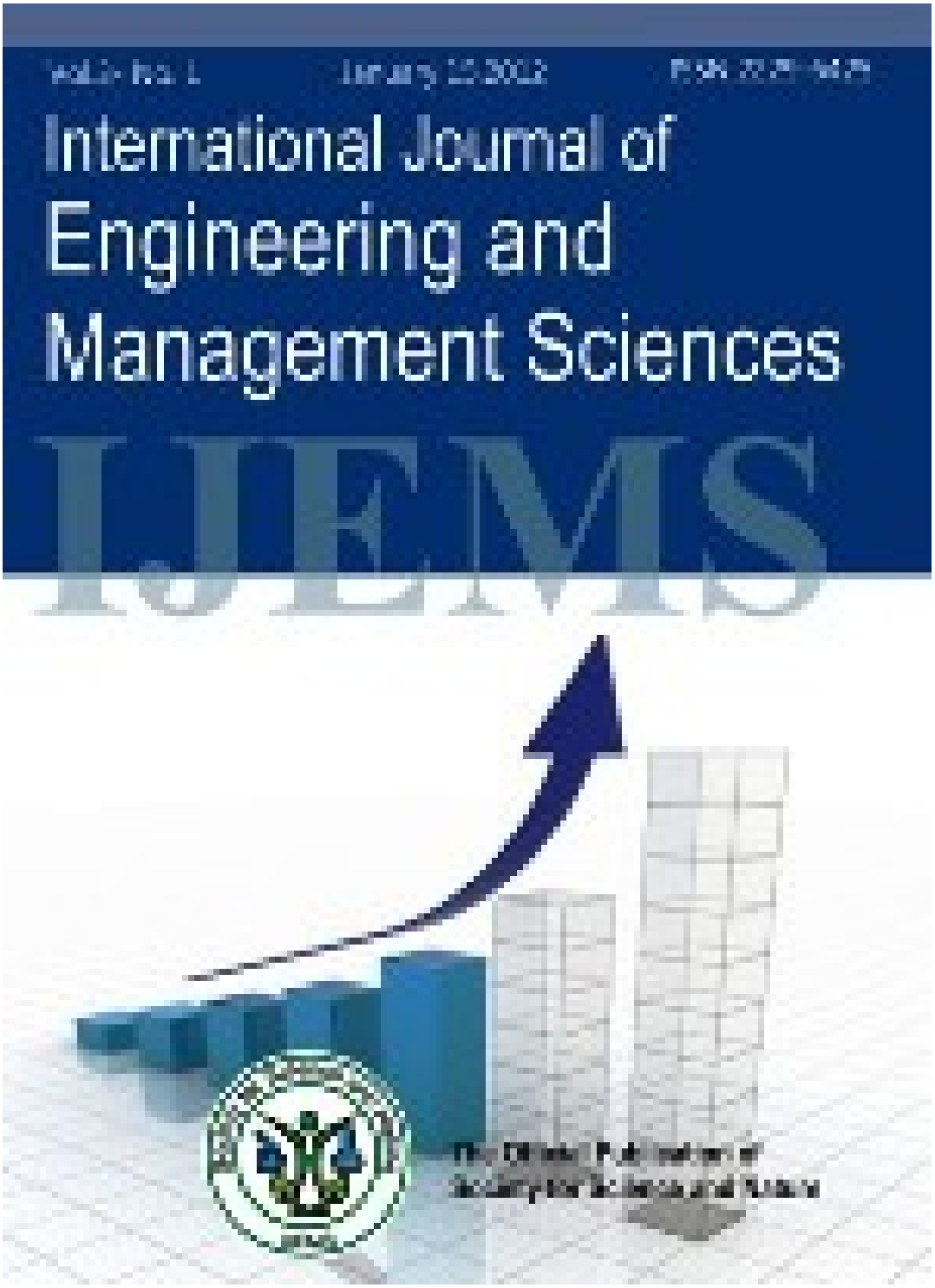

International Journal of Engineering and Management Sciences

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INTERNATIONAL JOURNAL OF ENGINEERING AND MANAGEMENT SCIENCES

www.scienceandnature.org

USE PATTERNS OF AEROSPACE MONOGRAPHS: A RESEARCH SURVEY OF AEROSPACE SCIENTISTS AND ENGINEERS OF BANGALORE

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ABSTRACT

A large number of Aerospace Monographs are frequently referred by the aerospace scientists and engineers of Bangalore for their day to day research work. A research survey was undertaken to ascertain the 'Use Patterns' of these Aerospace Monographs amongst these aerospace scientists and engineers of the selected 16 aerospace organizations of Bangalore. The study is restricted to the geographic boundary of the city of Bangalore. Out of the 650 survey questionnaires distributed to the scientists and engineers, a total number of 612 were received back and finally 583 responses found suitable for the study. The total percentage of responses usable from all the 16 aerospace organizations amounted to 89.7 percent. The analysis is based on the responses received from the aerospace scientists and engineers representing these selected aerospace organizations. The responses from the participants towards the use of Aerospace Monographs were graded on a scale of 4 to 0, 4 representing 'Daily' and '0' representing 'Never'. The major findings that the authors would like to report in this paper are: (a) *Analysis of Variance (ANOVA)* was applied for testing the significant difference among the mean scores attained from 16 aerospace organizations towards the Use Patterns of 'Aerospace Monographs' It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz ''Monographs in Aerospace History and Series (http://klabs.org/history/monographs/monographs.htm)', 'LS Monographs: Aeronautics, Aeroacoustics', 'NASA History Series Publications (http://history.nasa.gov/series95.html)', , 'RAND: Monograph/Reports | Aerospace (http://www.rand.org/pubs/monograph_reports/MR1187/', 'US Government Bookstore: Monographs in Aerospace History (http://bookstore.gpo.gov/subjects/sb-222.jsp)', The Aerospace Press / Corporation:(http://www.aero.org/education/tai/index.html) ', 'Aerospace Projects Review: (http://www.up-ship.com/apr/apr.htm)', 'Enchanted Rendezvous (history.nasa.gov/monograph4/foreword.htm)', *except for* 'American Institute of Aeronautics and Astronautics (AIAA) – The Aerospace (http://www.aiaa.org/content.cfm?pageid=174), (P=0.078)', 'NASA Dryden History Monographs Aerospace (http://cgi.ebay.com/Nasa-Dryden-History-Monographs-Aerospace), (P=0.055)', 'NASA's Origin and the Dawn of the Space Age (http://en.wikisource.org/wiki/NASA's_Origins_and_the_Dawn_of_the_Space_Age)' and 'Any other'.

KEYWORDS: Patterns of Use, Aerospace Scientists and Engineers, Aerospace Engineering Monographs

INTRODUCTION

A monograph is a work of writing upon a single subject, usually by a single author. It is often a scholarly essay or learned treatise, and may be released in the manner of a book or journal article. It is by definition a single document that forms a complete text in itself. An author may therefore declare her or his own work to be a monograph by intent, or a reader or critic might define a given text as a monograph for the purpose of analysis. Normally the term is used for a work intended to be a complete and detailed exposition of a substantial subject at a level more advanced than that of a textbook. Monographs form a component of the review of literature in science and engineering. Librarians consider a monograph to be a nonserial publication complete in one volume (book) or a finite number of volumes. Thus it differs from a serial publication such as a magazine, journal, or newspaper. Another definition says that, monograph is a work of research or literature written about a single, specific subject. It is primarily written by experts in a particular field of study for others in that same field of study. The language and information contained in a monograph is specialized and often filled with industry jargon. Monographs are popular in academic circles, among researchers and with literary experts.

A detailed definition describes monographs as a detailed essay or book on a very specific, often limited subject. It is designed to stand alone, and is usually not part of a series, unless the monograph is being released in several parts. Research libraries usually have a large collection of monographs, and an academic department at a university may also have an assortment of monographs published within its subject. In general, a monograph is very dense with information, and is of little interest to people outside the field. In order to gain respect within the academic community and tenure at a major university, an academic must publish monographs over the course of his or her life.

These scholarly treatises provide evidence that the academic is carrying out research in the field and analyzing already published information. A monograph usually brings new light to the subject, and it may contain breakthrough research. It also further refines the academic specialty of the author, and establishes the author as an authority on the topic. Usually, only one author is behind a monograph, although two academics may collaborate if they have been carrying out research together. A monograph is also only published once, as a general rule, unless it catches on as a textbook. Very rarely, a monograph will be of interest to a larger community, meriting a slightly bigger print run to meet demand. Because the print runs are very small, within several years of publication it can be difficult to obtain a copy of a monograph.

The aerospace engineering community considers Monographs as an important source of scientific and technical information to them. This enables them to keep abreast with global aerospace R&D and also contributes to their scientific progress. A research survey was undertaken amongst the selected 16 prominent aerospace organizations of Bangalore to ascertain the frequency of usage of 'Aerospace Monographs' by this niche community. The findings are presented in this paper with appropriate inferences.

AERADE'S AND IAIN'S (INTERNATIONAL PIONEERING INITIATIVES IN FACILITATING THE USE OF AEROSPACE ELECTRONIC INFORMATION RESOURCES

The Aerospace Information Management – UK (AIM-UK) project – found compelling evidence of 'under-utilization' of 'Electronic Information Resources' by the aerospace scientists and engineers. It recommended a number of initiatives to raise awareness and improve access to useful electronic information resources, and to reduce the threat of 'information overload'. In particular, there was a call to establish an Internet Gateway and Portal to the aerospace and defence community that would act as a 'jumping-off-point' for effective exploration and retrieval of information on the WWW. Launched in November, 1999, AERADE is specifically designed to meet this need. It is an initiative developed by the Cranfield University to enable aerospace and defence experts to find relevant information on the Internet. Today, the reports archive is a historical collection of over 10,000 significant technical papers and reports produced by the Aeronautic Research Council (ARC) and the National Advisory Committee for Aeronautics (NACA), Hanley; Harrington and Blagden, [1]. In the Spring of 1995, the Technical Information Committee (TIC) of the NATO Advisory Group for Aerospace Research and Development (AGARD) set up a Working Group to examine the issues, strategies, and actions required to develop and establish an International Aerospace Information Network (IAIN). The intention was to develop a mechanism for improving the access to, and use of, aerospace and aerospace-related information, by developing a self-sustaining, worldwide, network of partner organizations committed to sharing their data and information resources. After exploring a number of options, and evaluating the many existing models of international cooperative databases, the Working Group decided that the Internet would be the most suitable vehicle to provide such a mechanism, and developed a prototype IAIN Homepage to be used as a Proof of Concept. The prototype Homepage was inaugurated in April 1997 and now provides a limited catalog of aerospace information sources from which information searches can be launched. These sources will be expanded as new sources are identified.

The success of this concept will be determined primarily on its ability to deliver the desired data and information and needed services to the user. It should include:

- The ability to search for aerospace and aerospace-related data and information across
- Aerospace and aerospace-related data directory information
- The facility to order data products through a simplified "one-stop shopping" procedure the delivery of data to users on a variety of standard media, including electronic delivery where heterogeneous systems appropriate.

The Mission of AGARD:

According to its Charter, the mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes:

- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community
- Providing scientific and technical advice and assistance to the Military Committee in the field of
- Aerospace research and development (with particular regard to its military application)
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture.
- Improving the co-operation among member nations in aerospace research and development
- Exchange of scientific and technical information
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field.

The mission of AGARD is carried out through the Panels which are composed of experts appointed by the National Delegates, the Consultant and Exchange Programme and the Aerospace Applications Studies Programme. Participation in AGARD activities is by invitation only and is normally limited to citizens of the NATO nations, Walter [2].

REVIEW OF LITERATURE

Pinelli [3], interalia quotes Kaufman who opines that in the various factors relating to the use of technical information by engineers in problem solving, his study reports that in terms of information sources, engineers consult their personal collections first, followed by colleagues and then by formal literature sources. In terms of formal literature sources used for technical problem solving, engineers use technical

reports, followed in order by books, monographs and technical handbooks.

Mueller et al., [4], The authors in their paper focus on identifying information seeking behaviors specific to a corporate engineering environment and the implications of those findings. Their findings reveal that engineers generally like to help themselves to information. They will also use colleagues as a resource, but often rely on the library as a last resort or not at all. Books are critical to this population. They are comfortable with and use electronic resources, but also have a strong preference for accessing what can be considered more traditional library resources such as books and other physical items. This population often has a cycle for information gathering where the need for information changes drastically depending on the development phase of the project. They can have an extensive need for information during times of exploration and understanding on projects, but at other times, when their "heads are down" in terms of actual product development, they may seek no information at all. Information seeking from this group is generally in response to very specific problems or projects. They often seek answers to immediate problems, and need information quickly. Proximity of services and facilities is important. When interviewed, most engineers wanted a physical library or reading room in their specific location. We also observed that when engineers were reminded or informed of services, they used them.

Tucci [5], in his study on information seeking behavior of computer science and engineering faculty has observed that this community had diverse information gathering habits, but nine distinct behaviors or issues were identifiable: (a) Gateways, other than the library were used for obtaining information, (b) Book collection use was declining, (c) Databases: the lace of more subject specific databases resulted in migration to Google Scholar, (d) Accessibility was more important than relevance, (e) Printed journals were obsolete and there was a need for more online journals, (f) Improved communication with faculty were needed, (g) inter-library loan and policies needed to be updated, (h) inter-disciplinary work was increasing.

Pullar [6], in his paper addressing the information seeking behavior of engineering researchers opines that, the types of information useful to Science and Engineering researchers in the order of usefulness are: (a) Scientific and engineering journals (peer-reviewed), (b) Specialized science and engineering search engines and databases, (c) General search engines, (d) Online conference proceedings, seminars and theses, (e) Physical library, hard copy, books and British Library ILL, Web 2.0 resources – Wiki, RSS and Blogs etc.

Wang et al., [7], in their summary findings corroborate that the importance of information seeking using informal channels such as, reciprocal interaction at conferences and contacts with colleagues and subject experts. The participants in the research survey also valued formal resources for quality information that has been peer reviewed. Referred conferences have achieved high status in certain fields such as computer science. The internet is becoming more and more central to research information seeking. Many researchers have realized the need to effectively and efficiently manage retrieved digital information resources and are experiencing difficulties in organizing them. Library consortium has made a significant change to access scientific journals and the practice of registering research projects gives a good foundation for establishing institutional repositories. The open access movement would be a big boon to researchers living in a less privileged information environment. The authors in their conclusion say that, Active researchers should maintain an updated homepage to post their research output and publications (preprints). Personal homepage has become an effective channel for disseminating research output, simply because experienced researchers are likely to visit known subject experts' Webpages for information. Libraries and librarians must find new niches and new roles in the Internet age and actively transform traditional libraries entered on service and user instruction to a new information entity. It is clear that one of the new domains is the institutional repository for long term preservation of intellectual output and to facilitate open access. Librarians also must take more active roles in research to understand information users in today's fast changing environment, and to help physically scattered users effectively and efficiently use and manage new information resources and tools. To meet researchers' needs to manage information from various resources, current bibliographic tools are inefficient and must be redesigned to incorporate users' behaviors such as putting digital files in multiple folders.

Tenopir, et al, [8], in their research paper say that scholarly journals are an important source of trusted information, although the engineering professional reads fewer journal articles on average than do members of the scientific and engineering academic communities. Studies have shown that engineers spend a smaller proportion of work time reading from scholarly journals and that they read fewer articles than scientists and physicians. Nonetheless journals are useful and valuable to engineers, who also read many types of information resources, including standards, technical reports, books, and articles. When engineers read articles, they rate the importance to their job as very high. Other information sources—particularly oral reports and oral communications— are more important for engineers than for scientists or medical professionals. Recent studies confirm these trends, which have been observed for decades, although a growing percentage of reading is now from electronic sources.

Yousefi, et al., [9], in their results indicate that there are considerable differences in the information needs and information seeking behavior of those in the categories of Social Science and Engineering. In contrast, there are many similarities in information seeking behavior of those in the categories of Social Science and Accounting and Trade. Within groups, those in the category of Engineering showed stronger similarities in information needs and behavior than in the other two groups. For the Engineering group, the information resources available in the various departments were not adequately updated. Although they can obtain more updated resources in the network environments, they showed

less use of these resources and preferred printed materials. On the other hand, Social Science and Accounting and Trade experts tended to use network resources (especially Internet). They were found, nonetheless, to be considerably less skilled in using electronic resources. The Social Science experts did not stress the importance of newness of resources, possibly because of the nature of their discipline. The Engineers, however, placed the greatest importance on the age of the material: information resources older than 10 months were considered less valuable for their projects, and they preferred that resources be updated every six months. Those in the Accounting and Trade group claimed that all resources are equally valuable independent of their age. Among the three groups, library usage for Accounting and Trade experts was found to be the least, while the referring rate of Engineering and Social Science experts to the library was approximately equal. Library usage of engineering experts was found to vary greatly and was related to their occupational activities.

Sridhar, M. S. [10], while studying the information seeking behavior of the Indian Space Technologists says that, Unlike scientists, the space technologists are not motivated much by recognition, competition, visibility among peers and urge to write and publish (in the decreasing order of priority) while seeking information. On the other hand they are primarily motivated by a need for self-improvement, the desire to be up-to-date in the field of specialisation, maintaining professional competence, self-satisfaction and achieving the desired result in work (in that order). In consistency with the high ranked motives and purposes of seeking information, the requirements of S&T news and basic S&T information have ranked high for the space technologists. In addition, the space technologists seek more of theoretical background, experimental results, methods, processes and procedures, product, material, equipment and apparatus information and physical, technical and design data (in that rank order) than state-of-the-art, review literature, standard and patent specifications.

Engels et al [11], while studying the information seeking behavior and of engineering faculty in academic environments point out that, that electronic access to current and archived scholarly journals and Internet resources are important to meeting their research and information needs. Similar to their engineering colleagues in the corporate environment who rely on coworkers as trusted information sources, academic engineering faculty also rely on face-to-face discussion with their students and colleagues to help with their research and teaching. Faculty in all disciplines increasingly relies on electronic resources for their research and teaching. The study verified the trend that "the library's physical edifice and catalog have declined steadily as starting points for research." As a result, faculty are using online services for their discovery path, with the library becoming the 'behind the scenes' procurement agent clearly indicate that electronic access to journals, journal back files, and *even monographs* are important to their research and teaching. The library has a unique opportunity to develop its role as the procurer and curator of the electronic resources that engineering faculty demand. The library should act as procurement agents and organizers of access to electronic resources that will continue to serve the needs of engineers within their universities.

Khan et al., [12], in their findings note that the faculty seeks information for lecture preparation, improvement of their personal competencies and current awareness. They mostly use books and monographs for seeking formal information,. Also, they frequently use discussion methods of face-to-face with colleagues and friends as an information source of information. They also acquire information resources from their institutional library. Major obstacles while seeking information is lack of computer hardware and software. Google is mostly used as the search engine by them. Also, most of them have not received any formal training or orientation for using the online information resources.

Marouf et al, [13], in their study found that the respondents heavily depend on books and journals for teaching and on a larger variety of materials for research purposes. Their use of informal sources is comparatively less than formal sources. Journals and books are considered the most important sources to meet their needs. Among the informal sources, conferences, subject experts, and colleagues are given higher importance than librarians and government officials. Journals and books are used more frequently than raw data, technical reports, and manuscripts and primary materials. Their satisfaction level with all the sources is positive but higher for journals and books. Also, the level of satisfaction with informal sources is slightly higher than formal sources.

Kwasitsu, L., [14], in his study points out that that the educational level and the work role of an engineer will significantly influence that individual's information seeking behavior. The results show that the higher the level of education and occupational responsibility, the lower the dependency on internal sources of information (e.g. personal memory, colleagues, personal files.) The research additionally shows a strong relationship between those factors and a higher use of libraries as a source for quality information. The research also confirmed previous findings that accessibility and availability were of high value to all respondents (engineers) regardless of these factors. Sadly, in the study, corporate librarians were rated as the "least important sources for information."

Von Seggern, et al., [15], in his findings on the technical communications in science and engineering says that, that while engineers and scientists both place a high value on the importance of technical information, the previous research findings hold true in that their information usage patterns and behaviors are different (e.g. scientists use libraries much more frequently than engineers do.)

Anderson, et al., [16], in their study point out that that engineers prefer the accessibility of information versus the quality of it, and that using internal and personal communication channels are the preferred methods for obtaining it.

Fidel, et al., [17], investigates the complex aspect of accessibility in relation to the information seeking habits of engineers. From the results the authors attempt to clarify the distinction between "ease of use" and "ease of access." The research comprised interviews with the engineers as well as

analyses of the journals the engineers kept during this study. The article concludes that it is not enough to simply know that accessibility is an important factor in an engineer's selection of an information resource. It is necessary to understand the specific factors that influence the engineers' preference for one resource over another, in order to improve the design of information systems and services.

NATIONAL AEROSPACE LABORATORIES, BANGALORE AND ALLIED AEROSPACE ORGANIZATIONS IN BANGALORE

The Scope Of The Present Study

The city of Bangalore, Karnataka is considered the 'Aerospace Hub' of the country with many key aerospace organizations which have already been established several years ago like

- The Hindustan Aeronautics Limited (HAL),
- The National Aerospace Laboratories (NAL),
- The Aeronautical Development Establishment (ADE),
- The Indian Space Research Organization (ISRO),
- The Aeronautical Development Agency (ADA).

It also comprises many key Indian Air Force establishments like

a. Air Force Systems and Testing Establishment (ASTE),
b. Air Force Technical College (AFTC) and
c. The Institute of Aviation Medicine (IAM).

In a nutshell, many of these organizations come under the broad umbrella of

(i) Council of Scientific and Industrial Research (CSIR),
(ii) Defense Research and Development Organizations (DRDO),
(iii) The Indian Air Force (IAF),
(iv) Educational Institutions like IISc, and
(v) Major public sector undertakings and
(vi) The Department of Space.

All of them in their own way have significantly contributed to a large number of Indian aerospace programmes. The National Aerospace Laboratories is India's premier civil aviation R&D aerospace research organization in the country. Its main mandate is the 'Development of aerospace technologies with strong science content and with a view on 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'. 'Technology' would be its core engine-driver for the future. NAL is also best known for its main sophisticated aerospace R&D testing facilities which are not only unique for this country but also comparable to similar facilities elsewhere in the world.

OBJECTIVES OF THE STUDY

- To determine the types of electronic information resources, information requirements of the aerospace scientists and engineers.
- To ascertain the patterns of use of electronic information resources (more specifically, Aerospace Monographs) by the aerospace scientists and engineers of Bangalore.
- To ascertain whether the percentage of preference of the Use Patterns of 'Aerospace Monographs' by the aerospace engineers and scientists are approximately the same.
- To study whether there exists similar patterns (homogeneous) of use of 'Aerospace Monographs' amongst these aerospace scientists and engineers of the 16 aerospace organizations in Bangalore.

NULL HYPOTHESIS

There is no significant difference in the mean scores of 'Aerospace Monographs' amongst the aerospace scientists and engineers of the selected 16 aerospace organizations of Bangalore.

SAMPLE SELECTION

The present study is restricted to the selected 16 prominent aerospace organizations in Bangalore. A total number of 650 survey questionnaires were distributed amongst the aerospace scientists and engineers belonging to these 16 aerospace organizations. A total number of 612 questionnaires were received back finally 583 (89.7%) were selected for the study which were found suitable for the study.

METHODOLOGY

A survey questionnaire has been used to conduct this research study. The total population size of this research study is restricted to the 1220 aerospace scientists and engineers in Bangalore. The distribution of Source Data is indicated in *Table 1*. Random sampling technique has been used for selection of the sample size.

A structured questionnaire was circulated amongst the 650 (total sample size) scientists and engineers belonging to the 16 prominent aerospace organizations were selected for the study. Out of which, 612 filled-in questionnaires were received, and, finally, 583 (89.7%) usable questionnaires were selected for the study

Various statistical tests like calculating the arithmetic mean, Co-efficient of Variation (CV), generating the P-value tests for obtaining the probability of a test statistic, Analysis of Variance (ANOVA) tests for comparing whether the arithmetic means of several groups are all equal etc., were deployed on the data using the SPSS package. The responses received were tabulated using the SPSS package. The frequency of usage of Aerospace Monographs by the Aerospace Scientists and Enigneers of Bangalore is indicated in *Table – 2.* The frequency of usage of Aerospace Monographs was tabulate on a scale of 0 – 4, with 0 indicating 'Never' and 4 indicating 'Daily.

FINDINGS

Summary of Total Scores on Frequency of Usage of Aerospace Monographs for Scientific Research

The summary of total scores obtained with regard to 'Frequency of Usage of Aerospace Monographs' is as follows:

The highest mean score of 0.48(199.59) is accrued by the respondents of 'American Institute of Aeronautics and Astronautics – AIAA'. This is followed by a mean score of 0.44(CV=208.09) by the respondents of 'NASA History Series Publications'. The next highest mean score of 0.33(CV=283.29) is projected by the respondents of 'Any Other'. 'NASA Dryden History Monographs Aerospace' reflects itself with a mean score of 0.32(239.28). This is followed by a mean score of 0.30(CV=265.14) reflected by the respondents of 'NASA's Origin and the Dawn of the Space Age'. 'LS Monographs: Aeronautics, Aeroacoustics' presents itself with the mean score of 0.26(CV=288.73). This is followed by similar mean scores of 0.25 each accrued by the respondents of 'Monographs in Aerospace History and Series'(CV=280.89) and by the 'Aerospace Projects Review'(CV=279.35) respectively. The next highest mean score of 0.24(CV=287.51) is portrayed by the respondents of 'The Aerospace Press / Corporation'. This is followed by a mean score of 0.23(CV=311.99) reflected by the respondents of 'Enhanced Rendezvous'. The lowest mean score of 0.22 each is accrued by the respondents of 'RAND: Monograph / Reports / Aerospace'(CV=302.62) and 'US Government Bookstore: Monographs in Aerospace and History'(CV=295.69).

Analysis of Variance (ANOVA) was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the aerospace organizations for 'Frequency of Usage of Aerospace Monographs'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., ''Monographs in Aerospace History and Series (http://klabs.org/history/monographs/monographs.htm)', 'LS Monographs: Aeronautics, Aeroacoustics', 'NASA History Series Publications (http://history.nasa.gov/series95.html)', , 'RAND: Monograph/Reports Aerospace (http://www.rand.org/pubs/monograph_reports/MR1187/', 'US Government Bookstore: Monographs in Aerospace History (http://bookstore.gpo.gov/subjects/sb-222.jsp)', The Aerospace Press / Corporation: (http://www.aero.org/education/tai/index.html)', 'Aerospace Projects Review: (http://www.up-ship.com/apr/apr.htm)', 'Enchanted Rendezvous (history.nasa.gov/monograph4/foreword.htm)', *except for* 'American Institute of Aeronautics and Astronautics (AIAA) –The Aerospace (http://www.aiaa.org/content.cfm?pageid=174), (P=0.078)', 'NASA Dryden History Monographs Aerospace (http://cgi.ebay.com/Nasa-Dryden-History- Monographs-Aerospace), (P=0.055)', 'NASA's Origin and the Dawn of the Space Age (http://en.wikisource.org/wiki/NASA's_Origins_and_the_Dawn_of_the_Space_Age)' and 'Any other'.

FINDING AEROSPACE RESOURCES ON THE INTERNET

There are a larger number of web resources on Aerospace Monographs. Few of the selected resources which the authors felt would be of useful and ready reference to the aerospace scientists and engineers are listed below, *Table 3*. These web resources offer searching capabilities, access to full-text, ftp access and on-line ordering.

CONCLUSIONS

The main conclusions that we would like to draw from this study are:

- Aerospace Monographs constitute a major source of scientific and technical information to the aerospace scientists and engineers.
- Analysis of Variance (ANOVA) was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the aerospace organizations for 'Frequency of Usage of Aerospace Monographs'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores except for 'American Institute of Aeronautics and Astronautics (AIAA)– The Aerospace (http://www.aiaa.org/content.cfm?pageid=174), (P=0.078)', 'NASA Dryden History Monographs Aerospace (http://cgi.ebay.com/Nasa- Dryden-History Monographs-Aerospace), (P=0.055)', 'NASA's Origin and the Dawn of the Space Age (http://en.wikisource.org/wiki/NASA's_Origins_and_the_Dawn_of_the_Space_Age)' and 'Any other'.
- This also implies that, the percentage of preference of the Use Patterns of 'Aerospace Monographs' by the aerospace engineers and scientists are not approximately the same, except for 'American Institute of Aeronautics and Astronautics (AIAA)– The Aerospace (http://www.aiaa.org/content.cfm?pageid=174), (P=0.078)', 'NASA Dryden History Monographs Aerospace (http://cgi.ebay.com/Nasa-Dryden-History-Monographs- Aerospace), (P=0.055)', 'NASA's Origin and the Dawn of the Space Age (http://en.wikisource.org/wiki/NASA's_Origins_and_the_Dawn_of_the_Space_Age)' and 'Any other'.
- The study also reveals that there is heterogeneity in the Use Patterns of 'Aerospace Monographs', except for 'American Institute of Aeronautics and Astronautics (AIAA)–The Aerospace (http://www.aiaa.org/content.cfm?pageid=174), (P=0.078)', 'NASA Dryden History Monographs Aerospace (http://cgi.ebay.com/Nasa-Dryden-History-Monographs-Aerospace), (P=0.055)', 'NASA's Origin and the Dawn of the Space Age (http://en.wikisource.org/wiki/NASA's_Origins_and_the_Dawn_of_the_Space_Age)' and 'Any other' amongst the aerospace scientists and engineers of the selected 16 aerospace organizations of Bangalore.

ACKNOWLEDGEMENTS

The authors would like to express their deep gratitude and thankfulness to Mr. Shyam Chetty, Acting Director, CSIR-NAL, Bangalore for his overwhelming support and encouragement in facilitating easy access and strongly advocating use of electronic information resources for

aerospace research at NAL. The authors are also immensely grateful to him for according his kind approval to publish this paper. Dr. P. Marimuthu, Associate Professor and (co-author), Dept. of Bio-Statistics, National Institute of Mental Health and Neuro Sciences (NIMHANS), has spared his most valuable time in giving his expert statistical guidance in the interpretation of the data.

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Table-1: Distribution of Source Data

Sl.No.	Organizations	No. of Questionnaires distributed	No. of Questionnaires received	No. of usable questionnaires usable
1.	ADA	67	63	58
2.	AFTC	19	16	15
3.	ADE	14	12	12
4.	ASTE	33	30	29
5.	CABS	16	15	14
6.	CEMILAC	33	30	29
7.	C-MMACS	8	6	6
8.	DARE	11	9	9
9.	LRDE	5	3	2
10.	GTRE	24	22	21
11.	HAL	144	140	134
12.	IAM	40	36	33
13.	ISRO-ISTRAC	25	24	22
14.	IISc	38	37	34
15.	JNCASR	5	3	1
16.	NAL	168	166	164
Total		650	612	583 (89.7%)

Key: ADA=Aeronautical Development Agency,
AFTC=Air Force Technical College,
ADE=Aeronautical Development Establishment,
ASTE=Aircraft Systems Testing Establishment,
CABS=Centre for Airborne Systems,
CEMILAC=Centre for Military Airworthiness and Certification,
C-MMACS=Centre for Mathematical Modeling and Computer Simulation,
DARE=Defense Avionics Research Establishment,
LRDE=Electronics and Radar Development Establishment,
GTRE=Gas Turbine Research Establishment,
HAL=Hindustan Aeronautics Limited,
IAM=Institute of Aerospace Medicine,
ISRO-ISTRAC=Indian Space Research Organization,
IISc=Indian Institute of Science,
JNCASR=Jawaharlal Nehru Centre for Advanced Scientific Research,
NAL=National Aerospace Laboratories.

Table-2: Frequency of Usage of Aerospace Monographs

SN	Organizations	Mean and CV	Frequency of Usage											
			Monographs in Aerospace History and Series	LS Monographs: AeronauticsAeroacoustics	NASA History Series Publications	AIAA	NASA Dryden History Monographs Aerospace	RAND: Monograph / Reports / Aerospace	US Government Bookstore: Monographs in Aerospace History	The Aerospace Press / Corporation	Aerospace Projects Review	NASA's Origin and the Dawn of the Space Age	Enhanced Rendezvous	Any other
1	ADA	Mean	0.16	0.14	0.38	0.40	0.41	0.29	0.22	0.22	0.21	0.43	0.22	0.48
		CV	358.14	344.86	230.72	231.12	226.50	271.20	290.02	277.72	296.96	242.40	334.74	246.14
2	AFTC	Mean	0.60	0.33	0.20	0.20	0.33	0.33	0.47	0.67	0.73	0.40	0.27	0.40
		CV	186.87	217.12	207.02	280.31	185.16	217.12	196.17	193.65	166.75	227.56	222.61	207.02
3	ADE	Mean	0.58	0.75	1.00	0.75	0.75	0.58	0.42	0.58	0.75	0.42	0.50	0.33
		CV	212.59	162.06	112.82	128.71	128.71	154.34	216.08	154.34	100.50	160.45	200.00	195.40
4	ASTE	Mean	0.00	0.00	0.07	0.07	0.10	0.03	0.03	0.17	0.00	0.10	0.07	0.21
		CV	0.00	0.00	538.52	538.52	395.61	538.52	538.52	381.88	0.00	538.52	538.52	395.61
5	CABS	Mean	0.29	0.21	0.29	0.21	0.21	0.14	0.21	0.21	0.29	0.29	0.14	0.36
		CV	374.17	374.17	213.94	198.71	270.17	254.20	270.17	374.17	374.17	288.90	374.17	302.91
6	CEMILAC	Mean	0.41	0.34	0.93	0.62	0.34	0.24	0.48	0.31	0.21	0.45	0.55	0.48
		CV	199.25	260.26	159.65	208.35	302.93	344.05	245.22	229.52	373.93	227.70	230.22	225.70
7	C-MMACS	Mean	0.00	0.67	0.67	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		CV	0.00	244.95	244.95	167.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	DARE	Mean	1.11	1.00	1.11	1.22	1.22	1.22	1.22	1.33	1.11	1.00	1.33	1.44
		CV	105.00	122.47	105.00	106.50	106.50	106.50	106.50	106.07	114.24	132.29	106.07	98.58
9	LRDE	Mean	0.50	0.50	1.00	1.00	1.00	0.50	0.50	0.50	0.50	0.00	0.00	0.00
		CV	141.42	141.42	141.42	141.42	141.42	141.42	141.42	141.42	141.42	0.00	0.00	0.00
10	GTRE	Mean	0.14	0.29	0.24	0.48	0.24	0.19	0.19	0.19	0.33	0.33	0.05	0.24
		CV	334.66	274.32	262.45	170.85	183.30	315.83	356.81	315.83	238.75	289.83	458.26	322.74
11	HAL	Mean	0.28	0.29	0.43	0.37	0.28	0.21	0.21	0.25	0.28	0.30	0.25	0.34
		CV	254.40	262.53	224.00	224.52	252.76	321.84	299.67	283.59	275.18	259.91	315.76	285.07
12	IAM	Mean	0.33	0.33	0.61	0.39	0.27	0.42	0.39	0.45	0.36	0.61	0.36	0.27
		CV	244.95	266.93	184.20	219.28	247.21	243.19	245.29	246.53	246.14	197.57	255.56	293.80
13	ISRO-ISTRAC	Mean	0.00	0.00	0.36	0.50	0.32	0.14	0.09	0.09	0.00	0.27	0.00	0.18
		CV	0.00	0.00	248.09	202.37	263.60	342.88	469.04	469.04	0.00	323.67	0.00	469.04
14	IISc	Mean	0.18	0.12	0.24	0.71	0.24	0.09	0.09	0.09	0.15	0.09	0.09	0.09
		CV	326.29	456.77	257.54	165.54	257.54	429.31	429.31	429.31	340.30	429.31	429.31	429.31
15	JNCASR	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		CV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	NAL	Mean	0.23	0.24	0.45	0.56	0.31	0.16	0.15	0.15	0.19	0.21	0.19	0.29
		CV	295.92	294.75	184.98	176.83	235.12	338.27	296.01	321.66	278.40	268.52	302.06	300.34
Mean Scores of Frequency of Use of Aerospace Monographs		Mean	0.25	0.26	0.44	0.48	0.32	0.22	0.22	0.24	0.25	0.30	0.23	0.33
		CV	280.89	288.73	208.09	199.59	239.28	302.62	295.69	287.51	279.35	265.14	311.99	283.29
P Values			0.007	0.028	0.013	0.078	0.055	0.003	0.001	0.000	0.001	0.102	0.001	0.143

Table 3: Selective Web Resources of Core Aerospace Engineering Monographs

A E R O S P A C E MONOGRAPHS: SELECTED WEB RESOURCES

1. **http://klabs.org/history/monographs/monographs.htm**: NASA Office of Logic Design

Toward a History of the Space Shuttle: An Annotated Bibliography (Washington, D.C.: Monographs in Aerospace History No. 1, 1992). Compiled by Roger D. Launius and Aaron K. Gillette. Out of Print. This monograph provides detailed bibliographical information about the origins, development, and operation of the Space Shuttle. In the United States, detailed proposals for a reusable space vehicle were developed as early as the 1950s, and several projects reached the design and test stage in the 1960s. When actually built and flown in the 1970s and 1980s, the Space Shuttle became the cornerstone of the U.S. space exploration program. Throughout the long history of the Space Shuttle concept, numerous books, studies, reports, and articles have been written. This selective, annotated bibliography discusses those works judged to be most essential for researchers writing scholarly studies on the Space Shuttle's history. Along with a summary of the contents of each item, judgments have been made on the quality, originality, or importance of some of these publications.

An Annotated Bibliography of the Apollo Program (Washington, D.C.: Monographs in Aerospace History, No. 2, 1994). Compiled by Roger D. Launius and J.D. Hunley. Paperback. Commemorating the twenty-fifth anniversary of the Apollo 11 lunar landing, this small study contains a detailed listing and analysis of publications relating to Apollo program. Not technical in nature, this bibliography emphasizes the historical evolution of the effort to land Americans on the Moon during the 1960s and early 1970s.

Apollo: A Retrospective Analysis (Washington, D.C.: Monographs in Aerospace History, No. 3, 1994). By Roger D. Launius. Paperback. Commemorating the twenty-fifth anniversary of the Apollo 11 lunar landing, this small study analyzes the progress of Apollo during the 1960s and early 1970s.

Enchanted Rendezvous: John C. Houbolt and the Genesis of the Lunar-Orbit Rendezvous Concept (Monographs in Aerospace History, No. 4, 1995). By James R. Hansen.

Hugh L. Dryden's Careeer in Aviation and Space (Washington, D.C.: Monographs in Aerospace History, No. 5, 1996). By Michael H. Gorn. Paperback. This fascinating biography of Hugh Dryden covers his early years as a child prodigy, his work during World War II, his time at the NACA, and his dedicated service to NASA. It is the basis for a full-length biography that will be published by the Smithsonian Institution Press in 1998.
Women in Flight Research (Monograph in Aerospace History, No. 6). Written by by Sheryll Goecke Powers, this not only provides much information about women involved in (especially early) flight research at what became the Dryden Flight Research Center but also a lot of details about how data was recovered from research flights and about the early history of the Center.

Walking to Olympus: An EVA Chronology (Monograph in Aerospace History No. 7, 1997).Written by David S.F. Portree and Robert C. Trevino. This monograph is also available as a 3.5MB pdf file.

Legislative Origins of the National Aeronautics and Space Act of 1958: Proceedings of an Oral History Workshop (Monographs in Aerospace History, No. 8, 1998), John M. Logsdon, moderator. This monograph is available on-line in a text-only pdf file or a large (8 MB) pdf file with graphics.

U.S. Human Spaceflight, A Record of Achievement, 1961-1998 (Monograph in Aerospace History, No. 9). Compiled by Judy A. Rumerman, this monograph contains very useful summaries of each U.S. piloted spaceflight mission as well as overviews of NASA's major human spaceflight programs.

NASA's Origins and the Dawn of the Space Age (Monograph in Aerospace History, No.10). This monograph contains a narrative written by David S. F. Portree that covers the circumstances surrounding Sputnik, the International Geophysical Year, the birth of NASA, and the beginnings of the space race between the U.S. and the U.S.S.R. It also includes a useful chronology of events and reproduces nine key documents.

Together in Orbit: The Origins of International Cooperation in the Space Station, John M. Logsdon, 1998. Monograph in Aerospace History, No. 11. NP-1998-10-244-HQ.

Journey in Aeronautical Research: A Career at NASA Langley Research Center, Phillips, W. Hewitt, 1998. Monograph in Aerospace History, No. 12.

A History of Suction-Type Laminar-Flow Control with Emphasis on Flight Research(Monograph in Aerospace History, No. 13, 1999). *B*y Albert L. Braslow.

Managing the Moon Program: Lessons Learned From Project Apollo (Monographs in Aerospace History, No. 14, 1999). Moderator John M. Logsdon. Participants: Howard W. Tindall, George E. Mueller, Owen W. Morris, Maxime A. Faget, Robert A. Gilruth, and Christopher C. Kraft.

The Difficult Road to Mars: A Brief History of Mars Exploration in the Soviet Union, V.G. Perminov, *1999.* Monograph in Aerospace History, No. 15.

*Touchdown: The Development of Propulsion Controlled Aircraft at NASA Dryden (*Monograph in Aerospace History, No. 16, 1999). By Tom Tucker.

The History of the XV-15 Tilt Rotor Research Aircraft: From Concept to Flight, Martin Maisel, Giulanetti, Demo J., and Dugan, Daniel C., 2000. Monograph in Aerospace History, No. 17, NASA SP-2000-4517.

Hypersonics Before the Shuttle: A Concise History of the X-15 Research Airplane, Dennis R. Jenkins, 2000. Monograph in Aerospace History, No. 18, NASA SP-2000-4518.

Partners in Freedom: Contributions of the Langley Research Center to U.S. Military Aircraft of the 1990s, Joseph R. Chambers, 2000. Monograph in Aerospace History, No. 19, NASA SP-2000-4519.

Black Magic and Gremlins: Analog Flight Simulations at NASA's Flight Research Center, Gene L. Waltman, 2000. Monograph in Aerospace History, No. 20, NASA SP-2000-4520.

Humans to Mars: Fifty Years of Mission Planning, 1950-2000, David S.F. Portree, 2001. Monograph in Aerospace History, No. 21, NASA SP-2001-4521.

Flight Research: Problems Encountered and What they Should Teach Us, Thompson, Milton O. with J.D. Hunley, 2001. Monograph in Aerospace History, No. 22, NASA SP-2001-4522.

The Eclipse Project, Tom Tucker 2001. Monograph in Aerospace History, No. 23, NASA SP-2001-4523.

Deep Space Chronicle: a Chronology of Deep Space and Planetary Probes, 1958-2000 (Monograph in Aerospace History, No. 24). By Asif A. Siddiqi. This monograph is an excellent reference to the various deep space spacecraft that have been launched by the U.S., Soviet Union/Russia, and other countries since the beginning of the space age. The on-line version is set up with fully text searchable pdf files.

Mach 3+: NASA/USAF YF-12 Flight Research, 1969-1979, Peter W. Merlin, 2001. Monographs in Aerospace History, No. 25, NASA SP-2001-4525).

Memoirs of an Aeronautical Engineer: Flight Tests at Ames Research Center: 1940-1970, Seth B. Anderson, 2002. Monographs in Aerospace History, No. 26, SP-2002-4526.

Wilbur and Orville Wright: A Bibliography Commemorating the One-Hundredth Anniversary of the First Powered Flight on December 17, 1903, Renstrom, Arthur G. Renstrom, 2002. Monographs in Aerospace

History, No. 27, SP-2002-4527.

Concept to Reality: Contributions of the NASA Langley Research Center to U.S. Civil Aircraft of the 1990s. , Joseph R. Chambers*, 2003.* Monograph in Aerospace History, No. 29, SP-2003-4529.

The Spoken Word: Recollections of Dryden History, The Early Years, Curtis, Peebles, 2003. Monographs in Aerospace History, No. 30, SP-2003-4530.

American X-Vehicles: An Inventory- X-1 to X-50, Dennis R. Jenkins, Tony Landis, and Jay Miller, 2003. Monographs in Aerospace History, No. 31, SP-2003-4531.

Wilbur and Orville Wright: A Chronology Commemorating the One-Hundredth Anniversary of the First Powered Flight on December 17, 1903, Arthur G. Renstrom, 2002. Monograph in Aerospace History, No. 32, SP-2003-4532.

NASA's Nuclear Frontier: The Plum Brook Research Reactor, Mark D. Bowles and Robert S. Arrighi, *2003.* Monographs in Aerospace History, No. 33, SP-2004-4533.

Low Cost Innovation in Spaceflight: The History of the Near Earth Asteroid Rendezvous (NEAR) Mission, Howard E. McCurdy, 2005. Monographs in Aerospace History No. 36, SP-2005-4536.

PROJECT APOLLO The Tough Decisions, Robert C. Seamans, Jr., 2005. Monographs in Aerospace History No. 37, SP-2005-4537.

NASA and the Environment: The Case of Ozone Depletion, W. Henry, Lambright, 2005. Monographs in Aerospace History No. 38, NASA SP-2005-4538.

PROJECT APOLLO The Tough Decisions, Robert C. Seamans, Jr., 2005. Monographs in Aerospace History No. 37, SP-2005-4537.

2. http://www.aero.org/education/tai/index.html

   The Aerospace Press, the publishing arm of the corporation, publishes books and monographs on critical technical topics in aerospace science and technology. As copublisher, the American Institute of Aeronautics and Astronautics (AIAA) prints and markets the books.

3. http://www.signalcharlie.net/Aviation+Pathfinder
   This pathfinder is designed to help academic library users locate general sources of information on the subject of aviation, as well as more narrow resources on the subject. Materials are evaluated for currency, authoritativeness, relevance, scope and usefulness. Pathfinder resources will include indexes and abstracts, subject encyclopedias, databases, directories, dictionaries, almanacs, handbooks, biographical resources, bibliographies, association information, journals, government regulations and web resources. Also included will be information on creating successful search strategies and custom search engines that focus on aviation resources.

4. http://klabs.org/history/monographs/no_37/monograph37.pdf
   Project Apollo-The Tough Decisions

5. http://www.nasa.gov/pdf/621513main_RocketsPeopleVolume4-ebook.pdf
   Rockets and People: The Moon Race, Vol.IV

6. http://search.nasa.gov/search/search.jsp?nasaInclude=monographs

   Monographs related to NASA’s path-breaking efforts in Space Science

7. **http://history.nasa.gov/program.html**

The NASA History Program was first established in 1959 (a year after NASA itself was formed) and has continued to document and preserve the agency's remarkable history through a variety of products. Dr. Roger D. Launius, former NASA Chief Historian, wrote an excellent historiographic article about the history of the NASA History Division itself.

8. http://history.nasa.gov/series95.html#monographs

Monographs in Aerospace History

9. http://www.librarything.com/series/Monographs+in+Aerospace+History
Series: Monographs in Aerospace History

10. https://catalyst.library.jhu.edu/?f[series_facet][]=Monographs+in+aerospace+history&q=Aeronautics+Flights&search_field=subject

Monographs in Aerospace History

11. http://www12.zippyshare.com/v/36329563/file.html

Apollo - A Retrospective Analysis (Monographs in Aerospace History) PDF.pdf

12. http://history.nasa.gov/Apollomon/Apollo.html

Project Apollo: A Retrospective Analysis

13. http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.192.1243

Monographs in Aerospace History: Series 7

14. http://www4.uwm.edu/libraries/special/exhibits/hardie/hardie_digital/index.cfm

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15. http://www.centennialofflight.gov/essay/ Social/SH-OV2.htm

U.S. Centennial of Flight Commission. The Social and Cultural History of Aviation and Spaceflight