ADVANCED DIVING: THE NEXT GENERATION

: MATHEW PARTRIDGE

+ FOR NEARLY THREE DECADES SPORT DIVERS HAVE BEEN USING DIVE COMPUTERS FOR DIVE PLANNING AND DECOMPRESSION CALCULATIONS. SINCE THE INTRODUCTION OF THE FIRST ELECTRONIC COMPUTER IN 1979, THE ORCA EDGE DESIGNED BY DECO BRAIN HANS HASS, DIVE COMPUTERS HAVE EVOLVED INTO MODERN DIGITAL COMPACT WATCH-STYLE, MULTI FUNCTION, DIVE COMPUTERS, WITH LOTS OF BELLS AND WHISTLES FROM BUILT-IN DIGITAL COMPASS TO HEART RATE MONITORS. SO WHAT'S REALLY CHANGED IN THE LAST FEW YEARS IN COMPUTERS ADVANCED DIVERS ARE CHOOSING TO EXTEND THEIR DIVES AND PUSH DEPTHS FAR BEYOND THAT CONSIDERED THE NORM JUST A DECADE AGO?

First we need to consider the behind-the -scenes formula, the deco algorithm used to compute the NDL, or required deco stop time remaining. Professor Albert A. Buhlmann, M.D. published the results of his years of research in the first edition (in German) of a book entitled '*Decompression - Decompression Sickness*'. An English translation of the book was published in 1984. This book was the first nearly-complete reference for making decompression calculations and was widely available to the diving public free of copyright law. The algorithm calculated was based on real time data. As a result, the 'Buhlmann algorithm' was adopted by many of the manufacturers of wrist-style in-water decompression computers as well as programmers of desktop deco software programs. This style of algorithm considers dissolved gas within the body's tissue, hypothetical compartments with differing half times and usually compute considering either 12 or 16 hypothetical compartments - the ZH12/ZH16 model.

Mainstream manufacturers have sold thousands of this style of computers worldwide and they've helped to improve safety amongst sport divers. But to some people's dismay, they do not guarantee a diver will avoid a dose of the bends, even when the computer says 'all is well'. Physiology differs on an individual basis; levels of hydration, age, fitness, and Patent Foramen Ovale all play a part in avoiding DCI.

Technical diving, including use of Nitrox, Trimix, and rebreathers to push the envelope in deep wreck and cave diving, had us seeking more effective decompression models. This was because the 'bend-and-mend' approach to decompression from The Buhlmann calculations resulted in its fair share of problems on deep dives, especially those implementing helium mix at depth.

Decompression scientists and technical divers have been implementing a new style of decompression which also considers free phase gases. This form of decompression science is concerned with the formation, consequence, and safe elimination of gas bubbles that occur primarily within the blood as a result of gas micronuclei, tissue super-saturation, and ascent speed, as well as factoring in the gas within the tissues.

The origins of the free phase models begin in the commercial diving world and the practices followed by pearling divers in Australia and diving fishermen in Hawaii. In the 1980s decompression bubble models where presented by David Yount (Varying Permeability model or VPM) and Tom Kunkle (Surfactant Stabilized Model). Brian Hills 1977 book '*Decompression Sickness*' explored these concepts further. Currently the most high profile developments to free phase modeling are associated with Bruce Weinke and the RGBM (Reduced Gradient Bubble Model), and the V-Planner software

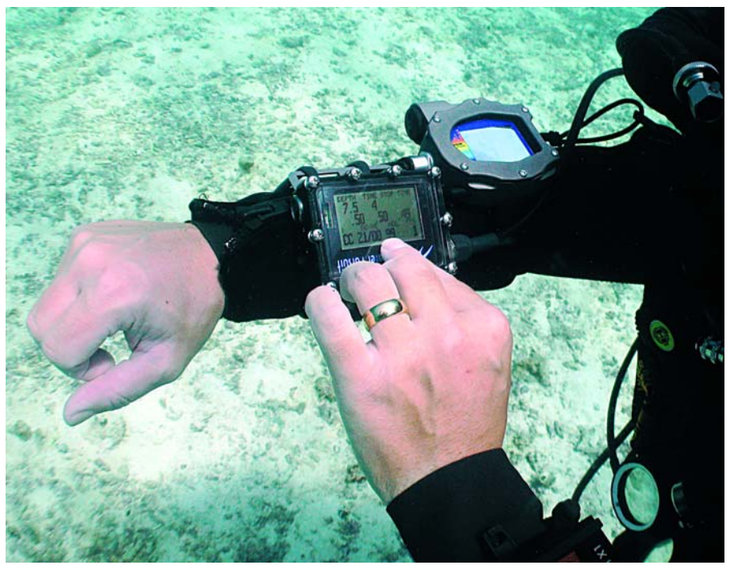
developed by Ross Hemingway using VPM foundations. Both platforms are being used by deep divers all over the world. In a nutshell, a diver executes a series of much deeper stops to help control the formation of critical bubbles. In doing these stops it's believed that the diver is preventing bubbles, rather than curing them by long traditional stops in the shallows.

Emerging technologies have allowed implementation of this new style of decompression into modern wrist-mounted dive computers, in the past only found in desktop planner form. So what does all this mean, you may ask? Well, if you're either new to diving or considering upgrading an existing computer, it's much more interesting to review what's in the dive computer as opposed to what it looks like. Advanced hardware and software developments have paved the way for manufacturers to introduce free phase deep stop computers for the advanced recreational and serious technical divers.

THREE OF THE LEADING ADVANCED DIVE COMPUTERS AVAILABLE TODAY

VR3 from Delta P Technologies, UK.
This computer has long been the leader in mixed gas and rebreather interface dive computers. It comes with both standard dissolved gas and free phase (VPM) algorithms that users can switch between based on the type of dive they are planning. At first glance the computer is a fair bit bulkier than the others reviewed, but that could be a good thing (especially if it's going to take a bashing, as a lot of my kit does). It has a host of user selectable features that include:

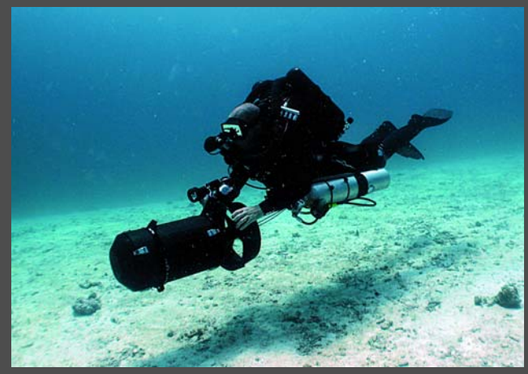
- User-changeable AA battery, either 1.6V alkaline or 3.6V lithium.
- External switches, meaning the computers are fully programmable underwater.
- Variable light settings.
- Right/left wrist mountable.
- You can install up to 10 pre-set gases in the gas list; air, oxygen or any nitrox, trimix.
- You can choose either mono, colour, or HD screen technology.
- With the optional analyzer mode enabled and cable fitted, the VR is capable of operating also as an oxygen analyzer.
- You can either select a pre-selected set-point when diving a rebreather, or interface direct to the unit and get real time PPO2 monitoring.
- All come complete with dive log software and are fully upgradeable as new technologies emerge.



Having conducted a series of dives using the VR3 it appears to be all you'd need for all levels of dives, from a shallow reef dive to an exploratory dive on a sub at 100 metres. On the downside, it's not the easiest computer to set up and use. It takes several dives to get used to all the press functions, but with a recommended read of the manual it is all soon figured out. The computer's strap is also a weak point for such an advanced piece of kit, but nothing a strong bit of bungee or a lanyard wouldn't fix.

X1 from Liquivision Products, Canada.
A revolutionary piece of hardware that allows a diver to select the software by download and personal model selection.
It boasts endless features, from its uniquely compact size, user rechargeable lithium battery, and funky touch navigation system. It has all the required planning features for both open and closed circuit nitrox and trimix. Here are a few of its other features:

- Custom software available.
- 128x64 OLED display (Organic LED) ultra-bright with giant fonts for easy readability.
- 350m depth rating.
- Four depth alarms up to 400m.
- Dive profile graph viewable directly on the unit.
- Dive log and summaries with large memory.
- Five salinity settings for extra accuracy.



- Up to 20 hours of actual dive time between battery recharges.
- Battery never needs to be replaced

This computer is set to take the advanced technical community by storm; they already have dealers all around the globe. On the down side... I'm struggling to find one. Ah, yes! Cost, at US$1750 plus software download, it's not cheap. But remember that old saying?

Shearwater Pursuit from Shearwater Research, Canada.
Designed by Bruce Partridge, who has designed and implemented computer systems since 1972. A very interesting addition to the world of mixed gas ccr computers in that it has a very solid easy-to-use interface and reliable design at a cost that's affordable. Its powerful feature set include:

- Easy to understand menus.
- Easy to read displays.
- Long battery life.
- Robust cases.
- Automatic backlight based on ambient light conditions.
- Full nitrox and trimix decompression planning.
- Closed circuit compatible.

Of all three of computers described, this is by far the easiest to use. It's a simple 'plug and play' device and comes complete with an easy PC interface that allows users to download updates free of charge as they become available. At just US$900 for the basic model, it's surely set to be a winner.

MY TOP TEN TIPS WHEN LOOKING TO GET A DIVE COMPUTER ARE:

- Consider its algorithm and take time to understand it. As most wouldn't go bungee jumping without first measuring the rope.
- Ensure the unit you buy is easily upgradeable as you master new skills and techniques.
- Read the manufacturers warranty to avoid any nasty surprises.
- Ask your local dealer to demo you the computers you're interested in.
- Buy from a reputable source to ensure back up support on your product.
- Consider battery options, is it user changeable vs rechargeable.
- Does it come with PC software and is it compatible with Mac.
- Consider Gas options, Nitrox, Trimix, Rebreather you may not need them now but getting a top speck unit from the off could save you money in the long run.
- Consider currency exchange and import duty if buying from abroad.
- Check out these links for more information on any of the mentioned Computers ???