

Currents

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50 YEARS • 1963-2013

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MTS

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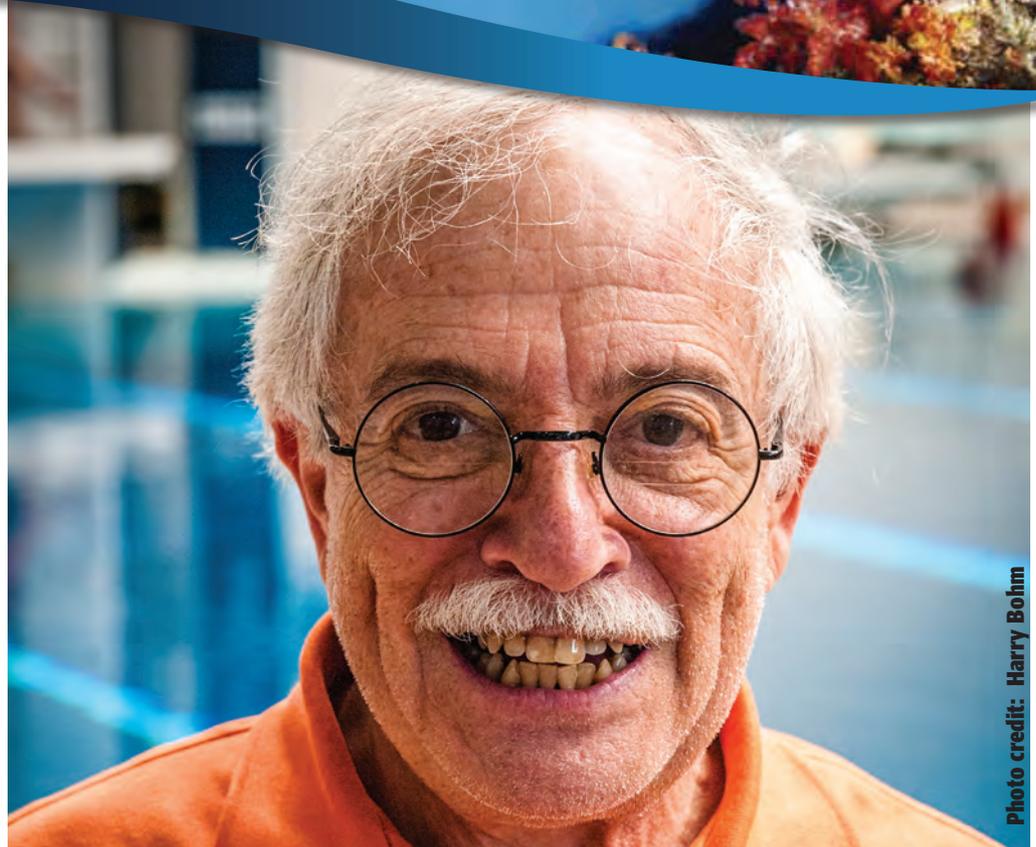


Photo credit: Harry Bohm

Martin 'Marty' Klein: Father of Side Scan Sonar

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(In 2013, as MTS celebrates its first 50 years, Currents will feature a member whose many accomplishments have contributed to the richness of the history of MTS. Here is Marty Klein's story.)

Commercial side scan sonar owes its start to MTS fellow Martin "Marty" Klein, recognized as the father of side scan sonar.

Side scan sonar creates an image of large areas of the sea floor. It uses a sonar device that emits a fan-shaped pulse down to the sea floor across a wide angle, perpendicular to the path of the sensor. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of

the beam. It is versatile, as it may be towed from a surface vessel or a submarine, or mounted on the hull of a ship.

Sound waves are produced by the underwater source traveling close to the sea floor. The sound waves are reflected on targets in the path of the waves and returned back to the source. Once received, the sounds waves are translated into electrical signals

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A Search for a Thesis Topic Leads to Life-Changing Events

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and sent back to the towing vessel, depicted as profiles of the structures below, and offering accurate mapping of the sea floor and/or structures.

Origins

MIT Professor Harold (Doc) Edgerton was experimenting with sonar while assisting Jacques Cousteau and his work photographing the deepest parts of the ocean floor. Precision-timed pingers were used to accurately measure the distance between the camera and the sea floor (necessary for camera focus). Doc noted that the pingers could record sediment layers and he began work on what he called a “mud-penetrator” to trace sediments below Boston Harbor.

Meanwhile, Martin (Marty) Klein was searching for a topic for his electrical engineering senior thesis. He stopped by Doc Edgerton’s lab to see if he had any ideas. Doc suggested Klein work on improving the “mud-penetrator,” including improving the signal processing. According to Klein, “That visit changed my life forever.”

With Klein’s electrical knowledge he was able to resolve the problems of trace noises, significantly improving the signal clarity, and also found a thesis topic. He additionally experimented with Edgerton on using the mud penetrator in a horizontal position — the beginnings of commercial side scan sonar.

Klein graduated from MIT in 1962 and went to work for Edgerton, Germeshausen and Grier (EG&G). The following year, April 10, 1963, the nuclear submarine USS *Thresher* sank off the coast of Boston in 8,400 feet of water. This began the first deep sea search ever conducted. Klein was called on to help design and install an EG&G side scan sonar, vertical sonar and long-baseline acoustic navigation system on the Bathyscaph *Trieste* (which had made the historic seven mile deep dive in 1960). Unsatisfied with the performance of this system, Klein went on to improve the side



Doc Edgerton, Marty Klein and Garry Kozak review a combined side scan sonar/sub bottom recording in Boston Harbor.

scan technology even more with a higher frequency and a narrower sonar beam, which resulted in much clearer imagery. With the new system a shipwreck image would actually look like a shipwreck. By 1966 the first successful side scan sonar was commercially available. It was introduced in one of the earliest MTS conventions.

Klein’s years with EG&G allowed him to demonstrate the abilities of the side scan sonar, including the discovery of a 2,000-year old Roman shipwreck off Turkey. This was the first ancient shipwreck discovered using remote sensing.

Opening Klein Associates, Inc.

In 1967 Klein made the bold decision to leave EG&G and open Klein Associates, Inc. Starting in the basement of his apartment, he faced competition from multi-million dollar companies. While the ability to accurately map the floor of various bodies of water was valuable, the need at that time was fairly small outside of military search/rescue needs.

He began by building a high com-

pany profile through shipwreck discoveries and thereby changed underwater exploration. In the mid-1970s his technology was used to locate both the *Hamilton* and the *Scourge* (War of 1812) vessels in Lake Ontario. His most famous side scan sonar-assist was the discovery of the *Titanic*.

In the 1970s, Klein and his side scan sonar device took several trips to Scotland to participate in a search for evidence of the Loch Ness monster Nessie. Although several images were obtained, no clear-cut evidence was produced to either confirm or deny Nessie’s existence. However his side scan sonar instruments showed the existence of caves in the steep walls of the Loch and evidence of large moving creatures in Loch Ness, in addition to large schools of fish that could support these creatures. He also discovered a World War II Wellington bomber in the Loch. This aircraft was recovered and is on display at the Brooklands Museum.

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Contributing to the Industry and the Next Generation

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Klein's Extensive Experience in a Variety of Surveys

He participated in the sub-bottom seismic profiling survey of the English Channel for the tunnel between France and England (now called the Chunnel). Klein participated in numerous surveys, including oil exploration surveys in Darwin, Australia and in the Gulf of Mexico, cable and pipeline finding surveys on the Hudson River; and other surveys in Canada, Trinidad, Norway, England and the Mediterranean. He also helped with a land survey for the Atomic Energy Commission in the South Pacific.

Klein has taken part in several marine archaeological surveys including a search in Turkey with a team from the University of Pennsylvania in which he helped to pinpoint an important wreck dating from 200 B.C. He also participated in a survey off the coast of Ashdod, Israel to search for an ancient harbor.

He has joined in dives of several research submersibles, including a 5,000-foot dive in the *ALVIN* with a team from the Woods Hole Oceanographic Institution in which he made the first sub-bottom profile from a deep submersible.

Side scan sonar was used to find the remains of the space shuttle *Challenger* as well as many other downed aircraft, including TWA Flight 800, which exploded minutes after takeoff

from JFK International Airport in 1996.

Marty Klein is credited with developing — and continually improving — a key marine technology. When he began, the offshore oil industry was just beginning its venture into deeper waters. ROV technology was in its infancy, and it seemed that manned submersibles would be the next technology “boom.”

Today's Value

Today side scan sonar is valued worldwide. Offshore energy companies, communications companies, accident investigation by governments, search and rescue missions all employ side scan sonar systems. It is also used in marine geology, hydrography, environmental studies, fisheries, dredging, and engineering projects. Underwater vessels, such as AUVs, are routinely equipped with side scan sonars.

Klein has been the recipient of many awards over the years for his pioneering work on side scan sonar. He is an MTS Fellow and a member of the National Academy of Engineering. Klein Associates was awarded the 1992 Compass Industrial Award for outstanding contributions to the advancement of the science and engineering of oceanography and marine technology from MTS, as well as the 2006 Compass Distinguished Achievement Award from MTS

(sponsored by *Sea Technology Magazine*) for outstanding contributions to the advancement of the science and engineering of oceanography and marine technology. In 2011 he received the Arnold O. Beckman Founder Award from the International Society for Automation for the invention and development of the dual channel side scan sonar instrumentation that has opened the world's ocean for exploration, safe navigation and underwater recovery.

The company he founded, now L-3 Klein, enjoys a worldwide reputation of excellence, and is the only commercial-off-the-shelf (COTS) sonar manufacturer that employs multi-beam side scan sonar technology — producing near photo-like images of the sea bottom.

One of the earliest MTS members, Klein remains active with MIT Sea Grant, the MIT Museum and the MTS-sponsored MATE-ROV program. Klein wishes to credit some of the mentors who helped him in his early career including Sam Raymond, founder of Benthos; Ed Curley, founder of EPC Labs; Charles Busmann, founder of Compass Publications and *Sea Technology*; and Bob Carlson, founder of Channel Industries.

MATE Competition

Marty continues his contributions to the industry — and to its ‘Next Generation.’ At the International MATE Competition, Marty has established the Martin Klein MATE Mariner Medal. This honor is presented to the individual or team that demonstrates outstanding passion — not just for winning but the entire competition process. This includes a genuine interest in the mission, and a penchant for a lifetime interest in the field. On the back of the medal is one of Marty's favorite sayings: Always ask how we can do this better.

The 2013 medal winner was Stanley Janicki of Sea Tech 4-H, of Mount Vernon, Washington.

Marty Klein holds an early side scan sonar prototype in Boston Harbor in 1965.

