

# MARINE TECHNOLOGY

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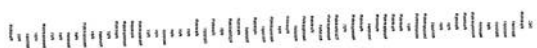


5-minutes with  
**Marty Klein**

The Godfather of  
Side Scan Sonar

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# *The Godfather* of Side Scan Sonar

*Marty Klein discusses with MTR his  
lifetime of development and discovery.*

**By Rhonda Moniz**



**D**oes your work require the use of side scan sonar or sub-bottom profiling? Maybe you are dredging a harbor, looking for a site location for a pipeline, or trying to find an ancient shipwreck? If so then you have Marty Klein to thank for making your job easier. Known as the godfather of side scan sonar, he has been a key player in the development of this technology. A technology that has allowed scientists, engineers, and governments from around the world, explore the oceans depths with precision and ease. This year marks the 50th anniversary of Marty Klein's auspicious beginnings as a graduate student at MIT working with the famed scientist, Dr. Harold E. "Doc" Edgerton of EG&G International, Inc. Marine Technology Reporter's Rhonda Moniz recently sat down with Mr. Klein at his home in Andover, Mass., to talk about his industrious career.

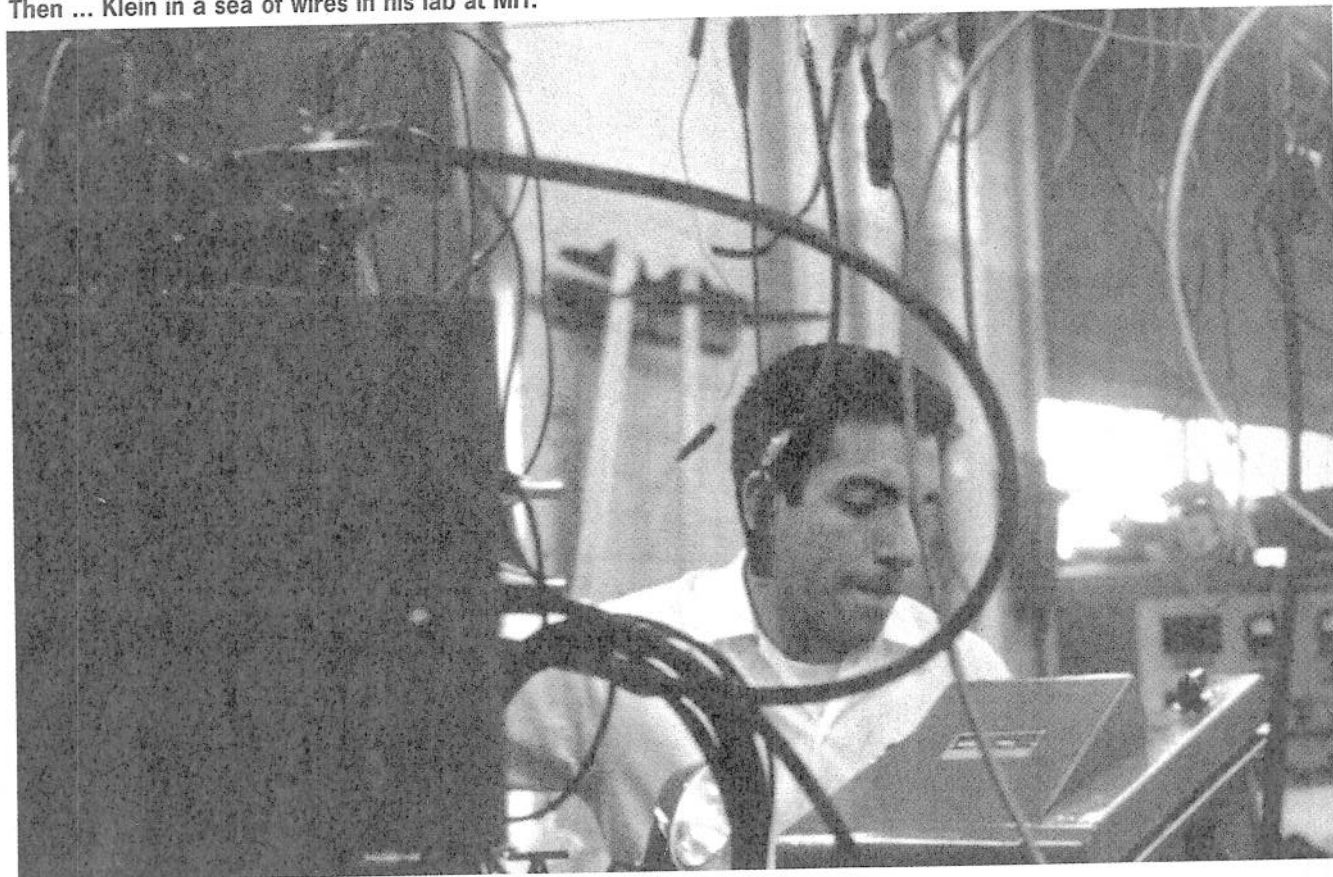
**MTR:** Take us back to the origins, the early stages of your career. How did you get involved in the development of side scan sonar?

**MK:** This is a special year for me so this question is timely. It was literally 50 years ago, I was a student at MIT and I had to do a thesis. It was my first introduction to the field. I was about to do a very theoretical thesis with lots of equations and calculations. Oddly enough it was about image processing. I didn't want to do it. I wanted to build something. I like to build things. I always wanted to build things. I wanted to do something practical, and it turned out by chance I knew of Harold Edgerton at MIT. He was the famous professor that developed the strobe light. I went into his lab on the fourth floor of a building at MIT and I asked him if he had anything interesting to work on. Little did I know it was to be a major day, my life was never the same after that.

**MTR:** How was this a pivotal point for you?

**MK:** Turns out Edgerton's expertise was in cameras and strobe lights. He had been introduced to Jacques Cousteau a few years earlier. National Geographic introduced Cousteau, who wanted to make pictures in the deepest part of the ocean. Edgerton and Cousteau started

Then ... Klein in a sea of wires in his lab at MIT.



a collaboration where Doc Edgerton made special cameras and strobes that could go several miles down in the ocean. They went out on expeditions and took the world's first deep water pictures. It turns out that to locate the camera they used a sonar device. It was a precision timed pinger that would send out pulses that would bounce off the seabed, and also go directly to the surface. They took those sounds and charted them on a special graphic recorder. They could watch the lines on this recorder. The lines would come together as the camera got near the bottom and when it got within 10 or 20 feet, they fired the cameras and took these deep sea pictures.

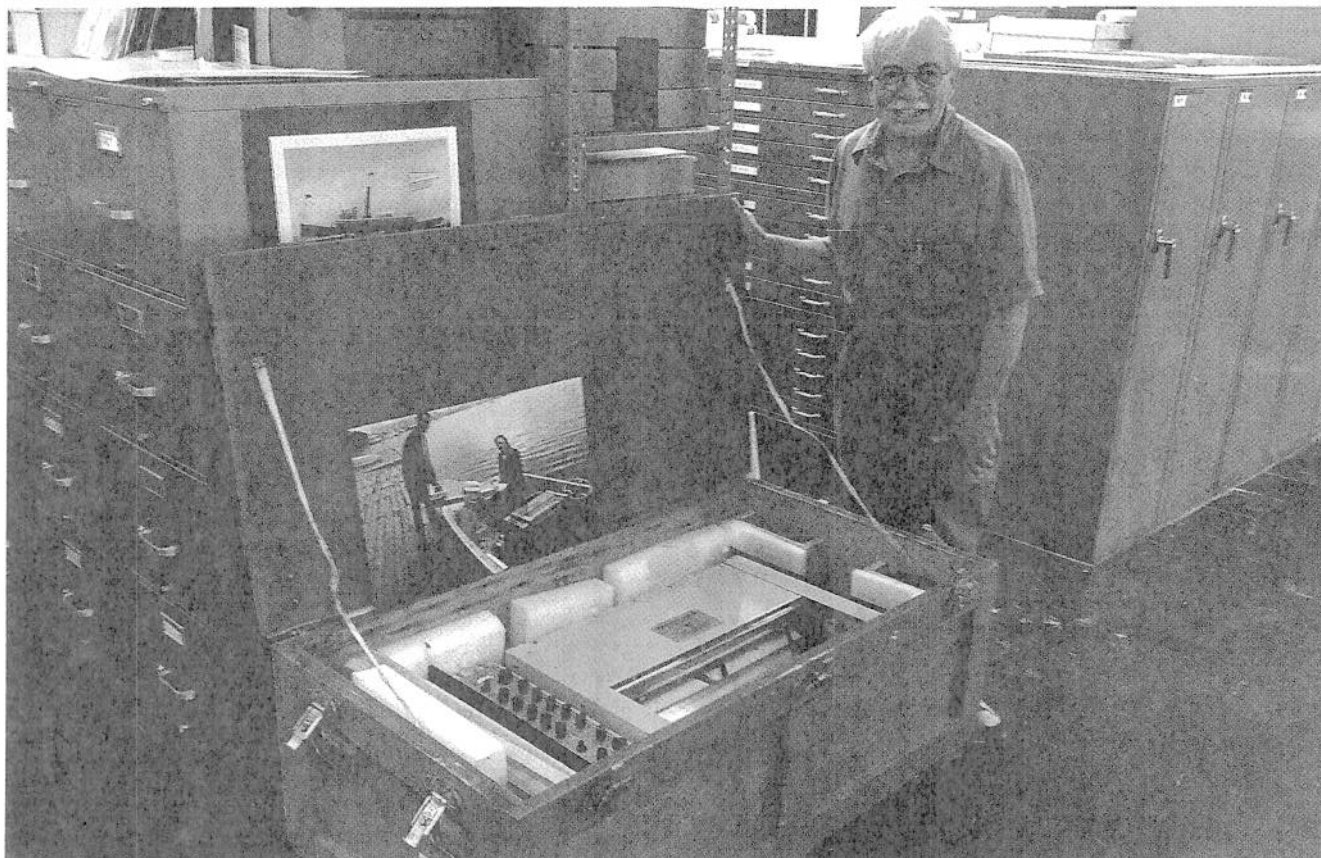
Doc, the scientist, and very curious person noticed that the pinger he was using was penetrating the bottom of the sea floor. He took an interest in the sonar and began working on a device he called a mud penetrator to penetrate the mud bottom. It just turned out by coincidence that I came onto the scene. I had no background in the ocean. I was an electrical engineer, but I knew about transistors. As a kid I had been a hobbyist and was fascinated with these new devices called transistors. I would actually build little radios. I grew up in New York City and I would go down to a place called radio row and I would buy parts. I would build my own little radios and amplifiers and inter-

coms and things like that. I started working on Doc's instruments to tune them for better results. One of the things that Doc did was to give me a key to his lab. Maybe it is common now, but in those days as a young student you did not get a key to a lab. I took that key as my most precious possession. I used to come in to the lab in the middle of the night to work on the instruments and I would fiddle around with the circuits to try to get rid of oscillation. Eventually I got it so that the signals I was getting on the profilers were just perfect. They looked like pencil lines and you could see the sub bottom layers. Doc and I used to go out and look under the tunnels in Boston Harbor including the Sumner and Callahan tunnels. We improved the picture a lot and I was thrust into the world of underwater exploration.

**MTR:** That is a pretty impressive introduction to the world of marine technology. Where did your career take you from those auspicious beginnings?

**MK:** I continued working in Doc Edgerton's lab. The great thing was he was a famous scientist and he knew people. He knew Cousteau; he knew the heads of Polaroid. The lab there had a constant stream of famous people coming in that you could meet and speak to and

**& Now ... Marty Klein stands by original sonar recorder now housed in MIT Museum.**



share ideas with. It was really wonderful, so I worked in Docs lab for a while. Doc had a company called Edgerton, Germeshausen, and Grier, Inc (EG&G). Doc had been part of the Manhattan project and had helped take pictures of the atomic bombs. Those pictures of bombs going off, those are actually pictures that Edgerton took.

His company EG&G then had an ocean technology division to make these cameras and pingers so I went to work there. I started working on these devices, and then the year after I graduated in '62 the submarine Thresher sank off the coast of Boston. It was a tragic event, but it was a watershed event. The Thresher sank in deep water, and I got involved in the first deep-water search ever done. So here was this kid, I have just come out of school, and I start working with the bathyscaphe Trieste. The Trieste had made the dive to a depth of seven miles in 1960 with Don Walsh and Jaques Piccard. The Trieste by this time was owned by the U.S. Navy and was called in to search for the Thresher. I was called in, again as a young engineer, to make a side scan sonar and sub-bottom profiler for the bathyscaphe. I got to not only work on this project, but I got to dive in the bathyscaphe. I got to know the pioneers in deep-sea work and it launched me on a career that although I am now retired, still goes on. I still have a fascination for the ocean and for the people who work in the ocean. So I have been very blessed to be close to this field, to make discoveries and to work with a lot of amazing people.

**MTR: It must have been quite the experience to work on the Thresher Project during the early years of deep-sea exploration. With the technology in its infancy it had to have been challenging.**

**MK:** Its funny, MIT is a tough place. You work very hard and you really don't realize how much they are preparing you for challenges and here I was thrust into this. Its years later that I really realize the challenges, the things we accomplished. We built whole pieces of equipment in a week or two. We were using what was then the latest technology. There were no computers. There were no integrated circuits or analog circuits, resistor capacitors. So it was a mix of ancient technology and what at the time was very modern technology. There were many challenges. One was that the Trieste went deep. Making things work in deep water is tough. I learned a lot from Edgerton himself. I also learned a lot from Sam Raymond who went on to found Benthos. Learning how to work in the deep ocean was a challenge. Doc himself had a pressure vessel at MIT. Sam also had a pressure vessel at Benthos so we

could take things to great pressure and test them. We could squeeze them and make them crush. There were also electronic challenges. We were dealing with very low-level signals and you are in a very noisy environment in a submersible. There is a lot of machinery so trying to get very sensitive low level sonar signals and other signals out of the noise was a tremendous challenge.

There are high levels of humidity in a submersible. Its like your in a cloud its damp so the equipment has to take tremendous punishment. It also has to be small. The equipment had to fit through an 18 inch diameter shell to get in. One of the first things we did was take a piece of plywood and cut an 18-inch hole and everything we made had to go through that hole including us. The people on the Trieste liked me because they were all these giant guys and I was a little guy so I could tuck myself in the corner while I worked on the sub.

**MTR: For those not familiar with the story of the Thresher could you give us a little backdrop?**

**MK:** The Thresher was a nuclear sub on a test dive. Its funny you asked me the question because I have been involved with a lot of shipwrecks. You try to detach yourself emotionally, but I still find it hard to this day. I still get chills. People like to talk about shipwrecks and treasures, but 129 brave people were in that thing. There was some kind of a pipe failure and it began to sink. The hull imploded and it sank in 8400 ft. of water. The Navy was involved in the search. One of the sobering things for me was it wasn't found with my equipment. The sonar's we were making back then could see things but they didn't have clear images. We were turning an echo sounder side ways and the beam was wide and frequency was low. We were getting blobs but we weren't getting pictures. It was after the Thresher search that I became determined to make side scan sonar that could really make pictures of things on the sea floor, so a shipwreck would look like a shipwreck and an airplane would look like an airplane. Something I am very proud of is this little tiny group at EG&G did make equipment that in fact made pictures where ships look like ships and so forth.

**MTR: It sounds like you have also been able to meet and work with interesting groups in the field.**

**MK:** Back in those days Doc Edgerton introduced me to a group in Boston called the Boston Sea Rovers. He was a member and scuba diver. They were, and are an amazing group of people. In order to test our equipment we had to go out in Boston Harbor or the Charles River. We worked



with divers, and Doc Edgerton introduced me to a man named Frank Scalli, who was a pioneer in diving instruction. They were a whole bunch of guys who loved the ocean and loved to dive and it has been an honor for me ever since. I have been connected with the Sea Rovers since that tie and so I would meet other pioneers in the field.

MTR: What were some other projects you became involved in?

MK: Well I was working in a variety of roles. We went on all sorts of expeditions along the way, which was wonderful because I could learn about the real world. One of the things I found as an engineer is that most people don't go out with equipment. They sit in a laboratory somewhere



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Above: Marty Klein returns to Loch Ness for Side Scan Expedition.

Below: Marty Klein (center) poses with fellow explorers during his first expedition to Loch Ness.



*Klein on his invitation last year to work in the field with Dr. Robert Ballard*

"I knew Bob (Ballard) back in the day before he was a famous star. We used to meet at Woods Hole. He was a young geologist ... I had the chance to go out with them last year and I was just in heaven for a number of reasons. The people on board are just amazing.

*Bob has the uncanny ability to find talent and encourage talent.*

So on board we had ROV people, navigators, biologists, educators, geologists, and archeologists. Often in the world of science people don't collaborate.

*Bob puts people together and there is a synergy. He gets people working together."*

or in a classroom and think about equipment. I had to go out all over the world on boats of every size. Everything from rowboats, canoes, and submarines, to giant Navy vessels. We had to go out and make this stuff work in very difficult conditions. It could be freezing cold and icy or it could be in the middle of a tremendous gale. We had to go places where you didn't have access to anything. You couldn't go to the hardware store. You couldn't go to Home Depot and pick up some stuff. You had to bring all kinds of spare parts and try to anticipate what might go wrong.

The other thing I learned was the equipment was abused. Even though you cautioned people things on the ship would get kicked and bounced and stepped on. The cables would get tied in knots. Just to keep things running was a tremendous challenge and a tremendous responsibility too because when you went on these trips you were responsible if anything happened or if anything went wrong. You are the equipment designer even though somebody threw your thing down the stairs or dunked it in the ocean it still is your fault if it didn't work. A lot of my emphasis in my whole career was making it better, stronger, and easier to use. I was in some ways a pioneer in materials, for instance I always wanted to make the cables we used stronger and more flexible. We were one of the first users of Kevlar. Kevlar was a Dupont fiber and when I would meet with cable manufacturers I would tell them I want it stronger, I want it tougher, I want to be able to tie it in knots and its still got to work. A guy was in my office from Boston Insulated Wire, which was the local cable company. He said there is a new material, it is a boron fiber made by Dupont and its called Fiber B. I

said we'll take it. Turns out it was Kevlar and so we were one of the first users of Kevlar. I did a lot of those kinds of things. I was often the first user of a certain kind of electronics, certain component or certain type of material. That was very challenging, but also a lot of fun. So I went off on expeditions, some were with Doc Edgerton who was great to travel with. For example we went and surveyed the English Channel. This was in the early 60's. There had been a plan for a hundred years to put a tunnel between England and France. We had a project to study the sub-bottom geology of the channel. We went between Dover England, and Calais in France. We went on 12 - hour days surveying the bottom of the channel. Years later the tunnel was actually built. My mother used to say, "Martin, you built that tunnel". There were a lot of other expeditions to look for ships, to look at geology or to look for downed aircraft. Some of those surveys were grim, plane crashes etc. We worked on the Mississippi River. The river is still periodically in the news. They are giant concrete mats that hold the river in place. I went down with Doc Edgerton to work with the core of engineers to use side scan sonar to look at the concrete mattresses in the river. We did other things like cable crossing. If a pipeline or cable was going to go across a river or bay we would survey the bottom and see that it was clear of obstacles. We could also see the cable after it was laid, we could see if it was moved or severed.

MTR: You have obviously been involved in many projects with a pretty large range of applications. What are some of the projects that stand out for you?

MK: I worked with the Marine Archaeologist George Bass

in 1967, we found a ship off the coast of Bodrum Turkey, and that was really the first find of an ancient shipwreck using high-tech equipment. Just before that Doc Edgerton used my sonar working with Alex Magee to find the Henry the VIII warship, the Mary Rose.

I was also a member of the hydrographic society. These are individuals who map the ocean floor primarily for navigation. You use this data to clear a harbor for a ship to come in. For a long time a harbor would be checked sometimes by an echo sounder but they would also drag a chain across the harbor between two boats at a certain depth and if the chain didn't hit anything they would declare it clear. When I first got into this kind of work I found this operation to be clunky and clumsy. I thought someday we are going to make equipment so they don't have to do that, and in fact they don't have to do that anymore. The Klein multibeam sonar is now used to substitute the wire drag search. We have also been involved with the military for mine hunting operations and of course when planes go down. Even though I am now retired when I hear on the news a plane has gone down, first it takes me back to when I was involved looking for these things, secondly somewhere around the world, I know one of my cus-

tomers is going to be on their way in the middle of the night to go do a search. A lot of these things have been found and I feel proud that I have had a part in making that happen.

**MTR:** You eventually started your own company.

**MK:** Yes, I was with EG&G for about five years. I was a kid and wanted to make better equipment. I didn't start it for financial reasons. I wanted to improve the equipment. The big company went too slowly for me and I went off on my own. I did some consulting at first. I did some consulting for MIT and Benthos among others, but my goal was to make new equipment and so I was living in Lexington, Mass., in a rented home and literally started the company in my basement, Klein Associates. In 1989 it was sold to a Japanese firm and then sometime later was purchased by L3 Communications. It is now called L3 Klein.

**MTR:** How has your technology fit in for the Offshore Industry?

**MK:** When I started making these things my goal had been to make a sonar to look like pictures so a wreck

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would look like a wreck, a pipeline would look like a pipeline, but when we first made the equipment the world did not know about side scan sonar. They did not know about high res sonar and in fact I personally would go to trade shows to introduce it to people. The first question everyone would ask was what is your range? How many miles can you see? Because people used to think of sonar for submarine hunting and sub sonar can see many miles, I would say, well its got a range of maybe 1000 ft and they would put their head down and walk away. It took a long time. I had to show pictures, here is a shipwreck this is an oilrig.

We were one of the first people who would go to the off shore conference. It was kind of amusing because the show was a huge show and we were a small company and we had no money. We would load up my Pontiac station wagon and we would drive to Houston. It took a long time for people to take us seriously. But they did and I am proud to say, side scan sonar is very commonly used in the oil industry to site oil rigs, to do cultural resource surveys, to look at pipelines and to look at conditions of pipelines. More recently in the BP blow out a lot of side scan was used to survey the area to see what was going on at the bottom. It is a tool used often in the offshore industry, but it was not when I started out.

**MTR:** You were in the field with Dr. Robert Ballard last year. What was that like?

**MK:** Yes, my friends and family kid me because I am supposed to be retired, but I am busy all the time. I was very fortunate last year to be invited on board the E/V Nautilus. I knew Bob back in the day before he was a famous star. We used to meet at Woods Hole. He was a young geologist. We would talk about our dreams and things that would happen in the ocean. He of course went on to find the Titanic, but he has had tremendous success in getting students and a lot of people involved in the ocean. His crew tow side-scan sonar and have Argus and Hercules for ROV operations. I had the chance to go out with them last year and I was just in heaven for a number of reasons. The people on board are just amazing. Bob has the uncanny ability to find talent and encourage talent. So on board we had ROV people, navigators, biologists, educators, geologists, and archeologists. Often in the world of science people don't collaborate. Bob puts people together and there is a synergy. He gets people working together. I loved every minute of it.

**MTR:** What are your plans to retire?

**MK:** I don't have any. Every day brings something new. *Exploration goes on.*

**Klein with side scan sonar in Boston Harbor.**

