The DIR Philosophy

By Jarrod Jablonski

A good SCUBA equipment configuration needs to support all of your diving whether that be an open water dive or a penetration dive inside a wreck or a multi-stage cave dive. The configuration must be able to adapt in such a fashion that the addition of items necessary for each dive does not in any way interfere with or change the core aspects. Diving with the same basic configuration allows the same response to emergency at all times while reducing task-loading due to familiarity . In other words, a good gear configuration not only helps solve problems, it prevents them.

By achieving a configuration which is streamlined and comfortable to dive with, you will experience diving with reduction in stress and task-loading thus increasing your enjoyment.

Strive to achieve a attitude where you NEVER accept any equipment situation where your own standards are compromised. Correct any equipment configuration problems immediately as opposed to waiting until the next dive.

Few aspects of cave diving engender biased convictions like the topic of equipment configuration. Different people diving in different environments often reach very different conclusions. This tremendous diversity often surprises the new cave diver who usually expects that there will be a consensus among the "professionals." In fact, this diversity has been known to initiate rather energetic disagreements and while cave diving has undergone some significant changes during the last roughly 50 years of its evolution, few aspects of the sport remain more hotly contested than gear configuration. Perhaps because one’s equipment is often a rather personal choice and people are prone to take offense when their decisions are challenged.

Regardless of the reasons, dozens of styles have been marched out to center stage and purported to be the most effective, the safest, the easiest, the cheapest, or lately, even the most "technical." Some people have casually recommended one style over another, others have adamantly insisted upon their configuration, while still others advocate that one just do what feels good. How can one sport support such a variety of opinions and, perhaps more importantly, how is a diver to dim the clamor of opinions in order to make a sound and reasonable decision?

The most sensible way to make any educated decision is to gather information and evaluate which of the available options best satisfies your particular needs. A diver will be able to swim themselves into a cave using almost any style of gear configuration. Many an open water diver has returned unscathed from a poorly chosen venture into the depths of our cave systems; based upon their safe return (this time), their consensus is to continue to breathe the short hose because they find it to be "more comfortable."

The long hose is usually "stuffed" during the equipment assembly portion of the dive. The hose must be run so that deployment allows the full length of the hose to be utilized. During the pre-dive drills so common in the cave community, the divers practice out-of-air drills and acquaint each other with the location and deployment method to be used in an emergency. Following the exercise, most divers have their dive buddy replace their hose back in the original position. Divers must therefore be wary that because they were unable to configure this vital portion of their equipment themselves, it may be done differently or even wrong. Some divers are able to "stuff" their own hose while in the water, but they remain a minority despite the potential risk.

Opinion on where and how to secure the second stage of the long hose varies among divers, yet most agree that the triangle formed by the chin to the nipples is the best region. Some prefer to use a retaining device like those often employed by open water divers to secure their octopus, while still others prefer to secure the second stage under the chin with a surgical band running around the neck. While still others prefer to secure the second stage under the chin with a surgical band running around the neck. This location does seem to limit the chance of having the regulator pulled free as it is away from the frequently abraded area of the chest and also is more easily retrieved when the chest is cluttered with equipment.

Occasionally, divers will secure the long hose in a retaining band, breathing off its regulator and donating it in an emergency. The short hose second stage would then be secured in one of the manners discussed above, usually below the chin. While a few divers utilize this style it is somewhat uncommon. Most divers breathing the long hose configure in the manner discussed below.

Evolution of the Hogarthian Style

The concept of Hogarthian diving is often misunderstood, sometimes misrepresented and occasionally complicated unnecessarily. In the simplest of terms, the Hogarthian concept embodies simplicity and functionality. At the heart of this concept is the conviction of minimalism. Items that are superfluous should not be part of one’s diving attire- when in doubt leave it at home.

On a deeper level the Hogarthian configuration is more than a style it is a system or perhaps more pointedly a process. Every aspect of the true Hogarthian dress is an integrated part of a life support system. Confusion sometimes arises when people try to review or adopt a single part of an integrated process. This system must be looked at and evaluated as a whole where it most effective. Certainly divers may choose to adopt isolated aspects of the system but adopting one aspect of an integrated unit cannot be considered diving Hogarthian.

The Hogarthian configuration is named after William Hogarth Main, a cave explorer of significant accomplishment. The individual components that resulted in this system grew from many divers all striving to maintain the original vision of clean task-oriented diving style. In truth, cave explorer Sheck Exley was one of the first cave divers to promote using the longer 7’ octopus hose as a

primary, donating air from the regulator in one's mouth. Yet, it was certainly Bill Main and Bill Gavin's early years of diving that defined the Hogarthian view of diving. There efforts not only resulted in the birth of the Hogarthian system but coupled with Parker Turner and Lamar English proved to be the genesis of the highly successful Woodville Karst Plain Project (WKPP).

Later, WKPP members George Irvine, Jarrod Jablonski, Casey Mckinlay, Brent Scarabin, Rick Sankey and a cast of indispensable members would continue refining the Hogarthian system, using it to establish a new age in cave exploration. From its early years the Hogarthian system was designed and refined by explorers focused exclusively on developing a user-oriented diving system. Over the years the efforts of the Woodville Karst Plain have grown into a membership of more than 80 individuals and pioneered a new age in cave research, exploration, and education. The Hogarthian concept continues to play a central role in the efforts of both the WKPP and an international host of leading explorers.

Breathing The Long Hose

Despite its growing popularity, many divers remain opposed to donating the regulator from their mouth. The following discussion reviews the most common resistance to donating the long hose from the mouth.

The last thing I want to do in an out of air situation is give up my primary regulator.

This concern does not really seem to be a rational fear. It is likely that a diver incapable of removing the regulator from his or her mouth for five to ten seconds is not skilled or practiced enough to be in an overhead environment. One may question this divers ability handle an out of air situation in which the out of air diver chooses the regulator in their mouth despite their best intentions. A diver with this degree of concern over the regulator in their mouth may find it quite a challenge to even deal with the very real possibility of an accidentally dislodged regulator.

By donating the long hose regulator from the mouth in an out of air situation one guarantees that the person most in need of a clean fully functioning regulator is going to get it. If you pass any other regulator to an out of air diver it is possible that the regulator received may contain contaminants that will be impossible for the stressed diver to manage. In essence, what you will have done is to place the last straw on the camel's back, creating the last problem your dive buddy can manage. The advantage of donating your long hose primary is that you are always ready for this very real possibility. You are, in essence, always prepared for any eventuality rather than maintaining a fixed picture of how things should operate. Emergencies have an annoying habit of not going as planned and the Hogarthian system strives to remain prepared to manage a variety of out of air scenarios.

I don't want to breathe my long hose , I want to have the best performance regulator in my mouth and the long hose decreases this performance.

With literally thousands of deep exploration dives accomplished by divers breathing the long hose, the performance argument seems rather a moot point. Yet, if one were to insist that the reduction of performance is unmanageable, it seems like a poor solution to leave the stressed, out of air diver gasping for air on this lower performance regulator so you can have a more relaxed dive. Your best performance regulator must be on your long hose and if its performance is unacceptable in a relaxed situation then it is certainly inappropriate to suggest that the your stressed dive buddy is better prepared for this increased resistance. The one thing to be clear on is that if the regulator you try to provide to an out of air diver is in any way substandard, you will be giving up the regulator in your mouth and your ability to handle that situation may make the all the difference.

I just don't want to deal with that hose on the second stage in my mouth.

Any skill worth learning usually takes refinement. The long hose may at times seem uncomfortable to some people, but regardless of your storage location, you have to deal with that hose. When you tuck a long hose into some surgical tubing you feel that it is forgotten and indeed for some it is, but what happens when it pulls free or is not set just right? If you rely on your buddy to arrange this hose for you, what guarantee do you have that it is to your liking or even correctly placed? In a sport that preaches self-sufficiency, does it seem logical to configure your equipment in a way that forces dependence on your dive buddy?

THE SYSTEM

No review of the Hogarthian style is complete without a discussion of the system itself. It is not merely the streamlined nature of their equipment nor the use of the long hose that sets the Hogarthian diver apart, it is the way the pieces are carefully arranged to create a harmonious system. Your equipment must function cohesively and be configured so as to provide you with the greatest support- it is after all life support equipment. For example, let’s assume that you have made the commitment to breathing the long hose. That decision, in and of itself must not be the end to your deliberation. In fact, it is really only the beginning. Where and how you store the balance of this length of hose and indeed how long it is are at least as crucial as your decision to use it as a primary.

Most practitioners of this style have opted for the 7’ length (nine is ridiculous and dangerous in most situations and 5’ is precariously short in restrictive passage) and then run it down the right side of their body, under a hip mounted light canister, across the chest and around the neck into the mouth. Do not try and wrap this hose around your neck multiple times (this may be quite dangerous) as its deployment will be time consuming and awkward. This system is ideal in that it allows nearly seven feet of house to instantly be available and the remaining two to be deployed with a quick flick of the hand. In addition, the diver can easily return the long hose to its original position. While some styles require another divers assistance, this system allows complete self-sufficiency. Many people argue that this ability to replace your own hose is

unnecessary as your deployment occurs only in times of emergency and would therefore eliminate the need to return it to the original position.

In fact, most situations that require the deployment of one's long hose are relatively temporary and regardless of the style chosen every diver must develop a way to manage a deployed hose. Thankfully, a complete loss of air is highly unusual. The high degree of reliability found in modern equipment, coupled with the redundancy of equipment used in overhead diving, severely reduces the likelihood of a diver ever experiencing a true loss of air. However, it is quite possible that one could experience a temporary loss of air for a number of reasons including: the rolling shut of a valve, the loss or failure of a regulator, the inadvertent closure of an isolator valve. All of these scenarios still leave the diver with an air supply yet several qualified individuals have drowned with significant air available so it is obvious that even the most temporary loss of air could be fatal.

Clearly even a temporary loss of air is a serious consideration, yet these situations are relatively temporary and when dealt with effectively they should pose no serious threat to the diver. Obviously the first line of defense in the temporary interruption of air is for the diver to solve the problem themselves. In most cases the diver need merely switch to their reserve regulator. Unfortunately some divers are not adequately prepared for this loss of air and may be caught unaware. Occasionally a diver experiencing an interruption in air supply will go to a dive buddy for air despite the air available on their own backs. This decision may be rather risky depending largely on the distance separating the divers but also upon their ability to manage the situation. While it would be preferable to solve the problem without the need for sharing air this may at times become a necessary or at least suitable decision.

Often these air sharing episodes are relatively short in duration and the problem is solved and the diver is returned to their own air supply. Following this transition the air donor must manage the no-longer needed long hose. To be sure, one has several choices when placed in this situation. One may simply try to get a dive buddy to restore their hose though in some restrictive or low visibility situations this may be difficult. One may also loop the hose and/or clip the second stage off to a D-ring. Regardless of one's choice it is important to try and retain this regulator in a manner that will reduce the likelihood of an entanglement that could create further task loading. Historically, diving accidents start as a series of smaller problems culminating in one apparently unlovable situation. The key to safely managing a small problem is to prevent it from escalating into a large situation. It is most important that the diver have a predetermined plan to manage issues like a deployed and no longer needed long hose. Certainly the ability to reconfigure your own long hose, regardless of your method, is highly beneficial.

Equipment Configuration

The debate over equipment goes well beyond the use of the long hose regulator and divers tend to vary in their solution to the many trials and tribulations of equipment placement. The new cave diver is often surprised at the energy

expended over the most seemingly minor decisions. Some divers appear fanatical in their struggle to refine their equipment placement. The only real consensus within the cave community maintains that divers entering an overhead environment should "streamline" their equipment. Exactly what is meant by that term seems to vary greatly, yet the rationale is that anything hanging free or protruding from the diver's body increases one's risk of becoming entangled in the guideline. Admittedly, some environments contain even more risk of entanglement than that found within most cave systems. For example, wrecks often contain all manner of entanglement including such hazards as disintegrating cable which may be more dangerous than cave line.

Regardless of one's environment, a truly streamlined diver is safer and more efficient. Items that are attached to the diver must be secured to limit or prevent the risk of entanglement. Nearly all divers preparing for overhead encounters talk about streamlining but their dedication to this concept varies greatly. Divers that discuss streamlining and then allow backup lights to swing freely from their tank seem to be missing the point. All equipment must be secured so as to truly limit the likelihood that the diver will become entangled, yet a properly configured diver should strive for more than this one aspect. For example, hoses should not only be configured to avoid entanglement but also to simplify one's access to their valves in the event that an emergency shut down becomes necessary.

Many divers appreciate that certain extraordinary dives may require a degree of refinement simply unnecessary for the average diver. Yet in much the same way space travel is merely a distant dream for the majority, the advances gained from this pursuit are abundant. How much of this refinement is reasonable or more importantly helpful? One's attention to detail should at least be proportional to the type of dives done, but that strict attention to detail couldn't hurt. If all your dives focus on the main line and your penetrations are modest, perhaps your idea of strict attention would be different. If your dives begin to incorporate stage diving and longer penetrations then undoubtedly you should exercise a complimentary form of attention. In general, always be aware that you should look at the entire package as it functions together. Your equipment should be a cohesive unit that facilitates your dives and not a haphazard collection of available items.

Too many divers today seem under the impression that more is always better. In cave diving what is needed is better; that which is not needed is a detriment. Equipment choice like most things is a cost vs. benefit analysis in which one must weigh the potential risk against the perceived benefit. The difficult part and in fact the thing that really defines a safe and effective diver is their ability to accurately evaluate the benefit while candidly weighing the acceptable risk.

From Head to Toe

The mask is certainly one of the most vital portions of the cave divers equipment. The importance of one's mask goes well beyond the obvious desire to see in your environment. The mask should fit comfortably, be low volume to reduce drag, and be reliable. The diver should be careful that the lenses of the

mask are not too easily removed as they may become dislodged accidentally. The strap must be secure and resilient so as to limit the risk of dislodging the mask or breaking the strap. The after market straps that substitute a neoprene style strap are usually quite comfortable and seem to be nearly unbreakable.

Some divers swear by the need for an extra mask yet many divers opt not to carry a spare mask. Masks are generally quite reliable and their failure unlikely. However, given the potential danger of losing one's mask it is worth consideration. While placing the mask one must be wary that it will not be damaged and that it is easily accessed. To that end, many people put the mask on a light canister, in a spare pouch on the belt, on their thigh, around the neck or in a suit pocket. The spare mask should also be the as small as possible while still providing a comfortable seal.

The diver should also be aware that when a spare mask is removed from any of the above locations and placed on one's head it will immediately begin to fog. Certainly, one could treat it with defogging agents prior to each dive; however, this is not only rarely done but somewhat ineffective. Most people disregard this fogging but it will frequently be very disconcerting. In addition, most people leave this spare affixed and rarely check its viability. One solution to all these problems is to pre-treat the mask with a concentrated defogging agent and place it in a water tight bag and then in a pouch. If the diver uses a pocket mounted to the side of the leg the belt remains uncluttered. Of course the mask must still be checked on a regular basis to insure its ability to function.

Dive Lights

Dive lights are an essential portion of your equipment yet more is again not always better. One primary and two backup lights should be fine for most situations. Unless you intentionally dive faulty equipment or ignore common maintenance the likelihood of a triple light failure is statistically insignificant. Divers that carry numerous backup lights are weighting themselves down without good cause. The most efficient solution to one's lighting needs is to focus on quality not quantity. As you begin to carry unnecessary equipment you often create more problems than you solve. The primary light must have a burn time at least equal to one's bottom time while the two smaller back-up lights should burn twice the planned bottom time. The fear over exiting with the inconvenience of a small reserve light has encouraged some divers to carry two primary lights. This is usually fairly prohibitive and generally unnecessary. Quality lights rarely fail and their failure is typically a bulb which will almost always fail when the light is activated at the onset of the dive. Given the unlikely nature of a light failure an extra primary light attempts to solve a nonexistent problem and instead forces the diver to deal with the very real problem of excess drag, extra weight, line entanglement and task loading.

The location of one's lights is a very important aspect of equipment configuration second only to the placement of the air delivery system. People commonly store the primary light on the hip, hanging from the bottom of the tanks, or occasionally mounted to the side of the cylinders. People that prefer the light hanging from the bottom of the tanks (often called butt mounted) claim

that the light is free from entanglement and leaves the body less cluttered and more streamlined. This appears at first glance to be a reasonable conclusion and admittedly there are those that function well within this system. Many of the disadvantages to this system appear small but are not inconsequential.

One of the most fundamental rules in overhead diving maintains that the diver must preserve a feet up attitude to reduces the risk of disturbing sediments. Therefore, it seems contradictory to place a canister below the tanks were they will tend to drag the legs down. Of course, one could dive some of the nearly neutral lights on the market and reduce this impact but if the canister leaks the result will be a significantly heavier light now creating a rather inconvenient buoyancy problem. In the wrong place the resulting feet down posture could be a problem and given that the configuration prevents easy removal of the light the diver has no choice but to continue the struggle.

The inconvenience of removing and replacing a light located below the tanks should not be ignored. Some people are fairly adept at the procedure, yet it is nearly always a bit of a trick to secure the light properly. The greatest disadvantage to this effort occurs when the diver experiences a problem with the light such as a flooded canister, a line entanglement, or a failure of the attachment hardware. The butt mounted light is difficult to reach and therefore the above situations may create problems the diver cannot manage adequately. Smaller, yet other realistic criticisms of butt mounted lights include the extra length of light cord necessary and the elimination of a the crotch strap as an ideal storage location.

A longer light cord increases the difficulty of maintaining a clean profile as one must maintain an even more troublesome length of cord which can easily snag on rock protrusions. The last notable disadvantage to the butt mounted light is the clutter below one’s tanks. While many argue that the area below the tanks is a wasted area and therefore perfect for the primary light others have found this region to be an excellent area for all manner of equipment storage. A d-ring attached high on the crotch strap provides ample storage for items like reels and lift bags. Reserve scooters are also easily towed from this area. In addition, divers with diver propulsion vehicles (DPV’s) should appreciate the amazing efficiency possible when towing a diver holding onto a crotch strap. The speed and efficiency gained by towing a stranded diver from the cave is remarkable and may well make enough difference to allow an otherwise questionable exit.

Mounting one’s light to the tanks presents some very simple disadvantages. Very few individuals opt for this method as it is an awkward, high profile, low efficiency system. A light mounted on one’s tanks will create unnecessary drag, increase the risk of line entanglements, and eliminate the possibility of underwater removal. Single tank divers are often limited by the equipment they wear and many buoyancy compensators reduce the locations available for mounting a primary light. Occasionally these divers will mount the light on their tank with a fair degree of success. However, most people using the large style canister light are diving double tanks and therefore have more flexibility, and usually avoid mounting the light on the tank.

Many of cave diving's most prolific explorers have relied on the hip mounted canister, yet the general community has only recently began to embrace its advantages. Some people complain that a canister on one's hip gets in their way and that it does not allow for the same streamlining that a butt mounted light provides. The opponents of hip mounted lights raise a couple good issues and like many controversies there is a measure of truth to their assertions. However, the biggest issue revolves around two misconceptions. First, the claim that the hip mounted light is less streamlined is only partially true. Many people having problems with this style mistakenly allow the light to hang too far down on the waistband. The light must be close to the backplate and under the shoulder. This location keeps it from interfering with one's kicking and places it in the same water column already broken by the shoulder. In this location the light is quite streamlined and will not have a negative impact on the divers speed in the water.

The second misconception involves wearing stage bottles. Some people believe that a diver with a hip mounted light cannot efficiently wear multiple stage bottles. Again one should look at the explorers in the community to judge the validity of that concern. Most of the active exploration done in North America is done by divers with hip mounted canisters. These divers often carry two, three, four or more stage bottles and manage quite effectively. Most of these divers place multiple bottles on one side of the body. A double stage dive would be conducted with the two bottles on the left side of the body, opposite the light canister. This system allows a diver more flexibility as one arm is unencumbered. The diver may more easily pilot a scooter and often finds that they can work through smaller areas with stage bottles intact. It is common to place the first bottle to be dropped on the outside where it is more easily reached. If neither bottle is to be dropped the richer mixture is usually placed on the inside or closer to the hip as it is the last to be used. If another bottle is needed one can clip another bottle to a small d-ring on the light canister.

Reserve Lights

Reserve or back-up lights are undoubtedly an important portion of the overhead diver's equipment. These lights must be reliable, stream lined, and conveniently located. As mentioned each must have sufficient burn time to allow a diver to manage even a delayed exit. The common recommendation is for each light to have a burn time at least equal to the expected bottom time. Following a primary light failure the diver must switch to the reserve light and initiate an exit. The time spent on a reserve light should not be much greater than half the divers bottom time, however, a reserve light should provide more time in the event of a delayed exit. While the primary light should contain rechargeable batteries the reserve lights must contain disposable batteries. These batteries have a more reliable burn time and will provide consistent and predictable results. The reserve lights are rarely used but when used they must be reliable.

These lights could be stored in several places and some people advocate that they be secured to the tank. If this location is chosen one must clip the lights to a d-ring on the tank and tuck the light into some type of restrictive band like surgical tubing. Far too many people leave the lights dangle and yet claim to be

streamlined. Leaving the lights merely hanging form the tank is an unacceptable practice for the efficient overhead diver. Mounting one's lights on the tank does keep them out of the way yet some people consider they are kept too far out of the way. This location inhibits easy access, limits one's ability to see if the light has been knocked on and forces one to remove the light prior to turning it on.

When placed on one's harness below the arms reserve lights tuck neatly out of the way and are essentially snag free. A diver experiencing a primary light failure with no other divers immediately around will find that a light which can be turned on prior to its removal is rather beneficial. If dropped this light can now be easily retrieved. Also, one can activate the reserve light and leave it affixed while managing any other equipment issues. Lights located on the harness below the arms are easier to remove, easier to activate, easier to replace and do not require that one add additional equipment like clamps and d-rings to the tank.

Manifolds

A manifold is a device that combines the supply of two, usually back mounted cylinders. The manifold allows one to breathe off two cylinders at the same time. All of the newer manifolds allow the diver to place two redundant regulators on their twin tanks and to shut off either one while maintaining access to both cylinders. In this way a regulator failure does not limit the divers use of any air. The valve controlling the failed regulator is simply shut down and allowing the diver to access all the air via the second regulator. Many of the newer manifolds also allow the diver to interrupt the flow of air between the cylinders.

Manifold failure is often considered to be one of the worst situations an overhead diver could experience. A catastrophic manifold failure could leave the diver without air in a matter of minutes. Obviously such a failure is cause for concern. However, our concern is usually not very justified as failures especially the catastrophic type are very, very rare. The alert diver has several different options in the quest to avoid this unlikely scenario. One could choose to dive without a manifold and altogether eliminate the problem. However, manifolds seem to be the best method to manage one's air supply as they always allow access to both tanks and require no taxing gas management.

Two reasonable exceptions are solo diving and side mount. In solo diving the diver is without a dive buddy and therefore a catastrophic failure of their gas supply would be fatal. Some solo divers use a manifold and carry a spare cylinder or "buddy" bottle. This tank is usually of moderate size (roughly 80ft^3) and provides a redundant supply of air for the exit. Independent valves require that the diver pay stricter attention to the one third air rule by using one cylinder for one third of its volume and switching to the second cylinder to continue the penetration. Upon exhausting the second third from tank two the diver must began the exit, switching back to the first tank after another third is used. Any variation of this system could prove fatal in an equipment failure as the diver would lose access to the air in that cylinder and may have an insufficient supply for an exit. It requires great care and superior gas management capabilities to

effectively monitor independent cylinders and experience has shown that most people do not posses the necessary management skills.

In researching the manifold controversy the author was unable to discover one event in which a manifold failed catastrophically. It seems a poor trade indeed to exchange the very low probability of a manifold failure for the very high probability that one will on occasion bungle the gas management. Most divers that support independent use admit that even they succumb to the use of a manifold in deeper dives as the increased consumption further increase the likelihood of a miscalculation. Obviously side mount divers and to a lesser extent solo divers fulfill a very specific need with independent valves. However, if one is not pursuing these activities then it makes little sense to configure as if you are.

PROTECTING THE AIR SUPPLY

Inverting The Tanks

Many new cave divers are struck by the apparent foolishness of mounting the tanks so as to expose the manifold. Many a new diver has asserted how much more secure the manifold would remain were the tanks inverted. Alas, that too met an early death. Inverted tanks require all custom length hoses to reach the now greater distance. These hoses are inconvenient to route and manage. Perhaps even more compelling is the difficulty in donning the system for if the manifold is on the bottom then special devices must hold the tanks while they are being put on. In short, avoid the time and energy and resist this temptation.

Cages

Cages or other protective devices over the manifold (such as "cobra guards") tend to be somewhat controversial topics. Supporters maintain that the manifold must be protected from the abuse of collision. The cages provide ample security and are therefore, the argument goes, indispensable. Most opponents are not really against the thing they purport to accomplish but challenge their "success." If we hit the ceiling on a regular basis and conclude that a cage is the correct solution perhaps our logic is flawed or at least questionable. Perhaps frequent impact with the ceiling should encourage us to slow down a bit and improve our technique. We should be wary of substitutions to becoming a better cave diver. OK, so everyone hits the ceiling on occasion but how hard and at what risk is your manifold. While swimming your velocity is minimal and the risk somewhat inconsequential.

Perhaps the diver on a propulsion vehicle reaches a velocity that demands our concern. After all, it seems that even the relatively minor risk incurred justifies protection. The diver has a variety of choices yet all essentially boil down to two very similar styles. One of these options place a large dome style cage over the manifold. This dome appears to be solid protection but also has an annoying habit of wedging its owner in small places. Given the likelihood of a manifold failure most divers would much rather go cageless and remain flexible in smaller areas. As one long time prominent cave instructor relayed, "I thought

cages were the way to go until I wedged myself in a tight passage at over 3000’ of penetration. I thought for sure the end was near and upon escaping my first action was to remove the offending cage." The diver may also choose the smaller more streamlined version of the cage which substitutes curved metal guards above your regulators. These seem to be a panacea if ever there were one. Two people on two separate occasions were able to break their din regulators off at the manifold despite the presence of these protective devices. If, in fact, these devices are limited in their ability to accomplish what they were designed for than their large line catching profile seems to be far more a risk than a benefit. Again the emphasis should be placed on improving one’s technique. The manifold is a highly reliable piece of equipment that will provide even the most abusive cave diver with years of stalwart reliability.

Isolators

Isolators are nifty little inventions that respond to our desire for the cake after it was eaten. They are an excellent idea in theory, and in practice probably fairly decent. As long as one maintains an awareness of their strengths and weaknesses they remain effective pieces of equipment. They are, however, not necessarily the saving grace everyone has you believe. First, while they may provide a redundant option to isolate your cylinders, they are also another valve and just as likely to fail as the one you are circumventing. Be aware that due to the nature of their construction failure of your isolator will only allow one cylinder to be isolated thus protecting only a finite amount of your available gas. Furthermore, one must always guard against the common occurrence of valves that are inadvertently turned off during filling or safety drills.

The experienced diver can make use of the isolator to add one more line of defense against the loss of an air supply. However, all divers must be aware that a closed isolator could create problems. If the Isolator is closed prior to filling only one of the diver’s tanks would be filled. If the tank filled is the one hooked to the pressure gauge the diver may mistakenly believe their tanks are filled. The symptoms of this error depend upon which tank the pressure gauge is attached and which tank the diver is breathing from. If the gauge and regulator are on the same tank the diver will should notice a more rapid depletion of their air supply. If the gauge and regulator in use are on different tanks the gauge will continue to read the same pressure as one tank is depleted. Divers have breathed this one tank dry and mistakenly believed they were out of air.

Generally, these scenarios should merely result in a shortened dive but the wrong set of circumstances could render this rather dangerous. In addition, the isolator could be mistakenly shut off by a "buddy" during the pre-dive safety checks. The diver should experience the same symptoms discussed above and the aware diver will notice either the unusually rapid depletion of air or the strange permanence of the air supply. Of course, leaving your isolator open, remaining aware of your isolator before and after an air fill and checking it yourself immediately prior to entering the cave should eliminate these problems and allow the valve to work to your advantage rather than to your disadvantage.

Knobs

It is shocking how few divers pay any attention to the type of knobs found on their manifold. Most people seem assume that the manufacturer has their best interest in mind and would selfishly protect their safety, just like politicians. Rubber knobs tend to be the best choice. They are durable, shock absorbent, shatter proof, and easy to turn. Their only downfall is that if you have a manifold that has one post shut down upon contact with the ceiling then you must be concerned with the ease with which these valves turn. The highly resilient rubber Sherwood knobs will roll more easily then any other knob, yet they are also the least likely to fail. In addition, they actually appear to absorb some of the shock of the collision rendering it less damaging. The alert diver merely needs to make note of the shutdown risk and check the valve following any contact (a wise habit to develop regardless of the knobs used). Plastic knobs do turn less easily but are dangerous because they can shatter, leaving you with nothing to turn on or off. The metal knobs attempt to solve this and the auto shut off problem yet fall a little short because they can bend upon impact and be rendered useless.

Tanks

The wide variety of tanks currently available provide the diver with numerous acceptable choices. Most cave divers prefer the larger volume lower pressure steel cylinders made by manufacturers like Pressed Steel and Faber. These tanks generally have a working pressure of 2,640psi. Many wreck divers still prefer the high pressure Genesis tanks (3,500psi) but this trend seems to be changing. The lower pressure tanks do not mandate high pressure to achieve a reasonable air supply but allow for higher volumes when necessary. Overpressurizing these tanks, for good or bad, has been a common practice in the cave community for more than two decades. The Genesis tanks are manufactured under a more precise system and the manufacturer warns that overpumping would be dangerous.

The tank one chooses should depend on your size, your needs and your available funds. Do the cave and yourself a favor and really evaluate your needs. Most people will find that 95ft^3 tanks are sufficient. These tanks are reasonably light and fairly priced. However, for longer dives or larger people 104's are a popular choice with the larger 121ft^3 also gaining popularity. One should also be aware of the manner in which a tank was galvanized. Some manufactures spray galvanize their tanks which does not always provide a consistent coat leaving them more prone to rust. Other manufactures "hot dip galvanize" their tanks creating a more even coat that significantly reduces the risk of rusting. Dolphin tanks and Press Steel tanks are the most popular "hot dip" tanks on the market.

The weight of the tanks, both full and empty, remains an important consideration for divers in all environments. The tanks must remain negative enough to prevent the diver from becoming positive during the dive. Some tanks are fine when full but the depletion of air leaves them too light to provide ample weight. One must insure that even empty tanks will not cause a rise to the

surface. If necessary extra weight should be added to prevent the diver from floating. Indeed an emergency air sharing episode that depleted most or all of the divers air could cause them to float to the surface unintentionally, ignoring hours of decompression. One may offset this problem with a conventional weight belt or even more preferably with weight placed behind the backplate where it will be completely out of the way. Most divers in wet suits and fresh water need no additional weight, yet everyone must evaluate this very important variable for themselves by testing their buoyancy with empty tanks.

The Harness And Backplate

Historically divers have bolted a backplate to the tanks with a buoyancy compensator sandwiched between. This system provides a continuous loop of 2" webbing woven through a rigid backplate. Many people have replaced the common metal (usually aluminum or stainless steel) backplate in favor of a strong plastic plate. Still another evolution has been the development of a soft backplate and harness. Some divers insist upon the need for a redundant BC to provide lift. While many people merely use two of the standard style compensators, manufacturers have responded to the demand for redundancy with a dual bladder BC.

While the majority of experienced cave divers continue the use of the standard backplate many new divers are opting for the newer soft pack. Commonly divers buy the newest of the available equipment assuming that any changes to a system must be improvements. The evolution of different types of harness systems is really more complicated than simply being an improvement over previous designs. Certainly one of the most hardened realities is that manufacturers make money by expanding their product line. New products yield more profit and slick new designs will often encourage people to commit to another purchase. In addition, as technical diving becomes profitable more companies vie for a share of the proceeds further increasing the variety of available options. The educated buyer should appreciate this variety as it allows one to choose the system that best suits their needs. However, one must truly be educated in the many subtle variations within the wide spectrum of equipment choices.

The evolution of the plastic backplate was probably a response to a number of factors. However, the diver need only consider the net result of this change. The plastic backplate is lighter and some see this as an advantage while others see it as a failing. Many divers need weight to sink or to compensate for the change in buoyancy caused by a consumption of air during the dive. If one needs additional weight then a lighter backplate will further increase the weight one must wear. In fact, many divers place weight under the backplate or use heavier stainless steel backplates to reduce or eliminate the need for a weight belt. Divers using a plastic backplate also may break the plate, a situation that may be rather distressing if one began to lose the tanks. While breaking a plastic backplate is extremely difficult it is possible. The only real advantage plastic backplates provide is the reduced wear on the divers webbing. Metal backplates can over time wear away on diver’s webbing. However this is a slow and gradual process that merely results in the need for replacement when the

damage becomes prominent. The plastic backplates do in fact reduce this problem but also force the diver to be creative in their use of weight buckles to prevent the webbing from slipping and changing the fit of the harness. Most of the communities seasoned pros prefer the stability and weight of a metal backplate and prefer to replace the webbing every several years. One must be wary of solutions to small problems that create significant hazards.

The once common continuous length of webbing that dominated the diving harness is now often replaced with quick release buckles and two piece webbing. If one were to ask a climber to use a plastic quick release clip to secure them to a safety line the response would probably be entertaining. Yet, that is essentially what many new divers unwittingly request. Quick release straps seem easy to remove because they are. They also may release or break at the wrong time. Most seasoned divers cringe at the thought of losing the tanks from their back as should all newer divers. In many cases this loss could prove fatal as the diver clings to tanks whose negative tendency stands in stark contrast to the divers positive tendency. It is possible to use double end bolt snaps to secure these clips yet this is unnecessary if one maintains the use of a one piece webbing.

The evolution of the soft backplate was initiated with the release of Diverite's Transpac. A phenomenal seller, the unit fast became a popular system for new divers. The Transpac and its peers are not necessarily an improvement in existing technology but rather indicate a shift in ideology. The early harness and backplate were designed to securely hold the divers tanks close to the body. Heavy cylinders must fit snugly or they will move on the divers back effecting trim. The Transpac substitutes a soft pack and reinforcement plates for the rigid backplate. The most highly touted advantage to this system is the comfort of the soft backpack. Interestingly enough these new systems began to incorporate quick release buckles and nonadjustable d-rings, items historically scorned by the community. These systems often use fixed d-rings occasionally allowing a couple of the 10-15 d-rings to be adjusted. These systems can be fairly comfortable and some people assert that they find their injured backs are less strained by the system. However, these systems are much bulkier, increasing one's drag and profile, with more d-rings than anyone could really use. The d-rings are smaller and in some instances somewhat triangular reducing their usefulness. The sewn rings are also more difficult to find by touch as they move around much more than the fixed d-rings of the older harness. Many divers seem to be very happy with these systems, however those that go on to work with multiple bottles often return to the more stable and lower profile configuration of the standard harness system. Given that most divers already wear a quarter inch or more padding in the form of a suit the newer harnesses seem to provide what few people need and sacrifice the stability and cleanliness so prominently a part of the early cave diving systems.

Weighted down by more than 100 pounds of equipment, many divers believe that they must have very large buoyancy compensators. In fact, many divers use BCs with as little as 45 pounds of lift while others insist upon dual BCs with a combined lift of 160lbs. Obviously, one's dry land weight is inconsequential and a BC with 55lbs is usually enough to float nearly any diver. Many divers

overweight themselves and then maintain a large reserve of air in their BC. Air in the BC. merely increases the drag resulting in a higher level of energy expenditure. Some divers insist on a reserve BC while others feel they are unnecessary. Generally the consensus is that while diving wet in an area with a deep or nonexistent floor (i.e. ocean or large cave) a redundant BC is a good idea. Many people feel that a diver diving a dry suit could use the suit for emergency buoyancy. This assertion is quite reasonable but should be practiced to determine one's proficiency.

In response to the technical divers concern over a loss of buoyancy several manufacturers have incorporated two bladders into one casing. These BCs have redundant exhaust valves and inflator systems. One should be wary of connecting both inflators at one time as a small leak from the inflator could continue adding air to the unaware divers BC. As the diver becomes more positive they will usually try to empty their primary BC remaining unaware of the secondary inflation. If the diver is unable to correct this problem quickly enough they may find themselves at the surface experiencing any number of maladies. The redundant BC inflator should be tucked away but within reach so that in the unlikely event of a failure an inflator can be connected. The spare inflator can be connected to the hose previously controlling the failed BC or to a hose attached to the corrugated hose but not connected to the power inflator.

Several of the new style BCs have become known as bondage wings because the contain numerous bands of flexible material that restrict the size of the wings and theoretically decrease their drag. When the BC is inflated the bands should stretch and allow the wings to fully inflate and when the air is released the bands shrink down the excess material of the BC. If one desires to use this system they must attach the flexible bands when the BC is inflated to insure that the bands do not prevent full inflation. The BC. should then be checked in the water to insure that the overpressure relief is not prematurely activated. Opinion, of course varies on the desirability of the system. As the wings get larger measures are taken to reduce their drag. Many divers still opt for the smaller size, eliminating the concern altogether.

The astute diver can make some fairly simple changes to their BC that will increase its ease of operation while also extending its longevity. First, one may cover the inner bladder with inner tube to protect its somewhat fragile design. The Seatech and ProSub BCs have a tougher casing then the early Diverite and are therefore less prone to puncture, yet the protective tube can be used for any style BC. The corrugated hose on nearly all BCs is far too long and is often impossible to streamline due to its length. By obtaining a much shorter corrugated hose and coupling it with a custom inflator hose the diver can significantly improve the cleanliness of their system. Finally, one should check all fittings on the BC and insure that they are secure. In some cases manufactures use one wire tie to secure the corrugated hose while a clamp would be far more secure.

Gauges are necessary pieces of equipment but people often succumb to the "more is better" philosophy. Two timing devices should be more than sufficient for anybody's needs. The gauges should be wrist mounted so as to avoid bulky

consoles and the resulting dredging effect they create. One's pressure gauge should be free from a bulky console and mounted in a clean but accessible area. A pressure gauge that is clipped to one's belt keeps the chest free from clutter and limits the items you will potentially drag in the mud. The advent of hoseless gauges promises to solve all these problems yet like most cure-alls I remain patiently optimistic but as yet remain unwilling to bestow all my air management faith in their reliability.

The Body is the central component to any effective diving locker and no discussion of equipment would be complete without giving it a mention. Many debates have revolved around the necessity of fitness in diving and no doubt these debates will continue for years to come. It seems that the most reasonable course would be to evaluate the type of diving to be done and adjust your level of fitness accordingly. The average diver should be seeking good cardiovascular fitness with aerobic activity- at least three days a week for a minimum of 20 minutes. However, good fitness can serve you in life as well as diving and a thorough fitness routine will leave you more prepared for the rigors diving can produce.

A person winded by a flight of stairs can certainly dive but their ability to manage stressful, air critical situations is limited by their physical response to elevated exertion. This may seem inconsequential in a leisurely dive but in an emergency it can make all the difference. Certainly excessive exercise could be a potential liability as scar tissue accumulation at the joints could reduce circulation. However, too much exercise is indeed a rare commodity.

Conclusion

The next decade of diving will undoubtedly be full of excitement and prodigious change. Undoubtedly equipment advancements will continue and many exciting advancements are bound to grace the diving world. Yet, regardless of the level of change beyond the year 2000, two things will undoubtedly remain constant. There will always be new equipment for people to obsess over and there will always be people arguing over how that equipment should be configured.

The preceding discussion attempted to shed light upon some of the basic tenants within the Hogarthian equipment configuration. As pertains to equipment more is rarely better and the Hogarthian diver be grudgingly makes additions to this minimalist attire. One should not take from this discussion the impression that safety equipment is dispensable and that the Hogarthian diver intentionally accepts additional risk. Quite the contrary the Hogarthian diver attempts to remove all possible risk by designing a holistic life support system that facilitates every dive. The risk should after all be a function of the environment and not the divers state of preparedness.