Leigh Cunningham

Redundancy ethic? Don't be dead – be a double bagger!

Double Bagging for Divers

Leigh Cunningham is the technical manager and TDI Instructor Trainer for Ocean College, Sharm El Sheikh.

Probably best known for his records - Leigh once held the record for the deepest dive in the Red Sea - and attempts of reaching extreme depths, he also has a wide range of teaching credentials to his curriculum:

TDI instructor trainer, DSAT Tech Trimix instructor, PADI MSDT IANTD Technical diver instructor CMAS 3 star instructor.

In the world of technical diving, a direct ascent to the surface is not an option if you run into a problem or emergency. For this reason, technical divers are required to carry back-up systems to resolve problems associated with equipment malfunction during a dive.

But what about the rest of us?

Text by Leigh Cunningham
Photos: Craig Nelson

Better be safe than sorry. This old adage certainly applies to diving too, and in this case redundancy pretty much translates into having a back-up for all important systems. After all, diving is supposed to be fun and a means of having adventures that enrich our lives, not something that will make us lose it.

Fortunately, there are a lot of good lessons and readily applicable techniques to be learned from the world of technical diving, that can make diving much safer, without being a real bother or overshadowing the experience. Using a seat-belt when driving a car has become second nature, as is carrying a spare tyre in the trunk. We will probably never, or rarely, actually have need of them, but when needed we surely appreciate these simple measures.

But here the similarities between driving and diving stops. Running out of gas when driving a car is mostly just an embarrassment and inconvenience, but for a diver it can obviously have dire consequences.

The meaning of redundancy In dive-speak, redundancy usually translates into having double tanks, double regulators, double this and double that. But what does redundancy really mean? The dictionary give us the following definition.

> **Redundancy**, in general terms, refers to the quality or state of being redundant, that is: exceeding what is necessary or normal, containing an excess. This can have a negative connotation, superfluous, but also positive, serving as a duplicate for preventing failure of an entire system.

The last sentence in the above definition is interesting, because it raises a very important question, also in terms of diving: When is something superfluous, and when is it an important safety measure 'preventing failure of an entire system'? Most of us will probably agree that using a heavy double tank rig for a shallow water dive is overkill, and we wouldn´t be bothered. But as we go gradually deeper and longer, we will also approach a point where a double rig becomes a very useful piece of equipment and a safety measure

So where is this point? Turning once more towards the above definition, *the entire system* refers not just to the mechanical equipment but also to the diver, along with his or her training and ability to cope with critical situations. For this reason, when to use then becomes a somewhat subjective and individual question. It is not, however, just a matter of what the diver can safely handle but also a question of mental comfort during a dive. Diving, we should not forget, is also about having a good time. Simply bringing the extra equipment - even on dives that do not venture into those depth zones where conventional wisdom would deem it absolutely necessary – means more than just additional safety. Just as importantly, the feeling of having that extra safety also translates directly into making the dives far more enjoyable. Because, while it doesn't lower any alertness, it does remove the latent stress-loading of *what if...*?. And this is certainly worth taking into consideration.

Being more concrete So, are there no absolute criteria as to when one should wear back-ups? Absolutely! For starters, with any kind of diving that carries a decompression obligation, and diving in overhead environment obviously qualifies, as set forth by various training agencies. But before it comes to that, why not make it a policy always to have a sensible margin of safety, and always use redundant systems for any diving close to the NDL limits or beyond, say, 30 meters?

What is needed? Regarding deeper dives, or dives with long bottom times, redundancy means diving with twin tanks and two sets of regulators. These tanks may either be independent or, which is more common, connected by a manifold. In either case, if there is a regulator malfunction on the bottom, there is a back-up system which can be switched to.

Size matters The tanks should also be big enough, not only to carry enough gas to complete the planned dive, but also to give an ample reserve supply to

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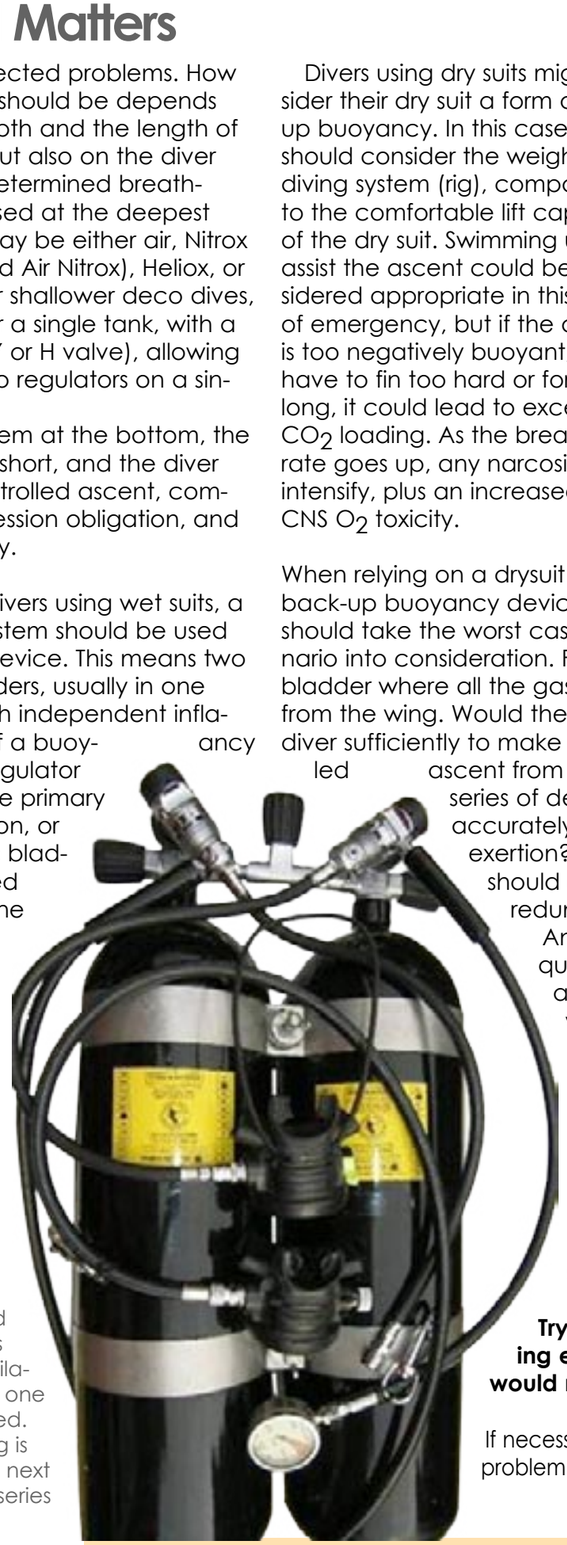
handle any unexpected problems. How big this gas supply should be depends not only on the depth and the length of the bottom time, but also on the diver and a previously determined breathing rate. The gas used at the deepest parts of the dive may be either air, Nitrox (aka EANx, Enriched Air Nitrox), Heliox, or Trimix. For shorter or shallower deco dives, divers might opt for a single tank, with a redundant valve (Y or H valve), allowing the diver to use two regulators on a single tank.

If there is a problem at the bottom, the dive would be cut short, and the diver would make a controlled ascent, complete his decompression obligation, and finish the dive safely.

Buoyancy: For divers using wet suits, a redundant wing system should be used as the buoyancy device. This means two independent bladders, usually in one outer shell, and with independent inflators. In the event of a buoyancy problem, i.e. the regulator supplying gas to the primary bladder, malfunction, or a problem with the bladder itself, or ruptured inflator hose, etc, the diver would switch to his back-up bladder, make a safe ascent, complete the decompression obligation, and finish the dive.



Twin tanks, manifold and two regulators with hoses routed so that both lift and breathing gases are always available - even with one first stage closed. Hose routening is the subject of next article in the series

Divers using dry suits might consider their dry suit a form of back-up buoyancy. In this case, divers should consider the weight of the diving system (rig), compared to the comfortable lift capacity of the dry suit. Swimming up to assist the ascent could be considered appropriate in this type of emergency, but if the diver is too negatively buoyant, and have to fin too hard or for too long, it could lead to excessive CO_2 loading. As the breathing rate goes up, any narcosis would intensify, plus an increased risk of CNS O_2 toxicity.

When relying on a drysuit as a back-up buoyancy device, one should take the worst case scenario into consideration. For example, a split bladder where all the gas is abruptly lost from the wing. Would the dry suit support the diver sufficiently to make a safe and controlled ascent from depth, through a series of decompression stops, accurately and without over exertion? If not, the diver should consider using a redundant wing system. Another important question is, whether a well worn dry suit with weak seals will be able to retain a sufficient volume of gas for a safe controlled ascent. If the dry suit has sufficient lift, then having a redundant wing system seems pointless.

Try to avoid carrying equipment, which would not be used.

If necessary, simulate the problem in shallow water with near full tanks. Dump wing gas, and see if you can establish neutral buoyancy using the dry suit alone

Spare mask can easily be carried in a pocket

Depth and time monitors

(Depth-timers): In this day and age of multi-gas Air/Nitrox, and mixed gas computers, divers have the luxury of having a continuously re-adjusted schedule with them on the dive, based on exactly what they are breathing,. When using Depth-timers, or computers in gauge mode, divers should carry back-up tables to have a schedule outside the primary plan, in order to handle any emergency causing a digression from the primary plan. Even those divers who use multi-gas computers, might opt for the additional security of back up tables and plans.

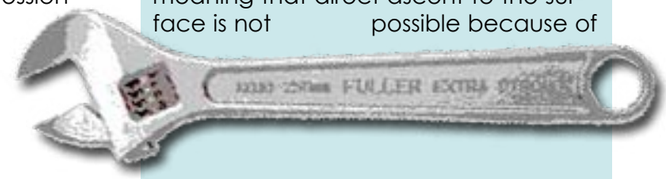
The down side of multi-gas computers is, they may encourage technical divers to rely on the ability to make new plans on the fly (during the dive), instead of making a structured depth and time plan before the dive. In spite of the risk of being considered old fashioned, I think it is safer to make a structured plan and do the required calculations using an appropriate decompression software before the dive, and consider the deco schedule, as generated by the multi-gas computer, as a bail out option.

Whichever system you chose, multi-gas computer, Depth-timer or computer in gauge mode, you need at least two to accurately finish the dive in the event one malfunctions.

Men in Black?

What is technical diving?

Some people define technical diving as diving in "overhead environments" meaning that direct ascent to the surface is not possible because of



a decompression obligation requiring decompression stops and/or a being inside a cave or a wreck.

The late Robert Palmer, once one of the gurus of technical diving, defined it as "the use of advanced and specialised equipment and techniques to enable the diver to gain access to depth, dive time, and specific underwater environments more safely than might otherwise be possible"

Mask: This is probably the most unlikely item of equipment you will have a problem with. But for any kind of dive that takes you into deep waters or a decompression schedule, you should certainly bring two. I can talk from own experience, as I once lost a lens during a dive. This was due to a hairline crack in the frame of the mask, which went unnoticed at the surface before the dive. The back up mask came in most useful, enabling me to read gauges, whereby I could ascend at the correct rate, perform accurate stops and finish the dive safely.

These artistic expressions might seem funny to some people but it gets to the point when required. The boat crew know who the diver is below it, and the face's and colors are descriptive.

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Reel and SMB (Surface Marker Bouy). These are very useful tools in all environments but let's talk open water. For open ocean drift decompression diving, deploying the SMB during the ascent, the diver creates a form of reference along which specific ascent rates and a complicated deco schedules are much easier to carry out accurately. The divers simply hangs under the SMB by being slightly negatively buoyant, and reeling up at the right time. The SMB also allows the boat and support team to track divers doing a decompression drifting under the buoy.

In an emergency, an SMB could also act as an emergency signalling device. For example, a red SMB could be a signal to the surface support team that everything is OK. If the diver suddenly has little or no gas, a differently coloured emergency SMB could be sent up as a signal for a support diver to bring additional gas in the water, or to see what the problem is.

The reel is also very useful on the bottom to ensure a safe return to a specific ascent point in low visibility. The diver simply ties the end of the line to the anchorline or downline.

Minimum. A minimum requirement would be at least one reel, and two SMBs. One SMB to let the support team know the dive is running according to plan, and one as an emergency signalling device. When doing drift decompression in the open ocean, it would be wise to take a back-up reel too.

Lights: In overhead environments, where dive-lights are necessary, back-up lights would fall under the redundancy ethic.

In short, any item of equipment used to conduct the dive safely, and which could possibly malfunction, should be duplicated with a appropriate back-up system

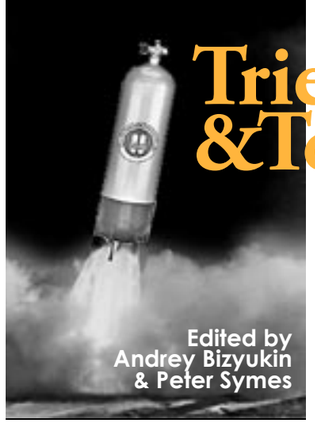
Summing it all up For the recreational community, where divers are staying within no-deco limits (NDL), the redundancy ethic does not apply with the same degree of necessity as it does for the technical or decompression diver. The non-deco diver can always, at any point during the dive, make a controlled ascent directly to the surface without stopping. *However,* while there are no clear-cut criteria as to when a diver should start to carry redundant systems, it is certainly something the advanced recreational scuba diver should look into as means of improving both safety and technique. In the event that a diver runs low, or out of gas, while his dive buddy is outside comfortable swimming range, an intermediary form of redundancy might be used in the form of a pony bottle, i.e. clamped to the side of the main tank, or a small spare air cylinder clipped to the BCD. However, a word of caution seems to be appropriate here. Divers are often seen to be putting more and more distance between buddy teams during a dive, or pushing past the accepted depth limit of 40 meters set forth by most recreational scuba agencies. They are, perhaps, relying on these stop-gap measures, which are of questionable value, if not outright inadequate, should any real emergency occur. In such situations, nothing can substitute the mental readiness stemming from having undergone some sort of advanced training and using redundant systems.

Think about it! ■

Next issue: *Kit configuration, streamlining and hose routing*

Double bagging

There are several explanations for where the expression *double bagger* comes from, but it is actually a piece of British Army slang. The idea is, that if a lady is hard on the eye, you need to put a paper bag over her head before you can get intimate with her. If she is really hard on the eye, you will want to have a second bag close at hand, in case the first one breaks. So, a double bagger will always have two bags ready – just in case. Not very PC, but it's history.



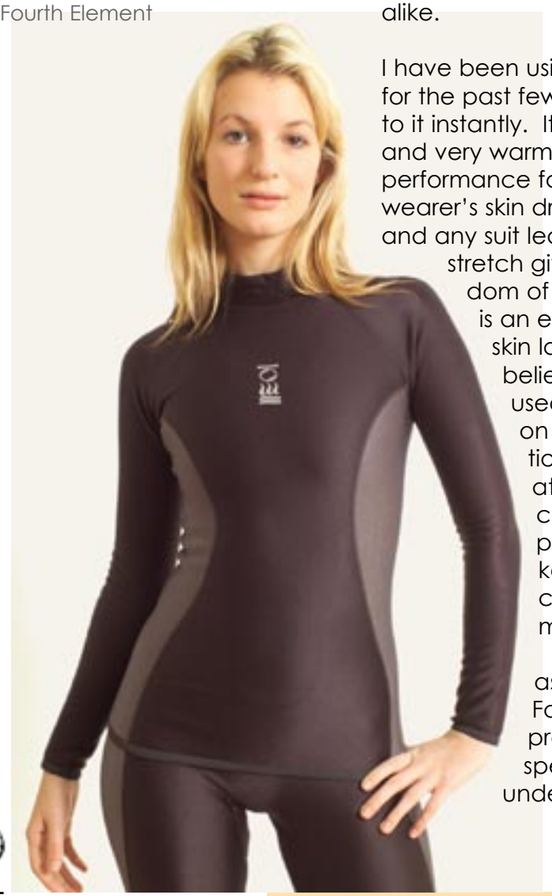
underwear

Thermocline

By Kevin Gurr

New undergarment from Fourth Element has been heralded as not less than a revolution. Well, is it?

Productshots are supplied by Fourth Element



Fourth Element launched itself into the diving industry in 2001 with the intention of developing an innovative range of technical clothing designed to combat the problems of thermal regulation in scuba diving. After lengthy research and development, their first product was the Xerotherm, a drysuit base layer undergarment that was extremely well received by technical and sport divers alike.

I have been using the Xerotherm for the past few months and took to it instantly. It is well designed and very warm and uses high performance fabrics to keep the wearer's skin dry from perspiration and any suit leaks. It's four way stretch gives complete freedom of movement and it is an excellent next to the skin layer whose warmth belies its weight. I also used it under a wetsuit on a recent expedition; even in a situation where it was completely wet, it performed very well, keeping me significantly warmer and more comfortable.

So, when I was asked to review Fourth Element's products designed specifically for use underneath wetsuits, I was really interested to see how they would have modified their approach and keen to test them as part of my cave diving equipment.

On initial inspection, the Thermocline garments have a more glamorous look to them than the black Xerotherm. Shiny or rubbery, they look like something from a Bond movie. The designers at Fourth Element have obviously put some time into the design of these garments so that they look good, but it is in their use of the fabric that the innovation shows.

Polartec fabric

Fourth Element has used another high performance fabric from Polartec, specially developed for water sports. Weight for weight, the fabric has the equivalent Thermal performance of 2.5mm neoprene, yet it is neutrally buoyant. This is significant for all divers looking to add some extra thermal protection without the need for additional lead. It has a fleece lining against the skin which has similar wicking properties to the Xerotherm fabric but this is bonded to a waterproof yet breathable membrane. This membrane makes the Thermocline fabric windproof and warm.

Antimicrobial

The fabric has an antimicrobial treatment to resist the build up of odours, but the garments are machine washable, making them easy to keep clean and smelling fresh. The Thermocline garments have two different outer finishes on top of the membrane. The shell finish has a woven nylon outer face similar to that of double lined neoprene and the skin finish has a smooth surface rather like rubber, which Fourth Element says is ideal underneath a wetsuit or semidry as it gives a very good seal against the inside of a suit.

There are several garments in the Thermocline range including short sleeved tops, vests, shorts and even a ladies' bikini. I tested the short sleeved raglan top and the men's shorts.

The Thermocline garments were extremely comfortable and gave excellent freedom of movement. Most significantly, they were warm and I could imagine many tropical applications where diving in just the Thermocline would not only be possible, but also desirable from the point of view of comfort and neutral buoyancy. It would also make a very good pool suit for training situations, being breathable above the surface and warm in the water.

I tried the Thermocline in two caving stuations. The first was in the Red Sea on fairly long dives of up to ninety minutes. I wore the Thermocline underneath a knackered old Cressi semi-dry which has more holes than it should. Much of the insulation work was being done by Fourth Element's undergarments and I was extremely comfortable and warm. The neutral buoyancy of the fabric meant that I needed no extra lead and had no changes in buoyancy with changing depth due to changes in the fabric.

Who's testing?

Kevin Gurr has been a leading figure in the technical diving community for more than a decade. He was the the first technical and cave instructor to be qualified in Europe and headed the IANTD in UK 1992-2004. Authored the acclaimed Technical Diver Student Workbook with Tom Mount as well as two workbooks for the Technical Diver and the Normoxic Trimix programs. Leader of numerous successful diving expeditions that include the Britannic and the Pilar Project, Kevin Gurr also heads up Delta P Technology, manufacturer of the successful VR3 and VR2 air and mixed gas dive computers. **www.vr3.co.uk**

After the dive, the speed at which the undergarments dried was fantastic. By the time I had got out of my wetsuit, the inside of the Thermocline had dried. The fleece is made using a hydrophobic polymer which does not hold water, which runs out under gravity. With so much less water next to the skin there was much less wind chill and the garments had dried within 15 minutes or so of wandering around the boat.

The breathablility of the fabric should not be underestimated when out of the water – it is much less sweaty wearing a Thermocline top than a neoprene vest or shorty wetsuit so you can keep it on between dives. It is also easier to keep clean. Simply rinsing in fresh water and hanging it up for a few minutes is all that is required during a dive trip and afterwards the Thermocline garments can be washed in the washing machine. The second test was a little more demanding of the thermal performance of the Thermocline garments. Caving in Swildons Hole in the Mendips, I used the same arrangement of the Fourth Element undergarments under my Cressi semi-dry. In air temperatures of 15ºC and water temperatures of about 5ºC, I was much warmer than I had anticipated, I did not feel the cold of the water and I have to put that down to the Thermocline as I know all too well that my old semi dry has lost its integrity.

Criticism

My only criticism of the Thermocline range is perhaps in the sizing which is a little on the tight side particularly around the shoulders – anyone thinking about buying it would do well to get some good advice about sizing from the manufacturers or retailers before purchasing. I raised this with Jim Standing at Fourth Element and he said that they would be working on making the sizing more consistent for future products.

At the same time I also suggested to him developing a long sleeved and long legged product to give more protection to the arms and legs. A long sleeved top will be available soon, he assures me and full length legs will follow.

Until then, the Thermocline Raglan top and shorts are an excellent way to increase the thermal protection of the body core and the vest and shorts combinations would also provide core warmth with just a little more freedom of movement in the arms. I believe this would be an excellent addition to most divers thermal protection systems, from technical cave divers to those who prefer more tropical conditions and just want the best in comfort and performance.

Sample prices

M Thermocline long sleeve top £65.00
M Thermocline shorts £45.00
W Skin Thermocline vest £48.00
W Shell Thermocline short £35.00

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