

Submersible Stress

Generating ICD Warnings

DCI - What Now?

The Art of Shooting the Bag

**Diving Pioneers & Innovators: A Series
of In Depth Interviews (Wes Skiles)**

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Editorial

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Welcome to the ninth issue of Tech Diving Mag.

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It's our second anniversary! So celebrate it with us and enjoy some unique first hand experiences. The contributors for this issue are world renowned industry professional Bret Gilliam, technical diving instructor, deep/cave diving guru, and book author Joseph Emmanuel, wreck diving explorer and commercial diving expert Rick Thomas and professional journalist, editor, technical diving instructor and rebreather instructor Fred Garth. Get to know more about them and read their bio at www.techdivingmag.com/contributors.html.

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As you might know, Tech Diving Mag is based on article contribution from the readership. So you're always welcome to drop me a line if you're interested in volunteering an article. One more much appreciated thing is your photos (even without articles)! For submission guidelines, take a look at www.techdivingmag.com/guidelines.html.

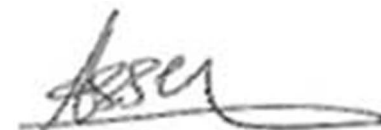
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Tech Diving Mag is very much your magazine and I am always keen to have your input. If you want to share your views, drop me a line at asser@techdivingmag.com.

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Asser Salama
Editor, Tech Diving Mag

Submersible Stress

By Bret Gilliam



There is really nothing new about deep diving submersible vehicles. Ed Link and other innovators dreamed up models back in the 1960s that seemed like they were excerpted from the pages of a Jules Verne novel. Originally, these subs were employed in pioneering oceanographic and scientific projects and were responsible for opening doors to the oceans' depths that had previously been considered unexplorable. As submersible technology became more affordable and diversified, the expanding commercial diving market quickly adopted such applications for survey and inspection work. In many instances, this proved far more cost effective than subjecting a diver to such an exposure.

I had firsthand experience with exactly this same scenario while working with Navy diving teams in early 1971. Our project was based in St. Croix, the largest of the U. S. Virgin Islands, giving us close proximity to the 11,000-foot depths of the Virgin Islands Trench only an hour's steaming time from the Fredericksted pier where our support ship docked next to our operations partners, the sleek "fast attack" Navy submarines. Our job was to film these submarines and we had already passed the 300-foot depth mark several times as our work gradually moved deeper. This posed obvious risks including oxygen toxicity, narcosis, prolonged decompression some 10-15 miles offshore, and a rather overwhelming population of oceanic white tip sharks that liked to try to chew on us with unabated enthusiasm.

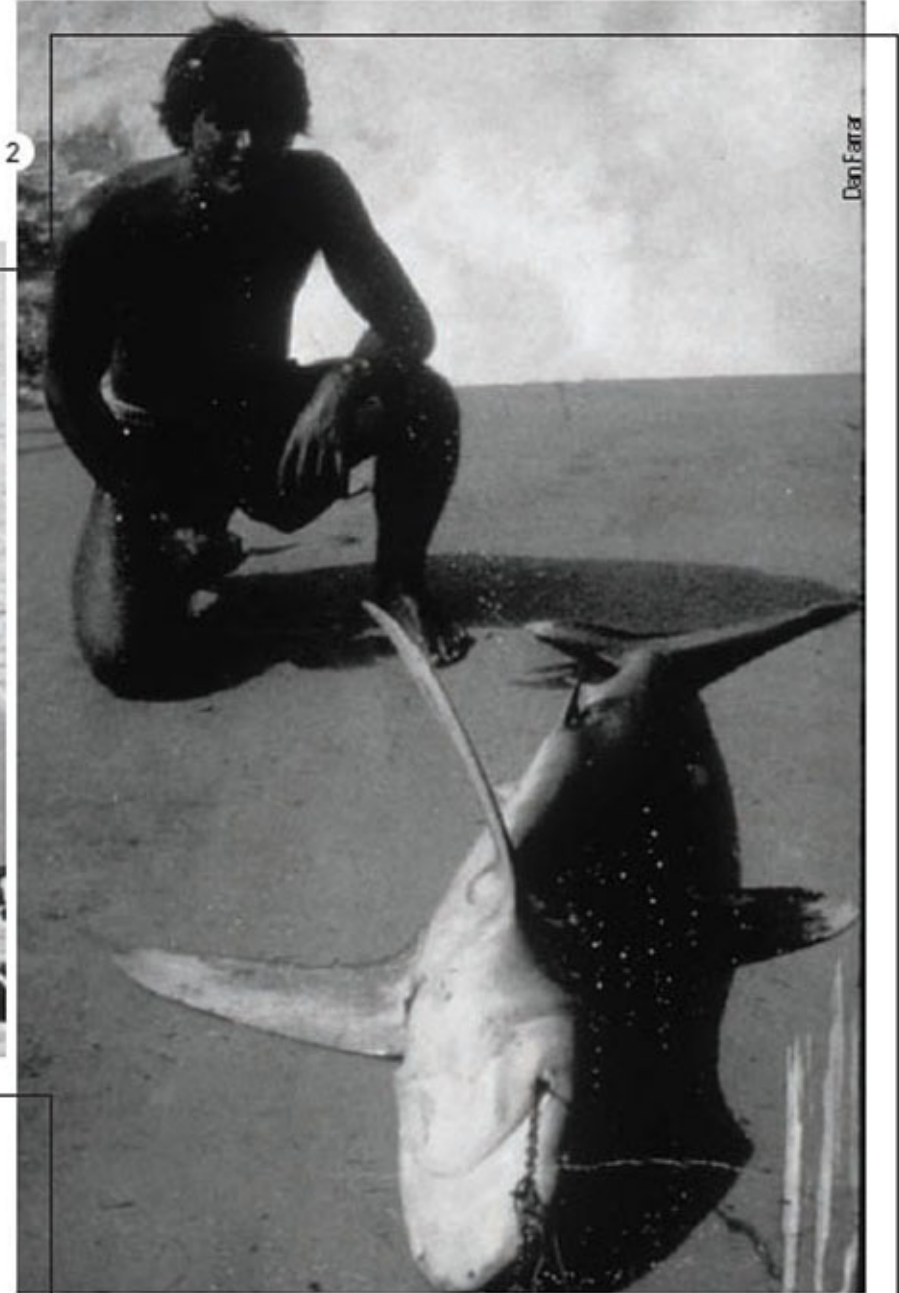
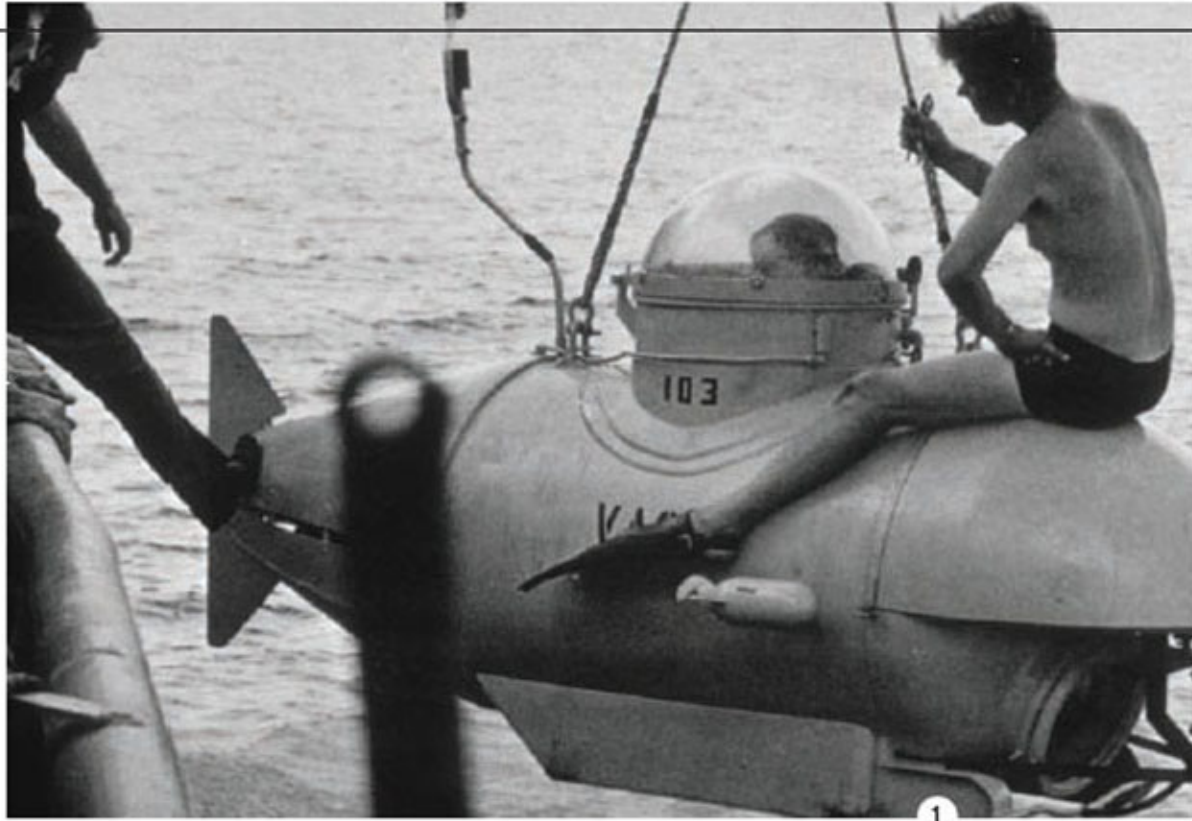
Our unit had been sent a small Kittridge one-man submersible but it was accumulating mostly dust and rust as it sat stored in a Quonset hut warehouse waiting for a suitable mission to justify its use. This sub was decidedly small: about 10 feet in length overall with barely enough interior space for a single operator to squeeze in. Most of the contraption was taken up with compressed air ballast, battery storage compartments, and a rabbit's warren of pipes, hoses, and wires.

As our dive teams realized that we'd have to begin working past 300 feet soon, a well-intended senior officer decided that now was the perfect time to bench the divers temporarily and see if the submersible would be a better and safer method of getting our film work accomplished. It sounded good on paper: no divers in the water to get bent or nibbled on by sharks. And the Navy's SOP called for a single technician, far below our pay grade, to be the operator. So they would even save money in the budget.

That last part didn't go over big with the three of us in the dive team. We figured that if we were no longer needed on the sub film project that the Navy would find some other project for us that could be far more unpleasant. At the height of the Vietnam War and the Cold War with the Soviet bloc, there was no shortage of nasty places that we could be reassigned.

A not-so-eager electronics technician was selected from the ship's crew to be trained as the submersible pilot. The Navy's logic was that his skill with electrical systems, radio communications, and other assorted gadgetry made him the perfect candidate to run the sub. We would mount our underwater 16mm cameras to the outside of the submersible's hull and show him how to manipulate the arms to point the lenses at the fast attack subs as they zoomed past. Like so many government plans, it was great in theory. But things quickly began to go awry.

For instance, it was determined on the first day of pilot training that the technician had some major issues with confinement in small spaces. And he didn't swim. The claustrophobic nuisance was supposed to be cleared up by sending him off to have a chat with a psychologist that could help him neutralize those fears with some sessions on the couch. As far as his inability to swim, the Navy decided that swimming was



1. Kittridge one-man submersible being hoisted over the side. January 1971.
2. Bret Gilliam aboard Navy support ship with 10 ft. oceanic white tip shark hooked during dive team's decompression.

not a necessary job skill since he would be put inside the sub on the deck of the ship and then lifted into the water by crane. Extraction following the dive was the same method so the imperative for him to actually be able to swim was considered a non-essential item to his resume.

Most of the first week was spent getting him familiar with the submersible's internal electrical, hydraulic, and breathing systems along with the theory of actually "flying" the contraption underwater. This required indoctrination to the compressed air and fixed ballast systems along with use of the diving planes and propulsion motor run by the battery banks that would operate the single screw and allow the submersible to tool around at barely 2-3 knots. All of this training was done in a simulator without requiring our hero to actually get inside the sub underwater. By the end of the week, as we watched from the sidelines, we decided that our odds of being reassigned were looking less and less likely. We even speculated about asking for a raise when the Navy brass came crawling back to us in act of contrition. So we passively watched with rapt attention... all the while doing our best to look supportive.

Finally the big day arrived when the first dive would take place. The submersible was trucked down to the pier and loaded on to the afterdeck of the ship by crane. I had to admit that the damn thing looked pretty small. It was only about the size of a VW microbus of that era and squeezing through the tiny hatch was akin to being strained through a pasta maker. The plan was for us to get the pilot inside, secure the hatch, and then carefully lower the sub over the side in the calm water next to the ship. The ocean bottom was only about 35 feet below us and the pilot was to practice his maneuvers and drills in this benign environment before we tried him in deep water where the bottom was over two miles deep.

Two major obstacles arose before we ever got the hatch closed. Apparently, no one had bothered to explain that the actual submersible had a hatch that required us to bolt the pilot in from the outside. The only way to get out was to come back to the surface and have the support team release the bolts and remove the hatch. As far as our neophyte pilot was concerned this little detail was a deal-breaker of the first order as he loudly protested about being "locked inside a coffin". However, he was persuaded to continue when it was pointed out that he couldn't swim anyway and therefore had to come back to the ship where they promised we would unbolt him. While the logic of this argument was indisputable, he didn't look any happier. But he was promised that a new hatch that closed from within was on the drawing board and would be fitted soon.

As he eased into the hatch opening, he read the plaque noting the depth rating of the submersible as "400 feet, experimental". This proved not be a major confidence builder either. The pale look on his face was not improved by the senior officer's assurances that he had no reason to go beyond that depth and that he had a variety of compressed air ballast tanks that could be blown to bring him up as well as a half-ton lead ballast pod attached to the sub's keel that could be jettisoned in a complete emergency. And heck, the bottom for this first dive was only 35 feet down. What could go wrong?

With those words of wisdom implanted, we finally got him inside and bolted down the hatch. A hemispherical Plexiglas dome was affixed to the hatch flange and provided the only view port for the pilot. He settled into the seat with his head in the dome and stared back at us like a condemned man asked to make himself comfortable in an electric chair. We gave him an enthusiastic "thumbs up" inquiry to see if he was ready for the plunge and got back a weak affirmative signal that decidedly seemed to lack conviction.



Submersible launched with ship crane into Georgetown harbor

Oh yeah... hand signals were all we had that day since the special radio for the pilot to communicate with his surface support team from the depths had yet to be installed as a newer unit was en route and would be ready the following day. But we exuded confidence as we smiled back and kicked the winch into gear lifting the sub off the deck and over the starboard rail. We held it steady after getting it into the water and pointed at the checklist through the dome while again inquiring with another “thumbs up” inquiry to be certain he was ready to be released from his last tether and begin the dive. A shaky thumb wagged from inside and I released the shackle.

In retrospect, I suppose we should have been suspicious when the sub began an immediate rapid drop to the sandy bottom and landed there in an explosion of silt that swiftly enveloped the entire area obscuring our view from the surface. But we figured that he was showing off with a grandiose start after his initial trepidation. His dive plan called for an internal systems run-through, tests to the backup breathing system, ballast and trim drills, and some simple maneuvers around the general area. He’d then return to the surface and we’d winch him back aboard.

It took about a half hour for the sediment and silt to clear and we watched from the surface with growing interest. But the submersible just sat there. After an hour or so, the diving officer suggested we don snorkeling gear and drop down to see what was going on. The shallow depth made free-diving a cinch and I settled down beside the plexi-dome and looked inside. A face contorted in terror and bearing a striking resemblance to the Crypt Keeper (or maybe Joan Rivers after her latest face-lift surgery) stared back at me in mute distress. I elected not to waste any time with a “thumbs up” as I could easily discern that the pilot’s thumb was not the finger he was stridently waving at me.

It turned out that in his initial angst he had failed to do his final ballast checks to attain positive buoyancy at the surface so when we released the hoist tether he plunged to the bottom like a falling meteor and then jammed the release on the lead weight pod. Apparently things went swiftly downhill from there and panic took over. With no radio to communicate and a wave of claustrophobia numbing his cognitive functions, he sat frozen at the controls in white-knuckled angst for over an hour until I showed up.

We quickly hoisted him back aboard but his career as a submersible pilot was over. A recurring image of what might have happened if the test dive had been conducted without a shallow bottom to arrest his descent haunted him for months. He would have passed the maximum “crush depth” depth rating for the sub in about four minutes and had a one-way ride to the abyss.

A quick survey among the rest of the crew revealed no one else who wanted to take over as Capt. Nemo. We were notified that the dive team would resume operations in two days. At least in our little universe, order had been restored and we were to remain safely in St. Croix for the duration of the Navy’s project. Sharks and long deep dives still looked better to us than a visit to Southeast Asia during that era. Ironically, I was later coerced into being a submersible pilot for more advanced vehicles and fell in love with technology.

But then again, I could actually swim...

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Generating ICD Warnings

By Asser Salama



© Jaap Voets

It's a known fact that we still do not have a complete, well-formulated scientific theory to describe the Isobaric Counter Diffusion (ICD). However, some PC-based decompression planning tools do warn us of the possibility of getting hit by ICD. So what's the model they use?

Well, there's actually more than one approach, but the most commonly-used in decompression programs is Steven Burton's. This model aims at NOT increasing the quantity of dissolved gas in the inner ear.

Given that the quantity of a particular dissolved gas in a fixed volume is equal to the solubility coefficient of this particular gas in that medium multiplied by the current saturation pressure, and that the total quantity of dissolved gas in that fixed volume is simply the sum of the quantity of each gas present, it's pretty easy to calculate the total quantity of dissolved gas in the inner ear at gas switch stops, which is believed where ICD takes place.

So at each gas switch stop, the following condition is to be verified, otherwise an ICD warning message is displayed:

(Fraction of helium in next mix * Helium solubility + Fraction of nitrogen in next mix * Nitrogen solubility) <= (Fraction of helium in current mix * Helium solubility + Fraction of nitrogen in current mix * Nitrogen solubility)

The common practice is to use the solubility coefficients of lipids (fats), which are 0.015 and 0.067 ml/ml.atm for helium and nitrogen respectively. As you can see, nitrogen is 4.467 (0.067 / 0.015) times more soluble than helium in lipids. This means that by increasing the nitrogen percentage no more than fifth (a little bit more conservative than 1 / 4.467) of the reduction in the helium percentage, ICD hits could be avoided. And that's what we know as the rule of fifth.

A problem with this model is that the scientific community tends to model the inner ear close to water, not lipids. The solubility coefficients of helium and nitrogen in water are 0.01 and 0.015 ml/ml.atm respectively, which will obviously result in less conservative ICD warnings.

It is worth noting that both options are implemented in at least one decompression planning tool (the latest version of [Ultimate Planner](#); version 1.2). This gives the diver the opportunity to choose how to model the inner ear. But be aware, so far no body claims to have a conclusive model for inner ear decompression.

Configuration

Units
Depth Meters Ft. SAC (RMV) Liters Cubic ft.

VPM-B/U and Buhlmann-GF/U
Symmetry [%] 100 95 88 78 67

VPM-B conservatism [%] 0 5 12 22 35 50

VPM-B tissue compartment set Dec-12 ZHL-16

Buhlmann's model ZHL-16B ZHL-16C

Buhlmann's gradient factors Lo [%] Hi [%]

Descent rate m/min

Ascent rate - deep part m/min

Ascent rate - shallow part m/min starting at m

Deco step size m

Bottom SAC (RMV) ltr/min

Deco SAC (RMV) ltr/min

Minimum gas switch stop time (extended stops) min

Last stop at double deco step size

ICD warnings for dives deeper than m

Model the inner ear as Lipid tissue Water tissue

O2 narcotic in END calculations

CCR set points Atm Bar

Choose the values you feel more comfortable with for generating ICD warnings.

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Optional second dimension of conservatism (/U)
Optional extended gas switch stops


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piece of software!”

Ben Reymenants - Instructor Trainer (TDI, SSI, PADI)


U
P
D
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D

Configuration

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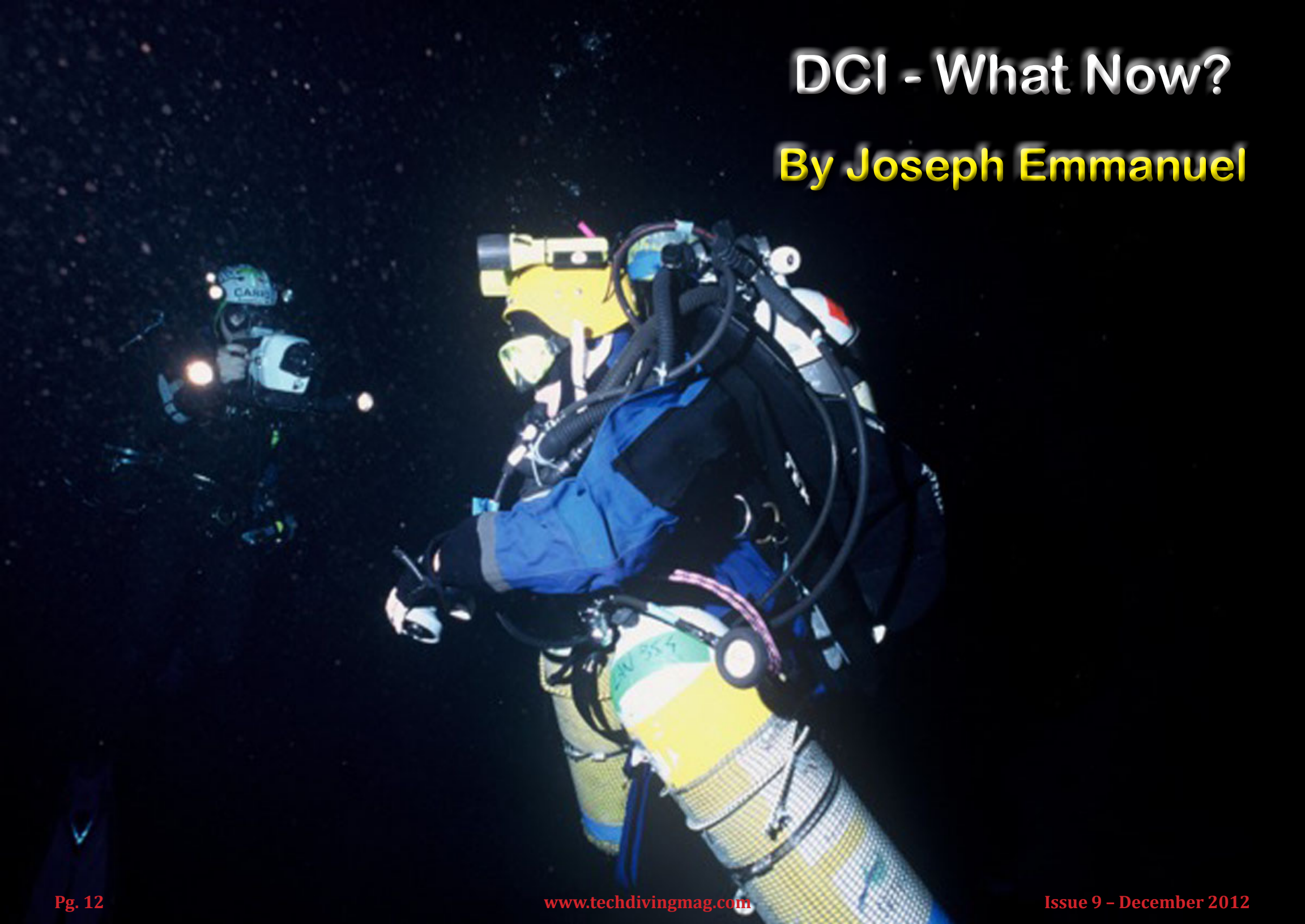
O2 narcotic in END calculations

CCR set points Atm Bar

OK

DCI - What Now?

By Joseph Emmanuel



In the eighth issue of Tech Diving Mag (September 2012), Bret Gilliam and Steve Lewis approached the topics of Decompression Sickness and Decompression Schedules respectively. In these excellent articles the authors point out the fact that even though some very clever people have focused on the physiology and procedures of decompression, there remain gaps between the theory and practice of decompression illness and how it can be avoided.

As a survivor of an 'incident' which doctors could not say with certainty was a decompression 'hit' as we say in the vernacular, I thought readers might find it interesting to see how much my experience underlines the degree of uncertainty in the type of diving we all regularly do.

As careful as I'd always been over the years, I was unfortunately to find out for myself, that no decompression model is foolproof. On Saturday the 3rd of January 2004 I was at Badgat, a disused mine used for cave diving site 4 hours from Johannesburg, South Africa. We were there for the weekend to support Verna van Schaik on a dive that she planned to reach 160 metres down the incline shaft.

We'd been at Badgat a few weeks earlier when Verna and I had done 108 metres down the shaft and along the tunnel at the bottom to retrieve a stage bottle for Don Shirley. I remember thinking what a great dive it had been and how everything had gone according to plan. I'd even been fairly warm most of the dive in spite of doing the dive of 133 minutes in my wetsuit.

On Friday the 2nd of January I did a build up down the main tunnel we called the highway, through the blast-door and down the shaft to around 60 metres. Also if memory serves me, the team placed some stages in the shaft at thirty six metres and even down as far as 80

metres. Excluding the Trimix dives these dives required an average of fifteen to twenty minutes of decompression. All of them went without any incident or indication of what was to come.

The dive

For the 160 metres dive I planned to use a profile I'd dived many times before with a helium mix of 8/60 (8% oxygen, 60% helium) this gives an equivalent depth of about forty metres which meant I would be very clear headed and able to assist Verna in transferring stage cylinders as she ascended the shaft.

I entered the water on schedule and swam to the blast-door via the highway. The highway is a tunnel approximately one and a half metres high by four-six metres wide that connects the main shaft to the open pit. It is approximately 110 metres long and sixteen-eighteen metres deep, depending on the water level. I followed our pre-laid jump-line from the entrance and soon found the permanent line that showed the way to the blast-door. This half metre by half metre door is set in a brick wall and was literally used to shield the effects of explosives set off during the active mining days. As I swam along the dark highway I swept my primary torch from side to side slowly, passed the first intersection that joins the two entrances to level one, the second intersection which joins the left and right hand sides of level one, and the other two possible routes I could take on this level, all the while running my dive through my mind and reviewing when I'd meet Verna and what I needed to do. I was confident everything was going according to plan.

Arriving at the blast-door I squeezed my single stage, my twin fifteen litre back mounts and myself through the door. Once through the door I checked myself to see everything was okay, and started down the shaft. As I moved down past the second level at twenty three metres, and the fourth level at about 70 metres I checked on Verna's stages to

make sure the valves worked and were not stuck closed.

Depth	Runtime	Gas
16	10	EAN32
36	12	HeliAir 8/60
110	21	HeliAir 8/60
73	26	HeliAir 8/60
60	29	HeliAir 8/60
50	31	HeliAir 8/60
40	33	EAN32
32	34	EAN32
28	36	EAN32
26	37	EAN32
24	38	EAN32
22	40	EAN32
20	43	EAN50
18	45	EAN50
16	53	EAN50
12	56	EAN50
10	63	EAN50
8	72	EAN50
6	80	Oxygen
4	92	Oxygen
2	114	Oxygen

My decompression schedule for the support dive to 110m

Rendezvous at 107 metres

I got to 107 metres a little earlier than anticipated, and although Verna did not appear from the incline in the next long two to three minutes I was not too concerned. Although after about a minute more I began to do the mental calculations for how long I could wait at this depth and have enough gas to be safe. I knew in the back of my mind that I had enough breathable gas to stay for about twelve minutes. As a

precaution I ascended to about 90 metres and waited.

An element of this type of support diving that is of vital importance and almost impossible to prepare for fully, is the way one's mind can begin to work against one. In fact the more knowledge you have the worse it can be. I knew exactly how long Verna could survive on the gas she had, I knew I had very few options if she was late or did not reappear in the tunnel very soon. I could swim down the tunnel and wait at the entrance to the inclined shaft for a minute or so, or I could go a short way into the incline shaft in an attempt to find Verna. This would have been a very risky proposition as it would almost certainly extend my bottom time beyond my planned stay. I'd then have to rely on the safety built into my decompression schedule, my experience, my faith and a lot of luck to get out of the cave safely.



Finally, and the hardest decision I could imagine having to make as a support diver, I could decide to begin my ascent, perhaps very slowly to give Verna longer to come out of the tunnel, but this option would mean that I was conceding that my friend had died and would not be coming back; something I knew I never wanted to do. I knew that Verna would be fully aware of the factors governing her chances of survival should something go wrong. I knew we had an almost unspoken agreement not to endanger our own lives to try and save another. No one wants two deaths in a hopeless rescue attempt. But I also know that we'd both try everything in our power to help the other if we thought there was even the smallest chance of success.

One minute stretched by, nothing but my own light and the sound of my own breathing. I spent another long minute occupying my mind by slowly sweeping my torch around the narrow confines of the bottom of the shaft and the even smaller square rock cavern I found myself in at 90 metres. Not surprisingly the scenery didn't hold my attention very long. The minute strolled by, still nothing. Finally, a faint glow appeared below me. As I descended again to the bottom the glow gradually grew into Verna as she emerged from the tunnel leading off the shaft at 107 metres. It's hard to describe the sense of relief that flooded through me. I remember speaking out loud into my regulator "I knew she'd be okay!". Very relieved to meet Verna, I checked she was okay and picked up two stages from her. At this point, at 110 metres, I struggled for a moment to attach one stage to my harness so I elected to simply hold on to it on the way up. This should also have caused no real problem since the stage was aluminium and nearly empty, therefore almost neutrally buoyant. But the effort of struggling to attach the cylinder was a factor I had not accounted for in my plan.

The doctors tell us that any exertion at depths like this can be a cause

of problems, but at that point I felt no pain or discomfort other than the effort of holding the tank. My first decompression stop at 73 metres more or less coincided with Verna's first stop as well. After that I pretty soon moved up on my own dive and left her in the care of the next support diver. I did not stay at 107 metres for more than about six minutes total. The dive itself went fine, although I was a little stressed when Verna was late for our meet up. All in all I picked up three additional stage cylinders which meant I had five on me as I swam back to the blast-door. To get through I had to methodically unclip each of the stages in turn, pass them through the door and clip them to the main line on the other side of the blast-door. Then I swam through and reattached each one to my harness. Once that was done I could finally start out along the highway to my oxygen cylinder that hung on a line at six metres just outside the entrance to the cave. At that point I experienced no discomfort or pain of any kind. I completed all my decompression stops up to six metres and changed to oxygen at the correct depth and time. My profile for this dive is shown at the end of this article. This is provided for information only and not intended for use by anyone other than the author.

As a comparison and to illustrate how our dive planning had changed over the years, I've included a table which, although designed for a 75m dive, is built up very differently. The major difference between the two is the inclusion of so called "Deep Stops". The technique of starting our decompression with short deeper stops. Back in 1993 we figured the faster you get shallow, the better. Time and the experience of divers from around the world have taught us differently. Most modern decompression theories build in some sort of "deep stop" in an attempt to minimise so-called micro bubbles in the tissues of the diver. Still I guess the term "deep stops" is accredited to Richard Pyle, an ichthyologist from Hawaii. Dr Pyle found that when he stopped on his way to his first scheduled decompression stop (to puncture

Author decompressing



deep water fishes' swim bladders) he felt much better after the dives. Richard Pyle duly documented his findings and the rest, as they say is history (Pyle, DeepTech 5:64).

Depth (m)	Time (min)	Gas breathed
36	3	Air – changed to HeliAir 50:50
75	10	HeliAir 50:50
36	1	Changed back top Air
18	7	Air
15	20/20	Oxygen/Air in 5minute intervals
12	15/15	Oxygen/Air in 5minute intervals
9	4	Oxygen
6	12	Oxygen
3	24	Oxygen
	131	Total Time

My decompression schedule for a 75m dive about 6 years earlier

Neurological bend?

Once I'd finished all my scheduled decompression stops I spent a few extra minutes on oxygen at six metres, as is my practice before finally surfacing after 114 minutes. I still had no pain or any other symptoms of DCI. After getting out of my heavy tanks and filling my BC to float my gear on the surface, I rested for a few minutes. In retrospect I might have waited a bit longer, although I can never know if it would have made any difference. I proceeded to climb up the ladder that leads out of the water and make my way up the twenty-odd metres of rough stairway and loose gravel to the top of the hole where I started to get out of my wetsuit. So much for no heavy exertion after a deep dive, but by then, although I didn't know it, I was probably already not thinking clearly. Within about twenty five minutes of surfacing, I began to see visual disturbances or 'auras' as they are called in a migraine headache. I should point out that I do have a history of migraines and sometimes quite bad ones. The problem is that the

symptoms I was experiencing at that point were no different to those I'd had with migraines in the past. These symptoms are very similar to those experienced by divers who have neurological decompression sickness! in-coordination, lethargy, fatigue, numbness, pain and headaches to mention a few. If it was indeed DCI it meant that a bubble/s of nitrogen or helium had formed during my ascent and lodged somewhere in my central nervous system or CNS. The bubble, or more likely bubbles could be anywhere from the spine upwards to the brain. If not very promptly treated this could mean temporary or permanent loss of memory, trouble walking and talking, hearing problems and other similar effects.

At its worst this type of decompression sickness can mean permanent paralysis or even death from a bubble in the brain. So what did I do? I took two muscle relaxants called Norflex, and promptly went to sleep. I woke up hours later, retching and unable to remember my name. More to the point, I was unable to articulate anything intelligible enough to convince my wife and friends that I was 'only' having a migraine. My wife and friends were by now becoming very concerned about me and, on the advice of DAN evacuated me to the hospital in nearby town of Barberton. From here I was taken by ambulance 450 kilometres to Pretoria, only to find the chamber closed. I was then flown courtesy of DAN to a mono-place chamber in Welkom, a relatively remote town, almost totally dependent on the mining industry for its existence. I arrived in Welkom on Sunday the 4th of January at 7:05 am. I was placed in the very able care of Dr Frik Ziervogel and Sister Hiske Smart. The doctor took one look at me and decided to take a conservative approach and treat me as if I had a neurological decompression illness. So I was placed in the chamber on US Navy Treatment Table 6. This table involves an almost five hour stay in a decompression chamber (more correctly termed a re-compression chamber). It's included at the end of the article for

reference only.

US Navy Treatment Table 6: Oxygen Treatment of Type II Decompression Sickness

Depth (m)	Time (min)	Breathing Media	Total Elapsed Time (hr:min)
18	20	O ₂	0:20
18	5	Air	0:25
18	20	O ₂	0:45
18	5	Air	0:50
18	20	O ₂	1:10
18	5	Air	1:15
18 to 9	30	O ₂	1:45
9	15	Air	2:00
9	60	O ₂	3:00
9	15	Air	3:15
9	60	O ₂	4:15
9 to 0	30	O ₂	4:45

Resolution

I responded to the treatment well and by the end of it could correctly fill in a form with my name, identity number, address etc. I should stress again that although I responded to the treatment table, I was at eighteen metres on oxygen for almost two hours and then at nine metres for a further two hours. This degree of oxygen might have had a neutralising effect on the Norflex. Besides, it was almost thirty six hours after I took the Norflex, so it had probably worn off anyway. Yet again, I'll never know. Even so, the doctors who saw me later were also not prepared to say it was just a migraine. They felt that my symptoms had presented too soon after the dive to make a definitive statement that what I had experienced was a migraine.

At this point the DAN doctors recommend I did not dive for six months just in case. In itself this was not a terrible thing. In fact I could count myself very lucky not to have any permanent damage. However there was an added complication. About two years prior to this incident I was diagnosed with a probable PFO or Patent Foramen Ovale. This is a condition where the flap of tissue that divides the left atrium of the heart from the right atrium does not fully close within a few weeks of birth. What this means is that blood coming from the veins can pass directly into the arterial system. Along with this, un-oxygenated blood can go bubbles of nitrogen absorbed by the diver during a dive. It is estimated that about one in three people have a PFO (Alert Diver September/October 2004). In non-divers it is usually not a problem. However, given the possibility of bubbles moving into the arterial system and worse still, the brain, in divers it can be very dangerous.

Even so, based on their current body of knowledge about this condition, doctors cannot give an accurate assessment of the increased risk of acute decompression illness, or even the more serious arteriole gas embolism. PFO is still not regarded as a negative indicator for diving, although as I've said some doctors have reservations about it. DAN studies estimate that "the estimated risk of a DCI incident characteristic of those correlated with PFO is between 0.002-0.03 percent of dives (Alert Diver September/October 2004)."

I was advised by some of the most knowledgeable doctors I know to continue diving in the conservative manner I had been doing, very carefully. And this I did. Via the internet I found out that migraine with aura is often found in people with PFO. I also discovered a relatively simple procedure that can close the PFO and possible stop the migraines altogether (Windecker,ESC Congress,2003). As a result of this, and in the light of my recent 'incident', I decided to have the PFO closed. At least this would remove one more risk factor from my

diving.

I met Dr Geoff Harrisburg at Sunninghill Clinic in February 2004. We chatted, and after doing an ultrasound investigation, he confirmed the PFO and agreed that given my history I should have it closed. The operation was scheduled for 2 March 2004. The procedure is a very modern form of heart surgery called a Trans-Catheter implant. As the name suggest, it involves implanting a small device in the heart to block the PFO. The device is a sort of two sided umbrella that is inserted via the large vein in one's groin and then literally pushed all the way into your heart where one end is pushed through the PFO and then opened followed by the other side. The two sides of the umbrella form a substrate on which new tissue grows and thus seals the gap. Surprisingly enough, the entire procedure can be done under local anaesthetic. In my case however, the doctor wanted to test a new ultra-sound device that provides images from within the heart during the operation. Because of this I was placed under general anaesthetic.



I was discharged from hospital the next day. Seven days later, one day after I got back to work, I found myself back in hospital. I was having considerable difficulty breathing and was in a lot of pain. Still, not wanting to wait for the evening or even for my wife to fetch me, I drove myself back to the clinic. A very good thing as it turned out. It transpired that I had a blood clot in my lung, or a Pulmonary Oedema. It may have been my body reacting to the implant and trying to heal it or just the inactivity of a week in bed at home. It appeared that combined with the blood thinning medication (which is standard with this kind of operation) the clot came loose and lodged in my lung. Almost 25% of my lung was affected and I was placed in the care of Dr Verena Ballhausen a specialist physician pulmonologist. Basically a lung specialist. She put me on a strong blood thinner called Warfaren for six months and blood test almost every two weeks. That became my routine for the next few months. Gradually we were able to drop back to one test a month and reduce the Warfaren to a minimum. I could only hope that at the end of six months I would be cleared to dive again. Even though I could not dive, we'd agreed that Verna's preparation for her record attempt later in the year had to go ahead. I would assist where ever I could.

Diving again

Exactly six months after my decompression incident I was back in hospital. I wanted to be very sure to consult all three doctors who had played a role in my PFO surgery and the added complication of the oedema. I was particularly concerned that I might not yet be fit enough to pass the lung function test which proves that one can move enough air in and out of one's lungs in one second. Finally, after months of Warfaren treatment and slow but steady improvements in my fitness, I went to see Dr Ballhausen again. Considering that when she first saw me I could hardly move the needle on the machine without wincing in pain, she was delighted when I passed a lung function test with flying

colours. I managed to reach 108% lung function. Basically my lung function was better than an average person's. So after a long road my lungs were working well again. In addition to this I had one last x-ray to get. Fortunately for me the x-ray showed no evidence of any scar tissue. Any scar tissue on the lung would probably have meant I could not dive again. My diving physician Dr. Frans Cronje' gave me the once over from a diving point of view and I was set to dive again.

The very next weekend after my dive medical I was off to Badgat with Verna and the rest of the new Xtreme-Dream team. I did however elect to follow Dr Cronje's advice and stay out of decompression requirements. I was eager to get back in the caves because in a little over a month we'd be off to Boesmansgat to support Verna in her attempt to become the deepest diving women in the world of scuba. The weekend was a very good one for me as it gave me a measure of confidence and a confirmation that I had not yet forgotten everything I knew about cave diving. Although to be honest I would have been surprised if I had felt any real trepidation before the sort of dives I did that weekend.

For her record attempt Verna chose the following team;

- David Shaw : Deep Re-breather Support (150m)
- Don Shirley : Deep Re-breather Support (120m)
- Derek Hughes : Deep Trimix Support (80m)
- Gareth Lowndes : Deep Air Support (50m)
- John de Wet : Mid-water Air Support (3-50m)
- Joseph Emmanuel : Shallow Air Support (6-20m)
- Allana Barber: Shallow Air Support (6-20m)
- Ian Gatley : Shallow Air Support (6-20m)
- Theo van Eeden : Photographic Support (20-30m)
- Kirsten Emmanuel : Surface Marshall
- Malcolm Smith : Medical Support from Netcare 911

- Claire Smith : Medical Support from Netcare 911
- Gordon Hiles : Surface Video

Still, some people might have been very nervous to dive again after what could have been a very close call, or not. As I say I'll never know for sure whether I had a cerebral bend or just a bad migraine. Anyway, my first dive that weekend was to help Verna take Allana and Ian (the newest members of Verna's XtremeDream team) on their first dive into the tunnels at Badgat. Alana and Ian were a couple, at times a stormy couple, which made me a bit nervous because emotional distractions on these expeditions could lead to someone making a fatal mistake. Nonetheless, I was impressed by Ian in particular, another IT person, but very much a person who was prepared to learn the skills he needed to become a good cave diver. A very calm demeanour made him very nice to have along. Allana was more excitable, but still, I have to say she put in far more hard work over the expeditions than perhaps her five foot something frame would have suggested.

The simplest dive one can do there is to enter via the right entrance and swim down the highway to the blast-door. But, even though the dive is only around sixteen metres average depth, by the end of the highway we'd be 110 metres into the cave and under about twenty metres of rock, with no way out except back the way we'd come. If either Ian or Allana suddenly discovered an aversion to dark places, we could be in very serious trouble.

So with Verna in the front with her very bright canister type primary torch lighting the way, and me with mine bring up the rear, we set off. Passing the landmarks I knew so well, I wondered if Ian and Allana would remember my advice to them to try and memorise the features of the cave as we went deeper and deeper in. How many junctions did we pass? How many holes in the floor did we swim over? On which

side of the highway was the permanent line laid? By asking them to do this I was trying to make them stay aware of their new surrounding and not become mere passengers on the dive. In cave diving, every member of the team needs to be alert to potential dangers, loose lines, silted passage ways, worse yet, lost lines or missing buddies. As things turned out they did fine and barring a little bit of silt at the narrow entrance, everything went well. Both new divers looked fairly comfortable in the water. But the next dive would be more of a test.

For the next dive of the weekend we decided to take Ian and Allana down to the second level of the caves, but via one of the holes in the floor of the highway. At the same time John, Derek and Verna would go via the shaft and try to join up with us on second level. We entered the main shaft as a group and Ian, Allana and I dropped through the floor of the hi-way onto the second level, which is at around twenty metres. As an exercise we had selected Ian to take in a reel that John and Derek had laid on an earlier dive. This he did very well. I had the strange sensation of observing other divers doing what I had done so many times. Keeping well off the silt lined bottom of the tunnel, reeling in the line, making sure that it was kept tight at all times and making sure the line doesn't slip into line traps. I led Ian and Allana to the drop-off from second level to third level.

This point in the cave system is well and truly in the maze. I pointed out the large wooded pillars that were used to hold up the roof in the days of mining, but now are so soft from being waterlogged for so long that you can literally push your finger into the solid wood. Clearly, not a place to tie a line your very life depends on. I make a point of showing both my friends good solid rocks and even some steel girders that can be used as secure tie-off points. Next we moved on round a corner towards the main shaft and sure enough we saw Verna, John and Derek's light coming down the passageway. We'd

Diving in WonderGat (WonderCave) near Johannesburg, South Africa



made our connection and a complete loop from the entrance to second level and out again. Getting our reels out was the task for the next day. For now we had reached our one-third rule and it was time to head out of the cave again. All in all I think Ian and Allana did pretty well for new guys.

I was back diving and lucky for me with no noticeable lasting effects of my ‘incident’, Ok, call it a bend. The next time we were to dive together it would be in Boesmansgat and we’d be busy preparing for Verna’s world record dive to 221 metres.

I hope my experience will inform other divers and illustrate, as Gilliam and Lewis discussed, that technical diving (i.e diving involving extended decompression) is far from an exact science and even when you stick to the plan, it is after all only a mathematical model, which may or may not work. I agree with Lewis when he urges us to record our data, cause it is data that can tell us what worked for us as individuals in our circumstances.

Safe Diving everyone.

This is an extract from my book “Into the deepest and darkest: Deep diving adventures in South Africa and the Gulf Of Aqaba”. It is available at Amazon Books or iBook Store (eBooks format).

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Deploying the Surface Marker Buoy (The Art of Shooting the Bag)

By Rick Thomas



The dive just wasn't supposed to be like this. A beautiful calm sea suddenly turned turbid with particulate and current. "John" was a fairly competent diver, but this dive was to be his deepest ever, a pinnacle dive for him. The dive started out well, the equipment check pre-dive verified the adequate gas supply and redundancy of equipment. The dive began as-planned, the wreck found easily enough. All went per-plan until the moment John lost contact with his dive buddy, a diver who had been on this wreck many times previously and was guiding John through the dive. Unfortunately the current kicked up and the visibility dropped as John was swimming out of the ship's structure; looking right, then left, now realizing he was alone at 190 feet. Completing a lost buddy drill without re-establishing contact, John decides to initiate the ascent on his own, a few minutes ahead of the planned bottom time. Reaching into his utility pocket John removes his surface marker buoy, feeling a little anxious in the water by himself, and attaches the line from his reel to the D-Ring on his SMB. Starting to drift away from the wreck's structure and losing visual references, John begins to inflate the marker. Distracted by the task of inflating his marker John is not aware that the line from his reel has gone slack, looping around his deco bottle's first stage regulator. As John blows his second breath into the marker he doesn't realize his ascent rate has increased. He has become task-loaded and now is in a near-vertical position in the water, gas is expanding in the SMB, his drysuit as well as in his wing. He looks up, sees his marker inflated sufficiently, and releases the marker, almost immediately realizing the line attached to his marker has come tight on his left side, bound to his deco-bottle! The combination of lift from his wing, dry-suit and marker has increased his rate of ascent dramatically. Near-panic, John realizes he is now in serious trouble, unable to dump gas from his suit and wing fast enough to overcome the expansion rate of the gas, as he desperately tries to free himself from the line attaching him to his ascending marker buoy. Reaching for his knife on his waist strap...

This scenario is a fictional account of a very real, potentially fatal diving accident, and represents a risk that all open-ocean technical divers face on almost every dive. "The Art of Shooting the Bag" is a skill we must master. It represents managing the greatest risk we likely will face in the dive, as well as our dive-team's security and well-being as it establishes contact with our surface support team.

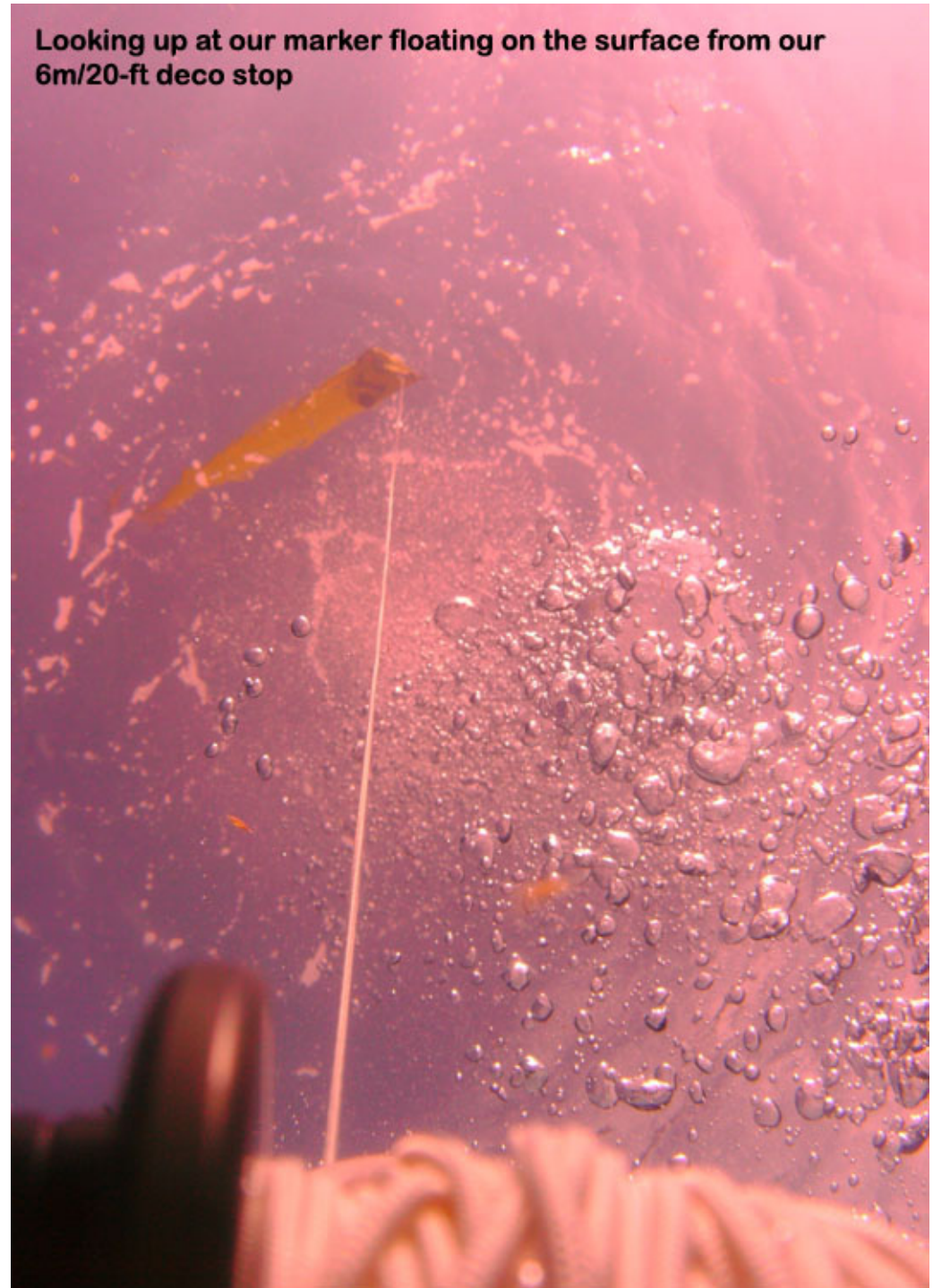
Technical Diving in the open ocean requires a high degree of skill and situational awareness, especially once the established bottom time has been reached and the ascent begins. Unless the dive is being conducted on an established shot-line or up-line/mooring-line, divers need to possess the skill to "shoot the bag". This is often treated as an "assumed skill"; certainly all of us have been taught how to shoot a bag during our technical diving training. How many divers actually practice and use the skill routinely? How many divers understand when to shoot the marker, what type of marker to use, what color marker to use, how many markers to send up, how much line to carry? I write this article from the perspective of diving with a well-established team of divers in south Florida; "Miami Wreck Exploration Project" www.miamiwreck.org. We are an established organization that over the years have tried many variations of the procedures described. We have adopted the following as our standard operating procedures today, and have seen most of the possible problems associated with sending a marker to the surface in the process of doing so.

The required skill of sending the marker to the surface cannot be over-emphasized. Sending the marker up may possibly be the most dangerous single act a diver will do in a deep dive with a decompression obligation. Fundamentally, the SMB is a buoyancy device that has the potential of changing yours or a team member's buoyancy quickly. In the ocean the marker buoy needs to be large enough to be visible from a long distance, thus the small 36-inch/1-meter sausage we all

may have initially trained with during our Fundamentals class is a completely inadequate marker for a serious ocean dive. I recommend a larger 74-inch (1.8-meter) marker for most ocean conditions. This equates to about 15-cu/ft. of flotation fully inflated, enough lift to pull a diver to the surface quickly, especially as Boyle's Law takes effect during the ascent. Too often I will see a diver pull his marker from a utility pocket, attach the line from his reel to the marker while losing buoyancy, get so focused on inflating the bag he loses perspective of the other team members and the slack line falling off his reel. He releases the marker only to realize too late that the line has fouled around his wing inflation hose or clipped off light! Having to resolve such a situation while on an ascent towards the surface can quickly bring into focus the inherent dangers of shooting the marker, and will call upon all of a diver's ability to quickly react to a problem in order to resolve the situation.

Miami Wreck Exploration Project's Rule number One: we shoot the marker as a team! We always dive in a team of two, or a team of three, depending on the number of divers on the manifest, diving in a team of three is preferred. In a team of two, one diver is in charge of sending the marker up while the other diver is responsible for managing the decompression schedule. During the marker deployment, the diver running the deco maintains buoyancy and becomes a visual reference point in the water for the diver that is deploying the marker. This visual reference is important to ensure the diver task-loaded with sending the marker up doesn't inadvertently descend deeper, or ascend shallower, faster than the dive plan allows. From a deep dive the ascent needs to occur as the bag is being deployed, and a proper ascent rate maintained, so ascent rates and buoyancy control is critical. Once the marker is attached to the line, the diver in charge of sending the marker to the surface hands his reel off to the other team member, then starts to inflate the marker. A cutting device should be readily

Looking up at our marker floating on the surface from our 6m/20-ft deco stop



available to both divers in the team. We avoid using a LP inflator hose to do this to minimize the risk of losing control of the inflation, or being fouled with the marker by the inflation hose. We orally inflate the marker. From depth, only two to three good breaths into the bag is sufficient to get the marker to the surface fully inflated. We use a closed-bottom bag with an OPV to ensure the marker will stay inflated on the way up and while on the surface. While one diver is inflating the marker, his team member(s) are managing the line, and ensuring that there are no other divers or structure is directly above the group. Once the bag has sufficient gas inside and is positively buoyant, the divers in the team make eye contact and ensure all are aware that the bag will be released. The diver with the reel signals with the accepted underhand “shoot the bag” hand signal that it’s okay to launch, and the diver responsible for sending the marker up releases the marker buoy. Immediately the other team member hands back the reel, allowing the diver responsible for the marker buoy the opportunity to now manage the line during ascent. Obviously in a three-man team, the diver running deco would not be the diver assisting in the marker buoy deployment.

Miami Wreck Exploration Project’s Rule number Two: Each team member must be proficient in sending a marker to the surface on his own. In the event of unanticipated team separation, each diver’s safety is dependent upon being able to send his own marker up, and managing his decompression while simultaneously managing the surface marker buoy. Because of this requirement all divers in our teams go into the water with a primary marker stowed under our back-plate. We use surface marker buoys on every dive, even the shallow recreation-profile dives. It is during these shallower dives without a serious decompression obligation where we train and maintain proficiency in sending the marker to the surface. It is our recommendation that all open-ocean divers practice this skill as

frequently as possible.

Miami Wreck Exploration Project’s Rule number Three: Make sure the boat and surface support team knows where the divers are at all times. This evolves into the discussion about when to send the marker up. Some divers wait until their first gas switch to deploy their marker. It is our experience that this may allow too much time and distance to pass before the marker buoy is up on the surface where the boat can see it. We shoot the marker buoy from depth, as we leave the wreck on our way up to our first deep stop. This means we will finish our bottom-time segment a minute or two early in order to be squared away and ready to deploy the marker buoy and stay on our dive plan. If we plan a dive to 200-feet/60-meters for 25 minutes, we let the boat know that they should expect a marker buoy on the surface at 27 minutes run-time. Remember your top-side crew and support is an integral and critical element of your dive plan. Executing safe technical dives in the open ocean requires that the dive plan is very specific and known to all parties involved. This way the boat knows when to expect to see the marker buoy, and roughly where in the ocean to look for it. They know where the wreck is; they recently dropped you onto the wreck. They should have a reasonable understanding of local conditions and currents, so for instance can anticipate that in a 3-knot current, the marker buoy will come up about 600-feet/180m away from the wreck, assuming the marker buoy is sent up on time.

Miami Wreck Exploration Project’s Rule number Four: Topside support knows how many markers to anticipate and what color marker buoy to look for. While we do not use the specific color of the marker to communicate a problem, we do determine prior to going into the water which marker the team will use. We have conducted several visibility studies to determine which color tends to be most visible, and have determined that the yellow marker buoy is the more



Managing equipment, scooter & line in deco

visible color on the surface under most weather conditions. Orange is arguably slightly more visible on a bright sunny day in calm blue seas, but yellow is far more visible in an overcast/rainy day on gray building seas. Each team will shoot one marker buoy, so if we have two teams of three in the water, there will only be two markers sent up to the surface. In this way, should one marker buoy come up early, or more than two markers come up at or near the anticipated/established run time, the topside crew can anticipate that perhaps a diver has become separated from the team. The color of the marker buoy is not important. Should we want to communicate a specific message to the boat during our decompression, we would write a message on a wet-note, and send it up on a second marker buoy attached to our primary marker's line. A second marker buoy surfacing next to our established surface marker buoy would immediately draw the attention of our topside support, and deliver a written communication describing exactly what our circumstance is.

Some common issues and considerations when deploying a surface marker buoy:

1. Are you diving with a new spool or reel? These are machine wound. The tightly wound line expands during the dive and upon deployment the lift bag pulls the reel out of the hand of the diver due to binding. Solution: unwind and hand-wind your new equipment prior to the dive.
2. The dive boat or a curious fishing boat drifts over the marker and pulls all the line from the spool. Solution: The team released the spool and deploys a second marker. Never clip off a reel or spool to your harness once the SMB is up on the surface.
3. The line on the reel/spool is in a tangle or somehow fouled and goes unseen until after the bag inflation. Solution: Cut the line or release

the reel, allowing the bag to ascend away from the team. A second bag is then shot. There should also be a discussion with surface support ensuring they know what a "dead bag" looks like compared to one with divers under it.

4. Strong currents at the surface or bottom pull all the line from a spool/reel. This can be a real issue with the team, as the diver holding the reel will be pulled at a faster drift rate than the divers not holding onto the line. This requires team situational awareness because in some instances it may be best to continue the ascent with the line out until the situation resolves at a shallower depth. Alternatively the team may decide to let go of the bag and re-shoot after ascending.

The Miami Wreck Exploration Project's procedures for the safe use of the SMB are simply based upon what we have found that works best from our many years of open-ocean technical diving. We do not pretend to believe our procedures are the 'be-all to end-all' approach to safe Surface Marker Buoy management, but have found that it works well for our approach to team-based technical diving. We share our Rules and Procedures in hopes other divers consider the implications of the "Art of Shooting the Bag", and adopt an established procedure for the team that works best for you. Dive safe.

Rick Thomas

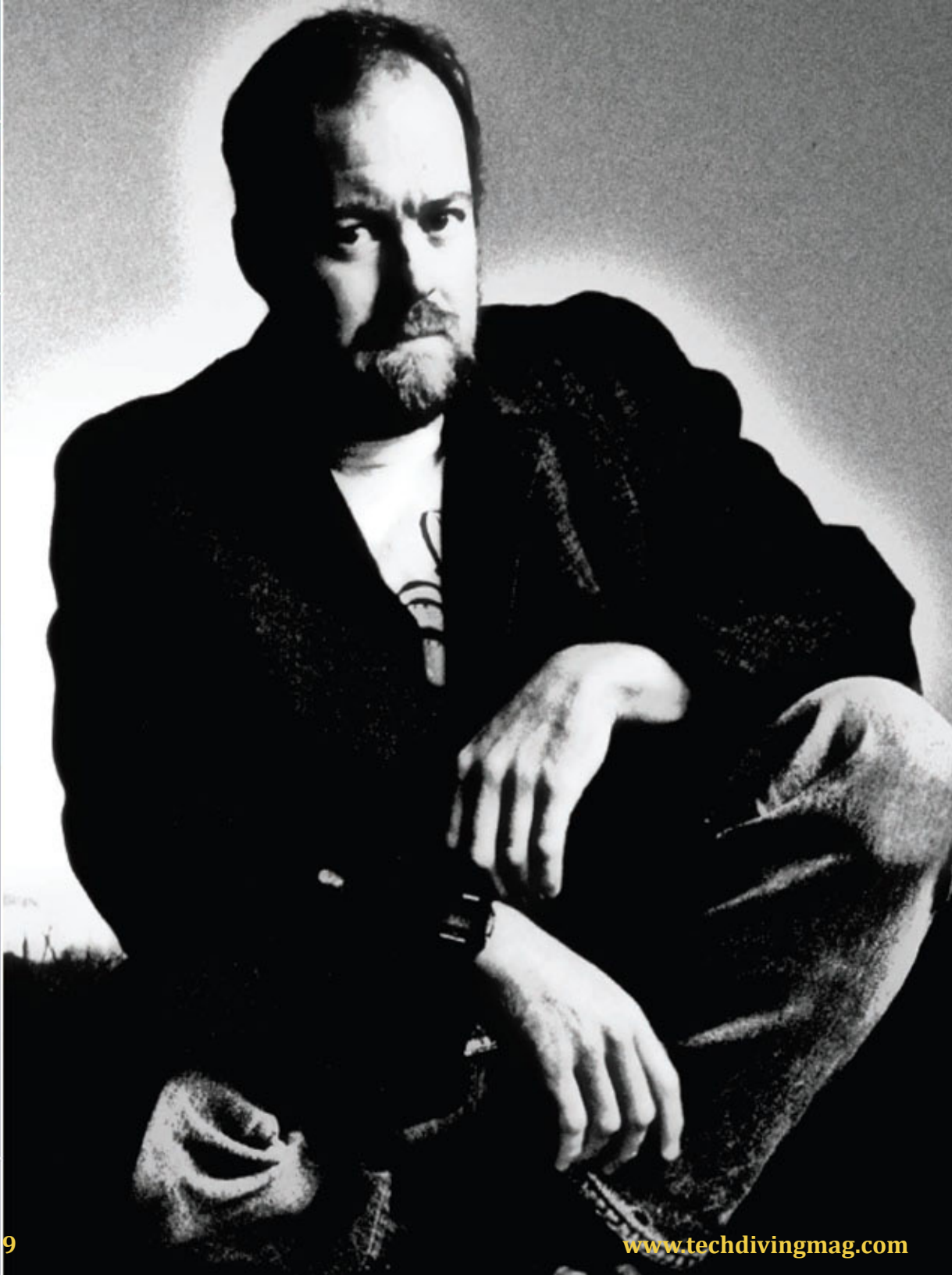
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Wes Skiles

CAVE DWELLER

BY FRED GARTH

You could call Wes Skiles a celluloid troglodyte – a cave dweller devoted to filming the earth’s underwater Swiss cheese. A lifelong resident of a dot on the map called High Springs, in the heart of Central Florida’s cave region, he can slip in and out of the Redneck role like a well-tailored pair of overalls.»

For instance, if you offered Wes a turtleneck on a cool day in New England, he’d probably think it was something to make soup with.

But he can also smooth talk the Editorial Board of *National Geographic* and get mucho dinero funding approved to blast off to the Antarctic wilderness under icebergs. First and foremost, Wes is a world-class explorer and filmmaker. He’s been the friend and understudy of caving legends like Sheck Exley and Parker Turner, both of whom died in their element while riding the razor’s edge. He’s helped to invent dive gear we use commonly today and has created other contraptions like an underwater decompression habitat for one of the world’s most ambitious cave exploration projects.

As a kid Wes made surf films then moved into diving where he’s crafted numerous movies, including a critically acclaimed IMAX film, *Amazing Caves*, with Howard Hall. He’s been the first to dive ice caves in the world’s largest iceberg and he’s been known to hang out with likes of the *Grateful Dead*. All this and the man’s still in his 40s. There’s probably no one on the planet who knows more about diving in cave systems, what rebreather to use, and how to record it all on film.

Skiles is uniquely successful in the decidedly niche market of cave diving. It’s a bit of a strange community. All the participants barely tally the number of divers on the Cayman dive boats off the west end any afternoon. Yet it seems that at any given time, there are bitter

rivalries and feuds that make the Sunnis and the Shiites look like kissing cousins. It’s a bit hard to fathom that such a small group can frequently display such dysfunctional behavior. Wes, on the other hand, rises above the fray and distinguishes himself with his talent... both as an exploration cave diver and as filmmaker/photographer that captures the pure adventure.

Cave diving is not for the faint of heart. It’s also not for most people in their right minds. It’s dangerous. When you’re a few thousand feet back in an underwater cave system and you have a problem... well, generally it’s a long friggin’ way to get out. There’s no option for a free ascent since there’s hard ceiling over your head and the only way out is the way you came in. And that may be more than an hour or so away. Lots of cave divers have tempted fate and lost. Some of the best explorers in the world have fallen victim. Skiles has managed, not only to survive, but to thrive in that harsh and unforgiving environment. He also brings a sly sense of humor to his work. Anyone who’s seen his act with the filthy false teeth and backwoods Billy-Bob dialect can’t possibly stifle a laugh. He even did that to Howard Hall on the IMAX set. (This perhaps cemented Howard’s long-held suspicion that cave divers inhabit a very special trailer park out on the lunatic fringe. Wes, by the way, has a double-wide.)

For those that have seen his images and his films, there is no question that Wes is the premier master of his subterranean craft. In person, he’s funny, erudite, and a well-informed conservationist who has a deep passion for preservation of the fragile cave systems that have made his career. In the spring of 2002, I corralled him for this interview. So hang on to your scooters while he takes us on a personal tour of his life and insights into the fascinating world of underwater caves. And a few deviations along the way.



How long had you been certified before venturing into caves?»Well, I really started going into caves before I was even certified. The springs around here were accessible to us and the nature of it just lead us into caves. Luckily I somehow instinctually knew to stay near the entrance and survived all that. I did my first open-water check-out dive when I was 13 where the grate is now at Ginnie Springs. That's the way they taught scuba diving back then. We didn't think anything about going back that far into a cave to take our mask off and buddy breathe and do ditches and dons all in an overhead environment.

When did you go from fresh water to salt water?»Right after we were certified we were ready to start down to the Keys and to West Palm and off Jacksonville and all that so I've been diving in those places since 1973 or 1974.

Did you ever think that High Springs would become the cave diving Mecca of the world?»Ha Ha. Well, I don't think I would have ever ventured to guess back then that this place would become the heart of technical diving and the cave diving capital of the world. It was just a place down a country road where there were some remarkable natural areas to go diving. And, back then, around every corner was a new discovery. I just don't think we ever expected how the cave community would develop.

How much does the area's popularity have to do with the natural resource and how much does it have to do with the people, such as yourself, who have promoted the region?»I hope I've never promoted the area in a way that would be negative to it. Hopefully, the efforts I've made have been an education to help people survive the experience around here and protect the resource. But I think it's just a natural process, that in teaching cave diving, the area gets promoted. People cut their teeth on cave diving down here and it's the first place

they're going to return to try out new skills and new equipment. And it's just a remarkable place. So with all of those factors you get a real charmed environment for people to flock to.

What is your favorite dive near your home?»Always a difficult question, the favorite dive. Since I continue to plug away at exploring virgin caves around my neighborhood, I would have to say that my favorite dive is the exploration I'm working on right now.

That's a good diplomatic answer.»Yeah it is. Certainly as far as falling into a springs, Ginnie Springs and the Devil's Eye is my longest love affair and the reason I live right here next to them.

So you're still able to find virgin springs, even today?»Oh yeah.

How much virgin territory is out there yet to explore?»Did I say there are still virgin springs and caves? I'm sorry I made a terrible mistake just then (laughs). No, there's nothing left for the next generation to explore. That's our philosophy, leave nothing for the next generations (laughs again). No, seriously, there's always something new to be explored out here. There's always new territory. Technology and knowledge put together will always carry us to new distances inside of our favorite caves and help us find new places we haven't discovered before.

So you're not talking about new entrances but simply further exploration of existing cave systems.»Oh no, no. New entrances. I mean, in the last 10 years our team has explored probably 60 to 80 new cave systems from the entrance. It comes from a collective knowledge that you can only get from living here. I've been right here in the middle of this thing quietly looking around with my friends. We're out on the river every weekend we can, kicking around and

checking systematically every square inch. So for someone else to step in and look at this area, it's mindboggling. There are thousands of miles of rivers and nooks and crannies and sloughs and you just couldn't begin right now and catch up with us because we've been going at it for 20 years.

Are you finding these new caves along the river banks, rather than back in the woods or around swamps and so on?»I decline to answer that question.



So you don't want a lot of people poking around looking for caves. Is that it?»No, they're welcome to come explore the area. That's not the point. Anybody that's an explorer will find stuff. But I'm not going to sit here in this interview and provide a list of how to find caves the way we're finding them. I don't want to be rude about it. It's just that we love our exploration.

It's kind of like keeping the secret of a good fishing hole, huh?»Exactly. When people ask me where I've been diving, I just say the Withalawasanta Fe or Chataholawithchee. And, they'll go, "Oh yeah, okay. I think I've heard of that." And they'll walk away scratching their heads and hope to find it on a map. Which, of course, they won't.

I remember the first article I edited for *Scuba Times* in 1986. It was a piece you wrote about recovering a body in a cave. How did you get into that?»The first recovery I ever did was in 1976, right after I had met Bob Wray. I was working at Steve Matheny's dive shop in Orange Park, Florida and Bob had seen my cave systems maps and had said, "Wow, you've been all through these caves." About two weeks later a drowning occurred at Ginnie and he told the authorities that he knew somebody who had mapped all these caves. So Bob contacted me. When I got there that evening the lights were flashing in the woods and the officer said, "There's nothing down here for you young man. Get out of here." And Bob Wray said, "No, no, this is the guy I called."

There were group of divers there including Lewis Sollenberger and Mary Melton and a few others and we went in and found the first body. Later on the next day we found the second and that was my introduction to it. I was still in high school at the time and it was a real eye-opening experience.

What did that do to your psyche?»Well, I was probably mortified at the thought. It really scared me because I didn't know how I would react. So leading up to that first recovery was by far the hardest thing. I mean my heart was racing and I was wondering why I was doing this. Then when I saw that body lying there covered in silt I was still calm. I went, "Okay, there's the body," you know, and nothing

happened and I was okay. Of course, I sat bolt upright in bed three or four times a nights after that, impacted by that fact that I'd seen such a grizzly thing. It was my first dealing with death. No one had died in my life and there it was in this sport I loved. But, you know, two, three, four, five, 15, 25 or 30 recoveries later, it was something that I had really adapted to. I felt it was an important part of cave diving's responsibility to the public and to the communities and these counties that owned these springs that we carry off a responsible duty and demonstrate that we can do it safely.

That *Scuba Times* article also had some outstanding images. What got you into photography?»I was always into it actually, from a very young age. I had land cameras as a kid then when I was 14, I bought a Nikonos. I saved up lawn mowing money for it. But I always had a fascination for photography. I was a photographer on the yearbook staff in high school and did all of my own processing and developing so I had a real love for that early on.

When did you make the leap to moving pictures?»Well, movies actually came first. My brother and I made surf movies before I got into diving. We were big into surfing and I was his editor. So we would go out and film and bring home 8mm and super 8 movies and put them together. So through that I got into claymation and stop-action photography and did a bunch of animated things in film. So I had that passion for it and my brother had a friend in Hollywood who was into filmmaking and I learned a lot from him. And then, all of our camera gear was stolen. It wasn't conceivable that we could replace it. Our parents had helped us buy it all and they weren't going to buy new stuff for us. So, I sort of got out of the motion picture stuff and dove into still photography.



Mark and Annette Long approach the "lock-out" chamber during the Wakulla II Project, 1998.

Wes Sikes

But as some point you jumped back into film.»Yeah, I was giving a presentation at a dive show and a guy from Sony saw one of my multi-projector shows. His name was Ira Freidman and he said, “You know, you should be doing your style of story telling in motion. And we’d like to sponsor you for a year with Sony equipment.” I said, “Okay” and he gave me two complete set ups of their 8mm equipment. And that was the beginning of the Sony 8mm format that eventually evolved into the DV format.

And what sort of housing did you use?»Well, Sony had a housing which was sort of a yellow round thing. But that same weekend I met Val Renetkins who would turn out to be a lifetime friend and partner. Val had a little thing called a Capsule 8 he’d built for the same camera. Just like Ira Freidman, Val offered me a housing. He said, “This is what you need. It has better optics, it’s a smaller package and has a wider angle lens and so on.” So, just like that, I had a complete system.

Val Renetkins founded Amphibico, right?»Yes. He started with *National Geographic* and then developed Aqua Vision, which became Aquatica. Then he started Amphibico.

Are you using his High Definition housings now?»I am. My philosophy has evolved and I’m now conscious and aware that what we do and see is unique and sometimes priceless. Knowing this, it’s important to capture our experience in the highest quality format available. High Definition is redefining how we look at the world. It’s an amazing technology that makes you feel like you’re actually there.

So what was the first underwater footage that you sold?»About two months after I got the video equipment I bought a film camera from one of Howard Hall’s old buddies, Larry Cochran. Howard,

Larry, Bill Lovin and even Cousteau had been using this design of tube camera. I started shooting film with that and I did the piece that *National Geographic* bought. So that was my first sale. Then the next two sales were to CBS and CNN with the Wakulla Springs Project.



Mexican Yucatan pack horses during 8km trek into Far Point Station during filming of *Most Dangerous Science*

So you started at the top and stayed there.»Well, I kind of always said I came in through the exit door from inside of an underwater cave. That was an environment that nobody was filming then so at that time I was the only show in town and it was easy to bamboozle people.

You mentioned the Wakulla Project, which I recall was in 1987. Tell us how that came to pass.»In 1985 I had written a thing called *The Future of Cave Diving* in which I drew a bunch of possible inventions: a habitat that you could weight down or anchor into a cave that you could bring air in and decompress inside of. Dr. Bill Stone was at that presentation. It was an AAUS meeting in Tallahassee and he told me about the things he was working on – the rebreather and other stuff for his cave projects – and he wanted to see if we could get together on all of these inventions for a project in Wakulla. So after a year of preparation, Bill’s amazing engineering, and our collective vision of building these things (certainly all at Bill’s hands as far as the designing and engineering) we put together the Wakulla Project, sponsored among others, by *National Geographic*.

For those who don’t know, Wakulla is one of the world’s largest cave systems and it’s also located near High Springs.»Well, not too far away. It’s a Florida State Park so we needed special permits and so on. They gave us two months to do the project.

What were some of the goals?»Deep penetration as well as developing a lot of technical diving techniques. I mean up until that point in time, people had never even postulated about the possibilities of doing what we set ourselves up to do. For the first time ever, we had a real cache of mixed gas and the help of Dr. Bill Hamilton, through Parker Turner I might add. We had a set of tables that would allow us to do some remarkable dives. This was prior to decompression

computers, prior to people doing these types of mixed-gas dives. We brought in German-made scooters because the scooter revolution had not begun and AquaZepp scooters were the best deal to get us far back in the cave very quickly. And so it was really a three-way show between Sheck Exley and Paul DeLoach doing a series of dives, Bill developing the rebreather, and our team of divers who, were filming the scientific work and pushing the exploration. It got to be quite an adventure where we were proving good things and bad things about diving at 300-ft. depths. And we learned the hard way to let go of our old ways and accept the new. Even while we were tuned into that idea it was hard to make changes because for many, many years things had been done a certain way and it required a lot of mind bending and flexing to step into this new arena of diving.

But it was by far, at that time, the most adventuresome cave diving ever done. In the end, Tom Morris, Paul Heinerth, and I made it 4,176 feet into the B Tunnel, which at that depth, no one had even contemplated going that far. It was a 14-hour dive including decompression. We had our portable habitat, the *Habitent*, so at least decompression was semi-dry.

The Wakulla Project kind of gets glazed over by a lot of people in today’s time. But if you look very carefully you’ll see that was the project that changed the whole world of technical diving: the way scooters were used, the way equipment was combined together, the way staging techniques were developed, the way gas mixtures were laid out in formal style for deco mixes - from the deep water deco nitrox mixes to O2 and then the deep water trimix and heliox gases we were diving. That was the beginning, the moment in time in which a big project verified and quantified that it could be done. And Bill Hamilton’s superb book kind of laid out the blueprint. From there, guys like Jim King stood up and went right into it with the Eagle’s

Nest project and then we started to see it just balloon one after the other.

So besides kicking off the technical diving revolution, what was the coolest thing you discovered?»That the cave just kept going and going. It was the dream and the hope, I mean, when I was getting ready for that project I remember laying in bed and dreaming about endless big tunnels and passageways going everywhere and the sensation of flying and that's exactly what we found. When we left it was still going so it was that big dream fulfilled. Flying through those big rooms and being able to film it all was incredible. I shot a lot of 16mm film and stills during that project. For me, the really exciting part was making history and being able to document it all.

As I recall you made history of a few cameras as well.»Yeah, we had a couple of things happen. One time the camera was tilted inside of the housing so we shot an entire day's worth of footage and it was all blurred. Then we had the Benthos camera, which was used on the *Titanic* expedition. It had just come off of that project and was given to us by *National Geographic*. Two of the magazine's long-time photographers, Al Chandler and Emory Kristoff, were there when that camera was passed on to me. And so I'm kind of boasting, "I'm using the camera that was used on the *Titanic*." I was pretty proud. When I asked them about maintenance they said, "No, no, don't do anything." And I'm thinking, "Boy that doesn't sound right. I don't know that they understand how sandy and silty our environment is."

But I wanted to do exactly what they told me so I didn't do anything. On one of the next dives the camera flooded. But Bill Stone, being infinitely resourceful, somehow cleaned it up and put it back together. So I took it on the next dive and this time it caught on fire. We were at 300 feet and basically had a bomb on our hands. It was smoking

and I could see sparks flying around inside the housing. So I literally dumped it off. We were loaded up with line and since we couldn't do any photography, I said, "Yahoo let's go" and that ended up being the deepest penetration we did on the project. So it's kind of a bittersweet story.

How has your luck been in getting more loaner cameras from Emory Kristoff?»Pretty good, really. We recovered the camera and I made a big impression when I sent it back with a note inside that just said, "Oops."

Was the camera flood the freakiest thing that happened?»No, there were several close calls all related to gas management. I built this sled that held tanks to the bottom of the AquaZepp and one time I just ran flat out of gas. As I was trying to figure it out, I kind of fell calmly all the way to the bottom into the silt at about 300 feet. We were back about 1,200 feet in the tunnel and that was real scary for my partner on that dive, Clark Pitcairn. He watched me go down into the silt and he was kind of like, "Come on Wes, come on Wes, get out of there." When we got back to the *Habitent*, he told me that he was going to get out of the project. He said, "When I saw you falling down there I realized that I didn't have it in me to help you. I have kids and I didn't want to die." I said, "Hey man, I respect that completely and I understand and embrace that." I didn't have any ill feelings at all.

Wait a minute, you said you ran flat out of gas and fell into the silt but how'd you get out?»Oh, did I glaze over that? I was able to switch to my back mounted gas and I ended up having plenty of gas. It was just a matter of getting used to the equipment.



Wes Skiles

Mike Madden and Eric Hutcheson during the Nahoch Project to connect Nahoch and Dos Ojos, 1995.

Sheck and Paul had a problem too, right?»Yeah, they were still trying to hang on to their old traditional trimix gases. They both fell into a narcosis and oxygen problem. The scooters failed on them and they got tangled into some line and we were all cognizant that they were very late. There were some tense moments but through Sheck's perseverance and Paul keeping his head, in what was a real mind-numbing experience for them, they were able to make it back. They ended up going through the various safety bottles we'd left behind. And they made it from stop to stop and finally back to the surface. At that point we drew a line in the sand and said there's no more old-style diving with trimix.

What was the problem with trimix?»It wasn't a problem with trimix, just the mixture that they choose to dive. Essentially they were diving with too much nitrogen and oxygen in their mix and it was almost lethal. We were using an 86/14 heliox, which totally eliminated nitrogen so the narcotic effect was gone and we took the oxygen down to a level that reduced the risk of oxygen toxicity. So that's what we all used from there on out.

How did you know to use that mix?»Well, at first we were trying to use the navy tables and my friend Parker Turner came to us and said, "Hey guys, you're going to kill yourselves trying to do this with navy tables. You've got to meet this guy Bill Hamilton." Parker had been out of cave diving for about a decade but was getting back into it. Anyway, he arranged a meeting with Hamilton right at the beginning of the project. So Bill came in and cut us a custom set of tables and off we went.

I know that was a blow to you when Parker had his accident. What happened?»It was a few years after Wakulla, and Parker had continued to perfect his cave diving skills. The best we could ever

tell was that the sand and rock slope above the opening at Indian Springs began to avalanche during their dive. So it closed the small hole they would normally have come through. On the way out, he and Bill Gavin found nothing. They just saw their line going into sand and rock. From there it's real sketchy as to what happened. Bill somehow made it through only to find that Parker had already made it through but had drowned just a few feet shy of getting to some extra bottles.

What about Wakulla II?»That was like the next generation literally. The gear had made quantum leaps. We had the rebreather working well and Bill just thought it was time to take the next step. Wakulla II represented the future of what was possible. Like Wakulla I, this project marked the beginning of a new world of possibilities. The centerpiece of the project was a fully operational saturation diving rig brought in from the oil fields. With his usual inventive flair, Bill engineered a way to make it all work in the confines of the spring. For the first time ever, divers were doing four and five hours at 300-ft. depths on rebreathers without a care in the world. It was really incredible. After a dive, the team would simply enter a lockout capsule on the bottom, and then be transported to the surface habitat. Using this concept, divers in the future will be able to perform a week's worth of exploration and only decompress once. Another very exciting development was the 3D mapper Dr. Bill Stone and Barbara Am Ende invented and proved during the project. For the first time we had true representations of the places we explored instead of the crude stick maps I'm famous for.

What about the WKPP? What's up with them?»Well, I doubt most of your readers know who they are, but they are the Woodville Karst Plain Project. They're a highly disciplined group of cave divers who have made a career out of diving mostly one major cave system. In doing so they have become the best at doing a certain type of hybrid

technical deep cave diving. I really don't think that anyone's done it better than those guys. They're quite extraordinary. Unfortunately, their current leader, who speaks for the group, is George Irvine. I've dealt with his type lots when I was in junior high school, ya know, the schoolyard bully. He likes to pick on, and attempt to demoralize anyone who doesn't follow his rules and conventions. Basically, he's a real dick, a total asshole. The way I look at it is people like him tend to come and go from this sport. One day the cave diving community will wake up and he'll be gone, maybe on to another sport to pick on.

The rest of the core of the WKPP has some really talented guys. They'll probably always have an elitist type of attitude that they are better than anyone else but I guess that's okay. So, I wait with my fingers crossed that those guys who are truly leading the WKPP will one day step up and take the helm and bring their group and technology and their incredible knowledge and experience into the community as a partnership where they can be functional. But until they do that, they're kind of a group on their own, is my attitude.

Does cave diving make people antagonists? You've got the WKPP and then all the infighting between the National Association of Cave Divers (NACD) and the National Speleological Society-Cave Diving Section (NSS-CDS). What's up with all that?»I think a lot of it is perception. People naturally congregate in different groups. The NACD and NSS-CDS offer different things so naturally you get different personalities. But the leaders of those groups get along. I know what you're talking about but I really don't think it's real. Like I said, a lot of it is perception.

What about the Mike Madden/Steve Gerrard battle that's been waged in Mexico's cave system? That's definitely real.»Yeah, but that's what happens. That's a good example. Those were individuals

who were in different groups. It's really between those two guys rather than the organizations themselves. The hearts of those organizations are dedicated to great things: education, conservations, protection of the environment and outreach.

On a more positive note, tell us about the accomplishments in Mexico at the Dos Ojos and Nahoch Nahich cave systems.»First of all it's just a fascinating wonderland down there. I mean we're able to do some big-time swims, some 18,000-ft. penetrations, where we're blending film making with exploration. Plus, I was fortunate enough to be part of the team that ultimately connected Nahoch to the ocean. And then a couple of years later it was time to do the IMAX film. We were scouting locations and had the challenge of unbelievable logistics of pulling off an IMAX film in an underwater cave in a jungle. So we had a very tough decision. I was like, "We have to do it in Nahoch to work with Mike Madden and everything." But the logistics just forbade it. There was no way we could helicopter everything in. There was no road in there at the time and I had to face reality that this Dos Ojos cave was better. And as I did that, I recognized that it was a great cave. I really started falling in love with Dos Ojos.



Has there been much competition between the caving groups to keep pushing further and further in order to make “their” cave the longest?»Oh yeah. Back in 1996 and before, there were lots of explorations competitions going on. Dos Ojos and Nahoch were at the peak of their potential connection and there were bands of cave divers working projects simultaneously just mere yards from each other in underwater distances but thousands and thousands of feet from the nearest entrances. The competition and the goals of who was going to connect what, got pretty heated. It got to its lowest point when the Mexican military was out hunting Mike Madden with guns and they had us cornered in one of the holes on the Ejido property. We were there, I guess I’ll say, improperly. We were informed that they were going to arrest us when we came out of the woods so our determination was to just stay in the woods. So we stayed in there for like 10 days eking out every scrap of food we had and kept on diving. When we finally came out there was no one there to arrest us... so I guess we just outlasted them. But eventually all of that settled down and we were able to laugh about it.

Being so close to one another, are Nahoch NaChich and Dos Ojos similar?»No, they’re remarkably different for being geologically so similar. There’s no doubt they’re related somehow or another but they appear to be within their own regime. So the big-picture geology that sort of controls how caves are formed and the past water level stands all made similar structured caves. Their orientations and their patterns are all laid out side by side. But their differences are quite remarkable in what must be the chemistry of the water in the two caves and therefore their appearance.

So what are those remarkable differences?»Nahoch is a much more consistently white, very clean laid out cave and Dos Ojos has a lot more mineralization and darkness in color and black walls in

places and speleothemes that are various colors. Both are amazing in their own way and when you dive both systems you go, “Yeah, this is cool.” I mean, you could drop me blindfolded into either systems and even though most people wouldn’t know, I could immediately tell which cave I was in.

Aren’t they both competing to be the world’s longest caves?»They were back and forth Guinness World Record’s longest caves. I think Nahoch held it the longest just because Mike and his team was diligent about pushing farther and farther and keeping it in the record books. But they still have not been connected yet. They still remain spitting distance from each other but not connected. Hope’s not given up. It’s funny. Here recently a lot of us joined together. It’s kind of like two bands, like *Bad Company* and *Foreigner*, breaking up and then reforming a new group. Paul and Jill Heinerth were on a lot of the big pushes on Dos Ojos along with Gary and Kay Walton, and since then some of our Nahoch crowd has started diving with those guys. Buddy Quattlebaum put on a trip recently where we all went out there to Pet Cemetery to look at the possibilities of taking what was left of the two old teams and giving it one more whack at making the connection between the two systems.

Pet Cemetery?»That’s one of the territorial entrances of the two cave systems. Actually it has a dry connection of the two caves. But it’s not a real cemetery. I guess it just has that appearance.

Then you were down there again in 1998 and 1999 doing the IMAX with Howard Hall, right?»Correct. Yeah, I was surprised to read that Howard thought I would be threatened to have him coming in. I really didn’t think that at all. Sure, I will give him that I was disappointed when I heard he would be filming because I believed cave divers would be the best people to film underwater cave environments

and there I had the advantage. But as far as Howard's expertise and knowledge as an IMAX cameraman there was no question that we were getting a dream team: to have me in control of directing and lighting the film and Howard coming in with the camera to film. All I can say is great things about the relationships that were formed when we got down there and how things laid out. It was an amazing team project and quite funny at times. And it was mind-boggling as far as the logistics and technology required to get 18,000 watts of permanent light into the cave and developing the illusion of cave exploration and discovery with such huge cameras that are so light hungry.

Were you satisfied with the film?»I was thrilled, sort of. I think it's a great film but as a purist there are always things that you see. I would have liked to see the cave-diving segment longer and I remember a lot of scenes that we shot that must have been awfully good that they passed on to go after the more glorified elements of the film. But, all in all, I was very pleased. It was a difficult but great team effort and I'm glad Howard enjoyed my serenading him so much.

Let's jump backwards in time to the film you made with *Grateful Dead* drummer Bill Kreutzmann. How'd you land that gig?»That evolved from one of the great women divers in our sport, Marjorie Bank. She and I were best friends and she called me one day and said, "Wes, have you ever heard of the *Grateful Dead*?" And, I just laughed. This was 1991, basically at the peak of their career, and she'd never heard of them. I couldn't believe it. And she asks me what she should wear. She says, "I'm going to their concert and there's this guy, Bruce Hornsby, coming to pick me up." And, I'm like, "Bruce Hornsby is coming to pick you up?" And she says, "Yeah, he's one of the players." So I say, "The keyboard player?" And she goes, "Yeah, I think that's it." So I'm just sitting there aghast that Marjorie is going to a *Grateful Dead* concert because she and the *Dead* are like oil and

water.

So I come to find out the she and Billy Kreutzmann had been on a liveaboard together and they had this run-in at the beginning of the trip about who would get the nicest cabin. Finally it settled out and Marjorie determines that this guy was just a "lovely fellow." But that's the way she was. So we were coming back from the Underwater Canada show and she asks me to come to Atlanta with her to see the *Dead*. We went straight in with our backstage passes and we met Jerry and Billy and Bobby and Phil and the whole group. And, of course, Jerry and Bob and Bill were all big into scuba diving. They had already seen a bunch of my films so they were like, "Tell us about this and what about that." So Billy came down to High Springs about two weeks later with some Betacam gear and wanted me to show him how to use it.

After a couple days of playing around with the camera in the springs he says, "I'm not really getting this, am I?" And I said, "Hey you don't just grab this stuff and start using it. It's taken me 18 years to get halfway competent and you don't just learn it in two or three days." So he goes, "Well why don't you come with me on this expedition. I'm going to take a sailboat 1,800 miles from San Francisco down to these islands, the Revillagigedos." So we jumped on this sailboat in San Francisco on what would become an epic journey.

And what was the goal of the expedition?»It was really about exploration in the spirit of cave diving but to go down and document and map and tell a story of the Sea of Cortez – stopping in fishing villages and meeting people and checking out marine life and filming and ultimately heading down to this group of island which have now become very popular. But back then hardly anybody had been there. So we dove Socorro and Benedicto and updated maps and drawings...



*Grateful Dead drummer Bill Kreutzman and Skiles during filming of *Ocean Spirit*.*

And taking a little LSD on the side?»No, (laughing) no LSD on that trip!

What was the film called and how did it play?»It was called *Ocean Spirit* and it was received extremely well and a well-done film. It's a very different kind of film.

How do we get a copy?»I think it's available on the *Grateful Dead* website.

Let's jump into gear. Are rebreathers passing us by? Are we relegated to cylinders until the end of time or will Joe Diver ever use a rebreather?»I believe we're marching quickly toward the ultimate evolution of rebreathers entering the diving market. I know people don't see it that way but it's coming. From my point of view, having been one of the first guys to ever dive a rebreather in a cave environment, they are now commonplace here. I mean, people are diving Megladons and Cis-Lunars. You see Buddy Inspirations and all kinds of incarnations in between. It's just a lot more prevalent. Photographers like Tom Campbell are diving rebreathers and filming in High Def. Howard Hall is doing it and I'm doing it. We're out there on the cutting edge in open water and technical environments using this technology. As history shows, when we do it, it becomes a permanent part of the sport.

Sheck and a small band of people decided to drill some holes in the first stage of a regulator. Back when I was a kid, I would go into this machine shop in Jacksonville and I would see chrome shaved off of regulator housings down to the brass. Joseph Califino, who was this old machinist, would be drilling holes in regulators where holes had never been and tapping in new hoses. We now all dive with octopuses and safe seconds and inflators. Those things were developments

out of needs for more efficiencies and more safety in cave diving, that ultimately became a permanent part of diving equipment. The Stabilizing Jacket, what is now the common design for buoyancy, came from Court Smith and me mixing buoyancy compensators and inner tubes and horse collars together and creating things that became a permanent part of better diving. So, I think it's at that point now with rebreathers. They're permeating all levels and one day we'll have hybrids. I think that's where we're headed, toward some hybrid like cars are going now. They still use gasoline but they also have battery power. I think we're going to find ourselves diving semi-closed rebreathers that are packed down so we're not diving 80s or 72s anymore. We'll be diving 30s or 40s and getting four or five times longer than a single tank allows us to dive. It's all good.

Except for Dräger's sporadic support, none of the mainstream manufacturers have embraced rebreathers. Why do you think that is so?»I think it hasn't gotten there economically and ergonomically yet. People are still putting them together with plumbing supplies and PVC and they're still garage-built things. What's going to happen is that one manufacturer will get a foothold firmly enough that the money will come and they'll overcome the liabilities and step into the big time. And that's forthcoming.

Do you see any other major gear developments coming down the pipe?»From a photography points of view, certainly digital image making and High Definition. I'm right there now working on these hybrid projects for *National Geographic*. We're now using digital image making in the pages of the magazine.

Digital still cameras?»Yeah. And I did the first ever, all digital presentation to the *National Geographic* editors. It was the first time a slide projector was not in the room showing images for a final

presentation. Up until that point all the presentations had gone, ka-plunk, ka-plunk, ka-plunk. And they all stopped and turned around and went, "Have we ever done this before?" And they all said, "No." And then they said, "Well this is a first. I guess we're going into the new millennium with this." And one of 'em said, "It better be good, Skiles."

It was a presentation on Antarctica and I did it all with my laptop and a projector and showed scans and frame grabs from three different formats: from regular traditional still photography with emulsion, from digital photography, and then from actual frame grabs off my High Def camera. This evolution is leading to a sort of hybrid world in which you can grab publishable photographs from motion picture frames and we'll be seeing more developments along the lines of digital matrix photography, which starts to truly compete with film emulsions. And when that happens, that's another evolutionary step for our sport because it just opens up a world of possibilities.

Are you're still shooting with still film?»Yeah, I'm going out this weekend and shooting with 70mm, 2 x 2 stuff. I still love the old traditional quality you get with film but there's nothing like the quick feedback that digital photography gives you.

How does High Def and IMAX cross? Are they two different graphs or do the lines cross somewhere?»Well, I think the lines will eventually cross and maybe trip each other up at the same time. There's a lot happening very quickly in the world of High Def and the most prominent area of High Def crossing over to IMAX is in the use of this equipment in 3D. They take two High Def cameras and stereo them together and shoot what is truly High Def, IMAX quality 3D film by doubling up on the images of two High Def cameras. When you put just a single High Def camera in the housing and say

this is shooting the same as 70mm film is shooting, that's just a joke. There's no way that it's there yet. It's the same as saying that the best digital still camera is shooting as good or better than film is. It's not there yet but it doesn't have to be.

We're going in the wrong direction. We're asking digital to become film. But what digital does much better than film is its own thing, digital. It should be kept in the digital domain and projected digitally. So what I think we're going to see is this split personality battle. I think we're going to see High Def theatres. We'll see what I call Digital IMAX theatres that can be built in half the size and a tenth the money. They'll give people similar experiences - the big images, the surround sound, the big action - so that now they'll be in museums and aquariums and special education outreach facilities and theme parks can have very specialized films. This is an area I'm very excited to be working in. I've just gotten a major contract with the State of Florida with the Department of Environmental Protection to create the first even High Def film on the Florida aquifer and the explorations inside the springs and caves to help share with the world the value of those resources. Initially, we're building a Welcome Center in Ichetucnee Springs State Park, which will show it in High Def with 6.1 surround sound. Ultimately, we hope this will be the flagship model for other facilities in Florida.

Stepping back, how did the whole digital presentation on Antarctica go?»I got the hair-brained idea to go to Antarctica, with some suggestions from Emory Kristoff. He told me that he knew about a ship that was going down there and that *National Geographic* wanted to hear a new idea from me so he thought I should go down. It was already one of my goals because I had always wanted to go down into that hostile environment and try out some state-of-the-art technology. So I went up to Washington, D.C. to give a presentation.

And the night before, Emory told me that I hadn't told him anything convincing. He said, "This thing better be good or you're dead meat." I was like, "Thanks Emory." And so I attempted to go to bed and really didn't have a strong story idea.

Paul and Jill Heinerth surface after a close call in Ice Island Cave



So, I decided to browse around on the Internet and stumbled on the fact that just two days prior to the meeting, the world's largest iceberg had broken off of the Ross ice shelf. I logged on and got into the conversation between two guys, Dr. Doug McAyeal and Matthew Lazarra, and they were talking about what was going on from their different disciplines. And I'm thinking, "This is it." So, I pinged those guys and asked them a little about it and went in the next day and said, "We're going to go to the largest iceberg in recorded history and we're going to go diving inside of it."

And that did it. So from that point on we put together a program to take rebreathers and High Definition equipment and a vessel capable of getting us there with a helicopter on the deck so that we could navigate and shoot aeriels and explore that world. About eight months later we were off. We set ourselves up for certainly what would become one of the most difficult expeditions in modern time in that we left out of Wellington, New Zealand on a 120-ft. boat with a 2,400-mile, one-way journey just to get there. We crossed what is the most violent sea on the planet, the Southern Ocean. On about the sixth day into the trip we hit 40 to 50 foot seas and I just got trashed for days on end. When we battled through that, at one point, rolled and thought we weren't going to come up. It was getting pretty ugly. We finally got a break in the weather and then got caught in a Katibotic storm, which is like a hurricane-force storm.

So we hid behind icebergs to get away from that, then we got trapped in the pack ice and we're all just trying to get near this iceberg. It was one thing after another that kept knocking us back. We finally decided we weren't going to make it to the iceberg and we retreated a little bit after being trapped in the pack ice for about five days. We set up base camp on an iceberg and got our wits about us and decided to give it one more try. During that time we were doing our forays

into the water with our rebreathers and the rest of the equipment. And ultimately, we still fell shy of getting to the iceberg. Finally the helicopter pilot, Laurie Prouting, a really amazing New Zealand bloke, and I hatched this hair-brained plan to fly the helicopter, hop-skipping it across icebergs and carrying in extra fuel on the skids and camping gear and physically fly to B-15. And that's what we did. We flew there and were the first human beings to land on the largest iceberg in recorded history and plant the flag. There's nothing to prepare you for the magnitude and the immensity of it.

So how big is it?»It's huge, 170 miles by 40 miles. It's about the size of Jamaica. And it's 2,200 feet thick on average so it's 2,000 feet deep under this thing since 10 percent of an iceberg sticks out of the water.

What else did you learn about it, besides the fact that it was really big?»The science we learned was quite remarkable. Through aerial photography and a few basic studies that we were given by the scientists on our ship, we were able to document some really profound things about the way B-15 was impacting the entire Ross Sea. Eventually we returned to the ship, we retreated from that area to find a new area of icebergs, and started diving inside the caves. It was ethereal to go inside the ice caves. Again I'm with Jill and Paul Heinerth, who were remarkable divers on this thing pioneering the use of Cis-Lunar rebreathers and using this technology to dive further and longer than any human being had ever done.

Where did you go after you left B-15?»We went around to a place called Cape Hallet on the mainland, which is a little tamer, and we found a group of really nice icebergs to explore.

How did you find the caves?»We started probing around and boating around. Basically, we looked for caves like we would look for springs

in Florida. We would systematically start exploring icebergs. We'd fly around and say, "Hey, there's an iceberg that looks like it has geology." Or I guess you'd call it iceology. And we'd find cracks and folds in the ice. Finally we found a place that had a huge crevasse in it. I wanted to film the first-ever attempt from above water and make sure that Paul and Jill took underwater cameras with them. So they entered the crevasse and while they were in there, I was left in the boat. All of a sudden there was this gut-wrenching sound and this chunk of ice about the size of a house turned and our boat got thrown about 18 feet into the air. We came down, almost tipped over and looked down and the crevasse was gone.

From our vantage it was closed. Sealed completely with them trapped inside. For the next 45 minutes we backed out of this thing because it was continuing to fall apart. We realized right then how unstable these environments were. The whole time we were thinking that Paul and Jill had been killed. Then they showed back up somewhere else. They hadn't experienced what we had and didn't even realize anything had happened.

After we got over that incident, we went back and continued exploring farther and farther back into these caves. We were using Oceanic drysuits, Patco suit heaters and the rebreathers with their warmer air so we were able to stay down much longer than people can normally stay in those kinds of waters. You've got to remember this water is 28 degrees Fahrenheit, only a tenth of a degree from turning into ice. We finally reached a point where we were a thousand feet inside this cave, which we called Ice Island Cave Number 4. Suddenly we found ourselves in a violent current situation, which was totally unexpected. We started trying to swim out and were making no progress. The thing that was holding me back was the High Definition camera and I was like, "I'm going to die before I drop this camera."



The rebreathers were really getting taxed. By the way, we had tried to do some open circuit stuff before and every time it failed miserably. Anyway, so here we were, down at 130 feet inside of an iceberg being pulled in by a siphon current. We were at 82 minutes and I remember thinking that we were really deep in shit. Luckily we were able to persevere. Paul got along side of me and we found some areas where the current wasn't so strong and somehow we were able to work our way out. When we reached the entrance we had a lot of decompression but not near as bad as if we had been on open circuit. During decompression, I realized that Bill Stone's Cis-Lunar rebreather had kept us alive in what would have been no-survivable conditions otherwise.

Sounds like Antarctica was one helluva a trip.»Yeah it was. We had the hellacious crossing and several near-death experiences. But overall it was another incredible adventure. The film is called *Ice Island* and will be released on PBS later in 2002. You can get copies through my company, Karst Productions.

What are some of the other most memorable projects you've worked on?»Well, several other projects immediately come to mind largely because of the drama that unfolded on each. The first was the expedition to Nullarbor in Australia. It was during that expedition that a freak storm collapsed a massive cave entrance. Thirteen unlucky individuals, including myself, were buried underground. It was one of the most horrifying experiences you could ever imagine. Fortunately, we were able to escape to a chamber where we were able to regroup. Over the next two days, Dirks Stoffels, the late Rob Palmer and I explored our way partially out of the cave. We were literally crawling and climbing in places where solid wall existed just hours before. Miraculously, a friend and fellow caver, Vicki Bonwick had managed to explore down from the surface and we met her on an unstable

ledge somewhere in the middle of the new cave. Everyone managed to escape unharmed but I lost a vast quantity of filming equipment.

The next would be trips I made to South Africa to film White sharks. No one had really started working there yet, so I built some really poor shark cages and literally hitch-hiked around from bay to bay exploring and filming. I had lost my first cage in a really violent storm so I built another that I thought would allow me more freedom to get really good shots of pointers without the cage. It ended up almost being my undoing. On one particular pass, a 14-ft. female hit the cage just right and it pried open like a Gary Larson cartoon.

The shark literally crashed into me and began to seriously trash me. My only defense was my 16mm film camera and it was a really good thing I had it. I kept screaming, "This is it, this is it." If you ever wonder what you might say when you think you're really going down that might be it. The shark swam us deep before it came to the end of the rope tied to the boat. When we stopped, the shark stopped struggling for a second and the foam blocks pulled us to the surface. For the people in the boat it was evidently an eerie and frightening site seeing this massive tail rise up out of the water. When that happened, the shark's position changed and I started pushing it away from me with my camera. As fast as it had happened, the shark popped out of the cage and swam off. When I surfaced one of the crew threw up on me because they thought I had been eaten.

Deciding I should leave that type of filmmaking up to Howard Hall, I retreated back to caves and joined up with my old friend Bill Stone for what would become one of the most extreme descents into the earth ever attempted. The place is called Huatatla in Southern Mexico and is poised to be the deepest cave on earth. I went down there to photograph it for *National Geographic*. I arrived to the news that

a good friend of mine, Ian Roland, was dead... nearly 5,000 feet beneath the surface. A week later, after we got Ian out, Sheck Exley drowned on his depth record attempt in Northern Mexico. It was an extremely tough time in my life. Not only did I feel like I had been playing dodge ball with the Grim Reaper, but now all of my friends were getting taken out - unable to dodge the ball in the ultimate game of life on the edge. To make matters worse, a week later I found myself trapped again, this time by floodwaters that came without warning. We were trapped for five days with no possible rescue or help from above. When the floodwaters finally receded I decided I'd had enough. It took me 18 hours to ascend on rope out of the cave system. On the surface, life never had seemed so beautiful.

What else is in store for you in the near or distant future?»Surviving is pretty much on the top of my list, but I pretty much plan on continuing to do what I have always have done which is to pursue adventures in exploration and filmmaking. It's a nice combination for me. I hope to continue to help encourage and advance technological tools to allow us to trek into the unknown and make images along the way. I would also really love to see the rebreather and one-atmosphere diving concepts reach their prime during my tenure as an explorer. With that in mind, I would like to think there are some more unthinkable projects out there for our team to crack.

Editor's note: There are about 40 copies of the original book still in Bret Gilliam's personal inventory. They are available as a Signed/Numbered Limited Edition personalized to each buyer by Gilliam at \$200 each, including shipping. He can be contacted for purchase at bretgilliam@gmail.com.

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