

**Between Bounce & Saturation: Diving  
The Tarbela Dam**

**Understanding Risk Management**

**Expedition Blücher 2014**

**Ultra Long Halftimes**

**Diving Pioneers & Innovators: A Series of  
In Depth Interviews (Bev Morgan)**

**Issue 17 – December 2014**

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# Editorial

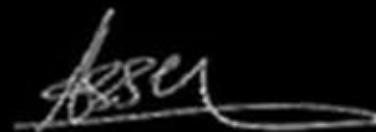
Welcome to the 17<sup>th</sup> issue of Tech Diving Mag. It's our fourth anniversary!

First of all, I'd like to mention that the co-author of the third part of the *Line Marking Systems In Use Around The World* series is Don Shirley, not André Shirley as indicated in the 16<sup>th</sup> issue. Sorry for the inconvenience.

The contributors for this issue are world renowned industry professional Bret Gilliam, technical diving instructor trainer and consultant Ben Reymenants, along with rebreather instructor Onno Kok. Take a look at their brief bio at [www.techdivingmag.com/contributors.html](http://www.techdivingmag.com/contributors.html).

Tech Diving Mag is based on article contribution, so you're always welcome to volunteer a piece and/or some photos. The guidelines could be found at [www.techdivingmag.com/guidelines.html](http://www.techdivingmag.com/guidelines.html).

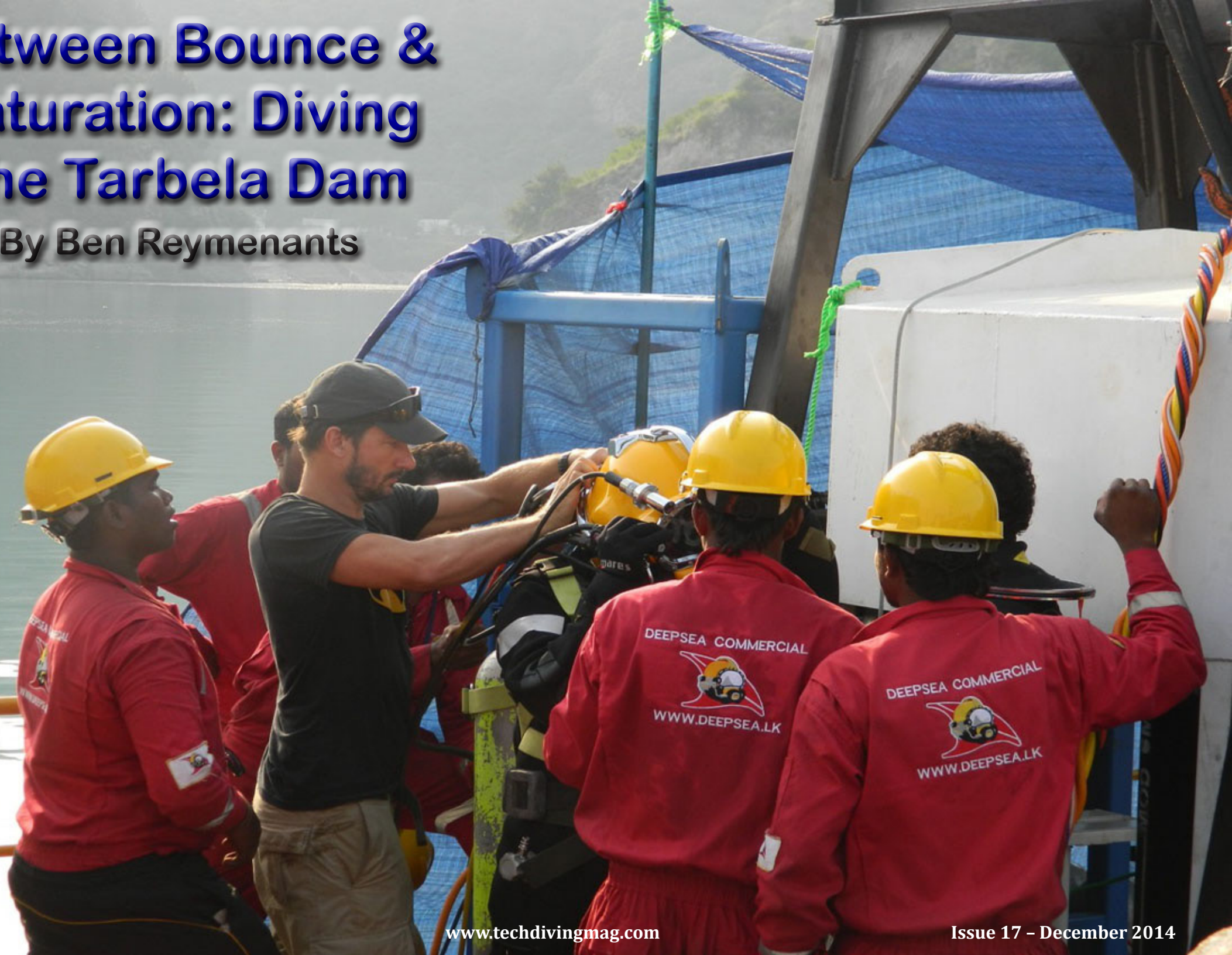
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**Asser Salama**  
Editor, Tech Diving Mag

# Between Bounce & Saturation: Diving The Tarbela Dam

By Ben Reymenants



It's 14 degrees C at 500m altitude, and I'm descending down the main tunnel. I pass the 30 ton slot cover and drop down in the main shaft, 1.2m wide by 6m long. The feeling of being in an elevator can't escape me. At 94m the walls disappear, indicating that I arrived in the main drainage pipe, 10m in diameter. I touch the silty bottom and look at my computer; 106m.

Last time someone walked here was 1972 and in dry conditions. I'm inside the bowels of one of the largest hydropower dams in the world, situated up the mountains in the Indus valley, North Pakistan.

This project attracted me because of several challenges; altitude, deep CCR Trimix diving and remote logistics. The fact that this dam will provide cheap and clean energy to half the country adds a warm fuzz.

The required dives are between 80 and 120m. The objective is to find a door that gives access to a tunnel, which gives access to the main irrigation tunnel. In 40 years this door has become buried under 7m of grey clay. The Chinese part of the team had arrived 3 weeks earlier. They have been pumping non-stop with water jets and air lifting pipes to remove the mud. After the 14<sup>th</sup> day, they finally hit metal. We descended, but visibility was so bad that measuring became impossible. More mud sucking...

A week later, a storm destroys the bridges and the crane on the platform. Two days are lost to weld everything back together.

Finally the weather clears up and it is my turn to jump in. Diving a rebreather, I'm much more mobile than the hard helmet divers, who are connected by an umbilical to the wet bell. Commercial dives between 90 and 120m are typically performed under saturation conditions, where the divers remain pressurized for the entire workweek(s) and

do one long decompression at the end. They basically live in a large chamber and transfer in a small bell - under pressure - which brings them every day to the work depth.

Saturation (aka SAT) systems cost millions and are generally very large.

Logistics and lack of a large diver support vessel, combined with bad roads make the option of getting a SAT system in this mountain region non-negotiable. So we opt for a surface supplied system with hard helmets and a wet bell, which carries enough backup to get the divers to the surface. The rebreather can perform non-working tasks like measurements and inspection, or fit in small shafts where a bell wouldn't be able to go.

Since we're operating in a grey area, between bounce dives and saturation dives, there's the need to find a middle path between a) saturation decompression - which takes days - and b) the short, aggressive decompression - usually followed by a short chamber ride.

With the first option being not practical and the second one being too aggressive, especially if relying on the 5 minutes window hastily trying to get into the deck's decompression chamber, something else had to be 'invented'. Here, the 'civilian' dive industry did take some leaps ahead of the commercial industry, where not much has changed since Buhlmann wrote his algorithm for Shell in the 1980s.

By now, the algorithm has been adapted and evolved. I worked with Asser Salama on a suitable gradient factor and implemented his new ZH-L16D algorithm, designed following the suggestions of Buhlmann.

Based on his personal communication with Professor Albert Bühlmann and Dr. Max Hahn, Dr. Albrecht Salm provided Asser with some details on which ZH-L16 halftimes would need getting altered to reflect cold and/or increased workload. ZH-L16D was accordingly introduced as a more conservative model than both ZH-L16B and ZH-L16C. This newer variant would generate more suitable schedules for unfit divers or for anticipated colder and/or more demanding dives, which is exactly what we needed for our dives on the Tarbela dam.

We chose a gradient factor 50/80 and ran the ZH-L16D algorithm with 78% symmetry. A distinctive feature available in Asser's [Ultimate Planner](#), the asymmetric gas kinetics mimic the lesser off gassing during deco, as divers heart rate slows down and peripheral vasoconstriction sets in because of high partial pressures of oxygen.

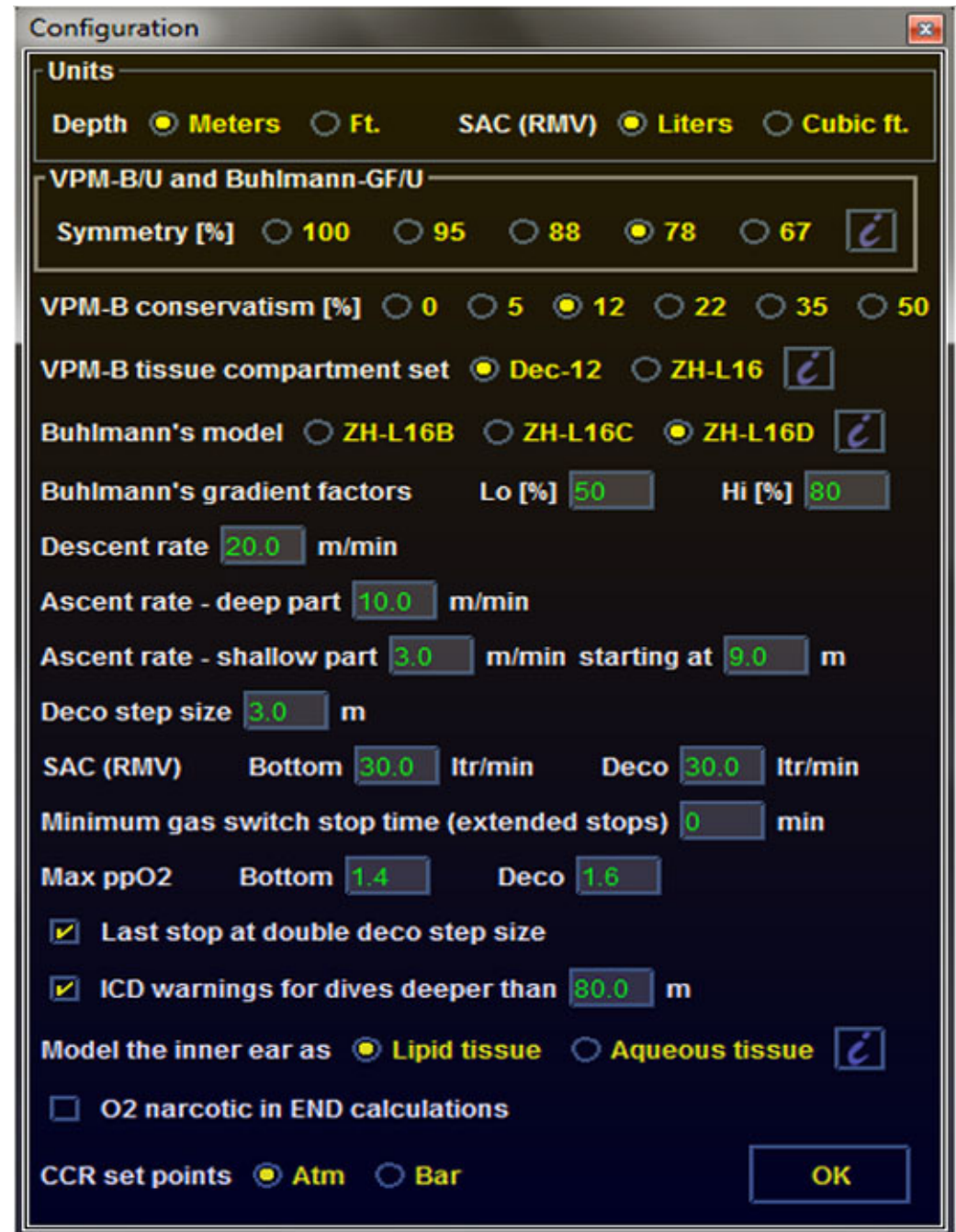
Mixes were 14/56, 50% and 100%. For the longer working dives, a 20 minute chamber ride was added within 5 minutes of surfacing.

The result was actually quite good. Divers were never tired.

I used the same algorithm on the rebreather with a 10/60 and felt fresh after every dive.

The Chinese contractors were extremely interested. Hundreds of pictures were taken from the rebreathers and the bell. They were obviously questioning their purchase of a Norwegian SAT system, for which they need 12-16 man crew to operate properly.

So, is this the advent of technical divers entering the commercial realm?



[Ultimate Planner](#) configured to cope with our commercial diving needs (altitude settings display in a different window)



Mixing gases

FT004

It might be a catalyst, but as long as underwater construction jobs take hundreds of man hours, saturation is still the weapon of choice. Short inspection dives, simple tasks and fast intervention is where the niche lies. There, a buddy team of well trained mixed gas CCR divers that are not easily bored by confined zero-viz spaces would make more sense than the latter.

For decades there has been a large gap between commercial diving and technical diving. Each discipline has their decompression algorithms, computers and breathing apparatus. Bridging that gap would benefit both sides in terms of cross-training, equipment affordability, evolution and moreover, accessibility.

Large cave systems and wrecks could be easily explored to the fullest with a SAT system. And the products of the commercial diving industry would be more affordable to the public if technical divers were used on a regular basis. Second is the flow of information, statistics etc. The tables and software used in the commercial world of diving is 100% different to what technical divers use.

The hard hat divers go mainly for straightforward tables as US Navy, bounce SAT and Comex. Bounce decompression dives are very conservative. And with saturation diving, the ambient pressure line is theoretically never exceeded.

Funny enough, not even 15 years ago I was diving raw Buhlmann. Or for the geeks, a ZH-L16B 100/100 gradient factor. I never got bent, but admittedly put focus on all other contributing factors as hydration, sports, rest and surface oxygen. Now I would be stamped a kamikaze. I do see a healthy tendency towards more conservative profiles, gradient factors as low as 20/70, sometimes combining with VPM, divers seem more educated and will have variable ascend

rates throughout the dive. Slowly we're drifting to partial saturation tables. Divers do object when their RGBM based computer gives them lengthy stops. But in the end, they'll hang it out. Early days was marked by short bounce dives on air or with minimal helium content. Now divers are making lengthy mixed gas dives with high helium content. I do see more skin bends and general type I DCI than in the earlier days, possibly marked by the slower tissue loading, higher helium content and asymmetrical off gassing due to cold or inactivity. So it is therefore only justified that longer, near saturation hang times should be deployed?

I believe there is true potential for a closer working relation between the commercial diving world and the high end tech diver. The autonomy and speed of intervention a standalone tech diver has can be sharpened by the discipline and attitude marking the commercial diving realm.



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# Understanding Risk Management

By Bret Gilliam



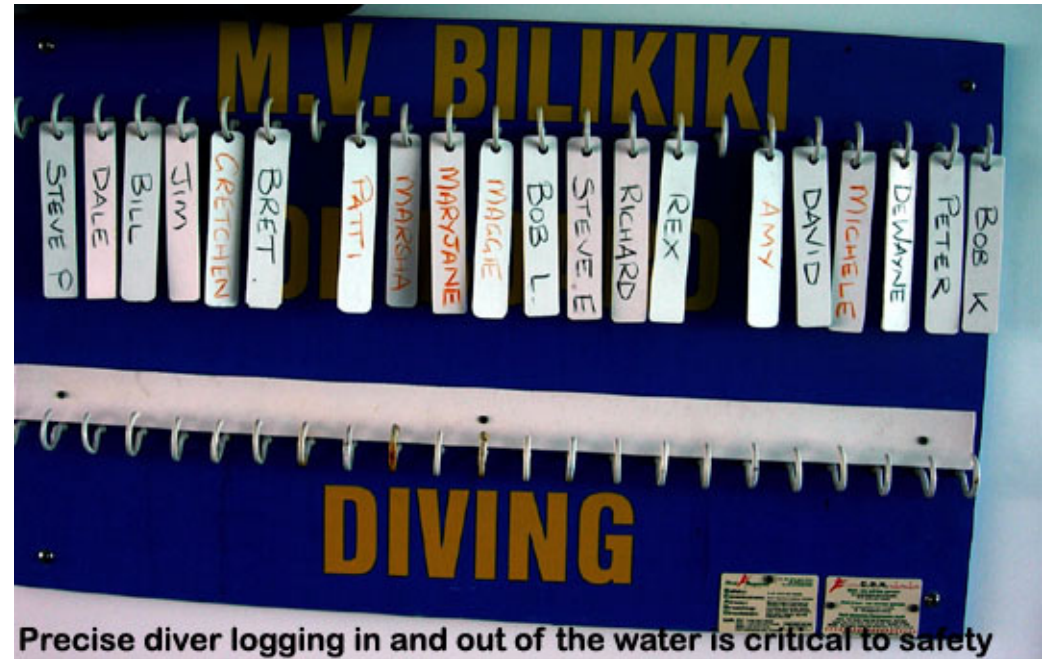
Did you ever tell someone that diving is a safe sport? That's a mistake; you weren't being accurate. "Safe" literally means "without risk". And nothing in life is safe. Diving like many other sports activities is inherently dangerous. In fact, a lot of the diving industry's risk management protocols were liberally adapted from that of the snow skiing business. Skiers hurtling downhill with their feet crammed into awkward boots affixed to two narrow planks had the unfortunate luck to break legs, ankles, arms and precipitate other accidents that often led to fatalities with alarming frequency. This, of course, also led to lawsuits and the skiing industry was forced to react defensively.

Over three decades ago, it was already standard practice to required to sign a Waiver and Release document in which the customer acknowledged his understanding of such risks and that it was their specific intent not to hold the ski resorts or their instructors liable if they were injured. As the popularity of other potentially dangerous sports became more widespread (think snowmobiling, ATV's, skateboard parks, skydiving, hang gliding, and even youth football and baseball leagues) the use of waivers and accompanying risk management practices to warn participants in advance of hazards became routine.

There are few buzzwords to come into the lexicon more important to professional diving instructors than "risk management" in today's society of litigation. Luckily there are some relatively simple steps that instructors can take to help balance the odds in their favor. The obvious first step is to acquire professional instructor liability insurance.

In today's world where even a stubbed toe on a dive boat is an excuse for a lawsuit, the specter of a negligence claim from an accident is sobering. Without specific insurance coverage for our particular and very esoteric needs, there is no protection from what can be staggering

costs to defend a lawsuit. Indeed, the cost for a successful defense for an *innocent* instructor could very well bankrupt the individual or his business without the protection of insurance to provide those expenses. But in addition to obtaining insurance, it's important to have a fundamental grip on the facets of risk management in order to conduct yourself with all possible caution to protect your students, divers in your care, and yourself.



### Teaching Defensively

Probably the single best advice an instructor can follow is to "expect the unexpected". In other words, never assume that anything will go right or as planned. You should never take for granted that all directions you convey will be followed. I've made it a practice since I began teaching diving back in the 1960s to always presume that students will suddenly divert into behavior exactly opposite to what has been briefed and I try to continuously think ahead to the myriad of contingencies that may spontaneously present that have to be quickly

responded to in order to prevent accidents. Remember: the whole purpose of supervision is to give the student diver a chance to learn the skills of diving and, if mistakes are made, the instructor is right there to help turn those mistakes into positive learning experiences instead of grim survival tests.

It is vital that instructors conduct all programs in accordance with agency standards. These provide a proven curriculum of academics and skills that progress the student on the path of self-sufficiency and independent activity. Training standards also are the boilerplate of defensibility should an accident occur and an instructor must justify his conduct in a lawsuit. It is your responsibility to teach in compliance with current standards and to update your course content as changes are made periodically. If you have any doubt about course standards, contact the training director at International Training Inc. headquarters office for an explanation. If you feel you need to deviate from some aspect of standards due to local site conditions, availability of confined water or pool facility, equipment in use, or any other possible non-standard situation, you must obtain a written waiver from HQ for your request. These are evaluated on a case-by-case basis. Never assume to deviate from a course standard without seeking approval.

Also, keep in mind that instructor/student ratios are based on site conditions. In situations that are not optimal such as reduced visibility, surf conditions, the presence of currents, and especially if your class has students needing special attention you should take precautions to reduce the number students and/or add additional assistant instructors to ensure proper direct supervision.

It would be great if we could just buy insurance and then teach the best course we are capable of with the confidence that even if an accident

happened... the insurance company would pay for a top notch defense and any reasonable jury would be convinced that we did the best job of training that we could and then acquit of us any wrongdoing. But that rarely happens so simply in the real world. We have become a litigious society and it's best to learn the protocols that can mitigate our professional risk.

### **Elements of a Law Suit**

Okay, it's time for Basic Personal Injury Law 101. Four things basically have to happen to allow a plaintiff (the individual or his heirs that have filed suit against you) to recover money:

1. He must be able to show damages, either financial or physical, or both.
2. He must be able to show that you had a duty to provide training in an atmosphere of reasonable safety.
3. That, by acts of commission or omission, you breached that duty.
4. Finally, that his damages were caused by your negligent performance.

I could make it sound a lot more complicated and throw in some flowery legalese that would send you running for a dictionary, but this pretty much sums things up. And remember another part of the personal injury equation: you will be judged by what the local community standard believes to be conduct that a reasonably prudent dive instructor would display in similar circumstances. So let's take a practical example:

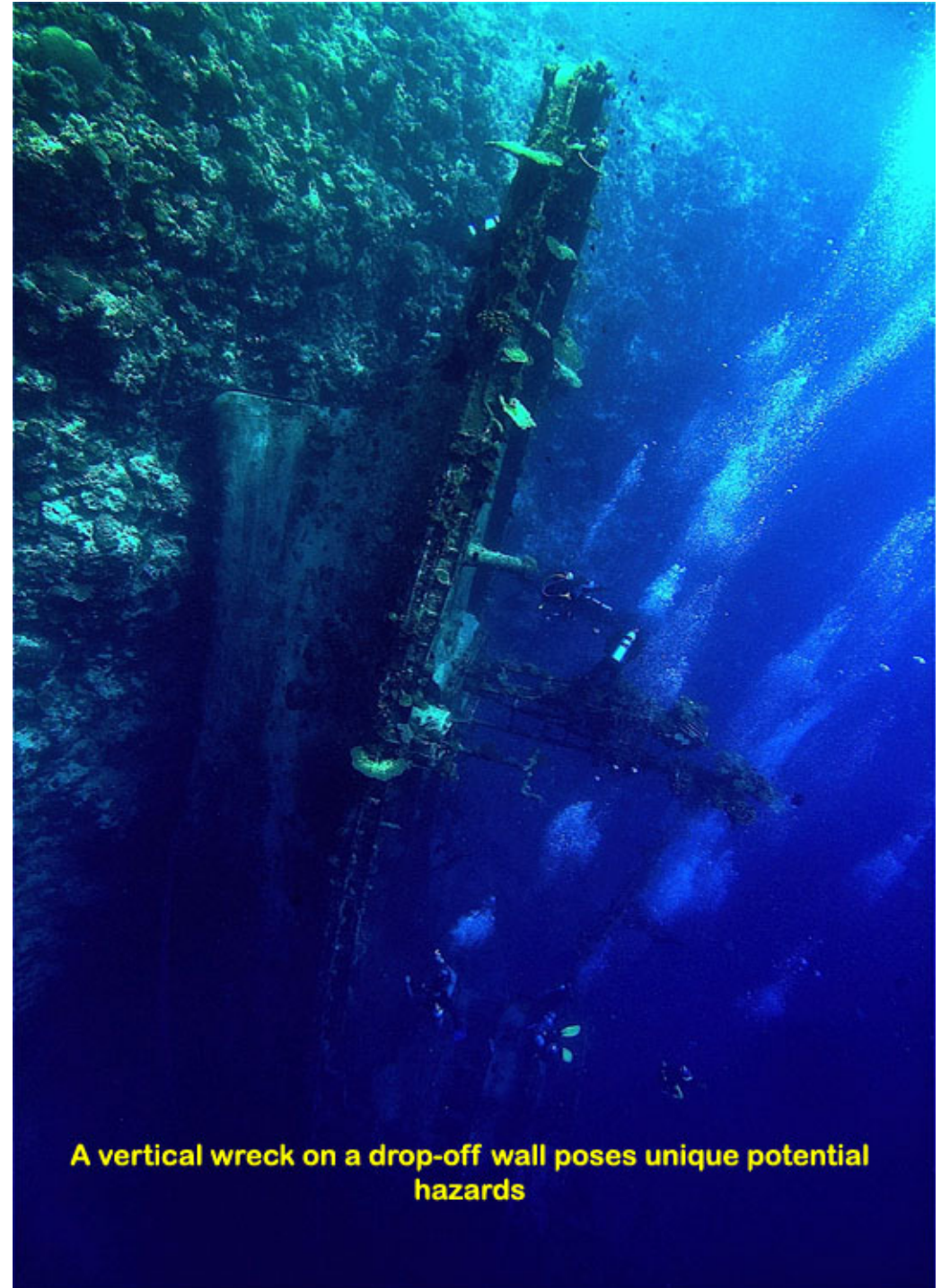
Jack Smith signs up for a basic dive course. He has never dived before and wants to learn. Bob Jones accepts him as a student. A

payment in the form of a course fee is exchanged. At this time, a basic contract exists between these two persons that Jones will teach Smith to dive and look after his wellbeing and safety during all aspects of that course.

However, Smith misses the class about the consequences of holding his breath on ascent and Jones never covers the material with him when he shows up for the first pool session. Sure enough, he holds his breath from the deep end of the pool when he accidentally floods his mask and panics. Smith suffers a fatal arterial air embolism and his family sues Jones.

1. Has Smith got damages? Yes, He is deceased.
2. Did Jones have a duty to provide a reasonable environment of safety for the dive course? Yes, he did.
3. Did Jones breach that duty? Yes. Smith never knew he shouldn't hold his breath while breathing from scuba because Jones never told him so.
4. Did Smith die because of Jones' negligence? That would be the inevitable jury verdict.

I used this example to hammer home a point. In entry-level scuba instruction, the students really don't know anything at the outset. They are blissfully unaware of the hazards of diving until you, as the instructor, explain things like bends, embolism, sea urchins, etc. They are, to draw an elemental analogy, a blank slate that you will fill in with information from which they can make decisions about how to conduct themselves while enjoying the sport.



**A vertical wreck on a drop-off wall poses unique potential hazards**

Of course, you give them a waiver to sign in which they are asked to assume the risk for the activities they will take part in. This is the basis of “informed choice” wherein an individual is advised of risks associated with an activity and makes a deliberate decision to participate with that full knowledge of potential hazards that could lead to injury or death. That’s why a properly executed waiver and release form is absolutely vital as part of your risk management.

### **Proper Use of Waivers**

Look at this tool as your first line of defense. It’s a contract between you and your student that essentially states: “Diving is potentially dangerous and here’s a list of all the ways you can kill or injure yourself; you understand these risks and agree not to sue me if an accident happens”. Is it really that simple? Not quite, but we’re getting there. Now let’s look at procedures for waivers and how to make them work for you.

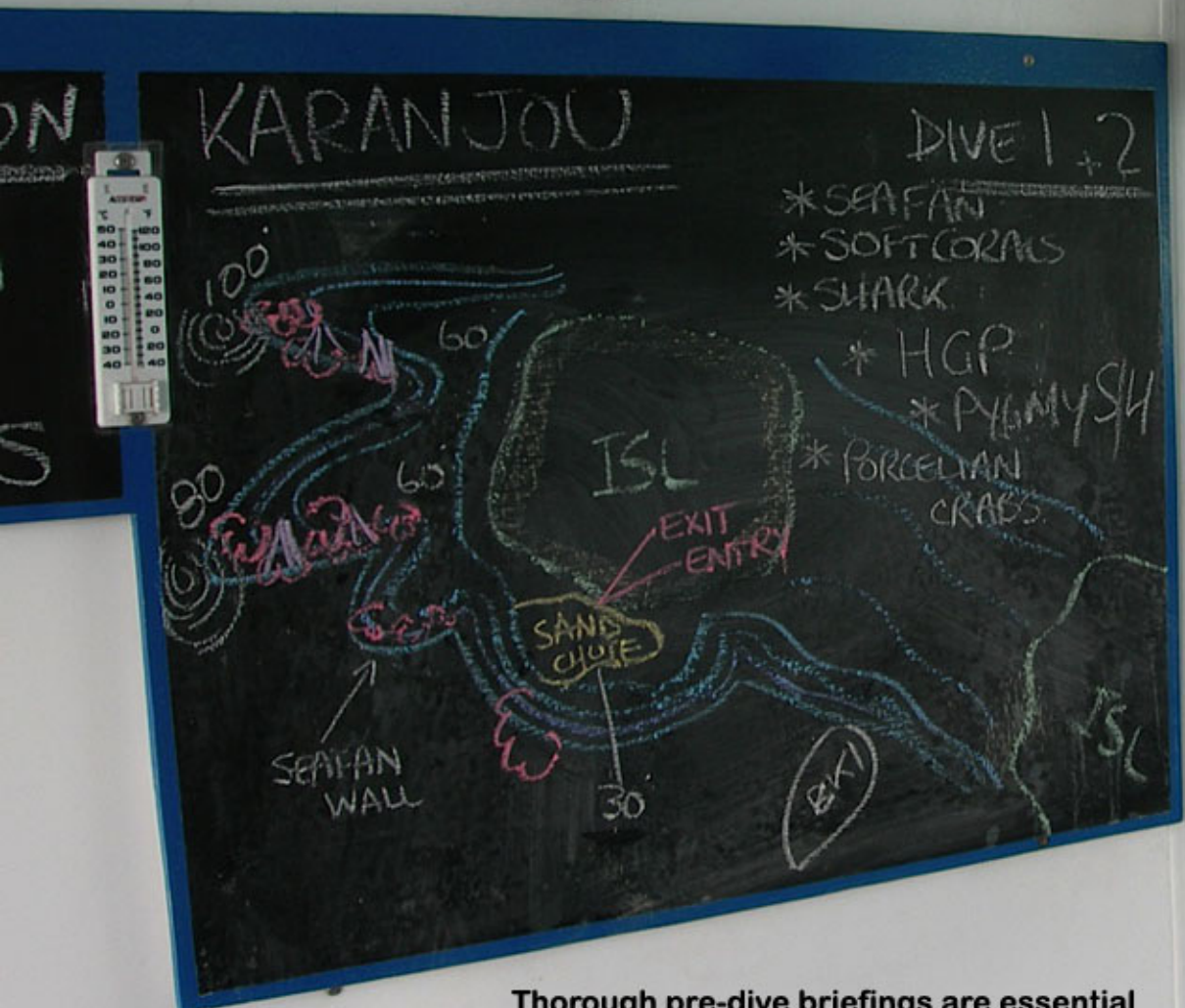
We have reviewed the basic elements that make up a lawsuit. Now let’s take a stroll through some of the front line risk management precautions that can help to nip a law suit before it ever gets into court or mitigate damages later on down the line. We’re talking proactive use of the arsenal of waiver & release forms available to the instructor. These will generally include at least a medical history form and a general release of liability and assumption of risk agreement. No instructor or dive vessel operator should conduct their activities without proper use of such documents. They will be vital to any successful defense should an accident occur.

The whole idea of waivers and releases is to establish a contract between the student and instructor that stipulates certain understandings as to the nature of the activities about to take place in training. However, it’s not enough to simply pass around a bunch of forms to be signed as

the boat is pulling away from the dock and hope for the best. In many states, asking a student to execute such a release without time for sufficient contemplation or under threat of monetary loss will alone be grounds to deny applicability.

First and foremost, the student must be made aware of the inherent risks and hazards associated with diving. The actual release form used by SDI, TDI, and ERDI for all its courses contains a variety of information that specifically identifies assorted dangers that might reasonably be anticipated to crop up. And, in no uncertain terms, the document explains that these things could happen to you if you decide to participate in diving.

After initial certification, subsequent waivers require the student to represent his diving experience and prior training. This is to clearly establish that the person executing the release has a body of life experience in the sport, separate from the specific warnings as to hazards and risks, on which he may base his decision to participate. For example, a person signing up for basic entry-level scuba really has no understanding of the inherent risks of the sport until his instructor covers that material in his class. On the other hand, a certified diver with six years of diving in a variety of conditions and depths since his original training already is aware of most of the standard hazards associated with scuba participation. He can make an informed decision based upon that experience and prior training as to whether he wants to assume the risk of more advanced or technical programs. And a judge or jury may hold him to his contract wherein he agrees that should he be injured or killed, he has effectively waived his recourse to sue the instructor.



Thorough pre-dive briefings are essential

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

### **Sign on the Dotted Line, Please**

Now let's get into the nuts and bolts of making a waiver & release valid and enforceable. The student is entitled to a reasonable atmosphere of reflection and thought before being asked to enter into such a serious contract. The instructor should advise all students at the time of enrollment that a waiver & release will be required as a condition of participation. Then the document should be offered well in advance of the actual diving day including the first pool session.

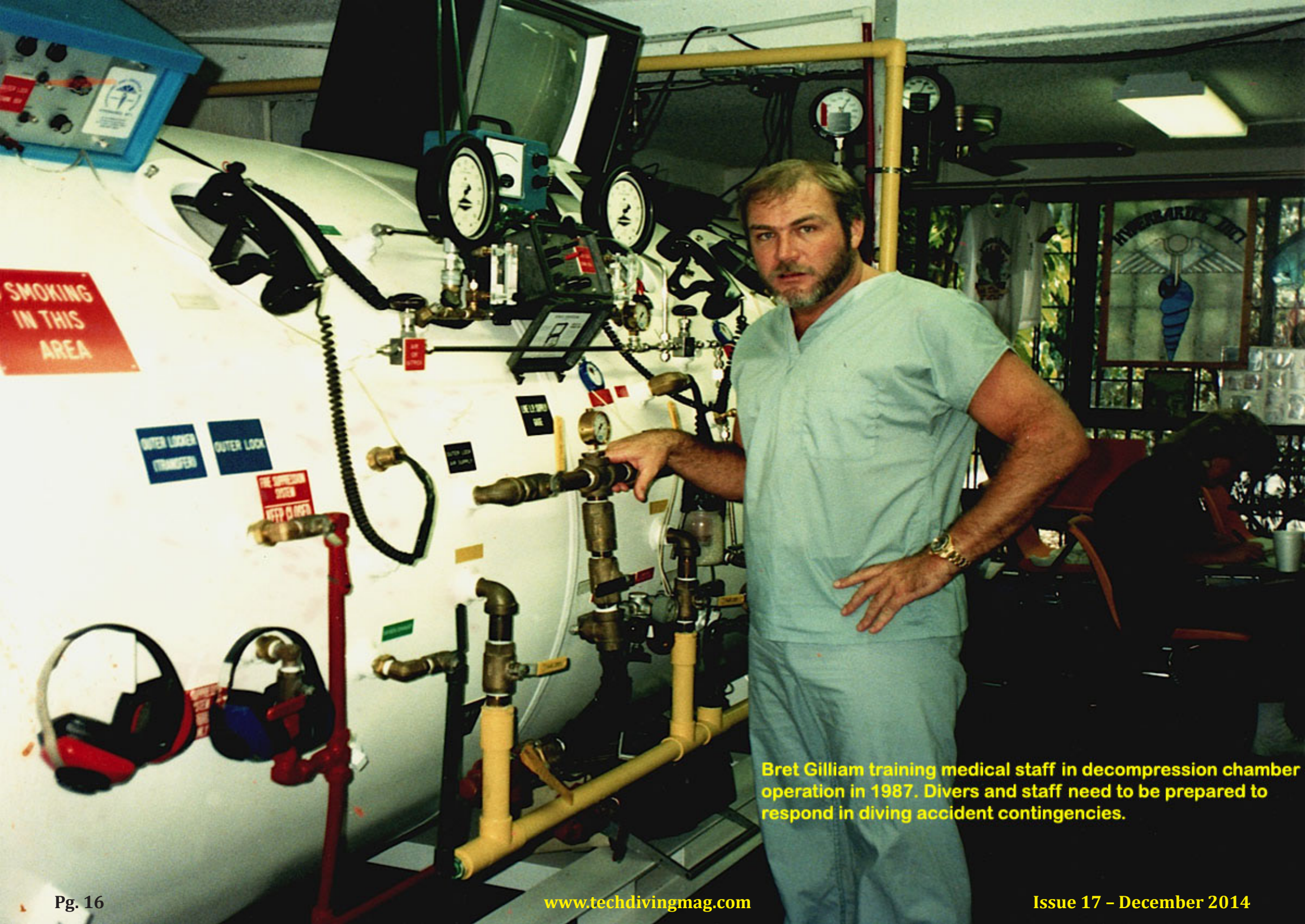
Asking a class to sign waivers shortly before water or pool activities begin does not meet the spirit of the release. Especially if it is implied that a student may forfeit any fees already paid if they refuse to sign. Duress of any kind, whether emotional peer pressure or financial loss, will probably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

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

If already holding prior certifications, I remind them that this form requires them to be truthful and honest with regards to their experience, training and capabilities. I always make sure that the form is witnessed by a third party. And finally, I explain that if they have any reservations about participating, they may withdraw without any loss of face and with a full refund. I also encourage them to discuss their participation in detail with family members so they are also fully apprised of the potential for injury or death. It's not a session that is particularly pleasant for either student or instructor, but it is one that won't be forgotten. I do the briefing with all students present as a group so everyone is equally aware of the material I've covered. In the event of an accident, they can confirm as witnesses the extensive detail I covered in a thorough explanation of the releases.

Minor children must have their parents or legal guardian sign the release as well since they are considered too young to independently execute a legal document waiving their rights to sue (this can vary state-to-state). I recommend that you have the parents either attend the first session of class or send the waiver home with the minor and then call the parent to brief them just as you would an adult class participant.

Do not allow students to make any changes to the waiver documents as this could serve to invalidate them. Make certain that all information is completely filled out, initialed, dated properly, and signed. In some states, waivers may be disallowed as a first line of defense where an attorney files a motion for summary judgment to have the lawsuit dismissed. But the waiver will still be admissible later at trial as an exhibit for the jury to consider to determine the student's informed consent and awareness of risk and his decision to assume that risk while participating in scuba training.



Bret Gilliam training medical staff in decompression chamber operation in 1987. Divers and staff need to be prepared to respond in diving accident contingencies.



## **Student Training Records**

Be sure to utilize the student training record folders to preserve written evidence of the student's successful completion of tests, skills, pool and open water sessions. This file is also the place to safeguard medical history forms, physician's approval if necessary, as well as waiver documents. These files should be preserved for a period of seven years. Obviously, if an accident were to occur during training they would be of immediate use. But they have additional importance if an accident were to occur after certification and a law suit was filed with allegations that the original course was lacking full content or that the student failed certain academic topics or skills without proper reinforcement or review to ensure the student's complete understanding or proper mastery of skills. Be vigilant in keeping your paperwork up to date as the training program proceeds and always be sure to review any incorrect performance by a student until it is properly completed.

## **Medical History**

Ensure that students complete the medical history form prior to any class activities, including academic lectures. It is recommended that instructors not coach students on completion of the form. However, it is appropriate to clarify any questions that may arise. Should a student accidentally respond to a question in error, a new form should be given to them to fill in with accurate answers. When a student indicates one of the areas that require a physician's medical approval, have the student provide the executed approval for proper documentation of the student record.

## **Summary**

It's serious stuff. It's necessary to cover all aspects soberly and professionally without any distractions. Teach your programs in strict observation of the agency's course standards and try to anticipate

situations where accident scenarios will arise. In technical diving and some advanced programs, we have a duty to screen less experienced or under qualified divers out of the programs. Sometimes this can be a difficult reality but you may save divers from themselves in the process.

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

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

***Bret Gilliam is a 44-year veteran of the professional diving industry with over 18,000 dives logged. He was the founder, President and CEO of International Training and its subsidiaries SDI, TDI, and ERDI. He pioneered most of the technical diving industry standards and was responsible for negotiating the first insurance coverage for technical activities. Regarded as one the top experts for diving liability issues in the U.S., he has made over 270 court appearances in both plaintiff and defense cases for civil and criminal actions.***

# Expedition Blücher 2014

Text by Onno Kok

Photos by Joeri Vinkx, Onno Kok, Morten Kjerulff  
and Ron Bruyn



*My scooter is running at full speed, while I am fighting to stay on the shot-line without being washed away. The current is quite strong, all ambient light is gone and the water is cold. At 80 meters of depth, finally the wreck appears and we can see the cannon at which the shot-line is tied. This week we are diving the Blücher, a huge warship at the bottom of the Oslo fjord. The dives are challenging, but the wreck is worth the effort.*

The last Saturday of June we arrive at the expedition ‘mansion’ we have rented for this week. In no time the house is filled with compressors, boosters, bottles, rebreathers, scooters and many bags of food. Outside the house, two RIBs are waiting to be used to take the divers and their equipment to the wreck. Once we have completed off-loading, there is no time to rest. Our Danish expedition members Esben and Morten have developed a diving habitat to make the long decompression in the cold water a little bit more comfortable. The four person habitat enables the divers to do decompression dry while being underwater. Very nice, but before we can use it, we have to position and connect it underwater.

### **The habitat**

After an hour and a half, the habitat is assembled and placed on the small RIB for transportation to the dive side. The habitat is however more than 1.5 meters high, blocking the captain’s sight of where he is going. A second person is therefore doing the navigation by shouting *left, right, wave and boat* to the blind captain. A nice way to enter the main shipping lane to Oslo, usually busy with cruise ships and cargo vessels. Thank god we are lucky and did not encounter cruise ships on our way. Big waves might have easily tipped the habitat of the small RIB (despite our careful attempts to tie it to the boat).



In contrary to many other wrecks, the location of the Blücher does not allow a direct descend to the wreck, as it is situated in the middle of the shipping lane. The best way therefore is to use scooters to reach the wreck after entering the water from the shallow side of the fjord. Another reason for the use of scooters is the current, which can be quite strong and is sometimes difficult to predict.

At about one third of the way to the wreck a lighthouse offers a perfect point to place the habitat. Unfortunately the first attempt to place the habitat does not work as we have hoped, despite a big effort by the whole team. There is no other option but to beach the habitat, put it back on the little RIB and return to harbour. However, we have learned a lot and are able to position the habitat at the planned location the next morning. Many strong lines attach the habitat to the bottom

and a couple of lift bags keep the habitat in position, even when it's not filled with air. In the habitat, small benches have been created to act as seats. Once the divers are in, a bottle of air is emptied into the habitat, creating a dry environment for decompression. Despite that, the divers of course need to stay on their rebreathers to breathe the right gas for decompression and avoid carbon dioxide issues.



### **The Blücher**

The Blücher was a German WWII heavy cruiser. At the beginning of the war, the vessel was the newest of the German Kriegsmarine and one of the largest heavy cruisers ever build. Her length was over 200 meters, crewed by 1600 sailors.

April 1940, the Germans started operation Weserübung: the invasion of Denmark and Norway. The Blücher was sent to occupy Oslo by destroying strategic targets in the city and after that invade Oslo using

2000 marine. April 9<sup>th</sup>, the Blücher arrived in the Oslo fjord. One important piece of intelligence the Germans missed out was that in the fjord, on a small island, three big cannons were placed, ironically even provided by the Germans in WWI. Two of them took the shot and fatally hit the cruiser: a hit in the battle station, causing the Blücher to be not directly able to return fire. After that the Norwegians launched two (very old) torpedoes, both hitting the Blücher and causing the big, proud ship to sink within two hours. Despite all efforts of the captain to beach the cruiser, 830 men lost their lives out of 2202 men on board.

### **Heavy dive**

On Sunday morning it is finally time to dive the Blücher! My buddy Ron and I prepare ourselves for the dive, while Joeri and Camiel are kitting up at the other side of the boat. We are all using rebreathers, scooters and three bail-out bottles each. Once in the water we connect the last stages and descend to six meters of depth where the guideline is starting. After an OK we proceed to the lighthouse, the first stop to the wreck. At the lighthouse we do a last bubble-check and continue to the wreck. At around 30 meters of depth the current increases. The deeper we descend, the stronger the current seems to get. While running the scooters full-speed to stay on the line we descend further into the black emptiness below.

At 80 meters we finally reach the wreck. The current is strong and despite clear water, all ambient light is gone. The shot-line is connected to the side of the wreck on one of the big cannons. The wreck is almost upside-down, which makes it a little more difficult to navigate in the dark waters. I hold on to the wreck to relax a bit (without being washed away) and try to situate where we are. Both the ride to the wreck and the wreck itself are quite impressive, so we take a minute to check if we are both OK to continue onto the wreck.



In the last couple of years I have visited many wrecks in the Atlantic and North Sea and have gotten used to many conditions. Despite that, the Blücher leaves a big impression in the cold, dark waters. After some time, we start having a look round the area of the shot-line to memorize where the shot-line is connected to where we would like to go in the next dives.

I don't feel comfortable yet on the wreck and I signal my buddy to start our way back to the lighthouse. Strange how some wrecks can impact you.

### **Huge wreck**

After the dive I hear I wasn't the only one who needed a little time to get used to the huge, intense wreck of the Blücher. However, in the next days we are getting more and more comfortable and are able to make very nice dives on the wreck, doing run-times of two to three hours. The big cannons, torpedo tubes, port holes and a lot of ammunitions are great to check out. During the week the current slows down, making the dives more comfortable. The water though remains very cold, which makes it a big pleasure to enter the habitat, have a drink and a bite while doing the decompression and mentally re-living the time on the wreck. The Blücher is a beauty, but isn't easy to dive. The depth of 80 to 95 meters, cold water and logistics make it quite an expedition. But one thing is sure: I want to go back again!

### **About the dives**

Max depth: 95 meters  
Run-times: 120-200 minutes  
Rebreathers used: Megalodon, Inspiration, Revo, modified Dolphin  
Gases: Diluent 8/65, bail-out TX10/60, TX35/35, NX70, 100% (drop-gas surface)  
Scooters: DiveX, Suex

### **Blücher**

Shipyard: Deutsche Werke, Kiel  
Launched: 8 June 1937  
Commissioned: 20 September  
Displacement: 14.050 longton (standard), 18.208 longton (loaded)  
Length: 206 meters  
Beam: 21,3 meters  
Draft: 7,7 meter  
Power: 132.000 h.p. (98 MW)  
Speed: 32,5 knots  
Crew: +/- 1600  
Armament: 8 × 203 mm, 12 × 105 mm, 6 × 40 mm, 12 × 37 mm, 32 × 20 mm, 12 × 21 in torpedo tubes, 160 mines











# Ultra Long Halftimes

By Asser Salama

© T. Timothy Smith



Since all tissues are alive, they need oxygen and nutrients, and they produce CO<sub>2</sub> as a waste product. Haldane assumed three hours are enough for nitrogen loading to reach saturation in goats, and presumed humans would reach full saturation in five hours. This means that the slowest compartment halftime would be around 50 minutes.

The perfusion limited decompression models use sets of halftimes covering a much wider spectrum. For instance, the halftime of ZH-L16's slowest compartment is more than ten and a half hours. It is established that a tissue with such a limited blood flow to create such a long a halftime would not have a reasonable blood supply (in other words, oxygen) to be viable, except for teeth and the very solid portions of bones, which are not really capable of dissolving inert gas.

If these ultra long halftimes are not 'physiological', what would they be representing? One opinion is that they're actual gas bubbles in equilibrium with the tissues, and that the compartments represent the different portions of the tissues and even portions of the cells, including the would-be existing bubble seeds. In this context, dissolved gas models are actually handling bubbles by accounting for their influence on inert gas uptake and elimination rates rather than trying to control their size and number.

Now let's take a look at what ultra long halftimes would do to VPM-B generated schedules. The majority of VPM-B planning tools use the ZH-L16 compartment set advised by Bühlmann. For the technical dives we do today, even for the bigger ones, using a different set covering a wider range of halftimes won't affect the generated schedules in any tangible means. The number of compartments won't affect the generated schedules either, as long as they're distributed properly. But when it comes to the extremist of dives, there would be a significant difference.

Dec-12 is an alternative compartment set I've implemented in [Ultimate Planner](#). It consists of 12 pair of compartments distributed evenly over a wider range than that of the ZH-L16. The diver can choose which set to employ. The generated schedules are generally very close, but take for instance Ben Reymenants' 239 meter (784 foot) dive in Sra Keow cave near Krabi, Thailand. On February 18, 2007, Ben glimpsed Sra Keow's floor after a 25 minute descent. For this dive, using Dec-12 instead of ZH-L16 halftime set would result in some 30 minute increase in the total run time. If, on the other hand, we used VPM-B with a set of halftimes covering up to 200 minutes only (approximately the slowest physiological tissue halftime; fatty marrow), Ben's schedule would have been cut by some 200 (yes, two hundred!) minutes.

# ULTIMATE PLANNER

## Your Decompression Planning Companion

INCORPORATING VPM-B AND BUHLMANN WITH GRADIENT  
FACTORS FOR OC AND CCR DIVERS

[www.techdivingmag.com/  
ultimateplanner.html](http://www.techdivingmag.com/ultimateplanner.html)

Models the inner ear as lipid or aqueous tissue (ICD prediction)

Accelerates no-fly time using surface oxygen/nitrox

Optional display of tissue loadings upon surfacing

Optional second dimension of conservatism (/U)

Optional extended gas switch stops

Comes in four different themes  
(including high contrast)

FREE  
SOFTWARE  
DIVERS

No-Fly Time Accelerator

O2[%] in the surface rich mix (99 or 100 for pure O2) 0

Use only pure O2 or Nitrox mixes (not Trimix or Heliox)

Minutes of breathing the rich mix on the surface 0

Minutes of breathing normal air before applying the rich mix 0

Accelerate

Breathing Mix Calculator

Depth 90.0 m ppO2 1.4 EAD/END 40.0 m

O2 Narcotic

O2 [%] 14.0 He [%] 50.0

Calculate



Altitude Settings

Dive altitude 0.0 m

Hours at altitude 4.0

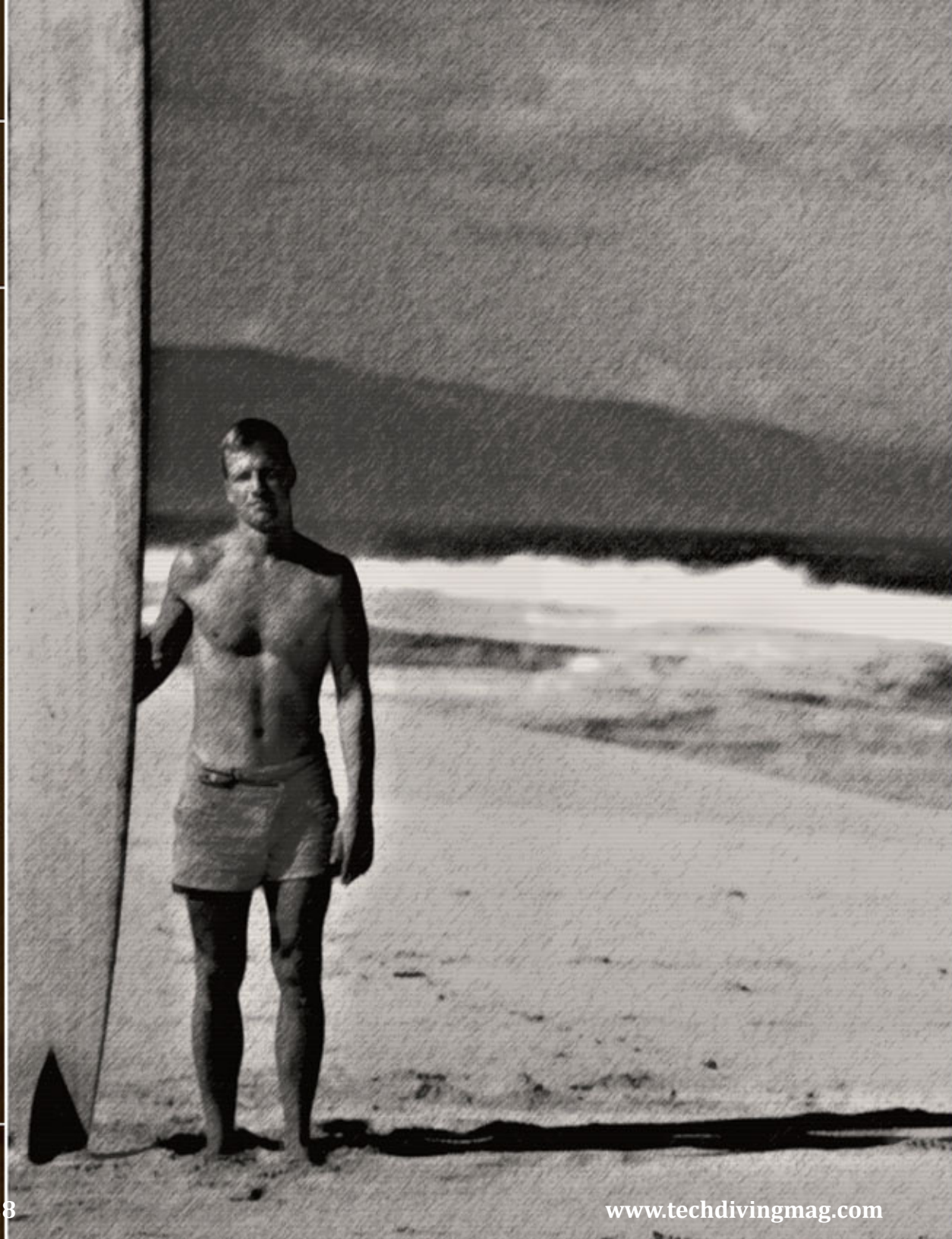
Diver acclimatized at altitude

Starting acclimatized altitude 300.0 m

Travel hours 8.0 OK

== Probably the most advanced / user  
friendly decompression software on  
the market! ==

Ben Reymenants  
Instructor Trainer (TDI, SSI, PADI)



# BEV MORGAN

PIONEER, PIRATE  
PHOTOGRAPHER  
ENTREPRENEUR

BY BRET GILLIAM

It would be difficult to imagine a man more deserving of the moniker “pioneer” than legendary commercial diver and manufacturer Bev Morgan. In a professional career spanning nearly six decades, Morgan has managed to leave his mark on diving in so many ways that the accomplishments of others pale in comparison.

From a modest start as a lifeguard, he’d go on to amass considerable wealth as the founder of Diving Systems International, the world’s largest manufacturer of commercial dive gear. Along the way he helped originate the first dive training programs in the U.S., started the company that became the multi-million grossing wetsuit conglomerate Body Glove, indulged himself in a variety of hedonistic (and sometimes scientific) voyages of discovery to the South Pacific and beyond, and ended up as soul mate and confidant to rock musician David Crosby. Honored by DEMA as one of its first inductees into diving’s Hall of Fame, Morgan remains an intensely private man who has shunned the limelight in spite of his considerable successes.

I originally trained to dive in 1959 using Morgan’s book, *Underwater Safety*, and he’s been a hero of mine ever since. Although he is the stuff of legend in diving and surfing, in real life he’s even larger. While standing well south of six feet in stature, he towers above most when you simply consider the contributions he has made to diving. And surfing for that matter. One of the things I’ve most enjoyed about Bev is his refreshing candor and point blank way of speaking. Ask him why he was first interested in diving and he’ll tell you straight off that it looked like a good way of getting girls at the beach. For a guy who never went to college, he will leave you simultaneously amazed and educated with the most complex engineering explanation you could hope for. Differential mixed gas formula equations? He’ll solve them from both ends and never spill his drink. Ask him for an opinion? You’ll get it “no holds barred” and with none of the expletives deleted.

Among military and commercial diving professionals he enjoys a reputation as “da man” and the “go to” guy for whatever piece of gear or methodology necessary to get the job done. When Hollywood needs impossible special equipment designed for underwater films, the solution is always, “Get Morgan on the phone!” And then there’s a few assignments he’s accepted from our government that he really can’t talk about... at least not when the tape recorder is running.

He’s a hell raiser in every sense of the word. That’s another quality I most admire about him. Bev is going to make sure a good time is had along the way. He’ll take care of business, but he’s not going to miss the party. His sense of humor is also the stuff of legend. A decade or so ago, we were having dinner in a swank restaurant in Texas when a member of our party began choking on a piece of steak that went down the wrong way. I jumped up to administer the Heimlich Maneuver to our gasping dinner companion and Bev watched with interest... never missing a bite of his own meal as pandemonium briefly reigned. On my third attempt, the piece of meat departed from the man’s clogged airway and sailed in a high arc across the table to land inches from Bev’s plate. He drained his wine glass, stabbed the offending morsel with his salad fork, and inquired calmly, “Are you done with this?” The whole room exploded in laughter and relief.

Since he’s been around long enough to pioneer both diving and surfing, he’s something of a cross-over cult figure. Bev built dive gear. And he built surfboards. He practically invented the scuba certification programs of the 1950s. He was the first to grasp the market for wet suits in both sports and overcame the initial disdain that surfers cast on any type of thermal wear by showing the retailers that it was good business. You see, in spite of Bev’s frequent departures from the entanglements of various enterprises to embark on sailing adventures leaving behind a long list of serial relationships with girlfriends and a

revolving door of wives, he had the inherent “business gene” that so very few possess. He was an instinctive entrepreneur who managed to make his avocations a career that made him staggeringly wealthy in markets notorious for financial failure. Surfing? Diving? When Morgan got involved originally these weren’t business ventures; they were bad habits.

He sailed across the Pacific exploring places that few white men had been in centuries. He helped “renew” the shallow gene pool on Pitcairn Island where the *Bounty* mutineers had settled in virtual isolation. He was one of the first to dive Cocos Island and Polynesia. When the lure of Hawaii’s infamous North Shore big surf was being ridden for the first time, it was Morgan standing tall with characters like Greg Noll, Ricky Grigg, Buzzy Trent, and other water rats with more guts than common sense who tackled Waimea and the Pipeline. He excelled as a photographer and his library of images chronicling surfing and diving from the early days to the modern era is a monument of captured history. He was a senior editor and writer for both *Surfer* and *Skin Diver* magazines in their start-ups. He smuggled lobster from Mexico into the U.S. along with a few other commodities that NAFTA didn’t figure on.

But most of all he changed the way men worked underwater by creating the revolutionary lightweight commercial gear that freed divers from the cumbersome hard hat dress that had dominated the piers, ships and waterfronts for nearly a century. That probably will be his legacy. The George Washington of the commercial diving industry.

What can I say? Morgan is a character of so many dimensions. World class businessman, world class *bon vivant*. And one hell of a guy to hang with. This interview came about over the course of three sessions from 1996 to 2004. The first time we let the tape recorder

run was at his hillside home in Santa Barbara. We continued again later in his waterfront offices. Finally, I tracked him down at his new home in the Santa Ynez valley, just over the mountains. His pal David Crosby lived just down the road and helped him find the place. (Now he’s moved again back to Santa Barbara. I wish I was his real estate agent...) Each time he greeted me warmly and we settled in for lengthy dialogues. I asked him to reminisce about his phenomenal career and the adventures that cropped up.



**Tell us about how you first got involved in this.»** As a kid, I didn’t know much about the water or any of those things, then one day, I drove by the beach and there were a lot of girls. So, I started going to the beach to look at the pretty girls. It turned out to be a neat environment.

**What year was this?»** I’d say around 1946. One day I was surfing in San Diego. It was a flat day and some divers went by. They were getting a lot of abalone and lobster. That got me real interested. They invited me over for a cookout on the beach. Turned out it was Connie

Limbaugh, Jim Stewart, Andy Rechnitzer who were going to Scripps, back in the early days. It looked like a real fun deal to get food out of the ocean. This chance meeting turned into a long friendship. A little later I was working with two fellows named Rex Guthrie and Tom King up at Los Angeles County Life Guards. They took a World War II frogman's mask and put a tilt valve regulator in it from a B-29 bomber oxygen unit. We breathed in through the nose and out through the mouth and the damned thing worked pretty good. When the Aqua-Lung came along it worked better so we bought a couple.

**When?»** That was probably 1949 or 1950. We bought the Aqua-Lungs in 1951 or '52 and began diving with them. As a lifeguard for the County Guards, I worked on their only boat at the time, named the *Baywatch*. One of the jobs was body recovery from the boat. We started recovering scuba divers because nobody knew how to dive and they were renting or buying the equipment with no training. The only instruction the Aqua-Lung manual gave was not to hold your breath when you come up.

**In those days there was no formalized training program, was there?»** Well, no. There was really only the YMCA. A guy named Fred Swankowski ran a diving class at the YMCA pool in Long Beach. I attended either the first or second class. At the time, the Los Angeles County Board of Supervisors was seeking to make it illegal to dive with scuba equipment due to the high accident rate. Back then, five or six out of 100 people diving would lose their lives; that was a pretty high percentage. My idea, along with Limbaugh and E.R. Cross, was to organize a board of advisors. The Board of Supervisors recommended that we start a diving instruction program, so they provided us with a budget. So I, along with Ramsey Parks, who was my diving partner at the time, put one together and it became the Los Angeles County dive instruction program.



Morgan with yellowtail, 1953

**What time frame are we talking about?»** We put it together in 1953. The following year we taught about 1,000 students in the LA County pools. We quickly realized that there was no way we could teach all the people in Los Angeles County, let alone everyone else interested in scuba diving. So, at the end of the summer of 1954 we put together an instructor's program and began developing a manual on how to instruct scuba divers. At that point it became obvious to me that this diving program should not be a government-controlled or dive club-controlled operation. I felt very strongly that it should be a dive shop-associated training program. My concept was a dive shop with a pool, classroom, workshop and showroom.

**In those days, how many dive shops are we talking about in the Southern California area?»** Two ! But the enthusiasm for the sport was overwhelming. *The Los Angeles Times* was very generous in giving article space and write-ups. We were in the sports section at least twice a month with good full-page features. At that time there was only one manufacturer in the United States and that was U.S. Divers. In those days there was no PADI or NAUI. Al Tillman, one of the fellows who had helped us start the LA County Instructor program, went on to start NAUI a few years later. It all grew out of that original little L.A. County course we started.

**Didn't you decided to try your hand at retailing around then?»** In 1955 I started a shop called Dive 'n Surf and later brought in Bill and Bob Meistrell. We sold the complete U.S. Divers line since they were the only company manufacturing dive gear in those days. They had the Aqua-lung. There was no other scuba available.

**Did you have suits in those days?»** Before I opened the shop I went to the Scripps library and ran across a report from a fellow named Hugh Bradner who recommended the use of foam neoprene for

military divers to keep them warm. The insulation was in the material itself so the diver got wet but stayed warm. He called his new suit a "wet suit." I read the report and it gave a source on where to buy the material. I bought a sheet of it and made myself a suit. It worked very well. I then made suits for all my diving buddies and that's how Dive 'n Surf began as a suit manufacturer.

**Who was using these suits?»** Scuba divers.

**What about surfers?»** No, not surfers. Surfers considered it chicken to put on a rubber suit so we couldn't break into that market, no matter what we did in those days. I remained with Dive 'n Surf until 1957 then I sold out to the Meistrells. We dove most of the time. We'd get up at 4:00 a.m. and go diving, then open the shop at 9:00 a.m. They were great partners but I decided to go adventure sailing and diving aboard a 61-ft. ketch named *Chiriqui*, so I sold out to them. I went down to the South Pacific with a crew of dive buddies for a couple of years. We did a lot of filming, 16mm stuff and lots of still pictures.

**Tell us about some of the places you visited. Did you dive while you were there?»** Yeah, had a compressor on board and a bunch of bottles, dove our brains out. It started out in Long Beach, went down along the coast of Mexico. We dove all the way down. We spent a month at Tres Marias, a group of islands off of Mazatlan. From there we sailed to Acapulco continuing to dive all the way down to Cocos Island. It was untouched in 1957, nobody had ever collected fish there. We offered to do a collection for Scripps. We soon found out the reason why no one had put together a fish collection there. There were a lot of sharks. A lot of sharks. Before we arrived in Cocos we read that the reef sharks chewed on the anchor chain when it was let out. I just laughed thinking it was a joke, but sure enough, when we pulled into Chatham Bay and dropped the hook, we heard all this



crunching. We thought we were dragging across rock or coral. When we looked, we actually saw that it was a bunch of sharks chewing on the anchor chain! As we let it out we thought, “Geez, we better rethink this.” We didn’t know if we were going to dive there or not. But, we found a place the next day where we could get our back against a vertical drop and jump in the water.

Sharks came at us right away. While in Mexico, we encountered quite a few sharks so we made “shark billys,” poke sticks about two feet long and made of ironwood. They were heavier than water so if it was knocked from your hand it sunk to the bottom, and the bottom was a much better place to be than mid-water to recover your “billy.” We didn’t go in the water without those shark billys. When the sharks swam up to you, you’d hit them in the nose and they would go away. We’d dive back to back, usually three men to a team. Two guys back to back, one guy fish collecting or whatever you are up to. We’d never spear too many fish unless we were next to the boat and could hand up the gun then jump in the boat after the fish was speared, and let somebody else haul the fish in. You might only get half of it in otherwise.

Our final day of diving at Cocos was out in the blue at the edge of a drop-off. Three of us had just dropped into the water from our 14-ft. skiff. Two very large sharks, not reef sharks, came slowly towards us. One guy, Lowell, froze. Ramsey Parks and I looked at him, then at each other. Lowell just hung there not moving. Ramsey and I had our shark billys at the poke position towards the two approaching big boys. When they were about 20 feet away they separated and split off to the side. We soon realized why. A third shark was approaching slowly behind them. This guy was really, really huge. I couldn’t really see how long it was and that didn’t matter. What mattered was how big around he was. He continued swimming slowly toward Lowell

who remained frozen in mid-water. His mouth was slowly opening. This monster shark was going to eat Lowell and his mouth was big enough to do the job in one easy gulp. It was as if the shark detected which of us was more scared. When the shark was about 10 feet away Ramsey and I swam toward it and started poking its nose with the billys. It broke off the approach and kicked its tail, which tumbled us as it swam away. Ramsey and I grabbed each side of Lowell and began shoving him into the boat. I don’t recall how all three of us got into the boat, but somehow we were all in the boat when the three sharks returned and started to bump against the bottom as if trying to dump us out. Ramsey fired up the outboard and took off at high speed back to the safety of the big boat. There was silence as we secured everything and set out to sea to find a better island to dive.

**Where did you go after that?»** We went to the Galapagos and we spent two months going through those islands. That was real interesting down there. We would see an occasional fish boat but no yachts. We were only the second yacht to ever go to Easter Island. There were many rumors about the big statues and roads into the ocean as well as the submerged cities. Much speculation was made about the statues in those days coming from the moon, because the experts couldn’t figure out where the quarry was or where they had been made.

**Had anybody been there before with any diving equipment?»** I don’t think so. We were the first to dive there. Thor Heyerdahl had been there six months prior to our arrival. He had a big expedition, *Kon-Tiki*, and all that. He explored the island and when he came out with his book, his information was more accurate than any expert’s previously. He even discovered a few atypical statues from the big-lipped ones.



**Did you continue on to the West Pacific?»** We went to Pitcairn Island and dove on what was left of the *Bounty*. The mutineers ended up there after taking the ship from Captain Bligh and leaving Tahiti. The remains of the wreck are up in the surf line, but we got a few pieces of anchor chain. Kind of neat to have a piece of that history.



**The start of Dive 'N Surf, circa 1955. Shown from left to right: Dale Velzy, Hap Jacobs, Bill Meistrell and Bay Morgan**

**Every other person there must have been named Christian.»** Well, there are about six common names: Christian, Adams and a couple of others. But that leads to an interesting point. Due to the fact that there are not many visitors, there was a lot of in-breeding on several of the remote islands including Pitcairn. They needed fresh genes, new blood. There were five of us young guys on the boat at that point. They would meet us with a reception committee and match up who was going to be with who.

Well, I guess you could say we did our duty. It kind of wore us out to stop at any particular island. So I guess there's more than a few Morgans out there now widening the gene pool. I like to think I did my part to ensure that the future generations of some of these remote Pacific islands remain healthy. And maybe they won't all look like Prince Charles.

From Pitcairn we went to Minerva Reef. We had read that German pearl divers worked there in the last century and got a lot of pearl shell. The visibility was the clearest I've ever seen in the world, anywhere.

**How clear?»** Well, I could see a hazy outline of the boat when I was standing on the anchor and we had the 300-feet of chain out. It was clearer than anything I've seen since, absolutely clear water.

**Probably only a handful of white people have ever visited there. What was your reception like from the natives?»** Very positive, everybody thought we were wonderful. For them, California was where all the movies were made and before we left we stocked up the boat with a lot of film. One of the guys on the crew had been to the South Pacific many times and he told us how they loved action movies, so we went up to Hollywood and picked up footage from fight scenes, we had two hours of nothing but violence. Fighting, riders getting shot off of horses – cowboys and Indians mainly. We spliced it together and made a feature film out of it with no story line, nothing, just violence. It was nothing but action, fighting, and crashes.

**Probably be a hit movie today.»** We'd set up a projector and screen in the most godforsaken island in the South Pacific and show this film. It was interesting, the natives would just yell and howl, they loved it. Anyway, they thought we were really unique creatures.

**How far out did you get into the Pacific?»** Tahiti. As many boat trips do, it all kind of fell apart in Tahiti. Before we arrived, we mutinied. A fellow by the name of Lowell Thomson was the majority owner of the boat, but we all had a share. He was a character. He had a mine in Idaho. He got hooked on diving. When we got to Easter Island, Lowell started acting weird, as people on sailboats do after a certain amount of time. All of a sudden we had a bunch of guns on the boat missing. We found out that Lowell had retrieved all of the guns and put them in his cabin. We didn't exactly know what he had in mind but it wasn't good. Somewhere between Pitcairn and Tahiti he brandished a gun at one of the crew. We found an old rusty shotgun in the bow of the boat that one of the guys had stored there. We threw a few shells in it then cornered Lowell with the shotgun and told him he'd be toast if he didn't behave.

He was confined to his cabin for nine days. We'd let him out with armed guards to eat and go pee over the side of the boat. We feared he'd shoot us. When we got to port in Papeete, he turned us into the authorities and we turned him in. The French were used to it – just another mutiny. We each went our separate ways in Tahiti. He sailed to Hawaii without our services, and the crew on that voyage also planned mutiny. So we weren't the only guys.

**Was it sometime after that when you began making gear?»** Actually, back when we had Dive 'n Surf, I tried my hand at some garage engineering. U.S. Divers had come out with a regulator called the Mistral. It was a nice venturi-assisted regulator. Single stage regulator, two hose. It worked fine on the workbench but once in the ocean, it would squirt water right on the choke center in the middle of your throat. So I fiddled around with it and got it to work properly by redesigning the damn thing. And wouldn't you know, the company actually incorporated my stuff and changed the regulator. I called

them up a few months later and said, "Hey, that was all my idea, what's the deal? You never paid me for any of that."

So the guy at U.S. Divers says, "Well, I tell you what, you have a pickup truck?" I said, "Yeah, so what?" He says, "How about if I give you everything you can put in your pickup truck out of my warehouse and we'll call it even?" I said, "You've got a deal!"

So I told the Meistrells about it and we all ended up in the damn truck. We got there and loaded that truck down to its axles. Everything they had, regulators and tanks, then drove off. I was happy and he was happy, it worked out fine. At any rate, it that was the first time I realized that I could fool around and come up with stuff.

After I came back from the South Pacific, about 1960 I began doing commercial abalone diving. There were times when the surf was up and we couldn't dive so I had time on my hands and worked on getting surf suits accepted by surfers. I've always worn a wetsuit surfing. I could care less whether or not it was chicken. I made 100 suits for surfers. They were called "short johns." They came down to the middle of your thigh with a Farmer John kind of upper. We sold them for \$15.

So I contacted my surfer buddies like Hobie Alter and the other board makers. They all had surf teams. I convinced their top 10 team riders to wear this wetsuit. First they said it was chicken and they weren't going to wear it. I told them if the profit off your wetsuit sales doesn't pay your rent, I'll pay your rent for you. Well, they all said that's different, it's not chicken to pay the rent. They all agreed to it. So I had 100 of the top surfers on the coast wear a wet suit all in the same week. They were warm and it wasn't chicken because all of the other good surfers were wearing them and all the younger folks, beginners

and all, thought the surfing wet suit was great from then on.

We had somewhere in the neighborhood of 1,000 orders that first week. So I'm knocking myself out to produce these things and my partners say, "Look this is little old lady work – we're not going to make these wetsuits." I tell them, "Guys you only have to work for about a month, then it's retirement city!" They said, "No, we are not making wetsuits, especially surfer wetsuits. It's beneath us, we're divers and we're not going to do it."

So, I packed the whole thing up on the truck and I drove up to the Meistrells and said, "Look, I want to sell you my new surfing wetsuit business." They weren't making surf suits at that time because nobody knew how to crack that market, except for O'Neil up north because of the cold water. Anyway, I took a sewing machine, a batch of rubber and by then 2,000 orders to Billy, and he said, "I don't know." I wanted \$3,000 for the whole package, business and all. He ended up buying it. They called me a couple of months later to say they were making a \$5,000 profit a day each on this deal.

**And that's how Body Glove started?»** That was the deal. Those guys made a nice bit of change over the years from that load of stuff in my pickup. As soon as I unloaded the rubber, the sewing machine and everything else, I drove straight to *Surfer Magazine* and got hooked up to edit the publication with John Severson for a year. At the end of the year though, the old dive itch just got to me. Danny Wilson had put his first bell together and had made his first helium dive in Santa Barbara so I just packed up and came to Santa Barbara and asked Danny for a job. Danny says, "Well, I tell you what, I don't know if you're qualified for this commercial diving." I said, "Let's not hear that again. This is a new deal, it's working out of the bell. You're not even going to use heavy gear."

"Well," he said, "you've got to pass the qualifications." He whips out two fifths of vodka and puts one in front of me. He then takes one himself and says, "You've got to keep up with me. If you can make it through the whole bottle you're hired."

So we sat down and talked diving and we talked drinking and we each drank, right out of the bottle... a fifth of vodka each. I woke up in the morning with my head in his toilet. His wife, taking pity on me, gave me a wet towel and said, "You've got the job."



**How about manufacturing commercial gear?»** When I went into the abalone business I had a difficult time finding a mask, so I built one instead. Being a surfboard glasser, I built the mold and made it out of fiberglass. It worked really good so when I got into petroleum diving, I just kept tinkering with the design. Many of the abalone divers graduated to petroleum diving when the oil companies started

doing offshore work. Prior to that, the only people the oil companies would employ were heavy gear divers who wore big metal helmets because they had always had bad luck with scuba divers.

Most scuba divers weren't journeymen plumbers and that's what they needed, so you had to be a hard hat diver to get any work in that business. I was a mask diver on the end of the hose, but not hard hat. I had to buy a hard hat and learn how to use it to get into the petroleum business. I then had the opportunity to design equipment that was more advantageous than the big metal helmets.

**But in those days there was considerable resistance to trying to simplify this gear.»** Yes, there was. Standard heavy gear had gone unchanged for 150 years. Very little had changed, a metal helmet covered your head and it married to a dry dress and you wore woolen underwear under it to stay dry. You jump into the water and walk over to the job site and do your job. But three-dimensional gear in which you could have the same communications that you have in heavy gear and you could walk on the bottom if you want and you can swim if you want – that is better gear. In addition to that, equipment you can put on by yourself is more efficient. Also, in most emergencies, you can take care of yourself. The primary advantage is the shorter training needed with the newer gear.

But probably the biggest single change that came up that you couldn't do in heavy gear was the dive bell. You couldn't dive out of it with heavy gear; it wouldn't fit through the hatch. So the guys had to switch to a lighter weight gear. I was getting nowhere trying to get any new type of helmets sold, so I went into business with Bob Kirby building heavy gear. Kirby was a metal smith and we built some beautiful copper helmets. We were spinning the domes and working the metal, putting ports in. As far as heavy gear is concerned, we built the best

diving helmets in the world. That was 1964. Everybody came to us for those helmets and then we said, yeah, but this little helmet here is better. There was no way for them to counter.

**You'd already established your credibility?»** Yeah, but it took seven years for them to accept the lightweight fiberglass helmets. At that point, there were less than 100 commercial divers and the petroleum companies projected that they'd need 5,000 for all the upcoming offshore work.

**Where were these guys going to come from?»** Well, there was only one base of divers – scuba divers. You can't go to the plumbers union and say we need 5,000 plumbers who like diving. You're going to have to go out and get divers who are willing to learn plumbing and that's what we did. We started schools to teach diving and one of them was here in Santa Barbara. The Santa Barbara Marine Technology Program. Another one started, Commercial Diving Center, (CDC) turned into the College of Oceanering in San Pedro.

The schools trained scuba divers to be commercial divers. The most they could have trained using standard helmets (heavy gear or copper hats) in the time allotted would have been about 300 or 400 divers, so we came up with the Band Mask. This design enabled any scuba diver to do a couple hours training and be fairly comfortable in this umbilical mask and have full communications. Now all they had to do was learn the trade of underwater plumbing and they didn't have to relearn diving. Within five years they were able to train 5,000 qualified divers because of this equipment. That put Kirby and me on the map. Kirby and I built a lot of equipment and supplied all of those divers.

**Morgan in classic hardhat dress, 1973**



That was also at a time when they switched from the concept of living underwater and working, to living on deck and taking an elevator down to do the work. These guys were stored at working pressure. They were put back in the bell and transported to the job site where they did the work, then moved back topside to sleep and eat.

**How long could some of these missions be?»** When they got into sat diving, there were 20-day dives. You put in your six-hour day on the bottom, so the guys would work three shifts with a couple hours going and coming.

**How deep did these divers get?»** They did good solid working dives around 800-1,000 feet in that area. A few did 1,200 feet, in test diving, of course, Comex had some guys go 2,000 feet.

**It's interesting, in an industry where no one manufacturer has ever achieved dominance, your company has achieved a market share that most people can only dream of. How did that happen? What do you estimate your market share to be?»** Oh, I have no idea, but it is a high number.

**It has been variously reported as high as 85 percent to 95 percent or more of the world market. Do you think that is accurate?»** It could be. I just have no idea. I started building the first commercial fiberglass helmets around 1960, then got set back and had to build metal helmets for a while. In essence, that makes 47 years we've been working with commercial stuff. Thirty of those years have been in intense manufacturing and development. I even dabbled in some sport scuba gear. For instance, I showed Gustav Dalla Valle (co-founder of Scubapro) the adjustable regulators that we've had on our unit since 1957. Six months later he came out with their adjustable second stage, even though he told me they weren't interested in it.

**Did he present you with the offer to back your truck up to his place?»** Nope, Gustav was tighter than the other guys. I never got anything out of him but a couple of great lunches and some wine.

**What trends do you see now in commercial diving? Is it growing or is it flat?»** Well, right now commercial diving is flat as far as the number of divers working, but there is always a chance it will expand. We're going through a lot of work right now. Many divers are busy maintaining the offshore towers. The way it works is when gasoline is high, the price of oil is high, of course, and the oil companies do all their maintenance because they have the cash flow to do the offshore maintenance. When it's lower, they pull back on the maintenance until the cash flow gets good. Well, you can imagine at nearly \$60 a barrel, which is where it is now, they want to get all the work possible done offshore, so all the divers are working but there are now fewer divers than there were 10 years ago.

**A decade ago, people hypothesized that the diver itself might eventually become obsolete and be replaced by ROVs or divers in one-atmosphere suits. Do you envision that happening?»** In water down to 150 feet, I don't think they'll ever replace the diver because they can still get more done and are still more economical than an ROV. The one-atmosphere suit is too clumsy, too expensive and too much work for that depth. What I'm finding is the ROVs actually create work for divers. For instance, there are cross girders and things on offshore platforms that have completely disappeared and nobody knew about it for a few years until the divers finally did their inspection. Now, ROVs go down and inspect anytime they feel like it. And what they find creates work for divers.

**Interesting. Beyond 150 feet, what would you consider a practical alternative to a diver?»** Zero to 150-165 feet is common air diving.

Beyond that, you need mixed gas. In Europe, you must have a closed-bottom bell that can be pressurized and brought on deck, so the price goes up quite a bit as soon as you hit 165 feet plus. In the North Sea you contend with cold, rough water – big seas, and it makes sense to have a closed bell. In the Gulf of Mexico, however, where you have warm, clear still water, you can dive using mixed gas with a “come home” open-bottom bell – a dome is all it is, you can descend to 220 feet. But beyond 220 feet, even in calm, still water, you should use a closed-bottom bell. Many projects are made more efficient when using a closed-bottom bell in 400-600 feet of water. Beyond that, saturation diving begins when you take a crew of divers and put them in a pressure vessel for 10 or 20 days of diving, the whole support gets very expensive.

**Are there as many saturation projects going on now as there were a decade ago?»** Yes, there are because they're saturating for shallower jobs. A few years ago when they did saturation, it was usually at 800 feet or so and now they'll saturate for a 200-ft. dive if it makes sense. The way it's done is you pencil out so many hours a day for sat diving and so much decompression and somewhere around 300-400 feet, it becomes economical. So there's actually more sat diving in shallower water now than there used to be.

**If you put a diver in sat with the hatch depth around 400 feet, it still gives him the excursion capability to go below that to what, another couple hundred feet or so with no decompression and return to storage?»** You can always cut your pressure in half without decompressing. So if you're stored at 400 feet, you can go to 800 feet. It depends on the logistics of support. You know, do they have a bell that will go that deep? Are the cables set up properly? Does the job require that many hours? Then there's the safety factor. So instead of storing the guys at 400 and making 800-ft. runs, the companies



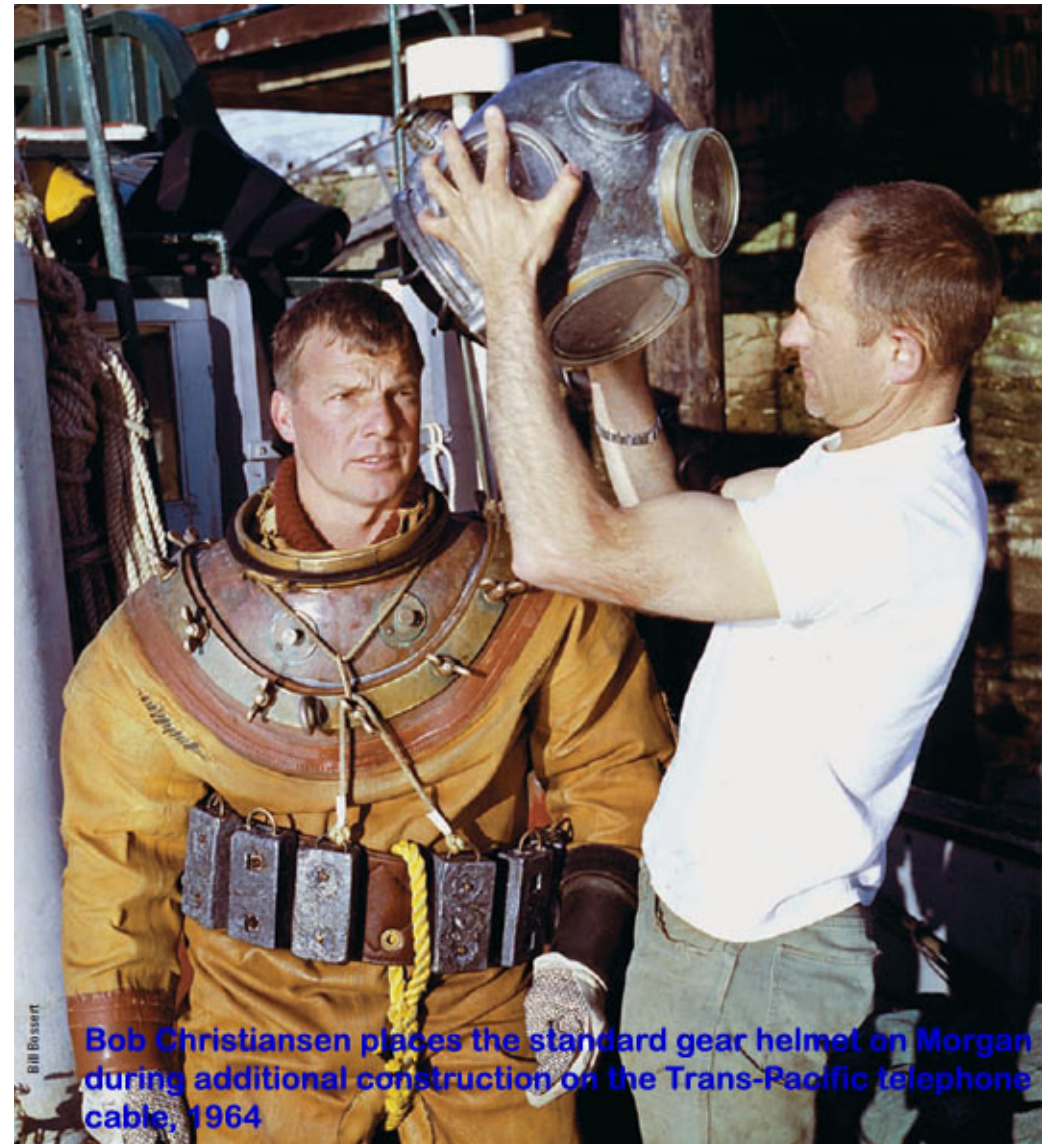
prefer to store the guys a little deeper so you don't have any chance of getting the bends.

**Your company gained a tremendous reputation early on with your lightweight divers' helmets. What other products are you making to support this? Are you actually designing suits and bells, things like this?»** No. We work with the suit manufacturers to marry the suits to the helmets, but we don't actually build the suits themselves. We build a few scuba-diving suits since we're going to have a neoprene department anyway, but no, we stick mainly to helmets and avoid chambers and plumbing and stuff like that.

**Has the old brass helmet been completely retired at this point?»** No. Many people still use them. A fiberglass version of the old metal helmet that operates the same way, with a breastplate and all, is still made. Some of the guys prefer it and it is good gear. It still has its place but it's not as convenient as the stuff we make.

**A few years back, you were working on a new split full-face mask that would be adaptable to a lot of uses.»** Well, the whole idea was to make a full-face mask with a trap door over the mouth – we call that a pod, and when you remove the mouth pod, it attaches very simply and easily underwater or on surface. So you can put on your mask and all your gear and still breathe air but not breathe your tanks down and then snap this in place. And because the pod provides a little dry area, you can take the mouthpiece out and communicate. Since then, we've also discovered that it's very comfortable to have your mouth in air. You've got the mouthpiece in place but there's no water on your mouth and it's more convenient – and feels better too. For a rebreather diver, it's very important because it's one more barrier to the water getting into the system. You don't want to get your chemical absorbent or your bags wet. We find the military divers

like this mask because it gives them that extra barrier. If they pass out, they don't flood. If they pass out, they don't drop the mouthpiece. Their buddy has time to go over and get him, and dry drowning is always better than wet drowning for bringing guys back.



Bob Christiansen places the standard gear helmet on Morgan during additional construction on the Trans-Pacific telephone cable, 1964

**In addition to your commercial interests, you also have a significant amount of military clients, don't you?»** Yes. We sell more or less to all the navies of the world; they're predominantly ships husbandry diving gear as opposed to swimming gear and now that we're getting into the new mask for swimmers, we find we're now getting more calls from all the foreign navies too.

**You've done some movie stuff, like *The Wreck of the Mary Deare* with Gary Cooper back in the '50s and now you've recently expanded into Hollywood support for their underwater needs. Tell us about some of the movie productions you've worked on.»** *Sphere* was a film we did in 1997 with Warner Bros. It was a lot of fun and very interesting to work with the movie people again. We designed the equipment to work in front of the camera. The whole idea was to allow the camera to see the diver's face in full – from the side and front view. We worked on the microphones to get studio-quality voice communication underwater. That was really tricky because you have backpressure resistance. All underwater breathing apparatus, including our helmets, have backpressure. We designed it so that when the actor divers talked on camera, we could tap off their microphone so that the production soundmen could take the sound directly from the helmet microphones. It was the first time the quality of sound was there and it didn't have to be dubbed in. We lowered the resistance for exhalation to the point of where they could act and enunciate and have no forced breathing resistance or forced vocal resistance. It made a big change.

**Now, I remember from working on movies like *The Deep* back in 1976, in those days, it was a real transition to get these actors in the water and to make them basically be able to function down there. You were working with Samuel L. Jackson, Sharon Stone, Dustin Hoffman and some others. How did they do?»** They did great. We

set up with Director Barry Levinson and told him we wanted to have the right instructors as well as the time to teach them properly in the swimming pool. The filming was done in tanks, but the movie was supposed to take place at a 1,000-ft. depth. They did a lot of trick stuff to get the water the right darkness and then we spent a month with the diving crew and the actors. By the time we finished with the new helmets and had broken them in, the actors were as comfortable as I've ever seen. On the first day of shooting, they went into an enclosed cave. Even though it was a fabricated cave, it was still a cave. It was about 50 feet long and I get nervous as heck when there's an overhead problem with novices. Well, these guys were beyond being novices by then. They went in there, played the part like troopers, and never had any trouble. It went off without a hitch and was a good shoot all the way through. No safety problems whatsoever.

**What are you concentrating on next?»** We're working on making the helmets lighter, which means making them less buoyant. We're also trying to bring the price down. The commercial market needs equipment at lower cost and we're working on production methods for doing that. So that's one of the challenges.

**What interests you most in diving today?»** A very lightweight, low-priced set of gear that will do everything our heavier stuff does. It's interesting that we called our helmets SuperLites. Though they are lighter than the older helmets, the SuperLites weigh 27 pounds average and that's not very light by today's standards. But nobody has yet made a lighter one. We've got them down to 20 pounds but they floated off your head. A true 10-lb. helmet that works well would really be needed but it's a difficult design to undertake and make economical for now. So I'd say that would be the biggest challenge. Another large challenge is to make breathing equipment that breathes so easily you'll never outbreathe it and you don't even know it's in

your mouth.



**When diving began back in that era, there really wasn't much difference between commercial and sport; it was sort of all the**

**same animal. Now we've seen tremendous jumps develop in sport diving equipment. Do you align yourself with any of these manufacturers, or do you take the best elements of that and design it yourself?»** There's a lot of looking at everybody else's equipment to see how they achieve better breathing. I look closely at Scubapro and Oceanic every year when they come out with their new lines. I also look at Atomic and U.S. Divers. All of those regulators are so good, it's incredible. If you come out with a super fine-tuned regulator and it only works once, that's no good. Commercial divers would line up to shoot us if we turned out something like that, because reliability is more important than anything.

**Your manufacturing facility has been in Santa Barbara, California for years but I know that you recently established offices in Panama City to put you at close proximity to the Navy Experimental Diving Unit. When did you make this move and how is this working out for you?»** Well, we started about seven years ago. We hired one man and had a small shop and we've grown over time. We've got five acres of ground and 10,000 square feet of buildings. It's testing, research and development only, no manufacturing. We're now an official testing body for CE marking for the European market. We're one of the only dive test houses in the U.S. that can do that.

**You have a unique relationship with the Navy. I can't think of another government contractor in a similar industry segment that has had the same side-by-side relationship.»** The Navy changes personnel every two years – they rotate, and you have to get along with the new guys. It's not so much creating and maintaining the relationship, though we do that, it's more that our focus has always been to provide our Navy with the best equipment possible in the world. By working very closely with them we always know what they need next.

In his office holding sketch of diving helmet, 2004



**In addition to knowing what they need next, do you ever suggest what they need next?»** Oh, sure. That's working together.

**You've been doing this for 50-some years now. What do you think has been the biggest innovation in commercial gear?»** You have to realize that the original Dean Siebe Gorman design of heavy gear helmet – the old metal and copper helmets, dominated commercial diving for 150 years. Though there were diving schools, training was done through apprenticeships, serving as tenders first, then working your way into diving over many years. The biggest factor that changed all that was offshore oil. The offshore oil companies met with commercial divers, myself included, and asked how many commercial divers there were in the United States. We estimated that there might be 400, part-time divers included. This was in the early 60s. They said they needed 5,000 divers over a ten-year span. The first thing that had to be done was to transition from the heavy gear – which took two to three years to learn, into something that scuba divers could quickly learn to use. So we set up the schools and the equipment to teach these folks. For years we had the market all to ourselves because we had patents on our basic designs in place so that they could not be copied. We're still patenting new things, but now we've got serious competition for the first time. It's good; it's gotten us off our butts. We're working our fannies off trying to stay ahead of the competition.

Let's face it, you can go along with a good piece of equipment you have patents on, then when the patents run out, the competition can come in, take your equipment, reverse engineer it and start right where you are. They paid nothing for engineering so they're able to sell their copies of your product cheaper. This takes away, or at least reduces your market share. That's where we are now. We're busting our rears to develop new innovations to beat the competition and as a

result, there are some interesting paths opening up to us. I mean, how does one improve something that's already working very well?

For instance, the diver's telephone. Instead of sending your voice messages back and forth on wire, you line the diver with the same wire and heat the diver with that same power source. It's those kinds of things that are in the future. Companies fight change because they don't want to inventory a new set of gear. Divers, however, are pretty innovative. If you've got a new gimmick or gadget, they'll go for it if it assists them on the job. Therein lies my paradox. I couldn't introduce something new when we had an iron grip on the market with our patents because nobody wanted change. Now that there's competition, divers are becoming more interested in new innovations – from me as well as the competition. It'll be interesting to see what direction this all goes.

**Six or seven years ago, there was a tremendous interest in rebreathers within the sport and tech communities, it's interesting that they really didn't go anywhere. We've seen almost an even dozen rebreather manufacturers, of which maybe only two or three are left. What do you think happened?»** Historically, though easy to use, rebreathers have always been a lot of work to maintain and prepare, whereas open circuit rigs require so little work it's incredible. They've even improved and become easier to use. You can throw them in the bilge and they still work. All you need to do is get somebody to fill the tank and you can just keep diving. If there's any maintenance at all, it's only once or twice a year when you take them in for a tune-up – replace the o-rings and stuff. That's far, far simpler than tearing down your rig and putting Sodasorb in it, or whatever you're using for absorbent, then making sure your bags are dry and on and on and on. So for the casual sport diver, they're discouraged by the amount of maintenance involved. First, they're

intrigued. They expect more bottom time. They expect quieter diving. And they get that but pay for it in maintenance, and they pay for it in money, whereas open circuit scuba, you can go anywhere in the world and get your tank filled. You don't even have to take a tank with you. They've got tanks. All you've got to do is show up and they'll outfit you where you go. You can't do that with a rebreather. We've made a few – strictly for the military.

**At one point there were many boutique-like rebreather companies but the only major player to ever really set their foot firmly in that market was Dräger. They did their own distribution for a couple of years, but eventually dropped that and handed it off to U.S. Divers, who apparently didn't even want it. They actually had the best semi-closed circuit rebreather out there. A lot of people still use them. It's too bad, it's a good product but it's not getting any support.»** Well, Dräger, you've got to understand, is an old line company that has been around for years and I really don't know whether they have any enthusiastic divers left on their payroll.

**That brings up another interesting note. When you got into this sport, it seemed that all the manufacturers were original first-generation divers. There were you, Dick Long, Dick Bonin, Gustaf Dalla Valle and Bob Hollis. Nowadays, it appears that many of these companies have been absorbed into other public companies and I wonder what you think about the leadership here? Can corporate suit bean-counters really lead diving innovation?»** Apparently not. I'll probably get skinned alive and roasted for saying that. Big companies have a lot going for them. They have big budgets, big money and mass production. They can buy things so much cheaper than the little guy. The little guy gets out priced by the big guy. In the beginning, when I got into the business, the big guys didn't even know what I was doing. I now sometimes wonder

if the big guys even understand what the sport is about. They've got money, but will they continue to come up with innovations? Well, whoever comes up with the innovations, if the big companies are quick enough to either buy them out, absorb them, make a deal with them or make their own version, then they'll continue to dominate the market. Where are the young entrepreneurs? Well, I've got a young fellow in my business from Poland who's willing to work 17 hours a day and bust his rear. He can start out seeing my stuff, which is fine, there's nothing wrong with that, and he's willing to invest the time to try and improve it and he is doing a good job. For the first time, I'm looking over my shoulder at competition. So what's going to get Scubapro, U.S. Divers and Mares to look over their shoulders and think the new guys are gaining on them?

**The guys at Atomic have done a pretty good job about making them look over their shoulder.»** They sure have. Here's where you had somebody in the business working as employees who pulled out and went off on their own and did well. Are we going to see more of that? Sure, but I bet the suits at Scubapro won't like it. Letting Doug and Dean go (the founders of Atomic) had to be one of dumbest things Scubapro ever did!

**As a photographer, you've been chronicling the sport of diving and surfing for half a century, I'm interested in what you think of the new digital camera systems. Is this going to have applications in commercial diving as it is in the filming industry and everything else?»** Oh, sure. Digital photography is creeping up on us like a monster. You know those pictures you hate to throw away but keep anyway? You look at them every now and then and go, "No, that one's not good enough." Now I can manipulate whatever was technically wrong with those photographs and restore them digitally. Recently, I've been interested in murals and the printed word on a

photograph in combination with enormous photographs. I've got photographs that I make wall-size, four foot by eight foot. I can stand back and almost feel as if I could walk into the picture. It's almost like *Dorian Gray* in reverse, my pictures aren't getting old, I am. But I can actually visualize walking into these prints and the bigger they get, the more I can see it and the more I can have a sense of being there now. I'm getting older and many of my friends are croaking so it's really neat to have a wall of photographs of friends – living and dead. I can vividly walk right into that picture and remember the details of the time. Well, I couldn't do that before. I had a wet darkroom but to make a big print took an enormous amount of labor and help. Now, I can clean up the picture or leave it as is and print it out at any size I want – well actually, I can print eight to a hundred feet. I can do it all myself.

**We've also seen the same revolution come along in motion picture video. Now you can buy a digital sport camera, toss it in a housing for a fraction of what it used to cost, and produce better stuff than we did in professional broadcast systems even 15 years ago.»** I recently spoke with Al Giddings, he's now got an outfit that can digitize and improve the stuff he used to shoot as A quality. It's just phenomenal. Yeah, the motion picture thing is growing too.

**Maybe someday we too can run ourselves through one of these things and rejuvenate our tired bodies. How old are you now, Bev?»** Seventy-six. Inside, I feel 20, but there are certain things that are more difficult to do nowadays.

**It looks to me like you'll continue going strong for a long time yet. As I told my wife, "If you pass away before me, I'll throw you a lavish funeral... and I'll bring a date!" You've managed to go through the turnstile of marriage quite a few times. How many**

Schooner *Mayan* outbound for the islands  
with David Crosby at the helm



Boyd Morgan

**wives have you had?»** I've had three wives... and I've lost three expensive houses.

**So you're probably happier just leasing rather than owning, I take it?»** Houses or women? I'm always open.

**One of your best friends over the years has been David Crosby, of Crosby, Stills & Nash fame, who is actually a rabid diver as well.»**

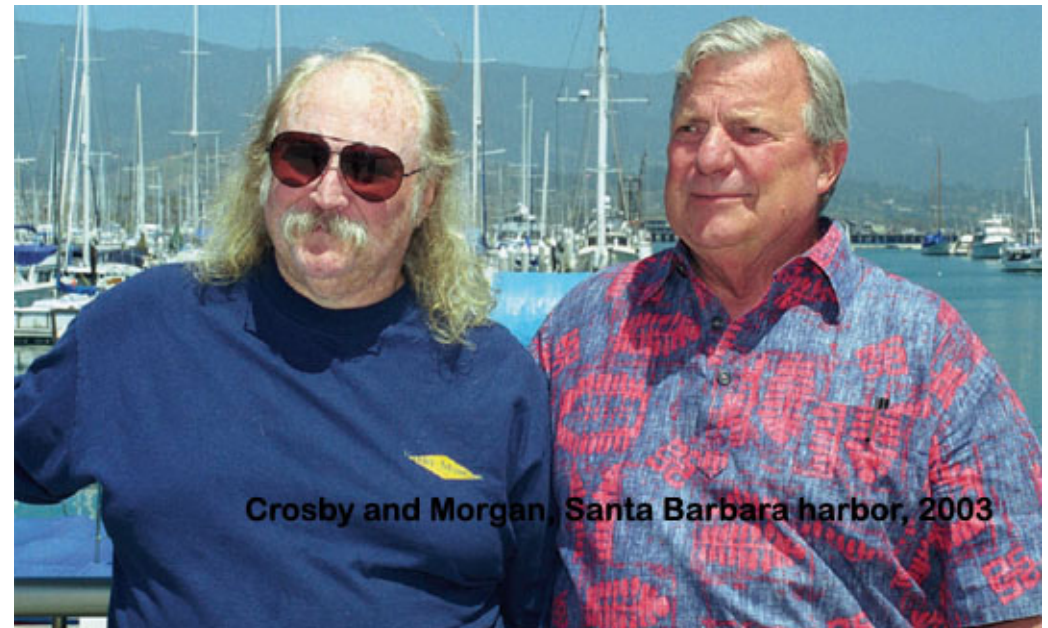
I had come back from a trip to Palau when a friend of mine invited me to Maui to photograph whales. He was the skipper on Crosby's boat, *Mayan*. So I went over and got on the boat and met David. You know I really enjoyed his music and it turned out he was an avid diver. He loved the diving and so we had a great time. He had this big old Alden schooner and he used it to get away from the crazy side of the record business and concert tours. It worked out well; I had a lot of underwater camera gear and time to break away to do things. Crosby had a great sailboat set up for diving, enjoyed diving and was a good guy. The boat always also seemed to have a lot of very good-looking girls aboard. Let's see now: big sailboat, lots of dive gear, lots of camera gear, good food, good music, good friends, lots of money, time enough between concerts and work to go anywhere we wanted. That started some 30 years ago.

We'd take off, go through the Panama Canal and over to the Bahamas and go diving for a few months. Fly home to work and then meet the *Mayan* at some new place. Sometimes in Tahiti, sometimes Hawaii, sometimes California. It sure has been fun. Actually, I guess that might be an understatement. Trust me, we didn't get bored. We're still at it.

David is a serious diver and I've known many divers in my life. He's probably the most dedicated diver I know. I'm not saying he's the

best diver in the world, but I don't know anyone who enjoys diving more. Let me put it this way: He had a liver transplant, he couldn't walk and his wounds were not quite healed, but he wanted to go diving so badly that he called me up. He wanted to do one more dive in case he croaked in the middle of his liver replacement recovery. I dressed him in a wetsuit that I built specially for him. I took him out on the boat and we winched him into the water, pulled him around underwater then winched him back out, put him on deck and took him home. Now, that's pretty dedicated! He's also a dedicated sailor. And a damned good one too.

**Jay Leno had a great riff about Crosby's liver. He said that Crosby might have been pretty wild and crazy but was a pretty good businessman. But this time he might have made a big mistake. His transplant cost about \$40,000 but the liver they took out of him had a "street value" of over a hundred grand!»** Hell, it might have been worth three times that!



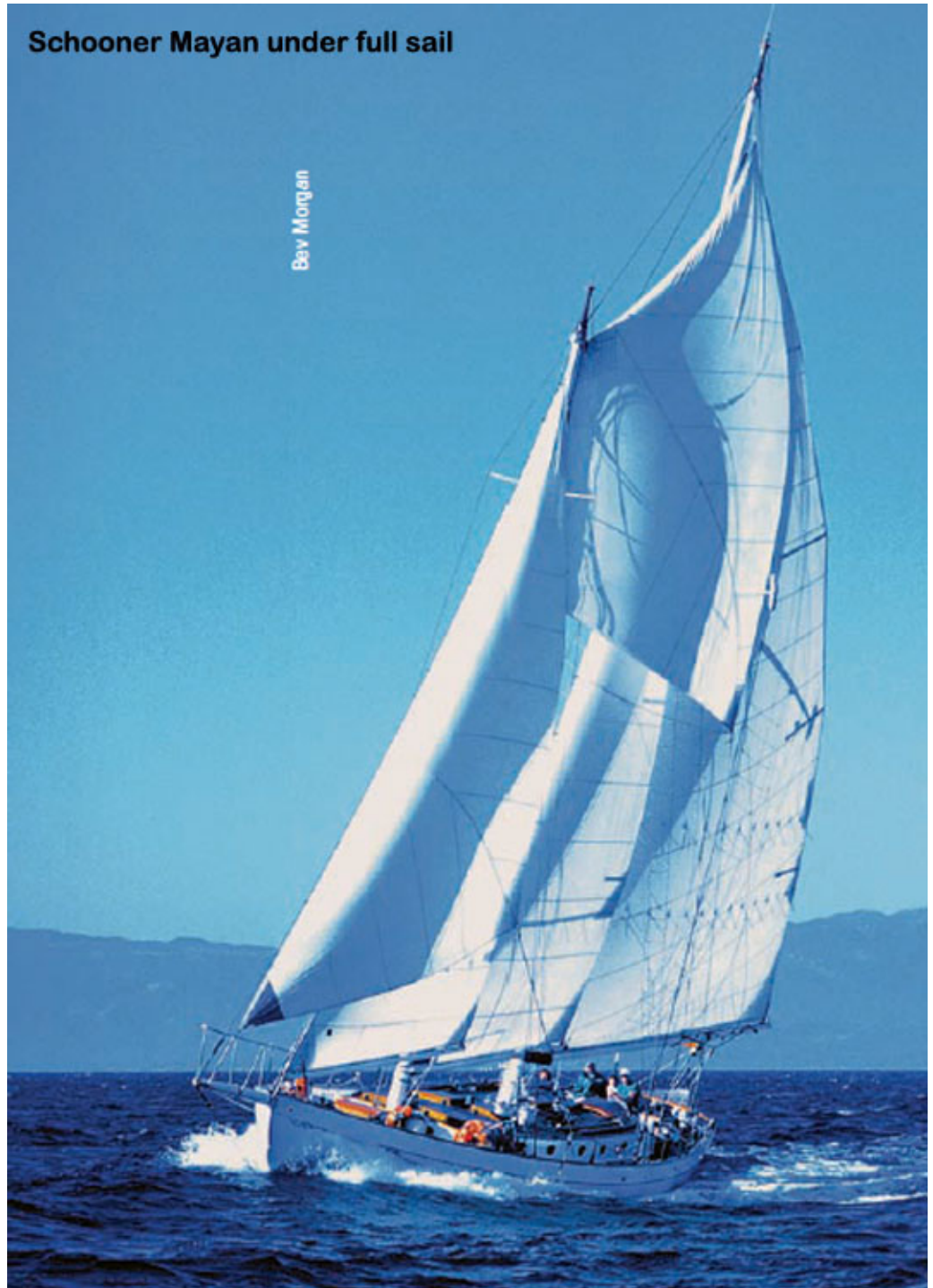


**At one point you preserved his boat for him when he had to go away for a while.»** Yeah, I bought the boat from him to protect it when he had some legal and health problems. It's a nice boat. Wooden Alden schooner, built in 1947 if my memory serves. She's been rebuilt a couple of times. David actually just got through rebuilding her for 10 times the amount of money I could buy an equal fiberglass one. I keep telling him let me get at it with my fiberglass and you won't have to rebuild it again.

**That would probably violate his “wooden ships” ethic.»** Absolutely. It's all in jest because he loves that boat and he wants to make one more go at the South Pacific so he'll probably do it.

**You guys think you might have a little fun along the way?»** I'm sure that we can find what it takes.

**I interviewed Greg McGillivray, the IMAX film director and producer, when he was doing *Coral Reef Adventure* about a year-and-a-half or so ago. He finally decided that the perfect music for the film was going to be a lot of the original music of *Crosby, Stills & Nash* and was delighted to discover that David was a diver and willingly lent their efforts to this project.»** I didn't know that. As good a friends as we are, we give each other a lot of space. For instance, by the time you go to print on this it will be old news, but David had some trouble back east recently (busted for possession of marijuana, but later acquitted). And instead of me calling him up and going, “Oh, my God, what happened?” I figure if he needs my help, he'd call me. Let him slay his own dragons. I've got my dragons, he's got his.



**David Crosby in trouble with the law for smoking grass? Who would believe it?»** Well, I don't think the latest incident was too big a shocker!

**Aside from being one of the musical geniuses of the era, he's managed to remain current and cutting edge from – well, from all the way back to the days of the *Byrds* to what they're still doing now, but he hasn't exactly been the poster child for clean living.»** He's one of the brightest guys I've ever known. I mean, I've known a lot of Ph.D.s that couldn't hold a candle to that guy's brain. It's just one of those things. And like he says, when somebody asks, "Are you really David Crosby?" he just says, "Somebody's gotta be."

**You've always had this trademark mustache, now I see a respectable, clean-shaven face. Will we see another launch of this mustache?»** Oh, of course. The last mask I developed has a pod that comes off on the lower end that seals across your upper lip and for someone with a reasonable mustache such as yours; it's not a problem. Mine however, was so big and bushy that when I put on the mask and tried to get the regulator through the hair, I'd get a mouthful of it.

**You've been the driving force in your company for all these years, but didn't you bring one of your kids into the business?»** Right. Connie, my youngest daughter, got interested in the business and came in. She's learning the business end of things and doing a great job.

**Back in the days when you were trying to convince commercial diving companies to go from heavyweight brass hats to lightweight commercial gear, did you ever envision that someday, an attractive, beautiful lady would be running the world's largest commercial diving company?»** No, I got pegged for that a few times.



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