

A dive to 313m...successfully

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I like to dive deep, I like a challenge and it's rewarding to do something difficult and return safely. In February 2003, I almost dived my last dive, and this was my first major diving incident in almost 3000 dives. This deep dive was to 260m as a practice dive for a deeper one soon after. The ascent plan was aggressive time wise, but I had built confidence in this particular decompression algorithm and had dived it "deep for long" many times. How mistaken could I have been? The decompression schedule proved woefully inadequate and the injuries I sustained will probably take a lifetime to fully recover from. During my rehabilitation I couldn't do much but read books and try to make the best of it. I went over my dive plan again and again, It was not until after the dive that I discovered that although it was commercially available dive software, It was not tested in any way, and had no place suggesting it could provide an ascent solution from a depth well within its stated specifications.

As time went by my health improved, and over the months I became proficient in dive table design and had reworked a dive plan, which I felt covered all the weaknesses of the February plan. My doctors had advised me against diving again, but what had become a career for 10 years was proving very hard to simply discard. If I had not been able to return to the sport I love, then the depression that was sure to follow would be harder to endure than any physical injuries I might suffer.

Anyways...now I can build my own dive plans incorporating years of deep dive experiences and its not rocket science at all with all the information freely available and man tested long before most of us were born. If its new (as I found out to my cost) it has not been tested outside of a PC or Petri dish. The dive plan software I worked on together with a colleague knowledgeable in programming skills, reflects information actually tested by commercial divers in the past, utilises data from large dives that have not worked recently and includes matrixes to avoid counter diffusion problems, It has already received interest from military and governmental academics. Even more so with its recent success on predicting the ascent solution from the deepest solo dive ever, at 313m without DCI. I believe that now, safe, extreme scuba doesn't need luck.

Right...less of the sobering stuff and more information on the dive...

(I think) A dive below 300m needs a rapid descent. This causes HPNS and this can be minimised by using a high Equivalent Nitrogen depth (END) value. I used an END over 70m. I kept the oxygen high on this dive also (Po2 was 1.6+). The reasons for this are as follows. The exposure was short, so not problematic (for me). Keeping the helium as low as possible in the bottom mix has many benefits, and it makes it easier to derive the next Trimix decompression gas. There will always be a step up in nitrogen on open circuit, unless you have "yet another bottle", too many bottles adds to the risk, and a support diver bringing gas to 150m+ is not ideal either! On the dive my nitrogen "spike" was down deep when critical tensions were not yet high. The 140m deco gas went up 10% nitrogen with a raise of 6% oxygen, this meant that the rest of the ascent gases could keep the same or more helium and critically...less nitrogen.

All the subsequent ascent gases kept the same helium content from 140m to 9m, the only changes were to increase oxygen and decrease nitrogen. At 9m, Heliox was used, it has no n_2 to complicate matters and is fast to decompress with. I managed oxygen toxicity by keeping PO_2 low from 6m. No "air breaks" were needed (call them what you want) Air breaks work OK in a o_2/n_2 (chamber) environment...but are possibly suicidal on a Trimix / Heliox dive. Trimix "air breaks" or Heliox "air breaks" are just as bad, for the same reasons. Managing Po_2 's to the 1.3 level is by far the safest way to deal with long decompressions.

Having no "p o_2 breaks" (better term for air breaks) is hard from a pulmonary toxicity point, also breathing heliox on open circuit for multiple hours is difficult. It might be "easy" to breath but the body wastes energy heating it (as it arrives in the lungs cooler than a typical nitrogen/oxygen mix and overall heat loss can reach unsustainable levels. (Helium has a high capacity to bleed heat from the body, which is strange for such a light gas)

I chose the heliox route, to avoid counter diffusion problems only (the cause of all my previous dive problems) and knew that its use was troublesome but less life threatening. To counter the enormous dehydration due to immersion diuresis on this almost 7 hour dive, I had to drink 2-3 litres every hour and this was difficult. A CCR would be the better alternative on the heliox deco (warm and moist) A dropping set point would be my choice also to counter the pulmonary toxicity and increased carbon dioxide complications. The longer times on deco that this would have caused would be worth enduring.

The OTU and CNS count on this dive was going to be high and managed, by not chasing the 1.6 Po_2 mantra, If I had then...who knows, although a drop in vital capacity was measured for 25days + after the dive. This may have been in fact, lung fatigue from breathing un heated un hydrated gases for long periods (my own view) or simply pulmonary toxicity

This text is not a recipe for deep dives, but simply how I did it and (possibly) how it turned out so favourably. You will note that I did not mention ascent rates (critical), where the deep stops were (critical), also I didn't mention any mix values or the stop depths/ times themselves.

Extreme deep diving successfully is a complex business. Its not really a competitive sport, in fact you are competing only with yourself...and if you lose, you lose the farm.

Since completing this deepest solo dive, I received numerous emails, mostly well wishes, but a few from would be "Extreme Explorers" less impressed. A few mails were from Explorers angry with me for not sharing information. My purpose for attempting this deep dive, was to find some answers and prove some theories.

Deep Explorers who are only interested in going on previously trodden ground, are not explorers but thrill seekers. If these divers want thrills then ...diving with an un-proven ascent plan is as thrilling as anyone could want! If people would like some tips on deep diving then of course I am happy to help in a professional level, the information I have at the moment has commercial value, and I will treat it as such.

Divers at Explorer level will either be diving in un dived areas of sea, or diving in unknown areas of physiology. The latter category have over the years proved again and again what does not work, but still many are willing to embark on virtual suicide missions believing that strength or fitness rather than technique, will somehow over come the physical brick walls of extreme deep diving. I have always tried to embrace new ascent solutions, but these can be every bit as precarious as the old school techniques.

From what I read of previous deep dive accounts, they all seem to follow similar themes. Dropping to maximum depth like the US dollar and then ascend like a jet fighter on afterburner. I thought this was wrong the first time I read it, a rapid ascent would ensure problems for later, but also, from my previous experience, too long spent in deep water would need serious redress also and could cost me as dearly as before. Deep water decompression is an emerging science. The benefits gained can be dramatic on the overall decompression by stopping deep for short periods, typically less than 30 seconds. Too many stops though below 200m though would add heavily to the overall decompression burden. I chose a relatively slow ascent rate from the bottom at around 18m per minute for my planned dive to 320m, the first stop was around 250m, with the next 4 within 18-20 metres of each other. I planned and planned this dive, fine tuning the gas mixtures so that the Nitrogen values would be dropping on the ascent after one initial spike early on in the ascent. Some bad gas choices on the ascent would impact heavily on the decompression, combined with too much and then too little decompression stops would have affects similar to my previous dive. The maximum depth gases for this dive would be largely helium with 20 per cent nitrogen and 5 per cent oxygen (ish). The relative ratios of the breathing gases can have a dramatic affect within the body as gases of different solubility and density jockey for up-take and/or elimination hierarchies.

I had built my dive plan for a deeper dive before deciding whether I was dive fit. During the subsequent months I returned to dive fitness (on my own estimation) and at 10 months post accident felt confidence and fitness were at levels necessary to attempt a deep dive.

Once the date of the dive was agreed, support divers would need arranging and briefing and the dive tanks filling. The tanks alone for myself and fourteen support divers would take 3 full days to fill, and use almost 60 cubic metres of helium. The tanks were filled just two days before the dive, and this in hindsight was too close as the process was stressful as was the loading of the dive boat during a squall that had recently blown in. I had insufficient sleep that night and would have made an excuse to postpone the dive had the weather not been perfect by providing gail force winds that day.

The team met early that morning, my feelings were not of confidence at all and, I felt relief that the weather was simply undivable. Normally I feel quite optimistic pre dive, but the sheer relief I felt of not going that morning was incredible. To postpone the dive was an expensive exercise for me, I could afford to fund one more attempt and then would shelve the project until I had saved enough to repeat the process. I had wanted to dive during a period of small tidal movement and the next window of opportunity was 2 weeks away and exactly 1 week before Christmas day. I did think of rescheduling into the new year as I did not relish the thought of Christmas Dinner in the recompression chamber and also

the unusual nagging doubts I kept having were taking their toll.

During the next few days I felt like the storm clouds were passing in my mind, I started to feel as good as I would need to soon. The following week passed easily and I managed several practice dives in less than ideal conditions. The day before the dive I went to bed early mindful of the current windy conditions. I woke up to blue skies and calm seas and I felt as carefree as a 6metre support diver! The journey to the dive site was 4 hours of smooth seas and I felt absolute confidence, this helped to ease all the support divers anxieties and put the whole boat into business mode.

I dived in Phuket Thailand 35 miles offshore. The dive site was on the edge of the continental shelf at 450m+ depth. The drop line was weighted and marked every 1m. The tides were right the day of the dive as was the weather. The dive had been aborted previously due to weather (and other less predictable factors). The dive boat and rescue boat were courtesy of ScubaCat.com (where I've been working). The support divers were great again as they were in February when they held me on the line while I convulsed vomiting for 3 hours due to counter diffusion induced DCI. Medical support is great in Phuket with plenty of state run (good, inexpensive) chambers and a selection of the "usual suspect" private chambers. Phuket treats its divers seriously and you need be never more than 1 hour from a chamber (our rescue boat had 900 petrol horsepower bolted to the back!)

The regulators were chosen for their heavyweight all metal construction helping to maximise internal temperatures. The DFC system is great at managing high gas flows with its smooth operation as opposed to venturi flow support, Finally no environmental seal means less intermediate pressure amplification with the ensuing high pressure seat instability etc The water temp was 3-4 c at depth, the gas flows were enormous but all resulted in zero free flow or stutter.

The descent went very smoothly, the unusual currents would go down then up then get weaker then stronger, but mainly because of the slack tide window and neaps dive time, the tides didn't have a detrimental effect. Once 180m depth came, it brought with it the darkness. Underwater lighting has come a long way in the last year and its now possible to virtually guarantee operation to 300m (with the right lights of course!)

My head mounted lights shone onto the down line and every while I would check my depth on the taped measurements against my depth gauges. By 250m I still felt in charge, my lowish helium content added the sort of (couple of pints) confidence that would help avoid helium tremors and other HPNS symptoms. The water temperature was chilling, but my dry suit kept the icy water out, I noticed the shakes in my body and hands, but couldn't really say whether it was the cold externally or internally or helium induced tremors. By 280m I started to grip the line tighter to slow down, I checked my back gas contents gauge and was not impressed by the figure. I had reached my gas turn around pressure by 300m. I didn't seem overly concerned and this concerned me! I dropped to 310m and looked again at the gauge, 20 bar behind schedule and planned drop time exceeded by one minute. At this time I looked down and saw a ghost like image of some kind of large hydroid, I scanned my eyes from left to right to check for any visual abnormalities and to check the distance more exactly of my jelly like visitor. The little checks I do told me that my concentration was sometimes

stalling into a complacent mind lock and this set the narcosis alarm bells ringing. This hydroid looked on course to hit my descent line and looked over 2 metres in length!

I checked the depth on the line, it was deep enough for today. I grabbed the line marker at 313m and headed for 249m the first deeper stop. I shut my eyes and ascended hand over hand, not wanting to see the contents gauge. When using twin 20 litre tanks, you have a virtual inexhaustible supply, even when they equalise with the surrounding water pressure at 26 bar, you simply head up 5m and because of the huge volume, you can breath again and again. (try doing this on twin 12's near 200m ;-)

The deeper stops came and went without drama, which was not surprising due to the slow ascent rate. The first gas switch was my only concern the rest would be easy. Because of the minimal time at depth, the risk was acceptable. The journey to the first support diver was uneventful (ish), I met Sveinung at 90m and he handed me a 15l of Trimix 14/56. Phil gave me a similar tank at 75m, as did Khun Gai at 60m.

All the subsequent decompression tanks had the same helium content and a falling nitrogen value. By 10metres I had started to detect a shiver in my body, maybe due to the high helium content in my dry suit inflation gas. This dry suit gas helped me avoid skin bends caused again by another kind of counter diffusion. At 9m the long heliox stops began, and this was supplied from the surface through long regulator hoses. A real drama occurred about 2 hours later when the tank I was breathing was changed at the surface. I still had the regulator in place when I felt my tongue get sucked through the second stage and could see the hose collapsing to the surface due to the vacuum! I pulled my now much longer tongue free and cursed the topside monkeys. This was very unpleasant, but could have been much worse. A small communication break down I think!

During the stops, I ate fun size mars bars and banana pieces while the support divers were having their lunch. I knew this was the case because of the chicken bones that were raining down around me. Small fish were closing in all of a sudden, to peck at all the goodies. I hoped a toilet flush wasn't coming next.

I got out of the water after 6 hours 36 minutes in it. I had got down deeper than any solo diver before me. I had surfaced under my own strength and more importantly without decompression illness. Although I was exhausted I was very happy.