



Underwater Communications (Synthesis Lectures on Communications)

Marco Lanzagorta

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Underwater vehicles and underwater moorings are increasing in tactical importance. As such, it is critical to have a robust and secure communication system connecting underwater vehicles on a long seaborne mission and a ground station. As a matter of fact, the deployment of efficient communication links with underwater vehicles is one of the greatest technological challenges presently confronted by the world's naval forces.

To circumvent most of the limitations involved in the use of RF or acoustic channels for perfectly secure communications with underwater vehicles, it is worth considering the feasibility of an optical channel to facilitate a two-way satellite communication link secured via perfectly secure ciphers enabled by a quantum key distribution protocol.

This book offers a concise review of underwater communications systems. Our approach is pedagogical, making a strong emphasis on the physics behind the attenuating properties of the oceanic environment and the propagation of electromagnetic signals in the ELF, VLF, and optical bands. We assume the reader is familiar with the basic principles of classical electrodynamics and optics.

The system design, components, and noise analysis of an underwater optical communications device are discussed in detail. Furthermore, we offer simulations of the performance of the communication system for different types of ocean waters. Our final conclusion is that it appears to be feasible to design and build underwater communications using optical classical and quantum channels secured with quantum key distribution protocols.

Table of Contents: Introduction / Electrodynamics of Attenuating Media / Underwater Communication Channels / Underwater Optical Communications: Technology / Underwater Optical Communications: Noise Analysis / Underwater Optical Communications: System Performance / Underwater Quantum Communications / Conclusions

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