*Int. J. Appl. Engng Ed.* Vol. 7, No. 4, pp. 328–330, 1991
Printed in Great Britain.

0742–0269/91 $3.00+0.00


# Aerospace Education and Technical Literature

R. J. HAVLIK
*Engineering Librarian, University of Notre Dame, Notre Dame, IN, 46654, U.S.A.*

*Technical literature is vital to aerospace education. One of the tasks of an aerospace education program is to teach students to make intelligent choices of the literature they will need and provide them access to the literature. After graduation the employed engineers may not have a large library accessible to them, and they need to be aware of the new information resources, techniques and choices available to them in their chosen field.*

## INTRODUCTION

IT IS said that in aeronautics, vehicles are designed by PhDs, built by people with Master's Degrees, flown by people with Bachelor's Degrees, and maintained by people with high school degrees [1]. Each group has its own technical requirements and level of information need. In aeronautics the technical literature publishing industry has patterned itself to meet these needs. International and academic publishers publish the more basic science and pure research information for the designers. Technical and engineering societies lean toward the builders. More popular publishers write for the flyer and aviation buff. Trade associations publish for the technician.

The literature in the newer field of aerospace has developed a similar pattern, but with some currently different concentrations. Because of the necessity of designing aerospace vehicles for hostile environments, heavy emphasis must be placed upon pure research and the extrapolation of theoretical research results not only in the physical sciences but in the life sciences, if human transport is projected. The experience of the effect of aviation on society has also given rise to a literature on the military and social concern of space flight.

The need for testing components of spacecraft in expensive artificially created hostile environments has also given extra emphasis on the utilization of technical reports, whose data can only be gathered with the financial support of government subsidies. Without such technical reports, the practical application of aerospace data would be impossible.

Because human space flight is so expensive, hazardous and limited, the popular press has been held to publishing for space buffs rather than the small number of space pilots or astronauts, which do not constitute a profitable market.

The specialization and complexity of component maintenance has also affected the technician's literature. Highly detailed and often classified manuals, dealing with small segments of a total vehicle, are often the prime source of information.

One of the tasks of an aerospace education program is to try to teach the budding aerospace engineer or scientist, how to make intelligent choices of the literature he/she will need, and provide for him/her, access to the literature either by on-site library collections or information retrieval and document delivery programs now available through modern technology. The following are some suggestions which should be considered in formatting an aerospace information retrieval strategy today.

## ACCESS TO AEROSPACE LITERATURE

The quickest access to large volumes of unclassified aerospace literature is through the use of on-line information retrieval services. Information utilities such as DIALOG [2], BRS [3], and others process and service on-line versions of printed indexing and abstracting journals. By the use of Boolean logic, and a given search strategy a computer can not only examine the bibliographic citation and the classifications or subjects given by an editor, but the words within the abstract itself. Some journals in the Aerospace/Defense Markets and Technology field such as *Air International*, *Aviation Week and Space Technology* and *Interavia* are also available in full text in selected databases and permit complete text searching.

While these on-line services include all types of subject databases which have implications for aerospace education, such as physical sciences, life sciences, social sciences and engineering, there are three databases that will contain the largest bulk of aerospace related information. They are the *AEROSPACE DATABASE* sponsored by the American Institute of Aeronautics and Astronautics, Technical Information Service, the NTIS database sponsored by the National Technical

* Paper accepted 1 August 1991.

Information Service of the U.S. Department of Commerce, and *COMPENDEX PLUS* sponsored by Engineering Information, Inc.

The *AEROSPACER DATABASE* provides references, abstracts and controlled-vocabulary indexing to books, reports, conferences and other scientific and technical documents in the world, dealing with basic and applied research in aeronautics, astronautics and space sciences. The database is composed of a combination of two printed publications: *International Aerospace Abstracts* (IAA) [4], and *Scientific and Technical Aerospace Reports* (STAR) [5]. The coverage is from 1962 to present. The *AEROSPACE DATABASE* is available only in the United States. Access by non-U.S. governments, or organizations may be allowed with the written approval of the American Institute of Aeronautics and Astronautics, Technical Information Service.

The *NTIS* [12] database is sponsored by the National Technical Information Service (NTIS), U.S. Department of Commerce. It indexes government-sponsored research, development and engineering reports as well as analyses prepared by federal agencies, their contractors, or grantees. Included are NASA reports and reports by NASA contractors. The reports are all unclassified, and publicly available from various agencies including NASA. The wide spectrum of subjects included in this database also make it an excellent source of data on non-technical, space related topics. Coverage is from 1964 to date. The printed equivalent is *Government Reports Announcements &Index* [6].

*COMPENDEX PLUS* is the machine readable version of *Engineering Index* [7]. It provides worldwide coverage of the world's significant engineering and technological literature including conferences. In addition to documenting aerospace engineering literature, it covers electrical, electronics, and control engineering, as well as computers, robotics, and fuel engineering, all of which are necessary in today's space age. Coverage is from 1970 to present.

These databases are a tremendous time saving service over manual searching of years and years of separate indexes.

Cost is a factor when an institution is trying to decide whether to utilize on-line services only, paper copies only or a combination of both. For example, on-line services are relatively expensive. If a user is unsophisticated in preparation of a search strategy, it may take several expensive searches of a given database before a final concept is conceived, since browsing and a product of it, serendipity, is difficult in an on-line system. With a printed version, review of the abstracts as the search proceeds, may evolve a different search strategy than expected when the search was started. This often occurs in an educational institution when an undergraduate is seeking an unspecified aerospace topic and can not afford the cost of an on-line 'fishing' expedition. If on-line costs are free to users, or the user is clearly sophisticated in defining his needs, on-line searching is the best route to go, however.

## DOCUMENT DELIVERY

The retrieval and delivery of copies of papers, reprints or reports, once identified, can be a problem. In a conventional library nothing is quicker than subscribing to a journal and having it at hand. Because of the high cost of international research and academic journals, care must be taken to subscribe and retain only those titles that will get most use. Suggested guidelines to their selection are *Ulrich's International Periodicals Directory* [8], The *Standard Periodical Directory* [9], and *Magazines for Libraries* [10]. Each has sections devoted to aeronautics and astronautics journals. All give data on the history, price and availability and the latter even has a short critical analysis of the best titles.

With the advent of new copyright laws and fees and modern copy machines, libraries are still not relieved of responsibilities for making copies of their own journals for patrons. While individual users may make single copies of articles for their own 'fair use', libraries must warn them and/or pay a fee in addition to the subscription price for the privilege of making copies. Extensive and expensive records must be kept if the library makes the copies.

Most libraries continue to rely on inter-library loan services to secure copies of articles in journals they do not own. The *OCLC Online Computer Library Center* [11] and other computerized networks have helped to identify the location of journal holdings, but unless a library is part of a telefax network, the time for document delivery may be slow. Although it may appear more costly per page, several of the on-line services offer a computerized ordering service. While delivery times of articles ordered through such services also is unpredictable, much of the worry of documentation for copyright purposes is taken over by the vendor.

Accession of technical reports is very important in aerospace education. Many educational institutions have been designated as depositories for *NASA* and/or similar reports. Because of the large number of older paper copies and the difficulties of their storage and control, sets of reports take up much room and may not be complete. The availability of reports in microfiche has helped the space problem but librarians are frequently reluctant to store or lend microforms. Unclassified reports, including *NASA* reports are currently available from the *National Technical Information Service* (NTIS) [12] and many institutions buy them only on demand and distribute them as they do reprints of journal articles.

One of the best sources for information sharing occurs between institutions of like interests. In

aerospace education there are numerous institutions devoted to the study and teaching of space sciences. These institutions frequently exchange series of reports that not only contain technical data but deal with curricula, study programs and the teaching of aerospace sciences. Since the field is as yet new, there is much interchange of faculties or professional contact at meetings and conferences. Recently the University of Toronto Institute for Aerospace Sciences published the *Directory of Aerospace Educational Programs in Canada, the United States and Abroad* [13] which lists names, addresses, and faculties of academic, technical/commission, and international programs throughout the world. This directory is an excellent start for creating your own informal information contacts, although its principal purpose is to aid students in the selection of excellent aerospace programs.

While there is a growing number of institutions teaching aerospace sciences and a growing number of AA, BS, MS, and PhDs graduating from them, not all graduates are fortunate enough to work for a large aerospace company or a teaching institution with an adequate library. Librarians can do much to ease the access to aerospace literature, but when a trained librarian is not available, the working engineer is on his/her own. Thus it is incumbent for institutions to teach or to at least make students aware of some of the newer and less formal ways of obtaining information in their field after they graduate.

## CONCLUSION

In conclusion, aerospace education is a relatively new endeavour. The growth of the information literature shows parallels to that of aeronautics, but new technologies, as applied to aerospace vehicles and information sciences, have created new demands and solutions for information retrieval and document delivery. Awareness and sharing of these technologies and information sources in the process of aerospace education, will help us to achieve our goals of more quality aerospace progams in the future.

## REFERENCES


1. Nova, *A look at how planes and pilots are adapting to high technology*. PBS-TV (26 July 1988).
2. DIALOG Information Services, Inc. 3460 Hillview Avenue, Palo Alto, CA 94304.
3. BRS Information Technologies, 1200 Route 7, Latham, NY 12110.
4. American Institute of Aeronautics and Astronautics, Information Service, *International Aerospace Abstracts*, New York (1961–).
5. *Scientific and Technical Aerospace Reports/National Aeronautics and Space Administration U.S.A.*, Washington, D.C., NASA, Office of Scientific and Technical Information, Supt. of Doc., U.S.G.P.O. (1963–).
6. National Technical Information Service, *Government Reports Announcements &Index*, Springfield, VA, U.S. Department of Commerce (1963–).
7. Engineering Index Inc., *The Engineering Index Annual*, New York (1969–).
8. *Ulrich's International Periodicals Directory*, 25th ed., New York, Bowker (1986).
9. *The Standard Periodical Directory*, 11th Ed., Oxbridge Pub., New York (1988).
10. W. A. Katz, *Magazines for Libraries*, 5th edn, Bowker, New York (1986).
11. OCLC Online Computer Library Center, Inc., 6565 Frantz Road, Dublin, Ohio, 43017–0702.
12. National Technical Information Service (NTIS), U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, VA 22161.
13. A. Sheridan and J. Mills, *Directory of Aerospace Educational Programs in Canada, the United States and Abroad*. Downsview, Ontario, Canada, Institute of Aerospace Studies, University of Toronto (1988).