

REVERSE ENGINEERING: SOUND DATA, SOUND DESIGN

Moeller Design & Development helps develop tagging technology to monitor killer whales.

NOAA Fisheries, an agency dedicated to the management of marine species, has protected marine resources since 1871 when its founding organization, the U.S. Commission of Fish and Fisheries first began marine conservation efforts. Today NOAA Fisheries remains committed to safeguarding endangered and threatened marine species while concentrating their efforts on increasing marine populations and improving ocean habitat. One marine species NOAA Fisheries has monitored over the years is the *Orcinus Orca*, commonly known as the “orca” or “killer whale.” When L60, a female orca born in 1972, washed up along a Washington shore, scientists continued to question the increasingly high mortality rates of this whale family. Since killer whales have a life expectancy similar to humans, the death of this 30-year-old orca not only validated the need for marine management but the eminent need for state-of-the-art research and development technology.

Rapid Product Development Demands Custom Solutions

Because orcas live in waters ranging from tropical to arctic and can be found at depths up to 100 feet in every single ocean around the world, monitoring these giant mammals is not an easy task. While tagging technology for marine applications has been used by research and conservation groups for decades, engineers continue to pursue new, conceptual designs for innovative equipment that will ultimately aid in achieving global research goals and objectives. “When NOAA Fisheries contacted us, it was evident that tagging technology was critical to the success of marine research and the future of marine resources,” said Lloyd Murrey, director of technical services at Moeller Design & Development (Seattle, WA). “In addition to the importance of capturing critical information, was NOAA Fisheries’ need for a custom approach to new product development.”

Founded in 1989, Moeller Design & Development is a leading product development services company in the rapid prototyping industry, serving clients in aerospace, automotive, government, medical, technology, and recreation industries. Moeller specializes in the application of state-of-the-art rapid technologies, such as stereolithography (SLA), reverse-engineering, CNC machining, QuickCast™, cast urethane prototype, and short-run production. Moeller partners with leading product designers and manufacturers such as IDEO, Kenworth, MicroSoft, Motorola, Philips, Siemens, and Toshiba.

One Size Does Not Fit All

Nearly two years after the death of L60, NOAA engineers and the Moeller product development team decided that anatomical data obtained from a killer whale could be used to develop a complex and sophisticated tagging instrument designed specifically for the killer whale species. In previous years, researchers and scientists had discovered that some tags were cumbersome, often causing dorsal fins to bend heavily to the right or left side while other tags would fall off, sinking to the bottom of the ocean shortly after being attached. This clearly indicated that a one-size-fits-all approach was not the key to a successful design—especially in the development of marine mammal tagging technology.

The best way to ensure successful data capture would be in the development of a device specific to the anatomy of killer whale with an attachment designed for the best possible dorsal fin fit.

“Climbing onto the back of a killer whale in an attempt to fit-check an attachment to a dorsal fin is a bit different than attaching a band to the leg of a migratory bird—if not impossible,” Murrey stated. A sound approach was offered when NOAA Fisheries delivered a frozen dorsal fin, which had been preserved for DNA and chemical analysis, to Moeller Design & Development’s product development facility in Seattle, WA.



Preparing a frozen dorsal fin for laser scanning, using target points to align multiple scans.



STL output created from point cloud data captured with a non-contact digitizer.

The Reverse Engineering Solution

Designing a custom attachment requires a multiple-phase approach to product development. The first being a reverse engineering phase, capturing the shape and dimensional data directly from a physical object without design documentation—in this instance, the data from a killer whale. With a non-contact 3D digitizer, the

Moeller team scanned the physical object, correctly aligning surfaces with challenging characteristics to create a precise digital image of a dorsal fin. The highly-accurate 3D measurements were manipulated with CAD software, generating the STL files needed to build a stereolithography part (or pattern). The stereolithography pattern will be used to build RTV silicone tooling from which a life-like dorsal fin will be cast with multiple urethane resins that mimic the properties, look, and feel of whale skin and tissue. The 3-foot-tall, female dorsal fin model will then be used by NOAA Fisheries for hydroanalysis and engineering check-fit for future prototyping and high-value, low-volume production at Moeller Design & Development.

For more information visit www.moellerdesign.com.