UNDERWATER SPELEOLOGY

National Speleological Society
Cave Diving Section
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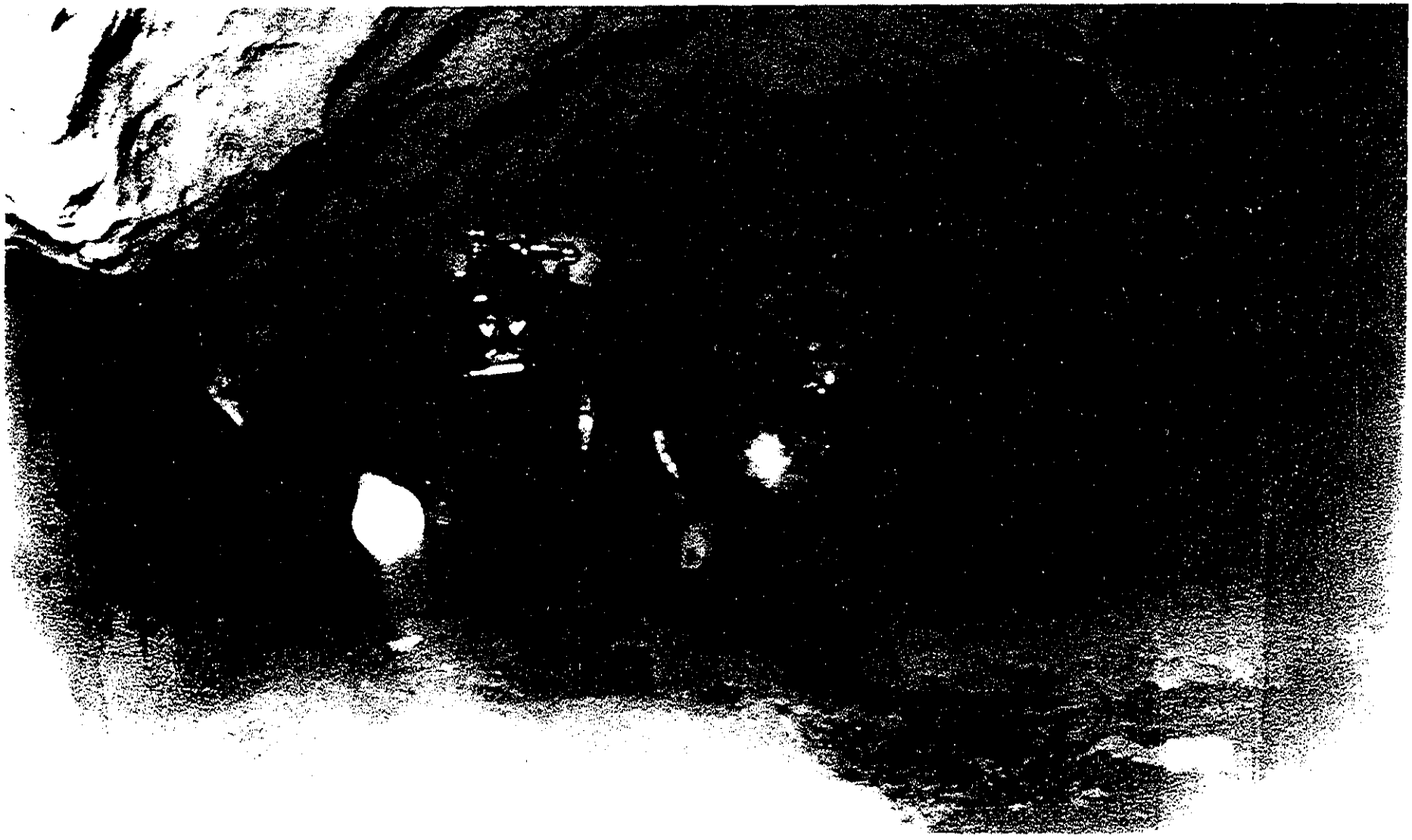
Wes Skiles and H.V. Grey in Bonnet Spring
Photo by John Zumrick, M.D.



UNDERWATER SPELEOLOGY

The official publication of the Cave Diving Section of the National Speleological Society, Inc.
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Magazine Submissions — We welcome all news items, articles, Letters to the Editor, photos, slides, cartoons, and other items of interest or importance to the cave-diving community from all members, subscribers, and other interested parties. They should be sent directly to the Editor, Carl Sutton (see address on left column). We can also use text processed in most IBM-compatible formats. (Please contact the Editor directly for details and arrangements.)

Advertising — The NSS-CDS Board of Directors has approved the reinstitution of paid commercial advertising for *Underwater Speleology*. Please contact the Editor, Carl Sutton, for information and arrangements (see address on left column).

The NSS and Cave Diving — Founded in 1941, the National Speleological Society joins together thousands of individuals dedicated to the safe study, exploration, and conservation of caves. The first cave-diving information ever published in the United States was in a 1947 *NSS Bulletin*. In 1948, NSS divers were responsible for the first cave dives in the United States using scuba. Prior to 1973, cave diving within the NSS was on a purely local level. That year saw the creation off the NSS Cave Diving Section to provide a vehicle for information exchange. Today, with over 750 members, the Cave Diving Section promotes safe cave diving through semi-annual workshops; cavern- and cave-diving training programs; warning-sign installations; search, rescue, and recovery through the National Cave Rescue Commission; cave exploration and mapping; several texts and publications on cave diving; and the bimonthly magazine, *Underwater Speleology*.

NSS Membership — The National Speleological Society welcomes the interest of anyone who has a sincere concern about the safety, study, exploration, and conservation of caves, wet or dry. You may join the NSS either by writing directly to its main office (National Speleological Society, Inc., Cave Avenue, Huntsville, AL 35810) or to the Cave Diving Section. Annual membership is $25.00 and includes subscription to the NSS's monthly magazine, *NSS News*, as well as voting privileges and discounts on publications and conventions.

CDS Membership — As a sub-organization or "section" of the NSS, the Cave Diving Section is subject to the bylaws and ethics of the NSS. Membership in the Cave Diving Section is open to anyone who is a member in good standing of the NSS. Annual membership is $10.00 per year and includes subscription to the CDS's bimonthly magazine, *Underwater Speleology*, as well as voting privileges and discounts on publications and workshops.

Subscription — If you do not wish to join the NSS and CDS, but would like to keep current on cave-diving events, exploration and technology, you are invited to subscribe to *Underwater Speleology* for $20.00 per year.

CDS TO EMPLOY GENERAL LIABILITY WAIVER FOR ALL MEMBERS

Frank Howard (NSS #27187), Chairman

Negotiations for the NSS-CDS to assume management of Yana Spring have encountered delays. At this time is it not known when that arrangement will be initiated. However, the NSS-CDS is expected to take over management of Alachua Sink before the end of calendar year 1992. Details on the acquisition of Alachua Sink will be published separately.

The NSS-CDS does not carry liability insurance. To protect the organization in the past, a series of liability waivers have been used for individual activities. The management plans envisioned for use at unmanned sites such as Yana Spring and Alachua Sink will require that liability waivers exist in advance to protect the organization, the Board of Directors, Guides, and Instructors. In addition, all volunteers from Board members to Workshop workers are in need of protection while contributing their services to everyday NSS-CDS activities.

Therefore, a general liability waiver will be installed as a condition of membership in the NSS-CDS effective January 1, 1993. This waiver has been prepared to protect the organization and its members for all activities. Legal advice has been employed in the finalization of the form and its contents.

The liability waiver will be mailed to each member along with a membership renewal form for each membership renewal due as of January 1, 1993. Renewals due after January 1, 1993 will not be accepted without the waiver.

Waiver use is necessary for the continued acquisition of management rights and control of underwater caves and for the protection of volunteers that serve on the Board or provide other services on behalf of the NSS-CDS.

This waiver policy is essential to the continued growth of the organization. The Board of Directors is unanimous in requesting all members to recognize the need for this measure and asks that all members support the adoption of the liability waiver as a means of protecting the long-term stability of the NSS-CDS. ■

CARL SUTTON TO EDIT NEXT ISSUE

Our new Editor, Carl Sutton, will be producing our next issue, the November/December issue, of *Underwater Speleology*. All articles, news items, announcements, letters to the editor, advertisements, cartoons, etc. should be sent directly to the new Editor.

Please make a note of his new address and new phone numbers:

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Carl plans to have a "Forum" topic discussed in each issue, which will include articles and interviews with instructors and other prominent divers. An important feature of the Forum will also be short responses from readers to topical questions. Brief, pithy answers are what are wanted here; no more than two paragraphs (the amount that would fit on a small note card or back of a post card). The topics for future Forums are:

NOV./DEC. - How do you plan your air for stage diving and why? Is there more than one safe method? For instructors: What do you teach?

JAN./FEB. - Is the number of required training dives adequate? For instructors: How can we help improve the experience of our students?

MAR./APR. - Should the NSS-CDS modify standards to allow for deeper diving during training? Why or why not?

MAY/JUNE - How important is the S-drill before each dive? For instructors: Is this a practice used only with students? Describe.

Carl needs these short responses well in advance of the publication date of the issues. Please start thinking about your answers to these questions and send them on in. ■

IMPORTANT NOTICE FOR CURRENT ABE DAVIS AWARD APPLICANTS

There has been a change in the application requirements for the Abe Davis Award. Abe Davis Award Coordinator, Wendy Short, announces the following:

All current applicants of the Abe Davis Award must submit a summation of their 100 cave dives. This summation should include information such as dive number, date, location, and maybe other information such as maximum depth, time, and partner. Any applications received without the summation will be returned. If there are any questions, please contact Lamar Hires, Training Chairman (contact information on inside front cover). ■

DIEPOLDER #2 REVISITED

A spokesman for Florida Speleological Researchers, Inc. has provided the following update on exploration activities at DiePolder #2 in Weekie Wachee, Hernando County, Florida:

September 26, 1992 marked the first of a series of dives made in an attempt to continue the survey of this going system. Using the new German twin 160-cu.-ft. cylinders with double stage, a small team (Gordon Watkins and Dustin Clesi, supported by Rich Nicolini and Sheck Exley) entered the downstream "Grand Aquifer" and penetrated another 495' into the syphon.

Known passage beyond the Flagroom was more than doubled—bringing surveyed passage to 1,200' beyond "the Pit" (below 320'). Two huge rooms were discovered at an average depth of 370', with the new line terminating in a small syphon tunnel at 390'.

Survey data indicate that known passage in the downstream cave is almost under DiePolder #3 Sink, although almost 100' deeper. Florida Speleological Researchers hopes to tap the "Lost Downstream" of #3 Sink that has never been discovered....by continuing exploration of this route. Other dives are targeting the upstream "Grand Aquifer." ■

ERRATA FOR ARTICLE ON LA GROTTE HENRI-COSQUER IN LAST ISSUE

Letter to the Editor (Carl Sutton),

October 16, 1992

Dear Editor,

"Discovery of Prehistoric Paintings by Cave Diving..." by Marc Van Espen (pages 7-8 in July/August issue).

There was an editorial change in the above article, where the words "by Oliver Wells" were added in the top line:

[Translated and revised by x Oliver Wells from: *Hippocampe* (Seahorse), Bulletin de la Ligue Francophone de Recherches et d'Activités Sous-Marines...

The above very kind editorial change makes me feel uneasy. Marc Van Espen approved the editing process, provided extra information in response to questions and put the article into its final form. The translation was carried out by my wife, Pamela Wells, and her brother, Paul Hubbard. I would like to ask that these three names should be added at the point marked "X."

Recently he wrote: "...I was back in the cave in June during four days. It was a wonder to be there with the scientists and have LIVE comments and explanations. They found a lot more engravings than...already known. There was a publication of the first scientific results.... The video movie we took in June is now ready for broadcasting on the French TV..." (J. Clottes, A. Beltrán, J. Courtin and H. Cosquer: "La Grotte Cosquer [Cap Morgiou, Marseille]," *Bulletin de la Société Préhistorique Française,* Vol. 89, No. 4, pp. 98-128, 1992.)

Unexpectedly we found ourselves in Spain in July and visited a cave with prehistoric paintings in it (La Cueva de Tito Bustillo). I had not realised how absolutely splendid these paintings can be and can recommend a visit if you ever get the chance.

Best wishes for your term as UWS Editor.
All the best. Yours,

Oliver Wells ■

MERRITTS MILL POND LABOR-DAY OUTING

by Eric P. Tasso (NSS #23744), Activities Coordinator

The Second Annual Merritts Mill Pond outing was held over the Labor Day weekend. Cave divers from all around gathered to enjoy some of the fine diving available in Marianna. Unfortunately, the weather did not cooperate, so we stayed as wet above the water as we were below.

For many, this was their first dive at the pond and the underwater conditions could not have been better. On Saturday, Bill Foote of Ocala and Kelvin Questel of Wooster, Ohio went on the downstream dive at Hole in the Wall. The rest of the group did a dive at Twin Cave. After the dive, we were welcomed back to camp by members of the Tallahassee Grotto, who had filet mignon and potatoes already cooking on the grill. There is nothing like a great home-cooked meal after a long dive.

Following dinner, Bill Foote and David Cope brought out their guitars and picked some tunes until all hours of the night.

Some members of the group camped at the Arrowhead Campground on the Mill Pond site. Those of us whose idea of camping is a room without room service stayed warm and dry at the Comfort Inn. As Sunday's weather improved slightly, Dan Lins and I prepared to explore the end of the Century tunnel line past London Bridge.

After analyzing the nitrox mix in both stage bottles and securing our backmounts, we began moving the equipment to the dive site. With 10 tanks and two scooters between us, it took us awhile to get all the equipment set up and ready. We were appreciative of the assistance from Rick Wolfe and Kyle Creamer of Roanoke, Virginia and Watson Boxley of Atlanta, Georgia since the site at the mill pond is not exactly easy to access. Two hours later, we were finally in the water. One of the most intriguing parts of the dive occurred at the end of the line some 5000' from the entrance where we found a remnant of pottery.

After 175 minutes of bottom time and a maximum depth of 107', we began our decompression. During this time, I speculated about the length of the dives that were required when the original divers laid this line. Since we were diving tables designed for Nitrox I with oxygen, we only spent 102 minutes decompressing rather than the 203 minutes stipulated on air tables. It is amazing how many advances have been made in this sport over the last few years and difficult to predict what impact mixed-gas computers will have on decompression time when this dive is repeated.

After reflecting on the trip, I hope this trek becomes an annual event to allow other divers to get the opportunity to experience this out-of-the-way dive site. Hope to see you next year! ■

WARNING: THEFTS OF EQUIPMENT UNDERWATER CONTINUE

There have been additional incidents recently of line reels and other equipment being stolen out of caves. Yet another diver was caught red-handed removing someone else's reel from a dive site. When asked to "explain" himself, the diver is reported to have said that he didn't think reels should be left in caves for any reason. (This, evidently, was his justification for declaring open season on other people's equipment.)

Fortunately, no one has been killed (murdered) yet as a consequence of these thefts; however, there have been some close calls. In one instance reported to the Editor, a gap reel was stolen at the exit side of the Mud Tunnel in Little River only moments after its owners exited by the main tunnel sharing air after an out-of-air emergency past the Florida Room. Had the cave-diving team had their out-of-air emergency earlier, while still in the Mud Tunnel, and come to the end of the Mud Tunnel line in low visibility and not found their gap reel at the exit side, they could have run out of air while searching for the main permanent line.

When they donor diver went back in to retrieve the gap reel, which had his name on it in large letters, he encountered another solo cave diver swimming out with it. At first he thought this individual had seen them sharing air on their way out and retrieved their reel to assist them. But during discussion on the surface the other diver said he hadn't thought that anyone else was in the cave, and that the reel had been "abandoned." He was also reported to have told them that he found Little River a very productive location, easily yielding him a couple of "abandoned" reels each weekend.

In another instance a primary reel run from the cavern to the start of the 70' tunnel was stolen out of Peacock while the divers were making their dive. Again, had they encountered bad visibility or had some other time-consuming emergency deep in the system, they may well have drowned—as have so many open-water divers who didn't have a line down to the 70' tunnel—while searching for the entrance.

Law-enforcement officials recommend marking your equipment, such as reels or tanks, very conspicuously with your name and Social Security number. Go to the extra trouble of having this information very conspicuously engraved indelibly on several sides of the gear. Tape and magic marker can be removed and reels or tanks sold as ostensibly

above-board "used" gear. Having your gear engraved with large, highly visible letters and numbers will make your gear a little less attractive to thieves looking for a quick resale.

Be suspicious of any used gear offered for sale that looks as though an attempt has been made to cross through identification marks. Don't hesitate to call your local law-enforcement agency to check on the bona fides of a piece of equipment being offered with a name and social security number on it, if they differ from those of the person attempting to sell you the equipment. (Report any thefts of gear marked with your name so that they can be entered into the NCIC computer.).

Team up with other cave-diving groups when possible and coordinate your gearing up, diving, and gearing down so that at least one team is on the surface at all times, guarding vehicles and making note of any other suspicious activities or persons.

What's the old joke?—"Never mind the dog; beware of Smith & Wesson"? Well..."Never mind the cave; beware of other divers with sticky fingers." ■

THE SAFETY LINE

by Wendy Short (NSS #30802), Safety Coordinator South

Dive planning is one of the fundamentals we all learned as new scuba divers. All too many times, however, dives just seem to "happen," without much forethought at all.

Thorough dive planning is essential to safe and enjoyable cave diving. The more complex the dive, the more time that should be spent working out the details. Some essential elements of diving planning are:

- Buddy teams—who goes with whom. If the group is large, it may be best for two people to pair up in a team even though the group is diving as a whole.
- Know the approximate bottom time for the dive and decompression requirements. Be prepared to decompress longer than you have anticipated. Make sure all stage bottles, oxygen, etc. are in place. You may want to post a spare decompression bottle even if you don't plan on using it.
- A team leader is assigned to every dive. He should make sure he has a primary reel, be familiar with the passage, and be sure he wants the responsibility of leading the dive. Usually this person is the most experienced one in the group.
- What is the goal of the dive? Exploration, enjoyment, penetration, a circuit? What pace will be set?
- Each phase of the dive should be reviewed, such as which passages to take, who will gap the jumps, etc. The more complicated this step is, the simpler the plan should be.
- Contingency plans are important. What if the dive is called before the objective is reached? For instance, if you're doing a circuit, at what point do you turn around the way you came, or when do you continue and complete it? If these issues are discussed beforehand, there will be no surprises. What if's are important. Try to discuss all possible complications and how they would get resolved.
- Discuss emergency procedures. All divers should be certified in CPR. Where is the closest phone, and is there a 911 number? Where is the nearest chamber and emergency room?
- The S-drill, safety check, and knowledge of your buddy's ability and equipment are important to the predive plan. Note your buddy's starting air pressure and expected turn pressure.

After the dive plan is discussed, each team member should verbalize the entire plan to the others so there will be no misunderstandings. Make a mental note during the dive of how much time and air it took you to reach key points in the cave; that will assist you in future dive planning.

If you have anyone waiting for you on the surface, tell them what time you expect to be up or at your decompression stop. (That way lunch can be ready and waiting when you're done.) "Plan your dive and dive your plan" is always a good philosophy. ■

LINE TRAP: AN INCIDENT

by R. D. Milhollin (NSS #29962)

Following a recent discussion with John Zumrick, I became convinced that sharing details of cave-diving incidents that did not result in tragedy, but could have, might help other divers avoid similar situations, perhaps preventing a future accident.

We can all learn from our own mistakes, and we can also learn from the mistakes of others. This is not an accident analysis; it is simply the narrative of a dive that caused anxiety. Cave divers with similar or related experiences are invited to prepare them for publication in future issues of *UWS*.

[Editor's Note: the author is a CDS Cavern Instructor.]

In June of 1992 I was involved in a series of dives on Cozumel with local Cavern Instructor Chuck Jones, Houston Cavern Instructor Terry Scoggins, and Texas cave diver Dr. Ise Kalsi. One of the dives involved descent into a rarely dived cenote which featured dark, red-stained tannic water toward the surface and fist-sized, sponge-like percolation at depth.

The first dive was made by Terry and Ise, who returned to report a huge room with fine visibility below 60'. The line in place was described, then Chuck and I agreed our objective would be to search the lower edge of the room for phreatic passage. Of course, any diver involved with such a venture should be fully cave trained and well experienced in cave diving under varying water conditions. Our equipment included double back-mounted 80's and separate K-valves.

I led the dive in, tying off the guideline at the surface. Chuck and I descended through low visibility down a short chimney and found a line tied off almost immediately, much sooner than Terry and Ise had described. Following this line, we descended at a 45° angle toward the large debris cone on the bottom, knowing that Terry had described a vertical drop. This was a little disconcerting at first, but we quickly realized we were on a different line than the first team. Our line ended at 130', tied off to a large log on the edge of the debris cone.

After exchanging OK's and signals to proceed with the search, I secured the search line to the exit. We moved slowly through a low wall opening with a smooth rock ceiling into a slightly vaulted passage running parallel to the main room. My hope was that this was the main tunnel of a branching cave system, and that the cenote we had entered was an offset sink, a rather familiar feature of the local geography. In reality this "passage" was just a continuation of the main chamber, with a lower ceiling and an unknown thickness of extremely fine silt from the debris cone forming the floor and part of the wall.

My mistake occurred as I entered the low area and turned to the right to explore the "tunnel." The line had to be placed against the ceiling, but I neglected to check the security of the placement. Once I got inside and began swimming forward, the line moved away from the open area I had entered and headed directly into the debris cone. Even with careful kick strokes the visibility behind my fins immediately deteriorated, so Chuck held on to the line at the log waiting for me to signal or for the silt to settle some.

I could see ahead and soon realized that forward progress would be blocked by the massive silt accumulations. After checking all possible leads, I turned around in the near-zero-visibility passage and began to follow the line back out to where my buddy waited. Of course, the line continued out, but now it led me into an impassible area between the silt-laden debris on the floor and the limestone ceiling. Not realizing the danger, I continued to reel out until things began to get tight, and I was finally wedged thoroughly in the trap.

I have been in small spaces underwater, and I have plenty of experience in zero visibility, but this was the first combination of the two in which the line out did not seem to lead to where I remember I had been before. Not a good feeling! The breathing resistance began to increase, probably due to low air in one tank combined with the thick, silt-laden liquid environment I now occupied. I would need to change second stages soon, and it would be difficult since I was severely wedged front and back, the other regulator nearly out of reach in this position and probably filled with mud.

At this point I realized my mistake. Line trap is a classic cave-diving predicament stressed at all levels of training. The first thoughts to cross my mind were "What a stupid mistake," "What will my friends say?" and "What a stupid way to die." I knew that panic was a real possibility, and would probably prove fatal. Only by banishing such useless thoughts and concentrating on the problem at hand could I successfully overcome this problem.

Drawing a deep, long breath, I began to crawl backward, away from the entrance, and began a series of three distinct tugs on the line, hoping to get Chuck's attention. The first few signals brought no answer, but I was slowly working free of the gravel, mud, and rock that had arrested my progress. Still no return signal, and, of course, at this most stressful of times—in no visibility and with no obvious way out—the reel jammed. Just then I felt the first of the return signals. Chuck was at the other end of the line after all, and following the line in, he had noticed the problem and rerouted the line. I could feel the line move to the side, and began to swim along it.

In my disoriented state it seemed to be heading the wrong way, but logic said the line had to go out. After what seemed like hours of inching along the line I felt a hand. I signaled "OK," then "Turn," and a few kickstrokes later emerged into clean water.

Still a little shaken, we took a few moments to check all gear and air supplies. Seeing that all was intact, we completed an initial scan of the area we had set out to survey, then began a slow ascent, completed the required decompression and exited. The red sun peering down through the forest canopy was a most welcome sight.

On reflection, I credit the exceptional training received at

each level of the NSS-CDS progression, which enabled me to rationally analyze the situation and to act appropriately. I further realized that the ability to remain calm and to control thoughts was at least partially the consequence of several years of cave diving in less demanding conditions, working up slowly to deeper dives, longer dives, more complex dives.

I did make a mistake. At each level of cave-diving training line traps were discussed. Yet a line was laid which slipped. Did I learn from this experience? You bet. Just as importantly, I hope someone else does, too. ■

RECENT ACCIDENTS — Editorial

In his article, "The Role of the Environment on Diving Safety," which appears elsewhere in this issue, Cave Diving Instructor Dale Fox generously gives the cave-diving community top marks for publicly documenting, analyzing and discussing cave-diving accidents with "the goal of determining what went wrong and of publicizing how others can avoid repeating the human error."

Unfortunately, however, the preparation of such analyses and reports is anything but a pleasant activity. As a consequence, the task has all too often fallen upon the editors of *Underwater Speleology* and *The NACD Journal* by default. (This editor, for one, will be incredibly glad not to ever have to write up such a report again!)

Accident analysis, however, is essential to the safe pursuit of our sport. This honest self-criticism cannot be avoided if we are to prevent similar accidents from occurring in the future. Even reports of mere "incidents" such as Cavern Diving Instructor Robert Milhollin's "Line Trap: an Incident" above provide invaluable and courageous insights into the causes and prevention of potentially life-threatening accidents. Readers are encouraged to report any lessons they may learn from similar episodes for the benefit of all.

I admit to having "fallen down" on the job on the last issue and not getting on the phone and badgering recovery divers and surviving buddies for the details. I confess that the thought of dragging through writing about yet another series of accidents was more than I could bear. But there's no getting out of it: If the facts as best I have been able to get them on short notice are not printed for other cave divers, the fatal errors may be repeated.

HOLE IN THE WALL, Merritts Mill Pond, Jackson Co., Florida. In late summer a very experienced dry caver from Australia, who had had a little cave-diving training, but who had not completed his full cave certification, drowned in Hole in the Wall. He was using all borrowed equipment that included twin-mounted 104's with independent K-valves. This was reportedly to have been his last cave dive before departing from the country. Reportedly, he had never dived the cave before or dived with his dive partner, nor was his partner very familiar with the cave system.

According to verbal reports, their destination was "Alfred's Room." They turned the dive on air. When the deceased went to switch regulators, he had a malfunction of some kind. As he was not terribly familiar with proper air planning for independent twins, he had not planned or managed his air with the proper balance, and was very low on air in his first tank. Shortly afterward, he signaled out of air to his buddy and the two attempted to share air with the buddy's long hose.

The deceased was reportedly having difficulty with controlling buoyancy. He was allegedly terribly negative and his buddy attempted to compensate for it with additional buoyancy. At one point the deceased apparently lost his grip on the regulator he was sharing and plowed into the thick silt on the flow, creating a heavy silt cloud, while the buddy shot towards the ceiling. Not knowing how far away they were from the entrance and now being low on air himself, the buddy elected not to attempt to search for the other diver in the local zero-visibility conditions, but to exit the cave immediately.

Recovery divers located the deceased's body only a couple of hundred feet from the entrance; one of his tanks was completely dry, the other had considerable air in it.

Commentary: Air planning and management for independent tanks is considerably more complicated than for a dual-valve system, and it greatly increases task loading. For these reasons, it is mostly discouraged for novices. Maintaining the recommended tank-pressure balances in conformance with the thirds rule would have gone a long way towards preventing this fatality. Clearly, unfamiliarity with the borrowed equipment and resultant lack of buoyancy control in a cave system with a terribly silty floor, also greatly complicated the air-sharing on the way out. Though it is easy to sympathize with a visitor's desire to get in as much cave diving as possible on a potentially once-in-a-lifetime trip, this, unfortunately, does not render the advice to build up experience slowly and conservatively any the less sound.

BLUE SPRINGS, Orange Co., Florida. On Oct. 1, a diver with an open-water divemaster rating died in Blue Springs, Orange County. The deceased and his buddy, also an open-water divemaster, were reportedly each diving a single 72 with no octopus regulators. They had no line or reel, and only a single light each. Both had dived at the spring frequently. At a depth of 110-120', near the crevice at the bottom of the spring where an extremely strong outflow of water passes on either side of a large boulder lying over the crevice, the surviving diver apparently popped the low-pressure hose serving his power-inflator. This caused the low-pressure hose to free flow and the surviving diver signaled for them to head up immediately. Shortly after the hose blew, the surviving diver ran out of gas, gave the out-of-air signal, and the pair began buddy breathing off the deceased diver's single second stage.

A dispute arose over the proper direction to take in order to exit the spring, with the deceased pulling further into the spring and the surviving diver pulling towards the exit. The surviving diver allegedly took a last deep breath from his

buddy's regulator and opted to free ascend. He was spotted by two cavern or cave divers (equipped with doubles and long hoses) on their way down. They gave him a long hose and breathed him up to the surface. At the surface the surviving diver told them that his buddy was still below. One of the rescue divers immediately went down after the missing diver. However, he was found with the regulator out of his mouth and attempts on the surface to administer CPR and mouth-to-mouth failed to resuscitate him.

Both of the divers' tanks were old and several years out of both VIP and hydro. The deceased's single steel 72cf tank was found to contain some 2400psig. The survivor related that the deceased routinely pumped his old steel 72 (rated to 2250psig) to 3500psig.

Commentary: Lack of proper training and equipment for the cave environment unfortunately took their frequent toll.

ALACHUA SINK, Alachua Co., Florida. In July, a newly certified cave diver died in an upper cavern area after becoming separated from the line in zero visibility during a sneak, night dive. The sinkhole is considered an advanced cave dive at best and visibility conditions in the basin were extremely poor due to the summer algal bloom.

A fairly short distance into the dive, the deceased and his surviving buddy realized that they had missed the main tunnel and turned the dive. In the low-visibility conditions, the surviving diver thought his buddy was in front of him and reeled out of the cave. When he reached the surface and realized that his buddy was still underwater, the surviving diver attempted several line searches and then went for help.

Rescue divers arrived quickly, hoping to be able to rescue the missing diver, who would still have had plenty of air at that depth, and began conducting an extensive search for him in what they reportedly described as the worst visibility conditions ever encountered at the sink. Attempts were even made to pump in fresh water in an effort to improve the visibility. Though he was carrying the small safety reel specifically recommended for lost-off-the-line emergency scenarios, the diver was apparently unable to find his way out, and it took recovery divers more than three days in the extremely poor visibility, to find his body.

Commentary: The exceptionally poor visibility made a difficult, advanced dive extremely difficult and advanced. The admonitions of highly experienced cave divers to build up experience slowly and conservatively cannot be repeated often enough.

DEVIL'S EYE, Gilchrist Co., Florida. In late summer a certified cave diver diving what was reportedly analyzed as a 39-40% nitrox mixture died during a stage dive deep into the system. The divers staged in on compressed air to the beginning of the Hill 400 jump, at which point they switched to their nitrox mixtures. At some point during the exit portion of the dive, the deceased apparently lost consciousness.

The family declined to allow an autopsy, so the exact cause of death is not known for certain; however, oxygen convulsion is suspected as a possible cause of death, although depth vs. partial pressure considerations were not beyond accepted valances. A detailed report has been promised regarding this accident.

ROUBIDOUX SPRINGS, Missouri. Just a few days ago, a trained cave diver died during a fairly routine penetration of Roubidoux Springs. It is something of a mystery as to exactly what happened and why, as there were apparently no equipment irregularities or malfunctions. At press time gas samples were still being analyzed and accident analysis was still in progress. A full report will be in the next issue.

WRECK DIVING ACCIDENTS. The wreck-diving community has been hard hit this summer, with a number of fatal and nonfatal accidents involving missed decompression on deep air dives and pushing of nitrox partial pressures resulting in convulsion and drowning; some involved divers trained in cave diving. These accidents are of concern to the cave-diving community because of shared concerns involving decompression, deep diving, mixed-gas management, and the problems of an overhead environment.

Of tragic loss to the cave-diving community is the death of father and son, Chris Rouse, Sr. and Chris Rouse, Jr., after a deep air dive on a U-boat in the Atlantic. A time-consuming delay caused by collapse entrapment or line entanglement at 220-230' apparently caused the pair to have a greatly extended bottom and to miss almost all of their decompression stops. Chris, Sr. reportedly collapsed on the ladder climbing into the boat, and Chris, Jr. died during treatment at the hospital. They will be deeply missed by many of their friends in the cave-diving community.

Other accidents included a fatal oxygen convulsion on the *Arundo* by a wreck diver who routinely made lengthy dives with nitrox mixtures that resulted in partial pressures of close to 2.0 and who routinely preached to other divers against the "excessively conservative" partial-pressure standards set by the U.S. Navy and NOAA.

There was a drowning of an inexperienced diver on the *Andrea Doria* who was diving trimix and ran out of air. The diver was reported to have had difficulty "managing his gas" on previous dives and was also using the tri-mix for suit inflation. (Water temperature was 45° and helium is noted for its high thermal conductivity.)

A cave-trained police diver drowned on a tri-mix dive on the *Andrea Doria* after apparently having gotten lost off the main line. Analysts believe he left the line to explore just a little further for artifacts without attaching any kind of gap reel. His primary light apparently failed, leaving him with only a single small secondary light with which to search for the exit. He ran out of gas and drowned before the rest of the team was able to locate him.

An experienced wreck diver reportedly in good physical condition making an air dive on the *Chester Polling* apparently suddenly lost consciousness on ascent from 170' and drowned in the arms of his dive buddy. According to reports, the surviving buddy called the dive after about 10-15 minutes and began to ascend to 140' to free their anchor. After returning from one last foray to the bottom, the deceased signaled that something was wrong, but didn't indicate what.

His partner took hold of him and began to ascend. The deceased diver went limp at around 90' and his regulator fell out of his mouth at 80'. At 15' the surviving diver removed the deceased's weight belt, inflated his BC, and sent him to the surface. The buddy completed 5 minutes of decompression, then surfaced and began breathing O_2. A nearby sailboat picked up the drowned diver and radiod the nearby Coast Guard Station. CPR efforts were unsuccessful. ■

CDS INSTRUCTOR ROSTER

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THE ROLE OF THE ENVIRONMENT ON DIVING SAFETY

by A. Dale Fox (NSS #22604)

[The following is a written version of a presentation made by the author, a CDS Cave Instructor, to the Armed Forces Institute on Pathology Perspectives in Diving Safety Seminar in Washington, D.C. on November 14, 1992.]

There is a saying to the effect that everyone wants to go to Heaven but no one wants to die—at least no one wants to die while participating in a leisure-time activity. If safety means reduced personal risk, then the desire to enjoy the pleasures of diving more than once has been the prime motivation for adapting our diving equipment and techniques to the underwater environment since man first ventured below the surface.

The world underwater is, as we know, a magnificent and beautiful, yet totally impassive, environment. It is, in a manner of speaking, the world's original equal-opportunity employer. It cares not a whit about race, sex, age, religion, level of education, social status, or political affiliation—it treats all mistakes with equal detachment. It often treats them brutally.

For humans, being underwater is also being in a foreign environment. Whether mankind was created or evolved makes no difference. We are land animals whose underwater survival is dependent as much on machines as it is on intelligence. Our safety underwater is, in fact, directly related to the equipment we use and the degree of intelligence with which we use it.

Over the years we have devised and built many varied diving devices in our pursuit of safety and comfort underwater. Not all these inventions have enjoyed equal success. Some worked. Some did not. Some, like dive bubbles, were gimmicks. Some, like power inflators, were inspired. All sought to meet a need and all contributed in some way to the current state where diving equipment is colorful, comfortable, functional, and reliable. Indeed, equipment designers and manufacturers have been very responsive to our demands for safe, reliable and moderately priced equipment. Just walk into any dive retailer and you'll see a bewildering assortment of every conceivable type and style of diving equipment. Not just the standard mask, fins, snorkel, wetsuit, tank and regulator stuff, but very advanced stuff like cameras, scooters, computers, metal detectors, bang sticks, powerful canister lights, line reels, dual manifolds, and Lord knows what else—all of it to help us survive in a potentially hostile environment and to enjoy it more.

What has all this to do with the role of the environment in dive safety? Nothing. Large-volume BC's, easy-breathing regulators, powerful lights, pony bottles, spare airs, chemical light sticks, computers, line reels, and the host of other equipment are nothing more than benign things which, in and of themselves, contribute nothing to dive safety. Safety comes from marrying up quality dive equipment with the diver's intelligence—the diver's desire to learn and understand the underwater environments and to develop and hone the necessary diving skills; the diver's wisdom to study how best to use equipment while practicing the art of scuba diving in various environments; and the diver's discipline to maintain a positive attitude toward diving safety.

It is my contention here—and this may offend some—that with one notable exception the dive industry has generally failed to address effectively how best to incorporate the plethora of available diving equipment into safe diving practices. With one notable exception the dive industry has generally failed to devote continuing and coordinated effort to understanding the impact of the various underwater environments on the safety of the sport. And with one notable exception the dive industry has failed to instill in divers a commitment to diving safety—the positive attitude that will promote safety throughout their diving careers. We, as an industry, spend more time instructing people in the "what" and the "how" of diving then we do in the "why." We seem to think that conditioning divers to jump through a predetermined series of skill hoops is all that is necessary—it goes a long way, but there is more.

The notable exception is the cave-diving community, which has, since its very beginnings, been painfully aware of the extremely harsh environment of the underwater cave. (I once had a student tell me that, as in foxholes, there are no atheists in underwater caves.) Cave divers have spared no effort to develop and refine the specialized techniques and procedures necessary to maximize cave-diving safety.

On the whole, cave divers have a healthy attitude towards accidents and incidents—they view them as object lessons from which the rest of the community can benefit. When a diving accident occurs in open water, our industry, fearing, I suppose, lawsuits and adverse business impacts, tends to clam up. The result is that any lessons to be learned from a tragedy are, at best, filtered to the diving public over a period of years or, at worst, are forced to be learned over, and over, and over again.

As a general rule cave-diving accidents are documented, analyzed and discussed with the goal of determining what went wrong and of publicizing how others can avoid repeating the human error—and virtually all diving accidents, including those in caves, can be traced to human error. In other words, cave divers tend to take responsibility for their actions and, when accidents occur, they are far more willing than open-water divers to point fingers, even at themselves.

Cave diving is statistically the most dangerous form of diving. As a ratio of the number of deaths to number of dives made, more scuba divers die in caves than in any other scuba-diving environment. One paper that categorized leisure activities according to their level of personal risk included open-water scuba diving in the "Risk Activity" category—where a performance failure might result in some degree of injury. It

included cave diving in the "High Hazard" category—where a performance failure is almost certain to result in death.

Statistics on cave diving are clear and these statistics have kept most divers and most diver training organizations from participating in cave diving—a good thing, from a selfish point of view. The sad part is that while the general diving public seems to be aware of the environmental risks associated with cave diving, they don't seem to be equally aware of the environmental risks in wreck diving, quarry diving, ice diving, river diving, rescue diving, archaeological diving, reef diving, ad nauseam.

Mark Twain, in misquoting a Disraeli line, is reputed to have said that humans make three types of statements and in descending order of reliability these statements are lies, damn lies and statistics. The statistics on cave diving are not as clear as they at first appear to be. If we look closely we find that fewer than 4% of all cave fatalities have occurred to divers formally trained in the techniques of cave diving. **More than 96% occurred to divers untrained for the cave environment.** This, I think, is the telling statistic—among trained cave divers cave diving is arguably the least dangerous form of scuba diving.

Cave divers, it turns out, are light years ahead of the dive industry in studying and understanding the demanding nature of their environment, in thinking the safety problem through carefully, in analyzing promptly cave-diving accidents and publicizing the results of these analyses, in selflessly sharing information in public fora, and in forming cave-training agencies which, while competitors, work together far more effectively than do other training agencies, in a true spirit of cooperation to advance the safety of cave diving rather than wasting their energies and priceless time in senseless fights and squabbles over the unimportant.

Let's look for a moment at this environment called the underwater cave and then look at the diving safety procedures it has spawned.

Underwater caves are formed in a variety of ways. There are lava caves formed during volcanic eruptions. There are sea caves formed by the relentless pounding of the sea and surf against rocky cliffs. There are coral caves, the most wide ranging of all cave types, that form as part of normal reef development.

The most elaborate cave type, however, and the one where most cave divers spend

their time, is the solution cave. This type of cave is formed over aeons by the acidic and eroding action of water on rock—specifically, soft and porous rock such as limestone. As water seeps through the rock's pores it slowly dissolves and carries away the rock, leaving behind great underground passageways called caves. (It is somewhat humorous to note that medieval alchemists spent their lives in search of the universal solvent, never realizing that they were drinking it.) Many of these passageways lie not only underground but also underwater. On our continent solution caves can be found in a great many locations, but they occur most spectacularly in Florida, Mexico and the Bahamas.

The solution cave is often long, many having miles of explorable passages. The solution cave is generally erratic, composed of twists and turns and drops and rises, having any number of explorable passages while also having an endless number of dead-ends. The solution cave may have tiny tunnels that one might be able to barely squeeze through or it may have incredibly huge, almost cathedral-like rooms hundreds of feet across.

The solution cave may have always been underwater and, consequently, have comparatively smooth and apparently nondescript walls; or, the solution cave may have at one time been a dry cave, in which case it is likely to have the familiar stalactites, stalagmites and other features so common in dry caves. The solution-cave system may, like the Devil's Eye system in Florida, have only a single practical (or known) point of entry and exit or it may have many. Entrance to a cave is either through a spring, where the water flows out, or through a siphon, where the water flows in. The entrance may be wide and easy or it may require a vertical power swim and pull against the current of a first-magnitude spring.

Once inside the cave the diver may be confronted with an array of environmental obstacles—various forms and quantities of silt; major and minor restrictions; current; light-absorbing black walls throughout; unexplored and unmarked passageways; various lines in which to get entangled; loose rock formations with their attendant risk of collapse; a totally foreign environment that constantly challenges the diver's ability to maintain orientation; and, increasingly, multiple dive teams in the cave at the same time causing the presence of multiple lines and the increased possibility of confusion and siltout when dive teams meet.

The very nature of the cave confronts the diver with a few easily identifiable environmental and performance challenges. First, it is an overhead environment where the diver's ultimate ace-in-the-hole—the ability to make a direct ascent to the surface—is removed. The "Thumb Up" signal no longer means surface immediately. It means the whole long dive must be retraced prior to surfacing. You cannot just go UP. You must first go OUT.

Second, the overhead environment puts a premium on air-supply management. As open-water divers we are conditioned to plan for a 500psi air reserve—to be back in the general vicinity of the exit point with about 500psi of air in our cylinders and to be on the surface with about 300 psi for our snorkel back to the beach or boat. As cave divers, and other penetration divers for that matter, we do not have the "general vicinity" luxury—we must arrive at the exact point of egress and must plan our dives not just to have enough extra air to extricate ourselves in the event of an emergency, but enough to extricate a buddy as well.

Third, when swimming in a tunnel only a few feet in diameter it is often difficult to be conscious of depth changes. The normal stimuli that open-water divers use, temperature and light changes, are not present in a cave. It becomes easy to find yourself calmly venturing deeper and deeper as well as further and further. The risks of narcosis and decompression sickness thus lurk throughout the cave.

Finally, cave divers carry large air supplies both for emergencies and to enable longer dive times. Additionally, for a variety of environmental, ecological and safety concerns, the cave diver generally refuses to wear gloves and often no hood. (Florida caves are 72°F year around and the caves of Mexico and the Bahamas are even warmer, though nowhere near warm enough to keep our bodies from cooling.) Combining longer dive times with increased exposure to cold results in an increased risk of hypothermia, with its significant side effects of increased probability of DCS and of diminished mental and physical agility.

In addition to the physical challenges of an underwater cave, there are psychological challenges to be recognized and confronted. These take the form of stresses that the cave diver must manage. There is the PHYSICAL stress caused by carrying equipment that weighs up to, and perhaps beyond, two thirds of the diver's body weight. Carting this load to the entry point on a hot afternoon can be an exhausting endeavor causing a significant reduction in a diver's performance capabilities.

There is the stress caused by TASK LOADING. The sheer magnitude of the physical and mental tasks that must be performed on every cave dive, even the easy ones—toting heavy equipment, air management, depth management, anti-silt swimming techniques, line discipline, combating currents, etc.—constitutes a significant add-on to the diver's stress baggage.

There is the stress that comes from a LOSS OF VISION, which can develop because of light failure or because the diver's lights were inadequate or because of a siltout. Even the most experienced cave divers in a very familiar cave will sense the cave as a new, unfamiliar environment when the lights are dimmed or removed.

There is the stress that comes from a LOSS OF ORIENTATION—getting lost in the cave. Line breaks, separation from a line, off-line siltout and sudden flow change all can effect adversely the diver's sense of orientation—that oneness with the environment that makes all types of diving so enjoyable.

There is the TIME-PRESSURE stress that results from myriad other concerns that the diver may have. Does my buddy know what to do in an emergency? Will I get lost or trapped in the cave? Have I given proper care to equipment reliability? Are my silt-control techniques going to be adequate? Am I adequately trained and prepared for the dive I am doing? Will some jerk steal my decompression bottles while I am in here? These are some of the pressures that the diver faces constantly. And the preeminent time-pressure stress question, Do I have enough air to complete this dive while handling any emergencies and conducting the required decompression?

Separately, each of these stresses can be handled easily. When they are all present at the same time in the same cauldron, however, the total stress load can become a major impediment to safe diving. These stresses are controlled by thorough and continuing training, experience and preparation for each specific dive. Cave divers learn from the very beginning that no cave is ever to be dived casually—regardless of how many times the cave has been dived before. All are to be dived with equal caution, respect, and preparation.

What has the cave-diving community done to address the dangers of cave diving and to promote cave-diving safety? As mentioned earlier, more than any other community, cave divers have systematically and openly addressed the problems and sought workable solutions. The basic methodology used is Accident Analysis.

In his booklet, *Basic Cave Diving - a Blueprint for Survival*, published in 1979 by the Cave Diving Section of the National Speleological Society, Sheck Exley, one of cave diving's most celebrated explorers and devotees (and a man who admits to being visibly nervous when not surrounded on all six sides by rock), published his analysis of the circumstances surrounding cave deaths. His hope was to discover the common threads of correctable human error, if any, among these deaths. He was able to isolate three rules for safe recreational cave diving—at least one of which was broken in each analyzed death:

A. A failure to have a continuous guideline back to open water.
B. A failure to confine the dive to depths of no greater than 130 feet.
C. A failure to observe the Rule of Thirds in air management.

Since publication of Sheck's booklet, two additional rules have been added:

D. Failure to have at least three working lights.
E. Failure to be trained in cave-diving procedures.

Accident Analysis was the methodology used to arrive at a set of governing safety principles for cave diving and it is the methodology in use today to keep the sport as safe as it can be. Accident Analysis, rather than being the statistical game so popular today, is a scenario-based analysis. Whenever and wherever cave-diving accidents occur, with or without the loss of life, the cave community, more than any other, is prompt to gather all available data and eye-witness accounts on the things that lead up to the accident, the equipment worn, the experience level of the divers, and the actions taken after the accident occurred. The background scenario is then published in the journals of the two cave-diving training associations. The goal is to educate other cave divers on the specific environmental situation encountered and on the human errors made. The philosophy is that when it comes to diving accidents, once is enough—that while there may be a need for every mistake to be made once, there most certainly is no need for every diver to make every mistake once.

Knowing that the overwhelming majority, over 96%, of all cave-diving deaths are of divers untrained in cave-diving procedures, the community self-polices, on a regular basis, the more popular underwater cave sites to keep untrained people out. A growing number of springs prohibit non-cave-trained divers from carrying lights. Instructors who take divers into caverns as the "fun and excursion" portion of open-water check-out dives have found themselves reported to their parent agency. Most such instructors do not appreciate this procedure and think that it is an overreaction. This forum is not the place to justify this procedure except to say that it was born of too many cave divers having to recover too many bodies from too many caves.

Every true cave diver considers it a personal responsibility to prevent non-cave-trained divers from going into underwater caves. This is not always an easy task as virtually all untrained cave divers wanting to "just look" at an underwater cave firmly believe that there is no undue risk, or that their personal experiences have given them the requisite skills to dive caves, or that they don't need special cave training because they didn't have special training when they began to wreck dive and ice dive, or (the worst ego of all) they are scuba instructors and can handle any situation. All of these people argue with you. Some do even dumber things.

I have had open-water divers blindly follow me into a cave because I had the big light and they wanted to see. One, after being escorted out of the cave and politely, but firmly, lectured, brazenly turned to her daughter and told her that she also should follow someone in for a look (!). Recently, an untrained cave diver with no working light followed a team of cavers equipped with double 104's nearly a thousand feet back into a cave before he was accidentally spotted. At the time he was extremely low on air. He is alive today because Providence caused one cave diver, just accidentally, to look behind him at the right time. Many dive plans have been ruined or delayed by thoughtless open-water divers not heeding sound advice and compelling cave teams to stand at the ready just in case. Many of these egos have become the subject of Accident Analysis.

The NACD and NSS-CDS have an aggressive program to visibly mark all underwater caves, at their entrance, with large, easily readable and understandable signs that warn divers of the hazards of going beyond—signs that bluntly say that divers die in caves—even instructors.

All of the caution, training, and preparation in the world will not prevent accidents from occurring. As we bang our cylinders off of cave ceilings we may damage the valves, causing a loss of precious air. Murphy's Law ("Bread always falls buttered side down") is alive and well in the underwater cave. Equipment will fail at the most inopportune time ("inopportune time" being a not too technical term for "inside a cave"). Divers will become narked. Hypothermia will confront some. Stress will take its toll, causing over breathing and poor judgment. All the exhortations notwithstanding, some divers will fail to monitor their air supply.

Because accidents will happen, cave divers spend a lot of time preparing their equipment and themselves to handle emergencies. They have instituted a great many diving innovations, many of which have been carried over into other diving disciplines.

- They first experimented with a variable-volume buoy-

ancy device for diver positioning in the water column.
- They tape mask and fin straps to prevent line entanglement.
- They route hoses under their arms to reduce their silhouette and to minimize silting.
- They have lights and other attachments on VERY short tethers to avoid entanglements, silting and damage to the cave.
- They weight themselves to be neutral AT DEPTH and thus gain better buoyancy control.
- They secure all equipment to their bodies/cylinders and ensure that none dangles down to snag lines and disturb the silt.
- They use a 7-foot octopus hose for air sharing while swimming single file through major restrictions.
- They eliminated the snorkel.
- They use BC "wings" to reduce the diver's profile and to provide BC support for heavy cylinders.
- They developed the Benjamin, or ideal, manifold in 1970.
- They developed the procedure for staging cylinders to permit further penetrations.
- They developed the first regulator-connected BC power inflator in 1971 for better buoyancy control.
- They developed the "snag-proof" guideline reel.
- They developed the cylinder side-mount configuration for traversing major restrictions.
- They developed the procedures for caging regulators and cylinder valves to prevent damage caused by banging into cave ceilings.
- They developed the marking arrows (Dorf Markers) and protocol for marking permanent and temporary guide lines in a cave.

Because an equipment malfunction in an overhead environment can be fatal, they are zealots when it comes to redundant equipment:

- Two regulators, both first and second stages.
- Two cylinders and ideal manifolds (although there is still discussion on the benefits of manifolds versus independently rigged cylinders).
- At least three lights.
- Two Line Reels.
- Two small knives.
- Two masks.

The increase in the number of diver propulsion vehicles in caves has generated a corresponding increase in the amount of attention and discussion given to the development of recognized procedures for using DPV's. Among them:

- Rules of the Road
- Air-sharing techniques
- Special equipment needs
- Training programs for using DPV's in underwater caves

But more important than the modifications to existing equipment, than the development of new equipment, than the development of specialized cave-diving procedures and techniques, was a single major contribution to diving safety that the cave-diving community gave to the entire diving industry. Long before PADI, long before NASDS, long before SSI, long before NAUI or the YMCA, or Los Angeles County or anybody else, cave divers in 1953 established the first formal diver training program in the United States, complete with written standards and written performance requirements. This was done by the Florida Speleological Society a scant one year after the first recorded U.S. open-circuit-scuba cave dive in the United States and only four years after the first commercial open-circuit scuba equipment was imported into the country in 1949.

In response to the demands of their environment, cave divers developed the now familiar techniques of penetration cave diving—techniques that are applicable to virtually all overhead-environment diving:

- Rule of thirds
- Anti-silt kicking techniques
- Line-reel use
- Emergency Procedures for overhead environments
- Diligent and detailed buddy checks prior to all dives
- Emergency-procedures practice prior to most every dive
- Three-person cave buddy team
- The decompression dive review and post-dive review

Cave divers have gone a long way towards proving that caves don't have to kill—that when you understand your environment, be it a cave, a wreck or open water, diving can be among the safest of risk activities.

None of what I have said is meant to say that cave divers are possessors of pure wisdom and do not do some dumb things. They do. In pursuit of more underwater time some double disk and over-fill cylinders. Prior to the common use of mixed gasses in cave diving, some cavers, in the quest for further and further exploration into caves, have pushed air diving beyond what a rational person would consider safe depth limits. Some make a habit of solo cave dives (the ultimate lack of redundancy). Some "home brew" their nitrox and tri-mix with less than due care.

Nor does any of what I have said in any way demean the contributions to dive safety or equipment development made by hundreds of divers in other scuba-diving disciplines. The diving industry has enjoyed a great parallel growth with a great many dedicated pioneers contributing to the overall advancement of our sport.

However, when it comes to a concentrated evaluation of their environment and the specific techniques, procedures and equipments necessary, cave divers, as a group, have been more organized and more directed and, I believe, more committed than have other diving disciplines. Cave divers can take just pride in the professional and unselfish manner in which they have approached their sport, analyzed their environment, developed specific skills and techniques, and instituted training programs to permit others to dive safely in underwater caves.

All this being said, however, in reality, when compared to the rigors of real cave diving, the 15 dives in a cave-diving training program no better impart the necessary skills and

techniques than does a standard entry-level scuba course when compared to the rigors of open-water quarry or reef diving. The substantive difference between open-water and cave training is not the number of dives made or the specific techniques taught, the substantive difference is the development in cave divers of a safety attitude that is based on a realistic awareness and discussion of both the beauties and the dangers of the cave environment.

It is fairly easy to teach technical knowledge. It is also fairly easy to teach mechanical skills. It is difficult to develop attitudes. Being difficult, attitude development is too often sacrificed in the training process or is given insufficient attention. Too many open-water scuba courses concentrate on cycling the student through little more than theoretical knowledge and a cookbook of individual skill requirements, with precious little focus on how the knowledge and skills fit together in various underwater environments to develop a safety-conscious diver. Cave-diving training is, arguably, more sophisticated than are most other diver-training programs—not because the skills and knowledge are more advanced or difficult, but because cave-diver training seems to be better at developing a safety awareness in the student. Cave training more effectively accomplishes training in the "what," the "how," and the "why."

This is the real relationship between the environment and dive safety—the realization that the diver is a guest in a foreign environment and that the environment is not going to change to meet the diver's needs. It is the diver that must adapt. This is the attitude that we must instill in ourselves, our students, our dive buddies—to respect the underwater environment both for its beauty and for its dangers.

For those of us who are instructors, the challenge is to adapt our training curricula to more fully develop a safety awareness—to more fully develop those positive attitudes that will forever predispose our students to think about and practice safety above all else. This positive attitude towards diving safety will last far longer than will competency in the mechanical skills we teach or in the sometimes esoteric knowledge we impart.

For those of us who dive, the challenge is to develop in ourselves the same positive attitude. We need to train ourselves to not be self-conscious about our attention to the basics of equipment maintenance and buddy checks and emergency-procedures practice. We need to train ourselves to analyze each and every dive with the goal of making the next one safer and more enjoyable. When we make a dive and fail to learn or relearn something, then we have become overconfident and cocky and are more likely to make a mistake. As I said earlier, the underwater world is a marvelous and welcoming environment, but one that is prone to treat mistakes unforgivingly. ■

ADDRESS CHANGES

Changes of address should still be sent or phoned in to the CDS Secretary, H. V. Grey, P. O. Box 12, Nokomis, FL 34274-0012, 813-484-7834, or mailed to the CDS's permanent address: P. O. Box 950, Branford, FL 32008-0950. ■

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CAVE DIVER'S USE FOR A SNORKEL #114

Courtesy of Joe Prosser

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