

DIR articles by George Irvine



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Doing It Right Gear Configuration

A good SCUBA equipment configuration needs to carry through all of your diving, from open water to cave in such a fashion that the addition of items necessary for each dive does not in any way interfere with or change the existing configuration. Diving with the same configuration allows the same response to emergency at all times while reducing effective task loading due to familiarity. In other words, it not only helps solve problems, it prevents them.

Let's start with the backup regulator (not the "safe second" or "octopus", the BACKUP). The backup must be instantly accessible. We hang it around the neck on surgical tubing or bungee which is held on by the tie wrap that holds the mouthpiece to the regulator. It must be up close to the neck in order to minimize the venturi effect on the reg, and to provide a strap to hold that reg tightly in the mouth when necessary.

That reg must be a non air balanced, low performance reg. The intermediate pressure of all regs should be held to a minimum to prevent free flow and stress on the second stage and hoses. Since most regs feed right to left, we initiate this regulator from the left post of the manifold, with its hose short enough so as not to "flap in the breeze" and wear out the swedge fitting. As with all hoses, we use a strain relief. We do not use "upstream" valve regulators, regulators that get water in them when scootering or in a current, or regs that require custom hose fittings. We use regs that can be taken apart and cleared underwater. We use regs that operate at low IP's. We leave them loose so that they can be changed underwater. For open water configuration assume that all hoses are off of the one reg, rather than the manifold doubles.

For manifolds we use the dual port style with a center shutoff for redundancy and to be able to solve the most common failure mode: loss of knob followed by a free flow, or roll-off followed by loss of the knob. Manifolds should have barrel style o-rings, no face seals, and should be adjustable. The ports would be 300 bar for more thread depth, and should be straight facing ports, no angles which end up breaking off DIN connections. Knobs should be spring loaded and soft with a metal insert so they do not strip out - no metal knobs. Metal dents and will lock off or on, and are hard to turn in a pinch. Burst ports would contain higher working pressure plugs, and be changed often.

The primary second stage reg is then on the right post for redundancy and ease of gas sharing. This is the long hose in any configuration. It runs straight down behind the wing, under the light (if a light is worn - around the knife or tucked into the belt if not) and back up the left side, behind the neck and into the mouth. When not in use, as in staging or deco, this reg is clipped off on the right chest d-ring using a breakaway clip. While you always must be willing to donate the reg that is in your mouth, switching to the long hose donation for traveling is a must. You NEVER put the primary reg on the left post due to the roll-off, break-off failure mode, the effective shortening of the hose for sharing and comfort of routing, and the oblique angles created in a traveling share that will restrict gas flow by being on that post. Hoses float, and since the diver should always be in a supine position for purposes of gas exchange and general good form, the hose will be held against the body and stay in place. This treatment of the hose solves several problems at once while not creating any and not interfering with the rest of the rig. To make the long hose breath the way you like it, adjust the intermediate pressure of the first stage, but keep it as low as you can. Today, we all use helium for deep diving, so the ease of breathing is greatly increased, allowing for lower intermediate pressures.

The pressure gauge is from the left run straight down the left side to the left side d-ring where it is clipped off. This has no boot, no console, and no other clap trap on it. The hose should be short enough to stay out of the slipstream and long enough to view when unclipped. It is read on the fly with the left hand. The inflator from the wings runs over the shoulder and through a small bungee attached with the left chest d-ring. This keeps the inflator where it can be located instantly.

The inflator must be long enough that it can reach the mouth, the dry suit inflation valve, and the nose for ease of operation with one hand controlling all three maneuvers. It must be long enough that it can be breathed by holding both buttons down at once (never "rebreathed", only breathed).

The low pressure hose to it must come from the right post. This then acts as a second backup or third regulator which can be used if the left post knob either gets rolled off or rolled and broken off. (The right knob can get broken off, but will roll "on", so would be broken off in the "on" position.) Also, you never want to discover you have a roll-off by not being able to inflate - an invitation to further problems. The inflator mechanism itself must not be air balanced or high speed - it must be a slow inflator so that runaways are easier to deal with. The diver must anticipate his inflation needs, part of good form which is the hallmark of the safe diver.

Wings must not be too big or too small. A diver must start with a balanced rig which gives him every chance to deal with emergencies. In ocean or lake diving, steel tanks should never be used without a drysuit. Double wings are an invitation to a disaster - do not use them. Elastic wings are a disaster waiting to happen. They can not be operated safely by mouth, they lose their gas if ruptured, they can not be breathed like normal wings, and they cause more drag than normal wings. For ocean, aluminum 80's are the tank of choice. If more gas is needed, take an aluminum stage, but don't risk your life being overweighted at the beginning of the dive. The buoyancy characteristics of aluminum, especially when using helium, are such that a weight belt and or canister light will provide the necessary ballast which can be dropped in an emergency, making the rig only reasonably negative when full, neutral when empty, but swimmable by dropping the weight. In cave, steel must be used with a drysuit and they must be negative enough to allow the diver to stay down in a low on gas emergency. There is nothing worse than being too light to stay off the ceiling while low on gas and then struggling. For this reason, the rig must be balanced to a no gas situation prior to cave use, and weighted accordingly.

The diver's harness is rigged from one piece of webbing - no buckles or disconnects or other failure points. One d-ring is on each chest, one on the left side. The crotch strap is also one piece, and has a loop in the front the the belt passes through. The belt buckle must be to the right side so as not to get opened by the crotch strap. This strap is necessary to hold the rig in place whether scootering or not. Any upward pressure on the diaphragm crated by unstrapped rigs increases the breathing rate and discomfort of the diver markedly. The crotch strap has a scooter d-ring just below this loop. We never use a quick disconnect here. The knife is in an open sheath on the waist belt left of the crotch strap, where it can be pulled like a gun. The backup lights are attached to the two chest d-rings and held to the strap by a bungee. This puts them under the shoulder and out of the way.

The light is worn to the right side on the waist belt, and is held on either by the same buckle that fastens the waist belt, or by a second buckle slipped on. The light head is held in the left hand, or clipped of to the right chest d-ring when not in use or when changing stages. There are no d-rings on the right side, but if a bottle is carried there for some reason, a piece of bungee cord on the belt will suffice if the bottle has the correct stage bottle buoyancy characteristics. The light is part of your weight and balance, should never be on the butt, and is under the shoulder where it is protected and out of the flow, and can be conveniently operated or removed if necessary.

Stages should be aluminum 80's. These swing equally from negative to positive with air, less negative with gas, by the amount of the air or gas carried. They are rigged with stainless steel bolt snaps, the size of which is determined by whether or not your diving requires gloves, and those are attached by a piece of 1/4" line run under a hose clamp halfway down the tank and tied to the neck. The upper clip should be tight to the break of the neck, the lower clip should have plenty of tail to work with. The bottle needs to be held close in the front and lose in the back to prevent drag. There should NEVER be any metal to metal connections of any part of your rig.

Stages need to be permanently marked as to their maximum operating depth in three inch high letters placed horizontally in the orientation of the tank on either side so that the diver can see what he is breathing, and so can his buddy, no matter where the tank is. The stage reg is rigged with a short pressure gauge which is bent back on itself to face the diver and held in place by bungee cord at the first stage, The reg hose must be the octopus length. The stage regs are always parked on the bottle and the bottle turned off unless in use. Stages are generally worn on the left side for streamlining, and because of the position and balance of the rest of the gear and the other hoses so as not to interfere with the operation of any other gear, as well as the scooter, which is driven with the right hand, favoring the right side.

To deploy a stage, we look for the correct depth marking, we put the reg around our neck, we then turn on the bottle, put the reg in our mouth, and if we can breathe, we are breathing the correct gas. It is just that simple. No other convolutions are necessary, and would only add to the chance for error.

Gauges and compasses are worn on the wrists. These must be situated according to need. In the ocean, the compass is paramount, and needs to be viewable and held in its correct orientation without interfering with other activities - that means the left hand, away from the scooter. The depth gauge and timer needs to be viewable all the time, so is on the right hand. Fins straps and mask straps should be replaced with springs and stretch material that will not rot and break on a dive.

To quote Bill Gavin regarding gear, a diver must "settle for nothing less than perfection. Those who do will discover on their own the value of such effort. Those who do not will never understand what the others are talking about". What we have presented here is called the "Doing It Right" system, and is a platform that is integrated completely and accommodates all contingencies and additions, but no phobias. Use it accordingly with one caveat - "Never break Rule Number One", which is "Don't dive with strokes". A "stroke" is somebody with an unsafe attitude.

Why the WKPP and GUE do bottle marking the way they do

The big risk in gas diving is breathing the wrong gas. The WKPP developed as part of its overall system a simple methodology for preventing this.

Bottles are marked horizontally on either side in the orientation of the diver as to the maximum operating depth of the bottle in three inch high numbers. It's that simple.

Since "20" can look like "70" the 20 foot bottle is also marked "OXYGEN" horizontally under the "20" (not necessary in the metric system). The diver's name is also on the bottles.

With thousands of man dives of decompression results in the field, we settled on standard decompression gasses: oxygen from 20 feet, 50% oxygen from 70 feet, 35% oxygen from 120 feet, and 18% oxygen from 240 feet for deco, with all gases conforming to a minimum standard of 120 feet AED and 1.6 maximum ppo2 for deco (with 100 AED and 1.4 maximum ppo2 for diving). Bottom tanks are labeled for maximum operating depth as well.

There is no excuse for not permanently and properly marking bottles no matter what gas is used. It is your life we are betting. Painted numbers can be knocked off with a swipe of PVC cleaner, and new ones painted on instantly. Tape can be used also, but nothing should be on the tank as to the contents other than the MOD and the dated analysis. Clean, uncluttered tanks are safer. They say a lot about the person diving them.

With the tanks correctly marked, we fill them according to the following regimen. Two pieces of tape are placed on the empty tank. After adding one gas, but before disconnecting it from the whip, one tape is marked with the date and the gas psi just added. The whip is removed and the next gas added. The same procedure is followed, marking the addition of the gas. The tank can then be analyzed if heliox or to see what the helium percent is by getting the oxygen percent, or the tank is topped with air. At that point the tank is analyzed and the analysis is written on the other piece of tape along with the date, the first piece of tape is then used to cover the tank valve mouth indicating a full tank.

For all tanks the analysis is left on until ready to dive, but can be removed at that point since the identification is by MOD only. Doubles whether used or not and unused stages must re-taped and dated as to analysis for travelling and storage. More smart people have been killed by failing to observe this rule than any other. To keep it simple, don't dive anything that does not have a current analysis. When in doubt, check it out.

With MOD it makes no difference where the bottles are located on the diver, but there should be no effort to identify a gas by its position - this leads to error. Both the diver and his buddies should be able to clearly see the MOD of the gas being breathed as a check on each other. The correct procedure when ready to breathe a gas is to locate the correct bottle by the MOD, remove the reg, place that reg around the neck and into the mouth, then go back and re-locate the correct bottle, and turn it on. **IF YOU CAN BREATHE, YOU ARE BREATHING THE RIGHT GAS.**

All bottles are turned off and the regs parked on the bottle when not in use - ALWAYS. This also makes buddy identification of your breathing gas easier in wreck diving where all bottles are carried. In cave, we NEVER carry a bottle past its MOD. Trying to maximize PPO2 past a depth for purposes of fear of decompression is too stupid to contemplate given the risk assumed in the process.

If you can not see the bottle, and can not identify the gas, you DON'T breathe it. You stick with what you know is ok until you can make a positive id. Missing a little deco gas is better than dying. Betting on a

system where any error could have been made (like putting the wrong cover on a reg) is inadequate for life bets.

All of our regs look the same - we do not take the chance of trying to code regs for gases. This allows putting the wrong reg on the wrong bottle, or the wrong cover on the wrong reg, among other things. It is akin to loading one gun with blanks and one with real bullets, and then trying to identify them in a dark closet before putting one to your head and pulling the trigger. Sound preposterous? This is exactly what you are doing if you code regs in any way. Oxygen kills you as dead as any gun.

On a more practical note, we leave our second stages hand tight on the hoses so we can change them out if one starts freeflowing. This way the main regs can be replaced with the stage regs (which bottles are turned off anyway until used), and then the stage regs switched around to provide something that works without killing the dive. This is SOP on long dives. This identical reg business also prevents any problem of switching seconds before a dive and then forgetting about it.

With the back gas, ALWAYS our deepest gas, we can always identify those regs. The backup is hung around the neck in the DIR system, and the other is attached to the long hose - both easy to identify. In cave diving, we do not carry a gas through or past it rated depth. You can see that for ocean diving , keeping the bottles turned off is the next best thing .

You can see that in teaching gas diving of any kind, the convenience of the MOD check on each other becomes paramount. Trying to id a student's gas by little labels, stickers, or a plethora of "nitrox " banners or little markings everywhere with reg jackets and colors and bands is not going to make it safer - it is going to make it a mess. I know that Jarrod Jablonski, in his training agency, GUE (Global Underwater Explorers) uses the WKPP method, as he should , he helped develop it and uses it in all of his diving.

Part of what makes a great system like this work is the ease of working it, and the perceived benefits thereof. The GUE/WKPP method requires doing nothing that takes you out of your way at all - it is just there, and provides so many solutions. Long drawn out convoluted systems break down in action and never work underwater, and in the end get discarded or poorly observed. This one is not only easy to do right, it is self-correcting in that it only falls together one way - you either do it or you do not know what you've got.

Efforts to complicate and "technify" diving make it more dangerous. Try a little simple logic.

Gas Mixing and Bottle Marking

Let's assume all bottles are correctly marked - that means MOD only, horizontally, in three inch high letters, on either side of the upper bottle in the orientation of the tank. All tanks turned off, all regs parked. To deploy, we locate the bottle by MOD, we remove the reg and put it in our mouth, we then relocate the bottle by MOD, and turn it on. If we can breathe, we are breathing the right gas.

Now, mixing. First put two pieces of tape or one GUE split tape on the empty bottle. Hook up to either gas, but I do helium first since I want my oxygen addition to be more in the middle of the operating range of the gauge, but it can be done either way. Figure the correct amount of helium for your mix considering coefficient of compressibility and heat expansion. Helium will need about 17% overfill to get the % you seek. Let's say we want 50% and we are filling to 3000. Fill the tank first to 1750 to get to half, but then add another 10% or so for heat expansion, so go to a total of 1900 roughly. It should cool back to 1750 or so. No sense getting real precise here, the heat expansion is simply equal to the ratio of absolute temperature change, using the Kelvin scale - just guess at it. Turn the bottle off, but do not remove the whip until you have written down the contents of the tank and the date. Now remove the whip.

Now, add the oxygen. Keep in mind that it will be heated and expanded, but not too badly. Go a little over your intended amount but not too much. Calculate this independently of the helium, and add it without regard for the "pressure" of the helium. If you added the oxygen first, keep in mind that it will have expanded as well from the heat of the helium filling and be giving you a higher overall helium pressure reading than you really have, so add a touch there if that is the case over and above the other two reasons. Do not remove the whip until you have written down the new gas added and the date. Analyze it if you please, to solve for the helium later to satisfy yourself.

Now add the air, unless that was heliox and we are done. Immediately analyze the gas and write the analysis on the other piece of tape or the split tape, write the date on it as well, and take the original tape off the tank and cover the valve with it to indicate that the tank is full. Do not move the tank until this is done. Obviously, the analysis should compare with the MOD. To dive the tank, you can remove the tape so as not to litter (and obviously the only thing we go by in water by is MOD), but if you do not use the tank, retape it and the valve, rewrite the contents and date, and transport that way, including partially full tanks that you intend to reuse (I reuse my deco tanks for two dives usually, so I may write something like "2000 psi 50% 10-18-00"). If you use it and are not going to reuse it, it is now assumed that the tank has some amount of that gas in it, but can not be used again unless reanalyzed, so is not retagged. It can not be stored full without a tape, and it can not be transported full without a tape. Doubles can not be stored untagged if they have gas in them, and if that mistake is made, dump the partial gas and remix rather than adding to a mix. A lot of people fool themselves this way on the helium %.

What is a Stroke?

Very simply put, a "stroke" is somebody you don't want to dive with. It is somebody who will cause you problems, or not be any use to you if you have problems. Usually, this is a reflection of the attitude of a stroke, but that can be inherent in the personality of the individual, or others can teach it.

For instance, if somebody is taught that diving is an "every man for himself" sport, that you "can't help somebody deep," that "my gas is my gas," or "know when to leave your buddy," then that is somebody you do not want to be in the water with. Some people are natural strokes, but all too many are created. Unfortunately, people believe best what they hear first, and given the low-level food chain structure of dive instruction, most strokes are man-made, and are then hard to fix.

Obvious strokes are not so bad - you can see them and you know to avoid them. Frequently they will give it away with their choice of gear and gear configuration. If you see something that is a complete mess, makes no sense, is less than optimal, or is designed to accommodate some phobia while ignoring all else, you are dealing with a stroke. If the stroke is pontificating about how he can "handle" deep air diving, or obsessing about depth, or appears to be trying to compensate for internal fears, this is an obvious stroke and you merely avoid them.

The really insidious strokes are those who pretend to be squared away, but are in this game for all the wrong reasons. Usually they wish to prove something to themselves or others, or to overcome some internal fears. These tend to try to do things that they are not ready to do, and when something goes wrong, they flee for their lives.

Diving is not an intuitive thing. It is not a natural thing. Natural reactions of human beings on dry land do not work underwater. To be a good diver, you have to control your natural responses, and know that they can only hurt you, not help you. A stroke cannot do that. A stroke is driven by fear, ego, bullshit and self-concern.

Deco

In determining where to start your decompression, the logic is very simple: you want to let gas escape from the tissues prior to bubbling. Once it bubbles, it will not escape. Rising up rapidly from depth is a good way to trap gas in tissues by forming bubbles which will then grow when you are higher in the water column. On the other hand, gas that bubbles into the blood is generally trapped by the lungs, but those with any kind of pulmonary or cardiac shunt are at risk if this occurs. If it occurs too fast, and/or the bubbles grow too large, they can block the effective lung function and will damage the capillary beds of the lungs. From depth, you want to remove gas in solution form.

The best way to do this is to begin your decompression stops at 80% of your profile in atmospheres rounded up. For a ten atmosphere dive, the first stop is 8 atmospheres, or about 240 feet. At the same time, the travelling time between 300 and 240 should be at 30 feet per minute max, so it should take you two minutes to get to 240.

There is a fine line between getting rid of gas and adding gas at this end of the deco. All you are trying to do is buy time to get the gas coming out in solution, and there is a point of diminishing returns for stops in the lower end of the deco range. The maximum deep stop is 5 minutes, the minimum is 20 seconds (30 FPM ascent). The best way to assure your ascent is at the correct speed is to physically stop every ten feet. That will get you your 20 seconds per ten feet. The range of bottom times that determine the length of the deep stops is 0-150 minutes. For 0, you still have the 30 foot rate, for 150 minutes you max out at 5 minutes per stop. Anything beyond this is effective saturation and the maximum applies.

These deep stops are equally divided at all depths up to 65 percent of the profile. At that point you begin lengthening the stops. Between 65% and 45%, the steps slightly lengthen, but max out at 10 minutes. Between 45% and 35%, the max is 20 minutes, between 35 and 25%, the max is 30 minutes, subject to certain parameters.

Going back to the deepest stop, if you switched gases, and 80% is where you need to switch gases on a long dive, you are maximizing the effect. If you use a helium based gas you further improve the results. Air is unacceptable as a deco gas as it causes damage that can not be fixed by decompressing, and further complicates the decompression due to the body's immune response to damage and the stress of rigid red cells jamming through small capillaries.

When you approach a gas change, you should be coming off of back gas. For the first deep switch, this is obviously the case. Having been on a low ppo₂ operating gas, you can afford to spike the ppo₂ with a deco gas, whereas you do not dare do that without breaking to back gas first. You do not use a full 1.6 ppo₂ for any part of deep decompression. The risk is too high. You don't want an oxygen reaction at depth as you will not have any chance of recovering from this, or surfacing and going back down. Be smart and rely on helium and gradient more than ppo₂ for these steps. Clearly, a 1.4 or less is preferred for deep stops max, whereas shallower you can do the full 1.6 because you are able to break to a lower effective ppo₂ shallow by using back gas. Some people stage a full face mask starting at these stops. JJ does this.

It takes a solid two minutes for gas to make its first pass through the body when you switch. The switch step should be the longest of the series that uses one gas. You are getting the best oxygen window for that gas at this point, and you just came from a low ppo₂, and the gradient is not that severe. As you move up, the steps do not need to be longer on the same gas. In fact, you are best served to do your last step before gas switch on back gas and to make it the shortest of the steps. Here you are relying on gradient and the toggle effect.

The toggling effect is simply alternating between higher and lower ppo₂'s in order to prevent the onset of lung tissue damage, swelling, adding of protective layers, and constriction of the blood vessels. The reduced ppo₂, especially the closer it gets to normoxic, will prevent and reverse these effects (other than the damage if it is already done). Using the gradient at this juncture is the best way to rid gas.

As you get up into the shallower areas prior to going to oxygen, you should take a full back gas break - what I call a "cleanup break". For instance, on a sat dive to 300, I will do 20-30 minutes on back gas at 50 feet. Cleanup breaks are effectively being done on long dives prior to gas switch if you do your last step on a gas by going back to the backgas.

In the 40-30 foot range from a deep dive with a long deco, it is unnecessary to extend the 40 and 30 foot stops at all. In fact these one can be sharply reduced if you have no shunts. You are better served by bubbling the gas into the blood stream at these depths, a far more efficient and rapid way to get rid of it. Bubbles trapped here can be fixed by going back down slightly, but doing it just right means that will not happen to a well perfused diver. For instance, on a sat dive to 300 that would call for 120-140 minutes at 40 feet on any deco program, I do 20 minutes and then move up.

Following each oxygen stint, you must break to back gas. If you were breathing oxygen dry, as in a habitat or trough, you must do a ten minute break before going back into the water. The ascent rate from your oxygen stop to the surface is one foot per minute for a long dive, a scaled down version of that for a short dive. The greatest case of bubbling offgassing occurs in the move from 10 or 20 feet to the surface. You want that to occur under some pressure and to be controlled by the slow ascent, so that when you are up, you will not get the sudden rush of bubbles that could shunt or cause other problems.

For shorter dives, the deco gases are added from the top down. In other words, your shortest dive might have just oxygen as the only different deco gas. A longer dive of the same profile may add the 50% gas. Still longer times would add the 35% gas and so forth. You weigh the advantage of the gas to the problem of carrying it. The effective shortening of the deco is not in play here because a shorter dive hits the minimum deco rules, so you have to do the time anyway. Longer dives demand the extra gases to stay efficient. Toggling and alternating are key to decompression. There is no way you can beat this by maintaining a high ppo₂.

Minimum Deco

The fastest on-gassing occurs in the early stages of any dive, the slowest on-gassing as time passes. Whenever you dive, you are loading up rapidly in the first few minutes. This gas needs to be eliminated in the proper fashion, not ignored. Sometimes, the proper fashion is merely a 30 FPM ascent rate, as in diving to 300 feet in a total run of 5 minutes and then back up in 10 minutes. As the dive gets longer, the deco at first jumps and then starts to slow its increase and eventually levels off at saturation. For dives in the 5-18 minute range, screwing up the deco is not necessarily a life-threatening event, and anything will pretty much get you off the hook. However, it is best to treat these dives as "minimum" deco requirement dives and use no shorting of the schedule. Beyond 20-30 minutes you are in the "mandatory deco" range, where you must not blow off the deco or you will likely be severely injured from it. If you really screw up on a dive like this, but are able to get at least 20 minutes on oxygen at 20 feet, your survival rate will be acceptable.

The mandatory range merely requires "correct deco", not excessive or prolonged deco, just the correct shape and approximate time. It is here and beyond that you can start using the techniques outlined in my previous post. Maximum deco is outlined in an example of a dive that I did with JJ this year. It does no good, and actually more harm to go beyond maximum deco, both in terms of oxygen damage and in terms of how the tissues relatively load and unload. Spending too much time at intermediate steps will merely load up the wrong tissues and make the upper steps less successful.

Keep in mind in minimum deco that the body's reaction to pressure changes is not necessarily instantaneous. This is why commercial divers can get out of the water from 40 feet, change out of their suit, and get into a chamber if they do so within five minutes. I do not know if this is still practiced in , but this alone should give you some clue as to why "minimum" deco is a must. Passing through the depth ranges on the way up too fast does not give the body's tissues time to off-gas into the blood stream. It takes at least two minutes for the blood to make a full pass through the body, and it takes a while for the gas to make it out. If you trap it, which is what happens when minimum deco is ignored, it will merely cause symptoms later when you are on the surface, subclinical symptoms, like tiredness, flu-like symptoms, etc.

I am the fastest decompressor there is, but I do not do anything that is not the right shape or anything that is inadequate. When you look closely at what I do, you will find that for most dives, my deco will be more involved than what is prescribed by any program, will be longer for short dives, and shorter for long dives, will be shorter for helium, and infinite for nitrogen-based gasses.

More on Minimum Deco

Decompression is a not linear event: twice the bottom time does not mean twice the deco, and half the bottom time does not mean half the deco. This is fairly intuitive, but for you Marines, the fact is that the fastest movement of gas occurs where there is the greatest differential. When you first go from one ATA to two for instance, there is a fast on gas rush, but as you stay there a while it slows down since the gradient factor powering the movement is lessening, like charging a battery.

On gassing is easy - you do not blow gas into the tissues in bubble form by on gassing. Off gassing is more tricky, as you want to prevent bubble formation in the tissues at all depths, and in the blood deep. Off gassing in bubble form into the blood is extremely efficient time wise and allows faster decompressions that avoid building in one tissue while eliminating in another, but this is for non shunt people only. Unfortunately for the shunts, the greatest incidence of bubbling into the venous blood occurs after you get out of the water.

It takes a certain amount of time to circulate the blood, maybe about two minutes, and it can take as much as five to get gas in solution to begin to come out of solution in bubble form in the tissues or into the blood in response to a reduction in pressure. Most of the short on/off's are handled well by the body in terms of outright pain or obvious symptoms, but they may cause the body's immune system to respond to the insult that is actually occurring, and uneven off gassing from sensitive tendon attachment points and live bone surfaces as well as certain dense muscle may not be able to accommodate the super short cycles. Tissues that are hard to on gas are not as much of an issue on minimum deco, only on longer exposures.

We have found that the short schedules under 30 minutes are inaccurate predictors. What we do is set a shape for the deco as if it were a longer dive, complete with starting the stops at 80% of the profile in ATA's, and merely go to a minimum reading for each stop. The minimum deep stop is 20 seconds at each ten feet, which is effectively 30 feet per minute plus the moving time. The max for these is five minutes for saturation (or anything within 85% of technical saturation, which I assume to occur at 150 minutes bottom time). The stops indicated by the shape of the deco curve higher up need to be done to a minimum number, like 1 minute for the deeper ones and then more when the gas switches come in. Give the gas a chance to work, then go back to the curve with the 1-2 or 3 minute stops. As you get higher up, the fact that you did the deeper part more meticulously will allow some abbreviation in the shallower steps.

In any of these decompressions, do your calculation and then discard the ten foot stop completely from the figures - throw it and its time out completely - that is total bullshit. Then ask yourself how much time do I need at 20. The answer is, enough to make it work if I did the deeper steps correctly. Two minutes on oxygen is not doing anything, ten is more like it. However, what you want to do is incorporate a slow ascent rate into the last 20 feet of the dive, so what was the 20 foot stop should be eased up from 20-6 in a steady motion after you have sat at 20 and allowed a full circulation of the blood and the effects of the pressure change and the gas to begin to work and a relative time based on your real bottom time where the total of the 20 plus ascent to surface is at least equal to your bottom time, again assuming you have done the other steps correctly. Do not waste a bunch of pyramided time at steps where there is little partial pressure advantage, use the gradient more in these cases, again assuming you have conscientiously done the lower steps.

Don't be in any big hurry to get up from the bottom, and do not be in any big hurry to get up from 30 feet to the surface. These two areas need careful attention. I think that if you discard the 10 foot silliness in any program and the unnecessary time, then put some of that time back into the correct shape and strategy, you will not only prevent the out right DCS, you will prevent the sub clinical DCS and the immune responses.

If you execute deco correctly and are in good shape and have no preconditions, you should be clean and ready for anything 30 minutes after you get out of the water. You can tell if you have not done what I am saying here, you will not feel so good. It will be subtle, but if you want to test it, try going for a run. If you are immediately short of breath, you blew the deco. If you can rock, you did it right. If you get bent trying this, then tough luck, blame JJ. In reality, you will feel a little sluggish and heavy just putting your gear away if you did an inadequate deco.

Now, if there are questions that can help with the understanding, bring them on. If anyone wants to argue with me, save your breath and be ready to show me your logbook, and don't bother with the IANTD, TDI, PADI, DAN or any other form of nonsense that is floating around out there. Nobody understands this like I do, and nobody can execute it like I do, and nobody has done it this way for as long as I have, not even my own team. I know for a fact that this is not only correct, it is correct beyond a shadow of a doubt. I remember getting Exley to get out of the water with me at Wakulla one time on my schedule. That was easy to do with him because he responded very well to peer pressure - I could get him to do anything I dreamed up. He spent the next four hours in the lobby of the Lodge getting FSU to Doppler him over and over just waiting for the big bends hit - never happened. That was nine years ago. We have really perfected it now.

The Bakers Dozen - 13 reasons why we do not use 80/20

1. This gas was introduced in an effort to overcome the inability of unqualified student "tech" divers to control their buoyancy in open water, and is as such is yet one more concession to doing things in a convoluted fashion to offset a self-inflicted set of problems brought on by the "doing it wrong" thinking that pervades diving today.
2. A heavy sea is not a problem for a deco stop if it is not posing a lung-loading problem. Look at your depth gauge in a heavy sea and "see" for yourself what the changes are - insignificant, and if they are not, you should either not have been diving or incurring a decompression liability of this magnitude in the first place. In the event of a change in conditions during the dive, see below where the 80/20 becomes a liability rather than an asset.
3. In the interest of using a standardized set of gases for which you can permanently mark your bottles, it is a poor concession to inability to sacrifice the benefits of pure O₂ to accommodate a real or perceived lack of skill - learn to dive before taking up techdiving.
4. In this same interest you will find that when you graduate to real diving, as in caves, you will not want to accelerate your ppo₂ at lower depths while still being faced with a long decompression at shallower depths, and making bizarre mixes to do this is a dangerous mistake (just like the fantasy of holding an accelerated ppo₂ on a rebreather throughout a deco). I am anticipating the thinking that the 80/20 crowd would then go to an additional oxygen in cave without accounting for total exposure, and subject themselves to the risk of tox in the final deco steps. Tox you do not get out of - bends you do.
5. The 80/20 mix is in fact totally useless and contraindicated as a deco gas. At thirty feet it is only a 1.52 ppo₂ (the real 1.6 ppo₂ gas would be 84/16) and as such does not either provide the right oxygen window, nor does it does it work as well as pure oxygen without an inert gas at any depth. The gas mixing in your lungs has already lowered the effective ppo₂ enough to prevent spiking at 20 feet anyway with the use of pure oxygen - in other words, we are dealing with a simplistic misunderstanding here, or "old wives tale" that is typical in diving.
6. If 100% oxygen is a perceived buoyancy control risk at 20 feet, then why is the same ppo₂ (intended) not a risk at 30 feet? This shows the total lack of reasonable logic involved in the decision to use this gas, as well as a lack of understanding of the whole picture (see the rest of this discussion).
7. Along those lines, all we hear is howling about "oxygen cleaning" above 40% mixtures, and dive shop proprietors on here complaining about scuba tanks with oxygen in them being filled in their shops. With a pure oxygen system, the tank only ever gets filled with oxygen from oxygen tanks, not from every dive shop compressor it sees. Again, this shows the total inconsistency of agency thinking, and reveals that the true reason for this gas is to pretend to lower liability for teaching incompetents to dive, which is bull, and to attempt to accrue some inventive accomplishments to the dive agency pundits who themselves prove that they do no real diving by making this recommendation in the first place. This is like the colored regs, the stages on either side, the quick-release buckle, and the poodle jacket: nonsense of the most obvious nature developed through one-dimensional thinking by those whose universe of understanding is not only severely limited, but blinded by the hubris of not being the "inventor" of the techniques that work.

8. Any perceived decompression benefit of using a higher ppo₂ at 30 feet with 80/20 is then given back by the lowered ppo₂ at 20 feet, not to mention the fact that the presence of the inert gas in the breathing mixture defeats the purpose of using oxygen in the first place (see the Physiology and Medicine of Diving). The ppo₂ of 80/20 at 20 feet is 1.28, not much of an oxygen window, and at 10 feet it is 1.04 - useless for deco. To make matters worse, you can not get out from your 30 foot stop in an emergency (not doing the other stops) on the 80/20 mix without really risking a type 2 hit.
9. This is a dangerous method to achieve a greater total volume of gas for the bad breathers (another obvious reason the gas is in vogue), who should not be incurring these decos, and even that benefit of having more gas is lost since it is breathed at 30 feet, and then has to last for the other stops. The fact is that gas is effectively saved by using the lower deco gas up to this point, relying on the pressure gradient to both achieve the deco and provide a break from high the previous gas's higher PPO₂ prior to going to pure oxygen where the spike could be a problem on an extreme exposure without an adequate low ppo₂ break (again this shows that the 80% user is a neophyte diver with no real experience or understanding of the true risks of these dives).
10. The 20-30% longer 30 foot time on the lower ppo₂ is not only overcome on the pure oxygen at the next stops, the breaks do not come into play until the initial good dose of pure oxygen has been absorbed, since you are not spiking from a high previous dose without a break that is effectively achieved on the previous gas. These things need to be understood and taught by the agencies, not some superficial convolution that is designed to obfuscate the problem rather than openly acknowledge and deal with it in a responsible fashion.
11. In an emergency situation, getting onto the pure O₂ for 20 minutes or so (for long dives something approximating the bottom time or a any decent interval) would give you a real good shot at getting out of the water having missed the rest of your deco and living through it with pain hits only. You have to think these things all the way though, not go for the transparent superficial thinking of those who merely are trying to "make their mark" with some "great" idea they can call their own. The acid test is, as always, is the calibre of the divers who adopt these practices.
12. If there is some problem with your deco or you otherwise develop symptoms and need oxygen either on the surface or back in the water, it is silly to have not had it there all along. 80/20 is a joke for that purpose, unless you have asthma, in which case any accelerated oxygen mix would be a nightmare. This is again part of the "thinking it all the way through" philosophy which is obviously missing from the 80/20 argument.
13. Only a card-carrying stroke would do something like this, and showing up with 80/20 is no different than wearing a sign on your back saying "I am a stroke, and have the papers to prove it". It announces to all the world that you have no clue, kind of like wearing clip-on suspenders or having dog dirt on your shoes.

Explanation of the Oxygen Window

As a dope's explanation of the oxygen window concept for you Marines, the best gas differential would be a vacuum relative to a partial pressure, right? Oxygen is the next best as it creates a similar effect in that the sum of the gas partial pressures is unbalanced by the fact that some of the oxygen is metabolized, more in a fit person. The greater the difference between the oxygen and the other gases up to the max differential described by the metabolism (maximum window), the greater the propensity for whatever is in the cells to come out and be displaced. For a fit person, the window is wider and by definition so is his vascularity and perfusion, so he decompresses better. These things are all tied together.

You open the window as wide as possible subject to 1) risk of tox or damage, 2) how long before the vaso constrictive effect offsets the benefit, 3) how long before the asthma like reaction sets in. You then alternate the process back to open up the vessels and lungs again, and repeat. All part of a good deco. Also it can be said that the sum of the inert gases is the other side of the oxygen window minus the metabolism drop of oxygen - there is no benefit to combining inerts - they act like one gas. Oxygen can be pushed to above its partial pressure effectiveness as a result of this imbalance for a "window" that then exceeds what would be the net effect of the partial pressures of the gases, and this is especially important in diminishing bubbles of inert gas as the pressure of the bubble can always be faced with a negative gradient or "tension" on the outside due to the fact that metabolized oxygen is creating a "vacuum" in the total sum of the partial pressures of the gases, leaving a consistent imbalance between bubble pressure and surrounding tension of any given inert.

This is why oxygen (pure, not 80/20) works so well in DCS cases after the fact to reduce bubbles, as well as the fact that saturation with oxygen tends to move that gas to where it is needed even if the vessels are blocked by damage.

Capice? For you geeks, see Eddie Bryan's explanation. When you are done with all that, go back and see what I said about how to decompress. How is all the matters.

Why We Do Not Bounce Dive After Diving In The WKPP

It is ok to offgas from the tissues into the blood stream in bubble form in the later steps of decompression as it is a more efficient, faster way of getting rid of the remaining gas (by reduced pressure) than by elevated oxygen alone (which starts taking exponentially more time with greater risk). However, this depends on having a good lung filter and no shunts.

All of you have been PFO tested if you are diving with us. The correct way to ascend from the last stop is one foot per minute for the bigger dives.

The greatest potential for offgassing in bubble form is when the pressure is totally removed back to one ATA out of the water. Now you get a real shower of bubbles, relative to what was happening in the water. A good, clean deco with the foot per minute ascent reduces this dramatically.

In MOST people, the greatest bubbling occurs out of the water and continues for up to four hours, not even peaking for a couple of hours. In a well vascularized, fit person like me, it is over with in 30 minutes. Don't bet on that with most of you.

In ALL people, the bubbles continue to grow in size after the pressure is off. They accumulate like gas into themselves from the surrounding blood or tissues (if there are bubbles in the tissues or injury sites) and they grow bigger. This is why you feel pain later rather than earlier if the bubbles are in joints or tissues - they get bigger before they begin to shrink. This is why what starts out as micro bubbles can get by the lungs and grow and get lodged downstream, and you get neurological symptoms later.

Now here is the important part. If you understand everything I have said above, then you know that bouncing to 20 feet or whatever to pick up a bottle and immediately returning to the surface is the like giving yourself a home-made PFO: the bubbles in the venous side compress enough to get past the lungs and then will reexpand on the arterial side and lodge in the worst places , the spine and brain blood supplies. You do not want this.

If you dive after dive, stay down and let everything reset. Get the bubbles all compressed, and then deco out and ascend accordingly.

I do not want support divers diving support within four hours of doing a real dive or deep support. This works out fine, since we have support activities lasting up to 18 to 24 hours and need to rotate everyone.

Let me assure you that we have found this out the hard way in the past. Parker used to get hot as hell when it would happen. In those days we had "volunteers", and they would all get bent diving to 20 feet to pick up bottles. We have also seen some severe cases of this where dives were done away from the project with no support, and the players went back for bottles later and got hammered.

Don't do it. Also, obviously, do not freedive after a dive. When you want to freedive, do that first and then go scuba diving.

Decompression and te CNS Oxygen Clock

For oxygen decompression and back gas breaks: We have found that 12 minutes on, 6 minutes off is the ideal. We only do oxygen at 30 feet in a habitat where we have caves that accommodate this. Otherwise we do oxygen at 20 feet or slightly less in the water with the same schedule. If anyone wants to go back over why we do this and how we determine bottom gas, deco gas and exposure (or how we arrived at what we do), I can repeat it.

The short version of the answer is that we came up with this (12 on, 6 off) by trying everything and arriving at that. We knew from any of our diving that long exposures to higher ppo2s left us feeling like we had a chest cold. We started out with the usual crap that is taught out there (20 on then break) and found that to be useless. We found loss of vital capacity with these regimens.

Now we have no such negative results. The oxygen takes less than 12 minutes to reach as high an effective saturation level as is useful. Beyond that the body reacts by constricting blood vessels everywhere which limits off gassing, by trying to protect the lining of the lungs and hence thickens the transfer area by adding cells and excreting mucous which impedes gas transfer, and by causing swelling of the lung tissue which further reduces gas exchange capability, not to mention scarring and long term damage that in my opinion will come back to haunt the agencies who teach the baloney.

Returning to a more normoxic ppo2 will reverse these effects. However, if you do not return soon enough, the effects take a lot longer to reverse. The big and important thing here is not to depend on reversing this action, but to preempt it and keep it from fully developing and thus make what does occur easier to reverse and at the same time actually improve your offgassing by opening the capillaries back up and allowing gas to escape from the tissues into the blood. This "togglng" back and forth has proven to be the absolute best method of gas use in decompression. DIR deco.

If you fail to do this at any point in the deco using high ppo2s you will merely be holding gas in tissues which may expand before it can be removed as you move up - another massive flaw in all of the existing deco programs. As you get higher in the water column, off gassing is more safely and effectively achieved by the moving the gradient and letting gas bubble into the bloodstream and be caught and removed by the lungs, but lower down this will not work - one more huge flaw in deco programs. You really should look on the WKPP site and read some of my profiles and decompressions on the longer dives to see all the massive deviations from what is thought to be correct by the agencies.

Helium

What is key with helium and why in real life it does shorten deco is that:

1. You do not get the damage with helium that you get with nitrogen,
2. It is far easier to breathe and causes you to develop less CO_2 ,
3. It is truly inert unlike nitrogen,
4. It lowers the narcotic effect and makes you more alert,
5. It does not precipitate the immune reaction that high partial pressures of nitrogen do and forms smaller bubbles,
6. It comes out of tissues more easily.

Repetitive Diving 1

Gas does not transfer from tissues into arteries or veins, it does so into capillaries. The arteries coming from the heart are huge, thick, elastic, pulsing conduits that get smaller as they branch out until they become capillaries, and then the return to the heart is through veins which are also thick and get larger as they combine to return blood to the right side of the heart.

That blood is then sent to the lungs, where the massive network of tiny capillary beds located in about 45,000 square feet of surface area, act as a "filter" for bubbles. The "filtered" and now oxygenated blood which has passed its CO₂ and other excess gasses to the lung space, goes back to the heart to be pumped through the system again. The whole trip takes about two minutes to happen.

You do not bubble into the arteries. If bubbles get into the arteries it is because they passed the filter or were "shunted" over through a PFO in the arterial walls, or because they were momentarily compressed enough to get past the lungs and then reexpanded as the pressure dropped prior to reaching the capillaries, in which case they lodge in the smaller and smaller vessels and block them. This occurs in bounce diving, as in doing a dive and then bouncing back down to retrieve something, like a deco bottle. This is why we do not allow bouncing in the WKPP, and why we require our support divers to stay out for 4 hours before diving shallow for support.

(See Why We Do Not Bounce Dive After Diving In The WKPP, page 18.)

Most people get the greatest rush of bubbles from the tissues into the blood stream upon surfacing from 20 feet or so. This is why we do that differently, post to follow. Most people tend to bubble for hours after a dive. Most bubbles tend to grow from the surrounding supply of gas before they get smaller and disappear.

If the bubbles are in the tissues, you have pain. The way to prevent bubbles in the tissues is to properly decompress starting deep and at a rate that allows the bubbles to escape to the blood stream. Deep this needs to be done carefully and in solution, shallow you can press the gradient and allow offgassing in bubble form into the blood stream. The difference is that if you screw up shallow, you can go back a little and fix it. If it occurs deep, that makes it impractical and a huge waste of time for nothing. For people with cardiac or pulmonary shunts, offgassing in bubble form is super dangerous. For those without, it is far more efficient. For those with PFO's, the risk is greatest AFTER they get out of the water for the reasons stated above (growth of bubbles and continuation of bubble offgassing).

I think you can see where I am going to tell you that you need to do your shallowest dives first, do your drills before you do your dives, and why you can basically ignore repetitive dives using the correct deco. You can NOT ignore them with respect to oxygen exposure.

This post is long enough, basic enough and preliminary enough. Now we can go on to the whole bit.

Repetitive Diving 2

First, what is the real risk? It is not DCS, it is CNS toxicity. The risk of pulmonary toxicity is also an issue more so than DCS.

Repetitive diving needs to be done with this in mind. You do not want to run high ppo2s over and over, and you certainly do not want to do multiday diving on high ppo2s. So the first thing we need to do is back off the working ppo2, and then plan the decompressions such that we are not accumulating an excess exposure.

If you do your decompression the way I outlined it in the other posts, including the way I ascend to the surface, you will greatly reduce the heavy bubble-form offgasing that generally occurs post-dive. If you are basically clean, you can dive again without penalty. If you are using the correct gas, the "residual" effect is greatly reduced. This effect is more designed to explain accumulation of gases in tissues which are not well perfused and as such tend to trap gas which becomes a battery for supplying gas to formed bubbles later on, so repetitive diving with a gut, or battery which holds gas, could contribute to making any bubbles on the next dive worse and contribute to them growing well after the dive.

This does not apply to most of us.

If you do the decompression for the subsequent dives correctly, there is no reason to belabor the issue.

From a logistical standpoint in the ocean, it is far safer to do a couple of back to backs than one long dive which requires a long mandatory decompression.

From a decompression point of view, we have seen that repetitive diving makes no difference, so we ignore the first dive in calculating the second. The only trick is that the second dive should be deeper than or equal to the first, and you can not bounce dive after a dive of any kind. We have done back to back 300's with 60 minute bottom times with no change of deco schedule. In the WKPP we have discontinued that practice due to the oxygen exposure risk, however.

Buddy Inspiration or Expiration?

Since those who do not know want to make an issue of me not being willing to waste my time talking about why elephants can't fly, I will waste all of your time with this one to get at those who keep recommending the Buddy Inspiration, and who apparently have an agenda with this thing and other shade tree rebreathers out there.

Besides all the failure modes common to all rebreathers, like if the mushrooms in the mouthpiece malfunction and take the diver hypercapnic or hypoxic right away, or a loop hose failure, etc, the Desperation has its own plethora of problems idiosyncratic to the unit. Other units have many of the same issues, and almost all of the civilian rebreathers are poor excuses for anything other than assisted suicide devices. In fact, most are merely copies of each other's bad ideas, and most are poorly funded, poorly capitalized, poorly tested and otherwise poorly conceived wet dreams. The Halcyon is a clever device, made more clever by Reinhard Buchaly, but is still a dangerous piece of 'kit', whereas the Buddy is a dangerous piece of 'shit'.

I will talk about the Inspiration Rebreather as it comes from the factory. There are many ways to modify the rebreather as one may observe on the Star Wars Bar Scene lists like 'rebreather@nwdesigns.com' and is a complete topic onto itself. I will stick to the basics here and leave the 'fix it at home' mods to the die hards on the other lists.

There is a small metal screw inside the oxygen sensor compartment, it is located directly across from sensor number two. Condensation often forms on this metal screw and will allow droplets to fall onto the oxygen sensors. This will happen particularly if the diver moves from side to side as in dumping gas from a drysuit or if they invert from horizontal for any reason.

Condensation is inherently found within this area and will form on the oxygen sensors even without this metal catalyst. The O₂ sensors are located on the inhalation side of the breathing loop, so you have warm gas that just went through the scrubbing process meeting with cooler gas that you will inhale thus the condensation forming on the cell faces. This condensation causes discrepancies/inaccuracies within the cell readings and they begin to VOTE trying to figure out which one is more than .2 bar out of line with the other. Cell warnings will manifest within this period of time and the diver will begin to get audible and visual alarms ...task loading increases.

The unit alarms if it senses a PO₂ over 1.6, which is a good thing. Problem with this is that many of the divers will run 100% oxygen at 20 ft, which is a PO₂ of 1.6, if they drop below the 20 ft they get an alarm, fair enough. If you have several Inspiration divers in close proximity with cell warning alarms, and high PO₂ alarms it becomes very difficult to know if the alarm is coming from your unit or from another diver. Some will be able to assimilate this to being in an area where several cellular phones begin to ring and everyone pulls out their phone to see if it was theirs. Mix this with CCR divers using wrist computers that alarm and you really have an orchestra playing down there, so much for the peace and tranquility of 'no bubbles'.

Weight must be placed on the top of the rebreather in order to balance the trim. If divers put too much gas in the counter lungs the upper body is lifted and trim is then off center. Gas in a counter lung is just another source to administer, along with drysuit, BCD, PO₂ on handsets, pressure in O₂ and DIL cylinders.

Many divers use the Inspiration to extend their times in open ocean, this in itself may pose problems. If the decompression gained by the increased bottom times is met with undesirable conditions such as rough seas it is not so easy to adjust buoyancy as with breathing open circuit. Many of the buoyancy

characteristics involved with rebreathers require a longer learning curve and must be anticipated, if the diver is not up to par they are much less forgiving than OC. If the constant PO₂ is increased or decreased too quickly due to unforeseen circumstances the diver could quickly become hypoxic/hyperoxic.

Mouthpiece does not have OC bailout built into it, bailout is a time of increased stress so it is pertinent the transition should be smooth without chance for a mistake. The bailout procedure on the factory unit uses a device called an Auto Air, this duals as a breathing device and BCD inflator. I couldn't imagine this being an effective tool for gas sharing, nor proper bail out for the user either, as the CCR mouthpiece has to be effectively closed before the transition to OC bailout is performed or it will flood the breathing loop making the diver negatively buoyant. Bail out should be in the form of a combination unit on the mouthpiece to facilitate safe transition.

If the O-ring on top of the cartridge lid is dirty or not aligned properly CO₂ will take the path of least resistance and bypass the carbon dioxide scrubber therefore breathed back into the loop. Hypercapnia begins and the diver is faced with another problem to solve.

As the diver descends they must equalize the counter lungs, if this procedure is not adhered to and they begin an uncontrolled descent the lungs collapse and the diver is not able to breath, an automatic diluent add is an aftermarket product which does combat this. But since we are talking factory here the diver is faced with equalizing counter lungs, ears, sinuses, mask drysuit, BCD, monitoring PO₂ on handsets, buddy position, light and depth in the water column. It has been mentioned before that this is 'a busy time'.

Inspiration does not have SS backplate and utilizes many plastic fastex clips, which some view as failure points. There are seven quick releases on the soft harness including the crotch strap and handset clips. The clips that hold the yellow casing lid on the unit break frequently so spares are required as well.

Often difficult to transport with Sofnolime, if you do not have an MSDS on your person you will be declined, even if you do have the Material Safety Data Sheet on hand and the handler does not feel comfortable with the issue they will not let the scrubber material on the plane. Most Inspiration divers seek out 'Inspiration friendly dive Centers' so they are able to obtain the wide array of parts required to service and maintain.

The oxygen sensors are proprietary to the Inspiration, which limits the diversity on this product. Many of the CCR's will allow various types of sensors to be used but not so the case with Inspiration's and it is strongly voiced by Martin Parker. Patrick Duffy with Oxycheq in the US sells similar sensors and says there is absolutely no difference between the Teledyne's he sells and the Inspiration sensors.

Scrubber canister is small (2.45 Kg of 8-12 mesh, 797 diving grade sofnolime) and does not facilitate the use many of the mixed gas Inspiration divers put it through. At depth CO₂ breakthrough is rapid even with a resting diver, if breathing resistance is elevated the scrubber is near void. With increased CO₂ build up the diver is of course exposing oneself to further malady. Diving high helium concentrations assist with this problem as it is less dense than air, easier to breath therefore less CO₂ buildup and the scrubber should last longer but it is playing on the edge. High PPN₂ should be ultimately avoided.

If counter lungs are not situated adequately they will float above the divers shoulders and increase breathing resistance. It is taught in the basic course to watch for this ... But they are clipped down with fastex buckles which as we know do fail on occasion. With the diver already quite task loaded on the CCR it is easy not to notice the lung has crept up, CO₂ will then increase from breathing resistance.

The LP hoses which feed the diluent and the oxygen inlets on the counter lungs use a different end than the BCD inflator. The BCD is inflated with Diluent gas, the same which you are adding into the counter lung, there is no sound reason not to have the same end on this for diversity. The reason the end is

different on the BCD inflator is to supply a greater amount of gas to the Auto Air regulator used as a bailout/inflation device. This Auto Air is prone to free flow situations and can dump the diluent gas if not tended to quick enough. Most Inspirations divers discard this Auto Air early into their CCR career.

If both handsets shut off in the water the diver is faced with a series of questions in order to `reboot` the system. One of the questions ask if you would like to calibrate 'yes or no' if the diver is stressed and chooses 'yes' they will effectively be adding 100% oxygen into the breathing loop no matter what depth they are at in the water column.

If the battery is low it will not supply enough EMF for the oxygen solenoid to open the valve and add life sustaining gas.

The control handsets are secured to the canister via rubber hose, the wiring is run through this conduit down to the electronic handsets that are monitoring the dynamics of the oxygen sensors. These rubber conduits enter into the scrubber/O2 sensor compartment where it is humid and if not perfectly sealed will allow condensation to migrate into the hose and wreak havoc with the electronics in the handsets. Many electronic problems with the handsets have involved this scenario.

See Mike Pizzios complaints on techdiver, see the archives of techdiver for info on the Desperation, see the UK coroner for what the bottom line on this thing is. My take? 'needs to be sold with a shovel'.

Diving to 18 Grand - Part 1

Many times I go down to Ft Lauderdale beach intending to swim 10,000 meters - the length of the beach and back. I have only made it twice. 5,000 is my normal workout, and I have done plenty of 6, 7, 8, and 9,000 meter swims, but 10 just does not come off so easily.

There are problems. The Man 'O War's, box jellies, and other stingers, the weather, the current, the fear of the tigers, the spookiness of being alone, the dehydration, the depletion of potassium and glycogen, and the humiliation of trying to swim with Russians and kids who feel no pain, have no fear, and keep the hammer down.

It is the same in cave exploration. You show up ready to play, but there is so much that needs to go right in order to pull it off. Parker always said , "you will never find any cave unless you have the True Heart". He mentioned some people to whom this applied (applies) so I would understand. Bill Gavin had a red heart with the word 'TRUE' on his scooter. Bill Gavin and I always found cave where there had previously been none. It always just 'appeared' for us, no matter where we dove. We even added line at Ginnie.

The same thing happened Friday. To tell you the truth, I was scared that Wakulla Springs cave was going to wall out at 14+ in the big conduit (the other 14 did wall out). We had hit a giant room that contained an amazing optical illusion making it look like the tunnel stopped, and we had opted for a tiny offshoot to get around it, and the current had been so bad in there that it stopped us dead coming out. Pulling on the rocks at 295 while 14 thousand feet out is not too cool. I was afraid it was a sinkhole coming up that not only would be too shallow, but that I knew from the surface was blocked completely. This would have told us nothing about the cave, and would explain nothing. That means it could not be right.

We discussed it. I threw out the optical illusion possibility to JJ and Brent. Brent said he swerved over there but saw nothing. I told him that behind him I could not see the ending wall. JJ said he did not see it either, but then the back guy always has the best view. The tunnel we had taken seemed to open a bit, but not knowing the tide , that tube represented a major risk. I had been in Spring Creek and knew exactly how bad it can really get when tide and rain go against you.

We had several options. We could go to the 'G's Little Tunnel', an open lead way out there, but we all agreed that this should connect to our last tunnel. We could go to the other 14 grand end to the west of Cherokee and see if we missed something, but none of us had marked any sure thing leads in there. The main end still had not been inspected in the rock slides, and had leads we had noted in the survey but not taken. These were giant leads, and they were in the conduit path of the cave. We needed a better look at that last 3500 feet of cave to be sure we had gone the right way. Indeed we had.

We had put more safeties in the cave on the previous two dives where we had worked tunnels closer to the entrance in the 7-8 thousand range. We had tested new routes for decompression and gas mileage (they were deeper) and for time. We had tried some new ideas with the scooters and with the drive gas. We rebuilt the rebreathers. We rearranged the plans and the logic. We threw some other options into the mix. We freed the rest of the team up to do their own explorations. We needed to see what really could be done, and we needed to be ready to do it anywhere.

Brent had Barry build him a new reel, one that holds 2700 feet of #24. He loaded that, I took a 1700 reel, JJ had an 1800. We met the night before and set up our gear, installing the deco bottles after the Park closed. In the morning at 6, we got rolling, with the first rebreather team of Trout, Rose and Mee taking off with our big scooters and drive bottles on their way to exploring M Tunnel where they added line in two leads. They dropped our gear at the furthest point where we were on the same route.

The B Tunnel team waited for us and went after us, going on to add line there. We would have three teams in the water doing gigantic dives - SOP for the KPP. Just as we were ready to dive, JJ's drysuit valve blew. This kind of thing is made more annoying by the fact that we bust our chops to have perfect gear. JJ had tested that suit several times that week. When gear breaks, we wonder if we are really supposed to dive that day. Last time we tried this, we had so many things go funky at the surface, and then my light bulb, which I had just changed moments earlier in my room, blew in A Tunnel because there was no argon in it. We opted for an easy dive that day instead.

This day we were not swayed. I looked at JJ - he was cool as usual, and behind him in the water was Brent, visible only by his face above the water, holding Barry's reel in both hands towards me. He had written 'Mack' on the yellow safety tape. He was laughing with that face of his that is so funny. The last time I saw that face was before the record dive at Chips when a certain detractor of ours told him that the only reason we could do anything is that we had all the gear, the team, and the best divers, and that otherwise we were 'nothing' at the NACD workshop. We were going diving.

We took off with our escort team who check the rebreathers and gear as we go in. I can not tell you exactly how we did this dive logistically, since we have a group who claims they know better than us how to do this and is trying to disrupt our work, but I can tell you the rest of the story generically.

We picked up our extra gear as we went by it, and moved it further into the cave. We also picked up the safeties we had left at 6500 on our last dive, and moved them forward (covering ourselves all the way to 14 thousand feet). We had already done every tunnel up to 11,000 (Cherokee Sink), so started working slowly and methodically from 11 grand.

I stayed on the line, Brent had the left, JJ had the right. When they went off, I held and spotted for them, adjusting as they moved in the 80 to 100 foot wide tunnel, and when they signaled me, I marked the leads and put them in the book, having kept track of exactly where we were, and I took a couple of survey shots to be sure, and made notes as to the location and the look of the tunnels. I could see the cave clearly in the backlight of my two partners.

After 138 minutes of checking and taking notes and sketches, we hit 'The Room' at 14 grand. This time Brent was on that wall, and he came back with THE signal. I gave him the 'end of the line is right there' signal, and he pulled out 'Mack'. That answered my question. I dumped my last safety and adjusted my rebreather to breath from both regs and all bottles at once (so I would not be interrupted while surveying). I now was drawing at 10:1 from 340 cubic feet of gas, I was on a 30 amp hour nicad light that looks like a Light Sabre, I was riding a Magnum Gavin scooter that is neutrally buoyant, and towing a full Gavin untouched, wearing new c-4 and a special hood that made the 68 degree flowing water feel like it was not there, and I was staring down a tunnel that looked like the most beautiful cave I had ever seen.

School bus sized boulders strewn around, white walls, giant width and height, and decent water. Huge white crayfish, old speleothems, natural black bacteria and the look of Tallahassee Power Cave with all kinds of spectacular features. The cave worked around some kind of sinkhole 300 feet above and took off for the ocean, making all kinds of unexpected twists and turns, but staying large with many side tunnels. It is as if the real volume of cave in this region does not even start until you get near Crawfordville.

The three of us moved slowly and carefully through the cave. You want to take as much in as possible when you are this far 'Downtown'. Information and data gathered from here might well be from the surface of Pluto, and must be treated accordingly. If we don't come back with it, nobody else ever will. This is why we are there, and our job is to produce that data. We do.

The next thing I knew, Brent was holding a loop of line in his hand, and 'Mack's' shiny new spool was empty in his hand. JJ was deploying his giant reel, and I heard them both laughing. When I got to them,

they both pointed at me and gave me the 'you're nuts' sign. We then had a hand signal discussion of who was more nuts, and we all kept pointing at each other.

Moving on, I started noting the time at each survey station. At 170 minutes, I still thought we could get out in 130 since 10 of that time had been checking out the stuff going into the last deco spot before we launched. I signaled JJ to wrap it up. He jokingly asked me, 'turn around?', and I pointed to my bottom timer. He tied it off, and then the discussion started up again as to who was most nuts. This time each of us was saying it was the other two. We had a good laugh, packed it in, and cruised on out. I left my whole collection of line arrows and their holder (which I keep in my pocket) on the line.

We had gone to our last scooter and left our big one, also we switched back to those when we got to them. It is always faster laying the last piece of line with minimal gear, but we have done it with everything on us. Also, we figure everything so that we have two (per man) of whatever it would take to get back to whatever we left. I keep that score running all of the time. We know what it rally takes to do, execute and get out of these dives, and we not only do not listen to anyone who has never done it, we invoke Rule Number One as to even being on the same property with anyone who thinks otherwise. This may make a few of you understand my huge distaste for B.S. in any form, and why there is no longer any question as to what the WKPP will and will not do, and there is no longer any question or discussion as to who knows best in that regard - we do.

At 14000 feet we started collecting our safeties, and I converted mine to a rebreather bottle on the spot and hooked it into my system for the ride out. I disconnected my back gas, and we took off. JJ and Brent were laughing and examining my converter, as it had not previously been seen by them. I saw them switch regs to a full safety, but mine are din. JJ had broken the knob of his bottle when went to turn it on, so he just unscrewed the reg, I took the bottle, and he switched to a safety. We put the other reg on his broken bottle, and added it to the outgoing batch.

Riding out towing all of the bottles took a lot longer that we thought. We picked up everything in the cave but one bottle that I did not pick up for fear that it could rip my drysuit - it was seriously crusted, and had been in there for a while. There is also another one that has been in there since 1993, which we keep forgetting to pull out. Seeing how delayed we were by the siphoning current and the wad of safeties, we left them all at 6500. This is where we need to leave from on our next dive, but we only need two of the bottles each to move forward. We may go do that open circuit with a rebreather team setup and then pull all of that stuff back to 3500 to go out of the cave completely and start all over again.

Following this dive we need to work the nasty water tunnels that nobody else will do, finish off the clear stuff that we have ignored for so long, and then we need to get on with Leon Sinks while we have the chance (the relatively 'clear' water). Next year we can rework the outer reaches of Wakulla Springs, since that is not going anywhere and we know exactly how to do it in one day of diving each time. By then, all of our guys will be on rebreathers and we will have our newest tricks in place for everyone. Also, we need our gear at the other sites - we are spread too thin now to be effective in the 200 square mile W.K.P. with so much in Wakulla.

At six hours we hit the first deco stop on the sand hill next to B Tunnel. We knew that the team above would be seriously worried, since we usually call the time exactly in advance. That bothered me a lot. I did my 250 stop, my 240, and then broke to 200 to see if anyone was there - they were not. I grabbed a Gator Aide and went back to 230. I got one drink before I lost the Gator Aide to the void above me. I turned off my light, drank some water, restarted my rebreather and floated in the dark. There was no sense looking at my depth or time, since I had not yet figured out a deco schedule, and had no tables with me.

One time I did a dive with Gavin, and at 120 feet after a few stops he asked me for the schedule. I asked him to show me his. He did not have one. I told him I did not have one. He then frisked me and looked

through everything in my pockets and my books. He wrote me back and asked if I had a 'New York Times' he could read. I told him to get out and get it out of the van and bring it back, or I would get out and read the schedule and come back to tell him what it was. This went through my head, only I remembered taking the deco tables out of my van, and throwing them in the trash a long time ago.

I wondered if I could just get out right there. 360 minutes or SIX HOURS at 285-300 is so ridiculous that I did not want to think about it. I started figuring for a full saturation dive. I knew what that looked like from 250-180, so worked on the rest. I could not come up with any reason to do more deco than for 3 hours, but I did come up with a few very compelling reasons to do LESS between 170 and 100. I tried it. In my mind I broke the dive into three dives: 120 to 40, 240-130, and 300 only. The first dive cleared in my mind 20 minutes into the 40 foot stop. The second nearly cleared after the a 40 minute 40 foot stop, but oxygen did not help it any, and the third cleared to 120 after the 170 stop, producing the second dive as the deco, that in turn producing the third dive as the deco, and all telling me the whole thing could well be done without ANY oxygen. That I was not willing to try, since I had to be back home the next day for sure. I knew absolutely what WOULD work, so did it. I went ahead with an 8.5 hour deco plan, but knew I was not going to get out before 2:00 am , so sent up word to Dawn to get me a room at Wakulla so I could get a couple hours sleep before I left. Panos got the room, and I got up in time to catch Barry Miller coming out of the water from his SECOND 3500 foot plus dive of the day (he , Chris Werner and Ted Cole went back in and cleaned up the gear which we left at 3500 feet).

I could not sleep in the trough since every time I fell asleep, I stopped breathing. Not wanting to die in my sleep after a record dive, I stayed awake. I realized that with the low level of CO₂ in my blood, and with my conditioning, my body was seeing no reason to breath for extended periods of time. With so much stored oxygen, that feedback mechanism was nonfunctional for me, and actually does not work in me unless the oxygen surrounding me is lower than in my body at one ata equivalent of air. I have tried it with the rebreather and with pure helium to see. I got out after 150 minutes at 30 without any problems, and went to my room.

At 5:30 I went back down to the dock and got on the horn with the divers who were still in the water. The whole WKPP crew was still out there at it, and going smoothly. I loaded my stuff and took off.

I waited until a reasonable hour and phoned Mercedes Scarabin to let her know that Brent was ok and that he was just packing up his stuff. I could not get Becca until later. Now I was driving along and I wanted to tell somebody what we did. Tell somebody about this dive. I called Carmichael, left a message. He phoned me back, he and Bill Mee were at Gavin's house. He said, "what do you want me to tell Gavin?". Tell him 18 grand. He will understand.

Then I was driving some more, thinking about who I could tell. There was only one person who I wanted to tell, and I could not. Parker Turner. I would have loved to be able to tell Parker Turner. I remember his frog, it had a name, but I forget it. It was some kind of bizarre rain forest frog. He told me that this frog was the 'best' cave diver. He still is, but we are not a bad second. I just wish Parker were here to tell about it.

Diving to 18 Grand - Part 2

.....starting back where we `left the bottles at 6500` ...
And before that.....

As we neared Cherokee Sink on the way out, I started looking for the old end of the line , hoping to spot the loop. I did not, but I noticed on my timer that we were at four hours of bottom time already, and that my two dive partners' lights were fading. We were 11,000 feet from home. We bobbed back and forth trying to get our speeds more closely matched, huddling together to be better able to see each other and the line. I got hung up in JJ. On the way in, I had gotten hung up in Brent and had to flash him to stop. He immediately tried to turn around to face me , thinking he needed to help me, but I grabbed him by the leg and pushed him forwards, giving him the `go forward` light signal while unhooking my rebreather gas block from his stage bottle - when we stay together, we stay together. We are a team.

I turned my light into my face to gauge its strength, and it blinded me. I ran into the roof. I reached back and checked my valves - everything was there. This was going to be a long ride. Six hours of scootering in 68 degree water in giant black tunnel may not seem like much when you read this, but it is about the time it takes to drive from Palm Beach to Tallahassee. Staying alert is critical. There are T's everywhere, and a wrong turn could really set you back, not to mention put you out of the path of the safeties. All three of us are navigating, usually I am in the back. I illuminate my compass every few minutes so I can constantly watch it, along with the clock. Knowing exactly where you are is at all times is critical : if something were to go really wrong, you have to be able to make the best decision on how to proceed.

Right near the end of the old line I felt like my scooter was slowing down. I signalled JJ that I was going to make the switch, and he did the same. The temptation to turn the scooter all the way up is overwhelming sometimes, and we had been gradually easing ours on up , hoping for more speed - we got less. In our thinking, the scooters are the most critical gear, and in our imagination, they are always a little suspicious. Both of us have switched scooters only to discover that the one we were riding was at full power.

A few dives ago, JJ had Brent and I hold at the beginning of the dive and he went back to our escort divers. He came back with both of their scooters, plus all of his own. I recognized them - both were ocean scooters I had built for time , not speed. I tried to take the one away from him, he kept it. As we passed each safety scooter on the floor, he switched, picking up speed, but somehow ended up all the way out at the J Tunnel with FOUR scooters on him. We laughed about that for a while. This time we switched, we were not laughing, and started the calculation on that scooter. I did not like what I came up with at all, but let's keep moving, we are 10,000 out, the clock is running, we are at 300 feet.

At about 9,500 feet we came into our previous scooters and drive bottles. JJ and Brent had hung theirs from a ledge in the ceiling, clipped to the line. I had set mine on the floor eighty feet away , holding the line down . Here there is the illusion of mounds of silt, but it is only four inches deep to the hard rock below. The ceiling is at 270, the floor at 300 right here. I dropped down and hovered, putting away my other scooter. I went to switch my drive bottles, and lost my double ender. No problem, being really anal, I had left a spare one on the line just in case. I dropped it. I could see the outline of both of them in the silt. Expecting to reach into endlessness, I was suprised to recover both of them only four inches down. Glad I dropped them. Glad I was breathing helium, able to hover inches above the floor with three scooters, two drive botles, four safeties, and pick two clips up out of the silt without even puffing it while wearing a rebreather with twim 160's attached to it. I was remembering what Parker Turner told me, "It is the basics that keep you alive". I was thinking, "This is my basic lobster-catching buoyancy control at work". I was also thinking, "how am I doing this with a rebreather?". It is a good thing I do not teach it, as I have no idea how I do it. I thought about the first question on my rebreather exam, "What kills the most rebreather

divers". I had answered, "Rule Number One", Jack Kellon got pissed , he said "Task loading". He told me Tom Mount had answered that question correctly, and he failed me and Bill Mee. We laughed until we cried, "Task Loading". Bill Mee and I are the only guys who ever failed the rebreather test. However, Mount and Jack were correct - turn your back on the rebreather snake and it bites you.

My dad had a German Shepherd named 'Lucky'. If you turned and walked away from Lucky, he bit you in the ass. He bit everyone but me and my dad. My brother was his favorite bite. The secret was to pet Lucky before you turned your back, and to display no fear of him. Everyone who did not 'pet the pony', or was 'scared' inside, got bit. Some things never change.

We passed a lead we had started a few dives ago. I looked down it with my light momentarily, and then turned away. Normally we do everything we can in each dive, but this one was over. I automatically checked for my reel - it was there, loaded. I later dropped it at 6500 feet to reduce drag, and the temptation (to JJ).

At about 8,000 feet out we were slow, we were loaded down, Brent and JJ were on backup lights, we pulled up to a safety bottle depot to pick them up, did it too fast, hit the trigger, and lost the line. It was broken and gone in the silt way between tie offs in a section of tunnel on a corner that is 120 feet wide, fifty feet high, and does not have a good reference to check the compass course. JJ and Brent were in front and I was behind. I yelled in my rebreather, "I have no ----- idea where the line is", and gave them the 'lost the line light signal'. They immediately froze still in place. Seeing that, I continued the signal and turned back , looking for my own smoke trail. Even in giant cave with a rebreather, there is the moving particle water trail that is your signature. I flipped on my powerful nicad light and illuminated my compass, held it back in front of me, spotted the 'smoke', and dove to the floor. Even in Tallhassee Tanic Cave, if the line has been in the silt, it will stay white. There would be no way to spot the suspended line, so I shrimp trawled for the line running a course perpendicular to what I knew the survey to be (you have to ignore the walls since they present the illusion of a four-way tunnel every time with no reference point). I did not need to plant and run a line, since I had the two best dive partners in diving - they held like a rock where they were. This is the kind of situation when Rule Number One means life or death. You could search for days in Wakulla for the line and never find it. This is why I dive with these two guys - they know what to do, when to do it, and they execute it perfectly every time no matter what else is going on - they are truly the best in the business.

I got lucky, 'scoring' on the first pass. I turned into the survey and signalled them that I 'had the line there, you go ahead and find it forward'. They did, we moved on. No reason to repair the line, we would be the only people who ever get that far anyway. That was a heart-stopper. We were already late, and Murphy says that when you get lost off the line, that is when your rebreather SHOULD fail, or your scooter should stick on, or your light go out. Murphy can't hang with us for 18 grand - (in other words, we got lucky this time, Murphy missed his chance, but that is because he had a much better one waiting for us).

We unloaded our cargo at 6500, now ready to 'fly' out of the cave. We hit a junction where you can go out two or three different routes at 6,000 feet. The safeties are in the main tunnel, but we have another tunnel that we like to ride for the scenic beauty, and because it is usually clearer. We had ridden it on the way in , and it was in good shape. However, it is a backflowing syphon on the roof, ingoing spring on the floor. The line is on the roof, but we know the tunnel and can ride the floor, but that , we discovered, is IF we have one thing - lights.

We checked our gas supplies and looked at each other, deciding on the scenic route out. We took that turn, expecting to burst into clear water any minute, and it never came. The tunnel was hosed, and had gone down in the five hours we had been diving past it. I figured out what had happened as I passed a familiar tie off point, but we were committed now .. I was thinking ,as I saw the line holding stiff in the current, 'This thing has sucked the tanic out of A Tunnel all the way down here - it must have rained like hell out there'.

Now Murphy got going. My light died, and so did the second lights of Brent and JJ - we were all on backup lights. I could see that Brent and JJ had the Rat Light, I had some other piece that was out of focus, but I did not want to go away from the working backup to pull a Rat light. I started thinking that the light must have water in it to be out of focus, so it is getting ready to fail. I went to check my nicad light to see how much power had built back up, turned it to my face and flipped the switch just as I passed through 306 feet - the test tube broke and it filled with water. I turned it off immediately - I would now REALLY need this if I had to signal, and it should work in the relatively non-conducting water. What next?

We came up on some really neat rock formations, poking our way long the ceiling with our little lights, and sure enough, there goes my scooter. I flipped on the crippled nicad light, signalled JJ, and he and I both went for the rocks to switch scooters. I did a quick calculation - I had about twenty minutes in my other scooter (maybe), my big boy should have about five of rejuvenated life, and my nicad scooter was 1000 feet ahead on the floor with an hour left on it. How bullet proof was that scooter now? There were four safeties each between there and the door - not enough to swim out.

We crossed through a nasty spot and blind jumped back to the A Tunnel line. I had done this twenty times before, but now it was absolutely critical to get it right and get to the scooters. As we pulled up to them, the other scooters began to fade. This was now a one shot deal. We sorted out the gear, got rid of everything that was not full or charged, checked our gas, and started out from 3500. My guage read 2000 on my back gas - I had ditched my drive bottles and was plugged into it. I started thinking, 'That guage has said 2,000 psi for the last two hours' - I dove down and grabbed a safety bottle.

Now the line is deep, and on the floor, and the vis has dropped. We usually just follow the cave in and out, but that was not in the cards now. We stayed on the line. This took us deeper and longer, but Murphy had given up on us, and everything went smoothly. What we did not know is that our support team had become so concerned that Dawn had sent Scott Landon and Steve Straatsma 3500 feet into the cave to look for us, and they had waited for us for twenty minutes at the 3500 T, and had had to turn back, not knowing which route we were on. Rat, Cole, and Werner were gearing back up (they had just done 80 minutes smoking B Tunnel, but still had FULL HUNDREDS left over from their dive. Werner left his leaning up against the tree and came back later to do the cleanup dive to 3500 with Cole and Rat. The Tough Guys of WKPP.

Later, when I got out and drove home, I was curious as to whether it was my head or my gear that was getting tired. I immediately took the scooters out of the van, ran through the checks and burn tested them - they all had tons of time left. It had been my imagination that told me the scooters were weak. I checked my guages - my back gas guage was perfect. I had only started with 3000. I had switched to back gas from a drive bottle that I thought was out - it was full, the stage bottle guage had stuck on zero due to the depth, so I did not use the bottle, thinking it was empty without questioning how it could be, but with the way that arrangement works, the rebreather does not like funky intermediate pressures, and I would take no chances of blowing an OPV to get the last of the gas out. I went to rebuild my nicad light only to find that the tube had a flaw all along, and that there was nothing else wrong. I checked the backup light, and it was perfect. I took my rebreather to Jerry to check. I had thought it was different. He said he had left my original ratio alone on the last rebuild. It was me, worrying too much. I had done my homework, my gear was perfect, and we pulled it off, despite the head and the best of Murphy.

What is it like diving to 18 grand? Well, it is like diving to 18 grand, and I think now we have shown that we are the correct team to explore cave in the WKP, and until you can say, 'been there, done that', this story says it all - not as easy as we make it look, but a lot easier for us than for anyone else, and it has always been that way. And the good news is that we have just now discovered where all of the really good cave is, we now have access to every last little bit of it for the long term, and are gearing up to go explore it.

Somebody out there think they have 'better technology', better skill, maybe 'do longer bottom times', maybe 'triple our distance'. Step on up and pet Lucky, and see if he bites you. When Lucky spots a battleship mouth, he goes straight for that rowboat ass.

My 77th Cave Dive

When I logged this dive in my book, I wrote, "this might be my last cave dive". It was my 77th cave dive, but someplace up near my 1000th "tek" dive, and I was still scared cave diving. Up to this point, I was always overwhelmed with joy at making it out of a cave alive, and empathized with Rob Palmer's mention of the "grass always looking greener and the sky more blue" after each dive in his "Blue Holes of the Bahamas" book, a story of exploration and adventure which describes accurately why we keep coming back.

I had only been a minor WKPP support diver up to this point. My instructor, who was also Director of the WKPP, extended my time to getting a cave card out for a full year, and I had received that card from him on the plane down to Mexico on the way to do some diving in a system that I had been exploring with some other WKPP Divers.

Lamar English had taken me under his wing immediately after I started the initial cave class, and I had found Jarrod Jablonski right away, so I had hit the ground running and was averaging about two cave dives per week. This day was to be my first support dive of any distinction in the WKPP. Parker and Bill Gavin were to do a dive to the end of Indian Springs to try extending that cave out past where Exley had left off in his exploration in a lead Gavin had spotted on an earlier dive.

The system had been down for months, and was now finally diveable. Parker had basically invited all his friends to come dive, and made up dives for us that were really unnecessary, but he wanted to get the team moving again. Lamar English and I were to put in the deep deco bottles and ride out a ways to mark unexplored leads. Bill Main and his dive partner were to put in the intermediate bottles and do the same behind us. Everyone else was supporting on land and in the basin, or just doing a dive.

Right from the start, things went strangely. Parker appeared distracted, and was not feeling well. Most of the more experienced WKPP divers were all sick and in street clothes, so could not dive and were running the surface, so I offered to do the dive in Parker's place. Parker said, "Don't you think that would be a bit much to bite off right now?". His stages were not all the way full, and he had a 3x Tekna scooter (Gavin had a Gavin). I offered my full bottles and more powerful scooter.

He said, "No, it's too late". He then asked me for the keys to my car. I had a built in phone, and a month later when I got the phone bill, I saw he had phoned his house. That was November 17, 1991 - I don't need to look at my log to remember that. His wife later told me that he called her to tell her he loved her.

I had mixed the backgas for both Lamar and myself, but had done so based on the wrong depth - we did not know the cave went deeper than 150. We dropped down to 110 feet and clipped off deco bottles for Parker and Bill, then took off upstream. Bill Main and his partner entered a few minutes later. Behind us, Main had called his dive about 1200 feet in and turned. Lamar and I rounded a corner about 3500 feet in and the depth crossed 150. I looked at my gauge when I had to clear my ears, and let off the trigger. I saw Lamar's blades stop spinning at the same moment. We were floating there, looking at the white tunnel in front of us. I reached for my wetnotes, try to figure out how I was going to tell Lamar that the analysis had come out two points over spec and that we had to turn - it was always me who weened on the long dives he liked to do, but he turned to me with the scariest look in his eyes I have ever seen, and took my notes from me. He wrote, "Bubba, we are a little deep for this mix", and I was off the hook, but the look sent chills through me. Now I was scared, but I did not know why.

We turned and scooted back towards the entrance, and came across Bill Gavin and Parker nearing the stage drop. Gavin was really something to see in the water, so we stopped about 75 feet away and turned to watch them make the switch. Gavin floated methodically and executed the perfect drop and switch.

Parker turned back and scootered a few feet towards me, let go of his scooter, switched his light to his right hand, held his left hand out to the side in an "OK" signal and shined the light on his hand. I returned the signal. He then went back to where Gavin was waiting and dropped his stage.

Lamar and I continued out, but never saw Bill Main - he must have turned right before we reached him. At the upstream/downstream T, Lamar stopped and checked his gas, pointed downstream and gave me the "little bit" signal. I checked my gas and gave him the "OK" signal. Again he suddenly stopped and that look came back, only this time he showed me the thumb.

Now I was scared again. We scootered back to the restriction and moved through. I was feeling a lot better now, we were out of the cave. I checked Parker and Bill's bottles - everything ok - and we started moving up to where Bill Main and his partner were decompressing above us.

At fifty feet, my computer wanted some unrealistic deco, so I took it off, strapped it to my scooter, and dropped the scooter to the floor below. It had been about 4 minutes since we cleared the restriction. Suddenly, everything cut loose. The water went rushing past us from above and the cavern blitzed in an underwater sandstorm. Bill Main and I both went instinctively to the ceiling to try to recapture what we thought was my runaway scooter - we both figured it had to be the scooter trashing the place and blowing the water on us from above. We could not see it sitting below us peacefully on the floor. What was really happening was that the water was rushing in from holes in the ceiling above, pulling sand and silt in with it, and in from the entrance to the cavern. What we did not know is that someplace in the system an aquaclude had cut loose turning the cave into a violent syphon which lowered the water level in the basin by a full foot and pulled whitewater rapids backwards up the spring run. The rushing water pulled sand and debris over the restriction at the entrance of the cave and the movement suddenly stopped. All of the silt and sand water had been sucked into the cave, so amazingly we were sitting in clear water again. I dropped down to my scooter, still not believing it was not responsible, only to find it untouched. I noticed that the deco stop was gone from the screen - it had been four minutes that the cave flowed backwards. None of us got it. Nobody on the surface got it. Nobody came in to check on us. This would be a day that ended the easy going "volunteer" WKPP of old, if it did not end it for ever. In fact, that day all but four of us quit the Project and most quit cave diving for good. Gradually, the cavern started silting out again. Lamar and I were getting uncomfortable about it, but we still did not know why. Bill Main and his partner had already long gotten out. We were at 20 feet. I decided to check on Parker and Bill, so I dove back down to 110 feet.

Everything appeared the same, but I did not go far enough to see the restriction, which was no longer there. The bottles were untouched in the same place I had put them, clipped to the line. I began wondering about the length of the dive relative to the gas supply, but these guys were the pros. I came back up to Lamar, and did not see the support divers come past me in the silted out cavern, but figured they must be there and must be silting it out.

What was really happening was that the cave had blown the restriction back open again, and the silt cloud inside was flowing out. Lamar and I surfaced.

Lamar was right up against me on the surface, and he had that look again.

We were out of earshot of everyone. He asked me if I saw Parker and Bill went I had gone back down. I said "no, their bottles are still there". He floated there thinking. Then the support divers popped up by the dock. Steve Irving asked them if everything was OK. One said, yes. Steve said, "Did you see them both, where are they?". One said, "I saw Bill". the other said, "I saw Parker, he waved at me". The other said, "That was not Parker, that was me".

Lamar got real close to me and whispered, "Bubba, something is not right. I am going to go check". He dropped down, and reappeared about two minutes later, again whispering, "Parker is screwed I found his tanks on the line with his light on and he and Bill are not there". I deflated my wings and dropped down, scooting down the now blacked out cavern to 110 feet. I passed one intermediate bottle clipped to the line and then I saw one deep bottle still clipped to the line.

I clipped in with my spool and hit the inflator, going to the ceiling. I kept trying to remember what that cavern had looked like, but I had never really taken a good look. I was amazed at how far up it went. I then started sweeping in the zero vis, banging along the ceiling of the cavern. I ran smack into Gavin. I could not tell who it was at first, and was feeling all over him to see if he was alive. He did not move, but I could hear him breathing. I found his pressure gauge and held it up to my mask it read zero. I grabbed his stage gauge and saw he had gas, He was on his shallow bottle. He had used the deep bottle and jettisoned it apparently, and was still sitting on the ceiling, off the line, silted out on the second bottle.

He passed me a little tiny slate. I could not read it. I pressed it up to my mask and shined my light at the side of the clear silicone skirt - "Parker is dead". I felt like my heart stopped. I kept holding the slate to my mask. I woke back up - I had to get Gavin to some gas. I asked him if he knew where his oxygen was. He said yes. I did not believe him. I don't think he cared where it was. I realized he was not in a good space. I could not get him to move. I tied my reel to him, then ran it to the trough, then out and to the surface, over to the dock and tied it off to a piling.

Everyone stopped what they were doing and looked down at me from the dock. I tied to get myself together to speak. "Parker is dead", I could hardly get the words out. Bill Main started pacing back and forth. He said, "That is not supposed to happen". I said, "Bill, you have to go down and get Gavin - he won't move". I tied off to him. Just follow the line and get him up to the trough. Lamar went down my line and Bill had his tanks on in seconds. They followed the line to Gavin, moved him to the trough and sat there with him for nearly four hours. I never asked what went on, but I didn't have to and didn't want to know. Bill Gavin was beyond upset.

When I saw that Bill Main and Lamar were on it, I went back down the main line, tied in and began sweeping again. I did this nine times with stages and backgas until I ran out of gas. I could not find Parker. I forgot to decompress, and just got out when the gas was gone. I was sick. The cops were there and it seemed like 100 other people were streaming in. I remember Tara Tanaka showing up and a bunch of other cave divers, like they appeared by some magic call. Everyone kept asking me if he could be in an air pocket on the ceiling, and I kept telling them that the ceiling was well under water. I got sick of telling them that and went to my car and called Alton. Alton loved Parker and so did I. Bill Main and Sherwood Schile got in the car and drove over to tell Penny Parker, not the kind of thing you ever want to have to do, and they were the only ones among us who could do it that day. We told the cops we needed to go reload our gas and come back to look for Parker. We all went back to Steve Irving's house where the compressor was. Bill Gavin parked his van outside and sat there all night, while Carlyanne Johnson stayed with him.

We went back down the next morning, and Gavin laid out the plan for clearing the restriction and bringing out Parker. Then the cops showed up and told us they had done it at 6:00 am. Parker had trained them to cave dive and do body recoveries. They did not want to leave him in there. Gavin and the rest then got ready to go in and retrieve all the gear that was behind the restriction. I did not want to get back in the water for gear, even with the light duty Gavin assigned to me. I got in my car and left for Ft Lauderdale. I cried all the way to Perry. I don't know whether it was because of Parker, or because four more minutes later would have meant all of us.

Gavin later told me that he and Parker had reached where the restriction was supposed to be and the line just disappeared under the sand, and that the main tunnel was totally blacked out. Parker's scooter had

failed and Bill was towing him. He got Parker to wait while he scooted back to the upstream/downstream T to see if maybe he had gone the wrong way.

Imagine what was going through the mind of an 18 year veteran cave diver diving in a place he knew like his own house. He came back to the restriction. For 45 minutes they tried to find a way out, tying in their spools to where the line was buried and searching forward. Gavin told me they were down to almost no gas, and he knew they were going to die. He said he did not want to see Parker die so he moved over to die by himself. At that moment, they felt the water flowing, and followed it. Parker had taken his tanks off and was dragging them behind him. Gavin left his on. Both had hit the entrance as it blew open with less than 100 psi in their tanks. Without his backtanks for weight, Parker must have been struggling to stay down, used the last of his gas and blacked out. The ceiling on the other side of the restriction is at least 30 feet above the floor, and he could not hold on.

Gavin made it the few feet to his bottle and got the deco gas just as he ran out. Gavin told me that knowing you are going to die is the most desperate feeling there is. He said you don't ever want that to experience that. All of our worst fears in cave diving demonstrated.

I called Jarrod. He said, "you have to get back in the water". I did not even want to take a shower, let alone go cave diving. A few weeks went by, and Jarrod told me to come up to High Springs and he would go diving with me. I called Lamar, and got him to meet us at Ginnie. We were both freaked, but JJ stayed real calm with us. JJ told me, "We'll just do an easy dive, you have to get back in". We geared up, and then Lamar stopped, "I just can't dive right now", so JJ repeated to me, "you have to get back in the water", so I went. He started out real slow and easy, attentive as always, no stress. The cave was clear and beautiful. It was night and nobody was there. We dropped our stage at the Hinkle and dove all over the back of the cave, in ever squirrely, crazy place JJ knew, and came back out about 90 minutes later with one of the best cave dives I had ever done. JJ got me back.

A couple of months later I called Bill Gavin and got him to go to Mexico with me. Parker had told him he needed to see the stuff that we had seen, so we took a couple of weeks and did the tour. By the end of the trip, Gavin was back and talking about moving to Mexico, but that experience never let him alone. In the film NHK made about the WKPP, in an interview with Gavin, he said, "A day has not passed that I have not thought about Parker".

Backup Lights

I am not sure what a Scout is in the first place, unless it is the Halcyon light that looks like the old Oceanics, and I carry three of them on dives where I might have to deco in the dark (3rd one in pocket for that purpose).

At one time we carried a second small primary with a 35 watt bulb and nicads to back up the old 5 hour halogens, but we have been running 13 hour lights ever since then and no second primary.

The backup lights have a few basic rules : they must not be used for anything but backup (hence the segregated 3rd light), they must have a focused beam good enough for your dive buddies to see you signal mixed in with their primaries (assuming dive buddies who are paying attention), they must have no switches, they must have replaceable batteries, they must be of a voltage that matches battery and bulb, not overdriven so they don't blow when you need them most, they must be three c cell in line with a twist on bezel, they must have a straight attachment point, they must be stowed DIR, they must be deployed properly, and they must be tested and voltage checked before the dive.

I know you guys all like to talk about stuff, and I know that everyone likes to reinvent the wheel, complicate things, make their mark, etc etc, but the best bet is to do what I did all along - go to the pros and find out what they do and why, and save yourself the bs. Backup lights are serious things, and I can tell you serious stories of very serious uses of them in situations where any CF would have been a death sentence.

Why we do not butt-mount lights:

- We use this position to tow scooters and to tow buddy in an emergency - his head is tucked in behind the tanks. We also keep the exploration reel there sometimes, and or the liftbag in wreck diving.
- We do not plaster our tanks with d-rings and convoluted crap like what is required to butt mount.
- We do not use metal to metal connections of any kind, and we do not clip things behind us that can not be unclipped from the front with one hand by reaching through - in the case of the scooter, it is clipped to the front and pushed back through. (By the way, whoever is the moron of the century that is teaching people to put brass rings with brass clips around tanks necks needs to be shot on sight - how stupid are these guys?)
- We do not have loose things or entangling devices behind us that can not be freed from the front with one hand and one motion.
- We do not sit on our lights, bang them on tanks, or have any sloppy gear.
- We do not expose our lights to damage of the cord, switch, or lid
- We do not put heavy objects on our legs (or on our knees in the case of 121's), and we are not stupid enough to use the Neutralite (which is neutral, but square). We need the extra weight of the Gavin light, but in the right place
- We do not use extra long cords that catch on everything just so we can put the light in the wrong place

- We do not reach behind us to turn on our lights , and we do not want them knocked off at an inopportune moment because the switch, cord, and interface are not protected. We are not stupid enough to use a twist-on light head, an MRI light head, or any other silliness like it.

The concept of 'less drag' is total bullshit - the light on the hip is in the lee of the shoulder where it is protected. The less drag bullshittters do no real diving and do not know what they are talking about - it just looks good to them because, like monkeys, they saw some other brain-dead moron doing it.

We park our long hose under the canister in its routing. The long hose does not need the canister to sit properly, but it is much neeter, and the hose will be tight to that point and not catch anything. The hose is where it is because the whole system is built together - a different subject - we have worked all of this out for every kind of diving, and do not change one thing as it causes something else and then something else to be changed, and pretty soon you are back to nothing functional.

The cord routing is a real mess and interferes with the stages and all of the other gear, or requires some hideous convolution of routing to keep it out of the scooter wash, out of the wreck or rocks, and generally out of trouble, and then you have some completely unsafe mess on your hands.

Only a complete and utter stroke would butt mount, and you will find that those who do either are 1) complete idiots, 2) have copied or been taught by an idiot, or 3) sell dive gear and can make the most money off of this ridiculous horseshit, which they will tell you ususally requires a list of horrendous crap so expensive as to equal the price of real gear plus a scooter. Your instructor is then riding YOUR scooter, and don't forget it.

If you can name one guy who does any serious diving like this, I will kiss your ass in Macy's window.

Just ask whoever taught you this stupidity about their biggest dive, how much gas it took, how long it took, and put it on here so we can all get a huge laugh.

Look at my video, "Doing It Right", and tell me what you think.

DIR Separation Protocol

This is how we handle buddy separation issues. It is the responsibility of the front diver to know if the next guy is there or not. If he is not, the front stops, turns, and retraces. If the third guy stops, the second guy must stop and deal with him. It is still the responsibility of the front guy to know if the second guy is there. A light flash would be great, but the protocol must work in the event that a light flash is not possible.

It is the responsibility of the guys in back to hold light on the person in front of them such that the front person can see the beam and know the buddy is there. We stay close in all cave, regardless of size, but in small cave this prevents losing buddy at every turn, and it allows the buddy to ride through any silt or halocline or whatever stirred by the front guy without stopping and starting. If the vis gets really bad, the back guy's responsibility is to either be in touch contact with the front swimming or to bump the fins with the vehicle if scootering. This is standard WKPP stuff and I expect everyone to know this and adhere to it. I hate diving with people who can't play by these rules as it results in a slinky dive and a stress out. I personally thumb any dive where this or other breaches of protocol occur.

The front guy can do a sidewave signal if he can not see the back guy, which tells the back guy to swing his beam across the front guy's mask, showing that he is there. If the line is buried, the front guy must signal no line with his light (slow back and forth), and the back guy must automatically stop and hold his position on the line that he can still see. When the front guy finds the line ahead, he signals a fore and aft sweep of the light indicating he has regained the line, and the back guy can then proceed by returning the signal (not an 'ok' signal).

We have no excuses for buddy separation lasting more than seconds. We stay as close as possible at all times. If you are not bumping into your buddy from time to time, you are too far away. The trick to what we do is team execution. The reason nobody can touch us in this game, including what are considered the 'best' in the world, is that they don't get this part. When Sheck Exley started diving with me, he was so amazed at what can be done our way that he talked to me every night at home and called me every day on his lunch break to talk about what dive we could do the next weekend. What Exley used to tough out by himself or with strokes over periods of weeks of aborted CFs, he could do with me in one day.

Just by way of comparison of philosophies, the UDSCT (made of up some of the most horrific idiots in Florida cave diving as well as the 'best' from Europe and other places) took 90 days of diving to get halfway out JJ and my line in the main tunnel of Wakulla, and JJ and I went back after they were booted out and added to the end of our own line (twice as far as their max pen) in one dive in one day. The difference is in the ability to work a dive as a cohesive team. The little details are what makes this happen.

DIR Sidemount

There is no big trick to DIR sidemount. In cold water, we use our dry suits and a normal backplate with a weight belt of our decompression backplates with tiny Halcyon wings. The backplate has two curved weights bolted through where the tanks would go, usually 20-24 pounds in two weights. The wing has enough lift to offset the plate and weights. The inflator of the wings is not hooked up to a tank. The argon bottle inflates the drysuit, and the wreck style argon location is used. The bottles are merely stage rigged with normal stages added, only on the right there is no lower d-ring, just a bungee loop that slides free on the belt. The light goes in the normal place, as does everything else on the harness. Stages are carried and breathed with the doubles being treated like back tanks. There is no long hose. If you need to share, you hand off and discard the bad bottle, if indeed it even comes to that with proper stage management, which it should not. There is no silliness with any other bondage arrangement that the strokes use.

In hot water, with wetsuit, we use the same thing with no weight for fresh and a smaller version of the weight for salt. We do not hook up the inflator to a tank.

This is not rocket science. The horseshit dreamed up by sidemounters is ridiculous. We don't do it unless we really need to look at something where there is no other way, and it is a logistic nightmare to set up, but it can be done right.

I have done it mostly in the Bahamas, and we do it every dive for decompression in the WKPP. We remove the back tanks or rebreather and go to the sidemount rig for comfort and so we can more easily get up out of the water in troughs, or habitats. Even then, we see no reason to create some stroke rig.

You act like you have some preconceived notion that I was going to say something as stupid as the Brits put on here, but as you can see, it is not necessary. I have been in plenty of no vis situations with my buddies, like JJ and Brent, and trust me, there was no problem keeping track, and any real diver knows that. For one thing, you can hear the other person breathing, and then there is touch contact. and all the other natural skills that are supposed to be taught in dive class, unless of course you were taught by assholes like whomever is teaching cave diving to the Brits, in which case they will tell you why they were so good at Normandy storming the beach and getting killed, a trait they think needs to be applied to diving. It does not. Diving should be safe and fun, and enjoyed with friends. If somebody wants to prove how tough they are, they need to get into one of those Gracie competitions, not do it in the water, or see how far they can stick a baseball bat up their ass (for the Brits that would be a cricket bat).

That last post by one of those morons was like some confession of sheer stupidity. In scanning through it, towards the end I picked up the words to the effect of 'getting some respect'. I don't respect morons, and I don't respect people trying to be tough guys doing stupid things and trying to pass them on to others.