

Preface to the English Edition

Knowing the history of a scientific or engineering discipline is instrumental to understand the state of the art, for putting current controversies, difficulties, and achievements into perspective, for avoiding repetition of past mistakes, and for chartering the course for future innovation.

Because of the confrontation of and the fierce competition between the superpowers, development of underwater acoustics, and especially its applications, in Russia and the Soviet Union took place largely isolated from similar work in the West. Many similar capabilities were achieved by the use of different technical means. Description of some of the major Russian and Soviet programs in underwater acoustics were classified or otherwise unavailable until recently. It is likely that making a detailed historical review of Russian and Soviet efforts accessible to the underwater acoustics community at large will unearth promising ideas and approaches, which are not well known in the West and are worth pursuing using modern technologies.

With the goals of providing a scholarly documentation of Soviet and Russian contributions to underwater acoustics and stimulating technical innovation as well as international cooperation in this field, we offer the reader *History of Russian Underwater Acoustics*. This book describes, using first-person accounts, the history of the development in the Soviet Union and, before and after its existence, in Russia of an extremely important technical field and how that history was influenced by the First and Second World Wars and the Cold War, by government bureaucracy, in both positive and negative ways, by the economic collapse of the Soviet Union, and most importantly, by the dedicated efforts of vast numbers of individuals including some of the greatest scientific minds of the twentieth century. We feel it will make fascinating reading to engineers and scientists who were or are engaged in similar work in the West, to historians of the Cold War and of the Soviet Union, to acting and retired officers and enlisted men in the world's navies, and to present day researchers who might benefit from learning about Russian scientific contributions.

This book is an English version of *A History of Russian Hydroacoustics. Articles, Essays, and Reminiscences* published in St. Petersburg, Russia, in 1999. Consisting of a collection of more than 90 articles written by more than 100 authors, the book was published in Russian to commemorate the 300th anniversary in 1998 of the Russian Navy. Preparation and production of the book was overseen by the Public Editorial Board, chaired by Dr. Yury A. Koryakin and composed of representatives of leading Russian research and development establishments involved in underwater acoustics. Publication was sponsored by acoustic hardware manufactures and a number of research institutions. The main driving force behind the book was its compiler, distinguished veteran designer of stationary acoustic systems, Dr. Yakov S. Karlik. The book provides a monographic overview, unparalleled in its coverage of the Russian and Soviet research and development in underwater acoustics, including programs that apparently have not been previously discussed in the open literature. The authors were strategically chosen to represent various research groups, design bureaus, manufactures, naval procurement units, civilian and naval institutions of high learning, and other organizations that contributed over the years to shaping Russian underwater acoustics. As a result, the book provides a rather complete and fair, albeit a somewhat mosaic, picture of development of hydroacoustics in the Soviet Union and in Russia. With numerous short, self-contained articles the authors and the book compiler have managed to convey a wealth of historic and technical material with a tremendous amount of detail in a form easily accessible to the lay reader while being captivating and educating for the experts.

The Russian book emphasized hardware development and their naval applications (see Preface to the Russian edition). This emphasis is reflected in the book's title. The Russian counterpart of the term hydroacoustics designates an engineering discipline, whereas underwater acoustics usually designates a physical science. To broaden the coverage, to provide scientific foundation for the engineering work, and to make the translated book of interest to a wider audience, a new chapter, *The Physics of Underwater Sound*, which comprises three extensive review articles on the science of underwater acoustics, is included

in the English edition. Review articles on the Soviet and Russian contributions to the theory and physical understanding of acoustic wave propagation, underwater sound scattering and acoustic signal fluctuations, and ambient noise in the ocean were written specifically for this book by leading Russian experts in the respective fields, Drs. Valery V. Goncharov, Eduard P. Gulin, Boris F. Kuryanov, and Yury P. Lysanov. Another addition to the English edition is an article by Dr. Nikolay A. Dubrovsky on dolphin acoustics; an important subject not covered in the Russian edition. Dr. Dubrovsky's article was translated from a manuscript originally written for a compilation dedicated to the 50th anniversary of the N. N. Andreyev Acoustical Institute in Moscow. On the other hand, about 10% of the material in *A History of Russian Hydroacoustics. Articles, Essays, and Reminiscences*, of mostly a personal and biographical nature, was deemed of lesser general interest and is not included in the English edition.

The idea for publication in English of a historical overview of Russian and Soviet research and development in underwater acoustics originated with a conversation one of us (OAG) had with Dr. Jeffrey Simmen, then of the US Office of Naval Research (ONR), on the sidelines of the Ninth L. M. Brekhovskikh Conference on Ocean Acoustics in Moscow, Russia, in May 2002. Dr. Simmen expressed a desire to complement an ONR-sponsored series of monographs summarizing US research in underwater acoustics with an authoritative account of the work done on the other side of the great Cold War divide. Since the end of the Cold War also marked the end of an era in underwater acoustics, it seemed desirable to produce a timely historical summary of the travails and accomplishments of the era while those who made the history were still available to give first-hand accounts.

Preparation of this book would not have been possible without the encouragement and support of Drs. Simmen and Ellen Livingston, who succeeded him as the manager of ONR's Ocean Acoustics Program. We are indebted to Drs. Igor N. Didenkulov and Yakov S. Karlik for their advice and help in preparation of the Russian text for translation. Josephine C. Novosel, Rita Lombardi, and Igor N. Didenkulov were instrumental in administering the translation project. We are grateful to Vladimir N. Mironov, Vasily V. Shushunov, Anna Khachatryan, and

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Preface to the Russian Version: A Word to the Reader

The beginnings of hydroacoustics in our country date to the 19th century. Its development was stimulated by the need for new methods and systems for underwater observations and for means to ensure the safe navigation of combat and transport ships, especially under adverse weather conditions. Also, reliable communication needed to be established between underwater platforms and surface vessels for implementing the idea of “secret ships.”

The first practical steps toward employing hydroacoustic equipment for safe navigation at night and in dense fog were made by Russian hydrographers. Submarine bells and hooters were installed in lighthouses on the Baltic and the White Sea and methods for their use were developed. The coming of radio to the Russian fleet brought about radio-acoustic methods of position finding. The creation of a means for underwater audio communication began simultaneously with the construction of the first submarines and a new generation of Russian cruisers.

In less than a century the fleet went from the use of single hydroacoustic instruments to the large-scale application of quantity-produced sonars and sonar systems. These systems helped maintain the strategic parity between the nuclear superpowers in the world’s oceans as well as solve complex economy and ecology problems relating to the marine environment.

A huge number of this country’s specialists in different professions were involved in this dramatic effort. It is impossible to count all those who contributed to the development of hydroacoustics. Many people dedicated all or the greater part of their lives to hydroacoustics and their work resulted in publications, state awards, and general recognition.

However, a considerable fraction of an army of scientists, designers, engineers, technicians, specialists in information science and information support, and administrators remain unknown to the public. Their efforts resulted in the present-day equipment that daily contributes to our country’s defense capability. They developed and expanded the

various aspects of theoretical and applied hydroacoustics, trained personnel, investigated the seas and oceans on research vessels and warships, drifting ice-floes, and deep-sea research vehicles. They tested various types of systems, carried out the repairs and modernization of equipment, compiled sets of standards and glossaries on all aspects of hydroacoustics, including those relating to the development and use of methods of sonar and sonar system operation.

Therefore, we dedicate this collection, in fairness, to this huge army of workers whose names are missing from the publications on hydroacoustics. At the same time, the names of many eminent people appear in this book in connection with their specific contributions to the development of hydroacoustics in this country.

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