



C.D.A.A. Newsletter

No. 78 - DECEMBER 2001

SENIOR

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- Email to seapics@alphalink.com.au
- Any files for inclusion should be saved as MS WORD text files or Quark if using a Mac. If mailing please save pics and text to CD, not floppy disc and include a hard copy, thank you.
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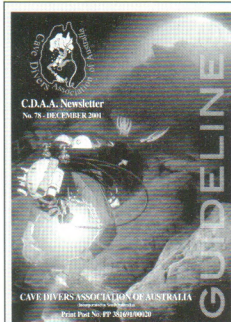
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GUIDELINES is a newsletter of the Cave Divers Association of Australia. All articles for the following issue are to be sent to the Editor, David Bryant, PO Box 2198 Rosebud Vic. 3939. All articles and submissions shall automatically constitute an expressed warranty by the contributor that the material is original. We assume no responsibility for unsolicited material. Articles and information may be reproduced without prior permission provided reprints are accredited to the authors and GUIDELINES. Private advertising for caving and diving equipment may be advertised free at the discretion of the Editor. Opinions expressed in GUIDELINES are those of the individual authors and are not necessarily those of the C.D.A.A.

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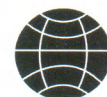
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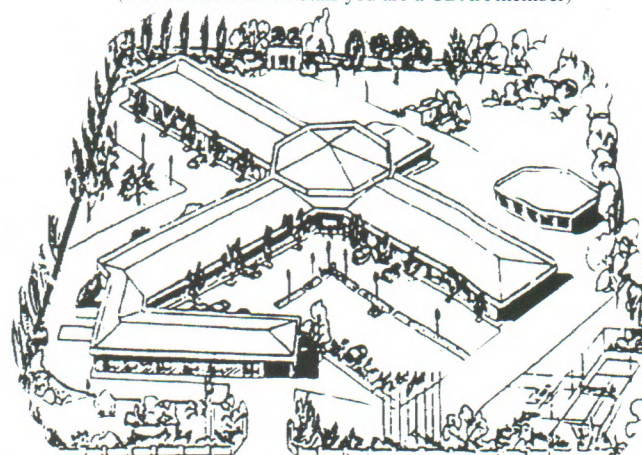


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IN REMEMBRANCE

Bertram Vivian Ashby

-VIV-

Born June 12th 1925 Mount Gambier, South Australia.

Died November 27th 2001 Penola, South Australia.

Dearly loved husband of the late Betty, much loved father and father in law of Robert & Allison, Trevor & Anne.

Loving grandfather of Brendan and Kerryn.

Viv flew Sunderlands (?) from Darwin in 1943 and told stories of how he put the lights out in Hong Kong after night bombing raids. A "Master Breeder" of cattle and after the war a

champion local cricketer. Owner of the property containing

"The Shaft". The CDAA provided a wreath and card plus e-mailed the family with our condolences.

Members Warrick McDonald, Phil Prust Linda Claridge and Gary Barclay attended the ceremonies.

APOLOGY

The last issue of Guidelines contained an article on McCavity Cave in Wellington NSW which was written by Gary Bottomley. There was also a photo showing the entrance restriction, which was taken by Helen Genitsaris. Both these credits were omitted during the publication process. I apologise to both individuals and thank them and all contributors to Guidelines. Without the generosity of such people our magazine would be much poorer.

Chris Edwards
Pub & Records Dir.

DID YOU KNOW!

WHAT'S IN A NAME?...

As of the 1st of June the SE. area of South Australia is being officially called the Limestone Coast. On entering Mt Gambier huge road signs have been erected showing pictures of the Blue Lake and other sites.

WATER'S RISING...

Water levels are up and reports state at least a 50mm rise in most diving sites has been the result. Prepare for wet conditions when travelling as the rain has not stopped for more than a few hours for the last few weeks. Crossing paddocks has caused bogging and slipping in normal cars, so that four wheel drives are necessary in some places. When driving on tracks try to spread the wear by driving out of the tyre gutters. Remember farmers allow us into their backyards and the last thing they want is it destroyed by careless motorists.

TANK CAVE ROAD IMPROVED...

The road to Tank Cave has been improved with about 4 truck loads of crushed rock added, this will be graded and compacted when it dries out. The stile, to enable our nature lovers to hop over the fence into the forest opposite Tank Cave, without causing damage is being built at the moment and will be installed soon.

A INVITATION TO YOU ALL...

From the ASF comes the information that their 24th Biennial Conference is to be held in Bunbury, Western Australia from the 2nd to 7th of January, 2003. They are already calling for expressions of interest from anyone with a desire to present either an article or presentation at the conference. If that sounds like you then please contact N. Poulter OAM, PO Box 120 Nedlands 6009.

Phone 0892762495. email underway@dingoblue.net.au

A Special Thank You...

For several years now Glenn O'Connell has been looking after and publishing Guidelines. As of this issue we have a new man on the job, David Bryant of Sea-Pics. I would like to personally thank Glenn for all his work and help in bringing the magazine to you the members. It is always a huge job and Glenn has always done it efficiently and without complaint.

I would also like to welcome David on board, his experience in the field of diving related magazines will be most welcome. It would help greatly if all contributions for Guidelines could be sent either to myself or to David from now on.

David can be contacted at (03) 59 863 104 or E-mailed at seapics@alphalink.com.au

A Simple Underwater Radiolocation System - "The Pinger"

Cave Mapping...

The traditional method of mapping an underwater cave is to take compass bearings, and water depth, at every point where the guideline changes direction. The length of each section of line is also measured. This allows the position of points in the cave to be determined with respect to the starting point. Unfortunately, in a complex cave, like Tank Cave, many readings are required to reach the more remote sections of the cave. This can give a significant error in determining the position of the remote sections. A radiolocation system allows a point in the cave to be found from above ground. Conventional above ground surveying techniques can then be used to locate the point very accurately. This allows remote sections to be correctly positioned on the map.

Location using a Magnetic Field...

Normal radio frequencies cannot penetrate through water and rock. However a magnetic field can penetrate water and limestone very easily. The diagram shows a simple idea for locating a point in an underwater cave. A bar magnet is hung vertically from the roof of the cave, and an observer on the surface measures the magnetic field until he finds a point where the field is vertical. This point is directly above the bar magnet in the cave, and is called "ground zero".

The observer can also measure the thickness of rock below his feet. He looks for a point on the ground where the magnetic field emerges at 45 degrees to horizontal. By measuring how far this point is from ground zero, and multiplying this distance by 1.77, the depth of the bar magnet below the surface can be found.



Pinger attached to a diver in the water.

Unfortunately this method would not work in practice. The magnetic field from the bar magnet will be too weak on the surface and it will be swamped by the Earth's magnetic field. The field from a bar magnet is called a "dipole field" and this drops off very rapidly with distance from the magnet. It diminishes in strength as the cube of the distance. In other words twice the distance means one eighth of the field strength.

Principle of Radiolocation...

Instead of a bar magnet the radiolocation system uses a coil, which is energised with alternating current at an audio frequency. The magnetic field produced by the coil is the same shape as the field of a bar magnet, but it is now an alternating field. This field can be picked up by a second coil, which is connected to an amplifier and headphones. The operator can now "hear" the magnetic field. The earth's magnetic field has no effect, since it is not changing with time and does not generate any sound.

The magnetic field direction is determined by a processing of "nulling". The receiver coil is turned until the signal can no longer be heard. This is called the "null" position. At this point the axis of the receiver coil is at right angles to the magnetic field. At ground zero the magnetic field is vertical and the receiver will null when the coil is horizontal. To find ground zero exactly the coil must null horizontally no matter in which horizontal direction the coil is pointing. The nulling method can also be used to find the 45 degree point, in order to measure depth.

Design of the Pinger Transmitter...

Adrian Richards and I have constructed a simple radiolocation system. We call it "The Pinger" because of the sound it makes.

For underwater use the transmitter needs to be small and easy to handle. Unfortunately the traditional designs of radiolocation systems use quite large coils, typically 600 mm or more in diameter. The size of the coil can be reduced by winding it on a core of material with a high magnetic permeability. However a core of laminated iron (like a transformer core) may not be suitable because of excessive losses at the audio frequencies used.

The pinger uses a core of laminated mu-metal with a length of 310 mm, and a cross section of 12 x 10 mm. This allows a long thin coil to be wound with characteristics similar to a much larger "air cored" coil. This coil, together with driver electronics and batteries, fits into a 600 mm length of 50 mm diameter PVC tube. The tube is permanently sealed at one end and has a threaded O-ring cap at the other. The inner workings can be removed via the cap for battery replacement or maintenance.

The pinger is weighted at one end and has a slight positive buoyancy, so that it floats upright in the water. At the top end is a central nylon spike, which is placed on the roof of the cave. The pinger can be left floating in this position and it will hang exactly vertically to give the correct orientation of the magnetic field.

The pinger is small and simple to use. It is fitted with two plastic rings for clipping to the diver in a similar manner to a stage bottle. Three identical Pingers have been made to this design so far.

The driver electronics for the pinger was designed with simplicity in mind. The coil is connected in parallel with a capacitor to form a tuned circuit, which resonates at 1.16 kHz. A tuned circuit allows a large alternating current to be generated in the coil, which in turn generates a strong magnetic field.

A simple oscillator provides the 1.16 kHz signal and this is amplified by a single chip audio amplifier and fed to a driver winding on the transmitter coil. Eight Alkaline C cells provide the 12 volt power supply required. The current drain when transmitting continuously is about 190 mA. The current consumption was reduced to about 70 mA by adding a circuit to pulse the signal on and off with an on time of about 33%. With this modification the battery life is more than 24 hours.

The pulse rate is different for the three pingers that have been made. This allows each pinger to be uniquely identified by its signal.

Design of the Receiver...

The receiver uses a coil identical to the transmitter coil. It is also tuned to resonate at 1.16 kHz. Use of a tuned receiver minimises interfer-



Divers with a pinger prior to diving.

ence from other signals, such as power lines and electric fences. The signal from the receiver coil is amplified by a single chip audio amplifier and fed to the headphones. The electronics is housed in a small die cast box, which can be mounted on a waist belt.

The receiver coil is mounted in a PVC tube. This is carried in one hand when searching for the pinger. The tube is fitted with two spirit levels. One indicates when the coil is horizontal, for ground zero determination. The other indicates when the coil axis is at 45 degrees, for depth measurement.

At Tank Cave there is almost no electrical interference, and the distinctive "beep beep" of a pinger can be heard at up to 90 metres from the transmitter. The pulsing of the signal assists in finding the pinger. It seems to be easier to hear a weak pulsing signal than a weak continuous signal. Plenty of signal strength was available for measurements at Tank Cave, since the pingers were rarely more than 20 metres below the ground surface.

Using the Pingers...

Placing of the pingers is usually done by volunteer divers. As the diver is preparing to enter the

water the pinger is switched on and the end cap screwed on. The pinger can be clipped to the diver's vest. One or more pingers to be easily carried without any interference to the enjoyment of the dive.

The diver is asked to place the pinger on the roof of the cave above a specified survey point. The diver is also asked to measure the roof and floor depths at this point. Metal clips must not be left on the pinger. They can cause the pinger to sink, or not hang vertically. Clips are normally left on the guideline nearby for use when the pinger is collected.

On the surface we can estimate when the pinger will be placed, and we have a reasonable idea of where to find it. The pinger can easily heard within 50 metres of ground zero. With a bit of experience the orientation of the magnetic field can be used to find ground zero quite quickly. Within five minutes the position and depth have been recorded and we can go looking for another pinger.

Later in the day the pingers can either be moved to new survey points or brought out of the cave. Bringing them out at the end of the day is preferred because the batteries can then be turned off and saved for more pinging on the next day.



Locating the 45 degree point for depth measurement.



Using the receiver coil to locate ground zero.

Future developments...

The main deficiency with the pingers at present is the range. They are fine for Tank Cave, but do not have sufficient range for the 100m depths found on the Nullarbor.

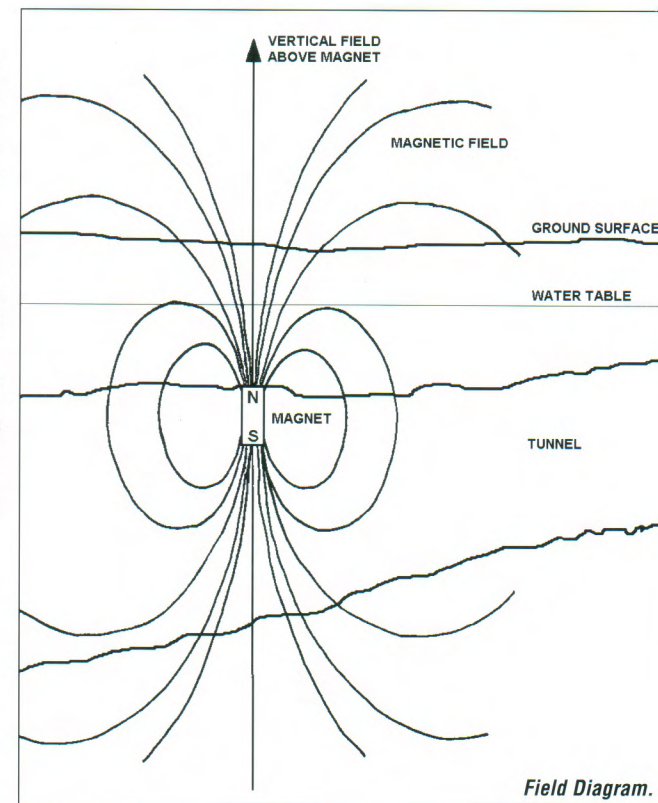
Prior to a recent trip to the Nullarbor a 50 gain preamp was added to the receiver coil. This allowed the signal to be heard through 100m of rock, but accurate measurements by nulling could not be achieved. The main problem was the large amount of amplifier noise (hiss) that tended to drown out the signal. Future developments planned are;

- Use of a low noise preamp.
- Adding a bandpass filter to the receiver to filter out broadband noise.
- Increasing the pinger output power.
- Auto switch off to save the batteries.

Thanks and Acknowledgments...

Thanks are due to;

- Adrian Richards for the construction of the receiver and other useful help and advice.
- Tony Carlisle, whose Nullarbor cave radio, first used in 1991, gave inspiration for this project.
- Brian Pease, whose informative web site gave me much needed technical information. Doing a web search for "Brian Pease" is probably the best way to find out about radiolocation.
See <http://radiolocation.tripod.com/>
- All of those people who have helped by carrying pingers underwater and making surface measurements.
- Landowner, Rob Dycer, for allowing us to have so much fun in, and underneath, his paddock.



~ MEASURING UP ~

Exploring the Limits of Oxygen Analyser Technology

By Robert N. Rossier

Precious little is more important than the oxygen in the air we breathe. Too little, and we become hypoxic. Without adequate oxygen, our vision narrows, our breathing rate increases and coordination is reduced. We feel fatigued, confused, apathetic. As the oxygen level drops more, we can become nauseated, convulsive and collapse into unconsciousness.

Too much oxygen is not much better. Exposure to high partial pressures of oxygen can lead to oxygen toxicity, the symptoms of which range from twitching muscles and tingling lips to full-blown convulsions. With too little or too much

oxygen, our continued survival may be measured in mere minutes.

Call it evolution, coincidence or divine design, our bodies perform best when breathing air at normal pressures. As we descend beneath the waves, and particularly when we do so breathing a gas other than air, it is absolutely essential to have an accurate measurement of the oxygen content of that gas.

Oxygen Measurement Technology...

Due to oxygen's inherent properties, several technologies can be used to measure the oxygen found in gas mixtures. Oxygen is affected by magnetic fields, a property not exhibited by other gases. Paramagnetic oxygen sensors meas-

ure the displacement of non-magnetic nitrogen-filled dumbbell assemblies suspended in a magnetic field in response to the magnetic attraction of oxygen. In essence, the magnetically attracted oxygen molecules push the non-magnetic dumbbells out of the way. The more oxygen

that's present, the more the dumbbells are displaced. Paramagnetic oxygen sensors are used commercially, but have not been adapted to portable monitors due to physical constraints.

Thermal conductivity is another way to measure the concentration of

The VN202 uses a flow diverter that attaches to the cylinder valve.

oxygen in a gas mixture. In a predominantly oxygen-nitrogen mix, the amount of oxygen can be determined by measuring the cooling effect of the gas flowing over a thermistor (an electrical resistor made of a material whose resistance varies sharply in a known manner with the temperature). The process requires careful flow-rate control, and is complicated by the effects of humidity and other gases. Magnetic wind oxygen analyzers use a combination of paramagnetic response and thermal conductivity measurement.

Polarographic oxygen sensors are used in the medical field to measure blood oxygenation. Oxygen diffuses through the skin and through a sensor membrane into an electrolyte between two electrodes. A small voltage is applied between the two electrodes, and the resistance measured between the electrodes is a function of the amount of oxygen present.

When it comes to portable oxygen analyzers used for diving, the most common technology by far is the galvanic fuel cell oxygen sensor (below). The sensor is comprised of a lead anode and gold-, silver- or platinum-plated cathode in a potassium hydroxide electrolyte. A sensing membrane, typically a very thin Teflon membrane, allows diffusion of oxygen

through a thin layer of electrolyte to the cathode. The oxygen oxidizes the lead anode into lead oxide. This chemical reaction generates a small current between the anode and cathode. The amount of oxygen in the gas is determined by measuring the strength of the current generated by the sensor.

Significant differences are found within the ranks of galvanic, fuel-cell oxygen sensor design. Designs are optimized to the specific application to provide the necessary response time, outputs, life, accuracy, size and price. Still, as a family, galvanic, fuel-cell oxygen sensors share a common set of operating characteristics.

Sensor Idiosyncrasies...

While the basic principles of a galvanic fuel-cell oxygen sensor may seem simple enough, the sensors do have their idiosyncrasies. Without a clear understanding of the subtleties, one might use them incorrectly and obtain inaccurate oxygen measurements of the gas in our cylinders.

An important point for any diver to understand is that although the analyser readout is in percent of oxygen, the sensor actually measures the partial pressure of oxygen. If the ambient pressure is 1 atmosphere and the gas being analysed is dry air, the reading will be 20.9 percent. However, if the pressure is higher or lower than 1 atmosphere, the reading will reflect the pressure differential. Calibrate the analyser in air at sea level and then take it to an altitude of 18,000 feet (0.5 ATA ambient pressure), and it will read roughly 10.5 percent. Zap the analyser to a "depth" of 10 metres in a hyperbaric chamber (2 ATA ambient pressure), and it will read about 42 percent. Obviously, proper calibration and measurement technique are critical to an accurate measurement of the oxygen content of a nitrox or mixed gas cylinder.

Another important consideration is that the output of the sensor varies with temperature. As temperature increases, the current-generating reaction within the cell increases, resulting in a higher reading for the same partial pressure of oxygen. This effect is compensated for by means of a temperature compensation circuit. The circuit is designed to have the opposite response to temperature as the sensor, thus



While electronics cases may appear similar, the method of getting the gas to the sensor can be markedly different.

negating the effect in terms of the readout. This works well as long as the temperature compensation circuit and the sensor are at the same temperature.

Simple to Use?...

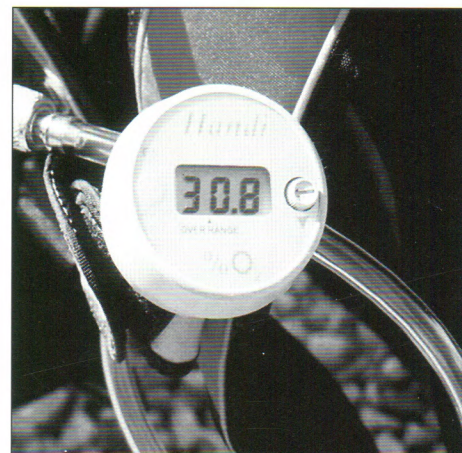
Portable oxygen analyzers on the market today are relatively simple to use, incorporating a small electronics module with LCD readout and calibration knob. The most obvious difference lies in the methods employed to get the gas from the cylinder to the analyser's sensor. Perhaps the simplest is the Analox Mini O2DII, which uses a simple adapter held against the outlet of the cylinder. Similarly, the auto-calibrating Abysmal OxySpy incorporates a plastic T-fitting assembly that presses against the cylinder valve port. The Vandagraph VN202 utilises a more complex adapter incorporating a diverter valve that attaches to a standard or DIN cylinder valve. With these analyzers, the cylinder valve is cracked open just until it hisses, allowing a low flow of gas into the sensor port.

Other designs offer more precise pressure and flow control of the sample gas. The Maxtec

Handi oxygen analyser incorporates a regulating valve that attaches to a standard BC inflator quick connect. The regulator reduces the pressure from intermediate pressure (roughly 9.5 bar) to 0.25 bar at the sensor. The OMS Oxygen Analyser II uses a flow meter or DIN adapter/flow regulator to properly set the flow rate.

Analyser Anomalies and Bad Measurements...

In general, divers using nitrox in a recreational, open-circuit scuba setting work to a +/- 1 percent accuracy. That is, we require our planned and measured cylinder oxygen percentage to be +/- 1 percent O2. Portable oxygen analyzers used in diving today are generally advertised as accurate to within +/- 1.0 percent of readout with a resolution of 0.1 percent O2, as long as the analyser is properly calibrated and the measurement is made in accordance with the manufacturer's instructions. Oftentimes, divers do not properly calibrate the analyzers, do not recheck calibration between measurements and do not follow the proper procedures for taking the measurements.



According to John S. Lamb, author of *The Practice of Oxygen Measurement for Divers* (Best Publishing, 1999), the most common mistakes that divers make when analysing the oxygen content of their cylinders result from "a lack of understanding of gas laws and impatience."

The first mistake is using an excessive flowrate, which can cause a pressure increase at the sensor resulting in a higher than actual oxygen measurement. In testing several portable oxygen analyzers, I found very little variation when the flow rate was increased beyond the manufacturer's prescribed limits.

Continuous-flow measurements can also be a problem in terms of temperature. "The gas released from the cylinder is at sub-zero temperature," notes Lamb, "and the sensor is temperature-compensated at room temperature." As explained in Lamb's book, the sensor has a thermal inertia and time is required for it to heat up evenly. It is therefore possible for the gas being measured to be at a different temperature than the compensation circuit. The result can be a reading higher than the actual oxygen percentage.

Whether calibrating with oxygen or analysing a cylinder with an oxygen-enriched breathing mixture, care must be taken to properly fit the analyser to the cylinder. An improper fit may result in entrained air entering the sensor and diluting the mixture, resulting in a lower than actual reading.

Calibrating an oxygen analyser in ambient air can become troublesome at altitude. If the

analyser will not calibrate to 20.9, the calibration can be adjusted to account for the reduced ambient pressure. One way to adjust the calibration is to take the ambient pressure in Bar, and multiply this number by 20.9 to get the adjusted calibration figure. For example, when making an altitude dive with an ambient pressure of 0.9 Bar (approximately 3,000 feet/900 metres above sea level), the analyser should be calibrated to 18.8 percent (0.9×20.9) in ambient air. The resulting measurement should then be adjusted by dividing by the ambient pressure in Bar. To continue the example, if the analyser reads 30.6, divide by 0.9 to get the adjusted value of 34.0 percent ($30.6/0.9$).

Likewise, it's especially important to calibrate before each measurement if the atmospheric pressure is changing, as with the passage of a front, since ambient pressure changes will affect calibration. One manufacturer also warns users to recalibrate the analyser if elevation changes by 500 feet/151 metres.

Humidity also affects the measurement of oxygen, particularly during the calibration process. The percent of oxygen in dry air is 20.9 percent, but as humidity increases, the percentage of oxygen in the atmosphere decreases. In 100 percent humidity at 27°C, the percent O2 in the atmosphere is 20.2. Thus, in these conditions, an error of 0.70 will occur when the oxygen analyser is calibrated to 20.9 percent. In itself, this is not generally a problem, but if this and other measuring errors occur, the result can be significant.

To avoid the humidity error, calibrate the analyser using dry air from a scuba cylinder rather than ambient air. Alternatively, circumvent the humidity error by using a calibration table, which provides a calibration number based on temperature and relative humidity.

Also of consequence is the fact that the sensor absorbs and offgases oxygen. As Lamb explains, "A new error is now occurring in some new designs that incorporate automatic calibration. Since the sensors take time to offgas absorbed oxygen, and the automatic recalibration may occur before this is complete, a cumulative error may occur when measuring cylinders one after another." To avoid this problem, verify calibration between measurements by testing a com-

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10	20.9	20.9	20.9	20.9	20.8	20.8	20.8	20.8	20.7	20.7
20	20.9	20.9	20.8	20.8	20.8	20.8	20.7	20.6	20.5	20.4
30	20.9	20.8	20.8	20.8	20.7	20.7	20.6	20.5	20.4	20.2
40	20.8	20.8	20.8	20.7	20.7	20.6	20.5	20.4	20.2	19.9
50	20.8	20.8	20.8	20.7	20.6	20.5	20.4	20.2	20.0	19.7
60	20.8	20.8	20.7	20.7	20.6	20.5	20.3	20.1	19.8	19.5
70	20.8	20.8	20.7	20.6	20.5	20.4	20.2	19.9	19.6	19.2
80	20.8	20.8	20.7	20.6	20.5	20.3	20.1	19.8	19.5	19.0
90	20.8	20.7	20.7	20.6	20.4	20.3	20.0	19.7	19.3	18.7
100	20.8	20.7	20.6	20.5	20.4	20.2	19.9	19.5	19.1	18.5
H2O at 100% RH	0.6	0.8	1.2	1.8	2.5	3.4	4.7	6.5	8.6	11.5

If the temperature and RH axis meet in this part of the chart, calibrate to the chart O₂ level or dry air to maintain 0.5% O₂ accuracy in NITROX.

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pressed air cylinder.

Final Measure...

In researching this article, I tested several analyzers to compare ease of use and repeatability of measurements, with several notable results. First, while the manufacturer's data might lead us to believe we can get precise and accurate measurements, doing so in the field is more difficult than expected. On all analyzers I tested, the air calibration number fluctuated significantly over a period of 3 to 10 minutes. I often saw figures of 20.6 to more than 23.0 percent when I rechecked air calibration after analysing a cylinder of nitrox. A cylinder of ostensibly 32 percent oxygen analysed at anywhere from 30.6 to 31.1 percent. Without carefully rechecking calibration, I easily obtained readings as high as 34.3 percent. When calibrating analyzers with pure medical grade oxygen, I found that calibrations varied from 96.8 to 100.2 percent oxygen, casting some doubt on the precision of measurements.

The bottom line is that oxygen analysis in the field is not an exact science. It's not beyond the realm of possibility to have an analysis that's off by 4 percent O₂, and that can make a significant difference on our dives. A 4 percent O₂ error easily translates to a PO₂ (partial pressure of oxygen) difference of 0.2 ata (atmospheres absolute), which on the high side represents a significant risk in terms of oxygen toxicity. On the low side, our EAD (equivalent air depth) might be 3 metres greater than we think. Either way, if we dive close to the limits, we can unwittingly exceed them.

Getting a reasonable measurement of the oxygen content of our diving cylinders doesn't represent a major hurdle in the diving world. The technology is readily available with analyzers selling in the US\$200-\$300 range. But as more divers switch from compressed air to nitrox and mixed gas, the need for understanding oxygen analyzers, for training in proper measurement techniques and procedures, and for using conservative diving limits becomes as critical as breathing itself.

CARE AND HANDLING OF PORTABLE OXYGEN ANALYZERS AND SENSORS

Although generally robust and reliable, precision instruments, portable oxygen analyzers should be treated with the same care and consideration as all life support equipment.

- Read and follow manufacturer instructions regarding analyser and sensor care and handling.
- Avoid exposing analyzers and sensors to extremes in temperature. Freezing a sensor or exposure to high temperatures (greater than 40°C) may cause permanent damage, including leaking of caustic potassium hydroxide (KOH). Avoid leaving analyzers and sensors in direct sunlight, in closed vehicles or in unheated spaces when temperatures are at or below freezing.
- Do not immerse analyzers in water. Although analyzers are generally designed to withstand shipboard elements, they are not waterproof, and they should not be immersed in water. Water on the sensor can result in inaccurate readings, and drying seawater can result in destructive and corrosive deposits.
- Remove batteries from the analyser for extended storage periods.
- Avoid rapid pressure changes. Rapid pressure changes may cause internal sensor damage and unreliable readings.
- Avoid using cleaning agents and solvents on the analyser. Such chemicals can cause corrosion and damage to O-rings, seals and electrical components and contacts.
- Avoid exposing sensors to freezing temperatures, physical shocks, vacuum or excessive vibration.
- Although airport security X-ray units do not adversely affect them, do not expose portable oxygen analyzers to strong radio, short wave, microwave, X-ray, high frequency or electromagnetic radiation. For more information, consult the manufacturer.

TIPS FOR ACCURATE OXYGEN MEASUREMENT

When diving with nitrox or mixed gases, safe diving practices require accurate measurement of oxygen. When using a portable oxygen analyser to measure cylinder oxygen content, consider the following recommendations:

- Read the manufacturer's instructions carefully and follow them precisely.
- Properly calibrate the analyser per manufacturer instructions. Recheck the calibration before and after each measurement. Take your time. Calibrations with pure oxygen and dry breathing air may help ensure proper measurement.
- To verify operation of the analyser during calibration with ambient air, blow gently on the sensor. Because of the reduced oxygen level in expired breath, the reading should drop to 17-18 percent.
- When taking measures, avoid excessive flowrates and increased pressures. Excessive flowrates can increase the total pressure to which the sensor is exposed; it can also reduce the temperature of the gas being measured. Calibration and measurement of breathing gas should be made at the same flowrate and pressure. When taking measurements, take your time.
- Never use an analyser with a suspect sensor. Replace leaking sensors and sensors that do not calibrate.
- Never trust an analyser that must constantly be recalibrated. Excessive drift may indicate sensor failure, a low battery or other analyser malfunction.
- Never use an analyser with a low battery. This can cause serious inaccuracies in the oxygen measurement. Most models have a low battery indicator to warn the user.
- Never use the analyser in a saturated, water-vapor environment. A film of water on the sensor can result in reduced response times and inaccurate readings.

MANUFACTURERS OF PORTABLE OXYGEN ANALYZERS

Abysmal Diving Inc.
6595 Odell Place, Suite G Boulder, CO 80301
Phone: +1-303-530-7248;
Ffax: +1-303-530-2808
www.abysmal.com

Analox Sensor Technology Ltd
Wainstones Court, Stokesley Industrial Park
Stokesley, England TS9 5JY
Phone: +44 (0)1642 711400;
Ffax: +44 (0)1642 713900
www.analox.net

Dive Rite
117 W. Washington St. Lake City, FL 32055
Phone: +1-904-752-1087;
Ffax: +1-904-755-0613
www.diverite.com

Global Mfg. Corp.
1829 S. 68th St. West Allis, WI 53214
Phone: +1-414-774-1616;
for dealer, 1-800-558-1811
Fax: +1-414-774-9568
www.gmcscuba.com

Maxtec, Inc.
6526 South Cottonwood St. (300 West)
Salt Lake City, UT 84107
Phone: 1-800-748-5355;
fax: +1-801-270-5590
www.maxtecinc.com

Ocean Management Systems
P. O. Box 146 (23 Factory St.)
Montgomery, NY 12549
Phone: +1-845-457-1617;
Fax: +1-845-457-9497
www.omsdive.com

Vandagraph LTD
15 Station Road, Cross Hills, Keighly
West Yorkshire BD20 7DT, UK
Phone: +44 (0)1535 634900;
Fax: +44 (0)1535 635582
www.vandagraph.co.uk

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FACTS, JUST THE FACTS!!

From the CDG Newsletter I have extracted the following interesting statistics which were gleaned from a recent survey conducted by one of their members, Peter Glanvill.

The following questionnaire asked about experience, use of decompression tables and computers, technical diving skills and experience and something about diving related diseases.

Cave divers are getting older - The median age for a cave diver is 39 and the oldest active diver is nearing 70!

The 71 respondents had clocked up nearly 34,000 dives between them and most had done around the 300 mark. The average number of years diving was 15 and ranged from 42 to 3 and most divers were doing about 25 per annum. One professional diver had clocked up 4500 dives and 2 others had done more than 2000 but they were the exception rather than the rule.

41% regularly went deeper than 30 metres and the median deepest dive was 57 metres. The deepest reported dive was to 110 metres! Dive durations were long, on average 50 minutes but many long dives were around 2 hours and the longest recorded (decompression) dive was over 16 hours!

When it came to use of tables, 34 used Buhlmann tables, 11 BSAC tables, 10 used none. The vast majority of respondents used Aladin computers, followed way behind by Suunto and then Oceanic. 11 used no computer.

Approximately 50 used other gas mixtures than air on a regular basis 20 of who were into advanced technical diving using Trimix (nitrogen oxygen and helium) or a helium oxy-

gen mixture (Heliox). Median dive time on mix was 60 minutes and the median depth was 50 metres.

32 odd used oxygen as a decompression gas 17 of whom used 100% O₂ and nobody had had any significant problems doing this. Most individuals used medical oxygen although 13 used oxygen marketed for welding. Of those 4 who had had oxygen problems, one had noticed a tight chest after using pure O₂ for long periods, one thought he had increased mucus production after an hour breathing it, one had had a twitching lip on one occasion and a tight chest for a day after using pure O₂ at 12 metres and the last had got a lip twitch from switching from air to an unknown mix of nitrox at a depth of 45 metres!

23 had some kind of technical diving qualification 17 having certification from IANTD, 6 from TDI and 5 with an assortment of other qualifications.

Most didn't think they noticed narcosis until a depth of over 35 metres and then didn't think it caused problems until something like 52 metres! One tough nut reckoned he only had problems at 80 metres.

Coming to diving diseases it was no surprise to find that 50% had had some form of barotrauma. A quarter of respondents had had problems with their ears, which included 11 who had actually perforated their eardrums. Two divers had had the alarming symptoms of vertigo. 10 divers had experienced sinus squeeze and 2 had problems with teeth. There were no cases of gas embolism.

Half those questioned had dived with a hangover and it affected per-

formance in 50% one diver actually vomiting underwater. 3 thought their hangovers were improved during the dive by the increased pressure of oxygen being breathed. Half the respondents had taken some kind of medication prior to diving the commonest was being antihistamines although more interesting substances included cannabis and synthetic opiate painkillers.

There were 8 cases of treated decompression sickness but two divers had to be treated twice. Nearly 3 times this number had had symptoms of decompression sickness but had not sought treatment for a variety of reasons the commonest being denial although distance to chamber and using in water oxygen treatment were also cited. Reported symptoms were Central Nervous System (CNS) in 7 cases, skin bends in 5, musculo skeletal in 6 and 8 were not described. 10 divers had been tested for intracardiac shunts (PFO's) that are thought to be a prime factor in divers developing decompression sickness when using decompression tables properly. Five had these shunts but only one had been treated for his DCS - the others had ignored the symptoms. Those who had never had any symptoms of DCS had no shunts. This gave a rate of shunts of 7%, which is higher than expected. An attempt was made to compare this group with ordinary divers but it proved difficult to get club members to complete questionnaires and I got far fewer replies. However open water divers seem to be younger, less experienced, but dive more often. They don't dive as deep. A quarter were female compared to the one lone female cave diver! None reported any symptoms of decompression sickness.

continued next page...

What conclusions can we draw?

It would have been interesting to compare these practices with those of 30 years ago. Certainly cave divers seem to be at the cutting edge of deep technical diving and most are training appropriately. What is worrying is the high rate of decompression sickness, which has certainly caused one or two cave divers to retire. Cave divers with shunts are probably at particularly risk because shunts tend to open if a diver exerts himself after the dive ~ which is what usually happens in caving! More investigation is needed here. Divers also need to report symptoms if they get them so that treatment can be started quickly. There is no shame attached to getting decompression sickness but there is plenty of evidence to suggest that residual damage to the nervous system occurs if it isn't treated quickly. It's sad that people are still reluctant to come forward and admit they have been treated. 1 thought things were improving on this score but it would appear not.

If you want be investigated for a shunt contact me or Dr. Peter Wilmshurst directly at Shrewsbury Hospital. 1 would be particularly interested to hear from anybody who has ever had the visual symptoms of migraine (expanding shimmering zigzag crescent lasting 20 minutes in both eyes) without the migraine. Peter Glanvill, July 2001 Reply to PFO and the Migraine Aura 1 read with great interest (as 1 suspect did others) R P Skorupa's article in CDG Newsletter 140 p. 1 & 2 titled 'PFO and the Migraine Aura' and whilst very interesting, some of the information it contains may not be absolutely up to date. The final paragraph however left me with two concerns, firstly the implication that a doctor would not have the operation and secondly that nitrox is an alternative. Nitrox is not an alternative and this is a common misconception. Whilst nitrox reduces the inert gas burden it does not eliminate it and

for practical purposes the critical depth is an EAD (equivalent air depth) of 7m. At an EAD of greater than 7m you are at risk given you still have an inert gas burden that can form micro-bubbles upon ascent and yet a depth threshold of 15m has been quoted by some who should know better. 1 am not alone in having suffered substantial symptoms when using nitrox as a bottom gas and in fact an incident earlier this year whilst diving Little River using EAN 34 led to me suffering a substantial bend complete with skin lesions and visual disturbances. All other activities for the dive could have been considered appropriate and even dodging US divers as they bolted from the cave did not interfere with a controlled ascent. Even a dive in Mexico with an EAD of 14m led to a small skin bend and minor visual disturbances! 1 have also induced a bend after pulling over a compressor many CDG Newsletter 141 - October 2001



NATIONAL DIRECTORS REPORT 2001

The Annual General Meeting was held on the 20th October at the International Motel. Although attendance was down, it still enabled a lively discussion to take place which I felt benefited the members present and help set future goals.

The positions up for election this term were National Director, Site Director and Publications and Records Director. A single nomination was received for each position, therefore those nominations were accepted. Chris and I will remain in our positions and Rob Brennan will take over from Steve Arnel as Site Director. Steve has served the Association well during his term and we all owe him and the many other volunteers, that work under his Directorship, our thanks.

This will be Chris Edwards third term in arguably the hardest position on the Committee. Chris's responsibilities, apart from his input in the day to day running of the Association, include the overseeing of our Web Site, Guidelines, Course Materials, Instructor Materials, CDAA Records and CDAA Products. To help him in this position Chris has assembled a bunch of tireless workers who most of the time receive little thanks for their work from our members. I would like to take this opportunity to thank Tony Richardson, Glen O'Connell, Deb Williams, Lorraine Hardman and Ellen Garratt for their dedication to the job. Chris won't tell you this, because that's not his way, to take credit, but I will. Chris is developing a new software package at the moment which will update our systems and make them user friendly. (Did I hear a collective sigh of relief from Linda, Gary, Paul and

Lorraine?) New hardware will be budgeted, so that we can run the system/s efficiently and quickly as well. Chris is also working on our CDAA Members and Instructors manuals and these will soon be available in CD format. As Chris can only get to dive on Sundays, because of his work commitments, and that's if he's reasonably close and not in some remote locality where his job often takes him, he still worked until late Saturday night and then drove the 5 hours to Mt Gambier that night to help on the Sunday at the Englebrechts West working bee to install the stairs. It's the dedication that volunteers like Chris put into our Association that keep it going and strong! At the 2000 AGM a number of things were requested, firstly to solve the Tank Cave ongoing "them and us" argument. I would like to think that this has been achieved. Occasionally we have small flareups and for those who subscribe to our web site you know that I will answer all questions immediately. If I have been a "bit in your face" I apologise but I will tell it how it is, that's my nature! For those that don't know Phil Prust, who a lot of members had thought slighted by events, he has now joined as a paid up member of the Tank Cave group. Phil has put things that happened before, behind him now and moved on to become one of our mapping team. I think Phil's input will not only benefit the Association but help heal the rift that existed. There are never winners in these situations, we all lose! Let's now move on and accomplish what we started at Tank Cave. We currently have a lot of the original Tank Cave divers back diving again. Richard Price our Business Director informs me

that we are right on budget with our costing so far and if Tank Cave applications to dive, keep coming we will reach our goal of making Tank Cave completely self sustaining. This means membership dollars will not be used to subsidise the site as previously requested by the membership.

The Directors were also asked to improve Guidelines. This I feel has been achieved in some ways but not others. Guidelines accounts for basically half of our expenses and if you have been on our web site you will have seen the opinions of many of our members about costs and the use of the Internet instead of hard copy. Advertising has increased and therefore income, content has improved and a lot of features brought up to date. I still get comments like "Oh, I haven't had that phone number for ages!" when referring to some listing. All I can say is if it's been ages then maybe you should have done something about it. In a perfect world each area of the CDAA would be interrelated with each other, sorry, it just doesn't work that way. If you want something updated or changed you need to notify the departments concerned. Guidelines is about to undergo a radical change and I hope you will like the new product.

Improvements to sites were also an important point brought up by members. Tank Cave, Englebrechts West, Englebrechts East and Gouldens have all undergone site improvements within the last 12 months. Future site improvements will be made to Kilsbys, Sisters, Gouldens, Little Blue, Fossils, Pines, One Tree and Ela Elap. Rob Brennan will be informing you of the working bees to enable this to happen. The Tank Cave (our most dived site) road is being surfaced with crushed rock, graded and shaped plus a stile, to enable getting over the fence, is to be installed. Future improvements here include remodelling of

the shed and a B-B-Q on site.

Other sites will see the installation of gear tables/stands to enable easier gearing up and we are looking at a change shed for Gouldens near the road. Negotiations are taking place as regards access to Barnoolut and other sites and we should see an outcome by Rob Brennan our new Site Director soon.

Re-breather and Tri-mix diving propositions have been presented and debated amongst our members over a long period now. We have reached the final stage and at the moment just awaiting fine tuning of the documents.

It has been a good two years and I would like to think the Directors have been able to solve the majority of problems that presented themselves. We can't do much about escalating insurance costs or keep everyone happy all the time but we will continue to try. I hope that my next two years in office will see the growth of the Association and result in a larger and stronger membership.

Warrick McDonald
CDAA National Director.

NEXT PENETRATION COURSE EASTER 2002

Limited places available!
Avoid disappointment by booking
EARLY. Remember only two Penetration
courses are scheduled each year, so
don't miss your opportunity to receive
world class instruction.

For more information contact
Paul Axton Standards Director on
03 9782 1671 or 0419 346442
or E-mail records@teksupport.net.au

CAVE DIVERS ASSOCIATION OF AUSTRALIA INCORPORATED
ABN 65 062 259 956
BALANCE SHEET AS AT JUNE 30 2001

	2001	note	2000	1999	1998
ASSETS					
Current Assets					
National Australia Bank cheque account	\$28,165.85		\$76,679.07	\$55,752.63	\$62,245.92
National Australia Bank Common Fund	\$59,964.00	8			
National Australia Bank term deposit	\$33,493.72		\$31,711.30	\$30,264.35	
ANZ term deposit	-	-	-	-	-\$8,963.72
Debtors - advertising	\$1,800.00	9	\$900.00	\$1,550.00	\$700.00
Debtors - CDAA products	-		-	-	\$1,449.00
Debtors - other	-		-	\$50.00	\$20.00
Withholding tax deducted	-		-	\$203.55	\$203.55
CDAA Products stock	\$7,573.41		\$10,749.85	\$5,230.46	\$1,707.69
Instruction Materials stock	\$417.15		\$1,308.54	\$57.58	\$1,065.00
Members Manuals stock	\$2,216.31		\$3,269.75	\$3,521.70	
Total Current Assets	\$133,630.44		\$124,618.51	\$96,630.27	\$76,354.88
Non-Current Assets					
Property, Plant & Equipment	\$7,169.70		\$7,169.70	\$7,169.70	\$7,069.70
less accumulated depreciation	(\$6,584.00)		(\$6,044.00)	(\$5,390.00)	(\$4,045.00)
Office equipment	\$11,203.59		\$11,203.59	\$11,203.59	\$11,133.64
less accumulated depreciation	(\$11,192.19)		(\$10,893.45)	(\$10,142.15)	(\$8,625.50)
Total Non-Current Assets	\$597.10		\$1,435.84	\$2,841.14	\$5,532.84
TOTAL ASSETS	\$134,227.54		\$126,054.35	\$99,471.41	\$81,887.72
LIABILITIES					
Current Liabilities					
Memberships received one year in advance	\$14,945.00		\$12,900.00	\$12,695.00	\$16,000.00
Instructor fees received one year in advance	\$40.00		-	-	\$40.00
Overpayments	\$655.00		\$530.00	\$500.00	\$350.00
Penetration course deposits	\$700.00		\$400.00	\$400.00	
Accrued expenses	\$11,981.95	10	\$7,475.92	\$1,073.55	
Creditors	-		-	\$150.00	
Tank Cave Fees Received in advance	-		\$4,180.00		
Total Current Liabilities	\$28,321.95		\$25,485.92	\$14,818.55	\$16,390.00
Non-Current Liabilities					
Memberships received two years in advance	\$3,800.00		\$3,450.00	\$3,050.00	\$1,895.00
Memberships received three years in advance	\$1,510.00		\$550.00	\$650.00	\$350.00
Memberships received four years in advance	\$440.00		\$300.00	\$50.00	\$150.00
Memberships received five years in advance	\$50.00		\$100.00	-	\$50.00
Memberships received six years in advance	\$50.00				
Memberships received seven years in advance	\$50.00				
Total Non-Current Liabilities	\$5,900.00		\$4,400.00	\$3,750.00	\$2,445.00
TOTAL LIABILITIES	\$34,221.95		\$29,885.92	\$18,568.55	\$18,835.00
EQUITY					
Members Equity as at 30/6/00	\$96,168.43				
add: 2000/01 Net Income	\$3,837.16				
CDAA Member's Total Equity	\$100,005.59		\$96,168.43	\$80,902.86	\$63,052.72
represented by:					
NET ASSETS	\$100,005.59		\$96,168.43	\$80,902.86	\$63,052.72

CAVE DIVERS ASSOCIATION OF AUSTRALIA INCORPORATED
ABN 65 062 259 956
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	2001	note	2000	1999	1998
INCOME:					
CDAA Products net income	\$3,033.30	1	\$881.40	\$1,496.04	\$1,761.06
CDAA Instruction Materials net income	\$3,336.46		\$5,350.70	\$7,003.35	\$7,166.96
Membership fees	\$35,210.00		\$36,235.00	\$38,570.00	\$38,755.00
Instructor's membership fees	\$1,200.00		\$1,400.00	\$1,310.00	\$1,440.00
Late membership fees	\$660.00		\$4,100.00	\$3,670.00	\$1,795.00
Joining and rating upgrade fees	\$3,923.00	2	\$4,200.00	\$5,560.00	\$5,880.00
Nitrox endorsement fees	\$640.00		\$500.00	\$1,110.00	\$1,210.00
Guidelines advertising income	\$1,800.00		\$900.00	\$3,650.00	\$2,550.00
Tank Cave Fees	\$5,315.00		\$4,025.00	-	-
CDAA Fundraising income	-		\$60.00	-	\$1,355.00
25 Anniversary receipts	-		-	\$1,560.00	-
Grants and donations received	-		\$70.00	\$1,000.00	\$1,590.00
Fines	-		\$45.00	\$48.00	\$200.00
Penetration course receipts	\$2,950.00		\$4,800.00	\$7,240.00	\$6,680.00
Interest income	\$4,127.76	3	\$2,377.43	\$975.77	\$1,594.86
TOTAL INCOME	\$62,195.52		\$64,944.53	\$73,193.16	\$71,977.88
EXPENSES:					
Administrative expenses	\$116.50		-	-	\$33.00
Accounting and audit fees	\$427.35		\$350.00	\$350.00	\$925.00
Aquatech commission expense	-		-	\$740.00	\$1,043.63
Advertising written off	-		\$1,100.00	-	\$762.00
Bad debts	-		-	\$20.00	-
Bank fees	\$272.49		\$70.37	\$28.00	\$288.80
Computer expenses	\$278.00		\$225.95	\$335.00	-
Courier/Taxi fares	-	-	-	-	\$132.72
Credit facility fees	\$971.25		\$1,025.33	\$682.43	\$66.00
Govt. financial taxes	\$67.94		\$90.00	\$175.15	\$208.84
Depreciation expense	\$838.74		\$1,405.30	\$2,861.65	\$3,643.50
Discounts allowed	-		\$150.00	\$100.00	-
Insurance	\$14,335.22	4	\$9,406.75	\$9,325.00	\$3,390.00
Members Manuals	\$1,429.44		\$1,330.45	\$1,071.75	-
Postage	\$1,134.64		\$1,073.75	\$2,614.95	\$2,507.59
Printing and Stationery	\$834.08		\$1,128.56	\$1,053.47	\$3,133.42
Penetration course disbursements	\$2,950.00		\$4,800.00	\$7,200.00	\$6,400.00
Repairs and Maintenance	-		\$307.96	-	\$191.83
Research and mapping expenses	-		-	\$20.00	-
Site expenses	\$777.50		\$58.13	\$171.50	\$70.00
Sundry expenses	-		-	-	\$251.55
Subscriptions	-		-	-	\$50.00
Tank Cave license fee	\$8,250.00	5	\$7,500.00	-	-
Telephones	\$471.50		\$1,433.83	\$3,001.21	\$1,953.53
Web Site expenses	\$4,495.14	6	-	-	\$708.00
CDAA Fundraising expenses	-		-	-	-
25 Anniversary expenses	-		-	\$2,402.12	-
Lamar Hires expenses	-		-	\$2,233.21	-
OzTek expenses	\$318.64		-	-	-
Guidelines Production	\$18,220.40	7	\$14,250.00	\$14,514.90	\$14,138.88
Guidelines postage	\$1,600.61		\$2,081.09	\$1,833.62	\$1,240.21
Annual general meeting expenses	-		-	\$1,446.05	\$1,381.11
AGM Directors expenses	\$478.17		\$918.79	\$940.14	-
Other meeting expenses	\$90.75		\$972.70	\$2,090.15	\$3,158.78
TOTAL EXPENSES	\$58,358.36		\$49,678.96	\$55,343.02	\$45,545.67
NET INCOME	\$3,837.16		\$15,265.57	\$17,850.14	\$26,432.21

CAVE DIVERS ASSOCIATION OF AUSTRALIA INCORPORATED
ABN 65 062 259 956
BALANCE SHEET AS AT JUNE 30 2001

	2001	note	2000	1999	1998
SALES:					
CDAA Products	\$8,938.60	1	\$3,271.45	\$6,831.55	\$7,784.90
Instruction Materials	\$5,230.00		\$6,789.00	\$10,225.00	\$9,670.00
LESS COST OF SALES:					
OPENING STOCK:					
CDAA Products	\$10,749.85		\$5,230.46	\$1,687.84	
Instruction Materials	\$1,308.54		\$57.58	\$315.00	
Members Manuals	\$3,269.75		\$3,521.70	\$650.00	
ADD PURCHASES:					
CDAA Products	\$2,408.86		\$7,779.94	\$8,738.58	
Instruction Materials	\$628.88		\$2,267.06	\$2,574.73	\$1,982.09
Members Manuals	\$376.00		\$1,078.50	\$3,943.45	
LESS CLOSING STOCK:					
CDAA Products	\$7,573.41		\$10,749.85	\$5,230.46	
Instruction Materials	\$417.15		\$1,308.54	\$57.58	
Members Manuals	\$2,216.31		\$3,269.75	\$3,521.70	
TOTAL COST OF SALES:					
CDAA Products	\$5,585.30		\$2,260.55	\$5,195.96	\$5,723.49
Instruction Materials	\$1,520.27		\$1,016.10	\$2,832.15	\$1,982.09
Members Manuals	\$1,429.44		\$1,330.45	\$1,071.75	
LESS POSTAGE:					
CDAA Products	\$320.00		\$129.50	\$139.55	\$300.35
Instruction Materials	\$373.27		\$422.20	\$389.50	\$520.95
GROSS TRADING PROFIT (LOSS):					
CDAA Products	\$3,033.30		\$881.40	\$1,496.04	\$1,761.06
Instruction Materials	\$3,336.46		\$5,350.70	\$7,003.35	\$7,166.96
Members Manuals	(\$1,429.44)		(\$1,330.45)	(\$1,071.75)	

Notes to the Financial Statements Year Ending 30th June 2001
CAVE DIVERS ASSOCIATION OF AUSTRALIA INCORPORATED

1. The increase in product sales was mainly due to receipts at Oztec.
2. The breakdown for joining and rating upgrades are: joining: - \$2973; sinkhole - \$270; cave - \$680
3. Interest received comprises amounts from the term deposit (\$1782.42) and the cheque account (\$2,345.34).
4. Insurance expense has increased due to the difficulty in securing insurance in the current environment.
5. Tank Cave license fee has increased by 10% for GST.
6. Web site expenses are those incurred in setting up and maintaining the official CDAA web site.
7. Guidelines production costs are for four issues as is the case for the previous two years.
8. Surplus cash has recently been transferred to an At Call common fund where a higher interest rate applies.
9. Major advertisers are paying an annual fee, \$1000 has been received subsequent to year end.
10. Accrued expenses are amounts relating to the 2001 financial year that were unpaid as 30th June. These expenses are reflected in the 2001 Income and Expenditure Statement and relate mainly to the June issue of Guidelines, materials production and product purchases.

IMPORTANT NOTICE PLEASE READ

This a reminder to all members that correct access procedure must be followed at all times if we are to ensure access privileges continue.

In particular members are reminded that ALL divers must sign in at Lady Nelson prior to diving Englebrechts and that non-members and members who are not appropriately certified MUST NOT enter the site. This means that you cannot invite your non-diving friend or partner to enter the cave while you dive! Likewise please remember that you are not permitted to pass on the key to other divers but must sign it back in on completion of your dive.

The Directorate will be conducting spot checks of sites such as Englebrechts in the future and any member found to have breached access protocol will be suspended from that site immediately.

NOTICE FOR INSTRUCTORS

Procedure for ordering student packs:

1. Check you are insured & financial.
2. Send order & cheque or by phone/credit card.
3. Allow 14 days from when the order is received - so allow plenty of time.
4. Student kits cannot be returned.
5. Instructors must be active.
6. Please do not pass my number on to dive shops - you should deal with them not me.

• INSTRUCTOR RENEWALS •

Several instructors have not yet renewed their CDAA ratings. Instructors must lodge their current insurance details and renewal fee or packages will not be issued and certifications rejected.

INSTRUCTOR RENEWALS ARE DUE AGAIN 31st DECEMBER 2001.
AVOID DELAYS IN PROCESSING YOUR REQUESTS FOR MATERIALS
BY SENDING YOUR RENEWAL ASAP. PLEASE REMEMBER IT'S A
BUSY TIME OF THE YEAR FOR EVERYONE.

Instructor Renewals
PO Box 8283, CARRUM DOWNS, VIC. 3201

Deb Williams
Instructor Materials Officer

Minutes of the CDAA AGM

Held at the International Motor Inn
Saturday 20th October 2001

1. Welcome and Opening.

The annual general meeting was opened by Kevin Burrowes #1750, the Public Officer of the Association at approximately 10.15am.

2. Apologies.

Apologies were received from: John McCormick #435, Chris Edwards #2247, Jane Bowman #1880, Noel Dillon #2038, Maria Brennan #1320, Andrew Seifried #2941, Terry Oakley #2841, Carlo Virgili #2215, Gary Barclay #1735, John Dalla-Zuanna #236.

3. Minutes of 2000 AGM.

The minutes of the 2000 AGM held on the 21st Oct. 2000 were published in Guidelines #74 issued Dec 2000 were proposed as a true and correct record. Moved by Warrick McDonald #1882, 2nd by Phil Argy #1789. Carried.

4. Business arising from the minutes of the 2000 AGM.

There was no business arising from the 2000 AGM.

5. 2001 Financial Statements.

Kevin Burrowes #1750 on behalf of Tammy Beattie #3068 moved to adopt the report and asked for any discussion on the financial statements.

- Glen Harrison #931 asked if web site expenses had a breakdown for hosting, development costs or product development costs. Richards Price #2880 explained that currently there was no breakdown but it could be produced if requested.
- Glen Harrinson #931 asked if Guidelines production could be looked at to reduce cost by changing the format or number of issues per year with an interim newsletter. Warrick McDonald #1882 replied and offered a complete analysis of Guidelines costing and that the Directorate was currently looking into a new publisher for Guidelines that would reduce costs from \$5000.00 per issue to \$3000.00 per issue.
- Phil Argy #1789 asked if the membership could be consulted more with regards to how association monies are spent and also if an anonymous incident reporting scheme could be set up and published in each issue of Guidelines to allow for information sharing through the membership. Warrick McDonald #1882 replied that the website is serving as a membership forum for transfer of information that is growing in availability.
- John Vanderleest #1965 asked if next year the accounts could have a budget which shows recurrent expenditure for the following year and planned major projects which are ratified by the AGM. Warrick McDonald #1882 replied that it is not covered under our constitution to do that.
- John Vanderleest #1965 moved that the directorate give consideration to allow the membership to approve major spending projects at each AGM. Seconded by Glen Harrison #931. Warrick McDonald #1882 spoke against the proposal to ratify the spending at the AGM because a minority could decide how the funds of all the members are spent. Richard Price #2880 spoke against the motion by pointing out that the association monies were already pre-allocated to ongoing running costs, leaving very little available funds for capital works projects.
- Glen Harrison #931 suggested that the association should have a business plan that looks at injecting some of the existing capital into areas that re-invigorate membership numbers and we need to look at why our membership is not rejoining and where the membership wants to spend the money.

Minutes continued...

Kevin Burrowes #1750 proposed that the financial statements be accepted. Carried

Kevin Burrowes #1750 thanked Tammy Beattie #3068 for the excellent work done on the financial Statement and moved that the thanks be recorded in the minutes.

6. 2001 Directors Reports.

National Director. Warrick McDonald #1882 thanked Kevin Burrowes #1750 for chairing the meeting and pointed out that as requested by the membership the minutes and financial statements were published before the AGM. The results of the office bearer's elections, one nomination was received for each position. National Director, Site Director and Publications and Records Director.

Warrick McDonald #1882 was returned as National Director, Chris Edwards #2247 was returned as Publications and Records Director and Rob Brennan #1321 took over from Steve Arnel #680 as Site Director. Warrick thanked Steve for all his efforts during his directorateship.

Warrick McDonald #1882 then presented his report

Warrick McDonald #1882 then presented a submission from Carlo Virgili #2215 and Glen Harrison #931 to hold the 30th Anniversary AGM in Melbourne.

Chris Edwards #2247 report was read by Warrick McDonald #1182 with special thanks to Lorraine Hardman #2824, Debbie Williams #3092 and Glen O'Connell #2166.

Steve Arnel #680 presented his report with special thanks to Colin Trager for all his help during his time at Barnoolut. Thanks to all the members who helped with the working bee's at Engelbrechts East and West. Thanks to Richard Price #2880 and Warrick McDonald #1882 for their effort in the Tank Cave access arrangements. Thanks to the site access managers Harvey Grantham #2619 and John Vanderleest #1965 (Tank Cave), Linda Claridge #2214 (The Shaft) and Mark Pain #2692 (Kilsby's). And a special thanks to the Landowners for their support.

Discussions were held as to the importance of re-establishing access to Barnoolut and various strategies to achieve this.

Richard Price #2880 presented his report and pointed out that insurance costs can only go up. However the association will continue to search for value for the membership.

Paul Axton #2826 presented his report and thanked Barrie Heard #262 for his efforts as Penetration course co-ordinator.

It was moved and seconded that the director's reports be adopted. Accepted.

7. Kevin Burrowes #1750 asked to have recorded in the minutes thanks to the directors for their efforts during the 2000-2001 year. Moved by Maree Toogood #2824 and seconded by John Vanderleest #1965 that Kevin Burrowes #1750 be appointed as the Auditor for the 2001-2002 year. Accepted.

8. No more general business.

9. Meeting closed 12.30pm.

WANTED



ARTICLES FOR GUIDELINES

**IF SIGHTED PLEASE SEND IMMEDIATELY,
TOGETHER WITH ANY PICTURES TO:**

**The Editor, David Bryant
P.O. Box 2198, Rosebud VIC 3939.**

REWARD

An even better Guidelines for everyone.

OZTek2002

Richard Taylor informs us that OZTek 2002 or OZTek3 as it is to be known is well down the planning track. To be titled "Challenging Our Limits", show convener Richard Taylor is assembling a star studded list of speakers.

For further information call:-

Richard Taylor

Director-TDI/SDI Australia & New Zealand



PO Box 894 Willoughby NSW 2068 Australia
Tel: +61-0500-834-269 Fax: +61-(02)-9958-3795
Mob: 0417-426-316 • ICQ#26790783

GUIDELINES DEADLINES

If you would like to contribute to Guidelines in 2002,
you should note the following deadlines for
submission of materials:

Deadline	for publication
20th Feb	March 2002
20th May	June 2002
20th August	September 2002
20th November	December 2002

CDAА SITE ACCESS

Remember: Access is a privilege, not a right. Please be considerate of landowners wishes.

CN = CAVERN S = SINKHOLE C = CAVE P = PENETRATION

SITE	LEVEL	OWNER	ACCESS DETAILS
MOUNT GAMBIER - SOUTH AUSTRALIA			
Ewens Ponds	Nil	DENR P.O. Box 1046 Mt Gambier 5290 (08) 8735 1177	Groups of 6 or more, phone/mail to Dept. of Environment & Natural Resources (DENR). Smaller groups, no need. Indemnity form to be completed.
Horse & Cart	CN	Peter Cunningham	By phone or mail, 1 week prior. Ph: (08) 8738 4003.
Tea Tree	CN	PO Box 2168, Mt Gambier 5290	
Little Blue	S	Port MacDonnell	Little Blue - permission not required - must carry card.
Allendale	C	Port MacDonnell	Obtain key from Mt. Gambier Tourist Information Centre.
Gouldens	CN	DENR	General Diving: Divers to contact DENR and notify of date and site to be dived.
2 Sisters	CN	P.O. Box 1046	Divers must have the correct CDAА diving endorsement for the site and carry current financial CDAА membership card. The diver must have signed an indemnity with DENR before access is permitted.
Fossil	C	Mt Gambier 5290 Ph: (08) 8735 1177	Training: The Instructor is to notify DENR of the date the sites are needed and to forward signed indemnities from each student and their temporary card number/ membership number.
Ela Elap	S	Mr. Peter Norman	By phone or drop in before diving.
One Tree	S	Private Bag 67, Mt Gambier 5290	Ph: (08) 8738 5287
Swim Through	C	Valerie Earl PO Allendale 5291	Currently CLOSED pending new access arrangements.
Piccaninnie Ponds	S	DENR P.O. Box 1046, Mt Gambier 5290	Permit holders by phone. Be aware of delicate vegetation. Indemnity form to be completed. Ph: (08) 8735 1177 Faxed copies of cards no longer accepted when booking.
Hells Hole	S	ForestrySA	Contact ForestrySA by mail, phone, fax or email to arrange permit. Collect permit from Regional Office or Carter-Holt Harvey Mill gatehouse.
Pines	P/C	PO Box 162	Jubilee Hwy., Mount Gambier. No diving on total fire ban days.
Mud Hole	C	Mt Gambier 5290 Ph: (08) 8724 2876 8.00am - 4.30pm weekdays Fax: (03) 8724 2885	Forest Work Bans may be applied by ForestrySA if forest fire danger is expected to reach extreme. Such bans also exclude the public from entering the forest. If in doubt, please check with Trevor Wynniat, although signs are generally erected at diving sites on such days to indicate such bans. Permits required for compressors during fire danger season.
Email: forestry.recreationse@saugov.sa.gov.au			
Kilsby's	S	Landowner leased to S.A. Police	Restricted access conditions apply - refer Guidelines Issue 54. Twin tanks, maximum of 40 metres depth. Write to: 40 School Road, St. Andrews 3761, Email: mpain@hipex.com.au, 4 to 6 weeks prior to wanting to dive. Please enclose stamped self-addressed envelope (Do not contact landowner). Access date now the first weekend of every month. No animals permitted. No mid-week diving.
		No Visitors	
Shaft	S	Generally open one weekend a month L. Claridge P.O. Box 290 North Adelaide 5006 Ph: (03) 5565 8793 A.H.	For access dates contact Linda Claridge. Also, see Special Access Bulletin in Guidelines issue 69. Nitrox as a diving mix is not allowed in the shaft. Deco mixes ATTACHED to a shot line are permissible. Divers applying to dive in the Shaft must have documented experience of a least 5 twin-tank dives. Sept 8/9, Oct 7, Nov 10/11, Dec 1/2. Email: garinda@tpgi.com.au
Ten Eighty	S	Mr. Colin Traeger	Sundays only Mail Booking Form to Colin Traeger 2-6 weeks prior, stating names/qual. of all divers, and time slot. Please include stamped self addressed envelope.
Bullock Hole	S	PO Box 12	Closed October to November for shearing.
Black Hole	S	Mt Gambier 5290 (08) 8726 6215	

CURRENTLY CLOSED

CDAА SITE ACCESS

SITE	LEVEL	OWNER	ACCESS DETAILS
MOUNT GAMBIER - SOUTH AUSTRALIA (continued)			
Max's Hole	C		Currently pending access arrangements with new owner.
Hann's cave	P	P & A Lasslett	Groups of four divers only apply in writing to Site Director. Limited groups will be allowed access over the summer months. The site is very delicate and therefore only limited access is available. Divers applying will be notified as to further access details. Please include a stamped self addressed envelope.
Engelbrechts		Mt Gambier	Obtain key from Mt Gambier Tourist Information Centre. Access agreement must be signed prior to diving. 2 divers must sign out keys, all divers must sign in advising which groups they are diving with.
- East	C	Council	Please book public holiday dives with lessee.
- West	P	Lessee Ph: (08) 8723 2299	
Three Sisters	P	Millicent Council	Contact Records Officer. Access available for experienced Penetration divers only. Low profile or side mounted independent air systems required. Access agreement must be signed prior to diving. Please allow 4 weeks for indemnities to be processed.
Idllebiddy (5L250)	P	ForestrySA PO Box 162	5L250 open every Saturday. 5L290 open every weekend. Max. 4 divers per dive per day, 1 dive per day for each site. Only Penetration divers.
Nettle-Bed (5L290)	P	Mt Gambier 5290	Bookings from Forestry Office - key from Lady Nelson. Contact ForestrySA by mail, phone or fax to arrange permit. Collect permit from Regional Office or Carter-Holt Harvey Mill gatehouse, Jubilee Hwy., Mt. Gambier. No diving on total fire ban days. Forest Work Bans may be applied by ForestrySA if forest fire danger is expected to reach extreme. Such bans also exclude the public from entering the forest. If in doubt, please check with Trevor Wynniat or Forestry Office, although signs are generally erected at diving sites on such days to indicate such bans. Permits required for compressors during fire danger season. Email: forestry.recreationse@saugov.sa.gov.au
McKay's Shaft	S		Contact South East representative Phil Argy at Mt. Gambier access and indemnities.
Tank Cave	P	Mr. DY CER	Access Manager: Harvey Grantham Email: lemaire@senet.com.au Ph: (08) 8370 9816
Baker's Cave	C		Please write to the Site Access Director to dive in Baker's Cave. Include stamped self-addressed envelope. Climbing equipment required.
NULLARBOR - WESTERN AUSTRALIA			
Cocklebiddy	C		Apply in writing for permission to dive at least 4 weeks in advance of trip to: District Manager, C.A.L.M., PO Box 234, Esperance, W.A. 6450.
Murra El Elevyn	P/C		Phone: (08) 9071 3733 Fax: (08) 9071 3657
Tommy Grahams	C		
Weebubbie	C		Apply to Gerry Falleiro, A/Assistant Project Officer, South East Region Land Administration Services Branch Phone (08) 9273 7215 Fax (08) 9273 7414 Email: gerry_falleiro@dola.wa.gov.au PO Box 2222 Midland WA 6936

N.S.W. - WELLINGTON CAVES

Limekiln (McCavity)	P/C	Both Penetration and Cave Level are being accepted for this cave depending on it's water level at the time. The cave has a restriction at the entrance which is underwater making it a Penetration Dive. During drought, the water level drops to form a small lake below the restriction allowing experienced Cave Divers access to this delicate cave.
Water (Anticline)	C	Affected by high CO ₂ levels during Summer/Autumn. Access arrangements are co-ordinated with an already commissioned research group. Contact Greg Ryan (02) 9743 4157 h, gregr@cs.usyd.edu.au
Rum Jungle Lake	S	Unrestricted access currently exists - Please refer advice in Guidelines No. 68 or check CDAА website.
Burrinjuck	S/C/P	This is a tri rated site. Please see details in issue No. 73. There are no specific access arrangements.

ACTIVE CDAA INSTRUCTORS

Any Instructor wishing material contact - (03) 9562 9264 (Fax) or email: debwilliams@bigpond.com

STANDARDS DIRECTOR:
Paul Axton
Telephone: 0419 346 442
(email) records@teksupport.net.au

INSTRUCTOR	CN	S	C	STATE	PHONE
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NSW & ACT

Nick Jones	•	•		ACT	0408 423 017 m
Peter Grills	•	•	•	NSW	(02) 4950 6262 (8am - 12 midday)
Andrew Robertson	•	•		NSW	(02) 9548 5987 h 0417 664 255 m
Des Walters	•	•	•	NSW	(02) 6041 1405 h (02) 6025 3506 w
Heike Apps	•	•	•	ACT	(02) 6291 0566 h

SOUTH AUSTRALIA

Greg Bulling	•	•	•	SA	0409 095 927 m (08) 8265 4978 h
Glen Harrison	•	•	•	SA	0427 608 609 m
Max Marriot	•	•	•	SA	(08) 8447 3360 h
Richard Megaw	•	•	•	SA	(08) 8344 1733 h

WESTERN AUSTRALIA

Gary Bush	•	•	•	WA	0402 339 652 m (08) 9367 4701 h
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VICTORIA

Paul Axton	•	•		VIC	0419 346 442 m (03) 9782 1671 h
Gary Barclay	•	•	•	VIC	(03) 5565 8793 h
Jane Bowman	•	•		VIC	(03) 9579 2600 w
Stan Bugg	•	•	•	VIC	(03) 9379 8791 h
Linda Claridge	•	•	•	VIC	(03) 5565 8793 h
Brian Cornell	•	•	•	VIC	(059) 85 2514 h
John Dalla - Zuanna	•	•	•	VIC	0407 887 060 m (03) 9484 1216
Chris Edwards	•	•		VIC	0417 116 372 m
Barrie Heard	•	•	•	VIC	(03) 5627 6474 h 0419 401 276 m
Warrick McDonald	•	•	•	VIC	(03) 9579 2600 w
Bob Wealthy	•	•	•	VIC	(03) 5985 8338 h

UP COMING COURSES

CAVERN/SINKHOLE AND CAVE COURSES, PERTH, W.A. RUNNING PART-TIME EVERY APRIL AND OCTOBER

Please call Gary for further details on
Phone 0402 339 652 or email gary.bush@bigpond.com

CAVERN/SINKHOLE COURSE, MOUNT GAMBIER. FEBRUARY 4th - 17th and MARCH 11-24

Contact Jane Bowman 03 9579 2600

CAVE COURSE, MOUNT GAMBIER. FEBRUARY 25th - 3rd MARCH

Contact Warrick McDonald 03 95792600 or email abocean@dingley.net

TRADING POST

FOR SALE

PEE VALVES – \$65.00

JUMP REELS – \$65.00

Please call (03) 5565 8793 or

Email: garinda@tpgi.com.au

TANK CAVE

From John Vanderleest, Tank Cave Co-Ordinator

I turned once again to try to get my bearings, but to no avail. I was lost. Whilst the sky above me was heavy in cloud, it was still letting enough sunlight through to let me know that I was travelling in a Northerly direction. Not that that was much help – I didn't have a map. All I could do was not to walk in circles and hope that I would eventually come across somebody who knew their way. What I would do for a good map right now? This sketch given to me by a friend wasn't much good. Although he was proud of the fact that he had explored the area, he didn't take detailed notes. Now here I was, looking at a piece of paper with rough sketch map that had no resemblance to what was actually here. His memory and reality were somewhat different. Some explorer – more like blunderer.

Explorers are the first to place value on the maps produced by other explorers. There is a saying between them - If you go there – bring home a map – otherwise you weren't there.

NOT TRUE I hear you say. I explore and don't bring home a map.

Ah, yes – but what is your starting point. Most people I know will take somebody else's map and search for areas that are not on the map. And when they find something new, they are normally busting to sketch a quick map for somebody else to go there.

The exploration of tank cave has been happening for a number of years. If fact,

so long, people keep asking why. Well this is how its being done.

Firstly, the obvious leads were explored very quickly. They were string lined, with stick maps being produced. From that point on – its been hard work. The main tunnels are used as base line from which all other exploration took place. Each time a new tunnel was found, it was methodically added to the map. Bearing, back bearing and trigonometry were all used to ensure that the tunnels were accurately tied in together.

Now lets think of the time underwater. With a lot of Tank Cave, the swim to and from the mapping area can take between 1 and 2 hours. This means that you have very little time to do any mapping. With more than 6KM of tunnel, this translates to years of activity.

To date, the mapping has all been achieved using a compass, tape measures and depth gauges. As there is only one entrance to the cave, all measurements need to be tied back to the entrance so that the map could be overlaid on the surface in order to see where the tunnels existed.

Now, the people mapping tank cave have added to a couple of new tools to their arsenal. The first of these is the use of cave radios. These devices, once activated, send out a magnetic pulse through the rock above. Using a receiver, a person walking above, can locate the device taken by the diver. Using a GPS and mod-

ern ground survey equipment, the tunnel maps can be pulled into line, allowing any discrepancies to be adjusted.

Over the past 12 months, cave radios have been used to obtain GPS locations of every line marker in the cave. Ground survey and water depths allow precise roof thickness measurements to be made.

So what are some of the most interesting finds.

1. We now know that Tank cave comes to within 10m of Fossils Cave. Sorry – it doesn't connect – so there will be no swim throughs.

2. The cave has a few areas that have dry sections of cave, only one of which comes close to the surface. Fortunately, there are no vehicle tracks in this area, and the farmer now knows where NOT to drive his tractor. And no – its not worth digging a new entrance.

3. The map produced using compasses and tape measures is extremely accurate. The mapping team have now collated quite a lot of material, including high resolution maps, photos, technical articles and video footage. A lot of this will be place on the CDAA Web site for all to see and read. Hopefully, a lot of this will be on the Web by the time you read this article. For those that want more photos, high resolution graphics, and perhaps, some of the video footage, a CD-ROM will also be produced.

Members who are interested in assisting with the tank cave mapping, either in-water, land surveying, web site updates, video editing or CD-production should contact the Directorate. Remember, there are no pre-requisites, no favouritism, and no funding. Members who do this, do it at their own expense. And its still worth it.



*Mt. Gambier surveyor Mark Oldfield making differential GPS readings at Tank Cave. Assisting is John Winkler.
Photo Ken Smith*

TANK CAVE

~ DATES FOR 2002 ~

	DATE	SPECIAL WEEKEND
1	Jan. 12 and 13	
2	Jan. 26, 27, 28	Australia Day weekend
3	Feb. 9 and 10	
4	Feb. 23 and 24	
**	March 2 and 3	Mapping weekend
5	March 9, 10, 11	VIC. Labour Day weekend
6	March 16 and 17	
7	March 29 to April 1	Easter
8	April 13 and 14	
9	April 20 to 25	ANZAC period
10	May 4 and 5	
11	May 18, 19, 20	Adelaide Cup weekend
12	June 2 and 3	
13	June 8, 9, 10	Queens Birthday weekend
14	June 22 and 23	
15	July 6 and 7	
16	July 20 and 21	
17	Aug. 3, 4, 5	NSW Bank Holiday
**	Aug. 17 and 18	Mapping Weekend
18	Aug. 30 - Sept. 1	
19	Sept. 14 and 15	
20	Sept. 28 and 29	
21	Oct. 5, 6, 7	SA Labour Day
22	Oct. 20 and 21	
23	Nov. 2 to 5	Melbourne Cup weekend
24	Nov. 16 and 17	
25	Dec. 1 and 2	
26	Dec. 15 and 16	
27	Dec. 21 to 24	Christmas

CDAA PRODUCTS ORDER FORM

Please make payable to:
CDAA, P.O. BOX 290
NORTH ADELAIDE, SA 5006

	QTY / COL/SIZE	ITEM	UNIT PRICE	TOTAL
BOOKS		Cave Diving Communications. A manual from NSS - CDS dealing exclusively with all underwater communications used in cave diving. Including touch, torch and line signals, and use of line arrows and jump reels. A must for all cave divers bookshelves.	\$17.50	
		Cave Diving - A Blueprint for Survival. A book by the world-renowned cave diver, the late <i>Sheek Exley</i> , this is a case study of a number of accidents that have occurred in the USA and how to avoid them.	\$15.00	
		Basic Underwater Cave Surveying. The standard publication for anyone remotely interested in research and survey techniques used in water filled caves.	\$30.00	
		CDAA Occasional Paper No. 2. From National Conference 1981. Includes topics such as Fossil Cave, Belay Techniques and Cocklebirdy 1979.	\$2.00	
		DAN Emergency Handbook. Revised 1995 edition by <i>Lippmann and Bugg</i> . Printed on waterproof paper this essential first aid manual should be part of every cave divers' kit.	\$17.00	
		NSS Cave Diving Manual. The standard reference manual in cave diving covering just about every conceivable topic. New Edition.	\$55.00	
		The Darkness Beckons. By <i>Martyn Farr</i> . The history and development of cave diving.	\$55.00	
		An Introduction to Technical Diving. By <i>Rob Palmer</i> .	\$45.00	
		Deep Into Blue Holes. By <i>Rob Palmer</i> . This is the project manual written about his trips to the Bahamas, diving some of the most advanced and spectacular caves in the world.	\$55.00	
		NSS Cavern Divers' Manual. The standard reference manual in cavern diving covering almost every conceivable topic. Also most principles behind safe sinkhole and cave diving.	\$30.00	
		Caverns Measureless to Man. <i>Sheek Exley</i> .	\$46.00	
		Cave Practice & Equipment. Edited by David Judson British Cave Research Association. Updated 295 Page book fully illustrated with over 200 line drawings & 33 pages of dramatic photographs. Full chapter on cave diving by <i>Martyn Farr</i> .	\$40.00	
		New Edition of Peter Horne's Lower South East Cave Reference. An illustrated catalogue of the Lower South East Region of South Australia.	\$130.00	
		Australian Caving Diving - A Contrast. By <i>Tony Carlisle</i> . Four short documentary type videos on Warbla Cave, Three Sisters Cave, The Road to Toad Hall and Tank Cave. Reviewed in Guidelines 54.	\$25.00	
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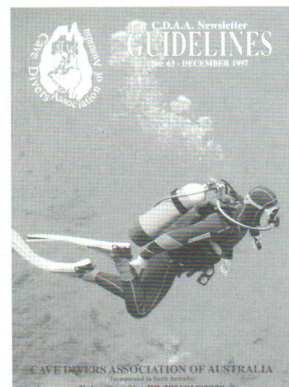
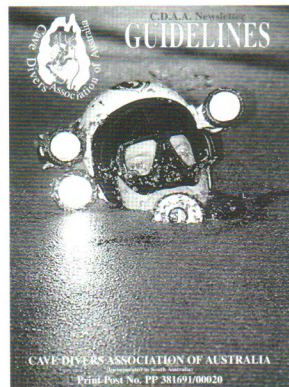
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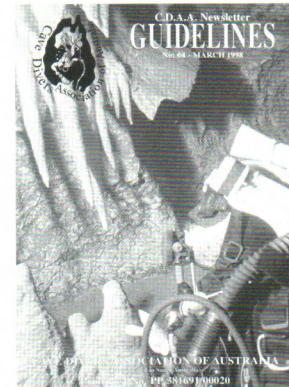
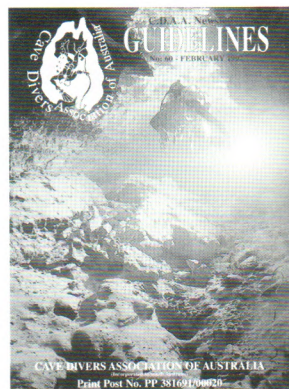
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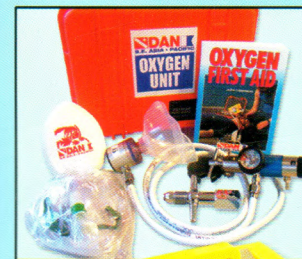
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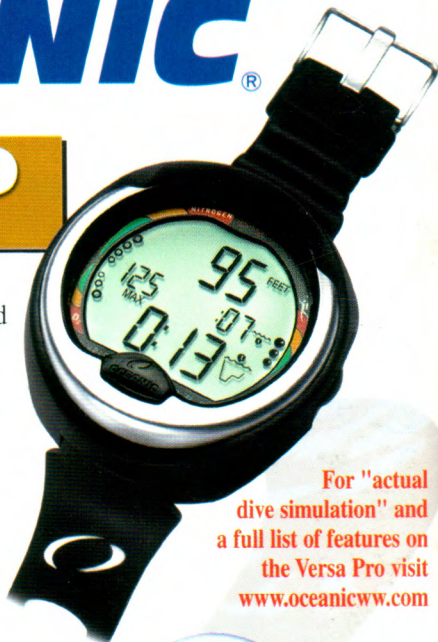
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