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Sound properties  
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Why use sonar for underwater operations and not radar? Unlike sound, light

and radio waves are types of electromagnetic waves. They can propagate

very well in a vacuum, but in mediums with high conductivity like seawater,

these signals experience severe attenuation and scattering. Acoustic waves,

on the other hand, require a medium and cannot exist in a vacuum. This is

because sound is actually a pressure wave that is created through the vibration

of material in a medium. In water, acoustic signals travel as compressional

waves that propagate longitudinally at the local speed of sound, independent of

the speci¯c characteristics of the signal such as frequency and waveform. The

local speed of sound, however, can vary depending on the water temperature,

pressure, and salinity.

A simplified formula for the speed of sound relating these quantities

was proposed in 1969 by CC Leroy [15].

c = 1492.9 + 3\*(T - 10) - 6 \* [10^(-3)]\*(T - 10)^2 -4 \* [10^(-2)]\*(T - 18)^2

+1.2\*(S - 35) – [10^(-2)]\*(T - 18)\*(S - 35) + (Z/61) (2.1)

Here, pressure is expressed as depth Z in meters. This equation yields a speed

accurate to 0.1m/s for a temperature less than 20\*C and in depths less than

8000m. Figure 2.2 displays how the speed of sound changes with temperature

and salinity. The values of salinity shown in the graph range from 29-45 ppt.

In Figure 2.3 depth and temperature are the variables, with depth ranging

from 0-8000 m. missing figure

Submersible vs Immersible Motors

<http://www.pumpsandsystems.com/motors/august-2014-differences-between-submersible-immersible-motors?page=2>

Many submerged motors rely on the effluent to stay cool and run continuously while submerged.

Immersible motors are specifically designed to be operated in a dry environment that might flood under unusual circumstances.

Conclusion

Application conditions should be the deciding factor between immersible and submersible motors. Immersible designs are more cost effective, but the submersible design is a better fit in an application that requires continual submergence.