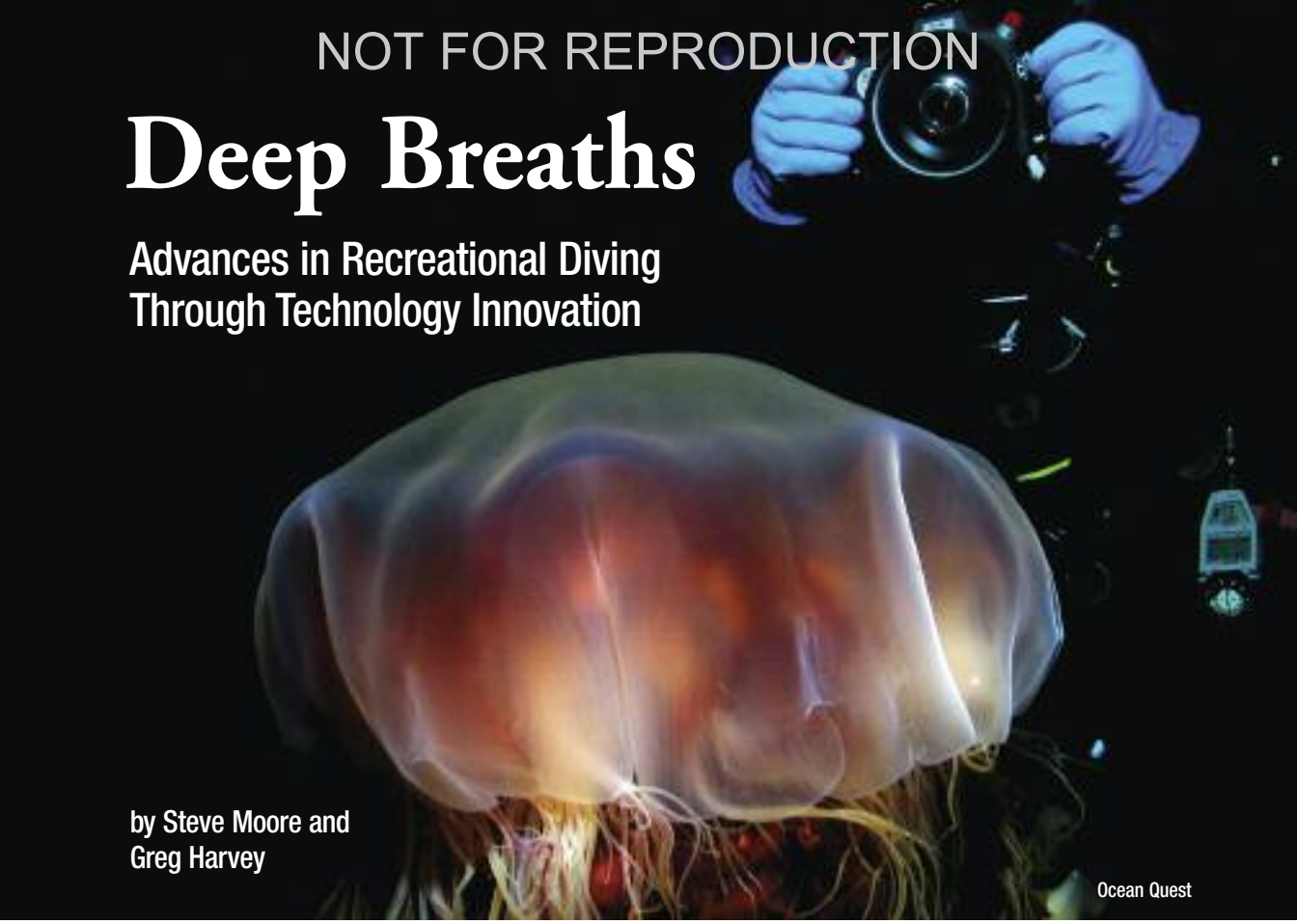
Deep Breaths

Advances in Recreational Diving Through Technology Innovation



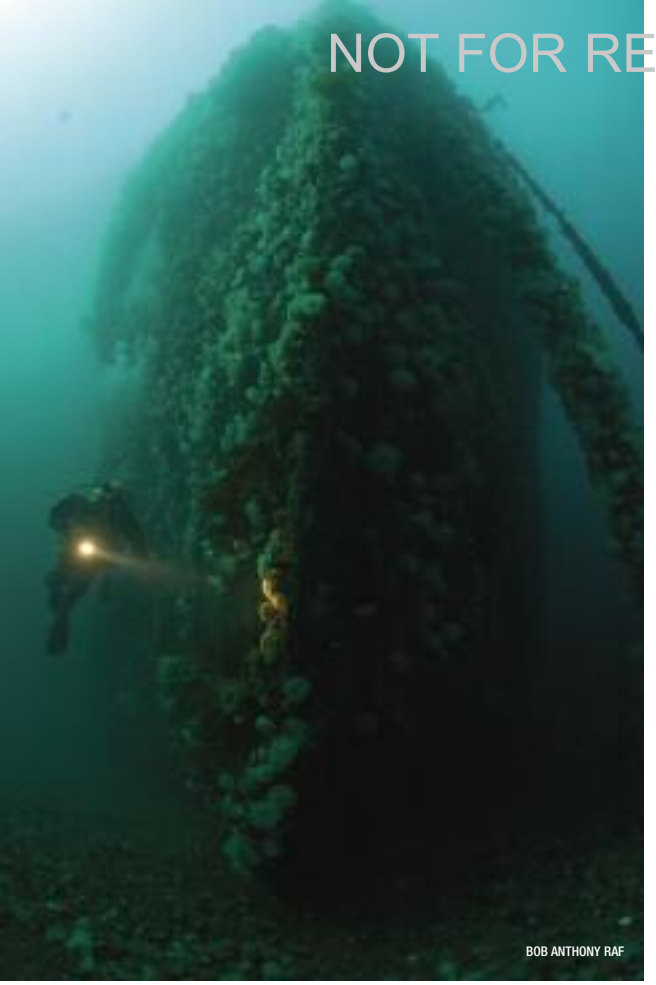
by Steve Moore and Greg Harvey

Ocean Quest

I wonder what Alexander the Great would have thought about Newfoundland and Labrador's beautiful underwater scenery had he taken his diving bell under our Atlantic waves back in 332 B.C - the year he used the device to observe military divers attacking port defences on the Mediterranean Island of Tyre. This is a period in history when archaeologists believe man had already been collecting items from the sea-bed for over 4,000 years. To think that this modern-day activity was employed so long ago in a war between the ancient Greeks and Persians is amazing, but it would seem like primitive equipment by today's standards. Rudimentary buckets or cauldrons were placed over a diver's head to trap air. This was the Navy SEAL equivalent of the day and a prime example of the use of technology.

An appropriate definition of technology, which applies to diving, is: Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. Indeed, the knowledge and processes developed over millennia, coupled with present-day science and apparatus are now enabling divers to routinely explore areas which until only recently were beyond our reach.

Since a French gentleman by the name of Jaques-Yves Cousteau and his friend Emile Gagnan paved the way by inventing the first fully automatic aqualung in 1943, recreational diving has boomed and with the onset of inexpensive air travel, diving tourism has grown equally well. Newfoundland and Labrador (NL) is rapidly finding its way to the top of many divers' gotta do lists and has seen a steady growth, attracting divers from around the world to enjoy its clear waters and abundant marine life around such sites as the Bell Island Wrecks - four Allied ore carriers sunk by German U-boats in 1942.



S.S. Saganaga sunk by German U-Boat U-513 in 1942 rests in approximately 110 ft of water. At 407 feet in length and covered in anemones and soft corals she's a photographer's paradise.

What is making diving easier and safer is the constant development of technology and unlike the SCUBA divers of yesterday, today's divers are speaking a completely different language. Whilst once they only talked about dive tables, buoyancy compensators, regulators, weight belts and, of course, fins (not flippers!), the divers of today are using acronyms and referring to gear that would be foreign to yesterday's divers. Talk of EAN, EAD, PO^2, FO^2, MOD, Trimix, Stage Cylinders, PDCs, Wings, Travel Gas, Deco Mix, HID Lights, O^2 Analyzers, Rebreathers and Pee Valves, is a reflection of the growing trend towards what has become known as 'Technical Diving.' The fast growing sector of technical diving is providing recreational divers with the knowledge, skills and tools to dive deeper, remain at depth longer and enter once prohibited overhead environments. In essence, Technical diving is SCUBA that exceeds the scope of recreational diving, requiring advanced training, superior skills and specialized equipment.

Everyone knows what a SCUBA Diver looks like, don't they? Skin tight wetsuit, cylinder on their back, mask, snorkel and a pair of brightly coloured fins, right? Not here in NL. Take a look at divers preparing to visit the Bell Island Wrecks, for instance or even the same island's flooded iron ore mine complex and you'll notice a big difference. Quite often, they're weighed down with two huge steel cylinders filled with a 'Trimix' blend of Oxygen (O^2), Helium (He) and air strapped to an inflatable 'wing', a separate 'decompression bottle' containing a high concentration of O^2, high performance breathing regulators, wrist mounted computers which look like huge watches, a high intensity lamp connected by an 'umbilical' to a large battery pack and maybe even a camera which is the size of a small car. All this over thick thermal underwear, a 'dry suit' inflated via a small cylinder filled with Argon (Ar) gas, a thick hood, gloves, mask and heavy rubber fins. They move around very slowly and deliberately, checking clips and gauges, bent forward under the weight of the equipment. Then – splash! The awkward looking figures shuffling around on deck have just transformed into sleek exploring machines – totally in tune with the collection of equipment and gases that will keep them alive throughout their brief journey. Our divers descend into the depths, confident that their training and experience will bring them back safely.

It's that very starting point – training – that gives would-be divers their first taste of the technology that is revolutionizing the sport and will take them towards technical diving. Online learning is now a major component in the diving industry. In the past, students would attend classroom sessions at a dive centre to learn diving theory but this is now available via the Internet. Innovative programs established by agencies such as SCUBA Diving International (SDI) allow the classroom work to be completed ahead of time, meaning students progress to 'wet' training much faster. Online learning has proven to be extremely effective and is available for continuing education programs beyond the basic diver level.

Computers come in many shapes and sizes and one that has become almost essential for divers is the Personal Diving Computer (PDC). Rarely is a SCUBA Diver seen without at least one these days. The often time consuming process of determining a safe diving profile to avoid decompression sickness (or Bends) by using complex decompression tables has largely been replaced by planning and diving with a PDC. A dive computer essentially provides the same function as tables but continuously calculates the actual depth and time, enabling a diver to safely remain underwater for longer periods, providing constantly updated information and warnings when required. PDCs are extremely versatile and can be programmed for the various mixed breathing gases commonly used by divers. A diver's computer will prompt 'decompression stops' at certain depths on an ascent to allow the body time to expel excess nitrogen absorbed during the dive. At this point, a diver will often switch to breathing a 'decompression mix,' which accelerates the process. Computers don't remove the need for thorough planning before a dive but they certainly increase the safety factor and allow divers to get the most from their activity.

So what's wrong with good old air? Why these 'gas mixes?' Well, the pressure of water and the effect it has upon the absorption of gas by the human body has always been a limiting factor for divers. To keep it simple, the greater the depth, the greater the pressure and the greater the amount of gas absorbed by the body when breathing. Nitrogen (N), which makes up 79% of air, has long been considered the 'bad guy' by divers because, when ascending, the decrease in water pressure allows it to expand in joints and tissue – a potential danger if ascending too rapidly and not allowing time to 'off-gas' safely.

This problem was identified in the late 19th century and prompted the development of the first decompression tables in the early 1900s. More recently, the use of mixed gases, blended with less N and more O^2 or even He, has enabled divers to extend their dive times at depths which were previously limited. Nitrox is the most commonly used and is simply O^2 mixed with regular air to produce a breathing gas with less percentage of N. A large proportion of divers use Nitrox and it is readily available at most SCUBA stores but it does have its own

Technical divers on the Bell Island Wrecks equipped with trimix gases to control their oxygen fraction and the narcotic effects of nitrogen.

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Diver photographing the propeller of the PLM 27 sunk in 1942 by German U-Boat U-518.

inherent risks because O^2 itself becomes a hazard to the Central Nervous System at a certain pressure. Divers will use a particular percentage, ie. 28%, 30% or 40% O^2, instead of the 21% in normal air, depending on the depth of dive they have planned. The only part of air we really need is the O^2 - the rest is 'surplus to requirements' so the use of He, an inert gas, in Trimix allows divers to reduce or even completely remove the N content in their breathing gas (a mixture called Heliox). It also allows them to reduce the O^2 content – remember that becomes dangerous too. He isn't as dense as nitrogen so divers get cold when breathing it – another problem! Let's fix that by using Ar, a much denser gas, as a dry-suit inflator. Wow, slow down - this diving sounds harder than rocket science! Not really. The training is readily available for experienced divers from many sources, one of the most prominent being Technical Diving International (TDI).

Computers and mixed gases have probably had the greatest impact on SCUBA Diving in recent years compared to other developments but there is a wide range of technology used by divers to keep them safe as they constantly expand the horizons of the sport. For example, regulators specifically designed for use in cold water, dry suits, scooters, etc – the list goes on. One invention rapidly gaining popularity is the Rebreather.

A rebreather is a machine which delivers breathing gas, then recycles what the diver exhales. Recycling lessens the volume of gas needed to be carried meaning it is more compact than regular equipment and extends the maximum duration underwater. Attempts at developing rebreathers date back to the late 1600s, long before regular SCUBA, and the idea has been used with some success for around 130 years. Nowadays, the technology is available to anyone and rebreather units are common. When the flooded Bell Island Mines were explored in February 2007, most of the

Diver exploring the bow of the *S.S. Rose Castle*. Sunk by German U-Boat U-518 in 1942. The *Rose Castle* is the deepest of the four Bell Island wrecks, resting in 150 ft of water.

international team of divers used rebreathers, which allowed them to venture much further, for much longer.

Diving longer can create problems, though. If you ask a technical diver what they do if they experience a full bladder during a dive and their answer is 'Depends,' it probably doesn't mean that they just consider their options at the time! Some will freely admit they wear diapers, others will proudly show off their custom fitted pee valve. Enough said about diving technology at its most basic!

Cave Diving is a branch of technical diving which is gaining popularity worldwide as technology has provided divers with the means to safely explore overhead environments. The cave diving team who explored the Bell Island Mines earlier this year declared them perfect for the activity and as a result TDI are now developing a 'Mine Diving' program which, when in place, could give the abandoned mines a whole new lease on life.

NL is considered a technical diver's and underwater photographer's paradise and prominent industry figures are visiting regularly. The Bell Island Wrecks are the main attraction due to their accessibility but the diversity of diving here, including with icebergs, whales and on some of the deeper marine life sites is affixing the province on the international diving map. It's not just visitors from other provinces or countries who enjoy what it has to offer.

Training for local residents is thriving and Conception Bay South now boasts the only TDI/SDI 5 Star Professional Development Centre in Atlantic Canada – Ocean Quest. With an on-site pool, state-of-the-art classrooms, sales & service centre, gas blending facility, Transport Canada certified dive boats and a large staff of diving professionals, Ocean Quest are considered to be industry leaders and have received several provincial and national awards for sustainable tourism. The region's first 'Discover Rebreather' program was held there recently by Ontario based Silent Diving Systems (SDS) and instructor

Using Closed-Circuit Rebreathers divers conduct final pre-dive checks before descending into No.2 shaft of the Bell Island iron ore mine complex.

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programs are frequent, keeping up with the demand for training as people realize what they have on their own doorstep rivals some of the well known warmer destinations.

Diving has come a long way since the days of our friend Alexander the Great. It has developed over the centuries – even Leonardo Da Vinci, who seems to have dabbled in most inventions we consider modern, had a hand in it when he produced a snorkel and fins in 1,500 A.D – but it has never been easier than now. Modern technology enables people with even severe disabilities to dive – as 'Scubility' pioneers SDI proved when they took muscular dystrophy sufferer Matt Johnson diving recently. As in the definition, it solves problems and extends human capabilities and as long as technology continues to develop, the possibilities for underwater exploration are endless.

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