

Underwater Acoustics

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History

- The first successful study of underwater acoustics occurred in 1826
- Scientists used a long tube to record how fast the sound of a submerged bell travelled across Lake Geneva
- The first practical usage of the information from the Geneva Lake experiments occurred in 1912, after the sinking of the *Titanic*.

History, Continued

- Reginald Fessenden invented a device that could both produce and detect sounds underwater.
 - He called it the Fessenden Oscillator
- In 1913 he was able to successfully detect a massive iceberg more than two miles away.
- However, it was not until after WWI that these detection mechanisms were mass produced.



How Does Sound Travel Through Water?

- Sound travels 4.3 times faster through water than air.
- Additionally, sound travels best through fresh water, than it does through salt water.



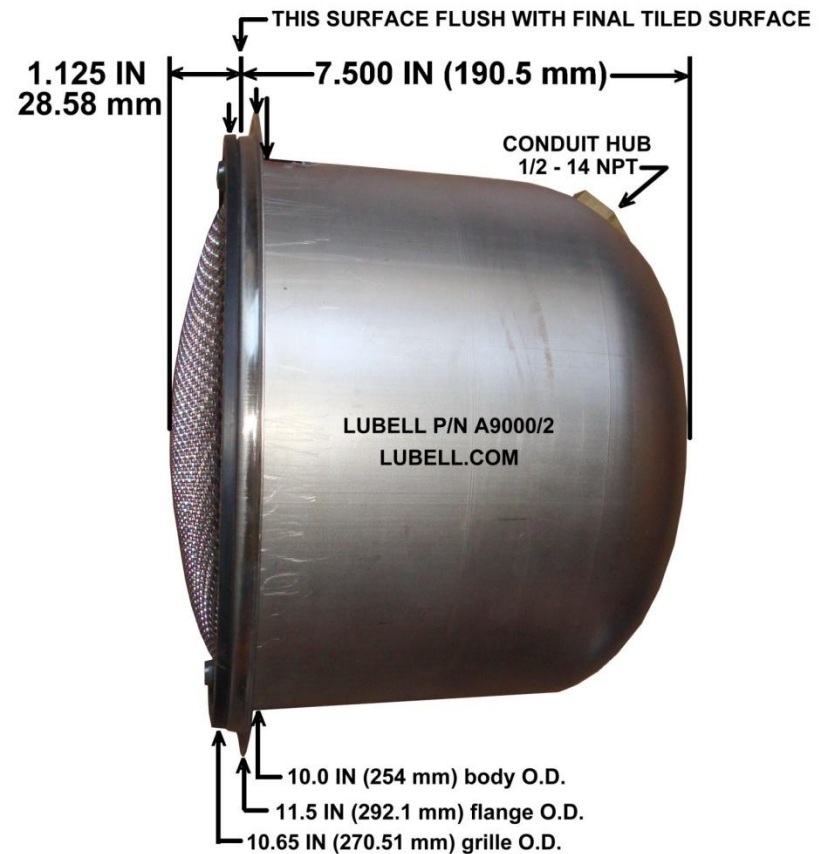
Underwater Speaker Systems

- Typical System
 - - Waterproof/Watertight Plastic Speaker
 - -Connects to Insulated Speaker-Wire
 - -Connected to Above Water Speaker
- Single speakers range from \$300-\$900



Construction

- Start With Jandy Ring (Outside Ring)
 - Speaker is fit onto Jandy Ring
- Take Speaker Wire and Pull Through Hole In Back
 - Leave about 10-12 feet of wire
 - Place wire into light niche
- Place Tab Over Speaker into the Niche



Quality

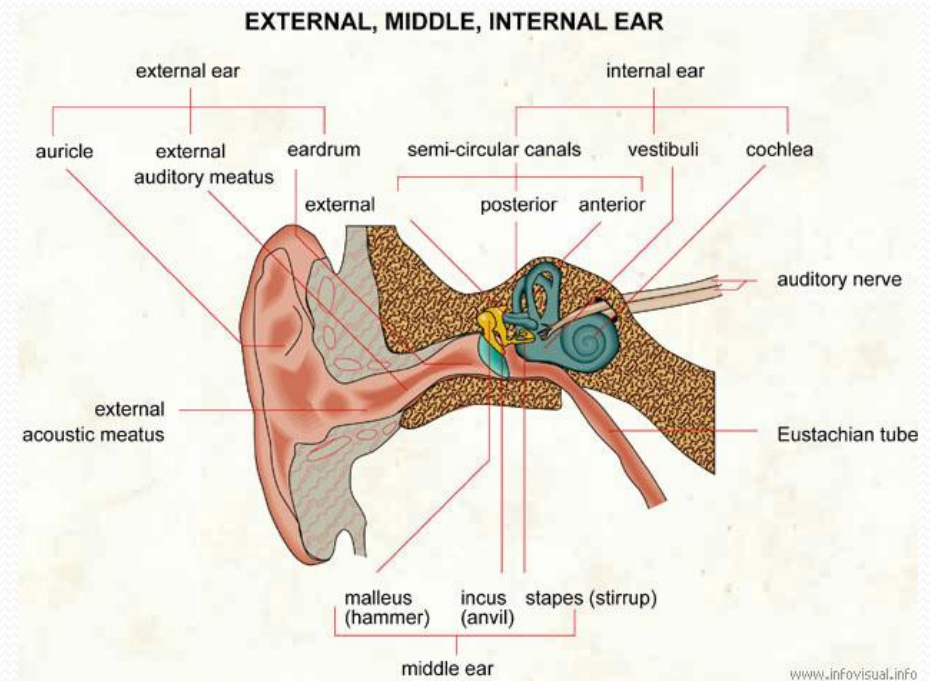
- Sounds more like a wooden instrument (specifically violin or cello)
- The sound excites the whole surface area of speaker rather than specific point
- Sound travels in water hitting both sides and bottom of pool then hitting the swimmer



Effect on the Ear

Ear Plugged by Water

- Bone Conduction
 - Hard for Ear to Find Exact Source
 - Whole Bony Structure Surrounding Cochlea is Excited
 - Occurs Because of Cancelled Air-Conduction



Sources

- <http://electronics.howstuffworks.com/gadgets/audio-music/underwater-sound-systems2.htm>
- <http://www.dosits.org/people/history/>
- <http://clarksynthesis.com/wp/wp-content/uploads/2011/07/AQ339-Jandy-Installation-Sheet.pdf>