

Background information

April 2010

Page 1 / 6

BioSUB

Rewind back to October 4th 2005. In a country town called Albury in Australia on the borders of New South Wales and Victoria one person was going to have the chance to live their dream. Lloyd Godson was invited to attend a “Live Your Dream” competition held by Australian Geographic. Out of 150 other participants Lloyd had one hour to convince Australian Geographic Managing Director Rory Scott and Adventurer and Mountaineer Greg Mortimer that his dream was worth a \$50 000 sponsorship prize.

The idea that was put forward was one that most people would not conceive as a dream and a stretch from what the judging committee defined as adventure. Lloyd explained to the judging committee that his dream was to live under water, while relying on the oxygen that plants give out for his air supply. Admittedly the first reaction that most people have is to question if Lloyd is mentally stable. After having met Lloyd and his partner Carolina Sarasiti it is clear that this project is in the hands of two very capable people.

With Lloyds eight years experience as a professional SCUBA diver he had come to know Draeger through our diving equipment. Lloyd then approached Draeger with the idea and we provided a solution to monitor Lloyd’s atmosphere with the Draeger X-AM 7000.

The project was called BioSUB and the habitat that Lloyd would live in for 1-2 weeks was named Rusty which was successfully lowered into a small lake called The Pit. The habitat was then filled with water and flushed through the valves on the roof. A couple of dives were made to check the atmosphere and take some items down such as plants and posters. Then the Biocoil which was going to help remove the CO₂ was taken down.

The Biocoil was created by a group of students from Cascade High School in the United States. The groups of students were affectionately known as the “Sewerage Sisters”. Originally the group of students was working to provide a solution for the Cascade Reservoir and was suffering due to the process of eutrophication (aging of the lake by excess of nutrients, water becoming more shallow, plant overgrowth). The Cascade High School group was already using the Draeger Multiwarn II to test the effectiveness of their Biocoil. Lloyd contacted the group of students to see if they were able to modify the Biocoil to help provide him with and atmosphere.

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Background information

April 2010

Page 2 / 6

On the 5th of April 2007 Lloyd was ready to begin the project. With partner Caroline on land coordinating divers to help monitor Lloyd it was all systems go.

The Draeger X-AM 7000 was chosen for the project as it has the capability to measure five gases and is able to record the results for 50 hours when set to record the results every minute. With an extensive portfolio of over 25 different sensors which allows the detection of up to 100 different gases and vapours we had a wide range of gases to select from to detect. For this project we decided to detect CO₂, CH₄, O₂, CO and H₂S. The X-AM 7000's rugged and water proof enclosure with an IP 67 rating was sure to handle the job with ease.

As the BioSUB is a confined space we primarily choose gases are required when in confined spaces. CO₂ was also chosen as this is the primary function of the Biocoil to remove the CO₂ from the air, with high concentrations of CO₂ there are dangers of severe headaches, flushed face, palpitations and mental depression. Other high risks that Lloyd may have encountered include an explosion hazard if there is too little oxygen and eye irritation and loss of smell from H₂S. CO may also be a problem in this situation as it affects the blood's ability to transport O₂ around the body and as the affect of CO is accumulative Lloyd needed a solution. For this we provided Lloyd with a Pac 7000 CO which has the ability to detect the carboxyhemoglobin (COHB) content of the blood.

During the project high levels of CO₂ were detected by the Draeger X-AM 7000, the habitat needed to be flushed with fresh air sometimes when the levels became too high. The levels of CO₂ were higher than expected due to Lloyd talking to visitors and media on-site constantly. Slight changes were made to the Biocoil to help enhance its performance. The compressor flushing the habitat was quite loud and normally needed to be run while Lloyd was sleeping. Carolina called Draeger Safety to see if we could provide a solution to the problem. Within moments of the call for help we were there with some Sodalime to help remove the CO₂ when needed. Sodalime is normally used in the Draeger BG4 for mines rescue, Sodalime works by scrubbing the CO₂ from the exhaled air.

The Sodalime was sent down to Lloyd in a waterproof case with a small fan to circulate the air. The Sodalime performed well above expectations due to the high levels of moisture in the air which sped up the process of removing CO₂.

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Background information

April 2010

Page 3 / 6

While on site it was clear just how much support and effort Carolina was putting into the project each day. Organising divers and meals for Lloyd as well as all of his other needs and maintaining the projects website www.biosub.com.au.

While in the BioSUB Lloyd was overwhelmed with the support and media attention that the BioSUB project received.

On the 17th of April Lloyd was ready to emerge from living in the BioSUB for two weeks. Crowds of kids from the local schools, media, friends and family gathered around the site. After a count down on shore Lloyd's father Russell went out in the kayak to knock on Lloyd's BioSUB roof to let him know it was time to come out. Just before the project started Draeger provided Lloyd and Carolina with a hamper to help celebrate the event. The hamper included things like a Draeger towel which Lloyd used when he was welcomed back on dry land and some champagne to celebrate with.

During a very hectic time for Lloyd and Carolina we managed to ask Lloyd a couple of question before he went to live in his underwater habitat for a couple of weeks.

Where did this idea come from?

It really has been a dream of mine to live underwater for a long time. Using plants as my life support was an idea I had to make it more exciting and add an experimental factor to the project. This is also what led me to contact Draeger initially. I needed a reliable way of monitoring my atmosphere while inside the habitat.

What is your background, what qualifications do you hold?

After completing high school, I did my level 2 commercial diver training here in Albury with Descend Underwater Training Centre. I then completed a Bachelor of Science at the University of Queensland with honours in Marine Botany.

What's your inspiration?

My Dad, he has always encouraged me to take risks in life and give things a go. As a kid, he always told me, "If you dream it you can do it" just before I went to bed. I try to remember this as often as possible.

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Background information

April 2010

Page 4 / 6

What would you like to achieve from this?

I would be happy if I inspired a few children to follow their dreams. Who knows, maybe I will unleash some of the countries next great adventurers, scientists and explorers.

What do your friends think of this?

They love it! Although they think I'm crazy, they think the concept is terrific and are keeping a close eye on my progress. A few of my friends are even involved directly by offering their skills where they can. My friend from high school, Jonathan Whilltessa, has done all of the 3D models of the BioSUB that you see on the website.

Where has the BioSUB van been lately?

Mostly back and forth between Albury and the project site which is about 10km down the road. Not far I guess, but lots of trips!

Do you have any concerns about being submerged for 1-2 weeks?

Not at the moment, but maybe my partner Caroline does! I am still too busy thinking about getting it all prepared, but I am sure the day will come when it all hits home.

What are your expected risks in terms of atmosphere?

I am expecting that the algae may or may not remove enough CO₂ and provide enough O₂. There is only one way to find out, and I am glad to have the X-AM 7000 to help me with that.

What safety measure are in place should something happen to your air inside the BioSUB?

I will have a back up of everything, including the ability to vent the habitat and scrub CO₂ if needed. There are two valves in the roof of the habitat where I can plug in two dive compressors to ventilate the air inside if necessary. I will also have SCUBA gear within arms reach at all times and I have an emergency system installed on my manhole for a quick and easy escape if needed.

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What is the expected life span of the Algae in this situation?

Algae has a quick turnover rate in general, but as long as they are well fed with nutrients and light they should keep reproducing.

How long has it taken you to accomplish the project this far?

From conception until now has been about one and a half years! It is about time I went and lived underwater I think!

Background information

April 2010

Page 5 / 6

What's going to happen to the BioSUB once this is complete?

Ideally, I would like to raise it to the surface and have it displayed in a maritime or science museum. That would be buzz to see it somewhere like that

How many people are involved in BioSUB?

It is mainly Carolina and I working on it at the moment but, thanks to the local dive school, we are putting together a list of volunteers to keep an eye on me when I submerge in April. Without them it simply couldn't happen.

How has the community responded to the BioSUB project?

The support has been outstanding! It always amazes me how kind people can be. Local businesses have played a big part in the success of the project so far. The support from larger companies like Draeger has also been a big help. The fact you have been to visit the site in person says a lot about the strength of Draeger's support.

Has this raised community awareness of the environment?

A significant part of the project is education, and I enjoy talking with school children and others about the science involved in the project. Its uniqueness captures their imagination and that leads them to an interest in the environmental sciences. In general, this project will encourage people to think more about sustainability, demonstrate scientific principles related to sustainability, and reveal something about how humans might live in alien environments.

Why did you choose Draeger equipment for this project?

When it comes to my safety I want only the best, and I know Draeger makes the best stuff on the market.

What methods of communication are available while you are in the BioSUB?

I have wireless Internet inside connected to a weatherproof laptop. I am still working on an underwater intercom system between the surface and the habitat. We did look at using the Panorama Nova mask, but I think this is best suited for short term dives and not as a continual communication link.

How much has to BioSUB cost so far?

Once I have the bill for the cranes I will have a better idea!

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Background information

April 2010

Page 6 / 6

What tests have been run on the algae that you are using?

Mainly just algal counts and looking at their general health. In the US, the students who designed the Biocoil for me have been using a Draeger device to monitor CO₂ and O₂ in a model of the BioSUB in their classroom and logging their results on a PC.

How long do you need to ride the bike for each day to power the lights?

I will ride it for a variety of purposes. It will also work as a roller pump to circulate the algae, so I could spend quite some time up there pedalling. I will also have solar power, so I guess it depends on how many nice sunny days we get while I am submersed.

What makes BioSUB unique?

Plants as my life support and probably the fact I am trying to make it self-sustaining. I will also be trialing some new inventions and am one of the few people in the world that have built an underwater habitat to live in themselves.

How Many schools are currently involved and how many countries?

Well, I spoke to over 2500 school kids for Science Week 2006 using online virtual classroom software. I also do regular school visits. I am not sure of the number, but they come from all over Australia and now the world. It is fantastic for us to get this sort of interest.

Will you continue to do more projects like BioSUB?

We sure will! We have the next one planned already and it is equally unique and exciting I think!!!

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