CHAPTER - VI

DEFENCE RESEARCH AND DEVELOPMENT ORGANISATION

LIBRARIES IN BANGALORE - BRIEF ACCOUNT

6.1 Growth and Development of Defence Research and
6.1.1 Objectives of DRDO
6.1.2 Organisation, Functions and Defence Plan
6.1.3 Functions

6.2 Defence Scientific Information and Documentation
Centre (DESIDOC)

6.3 DRDO Libraries

6.3.1 Aeronautical Development Agency (ADA)
6.3.2 Aeronautical Development Establishment (ADE)
6.3.3 Centre for Air Borne Systems (CABS)
6.3.4 Centre for Aeronautical System Studies and Analysis (CASSA)
6.3.5 Centre for Artificial Intelligence and Robotics (CAIR)
6.3.6 Centre for Military Airworthiness and Certification (CEMILAC)
6.3.7 Defence Bio-Engineering and Electromaterial Laboratory (DEBEL)
6.3.8 Electronics and Radar Development Establishment (LRDE)
6.3.9 Gas Turbine Research Establishment (GTRE)
6.3.10 Microwave Tube Research and Development Centre (MTRDC)
6.1 GROWTH AND DEVELOPMENT OF DRDO

Defence Research and Development Organisation (DRDO) owes its existence to the vision of the great son of India Pandit Jawaharlal Nehru. He was a scientist at heart and was greatly stirred by the decisive impact science and technology made in determining the final outcome of Second World War. The pursuit of Science and Technology for improving the welfare of the Indian masses was already on the cards. What was needed was its application to meet our defence requirements so that our nation could remain strong and self reliant. His was a great vision. Modern laboratories are working hand-in-hand with the fighting forces to provide the nation with up to date weapons and facilities.

Today, we remember with affection and strong conviction Panditji had on science and its relevance to our defence needs. It is this commitment to Science and his confidence in the nation and Scientist that made it all possible: DRDO is a force to reckon with.

The start was modest, with a number of technical development cells functioning in Ordinance factories and other establishments amalgamating to form the nucleus in 1958. Today the nucleus grown into a formidable Scientific and Technological force capable of addressing problems involved in the development of major hardware systems, the
indigenous development of which was considered impossible a few days ago.

It is the newly acquired maturity, confidence and competence that distinguishes DRDO from its past, stretching from the snow bound Leh, deep in the Himalayas to topological Cochin in the far south, from the desert land of Jodhpur in Rajasthan to the Monsoon forest of Tejpur in Assam, over (46) forty six laboratories and Establishments are now addressing problems associated with the design, development and testing a number of defence hardware, development of flight combat aircraft and a radar and many more projects which are underway in our laboratories over which our 25,000 Scientists, Engineers and Technicians are experiencing.

Electronics has always been a fast moving field. Changes and innovations are many and occur so rapidly it is difficult to keep pace with them. DRDO has three laboratories located at Bangalore, Hyderabad, and DehraDun to work in this area.

6.1.1 Objectives of DRDO

- To undertake research, design, development, engineering and technology transfer of weapons, weapon systems and equipment's for the Defence Services.

- To assist services in terms of operational necessities.

- To provide scientific analysis and options in technologies and product relevant to defence.
To foster national science and technology and industrial development through Direct/Spin-off benefits of Defence science and technology. In this age of technology, the defence of a country is dependent not only on the size of its Armed Forces, but also on modern weapons and equipment. The mandate of the department of Defence R&D is to enable the nation become self-reliant in weapons, weapon systems and equipment through research and development in wide ranging areas of modern technology.

The Department operates through complex network of over 46 inter-dependent laboratories and Establishments located nation wide, and manned over by 40,000 personnel. The profile of Defence R&D programmes range from relatively simple product improvement projects to complex programmes for development of sophisticated systems. A steady increase in the number of projects and the significant rise in high value major projects are shown in Chart-I (facing this page.)

The near term projects of the department emerge from clearly visible needs in respect of weapon systems, equipment and materials required to maintain the state of defence preparedness. Long term R&D policies and programmes are derived from a clear interactive analysis of the Threat Technology spectrum and a close dynamic interaction with the services synchronisation with their long term objectives. The departments in close collaboration with the three services has, for the first time, drawn up a 15 year perspective plan for systematic and planned enhancement of indigenous Research and Development capabilities in Scientific and technological areas of interest to defence.
6.1.2 Organisation, Functions and Defence Plan

The Ministry of Defence consists of three Departments viz.,

(a) Department of Defence;
(b) Department of Defence Production and Supplies and
(c) Department of Defence Research and Development.

Raksha Mantri is the head of the Ministry of Defence. Defence Secretary directly looks after the Department of Defence. He is the Secretary of the Ministry and also co-ordinates the activities of the three Departments in the Ministry.

5.1.3 Functions

The functions of the Departments of the Ministry of Defence are:

(a) Department of Defence, headed by the Defence Secretary deals with three services and the inter-services organisation.

(b) Department of Defence Production and Supplies headed by the Secretary (Defence Production and Supplies), deals with matters pertaining to Defence production indigenisation of imported item of equipments and spares, planning and control over the Departmental production units and Defence Public Sector undertakings.

(c) Department of Defence Research and Development headed by Secretary (D R and D) who is also the Scientific Adviser to Raksha Mantri, is engaged in rendering advice on Scientific aspects of Military
equipments and logistics and formulates research, design and development plans of equipment's used by the services.

6.1.4 Directorate of standardisation

Directorate of Standardisation is responsible for formulation, co-ordination and execution of the standardisation efforts in the ministry. The main objective is to establish commonalties in equipment and their components among the three services, so that the Defence inventory may be reduced to the minimum extent possible.

The Directorate's activities broadly cover:

(a) Preparation of statements such as Joint Services Specification (JSS), joint service Rationalised list and joint services of guides (JSG);

(b) Codification of defence inventory and

(c) Variety of reduction and inventory control.

Types of Standardisation Information available in the Directorate:

(1) A database of codified inventory of items which have been fed into the computer to check whether similar items exist in the defence services when a new item is introduced.

(2) The list of national standards adopted and used in defence available as compendium of defence stores prepared by this directorate.

(3) An index of defence standards published by this directorate. These standards are prepared only when no national standards exist or the existing national standards do not meet defence requirements.
The Directorate functions through various standardisation committees and sub-committees comprising members from various Product/Research/Inspection Organisation like DGQF, R and D, DGQA etc., besides representatives from the three services of the Ministry. The standardisation committee is composed as under:-

Chairman : Scientific Advisor to the Minister of Defence

Member : Chief of General Staff Army HQ. (HQ - Head Quarters)

- Chief of Materials, Naval HQ.
- Air Officer Maintenance, Air HQ
- Additional Financial Advisor, Ministry of Finance (Defence)
- Controller General, Defence Production
- Chief Controller of Research and development.

6.2 DESIDOC

DESIDOC is considered as the NUCLEAS of all activities of Defence. It serves as a nodal point for the diffusion, development and utilisation of scientific and Technical activities. The objectives, and functions have been summarised as below.

The DRDO library is a specialist library in Defence subject and will function as an integral part of Ministry of Defence, Govt. of India. Emphasis is placed on reports, standards and specifications, periodicals instead of book as in public and University libraries.
The Objectives of the DESIDOC

1) To build up and maintain a comprehensive and up-to-date collection of books, reports, standards and other materials relating to Defence research and development;

2) To organise the materials in a systematic manner in order to provide efficient and prompt service to the clientele;

3) To disseminate information by issuing project-oriented documentation lists and other current awareness services;

4) To provide other services such as compilation of current and retrospective bibliographies, procurement of photo copies, Microfilms, reprints and references services;

5) To cooperate with other organisations for exchange of information;

6) To serve as a nucleus for information on Defence service and its allied branches;

7) Maintaining liaison with other experiment stations and institutes concerning the problems of research and providing such advice;

8) To provide Translation services of documents published other than English;

9) To strengthen the national information policy - information resources, expertise in information handing and services;

10) To formulate information handling policy to guide information centers and services;

11) To establish specialised Centre, centers and excellence in Defence sector to support Technology transfer activity relevant to the Defence in terms of output in production of equipment's;
12) To setup the regional network and linking with national network on the one hand and the information systems and services of the global network on the other hand;

13) To determine the adopting models suited to the pattern of Defence information requirements and gare to meets the needs of all those who are involved within the region;

14) To maintain the activities of local levels regional levels, and national level requirements of information in Defence area;

15) To survey the existing resources and programs strengthening the information resources;

16) To identify users and information needs;

17) To encourage training of manpower as various levels and supporting research in information fields;

18) To conceive the problem area to be tackled in the development of national information system in Defence;

19) To apply and facilitate the absorption of Micro electronic mass medias to transfer of information;

20) To develop CD-ROM database search facility, on line information retrieval facility and the E-mail technology implementation in the network of DRDO libraries; and

21) To prepare an implementation plan giving a planned programme for developing a Defence information system.

Realising this, the Defence Research and Development Organization (DRDO) soon after its formation created the Scientific
Information Bureau (SIB) in 1958 to cater to the information needs of the organisation. In 1967 SIB was recognised and become Defence Scientific Information and Documentation Centre (DESIDOC) and was accorded the status of a self-accounting DRDO establishment.

DESIDOC provides Information to DRDO Scientists and Technologist (All Over India) both on request and in anticipation of demand. For this, DESIDOC Information specialists scan relevant literature available in the library and also conduct CD-ROM and on line searches of foreign databases as and when necessary. International databases are searched through the DIALOG Information service.

For Information Processing and Dissemination, DESIDOC is a pioneer among Indian Libraries and Technical information centers in automation of Information Services. The Centre computerised all the activities of Library. The data on the holdings of the DSL are maintained in a Database form and an integrated database of the holdings of all the DRDO libraries is being organised. These databases are available on-line through PSTN lines. For preparing input to these database, the Common Communication Format (CCF) promoted by UNESCO is used. The data on the periodical holdings of DSL has been brought out in a book form. The union catalogue of periodicals in DRDO libraries is under compilation.

Software for all these Computerisation activities has been developed in house. The library Management Software package
developed by the Centre is called DELMS (Defence Science Library Management System) and it provides for creation of databases and operation of library management functions.

Consultancy:

DESIDOC provides help and guidance to DRDO Libraries/Information Centers on request. Apart from this, many scientists of the Centre serve on the expert committees of -

- Bureau of Indian Standards;
- National Information Centre;
- Indian National Scientific Documentation Centre (INSDOC) and
- Indian Council for Medical Research etc.

Under consultancy project sponsored by the

- National Information Systems for Science and Technology (NISSAT);
- Ministry of Science and Technology.

DESIDOC guided establishment of a facility for on-line searching of foreign databases and trained the concerned staff at five centers in the country.

- Central Leather Research Institute (CLRI) - Madras
- Indian Association for Cultivation of Science - Calcutta.
- INSDOC, New Delhi
- National Aerospace Laboratory, Bangalore
- National Chemical Laboratory, Pune,

Under another project sponsored by NISSAT, DESIDOC developed an Integrated Library Automation package called SANJAY, based on CDS/ISIS (version 2.3) developed by UNESCO. In addition to this DESIDOC is also providing technical help to Delhi library network (DELNET), and Library Network (INFLIBNET).

6.3 DRDO Libraries

The DRDO libraries have been established keeping in view the nature of research work undertaken in their respective laboratories. The DRDO laboratories are interested in the area of research for finding indigenous methods for developing modern warfare equipments and methods. The laboratories are special in nature and are catering to the needs of their Policy Makers, Scientists, Engineers, Designers, Technicians, Administrators etc.

So the collection of the libraries is very specialised and the main concentration is given to procure rare and special documents in nature. The main emphasis is laid on in subscribing respective research Technical Journals dealing in their respective area of research. The collection of Technical Reports, Standards and Specifications, Microfiche, Micro Films,
Cartridges, Audio and Video Cassettes, CD-ROM Databases, Slides, Pamphlets, Brochures are collected to suit their requirements.

All the DRDO libraries are well equipped with modern facilities. Library activities have been computerised in most of the libraries and the libraries provides latest information service without any delay to its Scientists by using CD-ROM, Database search, on-line information retrieval service, Electronic mailing system.

The libraries keeping in view the requirements of their Scientists need they provide current awareness service, selective dissemination of information service to save the time of the users.

The libraries are involved in DRDO database network. All the DRDO libraries in India will come under this network which helps all the Scientists working in these organisation to have an access of collection of each library. It also takes care to avoid duplication of collection and procurement of very essential and required publications. It helps in saving money, time and duplication of work.
ORGANISATIONAL SPREAD - DEFENCE LABORATORIES
Table 2 - DRDO Libraries in Bangalore.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Name of the Establishments</th>
<th>Year</th>
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<tbody>
<tr>
<td>1.</td>
<td>Aeronautical Development Agency (ADA)*</td>
<td>1986</td>
</tr>
<tr>
<td>2.</td>
<td>Aeronautical Development Establishment (ADE)</td>
<td>1959</td>
</tr>
<tr>
<td>3.</td>
<td>Centre for Aeronautical System Studies and Analysis(CASSA)</td>
<td>1977</td>
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<tr>
<td>5.</td>
<td>Centre for Artificial Intelligence and Robotics (CAIR)</td>
<td>1986</td>
</tr>
<tr>
<td>6.</td>
<td>Centre for Military Airworthiness and Certification (CEMILAC)</td>
<td>1958</td>
</tr>
<tr>
<td>6.</td>
<td>Defence Bio-Engineering and Electromaterial Laboratory(DEBEL)</td>
<td>1982</td>
</tr>
<tr>
<td>7.</td>
<td>Electronics and Radar Development Establishment (LRDE)</td>
<td>1958</td>
</tr>
<tr>
<td>8.</td>
<td>Gas Turbine Research Establishment (GTRE)</td>
<td>1959</td>
</tr>
<tr>
<td>9.</td>
<td>Microwave tube research and Development Centre</td>
<td>1985</td>
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*Aeronautical Development Agency, Bangalore, autonomous body under Ministry of Defence Research and Development.

The following Organisations are not considered in the study:

- Advanced Systems Integration and Evaluation Organisation (ASIEO), being new organisation and utilising the ADE library facility.
- Centre for Military Airworthiness and Certification (CEMILAC).
- Defence Standardisation Cell (DSC).
6.3.1 AERONAUTICAL DEVELOPMENT AGENCY

The Aeronautical Development Agency is the nodal Governmental agency established for the monitoring and execution of the Light Combat Aircraft (LCA), the largest and most critical programme of this nature to be undertaken in the country. The ADA has to fund, manage and technically monitor the LCA programme and is responsible for all the work leading to type certification of the aircraft and on to series production.

The Project Definition Phase (PDP) of Light Combat Aircraft (LCA) was completed towards the end of 1988. The PDP, which was launched during 1987-88 was progressed by a well knit team of designers from ADA, HAL, DRDO, CSIR and other organisations under the functional control of ADA which took up the activities of evolving the airframe configuration, system architecture, component specifications, resource requirements and formulating schedules for full scale development. A systematic approach in documenting all design studies, calculations and rationale behind selection of design study reports.

The work accomplished during PDP was subjected to a series of critical reviews by specialists drawn from various R&D Organisations, academic institutions, IAF establishments, Government Bodies and private and public sector industries. The Governing Body and the Technical Committee of ADA held several meetings to consider managerial and technical issues connected with LCA tasks. During the year under report, exhaustive reviews of the LCA programme were
conducted covering various aspects which included technical and financial risks involved in the selection of design options and work sharing. Assistance of several agencies across the country was obtained for these reviews.

The Library of the Aeronautical Development Agency (ADA) is one of the best library among DRDO libraries. It has good facilities and excellent services. It serves not only it users in Bangalore but for all, DRDO Lab., in India. It is devoted specially to Aeronautics Engineering, both pure and applied. The library has given assistance to its Scientists, Engineers, Technicians from all the departments of DRDO and has played a significant role in achieving important defence project. So far the resources like US Military standards and specifications are concerned, the current and active standards and specifications are available in CD-ROM format and historical document are available in micro films cartridges format. Library is supposed to be the best among Defence R&D laboratories.

**Physical Feature**

**Situation** :- It is situated in Vibhuthipura, by the side of Hindustan Aeronautics Limited. This organisation is surrounded by greenery and has beautiful modern buildings and the library.

**Information Technology**

**Buildings & Furniture** :- The library has an independent building with a total area of 3600 Sq.ft in which 900 sq.ft is meant for reading purpose, keeping in view of another 15 years expansion provision. It has separate
section for modern equipments like Compact Disk Read Only Memory (CD ROM), Microfiches, Microfilm, Lamination, On-line etc. The library is provided with suitable furniture designed with readers comfort in mind.

Collection and Staff

The library has a wide range of collections mainly related to Aerospace Engineering, Books, Periodicals, Microfilms standards specification especially full text of military standards by United States of America, which is the active and historical collection. There are three professionals and six non-professionals working in the library nearly 284 members and 12 institutions are the members of this library.

Organisation & Service

The library has organised its collection following UDC classification and indexed as per the AACR with local variations. The library is providing vast range of services like indexing, Translation, CAS, SDI. The library is fully automated which provides services like on-line information retrieval services Dialog, CD-ROM full text of military standards, E-mail services.

CD-ROM Databases - United States Military Standards and Specifications.

The Military Standardisation and Specification programme of the U.S.Government was established in 1952 to improve the operational readiness and cost effectiveness of defence material by promoting development and use of common systems, sub-systems, equipment,
components, parts, materials engineering practices and technical data. The primary objective of the program is to ensure that optimal material standardisation is achieved during the design, development and acquisition process.

The following are the types of documents released by the Military Federal Standardsation services:

1. Commercial Item Descriptions (CIDs)
2. Data Item Descriptions (DIDs)
3. DESC/SMD Drawings
4. Federal Information Processing Standards (FIPs)
5. Federal Specifications
6. Federal Standards
7. Joint Army - Navy Specifications
8. Military Drawings
9. Military Specifications
10. Military Handbooks
11. NASA (KSC, GSFC, NHB) Documents
12. Qualified Products Lists (QPLs)
13. DoD Adopted Industry Standards - Notices
The Standards and Specifications are defined as follows:

(i) Military Specifications

complete descriptions of products which are intrinsically military in character or significantly modified commercial products, requiring special features, design packaging or quality assurance to satisfy military needs.

(ii) Military Standards

Document which describe Engineering and Management process, methods and design criteria data generating requirements, testing techniques and definitions.

(iii) Military Handbooks

Handbooks are reference documents which bring together, procedural and technical or design information related to components, equipment process, practices and services. A Handbook may serve as a supplement to specifications or standards to provide general design and Engineering data.

(iv) Military Drawings

These are references in many standardisation documents and supply management records to identify the materials, processes and Standard items incorporated in assemblies and equipment. They cover only those design features and physical items that are intended for use in design of items and equipments.
(v) DOD STANDARIDISATION ON CD-ROM

This provides convenient electronic access to U.S. Military and Federal Specifications and Standards and a wide range of related documents. This database is a full text image database. The index is a separate disk in ASCII format, which locates documents and access detailed summaries for each document. This helps to quickly locate the needed page, paragraph table or figure. This also saves time in building space time of reference documents or the quick identification of amended paragraphs. The document can be viewed or printed in hardcopy format. The specifications and standards are grouped into two categories i.e. current or active standards and Historical standards.

Historical Standards can be just as important in many situations as current standards. This is particularly true when designing modifications, additions and interfaces to existing products, systems and structures. Historical Standards can also help service personnel maintain, diagnose and repair existing equipment and help the designer understand how current standards evolved.

Why use Standards

Product qualify, compatibility safety and reliability are the goals of standardisation programs. Programs are designed to benefit everyone concerned.

Design based on accepted standards are usually less expensive to produce, since they are built upon proven performance and extensive testing. Many design parameters are already established in standards, so
one need not spend hours computing these requirements. And designing standards, in many cases, is a legal defence against product liability.

Standards help speed manufacture, improve efficiency, lower cost and reduce scrapple and wastage. Materials, components, and manufacturing procedures that are selected on the basis of standards are "tried and true" and often less expensive than custom made.

Standards guarantee performance, thereby opening up a wider, more receptive market. To ensure a stronger marketing position abroad, compliance with all applicable International and Foreign National Standards and technical regulations are essential.

The CD-ROM of Standards provides the researcher to get the document of full text data helps the Engineers and Scientists in meeting their requirements.

6.3.2 AERONAUTICAL DEVELOPMENT ESTABLISHMENT

The Aeronautical Development Establishment is engaged in design and development programmes on all other aspects of combat aircraft such as aerodynamics structures, flight controls, avionics, air armament and flight simulation. A major programme is that of the Pilotless Targe Aircraft (PTA), which is versatile vehicle for training of surface to air and air to air missile crew.

ADE undertakes such studies and projects as may be needed to develop the necessary expertise in the various disciplines/fields of technology, as decided by the Scientific Advisor to the Minister of
Defence. The trust areas are unmanned Aircraft, flight simulation, combat aircraft systems, Air weapons integration and Flight R&D. Necessary technical co-ordination of new designs of Aircraft, including helicopters to assist the Directorate of Aeronautics and Air HQ in producing the tactical-technical-economic specifications (T-T-ES).

The ADE library is the oldest among the DRDO libraries in Bangalore, which was established in the year 1959. This library has modest collection of 17,000 books, 210 periodicals (current), with 7800 back volumes of Journals, with a highest collection of standards numbering about 24,000.

Physical features

The laboratory is situated in Indiranagar, where the library is named as "KNOWLEDGE CENTRE", placed at heart of the campus. The library has an independent newly constructed huge building. It has independent halls like reading, book stack, back volume of Periodicals, Current periodicals, standards, Microfiches, Automation and Circulation Section. To run the activities of the library there are 10 professional and nine non-professional working. The library has thousand registered members and it provides services like Bibliographic, abstracting, indexing, translation, CAS, FSDI etc. The library is partly automated.

The library collections mainly covers Aeronautics with special emphasis to Aerospace Engineering pure sciences like Mathematics,
Physics, Chemistry, Engineering technology including Electrical, Electronics, Mechanics, Computer Science, designing etc.

Organisation of Collections

The library is following UDC system for classifying documents, cataloguing job is done according to AACR-I, and it provides indexing of periodical articles.

6.3.3 CENTRE FOR AIR BORNE SYSTEMS (CABS)

This organisation established in the year 1985 as a Project office named as ASWAC i.e., Aerospace Surveillance Warning and Control. During 1992 the ASWAC project office was converted as permanent DRDO establishment and named as Centre for Air Borne Systems (CABS), its main research activities are on 'Airborne Early Warning'.

Centre for Air Borne Systems was set up on 01 February, 1991 with the responsibility of guiding the development of technology for AEW/AWACS systems. The centre essentially acts as system house and an integration agency using all available expertise and infrastructure within the country. A number of studies and analysis exploring various technology options and designs carried out from Jul 1985 led to the formation of the Centre.

Since its formation, the Centre has been involved in the development of an Airborne Surveillance Platform. This development program aims at acquisition of indigenous technology for development of AEW/AWACS. The design of the platform caters for all subsystems
required by a full scale Airborne Early Warning (AEW) system, but with reduced functional capabilities. The ASP is a low cost, low risk technology development route which is capable of upgradation/translation into a fully functional system on a platform selected by the user.

The library has been shifted from ADE to its present campus in 1994. The library named as technical Information Centre is now placed in the 2nd floor of the main building specially designed for housing library, with a total area of 4000 sq.ft which consists of 1925 sq.ft stack area. Very huge reading hall measuring 1200 sq.ft has been provided with modern comfortably designed furniture.

Collection and Staff

As the organisation is mainly intended in finding indigenous methods for (AEW) Air Borne Early Warning systems. Library has very rare collection of subjects like Airborne Early Warning, AWACS, signals processing communication, software development Aerospace Engineering etc. The library subscribes very important periodicals numbering 42 like IEEE Introduction on Aerospace Electronic System etc.

The library has good collection of Technical reports, standards, Doctoral Thesis, project reports, photographs, video cassettes, Audio Cassettes etc. The library with one professional and two non-professional caters services to 15 institutions and organisations members.
Organisation and Services

The library has been organised in many sections like acquisition, periodicals, Circulation, Automation, Reprographic, and Binding sections.

The collection of the library has been classified according to Dewey Decimal classification system and indexed as per AACR-II with local variations. The library provides services like CAS, SDI, Online, Bibliographic, Reprographic, Micrographic, Online database search, and E-mail service etc.

Planned and developed Technical Information Centre Network (TICN) for CABS.

6.3.4 CENTRE FOR AERONAUTICAL SYSTEMS STUDIES AND ANALYSIS (CASSA)

CASSA carries out performance assessment and cost effectiveness studies related to aircraft, missiles, and other major systems. Software models have been used to assess air threats, formulation of and optimisation of the force mix.

CASSA activities have been for the most part, directed towards the requirements of the services (the Indian Air Force and the Indian Navy) and the system studies requirements for the major DRDO programmes and projects. In the year 1994, the major emphasis has been in the areas of War gaming and Simulation (for Air Force requirements), Performance modeling of sensors, Weapons evaluation modeling, and simulation, Reliability analysis of hardware systems.
b) The library was established in the year 1977 named as Technical information Centre, situated in ADE campus in its own building, Indiranagar, Bangalore.

Building and Furniture

The library has no independent building, it is attached to main building with a total area of 1800 sq.ft in which it provides a total stack area of 600 Sq.ft and 600 sq.ft has been provided for reading facilities. This library has been arranged with modern furniture.

Collection and Staff

Library has a very good collection of 3700 books on Aerospace Engineering and Allied sciences and it subscribes to 54 Technical Journals. It has also collection of Technical reports and very good back volumes of periodicals. Interestingly this library has no collection of standards.

The library is being managed by a professional with assistance of two non professionals.

Organisation and Services

The library is fully computerised. The collection has been classified as per Universal Decimal classification system, and indexed as per the Anglo Americal Cateloguing Rule.II. The collection arranged section-wise i.e., Book stack area, current periodical Section, back volumes of periodical section, automation section, reading section etc.
Along with the regular services it provides bibliographic services and current awareness services. The library does not provide user-orientation.

6.3.5 CENTRE FOR ARTIFICIAL INTELLIGENCE AND ROBOTICS (CAIR)

The Centre for Artificial Intelligence and Robotics (CAIR) was established in October 1986, under the auspices of the Defence Research and Development Organisation (DRDO). The character of duties of CAIR is:

(i) To conduct basic research in the fields of artificial intelligence, robotics and automation.

(ii) To conduct applied research and development in the fields of artificial intelligence, robotics and automation with emphasis on defence requirements.

The thrust of CAIR are as follows:

(i) Logic Programming

(ii) Knowledge-based Systems

(iii) Neural Networks

(iv) Robotics

(v) Vision

(vi) Control Systems

(vii) Learning Theory
CAIR is unique in combining, under a single roof, a wide variety of activities from the theoretical to the applied in a broad spectrum of areas from automation to learning theory. The air of CAIR is to create an intellectually stimulating atmosphere with excellent computing and library facilities. In support of its research activities, the Centre also has an active visitor's programme whereby a number of eminent experts from foreign universities spend varying lengths of time at CAIR. In order to facilitate visits by both national and international scientists, the centre has a variety of schemes such as Research Fellowships, Ad Hoc and contract appointments, as well as opportunities for sabbaticants to spend time up to one year.

In the short span of existence, the library CAIR has already built to a sound collection of about 1600 books on specialised topics such as Artificial Intelligence, Robotics, Vision, Pattern Recognition, Neural Networks, Control Systems, etc. Good books on mathematics, statistics, Simulation, Mechanical Engineering, Data Structures, CAD, Computer Architecture, Numerical Computation, Theoretical Computer Science, etc. are also available.

The Centre subscribes a total of 75 journals every year. CAIR scientists, using National Aerospace Laboratories and other libraries, in Bangalore.

CAIR is located in a three-storeyed building with a total floor space of about 3,300 square meters, on 1.75 acres of land. The building is
strategically located in the heart of Bangalore, across the street from the Governor’s residence.

6.3.6 Centre for Military Airworthiness and Certification (CEMILAC)

Resident Technical Office (Aircraft) was formed in 1958 under the aegis of Directorate of Technical Development and Production (Air) viz., DTD&P (Air), with its headquarters at New Delhi. During 1968, RTO (Aircraft) was brought under Directorate of Aeronautics (R&D), New Delhi.

The present office was renamed as Regional Centre for Military Airworthiness (Aircraft) viz RCMA (A/C) during 1988 under the Directorate it was renamed as Centre for Military Airworthiness and Certification (CEMILAC). Since the beginning of the formation of this office, it was functioning under DRDO.

RTO (A/C) is the first Resident Technical Office out of 3 such offices established in the country. The main objectives of this office are to exercise supervision over the design, development and manufacturing activities at the HAL works to ensure compliance of technical requirements and procedures and standards during development and manufacture. It approves and ensures promulgation of such actions as are necessary for maintenance of Airworthiness of aircraft in service and this office is governed by Government of India approved document called procedure for Design Development and Production of Military Aircraft and Airborne stores. (short title: DDPMAS 75)
The main thrust of Technical information centre (TIC) is towards information connected with Airworthiness, Certification, Type testing, accidents, Incidents, indigenisation, modifications and design approval of Military Aircraft. The objectives of TIC are to acquire and disseminate information required for the Airworthiness certification, modification & type approvals of the Military Aircraft. Technical information on aircraft such as Jaguar, Kiran, Marut, Ajeet, HPT-32, HIT-34, Mirage, Canberra, Hunter, Avro are available. In addition information on DRDO projects like AEW, Felcon, PTA, Prithi, Rocketpod, etc are also stored. This office was assisting from time to time civil airtworthiness certification, members in various committees formed by DGCA etc.

The following types of services are rendered to the users of the library.

**Reference Service:** Reference on availability of books reports journals etc., of TIC or any other aerospace library will be provided.

**Inter Library Loan:** The documents which are not available at RCMA (A/C), TIC will make arrangements to barrow from other libraries on inter library loan. The facility is operated through borrower tickets with HAL, (ADB) Library, central Library, ADA, NAL and through the Inter library loan request with all other libraries.

**Current Awareness service:** Xerox copies of content pages of core periodicals received at TIC are circulated and full articles are issued on request.
Selected dissemination of information: This service is rendered on selected topics by providing bibliographic information and selected full text articles from aerospace libraries.

**Article Indexing:** Bibliographic information from the current aerospace periodical reports, journals, etc., are reviewed on the subjects and following bibliographic information are published:-

1. Airworthiness,

2. Aircraft Accident

3. Recent Military Aircraft of the world


<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total collection at TIC</td>
<td>8,450</td>
</tr>
<tr>
<td>Specification and Standards</td>
<td>820</td>
</tr>
<tr>
<td>Reports</td>
<td>800</td>
</tr>
<tr>
<td>Aircraft publications</td>
<td>300</td>
</tr>
<tr>
<td>Aircraft Test Reports</td>
<td>650</td>
</tr>
<tr>
<td>Journals of Bound Volumes</td>
<td>400</td>
</tr>
<tr>
<td>Total No of Books</td>
<td>2,500</td>
</tr>
<tr>
<td>Hand Books</td>
<td>140</td>
</tr>
<tr>
<td>Reports generated by this office</td>
<td>150</td>
</tr>
<tr>
<td>Total number of Journals procured to TIC</td>
<td>54 (for the year 1995)</td>
</tr>
</tbody>
</table>
On the whole, it can be concluded that this office caters exclusively on specialised topics like Airworthiness, certification and type test data on aeronautical subjects which are not being dealt by any other library or Technical information centre.

CEMILAC is certifying organisation. It is not considered under the study.

6.3.7 DEFENCE BIO-ENGINEERING AND ELECTRO MEDICAL LABORATORY (DEBEL)

The main activities of DEBEL involves in the development of Metallic Mine detector, Biomedical pattern recognition and image processing system, Anti-G suit, Flying boots, Flying overalls Special flying gloves and software for medical auto diagnosis.

The DEBEL library is established in the year 1982 situated in its own building at ADE campus, Indiranagar, Bangalore. The library is surrounded by exhibition Hall and auditorium. The collection is oriented towards Aviation medicine Bio-Engineering and allied Sciences.

Building and Furniture

The library is well organised and is a part of the main building. It exists in first floor of the building as a separate wing, with a total area of 4000 sq.ft, stack area of 2000 sq.ft, a big hall measuring 2000 sq.ft is for reading purpose. It is well furnished.
Collection and Staff

The collection is of a rare variety and mainly concentrated on Aviation Medicine, Bio-Engineering Technology, Electro-Medical Aerospace Engineering as the subject is very special in nature. The collection of books is 3200 and it subscribe to 40 Technical periodicals and it holds about 400 back volumes of periodicals and it has collection of 850 standards.

There are two professionals who look after the library and its services.

Organisation and Services

The library has different sections such as acquisition, Technical, Periodicals, Standards, Circulation, Reference audio visual materials sections. The library has closed access system. It extends inter library loan facilities. It also provides documentation services specially current awareness services, selective dissemination of information service to its clients.

6.3.8 ELECTRONICS AND RADAR DEVELOPMENT ESTABLISHMENT (LRDE)

LRDE is the prime laboratory working on radar systems and techniques. Present emphasis is on surveillance radar’s for low level air defence, airborne interception systems as well as for maritime use. LRDE is engaged in digital signal processing and advanced antenna techniques including phased arrays.
The library came into existence in 1958 known as 'Information processing Group. It is a very old library amongst the DRDO libraries. It has large number of users not only from the organisation but also from other many institutions like IETE, CSI, CECRI, other than DRDO libraries.

**Situation**

It is situated in the outskirts of Bangalore city at a distance of 18 Kms and surrounded by Defence laboratories and residential quarters. It has very huge campus, and is surrounded by lush greenery. The library is placed at the heart of main building.

**Building and Furniture**

Library building is the part of the main building in the first floor. It is very big section accommodating information processing division. Audiovisual section, Book section, periodical section, Back volumes of Periodicals standards section etc. The library has very well designed furniture to suit the modern library system. Even the reading tables and chairs are designed keeping in view of readers comfort.

**Collection and Staff**

The main interest of this laboratory is in developing Electronic Radar development System, which is very special in nature so also the collection. The library has a vast collection of 13,000 books, subscribes to 200 periodicals, and a good number of back volumes. The collection of standards is to 200 only. It has a good collection of audiovisual materials
on Electronics Radar Development. The library has a librarian having an the assistance of 27 non-professionals.

Organisation and Services

To extend better service to the user the library has been organised in different units based on the needs and requirements of the users. The units are circulation, books, reference back volume of periodicals, current periodicals, Audio visual, reprographic, Binding etc.

The special services other than traditional services are Bibliographic, abstracting, indexing, current awareness service, SDI and so on.

The documents has been classified as per UDC and indexed as per AACR with local variations and also provides indexing of periodicals articles.

6.3.9 GAS TURBINE RESEARCH ESTABLISHMENT (GTRE)

The GTRE has been engaged in the design and flight testing of a repeat version of Orpheus jet engine, providing a base for the indigenous GTX demonstration engine, designed for a dry thrust of 4500kg and after burner thrust of 7000kg. Developed as a precursor for the full development programme, this demonstrator incorporated various advanced technologies such as a transonic compressor annular combustor, shrouded cooled turbine, fully variable nozzle with electro-hydraulic control system, using sophisticated materials.
The library established in 1959, situated in its own campus in CV Raman Nagar, Bangalore, surrounded by greenery and in the midst of the other DRDO laboratories.

This library is being selected to create Regional Database of DRDO libraries, Bangalore region.

Situation

The topographical situation of this laboratory is beautiful. It is situated outside the city campus is well planned and surrounded by the DRDO residential quarters and laboratories.

Building and Furniture

The library has a very big independent building spreading for 700 sq.ft area consisting browsing hall, reading hall, periodical hall etc. The building is designed to meet the future expansion of both vertical and horizontal with the provision to accommodate all sections even including computer section.

This centre is well equipped and provided modern and suitable reading furniture.

Collection and Staff

This library is very big, it serves vast range of Scientists, Engineers, Technicians etc. It has a collection of 6949 books are very special in nature and it has good collection of Technical reports upto 10,901 and it scribes to 132 periodicals, collection of 2771 standards special in nature related their research work.
There are nine professionals and with good number of non-professionals working in library to cater to the needs of Scientists.

Organisation and Services

The library has been organised into different section like Technical, Periodical, Back volume periodicals, Reports, Standards, Microfiches, Audiovisual etc.

The significant services of this library are bibliographic, indexing, CAS, SDI, CDROM, Dialog on-line extended to the users.

6.3.10 Microwave Tube Research and Development Centre, Bangalore (MTRDC)

Modern warfare whether offensive or defensive depends vitally on a sound electronics base. DRDO has therefore a chain of Laboratories specialising in various aspects of Electronics and Communications.

Established in the year 1985.

The Microwave Tube Research and Development Centre (MTRDC) at Bangalore has made significant progress in the design of advanced Microwave tubes utilising computer aided design (CAD). The centre established for the first time in the country.

Gridded Gun Technology

The "Traveling Ware Tube" (TWT) with its unique combination of bandwidth, power output and gain, finds potential application in several areas ranging from electronise warbare and space exploration to relaying of home video signals. The operation of TWT depends on the interaction
of beam of Electronics with an electromagnetic ware. All the latest helix and coupled cavity TWTs incorporate non-interesting gridded gun/Technology, utilising shadow grid pulsing. Thus gridded gun technology is being established for the first time in the country. Another important contribution of this laboratory is "Planar Wareguide Technology for Miniaturisation of system".

Physical feature

The MTRDC library is recent one among the DRDO libraries in Bangalore, placed at Bharath Electronics Limited Campus Jalahally. This library has vary specialised collection to cater the needs of specialists scientists, Engineers and Technologists. The advanced journals pertaining to their research work is being subscribed. The scientists and engineers are more dependent on Indian Institute of Science, National Aerospace laboratory and Bharath Electronic Limited libraries for extensive study and mainly dependent on standards and specifications and technical reports.

The book collection is mainly on electronics, aerospace engineering, computer science, physics, microwave, simulation, mathematics etc. Professionally qualified personnel are taking care of the library.
Organisation of the collection

The library collection is indexed and classified. The services are

- Reference service, lending service, inter library loan, binding service etc.

Information centre or library serves as an attributes of the pre-consultancy project verification for any study or innovation. This will be normally find the data for further search in their assigned job. The overall idea about the organisation and inter-personal relation and the resource availability holds the first rank. The present chapter has done the job of projecting the information of the entire net-work of DRDO libraries.

The succeeding chapter VII is the nucleus part of the investigation of the study and furnished all analysis duly interpreting the data. This chapter is divided in two parts.
Reference


