

Management of e-Resources in R & D Centers: A Case Study of the Information Center at NAL

Poornima Narayana* and I.R.N. Goudar**

Information Centre for Aerospace Science and Technology
National Aerospace Laboratories
Bangalore – 560 017, India

Abstract

The developments in information technology and their applications to library and information services have given new dimension to the entire spectrum of information management. The information generated is usually stored in four physical media: paper, film, optical, and magnetic disks. The e-document be it a book, journal, technical report, conference proceedings is portable; has random access to its contents; and the document can also be a multimedia object, in that it may contain not only text, but also graphics, drawings, photographs or video. Now we have the emergence of publications over the electronic networks and the activity took off in a big way following the invention of the World Wide Web. The Open Access movement is becoming the order of the day. More than 3000 journals are free on net for anybody to access. A number of Institutional repositories and e-Prints archives have thrown challenge to the publishing industry.

Consortium approach through different pricing, management and licensing models is enabling the libraries to provide access to thousands of e- journals, e-books and other kinds of e-documents. The Information center at NAL with its state-of-the-art library has progressed a good deal in this direction by acquiring different kind of documents especially e-form, cataloguing & processing them appropriately, storing and giving access to its patrons not only in library premises, but on to the desk tops spread in three different campuses through laboratory LAN and also extending selected services through Internet for the benefit of any body from any part of the world.

* Deputy Head, ICAST, E-mail: poornima@css.nal.res.in

** Head, ICAST, E-mail: goudar@css.nal.res.in

Created and maintained by ICAST the Portal ‘AeroInfo’ (www.aeroinfo.org.in) serves as one window information search facility for Web sources in aerospace science and technology. This virtual library facilitates multiple approach to information seekers as the web sources are indexed and organised using different schemes of classification including NASA subject categories. Care is taken to cover Indian aerospace sources exhaustively. The ICAST site (www.icast.org.in), apart from giving detailed information about library sources including books, journals, E-journals, databases and technical reports makes available different search tools for its users. Other details like working hours, library rules, staff details, contact persons, etc are provided. One can submit an online query and suggest documents for acquisition using online forms provided. The Library Database (OPAC) is probably is single largest in the country with more than 3.25 lakh bibliographic records of books, technical reports, patents, standards, journals, etc.

ICAST users can search International databases like Aerospace Database, NTIS, J-Gate, Medline, etc through campus LAN. Users can access more than 2500 full text journals covering titles published by Elsevier (ScienceDirect), ASME, AIAA, Springer, John Wiley, OUP, CUP, AMS, World Scientific, few Annual Series, etc. Created by ICAST an e-journals gateway with browse and search (alphabetical and subject wise) facility for titles provides access to more than 700 journals available free on the net. The Centre provides a number of web/e-mail based innovative information services including Journal Contents Service, News Clipping Service, Monthly Documents Additions Lists covering both Books and Technical Reports, Web Alert Service and Union Catalogue of Journals -CSIR and Aerospace Libraries, etc.

1.0 Introduction

The nature of document collections, user requirements and services provided vary depending upon type of library and information centers viz. academic, special or public. The R & D centers can be identified with special library category. Academic libraries especially meant for undergraduate level and below usually concentrate on textbooks and

very little on journals. On the other hand the ones at postgraduate and research level institutions do build journal and few other kinds of collections. While some public libraries too collect different kinds of documents in line with special libraries, the number is comparatively very small. Since R and D centers carry out both basic and applied research, need highly specialized journals and other kinds of documents like technical reports, patents, standards, conference proceedings, etc. Some of the universities and technological institutions like IITs, although are academic in nature carry out a good number of activities similar to R and D centers and there by their information requirements also change. While there is no hard and fast rule that what kind of libraries should provide what kind of services, usually the special libraries and few academic libraries provide specialized services like SDI, CAS, news clippings service, journals contents, web alert services, etc.

2.0 Digitization and e-Resources:

Since centuries, man has been recording, presenting and preserving information through various media like clay tablets, stones, palm leaves, leather etc. The invention of paper and the printing press brought a revolution in this direction. Subsequently, micro documents, audio and videocassettes also arrived on the scene. The 20th century witnessed a revolution in the form of computers for storing and retrieving information. Compact Disc read only Memory (CD-ROM) due to its enormous storage capacity brought a revolution in information storage and delivery mechanism, thereby setting a revolutionary trend in the information industry. DVD with much higher storage capacity, further revolutionized the information delivery mechanism. INTERNET with its world wide web converged the whole world into an information village. The information going electronic, knowledge storage and retrieval has become dynamic with the help of powerful retrieval engines irrespective of the storage media used, be it CD-ROM, Online or Internet.

The knowledge economy boosted by the rapid developments in information and communication technologies especially the networking power of Internet, Intranets and

Extranets have resulted in a remarkable improvement in the ability to generate, process, and disseminate digital information ultimately paving a way for paradigm shift in the information seeking behavior of researchers and knowledge workers. Slowly the static and paper-based libraries are being replaced step by step by dynamic digital/electronic/virtual libraries with flexible and efficient mechanisms for producing, organizing, locating, repackaging and accessing the information. Many libraries have gained experience in developing, building digital resources and their management.

3.0 E- Resources by Type

The five basic formats of information are text, image, sound, motion pictures and data. Digital information resources by type required by R & D centers and few academic libraries are as listed in Table 1.

Table 1 - Digital Resources by Type

Resource Types	Description
Conferences	A prearranged meeting for consultation or exchange of information or discussion. Meetings, Exhibitions, Trade shows and Fairs.
Guides	That offers basic information, tutorials and manuals.
Discussion groups	Any system that supports group messaging, e.g. a shared mailbox, Usenet, bulletin board system.
Electronic journals	Full text and Table of contents of online journals.
Patents	Official document of invention rights
Theses and dissertations	A lengthy, formal treatise for the doctoral degree at a university.
Abstracting and indexing databases	Secondary sources of information those index and abstract the primary literature like Journal articles.
Digital collections	Images, audio and video.
Product catalogues	Aircraft, Satellite products and spare parts, services and information
Library catalogues	Bibliographic databases of library holdings.
Museum, Archives	Artifacts, Paintings, documents
Virtual libraries	Multiple resource types on various subjects
Reference sources	Dictionaries, encyclopedias, biographies, abbreviations, thesauri, handbooks
Employment	Career sources, advertisements
Libraries	School, College, Universities and other Libraries
Organizations	Schools, Research institutes, Associations and Societies.

Companies	Manufacturers and industries
Directories	Various search engines with subject directories
Technical Reports	Internal research publications brought out an organization for limited circulation both within and outside

4.0 Aerospace Science and Technology and Aeroinformatics

The field of aerospace science and technology being inter-disciplinary in nature, quite a good number of branches from engineering and other disciplines like physics, chemistry, materials, etc contribute for its growth. The information generated gets into various forms like books, conference proceedings, journal articles, technical reports, standards and patents and is being made available through different media including CD-ROM and Internet. More than 350 CD titles cover aerospace literature of various types. More than 30% of Aerospace R & D communications are in the form of technical reports. NASA Technical Reports Server at <http://ntrs.nasa.gov/> is a rich source for both bibliographic and full text information on reports. Apart from about one hundred e-journals in Aerospace, more than 1000 titles in the related areas of Mechanical Engineering, Astronomy and Astrophysics, Materials Science, Physics, Chemistry, Electronics, Computer Science and Composites cover aerospace research papers selectively. The Web sites of AIAA, ESA and Embry-Riddle Aeronautical University list various Aerospace associations and organizations. The prominent bibliographic titles include Aerospace Database, NTIS, Compendex Plus, INSPEC, Metadex, Move-SAE, and FLUIDEX. Important databases on conferences, regulatory information, patents and standards include AIAA, ANSI, HIS, ISO, ASTM, ASME, ARINC, BSI, DIN, Defense Standards, FAR, JAR and Derwent Aerospace. Jane's Directories provide detailed information covering military and civil aviation. Most of these databases now have been made available on Internet. Aerospace community also need other kind of information like aerospace agencies, associations and organizations, corporate bodies, museums, library and information centers, news groups, aviation authorities, airports, airlines, training facilities, weather, etc. Many organizations have hosted aerospace information sources either through their own home pages or by creating tailor made portals by cataloging and providing links to world over Internet sources. More than 50 Virtual Libraries and Indexes serve as information sources specifically for aerospace science and

technology. In spite of this, aerospace community spends lot of time and energy in searching required information and some times get lost in the ocean of Internet.

5.0 Indian Aerospace Scenario

India, though a developing country has contributed enormously in the area of aerospace. The major bodies responsible for the development of Aerospace include Dept. of Space, Defense establishments, National Aerospace Laboratories, Aeronautical Engineering Departments of few Centers of learning. India began its space program with the establishment of the Space Commission and Department of Space 1972. Since then India has made steady progress in the development of launch vehicles and satellites. The first Indian satellite was *Aryabhata*, which was launched by a Soviet rocket on 19th April 1975. With the successful launch of the SLV-3 on 18th July 1980 when a 35kg satellite called *Rohini* was placed in LEO, India became one of the seven nations in the world to achieve space orbit capability. The 1990's saw major achievements in the form of Space transportation systems, Indian Remote Sensing Satellites (IRS), medium and long range missiles, helicopters and all-composite trainer aircraft. It is worthwhile to mention some of the recent successful space/aviation stories. Indigenously developed Light Combat Aircraft (LCA), *Tejas* just completed its 300th flight successfully and its fourth prototype (PV II) would be ready before February 2005. The first indigenously built 14 seater aircraft *SARAS* had its successful inaugural flight in August 2004. The first operational flight of *GSLV* (GSLV-F01) successfully launched *EDUSAT* from SDSC SHAR, Sriharikota on September 20, 2004. ISRO successfully launched recent versions of its satellites *INSAT-3A* and *INSAT-3E* during 2003. *BrahMos*, the supersonic cruise missile, was flight tested successfully and its naval version is likely to be operational some time during 2005. Some of the web resources covering the Indian aerospace scene are listed in Table 2.

Table 2 - Web Sources on Indian Aerospace

Indian Space Research Organization (ISRO)	http://www.isro.org/
National Aerospace Laboratories (NAL)	http://www.nal.res.in/
Centre for Space Science and Technology Education in the Asia Pacific region (CSSTE- AP)	http://www.cssteap.org/
Defense Research & Develop. Organization (DRDO)	http://www.drdo.org/
Department of Aeronautical Engineering, IISc, Bangalore	www.aero.iisc.ernet.in/
Department of Aeronautical Engineering, IIT, Mumbai	http://www.aero.iitb.ac.in
Aero-India	http://www.aeroindia.gov.in/
Department of Aeronautical Engineering, IIT, Chennai	www.aero.iitm.ernet.in/
Department of Aeronautical Engineering, IIT, Kharagpur	http://www.iitkgp.ernet.in/departments/home.php?deptcode=AE
Department of Aeronautical Engineering, IIT, Kanpur	http://www.iitk.ac.in/aero

6.0 NAL and Its Information Centre

National Aerospace Laboratories (NAL), a constituent of Council of Scientific and Industrial Research (CSIR), is India's pre-eminent civil R&D establishment in aeronautics and allied disciplines. NAL was set up at Delhi in 1959 and moved to Bangalore in 1960. NAL's primary objective, as articulated in its new Vision Statement, is the "development of aerospace technologies with a strong science content and with a view to their practical application to the design and construction of flight vehicles". NAL is also required "to use its aerospace technology base for general industrial applications" (<http://www.nal.res.in/>).

The Information Centre of NAL (ICAST) caters to the information requirements of the Indian aerospace community in particular and the engineering and technical personnel in general. ICAST is well known for its aerospace collections of books, journals and specifically technical reports from NASA, DLR, ONERA, NLR, ARL and UTIAS. The library has been recognised as the National Information Centre for Aerospace Science and Technology by the National Information System for Science and Technology (NISSAT/ DSIR), UNESCO and AR&DB. While the main library takes care all basic functions of information center covering all departments and visiting users including corporate members, sub-library housed in NAL Belur Campus provides immediate reference, reading and counter transaction facilities for divisions like Experimental Aerodynamics, Computational and Theoretical Fluid Dynamics, National Transonic Aerodynamic Facilities, Propulsion, Centre for Civil Aircraft Design and Development, CSIR Centre for Mathematical Modeling and Computer Simulation, etc.

ICAST Mission Statement

“Collection, organisation and retrieval of documents and acting as repository centre in the field of aerospace and related areas for providing specialized information services using various sources of information in electronic/print media and adopting developments in Information Technology for making services much more effective, exhaustive, dynamic and almost instantaneous”.

7.0 E-resources at ICAST and their Management

Apart from acquiring information resources in e-form, usually on CD-ROM and giving online access to a good number of primary sources like journals, standards or technical reports and bibliographic databases, ICAST has taken up digitization of a variety of information sources like technical reports, news clippings and copyright free journal articles published by NAL scientists. Different bibliographic databases have been created for different kind of documents with all necessary search features and links to full text documents. Taking advantage of both laboratory Intranet and Internet facilities at the institute the center provides web based services and access to e-resources available both

within and world over outside. The center has designed, developed and maintains an aerospace portal ‘ AeroInfo’, a gateway for different kinds of aerospace information sources on Internet. The website of ICAST gives access to - a good number of subscribed and free e-journals, OPAC, news clippings, commercial bibliographic databases, CAS Bulletins, union catalogues, etc. This site also gives general information about routine library matters such as rules and regulations, timings, library membership details, etc.

7.1 Access to External Sources through Portal ‘AeroInfo’

Few Gateways cover exhaustively the aerospace information with exclusive coverage on civil aviation, commercial airliners, airports, pilot sources, climatology & meteorology generated in US, Europe, Canada and few other developed countries with a meager coverage of information from developing countries like India. Most of these portals index web sources in a very general way, even that too without a search engine. Indian web sources listed in Table 2 cover mostly the information concerned to respective organizations. Considering these lacunae, ICAST launched a multipurpose Gateway ‘**AeroInfo**’, a WWW Virtual Library for Aerospace. (Appendix 1, URL: <http://www.aeroinfo.org.in>).

Many search engines and directories like *Yahoo*, *AltaVista*, *Google*, *HotBot*, *InfoSeek*, *Aeroseek* and a host of Virtual Libraries and Indexes meant for aerospace and aviation have indexed this unique portal. The Gateway gives access to both contents created in-house at the host center as well innumerable number of sources available on Internet. Unlike in many aerospace virtual libraries, contents of AeroInfo are indexed by multiple categories, so that visitor is being navigated one way or the other to the required source. The approach could be a general category, subject, document types like patents, technical reports, news, etc.

a) General Categories

Links have been provided exhaustively under this general categories like associations, books, companies, conferences, education, research, museums, clubs, software, weather, women, etc.

b) NASA Subject Categories

NASA subject categories are used world over to classify the documents. Interestingly none of the virtual libraries and other web sites including NASA sites have used to classify and index web sources in aerospace. AeroInfo uses these categories along with other ones (Table 3).

Table 3 - NASA Subject Categories used in 'AeroInfo'

Aeroacoustics	Avionics
Aerodynamics	Communication & Navigation
Aerothermodynamics	Composites
Aerospace Materials	Fatigue, Fracture & Failure Analysis
Aerospace Medicine	Fluid Mechanics
Aerospace Structures	Material Science
Astrodynamics	Mechanical Engineering
Astronautics	Meteorology & Climatology
Astronomy & Astrophysics	Missiles
Aircraft Design & Testing	Propulsion & Power
Aircraft Instrumentation	Rockets
Aircraft Profiles	Rotor dynamics
Aircraft Stability & Control	Satellites
Aircraft Structures	Space Craft Design & Testing
Airfoils	Space Sciences
Air Transportation, Safety & Certification	Space Transportation
Atmospheric Science	Space Vehicles
Aviation General	Surface Engineering
Aviation History	Wind Tunnels

c) Aviation

More than 100 subcategories like aircraft, airports, air cargo, airlines, helicopter, skydiving, ultra lights, etc are used to give access to thousands of aviation sources.

d) Interdependent Subjects

Links have been given to a good number of interdependent subjects like astronomy and astrophysics, avionics, composites, computer science, material science, mechanical engineering, etc considering their relation with aerospace area.

e) Indian Aerospace Sources

Considering the fact that Indian sources have not been indexed exhaustively by most of the virtual libraries, special care is taken in this regard. Sources have been indexed under four main headings viz. Aviation / Aeronautics Space S&T Associations/ Organisations. Sub-headings under each of these headings facilitate the searcher in visiting a good number of the specific sites of his interest. (Appendix 2)

f) Information by Source Types

Aerospace researchers, developers and practitioners usually look for various kinds of information available in documents like journals, technical reports, patents, regulatory information and news and other sources like conferences, virtual libraries. The portal facilitates the visitor to jump to any kind of sources of their interest given on the top of all pages.

7.2 Access to In house Contents through ICAST Website

The ICAST site (www.icast.org.in), apart from giving detailed information about library sources including books, journals. E-journals, databases, technical reports makes available search tools for its users (Appendix 3). Other details like working hours, library rules, staff details, contact persons, etc are provided. One can submit an online query and suggest documents for acquisition using Online forms provided. A detailed account is given about the host, the Information Centre for Aerospace Science and Technology (Library) of National Aerospace Laboratories, India covering general information like about ICAST, it's Mission Statement, Collection Statistics, Service Details and links to concerned staff, Staff, Membership details, Shelf arrangements of books, List of journals subscribed with hyper links the publisher's sites if available, Working hours, etc

a) E-Journals

ICAST provides seamless access to more than 2500 E-Journals to all three campuses of NAL published by leading publishers like Elsevier (ScienceDirect), AIAA, ASME,

Springer, etc. While access to ScienceDirect is facilitated by CSIR consortia rest are made available by NAL. Shortly CSIR consortia is likely to make available a good number of journals by many publishers. Out of this more about 800 e-journals are free on Internet. We have provided a Gateway for facilitating browsing titles alphabetically or by subject and searching using any word in the title of free e-journals (<http://www.icast.org.in/ejournal/ejournal.php>)

b) Databases

ICAST users can search International databases like Aerospace Database, NTIS, Medline, etc through campus LAN. Shortly 10 more databases will be made available through IP enabling. Users can access more than 2500 full text journals covering titles published by Elsevier (ScienceDirect), ASME, AIAA, IEEE.

c) J-Gate

This subscribed service provides browsing and database search facility for more than 12,800 S & T journals with linking facility to full text and indication of the article availability in local libraries

d) Current Awareness Bulletins

The center brings out the following monthly Current Awareness Bulletins covering the bibliographic details of documents acquired.

CABA (Combined Aerospace Books Additions)

CARA (Combined Aerospace Reports Additions)

e) OPAC (<http://www.icast.org.in/opac.html>)

The most important features of a library website, which we have added into our site is webopac. With more than 3.25 lakh records, which can be accessible from anywhere in the world. We have provided many cross references to access our database. Even we have divided our WebOPAC into several parts. Combine interface to search any database. One

one can search separate database like book, technical report, standard, patent by Author, Title, Publisher, Report No., Keywords, etc.

f) News Clipping Service (<http://www.icast.org.in/news/newsclips.php>)

This most appreciated Web based service is being provided for the past few years covering news items on Aerospace, Aeronautics, Aviation, specific items on S&T and IT. All news items on CSIR, HAL, DRDO, ISRO are also covered. At one click one can view all news on NAL, CSIR Labs; perform field based searching using title words, keywords, subject headings, place of origin of news and simultaneously browse the Archive by date retrospectively till 1995. ICAST plans to cover many other Indian, Foreign newspapers and other media.

g) Union Catalogue for Serials

Holdings of Serials in CSIR Libraries (<http://www.icast.org.in/csircatalog.html>)

One can browse the titles by alphabetically, search titles by using any word in the titles or know the titles available in any particular laboratory. More importantly one can automatically generate an online request to the source organisation with minimum input, without even being aware of to whom to send the request. Contact address is also made available for any requirement. The following two current lists of serials have been made available with similar features:

Current list of CSIR LICs (<http://www.icast.org.in/csir/union/csirlib.html>)

Current list of Aerospace Libraries (<http://www.icast.org.in/aerolib/union/aerolib.html>)

h) Digital Repository of NAL publications (Intranet only)

(<http://192.168.6.60/cgi-bin/library>)

Presently available on ICAST's Intranet site, a digital repository of NAL Publications has been set up using GSDL (Greenstone Digital Library). The Search/Browse is facilitated using various keys viz; organisation, different divisions, author, title, keyword with a link to the full text of the item, be it journal article, technical reports, patents, papers presented in Conference/Symposiums. ICAST also has installed another Open Source Software

DSpace on trial basis facilitating the Scientists to load their own publications. The National Centre for Science Information at IISc has taken a project, sponsored by Aeronautical Research and Development Board on “Interoperability of Institutional Repositories”, for which ICAST has been designated as one of the two test beds. A good number of full text publications by NAL scientists have been loaded on to the server using E- prints Open Source Software.

8.0 Proposed Project DALIC

As a part of 10th five year plan of NAL, ICAST has proposed for setting up of Digital Aerospace Library and Information Centre (DALIC). The project broadly aims to provide a digital platform for providing fast and reliable access to worldwide aerospace information created and processed in various kinds and forms. Various objectives include:

- Setting up of Digital Aerospace Library and Information Centre (DALIC) for meeting the ever-growing information requirements of aerospace community in the country in general and those of NAL Scientists in particular.
- Enrich E-documents in thrust areas like Civil aviation, Composites, Smart Structures etc.
- In house contents creation covering
 - Technical reports brought out by NAL and other organization
 - Copyright free aerospace literature available in various kinds and forms.
- To provide fast and reliable access to international databases both bibliographic and full text.
- To host library databases of various aerospace institutions in the country and make the union catalogue available through Internet.
- Set up Virtual Information Centre for
 - IPR information in Aerospace
 - Database of Indian Aerospace Organisations
 - Database of Indian Aerospace Engineers
 - Database of Indian Aerospace Industry
 - Union list of Periodicals

- Aerospace Events Database.

8.1 Benefits and Deliverables

- Information Infrastructure
 - Technical Reports Server
 - Mirror site for World's leading aerospace servers
 - Bibliographic Database Server
 - Server for hosting Indian Information sources mentioned in objective No: 6
- Information Services
 - Access to bibliographic database
 - Access to full text databases
 - Access problems of Indian aerospace organizations, Industry, S&T personnel.
 - Effective document delivery service.
 - Access to electronic journals not covered by CSIR Consortia especially the ones in aerospace area.

9.0 Conclusion

In the midst of data explosion, we find ourselves victims of information poverty – unable to find useful information. The heterogeneous nature of the documents both in terms of physical forms, types, sources of generation following different standards and that of users carrying both research and development work demanding services suitable to them and co-existence of both old timers loving only print documents and younger scientists asking for documents on to their desk tops, the responsibility of information professionals is becoming much more challenging. Electronic information sources are the prime attraction of readers in today's networked environment. It is equally evident that it is difficult to know what information exists, what format it is available and where to look for it. Many search engine, directories and virtual libraries facilitate retrieving information required from web sources. Creation of one's own library website plays a significant role in providing single point access to e-resources created within and also available elsewhere free or against subscription on Internet. The Portal 'AeroInfo' and the web site of ICAST are good examples in this endeavour.

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