Free Flow

The magazine for LSAC

May 2005
Issue 88

In This Months Issue

Cover Photo Courtesy of E. Litchfield

Free Flow

Free
It should be

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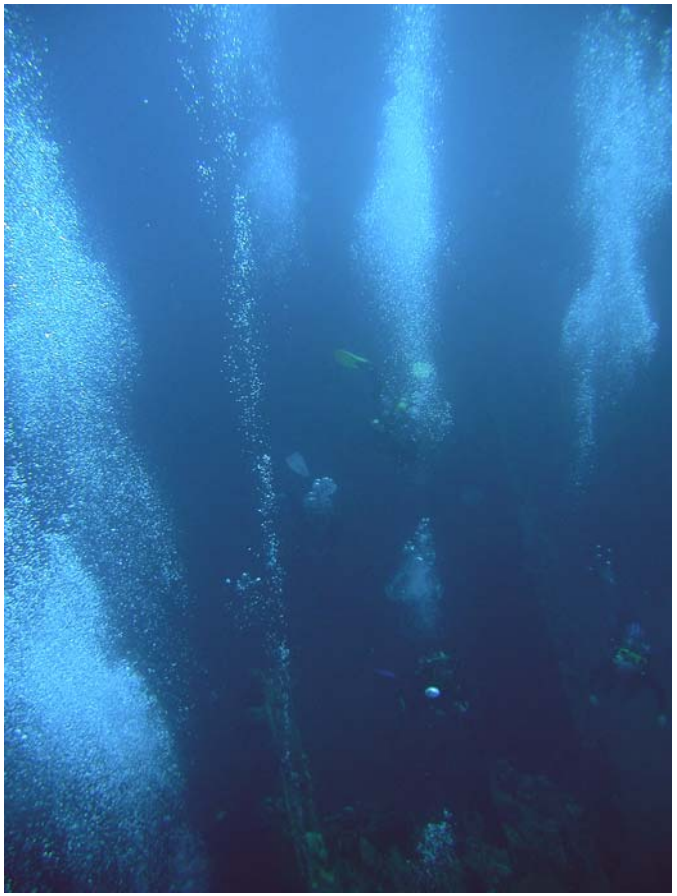
Editors Bit...



Just a little reminder for those of us playing on the Trapeze

A little while ago I came across some interesting items on AAS and Octopuses and have been waiting an opportunity to include in Free Flow. So have taken the plunge and put them all together in an unusual Free Flow.

I was going to call it a Special edition but after last months Special Edition I thought too many Special's means it's not Special any more. After all this is a quality publication, we must keep up the standards. Just because we sometimes get lavatorial overload don't mean to say its Pants !

Pete

Page 3 Luvlies

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This months luvlies demonstrate a perfect example of search and recovery followed by diver rescue. Daz expertly recovers his dropped computer then pretends to be a flounder so that Dave can hone his rescue skills. A fine example of BSAC training at it's best. Well done to both of you.

If you would like to become Miss or Mr June or know someone who should be, then please email me with the photo and a brief description of why the person should be a page 3 lovely.
pete.barnard@power.alstom.com

Wanted

Chairman Bill

Have you seen this man last seen heading South on M5 after Easter trip to Loch Fynne.

Club members are becoming increasingly concerned having missed Jon's happy smiley face Chairing the Tues. meetings.

If you have any news of his where abouts (or any good gossip) please inform his friend and colleagues at LSAC (or the Ed with the gossip)

There is a substantial reward for finding and retrieving our beloved Chairman. I'm not sure what the reward is but I'm sure its substanstial

Diving Officer's Report

Hello all

We are now just entering the main dive season and the next trip is next weekend to Plymouth. A lot of the trips are filling if not already fall, so if you are planning to do some diving then book now to avoid disappointment. The link below will take you to the trips page on the web

http://www.netcomuk.co.uk/~lucyht/Lsac/currenttrips.htm

Whilst on the subject of diving and diving related activities we have provisionally announced the dates for the Boat Handling and Diver Cox weekend

For those of you who have not completed a boat handling course you do not need to have any diving qualifications or previous boat handling experience. The weekend is very much aimed at teaching you the basics, including chart work, a little bit of theory and a lot of practical sessions. It is a fun weekend

For those of you have already completed your boat handling course you need to get a bare minimum of 5 hours behind the wheel

You will need to have practised dropping off and picking up of divers. Slow manoeuvres as well as driving the boat on the plane in different conditions.

Ideally 15 hours of experience or more would be of benefit. If you wish to venture on and carry out this test we will put together some sessions on GPS, chart work, Knots etc prior to you taking the test.

The course will be held down at the Mount Batten Centre in Plymouth and I suspect the costs will be around about £130 including B&B (this does not include beer tokens or meals)

If you are interested in attending then a place can be secured by paying a £25-00 deposit to Ian Jennings. Places are limited so don't hesitate, and the sooner the deposits are in the sooner I can book the accommodation, always a bonus in November.

The use of Octopus and kit configuration has been included below, it is an interesting read, please take note of it. If you wish to read the full HSE report then follow the link below
http://www.hse.gov.uk/research/rrpdf/rr341.pdf

I contacted BSAC to get there stance on the report and they have issued the following statement

Response to HSE Press release ' Performance of Octopus regulators for Scuba Diving'

The BSAC has for many years advocated diving with the minimum of a suitable octopus rig.

The advice contained in the HSE Press Release concurs with BSAC advice concerning the best combinations of primary and octopus regulators.

The BSAC fully supports that further risk control can indeed be gained by carrying separate gas supplies with suitable independent regulators.

Divernet News, dateline 27 April 2005

HSE warns against octopuses on cheap first stages

Test results confirming that octopus rigs can lead to breathing difficulties under certain circumstances have been published by the Health & Safety Executive.

Key areas of concern are where an octopus set-up, in which two second-stage demand valves operate off a single first-stage regulator, is based on a less expensive, lower-performance first stage; and where the second stages feature either inefficiently old or inappropriately paired units.

The HSE commissioned the research following difficulties experienced by some divers using second stages as octopus rigs in emergencies. Dual hyperbaric breathing simulators to test a number of octopus configurations, at varying ventilation rates, depths and air supply pressures.

"The research found that the performance of a first-stage regulator is a vital factor when determining the performance of a complete system, and that reduced breathing performance was experienced when using low cost/performance first-stage regulators compared to high cost/performance models," says the HSE.

"In addition, tests showed that the poorer performing demand valve of any octopus pair will experience a greater loss of performance with increasing depth and ventilation rate when compared to the better performance valve."

It was recommended that a high-performance first stage should be acquired if an octopus rig is to be based on it. Any two demand valves set up as octopus partners should be of similar performance. Older valves, or ones where performance may have degraded, should not be used.

Although octopus rigs are used by most divers, the HSE stressed that they are best avoided altogether when considering emergency arrangements.

"HSE recommends the use of a completely independent secondary gas supply system, for example a pony cylinder set-up," said Chris Sherman, Chief Inspector of Diving. "That way, if there is a problem with the octopus system or if a buddy pair become separated, divers have a much increased chance of survival in the event of running out of air."

An alternative is the twin-cylinder set-up, which works well for the wearer, though not of course for another diver if separation occurs.

The HSE report, Breathing Performance of 'Octopus' Demand Diving Regulator Systems, are available from HSE Books, tel. 01787 881165.

A special DIVE report into alternative air sources

We've all used one in training, we all know why we carry them, but are we really prepared to use our alternative air source in an emergency? And if we do, will it actually work?

Running out of air is one of the primary causes of diving incidents and deaths. Out-of-air emergencies happen, regulators do fail, and there's no reason it won't happen to you. All divers need to be able to choose the right back-up system for their type of diving and they need to practise using it.

DIVE carried out a series of tests with a large group of divers in Gibraltar – some were relatively inexperienced, many were highly-qualified instructors. The results revealed that great care is needed in picking the right alternative air source and far, far more practice is necessary for using one.

OUT OF AIR

You're nearing the end of your dive and suddenly your buddy swims up to you, arms flailing and eyes like saucers. He's out of air and you have to deal with it. If you're recently trained, or practise regularly, there may be no problems – but how many divers regularly practise safety exercises? If your response isn't immediate, you can be sure the situation will get worse.

We video-taped two days' footage of ten buddy pairs simulating an out-of-air emergency. On day one divers were paired with familiar buddies, on day two we mixed them up, and in most cases we paired people from different training backgrounds. They were asked not to discuss the exercise before the dive, but just to get into the water and carry out the simulated emergency. The results help to build a clear picture of the problems that can all too easily be encountered.

What we learned

Confusion over signals: The absence of a standard signal led to a communication breakdown. The BSAC divers indicated 'out-of-air' with a chopping action to the throat. The PADI divers did it by drawing their hand across the throat – this was interpreted as a danger signal by the BSAC divers.

Inadequate signals: Alarmingly, we observed inadequate signals from almost half the divers taking part in the tests. Only 40 per cent used an exaggerated motion that would have been easy to interpret in low visibility.

Most of the divers delayed their ascent unnecessarily: As soon as two divers are breathing from one cylinder they must begin their ascent immediately. We expected to see a fairly straightforward ascent to the surface from our test divers. What we actually saw was nothing like that – 50 per cent of the pairs delayed their ascent for an unnecessary period of time. In two cases no ascent was made for more than two minutes – a serious waste of air.

Most of the divers failed to form a good grip: It's vital that both divers get a secure grip of each other as quickly as possible. If they separate, the out-of-air diver will lose his or her only air source and may drown. Only three pairs carried this out successfully. Most of the divers, including some highly-qualified instructors, appeared unsure of which grip they preferred to use and even which hand to hold

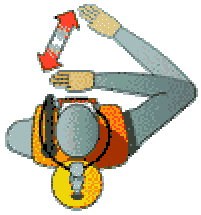
on with. We watched divers completely releasing their grip to dump air from their BCD or drysuit.

Some of the divers descended without noticing: The exercises were carried out in mid-water. Of the ten pairs, three descended several metres and seemed unaware of it. Incident reports detail divers accidentally descending 25m to the sea-bed before realising.

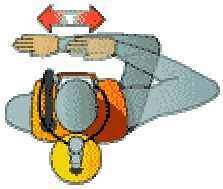
Practice makes perfect: Only 26 per cent of the test divers regularly practised alternative air source ascents – it showed. There was a significant improvement in most of the divers' performance on the second day. They seemed far more confident when carrying out the ascent, despite the fact that they were now diving with a completely unfamiliar buddy

Sign Language

SSI



BSAC



PADI

Hand signals for 'I am out of air' would ideally be identical regardless of the training agency. Unfortunately, as the diagrams show, this is not the case.

What we recommend

- Know what it feels like to be running low on air. If you've experienced the sensation of your air running out once, you probably won't forget it. To safely simulate running out of air you should be in a shallow, controlled environment, such as a pool. Have your buddy turn off your air while you watch your gauge. When you can't get any more air from the regulator, signal out-of-air, and your buddy can open the cylinder valve again.

- If you're out of air, use the signal you know. Make it clear, and don't stop signalling until someone responds. If you get no response, take your buddy's alternative air source.

- Always grip your partner with the right hand. This will make it easy to dump air from your drysuit or BCD without needing to release your hold. Taking hold of your buddy's BCD shoulder strap is taught by many instuctors, but is it really the best grip? What happens if the diver has a stab jacket with no shoulder straps? The forearm-to-forearm grip is better. If you're the one giving the air, the physical contact will reassure the out-of-air diver you're not going to let go and you'll feel their grip get tighter if they begin to panic.

- Don't hang around. The more breaths you each take before beginning the ascent, the less likely you are to be successful. Make the minimum of signals and head for the surface. There's nothing wrong with using a quick squirt of air to get you both moving. Gauges can be checked once you're on your way up – they will confirm you are ascending.

- If you're at depth, make the first part of the ascent quickly and slow down as you reach the last 10 or 15m. You don't need to ascend at the speed your computer indicates you should, as it's probably a lot more conservative than you can afford to be at this stage.

- If you're the receiver of air, let your buddy take control of the ascent. He or she is the one with the air. If you're the air donor, take charge of the situation. This will reassure the other diver and should reduce the chances of them panicking.

- Practise as often as you can, it does make a difference. We suggest practising an ascent from time to time at the end of a normal dive – if you do, make sure you have discussed it with your buddy prior to your dive and that the conditions are safe.

- Include the out-of-air emergency in all pre-dive briefs. Discussing signals and procedures before entering the water will leave you in no doubt of the correct action to take. Remember, your time on the surface isn't limited, but underwater you'll value every second.

Alternative air sources

Performance

It's important to choose the appropriate type of alternative air source for the diving you do. Divers usually use one type in training and often look no further when choosing their own alternative air source. If they become involved in more adventurous diving they run the risk of being poorly equipped to deal with an emergency. We took different types and makes of alternative air sources to the BSAC maximum recreational depth of 50m. Performances were monitored at low tank-pressures and during ascent.

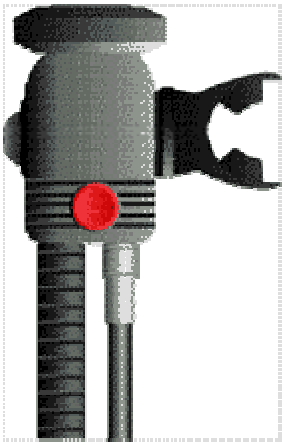
Testing equipment

All the equipment used was new or well-serviced – that way we could be certain that any shortcomings were not due to poor maintenance. Where possible the alternative air sources were used on a balanced and unbalanced first stage to observe any change in performance. We used different makes of the same type of alternative air sources to gain more accurate results. We have not compared one make to another, and it must be remembered that testing was subjective.

Octopus:

The octopus is the most commonly-used alternative air source. This is basically any regulator second stage intended for use as an octopus, although most divers use a manufacturer's dedicated octopus second stage, which is brightly coloured and connected to a longer hose. Choosing the same make of octopus as the first stage and primary second stage ensures the best performance. Divers who make penetrations into wrecks or caves must use an extra-long, two-metre hose to enable a buddy to breathe from the alternative air source while swimming directly behind them. These have been adopted by other recreational divers who prefer the system. Of the alternative air sources we tested, the octopus system provided the

highest performance. We would recommend you use the highest performance first stage you can afford. The performance of your octopus is directly affected by the ability of the first stage to deliver enough air – this becomes very important when there are two divers breathing from one regulator. The octopus is a safe system to use at depth, but you must carry enough air in reserve for two divers; or use a pony cylinder.

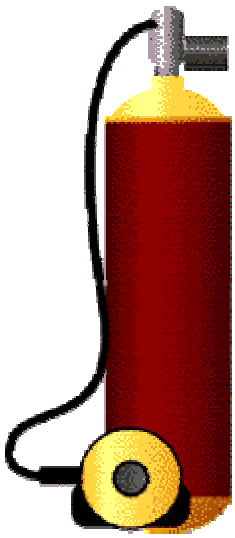


Octo-inflators:

These combine the octopus with the inflator of a BCD, either integrated into one unit, or as a specially-designed octopus placed in line with the inflator. Its location dictates that in an emergency, the air donor must offer their primary regulator to the out-of-air diver, using the octo-inflator themselves. Photographers' models choose to use them to reduce the number of hoses that show in a picture, or travellers, who wish to carry the minimum amount of kit. We were surprised by the relatively good performance of these at 50m. There was more breathing resistance than with the octopus regulators during both inhalation and exhalation, but they delivered good amounts of air. Their effectiveness in a real emergency is something that can't be tested. We recommend this system is used at shallower depths and with a buddy who is familiar with it. If you do use an octo-inflator, remember that dumping air through your inflator might be a problem when you're breathing from it (some new systems have overcome this problem). Fit an independent pull-dump on the opposite shoulder.

Pony set-up:

Redundant air is the choice of most deep divers and other more conscientious divers. While small redundant air supplies with built-in regulators do exist, they provide little air. To be of any real use in an emergency, you need a two- or three-litre pony with a first and second stage regulator. Divers undertaking extended decompression stops will carry larger redundant air or Nitrox, should it be required. With a pony set-up there should only ever be one diver breathing from it, which creates less demand on the first stage. So, if you can't afford a high performance regulator, go for a basic but robust system for use with a pony bottle. Remember, if you ever find yourself using it there's only one way you should be going – up!



DIVE recommends:

- For normal recreational diving, consider a pony cylinder. It's the safest way to dive. It provides you with a completely redundant air supply that can be used in any emergency.
- It's probably best to use a three-litre pony. Some manufacturers offer two-litre cylinders. They are more compact, but the bottom line is that you have less air.
- Never plan to use your pony for air during any dive. It should be regarded as a bail-out system only; not as an ascent cylinder. Misuse has cost lives.
- If you're planning a decompression dive, a three-litre pony may not provide you with enough air to safely complete decompression before ascending. Consider a larger redundant air source, or at the very least, a safety cylinder hung at your stop depth.

Air Consumption

Breathing rates vary dramatically between divers, a fact that must be taken into account when determining the correct amount of air to leave in reserve on a dive. You may think you've allowed enough, but what happens when your air-guzzling buddy wants some of yours as well? We ran some tests on air consumption, and got some revealing results. Dives were made in pairs, following the same profile, with a maximum depth of 50m – two sets of stops on ascent, one minute at 9m followed by six minutes at 6m. Total ascent time was 11 minutes. The test air was carried in redundant cylinders. The divers only switched to the test air as they began ascending.

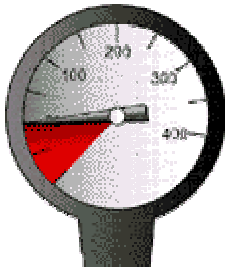
The Divers
•24 per cent of the test divers were entry level
•41 per cent of the divers had taken training beyond entry level
•35 per cent of the divers were instructors
•40–50 per cent had used an alternate air source for real.

What we learned

One pair used more than half their air during the ascent: On reaching the surface one pair had breathed 1,300 litres of air. The second pair had used 1,000 litres. If this had been a real dive and the agreed air reserve pressure was 100 bar (a realistic pressure), the first pair would have run out during ascent – forcing them to omit mandatory decompression stops.
A full three-litre pony bottle didn't get one diver to the surface: Before ascending, the diver switched to the full pony bottle. After just five minutes the cylinder was at 100 bar. Two minutes into the 6m-decompression-stop it ran out. In just two breaths the regulator went from 'breathing fine' to failing to deliver air – an indication that failure to check your cylinder pressure could be fatal.
The pressure inside the pony bottle dropped significantly as it cooled at depth: The cylinder had been filled at least two days before it was used on the dive. At the surface it read 200 bar, but at 50m the pressure was only 170 bar.

50 bar myth

Calculate your ascent gas



Litres per minute breathed on the surface x full ascent time x absolute pressure in bar at start of ascent = litres of gas required for the ascent

Litres of gas required x 1.5 = reserve gas added

The widely-used practice of finishing a dive with 50 bar is rarely questioned as a safe diving technique. If you undertake deeper decompression dives with mandatory stops, consider a far larger reserve. Some cave divers estimate that it may take as much as five times the amount of air to support two divers in an emergency as one breathing normally. Technical divers calculate the amount of air they need for a dive and then double it as a safety measure. For most recreational decompression dives you don't have to go quite that far – a further 50 per cent in reserve should suffice. The equation on the right shows how to calculate the amount of gas you will need.

What can go wrong

Blind reliance on an alternative air source may be misplaced and could cost your life and that of your buddy. There are many reasons why a diver may not be able to breathe underwater. These can be loosely categorised into problems of technique which reflect an individual's personal skills and training, and equipment failures for which the diver may or may not be wholly responsible. These examples either reflect incidents we have personally witnessed or are drawn from documented accident and fatality reports.

Buddy Dependency – Myth and Reality

While the buddy system has been the cornerstone of safe diving as defined by the training agencies, the concept is now under re-evaluation. Several agencies including the BSAC are believed to be considering making solo diving legitimate in some circumstances. Incident reports indicate that in many situations the buddy diving system has not saved lives. During shared ascents that appear to have been progressing well, the sharer has suddenly rejected the mouthpiece and inexplicably broken away. If panic is to blame then agencies need to establish why divers panic and what measures can be taken to prevent it. Using an independent air source means the minimum of task loading – simply switch regulators and make a normal ascent. Buddy dependence and the task loading encountered in an out-of-air scenario may be too much for some divers.

- Out of air – You would be amazed at the number of people who think an octopus will miraculously provide them with air despite their tank being empty. Alternative air sources connected to your tank obviously DO NOT work when that tank is empty.
- Free-flows and lock-ups – A free-flow can leave you totally out of air unless you have another cylinder. A first stage lock-up will cut off the air supply to both primary and secondary mouthpieces.
- Inadequate performance – Air sharing will at least double the demand on your regulator. A low performance, poorly-maintained first stage may fail to deliver.
- Breathing from wrong gas source – Divers using ponies have been known to accidentally begin the dive breathing from their pony regulator. When the pony ran out at depth they spat out the mouthpiece, believing their primary had failed, and reinstalled the regulator from the empty pony with tragic results.
- Inadequate gas supplies – An AAS is only good for as long as it lasts. If there is insufficient gas in it to get you, or you and your buddy, to the surface, it's nearly useless. You'll simply run out again.
- Inaccessible AAS – We've seen AASs zipped into BCD pockets and secured to D-rings with karabiners. Seconds count. Failure to quickly and cleanly deploy or obtain an AAS may render it useless in an emergency.
- Poorly maintained secondary – We've seen one second stage with a paper clip in it, know of another that was home to a fireworm, and have breathed off regulators with leaky exhaust valves or diaphragms. Some we've tried have been almost impossible to draw air through, even in a pool.
- Deliberately disabled secondary – One tester had disconnected his combined octopus/inflator hose because a valve failure meant it kept inflating his BCD.
- Problems with pressure gauge readings – Over time, many gauges lose accuracy. Fatalities have occurred, for example, when the pressure gauge read 40 bar but the tank was empty. In other incidents problems have occurred with air remaining. It's possible that while air remains in the tank the regulator can't supply a sufficient volume to support both divers.
- Air turned off by accident underwater – Incidents have occurred when cylinder valves closed as they became caught on cave walls or wreckage. In cases where divers have used more than one cylinder, the wrong valve has been

turned off by accident, leaving a diver without air.

- Unfamiiar kit – Purge buttons are not always obvious and second stages can seem to face the ‘wrong’ way. This can increase the chances of the second stage flooding, or breaking your mask seal with the upturned exhaust tee. Anti-free-flow devices also make breathing more difficult and may cause additional stress. Task loading can become insurmountable.

Miniatures

Small-volume air cylinders with in-built regulators are available as last ditch attempt safety devices. They are not a substitute for an alternative air source, as they only contain around 80 litres (a pony bottle, by comparision, usually holds 460 to 700 litres). Our limited testing did not establish a maximum operating depth from which these alternative air sources would bring a diver to the surface. Although claims of up to 48 breaths on the surface are made, we found our testers got between 17 and 32. An ascent begun at 40m emptied the cylinder by the time 30m was reached. It provided just five breaths. However, we were surprised at how well the unit breathed at depth.

Wear it well

1. HOSE UNDER THE RIGHT ARM

At a recreational diving level, equipment configuration is discussed but never really highlighted as an important element of safe diving. For this reason it's something many divers never truly understand. If we're lucky, we may learn some basic tips, such ensuring the octopus is the last hose to be attached, so it is unobstructed should it need to be released quickly. This is an attitude far removed from that of the technical diving community, for whom configuration is emphasised as a critical safety element. In fact it is recognised as an area that demands hours and hours of fine-tuning in the water and on the surface.

Here are some basic ways of wearing an alternative air source. Find a method you are comfortable with and stick to it – and make sure you know how your buddy configures his or her alternative air source.

This is the most conventional way to carry an alternative air source. **FOR:** The hose is kept under the arm, reducing the chances of it snagging. **AGAINST:** The diver must release it from under their arm when it's being used. It's difficut for an out-of-air diver to locate the second stage unless their buddy is facing them. **RECOMMENDATION:** This system must be used with a coloured hose. **Hose under the left arm** – This system is the same as under the right, but any diver who uses it must have the correct second stage. A dedicated left-hand regulator or one designed to be used from either side must be used.

2. HOSE OVER THE SHOULDER

This has been adopted by some recreational diving instructors.
FOR: The hose is unrestricted. If a diver needs to use the alternative air source, they simply take it. when it's used with a coloured hose it is clearly visible to other divers.
AGAINST: The hose is more likely to become snagged.

3. SECOND STAGE POSITION

There are various views on the most appropriate place to secure an octopus second stage. The 'torso triangle' is taught by training agencies and serves as a rough guide for novices. Some would argue that the bottom right position is best for right-handed divers, and the reverse for left-handers. We found it was most visible towards the top half of the chest.

4. LONG HOSE

The extra-long hose came from cave divers, who sometimes need to exit small spaces, so can't dive side-by-side. This system is an excellent choice for divers involved in any advanced penetration diving, but the extra length of hose must be stowed correctly. For these set-ups, your primary regulator is your octopus.

FOR: The additional length is more comfortable for the diver breathing from the alternative air source.
AGAINST: It's easy for divers to drift apart, as the out-of-air diver would feel less likely to lose the second stage.

SET-UP 1

For this system, simply tuck the excess length of hose into bungees around your cylinder. If you donate the octopus, the hose will come loose as your buddy pulls it.

SET-UP 2

Only for experienced divers. Bring the second stage on the long hose under your right arm. Take it around the back of your neck and stick it in your mouth. If your buddy needs it, they take it out of your mouth and you dip your head to help its release. You then breathe from your other second stage.

SET-UP 1

SET-UP 2