Rocket science leads to new whale discovery

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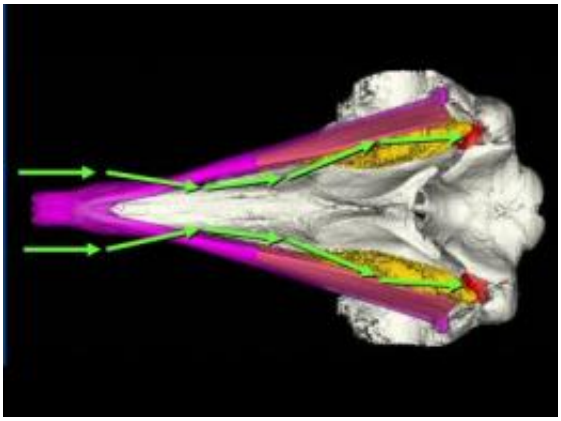

This simulated bottom view of the head of Cuvier's Beaked Whale is pointing to generalized pathways or "rivers" of sound passing in front, underneath the jaws (magenta), through the fat body (yellow), and to the ears (red). The simulated model, developed by Dr. Ted Cranford's team at San Diego State University and the University of California at San Diego, suggests that mid-frequency active sonar sounds are largely filtered before reaching the animal's ears. Credit: Dr. Ted Cranford

Rocket science is opening new doors to understanding how sounds associated with Navy sonar might affect the hearing of a marine mammal - or if they hear it at all.

The same type of large industrial sized X-ray scanners that NASA uses to detect flaws in the space shuttle's behemoth solid fuel rockets is now allowing scientists to peek inside the giant head of a whale. The scans are providing detailed three-dimensional replicas of a whale's hearing

anatomy using a breakthrough method developed by Dr. Ted Cranford, a marine biologist sponsored by the Office of Naval Research (ONR) and the Chief of Naval Operations Environmental Readiness Division (N45).

Using a simulated model of a male beaked whale's head, Cranford's team at San Diego State University and the University of California at San Diego (UCSD) has unveiled data that suggests mid-frequency active sonar sounds are largely filtered, or "muffled," before reaching the animal's ears. The findings also suggest that higher frequencies used by whales to hunt prey are heard at amplified levels without any dampening.

"Even though these findings are promising, our next step is to reproduce the study with a similar species for which hearing tests are available, such as the bottlenose dolphin. If we obtain like results, it will help to validate this new discovery," said Cranford.

The innovative approach integrates advanced computing, outsized X-ray CT scanners, and modern computational methods (developed by Dr. Petr Krysl at UCSD) to generate the reproductions in minute detail. The simulation, also referred to as a "finite element model" or FEM, accurately describes the interactions of sound with the whale's hearing anatomy. In addition, it forecasts and analyzes incoming sound received at the ear and provides a description of how different characteristics combine to create movement throughout the ear.

"The simulation technology is powerful because it provides a means to look at a broad range of species, from whales to fish, for which we may not otherwise be able to study hearing," according to ONR program manager, Dr. Michael Weise. "Virtual experiments can also provide potential for evaluating and directing mitigation efforts."

In October, Cranford earned top honors for a presentation entitled, "Knocking on The Inner Ear in Cuvier's Beaked Whale" at the 18th

Biennial Biology of Marine Mammals Conference in Quebec, Canada. The development is gaining widespread attention throughout the scientific community as a credible and highly useful tool.

Source: Office of Naval Research