Underwater Speleology

Journal of the Cave Diving Section of the National Speleological Society

Volume 50, No. 1
Spring 2023

NSS-CDS 50th Year Anniversary
1973-2023

Paul Heinerth, Master of Ceremonies

Register here!

Tales from the Back of the Cave

A panel discussion with early cave divers. Learn how they developed their techniques, equipment, and the skills required to push, survey, and name the springs that we dive today. What was it like to be some of the first divers to explore Diepolder, Eagles Nest, Madison, Peacock and Wakulla? This is a rare opportunity. Don't miss it!

Conference itinerary on p. 39 and on the Facebook Group Page

Speakers: Guy Bryant * Larry Collins * Lamar English * Steve Forman
Paul Heinerth * Woody Jasper * Mark Long * Mike Poucher

Guy Bryant donated this design for the conference's commemorative shirts. Sheck Exley hand drew this image on a tee shirt as a gift for Guy. Guy will bring the original to the conference for everyone to see.

Cover: Andy Preas lights up a formation at Cenote Buena Vista, part of the Tajma Ha cave system near Xpu Ha, Mexico. © Natalie L Gibb 2019

Underwater Speleology

Volume 50, Number 1
Spring, 2023

features

columns

EDITOR
Barbara J Dwyer

SENIOR EDITOR
Michael A Raymond

ASSOCIATE EDITOR
Jenna Kreider

CONTRIBUTING EDITOR
Michael Menduno

Underwater Speleology (UWS) is published quarterly (four times yearly) by the NSS-CDS, 295 NW Commons Loop, Suite 115-317, Lake City, FL 32005.

UWS is a membership benefit. Information about membership fees and registration can be found at https://.nsscds.org.

Please send address changes to cds-manager@nsscds.org or to 295 NW Commons Loop, Suite 115-317, Lake City, FL 32005.

NSS-CDS is a 501(c)(3) nonprofit organization.

chair's note

Fellow cave divers —

This year we mark the NSS-CDS's 50th anniversary. In 1973, cave diving members of the National Speleological Society (NSS) organized to form the Cave Diving Section during the annual NSS meetings in Missouri and Indiana. Sheck Exley was the first chairman. In addition to training and exploring, Sheck published Volume #1, Issue #1 of the journal that later became *Underwater Speleology*. He also made the drawing that will be used on the conference tee shirt.

By 1976, the NSS-CDS was the largest cave diving organization in the world, a position that it has maintained continuously since that time.

May 2023 conference. Our workshops are one of our strongest ways of sharing information. The 2023 International Cave Diving Conference on Memorial Day weekend promises to be a stunner. We'll kick off the weekend with a Friday evening social at the Harkness Armory in Lake City. It's a great opportunity to catch up with friends before settling down to discussion on Saturday.

Back by popular demand, some of our veteran cave divers (many of whom still are diving) will talk about the excitement of scoping out new systems, diving with the equipment that they created and modified, and how cave diving and exploration have evolved.

Our sponsors have generously donated door prizes and raffles ranging from rebreathers, wings, and computers to a week's lodging and cave diving in Tulum with gas and guided cave diving included.

The annual members' meeting will be held (in person) during the conference.

Winter workshop. I would like to thank Gayle Hall, Lee Ann Waggener, the speakers, volunteers, sponsors, and attendees who made a chilly but sunny Winter Workshop at Hart Springs such a huge success in January. We had planned for a maximum number of about 100 attendees, based

by Andrew Pitkin

on past attendances at similar events of 60-70 people. One hundred and twenty five people attended, which shows that there is a real appetite for in-person meetings with great content.

Unfortunately I missed all of the presentations as I was outside with Natalie Volk, Dave Lizdas, and Matt Vinzant setting up ropes for the vertical workshop, which many people seemed to enjoy. The workshop presentations were videoed, however, so any of us who missed them will be able to view them shortly. We're working on getting them posted.

A special thanks to Adam Hughes, who put in a lot of the work to make the Hart Springs workshop happen. Adam also is organizing the Annual Conference, which is almost here. Join us in Lake City over Memorial Day weekend.

New cave diving sites. The CDS has been working with the State parks to open two new sites, Meeting House and Clearcut Sinks. The 717-acre Ferrell Tract has been incorporated into the Edward Ball Wakulla Springs State Park, but some improvements need to be made before these can be opened to the public. Terry DeRouin is leading the fundraising effort, and organizing volunteer work parties to get the sites ready for opening. The whole cave diving community needs to thank him for pushing this project along. We will keep you posted about progress, and as soon as we know when these sites might be open for diving, we will let you know. Meanwhile, check out the story on page 6.

On a somber note, we lost two of our longtime members, as well as a friend of the springs, last month. Joe Citelli, a previous Chair of the NSS-CDS, lost consciousness while conducting a training dive on the Lowrance wreck. He was brought to the surface and eventually to a hospital but did not survive. A memorial fund has been started in Joe's memory.

Captain Tom Macmillan died, apparently in his sleep, at his home in Charleston, SC, in mid April. We will have more in the next issue.

Mark Wray, owner of Ginnie Springs Outdoors, also died in early April.

Rebreather Forum 4. I have just returned from Rebreather Forum 4, held in Malta. It had been over 10 years since the previous event, Rebreather Forum 3 in Orlando, Florida. It was packed with world-class speakers, instructors, and exhibitors in the picturesque old campus of the University of Malta in Valletta, the medieval walled capital city. It was an exciting but also sobering mix of technological and scientific innovation and accident data. The proceedings and consensus statements will be published in due course, but without giving away any secrets I can say that in addition to the well-understood hazards of hypoxia, hyperoxia, and hypercapnia, the most prominent, and possibly preventable, cause of death in this older cohort of divers is cardiovascular disease. Many cave divers are also in an older age group and I would implore any of you who fit that description to make sure that you are minimizing any preventable risk factors for cardiovascular disease such as high blood pressure, adverse lipid profile, and so on. Your primary care physician is the ideal person to help you with this.

'Looking forward to seeing everyone at the 2023 International Cave Diving Conference in Lake City.

Andrew Pitkin
NSS-CDS Chair

Wakulla Sinks Improvements in a Holding Pattern

by Terry DeRouin

Thank you to everyone who has donated and pledged support for the Wakulla Sinks projects—Meeting House and Clear Cut sinks. We have met our original $4000 goal for basic infrastructure and—thanks to your generosity—have received over $10,000 with additional funds still committed.

Phase I of the project provides for fencing for the parking lot, signage, gear assembly platforms, and stairs for sink access at Meeting House. Additional funds for Phase II cover more parking, a porta-potty, and improvements at Clear Cut. Any extra cash will go to a special fund to open and maintain more sites.

Please continue to donate. We have many more plans to realize.

The building dates still are pending state approval. The work parties will include social get togethers, featuring cook outs (alcohol prohibited). Park admission fees will be waived for workers and family members. The park is offering free glass bottom boat rides and excellent hiking trails.

Please register at the NSS-CDS store for the day(s) that you can volunteer and indicate if you can bring tools. Also note any special skills that you are able to contribute.

The NSS-CDS thanks Park Manager Amy Conyers for making this possible and you – the generous divers who have helped realize this and future projects.

I will announce soon when the sites will be open for diving. If you can volunteer or contribute to the material fund, please contact me, Terry DeRouin, via email or at 404.680.3694. We're also discussing opening additional sites. If you have recommendations, contact me with the details.

Meeting House Sink. Courtesy of Terry DeRouin.

Stair plan for Meeting House. Courtesy of Sidney Ruetz and Howard Smith.

Known Exploration History of Meeting House Sink on the Old Ferrell Property

Steve Cushman was told by the Ferrell family that there was a gathering spot near the sinkhole long ago, instead of a church. That is where the "Meeting House" name originated. Details are unclear.

July 16, 1988: Tanaka, DeLoach, and Exley dive Ferrell's Sink (believed to be Meeting House Sink) to a depth of 135 ft adding ~175 ft of line. They turned back due to poor vis in tannic water below 30 ft. – *T. Tanaka's logbook*

May 7, 1995: Barry Miller, Rick Sankey, and Brent Scarabin explore Meeting House Sink, adding 854 ft of line and discovering an upstream/downstream junction. – *C. Werner (date is approximate).*

1995/96: Several dives in Meeting House Sink pushed the upstream and downstream passages to two very small restrictions after a few hundred feet. Barry Miller, Brent Scarabin, Rick Sankey, and other WKPP members made several dives trying to get beyond the restrictions. However, their back-mounted configurations permitted little progress. – *C. Werner (dates and number of dives unknown).*

2013: The Aquatic Science Association started to dive Meeting House sink. They secured an agreement with the Ferrell family in exchange for maintaining the property. They made a few dives both upstream and downstream on open circuit and added a few hundred feet of line downstream.

Map courtesy of Andreas Hagberg. © Andreas Hagberg.

2017/2018: Andreas Hagberg and Luke Alcorn started diving the biggest downstream passage in late 2017. They began exploring and mapping new passages using sidemount rebreathers early in 2018..

2018/2020. Andreas and Luke added a combined distance of around 13,000 feet, mostly in passages 260-290 ft deep.

Steve Cushman and Colin Irons (Aquatic Science Association) built a set of stairs and a decompression habitat to support these dives.

Late 2019: Conservation Florida negotiated a deal with the Ferrell family for state acquisition. The property is now under State ownership and is managed as part of Wakulla Springs State Park. State acquisition paused diver access and exploration in Meeting House Sink while an ecological restoration was in progress. The site is currently under review for diving.

Information courtesy of Andreas Hagberg and (dated before 2013) Chris Werner

WKPP Divers Connect Chip's Hole and Wakulla Cave Systems

On January 7, 2023, at approximately 12:45 pm, WKPP exploration divers Blake Wilson and Steve Cox established the physical connection between two of the longest underwater cave systems in the world, located in northern Wakulla County, Florida.

The team entered the Wakulla Cave System from Turner Sink (within Edward Ball Wakulla Springs State Park) to continue exploration and mapping of a passage identified in 2021 as the most likely connection to the nearby Chip's Hole Cave System. In June, 2021, WKPP divers released two gallons of dye from a strategic location in the Chip's Hole System and placed sampling sensors in and around Turner Sink in an effort to identify the path of the dye and potential areas where the massive cave systems might connect. The dye trace results revealed one primary target.

The WKPP exploration team has been pursuing that target for the past 18 months in hopes of finally connecting the cave systems. Using special cave diving equipment for deep, restrictive passages, the explorers were able to further the exploration of this target passage over a series of dives and remained confident they were on the right track. Recent dry weather and minimal rainfall have provided clear water conditions within the cave systems, enhancing the exploration efforts.

Saturday's dive plan involved returning to the limit of exploration in the target passage and pushing further to close the gap. During the previous dive a week earlier, the team caught a break as they discovered a large vertical chamber where the cave passage ascended from 150ft to 50ft depth with ongoing passage and good flow at the top of the chamber. Fifty feet was the last recorded depth during the exploration from the Chip's Hole System so they knew they were close to making a big discovery.

Upon returning to the vertical, "waterfall" room on January 7, the team assessed the way forward and discovered within less than 100ft a stained cave diving guideline and survey marker partially buried in the silt covered floor. They verified the marker as a Chip's Hole marker they placed during exploration in 2016 and proceeded to enter the Chip's section to confirm the connection was finally established. The team discovered the June 2021 dye trace injection

(continued on p 16)

Steve Cox and Blake Wilson connected Chip's Hole to the Wakulla Cave System. © Lauren Wilson.

Human Factor Considerations in Cave Diving

by Brett Smith

Risk management and the reasons for it underscore every cave diving technique and procedure. During my six years of experience in nuclear waste remediation, I have seen firsthand how applying human performance indicators promotes safety. Cave divers, like nuclear workers, use training, judgment, operational discipline, practice, and time-tested procedures to identify hazards.

Human performance indicators (HPIs) are safety tools that enable the nuclear industry to mitigate or eliminate risks. These are an individual's physical or cognitive capabilities or behaviors that affect the functioning of technological systems and the human-environment equilibrium. Reducing the frequency of human error and its consequences improves dive safety. Human error can be defined as an individual's deviation from acceptable or desirable practice that culminates in undesirable or unexpected results—for our purposes, a cave diving accident.

How we got here

The concept of human performance improvement is used in many disciplines, including nuclear, aviation, manufacturing, sports, commercial diving, and the maritime industries. The study began in the late 19th century as psychology developed and grew. Engineers at Bethlehem Steel observed that providing workers with user-centered customized tools resulted in a three-fold increase in output.

After World War I, the US Army began to develop methods for pilot selection and training. It studied how aircraft controls, displays, and G forces affected pilots' behaviors.[1] The first G suit was developed in 1937 as a product of human performance research.

The military sponsored most human performance research during the Second World War, followed by civilian companies such as Bell Labs, McDonnell Douglas, and Boeing. These corporations concluded that work output did not depend solely on human skills and technology but rather how the person, the machine, and the process interacted to create a dynamic system.[2]

Why don't people do what they know how to do?

Preventing accidents requires that we understand how and why errors occur and employ the preventive techniques that we learn. How we do this is important. People are responsible for the majority of accidents. A cave diver, his or her equipment, the team, and the environment all interact to influence stress and behavior. Experiencing high stress, combined with two or three seemingly "minor" factors, can easily cascade into panic. Failure to control panic means that an accident is likely to occur.

Dive safety is primarily a function of four factors: the environment, equipment, individual diver performance, and dive team performance. The water is a harsh and alien environment which can impose severe physical and psychological stress on a diver. The remaining factors must be controlled and coordinated so the diver can overcome the stresses imposed by the underwater environment and work safely. Diving equipment is critical because it provides us life support. But individual diver panic and associated performance degradation cause most accidents.[2]

Technical dive educators have long understood this. Sheck Exley saw early on that divers perish in caves for a few specific reasons. His "rules for basic cave diving"[3] fostered a safe diving culture through training and sharply reduced the death rate. The WKPP developed rigorous safety standards during its explorations, resulting in its own culture of excellence and success. More recently, Gareth Locke has formulated these human factors as "counter errorism" and has worked to reduce the culture of blame that we often see following a diving accident.[4]

What are the human factors?

There are two broad groups of human performance indicators. Error precursors include the risky conditions/actions that lead up to an accident. These factors can include hazardous conditions,

Figure 1. "Error precursors" are the risk factors that make accidents likely to occur.

task loading, and equipment failures to name a few, but it is the behavioral approach that determines the outcome. Error reducers include the actions that prevent or reduce the risk or severity of accidents. (See Figures 1 and 3).

What's killing trained cave divers continues to be the human factors. They get lost. They run out of gas. Or they breathe the wrong gas at the wrong depth.[5] We have many ways to check ourselves—monitoring our gas carefully, keeping our dives straightforward—to prevent accidents.

The mechanical checks are the easiest. Recognizing the "people" factors that may underlie the failure to perform them is the larger, less visible obstacle.

Stress and panic

One definition of stress is "the result of an imbalance between the demands placed upon an individual and the capacity of that individual to respond to the demands."

A person tries to reduce stress by taking actions to change the situation. Every diver knows the maxim to stop, think, and act. Failure to cope with or compensate for problems leads them to accumulate. Stress levels increase, and the diver may panic.

The Swiss cheese model

Most cave diving fatalities result not from a single issue but from a cascade of problems. The "Swiss cheese" model illustrates the cascade. If the cheese slices were stacked, it's unlikely that any "holes" would show through the pile. The "holes" represent error precursors (hazards), while the "slices" themselves are lines of defense.[6] When the "holes" align, an accident occurs. Error reduction tools help to misalign possible "holes" to offset the conditions and behaviors that line up to allow an accident (see Figure 2).

Error precursors (risk factors)

It is said that cave divers are susceptible to accidents around the time of their 100th dive. They have enough experience to be comfortable but not enough to be cautious.

Complacency hinders the situational awareness and alertness necessary to prevent accidents. It can lead to skipping basic procedures. For example,

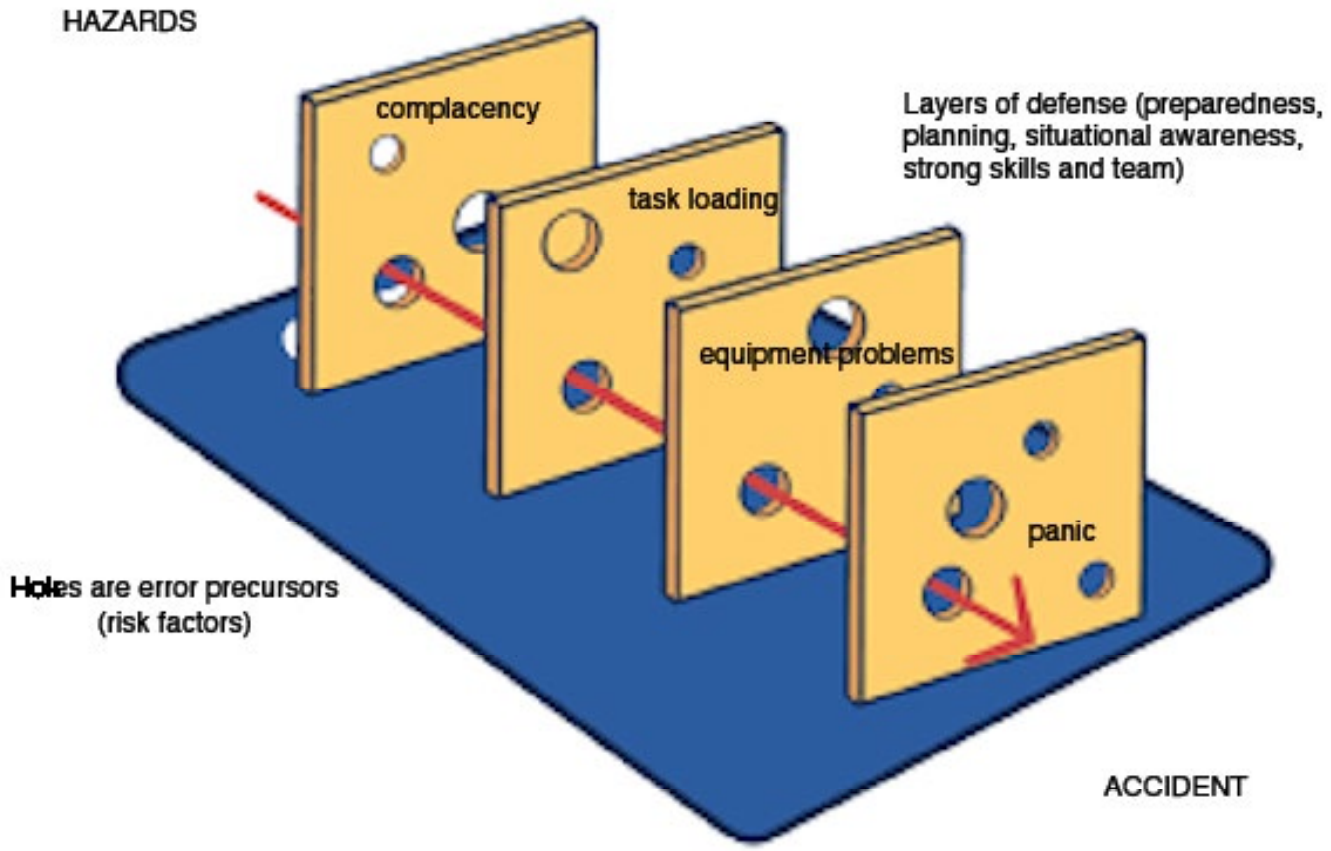


Figure 2. The Swiss cheese model and accident analysis.[6]

the importance of analyzing breathing gas and labeling tanks accurately has been drilled into all cave divers since the advent of mixed gases. Yet failure to do this remains a cause of accidents. For example:

When preparing for a dive at Devil's Eye, a diver had a tank that was marked "oxygen 20." He insisted that it contained nitrox and that he had recently filled it himself. He did not analyze the gas, and his teammates did not insist. The diver had a seizure and drowned. Subsequent gas analysis revealed that his tank had indeed contained pure oxygen.

Another diver perished at Little River while decompressing using a tank without legible markings. A recovery diver noticed that the tag was marked "he" in small letters. Gas analysis showed that the tank contained trimix with 13% oxygen.

Cheating turn pressure and making blind jumps might seem innocuous until a couple of other things go wrong and the diver is rushing to exit. Becoming overly comfortable risks losing sight of how unforgiving submerged caves are.

Task loading. New cave divers may feel task loaded when running a guideline into high flow. Adding complex navigation, using stage bottles and DPVs, and photography all contribute to increased workloads. Adding a little distraction may cause the diver to miss a jump or lose sight of a buddy or the guideline.

Most of the recent cave diving accidents on the Yucatán peninsula have involved camera use, becoming lost, and running out of gas. Cave instructor and photographer Natalie Gibb proposes that camera use be added to the critical factors of accident analysis.[7]

Two cave divers perished in Sistema Sac Actun during a stage dive in which they filmed each other. One diver had about 150 cave dives and the other 75. Accident analysis concluded that they failed to use the rule of thirds and had mismanaged their stage gas. The report concluded that videography may have contributed to lack of awareness due to increased task loading.

The number one navigational mistake in Mexico is to blindly follow arrows and lines to the death.[8] The Yucatán cave systems are complex with multiple

cenote entrances and exits. This may sound like a benefit, but it's not possible to exit the water in all of the cenotes. Even if you could get out of the water, you could find yourself deep in the jungle without a road or the ability to call for help. Several years ago, a diver perished from exhaustion after blindly following cave arrows to an alternate exit, then wandering lost in the torrid jungle heat.

Guideline conventions can vary. Tee intersections are rare, for example. Jumps are marked with a single arrow versus the double arrows used in Florida's more heavily dived caves. Double arrows in Yucatán peninsula caves indicate a particularly important jump, such as one to complete a circuit or traverse. A set of three arrows with two pointing in one direction and one in the opposite direction, indicates two exits with one being closer in time or distance. REMs (reference exit markers) are more commonly used. Because flow is low or imperceptible, you may not be able to count on it to identify direction.[8]

Risk taking often includes goal-oriented diving. It may mean rushing and cheating on gas management in order to reach a destination. Divers who take risks can be more likely to overestimate the team's abilities. The least-experienced team member determines the dive's complexity.

Recently, an experienced diver explored a new section of cave after reaching his turn pressure. He became stuck, silted out the cave, and breathed all of his gas. He was found dead within an arm's reach of his stage bottle.

Competitive diving, one upsmanship, and deviating from the plan creates stress and mistrust on the team and causes disruption above and below the water, as one diver noted:[9]

"Diving in caves with my significant other brings out our most difficult and competitive features. In addition to needing to demonstrate the "better than" when we dive together, he deviates from the dive plan, does not stay together, and takes off and leaves me. This happens both above and below water. Recently it became so bad that I left a vacation early and am considering not diving with him in caves any more."

Rushing invites errors. A diver arrived in cave country on Friday afternoon and wanted to dive that evening. After a painful episode of the "bends," he reflected on how he had filled and analyzed his tanks.

"I hopped quickly from tank to tank not fully letting [the analyzer] settle. This likely caused the incident. I noticed that my back gas was down around 28%. That should have been a red flag, but I just figured no big deal—I'll just put that as my mix on the computer, and it will be fine.

I later found that another set of doubles that I had filled at the exact same time was confirmed to be air by three different analyzers. So there is a very high probability it was air in my back gas. It was my fault because I likely grabbed the wrong fill whip."

This diver developed excruciating elbow and shoulder pain in the left elbow following his two-hour dive at Devil's. He recovered without needing recompression. "The most important lesson here is to never ever be in a hurry," he said. "Always fully analyze to get an accurate reading. It's pretty basic but it shows how being in a rush can easily lead to a problem. Luckily mine was nothing major but could have been fatal in another scenario."

"Time outs" interrupt the urge to rush. These can be as minor as delaying to adjust equipment or as formal as canceling the dive. Here is an example from the nuclear industry:

On 2 December 1942 shortly before the [first nuclear] reactor was expected to reach criticality, [physicist Enrico] Fermi noted the crew's mounting tension. To make sure that the operation was carried out in a calm and considered manner, he directed that the experiment be shut down and that all adjourn for lunch."With this kind of safety-focused leadership, it is no wonder that the operation of reactors to date (in 1964) has been singularly free of mishaps." [10]

Error reduction strategies

These are the behaviors by which we can mitigate risk to prevent accidents. We know that our dive environment is unforgiving. Reducing the likelihood of accidents involves recognizing our capabilities and limitations, rigorous dive planning, and clear communication. I've separated the discussion into before, during, and after the dive.

Preparedness begins well before the dive with good physical and mental fitness, rigorous planning, equipment checked and packed, and any errands taken care of beforehand. Everyone should want to make the dive and be free from worries, high

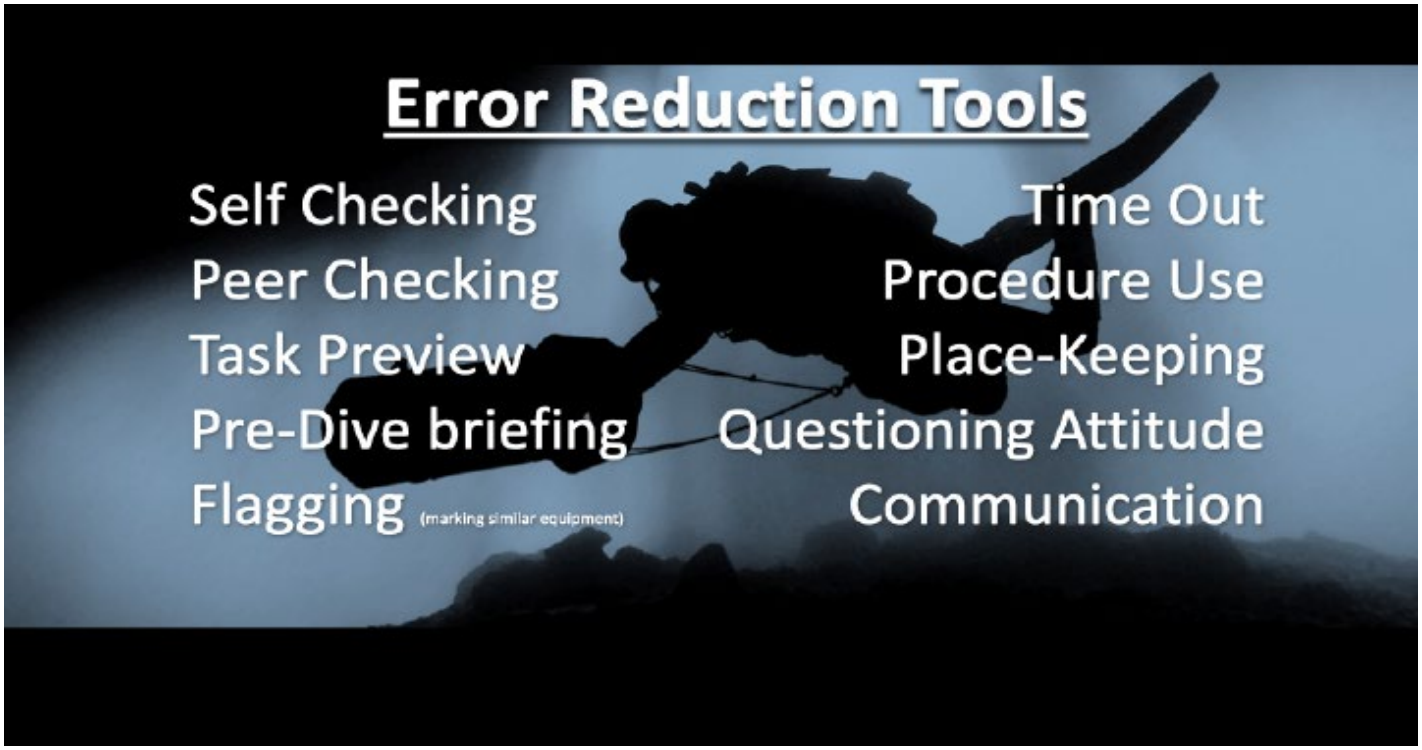


Figure 3. Error reduction tools.

emotion, or distraction. It's not a good idea to coax someone to do a cave dive if s/he appears upset or reluctant.

Pre-dive preparation and local conditions. Maps and weather reports may be helpful, but local cave divers are your best information source. They may be able to facilitate relationships with landowners. They're likely to know about closures, cave conditions, or guideline changes.

Florida's heavy rains, for example, flood the caves and cause them to siphon. They look very different when the siphon reverses following a flood.[11] Visibility deteriorates. Silt covers the walls, floors, and formations. Outflow increases, and water levels fluctuate. Guidelines can be buried or broken. Fallen tree branches or other debris can block an exit. Local divers would likely know the conditions as well as which sites are off limits.

> *Several new cave divers from out-of-country, unfamiliar with Manatee Springs' fierce outflow, made an unverified traverse from Catfish Hotel to the mainspring. The torrential force wedged one exiting diver between the rocks. Her friends were unable to free her.*

This fatality might have been avoided had the visitiing divers talked to locals, who knew that there had been rock collapses that made this exit treacherous.

At the dive site. Thoroughly reviewing the dive plan and previewing tasks ensure that everyone understands his or her role. An important step includes a thorough equipment check.

Be alert to any clues that warrant reconsideration of the plan (weather or bad visibility, any frustration or reservation about the dive, a teammate's or anyone's having a problem with the dive plan). Watch out for anyone who wants to dive beyond his or her training and abilities and/or is extremely goal driven.

Checklists prompt divers to do what they know how to do. A successful checklist is one that the diver wants to use.[4] Lists should be short and concise. What's more important than the items listed are the expected responses.

Divers have long relied on their own memories rather than use checklists. Rebreather divers use checklists that are unique to their particular rig and setup. Some open-circuit divers consider them extraneous or unacceptable. However, checklists have proven their value in other disciplines, including aviation and surgery.

One study showed that although only 20% of a surgical team's members thought checklists were useful for their own practice, 94% would want one used if they were the patient. When this team

began to use checklists for anesthesia and immediate pre-operative and post-operative care, mortality decreased by 47% and complications by 37%.[12]

Cave divers can benefit similarly. Lists help to verify that all pieces or equipment are present and working. Gas analysis and accurate bottle marking avoid disaster as described above.

Conservative planning involves considering everything that could go wrong, and how the team will handle it? What procedures would be used in the event of a lost or missing diver? Is the rule of thirds conservative enough for this dive? Is the team prepared to handle equipment failures and have sufficient gas to exit?

> *Two divers planned to swim to 3700 ft at Devil's Ear. At about 3500 ft penetration, a high-pressure hose tore for no apparent reason and spewed gas. The diver was in side mount configuration and was able to "feather" the valve and conserve gas until the pair reached their stage tanks. They posted the incident on a forum to remind people to dive conservatively "because the shit hits the fan every now and then."*

Pre-dive briefing. Is everyone clear about the dive and the procedures required? What is the sequence — who leads, who follows, and in what position? It's helpful to review and practice underwater signals with new or international team members.

Answer all the "what if" scenarios and plan how to deal with them should they arise. Global Underwater Explorers (GUE) has long standardized its pre-dive and equipment checks "GUE EDGE" (Goals, Unified team, Equipment - Exposure, Decompression, Gas, Environment) as part of its commitment to team diving.[13]

During the dive. Situational awareness is probably the most important factor in reducing errors. Are all team members responding to signals and communicating? The examples above illustrate how easy it is to lose a guideline or miss a jump that is concealed by a rock. Sighting unfamiliar formations on the return trip might be a clue that the team has missed an intersection.

> *A team of three cave divers became temporarily lost at Little River in good visibility. The lead diver, who was videoing the cave, and his friends swam to the Florida Room via the Merry-go-Round. They turned at thirds with the videographer now last in line. After pulling their cookies at the Merry-go-Round, they continued but felt that the exit was taking too long. All of the three divers had missed the tee to the exit and didn't realize it until they again reached the tee to the Florida room. They fortunately had plenty of gas to exit.*

To the divers' credit, they posted this episode on a "lessons learned" section of a cave diving forum. Most comments were supportive and appreciative of the discussion Another diver noted that he had made the same mistake.

After exiting the cave is a good time to practice emergency drills because there is no time pressure. "Drill as if it's real, because one day it may be" keeps skills sharp and imprints them into muscle memory.

After the dive. The "debrief" should focus on what went right and what didn't. A cave diver who has missed a jump, gone off the line, or not responded to a communication usually knows it. It's constructive to hone in on the contributing human factors that create an environment in which accidents are likely to occur. In the example above, all of the three divers missed the exit. Discussing the importance of situational awareness, attention to navigation, and the responsibility to work together as a team is more conducive to safety than is blaming and shaming.

Figure 4. The building blocks for a just culture.

Create a just, safe culture, not one of blame

A just culture is one in which people are accountable and are able to learn from mistakes. Errors result from predictable interactions between the environment, equipment technology, and divers. A just culture has no tolerance for reckless behavior, yet recognizes that competent cave divers make mistakes. Focusing on the human behavior that we can modify is more conducive to safety and learning than is fault finding.

The NSS-CDS promotes a culture of safe cave diving through its membership, instruction, and workshops. People are talking much more about safe diving and how we can improve our outcomes. Using human performance improvement tools may prevent an accident. At the very least, this information can help us understand how our interaction with our equipment and environment help us to plan and execute safe cave dives.

References

1. Nazaruk M: A brief history: the evolution of human factors, human performance. Drilling Contractor, September/October 2019.
2. Blumenberg MA: Human factors in diving (thesis). Marine Technology and Management Group, UC Berkeley, 1997.
3. Exley S: Basic cave diving: A blueprint for survival. 5th edition, NSS-CDS, 1986.
4. Locke G: Under pressure: Diving deeper with human factors. Human in the System Consulting, 2019.
5. Averill H: What really kills cave divers? cavediver.com
6. Underwood P, Waterman P: Systems thinking, the Swiss Cheese Model and accident analysis: A comparative systemic analysis of the Grayrigg train derailment using the ATSB, AcciMap and STAMP models. Accident Analysis and Prevention 68:75, 2014.
7. Gibb N: Cameras kill cave divers—again. *InDepth*, March 4, 2020.
8. Gibb N: Zen and the art of Mexican cave navigation. *InDepth*, July 2, 2020.
9. Oigarden WB: Dyadic adjustment and personality traits in cave divers: An exploratory study (doctoral thesis), Barry University, 2013.
10. David Okrent , Nuclear Reactor Safety on the History of the Regulatory Process
11. Averill H: Cave diving after the flood. cavedive.com
12. Haynes AB, Weiser TG, Berry WR, et al: A Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population. New Engl J Med N Engl J Med 360:491, 2009.
13. Fifis D: The GUE predive sequence. InDepth, July 2, 2020.

Author Brett Smith (rear) dives with his father Don in the Peanut Tunnel, Peacock Cave. © Fan Ping.

Brett Smith was recently full-cave certified in Mexico and dives mostly in northern Florida area. He is a production operator at the Savannah River nuclear plant, a member of the site's behavior-based safety team, and a member of the local safety improvement team in behavior-based safety.

(continued from p. 8)

containers further into the Chip's passage and the realization the connection had finally been made after 25 years of work became apparent. Upon completing the cave mapping survey plus video footage, the team began the 60min exit back to Turner Sink to complete the obligatory in-water decompression before surfacing to share the discovery with the support team.

At more than 38 miles of mapped cave passageway, the Wakulla Cave System is the longest underwater cave system in the USA and ranks among the largest, longest and deepest cave systems in the world. It extends from beneath the Apalachicola National Forest in southwest Leon County and trends southeast into Wakulla County towards Wakulla Springs before turning south towards the Gulf of Mexico. The system crosses beneath federal, state, corporate and private property with 28 confirmed entrances (sinkholes-karst windows) including Wakulla Spring.

The Chip's Hole Cave System (Pipeline System) is currently mapped at roughly 7 miles of cave passageway with two known entrances located on St. Joe Paper property northwest of US319 and SR267 in northwest Wakulla County. Both the Wakulla and Chip's Hole systems drain massive amounts of freshwater south-southeast into the Wakulla Springs Basin and towards the Gulf of Mexico. As with traditional cave exploration protocol, the Chip's Hole System will be absorbed into the Wakulla Cave System and the new totals will be 45 miles and 30 entrances.

© Lauren Wilson.

Established in 1990, the Woodville Karst Plain Project (WKPP) is a 501c3 non-profit scientific research entity dedicated to exploring, surveying, supporting research and promoting public awareness of the flooded cave systems beneath North Florida's 450 sq mile Woodville Karst Plain. Membership is open to qualified cave divers, researchers, and those committed to protecting these resources for future generations. Current WKPP partners include US Forest Service, US Fish and Wildlife Service, State of Florida, Florida Geological Survey, Northwest Florida Water Management District, National Speleological Society, Wakulla Springs Alliance, universities, and corporate and private landowners.

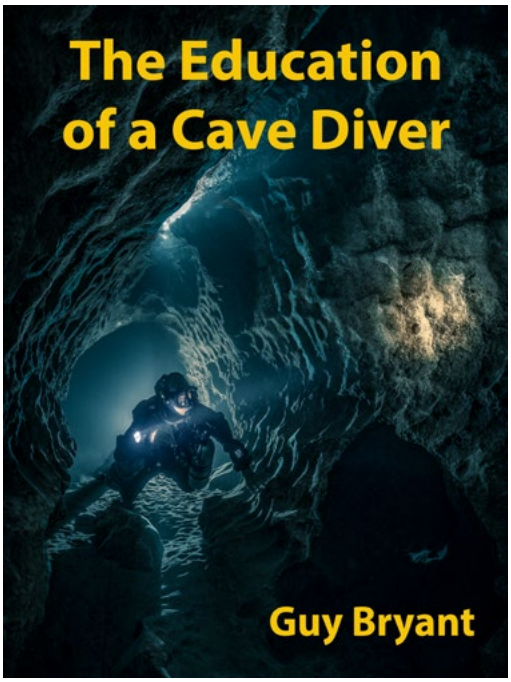
The WKPP has explored and mapped more than 35 miles of cave passage within Florida with more than 22 miles below 190ft depth. Exploring, mapping and documenting these vulnerable, hidden resources and providing critical data to federal, state and local resource managers so they may better manage and prepare for threats to these resources has always been and will continue to be a priority for the WKPP. Relevant data specific to this connection including updated maps, GIS Shape files, reports, video and images will be forthcoming.

The NSS-CDS annual members' meeting will be held (in person) during the International Cave Diving Conference.

Book Review

The Education of a Cave Diver by Guy Bryant

by Kelly Jessop



The sport of cave diving has little written history, much of it surviving as an oral narrative shared and handed down among cavers. As with all oral traditions, as keepers of these historical narratives age and die, stories can be lost forever.

Knowing our history is imperative—so much of what we have learned about cave diving comes from accident analysis, which forms the rules necessary for survival. There are also stories giving credit to original explorers and developers of equipment and anecdotes focusing on the people and personalities involved in the sport.

Most of us got our first glimpse into these elements of cave diving with Sheck Exley's *Caverns Measureless to Man* and, to a lesser extent, *Taming of the Slough*. As an educator, Exley felt compelled to write down some of the narrative we enjoy and appreciate, but we have longed for more.

Some of this longing has been soothed over the years with articles appearing in *Underwater Speleology* and the NACD journal; however, these articles don't provide a continuous, uninterrupted story. Instead, they provide small windows into scattered events.

News of a new volume's publication, then, was met with great excitement and anticipation. Guy Bryant's *The Education of a Cave Diver* is now available on Amazon in Kindle, hardcover, and softcover formats, featuring brilliant color photography and a slightly larger font so it can be enjoyed by aging cave divers who require progressive lenses and struggle to read decompression information on a dive computer.

The Education of a Cave Diver is an autobiographical account of Bryant's journey as he becomes a cave diver and finds longevity in a sport in which the average participant only lasts three years. The beginning chapter introduces us to the author and how he ended up in south Georgia, what led to his interests in diving and caves, and how he came to marry those two interests together. His start in cave diving came at a time when there wasn't much formal training available and in a period during which the sport was being developed through accident analysis. His training was very similar to the mentoring-based training of the British Cave Diving Group. He details the relationships he developed with divers who helped with his education, many of whose names you will recognize.

Bryant also describes the cottage industry that developed within cave diving. As necessity gave birth to invention, people built specialized equipment in their garages such as lights, wings, and scooters, producing safe and reliable equipment for the cave environment through painstaking trial and error. With this new equipment came the need to develop procedures to use it safely and avoid accidents.

As Bryant's cave-diving skills developed, he entered the world of exploration. He provides details of some of his favorite projects, as well as vivid descriptions of diving places that we know well. His accounts of these dives reflect sharp-eyed observation and meticulous, detailed note taking. His sense of humor shines through many of the stories as he relates amusing anecdotes, jokes, and pranks. We also sense his frustration when a project is scooped by others, intentionally or unintentionally.

Anyone who knows Guy Bryant understands that his exploration isn't just about cave diving—he has a strong desire for adventure and world travel. His passion for photography ensures his trips are well-documented. By sharing examples of his work, he also shares candidly his development as a cave photographer for the benefit of the reader with similar aspirations. This material makes a perfect coda to the book.

The Education of a Cave Diver is an excellent addition to the available titles on the sport. It will be enjoyed by cave explorers at all levels of expertise, from novice to veteran, as well as anyone, regardless of diving experience, who wants to understand the sport's evolution. It provides a thorough and well-organized treatment of the sport's development and growth. All cave divers can benefit from studying Bryant's experiences. With the few available titles we have all read and reread, this book earns a position of prominence in anyone's library.

Kelly Jessop is a longtime cave diver and CDS member. He served several terms on the Board of Directors. Kelly has worked with landowners, the State, and other stakeholders to keep caves open to diving. He even has managed to get some caves open after they've closed due to an accident.

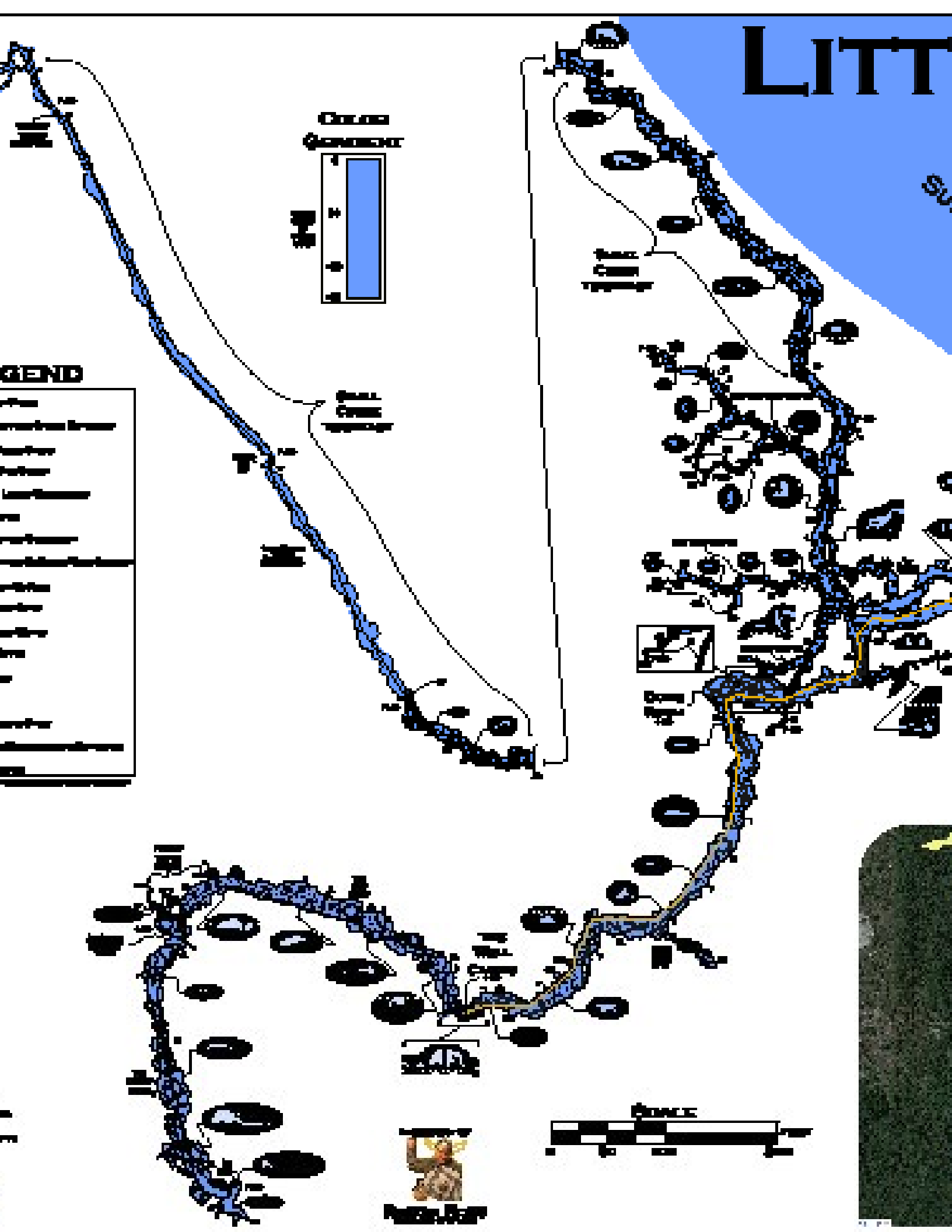
Milestone cave dives - *continued from p. 38*

Almost two and a half years later, I made my 93rd cave dive to Dan's cave with Brian Kakuk and Gus González. We visited Fanghorn Forest and Cheap Seats Wrigley Field. I was much improved and was excited to show Brian. I was diving the sidemount rebreather rather then the back-mounted rebreather that I had used for my original cave training. So we got to go to more places! After much practice I was honored and excited to return to where my cave diving started, the Bahamas' Crystal Caves. I had been telling my Dive Talk partner Gus González about them and about Brian over and over. Gus says he also got cave certified so he could see this cave. So it was a thrilling moment: I convinced Gus to get certified in order to see Fanghorn Forest, and Doug convinced me to get certified to see Fanghorn Forest. So when we got there again, I cried again.

What I have learned is that even someone like me who had decades of only open-water, open-circuit, split-fin diving can transform into a safe and responsible cave diver. I still have much to learn and will need to practice forever.

I completed my 100th safe cave dive on 6/4/22 at Eagles Nest in Florida and earned the Abe Davis Award. I'm not good at "short stories". But these were two such two HUGE milestone dives that I had to include them.

— Woody Alpern


LITT
GEND

LE RIVER SPRINGS

SUWANNEE COUNTY, FLORIDA

SUWANNEE RIVER

SURVEY & CARTOGRAPHY BY ADAM HUGHES

TOTAL PASSAGE LENGTH: 8,138.7 FEET

MAXIMUM DEPTH: 129 FEET

SPRING ENTRANCE


DONT GIVE UP
THE SHIP

American Sump Rescue Symposium

by Michael A. Raymond, Aaron Thomas, and Ian Flom

Nine American sump divers got together on Dec 10th, 2022 to conduct sump rescue training. A sump is an underwater tunnel with at least one entrance in dry cave. In the event of a rain storm raising the water level and trapping cavers, or an injury to a scuba diver in dry cave beyond a permanent sump, the members of the American caving community would be called upon to conduct a rescue. While civilian authorities would be in command, sump divers would provide expert advice, bring supplies to the trapped persons, and possibly swim those persons to safety.

To the best of our knowledge, this was the first-ever symposium in the U.S. focused on sump rescue. Many of the individual attendees had participated in training outside of the U.S., and had been discussing the topic online together for years. It was thought that we would never be able to do an in-person event because there were no sumps that were safe enough to train in. Once we realized we could practice all the key skills at a swimming pool or open water dive site, a major hurdle had been passed. We could start planning. There is only a small community of sump divers, and we are spread out across the country, but we settled on a site near many at Gray Quarry in Gray, TN.

We split the one day of training into two portions. We began with several hours of discussions about sump rescue theory, equipment, problem sets, and techniques. In the later portion we got into the water to practice some of the rescue tasks and try special equipment.

Attendees

Jimmy Bennet (TN), Ian Flom (KY), Chris Garguilo (VA), Terry Hall (GA), Ashley Lewis (VA), Jon Lillestolen (VA), Michael Raymond (MN), Chrissy Richards (TN), Jason Richards (TN), Aaron Thomas (VA)

Morning Classes
Michael Raymond -

High-Level Decision Making

To kick things off, Michael led a discussion on the flow of events in a sump rescue. This included the decision making processes for sending divers to look for missing people, as well for whether non-divers should be swum back through temporary sumps. Both of these decisions need lots of information, and we discussed what to collect.

We talked about the two main types of patients. One type are dry cavers who get caught behind temporary sumps after a rainstorm. The other type are sump divers trapped behind a permanent sump because of injury, equipment problem, or problem with the sump itself. While the priority for both types of patients would be rewarming them, the solutions for getting them out of the cave would differ significantly.

We also worked to define a worst case scenario to focus our training. If we are prepared to conduct a rescue in that scenario, then everything else will be easier. To come up with the worst case, we canvassed the attendees to learn about their sumps. In VA there are very deep sumps, while in MN there is

Jon Lillestolen discusses the KED backboard. © Chrissy Richards.

Aaron Thomas, Jason Richards, and Chrissy Richards discuss their training dives. © Jon Lillestolen

climbing (SRT) required between sumps. We agreed the worst case was a cold 2000' long 200' deep sump. We did not settle on a worst physical injury, but options include a smashed face, compound broken leg, or back injury. Most interestingly, we agreed the largest hurdle would be working with incident managers who did not understand the complexities of a sump rescue, including the time pressures, and that there are people they could call upon to assist.

Ian Flom - Initial Response Team (IRT) and Simple Medical Equipment

Hypothermia is the greatest risk to anyone trapped beyond a sump. To this end, Ian led a discussion of the things to bring and the ways to bring them.

The most important things to bring are items to warm patients. Candles and contractor bags can be used for Palmer Furnaces, and can be safely carried in thigh pockets. Camping stoves can also be swum. For chambers with limited volume, iron-based chemical heating packs can warm patients without generating toxic fumes. Items to sit on to prevent heat conduction are also useful. These include small foam pads, Thermarest pads, or BCD wings.

Anything needing a dry space can be carried in a dry bag, dry tube, or in some sort of plastic container (Derrin Drum, Nalgene). Old dive battery housings may work for small items. Jon raised the idea of vacuum sealing items. One discussion focused on the topic of carrying items inside your drysuit. Unzipping your drysuit inside a cave risks not being able to re-zip it. Stuffing things under a wrist seal risks tearing the seal.

There are other items that might be useful. Pain management is easy to carry with a small amount of Aleve, Tylenol, Aspirin, etc. Bring duct tape for many reasons, including its potential for drysuit repair. Water purifiers are small, easy to carry, and very robust.

Patient psychological care is also important. There are records of patients believing they hallucinated the visit of a rescuer. Leaving a light with the trapped party serves the two purposes of providing illumination and proving that someone really did visit them.

Jason Richards - Considerations for Swimming out a Patient

Jason told a story about an incident where he swam out his dive buddy after the buddy panicked and did not think he could make it out of the sump on his own. Jason suggested that teaching a Discover Cave

Diving (DCD) class to an inexperienced diver or non-diver is not a good solution. In Jason's story, he asked the other diver to remove his mask and Jason pulled him through the sump. He suggested we practice this and use it as a technique for extracting patients. He suggested no masks, hands on regulator(s) and give the patient a pep talk before diving covering the need to remain calm, keep breathing, and to not reach out or try to swim. The point being that the patient is not expecting to have an airspace around their nose and eyes, and failure of the mask seal, either by accident or patient movement, is no longer a concern, and reduces the possibility of patient panic when the mask partially floods. This is particularly distressing for non-divers who are not going to be able to learn how to successfully clear a mask in a short discover scuba class.

Ear clearing is a concern. However, even the worst case injury of burst eardrums is minor compared to the long-term effects of being stuck beyond a sump. Suggestions were made following the water exercise that carrying a swimmers nose plug would help to simplify the no mask approach.

Michael followed this up with the story of the 2019 rescue of two German cavers trapped beyond a temporary sump. In a commercial cave, a tour guide and tourist got trapped by rising water during a rainstorm. The tour guide was open water certified but the tourist was not. Rescuers swam in a stove to heat water, and used hot water bottles to warm the patients. They then helped the tour guide dive out through the temporary sump. After a thirty minute DCD class, they helped the tourist swim out as well. During this swim, the plan in case the tourist panicked was to bear hug him, swim him out of the sump, and revive him on the far side.

Jon Lillestolen - Patient Movement

Jon led a discussion on additional issues regarding swimming patients.

Backboards and litters available to rescuers may be limited to what's available on local EMS and rescue vehicles. Something with handles or grab points is best. If the patient is in dive gear, there should be enough grab points available.

One commonly available device on ambulances is a Kendrick Extrication Device (KED) which is good because it provides some rigidity as well as handles, in addition to being smaller and easier to transport

Divers gear up to start the training session. © Jon Lillestolen.

Many divers got their first exposure to FFM use. © Jon Lillestolen.

One discussion focused on leashes and, if used, what their maximum length should be. A leash would be used to keep the patient attached to a rescuer while the rescuer used both hands to solve some problem.

A length of about 6 feet was decided to be the max length. There should be plenty of webbing or rope available during a rescue to make extra grab handles and leashes. The risks of a panicked patient taking a rescuer for a trip were also discussed.

There was also a discussion about the maximum number of people to send with a patient. There seemed to be consensus that there shouldn't be a reason to have more than two people swim with a patient at a time, especially if dealing with low-visibility or small spaces.

Ashley Lewis - Patient Packaging in KED, OSS, SKED

Ashley Lewis led a quick class on the KED spine board. It is very similar to the Oregon Spine Splint (OSS) that many National Cave Rescue Commission (NCRC) students are familiar with. The Petzl Nest litter and the Yates SPEC PAK, a spine board designed to make dragging easier were also discussed.

This led to a discussion of whether litters or spine boards would be needed for swimming patients. Cervical spine immobilization may not be necessary in the water. For other injuries, equipment like fins can be used to splint arms and legs.

A discussion on swimming patients face up or face down covered the reasons some teams choose one or the other. Face up is desired by some teams because it makes patient monitoring easier, but if a Full Face Mask (FFM) leaks then it will be increasingly uncomfortable for the patient. Face down is desired by other teams because it solves the mask leaking problem, and some regulators are meant to only be breathed from in that position. If the patient gets dragged across objects they may make contact with the patient's face though. After patients are slid into the water face-up, rotating them face-down for swimming can be an awkward procedure that requires practice.

Terry Hall - Full Face Masks

Terry Hall led a class on Full Face Masks. Many attendees had never used a FFM, and so this was a good chance to try them out. Getting a FFM to seal to your face is a difficult task. Putting one onto a patient is even more difficult. We had a healthy debate about when to use a FFM with a patient as opposed to a regular second stage regulator, with the end consensus being if the patient was conscious and aware, they should not be in a FFM.

The mask brands and models mentioned and/or shown by Terry include:

- OTS Guardian (Aaron says this is what Blacksburg Cave Rescue uses and he highly recommends them)
- Interspiro AGA
- Scuba Pro
- Kirby Morgan M48 Mod 1
- Ocean Reef Neptune

FFMs should be commonly available among public safety dive teams. It was mentioned that FFMs may conflict with a patient's helmet, and in this case the FFM should be preferred over the patient wearing a helmet.

Michael Raymond - Gas Considerations for Divers

Michael led the last discussion about breathing gas issues. In America we have a small number of 2000' foot or longer sumps. Given gas planning assumptions, this would likely require us to change the scuba tanks a patient was breathing from along the way. We had a chance to discuss gas blocks, quick connects, and related issues.

For gas planning, it was noted that experts in other areas recommend 1.4 cubic feet of breathing gas per minute as the worst case. The team agreed to use that value. Michael noted that the Italians place stage bottles for patients every 100M for shallow sumps and every 50M for deep sumps. He believed a stage swap was done at every bottle no matter the level of gas in the patient's tanks. The patient would be on a gas block connected to two cylinders, and one of them would only be used as the supply while the other bottle was swapped out. It was agreed that the QC-6 connectors are the standard, with Male QC-6 fittings on supply bottles, and Female QC-6 fittings on the gas block receivers.

After Action Report on Morning Session

Everyone reported the sessions and location being good and a great basis for future discussions and training. Gray is available for future training events, but it may be more useful to move around the country to allow people that may not otherwise be able to travel far to attend. We will send out communication on future dates and locations. Things to change or add include more discussions on what equipment people use for their own sump diving projects and where to buy it. Also, future classes should probably span a full weekend to be able to cover more gear and skills. Mentone Alabama was mentioned as a good future training site if we wanted to combine a training event with one of the annual NCRC sessions.

Afternoon Diving

After lunch, we put on our scuba gear and practiced underwater skills in the flooded quarry. All of the tasks were performed in open water. We feel that every task in sump rescue can be trained and practiced in open water, as opposed to a cave. This increases safety, observability by other students, and the number of repetitions that can be performed. Training in actual sumps would add realism, and force the members to deal with confined spaces and limited information though.

Safety and videography of the training were led by Chrissy Richards. As the Safety Officer for the day, she instituted a system to ensure that all tanks were analyzed before being taken to the water. Interestingly, one tank was identified as having been mis-analyzed using this double-check system. She also had everyone use personal cookies to mark whether we were in the water or on shore. This helped with accountability.

For the first underwater task, we practiced swimming non-divers. We split into two-person teams. One diver took off their fins and mask, and focused on just breathing. The other diver had to move them along a guideline. This included changes in depth. We found that controlling a patient's buoyancy while also moving them along is a skill we all need more practice at. Trim was a major issue, as for some of us, heavy fins are important to our weighting and

trim. Patients must be properly weighted and trimmed before being moved. For the patients, they weren't used to their eyes being exposed to cold water, and it took getting used to. It was identified that many divers had significantly unique wing and inflation systems. Learning how to inflate and deflate the casualties' inflation systems (wing and drysuit) and being in a position to do so while swimming had a significant impact on the successful outcome of the movement of the patient.

For the second underwater skill, we brought out two FFMs. The divers who had never used one before were given a chance to dive with them. This included practicing bailing out to a second stage regulator. We switched to teams of four divers. One was the patient, two were there for propulsion, and the last for safety. We swam the patient along the underwater course again. We found that we needed better ways to keep the two rescue divers from kicking each other, and also communicate about who was managing what.

For the last task, we practiced transitioning a patient from the shore to the water. Moving a patient into and out of the water is one of the most complicated tasks. It can take a long time, with people not moving much, which can result in everyone rapidly cooling off. We slid the patient (Jason) into the water face up. Jon took over and led the process of getting Jason's tanks attached and hoses routed. We then flipped Jason over and started swimming with him. There are several ways to perform this task, and we know we need to practice a lot more.

Findings / Agreements / Areas of Focus

- We will use 1.4 cubic feet / 40 liters per minute as the breathing gas planning factor for patients.
- QC6s will be the standard connector for scuba equipment meant to be attached and detached underwater with QC6 male on the supply bottles, female on the gas block.
- We will swim patients face down by default.
- Swimmer's nose plugs should be part of the rescue kit if using the no-mask approach.
- We will refine guidance for when FFMs should be used with patients.
- We will research hardware for long-range through-sump communication.
- We will gather a list of special equipment for sump rescuers and how to acquire it, and post it on the sump rescue website.
- Future training will include practice swimming non-divers and immobile patients.
- We will continue to recruit sump divers to join our training events.
- We will find additional ways to improve communication and collaboration between incident managers and sump rescuers.

Next Steps

We came away from the training with several action items. One is that we need to do similar training regularly in the future. We'll try to move the training site around so that more people can participate. Attendees said they'd prefer a two-day session to help justify the travel.

Aaron Thomas took notes on each of our sessions. We'll be going over those and making improvements to the sump rescue manual. We identified we need to come up with lists of recommended rescue equipment. There's also new equipment, like long-range electronic telecommunications, that we need to experiment with.

All in all, we believe that this was a good first step. Many people met for the first time, and/or saw people they had not seen in years. We brought a lot of issues out in the open. We had a chance to test whether procedures in the Guidelines to Sump Rescue manual worked or not. We all realized we have a lot of work to do to improve.

Lastly, we'd like to thank Gray Quarry for hosting the event. Their site was perfect for what we needed.

Michael Raymond is at work on a book about sump diving. He is Senior Editor of Underwater Speleology.

'See you at the 2023 International Cave Diving Conference May 26th - May 27th, 2023, Lake City, FL

Milestone Dives and Awards

by Gayle Hall

Congratulations to our members who've recently achieved milestone dives and awards. Let us know if you want to write up your special dive and publish it in *Underwater Speleology.*

Abe Davis Award

Brad Acker	Jan 12, 2023	Steve Forlenza	Feb 01, 2023
Pete Kibler	Jan 13, 2023	Bob Sumner	Feb 12, 2023
Kelly Baker	Jan 27, 2023	Gus González	Mar 14, 2023
Jayme Lustenberg	Jan 28, 2023	Annie Wolf	Mar 15, 2023
Joe Rinaldi	Jan 28, 2023	Mike Cleary	Mar 15, 2023
Carolyn Donahue	Jan 28, 2023	Frank S Stopa	Mar 25, 2023

Henry Nicholson Award

Laura Battle Jan 12, 2023

Gayle Hall Apr 25, 2023

Sheck Exley Award

Lanny Vogel Jan 13, 2023

NSS-CDS 2023 Winter Workshop

Winter Workshop Wrap

by James Chandler and Gayle Hall

Photos by Lureen Feretti and Tom Johnson

Though the North wind blew across the Hart Springs grounds on a chilly (by Florida standards) January Saturday, the presenters and activities inside the Hart Springs pavilions kept everyone warm and entertained.

The NSS-CDS Winter Workshop did not disappoint.

It was a great opportunity to support the CDS while socializing with other cave divers, to learn more about our local Florida water quality, and to see what's new with cave imaging. It also offered some thoughts about what could happen in the event of a medical emergency at or around a remote dive site.

Members who attended from out of state were able to take the opportunity to catch a few dives before or after the workshop. People came from as far away as Pittsburgh, North Carolina, Northern Virginia, Missouri, and even Sweden. This was the best-attended CDS Winter Workshop in history — approximately 125 people attended.

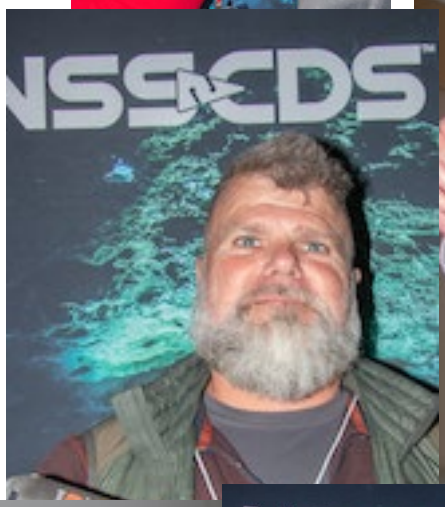
The program mixed science, high adventure, and a special tribute to CDS veteran Forrest Wilson. Paul Heinerth, our Emcee extraordinaire, kicked off the program, introduced the speakers, and presided over the raffles and door prize awards.

Terry DeRouin presented a tribute to Forrest Wilson, who was unable to be present. Terry highlighted Forrest's more than 48-year career with the CDS as a diver, a teacher, and an inventor. Using primitive (by today's standards) equipment that included an MSA miner's electric headlamp, Forrest was the first diver to map more than a mile of virgin underwater passage. As an inventor by nature and a physicist by education, Forrest built an early rebreather. He created the first "jam-proof" cave diving reel designed with enclosed transparent sides so that user could see what was going on with the line. The Wilson line arrow, however, is Forrest's best-known equipment contribution.

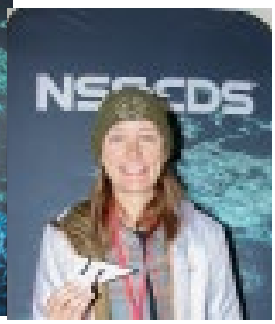
(continued on page 34)












Photos p 30, 31, 33 © Lureen Feretti.


NSSEDS
of 50
SANDY
Robinson

(continued from p. 31)

Forrest also developed the Wilson Line arrow, which rapidly became the world standard. Divers had no uniform method to mark cave directions until Lewis Holtzendorff created arrows from duct tape after a lost diver fatality at Peacock Springs in 1976. The "dorff" markers were a start but they eventually deteriorated or fell off.

During a CDS workshop, Forrest designed the plastic markers that shortly became the world standard. He hand made 100 of these and brought them to the old Branford dive shop to be sold. The owner commented that, "there are only 10 caves, and if you put 10 arrows in each cave that would be 100 arrows," and that he wouldn't ever be able to sell another line arrow."

All of Forrest's hand-made arrows were sold. One of his students owned a cave rope manufacturing company. He requested one "perfect" arrow to use for an injection mold. Eventually, Dive Rite bought the mold from him. The rest, as they say, is history.

Forrest also designed and built himself an airplane using a proven aeronautical design.

Working with Wes Skiles and Joe Prosser, Forrest developed a training program that has produced more qualified cave and cavern divers than all the other organizations combined. He served as the NSS-CDS's first Training Director in 1975.

As a tribute to Forrest, the CDS designed 50 oversized commemorative cave arrows, which were awarded as door prizes at the workshop. Many thanks to Terry DeRouin and to Lamar Hires and Dive Rite for manufacturing and donating the arrows.

Tom Sawicki spoke about the Floridan Aquifer's mysteries. © Tom Johnson.

Forrest Wilson and friends at the Black Lagoon, Hart Springs. © Jill Heinerth.

Don't miss Forrest's 2016 Luminary speech.

Most excellent presentations

As usual, the workshop showcased our members' diverse fields of study and areas of expertise.

Tom Sawicki, PhD, talked to us about his work monitoring the cave crustaceans and biodiversity in the Floridan aquifer. He and his students study isopods and amphipods and how they evolve. They've been at work in Lake Jackson, which was connected by a dye trace to Wakulla Springs, and discovered a surface water relative (*Crangonyx apalachee*) of the cave critters that lives only in Lake Jackson. Tom is an associate professor of biology at Florida A&M and a longtime cave diver.

A panel discussion about "just culture" and dive safety followed, featuring Christine Tamburri, Charlie Roberson, and Jared Hires.

Patricia Spellman, PhD, discussed the Floridan aquifer's water quality and how high nitrate concentrations and subsequent algae growth are affected by karst flow dynamics. Nitrates stay in the matrix (walls) for many years and produce a delayed effect. Scientists also are seeing an increase of potassium, sodium, magnesium, and other ions, possibly from fertilizer, that are changing the aquifer's chemistry. Patricia is an assistant professor of biology at the University of South Florida,Tampa, FL.

We broke for lunch of barbecue and southern food. Guy Bryant and Sandra Poucher signed copies of their recent books. We enjoyed visiting our vendors' booths and checking out the most recent gear.

Three breakout sessions followed lunch. Andy Pitkin, Natalie Volk, Dave Lizdas, and Matt Vinzant led a vertical training, necessary for sump diving and exploration. Fan Ping hosted a photography workshop. Finally, James Chandler and Lee Ann Waggener, RN, led refresher workshops for CPR and use of the AED.

Financially the workshop was a success. Adam Hughes reports a profit of $207 (income of $3110 and expenses of $2903). It's not an enormous profit, but it's impressive compared with previous events. Our Winter Workshops have never yielded a profit, at times never even coming close. This is the first time that a Winter Workshop was financially self-sustained. The only other one that came close was the 2017 event (run by Ken Sallot). The last Winter Workshop we held was in 2019, and the attendance/revenues generated at this year's event shattered that.

More thanks. The NSS-CDS Board of Directors is grateful to the many volunteers who helped to make this event such an amazing success. The entire organization owes much gratitude to Gayle Hall, who organized the workshop. Gayle spent numerous hours coordinating with sponsors, the venue managers, speakers, vendors, and other volunteers. Without Gayle's efforts, the workshop would not have been the resounding success that it was.

A big thank you to Lee Ann Waggener who co-organized the event and the delicious southern lunch we all got to enjoy.

Photographers Lureen Feretti and Tom Johnson contributed the excellent photos that accompany this story. Many thanks to Bryan Buescher for videoing the presentations.

Renée Power and the Mighty Cavengers always come through to keep our events on track. They manage the behind-the-scenes work, such as greeting people and signing them in, organizing the raffles, getting us fed, and managing the unheralded job of post-event clean up.

Oversized commemorative arrow pays tribute to Forrest Wilson. Courtesy of Lee Ann Waggener.

Patricia Spellman spoke about the effect of flow dynamics on nitrate levels in the springs. © Tom Johnson.

If you were unable to attend the 2023 Winter Workshop, you will have to make the International Conference on May 27, 2023, in Lake City, FL. This year marks the NSS-CDS's 50th birthday, and we're celebrating More than 250 people already have signed up, putting this conference on track to be our biggest and best yet (although topping last year's awesome event will be difficult).

Event registration is available on the NSS-CDS website. Registration with tee shirts has closed, but you still can register through 12:00 pm on May 24, 2023. After that, tickets will be available for purchase at the door.

Members $55.00 Nonmembers $65.00

Sincere thanks to our amazing sponsors and to everyone who donated terrific prizes.

Bahamas Underground
BigBlue
Diver's Alert Network (DAN)
Dive Outpost
Extreme Exposure
Garmin
North Florida Cave Training
Tusa
Be Water Imaging
Cave Country Dive Shop
Dive Rite
Dive Soft
Fourth Element
Halcyon
Stream2Sea
Ursuit

Please patronize and support those who support us.

Boy who Survived Thai Cave Ordeal Dies at Age 17

BANGKOK — One of the 12 boys rescued from the flooded Chaing Rai cave, Thailand, in 2018, died in England on February 14, 2023. He had been attending a sports academy there, according to the foundation sponsoring his studies.

A teacher found Duangphet “Dom” Phromthep unconscious in his room at the Brooke House College Football Academy in Leicestershire. He died two days later in a hospital, according to Thailand’s Zico Foundation.

The cause of death has not yet been disclosed, and Dom had apparently been in good health. However, several news agencies reported that he may have suffered a head injury. UK officials opened and adjourned an inquest. The coroner provisionally identified a cause of death but will not disclose it officially until a formal hearing in July 2023. Leicestershire Police said that his death is not considered suspicious.

Last August, Dom’s team mates rejoiced when he won a scholarship to the Brooke House College Football Academy in Market Harborough. "Today my dream has come true," Dom wrote on Instagram. Now his mates are mourning him with messages on social media.

Dom smiles at rescue divers when the group was discovered.

Duangphet “Dom” Phromthep, his teammates, and their coach survived nine nights before rescue from Chaing Rai cave

Dom was the captain of the Wild Boars youth soccer team in Chiang Rai province in northern Thailand. Twelve team members and their coach were trapped by rapidly rising floodwaters after deciding to explore a cave. They spent nine nights lost deep in the cave before rescue divers Rick Stanton and John Volanthen spotted them huddled on a dirt bank above the rising water line. The unprecedented rescue effort required eight more days and the expertise of cave divers from all over the world. The boys would be lightly sedated and each guided out by a team, passed from one rescue worker to another.

The rescue riveted the world’s attention, and the story has been retold in several movies and books, including the 2022 feature film “Thirteen Lives,” the 2021 National Geographic documentary The Rescue, and Rick Stanton’s book Aquanaut.

Dom’s body was cremated in the UK where Buddhist monks performed funeral rites in accordance with his family’s wishes. The family watched a live video stream of the funeral in the U.K. from Chiang Rai. Dom’s ashes were returned to his family in Chaing Rai and scattered at the Mekong River.

by Barbara Dwyer

Thanks to Our Hart Springs Winter Workshop Sponsors

January 14, 2023

fourth element

DIVE RITE
Equipment for Serious Divers

DAN

EXTREME EXPOSURE
FOR THE EXPLORER IN YOU

GARMIN™

bigblue®
THE BRIGHTER IDEA

URSUIT

DIVE OUTPOST

DIVESOFT

HALCYON
Dive Systems

TUSA®
FIND YOUR OCEAN

BE WATER

STREAM2SEA®
Reef safe • Biodegradable

Milestone Dive Reports and Write Ups

DPV Training on my Abe Davis Dive

My Abe Davis Milestone dive was with the same person as my first dive after completing Full Cave: NSS-CDS instructor Roger Williams, about 15 months later. We went to Cenote Escondido/ Mayan Blue in Tulum for my first dive of a Cave DPV course.

Roger had high standards for taking the class. Beyond wanting me to have a certain number of dives, he required that my buoyancy, stage drops and retrieval, and line running be close to perfect before starting. Fortunately, I had awesome buddies who graciously swam with me up and down the lines of North Florida caves and gave me critiques to prepare.

The dive itself was just to get comfortable on the DPV in a cave. After several hours of drills in open water, I ran lines to the main lines, and we traversed from B Tunnel to A Tunnel and back. A lot of the dive was through the middle of the halocline layer, and Roger made sure that I appreciated the impact of scootering in a complete blur out. I spent most of the dive laughing while looking at shadows and lights.
I mentioned offhand that this was my 100th cave dive, and Roger made a "proud instructor" Facebook post as he tends to do and sent me the form to complete. There was not much ceremony; no pictures were taken, but I am excited to see the new caves that the award opens up!

— Sterling McMahan

Sterling McMahan in Cenote Nai Tucha. © SJ Alice Bennett.

Translucent stalagmite in Dan's Cave. © Brian Kakuk

Abaco Dives Lead up to Abe Davis

My two most "milestone "cave dives were not for a formal award but stand out most in my mind.

The first (July, 2019) is my graduation dive (officially cave dive #1) to "Fanghorn Forest" with my CCR cave instructor Brian Kakuk and my original CCR instructor Doug Ebersole, who flew into the Bahamas just to do this celebration dive with me. Cave training had not come easy to me after decades of warm-water open-circuit ocean diving. Taking cave training in CCR made it that much harder.

After nine or ten days straight with Brian, I finally earned his confidence to graduate and go on a stage dive to Fanghorn Forest. On the day before we were to go, I screwed up a critical skill. Brian let me correct it. I still practice it in my mind, because it's important and it almost derailed my trip to Fanghorn. Brian was patient and transformed my way of thinking about diving and about diving itself.

When we arrived at our destination, Brian pointed out the "Fanghorn" marker, and I immediately began crying in my mask. I made it to Fanghorn Forest with my mentor Doug Ebersole, who had convinced me to get cave certified in large part to see Fanghorn. Also I had earned the confidence of one of the great cave divers—Brian Kakuk, who discovered Fanghorn Forest.

(continued on p. 19)

2023 NSS-CDS International Cave Diving Conference

Master of Ceremonies: Paul Heinerth

8:00 – 8:45	Doors open (serving coffee, snacks)
8:45 – 9:00	Opening remarks
9:00 – 10:15	*Panel: Tales from the Back of the Cave* (Various Speakers)
10:15 – 10:30	Break and door prizes
10:30 – 11:15	*Exploring and Mapping Underwater Caves in Hawaii* Jason Richards
11:15 – 11:30	Break and door prizes
11:30 – 12:00	*Diving divert monitoring as it pertains to the cave community* Frauke Tillmans
12:00 – 1:30	Lunch: 2023 NSS-CDS Annual Membership Meeting
1:30 – 2:00	door prizes
2:00 – 2:45	*Human Factors Approach to Learning from Unintended Outcomes* Gareth Lock
2:45 – 3:00	Break and door prizes
3:00 – 3:45	*Last 50 Years of Changes in the Florida Springs* Robert Knight, Ph.D.
3:45 – 4:00	Break and door prizes
4:00 – 4:45	*Cave Diving in France* Paul Heinerth
4:45 – 5:00	Closing remarks and Awards
5:00	grand prize drawing: Fathom Gemini CCR

Cave Diving Section of the
National Speleological Society, Inc.
5200 NW 43rd Ave., Ste. 102-380
Gainesville, FL 32606

RETURN SERVICE REQUESTED