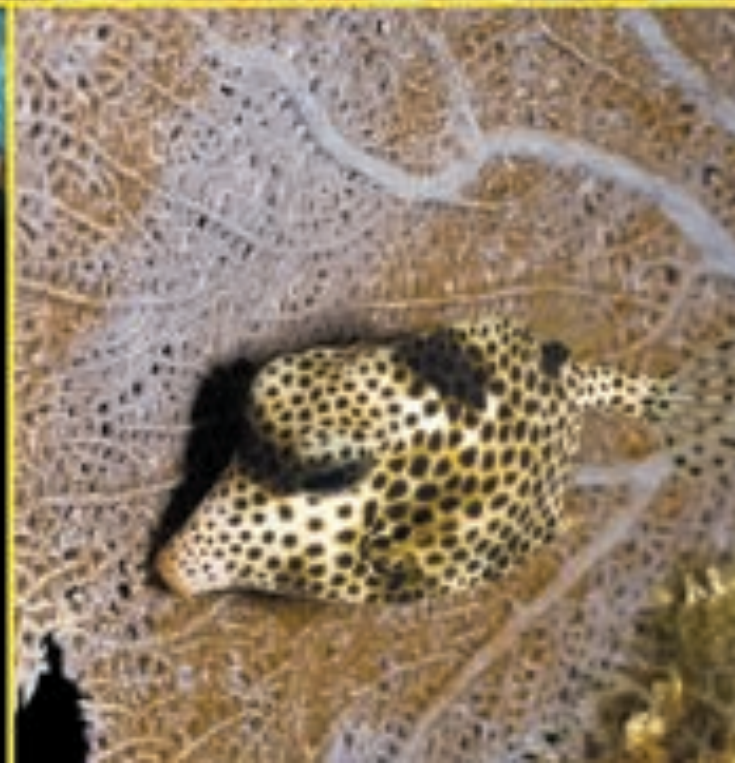
Photography has always been something that Warren Lo has been interested in. As a kid, he got his first film SLR camera in high school, and began shooting pictures of anything and everything. Experimenting with different types of cameras, he eventually ended up shooting most of his work in medium format using a Pentax 67. His freelance work during university, shooting pictures for various independent newspapers as well as the odd wedding here and there, made extra money to help fund his photography.

In 2003, Warren discovered scuba diving, and was instantly hooked. Developing a love for the sport, he spent as much of his free time as possible learning and diving. At first, he hadn't realized that underwater photography even existed. But he soon discovered that his first passion for photography could be combined with his new passion for diving. As a photographer, he loves sharing with others what he sees behind the lens. And that has also carried through to his underwater work.

He dives as often as he can, and has even become certified as an open water scuba instructor so that he can teach others the ways of diving and instill his passion for diving in his students. Naturally, one of his favourite courses to teach is underwater photography.

Living in Toronto, Canada, the vast majority of the diving near his home is cold fresh-water wreck diving, which has been







Warren's main focus is in diving. From the warmer, fast-running waters in the St. Lawrence River to the colder, blue waters of Lake Huron, wreck photography has been his mainstay. There is something very alluring about seeing a shipwreck up close that is a hundred or even two hundred years old, and being able to capture images to share. It's like being able to walk into a page in history. That's not to say that he does not enjoy going to warmer climates and shooting colourful marine life. He makes it a point to take a couple of trips a year to the tropics to do just that. The next big trip is in November 2007; he plans on visiting Truk Lagoon and Palau to explore the deeper wrecks and marine life. Before that, however, there will still be many trips closer to home to sites along the Great Lakes, including places such as Brockville, Kingston, and Tobermory.

As an extension of his underwater photography, Warren has begun traveling down the technical diving road. Training in decompression and mixed-gas diving has allowed him to access deeper and less-frequented wrecks. He also has recently been trained as an electronic closed-circuit rebreather (CCR) diver, which has added yet another dimension to his underwater photographic capabilities. The ability to take pictures in a bubble-free environment has huge benefits in photography. Not only will the CCR maximize bottom time and minimize decompression time while adding a margin of safety, the lack of bubbles means less chance of disturbing a wreck environment. In the tropics, this means getting closer to marine life for photo opportunities not possible on traditional open circuit scuba.

So, what is in store for Warren in the future? He plans on continuing his own dive training, and expanding his experience in diving and underwater photography. He also plans on continuing to travel to new dive destinations while expanding his portfolio of work, which can be found at

www.warrenlophotography.com





Using photo mosaics to document underwater sites is not a new technique; it has been utilized by a generation of diving scientists. Advances in digital photography and digital image manipulation, however, have allowed more options for correcting image distortions, which in turn allows a greater freedom in image collection – a distinct advantage on deeper sites where bottom time is at a premium.

Traditionally, photo mosaic documentation began with a rigid frame or grid placed over the site to be documented, dividing the site into equal sections. A still camera, mounted atop a triangular tower, was then moved section by section, taking sequential photographs at a consistent distance and angle from the bottom. Keeping the camera at consistent depth and angle was of great importance, as variations in distance or angle created scale and proportioning errors that could not be easily corrected. This process required vast amounts of bottom time to set up the site and capture images.

Using digital video rather than a still camera maximizes productivity during limited bottom times, allowing the capture of literally hundreds of images in a matter of minutes while traveling over the site at a consistent depth and speed, freeing the diver from stopping every few feet to ensure adequate image overlap. Still images can later be captured from the digital video to create the photo mosaic.

The key to all methods of digital video capture is to keep the camera steady and at a perpendicular angle to the bottom. This requires a camera housing that is nearly neutral in buoyancy, as well as using good buoyancy techniques. To keep the camera at a perpendicular angle to the bottom, the authors utilize a simple plastic bubble level that is available at any hardware store. Attached to

the back of the camera housing, the bubble level provides a quick visual reference for camera angle. These cheap plastic levels have been used effectively to depths of 175 feet without problems. To maintain a consistent depth, a small digital depth gauge can be affixed to the back of the camera housing, but a wrist-mounted depth gauge, rotated to allow viewing without moving the camera, has proven to be more than adequate.

To begin, the camera operator must first determine the optimum depth and lane width for the passes with the video camera. This is accomplished by holding the camera perpendicular to the bottom while viewing the site through the camera's viewfinder. The goal is to create a balance between the captured image's width and detail by changing camera depth above the site. While looking through the viewfinder, adjust the camera depth to achieve the widest possible coverage area while maintaining adequate detail within the viewfinder. Camera exposure often needs to be adjusted while determining the optimum depth. Obviously, sites with poor visibility will require the camera to be closer to the site, while sites with unlimited visibility will allow the camera to fly much higher above the site. If passes are made too far above the wreck, fine image details are lost. If passes are made too close to the wreck, the field



VIDEO CAPTURE SHIPWRECK PHOTO MOSAICS

By Tamara Thomsen and Keith Meverden

Left: Photo mosaic of the 123-foot schooner *Rouse Simmons*, which lies in 170 feet of water in Lake Michigan. The video was captured during one 25-minute dive, and the mosaic is assembled from 242 individual images and is 88,939 KB. Courtesy: Wisconsin Historical Society

of view will be so narrow that a very large number of images will be needed to construct the mosaic.

Once the optimum depth level has been determined, the coverage width of the camera lens will need to be determined by picking two objects on opposite sides of the viewfinder. The distance between these objects is the field of view, and all passes over the wreck should be approximately one half to two thirds this distance away from one another. This will allow adequate overlap between lanes to ensure the site is thoroughly captured with no "dead spots."

With the optimum depth and lane distance determined, the camera operator is ready to begin "mowing the lawn" over the site. On small sites it is possible to simply swim the video camera over the site while maintaining a consistent depth, but this allows much more camera shake than other methods. Movement from diver kicks, adjustments to buoyancy, or even checking depth gauges creates small movements in the camera, which detract from the captured image quality.

The authors have found the most efficient method is to mount the camera to the nose of a DPV, allowing a diver to operate both the camera and DPV. The diver first finds the optimum depth and lane spacing as above; and, after turning the camera to record, simply flies the DPV over the site with the camera attached to the nose. Even with a long-bodied DPV, the bubble level mounted on the back of the camera is easily visible, and a wrist-mounted depth gauge can be easily read to maintain a consistent depth. This also allows one hand to remain free to signal other divers, equalize, or maintain buoyancy.

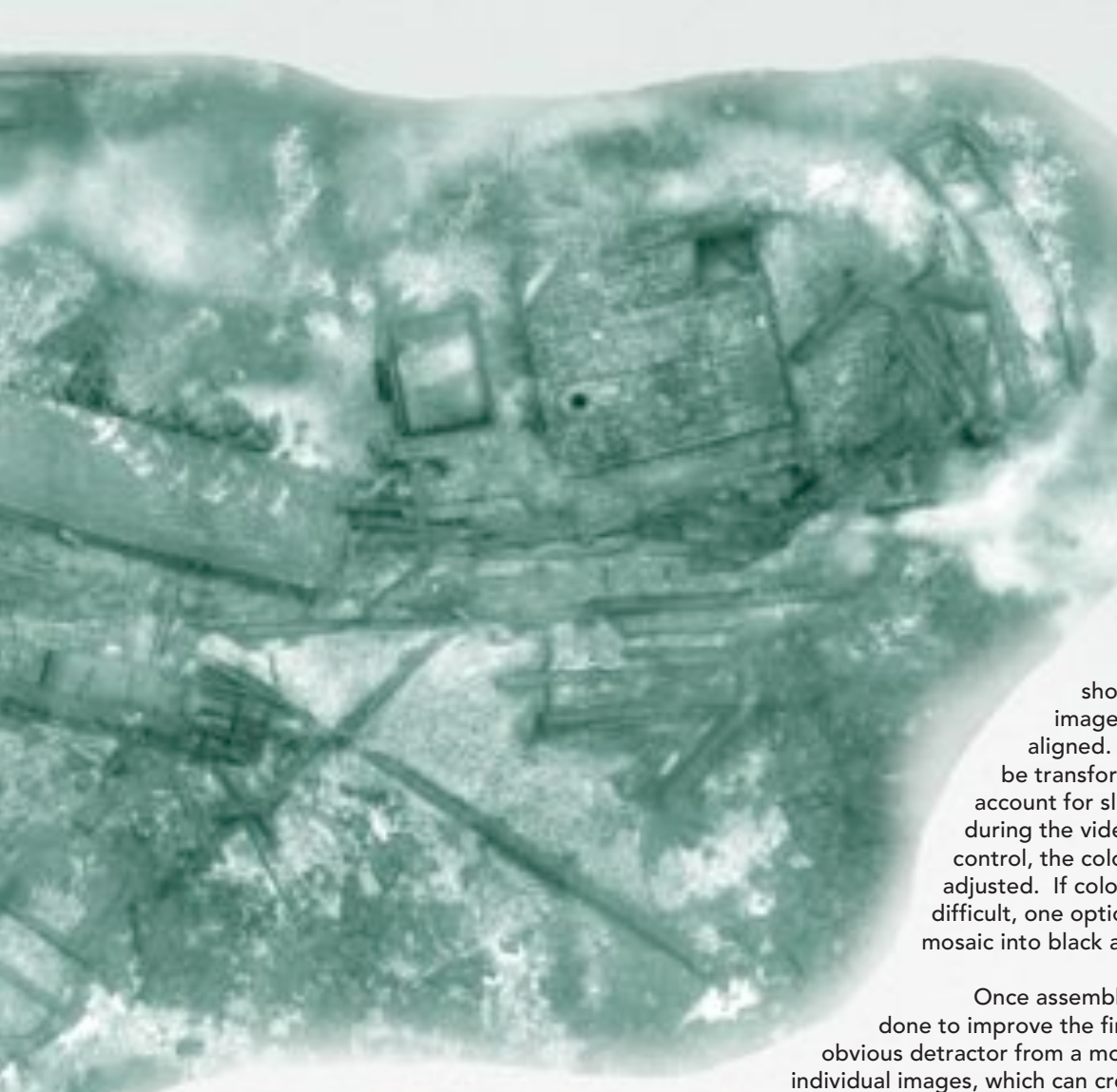
The DPV's speed has a large effect on captured image quality. High speeds allow complete site coverage in a minimal amount of time, but create challenges for capturing overlapping still images from the video, and often result in blurred still images. For sites with large variations in relief or with fine detail, mosaic production is made easier by capturing the video in one direction

only (i.e. all video passes are made from bow to stern, with the return pass un-filmed). This is especially helpful if there are many shadows created with artificial lighting or on bright, high-relief sites.

Once topside, the next step is to capture individual still images from the video. Start at the beginning of the first pass and begin capturing still images onto a large capacity memory stick using the photo capture feature on the video camera. Successive images should overlap by about one-third. Still images should be captured in as high resolution as possible, but it is not essential that the image quality be as high as that of still camera images. The final mosaic will be a compilation of many images and the completed mosaic will usually be quite large, making the resolution of each individual less important. All still images should be captured before assembling the mosaic. Move the captured images from the memory



Diver collecting video with nose-mounted Light&Motion camera on a Silent Submersion UV-26



Left: Photo mosaic of the 75-foot scow schooner Ocean Wave, which lies in 110 feet of water in Lake Michigan. The video was captured during one 12-minute dive, and the mosaic is assembled from 80 individual images and is 63,714 KB. Note the diver off the port bow. Courtesy: Wisconsin Historical Society

stick into folders labeled "Pass 1," "Pass 2," etc. Organization is key. All images should be reviewed as they are transferred from the memory stick. Occasionally a captured image will contain a lot of blurred movement, making it unusable. It is easier to recapture the image immediately than to wait and have to search the entire video for the proper location from which to re-capture the image.

Software such as Canon PhotoStitch that automatically assembles series of images to create panoramas is rarely successful in assembling underwater mosaics. The best results are achieved by hand-assembling the images in Adobe Photoshop. Begin by opening the images one at a time in Photoshop. If the site has a large feature that can be used as a visual baseline, such as a ship's keel, start the assembly process along this feature and assemble the mosaic outward from there. Once the first pass is completed, ensure the assemblage of images is straight and does not curve one way or another. If the first pass of assembled images curves, flatten the images (from the pull down menu under "Layer") and then use the Liquify filter to straighten out the anomalies. The brush size and pressure may have to be adjusted. If the video was shot with a wide-angle lens, the best results are achieved by using only the middle portion of each image (due to edge distortion created by the wide angle lens). Extra time

should be taken to ensure the image edges are accurately aligned. Some images may need to be transformed or scaled in order to account for slight changes in depth during the video capture. For more artistic control, the coloration and tone can be adjusted. If color matching of images is difficult, one option is to turn the completed mosaic into black and white.

Once assembled, a few things can be done to improve the final appearance. The most obvious detractor from a mosaic is visible edges of individual images, which can create a "patchwork" appearance. This can be reduced by flattening the image and cleaning the individual image edges with a combination of Photoshop's Healing Brush, Patch, and Blur tools. Once the mosaic is flattened and the image edges are hidden, the mosaic can be scaled for accuracy. Significant site features should be measured during the dive, and these measurements can be used to adjust the mosaic to a specific scale. Photoshop's Liquify filter is used to stretch the mosaic until the mosaic's measured site features match the chosen scale. If only certain areas of the mosaic require stretching to scale, areas that do not need adjustments can be frozen while areas needing stretching are moved.

The important thing to remember is that some techniques will work better for some sites than others. The techniques described have worked for the authors on shipwreck sites upwards of 350 feet in length and to depths of 175 feet.

Tamara Thomsen manages the U.S. office for Delta P Technology, Ltd., and owns Diversions Scuba in Middleton, WI www.diversions-scuba.com.

Keith Meverden works as an underwater archaeologist for the Wisconsin Historical Society's Maritime Preservation and Archaeology Program, and owns Points North Diving. www.diversions-scuba.com/pointsnorth

KIJA BLUE



Text and Photography
by ADM's Australian
staff photojournalist
Richard Harris

AUSTRALIA'S
REMOTEST CAVE
EXPLORATION

The massive collapse that marks Kija Blue is nearly 300 feet in length, and bordered by sheer 70-100 foot high walls.



High noon sunlight floods the cave entrance, illuminating the cobalt blue water as the dive team descends deep into the darkness.

A lone fly drank from the tiny pool of moisture in the corner of my eye. I swatted it away, then stretched and yawned as the dawn broke in the Australian Kimberley. There really was no need to slake its thirst on me, for just 200 metres to the north lay a cavernous body of water, perched within the ancient red sandstone and dolomite of the arid northwest. A massive sinkhole or cenote, many miles from the remote township of Warnum was the reason for our makeshift camp in this loneliest part of Australia. Swags and wetsuits marked the temporary home of the six explorers who came from different corners of the country with the common goals of discovery and adventure...

It was clear from the somewhat disorderly campsite that camping was not the focus of the group. Over at the sinkhole, the scene was different. Mixed gas closed circuit rebreathers (CCRs), masks, fins, reels, slates, and the other tools of exploration cave diving were arranged in neat piles by each diver in readiness for the day's mapping work. Everything prepared, then checked and double-checked before a dive into the spectacular unknown of Kija (pronounced "gidja") Blue.

Just six years before our visit, local caver John Storey located and dived the site in a quick single tank sortie. So stunned was he by the beauty of the cave, he vowed to protect it by keeping its location a secret. In 2005, after some clever detective work by the local

cavers, Paul Hosie, Paul Boler, and Ken Smith spotted the cenote from a light aircraft. They then visited the sinkhole for three short days as part of a larger caving trip. Expecting nothing more than a small lake in one corner, they planned only three or four short dives to document the site and tick it off Paul's long list of possible caves. But what they saw in those brief dives amazed them; an azure blue cenote of such clarity, size and depth that they knew they would need to return for a larger and better prepared expedition to fully document the extent of the cave. In addition, the depth of the site (over 75 metres in one area) meant that more sophisticated equipment and techniques would be required to safely perform the exploration and survey work. With this in mind, Paul Hosie assembled a team of six experienced "technical" cave divers who could undertake the dive. A highly proficient team traveled to the farthest reaches of the Kija people's traditional land.

Paul Hosie, one of Australia's most prolific cave explorers, has discovered and documented literally miles of submerged passage, especially in the arid Nullarbor region, the Roe Plains, and the Ningbing Ranges of the northern Kimberley. Also from Perth, veterinary surgeon Craig Challen can claim to be one of the very few divers to have ever seen the final sump of the famous Cocklebidy Cave on the Nullarbor Plain, over 6 km from the cave entrance. The third member of the Western Australian contingent was Steve James, an ex-



Paul Hosie gathers equipment after the 60-foot rappel into the cave entrance, the easiest and quickest method to gain access to the subterranean lake.

Navy diver with extensive deep CCR diving experience. From the other side of the country came the "East" team: John Dalla-Zuanna ("JDZ"), one of Australia's most experienced cave divers, instructors and deep CCR divers; Ken Smith, the softly spoken, humorous Adelaide nuclear physicist who brings not only enormous caving experience to the project, but also a myriad of home-made electronic radiolocation gadgets ("Pingers") to assist with the cave surveying. And finally, yours truly, an Adelaide doctor, a CCR diver, and underwater photographer!

So six cavers from around Australia met to participate in an amazing adventure, to dive in, survey, and document in detail what could be the remotest dive site in the world. Remotest dive in the world? A big statement, but one needs to understand a bit more about this part of Australia. The Kimberly in Australia's northwest, an area of over 423,000 square kilometers (larger than the UK), has a population of less than 40,000 people, most of whom live in the few major towns like Broome and Kununurra. It is a very large and empty place! Once on site, we were very much on our own, so preparation was all important. After meeting up in Kununurra, we transported all the equipment down to a nearby airfield. From there, six helicopter flights would transport us and all our equipment out to the cave where we camped for 10 days. Everything we needed was on the choppers. Food, clothing, dive equipment, mixed gas supplies, communications, first aid, photographic and survey equipment, compressor, and generator...the list seemed endless. The only thing we didn't need was water; there was plenty of that!

The Kimberley can lay claim to some of the world's most ancient geology. The Proterozoic sandstone and dolomite that holds the cenote is 1400 million years old. The massive collapse doline that marks Kija Blue is nearly 100 metres in length, and bordered by sheer 20-30 metre high walls. The heavy equipment was lowered over one of the precipitous walls to the base, and then carried down the boulder slope to the water's edge. Each night we mixed our precise cocktail of helium, nitrogen, and oxygen so that all would be ready for the morning. Before every dive, it was analysed with a Dive Rite Analox trimix analyser to double-check the contents of the breathing gas.

The group divided themselves into buddy pairs for the exploration work: JDZ (Prism CCR) and Harry (modified KISS CCR) as one deep team; Craig and Steve who both dive the Megalodon Rebreather comprised another. Paul and Ken gave shallow support and performed survey diving to 60 metres depth. One of the major obstacles to the planning of remote deep diving like this was our ability to transport in sufficient bailout gas in SCUBA cylinders for use in the event of a primary rebreather failure. The limited payload weight of the Jet Ranger helicopter meant that every kilo had been counted long before we even arrived in the Northwest. Our approach to this problem was the development of 2 "BOBs" or bail-out rebreathers. Not a completely new

Craig Challen and Paul Hosie
conducting their final
equipment checks before the
large push dive to over 110m
/ 364ft deep.





John Dalla-Zuanna (JDZ) pauses to assemble survey notes during an exploration dive in Lake 2.

concept in the world of rebreather diving, but certainly amongst the first to be used in Australia, especially in the side-mounted configuration. The two new rigs had been tested by JDZ and I during shallow cave and ocean dives, but holdups with their development meant that R&D was definitely ongoing! One deep team was in the water at a time, with the second assisting them and preparing for their own dive. Unfortunately, problems with the new BOBs would prevent them playing any major role in the exploration (i.e. they broke!).

The helicopter flight out to the sinkhole offered breathtaking views of the golden sandstone, waterholes, and ravines. After an initial flurry of activity unpacking and setting camp, we quickly developed a routine. Out of our swags at around 5 a.m., coffee and porridge before hiking up the rocky hill to the sinkhole with freshly charged rebreather cylinders, batteries, and CO2 absorbent for the day. The Kimberley dawn warmed our bones after the near-freezing nights. Gear was lowered into the hole, followed by a 20 metre abseil to the top of the talus slope. A further 25 metres down the unstable talus to the lake edge with all the gear, and we were well and truly warmed up!

Based on the rudimentary map made by last year's expedition, we commenced a systematic exploration of the cave. Using hundreds of metres of pre-knotted line, divers swam out in a radial pattern over the ensuing days to find and map the farthest reaches of the cenote. Massive, bus-sized boulders lay strewn about from the collapse of the dolomite into the lake chamber. Working our way between them, they created a complex labyrinth within the hole. Over the subsequent days, divers started to return with depth measurements of 75, 80, 90, and then, finally, 106 metres. Trying to lay line in the increasingly narrow, deep, and silty conditions at the back of the cave became more and more challenging. Line once laid, was surveyed on the return journey to gradually build up a picture of the enormous chamber. After initially performing two dives per day, the deep teams dropped back to single daily dives as the cave became deeper and dive times ran out to three and four hours. We staggered back into camp around 5 p.m. on most days to begin the chores of gas mixing, battery recharging, and data entering before a quick meal, a glass of boxed red, and collapse into bed to do it all again the next day!

By day, we were treated to a spectacular light show as the sun shone down into the cave lakes; by night, the sky was lit up by the Milky Way in all its glory, and the Capricornids meteor shower. What a truly beautiful place. As I wrote this, I sat under the brilliant stars, wearing a net over my head to keep a

sudden swarm of tiny moths from my nose and eyes as they bathed in the light of the laptop! Ken was next to me entering data from his pinger points and the day's survey lines into the map. The rest of the team was already snoring, and it was only 8:15 pm!

As the week progressed and the dives became deeper, the cave became tighter and siltier in the areas of rock collapse below 80 metres. From this point, we began to dive solo because of the risk of silting and entanglement whilst in buddy pairs. After six full days of diving the cave was beginning to reveal its secrets, with the furthest extent several hundred metres down the ridge south of the doline, at a maximum depth of 111 metres. At this level, the cave passage through the boulders was continuing and the talus slope was slowly but steadily dropping. We certainly had a major cave system on our hands — and only two full diving days left!

As is often the way on these trips, the best parts of the cave are only discovered towards the end of the expedition. With time running out, we were into a major tunnel at significant depth, with dives now running out to between 4 and 5 hours! The use of a scooter made the 300-400 metre swim down to the exploration area quicker, but it was still fairly arduous.



Steve James returns from a deep exploration dive with his Dive X-Tras scooter.



Paul Hosie "posts" himself down the slot to access the massive chamber below.



JDZ emerges from the silt as he takes survey measurements in the "Colossal Room," depth 60m/200ft.



Our own personal 100m lap-pool! Lake One in Kija Blue.

The Kija Blue Deep Cave Diving Team from L-R: Steve James, Paul Hosie, John Dalla-Zuanna, Craig Challen, Richard Harris and Ken Smith.



The risks of decompression illness (DCI) are theoretically high doing multi-day deep dives, followed by significant exertion. In fact, each of the four deep divers experienced some symptoms of DCI and also probably pulmonary oxygen toxicity during the week. "Niggles" requiring extended decompression or surface oxygen occurred on two occasions. Profound fatigue and itchy skin occurred in two other divers. A dry cough and breathlessness were seen after three dives. But in four divers performing over 20 dives in total between 80 metres and 111 metres, this was felt to be acceptable. However, it shows that even with relatively conservative dive planning, good attention to hydration, no alcohol, and plenty of sleep, multi-day deep diving is not without risk. The team was both prepared and trained to perform in water recompression in this remote location for a more serious episode of DCI, and a disaster plan was lodged with local emergency services and the nearest chamber.

Day 10 and with the diving finished, a long day of extracting all the gear from the cave and flying back to town in the helos was followed by more than a few celebratory beers! We were pleased that we had safely explored and mapped a large part of this enormous and beautiful site in the remotest part of the Australian outback. Water, rock, and fauna samples had been sent to the Western Australian museum to further increase the existing knowledge of the cave. And the best part of all? The big question mark on the map at the bottom of the cave that means we'll have to do it all again next year!

Acknowledgments. The team would like to acknowledge and thank the local cavers in Kununurra who "rediscovered" the cave: John Cugley, Dave Woods, and Donna Cavlovic. Their generosity and passion for caving and cave conservation is second to none. Thanks to our major sponsors Seaoptics Adelaide and Dive Rite Australia for their tremendous support. Thanks also to CCR Diving in Perth and John Lippmann from DAN Asia Pacific.

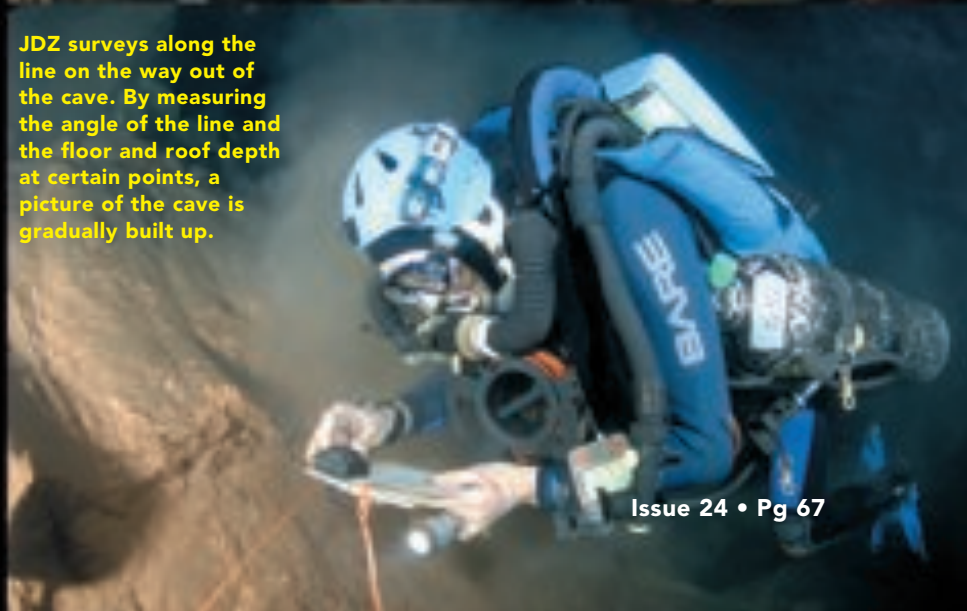
www.divedoc.net



JDZ and Richard Harris swim out of the "Colossal Room," at a depth of 200 feet, surveying as we go.



Craig Challen with the Megalodon rebreather prepares for a deep dive. The full facemask is insurance against the risk of convulsions when exposed to high levels of oxygen...one of the dangers of deep rebreather diving.



JDZ surveys along the line on the way out of the cave. By measuring the angle of the line and the floor and roof depth at certain points, a picture of the cave is gradually built up.

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Dos Winkel
Photography
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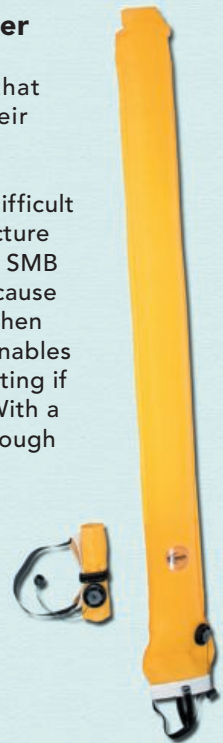
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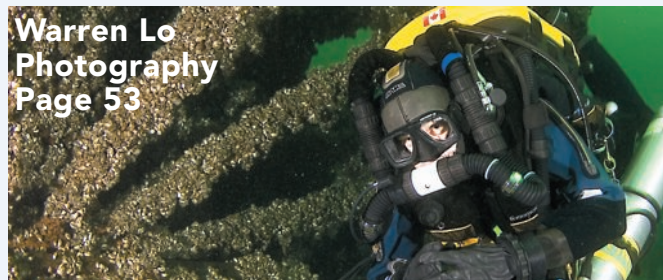
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Warren Lo
Photography
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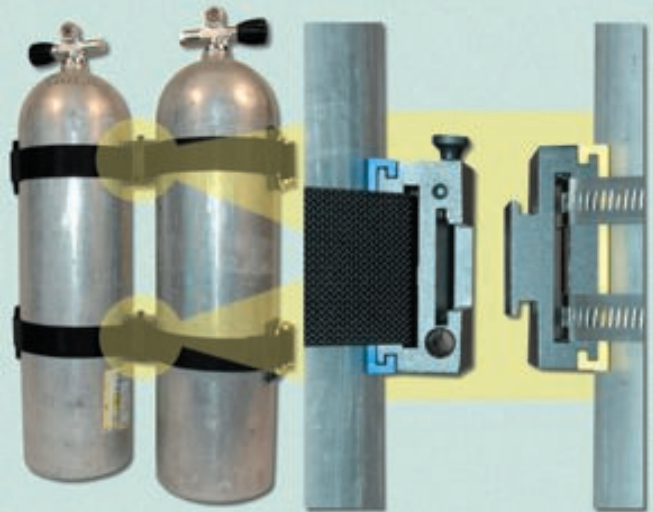
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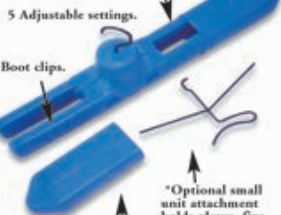
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THE NEW KID ON THE BLOCK COPIS MEGALODON MCCR

by ADM Staff Photojournalist Mel Clark

The COPIS is a manual Megalodon. It is a high quality recreational and technical CCR that boasts all the same features of the Megalodon, but operates manually — adding simplicity and reliability.

A manual CCR (mCCR) differs from the electronic CCR (eCCR) in that it has no computer or solenoid. Maintenance of the PO₂ is solely the responsibility of the diver. The COPIS has three PO₂ sensors and displays to let the diver know what his/her PO₂ level is. The diver then responds to the information by adding either oxygen or diluent to keep the PO₂ at the desired level. In this system, the computer is the diver's "brain," and the solenoid is the manual add valve coupled with the

constant oxygen flow into the loop. Since the COPIS has a constant flow of oxygen into the loop, the PO₂ maintenance by the diver will be easier. When the oxygen flow is "keyed" correctly for the divers, VO₂ usage manual oxygen additions will be minimal. This is not to say the diver does not have to monitor the PO₂ every few minutes.

The COPIS Meg is essentially the same as the APECS Meg, except that it does not have a setpoint controller nor an oxygen solenoid. The oxygen first stage regulator and inline flow restrictor is designed to allow a settable oxygen flow into the breathing loop. The COPIS is a modular system, allowing the diver to



COPIS mCCR Head

COPIS Handset Features

- Three PO2 Numeric Displays
- Magnetic switches - no through housing penetrations
- Individual Sensor Calibrations
- Backlighted LCD Displays
- Durable Copolymer Acetal Housing
- Polycarbonate Lens
- Wet sensors to prevent accidental recalibration while diving
- Low battery indicators



Battery Features

- One atmosphere o-ring sealed battery box
- Battery life tests at least one month continuous run

upgrade and change the CCR as needed. If the diver later wants an eCCR, all they need to do is purchase an APECS head. Also, the ability of the COPIS to use virtually any cylinder size allows great flexibility when traveling. The COPIS can be packed in carry-on baggage, assuring it will arrive unharmed.

Like the APECS Meg, the COPIS has several scrubber options. The standard scrubber is the 5.5-pound axial scrubber. The diver may choose to upgrade to a radial scrubber. The diver has the same options in scrubber can size as the standard COPIS or mini-COPIS.

The COPIS offers great protection from a caustic cocktail. Starting with the OTS CLs, and the completely partitioned T-pieces, followed by the large water trap in the bottom of the scrubber, you could virtually flood the whole system without inhaling caustic cocktail. The OPRV located on the exhale CL at the bottom allows the diver to de-water the system, if necessary. Furthermore, a flooded system would not likely result in expensive repairs. This is due to the triple display being a separate sealed unit. The battery box in the head is also sealed.

COPIS MEGALODON mCCR

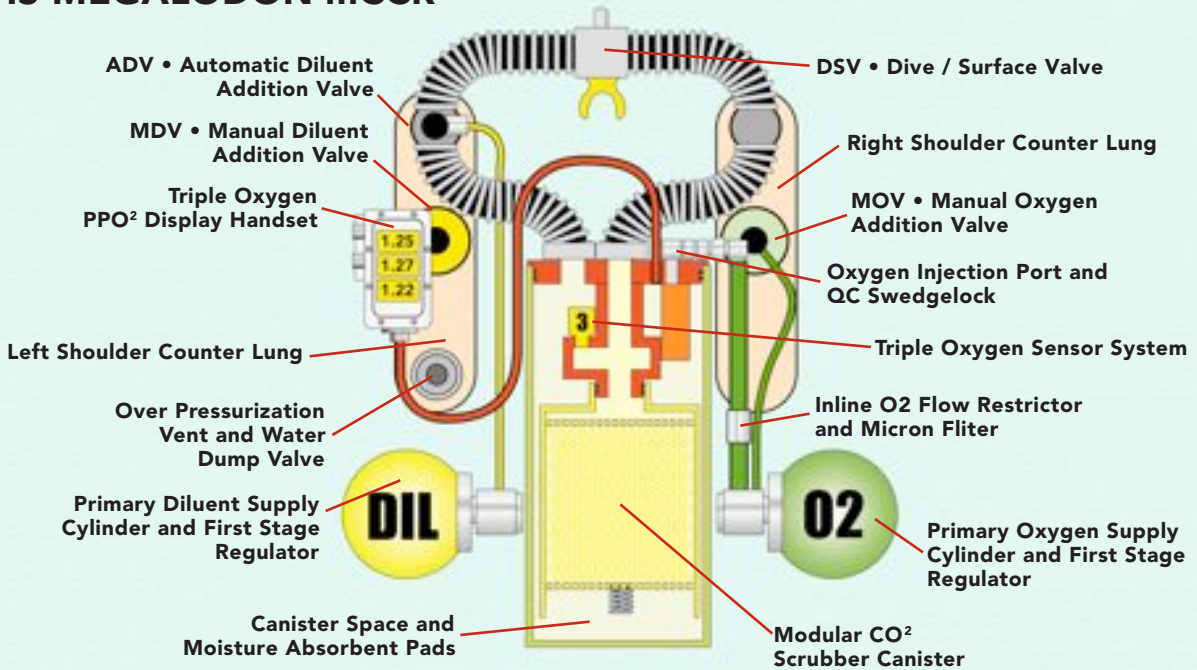


Illustration by Curt Bowen

The COPIS is one of the best work-of-breathing (WOB) rebreathers on the market. The OTS CLs not only offers excellent WOB regardless of diver trim in the water, but also allows for plugging in off-board gases with standard fittings. This removes the traditional depth limit restriction of constant-flow manual CCR's. This depth limit is due to the oxygen regulator being fixed so it cannot compensate as depth increases. This is important or the oxygen flow will increase as depth increases, resulting in a hazardous hyperoxic situation. But by preventing the regulator from compensating as depth increases, the regulator will no longer allow oxygen flow — nor will the diver be able to manually add oxygen at the depth that is the same as the interstage pressure (IP). This is where the diver would plug in off-board oxygen supply to the OTS CL mixed gas bypass valve. Now the diver can carefully add oxygen manually to the loop to maintain the PO₂. The OTS CL has the same Meg high flow automatic diluent valve (ADV) on it. This is a huge safety feature that allows the diver to perform open loop diluent flushes and change the loop gas quickly. This also allows the diver to add diluent to the loop in a hands-free mode.

Other key features of the COPIS include the easily removable head. This allows the diver to take the head assembly to a location where it can be dried without having to lug the whole unit. The OTS CL are easily removable, allowing for proper sanitization and complete drying. The oxygen regulator IP is adjustable, allowing the diver to increase or decrease the constant oxygen flow to suit their VO₂ needs. Optionally, the COPIS is available with a HUD. The HUD will act as a secondary display and give the unit total redundancy.

www.customrebreathers.com



Photo by Curt Bowen

John Chatterton and Richie Kohler present

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San Salvador

Doorway to the New World

**Text and photography by ADM staff
photojournalist John Rawlings**

Mutiny was in the air.....it was a palpable feeling aboard the ship that everyone aboard could sense. Fear, too, was in the air, permeating everything like a creeping vile, living thing. The secretive looks and grumbling amongst the crew had risen daily, and Columbus knew that his time was almost out. Although he did not know it, that very night many of the crew had met secretly deep in the holds of the ship, ultimately agreeing to throw him overboard the next day and sail back to Spain. It was October 11th, 1492, and the world was about to change forever.....

Pacing the deck of the *Santa Maria* that night around 10:00 PM, Columbus stared out into the darkness, hoping against hope that his eyes would find a sign in the utter blackness.....turning slightly, he froze in place – a dim flicker of light danced in the distance. Later, he was to write that it was “like a little wax candle lifting and rising”. Speaking about it only to his steward and the purser, Columbus kept the news of the flickering light from the crew lest it prove again to be a false sighting. Later, around 2:00 AM, a single cannon shot echoed across the water from the *Pinta*, the lead ship. One of her sailors had spied the moonlit shore of an island directly ahead in their path. Many prayers of thanksgiving rose to the heavens that night as the crews of the small fleet joyously stumbled on deck.....it was the 36th day of a 2,400 mile voyage marked by uncertainty and fear of the unknown.

At daylight, Columbus had himself rowed ashore, where he waded through gin-clear turquoise water and ascended a gleaming white beach to claim the island in the name of King Ferdinand and Queen Isabella of Spain. He named his discovery “San Salvador” – “Holy Savior”, in honor of God, whom he believed had led him safely to this place.

Over 5 centuries later, my best friend and dive buddy, John “Sparky” Campbell, and I stood on that very same beach and read the inscription at the base of a huge snowy-white cross marking the spot that Columbus first came ashore in the New World. Gazing about me in the sun, with sand between my toes and palm





trees lazily moving in the breeze, I felt that history was washing over me. For good or ill, this was where it started.....

Claiming its place in history, San Salvador is home to many monuments, ruins, and shipwreck sites guaranteed to attract the history buff like honey draws a bee. At one point the island was known as "Watling's Island" after a notorious buccaneer that used it as his primary base of operations - the ruins of his fortress home can still be explored. The island is surrounded by clear rich blue waters giving divers visibility approaching 150 feet, a real attraction for underwater photographers. I'd always had an interest in the island due to its historical importance, but had somehow never managed to make it there. At the 2005 DEMA show that oversight was due to be corrected. While attending one of the larger parties, my friend, Kim Smith, came up to me and said, "John, they're calling your name up on stage for something...." To my utter delight, my name had been drawn for a trip for two at the Riding Rock Inn on San Salvador, and plans instantly began to be made. My favorite dive destinations are small and "out-of-the-way" - locations that aren't covered with tourists, Pizza-Huts and time-share salesmen. I like places where there is still a local flavor in the air, the people have kept their distinct life-style intact and you can immerse yourself in enjoying the uniqueness while you are there....San Salvador is one such place.

Today San Salvador as one of the myriad islands making up the Commonwealth nation of the Bahamas. In reality, it is the exposed peak of a submerged mountain reaching over 15,000 feet to the floor of the Atlantic Ocean. San Salvador is one of the easternmost islands of The Bahamas archipelago and is 12 miles long, five miles wide. The island encompasses approximately 63 square miles and has a population of approximately 1,000 residents. While not exactly isolated, the island does not teem with tourists and does not boast an exotic night life - but it is appropriate for those wanting to dive and get away from such things.

The Riding Rock Inn really isn't for those divers that demand snobbery, luxurious elegance, massage tables, "tres-chic" nightclubs and the talents of a 5-star chef from Paris. Instead, it reminds me of a good, comfortable motel in middle-America....except it's right on the beach.....and with well-maintained dive boats! The Inn is an older, clean and comfortable place to relax during the rare times in which you aren't diving. Family owned and operated, (a day didn't go by in which we didn't see one of the family at least 2 or 3 times), the employees are local Bahamians with an infectious enthusiasm for treating their guests like old friends who have recently returned for a visit. We especially enjoyed our meals, each one served with distinct Bahamian subtleties and flavors (inevitably involving conch) - and some of the individual dishes I shall

remember vividly for a long time to come. Our "night-life" consisted of conch fritters and rum punch in the resort's Driftwood Bar with the other guests – a small troop of devoted divers from Mississippi.

Our first dive of the week was at a site known as "Devil's Claw", named after three cuts in the wall with a large coral head slightly offshore of them. Our crew said that from above the three cuts look like the fingers of a claw and the coral head resembles the heel of the paw.....I guess that I'll have to take their word for that! However, once in the water I didn't need to take anyone's word for the beautiful vistas that opened up before us. Visibility in the waters surrounding San Salvador is typically 100 feet + and we were able to see an astonishing array of colors and sea life on each dive. I think that I shall remember the sponges of San Salvador most of all - the bright orange of huge elephant ear sponges shown out like searchlight beams as we slowly descended and the pale purple hues of stove-pipe sponges softly dancing in the current. Swimming out across the sand, we found that the wall at Devil's Claw descended like large steps, the first from around 45 FSW down to 80 FSW then again from about 100 to around 150 FSW. Looking off into the blue, we could see that the bottom then seemed to gradually taper off until disappearing with a final plunge down into the abyss. Scalloped hammerhead sharks, *Sphyrna lewini*, are frequently spotted at Devil's Claw, but we were not destined to see them on this first day.

During the week we found that this was fairly typical of the dive sites – walls descending in step-like layers extending far past recreational limits – enabling divers to plan dives to the depths within both their training and comfort levels. While the pattern was similar, the profuse variation found at each site and the seemingly untouched life enshrouding each wall made each dive a treasure to be remembered. As is typical in the Bahamas, sponges are the most prolific form of life on the walls, the species changing with depth as the diver plunges downward – here an azure vase sponge glistens amidst a cluster of sea fans, there a monstrous barrel sponge stands majestically covered with hundreds of tiny blue chromis darting amongst its deep folds, and over there a red rope sponge points outward from the wall with several "fingers", while every other part of the wall is covered with splashes of color from various species of encrusting sponges in white, reds, blues and yellows. On the walls of San Salvador it is easy to visualize an artist gone mad – throwing colors in all directions as part of his creation.



Ascending the face of the wall at one site, "Telephone Pole", Sparky and I crested the top and slowly slid amongst the hard corals in the shallows. A Spotted Moray, *Gymnothorax moringa*, briefly glared back at me after the flash of my dual strobes startled it as it peered from its refuge. I heard Sparkey's tell-tale "sea-lion" grunt, and from the corner of my eye I saw him beckoning to me. A cluster of other divers from our boat were gathered around something in the shallow, sandy bottom and were obviously looking at it with intensity. Swimming over to the group we found a fairly large metal monument mounted into the bottom and surrounded by fine white sand. As the other divers swam away we moved closer, and were astonished to see that this monument is supposed to mark the exact location at which Columbus anchored on that incredible October day back in 1492. Reading the words enscribed into the metal, I noticed a tiny little juvenile Spotted Drum dancing within a hollow in the sand beneath the monument's base....the contrast was beautiful and somehow poetic.

Our stay in San Salvador was like that.....dive after dive.....sweeping along the walls past incredible splashes of color. The sites rattled by....Doolittle's Grotto....Orbit's Canyon....the Black Forest.....each of them given a name by some long-forgotten diver based on some physical feature and each providing astonishing scenes to remember. Our final dive of the week saw Sparky and I ascending the wall and moving across the shallow flats toward the anchor line, our trip almost done. Hearing his sea-lion call again I turned in his direction, only to see a large silver streak shoot past us like a torpedo. Whirling around, I saw the shape turn swiftly and dart back towards us....another one in the background moving just as fast. The Hammerheads had decided to see us off. With my 10.5 mm wide-angle lens at its best at close-quarters, I waited for what seemed like an eternity for the sharks to shoot past again, but in the blink of an eye they turned toward the edge of the wall and shot out into the blue. Though I missed the shot, it seemed an exciting and fitting end to our week - a colorful trip back into time for us amidst the raw beauty of the forgotten isle of San Salvador.

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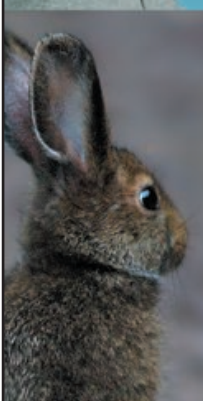
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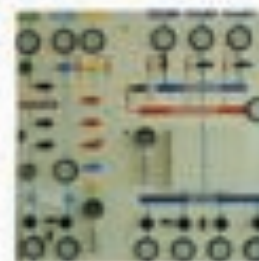
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