

Divers Alert Network 2007 Internship Final Report

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2007 DAN Intern**

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Introduction

One of the most frequently asked questions you hear when you are a senior in college is, "What are you doing after you graduate?"

When I was a sophomore/junior and asked that question to friends who were graduating in my field, their answer would always be "I don't know yet." I was determined that I would not be that person who didn't know what the near future held.

But I was. Going into the first semester of my senior year, I did not know what was in store for me after graduation. Still, I was applying for jobs and looking into internship possibilities. And because of my strong passion for scuba diving, I was sure that I wanted my internship to involve that sport.

I received an email from the department of my school about upcoming opportunities: This led me to the Our World-Underwater Scholarship Society internship. I decided to apply for a number of the internships, hoping that this would finally be my answer to the perennial question.

I can remember exactly where I was when I got the phone call saying I was chosen to be the intern for Divers Alert Network (DAN) in Durham, North Carolina. I finally had a plan for after graduation, but little did I know what my summer would entail and what this opportunity would provide me with for my future plans.

Training Week

In the beginning all I knew was that I would be analyzing cave diving fatality cases. However, I did not know how exciting it would be to do this kind of work.

The initial week of the internship was slated for training. This week was held at DAN Headquarters with the other interns DAN funded. These interns were going all over the world to collect data for Project Dive Exploration (PDE). This program encourages people to send in their dive profiles to DAN to compile a large database for analysis. At first I was slightly jealous that I was remaining in Durham while my newfound friends were heading off to places like the Cayman Islands, Scotland, California, and other far-flung destinations. Little did I know I was actually getting the benefit by staying in Durham.

To begin with, we were given a tour of Headquarters. Having been a DAN member for 10 years I still did not realize what all DAN was about. Its services range from the Medical Line and the 24-Hour Diving Emergency Hotline, to training, membership, insurance, producing Alert Diver and the many aspects of dive research.

The week was filled with lectures given by doctors in conjunction with Duke University and DAN on various topics. We were given an introductory talk by the CEO/President of DAN, Dan Orr. Other topics of discussion included decompression theory and physiology, public speaking, and the risks of decompression sickness. The other interns were trained on using the software for entering PDE data, with time to get comfortable with that program.

One of the most exciting things was the tour of the hyperbaric chamber at Duke University Medical Center. In just a week at DAN headquarters I learned a great deal of information about a field that I never really knew existed. Part of not knowing what my future would be like after graduation was that I did not know what direction to take. I could tell that this internship was opening doors I never thought of. I was excited to start the internship and learn more about my project.



Left: The entire group of DAN interns posing in the lobby at DAN headquarters in Durham, NC. Right: Interns role-playing for PDE collection as we headed out for an offshore NC wreck dive.

My Project

The project I was assigned to was looking at cave diving fatality cases. In the past when a cave fatality would occur, it would be set aside and not included with the recreational fatality cases. I was informed that there were approximately 500 cave cases dating back to the 1960s. My first task was to read up on cave diving and the risks of it (since I was not a cave diver myself, I had some things to learn) and ultimately form a questionnaire that could be addressed to each fatality.

Sheck Exley, a world-renowned cave diver, published a book called “Basic Cave Diving: A Blueprint for Survival” that explained the basic rules of cave diving. These rules were incorporated into the questionnaire so that the rules most commonly broken could be determined and its relevance to the fatality. [Did you know he died in April of 1994 in a cave diving accident?]

Once the questionnaire was constructed, I began to enter each fatality case into the database. This was an interesting process that became slightly tedious. However, each case was unique and interesting in its own way. Another intern, Peter Buzzacott, was working with me on cave fatalities. Peter's input was slightly different. He was constructing a flow chart that could be a tool to use with cave fatality cases to help in determining the trigger that ultimately caused the fatality.

Each case that I would review Peter would as well so that an inter-agreement could be established to determine how well his tool was working. This was also a way to develop and refine the tool. I spent many weeks entering cases into the database. Every so often a new cause of death would be added to Peter's flow chart, as well as new triggers. After a number of cases were entered, I decided that my project and eventually my paper would be based on the cave diving rules set out by Exley. I wanted to see the differences in the fatalities before and after the publication of his book. I was curious to see the rules that were broken and if they were even relevant to the cause of the fatality.

Current Results

These results are those that have been reviewed as of August 15, 2007. Of the 500 total cave fatality cases, 327 cases have been analyzed. A very interesting find with the numbers the data produced showed the most commonly broken rule was the least relevant to the victim's death: This was the "three lights" rule. In many of the older cases, only two lights were typically taken by the divers.

The next most commonly violated rule was the training axiom that states that you must be cave-certified to enter into an underwater cave system. This rule was typically broken in conjunction with another broken rule. Not only was this the second most commonly broken rule, it was also the most relevant violation related to the cause of death. Open water training explains the importance of all the rules and why they should never be broken; it makes sense, then, that it is a broken rule that is most commonly relevant to any fatality.

The guideline rule was the next rule most often broken. However, it was not as relevant; in only about half of the cases where the line rule was broken was it directly relevant to the fatality. In many instances the violation of the guideline rule went in conjunction with the so-called "rule of thirds," the next commonly broken rule. The violation of the one-thirds rule was relevant to the death of the victim in over half of the cases. In a number of cases, the victims did not have a guideline – another broken rule. However, if they had not also broken the rule of thirds, they might have had enough air to find their way back out of the cave system.

The depth rule in Sheck Exley's time was to not go past 130 feet. In today's time there are a number of safe ways that divers can surpass 130 feet,

but this should not be attempted breathing air only: Gas mixtures of helium, nitrogen and oxygen make it safer to go to much greater depths. To account for this, we checked off the depth rule as broken only if the diver was using air at depths greater than 130 feet. This rule was the least commonly broken, and in only half of the cases where it was broken was it relevant to the death of the diver.

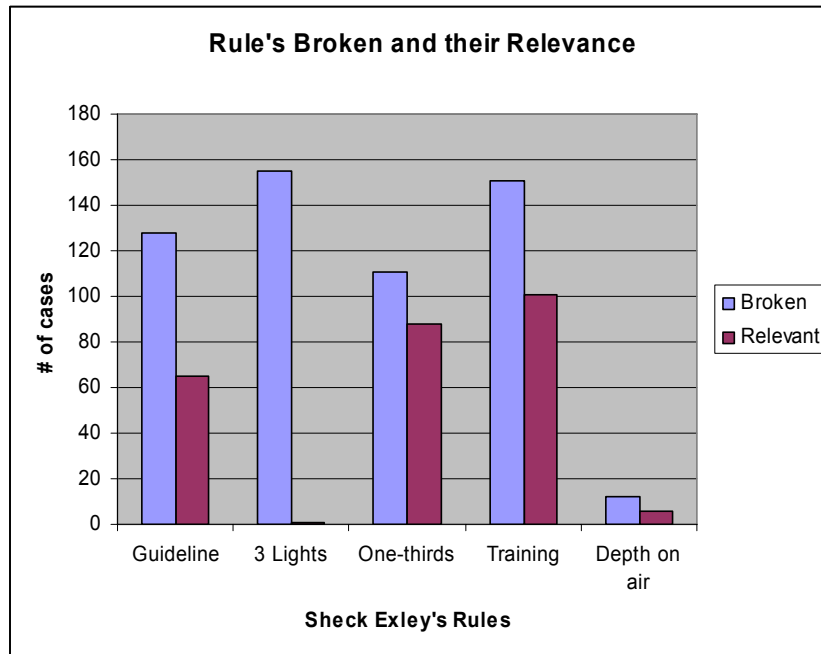


Figure 1. This simple graph shows the broken rules and their relevance to the diver's death.

Data is still being entered into the database and no hard stats have been applied to the current data. The information just provided is just basic numbers computed out of the number of cases finished as of now. This internship is being continued so the project can be finalized.

Hyperbaric Chamber at Duke Hospital

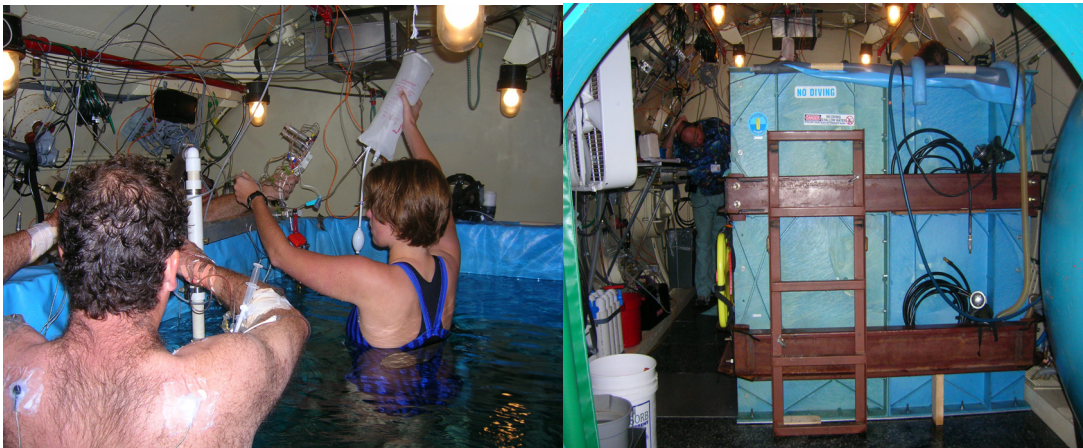
There are a number of studies that are carried out at the chamber at Duke. These include a NASA study, flying after diving, and a carbon dioxide study. Being able to be involved with anything at the chamber was exciting to me, so I volunteered to be a subject for the NASA study.

This was quite an experience: I was able to get my VO₂ max, body fat percentage, and other procedures tabulated. The study itself took the subjects to 30,000 feet of elevation to simulate being in space. There the subject did "work," which included sit-ups, arm pulls, and other exercises that would be comparable to what astronauts could do while in their suits. All of this occurs while breathing 100 percent oxygen.

After this study I was “hooked” and wanted to do more around the chamber. I then was able to start doing the data recording for the NASA and flying after diving studies. With that, I was sitting outside the chamber recording Doppler images and sound that watched and listened for the presence of bubbles.

I also was able to be a tender for the CO₂ study. With that study, the subject received a catheter and an arterial line. The arterial line was to draw blood during the experiment, and the catheter was in place to get pressure readings by inflating a small balloon on the end of the catheter. The subject performed six minutes of exercise on a stationary bicycle at the surface. The subject then performed another six minutes of exercise in a pool with approximately 4 feet of water; this was on a bicycle made for the rider to be prone (horizontal). The water temperature was 70°F. During each six minutes of exercise, the subject had his blood drawn and a pressure reading from inflating the balloon at the end of the catheter. Then the chamber was pressurized and the subject and tenders were taken to a depth of 120 feet, where three rounds of six minutes of exercise were conducted in 85°F water. This was followed by approximately three hours of decompression before surfacing.

I decided to volunteer next for the flying after diving study. This study conducted a dive to 65 feet for 60 minutes followed by a four-hour flight at 8,000 feet of altitude. There was a 12-hour period (known as a surface interval) between the dive and the flight. During the dive the subjects were set up on bicycles. Two subjects were set up in the chamber dry on a bicycle and one subject was inside the pool on an underwater bicycle. We were on the bicycle for 50 minutes at 50 revolutions per minute. After the dive was over we received Doppler readings at 30 minutes after the dive and then again after 60 minutes. During the flight we received Doppler readings every thirty minutes to listen for bubbles during the four hour flight.





Top Left: The tender is getting the subject ready to get on the underwater bicycle for the CO₂ study. Top Right: The pool inside the chamber where the CO₂ study is done and the pool portion of the Flying after Diving study. Bottom: One of the Chamber operators at “command central”.

Diving Experiences

I have been diving for almost 10 years but have yet to experience North Carolina diving. I was excited to get to do offshore wreck diving, having heard how awesome it is. I also got to experience quarry diving.

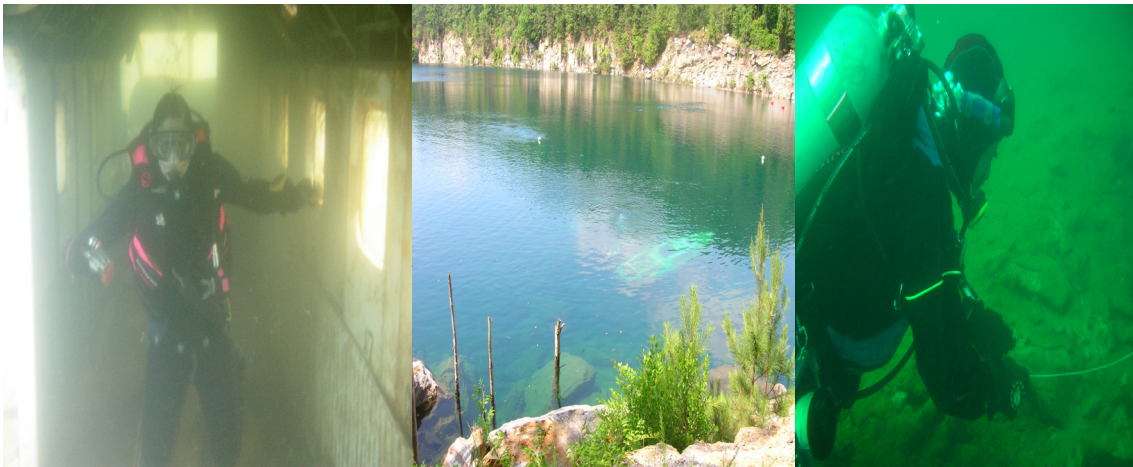
I was very eager to get in as many dives as possible while I was here for my internship. I did not realize the difference of the conditions of quarry diving versus the other dives I had made. My first quarry dive was at Fantasy Lake, and it was a fun experience. I never knew that sunken boats, buses, and planes could be so exciting. My next quarry dive was in Virginia at Lake Rawlings. This was also a fun dive. The trend that I started to see was most quarries are quite cold. I am not very used to cold water, so this was a new experience.

The interns were assigned a trip to Dutch Springs in Bethlehem, Pennsylvania, to conduct PDE research as well as participate in a rebreather social that was put on by Dive Rite. This was quite a fun weekend. I only did one dive; the water was really cold, and it was not very pleasant for me. I spent the rest of my time socializing among the technical divers and rebreather manufacturers that had come out to show off their equipment. I was given a run-through on the upkeep and preparation for using a rebreather. It was a great experience because of the people I met and the amount of knowledge that I gained.



Left: Alex Ruhle and I at the Rebreather Social manning the DAN booth. Middle: The DAN booth promoting Project Dive Exploration at Dutch Springs. Right: All the manufactures at the social and their stations where their units were set up.

I attempted a fourth quarry experience at Blanch Quarry in North Carolina. This site is for members only and has unique fish as well as sunken objects to explore. Diving along the wall is very beautiful. The water, as predicted, was quite cold, approximately 47°F at about 55 feet of depth. After those dives I decided that until I could afford a dry suit quarry diving was not for me: I spent more time trying not to think about how cold I was instead of enjoying the diving.



Left: Myself at Fantasy Lake in a school bus. Middle: An overview of Lake Rawlings. Right: My roommate reeling in a line with his mask off to simulate silt out.

Other Experiences

Before moving to Durham, I applied for a part-time job at a bicycle shop in the area. I thoroughly enjoy biking and wanted to gain experience in that area as well as make some side money. Two weeks after my arrival I was called in for an interview and was given a part-time position. This has been a really great experience and has come to be a huge part of my future.

An issue arrived mid- July about my project at DAN. Due to the large amount of cave fatalities and the time it took to enter them in, my advisors were concerned with making sure I was able to get a paper out of the data before my time here ended. It was suggested that I enter only approximately 150 cases before and after the publication of Sheck Exley's book in order to get the stats I would need to produce a paper.

I mentioned that since I have already graduated that I could stay longer provided that I had funding and housing. My project advisors pointed out that an extension of my internship could possibly be arranged in order to be able to produce a paper including the entire cave diving fatality cases.

While this is going on, at the bicycle shop other things were evolving. Another store was being opened and they needed full-time employees. I was offered a position with benefits and paid vacation, which is very important to a recent graduate who is going to be removed from their parents' insurance at the end of the year.

With all this going on, I was trying to decide what was best for my future and exactly what direction I wanted to go. Being at DAN and getting involved with studies that I never really knew about prior sparked a new interest. I decided that this is a field that I would be happy pursuing. With that in mind I decided to accept the full-time position with the bicycle shop: This would solve my issue with insurance as well as give me time to get residency so that I could go on to graduate school in North Carolina. As far as my time with DAN, I will continue my project working part-time and getting as much experience as I can within the next year.