decompression strategies

High Tech Time Management?

Have you ever noticed that your dive times, sometimes, just don't seem to add up, particularly on deeper exposures?

Your dive plan calls for a 30 minute run at 215 fsw max depth on air, and you managed to get a hold of a some reliable air w/O_2 decompression tables just for that purpose.Your planned decompression (calculated at 220 fsw) is 87 minutes, with a first stop at 80 fsw, and calls for switching to pure O_2 at your 20 fsw. You plan to pull your 10 at 20. Of course the 87 minutes does not include your five minute planned air break (You *are* planning to take an air break every 25 minutes or so on O_2, right? Just to play it safe).You calculate your total planned dive time as follows:

Bottom time	30 min	
Ascent time	4 min	
Decom time	87 mir	
Air break	5 min	
Safety Stop	5 min	(It pays to be conservative)
Total Time	131 min	

The dive goes like clockwork.Yeah, got a little gooned —"So when are we going to get a gas station in our area," but you and your dive partner had been there before. **Total dive time: 152 minutes, *21 more than planned*.** What happened??

What often happens on long multi-stage hangs is you end up spending extra time at depth, whether it's spending a few extra minutes getting up to your stop, waiting now and then before starting your stop timer while adjusting a piece of gear, or simply losing track of the time. The results are cummulative. This inevitably leads to longer hangs (not too bad), and depending on where (and on what) the dallying ocurrs, can result in increased, but unrecognized, decompression obligations (not so good), particularly if your schedule involves lots of deep stops.

The solution is ***runtime decompression***, an alternative user-friendly accounting procedure for managing your stops, based on keeping track of your actual clock or running time versus timing each stop. The result is a hang that more closely matchs your planned schedule, and a bit more precision to your operation to boot.What's more it's easier to use for some operations, and easy to implement. Any schedule can be converted into a runtime format, and written on your slate or a piece of duct tape. Then all you do is follow your watch. A runtime schedule looks something like this.

Profile: 220 fsw, 30 minutes (Air w/ O_2 decompression)

Depth	Run Time (min)[1]	Comments
220	—	Leave wreck at 30 min, 60 f/m ascent
80	32	Air
70	34	
60	38	
50	45	
40	52	
30	64	
20	83	Switch to O_2. Five min. air break at 109 min
S	127	Safety Stop?

[1] Shows starting time at stop from leaving surface. Note, "decompression time" schedules can also be used, calculated by starting your clock at your first decompression stop.•

So, what do you do when you look at your time piece and realize your running a liitle bit behind. As runtime advocate Jim King, Deep Breathing Systems says, "Ya kinda take a deep breath and bleeend up."

Pull Your 10 at 20, and Take A Break...

With surge and related buoyancy issues at 10 fsw, a lot of open ocean divers are pulling their 10 fsw stop at 15-20 fsw (carrying out both the ten and twenty foot stop at 20 fsw), a practice common in underground circles as well. Pulling your 10 fsw works fine as long as your following a computer, though you may hang a little longer to account for the additional pressure (slowed off gassing). For air (and nitrox) decompressions, you can't just add your 10 and 20 stop table times and be done with it.

Of course, that all changes, if your decompressing on O_2, since there's no longer any inert gas in your decompression mix to load up on. It's all going out, in what's called the *oxygen window*. What's more is that your better off running your entire oxygen stop at 15-20 fsw, though there's a slight increased risk of toxicity. But then that's why God created air breaks; i.e. breathing air for five minutes, following every 25 minutes or so of pure O2. Note: air breaks do not count towards your O2 decompression time, but they do greatly reduce your sensitivity to oxygen toxicity, and in general are a good idea. So take a break, and ask yourself...

Is Nitrox 50/50 A Better Decompression Mix Than O_2?

Recently, several groups have come out advocating that the use of EANx 50 (50% oxygen, balance nitrogen) for decompression, as a safety hedge on air dives, instead of using pure oxygen.The idea is to breathe the nitrox mixture on all stops of 70 fsw (the MOD of EANx 50) and shallower, versus switching to O_2 at the 20 and 10 fsw stops.Their reasoning is that oxygen involves greater expense, considerable investment in oxygen-cleaned equipment, and is subject to greater risk and potential misuse, "..most divers won't use it correctly." So what's the story?

The use of either EANx or O_2 as a planned safety hedge, or as an integral part of a special table, is a smart idea, particularly if your dive calls for more than about 20 minutes of decompression (see *AquaCorps* Vol.3, Winter 1991, *Oxygen, "The Princess of Gases," Why you Should Use it for Decompression,* John Crea). Which you should use depends on the dive and your operational considerations. For dives in the 40-150 fsw range, and short (less than 20 min.) deep dives, using oxygen at the 10 and 20 fsw stops results in a better decompression.Beyond that, for example a 20-25 minute dive in the 150-220 fsw plus range, the results seem to be about the same.

As for expense, that's another story. The cost of pure oxygen is considerably less than than a nitrox mixture (See *Supply Side Economics*, page 6). Furthermore, while the proper use of oxygen does require that equipment be oxygen cleaned and compatible, the same is true of high oxygen content nitrox. NOAA, and most knowledgable professionals reccomend using dedicated, oxygen clean equipment for EANx mixes above 40%. Oxygen cleaning is a simple inexpensive procedure, which in the words of Dr. R.W. Hamiliton, "is equivalent to dishwasher- cleaned dishes." (See *Technical*

Diver, Issue #1, Winter 1991 for procedures.) According to Dr. Hamilton, the differences in risk between using EANx 50/50 or O_2 are negligble, as long as divers limit the use of O_2 to 20 fsw or less.

As far as not using oxygen correctly, we at AquaCorps have a philosophical problem advocating that technical divers take shortcuts. If a diver is not prepared to invest in the time and expense to do it right, they shouldn't be making the dive. Safety is too important to sacrifice for any exposure. After all, if the dive is that good, you'll want to come back and do it again.

Hang in there.

M2

Enriched Air Applications

Application	Issues	Potential Benefits of EANx
Instructors/Dive masters	Multi-day/multi-level repetitive dives	Increase safety margins (breathe EANx, use air tables)
Photography/Scientific	Working time at depth (typically No-Stop)	Extend no-stop times
Hunting	Multiple repetitive excursions–increased DCS risk	Add decompression safety margin
Shallow water Wreck/Cave Diving	Lengthy decompression times	Reduce decompression obligations and increase reliability
Deep diving (air/mix)	Reliable decompression	Use as a decompression gas to add safety margin and/or reduce decom time
Search & recovery	Limited search times (typically no-stop) repetitive dives	Increased no-stop times shorten surface intervals
DCS-susceptible individuals	DCS risk	Reduce DCS risk and increase safety

What Goes Around Comes Around

Many of the ideas and concepts expressed in AquaCorps are the result of our conversations and letters with subscribers, contributors, and other professionals involved in diving, along with our ongoing research. Part of our job at AquaCorps, is to synthesize the good stuff and communicate it back out to you. That way we can all benefit from it.

Collectively, we have an enormous amount of knowledge and experience in the community. The key seems to be finding out what we do know, and what we don't. Thank you for your help and contribution to this effort.

What Mix?

Enriched air comes in two standard varieties and a host of custom blends. NOAA, which was responsible for pioneering enriched air diving in government and scientific circles, developed two standard mixes in order to simplify their operations.

NOAA Nitrox I (EANx 32%) consists of 32% oxygen /68% nitrogen, and has a maximum operating depth (MOD) of 130 fsw (actually 132 fsw using a PO_2 of 1.6 ata).

NOAA Nitrox II (EANx 36%) consists of 36% oxygen /64% nitrogen, and has an MOD of 110 fsw (113.6 fsw at 1.6 ata PO_2). Many technical divers are also utilizing these standard to mixes for operational simplicity and ease of mixing.

Custom Blends are designed to optimize decompression for a given exposure by running the PO_2 as high as feasible (1.4 ata is reccomended. See **The Limits of Oxygen**, page 4) for a given maximum working depth.

For example, the optimal blend for a dive with a maximum working depth of 80 fsw is EANx 47%, calculated by using the MOD formula, and solving for FO_2 , using 1.4 ata as the maximum PO_2.