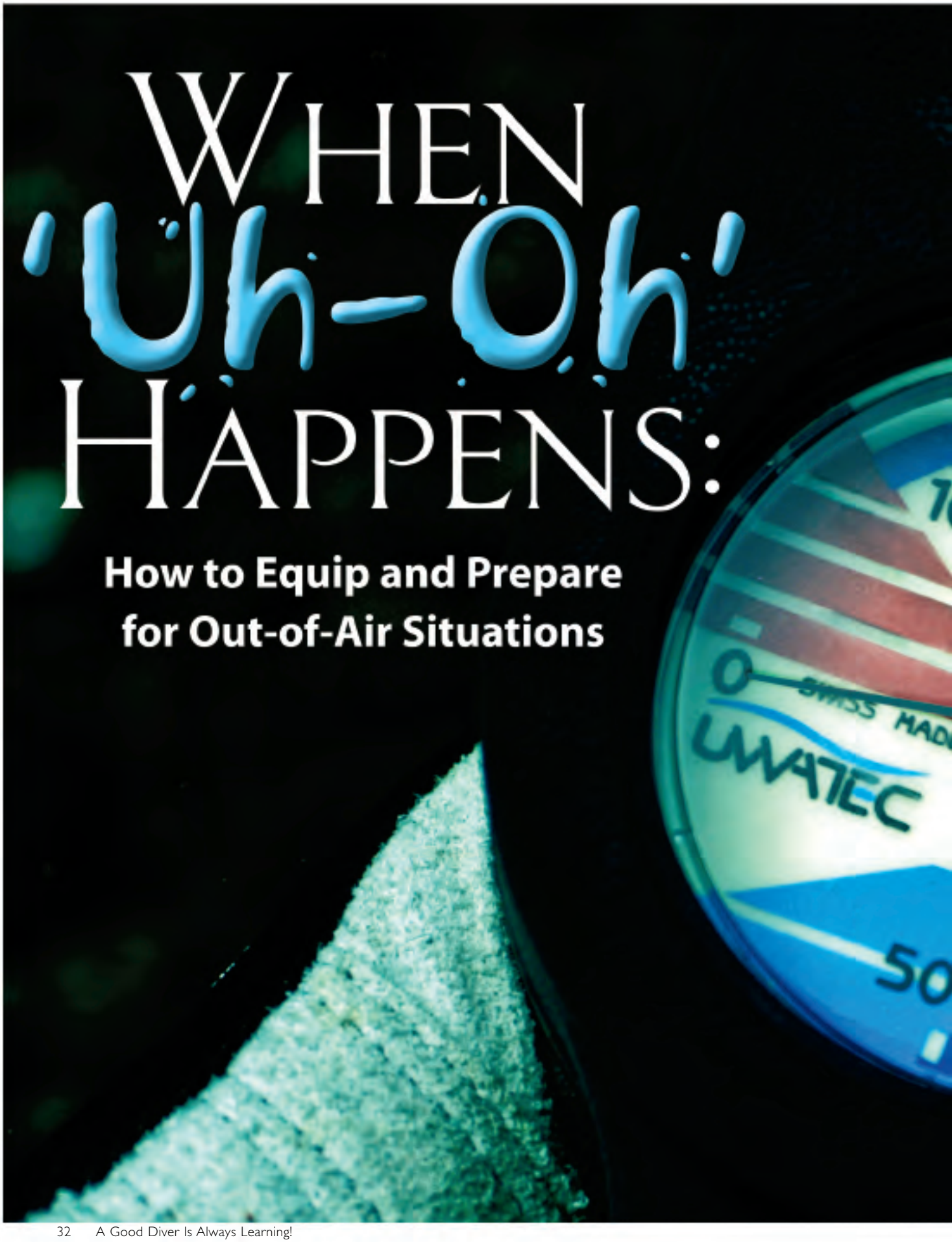
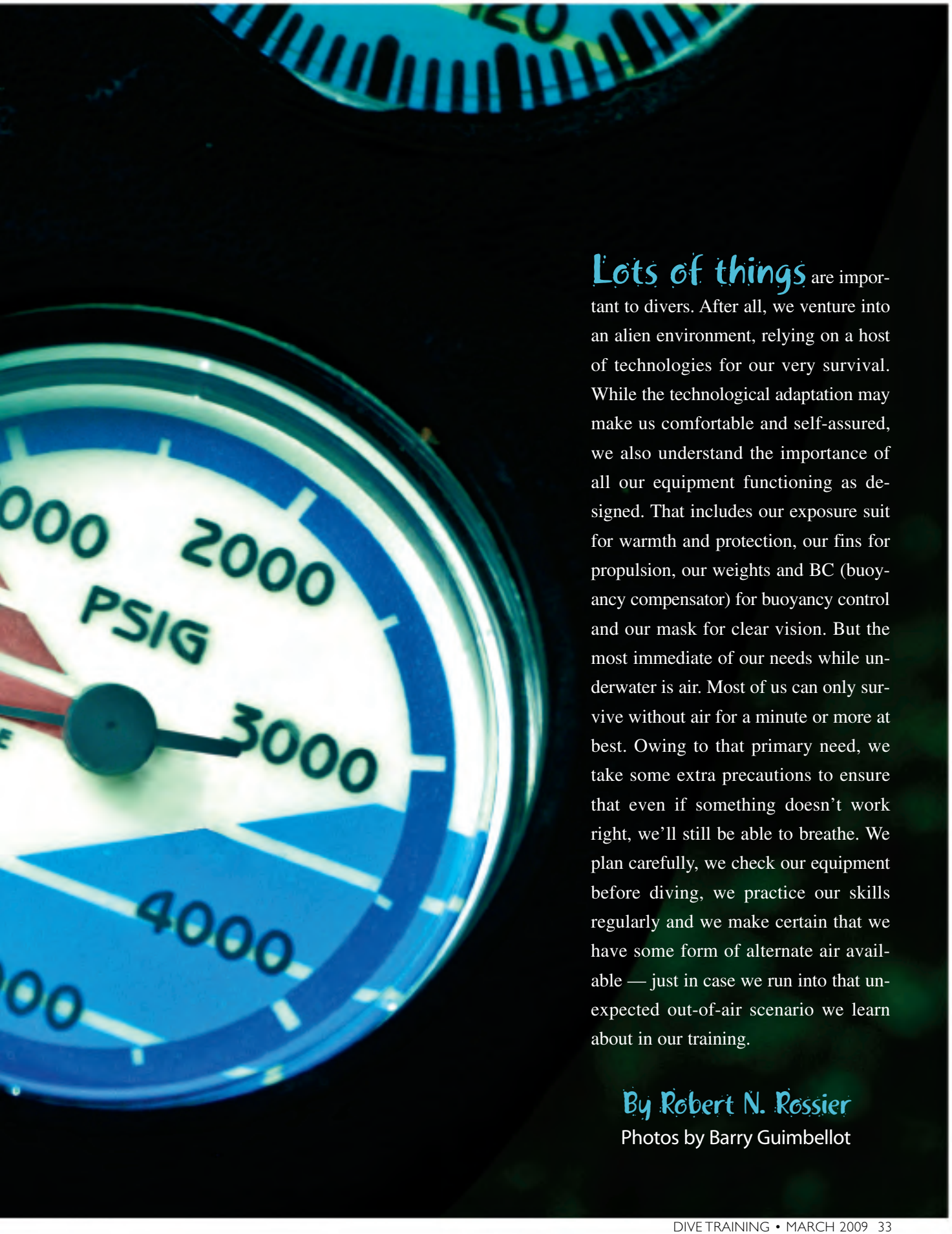
When 'Uh-Oh' Happens:

How to Equip and Prepare for Out-of-Air Situations





Lots of things are important to divers. After all, we venture into an alien environment, relying on a host of technologies for our very survival. While the technological adaptation may make us comfortable and self-assured, we also understand the importance of all our equipment functioning as designed. That includes our exposure suit for warmth and protection, our fins for propulsion, our weights and BC (buoyancy compensator) for buoyancy control and our mask for clear vision. But the most immediate of our needs while underwater is air. Most of us can only survive without air for a minute or more at best. Owing to that primary need, we take some extra precautions to ensure that even if something doesn't work right, we'll still be able to breathe. We plan carefully, we check our equipment before diving, we practice our skills regularly and we make certain that we have some form of alternate air available — just in case we run into that unexpected out-of-air scenario we learn about in our training.

By Robert N. Rossier

Photos by Barry Guimbellot

To avoid minor leaks such as the one pictured here, divers should verify that the O-ring is in good condition before attaching the regulator to the cylinder.

Back in the "old days" of diving, the way to deal with an out-of-air scenario or a regulator failure was a technique called "buddy breathing." Using this technique, divers would pass a single regulator back and forth, taking turns taking a breath. While some instructors might still teach the technique, few divers actually resort to buddy breathing when an out-of-air situation arises. Today, numerous options are available for divers who experience the need to share air, and virtually every diver carries some form of alternate air system.

Why Alternate Air?

The possible need to share air with another diver stems from two primary causes. The first and most obvious is that a diver is out of air, and there are many reasons why this might occur. Perhaps one of the most common occurrences is when a diver mismanages his air supply, or somehow loses track of his air supply, and then realizes too late that his cylinder is empty. A study by the South Pacific Undersea Medical Society reported back in 1995 found that roughly half of the out-of-air incidents reported by divers occurred when the divers either forgot to check their pressure, or had an inaccurate pressure gauge. Out-of-air scenarios can also occur as a result of entanglements; a diver at depth becomes entangled, and the time-consuming process of extracting the diver from the entanglement uses up his final air reserves. It's not a common occurrence, but it does happen on rare occasions.

The second cause that leads to an air-share situation, while rare, is a mechanical failure that empties the cylinder or disables the regulator. Potential mechanical malfunctions include loss of air due to a failed O-ring, a loss or failure of the mouthpiece, failure of the second-stage diaphragm, unseated exhaust ports, or an internal first-stage failure. These sorts of malfunctions have resulted in roughly 20 percent of the out-of-air incidents reported by divers.

One of the most common regulator problems experienced by divers is a free-flow condition. In fact, a recent survey found that roughly half of the divers had experienced such a condition. While we might expect to be able to continue breathing from a free-flowing regulator, the problem can rapidly escalate into an out-of-air situation.

When something goes wrong with our breathing system, we have two

The Predive Regulator Check

Many of the out-of-air situations experienced by divers can be avoided by carefully completing predive safety checks. In particular, divers should carefully inspect and function-check their regulators before entering the water. The following procedure can help divers identify some of the problems that lead to regulator failures or problems while diving.

Check the inlet screen on the first stage for signs of debris or contamination. If the screen is discolored or partially clogged by debris or particles, have it serviced, and check the cylinder for contamination.

Inspect the mouthpiece (primary and octopus) to verify the condition of the rubber, and replace if it appears damaged or deteriorated. Check that the mouthpieces are securely attached to the regulator body. Most manufacturers use a nylon tie to secure the mouthpiece to the regulator body.

Verify that the O-ring is in good condition before attaching the regulator to the cylinder. Replace damaged or deteriorating O-rings.

Draw slightly on the mouthpiece of both the primary and octopus before turning on the air. If you can draw air, there may be a problem with the diaphragm, exhaust valve(s) or the mouthpiece.

Make certain the air is turned on by turning the handwheel on the pillar valve counterclockwise.

Take a few breaths on the primary and octopus regulator to make certain they both work.

Verify the function of the purge buttons.

Verify that any adjustment knobs on the regulators are properly set.

Also check to see that the alternate air/octopus is properly secured in its proper location, and be certain to know where your buddy keeps his alternate air.

good choices: use our own alternate air system if it is working, or find a buddy with whom to share air. There's also a less desirable choice: a fast free ascent to the surface. Exactly how the situation is resolved depends on the particular type of alternate air systems with which the divers are equipped. Divers have a variety of options from which to choose, and they each offer their own advantages and disadvantages.

The Octopus

By far, the most common type of alternate air system used by divers today is what's referred to as an "octopus." The octopus is an extra second-stage regulator that attaches to the first-stage regulator via a standard low-pressure air hose. This allows a diver to share his air with another diver who has suffered an out-of-air situation. It also provides a diver with a spare second stage that can be used in the event that his own primary second-stage regulator suffers a problem.

While the octopus is generally considered standard equipment in recreational diving circles, it can suffer from any number of shortcomings. One of those is hose length. The shorter the hose that connects the octopus regulator to the donor's first stage, the more cumbersome it is to share air. This is especially true if the air-sharing divers must swim any distance underwater before surfacing. Even when making a controlled ascent, divers find it easier to manage the situation and control their buoyancy if the hose that connects them is of adequate length.

The next potential shortcoming of an octopus is the configuration of the octopus regulator. While it might seem that any functional second-stage regulator connected to the end of a hose would suffice, such isn't always the case. If a regulator arrives upside down at the mouth of a desperate diver, and the diver can't get it in his mouth to breathe, panic can occur. Instead of quickly getting that much needed breath, the affected diver might head for the surface instead. While a sufficiently long hose might alleviate the problem, an octopus regulator that is configured differently, such as a side-exhaust design, can sidestep the problem entirely. In fact, most manufacturers sell ergonomically designed second-stage regulators specifically suited for use as an octopus.

All that brings us to the next matter of concern: the placement and se-

Avoiding Out-of-Air Scenarios

Avoiding out-of-air situations involves careful dive planning, thorough equipment checks and careful monitoring of all dives. As a minimum, consider the following:

Planning: Choose reasonable limits for depth and air reserves. Carry the proper equipment, including an alternate air system, for the diving environment.

Equipment checks: Inspect primary and alternate air regulators before each dive. Verify that the pressure gauge reads "0" when the air is turned off and the hose depressurized. Turn the air on fully, and then verify the cylinder pressure. Test the primary and alternate air regulator before entering the water. After entering the water, recheck the security of the alternate air regulator.

Monitor the dive: Check your cylinder pressure, and that of your buddy, on a frequent basis. Monitor depth, and don't exceed the planned depth limits or minimum air reserves.

curing of that octopus regulator. It is generally agreed that an octopus should be located on the diver's chest, where it is easily seen and ready for use. A dangling octopus can drag on the seabed, dredging up sand, silt and mud, and thus putting its reliability in considerable question. Nothing is worse than not being able to find that octopus when it's needed, or sucking in a mouthful of mud, sand or silt.

Finally, keep in mind that a first stage failure affects both the primary regulator and the octopus, and while such occurrences are decidedly rare, any number of issues could cause such a failure. If the cylinder O-ring blows out, then all the air bubbles away in a hurry. If the inlet filter for the first stage becomes blocked with debris from a poorly maintained cylinder, then airflow into the first stage may be severely restricted or prevented entirely. Even a violent free flow of a primary second-stage regulator can quickly empty the contents of a cylinder. Naturally, if the first-stage regulator itself malfunctions, having an octopus won't be of any help. In any of these cases, a diver needs either a redundant air supply, or a nearby buddy with a ready alternate air system.

Integrated Air Inflator

Another approach to the alternate air solution is what divers call an alternate air inflator. This is a second-stage regulator that is integrated with the diver's BC inflator. An integrated air inflator has both advantages and disadvantages. On the plus side, the integrated air inflator design minimizes the tangle of hoses with which divers must contend. The alternate air is less likely to drag on the seabed than a conventional octopus, but it must be kept secure, lest it float out of reach. On the flip side, many integrated air inflators have a relatively short hose, so a diver who chooses this as his alternate air source might consider equipping his primary second-stage regulator with a longer hose to make air sharing with another diver easier. As with the standard octopus, the integrated air inflator won't help if the underlying problem is an empty cylinder or a first-stage failure.

Data from various sources suggests that roughly one-fourth to one-half of recreational divers use an integrated air inflator as their alternate air source. That being the case, an out-of-air diver could easily end up sharing air with a diver equipped with an integrated air inflator. From that perspective, it's a good idea for all divers to become familiar with alternate air inflators.

Redundant Air

For some divers, the preferred choice for alternate air is backup air in the

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form of a redundant air system. These include "bailout bottles" or "pony bottles," or hand-held canisters with an integrated regulator.

A bailout or pony bottle is a totally redundant, smaller cylinder, equipped with its own dedicated regulator. The cylinder can be attached to the primary air cylinder, or attached via harness to a convenient location such as the diver's BC.

The hand-held units are smaller yet, ranging in size from the 1.7-cubic-foot Spare Air® to a 6-cubic-foot pony bottle from H2 Odyssey that can be set up as a hand-held.

The advantages of the hand-held systems are that the regulator and mouthpiece are part of the unit, they are compact and easily clipped to a diver's ensemble, and can be easily passed off to another diver. They are also easy to use and easy to travel with. They can be filled at an air station or filled from a standard scuba tank.

In many regards, the choice between a conventional pony bottle and a hand-held unit is a matter of preference, economics and diving conditions.

One issue surrounding the use of redundant air systems is that of capacity. Spare Air® units are available in either 1.7-cubic-foot, or a 3-cubic-foot capacity (either standard air or nitrox). The 3-cubic-foot Spare Air unit is advertised as providing 57 breaths at the surface. The 1.7-cubic-foot unit provides 30 breaths at the surface. Pony or bailout bottles range in size from roughly 6-cubic-foot to more than 30-cubic-foot capacity.

Naturally, the deeper the dive, the fewer breaths any system — pony bottle or hand-held — will provide so for deep dives greater capacity is required for the redundant air system. Breathing rate also has a pronounced effect on the desired capacity. Finally, our style of diving will affect our redundant air needs as well.

No matter what happens to the primary air supply and regulator, either of these redundant air systems will provide that all-important life-support function.

Making it Work

Having an alternate air system is one thing, but making certain that an air share situation will go smoothly in time of need is quite another. To be fully prepared for dealing with an out-of-air scenario requires a four-pronged approach. The first is planning. This includes being familiar with the dive environment, setting reasonable limits for depth and air reserves, and having the right equipment to meet the expected challenges.

Next, the alternate air system must be properly configured. For an octopus, that means making certain the hose is of adequate length, the second stage can be readily placed in a buddy's mouth, and that the regulator is secured in the proper location where it can be readily found and used. Redundant air systems must be appropriately sized for the depth and the diving environment, configured for easy access, and function-checked before diving. Studies have shown that divers are less likely to check the operation of their alternate air system than they are their primary system, and this has led to numerous incidents in which the alternate air system did not function when needed.

To be thoroughly prepared, divers must be familiar with the various alternate air systems available, and in particular, with their buddy's alternate air system. In addition to that basic familiarity, dive buddies are encouraged to practice air share drills on a regular basis, or at least when diving with a new buddy, or with new equipment. The more frequently a diver practices air sharing, the more comfortable he will be when using the skill for real.

Divers have a host of options available when it comes to the equipment chosen for diving, but remember that breathing isn't optional. The choices made for our alternate air system determine how we will resolve an out-of-air scenario. By understanding the options, and making informed choices, we can take the steps necessary to make certain that we can always breathe easy.