TECHNICAL NOTE

PATTERNS OF USE OF AEROSPACE ENGINEERING E-TECHNICAL REPORTS BY THE INDIAN AEROSPACE SCIENTISTS AND ENGINEERS IN BANGALORE: A RESEARCH SURVEY

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Abstract

A large number of aerospace e-technical reports are frequently referred by the aerospace scientists and engineers for their day to day research work. A survey study was undertaken to ascertain the most frequently used aerospace e-technical reports amongst 16 selected aerospace organizations of Bangalore. The study is restricted to 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 were selected for the study. The total responses usable from all the 16 aerospace organizations amounted to 89.7 percent. The analysis is based purely on the responses received from the aerospace scientists and engineers representing these selected aerospace organizations. The responses from the participants towards the extent of use of the e-technical reports were graded on a scale of 4 to 0, 4 representing to a great extent. The major findings that the authors would like to report in this paper are: The most frequently referred aerospace engineering e-technical reports by these scientists and engineers are: (a) 'USA, NASA', followed by, (b) 'USA, AIAA', (c) 'Indian NAL', (d) 'AGARD', (e) 'British ARC and RAE', (f) 'ESA', (g) 'French ONERA', (h) 'German DFVLR, DLR and MBB', (i) 'Dutch NLR', (j) 'Russian TaAGI', and, finally, (k) 'Japanese NAL'. Analysis of Variance (ANOVA) was applied for testing the significant difference among the mean scores attained from 16 aerospace organizations towards the 'Use of e-Technical Reports'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'AGARD', 'British ARC and RAE', 'ESA', 'Indian NAL', 'German DFVLR', DLR and MBB', 'Japanese NAL', 'Russian TaAGI', 'Dutch NLR', 'USA, NASA' and 'USA, AIAA', except for 'French ONERA' ($P = 0.092$).

***Key Words**: Patterns of Use, e-Technical Reports, Aerospace Scientists and Engineers, Aerospace Organizations, City of Bangalore*

Introduction

A technical report (also: scientific report) is a document that describes the process, progress, or results of technical or scientific research or the state of a research problem[1, 2]. It might also include recommendations and conclusions of the research. Unlike other scientific literature, such as scientific journal articles and the proceedings of some academic/scientific conferences, technical reports rarely undergo comprehensive independent peer review before publication. Where there is a review process, it is often limited to within the originating organization. Similarly, there are no formal publishing procedures for such reports, except where established locally. Technical reports are today a major source of scientific and technical information. They are prepared for internal or wider distribution by many organizations, most of which lack the extensive editing and printing facilities of commercial publishers. Technical reports are often prepared for sponsors of research projects. Another case where a technical report may be produced is when more information is generated for an academic paper than is acceptable or feasible to publish in a peer-reviewed publication; examples of this include in-depth experimental details, additional results, or the architecture of a computer model.

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Technical reports are now commonly published electronically, whether on the Internet or on the originating organization's intranet. Many organizations collect their technical reports into a formal series. Reports are then assigned an identifier (report number, volume number) and share a common cover-page layout. The entire series might be uniquely identified by an ISSN.

Patterns of Use of Electronic Information Resources by Scientists and Engineers

During the late 1980's and the early 1990's many new information technologies emerged that revolutionized the way in which people searched for and gathered information, Gleeson [3]. Curtis, Weller and Hurd [4] opine that between 1994 and 1996 there was a profound shift in electronic resource usage by scientists. The shift could be attributed to the increase in popularity and usability of the Internet itself as well as the resources it contained. Electronic information resources are obviously an upcoming and endearing activity among all the scientists and engineers irrespective of their disciplines and work environment. Several studies conducted reveal that the use of e-resources has improved the quality of research work and inspired new ideas. About 60 percent of the researchers feel that the use of electronic information resources has made it easier to keep up-to-date with the developments in their field, and greatly saved their working time.

Technical reports describe the progress or results of scientific or technical research and development. They are usually produced in response to a specific request or research need, and serve as a report of accountability to the funding organization. Technical reports usually fall into two categories: (a) Government and sponsored research reports and (b) Privately funded research reports. Both categories may include national or international reports by university departments, institutes, private industry, or government agencies and laboratories. Publication and dissemination of technical reports has not been centrally coordinated; therefore, it may be particularly difficult to identify and locate them.

Some of the interesting studies on technical reports are: Michel [5] reports a systematic survey of the information habits and practices of engineers and scientists in the U.S. aerospace industry, under the Knowledge Diffusion Project. According to Bryant [6], technical report literature forms a significant portion of the information that engineers and scientists may find useful. Even so, different disciplines place varying amounts of emphasis on technical report literature. Some subject areas provide good indexes to this material while others may not. Reports prepared at academic institutions may be well indexed within the institution but not generally known outside. Technical reports prepared by, for-profit companies and organizations may be completely proprietary and remain essentially invisible to anyone outside the organization. Bryant [6], also reports a list of resources which offer several ways to search technical reports.

According to Pinelli et al. [7], the U.S. government technical report is a primary means by which the results of federally funded R and D are transferred to the U.S. aerospace industry. However, little is known about this information product in terms of its actual use, importance, and value in the transfer of federally funded R and D. To help establish a body of knowledge, the U.S. government technical report was investigated as part of the NASA/DoD aerospace Knowledge Diffusion Research Project. The authors in their report, summarize the literature on technical reports and provide a model that depicts the transfer of federally funded aerospace R and D via the U.S. government technical report.

Pinelli et al. [8], in a survey of randomly drawn sample of American Institute of Aeronautics and Astronautics (AIAA) members, investigated the relationship between the use of U.S. government technical reports by the U.S. aerospace engineers and scientists.

Swarna et al. [9], in the scientometric analysis of the BARC scientists mention that technical report is one of the media to record the scientific information generated by scientists and engineers. Their results also indicated that the type of documents referenced in the technical reports indicated first rank for journal articles, followed by books, technical reports, conference papers, standards/codes, personal communications, patents, theses, drawings and lectures.

A study made by Walker [10] attempts to determine how and from whom authors of journal articles citing technical reports learned of those reports and how and from whom they obtained copies. An attempt was also made to find out how reports were used in the research reported and what kind and level of use was made of them. The survey questionnaire revealed that 'Colleagues were, as expected, the primary sources of reports and information about reports'. Walker also opines that the librarians can play a 'even greater role' in serving the needs of the

researchers by ensuring the availability of 'technical reports' which are of a 'relatively obscure publication type'.

Identifying Technical Reports Using Indexes and Abstracts

Indexes and abstracts databases from the Stanford Science and Engineering Libraries are a good place to begin to identify technical reports by topic, report number, author, etc [2].

National Technical Information Service (NTIS): NTIS Database covers 1964 to the present. It is the primary resource for accessing U.S. Government sponsored research and worldwide scientific, technical, and engineering information. NTIS is the central source for the sale of unclassified and publicly available information from research reports, journal articles, data files, computer programs and audio visual products from Federal sources. Information is also available from international government departments and other international organizations including those in Canada, Japan, the former Soviet Union, and both Western and Eastern European countries. The database is accessed via EBSCOhost.

Aerospace and High Technology Database: The Aerospace and High Technology database covers 1962 to the present, with about half of the records dated after 1982. As of January 2008 there were 4 million records. The database indexes basic and applied research in aeronautics, astronautics, and space sciences, and also covers technology development and applications in supporting fields such as chemistry, geosciences, physics, communications, and electronics. The main sources are over 3,000 periodicals, conference proceedings, technical reports, trade journal/newsletter items, patents, books, and press releases, but reports by NASA, other U.S. Government agencies, international institutions, universities, and private firms may also be included. Access to the database is via CSA Illumina.

Technical Reports from Stanford: Technical reports owned by the Stanford Libraries are cataloged in Socrates. Many of these reports can be located in Socrates by author, title, and performing organization. Some reports, including NACA, NASA, and AGARD, are only catalogued as a serial such as "NASA Technical Memorandum". In these cases it's best to search under the series name, and limit the search to "periodical title " to see which library owns the report series.The Branner Earth Sciences Library has published a specialized guide to Finding Technical Reports in the Earth Sciences.For additional assistance in locating technical reports owned by Stanford or in obtaining reports not owned, the reference desks at the Engineering, Math/CS, or Earth Sciences Libraries may be contacted.

Technical Reports from University of Virginia Library: Searching for technical reports from the University of Virginia Web Site is fairly simple. The various technical reports resources (largely catering to aerospace engineering) and also other allied engineering disciplines are comprehensively indicated with appropriate hyperlinks to the parent site. There are also interesting click buttons on the web site to find articles, books, web pages, facts, patents, standards, technical reports, dissertations, Government and Military information [6].

Finding Technical Reports on the Internet

There are many technical report sites on the Internet. Many of them offer searching capabilities, access to full-text, ftp access and on-line ordering. Some of the most popular technical report sites on the Internet are listed in Table-1. These technical reports web sites largely cater to the needs of the aerospace engineering community and also other allied engineering disciplines.

Objectives of the Present Study

- To ascertain the patterns of use of e-technical reports by the aerospace scientists and engineers.
- To find the specific patterns to be noticed in the e-technical reports use by these scientists and engineers.
- Whether the use patterns of e-technical reports by the Indian Aerospace Scientists and Engineers are Homogeneous or Heterogeneous in nature.

Sample Selection and Methodology

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

The present study was conducted through a questionnaire survey. It was an initiative of the National Aerospace Laboratories jointly with the University of Mysore as a part of an ongoing doctoral research work for studying the 'patterns of use of electronic information resources'

Table-1 : Important Technical Reports Web Sites

Sl. No.	Nature of the Technical Report Web Site	Description of Contents Available on these Technical Report Web Sites
1	AERADE Reports Archive	The Aerade Reports Archive incorporates more than ten thousand, historically significant, digitised reports from the Aeronautical Research Council (ARC) - the principal agency in Great Britain with a major output of reports on matters aeronautical, which existed from 1909-1979, and published reports until 1980. also included are reports from the US National Advisory Committee for Aeronautics (NACA) - chartered in 1915 and operational from 1917-1958.
2	Army Corps of Engineers Research and Development Center (CRREL)	The results of CRREL's research projects are published in a technical report series covering topics of interest to Civil and Environmental Engineers. As each report is published, it is made available on the Web. Reports from 1995 to date are presented here, as well as older ones.
3	Computer Science Technical Reports at Stanford	Stanford Computer Science Department's Technical Report Electronic Library was part of an ARPA funded project, directed by CNRI, to develop concepts for linking electronic libraries. This server allows you to retrieve and view technical reports from participating institutions and other sources of Computer Science Technical Reports.
4	Contrails - the Wright Air Development Center Collection	This sire is a permanent digital repository for 1000 technical reports issued by the Wright Air Development Center/Wright Air Development Division through-out the 1950's and 1960's as part of the "race for space". the site also pursues the digitization of any government publised resources that contribute to this history, including technical reports published by the Wright Air Development Center, its successors, and other agencies. Sponsored by the Paul V Gavin Library, Illinois Institute of Technology.
5	Defence Technical Information Center (DTIC) Scientific and Technical Information Network (STINET)	DTIC's Tehnical Report collection includes all unclassified, unlimited technical report citations full-text online. The scope of DTIC's collection includes areas normally associated with Defence research; however, since DoD's interests are widespread, the collection also contains information relating to hard sciences such as biological and medical sciences; environmental pollution and control; and the behavioral and social sciences.
6	Department of Energy Information Bridge	The US Department of Energy Information Bridge provides free access to full-text DoE research and development reports and the DOE contractor research and development community in physics, chemistry, materials, biology, environmental sciences, energy technologies, engineering, computer and information science, renewable energy, and other topics. The currentcollection includes reports that have been received and processed since 1995. Legacy documents are added as they become available in electronic format.

Table-1 (Contd) : Important Technical Reports Web Sites		
Sl. No.	**Nature of the Technical Report Web Site**	**Description of Contents Available on these Technical Report Web Sites**
7	E-Print Network	E-Print is a gateway to over 27,850 Websites and databases worldwide, containing over 5 million. e-prints in basic and applied sciences, primarily in physics but also including subject areas such as chemistry, biology and life sciences, material science, nuclear sciences and engineering, energy research, computer and information technologies, and other disciplines of interest to DOE.
8	Energy Citations Database	The Energy Citation Database (ECD) provides free access to over 2.3 million science research cittions from 1948 through the present, with continued grwoth through regular updates. There are over 150,000 electronic documents, primarily from 1994 forward, available via the database. Citations and documents are made publicly available by the US Department of Energy (DOE) and cover topics such as chemistry, physics, materials, environmental science, geology, engineering, mathematics, climatology, oceanography, computer science and related disciplines. It includes citations to report literature, conference papers, Journal articles, books, dissertations, and patents.
9	ENERGY files	Energy files is a metasite of over 500 database and Web sites containing information and resources pertaining to science and technology of interest to the Department of Energy, with and emphasis on the physical sciences.
10	EPA National Service Center for Environmental Publications (NSCEP)	NSCEP was created by the EPA as the Agency's central repository and distribution centre for EPA publications. You can browse the National EPA Publications Catalog, order documents or see what's new.
11	FIREDOC	FIREDOC is a fire research bibliographic database with 70,000 published reports, Journal articles, conference proceedings, books, and audiovisual items. Each reference has complete citation information and there is a direct link from the FIREDOC record to Building and Fire Research Laboratory (BFRL) Publications Online if the item is available. Currently, links exist for BFRL fire research publications from the year 2004.
12	Hewlett-Packard Laboratories Tehnical Reports	Available here are abstracts of HP Labs Technical Reports from 1990 to the present. Also included are some Heritage Tehnical Reports from Digital Equipment Corporation (DEC). Compaq and Tandem. Many full images of reports are also available. If you see a report that does not include the full image, you can request a paper copy from HP Labs Tehnical Reports Department.
13	IBM Research Reports	Searchable index of research reports. Some reports are available for download. Once a technical report is published in either a Journal or Conference proceedings, it is some times replaced with a reference to the external source.

Table-1 (Contd) : Important Technical Reports Web Sites		
Sl. No.	**Nature of the Technical Report Web Site**	**Description of Contents Available on these Technical Report Web Sites**
14	MIT Center for Advanced Nuclear Energy Systems (CANES)	The Center's programs involve the development and application of methods for the design, operation, and regulation of current and advanced nuclear reactors and fuel cycles. CANES provides reports on Nuclear Engineering at MIT since 1990.
15	NACA Digital Library	The National Advisory Committee for Aeronautics (NACA) was the predecessor to NASA. This site provides access to bibliograph citations to all NACA reports from 1921 to 1958, plus the full-text of many reports.
16	NTRS - NASA Technical Reports Server (NTRS)	NTRS provides access to over 1 million aerospace related citations, 90K full-text online documents, and 111K images and videos. NTRS numbers continue to grow over time as new scientific and technical information (STI) is created or funded by NASA. The type of information found in NTRS includes : conference papers, images, journal articles, photos, meeting papers, movies, patents, research reports, and technical videos. Documents published prior to 1959 can be found in the NACA collection, which contains the full text of Technical Notes, and Technical Memoranda from 1917-1958.
17	Networked Computer Science Technical Reference Library (NCSTRL)	A large database of computer science related technical literature.
18	NSCEP/NEPIS - Environmental Protection Agency's Gateyway to Free Digital and Paper Publications	NSCEP/NEPIS is the US Environmental Protection Agency's publications resource for over 26,000 digital titles are available FREE of charge to search and retrieve, download, print and/or order from the National Service Center for Environmental Publications (NSCEP).
19	NTIS - National Technical Information Service	Engineering Village is the premier web-based discovery platform meeting the information needs of the engineering community. By coupling powerful search tools, an intuitive user interface and essential content sources, Engineering Village has become the globally accepted source of choice for engineers, engineering students, researchers and information professionals. Engineering Village provides access to today's most important engineering content through one single interface : (a) Compendex ®, (b) engineering Index Backfile, (c) Inspec ®, (d) Inspec Archive, (e) NTIS, (f) Referex, (g) Patents from USPTO and esp@cenet, (h) Ei Patents (i) EnCompassLIT, (j) EnCompassPAT, (k) GEOBASE, (l) Chimica, (m) CBNB, (n) PaperChem, (o) GeoRef
20	Office of Technology Assessment (OTA) Legacy	The OTA Legacy site includes a complete archive of reports and information about the history and impact of the now-defunct agency. "OTA provided Congressional members and committees with objective and authoritative analysis of the complex scientific and technical issues of the late 20th century".

Table-1 (Contd) : Important Technical Reports Web Sites		
Sl. No.	**Nature of the Technical Report Web Site**	**Description of Contents Available on these Technical Report Web Sites**
21	OpenSIGLE	OpenSIGLE - System for Information on Grey Literature in Europe is your open access to SIGLE bibliographical references of reports and other grey literarue (GL) produced in Europe until 2005. Examples of GL include technical or research reports, doctoral dissertations, some conference papers, some official publications, and other types of grey literature. OpenSIGLE covers pure and applied science and technology, economics, other sciences and humanities.
22	Science. Gov	Science.gov searchers across the web sites of over 50 US government agencies, and many of the resources are full-text.
23	Scitopia.org (Integrating Trusted Science + Technology Research)	Search over 3.5 million documents, plus patents and government data. Leading society publishers spanning 350 years of sci-tech scholarship help you with your queries.
24	STINET (Scientific and Technical Information Network)	The Defense Technical Information Center (DTIC®) has served the information needs of the Defense community for more than 65 years. See below to learn more about DTIC : DTIC, Online Information for the Defense Community, Defense Technical Information Center, Virginia
25	TechXtra	Use TechXtra meta-seraching tool to find articles, key websites, technical reports, books, industry news, job announcements, e-journals, e-prints, thesis and dissertations in Engineering, Mathematics, and Computing.
26	TRAIL : Technical Report Archive and Image Library	Trail is a collaborative project to digitize, archive, and provide persistent and unrestricted access to federal technical reports issued prior to 1975.
27	Virtual Technical Reports Center	a group of institutions which provide either full-text reports, or searchable extended abstracts of their technical reports. This site has links to technical reports, preprints, reprints, disserttions, these, and research reports of all kinds. Some metasites are listed by subject categories, as well as by institution. Supported by the Univ. of Maryland.
28	World Resources Institute	WRI provides the complete text of over 300 reports, papers, and books on environmental issues. Inclues online editions of its flagship publication, World Resources, Many publications are available in Adobe Acrobat format from the Publications Menu.
29	WorldWideScience.Org	This golbal science gateway searches national and international scientific database, providing one-stepsearching of global science sources. It currently searches 15 countries technical reports collections at once.

Table-1 (Contd) : Important Technical Reports Web Sites		
Sl. No.	**Nature of the Technical Report Web Site**	**Description of Contents Available on these Technical Report Web Sites**
30	Quakeline	Quakeline is a freely available bibliographic database developed and maintained by the Information Service of the Multidisciplinary Center for Earthquake Engineering Research (MCEER). It covers earthquakes, earthquake engineering, natural hazard and disaster mitigation, and related topics. Varied publications are featured, including books, journal articles, conference papers, proceedings, technical reports, CDs, slides, and videos. The daatabase is updated on a monthly basis and currently provides content for over 44,900 records.
(Source : Kathleen, G [2], Stanford University Library and O'Bryant, F [6], Unicersity of Virginia Library)		

amongst Aerospace Scientists and Engineers. These were selected from key Indian Aerospace Organizations which have already been established several years ago like

- Hindustan Aeronautics Limited (HAL)
- National Aerospace Laboratories (NAL)
- Aeronautical Development Establishment (ADE)
- Gas Turbine and Research Establishment (GTRE)
- Aeronautical Development Agency (ADA) and
- Indian Space Research Organization (ISRO)

They also comprise many key Indian Air Force establishments like

- Air Force Systems and Testing Establishment (ASTE)
- Air Force Technical College (AFTC) and
- Institute of Aviation Medicine (IAM)

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

- Council of Scientific and Industrial Research (CSIR)
- Defense Research and Development Organization (DRDO)
- Indian Air Force (IAF)
- Educational Institutions like Indian Institute of Science (IISc) and
- Major public sector undertakings

All of them in their own way have significantly contributed to a large number of Indian aerospace programmes, [11]. In the present study, the authors have tried to assess the use patterns of aerospace engineering e-Technical Reports by these scientists and engineers.

Scores were assigned for the responses of the questionnaire. The score ranges from 0-4, indicating that the score of 0 means 'Never Use', 1 means 'Monthly', 2 means 'Fortnightly', 3 means 'Weekly' and finally the score of 4 means 'Daily'. Table-2 shows the format of the questionnaire on a scale of 0 to 4.

Analysis of Usage of Most Popular e-Technical Reports by Aerospace Scientists and Engineers

Aerospace scientists and engineers periodically refer to several popular e-technical reports to keep track of the progress or results of scientific and technical research and development in the field of aerospace engineering.

Table-3 reflects the usage patterns for some of the most popular technical reports by the aerospace scientists and engineers from 16 aerospace organizations in Bangalore, for their research work. The mean scores for the different technical reports usage are reported here.

The most frequently referred and used e-technical reports by the aerospace scientists and engineers from the mean scores obtained and from the CV(Coefficient of Variation) values calculated are as follows: 'USA, NASA' gets the highest mean score of 1.84 (CV=77.72). This is followed by 'USA, AIAA' with a mean score of 1.81 (CV=82.87). The third highest mean score is obtained by

Table-2 : Frequency of Usage of Aerospace Engineering e-Technical Reports						
1.	AGARD	4	3	2	1	0
2.	British ARC and RAE	4	3	2	1	0
3.	ESA	4	3	2	1	0
4.	Indian NAL	4	3	2	1	0
5.	French ONERA	4	3	2	1	0
6.	German DFVLR, DLR and MBB	4	3	2	1	0
7.	Japanese NAL	4	3	2	1	0
8.	Russian TaAGI	4	3	2	1	0
9.	Dutch NLR	4	3	2	1	0
10.	USA, NASA	4	3	2	1	0
11.	USA, AIAA	4	3	2	1	0
4 = to a great extent, 3 = to moderate extent, 2 = to a little extent, 1 = not at all, 0 = cannot say						

Table-3 : Use of e-Technical Reports

SN	Orgn	Mean and CV	AGARD	British ARD and RAE	ESA	Indian NAL	French ONERA	German DFVLR DFR and MBB	Japanese NAL	Russian TaAGI	Dutch NLR	USA, NASA	USA, AIAA
1	ADA	Mean	2.24	1.29	1.26	1.55	0.93	0.79	0.79	0.76	1.03	1.98	2.00
		CV	56.70	89.15	91.27	67.74	100.00	117.72	120.25	113.16	108.74	69.70	72.00
2	AFTC	Mean	0.40	0.27	0.27	0.93	0.27	0.13	0.33	0.20	0.33	0.93	0.67
		CV	227.50	218.52	218.52	154.84	259.26	269.23	272.73	205.00	272.73	143.01	156.72
3	ADE	Mean	2.75	2.00	1.58	2.33	1.33	1.75	1.00	1.33	1.33	3.08	3.00
		CV	41.45	70.50	78.48	45.92	97.74	49.71	74.00	86.47	92.48	25.65	40.33
4	ASTE	Mean	2.24	1.03	0.83	0.66	0.55	0.24	0.17	0.21	0.17	1.76	1.79
		CV	71.43	123.30	132.53	130.30	198.18	241.67	223.53	233.33	276.47	78.41	89.94
5	CABS	Mean	1.00	1.36	0.64	1.64	0.86	0.71	0.50	0.50	0.50	2.21	2.21
		CV	118.00	74.26	115.63	65.59	136.05	139.44	130.00	130.00	152.00	53.85	53.85
6	CEMI-LAC	Mean	1.97	0.97	0.76	1.17	0.97	0.59	0.34	0.69	0.83	1.21	0.86
		CV	83.25	136.08	155.26	116.24	142.27	189.83	252.94	178.26	163.86	117.36	145.35
7	C-MMACS	Mean	0.00	0.00	0.00	1.17	0.17	0.17	0.17	0.17	0.17	0.83	0.17
		CV	0.00	0.00	0.00	125.64	241.18	241.18	241.18	241.18	241.18	140.96	241.18
8	DARE	Mean	1.11	0.89	1.22	1.44	0.89	0.78	1.00	1.11	1.33	1.89	1.33
		CV	105.41	104.49	98.36	86.11	142.70	124.36	132.00	130.63	106.02	67.20	118.80
9	LRDE	Mean	0.00	0.00	2.00	1.00	1.00	2.00	1.50	1.00	1.00	1.50	2.00
		CV	0.00	0.00	141.50	141.00	141.00	141.50	141.33	141.00	141.00	141.33	70.50

Table-3 (Contd) : Use of e-Technical Reports

SN	Orgn	Mean and CV	AGARD	British ARD and RAE	ESA	Indian NAL	French ONERA	German DFVLR DFR and MBB	Japanese NAL	Russian TaAGI	Dutch NLR	USA, NASA	USA, AIAA
10	GTRE	Mean	2.24	1.29	1.26	1.55	0.93	0.79	0.79	0.76	1.03	1.98	2.00
		CV	56.70	89.15	91.27	67.74	100.00	117.72	120.25	113.16	108.74	69.70	72.00
11	HAL	Mean	0.90	0.94	0.91	1.23	0.70	0.84	0.58	0.63	0.65	1.31	1.29
		CV	122.22	112.77	113.19	95.93	138.57	127.38	136.21	133.33	133.85	100.00	103.10
12	IAM	Mean	1.85	0.76	1.03	0.85	0.70	0.73	0.73	0.67	0.64	1.45	1.30
		CV	84.32	135.53	115.53	124.71	131.43	138.36	138.36	147.76	134.38	97.93	116.15
13	ISRO/ ISTRAC	Mean	0.86	1.23	2.14	1.23	0.91	1.32	0.50	0.59	1.32	2.59	3.05
		CV	125.58	93.50	64.95	96.75	112.09	88.64	148.00	144.07	97.73	45.56	27.54
14	IISc	Mean	1.29	0.94	0.97	0.82	0.94	0.76	0.53	0.47	0.76	1.94	2.53
		CV	90.70	97.87	112.37	114.63	107.45	130.26	115.09	119.15	117.11	63.40	56.13
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
		CV	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	1.63	1.11	0.92	2.32	0.99	1.05	0.60	0.59	0.84	2.15	2.09
		CV	83.44	104.50	118.48	53.88	111.11	111,43	133.33	137.29	125.00	67.44	72.73
Mean Score of Extent of Use of e-Reports		Mean	1.51	1.04	0.98	1.55	0.86	0.85	0.57	0.61	0.77	1.84	1.81
		CV	92.72	109.62	115.31	83.87	123.26	127.06	143.86	140.98	133.77	77.72	82.87
P Values			0.000	0.005	0.000	0.000	0.092	0.000	0.023	0.024	0.002	0.000	0.000

'Indian NAL' with a mean score of 1.55 (CV=83.87). This is followed by 'AGARD' with a mean score of 1.51 (CV=92.72). Next comes the 'British ARC and RAE' with mean score of 1.04 (CV=109.62). The next highest mean score is taken by 'ESA' with mean value of 0.98 (CV=115.31). This is closely followed by 'French ON-ERA' with mean score of 0.86 (123.26). The next highest mean score is attained by 'German DFVLR, DLR and MBB' with mean score of 0.85 (CV=127.06). 'Dutch NLR' comes next highest in the mean score aggregating 0.77 (CV=133.77). 'Russian TaAGI' occupies the next highest mean score obtaining a value of 0.61 (CV=140.98). Finally, 'Japanese NA'L comes up with the least mean score of 0.57 and aggregating a CV value of 143.86.

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

Conclusions

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

- e-Technical reports are extremely important to aerospace scientists and engineers.
- For aerospace scientists and engineers, they are a major source of scientific and technical information.
- Analysis of Variance (ANOVA) was applied for testing the significant difference among the mean scores attained from 16 aerospace organizations towards the 'Use of e-Technical Reports'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'AGARD', 'British ARC and RAE', 'ESA', 'Indian NAL', 'German DFVLR, DLR and MBB', 'Japanese NAL', 'Russian TaAGI', 'Dutch NLR', 'USA, NASA' and 'USA, AIAA', except for : 'French ONERA' ($P = 0.092$).
- This implies that the 'Use Patterns' of e-technical reports amongst the selected 16 aerospace organizations are 'Not Uniform', except for 'French ONERA'.
- This also implies that except for 'French ONERA', the use patterns of e-technical reports amongst the aerospace scientists and engineers are 'Heterogeneous' in Nature.

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