DEFENCE RESEARCH & DEVELOPMENT ORGANISATION

(1958-1982)

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PREFACE

The monograph is about the Defence Research and Development Organisation (DRDO) of the Ministry of Defence, Government of India. It has been long in the coming. It was in 1994 that Dr APJ Abdul Kalam who was the Scientific Adviser to *Raksha Mantri* mooted the idea of writing the History of DRDO to three of us, Mr NS Venkatesan, Dr Ramadas P Shenoy and Dr A Nagaratnam. All of us had retired from DRDO after long service in the Organisation. Mr Venkatesan and Dr Nagaratnam had been with the Organisation from the Defence Science Organisation days while I had joined the DRDO soon after it was formed. We had worked with six Scientific Advisers beginning from Dr DS Kothari and ending with Dr VS Arunachalam. We had seen and experienced the changes that took place, the progress that was made, the problems that were faced and the achievements that were reached. Each of us agreed to write about the activities in specific science and technology areas in which we had either worked or had more than a passing knowledge.

To write about such a vast organisation, assistance was provided by the DESIDOC. Dr SS Murthy who was Director of DESIDOC at that time took upon the responsibility of collecting historic data from archives and from their own records. In addition, he organized several face-to-face meetings with top bureaucrats, eminent scientists and high ranking military officers who had retired but who had either served the Organisation earlier or who had close interaction with DRDO when they were in service. The DRDO Laboratories and the respective Directors, the Directors at DRDO Head Quarters and their personnel in most cases cooperated by providing detailed account of activities and helped in filling up the information gaps. Many senior personnel within the organization were also of help in providing their own perspectives on some of the major events that took place in this period. Thanks are due to all these eminent and senior personalities who took time to provide information and insight.

As things turned out, both Mr NS Venkatesan and Dr A Nagaratnam sent me their manuscripts but I found it difficult to draw a cogent picture of the progress across technologies or disciplines during the tenure of each Scientific Adviser. I started all over again, visiting major laboratories,

requesting heads of these laboratories to furnish dates and further details and slowly collected information and assembled data. I began the process of correlation with available records and specific narrations of events by the personalities to whom we had talked earlier. It was a long and arduous road relating the flow of events during the stewardship of each Scientific Adviser in the first twenty five years of the DRDO.

The book describes the events up to 1982 in four chapters: The first deals with the scenario that existed before independence under British rule and circumstances which introduced rudimentary military science for replacing stores locally. The post independence scenario deals with reports of OH Wansborough Jones and PMS Blackett on likely requirements of Indian Defence and identification of probable areas of research. The appointment of Dr DS Kothari who was Professor of Physics at the University of Delhi, as the Scientific Adviser and the setting up of the Defence Science Organisation are then brought out. The areas of research activities included operations research, physiology, applied psychology, electronics, food and nutrition, applied chemistry. The Chapter ends up with the contributions made by the organization to defence in its advisory role.

The second Chapter gives a picture of the process of transforming the Defence Science Organisation to Defence Research and Development Organisation for undertaking research and development in hardware, software and processes to meet the needs of the Services. The Chapter goes into detail the stewardship of Dr S Bhagavantam who, as Scientific Adviser over a period of about eights years built a cohesive organization while at the same time expanding the scope of its activities to cover all essential science and technology areas of application to the Services. The guidance and direction provided by him and the difficulties faced in operating within the government framework are also brought out. The Chapter ends up with the efforts and contribution of DRDO to meet the short term needs of the Services.

The third Chapter provides an insight to changes that took place in the next twelve years with three eminent physicists of the country assuming charge as Scientific Advisers for a period of about four years each. The contributions of Dr B D Nagchaudhuri, Professor MGK Menon and Dr Raja Ramanna to the growth and to the betterment of DRDO are presented in this Chapter.

The fourth Chapter highlights the growth of the major laboratories in the Organisation during the twenty five years of the existence of the DRDO. The charter, initial state and status of the major laboratories, the

difficulties faced during the learning period, the building up of the infrastructure, the challenges to be overcome in stepping up of the tasks from short term response to new system development and the achievements up to 1982 are presented in a consolidated manner. A short Epilogue has been added to bring out the contributions made by the DRDO in the areas of missile, aircraft, tank and electronics systems to the nation since 1982 under the helmanship of Dr VS Arunachalam, Dr APJ Abdul Kalam and Dr V K Aatre.

Before I conclude, it would be remiss in my part if I do not acknowledge the contributions of personalities who provided encouragement, assistance and made my task easier. First and foremost is Dr APJ Abdul Kalam who had the vision that the efforts of the early pioneers of DRDO needs to be recorded for posterity and then requested three of us to undertake the onerous task. I owe a debt of gratitude to Mr N S Venkatesan who alas is no more, and to Dr A Nagaratnam for the manuscripts they had provided and started me on this journey. Dr VK Aatre who had assumed charge as Scientific Adviser in 1999, took active interest in this project and but for his urging and constant encouragement, I would not have completed the first twenty-five years of the history of progress of the Organisation. I would like to thank him for it. I also record my appreciation of Shri VP Sandlas, former CC R&D (S) who as a Chairman of DRDO Monographs Committee, monitored this activity. Dr SS Murthy who was Director, DESIDOC in 1994 provided valuable assistance to get the project going and thanks are due to him from all the three of us. Dr Mohinder Singh, Director, DESIDOC is another person I would like to extend my thanks, because he would frequently telephone me from Delhi and visit me in Bangalore, and quite often, acceded to my request for more information about specific events of the past. In the final stretch of my effort to complete the writing and assemble it in a book form, I received considerable help from LRDE, Bangalore. I would like to thank Mr KU Limaye, Director, LRDE for the helping hand he and his people extended.

Bangalore
16th June 2004

Ramadas P Shenoy

THE BEGINNINGS – DEFENCE SCIENCE

CHAPTER 1

THE BEGINNINGS – DEFENCE SCIENCE

1.1 INTRODUCTION

Historically, nations had fought their wars with weapons developed before the outbreak of the conflict and produced these in large numbers with the onset of hostilities. Because of a lack of organised approach, the time normally taken to realise a weapon from concept through stages of research, development, testing, production in large numbers, training of the soldiers to use the weapon, and formulation of the tactics by the commanders, was far too long. No radical innovation, leading to the development and production of weapon systems, was therefore attempted during earlier wars and scientists and technologists were never taken into the military other than as combatants. The first break from this tradition came about in the World War I by the introduction of poison gas by the Germans and the tank by the Britishers. These were developed after the hostilities had commenced and were aimed at breaking the stalemate of the trench warfare. However, it was during the World War II that the break from the earlier tradition was final by the formation of essentially a civilian organisation which innovated for the military during the war period and provided the Allied Forces led by the USA, new weapon systems such as, the microwave radar, proximity fuse, and atomic bomb, to name a few, which tilted the balance against the Axis Forces led by the Nazis. In the immediate aftermath of the war, geopolitical considerations led to the Cold War which polarized the developed world into two main blocks holding distinct ideologies, with the USA being the leader of the Western Block and the USSR the leader of the other. The advice of Dr Vannevar Bush, that, "It is essential that the civilian scientists continue in peacetime some portion of these contributions to national security which

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[1]James Finney, Baxter 3rd. Scientists against time. The MIT Press, Cambridge, Mass., USA, 1946. pp. 1-117.

they have made so effectively during war", was accepted and the close association of the scientists with the military continued in the USA[2,3]. In the decades after the cessation of the war, the US Department of Defense became instrumental in the development of electronics, aerospace engineering and other technologies, and sciences related to military operations. Integrated circuits, real-time applications of computers, software, supersonic aircraft and space technology, came into being and were progressed at a rapid pace that normally would not have been possible in the commercial competitive environment of that time.

1.2 S & T ACTIVITIES RELATED TO DEFENCE BEFORE INDEPENDENCE

1.2.1 Conditions Before World War II

The major military and economic power on the side of the Allies in the beginning of the World War II was Britain, which had an empire including India, to defend against the Germans and the Japanese. Even though in the period between the two wars, the admirals and the generals in Whitehall had shown little interest in science and technology, the threat of a major war, under which the country had lived for some years, had turned the thoughts of many of its talented scientists – even as early as 1934 – to problems of national defence before the hostilities had begun. The success of a scientific solution to the menace of the German magnetic mines to the Allied shipping was instrumental in bringing science and scientists of Britain fully into the war from its very early days. As the war waged, the British scientists from the universities were asked to participate in the problems concerning military requirements.

On the other hand, the policy followed by the British in India towards scientific and technical education, scientific and industrial research and development was in keeping with their role as colonial rulers. Even though India had a long and rich history of distinct indigenous techno-scientific traditions, the colonial policy did not encourage generation of technical knowledge or ensure its integration into the knowledge base existing in the country. Colonial, commercial and Government imperatives set the parameters for the transfer and absorption of new technologies by the local population. For example, the colonial

[2] Head, Office of Scientific Research Development, USA, during World War II, which was largely a civilian science organisation.

[3] Science, Technology and the Military by Wm, A Smit, *In* Handbook of Science and Technology Studies. Edited by S Jasanoff *et al*. Sage Publications, Delhi. 1995, p. 598.

Government had set up, by the turn of the last century, a dozen scientific institutions such as the Geological Survey of India but the work done by these organisations were specifically aimed to serve the commercial interests of the British. During World War I, when the lack of industrial development in the country and the uncertainty of imports affected the supply of manufactured goods, the colonial Government responded by setting up an Indian Industrial Commission (IIC). The IIC in its report suggested that manufacturing activities would have to be preceded by adequate scientific and technical services which were deficient in the country. In spite of limitations imposed by the colonial rule, local efforts and achievements in education had resulted in the country having a scientific and technical workforce by the time World War I had been declared in Europe. In the beginning of the 1930's, even after repeated demands by the provincial Governments, scientists such as the Nobel Laureate Sir CV Raman, Dr JC Bose and some prominent British scientific workers, the colonial Government in India resisted pressure to set up a central body for scientific and industrial research similar to the Department of Scientific and Industrial Research (DSIR) set up in Britain after World War I. Later, even after the Governor General of India was advised by the British Government to set up an organisation similar to the DSIR in UK, it was not accepted on financial grounds. Instead, the Bureau of Scientific and Industrial Research (BSIR) was set up under Mr A Ramaswamy Mudaliar, Commerce Member of the Governor General's Executive Council with Dr Shanti Swarup Bhatnagar as the scientist-in-charge. The scope of BSIR was limited to war-related research in collaboration with academic laboratories. For example, the Indian Institute of Science in Bangalore, was involved in training a considerable number of technicians in testing and calibration of electrical and radio instruments, in the repair of mechanical appliances for the Royal Air Force, and in the production of chemicals and gases for the fighting services. Even with meagre budget of Rs 500,000, BSIR by 1941 was able to work out a number of processes at the laboratory level for utilization by industry and thus established the case for greater funding by the Government. Mainly through the efforts of Mr Mudaliar and Dr Bhatnagar, in 1942 the Council of Scientific and Industrial Research (CSIR) was formed as an autonomous body with a research grant of one million rupees. However, throughout the war period, the application of the colonial policy in the domain of scientific research and cooperation excluded Indian scientists and scientific and industrial organisation from receiving valuable scientific inputs in such fields as nuclear energy, guided missiles, chemical and metallurgy of processes, new materials, and so on, while their

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About the Author

Ramadas Panemangalore Shenoy received his MSc Degree in Physics from Banaras Hindu University and continued his higher education at the Indian Institute of Science, Bangalore for the post graduate Diploma and DIISc in Electrical Communication Engineering. He proceeded to University of Wisconsin, USA for PhD in Electrical Engineering in 1957. He joined the Electronics & Radar Development Establishment (LRDE), Bangalore in 1961 to work on radar development for the Armed Forces. From 1967-71 he worked at the Defence Electronics Laboratory, Hyderabad as Deputy Director and initiated system development activities related to radar and associated electronic warfare. In 1973, he joined LRDE as Director and remained there until 1987 when he became Distinguished Scientist. During his tenure as Director LRDE, many systems such as time division electronic exchanges, computer based nodal trunk switch, sound ranging system for location of guns, radar distance measuring equipment and a new generation of radar systems INDRA were successfully developed and productionised.

Dr Shenoy has been the recipient of many national awards such as the Padma Shri in 1987, the first IETE-IRSI Award for pioneering radar development in India, prestigious Aryabhatta Award (2000) for contribution to promotion of astronautics in India and the most prestigious Life Time Achievement Award (2001) from DRDO for long term and outstanding contribution to radar technologies and continuous support and guidance to DRDO. He is still associated with DRDO, in the field of radar and microwaves tubes. He has authored several national and international publications in the field of radar. He is a fellow of the Indian National Academy of Engineering and a Distinguished Fellow of the Institution of Electronics and Telecommunication Engineering.

About the Book

The book is an authentic description of development of Defence R&D in India and first of its kind which traces the origin of military research, its need under British rule in India in early twentieth century, the R & D during two World Wars, the independent India and defence strategy at that time to inception of Defence Research Organisation, appointment of first Scientific Adviser and evolution of separate Defence Research & Development Organisation for catering to needs of Armed Forces in India. The book vividly describes the birth pangs of the organisation, the hurdles faced and contours of current organisation as envisaged by the founding fathers of Independent India, and the milestones achieved during 1958-1982 and makes an engrossing reading.

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