Dr. Jim Miller interview on Discovery of Sound in the Sea

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Interview Transcript

Q1
How did you first become interested in science?

"The first time I really got interested was watching television, watching Jacques Cousteau on television. Jacques Cousteau, for people who don't know, was an oceanographer who did a lot of public outreach in science and ocean science, and I was just fascinated by the ocean and diving and seeing the reefs and the fish and the whole environment. At the same time we were landing people on the moon. I was twelve years old when Armstrong and Aldren landed on the moon, and seeing that just grabbed my imagination, so I just really got excited about technology. The beauty of the ocean and the fascination of technology are what set up my career."

Q2
What is the focus of your research and why did you choose this field of study?

"The focus of the research that we're talking about is the development of a sonar for obstacle avoidance for ships, but some of those obstacles that ships run over are whales. One of the leading causes of death of the great whales, the large whales, is getting run over by ships. We decided to develop a high frequency sonar to warn ship operators that there is a whale ahead of them so they can go around them."

Q3
What have been some of the recent discoveries in obstacle avoidance and navigation?

"One of the most interesting things is that some of the whales are easier to see underwater than with sound, than other whales. For instance, the muscular whales, like the blue whale and the humpback whale are relatively good reflectors of sound. So you can see them at a greater distance. But other whales, the ones that have a lot more blubber like the right whale, almost have an acoustic coating that keeps the sound from reflecting off of them and they're harder to see. So we detect them at a shorter range and we didn't expect that."

Q4
How do you use acoustics to detect and avoid underwater obstacles?

"Really we use sonar as a technology or as a device to look for whales. And sonar really is Mother nature's invention. Dolphins, bats, for instance, use sonar, which is also called

echolocation. Where the animal emits a sound, the sound travels and comes back, and the animal measures the time it takes to go out and come back, and that's related to the distance that the target is at, whether it be a fish for the dolphin or the whale for obstacle avoidance sonar. And we just tried to copy Mother Nature. And sonar is actually a very old technology. It was really first invented by humans in response to the Titanic hitting the iceberg. There were two patents that came out right after the Titanic hit the iceberg, one in England and one in the United States, and so its sort of wrapped up with ocean technology."

Q5
What challenges have you faced in studying obstacle avoidance?

"The greatest challenge for the technology that we work with is going from the laboratory to the sea. Things that might work in the laboratory, where things are warm, there's lights, and it's not rocking is one thing; but then go into the sea, to go to the ocean and try and make it work where it might be rough, it might be cold, it's salty, the wind's blowing, the seas are-your're sea sick and your're trying to get everything to work there is a huge challenge. And that's the greatest challenge, to go from the laboratory to the ocean."

Q6
What has most surprised you about avoiding obstacles and navigating?

"Just how smart dolphins are. We were on a test where we were testing our sonar and we 'pinged' and it turns out that there were some dolphins near by. So they 'pinged' back at us. And we said, that this wasn't something that we were expecting and so we changed the signal and basically went, 'ping ping' and the dolphins went 'ping ping'! We soon found out that we didn't actually know at the time though what it was, and then the observers on deck said, no there's dolphins here. And that was suprising - how smart they are. The problem that poses though is that we want to develop a system that they can't mimic because we're looking for signals and if a dolphin emits the signal that's one of ours, we're going to think that there's a target there, and we won't know the time, and everything's going to be off. So a recent challenge for us is to design a signal that can't be mimiced. And that's a topic of hot research right now, to try to figure out how we can design a signal that the dolphins can't copy."

Q7
What skills are important in your area of research?

"In my area of research, mathematics, science, including physics, also a passion - you've got to be excited about what you do. You've got to have the technical skills, but the excitement and the passion is what carries you through the hard spots. When you face a challenge and you come back and you hit a wall. What's going to get you over that wall? Well, it's your passion, your excitement and your drive - so that's what is required."

Q8
What are the opportunities in ocean engineering? Can people without PhD's participate in some way in this type of research?

"There are problems that require a whole set of, a team of people with very different skills and backgrounds. And the team could - some of the team members could have Bachelor's Degrees in ocean engineering or mechanical engineering or one of the other engineering disciplines, or marine biology. And there are problems - or parts of the team members who have Masters Degrees or that have PhD's. So, to solve a problem it takes all sorts of different skills and just, you know, if a person wants to stop and get a Bachelors Degree that's great. There's a set of problems that can be solved at that level."

Q9
What is the greatest impact/relevance of your research?

"The greatest potential impact of the research is that we're going to keep some whales from being run over. One of the leading causes of death of the great whales is being run over by vessels and if we can prevent a few of those, I think that would be of great significance. The other thing that's important is that we've designed the sonar to see rocks, and if a ship, oil tanker, installed our sonar, perhaps we could avoid an Exxon/Valdese accident. And that might not only save the whales but it could save a lot of birds and other animals, otters and things like that, that could be impacted. So, the use of this technology has a lot of positive benefits and that's very satisfying."

Q10
What continues to inspire you about your work?

"Just the beauty of the ocean and the going out some days when its nice and calm and warm, its an absolutely beautiful place to be. Its so relaxing and really makes you feel calm. You know, the stresses of the day on land don't even extend to the sea. When you go to sea it's a different world, and that is - I love going to sea. I'll spend a month at sea and just come back refreshed and rejuvinated, and that's pretty exciting."

Q11
What advice would you give a high school student who expressed an interest in pursuing a career in your field?

"To take the most difficult courses they can in their high school. To take everything that their high school has to offer. College courses can be barriers to success and what you have to do is to get up a head of steam and get some momentum to break through those barriers. And taking the hardest courses in your high school, math, physics, chemistry

and all the other courses, science courses-is to just break through those barriers, get some head of steam up and break through those courses."