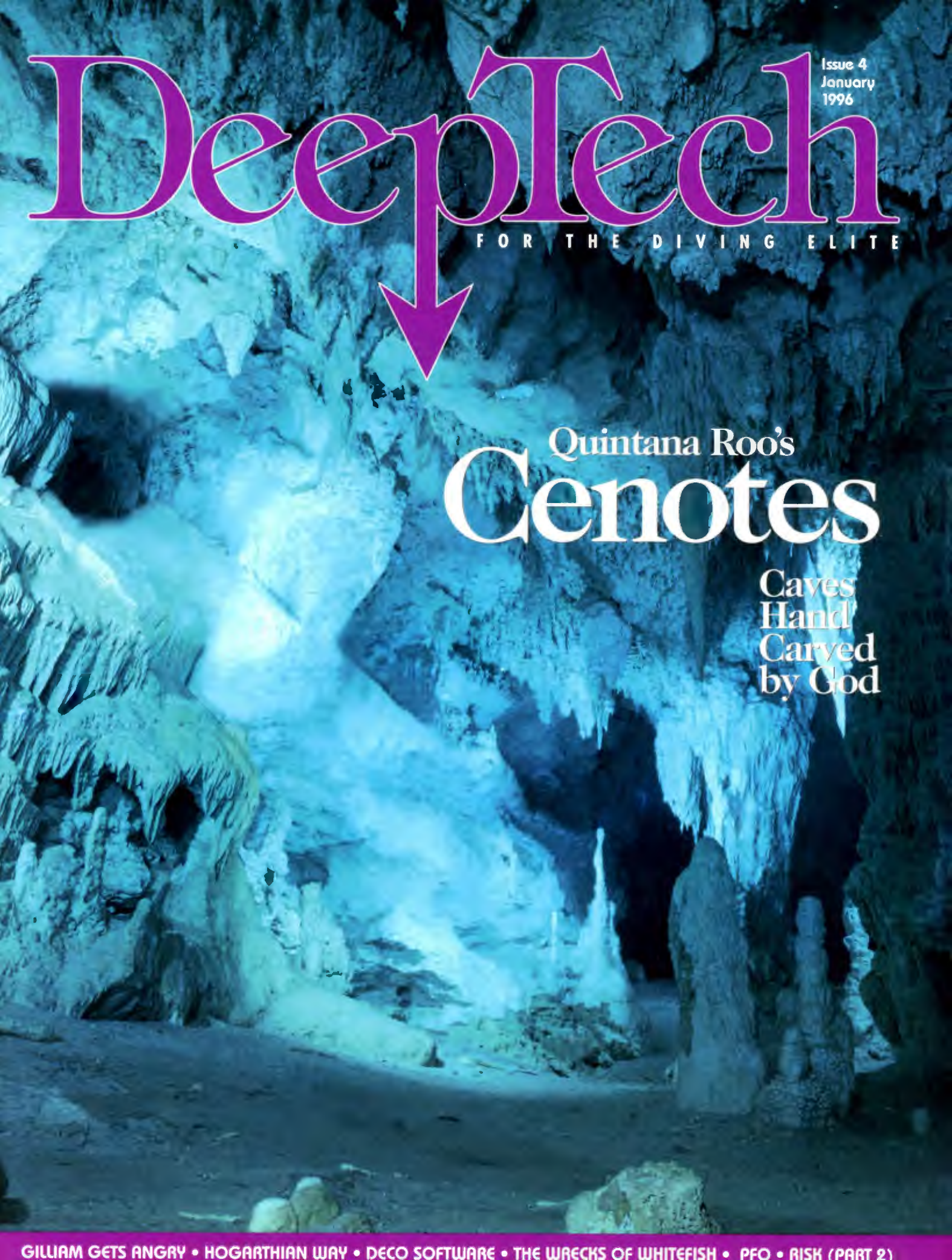

DeepTech

Issue 4
January
1996

FOR THE DIVING ELITE

Quintana Roo's Cenotes

Caves Hand Carved by God

GILLIAM GETS ANGRY • HOGARTHIAN WAY • DECO SOFTWARE • THE WRECKS OF WHITEFISH • PFO • RISK (PART 2)

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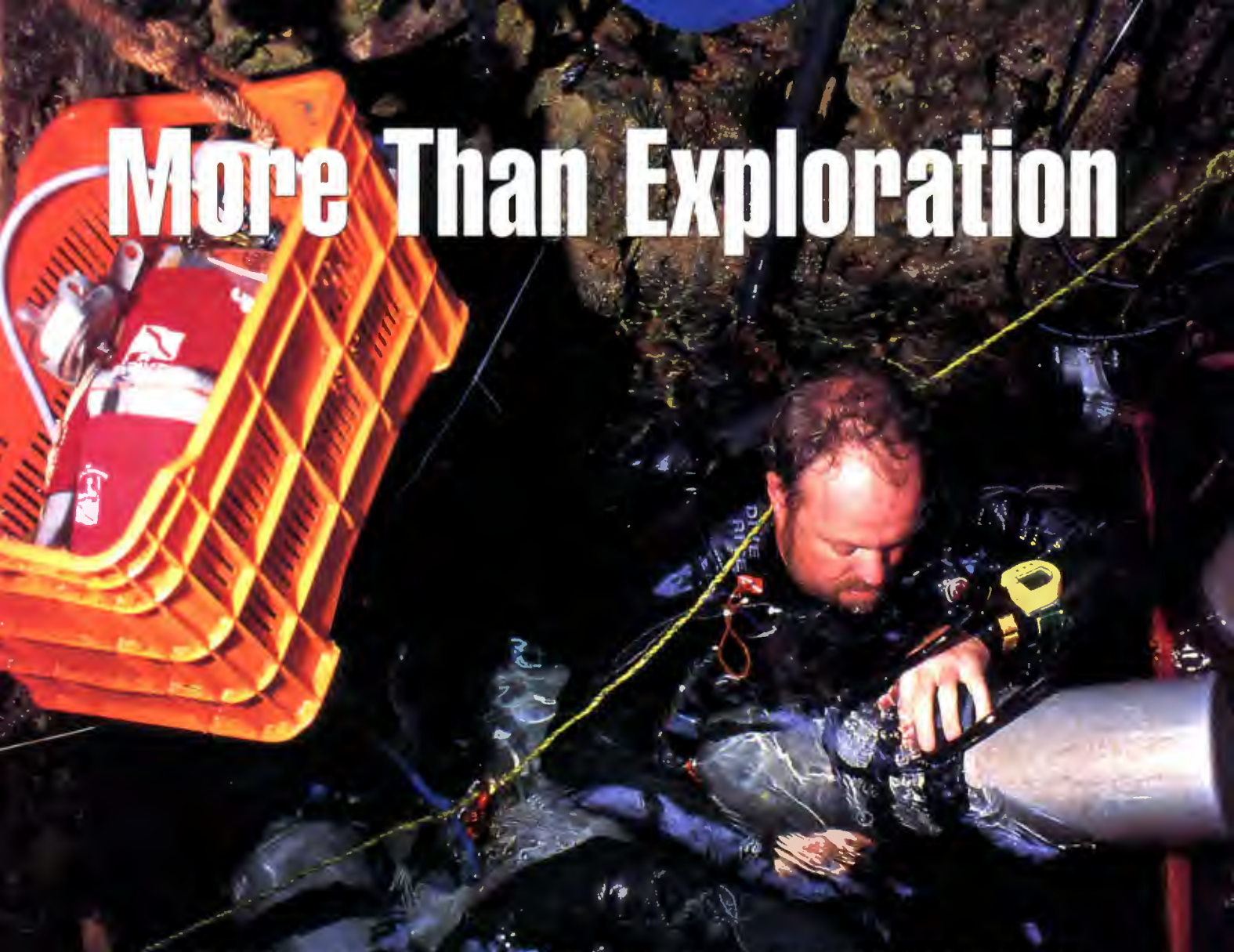

More Than Exploration

The accomplishments of Project Nahoch 95 are monumental. In addition to surveying nearly five miles of new passageway, team members for the first time connected a major Yucatan cave system to the sea.

Exploring such a system is challenging enough. Imagine the hurdles faced by film maker Wes Skiles, who documented the expedition for the PBS/Bill Kurtis series, *The New Explorers*. How can one diver effectively transport seven cylinders, two scooters *and* video equipment over 12,000 feet into the Nahoch Nah Chich system?

Wes' solution was the Transpac. As he puts it, "The Transpac provides logical solutions to all your technical diving needs." ■

Sheck Exley

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Technical Diving International
Chester Morrison, Director
141 Hotchkiss Street
Gravenhurst, Ontario P1P 1H6
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TRAIN WITH THE ELITE

Mike Wisenbaker

Mike Wisenbaker

The Dog Days of Summer '96

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Robin Graters

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And who is hosting this awesome event? Who else...

DeepTech

Take the next step. Look for details in the April Issue.

941-365-0641

DeepTech

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DeepTech's Advisory Board provides invaluable technical information, insight and advice. Their generous contributions of time and information are greatly appreciated.

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WARNING:

Diving is a potentially dangerous activity. Neither DeepTech, nor it's contributors accept liability for diving related injuries incurred by our readers. The materials contained within this journal are for informational purposes only and are not intended as a substitute for dive training.

Cover photo by Charles Bisch.
Cenote Sac Actun in Quintana Roo Mexico.

Mike Wisenbaker

Contents

The Future You Have Always Dreamed Of

There is no question about it, IANTD gives you the future you have always dreamed of. Certification courses are available for openwater, nitrox, deep-air, trimix, gas-blender, overhead, cave, wreck, DPV, and rebreather. Dare to become the diver you've always known was possible. IANTD gives you an overwhelming value with superior services, basic through techdiver training, and exceptional training materials. Visit the IANTD Journal, full color catalogue, IANTD instructors, IANTD facilities, and general information on IANTD's Web site: http://www.empg.com/iantd-hq.

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THE PUBLISHERSPAGE

By WIN**REMLEY**
and CURT**BOWEN**

This issue, we would like to say a few words about standards here on our Publisher's Page, but first a few comments about our new format. As you probably noticed we dropped the "Journal" from our name. We are now just "DeepTech." We have also changed a number of other cosmetic features in our magazine that we hope will make it easier to communicate our ideas to you. Most notably we have changed the typeface for the editorial articles to a more traditional serif face that is easier to read. We have also begun to introduce more color to the interior. This is a trend that will continue as more subscribers and advertisers come on-line with us.

As for the content, there will not be much change other than fine tuning. We will continue to focus on the technical aspects of diving that apply to mainstream techdivers—real stuff for real people!

Please keep those letters coming to our fax, mailbox and email. Many of the changes we have made thus far to content and appearance have been in response to reader feedback. DeepTech shall continue to be responsive to these requests. We also have a couple of new advertisers this issue. We ask that you support them with your business since they help support us in bringing DeepTech to you. Now about those standards...

Standards

Few topics excite as much heated debate as standards. The moment someone advocates ENDs less than 130 feet, or ppO2s less than 1.4 ATA, or breathing from the long hose, or breathing from the short hose—someone else jumps up with clenched fists and angrily says "You can't tell me how to dive. I'll dive any damn way I please and you can shove your weenie standards you know where!" This comment was actually written by a diver on the internet in response to a posting by another diver who voiced an opinion for a new ppO2 standard of 1.4 ATA in technical training.

The truth of the matter is that this eloquent opponent of standards is absolutely right. There are no scuba police. No one is going to get pulled over and told to breathe into a machine to check their narcosis level. And you can't get a ticket for breathing from the wrong hose. While you are underwater you, and you alone, are responsible for yourself and your safety—or are you? If you gack on a dive while breathing air at 280 ft. you can bet your bottom dollar that your next of kin will hire a lawyer to find out if your instructor taught you to dive this way. And if he did, the courts will probably find for the plaintiff and assign responsibility for your death to someone besides you.

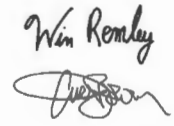
It has been said that standards teach divers to simply obey and not to think, and that standards only teach divers rules and not to prepare for emergencies. I disagree with this belief vehemently. I do not think of us as Stepford divers incapable of behaving as individuals. Nor do I think that divers are necessarily acting as individuals and thinking for themselves when they convulse at 280 ft. on air. Every diver I know is blotto at 280 ft. on air.

Standards serve to provide guidance in training situations where, presumably, the students are in learning mode. Standards provide arbitrary limits and conventions for the student to follow while they gain the necessary experience to make intelligent, informed decisions about their diving practices.

None of my instructors, for example, have ever simply said "Don't dive a ppO2 greater than 1.4 ATA and never-mind why—just don't do it." All my instructors, recreational and technical, have gone out of their way to explain the thinking behind the standards and presented emergent beliefs about the theories. And I refuse to believe that my personal training experiences are unusual. As an instructor myself, I have first hand knowledge of the emphasis that training associations place on giving students all the information they need to dive with minimum risk.

Standards clearly have a place in dive education and we need to agree as a community on what those standards should be. Yes, there will invariably be discussion and argument on the various topics. This does not mean, though, that we are telling each other how to dive. It does, however, have implications on our personal dive habits. A diver who routinely dives to 280 ft. on air will probably think the standards are for weenies and real men needn't bother with them. To those divers I say relax, go diving, and afterwards enjoy a cold PBR while you try to remember what you saw!

Win and Curt



KEEP UP THE GOOD WORK

The latest DeepTech arrived yesterday, and I wanted to compliment you. Again, you've done a great job. The Homebrew article was interesting, most of the info there I've gleaned in fragments elsewhere, but you did a good job of presenting it in one place at a not-too-high, not-too-low level. The Fitz article was also good. The Skiles images were beautiful, especially the cover, which I didn't see described anywhere. Is it taken from Devil's Eye? [Devils Ear, actually-WR]

One criticism though, the NACD Workshop you announce in the News section came and went before the magazine arrived.

I have to say it was funny seeing a picture of George Irvine for the first time. I don't mean that in either a positive or negative way. It seems to occur every time I form a mental image of someone I haven't met face to face the image doesn't match reality. Throw in a picture of yourselves sometime.

Robert Miller
Fort Worth, Texas

I just finished reading Issue #3. The quality of the information provided by your magazine is very impressive. I subscribed sight unseen based on word-of-mouth and I am not disappointed. Keep up the good work. And the more technical the better.

Bruce J. Belschner
71301.2774@compuserve.com

LESS FILLING! TASTES GREAT!

Received my copy of DeepTech today. Thanks, it's very impressive! Good luck maintaining the balance of articles for both novice "tekkies" and the "been through the mill" veteran. So far, so good.

Bob Decker
rdecker388@aol.com

Regarding your magazine being too technical or not technical enough: The comments from the entry level techdivers are exactly what they should be. These new tekies are craving information that none of the other magazines are supplying. And yes, they are overwhelmed, as they should be. DeepTech presents divers with raw and cutting edge facts that are pushing this sport beyond the expectations and training level of most divers. By keeping the discussions and articles on a relatively technical level, DeepTech is forcing the new tekies to do more research and study to keep up, which will eventually help them to mature into responsible divers.

There are already plenty of magazines that cater to the non-techdivers. The minority that are techdivers, need and want this information so that we may continue to understand and be safe.

Robert Miller
Ft. Worth, Texas

HOMEBREW

I enjoyed reading the piece on Homebrew. There is a correction needed regarding medical grade and aviation grade oxygen though. First there is a substantial difference in dryness between the two. Aviation grade is much drier to prevent regulator freezing at altitude. Use of aviation grade in diving applications contributes to dehydration, a possible predisposing factor to DCS. While hard to quantify, use of medical grade rather than aviation grade may make a one to two percent difference that keeps someone from getting bent.

Second, with regard to price, a recent check here in Orlando, Florida, showed aviation grade at $27 for 300 cu. ft. and medical grade at $30 for the same quantity. Thanks for getting the word out on gas mixing.

Tom Turner, Technical Editor
Sport Diver Magazine

Partial pressure blending doesn't always start off with a completely drained cylinder. Not only is it more economical to top-off a bottle of EANx, but positive pressure in the cylinder discourages casual contamination and loose valves.

For the homebrewer, certain mixes aren't always practical either. The amount of banked gasses, cost of plumbing, cylinder deposits, cylinder rentals, accurate gauges, analyzers, and higher pure gas cost at retail pricing isn't always worth it. Blending 80/20 in any quantity takes a substantial amount of O2. Gas volume suffers when blending to lower final pressures if you don't have enough O2.

Regarding your O2 cleaning procedures: after oxygen cleaning a part or cylinder, blow dry with hydrocarbon free air otherwise the part is no longer O2 clean. EPDM O-rings are also acceptable for use in oxygen systems and generally have better abrasion resistance. This could be important in some environments.

When using TSP, (environmentally irresponsible to use), or SD-113, water temperatures of 170°F are required for these chemicals to work properly.

The things you said in support of tech dive shops is great. I'm sure other owners feel the same way. Supporting your local dive shop provides jobs in the community, and most importantly it's where you go to get your dive shop "fix". Keep up the good work!

Frank Zarik
President, Aqua Sapiens Diving
North Vancouver, BC, Canada
aquasapiens@intergate.bc.ca

In your article on Homebrew you made some good comments on O2 meter checking of the mixed tank, such as O2 sensors lasting for only about a year and gas calibrations being good only if the meter is reading within .2% of the calibration gas. The other greatest cause of mixing error is the fill pressure gauge. Most fill pressure gauges are accurate to within 10 to 100 psi. These gauges are also subject to damage from being knocked around.

The most accurate mix you can get by using only a standard gauge is ±40 ft. of depth for a specific ppO2. The only way you will know what you have in your tank is by testing with a properly

calibrated O2 meter. And even with a meter that has .2% accuracy there is still the potential for a ±20 ft. depth error for a specific ppO2.

These inherent errors require divers to be conservative, dive the next deepest mix for your planned dive (i.e., a 240 ft. mix for a 220 ft. dive). Also remember that O2 sensors can fail.

If you don't have an O2 gauge, or if your O2 gauge is not accurate to within .2%, or if your O2 gauge is "acting a little funny", then don't mix gas. If you don't like the cost of purchasing and maintaining O2 fill and testing equipment, then stay home or have a qualified shop mix your gas for you.

Peter Johnson
Fairfield, CT

In regards to cleaning tanks and valves, Krytox™ and Viton™ are both registered trademarks of Dupont and should be listed as such. For anyone requiring technical information about Viton™ they can call Dupont Engineering Polymers at 800-452-1454, x2532. For technical information on Krytox™ they can call Dupont Specialty Chemicals at 800-424-7502.

J. Scott Landon
landonjs@a1.swest.umc.dupont.com

Your article on Homebrew was very informative—maybe too informative. Do you think it is wise to put out that much info on gas mixing? You know that some clown that has more money that brains is going to try to mix based on your article. I liked your disclaimer at the bottom of your opening page but please don't lose sight of responsibility in information about techdiving.

Bob Claudy
bclaudy@aol.com

WES SKILES

Just got my 3rd issue of DeepTech. Outstanding! The cover photo [Devils Ear by Wes Skiles] will now permit me to show the wife and friends just how wonderful deco can be! Keep up the good work!

Robert Laird
rlaird@pel.com

I really enjoyed reading your latest issue of DeepTech, especially the profile of Wes Skiles. I think you're doing an excellent job with the magazine. Keep up the good work.

Mike Wisenbaker
mwisenbaker@mail.dos.state.fl.us

GEORGE IRVINE

I am in awe of the work that I have read about concerning the Woodville Karst Plain Project. The accomplishments of the group working there under the leadership of George Irvine is not merely beyond my abilities but nearly beyond my ability to imagine.

It was my hope that Mr. Irvine's "Do It Right" opinion piece (Issue 3-Sept. '95) was somewhat tongue in cheek. Professional opinion writers write to provoke thought, whether or not they truly hold every opinion they express close to their heart. Did Mr. Irvine have the same intent? Upon several readings I concluded that he was serious about the absolutes he has come to embrace.

I guess what disturbs me about the piece is his bringing down judgment so adamantly based on gear configurations alone.

I'm not a gambling man, but I'd feel safe to wager that Bill Main did not receive enlightenment into the Hogarthian system while meditating under a tree. He probably was not taught the style by his cave diving instructors back when he was a neophyte. He probably developed it one step at a time, first imagining and discussing innovations with counterparts in the sport, then experimenting with the innovations in open water, then applying them in cave use, then refining and finally incorporating or rejecting them in all or in part. Eventually he had it down pat, everything he needed and nothing he did not need. His Hogarthian system consisted of doing what any true professional does, from Olympic downhill skiers to jet pilots to scientists and surgeons. They do the exact same thing the exact same way every single time. Do not mess with success.

I assumed that this was how Bill Main came to his style as it was how I came to mine. Each and every change of configuration is adapted to rectify a shortcoming in the system's particular theater of application. The hardest part in adaptation is breaking from conventional thinking to find the best solution in the least complicated manner.

I would hope that Mr. Irvine would understand, appreciate and respect this.

Mike Nelson
Fertile, Iowa

In "George's Opinion", he mentions the "Hogarthian system of gear configuration" but he doesn't describe it in any detail. Would you detail it in a subsequent issue? [see page 40, this issue-WR]

Frank Farmer
Cofounder, California Wreck Divers
farmer@loop.com

It is hard to believe that a person with such tremendous accomplishments, like George Irvine, can be so arrogant. Part of me wants to follow and learn from him and the other part wants to punch him in the mouth.

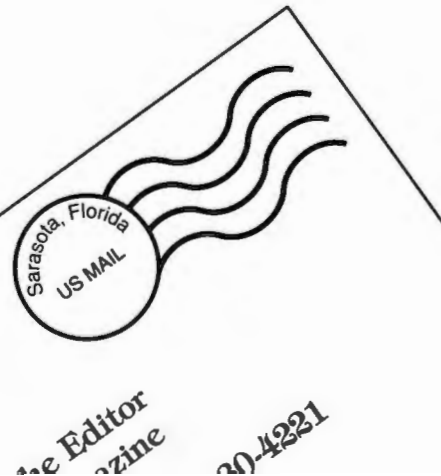
Dan Adams
via the Internet

How can a magazine like DeepTech give space to a self important, egotistical, arrogant, blowhard like George Irvine? True, there are only a small handful of people that could push a mile into a cave at 320 ft. but his irresponsible trashing of everyone who holds an opinion different than his stains his accomplishments as well as those who dive with him. When is the WKPP going to get a responsible leader?

Mark Maslow
via the Internet

Who, or what is a George Irvine?

Dr. J. Frank White
Guam



Diving**News** **Exploration**Updates and**Discoveries**

DeepTech's Dog Days of Summer '96

In August of 1996 DeepTech will host a training event unlike any other. The finest technical instructors from ANDI, IANTD, NACD, NSS-CDS, PSA, and TDI will come together to provide the highest quality, serious in-water training experience available on this planet. Advanced technical courses in Cave, Trimix, Deep, Rebreather, and Cavern diving will simultaneously be conducted under the blistering Florida Summer sunshine.

Course format will be both classroom and in-water training. Dates and costs for this event were unavailable at press time, however, DeepTech will provide full details in Issue 5 and in a special mailing to be sent to all DeepTech subscribers in February.

Circle August on your calendar and save a few days of vacation—you won't want to miss this incredible event. For more information contact DeepTech at P.O. Box 4221, Sarasota, Florida 34230-4221 USA, or call 941-365-0641, or fax 941-955-7446, or email deeptek@aol.com.

RBC Ships First Production Rebreathers

RBC, on November 25, 1995, began shipping full production units of their new Odyssey rebreather. The production Odysseys are being assembled by a new Ft. Lauderdale based company under agreement with RBC. RBC's engineering headquarters will remain in Palm Beach.

The Odyssey is the first American made passive gas addition nitrox rebreather available to nitrox and rebreather certified advanced recreational divers. Two configurations are currently available: the Odyssey and the Odyssey-Tech with the only difference being the Tech has twice the gas supply and lasts more than three hours at any rated depth. The Odyssey has been field tested to 240 feet.

The Odyssey's passive gas addition mechanism significantly reduces operational related expenses, which should average about $20 per day for gas and scrubber absorbent material.

Interestingly, among those to receive their Odyssey's in the first shipment were Tom Mount, President of IANTD, and Hal Watts, President of PSA.

Beneath The Sea Turns Twenty

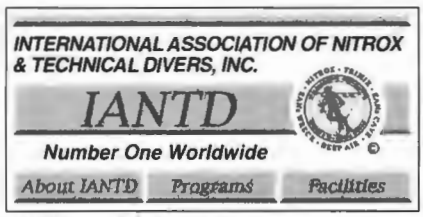
Beneath The Sea's 20th annual dive show will be held March 22-24 at the Meadowlands Exposition Center in Secaucus, New Jersey, near the Meadowlands Sports Complex. Exhibitors, seminars, workshops and social functions will be featured during the three day show. Approximately 10,000 divers are expected to attend the show. For details visit the BTS web page at

http://www.cyberus.ca/~bts/, or email zig4bts@aol.com, or write BTS, P.O. Box 644, Rye, NY 10580, or fax 914-644-4315, or call 914-644-4310.

ADEC'96

The annual Asian Diver Exhibition and Conference (ADEC) will be held May 17-19, 1996 at the World Trade Center in Singapore. A diverse group of exhibitors from 22 countries will be showing products for both recreational and technical diving. For more information on ADEC'96 write to ADEC, 100 Beach Road, #26-00 Shaw Towers, Singapore 0718, or call +65-294-3366.

The IANTD Goes Internet



IANTD's new Web Page on the Internet can be found at the address: http://www.empg.com/iantd-hq

The International Association of Nitrox and Technical Divers (IANTD) has added a robust set of internet services to their worldwide network of dive facilities and instructors. From anywhere on the planet computer users with the capability to browse the World Wide Web can access the IANTD Home Page using the URL (address) http://www.empg.com/iantd-hq. Electronic mail users can send mail over the internet to IANTD using the email address iantdhq@ix.netcom.com. Both the email and web page operate 24 hours a day, 365 days a year.

The web page offers general information on IANTD, their Board of Directors, staff, plus comprehensive information on all courses offered by IANTD. Selected articles from past issues of the IANTD Journal are also available as well as an on-screen full color catalog of all IANTD products. Sales of these products through the web page is not initially being offered. Instead, users are referred to the IANTD facility nearest them. IANTD facilities and Instructors can also participate by developing their own web page on IANTD's system for a modest fee.

WKPP Exploration Update

The Woodville Karst Plain Project (WKPP), under the direction of George Irvine, has continued to focus exploration and water study activities in Wakulla in recent months. Casey McKinlay and George Irvine pushed A Tunnel on a double stage and added to J tunnel, however, with depths of approximately 300 ft. and visibility at five feet, progress was slow going. Typical dive profiles for these explorations is 1 hour of dive time at 300 ft. with 4 hours of decompression.

Steve Irving and David Miner concentrated on a lead off of the crossover tunnel, and discovered another room with multiple tunnels leading out, which further complicates the B tunnel-C tunnel maze.

Pete Gomez and Larry Care took water samples from several spots along A tunnel for the water studies.

Bob McGuirre, Rick Sankey, Bill Mee and Bill Main took video of the crossover tunnels which will be used in the making of digitized maps for a future Warner Television production.

Jim Wei has been directing the support crew activities, performing an amazing job of putting the divers in and out without incident. Of the teamwork George Irvine said, "The efficiency of this team is unbelievable, which is a good thing since we just picked up 32 new exploration targets. These guys are going to be very busy for a long time."

Project Nohoch Concludes 1995 Exploration Activities

The last week of October, 1995 brought an end to the diving exploration and scientific research by Project Nohoch and the CEDAM Cave Diving Team. The extensive Nohoch Nah Chich cave system in Quintana Roo, Mexico was

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Gilliam Gets Pissed Off!

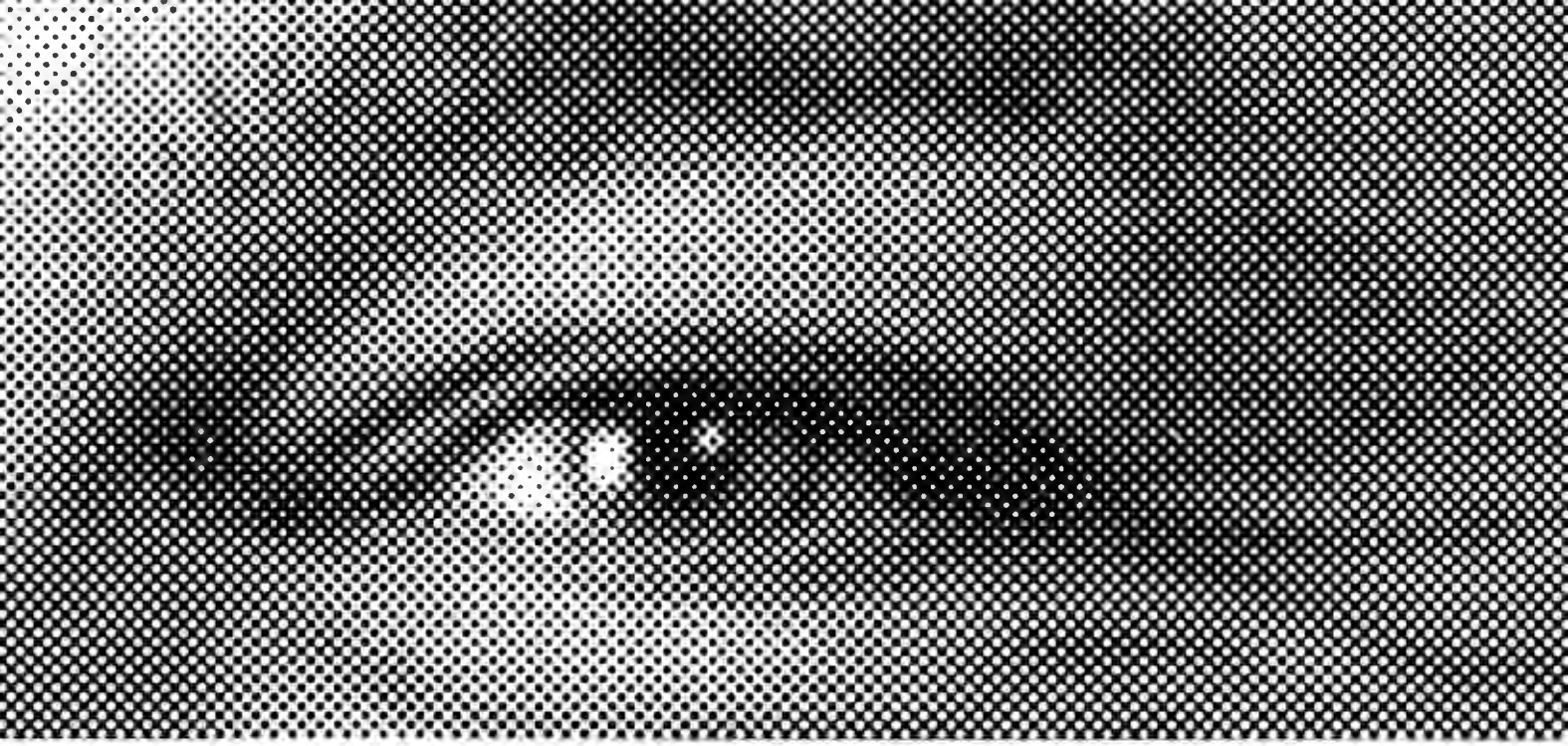
AN INTERVIEW WITH BRET GILLIAM, FOUNDER AND PRESIDENT OF TDI

By WIN**REMLEY**

Bret Gilliam is one of diving's most enduring personalities and also one of the industry's most successful entrepreneurs. A self-made millionaire by the age of thirty-four, he has invested in nearly every phase of the diving industry including resort ownership, live-aboard vessels, cruise ships, training agencies, publishing and filming. He holds licenses as a United States Coast Guard Merchant Marine Master, aircraft and deep submersible pilot, and recompression chamber supervisor. He has personally logged over 14,000 dives since he began diving at age eight.

Gilliam began his professional diving career in 1971 with a special U.S. Navy team working with fast attack nuclear submarines in the Caribbean. That led to other commercial diving work and soon he founded V.I. Divers Ltd., Southern Exposures (a publishing business), and a yacht charter company in the Virgin Islands. After selling his Virgin Islands holdings in 1985, he spent two years on filming and consulting projects while cruising aboard his 68 ft. yacht *Encore* before being recruited as an executive to manage the diving and ship operations with Ocean Quest International. Ocean Quest's 487 ft. dive/cruise ship became the world's largest sport diving operation and keep Gilliam at sea for nearly three and a half years.

In 1990 following the sale of Ocean Quest, Gilliam moved to an island in southern Maine where he relocated the offices of Ocean Tech, his consulting



firm. In 1991 he was elected to NAUI's Board of Directors and became President in 1994. That same year, he and Mitch Skaggs, formerly of H2O Scuba, formed Technical Diving International (TDI) which has grown into one of the largest training organizations for nitrox, trimix and other technical programs. DeepTech caught up with Gilliam at the TDI offices for this interview:

DT: Why the diving and shipping industry as a career?

GILLIAM: I don't really think I ever had much choice when you think about it. I was born at the U.S. Naval Academy. As a baby my first word was "boat", and I learned to swim before I could walk. My father was a senior naval officer who indulged my passion for snorkeling and diving by letting me go through an early YMCA program in 1960 after watching the first episode of Sea Hunt. That year my family had moved aboard an 80 foot motor yacht and when my dad was transferred we simply moved our boat to his next duty station. By the time I was in high school we had covered the entire Atlantic seaboard from Maine to Key West, and Florida twice. So diving and boats were my whole life. The only time I lived ashore was when I went off to college. Ever since I was 21 I've either lived on an island or commanded a ship somewhere. What else was I going to do? Sell insurance?

DT: How did a 21 year old with no formal business training survive in the shipping industry?

GILLIAM: Common sense got me through a pretty steep learning curve about business and management. Since no bank would loan me money in those days, I was playing with my own chips. If I failed, I was doomed to getting a real job that would require me to wear shoes and get a haircut. Maybe that was my best motivation. But my philosophy was quintessential 1970's hippie-zen-chic: treat your customers like you'd want to be treated yourself, and give them a good value for their dollar. Sort of an entrepreneur's "golden rule." And I never hesitated to expand in order to have the largest vessels, the best equipment, and the widest variety of services. It paid off, I've still got customers with their grown up kids coming back to me now that have been with me in various operations for over twenty years. That same philosophy has made TDI a stunning success in a short time.

"Oh yeah, the infamous "wah wah" expose. Well, first of all let's get a few things straight..."

DT: In the nineties, you've been regarded as one of the leaders in technical diving. How did you get into that type of diving?

GILLIAM: I guess the best answer is that I was already in it since the early seventies but we didn't have a name for it then. Some of the stuff we did for the Navy during the deep submarine filming projects was so out on the edge of the envelope that I don't think anyone ever

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went back and tried it after we finished in 1972. We were doing 400 foot air dives as a matter of routine and heliox a whole lot deeper. And all this was in the open ocean, twenty or thirty miles from shore, in 12,000 feet of blue abyss. Sometimes our decompressions would run over three hours. It can be disorienting diving in blue water with no bottom reference. Most of the regular Navy divers that preceded my team didn't like it out there at all. In fact, everyone who had been assigned to this project before us found an excuse to be relocated. It was spooky in a lot of ways.

DT: Your team developed some special techniques during this period.

GILLIAM: That's right, and as usual, necessity was the mother of invention. Because of the depths and bottom times we were pulling while filming these subs whizzing by us, we really had some ungodly deco hangs. And we didn't care so much about the hours of deco, it was the problems with white tip sharks during the hangs that stimulated our interest in anything that would get us out of the water faster.

DT: Any close calls with the sharks?

GILLIAM: They were attracted by the low frequency sound signatures that were in the water during our work. It was just like ringing a dinner bell! Sometimes we'd have more than two dozen around us at once and they were the most pugnacious, determined predators we'd ever seen. I mean they'd swim right up and bite our cameras, our fins, even the damn hydrophones. After tap dancing with those guys for a couple of hours or so, you were a nervous wreck.

So we "borrowed" some real primitive nitrox theory and applied it to accelerating our decompression during the deeper stops and went to pure oxygen at 40 feet. [Editor's Note: Decompressing on pure oxygen below 20 ft. is not recommended due to CNS O2 toxicity.] With a bit of tweaking as we gained confidence from our trials, we eventually cut our deco hangs by about sixty per cent. Even then, the sharks drove us nuts.

DT: Who else was around in those days doing early techdiving?

GILLIAM: Well, we sort of operated in our own little vacuum until late 1972 when I met Tom Mount. He was hooked up with Dr. George Benjamin doing some amazing deep Blue Hole explorations in Andros. Hal Watts was real active in both cave and deep diving. And then Sheck Exley bumped into me in Florida and found out we had a lot in common. Sheck didn't do much ocean diving because he got sea sick and really loved cave exploration, but we kept up a running correspondence on various deep diving techniques that continued right up until his death last year.

A lot of the definitive stuff on all sorts of procedures, gear configurations, special tables, and cave diving innovations came out of this period. But it was a pretty closed community. There was not a lot of shared information back then except among the cave guys and even then it was limited. We didn't have the communications systems and publications then that are common place today. In 1974 I published one of the first formal papers on techniques for deep air diving and I had people tracking me down from all over wanting more information or with new ideas to share. About that same time Sheck published something on oxygen for decompression and all of a sudden there were a lot of divers coming out of the woodwork wanting to share ideas for the first time.

About this time I met Dr. Bob Dill. He was a Ph.D. in underwater geology and had a reputation as something of a gonzo scientist. Bob would do anything if it advanced his research and he couldn't care less about critics who questioned his methods. He hired me for a whole series of projects that spanned about five years while he was director of Fairleigh Dickinson University's West Indies Laboratory in St. Croix. He was also a fund raising genius who brought the Hydrolab saturation habitat program to the Virgin Islands. Just before I met Bob, Cousteau had taken him along as a scientific advisor for the Calypso when they explored the great Blue Hole in Belize. Bob would go blasting off on some pretty deep stuff and scare the hell out of the Calypso team but they loved his passion for exploration—and the samples he brought back. He was one hell of a guy.

DT: So deep diving was controversial even twenty years ago?

GILLIAM: Yeah, to some. But mostly those involved were professionals and not much of what we were doing got

out into the sport diving public. A lot of the real deep air work that Sheck, Mount, Frank Martz, Jim Lockwood and others did was basically kept in the closet. Primarily people were concerned about unqualified and inexperienced divers getting themselves in trouble.

But there were a few places that offered training on a regular basis if suitable candidates inquired. I think Dick Birch at Small Hope Lodge in Andros has been taking people deep diving since the sixties. We did a lot of training at V.I. Divers in St. Croix and so did Unexso in the Bahamas during the seventies. And all this went on without incident.

I think the controversy really got started up again when there was more publicity focused on technical diving in the nineties. Accidents have a way of making headlines. Never mind that most accidents were predictable and usually involved divers that were not properly trained or prepared.

DT: Speaking of headlines, you were profiled in a recent aquaCorps issue that was critical of deep air diving. What's your reaction?

GILLIAM: Oh yeah, the infamous "wah wah" expose. Well, first of all let's get a few things straight. Neither myself or Joe Odom, who was also sandbagged by the aquaCorps writers, had any intention of being on the record for publication. Michael Menduno called us up and tape recorded us without our permission or knowledge and then used those brief conversations out of context to create a Geraldo Rivera style sensational feature.

"Menduno called us up and tape recorded us without our permission... and then used those brief conversations out of context to create a Geraldo Rivera style sensational feature."

Most of his facts are incorrect and he conveniently omits that the guys on those dives were diving on their own, outside of any training program. What's more important is that we're talking about some of the top professionals in the world who were hand picked to be the core base of rebreather instructor trainer/course directors on the new Atlantis I units. Our dives were made during a break in the rebreather work and each participant made his own decision as to his dive profile, equipment and decompression. Odom and I were diving on our own enjoying a beautiful wall in warm, clear calm water. The conditions were ideal and we had absolutely no problem. Menduno went looking for problems and essentially invented them to make a tabloid story.

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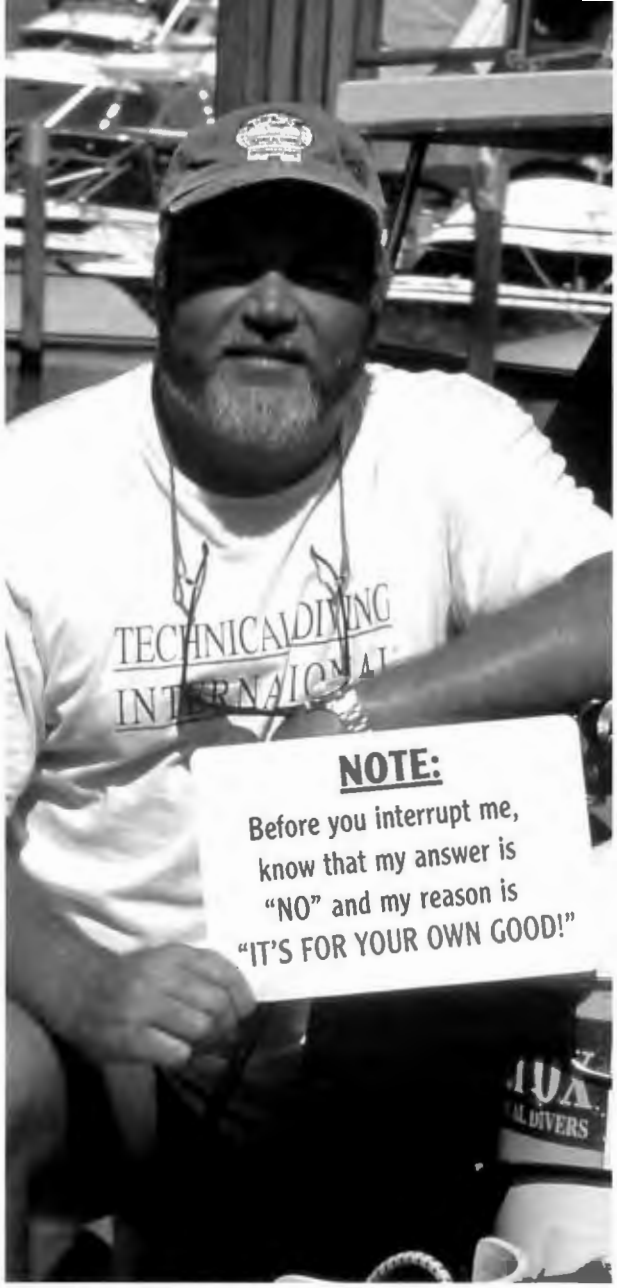

DT: The basis of Menduno's criticism was that you should be held to a higher standard since you are President of TDI and Odom is Chairman of the NSS-CDS.

GILLIAM: That's a bunch of crap. We were not conducting training. We were diving for purely personal enjoyment on what amounted to our day off. By that kind of goofy logic, I guess I should never dive below 130 feet because I was the Chairman of NAUI last year.

And let's get a bit of reality in place here. It's no secret that I dive deep on air. I've made a career out of it for the last twenty five years including being the world record holder twice. And I've written a couple of best selling books on the subject. Hell, *Deep Diving* went into its second printing in less than two years. Anyone can pick up a copy and read in great detail accounts of dives far more dangerous and demanding. And those accounts are provided for a reason: to warn less qualified divers of the significant hazards once you decide to step outside certain physiological parameters.

Within the confines of training, virtually everyone subscribes to rather broad based oxygen and narcosis exposures because we have an empirically derived data base that allows reasonably predictable reactions for the average diver under those conditions. Their window of vulnerability is fairly definable and several decades of practical experience based on NOAA, Navy, scientific and commercial man hours has proved the efficacy of these exposures.

Does that mean that a professional cannot make a personal decision to venture beyond that in pursuit of exploration, photography, research or simply because it's a nice day and you feel like it? Of course not. Do I encourage others to push limits? Absolutely not! And that's why we were so pissed off when this bull shit piece came out. I worry, with considerable justification, that someone will read something like the wah-wah article, try it themselves and get killed.

DT: Is deep air diving a viable practice?

GILLIAM: It is within limits. And those limits will vary greatly with the individual, his experience, his fitness and his psychological comfort. The environment also makes a huge difference. Most experienced divers can be trained to dive in the 200-220 foot range with a reasonable risk factor. But it requires a regime of supervised training under a specially qualified instructor through programs like those offered by TDI, IANTD, and PSA. Beyond that depth, the average guy should get on trimix if he wants to go deeper.

But if I can work in deeper water on air with a compact streamlined rig, I am far more mobile and able to perform better simply from the standpoint of swimming. You try to operate complex camera systems when filming unpredictable marine life or rapidly moving subs or other specialized vehicles if you're dragging trimix gear and stage bottles with you. Forget it! You just can't do it. I can go in the water on one primary cylinder, rendezvous with oxygen for deco if necessary, and still maintain complete control and flexibility since my gear load is so slight by comparison. Then again, I've got a very high tolerance for narcosis and have refined my dive technique to minimize susceptibility to oxygen toxicity.

And remember that mixed gas is not always available. Mitch Skaggs just got a deep survey job in Madagascar that will have to be done on air. So you either work that way or pass on the project. But we get paid bloody well for the work and for us, it's no big deal.

DT: Some have suggested that your minimalist approach isn't adequate.

GILLIAM: For who? I'm not dressing myself to please some critic. I'm putting together a gear package that works for me. That's all I care about when I'm working. It's got to get me to the job site and back with a reasonable factor for unforeseen circumstances. And I've refined what I wear over the years to exactly match my needs for each situation. That may change daily. But most importantly I'm not having any problems!

I've been concerned for quite a while with this mindless obsession some divers have with over-equipping themselves. Eventually we end up with divers who can barely swim. I like the ability to physically swim away in a contingency and by matching my gear to my dive profile pretty precisely, my gas volume needs drop dramatically. This tendency to overload with gear has a lot of these divers in a rather ridiculous situation: they have to have incredible gas volumes available just to carry all the extra cylinders and rig they've burdened themselves with. It's the concept of diminishing returns carried to extremes. Can these guys work in deep water on compressed air? Not a chance. They can barely function on trimix.

DT: So what do you recommend?

GILLIAM: I've tried to make it a policy not to be critical of an individual's gear setup although you just lured me into the discussion. What works for one guy may not work for someone else. The diver should wear whatever he feels comfortable with and works for him. But I'm continually amazed at morons like Menduno who want to tell others what to wear or what limits should be placed on physiological exposures. And let's remember that Menduno and most of those brilliant intellects at aquaCorps aren't really tech divers at all themselves. They barely dive at all.

"it just chaps me to have to put up with that level of self-righteous crap from people who are not even qualified to do even entry level tech diving."

DT: Does a writer need to be a techdiver to write about it?

GILLIAM: There's credibility factor here that the reader needs to understand. Other publishers like Ken Loyst, Fred Garth, Pierce Hoover and you guys at DeepTech are actually going out and doing this stuff. Many are tech instructors. Even Bill Gleason at Skindiver is a solid active diver who gets out there and dives. These guys have a background of experience.

I remember at couple of years ago, Tom Mount, Mitch Skaggs and I invited Billy Deans to dive the Hydro Atlantic with us off Pompano Beach and told him to bring Menduno along since he was driving up from Key West. That wreck is only about 145 feet deep to the main deck

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and most tech guys could do it in their sleep. But he was incredulous that we suggested taking Menduno. Billy said he wasn't even vaguely competent. I guess he should stick to appearing in diaper ads or that bondage and discipline stuff they've been featuring lately. At least he'd be writing about something he knows.

DT: We seem to have struck a nerve here.

GILLIAM: Yeah, I guess you have. But it just chaps me to have to put up with that level of self-righteous crap from people who are not even qualified to do even entry level tech diving. Most divers are pretty independent and are capable of assessing risk for themselves. I don't presume to tell others what to do or how to dive. I think I speak for a whole lot of the tech community when I say "mind your own damn business" when it comes to our personal diving. I know Sheck felt that way and Jim Bowden has had to go through it recently with pinheads who want to second guess his cave exploration. So did the group who dove the Lusitania last year. But I guess it's human nature for those who cannot do what others are capable of doing to sit on the sidelines and criticize. I say screw 'em. They should stay on the couch and watch reruns of Sea Hunt, they're assholes.

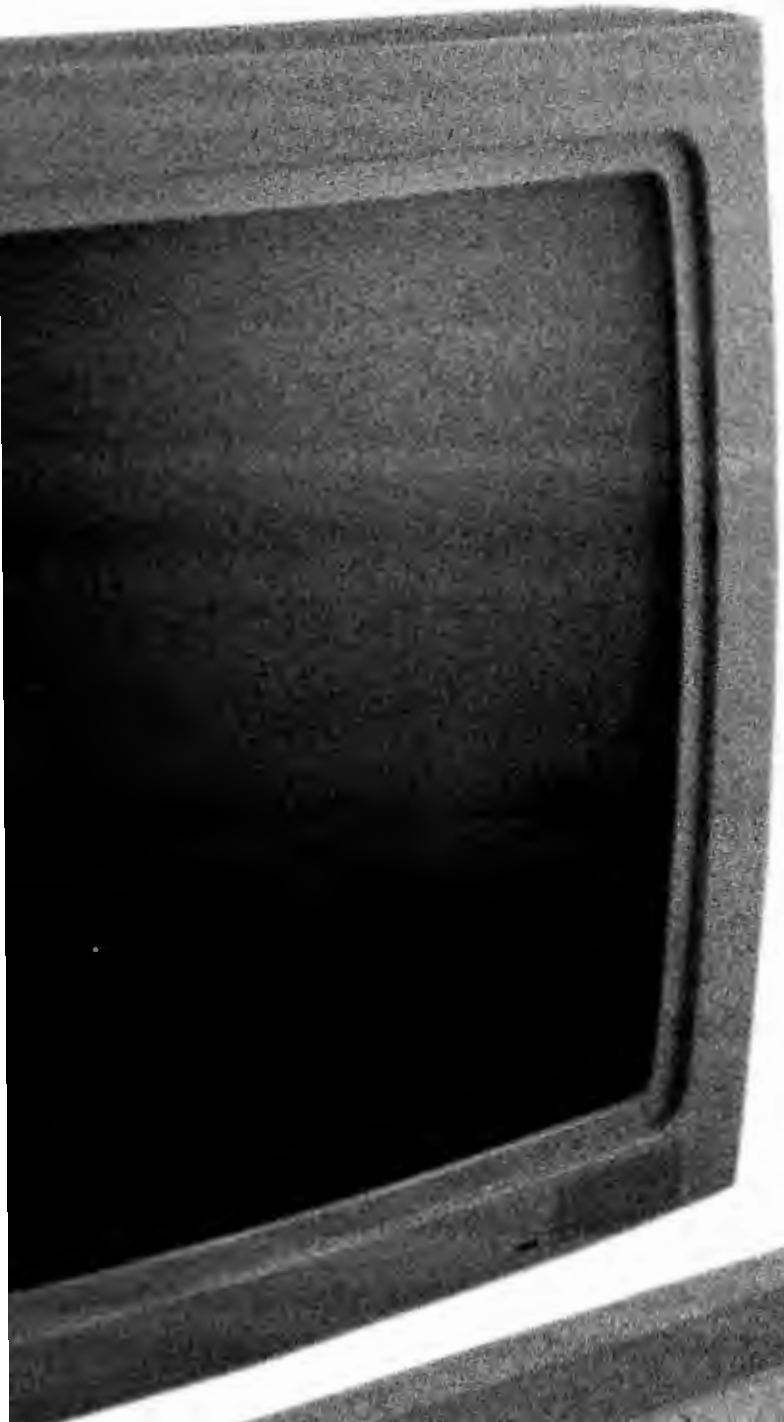
DT: Do you have any last thoughts on this controversy?

GILLIAM: Yes. Fundamentally, it comes down to separating the role many of us play in training divers and the other role we may play as professionals where we routinely set limits based on our own experience and refined methodology to accomplish the objectives set by the client who's paying the bills.

I'm proud of the fact that TDI has never had a training accident of any kind. Our curriculum for nitrox, trimix, extended range, rebreathers etc. is educationally sound, insurable, and legally defensible. And when I perform that role, I religiously adhere to the limits we set for those programs. Training is supposed to make divers aware of all the elements of the diving they want to pursue. But once they depart our direct supervision, they're on their own and can set any limits they want to and I'd the last person to criticize any individual's freedom. And I'd like the same simple courtesy extended to me, Joe Odom, Jim Bowden, Gary Gentile, Polly Tapson or whomever. None of us ever shackled another diver to us and forced them to be dragged along. Indeed, most of us prefer diving alone because we don't like having to worry about someone else who may screw up.

As far as aquaCorps goes, the reaction of most of the people I've spoken with has been "What's the big deal?" And I know that a lot of advertisers and subscribers have simply voted with their pocketbooks and decided to look elsewhere to market their product or get their information. With the current selection of publications, there's certainly plenty of alternatives. And the others actually publish on a regular schedule. Wow, what a concept!

A **HARD** LOOK AT DECOMPRESSION **SOFTWARE**



By BILL**HAMILTON**
and GEORGE**IRVINE**

Since scuba diving became popular after World War II most divers have relied on the U.S. Navy Standard Air decompression tables. More recently new air tables have come from Canada (the DCIEM tables), and the U.K. (the BSAC tables), and there are some others not so well known; add computers to this and air diving is well covered. For diving with mixtures other than air, all the recreational and sport diving communities had to work with were ad hoc tables created by themselves or "air equivalent" tables such as those created by NOAA and various training organizations for enriched air "nitrox" diving. Commercial diving companies, at least some of them, developed their own tables, but they were based on a different diving scenario, using hoses, bells, and techniques such as surface decompression. Suitable tables for heliox and trimix diving by self-contained recreational divers were simply not available.

The need for special tables by some of the more assertive cave divers and their colleagues such as Parker Turner, Bill Gavin, Bill Stone, and others, led to development of a new style of diving based on custom decompression tables as well as many other innovations, special equipment and techniques. The early programs used tables prepared by Dr. Bill Hamilton using his "DCAP" program. This was for all practical purposes the dawn of "technical diving," and it depended on custom tables.

Almost immediately other enterprising individuals began to input Dr. Buehlmann's decompression algorithm into spread sheets or original programs to generate schedules for

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trimix diving. Buehlmann's algorithms were chosen first because they were available (in published form), but also because in many cases they were suitable for this type of diving. The first to bring a commercial "do-it-yourself" decompression computation program to market was the late Corey Berggren with the DPA, and this was based on Dr. Buehlmann's algorithm.

The real question is, "What really works?" This has been answered in a number of ways to the satisfaction of most divers. In a nutshell, most applications using Buelhmann's implementation of the Haldane concept will yield satisfactory results. Professional table generators like Hamilton Research, as well as some commercial diving companies and military diving operations have formulas, some of them proprietary, tested with hundreds of man hours, but the software which is now available to most divers seems to match these results fairly closely.

However, a couple of caveats apply to those who plan to use decompression software: (1) you need to understand decompression before you try to use these devices, and (2) they are theoretical (model based) and may not work in all cases, and are not likely to work when carried to extremes. To borrow from Dr. David Elliott in this regard, "Don't worry about what you don't know, worry about what you think you know which may not be right".

The Review

We review here six currently available programs from the viewpoint of using them as a diver, with comments on the basis of what they do.

The six programs are: Abyss, by Abysmal Diving; DECOM by Bell Computing; DPA by Cybertronics; Dr. X, by Deep, Inc.; MigPlan, by Mig Technologies; and ProPlanner, by Aquatronics. A comparative listing of the programs and key characteristics is given below.

The recommended decompression for a given profile are quite similar for all the programs, all things being equal, i.e., using similar so-called "safety" factors (better to say "conservatism" since safety is more complex than this). This is not surprising since they all use the same basic computational method or algorithm. Some of these can be adjusted severely, some mildly, some not very much.

All of these programs produce adequate decompression schedules, but our experience suggests that all of them when used in their default or intended fashion produce schedules that are subject to improvement. This is not to say that they do not adequately reflect the theories upon which they are based; they do. The problem is that not any one of these theories even comes close to being an adequate description of the physiological decompression process. This is why it is more correct to talk about a computational algorithm than a model, which has more intricate implications.

One way to get a proper decompression would be a combination of bubble mechanics to pick up the deep stops, and control of off-gassing to manage the shallow stops. A straight Haldanian

Program	Version Tested	Authors	Cost	Platform	Gasses and Limits	Model	CNS O2 Tracking	Gas Mixing	Dive Logging	Altitude Diving
Abyss	Recreational v1.2	Chris Parrett Paul Rony	$79.99	Windows	Air Max 130 ft.	Derived Bühlmann 32	Yes	No	Yes	Yes
	Nitrox v1.2	Chris Parrett Paul Rony	$99.99	Windows	EANx 32 & 36 Max 180 ft.	Derived Bühlmann 32	Yes	No	Yes	Yes
	Tech Nitrox v1.2	Chris Parrett Paul Rony	$199.99	Windows	O2/N2 Mixes Max 227 ft.	Derived Bühlmann 32	Yes	No	Yes	Yes
	Mixed Gas v1.2	Chris Parrett Paul Rony	$299.99	Windows	O2/N2/He Mixes Max 325 ft.	Derived Bühlmann 32	Yes	No	Yes	Yes
	Advanced Mixed Gas v1.2	Chris Parrett Paul Rony	$399.99	Windows	O2/N2/He/Ne/Ar Mixes, Max 650 ft.	Derived Bühlmann 32	Yes	No	Yes	Yes
DECOM	v6.5	Abdur Chowdhury	$69.99	DOS	O2/N2/He Mixes	Bühlmann 16	Yes	Yes	Yes	Yes
DPA	v2.1	Cory Berggren Jim King	$79.99	DOS	O2/N2/He Mixes	Bühlmonn 12 or 16	Yes	Yes	No	Yes
Dr. X	v5.03	Sheck Exley	$250.00	DOS	O2/N2/He Mixes	Bühlmann 16	Yes	Yes	No	Sea Level Only
MIG Plan	v1.0	Dan Nafe Jody Svendsen	Freeware	DOS or Mac	O2/N2/He Mixes	Bühlmann 16 or Huggins 12	Yes	No	No	Sea Level Only
ProPlonner	Air v5.0	Kevin Gurr	$200.00	DOS	Air Only	Bühlmann 16	Yes	Yes	Yes	Yes
	TriMix v5.0	Kevin Gurr	$350.00	DOS	O2/N2/He Mixes	Bühlmann 16	Yes	Yes	Yes	Yes
	Nitrox Rebreather v5.0	Kevin Gurr	$450.00	DOS	Nitrox Rebreathers	Bühlmann 16	Yes	Yes	Yes	Yes

approach to picking up the deep stops, as done for example by MiG Plan, can swell the shallow stops to an unmanageable level, much like all these programs will do if the conservatism factors are bumped up. This can usually be through some form of legerdemain, like changing the conservatism factors while running, or inserting a different gas, or using a greater depth (a common and effective method is to lower the oxygen fraction). In other words, you more or less have to already know the answer before you ask the question.

Abyss has just released a new version of its software, 1.4, which incorporates some constraints based on Bruce Wienke's Reduced Gradient Bubble Model. This only increases the necessary decompression, it will not reduce it. It examines dives fitting the popular concepts of dives believed to be unusually risky, such as closely spaced repetitive dives, yo-yo dives, deep after shallow, and some patterns of multiday diving. It then increases the required decompression to compensate, according to Wienke's bubble model. We have not yet tested this version. It does not calculate dives according to the RGBM model, it just modifies what you have. Abyss also allows the user to program the anticipated work load of the diver and provides some options for introducing conservatism according to a logical but arbitrary plan, and it provides a thermal compensation and other parameters as well. In all, Abyss has over 800 factors that can be adjusted by the user.

General Comments

All six programs are intuitive and generally are self-explanatory and easy to use, with the more complex, like Abyss, requiring more effort but yielding more information. All have a simple mode, like the "walk through" in Dr. X which asks the user for very little detail of the dive.

All except Abyss and Mig Plan have a gas mixer, which is easy to use in DECOM, and somewhat archaic in ProPlanner and Dr. X (Dr. X expects all mixes to be made with pure helium and air).

Narcosis

All of the programs provide some method of estimating the narcotic dose of a given gas mix at a given depth. There are a couple of problems with this. First, as a reminder, because of its narcotic properties diving deep with air is highly dangerous when a situation presents itself that might require concentrated thinking. Likewise, when diving with either trimix or enriched air it is foolhardy to push the narcotic limits. Given this, the programs all allow the diver to calculate the level of narcosis of the current mix. However, as far as we can tell all except Abyss do it on the assumption that only the nitrogen is narcotic, and that the equivalent narcosis of a mix can be calculated by considering only the nitrogen partial pressure in the mix. In fact, oxygen is also narcotic gas. Most likely it is even more narcotic than nitrogen. There is little documented data addressing this question, but what little is available says that there is little or no difference in narcotic potency (as measured by performance testing) between air and an N2/O2 mixture at the same total pressure. Thus the way to calculate the equivalent narcotic depth is to consider both the nitrogen and oxygen components and compare the total with air at the same depth. Abyss provides a more sophisticated method of estimating narcosis and even allows the user to consider oxygen to be narcotic (which is probably the right thing to do—this is new ground for us to cover).

Another hazard lurks in the concept of a "personal narcosis depth," such as that calculated by Dr. X and ProPlanner. It is indeed true that people vary somewhat in their susceptibility to narcosis (and to oxygen toxicity as well, perhaps even more). This allows the "macho man" to labor under the mistaken belief that his tolerance is greater than anyone else's, and to plan his mixes accordingly. Suffice it to say that there are some notable examples that this is not a good practice.

Oxygen Exposures

All of the programs provide help in managing the exposure to oxygen, particularly with regard to avoiding CNS O2 toxicity which may manifest itself as a convulsion. Some programs beep when the current profile contains a ppO2 regarded as excessive. The diver's approach to the limit is also monitored. The basis for this is the method used in DCAP, which is essentially an interpolation of the limits for oxygen exposure in the 1991 NOAA Diving Manual. This calculation produces an oxygen limit fraction by accumulating each minute of exposure in fractional increments as a portion of the total limit, such that when the increments add up to a value

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Future Updates

Dr. X—Sheck Exley built a expiration time limit into Dr. X that renders the program unusable after January 1, 1996. This combined with his unfortunate death last year made the future of his Dr. X software unknown. Ralph Hood, of Underwater Connections, Inc., has recently worked out an agreement with Mary Ellen Eckhoff, Sheck's partner, to continue development and support of Dr. X. Underwater Connections is modifying the program to remove the expiration date feature and will continue sales and support of the product along with the Macintosh version that Sheck was completing just prior to his death. All proceeds from sales of Dr. X will be donated to the Sheck Exley Safety and Education Fund which is being administered by the NSS-CDS.

Adept—The only decompression program to be ported to a Personal Digital Assistant (PDA) is a program called Adept, developed by Andrew Pitkin. Features of Adept include support of any O2/N2/He mixture, Bühlmann 16 modeling, multilevel and repetitive dives, gas consumption, CNS O2 tracking and gas mixing. Adept runs on an Apple Newton MessagePad and requires about 200k of memory to run. Pitkin is actively working on a Macintosh version that should be completed sometime in 1996. Questions regarding Adept can be sent to Pitkin at apitkin@cix.compulink.co.uk.

Abyss—Abysmal Diving, Inc. is currently working on a Macintosh version of Abyss that should be shipping by Spring of 1996. The next Windows version (v1.4) will include a Gas Mixer and incorporate Dr. Wienke's RGBM modeling theory.

DECOM—Bell Computing will release version 6.6 early in 1996 and is beginning work on a windows version as well. Upgrades are free within 90 days of purchase.

of 1.0 the diver has reached the NOAA limit. This is also commonly referred to as "CNS%," which is the same thing but presented as a percentage instead of a fraction. CNS% refers to the percentage of the allowable exposure that has accumulated. Abyss allows the user to adjust the formula for calculating the approach to the limit. Abyss also allows the user to select a recovery halftime. This is the decay of the limit fraction during the time when the oxygen exposure is normal or nearly normal.

It should be pointed out here that just like a decompression table does not guarantee a diver will not get DCS, staying within the oxygen limit does not guarantee a diver will not get CNS toxicity.

Mig Plan and ProPlanner Summary

ProPlanner and Mig Plan are relatively simple programs without much flexibility and are inappropriate for technical or complex dive plans. However, they will work fine for routine recreational or rectangular applications.

DPA and Dr. X Summary

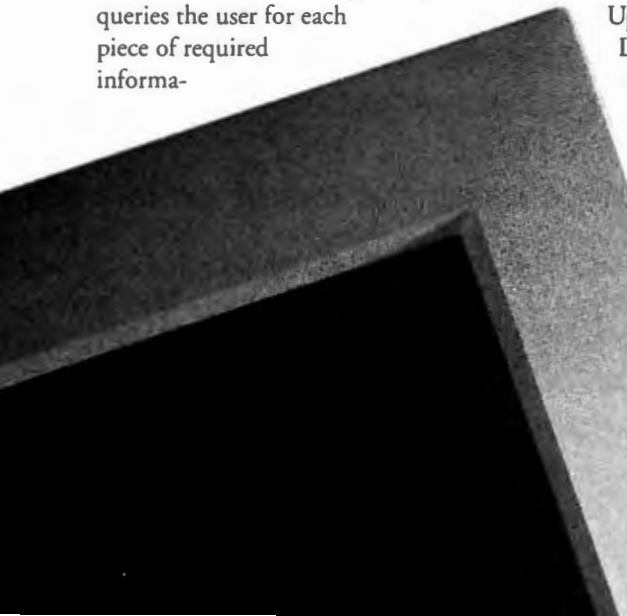
In the midrange there is DPA and Dr. X. They are good for more complex, multilevel dive plans, and are great to use for learning this kind of diving, as they walk the user through the dive. DPA is less user friendly, but more powerful; it allows the user to go back and dynamically change the dive plan and see the effect on the profile. DPA has some routines in the latest version that emulate the popular trimix method developed with Hamilton's DCAP. Dr. X has a terrific walk-through mode that queries the user for each piece of required information throughout the dive. This is an excellent feature for novices.

DECOM Summary

This leaves the real contenders, Decom and Abyss. These programs are intended for the pros, and they merit careful use. Decom has wonderful features, like displaying the changes in the ceiling throughout the input process, and allowing in-gassing and off-gassing to be conducted in any sequence. Conservatism factors can be set at any level, and you can move any direction throughout the decompression. It will allow a batch or "family" of tables to be generated with different matrix times in one location, and this can be done with tables overall. It allows the oxygen limit fraction or CNS% function to be monitored. We have calculated extremely complex multilevel dives with Decom, and have found its recommendations to be compatible with profiles actually used and successfully concluded on some of the biggest cave dives ever done.

Abyss Summary

Abyss is a masterpiece. Chris Parrett has really poured his heart and soul into this one. It is Windows based, and fully incorporates the graphical user interface inherent in Windows. Abyss provides the user with access to the building blocks of the decompression algorithm, including such things as factors for each of thirty-two tissue compartments (32 compartments allow for some fine tuning, but for practical purposes this is more than is really needed). It offers three basic variations on the algorithm, using different levels of conservatism achieved by slowing the outgassing. Upcoming versions will incorporate Dr. Bruce Wienke's RGBM bubble theory as well. The program allows virtually every aspect of the dive to be specified, and the user's personal variables like age and weight can be entered in as variables as well. The graphics are fantastic, and the program is well written and well supported. It comes with an extensive manual as well as comprehensive on-line help. It also tracks the oxygen limit fraction and will generate sets of tables entirely or in sections.



Real World Analysis by George Irvine

Most of our extreme dives are conducted according to commercial tables produced by Hamilton Research. I checked sample Abyss and DECOM dive plans against dives in my logbook that produced asymptomatic decompressions which were confirmed by doppler. Both programs produced tables that matched what I had used, so long as I injected three or four short deep stops into the plan prior to using the first stop recommended by each of the programs. Whether or not these deep stops were necessary is supported only by the fact that I did get mild DCS (Type I) when I didn't do the deep stops. However, I only allowed this to happen twice in 200 dives, so this is not exactly conclusive. The point is that both Abyss and DECOM produced tables as good as the custom tables I have used from commercial sources. I also checked some wreck dive profiles that had worked well in the field and found the same conformance. These are a very few data points, but they are better than none.

Some examples follow: Indian Springs is a peculiar dive in that you must travel a mile at 150 feet and then drop to 300 feet for exploration. This we do with trimix carried on our backs and with nitrox and trimix placed in stages in the cave. At Sally Ward Spring, we go in at 100 feet for several minutes, drop to 300 for several minutes, come up to 250 feet for a while, and then begin exportation at 220, reversing this process on the way out. In Leon Sinks, we get multilevel dives which result in bottom times of over 100 minutes with 220 ft. profiles, and have shallow spots interspersed throughout. At Wakulla Springs, we deal with rectangular profiles in the 300 foot range, with bottom times of 75 to 100 minutes, and at Manatee, we deal with up to 300 minute bottom times. Testing all of these complex profiles on DECOM and Abyss resulted in profiles that matched our experience with commercial tables.

Where to Get Them

Abyss—Abysmal Diving, Inc., 6595 Odell Place, Suite G, Boulder, CO 80301, USA, 303-530-7248, chris@abysmal.com. Also available at any IANTD Facility.

DECOM—Bell Computing, 808 South Highland Street, Arlington, VA 22204, USA, 703-658-8596, rbell@cpcug.prg

DPA—Deep Breathing Systems, Inc., P.O. Box 4220, Severille, TN 37864, USA, 423-453-7177, 72425.1612@compuserve.com

Dr. X—Underwater Connections, Inc., 171 Cornell Dr., Newport News, VA 23608, USA, 804-872-8741.

Mig Plan—Macintosh version available for download at http://www.safari.net/mig. DOS version available for download at http://shadow.net/mig.

ProPlanner—Available at all IANTD Facilities. For the facility nearest you call 305-751-4873 in the USA, or call 01202 632932 in the UK.

Dr. R. W. Bill Hamilton is Founder and President of Hamilton Research. George Irvine is Director of the Woodville Karst Plain Project and a Stock Broker in Ft. Lauderdale, Florida.

Quintana Roo's Cenotes
Caves Hand Carved by God

By STEVE**GERRARD**

Beginning in the early 1980's cave divers realized that a gold mine of cenotes (see nó tāyz), meaning natural well, existed in the Yucatan Peninsula. To date over 100 miles of underwater cave passage have been surveyed in the Yucatan. The total number of cenotes is unknown and cannot be determined since a low canopy of dense tropical jungle hides the entrances to these profoundly beautiful caves. With few roads or trails established in the jungle, accessibility is limited and often difficult.

One doesn't need a degree in geology, hydrology, or geomorphology in order to understand the formation of these natural wonders. Simply put, caves are formed by moving water. Rainwater drains from the jungle interior and meanders slowly to the Caribbean Sea. The Yucatan Peninsula, which has mostly flat topology, is an ancient sea atoll containing millions of years worth of ocean sediments which, over time, formed layers of geological history consisting of coral reefs, animal remains and sand particles. The groundwater seeps into the flat landscape in its quest for the Caribbean. The flowing underground water slowly erodes passages through the layers of underground limestone and other sediments until caves are formed. The Yucatan is unlike any other place on the planet, in that it uniquely contains all ingredients required for the formation of a high concentration of caves within a small, flat area. It's the best Swiss cheese a cave diver could hope for. Depths within the Yucatan cenotes typically vary between 10 and 50 feet deep. These relatively shallow depths provide divers geared with doubles with long, leisurely dives.

What makes the cenotes so incredible is the crystal clear water and the interesting cave formations. They form a panorama of unforgettable beauty. An endless variety of formations includes the complete caver's spectrum of attractions such as stalactites, stalagmites, soda straws, bacon strips, rim pools, halagtites, waterfalls, columns, etc. Fairly recently, ecologically speaking, these caves were given the opportunity to become dry enabling nature's chisel and mallet to reshape the calcium carbonate of the soft limestone into profoundly beautiful sculptures. The delicate creations bring forth feelings of awe and wonder.

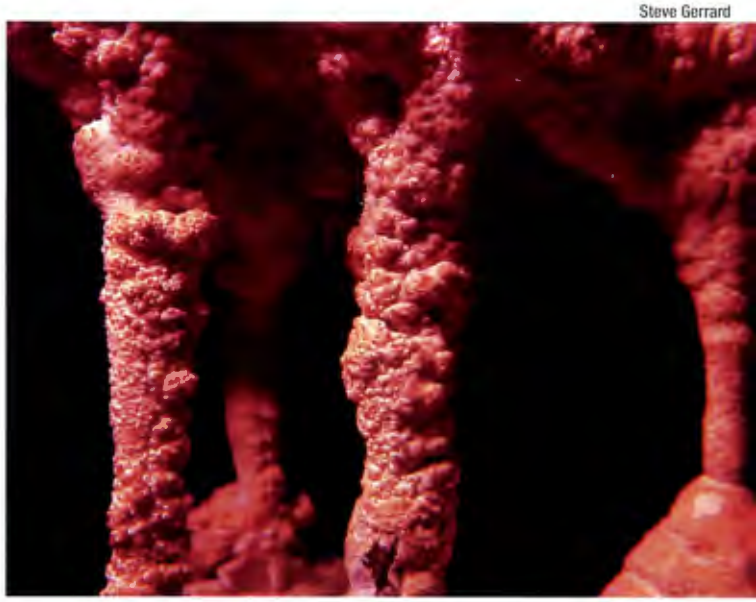
Choosing the best cave dives from such an immense concentration of underwater caves is next to impossible, they are all excellent. Ask ten cave divers their favorite and the odds are you will get ten different answers. After years of diving the cenotes, here is this authors humble opinion of the ten best cenotes in the Yucatan.

Cenote Carwash and the Room of Tears

Though many caves, perhaps, are considered better, this particular system still makes it to the top ten. The Carwash is by far the most popular cenote due to its easy accessibility and clear water that offers a huge, cavern entrance. This site has become a popular dive for divers from all skill levels. Parker Turner and Mike Madden found the Room of Tears during the summer of 1995. The flurry of excitement caused by the discovery of this one little room set the stage for an explosion of interest and desire to see something new and exciting.

Accessibility of the Room of Tears has stimulated an emotional debate since it was first located. Should the offshoot guideline be easy for the touring cave diver to find or deceptively hidden as if it were the treasure of the Sierra Madre? This conflict stems from the desire to protect the pristine nature of this beautiful passage. The question is whether it is best to mark the passage so that everyone can easily find it, or leave its discovery to only those who possess sufficient explorer skills to find it on their own. The theory being that successful explorers will have proper conservation techniques thereby protecting this treasured resource.

Steve Gerrard



Cenote Taj Mahal ▶

Regardless of your viewpoint, Cenote Carwash and the Room of Tears is still a classic. For those who saw it in the beginning compared to today, yes, there is some damage. All divers, regardless of their skill level, leave some damage when they dive. It cannot be avoided. What can be stressed, though, is the proper attitude of minimizing the impact of divers.

Charles Bisch

Cenote Sac Actun ▶

Beyond the Room of Tears awaits the Basement, Dreamland, and the Lotus rooms. All are beautiful, fragile and require special care. It is suggested that before one dives to this point, make an honest assessment of your personal ability and skills. If you are not able to assure yourself that you can protect this unique "glass house", then please continue to build your skills so you may return someday to view the beauty without impacting its appearance.

Cenote Dos Ojos, Dos Palmas, High Voltage, Monolith Traverse

Commonly known as "The River Ride." This is the world's second longest explored underwater cave system—at least until it becomes connected with Nohoch Nah Chich, which is eminent. Cenote Dos Ojos means "two eyes" as two gigantic cenotes exist within 250 feet of each other. Dos Ojos was discovered and initially explored by Jim Coke and Johanna DeGroot in 1986. Like so many of the cenotes it was logistically difficult to get to. It is similar to Nohoch Nah Chich with shallow depths, elegant decorations and crystal clear spring water. Coke and DeGroot initially explored 6,000 feet of passage. Today it stands at 112,000 feet and is still going like a freight train.

Paul Heinerth

Cenote Sac Actun ▶

The Traverse is approximately 5,500 feet long with four openings or potential bailout points along the way. Maximum depth is 36 feet with the average closer to 16 feet. The fresh water drainage is strong enough to encourage divers to go in the downstream direction. Entering from East Dos Ojos, the continuous guideline begins. It usually takes 45 to 50 minutes of swimming and casual drifting before arriving at Cenote Dos Palmas, named after the two palm trees growing in it's basin. Continuing another 30 to 35 minutes, you reach Cenote High Voltage, locally known as "Tic Te Ha." The last section takes you through

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Cenote Sac Actun

Cenote Tapir's End, named after a dead wild pig skeleton that was found there. The dive concludes at the Cenote Monolith, named for a huge rock that leans against the ledge entrance to the water. Total traverse time is usually about 100 minutes with 1000 psi or more left in your doubles if your air consumption is anywhere near conservative. A dive well worth the effort.

Cenote Esquelto

The Skeleton—also known as the Temple of Doom. Cenote Esquelto was first discovered and explored by Mike Madden and Denny Atkinson during July of 1986 by following a "tip" from a local taxi cab driver. During the summer and fall of 1986, 6,000 feet of cave was surveyed including two large rooms. One room was named the "Coliseum" because of its size and the second was named "The Fang" room because of an enormous 200 foot stalactite hanging squarely in the center of the room. Cave divers Paul DeLoach, Tara Tanaka and Dr. John Zumrick, residents of Florida, also contributed to its exploration at this time. DeLoach was so impressed with this cave that he said it was "the prettiest he had ever seen" and ranked it over the Sally

Charles Bisch

Ward Spring in Wakulla County, Florida. That's a tremendous compliment.

What makes Cenote Esquelto such a joy is the cobalt blue salt water and the snow white walls and floors that line the cave. The main gate is known as the Madonna Passage that reveals two pretty eight foot brown stalagmites. About 600 feet into the system divers encounter a "T" marked with orange arrow markers. If you head straight you enter the "Coliseum Room." Turn left and swim 250 feet, and you enter a football field size room containing "The Fang."

During the months of October and November, 1995, cave explorer and Instructor Gary Walten with the help of Sam Meacham and Gary's wife Kay, added 3,500 feet of new surveyed passage. This cave system is a classic and deserves to be part of the 10 best cenotes in the Yucatan.

Cenote Naharon

The Myan Blue Traverse. Two cave systems were connected in 1989 by Jim Coke, Tom Young, and Paul Heinerth as

continued next page ➡

Lalo Fiorelli

▲ Cenote Esquelto—Temple of Doom

the first official swim through. A year earlier, Mike Madden and Johanna DeGroot, in a separate, parallel route tied the guideline from Mayan Blue to the end of a string installed by Parker Turner in a siphon portion of Naharon that Parker said was the most gruesome dive from hell he had ever seen. That remark totally discouraged a traverse swim though for that passageway.

Make no mistake about it, this dive is not easy. It requires six reels, including four jumps, and there are no bail out points. The guidelines are set up to require cave divers to do set up dives to become familiar with the route and requires a stage bottle. Yes, it is a hell of a swim but it is also a lot of fun. It is about 5,000 feet in length with a typical bottom time of 75 to 90 minutes depending on route. There are two restrictions, a halocline and a wide variety of sights to entertain you along the way. This is a very satisfying dive that requires good planning and preparation. You'll enjoy it!

Cenote Mundo Escondido

Hidden World. This cave is located directly between the two largest cave systems in the Yucatan, the Nohoch Nah Chich and Dos Ojos. Mundo Escondido was first explored by Buddy Quattlebaum and Gary Walten during March of 1994. This cave begins with a 20 ft. dry well shaft that leads to the water. The shaft is barely large enough for a diver to enter, and requires ropes to lower gear down. Transporting equipment to the dive site is a logistical challenge requiring the stoutest of 4X4 vehicles. Though it won't be anyone's favorite cave for convenience and ease, it definitely makes up for the hard work and hassle by dazzling the imagination of any cave diver. This cave will make your mouth drop and forget who Marilyn Monroe was. In a word, it's awesome. Shallow and midsize passageways prevail. The upstream lead is an impressive review of power with art.

Steve Gerrard

◀ Cenote Myan Blue

Cenote Nohoch Nah Chich

The Giant Birdhouse. Nohoch Nah Chich is the world's longest explored/surveyed underwater cave. As of November of 1995, this giant cave system has yielded over 160,000 feet of surveyed passageway. It was first dived in November of 1988 after being located based on a tip from a Myan employee. Mike Madden has organized an annual exploration project to Nohoch Nah Chich that has included over 35 persons and a well financed and marketed organization with a dedicated drive to keep pushing the line.

After early dives in Nohoch Madden reported shallow, crystal clear water and stunning decorations that overwhelmed his imagination. With further exploration, what eventually became the most impressive feature is the immense size. Never deeper than 25 feet, the giant hallways obviously formed the

basis for the name. Floor to ceiling distance is twenty feet or more in most areas. The cenote basin provides a pool of water that stretches far into the cavern zone and is ideal for snorkelers. Today, it serves as one of the most popular snorkel/adventure trips along the Yucatan coast with groups from several hotels and resorts and an abundant supply of tourists from Cozumel.

Diving Nohoch upstream will knock your eyes out. However, because Nohoch requires a 50 minute hike and equipment portered in by horse, it is logistically difficult and expensive. About one thousand feet upstream divers pass through "Heaven's Gate" to a passage called "Disneyland". To say Disneyland is huge would be an understatement. Every turn provides formations of unique character and delight. Because it is so shallow, there is enough air and time to include several loops on established lines all equally as impressive. All dives in Nohoch must be accompanied by a guide from Madden's dive shop, Cedam Dive Center, per agreements with the landowner. If you have the time, add this dive to your list of sights to see.

Cenote Systema Ponderosa

Early in June of 1990 Bill and Joyce Matthews, of Palmul, mentioned to Tony and Nancy DeRosa that there was a beautiful cenote in Playa Del Carmen. Always energized to find something new the DeRosa's decided to have a look. They found a fifteen foot drop to a body of water that looked emerald green due to the surrounding lush foliage and clear water. Jumping in with single tanks they saw daylight in the distance underneath the ledge heading east. Swimming through 300 feet of passage they emerged into another cenote that was a typical circular collapse packed tight with palm trees and mangroves. The traverse had such a large diameter, that they knew immediately this was part of an outstanding cave system.

They invited me to help explore the cave during the second week of July in 1990. Enroute to the cave I was blindfolded as a joke meant to emphasize the precious nature of this jewel. I wasn't disappointed. We spent four days exploring and surveyed 7,500 feet of passage. It was the third day that gave us the real reward though. Early on we found a tunnel heading east. Not large, not small, just kind of average. It kept teasing us with annoying haloclines and percolation. The reel kept spinning and the passageway kept going. Finally we hit pay-dirt. We entered a gigantic room where our lights were absorbed by the dark void of water. It was over 100 feet wide and 300 feet long. We named it the "Pool Hall" as if it were a billiard table with pockets at each corner. At the other end, the room bent to the left. Looking up, we noticed that the surface had an air pocket where our exhaust bubbles broke apart. We ascended and carefully decided to try breathing the air. The air seemed fine but what we saw when we shined our lights around in the air was mind boggling. We were stunned by the incredible decorations. We felt as though we were in an elegant china shop. We named it "The Chapel" since is was so beautiful a wedding could have been conducted there. The name has held true for the hundreds of cave divers who have witnessed this gallery. Today, over 34,000 feet of surveyed passage have been explored in Systema Ponderosa, with connections to at least nineteen cenotes. A cave diver can be happy for many days here.

Cenote Systema Sac Actun

The White Cave. Easily the favorite of most cave diving visitors, Systema Sac Actun is easy to locate and get to. This shallow cave system is Picasso's playhouse. There's no place within that will disappoint the eager cave diver. It was discovered by Steve DeCarlo and Jim Coke during November of 1988 while flying Steve's private airplane purposefully looking for new cenotes along the Coba Road near Tulum. It's a coincidence that two of the most beautiful cave systems in the Yucatan, Systema Sac Actun and Nohoch Nah Chich, were discovered during the same flight.

Depths of 45 feet or less and swimming pool clear water add to the appeal of

continued next page ➡

▲ Cenote Mundo Escondido—Outside View

Steve Gerrard

▲ Cenote Mundo Escondido—Inside View

Steve Gerrard

▲ Cenote Systema Sac Actun

Steve Gerrard

▲ Cenote Naharon

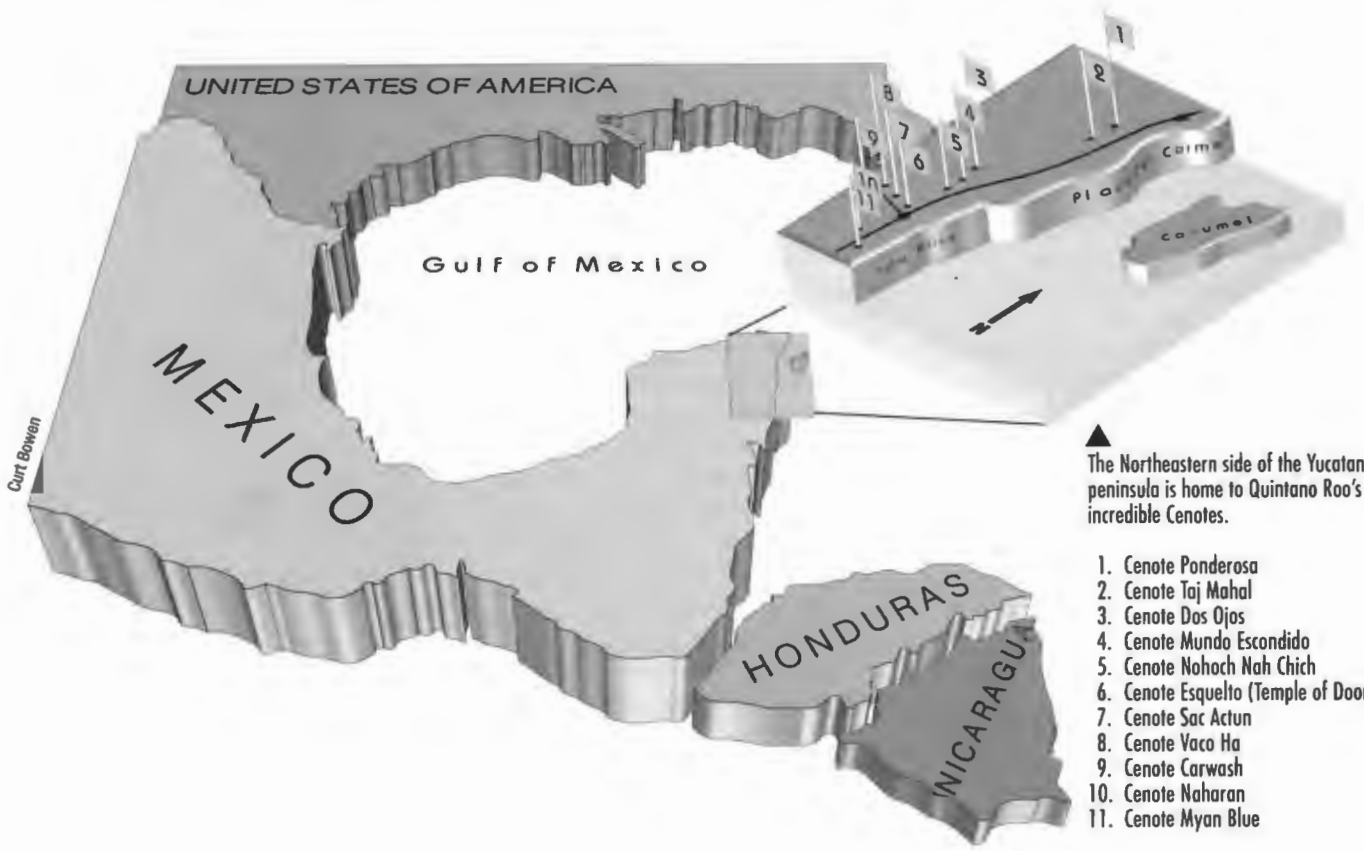
this cenote. It is a cave photographer's dream. Thousands of columns, hanging stalactites, tiny soda straws, chandeliers, rim pools, and frosty overflows abound.

Jim Coke and Tom Young, residents of the Houston area, teamed up to produce an outstanding map of Systema Sac Actun. There is currently 17,000 feet of surveyed passage with nine openings to the surface.

The most popular section is known as the "Cuzan Nah." The best place to enter is Cenote Hotul, located in the middle of the system. Though more difficult to enter, due to a long hike, it provides better access to all sections of the system. This cave will make you dance with joy—it's that good.

Cenote Taj Mahal

The Palace of Ornaments. Paul Heinerth, of Hudson, Florida, said it best, "The size of The Jumna River compares to the rooms of the great cave system Diepolder in Hernando County Florida." However,



Curt Bowen

▲ The Northeastern side of the Yucatan peninsula is home to Quintano Roo's incredible Cenotes.

1. Cenote Ponderosa
2. Cenote Taj Mahal
3. Cenote Dos Ojos
4. Cenote Mundo Escondido
5. Cenote Nohoch Nah Chich
6. Cenote Esquelto (Temple of Doom)
7. Cenote Sac Actun
8. Cenote Vaco Ha
9. Cenote Carwash
10. Cenote Naharan
11. Cenote Myan Blue

Steve Gerrard

▲ Cenote Taj Mahal—Unusual Cave Formation

Steve Gerrard

▲ Cenote Taj Mahal—Fossilized Sea Urchin

instead of 240 ft. depths, this colossal passageway is only 40 ft. deep. Talk about clear thinking and enjoyment.

Cenote Taj Mahal was first explored by Nancy DeRosa and her brother Wayne Nefzger after receiving permission from the Don Feliciano, the landowner. Bill and Joyce Matthews of Palmu were instrumental in helping to secure permission for the dive. Accessibility was nearly impossible at first, being located deep in the jungle two kilometers from any semblance of road or trail. As luck prevails a new resort was constructed in 1993 that leased the land for use of natural material. They bulldozed a road that ended only 200 yards short of this cenote. The landowner pushed the trail directly to the cenote.

Nancy's husband, Tony DeRosa, joined the team and the exploration continued. The excitement was contagious. On the fourth day, Nefzger was unavailable so I was offered an invite to go explore. It was the sixth exploration day. Never in my cave diving career, had I seen such immense passageway. It left me speechless. We pushed it a total 2,400 feet from the Cenote Taj Mahal to a new cenote we named Cenote Shan Jahan.

This river passage will impress every cave diver who visits here. Loaded with fossilized shells, sea urchins and coral, this mammoth conduit clearly displays the geological past. Huge boulders the size of houses and massive slabs of limestone abound. The Jumna River is an excellent example of a great dive.

Cenote Vaca Ha

The Cow Well. This dive usually blows the mind of the cave diver who dives this site for the first time. Cenote Vaca Ha was first shown to Tony DeRosa and I by Don Camillo, the land owner, in May of 1992. It was appropriately named since it looked like a tiny water filled hole that the cows drank from. We were skeptical that diving into a dark little hole was such a smart thing to do. We were desperate though, since we had already promised a unique dive to an exploration group due to arrive in a few weeks. Desperate people do desperate things. I descended into the hole with a reel and guideline thinking that this was really nuts. I was disappointed to find only a small room but I kept poking around. I found a tight restriction and squeezed through about 40 feet of cave and presto—a huge, pristine passage lay before me. Stretching my reel to it's 350 feet, I knew it would be a winner.

In August of 1992, Cliff Keck and Allen Jonushaitis were given the honor of the first dive. They laid 1,800 feet of line and discovered one of the most beautiful caves in the area. The first 600 feet is fresh water richly decorated with columns. Then it dramatically changes into a fault-line passage and blazes on as if it were a subway tunnel. It's not a long cave system. There's only a total of 4,000 feet of surveyed passage. According to survey data, it sits only 200 feet away from a passage known as "The Drain" in the Cenote Carwash system. Several attempts to connect the two caves have been made without success. Cenote Vaca Ha's unique entrance and beautiful hallways provide enough charm and energy to satisfy any cave diver's appetite for a rewarding dive.

The Best Cave Diving in the World

These ten caves represent a portion of a concentrated, abundant supply of cenotes and cave systems located within close proximity in the Tulum and Akumal area of the Yucatan. With accessibility and logistics slowly becoming easier and more convenient, this new frontier has evolved into a popular dive destination for cave divers around the world. For adventure, breath taking sights and awesome diving, this paradise is second to none.

Steve Gerrard has been actively cave diving since 1975. He guides and teaches cavern and cave diving along with technical nitrox for Aquatech/Villas DeRosa located at Aventuras Akumal, Mexico. Steve can be reached in Mexico at: 011-52-987-42171.

Whitefish

Divers from the Great Lakes Shipwreck Historical Society remove the wheel from the Superior City for display in the Shipwreck Museum.

Point

THE DEEP WRECK HOLY LAND OF LAKE SUPERIOR

By RICHARD**MANNESTO**
and CURT**BOWEN**

Lake Superior, also known as "Kitchigami" by the indigenous Indian population, is the largest of the Great Lakes as well as the widest and deepest. It is the only home of the Atikameg or Whitefish, a small Mullet like fish that is typically smoked before eating. Whitefish Point, a peninsula on the Southeast side of Lake Superior near the point where Lake Huron connects to Lake Superior, is named for the large amounts of Atikameg found there. The large amounts of shipping traffic traveling between Lake Superior and Lake Huron combined with the often severe storms common to this area have contributed to Whitefish Point becoming known as the ship graveyard of the Great Lakes. Whitefish Point, jutting out into the lake forms an obstacle that all vessels must successfully avoid.

Large scale shipping was introduced to this area with the discovery of ore and other resources around the shores of Lake Superior in the early 1800s. With the completion of the St. Mary's Falls Canal, a series of locks and canals connecting Lake Superior and Lake Huron, shipping rapidly grew between the lakes. Large ships, some 700-800 ft. long, traveling North or South around Whitefish Point must maneuver through relatively narrow shipping lanes in close quarters. With increasing demands on shipping in this area many shipwrecks in the Whitefish area have occurred due to collisions in the fog, blinding snow, and poor communications. Lake Superior is also known for the strength of the storms that blow here. Savage storms frequently pound Whitefish Point and are one of the major contributors to the dozens of large wrecks in the area.

Ships that have sunk in Lake Superior are remarkably well preserved due to the cold (36° F) fresh water. Little decay occurs in the near freezing temperatures. Thermal protection for divers becomes as critical as gas supplies when diving these wrecks. An unprotected swimmer would last only a few minutes before hypothermia would set in.

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Photo by Thierry Begnoche

Depths for the wrecks of Whitefish Point vary with almost all of them below the 130 ft. limit for sport diving. Typical depths are in the 150-300 ft. range with some, like the Fitzgerald much deeper (540 ft.). The cold water temperatures combined with the depths limit diving this shipwreck holy-land to only highly experienced techdivers.

Local laws prevent the removal of artifacts from any of the wrecks in Lake Superior. These laws are enforced with heavy fines and a short stay at the local correctional facility. The shipwrecks of Whitefish Point represent a significant part of the history in this area and are protected by the local people and organizations like the Great Lakes Shipwreck Museum (see sidebar pg 37).

The Vienna 1873-1892

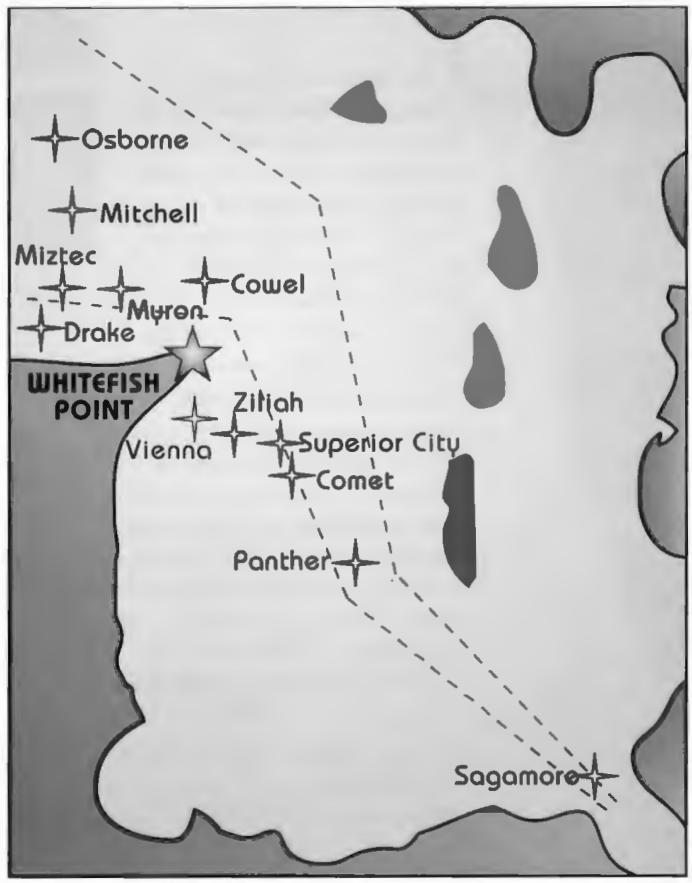
History—On September 16, 1892, the 191 ft., 1,006 ton Vienna rounded Whitefish Point with the schooner Mattie C. Bell in tow. The upbound steamer Nipigon approached with the schooners Melbourne and Delaware also in tow. Both vessel operators issued port to port passing signals, but the 191 foot, 626 ton Nipigon veered at the last moment and smashed into the Vienna's port side. The lines to the Nipigon's schooners were quickly cut and the Nipigon attempted to drag the Vienna into shallow waters. The lines to the Vienna broke and she sank in 147 feet of water.

Diving Impressions—Located just a few miles south of Whitefish Point, the Vienna is one of the more popular wrecks because the site is protected from the strong northwesterly winds. The wreck sits upright and a permanent buoy is attached to the stern railing making. Most of the decking and the cabins were ripped free during the sinking. The large hole caused from the collision can be located on the port side towards the bow. The steam engine sits in place with the stack lying on its side on the deck. The mast and rigging has been snapped off and is scattered randomly on the deck. One of the original life boats later washed up on shore and was sunk onto the deck of the Vienna for divers to see.

Terry Begnoche

The rudder and propeller on the Vienna are still in relatively good condition for having sunk in 1892. The near freezing water temperature preserves the ship from decay.

Dozens of large ships have sunk near Whitefish Point due to heovy shipping traffic, relatively norrow shipping lanes, and the severe weather common to Lake Superior.



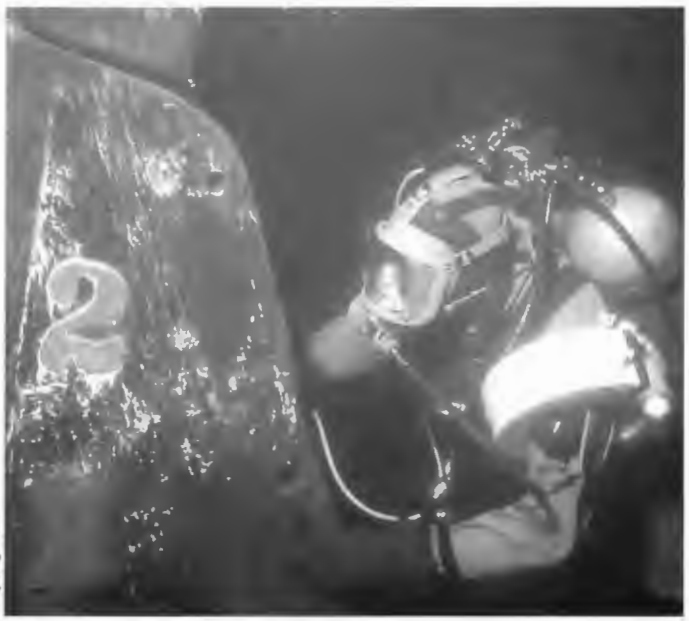
Curt Bowen

Terry Begnoche

On the Vienna, a diver searches for artifacts below deck. Many artifacts from the Vienna have been collected and are on display at the Great Lakes Shipwreck Museum.

Terry Begnoche

A diver examines the pig iron ingots located just forward of the steam engine on the deck of the Comet.



Terry Begnoche

A diver examines the rudder located at the stern end of the Comet. Many artifacts can be seen in the debris field which is spread around the stern.

The Comet 1857-1875

History—On August 26, 1875 the 181 ft., 621 ton Comet rounded Whitefish Point, carrying 70 tons of silver ore, 500 tons of pig iron, and a large shipment of wool. According to a survivor, Frances Dugot, the Captain of the Comet, spotted the Canadian steamer Manatoba just ahead. He then turned the Comet hard to port and gave a blast on the whistle. The Manatoba sliced deep into the bow ripping a fifteen foot hole into the Comet. Reports from the crew and witnesses on the Manatoba stated that the Comet changed directions just before the ships passed bringing the Comet directly into the path of the Manatoba. Dugot had apparently misjudged the direction of the Manatoba. After the collision, the Comet pulled free and swung around accidently smashing hard into the side of the Manatoba. The Comet quickly sank. The cabin structure separated from the deck as it disappeared below the surface. Six of the crew jumped to the

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Manatoba and another four were later rescued from the water. Six men were sleeping in the forecastle of the Comet and believed to be crushed by the impact. Another four crewmen were also lost in the dark waters. The cargo of unrefined silver ore distinguished the Comet as the only treasure ship sunk in Lake Superior. Kent Bellrichards located the wreck in the 70's.

Diving Impressions—The Comet sits upright in 240 ft. of water sunk deep into the mud bottom. The two wooden support arches, added to the Comet to increase structural strength, tower over the wreck. The steam engine, condenser, rudder, and prop are still in good condition on the stern section. Towards the center, the silver ore spills out into the mud where the Manatoba split the hull. The wool and pig iron bars are located just forward of the steam engine along with the smoke stack. The cabins were ripped off during the sinking and are scattered in the debris field around the wreck. The ship's name "Comet" is still visible on the condenser tank adjacent to the steam engine.

The ship's engine controls of the Superior City lay on their side inside the pilot house. Evidence of the tremendous explosion that sank the ship. ▶

Terry Begnoche

Ship Name	Configuration	Weight (tons)	Cargo	Year Built	Date Sank	Depth (ffs)	Method Sank
Vienna	191 ft. Wooden Steamer	1,006	Ore	1873	Sep 16, 1892	147	Collision w/Nipigon
John M. Osborn	178 ft. Wooden Steamer	891	Ore	1882	Jul 27, 1884	180	Collision w/Alberta
Comet	181 ft. Wooden Steamer	621	Silver Ore, Iron	1857	Aug 26, 1875	240	Collision w/Manatoba
John B. Cowel	420 ft. Steel Steamer	4,731	Coal, Iron Ore	1902	Jul 12, 1909	220	Collision w/Issac M. Scott
Superior City	429 ft. Steel Steamer	4,795	Iron Ore	1898	Aug 20, 1920	265	Collision w/Willis L. King
Zillah	202 ft. Wooden Steamer	1,100	private yacht	1890	Aug 20, 1926	252	Winter Gale
Miztec	194 ft. Schooner Barge	777	Salt	1890	May 14, 1921	50	Storm
Myron	186 ft. Wooden Steamer	676	Lumber	1888	Nov 22, 1919	50	Storm
Panther	237 ft. Wooden Steamer	1,373	Wheat	1890	Jun 27, 1916	105	Collision w/James Hill
Drake	201 ft. Wooden Steamer	1,102	Unknown	1882	Oct 2, 1901	55	Storm
Sagamore	308 ft. Whaleback Barge	1,601	Unknown	1892	Jul 29, 1901	72	Collision w/N.Queen
Samuel Mather	246 ft. Wooden Steamer	1,576	Wheat	1887	Nov 22, 1891	195	Collision w/Brazil

John B. Cowel 1902-1909

History—On July 12, 1909, at 5:30 a.m. the 420 ft., 4,731 ton John B. Cowel encountered a dense fog seventeen miles from Whitefish Point. The Issac M. Scott came unseen out of the fog and slammed into the port side of the Cowel. The Cowel, carrying 7,024 tons of iron ore, was quickly pulled down into the dark water. Fourteen crewmen perished on the wreck. A survivor recalled "When the ship sank, I was stuck in a whirlpool, wrenched and whirled until I thought my legs would be pulled off. I saw a body along side me. It was Will Thomas, my assistant. I tried to revive him when a broken hatch cover floated up and struck the lad, crushing his head. My life preserver came off and while I was floundering around in the water, another hatch cover came up. I grabbed the ring and pulled myself onto it. It was three quarters of an hour before a lifeboat picked me up." The Cowel was discovered in 1972 in 220 feet of water, approximately two miles north of Whitefish Point.

Diving Impressions—The stern section is sitting upright and is tilted 15 degrees towards amidships where the vessel split in half. The cabins are in good condition but access to the hull is limited due to the collapse of the ceilings during the sinking. A large stern anchor, life boat davits, capstan, and propeller are also in relatively good condition. The hatches to the cargo holds are missing, exposing the ore. Many artifacts like dishes, personal items, and rigging are scattered about the decks.

The Superior City 1898-1920

History—On August 20, 1920, the 429 ft., 4,795 ton Superior City, fully loaded with ore, was downbound in a heavy fog when the larger 580 foot steel steamer Willis L. King slammed into the Superior City's port side. The crew of the Superior was on the deck attempting to lower the life boats when cold water flooded the boilers causing a large explosion that killed 28 crewmen. The explosion was so powerful it almost ripped the stern

continuednext**page** ➡

The Great Lakes Shipwreck Museum

Tom Farnquist, curator and dive team leader has developed an exceptional museum depicting over 170 years of maritime accidents on Lake Superior. A dive trip to Whitefish Point is not complete without visiting this remarkable museum. Along with being the museum's curator, Tom Farnquist has also formed the Great Lakes Shipwreck Historical Society. This nonprofit organization is responsible for much of the exploration, discovery, and documentation of the many wrecks in Lake Superior. For information about the museum or to join the society, call 1-800-635-1742.

Terry Begnoche

Terry Begnoche

Terry Begnoche

Curt Bowen

section from the ship. The wreck was discovered by John Steele in 1972.

Diving Impressions—The Superior lies in 265 ft. of water with the stern section tilted up at a 45 degree angle. Dropping down over the stern you can see the name, propeller and rudder. A swim down the stern deck can be confusing due to the angle. Dishes and other artifacts are scattered about the stern section. The pilot house is intact on the bow section. The wheel and compass were removed by the Great Lakes Shipwreck Society and can be seen today in the museum. Many artifacts are scattered around the pilot house along with personal belongings of the crew.

John M. Osborn 1882-1884

History—On July 27, 1884 the 178 ft., 891 ton John M. Osborn left Marquette towing two schooner barges. Traveling in a thick fog, the crew periodically sounded the ships horn to warn other vessels of it's approach. The answering blast of another horn came just seconds before the Alberta rammed the starboard side of the Osborn between the main and the mizzen masts. The vessels fortunately remained locked together long enough to enable most of the Osborn crew to climb aboard the Alberta. One of the courageous passengers on the Alberta climbed over to the sinking Osborn to help rescue the engine room crew. While he was below deck, the Osborn broke free of the Alberta, taking him and three Osborn crew members to the bottom. The Osborn was discovered in 1984 six miles north of Whitefish Point.

Diving Impressions—The Osborn lies upright in 185 feet of water and is considered one of the best wreck dives at Whitefish Point. The ship is mostly Intact with the masts laying across the deck over the side. There are plenty of artifacts to see including rigging, dishes, and personal items. The collision area is easy to locate on the starboard side. The engine is interesting with tongue and groove wainscoting supporting it. The bow is in relatively good condition with the anchors laying on the deck. The holds

Terry Begnoche

▲ The Superior City is remarkably well preserved as shown by this photo of the pilot house interior.

Divers peer into the pilot house windows of the John B. Cowel in preparation for penetrating the wreck interior ▼

Terry Begnoche

The Osborn's twin anchors are located on the deck, near the front of the bow section.

Terry Beignoche

Many artifacts can be found below deck on the Osborn like this beverage container.

Terry Beignoche

are wide open and many artifacts can be seen such as block and tackle, dishes, and wheelbarrows.

The Zillah 1890-1926

History—On August 20, 1926 The 202 ft., 1,100 ton Zillah encountered one of Lake Superior's fierce storms and unpredictable gale winds. With water crashing over the side and the Zillah taking on water, the captain tried to steer around Whitefish Point to gain protection from the high winds. Listing badly, the Zillah signaled for assistance from the Coast Guard. The Coast Guard managed to rescue all crew members but the Zillah herself sank.

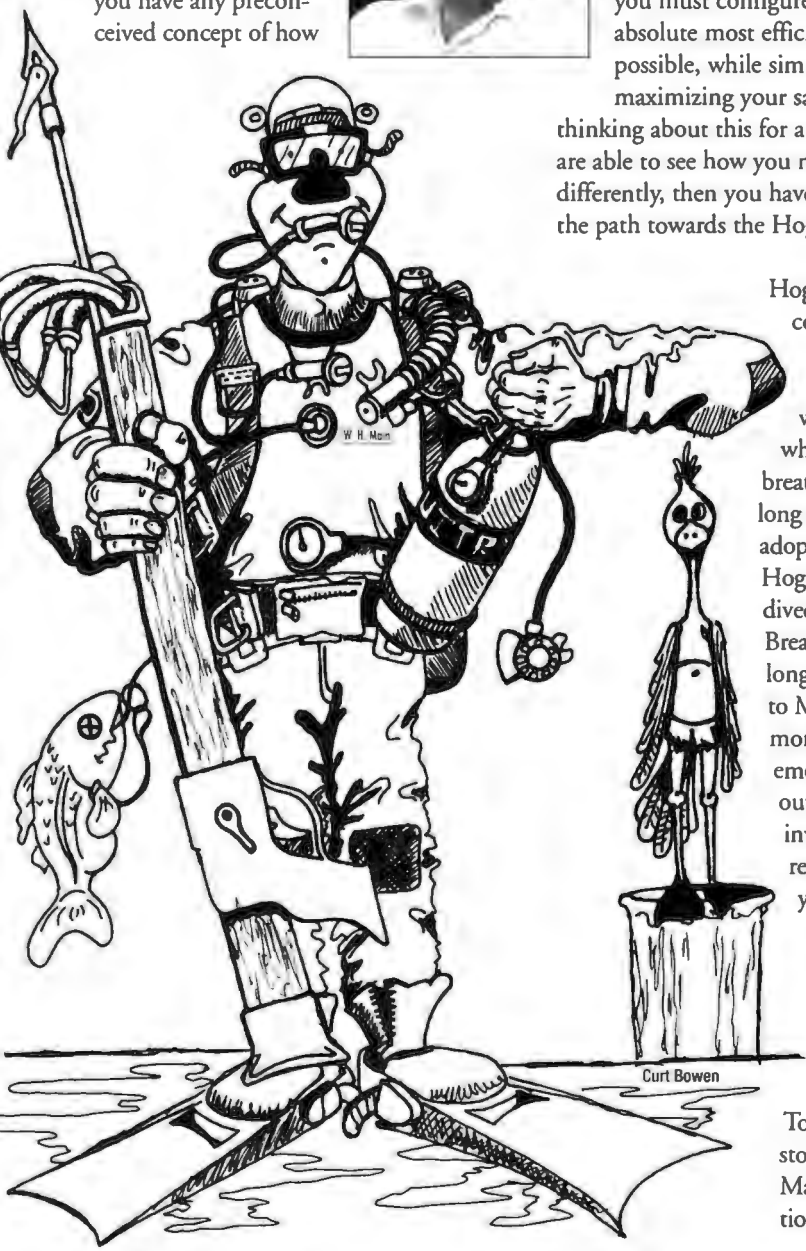
Diving Impressions—The Zillah has not been dived as much as other wrecks due to the depth. However, this is changing with the increased popularity of mixed gas. It sits upright in 252 ft. of water and the stern cabins were blown off when she sank. The boilers, engine and coal bunkers are in relatively good condition. The bow is intact but the wheel has been removed. Many artifacts such as block and tackle and hatch covers can still be seen laying about.

Richard Mannesto holds a Masters Degree in Maritime History and Nautical Archaeology from East Carolina University and has been an active wreck explorer for 22 years. He is regarded as one of the most knowledgable shipwreck archaeologists in the United States. Curt Bowen is an explorer, Co-publisher of DeepTech and an active instructor for NAUI and the IANTD.

The Hogarthian Way

By WIN**REMLEY**

Imagine for a moment that you own no dive gear whatsoever. Nor do you have any preconceived concept of how scuba gear should be arranged, connected or configured. Also imagine that you have access to any type of gear you wish, and that you must configure it in the absolute most efficient means possible, while simultaneously maximizing your safety. After thinking about this for a minute, if you are able to see how you might do things differently, then you have started down the path towards the Hogarthian Way.



Hogarthian gear configuration began, not surprisingly, with Sheck Exley whose style of breathing from the long hose was adopted by Bill Hogarth Main, who dived with Exley. Breathing from the long hose, according to Main, is safer and more efficient in an emergency, since an out-of-air diver will invariably rip the regulator out of your mouth rather than spend a lot of time searching for your octopus.

To make a long story short, Bill Main is a perfectionist. He began applying the "safer and more efficient" philosophy to every component of dive gear. He reduced the amount of gear taken underwater, he removed unnecessary D-rings and clips, and he rearranged his gear to promote efficiency and safety to the extreme. He examined every assumption and convention for soundness, and if they were found lacking he changed it. He developed his philosophy to be dynamic. The proper configuration for a warm water cave dive, for example, is different than that used for a cold water wreck dive in the ocean.

Bill Main's friendship with Bill Gavin lead to the development of the second component of the Hogarthian Way—the holistic component. It was Bill Gavin's philosophy that the most important piece of dive gear owned by a diver, is his own body. A healthy, well functioning body, Gavin argued, is both more efficient and safer while diving. Gavin even included the diver's attitude and state of mind as a component of the Hogarthian Way. A rigorous program of exercise, eating healthy foods, and abstaining from alcohol, tobacco and drugs are part of this philosophy.

George Irvine, director of the Woodville Karst Plain Project (WKPP), took this emergent philosophy and ran with it. He added the third and final component of the Hogarthian Way by arguing that the best dive equipment available should be used while diving. George started from scratch and purchased state-of-the-art equipment for every component of technical dive gear he required. He bought the best regulators, the best cylinders, the best dry suit, etc. that he

could find. And if a suitable component could not be located, he and Bill Gavin, who happens to be an engineer, designed it from scratch. The scooters used by the WKPP are one example of this. These scooters, custom built by Gavin and Irvine, are routinely used at depths of 300-400 ft. with a run time of more than two hours.

Describing all of the specific methods and techniques adopted by Bill Main, Bill Gavin, and George Irvine are beyond the scope of a magazine article. However, below are listed some of the specifics. Refer to the illustration for these descriptions.

Harness—A simple webbed harness should be custom fitted and adjusted so that the diver can easily reach all manifold knobs while wearing the harness in the water.

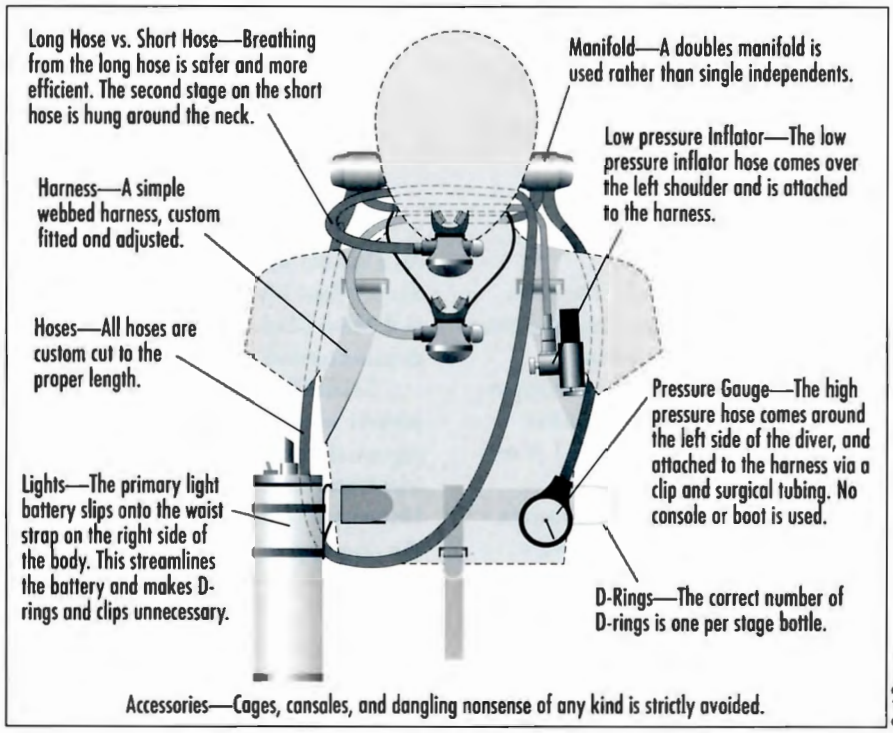
Hoses—All hoses, high pressure and low pressure, are custom cut to the proper length. The "one length fits all" philosophy of the manufacturers is rejected.

Long Hose vs. Short Hose—Breathing from the long hose is safer and more efficient as described earlier. The second stage on the short hose is hung around the neck with surgical tubing so the diver can simply dip his chin and bite the mouthpiece.

D-Rings—The correct number of D-rings is one per stage bottle. Stages are clipped at one end only so the other end can float behind the diver as he swims or scooters, thereby minimizing drag. The D-rings are bent slightly to prevent them from laying flat against the harness, which makes them easier to grab.

Manifold—A doubles manifold is used rather than single independents due to the complexity of air sharing rules with independents. Single independents are seen as prevention for a non-problem, a manifold failure, and only serve to complicate things.

Accessories—Everything should be firmly attached to the body or placed in pockets. Cages, consoles, and dangling nonsense of any kind is strictly avoided.



Curt Bowen

Lights—The primary light battery slips onto the waist strap on the right side of the body. This streamlines the battery and makes D-rings and clips unnecessary. Backup Lights should be streamlined by attaching to the harness with surgical tubing and a clip.

Low pressure Inflator—The low pressure inflator hose comes over the left shoulder and is attached to the harness. Dangling wing inflators or inflators hooked around the left arm are not acceptable since they increase drag and are potential entanglement hazards.

Pressure Gauge—The high pressure hose should come straight from the first stage, over the top of the wings, around the left side of the diver, under the arm, and attached to the harness via a clip and surgical tubing. Note that this is a pressure gauge only, gauge consoles and rubber boots are unnecessary and increase drag.

Personal Preference—Strict Hogarthians believe that there is only one best way. "Personal preference" is a euphemism for "I don't want to do it right."

Hogarthian philosophy attempts to prevent emergencies that can really happen rather than prepare for every possible emergency. This comes from the belief that most accidents don't happen as a result of equipment failure, but rather from the diver failing to adequately prepare. This can happen by divers not properly cleaning and servicing their equipment, or by overweighting themselves with too much equipment, or by configuring their equipment in a manner that is confusing, etc.

To use analogy: Volvo advertisements claim that if you are going to have an accident you are better off having one in a Volvo because they are heavier, stronger and built to survive an accident. BMW, on the other hand, claims that the best way to survive an accident is to not have one. They instead place emphasis on performance features like braking, cornering, and acceleration. BMW, albeit unknowingly, embraces the Hogarthian Way.

Following the path towards the Hogarthian Way may seem like a tall order to most divers. In truth, there are few purists. However, adopting principles like removing unnecessary dive gear, or saying no to that piece of cheesecake, or getting daily exercise are simple and cost free ways to begin the journey.

Win Remley is Co-publisher of DeepTech and a NAUI instructor.

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the subject of the research. The team made significant progress despite a nine day interruption by Hurricane Roxanne. The sixteen divers participating in the research and exploration surveyed 24,889 feet (4.7 miles) of new cave passage this year.

Exploration in the southeastern section of the cave by team divers Chuck Stevens, Eric Noftall, Eric Hutcheson and Mike Madden yielded the long sought connection to the Caribbean Sea at Cenote del Manatee. This connection marks the first time a major Yucatan cave system has been physically connected to the sea.

Significant advances were made towards connecting Nohoch Nah Chich with the adjacent Dos Ojos cave system by team divers Wes Skiles, Tom Morris, Eric Hutcheson and Mike Madden during six hour no decompression dives into the system.

Scientific studies during the project were conducted under the supervision of Dr. Elva Escobar of the Mexican National Autonomous University (UNAM) which continued the ongoing study of the cave system's water characteristics and fauna.

The month long effort was funded by the team director, Mike Madden and sponsorships provided by the Rex Foundation, Mr. Hank Manley of Manley Performance Products, American Underwater Lighting, and the Hotel Club de Playa Puerto Averturas.

Adding this years' expedition total to the previous exploration conducted by the CEDAM team, the Nohoch Nah Chich cave system now has 158,432 feet (30 miles) of surveyed passage.

The CHC 1996 EDAM and ERD Schedule

The Catalina Hyperbaric Chamber (CHC) has set March 17-22 and August 4-9 for their Emergency Diving Accident Management (EDAM) courses in 1996. The EDAM course is a Sunday-Friday intensive program offered to all divers interested in accident prevention, recognition, assessment, and treatment of DCS and air embolism cases.

CHC's annual Emergency Response Diver (ERD) course is scheduled for October 20-25, 1996. The ERD program is a hands-on, workshop style course dealing with boat and beach rescue techniques, effective CPR, and first aid.

The cost of either course is $600 and space is limited, early registration is recommended. Tuition includes housing and meals at the USC Wrigley Institute for Environmental Science. For more information contact Karl Huggins, USC Catalina Hyperbaric Chamber, P.O. Box 5069, Two Harbors, CA 90704, or call 213-743-2412, or fax 310-510-1364, or email huggins@mizar.usc.edu.

DAN's Project Dive Safety DAN

Divers Alert Network (DAN) has launched Project Dive Safety, an ambitious research project with an international list of participants. DAN Europe has also conjointly announced Project Immersione Sicura (Safe Dive) to augment the research.

The goal of the project is to collect one million dive profiles, dive outcomes and diver characteristics for DAN's research database by the year 2000. The data will be used to identify dive profile characteristics that contribute to risk of Decompression Illness (DCI) and other research projects.

A group of Field Data Coordinators (FDC's), research volunteers from all over the world, are being trained to collect dive data via small dive computers to be worn by divers as they dive these custom programmed computers collect and record all aspects of the dive for the database. The dive data is then downloaded to a computer and transmitted to DAN for collating and analyses.

For more information on Project Dive Safety contact DAN Research at 919-684-2948 x262, or write to DAN at 3100 Tower Boulevard, Suite 1300, Durham, NC 27707 USA.

EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT

Patent Foramen Ovale

By GEORGE**IRVINE**
and DAVID**DOOLETTE**

Commercial diving long ago discovered that there are certain preconditions that increase a divers risk of Decompression Illness (DCI). Identifying these preconditions can provide divers with the opportunity to optimize their decompression procedures and reduce accident rates. The British recreational diving community long ago discovered that rapid onset neurological DCI occurring in divers using computers who fulfilled all decompression obligations can be correlated with a condition known as Patent Foramen Ovale (PFO).

Simply put, a PFO, or cardiac shunt is nothing more than a physiologic defect that can allow a portion of the blood traveling through the heart to be shunted, or detoured, into the arterial circulation without having first passed through the lungs. In adults, blood entering the right atrium of the heart from the venous system, is pumped to the right ventricle, and is then pumped through the pulmonary arteries to the lungs capillary beds, where it is oxygenated before returning to the left atrium. The blood is then pumped into the left ventricle, and from there is pumped through the arterial side of the circulatory system supplying all the body tissue. Patent Foramen Ovale, Latin for "open oval hole," starts out harmlessly enough in all human beings during the prenatal stage of development. Before birth, there is a flap between the right and left atria of the heart (see figure 1). The fetus receives oxygenated blood from the placenta via the umbilical cord, which empties into the venous circulation and is carried directly to the right heart. The foramen ovale between the right and left atria allows this oxygenated venous blood to pass directly into the arterial circulation where it is needed, bypassing the useless, fluid filled lungs. When the baby is born, the lungs fill with air, and the resulting drop in right heart blood pressure below left heart pressure causes the flap to be pushed shut, and in time heals permanently closed. Or, at least it is supposed to (see figure 2). In an estimated thirty percent of the population, there is some degree of incomplete closure, or a "swinging-door" effect of this flap (see figure 3). These heart defects can range in severity from those that allow a minor leakage of blood, only under conditions of increased right atrial pressure, to those that allow unhindered shunting of blood in ten to fifteen percent of the population.

"Divers who have experienced rapid onset neurological DCI show a high incidence of PFO."

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Figure 1

Before birth, there is a flap between the right and left atria of the heart. The fetus receives oxygenated blood from the umbilical cord, which is carried directly to the right heart. The foramen ovale between the right and left atria allows this oxygenated venous blood to pass into the arterial circulation, bypassing the fluid filled lungs.

Curt Bowen

Figure 2

When the baby is born, the lungs fill with air, and the resulting drop in right heart blood pressure below left heart pressure causes the flap to be pushed shut, and in time heals permanently closed.

Curt Bowen

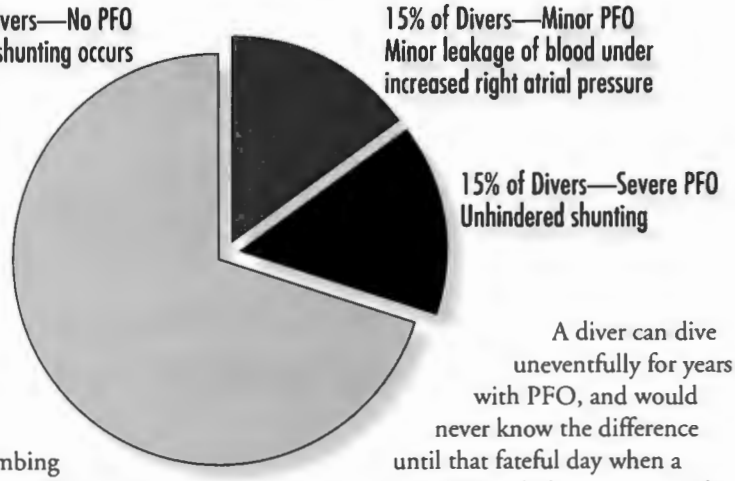
The reason that a PFO is a problem in diving is that the lungs help protect us from decompression illness. Upon decompression, bubbles form in the venous circulation, and these bubbles are normally filtered out of the blood as it passes through the lungs. While the body can withstand a considerable load of venous bubbles (silent bubbles) without symptoms of decompression illness, even a small quantity of arterial gas bubbles can cause debilitating, or life threatening, decompression illness.

Venous blood, containing bubbles, can be shunted across the heart via a PFO into the arterial circulation. These bubbles will distribute according to buoyancy in the large arteries near the heart, and very likely ascend the carotid arteries toward the brain. Bubbles passing through the brain disrupt normal function and may even lodge temporarily in the smaller arterioles, blocking blood flow and having the same effect as a stoke. Any body function can be impaired by the ensuing brain damage, but frequently affected are: urinary control, speech, and motor control. At worst, these bubbles can cause paralysis or death. This condition has been termed "paradoxical gas embolism," so named because of it's similarity to Cerebral Arterial Gas Embolism, one of the most dangerous forms of DCI, thought to occur as a result of breath-holding during ascent. Both these forms of DCI are characterized by neurological symptoms beginning either during ascent or within 30 minutes of surfacing. These conditions are often categorized under a dive industry euphemism called the "undeserved hit", because they can occur even if all decompression obligations are fulfilled.

Divers who have experienced rapid onset neurological DCI show a high incidence of PFO that allow unhindered right-left blood shunting, so divers with this condition probably have a higher risk of paradoxical air embolism than the rest of the population. In addition to a PFO, a paradoxical air embolism requires venous bubbles, but these form after most dives. Since you are reading this in DeepTech, it is safe to say that you may at some time

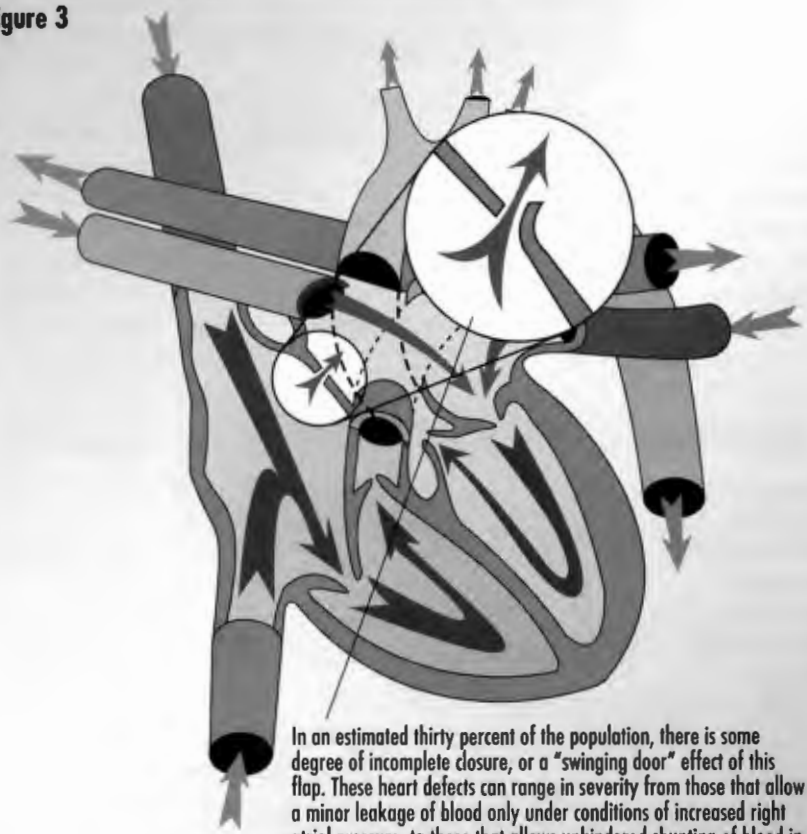
dive in a fashion that could lead to significant bubble formation, even if you don't typically build up large inert gas loads. For example: lets say you have been vacationing in the Solomon Islands for three days and are already residually loaded from your diving. Your regulator fails while under a short decompression obligation on a 100 foot dive. You have to do an emergency swimming ascent and bubbles form in your blood from skipping your decompression stop. Combine this scenario with a PFO and you may get DCI and end up in a wheel chair.

Divers with PFO that only shunts blood with increased right atrial pressure are probably not at increased risk of paradoxical air embolism. However, many circumstances can lead to increased right atrial pressure, and promote right-left blood shunting, and this might put a diver with any type of PFO at risk. The Valsalva maneuver, for example, can temporarily increase right heart pressure, which might also occur as a result of urinating in your wetsuit, coughing, sneezing, climbing a boat ladder, or lifting tanks. Right atrial pressure will also increase when blood flow to the heart is increased by a well-meaning but ignorant divemaster putting you in the Van Trellenberg position on a dive boat to relieve the bends that he is helping to cause! Another way could be that excessive venous bubbles cause the blood flow through the pulmonary capillary beds to become restricted, building back pressure on the right atrium.



A diver can dive uneventfully for years with PFO, and would never know the difference until that fateful day when a paradoxical air embolism occurs. Indeed, the statistics bear this out, since thirty percent of divers who have never had DCI have a PFO, just the same proportions as the rest of the population. Nevertheless, PFO is a concern for divers, and is just now getting some attention from the hyperbaric community. The figures suggest that a PFO should not stop you from diving, but you might stop and think about the risk and modify your diving habits. If you want to do high exposure dives, or even if you just want to eliminate this one DCI risk factor - get tested for PFO. An echocardiogram with Doppler will show most PFO's. This is simply an ultrasound scan of the heart done by moving the instrument over the surface while watching a TV screen, which forms an amazing image of the heart, valves, and blood flow. Modern ultrasound equipment will make the heart look like you are holding it in your hand, and the test is less expensive than a dive computer. An extended test and monitoring period of 30-45 minutes is recommended with efforts designed to setup PFO shunting. Some doctors already have this equipment and can perform this test in their offices. If not, it is a simple matter to schedule the test in your local hospital.

Figure 3



In an estimated thirty percent of the population, there is some degree of incomplete closure, or a "swinging door" effect of this flap. These heart defects can range in severity from those that allow a minor leakage of blood only under conditions of increased right atrial pressure, to those that allows unhindered shunting of blood in ten to fifteen percent of the population.

Curt Bowen

George Irvine is a Stockbroker and Director of the Woodville Karst Plains Project (WKPP), and has many cave exploration accomplishments to his credit. Dr. David Doolette is in the Faculty of Medicine at The University of Adelaide, Australia, where he teaches physiology and pursues his research interests in diving and hyperbaric physiology. David has been diving for 16 years and is an active cave explorer.

Risk and the Waiver

An Overview of the Legal Aspects of Risk Management (Part 2)

By BRET**GILLIAM**

Last issue we took a look at the basic elements that make up a law suit. Now let's take a stroll through some of the front line risk management precautions that can help to nip a law suit in the bud before it ever gets into court or mitigate damages later on down the line. We're talking proactive use of the arsenal of waiver & release forms available to the instructor.

These will generally include at least a medical history form and a general release of liability and assumption of risk agreement. No instructor or dive vessel operator should conduct their activities without proper use of such documents. They will be vital to any successful defense should an accident occur.

The whole idea of waivers and releases is to establish a contract between the student and instructor that stipulates certain understandings as to the nature of the activities about to take place in training. However, it's not enough to simply pass around a bunch of forms to be signed as the boat is pulling away from the dock and hope for the best. In many states, asking a student to execute such a release without time for sufficient contemplation or under threat of monetary loss will alone be grounds to deny applicability.

Assumption of Risk

First and foremost, the student must be made aware of the inherent risks and hazards associated with diving, particularly technical diving. This article is accompanied by an actual release form used by Technical Diving International (TDI) for all its courses. You will note upon examining its content that this document contains a variety of information that specifically identifies assorted dangers that might reasonably be anticipated. And, in no uncertain terms, explains that these nasty things could very well happen to you if you decide to participate in this type of diving.

The document further requires the student to represent his diving experience and prior training. This is to clearly establish that the person executing the release has a body of life experience in the sport, separate from the specific warnings as to hazards and risks, on which he may base his decision to participate.

For example, a person signing up for basic entry level scuba really has no understanding of the inherent risks of the sport until his instructor covers that material in his class. On the other hand, a certified diver with six years of diving in a variety of conditions and depths since his original training is already aware of most of the standard hazards associated with scuba participation. He can make an informed decision based upon that experience and prior training as to whether he wants to assume the risk of more advanced technical programs. And a judge or jury may hold him to his contract wherein he agrees that should he be injured or killed, he has effectively waived his recourse to sue the instructor.

"I suggest you take a reality pill and settle in for a grim introduction to the wonderful world of personal injury litigation. Bring your lunch, 'cause you're going to be a while."

That, in a nutshell, is the whole basis of upholding such documents: Did the person signing understand the risk and was he capable of assuming that risk? Secondly, did the person know that by signing such a release that he had legally abandoned his right to sue for anticipated hazards even including negligence on the part of the instructor?

Sign on the Dotted Line, Please

Now let's get into the nuts and bolts of making a waiver & release valid. The

continued next page ➡

Liability Release and Express Assumption of Risk

Please read carefully and fill in all blanks and initial each paragraph before signing at bottom. I,_____, hereby affirm that I have been advised and thoroughly informed of the inherent hazards of technical scuba diving activities.

_____ Further, I understand that diving with compressed air, oxygen enriched air (Nitrox), oxygen, heliox, or trimix involves certain inherent risks including decompression sickness, embolism, oxygen toxicity, inert gas narcosis, marine life injuries or other barotrauma/hyperbaric injuries can occur that require treatment in a recompression chamber. I further understand that the open water diving trips, which are necessary for training and certification, may be conducted at a site that is remote, either by time or distance or both, from such a recompression chamber. I still choose to proceed with such instructional dives in spite of the possible absence of a recompression chamber in proximity to the dive site.

_____ I understand and agree that neither my instructor(s),_____, nor the facility through which I received my instruction,_____, nor the training association, _____, nor any of their respective employees, officers, agents or assigns, (hereinafter referred to as "Released Parties") may be held liable or responsible in any way for any injury, death, or other damages to me or my family, heirs, or assigns that may occur as a result of my participation in this diving class or as a result of the negligence of any party, including the Released Parties, whether passive or active.

_____ In consideration of being allowed to enroll in this course, I hereby personally assume all risks in connection with said course, for any harm, injury, or damage that may befall me while I am enrolled as a student of this course, including all risks connected therewith, whether foreseen or unforeseen.

_____ I further save and hold harmless said course and Released Parties from any claim or lawsuit by me, my family, estate, heirs or assigns, arising out of my enrollment and participation in this course including both claims arising during the course or after I receive my certification.

_____ I also understand that technical diving activities are physically strenuous and that I will be exerting myself during this diving course, and that if I am injured as a result of heart attack, panic, hyperventilation, oxygen toxicity, inert gas narcosis, drowning, etc., that I expressly assume the risk of said injuries and that I will not hold the above listed individuals or companies responsible for the same.

This document is provided courtesy of TDI, 9 Coastal Plaza, Bath, ME 04530 207-442-8391, 207-442-9042

◀ Cut page along dotted line and photocopy for use in technical dive training classes.

_____ I understand that these activities may place me deeper than I am able to safely execute a free (without breathing gas) ascent from.

_____ I understand that I am to furnish my own equipment and that I am responsible for its operating condition and maintenance.

_____ I further state that I am of lawful age and legally competent to sign this liability release, or that I have acquired the written consent of my parent or guardian.

_____ I further state that I am already a qualified and certified scuba diver from the following training agencies:_____, and that I hold training to the level of_____. I am aware of the required certification level and/or experience necessary and recommended to enroll in this diving course and I stipulate that I meet those requirements for prior certification or equivalent experience. I have been a certified diver since_____and have been diving for_____years for a total of_____dives to a maximum depth of_____ft.

_____ I understand that the terms herein are contractual and not a mere recital, and that I have signed this document of my own free act.

IT IS THE INTENTION OF BY THIS INSTRUMENT TO EXEMPT AND RELEASE MY INSTRUCTORS, (AND OTHERS), THE FACILITY THROUGH WHICH I RECEIVED MY INSTRUCTION, AND TECHNICAL DIVING INTERNATIONAL, AND ALL OTHER RELATED ENTITIES AND RELEASED PARTIES AS DEFINED ABOVE , FROM ALL LIABILITY OR RESPONSIBILITY WHATSOEVER FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH HOWEVER CAUSED, INCLUDING, BUT NOT LIMITED TO, THE NEGLIGENCE OF THE RELEASED PARTIES, WHETHER PASSIVE OR ACTIVE. I HAVE FULLY INFORMED MYSELF OF THE CONTENTS OF THIS LIABILITY RELEASE AND EXPRESS ASSUMPTION OF RISK BY READING IT BEFORE I SIGNED ON BEHALF OF MYSELF AND MY HEIRS.

_____ _____

Signature of Student/Participant Date

_____ _____

Signature of Parent or Guardian (where applicable) Date

_____ _____

Witness Date

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student is entitled to a reasonable atmosphere of reflection and thought before being asked to enter into such a serious contract. The instructor should advise all students at the time of enrollment that a waiver & release will be required as a condition of participation. Then the document should be offered well in advance of the actual diving day.

Asking a class to sign waivers a few minutes before departing on the boat does not meet the spirit of the release. Especially if it is implied that a student may forfeit any fees already paid if they refuse to sign. Duress of any kind, whether emotional peer pressure or financial loss, will probably cause a judge to cast a less than sympathetic eye on the release should Joe Diver meet with a mishap on the dive that day.

I handle execution of the waiver & release documents as one of the most important parts of my relationship with students or divers participating in tech activities. I explain at the outset that this is a formal contract that affects their legal rights and the rights of their family. I reaffirm that this a potentially hazardous activity and that accidents can happen even if both the student and I perform to the best of our ability. I read the entire document out loud and after each paragraph ask for any questions. Then I have each student initial that section in the line provided.

I remind them that this form requires them to be truthful and honest with regards to their experience, training and capabilities. I always make sure that the form is witnessed by a third party.

And finally, I explain that if they have any reservations about participating they may withdraw without any loss of face and with a full refund. I also encourage them to discuss their participation in detail with family members so they are also fully appraised of the potential for injury or death. It's not a session that is particularly pleasant for either student or instructor, but it is one that won't be forgotten. I do the briefing with all students present as a group so everyone is equally aware of the material I've covered. In the event of an accident, they can confirm as witnesses the extensive detail I covered in a thorough explanation of the releases.

It's serious stuff. It's necessary to cover all aspects soberly and professionally without any distractions. Teach your programs in strict observation of the relevant agency's course standards and try to anticipate situations where accident scenarios will arise. In technical diving, we have a duty to screen less experienced or underqualified divers out of the programs. Sometimes this can be a difficult reality but you may save a diver from themselves in the process.

Accidents can happen. They may be due to events beyond anyone's control or ability to have foreseen. The British have a wonderful legal term for the basic "Shit Happens" accident scenario. They refer to this as "death by misadventure". This sounds even better with the proper accent. And in their legal system, it's unusual for someone to recover damages in such a case.

But if you're counting on that to protect you in the U.S. where people sue each other in such nonsense as dog paternity actions, well, I suggest you take a reality pill and settle in for a grim introduction to the wonderful world of personal injury litigation. Bring your lunch 'cause you're going to be awhile. And you better hope you packed some properly executed waivers & releases. Otherwise it's heartburn.

Use the risk management tools available and teach defensively. You can take that advice to the bank.

Bret Gilliam is a 25 year veteran of the diving industry and President of Technical Diving International (TDI). He pioneered much of the technical diving industry standards on insurance coverages. Regarded as one the top experts for diving liability issues in the U.S., he has made over 150 court appearances in both plaintiff and defense cases for civil and criminal actions.

Deep Air

IS IT UNSAFE, OR REQUIRED TRAINING?

By HAL**WATTS**

Do we need Deep Air Diving? This question has come up often since mixed gas diving has gained popularity in recent years. Some mixed gas divers and instructors believe that since mixed gas training is readily available, deep air diving is suddenly unsafe and should no longer be taught. More on this later. First let's define deep air diving. Deep is a relative term—relative to the diver, the equipment, and the diving environment.

The Diver

One problem with any level of training is that a diver takes a class and then seldom, if ever, does the type diving that was learned in the course. Lack of qualified dive buddies and inaccessibility of extended range dive sites are but two reasons for this. Once an advanced level of training is completed, the diver must participate in this type of diving in order to maintain the skills. Extended range diving requires that the diver do three things, practice, practice and practice.

Extended range diving is similar to flying an aircraft in that emergency procedures must be in the forefront of one's brain. I happen to be a pilot and I can remember my flight instructor telling me that whenever I'm in the air, I should always be looking for an emergency landing site, and to rehearse what to do in case of a stalled engine or loss of fuel. Humans do not naturally find themselves 200 feet in the air nor 200 feet below the surface of the water. To be in either place requires proper equipment, training, attitude and planning.

Most flying incidents are "pilot error", not equipment failure—just like diving. I use the word incident rather than accident since accidents are usually unavoidable. In diving, most incidents are avoidable if divers would plan their dive, and dive their plan. Divers must be qualified and practiced for a given dive or it may very well be considered too deep—no matter what the depth.

Equipment

This is the tricky part. Just how much equipment do you need to do a deep air dive? To quote Bret Gilliam, President of TDI, "Don't wear so much gear that you look like a traveling dive shop. Wear just enough to make the dive in the safest manner." This may not be his exact words, but the idea is the same. I fully agree with Bret. There clearly have been incidents caused by a diver carrying too much gear, just as there have been incidents caused by not having enough gear.

The four requirements to maximizing safety in extended range diving are: training, equipment, dive planning and dive execution. To leave out any of these would be flirting with an "incident." When a diver takes a deep air course from a qualified and certified instructor, the instructor will assist in the selection of equipment, so as to ensure not too much and not too little.

Environment

The physical environment is more important than most divers believe. Making a deep air dive to 100 ft. in Nassau on the wall with 100 ft. visibility, no current and warm water is one thing. Making a 100 ft. dive in the Northeast USA in February with 40°F water, limited visibility and a ripping current is a bit different. I'm not saying that diving in the Northeast isn't fun—they have some excellent wrecks there. I'm merely pointing out that what may be considered shallow diving in the Bahamas would be considered deep in the Northeast. There have been fatal incidents in Mexico, the Bahamas and other tropical sites that may have been caused by the fact that the waters were warm, clear and had little or no current. How can this be, you may ask? These tropical dive sites lack the environmental cues that signal divers used to more harsh conditions that they are, in fact deep. Cues like poor visibility, thermoclines, and currents are absent causing some divers to be lured into a false sense of safety. It is easy to exceed your dive plan in these settings and get into trouble. A diver should receive training in the environment that they are planning to dive in.

Is Deep Air Training Needed?

Yes, I'll explain. Most extended range divers will eventually want to have custom blended nitrox for their dives and/or decompression gasses. Use of custom nitrox blends is taught in a technical nitrox course by most training associations. Most associations have deep air certification (to 170 ft.) as a prerequisite for technical nitrox. A depth of 170 feet is deep in any environment. This may sound strange coming from a person who holds the world record deep air cave dive (415 ft.), however, as stated in the beginning of this article, deep is a relative thing. The gas switching skills used in technical nitrox courses are taught and learned in deep air courses. A deep air course is better for teaching these skills since air is more forgiving than trimix or heliox.

Additionally there are times when a mixed gas diver, in an emergency, will have to switch to air at depth. If they have not been trained in deep air, or if they have no experience with deep air, they may not be able to cope with the narcosis, thus precipitating an incident. Mixed gas diving has its place and will continue to grow in popularity, but the skill foundations should continue to be learned in deep air classes.

Hal Watts is founder and president of The Professional Scuba Association (PSA) and an instructor trainer for IANTD, TDI and SSI. He is the owner of Forty Fathom Grotto, a dive training facility in Ocala, FL. Hal can be reached at: 1994 Palm Lane, Orlando, FL 32803-1547, 407-896-6294.

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A Peek Inside the Lab at Cochran Undersea Technology

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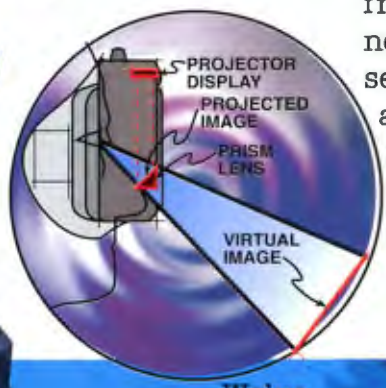

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