

A rebreather checklist, such as this TDI/SDI preflight checklist, is an essential procedure in preparation for every dive.

Text by Simon Pridmore

In rebreather diving, preparation and checklists are essential for staying alive. So, why do some rebreather divers skip their checklists? Simon Pridmore takes a closer look, offering insights and tips for diving safely in an excerpt from his recent book, *Technically Speaking: Talks on Technical Diving, Volume 2: Foundations and Strategies*.

When you do rebreather diver training, you are taught to use detailed, written checklists to make sure:

- You have done everything you need to do,
- You and your machine are properly set up and ready for the dive, and
- Back-up plans and equipment are in place if something goes wrong.

This is because, whereas failing to prepare carefully and forgetting something in normal, open-circuit sport diving rarely results in anything more serious than a minor inconvenience, in rebreather diving, omitting part of your preparation can kill you.

The first thing good rebreather instructors do when they begin a course is teach their students to create pre-dive and post-dive checklists. They then instruct their students to either tape these checklists inside the rebreather casing or keep them on slates that they will always carry

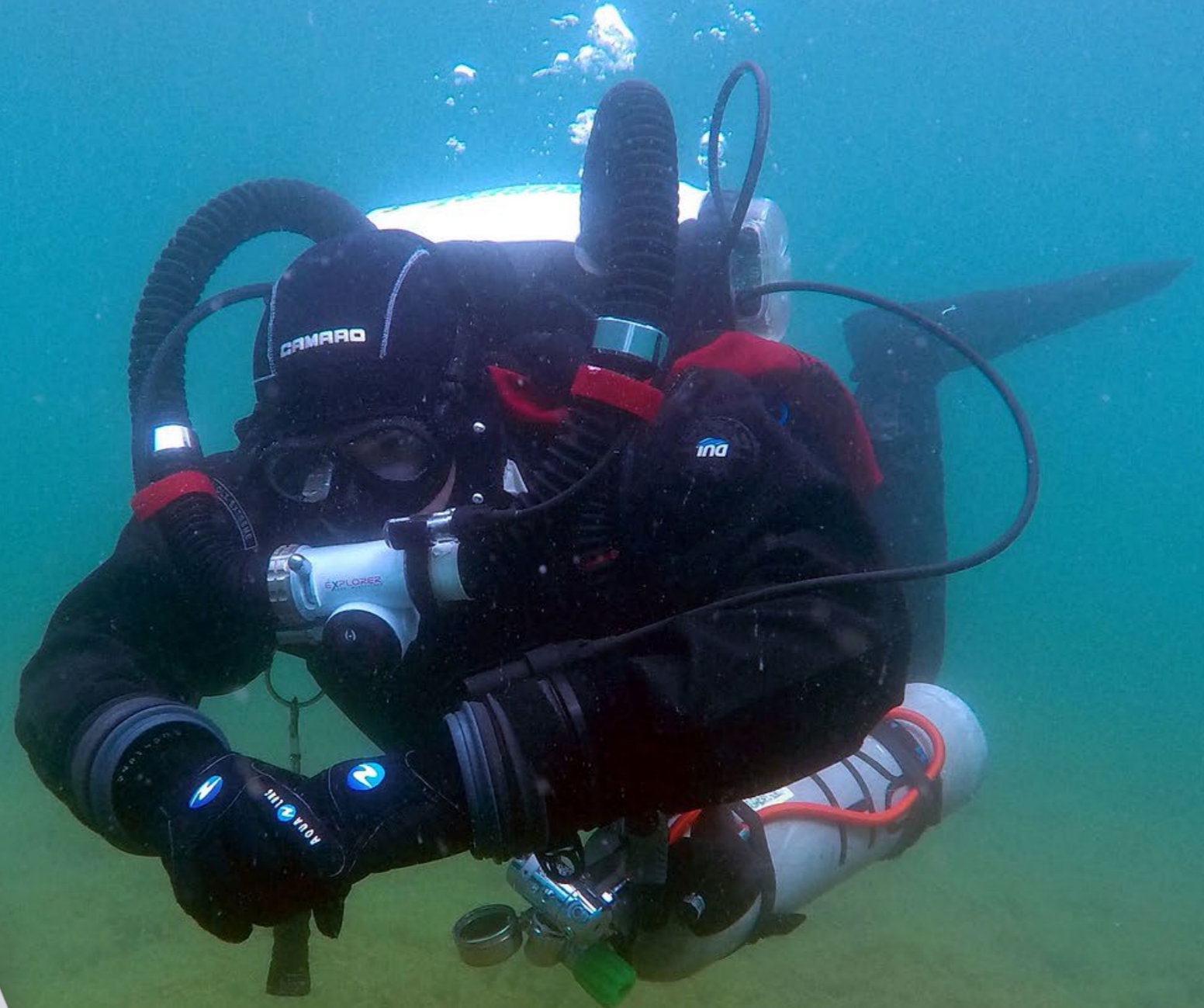
with them. Some rebreather manufacturers provide purchasers with a pre-dive checklist as part of the package. Students are trained to use their checklists on every dive, no matter how deep, even for swimming pool sessions.

Checklists have been part of the process of preparing for a rebreather

dive since sport divers first began strapping themselves into Cis-Lunars, Inspirations, Prisms and the like.

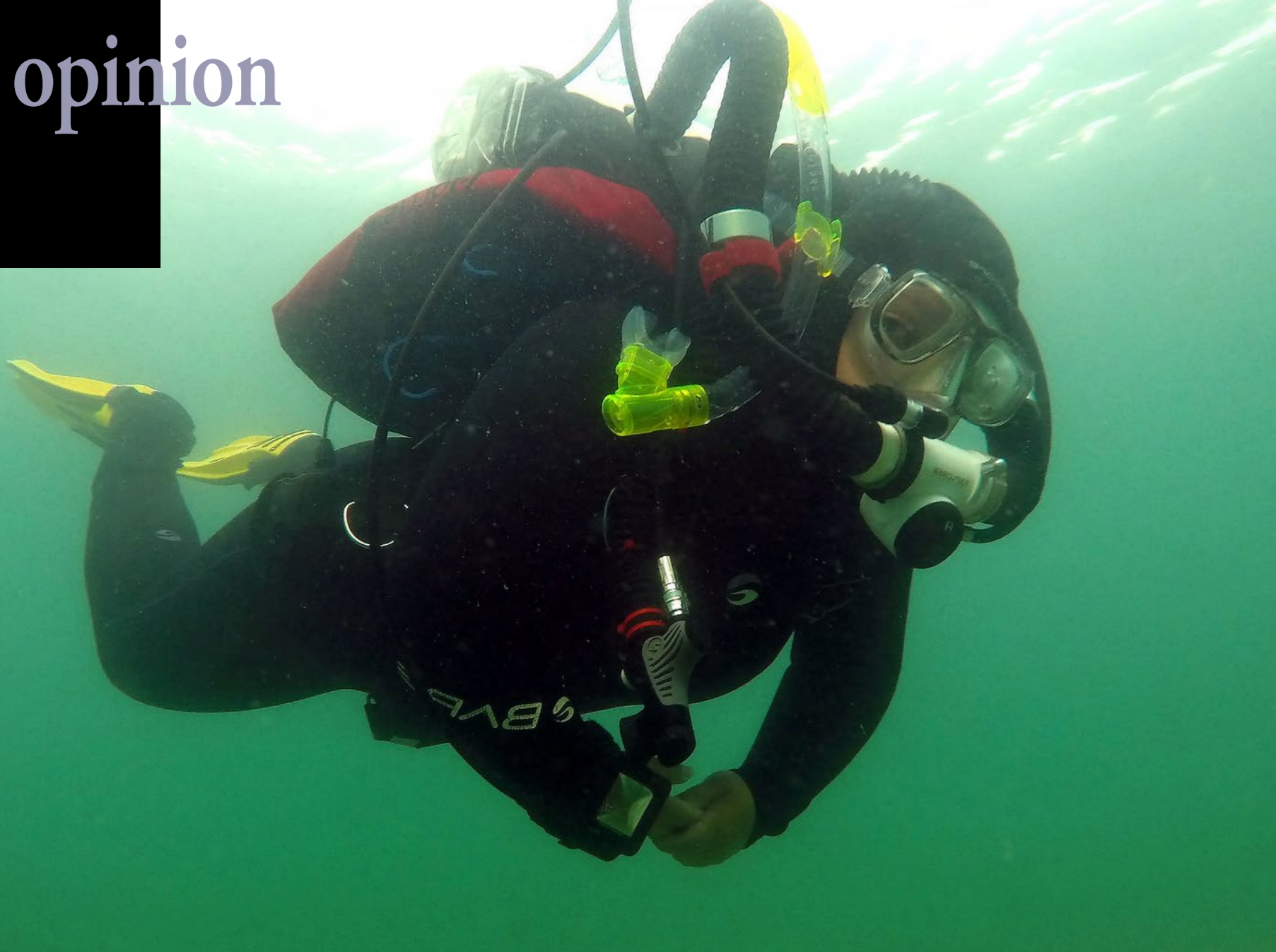
In 2014, their value was reinforced in the Rebreather Forum 3 consensus statement, the first section of which was entirely devoted to checklists. This was twenty years after scuba divers

began using rebreathers. You might conclude, from their prominence at the very top of the consensus statement, that the Forum had found that checklists were not being used nearly as universally as they should be, and that divers had lost their lives as a result. And you would be correct.



Checklists

A Rebreather Safety Strategy



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A New Dive Book from Simon Pridmore

Technically Speaking: Talks on Technical Diving Volume 2: Foundations and Strategies is the second book in this series by best-selling author Simon Pridmore.

Part one, "Foundations", is for people who are thinking of getting into technical diving or wondering what technical diving is all about, introducing topics such as the pros and cons, the attributes you need, how to prepare, what to expect from a course, how to choose your training path and common mistakes new technical divers make.

Part two, "Strategies", is for qualified technical divers looking for new perspectives and insights. The topics also include examples to follow and precedents to avoid if you want to prosper in this most challenging and complex of sport diving's disciplines.

These talks reflect Simon's take on dive safety and technique, and he shares

what he has learned over the decades he has spent involved in technical diving, identifying areas where further progress in the sport is still needed and where common practice could be improved.

Author Simon Pridmore has been at the sharp end of the scuba diving industry for 30 years. He pioneered mixed-gas deep diving in Asia, and he has held the regional franchises for IANTD in the western Pacific and the United Kingdom. He also spent several years working for cutting-edge mixed-gas computer and rebreather manufacturers VR Technology. Today, Simon is one of scuba diving's most prolific writers, with a five-volume *Scuba* series, several guides for travelling divers, a biography, a novel and even a couple of divers' cookbooks to his name.



Available in hardcover, paperback and ebook at **Amazon, Barnes & Noble, Kobo and Apple**. See: SimonPridmore.com

A senior figure in the dive industry, who has been involved in the investigation of numerous rebreather diver fatalities over the years, once stated in a paper on the topic that, in all the cases of diver death he has ever been involved with, he has never seen a pre-dive checklist on the deceased diver's person, on the rebreather they were using or among the items of equipment they left behind that day.

Just as with beginners and the buddy check process, the pre-dive procedure taught and practised religiously in rebreather training programmes is often abandoned shortly

after the course finishes.

I was once a small part of a team that developed a new brand of rebreather. We assembled a top bunch of divers, who were to become the first divers and instructors on the unit, and took them to the Red Sea for training. Then, the day after the course ended, we all went for a fun dive.

We were on the boat, setting up, and one of the recently graduated students stood up first and headed for the dive platform, rebreather on his back, fins in hand.

"Have you gone through your checklist, mate?" someone called out. "Yeah, yeah, all done, all good.

See you in the water," was the reply.

"You might want to sit back down and just run through it again, one more time," his teammate advised.

A little laughter broke out around the dive deck, but those of us involved in developing, distributing and conducting training on the unit were not laughing. We just looked on in horror.

As the diver, a potential future rebreather instructor, stood there, we could see that he had forgotten to attach any cylinders to his rebreather. This was absolute proof that, on his first day as a certified diver on this unit, he had already decided that

he did not need to follow a checklist. Had he done so, of course, he would have noticed early on in the process that his cylinders were not attached.

We ended up including a pre-dive checklist as part of the unit's electronics package. This took the user through all the unit's diagnostic functions and required them to conduct a full pre-breathe before diving. If the diver did not complete the checklist or the diagnosis revealed problems, the unit would remain in Do Not Dive mode. This would not prevent a diver from jumping in the water with it anyway, but it raised the degree of negligence required.

Not high enough, though, as you will discover.

Checklist specialists

In other fields of human activity, often in situations where lives are at risk, checklists are deemed essential. Pilots, even when taking off on their own in a small aircraft at dawn from a deserted airfield, will still follow their checklist to the letter.

For example, if this tells them they need to get out of the plane and double-check that nobody is standing close to the propellers, then this is what they will do, even though there is nobody even in sight, let alone



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Before every flight, pilots go through a checklist to test the aircraft systems as a matter of standard procedure on every flight.

near the aircraft.

In a hospital, an intern examining an elderly lady patient will still enquire if she may be pregnant, as this is one of the questions on their checklist. Of course, they will smile as they ask and expect the usual humorous retort, but the point is that the checklist is their guarantee that every aspect of the examination is covered. They are taught that they should never omit a question, even if they are pretty sure it may not apply.

We human beings cannot be relied

upon to always remember everything, so, especially when lives are at stake, we need a foolproof memory prompt. This is where the checklist comes in. It is an essential tool that makes sure that nothing essential is missed.

When you board a plane, behind the locked door in the nose of the aircraft, the pilot is going through a checklist, testing the aircraft systems to make sure they are all working. If there is a problem, the plane will not take off until it is fixed. It does not matter if there is a businessman

in first class who will miss an important meeting if he does not arrive on time or a couple of anxious parents in economy class who may not get to see their daughter graduate if they are delayed. The plane will go nowhere until the pilot is happy that everything is working properly. Nobody in their right mind, even people whose plans are affected by the need for some last-minute maintenance, would want things to be any other way.

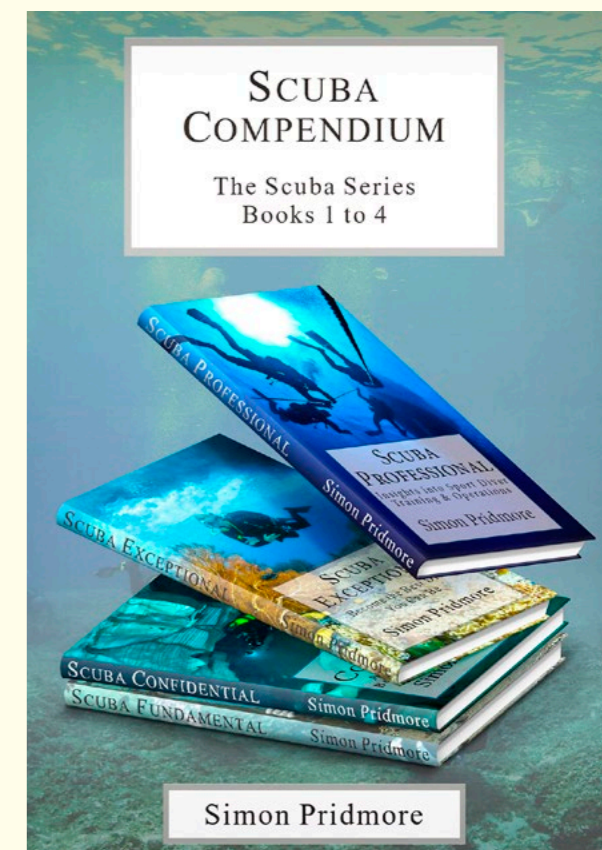
NEW 4 in 1!

Simon Pridmore has released a new single-volume e-book, bringing together four books in his bestselling *Scuba* series:

- *Scuba Fundamental – Start Diving the Right Way*
- *Scuba Confidential – An Insider's Guide to Becoming a Better Diver*
- *Scuba Exceptional – Become the Best Diver You Can Be, and*
- *Scuba Professional – Insights into Sport Diver Training & Operations*

As Simon puts it, this is “a remastering and repackaging of the original albums rather than a greatest hits.” Nothing is missing. *Scuba Compendium* gives e-book readers the advantage of being able to access all the knowledge contained in the four books in one place, making this a unique and easily searchable work of reference for divers at every level.

Simon has always promoted the idea of safer diving through the acquisition of knowledge, which is why he has chosen to release this highly accessible version. If you have read his work before, you will know that he provides divers with extremely useful advice and information, much



of it unavailable elsewhere; his points often illustrated by real life experiences and cautionary tales. He examines familiar issues from new angles, looks at the wider picture and borrows techniques and procedures from other areas of human activity.

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What is the problem, and how can it be fixed?

So, if doctors and pilots can follow checklists diligently, why are divers, as a group, unable to do the same? Following the Forum recommendations, manufacturers and training agencies have tried to create a culture within the community that promotes checklist use, but the evidence suggests that while awareness may have grown, attitudes among rebreather divers towards routines in general and checklists in particular have not changed.

Fatality investigations and the ensuing court cases demonstrate this all too clearly. In an inquest into the death of one rebreather diver in the United Kingdom a few years ago, a succession of friends and family testified that the victim was a careful diver, one of the best, someone who was painstaking in his preparations. He could not have made a mistake on the day he died. He did not make mistakes. It had to have been a defect in the rebreather unit he was using that caused his death.





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Then, an eyewitness was called to the stand. This was one of the other divers who had been on board the boat that day. He testified that the victim seemed to be in a hurry and did not appear to have any type of checklist in hand. He switched the rebreather's electronic handsets on and got annoyed when an alarm started to beep. He tried various things, but the alarm would not stop. Finally, with his frustration mounting, he picked up the handset and smashed it down on the boat railing. This stopped the beeping. Then he got to his feet, headed for the stern and jumped into the water. His body was recovered a couple of hours later.

So, again, why are divers so reluctant to adopt a formal pre-dive check procedure, even though they are taught to do it during their training, and there is ample, incontrovertible evidence that the simple fact

of failing to follow a formal pre-dive procedure has led directly to many rebreather diver deaths?

It cannot be simply a matter of human nature. Pilots and medical professionals seem to have no trouble maintaining checklist discipline. Is diver training at fault? Is insufficient importance placed on having a set pre-dive routine? Are students given the impression that the emphasis on checklists during their courses is just to satisfy training agency requirements, and that, once they are out of class, they no longer need them?

Or is it the case that new divers follow the example of more experienced mentors, and that an indicator of professionalism and expertise is to appear to be so adept as to be able to do everything on instinct and muscle memory? Is complacency seen as an admirable trait among divers?

Certainly, rebreather divers as a

community have to tighten up their act. Despite constant reminders of the importance of checklists, ever more cases are added to the catalogue of near misses and fatalities.

I am afraid it is up to us, individual divers. We cannot expect any more handholding in this respect. Manufacturers and training agencies have stated publicly that they have done everything they can in terms of creating a checklist mentality, and experts agree.

This is our problem, and we have to fix it.

The need for change

The scuba diving world is largely self-policing, and the strategy of experienced divers enforcing good habits by example has worked to keep the sport relatively safe for decades. So, probably the best way to proceed is for instructors and "senior" rebreather divers to set the standard themselves and also speak out when they see someone demonstrating bad habits.

In a perfect world, if divers were to get into the habit of maintaining a formal, pre-dive routine early in their diving lives and stick to it—and if this was universally encouraged and followed—then, when they graduated to rebreathers, they would probably adapt seamlessly to the practice of using a checklist religiously.

However, this would involve re-educating the entire diving world, which is an impossible proposition.

Therefore, for rebreather divers, the message is simple: If you want to avoid having your name added to the growing list of rebreather fatalities, always conduct a pre-dive check. Do it with a checklist in hand and choose an environment where you have as few distractions as possible.

I should give an honourable mention here to Dirty Dozen Expeditions, which operates remote technical diving trips for both open-circuit and closed-circuit divers. They have a checklist that their deck supervisor runs every diver through before they go in the water, to supplement (not replace!) the diver's personal checklist. If you are running technical dives, this is an excellent example to follow, and I highly recommend it.

Pre-breathes

A key preliminary procedure for every rebreather dive is the five-minute pre-breathe. On the boat or the beach, after assembling the unit, donning it and running through their checklist, the diver will sit and breathe from the rebreather for five minutes to make sure that everything is functioning cor-

rectly before they enter the water.

In the early days, the pre-breathe was considered to be useful in protecting a diver from hypercapnia. It was thought that, during their pre-breathe, the diver might be able to detect that their canister had not been prepared correctly and CO₂ was breaking through. We were not quite sure what the signs would be—a headache, or some heavy breathing, maybe?

Anyway, we now know that we were being, at best, over-optimistic, and, at worst, delusional. You cannot detect a CO₂ breakthrough via a pre-breathe. In our defence, at that time, as I explained earlier, we were diving with no real protection against hypercapnia anyway, so we tended to clutch at any straw held out to us.

Nevertheless, it is still crucial to

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conduct a pre-breathe before every single rebreather dive. The pre-breathe confirms that the electronics are working. It confirms that the cylinder valves are open and that the rebreather can maintain the desired level of oxygen. It tells the diver that the CO₂ sensors or temperature monitors are functioning, and reassures the diver that the rebreather is correctly assembled and activated.

As a side benefit, many rebreather divers find that a five-minute pre-breathe just before getting into the water provides them with a perfect

opportunity to calm the mind, clear the mental cache and turn all their attention to the dive ahead.

In short, there is never any reason for not doing a pre-breathe before every dive.

An entirely avoidable tragedy

Only a couple of years ago, a young man managed to enter the water on a trimix rebreather training dive without first opening the valve on his oxygen cylinder. He stayed on the surface for the other divers to join him, rebreather mouthpiece in place, but, while he

was waiting, the oxygen level in the gas he was breathing was dropping, and, with the oxygen cylinder valve switched off, the rebreather could not add further oxygen to the loop to maintain the required PO₂.

As the oxygen level fell still further, the young man became hypoxic and lost consciousness. His mouthpiece fell out of his mouth and dropped into the ocean, allowing water to pour into his rebreather, making it heavier and dragging him underwater. He drowned, leaving behind a wife, three children and devastated family and friends.

It is hard to understand how this could happen, given today's well-established rebreather diving practices and training procedures and what we all know about how rebreather divers have died in the past. Yet it did happen. It was a terrible waste of a young life and could so easily have been prevented.

If the diver had run through a pre-dive checklist and done a pre-breathe on board the boat before getting into the water, he would have noticed that his oxygen valve was closed and he would have opened it.

This story would be tragic enough if the diver had just been on a fun dive. Then the incident could be consigned to the long list of rebreather

fatalities caused by human error. A diver made a mistake. End of story. But this was a diver who was undergoing training. His rebreather instructor and other qualified rebreather divers were on board, and nobody was watching out for him.

This points to an institutional problem.

It is impossible that anyone involved, even peripherally, with rebreather diving in recent years can be unaware that every single expert in both the manufacturing and training camps advocates using a checklist and doing a pre-breathe when preparing for a rebreather dive.

All rebreather instructors and experienced rebreather divers have friends and acquaintances who have died while using a rebreather and would not be dead if they had just done a pre-breathe and run through a checklist before the dive that killed them.

For someone to die like this in the 2020s, and on a training course, seems impossible.

Yet it happened.

Again, the message is clear. This is our problem, and we must fix it. ■

Simon Pridmore is the author of the international bestsellers Scuba Fundamental: Start Diving the Right Way, Scuba

Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Exceptional: Become the Best Diver You Can Be and Scuba Professional: Insights into Sport Diver Training & Operations, now available as a compendium. He is also co-author of the Diving & Snorkeling Guide to Bali and the Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia. His latest books include The Diver Who Fell from the Sky, Dive into Taiwan, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! and the Dining with Divers series of cookbooks. Visit: SimonPridmore.com.



The pre-breathe procedure is a critical part of the pre-dive safety check of rebreather equipment before every dive.



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