Rebreathers, Mixing it up part 2

By Mathew Partridge.
TDI CCR Instructor Trainer.

Having received several emails from rebreather divers asking questions surrounding mixed gas diving on a rebreather, I have decided to compile an article highlighting how I plan and execute my deep rebreather dives. This article is not intended as a substitute for proper training as before you try to implement what is discussed below you must first fully understand the risks involved that are presented during mixed gas rebreather training. For the purpose of this article I am assuming the techniques and procedures are those I adopt in the open ocean even though most of my overhead diving adopts similar methods.

The rebreather world is a continually evolving one as we find better ways of executing deep dives using this technology. So keep this in mind when reading this article that advancements are being made every year and it's the job of an exploration rebreather diver pushing the envelope to stay up-to date with modern trends and technologies.

My Current Equipment Configuration

I will start by looking at the equipment I use at current for my deep mixed gas dives. I have been diving exclusively on the Inner Space Systems Closed Circuit Megalodon Rebreather for the past two years. I believe this to be one of the best rebreathers currently available on the market today. It is built like a tank and totally module in design; it has a very stable electronic package that I have yet to have any major problems with other than some failed handset magnets and broken battery connections and have completed around 400 dives on the unit to date. The support from the factory is exemplary as the man behind this unit (Leon) and his team, are always on hand to help even as I am on the other side of the world.

My current setup is shown in the picture below. I am diving the unit now with 9ltr tanks onboard to provide excessive gas supply, I do get asked often why so large tanks, I generally reply with "why not" but the real reason is boosting high pressure oxygen in some of the areas I am currently diving is a logistical problem, they also provide me with addition gas supply I can use for OC bail out if it is required. They are nice and streamlined compared with11ltr (S80 Aluminum) tanks. I choose to dive valves down and longer tanks tend to protrude too high and throw my trim totally out. I am also able to run my Golem BOV direct from my on-board gas supply knowing there is plenty of gas available even at max depth.

I choose to use a stainless steel Custom Divers Plate with a custom harness adding extra weight to the rig when using a dry suit I find this better than adding external KG's to a

weight belt. For buoyancy I use a 45lbs lift Halcyon Pioneer wing that has worked well since the beginning of diving with my Meg. One of the best things I added to my rig was the Golem Armadillo side-mount kit for attaching my stages as it positions the tanks slightly under my arms providing a streamlined clutter free chest. Golem have also kindly supported me with one of their newly produced radial scrubbers but I have not done too much with it as yet, so yes guys and girls I have been using the standard axial scrubber for up-to 7hrs with no problems on dives that were not considered excessively deep 60-90m. For my up and coming dives I will be using the new radial filled with 797 slime for dives planned to between 120 – 170m for up-to 7 hrs solid durations.

Some modifications I have made to the unit from standard include removing my high pressure gauges on both the O2 and diluent first stages, liquid filling my handsets and customizing all my hoses for a more streamlined routing. I added some custom neoprene hose protection that adds decent protection and just enough additional buoyancy for my Golem BOV. Its worth noting that as each dive is completed I always end up fine tuning or changing something usually only small but its an evolving process to achieve a perfect rig.

Additional equipment I am using other than my rebreather include the Delta P VR3 and cutting and modifying tables from the V-Planner decompression software. A Custom signature Dry Suit kindly supplied by DUI should keep me warm for long exposure. I have always dived using Apeks regulators for open circuit and continue to use them exclusively on all my stage/deco cylinders. It is not to interesting for me to include a full overview of my entire kit as a lot of it really isn't worth recommending and tends to get replaced quite a lot due to its poorly made existence.

Dive Planning & Set-point selection.

This chapter generally brings many different debates and I follow a strong belief of what works for me, works for me and are known by my students for using a frustrating Thai phrase of " It's up to you" Sometimes a little difficult for them to grasp but all divers especially deeper extreme divers have to wake up-to the fact that its not a bed of roses and people do die even when following standard safe diving practices. It is rocket science when you start to try to understand the physiological effects of extreme diving. As the point of this is not to provoke discussions on why I dive this way just to inform those interested what I am doing.

I will start by explain my initial concerns when executing more extreme dives using my rebreather; the number one problem areas for me is CO2 with no effective way of knowing how much really is in the loop you are always at a high risk. At this time I can only ensure stringent unit checks are done prior to diving and ensure I have adequate bailout options. Having conducted several experiments on myself to how I react under high levels of CO2. It's clear that there is no room for error. I have not experienced any of the commonly described signs or symptoms prior to suffering impairment and

requiring assistance. These self-studies just reiterated my belief in using a BOV and carrying adequate bailout gas, enphasis on the word adequate.

The potential for higher CO2 in the loop is also responsible for my chosen set point of 1.0 on the bottom as it does not dramatically cause havoc to my deco obligation compared with say 1.3. It's also super easy for me to follow my HUD on the Meg without to many blinks in the corner of my mask.

Another big issue is always going to be the decompression schedule and there are just so many variables to consider for this. Fitness, hydration, mental-well-being, workload and the skills required making these kinds of dives.

Using the dive planning software is the easy part as most are relatively click and play. What's not so easy is staying fit for diving and trying to escape all the day-to-day stresses prior to a big dive. I find myself permanently battling these areas as its just to easy to not go the gym and drink singha's in the evening but it's a must do situation for these type of dives. This is not as much a problem as it used to be as becoming a Father changes your evening activities somewhat.

I usually start planning big dives a few weeks in advance so I can adjust and evaluate the plan several times before the dive. I try to complete all decompression schedules from first stop without going to max depth in a similar environment before hand to ensure fitness and comfort as if the shit hits the fan I should be able to abort without any really big issues. Having said that I do not follow bail out schedules that may be required if it all goes pear shaped as I simply cannot afford to waste the gases and the run times do become considerably longer which has not been practiced but I feel this would be a little over kill.

I have been using VPM-B in CCR mode diving selecting a set-point of 1.0 for the bottom phase adjusting this on accent up-to a maximum of 1.4 if I stay on the rebreather and on some dives switching to 80% at 9m and O2 at 6m continuing to breath O2 while back at the surface. The problem here appears to be when bailing out and touch wood this has not happened to me below 85m. Isobaric Counter diffusion issues seem to be a big deal only when using OC or bailing out to OC due to the unit failing with some divers suffering DCS in the middle ear during gas switches, resulting in extreme vertigo and vomiting. Some of these divers have ended up with additional decompression issues from not completing their required deco for risk of drowning and dehydration concerns. The best way I can see to managing this risk is ensuring the gradients of inert gases during required switches are kept minimal.

Another consideration is always going to be the amount of bail out gas required for the dive. The certified Advanced Trimix diver is usually introduced to the team gas sharing philosophy but at these depths it's quite difficult to find a suitable dive buddy. So on all dives below 100m I would consider support divers, leaving me the job of carrying only bottom gas generally in two side slung deco tanks, With the plan to meet a support diver

some were around 90m with additional gases, additional support is then generally provided around 50m and up in the shallows when long stops are.

I have started to investigate the possibility of using a second redundant rebreather but have yet to find anything I think reliable enough when put under stress at depth.

It is a proven fact that Hydration and cold play an important role in avoiding the bends so taking refreshments in easy squeeze bottles is a winner as I have tried the camel packs and I always end up drinking sea water and choking, I also find it quite nauseating trying to eat underwater and having recently clogged my mouth piece with mars bar and partial flooded my loop as a result I have decided to stay with liquid food supplements for nourishment. On the thermal issues I have tried to choose appropriate exposure protection with a great suit from DUI but if it were to flood theirs not a lot you can do other than grin a bare it. I was once told by one of my mentors stay and complete all your deco if your cold as the cold generally doesn't kill you but missing loads of your deco will. Something I have done several times due to wearing inappropriately thick wetsuits, thinking it would suffice as the water is usually 26 degrees and then finding it is was 19 degrees on the bottom, shit you get cold fast. I do get some funny stares from divers gearing up here in the tropics when they see me in a dry suit but at least I'm not the one freezing my ass of after one hour.

On a final note it goes without saying that I would not recommend you try this type of diving without the proper training and experience. Consulting with fellow divers in the community helps enormously and I strongly believe I can continually learn new techniques and procedures from those with much more experience than me.

I hope you found this article interesting and wish you all safe and exhilarating adventures.

If you are interested to find out more about this type of diving please feel free to get in touch with me at info@tech-ccr.com

To read more about the equipment mentioned in this article you could try visiting the following links.

www.tdsidi.com
www.rebreatherworld.com
www.thedecostop.com

www.customrebreathers.com
www.dui-online.com
www.golemgear.com
www.vr3.co.uk
www.v-planner.com