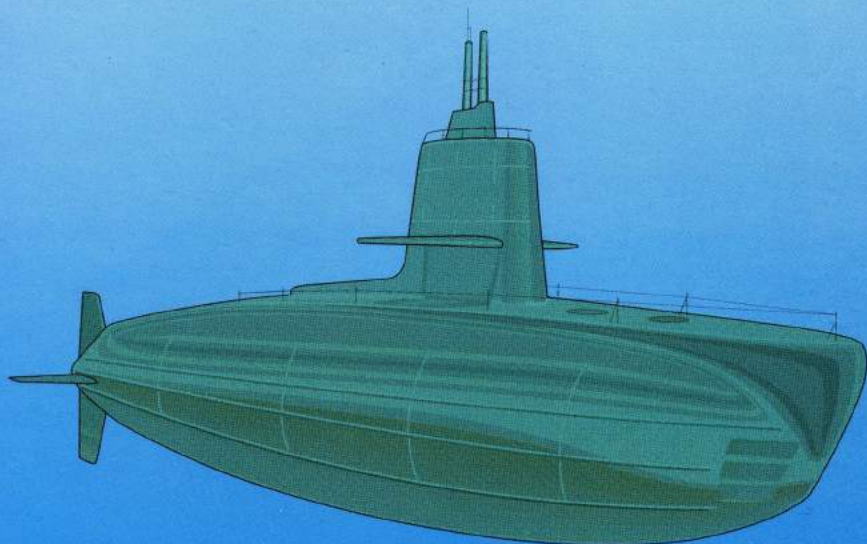




ENVIRONMENT IN SUBMARINES



MVR Koteswara Rao

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MVR Koteswara Rao

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PREFACE

The technical monograph *Environment in Submarines* is first of the kind in the field of environmental science relating to closed spaces. The need of such a document covering all facets of the enclosed environment has been felt since long. Not enough literature exists on this subject, mainly because an enclosed environment cannot be perceived in day-to-day events, and also not many investigators have access to this. Environment in the submarine is thus a fully air-tight one, wherein no external air finds its way inside and the internal air requiring constant revitalisation. In this monograph, effort has been made to picturise the actual conditions prevailing in the submarine and also to describe a variety of problems faced by the habitants. The monograph depicts the successful trials to solve these problems to ensure a safer environment. A vivid description was given about the R&D work in monitoring, control and management of the environment. The author himself was engaged in these activities over the last two decades and has drafted realistic information in this monograph.

The monograph has been divided into ten chapters and contains six appendices apart from subject index.

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MVR Koteswara Rao

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CHAPTER 1

SUBMARINE DEVELOPMENT

The submarine is a sea-going vessel designed to navigate underwater in dived condition as well as on sea surface. Efforts to design and develop this class of *seafaring* vessels date back to early 1776. The earliest submarine, *Turtle* was designed by David Bushnell in 1776 at Yale University, USA. Later, *Nautilus*, another new design submarine was built by Robert Fulton in the US. The next discovery was the submarine *Hunley*, which really operated underwater and sank the Union ship *Houstanic* by ramming the surface ship with a charge of gun powder in 1864. The submarine *Holland* was built for the US Navy by John P. Holland in 1900. The next design, an unproven submarine model by name *Skipjack*, came into existence in 1911 with a diesel engine. Subsequently, based on designs made in the US and Germany, a series of submarines and U-boats were produced, which were employed in World Wars I and II respectively. The chronological development of submarines and their unique underwater performance starting from 1776 to 1963 is shown in Table 1.1¹.

Table 1.1. Chronological development of submarines and their unique performance

<i>Year</i>	<i>Submarine</i>	<i>Unique performance</i>	<i>Designer</i>
1776	Turtle	First war submarine	David Bushnell
1800-1	Nautilus	Forerunner of today's submarine	Robert Fulton
1864	Hunley	Sank the warship <i>Houstanic</i>	James R. McClinton & Baxter Watson

Contd

<i>Year</i>	<i>Submarine</i>	<i>Unique performance</i>	<i>Designer</i>
1897	Argonaut	Odd-shaped	Simon Lake
1900	Holland	First accepted submarine	John P. Holland
1911	Skipjack	First use of diesel engine	–
1914-17	U-Boats (Germany)	World War I naval submarines	–
1914	Skipjack	First American submarine to cross the Atlantic	–
1936	Fleet submarine	Launched by USA	–
1944	U-Boats (Germany)	Snorkel attachment for greater underwater diving	–
1945	Japanese I fleet	Sunk warship US Indianapolis	–
1954	Nautilus	First nuclear powered submarine	Due to the efforts of Admiral Hymen & G. Rickover
1958	Nautilus	Crosses the North Pole underwater	–
1959	Triton	World's largest submarine	–
1959	George Washington	First Polaris carrying submarine commissioned	–
1961	E. Allen S. Houston, etc.	Nuclear warship	–
1963	Lafayette class	Nuclear warship	–
1967	Toti	Italian, single hull type	–
1967	Sjoormen	Swedish, single hull type	–
1969	Class 206	German, single hull type	–
1975	Agosta	French, double hull type	–

Source: Gilmore, H.H., 1962.

About the Book

The monograph on Environment in Submarines is the first of its kind in the field of environmental sciences relating to closed spaces. Not enough literature exists on this subject mainly because an enclosed environment cannot be perceived in day-to-day events and also many investigators have no access to such an environment. Thus, there is a need of such a document covering all facets of the enclosed environment.

The author has picturised the actual conditions prevailing inside the submarine and also dealt with a variety of problems faced by its habitants, and has offered solutions to ensure a safer environment. This monograph serves as a source book for scientists, naval personnel and marine engineers.

About the Author

Dr MVR Koteswara Rao did his post graduation from Andhra University and Doctorate in Chemistry from Indian Institute of Science, Bangalore. He served the Defence R&D Organisation as a Scientist for 32 years and executed a number of projects related to the environment in submarines. He was also trained in West Germany, in 1984. He also participated in an international symposium in this field organised by the US Environment Protection Agency in 1986. He has published several papers in the field.

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