A HISTORY OF SCUBA DIVING: PAST AND FUTURE

FEATURE AND PHOTOGRAPHY **PATRICK VAN HOESERLANDE**


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Is it because we feel freed from gravity in water? Or is it because we return to the 9 months we had felt so secure? Or are we bitten by a drive to discover other worlds? Or do we want to push our limits? Who will tell? One thing is for sure, from the evolutionary phase we came crawling out of water to develop further on land; we have as human beings, kept an adventurous outlook when it comes to water. Throughout the history of humanity, we find evidence of continuous desires to get closer to the world we know so well as divers.

WHO INVENTED DIVING?

Somewhere in a distant past, a bearded ancestor dressed in deer skins was scraping mussels off a rock when his knife fell into the water. The knife whirled to the bottom. Only by jumping in the water could he recuperate it. And so he chose to dive in. At that moment, he opened up a whole new era, that of the 'homo aquatica'. Whether it's for salvaging valuable objects or for fishing, from that moment on the genie was out and the desire to dive was no longer oppressed. The diver wanted to go deeper and stay down longer, but unless he could find a way to breathe underwater, his explorations were short.

The most famous diver from antiquity is the Greek, Scyllis. 2,500 years ago, he was taken prisoner aboard the ship of the Persian King Xerxes I. There he learned that Xerxes was planning to attack the Greek fleet. He grabbed a knife and jumped overboard. Despite their efforts, the Persians could not find him. After a while they considered him drowned. Under the cover of night however, he came back. Using a hollow reed as a snorkel, he swam from ship to ship and cut all the anchor lines. This made the entire fleet drift away and thwarted the Persian victory.

You could snorkel with a hollow reed, but it was soon clear to forefathers that a hollow tube longer than 50cm did not work well. At a certain depth our lungs cannot overcome the water pressure and ventilation becomes ineffective. Breathing using a bag did not meet expectations, the bag was emptied too soon and the inhalation of the same air created problems with too much CO_2. How could one go deeper and stay underwater longer?

In the 16th Century, some enthusiasts began to experiment with dive bells. These were infact nothing more than a large, reversed bucket that contained an air bubble. The bell served as an air pocket for a free diver to refresh the air in his lungs after every short stay outside the bell. He could repeat this procedure until the compressed air supply was no longer usable. Later, the air was refreshed or replenished via a pump system on the surface making longer dive times possible. After a while, the divers got a suit to sustain the cold and the bell was getting smaller until it fit over the diver's head. That was the start of helmet diving ('scaphandre') or diving with an air hose. The next step was to get rid of the air hose, the diver's lifeline from the surface. Some people found helmets and suits to not be enough and decided to close the bell and by doing so invented the submarine.

This evolution shows the 4 ways invented to immerse and explore the underwater world in a more or less comfortable way: apnea, with an air supply from the surface, with an independent air supply and in a submarine. Although the development of these four methods occurred independently of each other, they do influence each other. Apnea diving, followed by diving with a hose laid the foundations for our scuba diving of today. It is not surprising that these two disciplines play an important role at the very beginning of the scuba diving timeline. To produce a complete list of important data is nearly impossible, so I propose a quick, short dip into history:

1535 – Guglielmo de Loreno develops the first real diving bell.

1650 – Guericke invents the first, effective air pump.

1667 – Robert Boyle, English physicist and 'father' of the law of Boyle, detects a gas bubble in the eye of a viper after putting it under pressure, followed by a decompression. The scientist observed the very strange behavior of the snake, making this the first written report of a decompression bubble and disease ('bends').

1691 – Edmund Halley claims a patent on a weighted diving bell with an air hose to the surface.

1715 – John Lethbridge builds an oak diving cylinder placed under pressure through a pipe. The operator is able to work with his arms free through holes in the cylinder.

1825 – The race for the first workable piece of scuba equipment is won by the English inventor, William James. His system consists of a cylindrical air tank with a pressure of 30 bar. There is no trace of a successful dive.

1826 – Charles Anthony and John Deane introduce a patent for a firefighter's helmet. Connected with belts to the body and equipped with a hose, this helmet is also used for diving.

1828 – John Deane and his brother use the helmet in combination with a diving suit.

1837 – The German inventor Augustus Siebe, who lives in the UK, connects Deane's diving helmet with an air filled, rubber suit. This fully closed diving suit connected to an air pump at the surface, is the first reliable diving suit and is the prototype of the contemporary models. In his eulogy, Siebe is called the father of diving.

1839 – Seibe's diving suit is used in the salvaging of the British warship HMS Royal George at a depth of 20 meters. During this salvage operation, the divers complain of 'cold and rheumatism'. This is one of the first reports on symptoms of decompression sickness during diving operations. Another first, is the use of the buddy system.

1843 – After the experiences gained during the salvaging of the HMS Royal George, the Royal Navy opens the first diving school.

1865 – The French mining engineer Benoit Rouquayrol and the Naval Lieutenant Auguste Denayrouse, patent the 'Aerophore'. This device consists of a horizontally placed steel tank (pressurized to15 to 25 bar) on the back of the diver which is connected through a valve system to a mouth piece. The diver only gets air when he breathes. A membrane controls the breathing pressure as a function of the ambient pressure. In normal situations, the low pressure tank is connected with a hose to an air pump at the surface, but the diver can disconnect the hose to dive 'unconnected' for a few minutes. The 'Aerophore' is the first 'on demand' underwater breathing apparatus and is the forerunner of our modern scuba equipment. It is also the first application of the 'bail out' safety feature. For years, it's the standard equipment in various navies. In his "20,000 miles Under the Sea', Jules Vernes equips his heroes with the 'Aerophore'.

1876 – The English merchant Henry A. Fleuss develops the first workable, independent diving equipment based on the use of oxygen. This device is a closed system in which the exhaled carbon dioxide is absorbed by a rope soaked in caustic potash and is the basic design for our modern rebreathers. Although limited in workable depth (the toxicity of oxygen at great depth had to still be determined by trial and error) this bubbleless device allowed an autonomy of almost 3 hours.

1878 – The Frenchman Paul Bert (the Paul Bert effect!) publishes his book 'La Pression Barométrique', a 1,000 pages long description of his studies of the effect of changes in pressure on the body. He demonstrates that decompression sickness is caused by the formation of nitrogen bubbles and suggests a gradual ascent as a preventive measure. Bert explains the relationship between the observation of Boyle and the symptoms of decompression sickness diagnosed with caisson workers. He also suggests recompression as a cure.

1893 – Louis Boutan invents the first underwater camera.

1906 – The British government asks the leading scientist, John Scott Haldane to research the prevention of decompression sickness. 2 years later, he and two others publish the fundamental work 'The Prevention or Compressed-Air Illness'. Thanks to their studies on goats, the scientists argument to use decompression stages. The dive tables based on this fundamental work, are very quickly adopted by the British Navy.

1911 – The German Draeger introduces a reliable oxygen rebreather.

1912 – The US Navy tests tables published by Haldane. This leads to the first US Navy dive tables which will protect many divers from the bends.

1920 – In the USA, research starts on the use of helium-oxygen mixtures for deep diving.

1923 – W. H. Longley becomes famous for the first underwater colour photographs.

1924 – The US Navy and the Office of Mines lead the first experimental helium-oxygen

dives. Until the start of World War II, the USA retains the monopoly of helium.

1930 – The American ex-pilot and author, Guy Gilpatric residing in France, experiments during spearfishing with rubber pilot goggles. The modern version of the dive mask that covers nose and eyes is the result of a combination of ideas from the Russian, Alec Kramarenko and French, Yves Le Prieur and Maxime Forjot.

1933 – The Frenchman Louis the Corlieu patents the first dive fins, the 'Swimming Propellers'. The snorkel completes the basic diving equipment.

1933 – The French captain at sea, Yves Le Prieur, fits the 'Aerophore' (see the year 1865) with a specially developed valve in combination with a high pressure tank (100 bar). This gives the diver a certain degree of autonomy while he is not hindered by all kinds hoses and lines. However, the device has no regulator. The diver gets air by manually opening a valve. The expired air escapes along the edge of the mask. Three years later, this device is in the inventory of the French navy.

1936 – Le Prieur starts the world's first scuba diving club, called the 'Club des Sous-l'Eau'.

1938 – After years of successful writing for The Saturday Evening Post about his adventures in the Mediterranean, Gilpatric publishes the first book on amateur diving, 'The Complete Goggler'. One of the readers is the French Naval Lieutenant, Jacques-Yves Cousteau.

1938 – Edgar End and Max Nohl make the first scheduled saturation dive. Together they stay 27 hours at a depth of 30 meters in a hyperbaric chamber. Although the decompression lasted five hours, Nohl suffered from the bends.

1941-1944 – During World War II, Italy uses scuba divers with midget submarines and closed systems to sink British warships and merchant ships. Later in the war, the British use a similar tactic to sink the German battleship, Tirpitz.

1942-43 – Jacques-Yves Cousteau and an engineer from the Parisian firm, 'Air Liquide' – Emile Gagnan, work together on an expansion valve that provides the diver with air on demand. Until then a diver received air continuously, or after manually opening a valve. Why the 19th Century invention of the 'Aerophore' was forgotten, we do not know. But in January 1943, they connect this regulator with a double air tank and a mouthpiece and test the configuration in the Marne. After placing the intake and the exhaust valves at the same height, they patent the 'Aqua Lung'. This system represents a milestone in the history of diving.

1943 – Cousteau and two friends, Frederic Dumas and Philippe Tailliez, make more than 500 dives with the 'Aqua Lung'. Hereby they go deeper with every dive. In October in the Mediterranean Sea, according to the plan Dumas dove to 70 meters and experiences 'l'ivresse des grandes profondeurs', better known as depth narcosis. In 1947, he reached 94 meters.

1946 – Cousteau's 'Aqua Lung' is sold on the French market.

1951 – The reserve valve, later known under the name "J" valve, has been developed.

1953 – Cousteau, Dumas and Dugan publish their book, 'The Silent World'. This book tells about the development and the first tests of the Cousteau-Gagnan 'Aqua Lung'.

1955 – Al Tillman and Bev Morgan create the first formal certification program for diving instructors.

1956 – Scientists at the University of California design the first wetsuit. Ted Nixon uses the 'red-white' flag for 'divers in the water'.

1958 – Sherwood Manufacturing announces the invention of the piston regulator.

1959 – On January 11th in Monaco, Cousteau founded the 'Confédération Mondiale Des Activités Subaquatiques' (CMAS).

1962 – In September, the first underwater habitat experiment, Conshelf One ('Continental Shelf') starts. Under the leadership of Cousteau, Albert Falco and Claude Wesley live for seven days at a depth of 10 meters. They use their underwater house 'Diogenes' as a base for their dive explorations.

1970 – The system of certification as an indication of the level of training and experience wins popularity in the world of divers.

1971 – The firm ScubaPro introduces the first BCD on the market.

1983 – The first commercial dive computer, the 'Orca Edge', is put on the market. Several manufacturers follow and a few years later, the dive computer becomes part of the standard diving equipment.

1990 UNTIL NOW – Each year, hundreds of thousands of people start to dive. Encouraged by a growing market, new developments that make diving easier and safer, find their way to the public. To distinct themselves from the recreational diver groups, specialized divers are formed. An example is the 'Technical Divers', non-professional divers who use advanced technology such as oxygen, helium, 'full face' masks, propulsion, etc.

AND THE FUTURE?

After running through the history, let us now focus on the future. It is not without risks to predict how diving will look over a number of decades. I will nevertheless make an attempt.

Unless space travel will be within everyone's reach, diving will still be the only way to discover a completely different world. The human desire to explore unknown things will further increase the popularity of diving; the market is not saturated yet and will stay so for long. This, of course provided that humanity is in time aware that the oceans need our protection and that we will actually need to do something about it. It gives little satisfaction to dive below the water's surface to go to see some bleached coral reefs and fields of fish bones filled with mud. In that kind of future, we will admire the few rescued marine species that will be protected only behind glass in an aquarium as part of our natural history. We must work together to ensure that in the future, fish are not something strange to discover in a place called Aquatopia.

Let us leave this pessimistic idea of the future behind. I'll take you on a diving holiday somewhere in a brighter future. For this diving trip, we are in 2030 where we have booked a nice hotel. No, not the type that we know nowadays, but a hotel underwater (you can find them near all the beautiful dive sites). An under sea boat or a hyperbaric elevator brings us as hotel guests, down to 30 meters from which our daily dive trips will begin. If we open the shutter of our window, the miraculous colours of the house reef lighten up our room. Looking around, we discover some lovely spots for our next dives and in the distance we perceive the shape of a whale. Magnificent. But you should see the scenery at night. Stimulated by exterior lighting, there is marine life everywhere. The visual spectacle is simply inconceivable. Fortunately, they turn the lights off around midnight; otherwise we would never go to sleep.

Thanks to new materials and product developments, almost everyone can enter the underwater world. The combination of micro-electronics, atmospheric diving suits and mini

submersibles makes it possible that somebody can, without theoretical or pool training, enjoy the marine fauna and flora.

However, we are interested in the contact with the water and prefer classic diving to all that touristic high-tech stuff. Although we like to call it 'classic', our equipment is not what it was 15 years ago. Our suit is made from a substance that despite its thin layer, quasi completely isolates us from the water. This suit keeps our skin and our whole body at a constant, comfortable temperature. The very smooth outer coating lets us glide frictionless through the water and dries immediately once we get out of the water. No wet suits to stow anymore. Through an ingenious system, it is very easy to put it on and move around, but as soon as we go in the water, the suit becomes 'glued' to our body.

Our fins look like those of the old models, because despite all efforts, no significant improvements were introduced. Although we still wear them, we use them only for small movements and for our own convenience. Miniature propellers provide us now with the necessary propulsion for covering long distances (other propulsion systems were either too expensive or too noisy). Scuba diving in a strong current is no longer a problem and the limitation of 0.5 knots is something of the past.

The biggest changes are found in the pack that we carry on our backs. The very compact and light backpack is a wonder of high technology. Some fifteen years ago, the two stages were replaced by an electronically controlled rebreather. It's only in the pool that we sometimes train with the old, mechanical regulators to show them to the new generation divers or out of pure nostalgia for the old days. The composite tanks contain oxygen and helium under extremely high pressure. Despite their limited size, they give us a very large autonomy. In addition, our rebreathers are equipped with a membrane that filters oxygen out of the water. This gives us an almost unlimited bottom time. A network of four small supercomputers control this system meticulously and projects useful information on our full face mask.

By a network of sonic beacons in the vicinity of the hotel, we can perfectly orient ourselves. Direction and distance are continuously projected on our full face mask. If we go outside this sonic zone, our integrated compass and inertial platform provide us with the necessary navigational data. This system is so refined that wreck and cave divers abolished the reel long ago.

Through an underwater communication system, we cannot only talk to each other, but also with our computer and in the case of an emergency, with an emergency station for divers.

In addition to our mask there is a mini camera allowing instantaneous identification of fauna and flora. The computer detects marine life faster than us; projecting all information on the species, lifestyle, hazards…This camera runs continuously to record our dive and to adjust our dive torches in relation to visibility and the surrounding light. The light intensity of the latter is minimal because our masks are equipped with night vision technology. The camera has landscape recognition software that makes it possible to find our way back in the rare event we get lost.

And there are more perks in our backpack: the system ensures that we always have neutral buoyancy. Although the button still exists, manually inflating or deflating is rarely done. Sensors detect our intention to go up or down and manage the BCD accordingly. In the unthinkable situation something goes wrong, all biomedical functions are carefully and permanently monitored, the backpack activates the emergency procedure. As a perfect buddy, it brings you safely to where help is available (even in a closed environment). Once there, it warns the emergency services and keeps them informed.

The system is not only our buddy, but it also takes care of the other divers in the group. The computer follows our buddies and tells (yes, you not only get visual, but also auditory information) you where they are. The buddy line together with the buddy concept was deserted years ago as it was no longer needed. We dive with two because we like it, not because it is a rule (an attempt to send robots as buddies was too expensive, cumbersome and unnecessary for the modal diver).

Our diving equipment is capable of doing so much more, but I find those so normal that I have forgotten them.

If you think this vision is exaggerated? Let's talk again 15 years from now. Or better, let's meet and dive then.

SOURCES:
Barlow Rich, 'Future Gear', **www.scubadiving.com**
Hanauer Eric, 'Diving Pioneers: An Oral History of Diving in America'
History of Diving Museum, **www.divingmuseum.org**
Marine Bio, **http://marinebio.org**
O'Brien Brendan, 'Future Shock', **www.divernet.com**
'Scuba Diving History Time Line – A Letter History or Scuba Diving', **http://scuba.about.com**
'Scuba History', **www.about-scuba-diving.com**
The Historical Diving Society, **www.hds.org** and **www.thehds.com**