

HYDRO INTERNATIONAL INTERVIEWS MIKE PURCELL

Lessons Learned From the AF447 Search



It was a rainy day at Woods Hole, Massachusetts, USA. The scenery reminds me of the Twin Peaks atmosphere. I am about to interview Mike Purcell, the man whose search team finally found the wreckage of flight AF447 in the deep ocean in 2011. Only five years after this tragedy a second airliner, the MH370, vanished into the deep ocean. Major search operations have been going on since then. Hydro International found this to be a good reason to look back with Mike and see what lessons have been learned in this deep ocean search operation.

When did WHOI get involved in the AF447 search?

We were asked to participate in the search that started about ten months after the crash by the BEA, the French Bureau of Aeronautical Safety. We worked from the M/V Sea Worker with three identical AUVs. It was a large mission with a lot of people on board. As I said, the terrain was so rough that we really had to learn about it. On the first three missions we ran into vertical cliffs. In the first week we operated just one AUV. Good multibeam data were available of the entire search area, collected by former research vessels. After a steep learning curve we were successful in operating the three vehicles.

The search in 2010 was unsuccessful. So a new operation was started in 2011.

It took almost a year before a new search operation started in phase IV. Especially Air France and Airbus really wanted to know what had happened with that plane. The search operation in phase IV changed entirely - we went on a much smaller vessel, with a smaller team entirely focused on the AUV search operation. Operating AUVs does not require a very sophisticated vessel, which allowed us to keep the costs lower. You don't need DP, you don't need an ROV in the search phase. We were able to use the AUV cameras to identify side-scan sonar targets. We did not have to bring anything back, we only had to locate it. And if we were to find it they would organise a follow-on operation, for which they already had bids available. Deploying our own Launch and Recovery System (LARS) ensured smooth and effective operations

Can you describe the moment that you found it?

We found it on the 9th day! Mission 109. We got those side-scan images and we were quite sure that this was going to be it. An exciting moment! We sent out Mission 113 to take pictures. When the vehicle came up to the surface we had the worst weather. It was the worst storm during the 70 days that we were out there. We had to wait 2 hours to get the AUV on board. Weather conditions could change rapidly in this region. Once we got it on board, it took several hours to download all the pictures. However, we could start looking at the pictures we had downloaded and there was no doubt! We had found it! In all we took 85,000 pictures.

I can imagine that finding the plane resulted in mixed emotions?

From a professional point of view it felt like a great achievement. We had made a big commitment to the search for two years and we were happy that it turned out to be successful. It was also good to see that a technology that we had been working on for a long time made a significant contribution. On the other hand, at the moment of finding the wreckage we suddenly realised what a catastrophe it was. It definitely affects you emotionally. It was not easy to look at the pictures, but I know from talking to relatives of victims that it meant a lot to them that the plane had been found. And in the recovery operation a lot of the remains were recovered. I know this provided closure for some of the relatives and friends of the victims. This is one of the reasons for making a similar effort with the MH370 flight.

What do you consider as critical success factors?

Using the right equipment! The AUV was definitely the right piece of equipment for the AF447 search. In phase III, when the towed system was there, we went back into areas that they had already surveyed but that required another look because of the terrain. Having multiple vehicles definitively allowed us to cover a lot of ground faster. And running the three AUVs at one time resulted in a very effective operation. We managed to cover up to 240km²/day in the more benign areas. I think even operating 4 vehicles at the same time would be possible. You might need a second launcher and a few extra people. If you have 4 vehicles you cover the ground so fast that you might not be able to move the LBL transponders fast enough with one ship. There is certainly an advantage when operating identical AUVs compared to operating different AUVs that might have different navigation systems. Because we developed the AUVs here and experienced just about everything that could go wrong, I think we took a more aggressive approach in using them. But in the end, in my opinion, the most important factor in this tough environment is perseverance. You will not find it until you look in the right place. The more places you look, the more chance you have of finding it. So just start mowing the lawn and keep on doing that as fast as you can.

What lessons did you learn from this operation?

What we discovered is that you are dealing with a lot of uncertain information in such a search operation. You cannot count on the pingers: after a crash it is always unclear if they are going to work. They towed the pinger locators right over the wreck shortly after the crash, and they didn't hear anything. When the black boxes were found, only one pinger was still attached. The other one was never found. So you cannot fully rely on these tools. And you can't rely 100% on the oceanographic modelling. The modelling by the oceanographers should lead to an estimated point of impact. But there just wasn't enough information to develop a good model. There are no extensive measurements of that area. At the time, these data did not provide the answers we needed.

How would you compare towed versus AUV search operations?

It has a lot to do with what the terrain is going to be. If you are working in rough terrain the AUVs perform better. Since the towed systems can put power down the line, they can look at longer ranges. In cases where the search area is very large then you can tow for long distances without having to turn around. Turning a towed system takes a lot of time, while an AUV can turn around in 10 seconds. If you have multiple AUVs you can compete with a towed system's coverage rate. You can be a lot more flexible in your search strategy using AUVs. It is easy to go back to an area that you have missed. Or checking a target by taking pictures can be done easily, without having to pull a towed vehicle out of the water. And your side-scan data will have a higher resolution. On the other hand, many survey companies are more familiar and experienced with using towed systems, making it a more robust choice.

What are the major differences compared with the MH370 search?

We are currently not directly involved. It would be a tough project for us. To take a lead in such a large project. You have to look at 60,000km² in 300 days, that's a huge contract. We were contacted by many parties. There is hardly any knowledge on the position and the search area is much larger - more than 4 times the size of the AF447 area. Even this search area has many uncertainties. A key factor is that no floating debris has been found so far. They are further from shore, which makes the logistics more difficult. The weather there is potentially much worse and could be a real factor. It also affects AUV operations. Fugro won the Australian Government's contract. At this moment [December 2014, ed.], they are primarily doing towed sonar operations using two vessels in the southern part of the search area. The more south, the rougher and deeper it gets. And Phoenix is out there with a third vessel on a Malaysian contract in the northern part of the search area.

Could the black box pingers be improved?

Black box pingers ping at a very high rate, every second. They don't need to ping that often. So they are just using old technology developed for something else. This could change. A lower frequency would extend the range. Using a transponder instead of a pinger would also be an option.

I'm not an aviation guy but there is obviously the possibility of reporting location information once every minute or every second, rather than once every 10 minutes. That would lessen some of the issues. Why the MH370 stopped transmitting the information is a mystery.

Two airliners disappeared into the deep ocean in a period of five years. The search for a black box pinger calls for a really rapid response. Is the world community ready for such a rapid response?

The towed pinger locator operations in the MH370 search did not start until almost a month after the disappearance. Approximately 62% of the battery life of the black box pingers had by then already been consumed. As a result of the AF447 crash, the required battery life will be increased to 90 days as of March 2015 and a low frequency pinger 8.8kHz will be mandatory, increasing the range from 1km to 4km. The US Navy has a contract with Phoenix to be almost on standby for search and recovery operations. They can respond really quickly. But it is costly to have the equipment on standby. A relatively small joint investment by the airlines industry could ensure that they have the right personnel and equipment on standby.

Michael Purcell

Michael (Mike) Purcell (56), the man whose team finally found the wreckage of flight AF447, works at Woods Hole Oceanographic Institute (WHOI) as principal engineer in the Oceanographic Systems Laboratory. He started at WHOI in 1991 as engineer in the Oceanographic Systems Laboratory working with towed systems and Sea Floor Observatory Systems. He has been working on AUVs since 1994. During the AF447 search operation he was Chief of Sea Operations on the research vessel Alucia operating 3 Remus 6,000 AUVs.
Email: mpurcell@whoi.edu

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