

June 2005  
Issue 89



## In This Months Issue

Air Composition

Causes of DCI

Cover Photo Courtesy of Ian Jennings



# Free Flow

At all good Newsagents now....  
Hence only downloadable from lsac.co.uk

## Editors Bit...



**This is called luxury. Thanks to Mike Flatt who came prepared with flasks of sausages, onions and bread rolls to provide hot dogs between dives. Even ketchup on demand ! Bear in mind this was mid winter, i.e. end Jan, down at Plymouth. Roll on next Jan.**

**PS. Check out the sea state. Calm or what.**

### CONTENTS

- Page 1 Cover
- Page 2 Editors Bit
- Page 3 Page 3 Luvilies
- Page 4 Chairman's Report
- Page 5 Diving Officer's Report
- Page 6 Composition of Air
- Page 7 Causes of DCI
- Page 9 Revolutionary SCUBA System
- Page 11 Tuesday Calendar
- Page 12 Dive Calendar

I can always tell when the Dive season is well under way. Apart from the fact that club members are shooting off to various dive destinations I can tell by the number of "I do you a write up for Free Flow for that trip".

To be fair it is the Dive season after all and what's more important providing copy for Free Flow or Diving/planning the next \dive. On this one I think we'd all agree the former.

So to compensate for lack of Dive Reports am having to resort to some fillers from my stock pile.

Pete



# Page 3 Luvlies

Free Flow  
June 2005



Government Health Warning: If the wife says smile for the camera and she's squeezing your Jewellery swallow hard and don't blink.

If you would like to become Miss or Mr Aug or know someone who should be, then please email me with the photo and a brief description of why the person should be a page 3 lovely. [pete.barnard@power.alstom.com](mailto:pete.barnard@power.alstom.com)

# Chairman's Report

The diving season has got off to a flying start already (where has the year gone) and the rest of the year is looking very healthy with trips to the Farne Islands, Dover, Pembroke, Cornwall, Plymouth and the Isle of White, among others, already pencilled in. Although it looks very busy, there are still a few weekends/ weeks still free.

It was good to hear that the second trip to West Bay passed without incident, on the dodgy new slip, having witnessed what could have been a nasty accident the week before. It was a good reminder of how dangerous these places can be, with people moving trailers in and out and the very slippery surface, we should all take care.

The Interest Evenings are looking a bit empty at the moment, so if any of you fancy entertaining us for an hour please come forward, or perhaps you know someone that might have something interesting to talk about.

Don't forget, those of you with cameras, we are still looking for some video clips to turn into a DVD for potential new members. It does not have to be just about diving; a club BBQ or party would be great to show that we can have fun away from the water as well.

Happy and Safe Diving,

Bob.

# Diving Officer's Report

Well having had the benefit of seeing this months FreeFlow before it has gone to press (largely because I didn't get my piece in on time) I can honestly say there are some less flattering pictures of the editor floating around. Maybe his email wouldn't accept them☺ or, maybe I should just include a couple in my report.

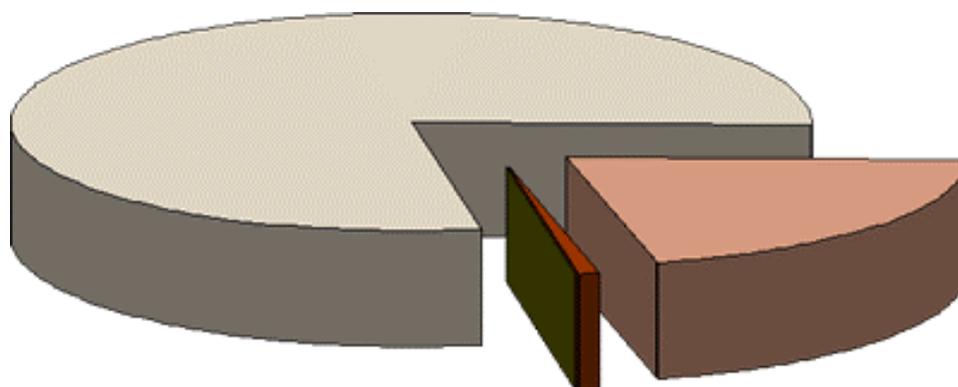
As always there is plenty of diving going on and can I make the opportunity to say to those people who require training, seize the opportunity to take up the offer of an instructors time down at the cove. It's not the first time I have witnessed more than one instructor diving together due to a lack of trainees to take in. So if you see the offer then don't be shy, take them up on the offer. If you don't see the offer then instructors can quiet often be bribed by the mention of a pint in the pub. After diving activities have finished of course. And in case that isn't enough to get you in the water following a trip to the cove at the weekend I can honestly that the water temperature is very pleasant at the moment and the vis good to.

As always with diving I would prefer to know when you are going than not, this is as much so I can make sure that your diving abilities are matched and to give you advised if this is required. Please bear in mind also, that if you are diving abroad you are still to stay within your training guidelines, depths and experience. You may not be diving with a BSAC branch or school but you are still diving with your BSAC qualifications and representing the club. If you intend to do some training abroad at a BSAC school you must come and talk to me prior to going ahead.

As always safe diving

Neil B

# Composition of Air



Nitrogen
  Oxygen
  Argon
  Carbon Dioxide

Component	Symbol	Volume	
Nitrogen	N <sub>2</sub>	78.084%	99.998%
Oxygen	O <sub>2</sub>	20.947%	
Argon	Ar	0.934%	
Carbon Dioxide	CO <sub>2</sub>	0.033%	
Neon	Ne	18.2 parts per million	
Helium	He	5.2 parts per million	
Krypton	Kr	1.1 parts per million	
Sulfur dioxide	SO <sub>2</sub>	1.0 parts per million	
Methane	CH <sub>4</sub>	2.0 parts per million	
Hydrogen	H <sub>2</sub>	0.5 parts per million	
Nitrous Oxide	N <sub>2</sub> O	0.5 parts per million	
Xenon	Xe	0.09 parts per million	
Ozone	O <sub>3</sub>	0.07 parts per million	
Nitrogen dioxide	NO <sub>2</sub>	0.02 parts per million	
Iodine	I <sub>2</sub>	0.01 parts per million	
Carbon monoxide	CO	trace	
Ammonia	NH <sub>3</sub>	trace	

## Causes Of Decompression Illness

Generally, decompression sickness (DCS) occurs on ascent from a dive, when nitrogen bubbles form in the blood stream and tissues of the body. This leads to the diver's symptoms, including 'The Bends'.

Nitrogen gas makes up 78% of the air we breath every day but remains inert at atmospheric pressure and is not metabolised by the body. But as a diver descends the pressure of the nitrogen in the diver's air tank increases. The pressure due to nitrogen in the tank relative to the other gases (including oxygen) is called its partial pressure. As the diver descends the nitrogen's partial pressure increases by 11.6 pounds/sq inch (or 600 torr) for every 33 feet. This added pressure causes nitrogen to dissolve into the bloodstream and it is deposited in the tissues. The longer the diver remains at high pressure, the greater the amount of nitrogen there is dissolving into the blood.

DCS occurs when a diver ascends too quickly. If the rate of decompression exceeds the rate at which the saturated tissues can eliminate the nitrogen by diffusion, then the excess will come out rapidly as gas bubbles in the blood.



This effect can be described by Dalton's Law of Partial Pressures and Henry's Law.

$$\text{Dalton's Law : } P(\text{total}) = P(\text{oxygen}) + P(\text{nitrogen})$$

This means that the total pressure in a mixture of gases is equal to the sum of the partial pressures of each gas in the mixture. In the case of air, 78% of the total pressure is due to nitrogen and 21% is due to oxygen.

***Henry's Law: The concentration of a dissolved gas in solution is directly proportional to the partial pressure of that gas above the solution.***



Taking these concepts into account we can see that as the diver descends, the total pressure of the water must increase due to the added weight of the water overhead. Therefore, the partial pressures of the gases in solution increase proportionally. Henry's Law tells us that due to the increased pressure, the concentration of gas in solution will also increase. So as depth increases, more compressed air diffuses into the diver's blood.

The excess oxygen is simply metabolised via aerobic respiration in the tissues (although oxygen toxicity can occur at great depths). But in the case of nitrogen, a substance not metabolised by the body, it is stored up in the tissues until decompression occurs and it can be eliminated by diffusion. If the rate of ascent

(decompression) is slow enough, the nitrogen can diffuse out safely along a shallow pressure gradient. A fast ascent increases the pressure gradient to an extent that the nitrogen is forced out of the tissues in bubbles.

So generally, the risk of developing DCS is related to increasing depth of the dive, the amount of time spent under pressure and the rate of ascent from the dive.

### References

**Emedicine - The Bends - Decompression syndromes: Article by Eric Mowatt-Larssen.** URL: <http://www.emedicine.com/aaem/topic535.htm>  
**Causes of DCS, assignment for Bio 312, Animal physiology at Davidson college.** URL: <http://www.bio.davidson.edu/courses/anphys/2000/zsoldos/causes.html>



At last we are just about ready to move Undersea Adventures Ltd., Watersports Warehouse, into its new home.

It's been a long time coming, we effectively grew out of our existing premises 2 years ago and have been surviving since then using a combination of temporary storage units and rented space elsewhere. The new premises is much larger than existing premises with 5,000sq ft of floor space incorporating our new, considerably larger retail shop giving us more room as we continue to expand our growing business.

Our new trading address, from Monday 6th June 2005is:

Undersea Adventures Ltd  
7 Hayle Industrial Park  
Hayle  
Cornwall  
TR27 5JR  
New phone number :01736 75 1066 & Fax : 01736 75 1067  
Our web address & e-mail as before.

We do hope you will take the time to come and visit us at the new premises - have a great diving season !!

[www.watersportwarehouse.co.uk](http://www.watersportwarehouse.co.uk) the online shopping site of Undersea Adventures Ltd

Established in Cornwall since 1989 - [www.undersea.co.uk](http://www.undersea.co.uk)

[www.reefwear.co.uk](http://www.reefwear.co.uk) the online shopping site of Windswept Ltd

Tel: 01736 333040

**Exclusive for IsraCast!**

## **LIKE A FISH – REVOLUTIONARY UNDERWATER BREATHING SYSTEM**

- Iddo Genuth for IsraCast -

**An Israeli Inventor has developed a breathing apparatus that will allow breathing underwater without the assistance of compressed air tanks. This new invention will use the relatively small amounts of air that already exist in water to supply oxygen to both scuba divers and submarines. The invention has already captured the interest of most major diving manufacturers as well as the Israeli Navy.**

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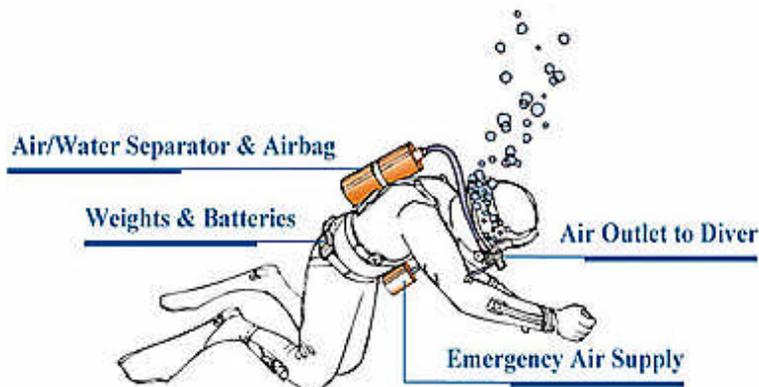
The idea of breathing underwater without cumbersome compressed air tanks has been the dream of science fiction writers for many years. In George Lucas' movie "The Phantom Menace", Obi-Wan whips out a little Jedi underwater breathing apparatus and dives in. As things tend to happen in our world, yesterday's science fiction has turned into today's science fact due to one Israeli inventor with a dream.

There are a number of limitations to the existing compressed air tank underwater breathing method. The first is the amount of time a diver can stay underwater, which is the result of the compressed air tank capacity. Another limitation is the dependence on compressed air refueling facilities near the diving site which are costly to operate and are used to compress the gas into the tanks which might be dangerous if not handled properly. The final problem has to do with the actual use of compressed air tanks underwater. When these tanks are in use they empty out and change the balance of the diver in the water.

Engineers have tried to overcome these limitations for many years now. Nuclear submarines and the international space station use systems that generate Oxygen from water by performing 'Electrolysis', which is chemical separation of Oxygen from Hydrogen. These systems require very large amounts of energy to operate. For this reason, smaller, diesel fueled submarines cannot use these systems and are required to resurface to re-supply their air tanks every so often. Divers can't even consider carrying such large machines not to mention supplying them with energy. To overcome this limitation an Israeli inventor, Alon Bodner, turned to fish.

Fish do not perform chemical separation of oxygen from water; instead they use the dissolved air that exists in the water in order to breathe. In the ocean the wind, waves and underwater currents help spread small amounts of air inside the water. Studies have shown that in a depth of 200m below the sea there is still about 1.5% of dissolved air. This might not sound like much but it is

enough to allow both small and large fish to breathe comfortably underwater. Bodner's idea was to create an artificial system that will mimic the way fish use the air in the water thus allowing both smaller submarines and divers to get rid of the large, cumbersome compressed air tanks.



The general structure of the system

The system developed by Bodner uses a well known physical law called the "Henry Law" which describes gas absorption in liquids. This law states that the amount of gas that can be dissolved in a liquid body is

proportional to the pressure on the liquid body. The law works in both directions – lowering the pressure will release more gas out of the liquid. This is done by a centrifuge which rotates rapidly thus creating under pressure inside a small sealed chamber containing sea water. The system will be powered by rechargeable batteries. Calculations showed that a one kilo Lithium battery can provide a diver with about one hour of diving time.



Alon Bodner

Bodner has already built and tested a laboratory model and he is on the path to building a full-scale prototype. Patents for the invention have already been granted in Europe and a similar one is currently pending examination in the U.S. Meetings have already been held with most major diving manufacturers as well as with the Israeli Navy. Initial financial support for the project has been given by Israel Ministry of Industry and Commerce and Bodner is currently looking for private investors to help complete his project.

If everything goes according to plan, in a few years the new tankless breathing system will be operational and will be attached to a diver in the form of a vest that will enable him to stay underwater for a period of many hours.

**OPEN-CIRCUIT SELF-CONTAINED UNDERWATER BREATHING APPARATUS  
PATENT:**

[WO0240343](#) (May 23, 2002) and [EP1343683](#) (September 17, 2003)



[write to Alon Bodner](#)

DATE	INTRO/OCEAN DIVER	SPORTS DIVER	DIVE LEADER	SKILL DEVELOPMENT	INTEREST EVENINGS	POOL TRAINING
04-Jan-05	<b>NO CLUB - HAPPY NEW YEAR</b>					
11-Jan-05	OT4 Catch up - Pete Barnard					
18-Jan-05	OT7 Catch up - Neil Tomlin				Dive Trip Planning	
25-Jan-05	EXAM - Neil Tomlin				Dive Trip Planning	
01-Feb-05	Drysuit Intro - Roger Holmes				Dive Trip Planning	
08-Feb-05				Dive Planning & Marshalling	Equipment maintenance-Pete Barnard	
15-Feb-05				Dive Planning & Marshalling	Alex Bullard-Diving south China Seas	
22-Feb-05		ST1- Jon Brewis		Dive Planning & Marshalling	Frans talk on New Zealand	SS1
01-Mar-05		ST2 - Neil Brown		Dive Planning & Marshalling	O2 - Refresher	SS1
08-Mar-05		st2 Pratical		Dive Planning & Marshalling	Boat Instruction NS	SS1
15-Mar-05					Open Forum	
22-Mar-05		ST3 - Pete Barnard				
29-Mar-05	<b>NO CLUB - EASTER</b>					
05-Apr-05		ST4 - Roger Holmes			Sponsored Snorkell Pete W	TRY DIVE
12-Apr-05		ST5 - Gary Rose			Chartwork NS	TRY DIVE
19-Apr-05	OT1 / INTRO - Neil Tomlin	ST6 - Phil Turney			New Zealand Talk Fran	Intro Course
26-Apr-05	OT2 - Jon Brewis	Catch up week			Tides NS	OCEAN DIVER
03-May-05	<b>No Club May Day Bank Holiday</b>					
10-May-05	OT3 - Neil Brown	REVISION - Neil Brown		AT2 - Advanced Diving - Neil Tomlin		OCEAN DIVER
17-May-05	OT4 - Richard Green	Exam - Neil Brown		AT2 - Advanced Diving : Twinset configuration - Roger Holmes		OCEAN DIVER Twin Set
24-May-05	OT5-Roger Holmes			AT2 - Advanced Diving : Rebreather awareness - Fran Duinker		OCEAN DIVER Rebreather
31-May-05	<b>NO CLUB - WHITSUN BANK HOLIDAY</b>					
07-Jun-05	OT6 - Gary Rose			AT2 - Advanced Diving : Rebreather awareness - Fran Duinker		OCEAN DIVER Rebreather
14-Jun-05	OT7 - Phil Turney					OCEAN DIVER
21-Jun-05	Catch up week			O2 CPR Neil T		OCEAN DIVER
28-Jun-05	REVISION - Neil Tomlin			O2 Diving Incidents Pete W		OCEAN DIVER
05-Jul-05	EXAM - Neil Tomlin			O2 Casualty Assesment Neil B		OCEAN DIVER
12-Jul-05				O2 admin practice Equip Jon B		OCEAN DIVER
19-Jul-05				O2 Use of admin equip All		OCEAN DIVER
26-Jul-05	Drysuit Intro - Pete Woodcock			O2 Positive Pressure vent/Assesment Fran D/All		OCEAN DIVER
02-Aug-05				O2 Positive Pressure vent/Assesment Fran D/All		
09-Aug-05						
16-Aug-05						
23-Aug-05						
30-Aug-05	<b>NO CLUB - AUGUST BANK HOLIDAY</b>					
06-Sep-05		ST1- Pete Woodcock				SS1
13-Sep-05		ST2 - Ian Jennings				SS1
20-Sep-05		ST3 - Bob Mulholland			Marine Biology Anne Marie	TRY DIVE
27-Sep-05	<b>AGM</b>					
04-Oct-05	OT1 / INTRO - Neil Tomlin	ST4 - Nigel Spickett			North Ireland Fran	Intro Course
11-Oct-05	OT2 - Ian Jennings	ST5 - Fran Duinker				OCEAN DIVER
18-Oct-05	OT3 - Bob Mulholland	ST6 - Alex Bullard				OCEAN DIVER
25-Oct-05	OT4 - Nigel Spickett	Catch up week				OCEAN DIVER
01-Nov-05	OT5-Fran Duinker	REVISION - Neil Tomlin				OCEAN DIVER
08-Nov-05	OT6 - Alex Bullard	EXAM - Neil Tomlin				OCEAN DIVER
15-Nov-05	OT7 - Neil Tomlin					OCEAN DIVER
22-Nov-05	Catch up week					OCEAN DIVER
29-Nov-05	REVISION - Neil Tomlin					OCEAN DIVER
06-Dec-05	EXAM - Neil Tomlin					
13-Dec-05	Quiz and Social Night					
20-Dec-05	Christmas No Meeting					
27-Dec-05	New Year No Meeting					
	INTRO/OCEAN DIVER	SPORTS DIVER	DIVE LEADER	SKILL DEVELOPMENT	INTEREST EVENINGS	POOL TRAINING

## Trip Calendar 2005 & 2006

Click on the name of the Organiser to Email them

Dates	Destination	Type of diving	Organiser	No of Space	Minium Level	Comments
29th 30th Jan	Plymouth	2 x Ribs	<a href="#">Roger Holmes</a>	Full	Sports	Boat Handling Weekend!
6 <sup>th</sup> March	Red Sea	Hard Boat	<a href="#">Roger Holmes</a>	Full	Sports	Fully Booked
25th 31st March	Loch Fyne	2 x Ribs	<a href="#">Neil Brown</a>	Unlimited	None	
May week day	Weymouth	Hard Boat	<a href="#">Roger Holmes</a>	?	DL & above	
14th 15th may	Plymouth	2 x Ribs	<a href="#">Nigel Spickett</a>	10	Sports	
21st 22nd May	West Bay	Skinny Dip	<a href="#">Neil B &amp; Neil T</a>	Unlimited	Sports	Dive leader training weekend
28 <sup>th</sup> – 30 <sup>th</sup> May	West Bay	2 x Ribs	<a href="#">Martyn O'Driscoll</a>	10	Ocean	
18 <sup>th</sup> 19 <sup>th</sup> June	Farnes	3 boats Joint RRSAC trip	<a href="#">Fran Duinker</a>	15	Ocean	
1st 4th July	St Abbs	2 x ribs	<a href="#">Jon Brewis</a>	10	Ocean	
16th 17th July	Dover	2x rribs Joint RRSAC trip	<a href="#">Fran Duinker</a>	?	Exp Sports	
23 <sup>rd</sup> July – 1 <sup>st</sup> Aug	Pembroke	Lucky Dip	<a href="#">Martyn O'Driscoll</a>	10	Ocean	
13th 14th August	Whitby	2 x Ribs	<a href="#">Pete Woodcock</a>	10	Exp Sports	
10 <sup>th</sup> – 17 <sup>th</sup> Aug	Cornwall	Lucky Dip	<a href="#">Mike Flatt</a>	6	Ocean	
18 <sup>th</sup> / 19 <sup>th</sup> 20 <sup>th</sup> Aug	Plymouth	Luck Dip	<a href="#">Mike Flatt</a>	6 or 10	Sports	
27 <sup>th</sup> – 29 <sup>th</sup> Aug	Plymouth	2 boats	<a href="#">Claire &amp; Neil</a>	10	Ocean	
3 <sup>rd</sup> 4 <sup>th</sup> Sept	Stoney	24hr Sponsored Snorkel	<a href="#">Pete Woodcock</a>	Unlimited	All	
2nd September	Weymouth	hardboat	<a href="#">Neil Tomlin</a>	?	DL & above	
10th,11th Sept	Isle of White	2 x Ribs	<a href="#">Nigel Spickett</a>	10	Sports	
17 <sup>th</sup> 18 <sup>th</sup> Sept	Brixham	2 boats	<a href="#">Fran D &amp; Pete B</a>	Unlimited	All	
30th Sept 1st Oct	Kirkby Lonsdale	River Diving/Walking	<a href="#">Bob Mullholand</a>	Unlimited	All	More of a social weekend
12th 13th Nov	Plymouth	Boat Handling/diver Cox	<a href="#">Neil Brown</a>	?		
2006						
1st 7th July	St Kilda	Hard Boat	<a href="#">Nigel Spicket</a>	12	DL & above	To be DL by time of going
12 <sup>th</sup> – 19 <sup>th</sup> Aug 2006	Scapa	liveaboard	<a href="#">Mary Pearson</a>	Full	Expe Sports	Fully Booked