

OPEN ACCESS JOURNALS AND ITS USE PATTERNS AMONG THE AEROSPACE SCIENTISTS AND ENGINEERS OF BANGALORE

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ABSTRACT

It is absolutely clear that the use of electronic media to support scholarly scientific communication has undoubtedly been one of the paradigm shifts in the practice of science in this era. In fact, the arrival of e-journals has greatly affected the way a scientist or an engineer seeks this information, acquires it and then uses it effectively. Scientists and engineers in aerospace organizations are currently working on projects which are of strategic importance to this country. These scientists largely depend on rapid collection of information from various 'electronic information resources'. A research survey was undertaken to ascertain the 'Use Patterns of Open Access Journals' amongst the aerospace scientists and engineers of 16 aerospace organizations of Bangalore. The major findings of this study are: 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 Access and Usage of Open Access Journals'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores for, 'ICAST, NAL Gateway of Free Journals', 'Directory of Open Access Journals (DOAJ)', 'General Science', 'Technology and Engineering', 'Earth and Environmental Sciences' and 'Physics and Astronomy'.

KEYWORDS: *Electronic Information Resources, Use Patterns, Aerospace Scientists and Engineers, Open Access Journals, City of Bangalore, 16 Aerospace Organizations of Bangalore.*

I. INTRODUCTION

The Aerospace industry is not a homogenous industry but it consists of several sub industries: the civilian aerospace industry, the defense or military aerospace industry and the space industry. Each of these industries faces a different industrial structure, a different innovation system and faces different major challenges. In a nutshell, the aircraft industry can be described as a multi-technology sector.

In fact, the Aerospace sector is highly R&D intensive and levels of competition are high. Knowledge production in the Aerospace industry is paramount. It is not only a high-tech industry but also a powerful driver of innovation in the economy as a whole. These Aerospace companies consider forecasting technology and markets and in-house R&D capacities as the most important innovation drivers of the sector, [22].

In this information explosion age, it is practically impossible for an aerospace scientist or engineer to carry out his research work without embracing the network and internet technologies. These scientists and engineers greatly depend upon these electronic innovation tools for accessing electronic information resources in the form of e-journals related to aerospace engineering right at their desktops. In fact, many of the scientists in today's R&D organizations have the unique privilege of downloading full-text e-journals right at their desktops through their organization's e-conglomerate. For a research scientist today, with access to the Internet, working across continents and in different time zones and keeping in touch with his peers has indeed become a reality due to the exponential

growth of the telecommunication infrastructure the world has witnessed. Most surprisingly, all this knowledge acquirement happens with very marginal costs of communication. It is very clear that the World Wide Web has largely facilitated and propelled the emergence of these electronic information resources.

With reference to this research survey, Open Access Journals are defined as scholarly journals that are available online to the reader without any financial, legal, or technical barriers other than those indivisible from gaining access to the internet itself. Some of these are subsidized and some require payment on behalf of the author. The subsidized journals are generally financed by an academic institution, a learned society or a government information center, and those requiring payment are typically financed by money made available to researchers for the specific purpose from a public or private funding agency, as part of the research grant. Apart from these, there have also been several modifications of open-access journals that have considerably different natures, namely: (a) hybrid open-access journals and (b) delayed open-access journals.

Open-access journals (sometimes called the "gold road to open access") are one of the two general methods for providing open access. The other one (sometimes called the "green road") is self-archiving in a repository. AT CSIR-NAL, we follow the "green road" path and large number of NAL Scientists deposit their journal articles, books, book-chapters, reports, technical documents etc... to this Institutional Repository.

On the other hand we have the publisher of an open-access journal called as the "open-access publisher", and the process is named, "open-access publishing".

In a looser term, open-access journals may be considered as:

- Journals entirely open access
- Journals with research articles open access (hybrid open-access journals)
- Journals with some research articles open access (hybrid open-access journals)
- Journals with some articles open access and the other delayed access
- Journals with delayed open access (delayed open-access journals)
- Journals permitting self-archiving of articles

The first digital-only, free journals (eventually to be called "open-access journals") were published on the Internet in the late 1980s. Among them was *Bryn Mawr Classical Review*, *Postmodern Culture*, *Psycology*, and *The Public-Access Computer Systems Review*.

In 1998, one of the first open-access journals came up in the field of medicine: the Journal of Medical Internet Research (JMIR). Its first issue was published in the year 1999. One of the more unique models is utilized by the Journal of Surgical Radiology, which uses the net profits from external revenue to provide compensation to the editors for their continuing efforts.

One of the very first online journals, GeoLogic, TerraNova, was published by Paul Browning which started around 1989. It was not a discrete journal but an electronic section of TerraNova.

In a broader sense, open-access journals are divided into those that charge publication fees and those that do not.

Fee-based open-access journals: Fee-based open-access journals require payment on behalf of the author. The money might come from the author but more often comes from the author's research grant or employer. In cases of economic hardship, many journals will waive all or part of the fee. (This generally includes instances where the authors come from a less developed economy).

No-fee open-access journals: No-fee open-access journals use a variety of business models. As summarized by Peter Suber [17]. "Some no-fee OA journals have direct or indirect subsidies from institutions like universities, laboratories, research centers, libraries, hospitals, museums, learned societies, foundations, or government agencies. Some have revenue from a separate line of non-OA publications. Some have revenue from advertising, auxiliary services, membership dues, endowments, reprints, or a print or premium edition. Some rely, more than other journals, on volunteerism. Some undoubtedly use a combination of these means."

In a nutshell: Open access publications are freely and permanently available online to anyone with an internet connection. Unrestricted use, distribution and reproduction in any medium is permitted, provided the author/editor is properly attributed. Open access has gained tremendous support from both authors, who appreciate the increased visibility of their work, as well as science institutions and funders, who value the societal impact of freely available research results.

Some of the most significant benefits of Open Access Publications are:

- Free availability
- Authors retain copyright
- High quality and rigorous peer review
- Rapid Publication
- No space constraints
- Compliance with open access mandates
- Citation tracking and inclusion in bibliographic databases

Some of the significant benefits of OA Research are:

- Accelerated discovery
- Public enrichment
- Improved education

This paper consists of fourteen sections. 1. Introduction: talks about the characteristics of the Aerospace Industry In a nutshell, the aircraft industry can be described as a multi-technology sector which is highly R&D intensive and knowledge production is paramount. It is also a powerful driver of innovation. Most importantly, it highlights the importance and dependence of electronic information resources, namely e-journals to the Aerospace Scientists and Engineers for their day to day R&D activities and to keep in touch global R&D. 2. Open Access Movements and Initiatives: Since the research survey is on 'Use Patterns of Open Access Journals by this niche community' the section narrates some of the important open access movement and initiatives that took place from late 1990s to the present day. 3. Review of Literature: brings to the attention of the reader various current work that is going on the area of Open Access Journals from researchers across the globe. 4. CSIR-National Aerospace Laboratories: Introduces CSIR-NAL as a premier Civil Aviation R&D Establishment in the country and its mandate and mission. 5. CSIR-NAL'S Open Access Initiatives. This section touches upon the open access initiatives that are in place at CSIR-NAL. It talks about its Institutional Repository which is operational which largely showcases the research output of its scientists, engineers and technologists and is serving as the digital repository of the organization's R&D achievements. 6. Objectives of the Study: The main objective of this research survey is described here. 7. Null Hypotheses: Every research survey begins with a null hypotheses and finally discusses whether the hypotheses is either supported or not supported after the analysis of the findings. 8. Material and Methods: The methodology adopted for this survey is discussed in this section. 9. Results and Discussion: The result of this survey is indicated here. 10. Finding Aerospace Open Access Related Resources on the Net: For the benefit of the aerospace scientists and engineers few of the significant Aerospace Related Open Access Resources are indicated. 11. Conclusion: The conclusion of this study is highlighted. 12. Future Work: Some thoughts on future work in this direction 13. Future Issues of Importance: Recent developments happening in the area of Open Access 14. Acknowledgements: Due recognition and gratitude to the organization's management. 15. References: Work done in this area by researchers world-wide is referred and cited in the relevant sections in the paper. 16. Web References: Web resources cited are indicated here.

II. OPEN ACCESS MOVEMENT AND INITIATIVES

There were a large number of separate e-print repositories beginning to appear in the late 1990s, it was a movement started to develop among stakeholders in the scholarly communication process. It also became clear that their usefulness would be enhanced by the development of interoperability between them. The Open Archives Initiative (OAI), which emerged actually from the Santa Fe Convention held in 1999, addresses this issue (www.openarchives.org/). It aims to create cross-searchable databases of research papers and make them freely available on the web, via the internet, by developing and promoting inter-operability standards that will facilitate the efficient dissemination of content [1].

The authors in their paper mention that at the centre of this work is the OAI metadata harvesting protocol (www.openarchives.org/OAI/openarchivesprotocol.htm). This creates the potential for interoperability between e-print repositories by enabling metadata from a number of archives to be harvested and collected together in a searchable database. The harvested metadata is in Dublin Core format and normally includes information such as author name, keywords in the title, subject terms, an abstract and date [1].

Further, they highlight that, eprints.org (www.eprints.org) developed at the University of Southampton, was the first free software to enable any institution to install OAI-compliant archives (using OAI metadata tags). It is designed to run centralized or distributed, discipline-based or institution-based archives of scholarly publications. As the most established OAI-compliant archive, it is now known as GNU eprints (eprints.org). There are also other more recently released repository OAI software applications, such as Dspace, developed by MIT Libraries and Hewlett Packard (www.dspace.org), which are being widely adopted in many institutions with diversified specializations.

Another important development that took place in this direction was the Budapest Open Access Initiative. In December 2001, the Open Society Institute (OSI) convened a meeting in Budapest. The major aim of this meeting was to speed up progress in the international efforts to make scientific and scholarly research results freely available on the internet. The participants were from various academic disciplines and nations. They brought their first-hand experience of many of the ongoing initiatives that make up the open access movement. Most importantly, they examined the most effective and affordable strategies for coordinating separate initiatives and best serving the interests of research, researchers, and the institutions and societies that support research. Finally, the gathering explored how OSI and other foundations could use their resources most productively to aid the transition to open access and to make open-access publishing economically self-sustaining [1].

The authors also mention that as on March 2005, there have been around 3,650 individual and 304 organization signatories to the BOAI Budapest Open Access Initiative (www.soros.org/openaccess/view.cfm). In a nutshell, the BOAI came into being a “statement of principle, a statement of strategy, and a statement of commitment”.

There seems to exist a strong international movement that, at least in some scientific areas, seeks to make research papers available by this method. The SPARC Open Access Newsletter (www.earlham.edu/~peters/fos/index.htm), published by Peter Suber, is a highly useful resource for keeping up to date with developments in all areas related to electronic scholarly publishing, (in particular, Timeline for Open Access Movement at www.earlham.edu/~peters/fos/timeline.htm, which is the most comprehensive account of major developments). The frequently updated Scholarly Electronic Publishing Bibliography, 1996-2005 (<http://info.lib.uh.edu/sepb/sepb.html>), published by Charles Bailey (1996-2005), includes two sections with relevant articles, “New publishing models” and “Repositories, e-prints and OAI” [1].

According to [2], Scholarly articles can be made freely available to potential readers in two main ways – by being published in an open access journal (OAJ), or by being deposited in an electronic repository, which is OAJ-compliant and that is searchable from remote locations without access restrictions. The authors also highlight that, open access journals share one characteristic: they make their quality-controlled content freely available to all comers, using a funding model that does not charge readers or their institutions for access. There are several operational models in place: (a) D-Lib Magazine (www.dlib.org), which is funded by grants from DARPA (Defence Advanced Research Project Agency) and NSF (National Science Foundation).

The other main model for open access is that of commercial publishing. In this model, authors or their institutions pay a fee to have an article published, and the publisher then makes the article freely available electronically, after publication. There are several publishers using this model, such as BioMed Central (BMC) (www.biomedcentral.com), which launched its open access publishing service in 2000 [3].

Later on, to increase the visibility and ease of use of open access scientific and scholarly journals in order to promote their increased usage and impact, The Directory of Open Access Journals (DOAJ), produced by the Lund University Library (www.doaj.org) was created.

Slowly and steadily, the open access started gaining momentum. International organizations and international conferences proved to be an important influence and contributing another dimension to

the open access movement, as can be seen from statements issued by OECD and the UN World Summit, on the Information Society: OECD Declaration on Access to Research Data from Public Funding, 30 January 2004 (http://www.oecd.org/document/0,2340,en_2649_34487_25998799_1_1_1_1,00.html) . UN World Summit on the Information Society Declaration of Principles and Plan of Action, 12 December 2003 (www.itu.int), Document 1. (www.itu.int), Document 2. [1].

In parallel, elsewhere in the world, In parallel, The Berlin Declaration on Open Access of 23 October 2003, (www.zim.mpg.de/openaccess-berlin/berlindeclaration.html), which defined open access as “immediate, permanent, free online access to the full text of all refereed research journals articles” (2.5 million articles a year, published in 24,000 refereed journals, across all disciplines, languages and nations). This has so far been signed by almost 55 institutions worldwide. The numbers are only increasing. Some of the most popular institutions under this umbrella have been: (a) large national research organizations like: France’s CERN; Germany’s Max Plank Institutes; national academy of sciences belonging to China, India and Netherlands combined with several individual universities and research funding organizations. Another turning point was the The “Berlin 3” meeting which took place in March 2005 gave a lot of prominence to the open-access issue [4].

For the benefit of the readers, the timeline of the “Open Access Movement” could be found in the following URL: <http://legacy.earlham.edu/~peters/fos/timeline.htm>.

III. REVIEW OF LITERATURE

Hemminger et al., [5], while studying the information seeking behavior of academic scientists, opines that researchers at institutions with less comprehensive library journal subscriptions may rely more heavily on freely available materials such as open access journals and author Web sites. Also, researchers indicate a strong preference for obtaining information in the most convenient way possible, which generally means for free (they do not pay directly) and via electronic access. Four of the top five sources are electronic and print library journals, open access or otherwise free journals, and author Web sites.

Tenopir et al.,[6], in their study highlight that the number of readings increased by an estimated 130 readings per scientist from 1977 to 2005. The “other sources” increased by about 20 readings which might be attributable to Open Access initiative indicated by 11 readings from preprint; 19 copies provided by authors, colleagues, etc.; four from an author web site and two from other web sites.

Maria et al., [1], bring to the attention of the readers that the impact of the open access movement, which came to fruition after the OAI Metadata Harvesting Protocol was established, as it creates the potential for interoperability between e-print repositories. It concludes by outlining the challenges for information managers in developing the full potential of open access. The paper analyses ways in which self-archiving has developed – subject versus institutional – examines some of the benefits and drawbacks of self-archiving and puts into perspective the impact of this innovative development on scholarly publication which, through the open access movement, introduces new business models in this area. The paper further discusses that for scholars and academics, there are several benefits to be gained from archiving their scientific work in e-print repositories. Numerous studies have demonstrated that open access also increases impact. The authors inter-alia quote Hitchcock’s work [7, 10], “The effect of open access and downloads (hits) on citation impact: a bibliography of studies”, which provides evidence that work that is freely available is more often cited. To conclude, they say that, open access journals share one characteristic: they make their quality-controlled content freely available to all comers, using a funding model that does not charge readers or their institutions for access.

Mann et al., [8] in their study mention that that while the evolving information society is freely opening and sharing its diaries, social networks and source codes, it remains to be seen if the same will come true for scientific knowledge. Despite strong sympathy for the idea, scientists balk at Open Access publishing.

Turk [9], divulges that many studies which have intended to demonstrate that Open Access publishing policies significantly improve the impact of scientific papers. All these studies use some number of citation counts as a surrogate measure for impact. Some studies concentrate on the level of individual articles, but others focus on the journal level. The author adds that the WWW provides an efficient way of disseminating and accessing scientific information, where many open accessed and free

resources are available. As a result, the number of web citations has been increasing Maharana, [11]. Also, the value and visibility of Open Access journals and the web citation counts have been prominent topics of debate in the library and publishing communities for many years McVeigh [12]. The author also inter-alia mentions quotes Bessemer [13], that studies that concentrate on the article level find a positive correlation between Open Access and the extent to which articles are cited.

John [14], says that the great libraries of the past -- from the fabled collection at Alexandria to the early public libraries of nineteenth-century America -- stood as arguments for increasing access. According to the author, a commitment to scholarly work, carries with it a responsibility to circulate that work as widely as possible: this is the access principle. In the digital age, that responsibility includes exploring new publishing technologies and economic models to improve access to scholarly work. Wide circulation adds value to published work; it is a significant aspect of its claim to be knowledge. Most importantly he argues that, open access can benefit both a researcher-author working at the best-equipped lab at a leading research university and a teacher struggling to find resources in an impoverished high school.

According Houghton [15], the open access movement is now gaining impetus, as most recently indicated by the Berlin Declaration? These new digital environments have the potential to transform the process of publication, particularly in the context of collaborative research. They also add that, Open access digital repositories, operating in parallel with existing commercial publishing mechanisms, provide an opportunity to develop a sustainable information infrastructure for both traditional and emerging modes of knowledge production. Together, they provide the foundation for more effective and efficient access to, and dissemination of scientific and scholarly information.

Bergmann [16], says that, librarians, faculty members, and researchers worldwide have become change agents, supporting new open access (OA) mechanisms for scholarly discourse and the sharing of new research. Their OA mechanisms include OA journals, digital e-print archives, and institutional repositories. He also adds that, the promise offered by the Internet, coupled with the substantial funding pressures created by these publishing world developments, has led to the emergence of the open access or "OA" movement to create broad digital access to scholarly work, at no charge. He inter-alia quotes Suber [18], by saying, "Open Access literature is digital, online, free of charge, and free of most copyright and licensing restrictions. What makes it possible is the internet and the consent of the author or copyright-holder. OA is entirely compatible with peer review, and all the major OA initiatives for scientific and scholarly literature insist on its importance"

Ghosh et al., [18], mentions that open access, a philosophy facilitates availability and distribution of scholarly communication freely, as a means to solve the problem of inaccessibility primarily due to financial constraint particularly in the context of developing countries. Open access endeavours to reduce barriers to scholarly communication. The open access literature available in various forms like open access archives, institutional repositories, open access journals and off late open courseware. The author adds that, the availability of open source software has accelerated this development. In India, various open access initiatives have been undertaken and are operational. Some more are in developmental stage.

Aymar [19] opines that, Open Access, which has become a mainstream issue, is spreading to all areas and actors of scholarly communication and affecting its entire spectrum, from policy making to financial aspects. Notably, Open Access models are actively being proposed by scholars, libraries and publishers alike. The author also adds that, any Open Access initiative can only succeed if it is truly global in scope. With specific reference to this paper, he says, SCOAP3, the Sponsoring Consortium for Open Access Publishing in Particle Physics, aims to convert to Open Access the HEP peer-reviewed literature in a way that is transparent to authors, meeting the expectations of the HEP community for peer-review of the highest standard, and administered from the journals that have served the field for decades, while leaving room for new players.

Xi Niu et al., [23], presents in his research paper that researchers showed a strong preference for electronic versions of resources rather than print formats, as indicated by the top four resources. Electronic journals accessed through the library and open access electronic journals are the two primary methods of accessing electronic resources. In the conclusion there is strong emphasis that many professors have begun utilizing blogs, wikis and multimedia (e.g., YouTube) to communicate with their colleagues or students. Collaborative search systems (I-SPY), Academic social bookmarking systems (CiteULike), open shared rankings and reviews (Faculty 1000, Adobe Acrobat

8.0), open access journals (PubMedCentral, BioMedCentral, PLoS), and online sharing bibliographic databases and annotations (Connotea). All these are examples of new scholarly communication information technologies.

Jamali et al., [24], in their research survey opine that, Physicists in High Energy Physics (HEP) relied mostly on searches in subject databases (arXiv.org) for identifying articles they read. The second most used method was searching in Google. The fact that Google was the second used means by which articles were found in the field of HEP might be because of high availability of open access material in HEP that makes everything searchable by general search engines such as Google.

Björk [25], discuss the issue that the ratio of open access papers to the overall number of papers published is a much more important indicator of the growing importance of open access than the number of open access titles compared to the number of titles in general.

Nicholas, et al., [25], evaluating the use and impact of e-journals using deep-log techniques in the UK mention that open access journals featured strongly in the ranked lists of life sciences and history; and Google was an extremely popular means of accessing journal content, especially so in the case of historians.

IV. CSIR-NATIONAL AEROSPACE LABORATORIES, BANGALORE

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.

V. CSIR-NAL'S OPEN ACCESS INITIATIVES

The CSIR-NAL Institutional Repository is the digital archive of the research output of its scientists, engineers and technologists. This initiative which began around 2003 was set up initially using Greenstone Digital Library (GSDL). Later on it migrated to GNU Eprints 2.0 platform for its archiving and managing its digital collections. In 2010, the IR software was upgraded to GNU Eprints 3.0 which comprises of several new features. In a nutshell, the knowledgebase of this repository mainly consists of journal articles, conference papers, technical reports, presentations, project documents, patents, theses, images and book chapters. The focus or the main objective of establishing this repository was to establish a platform for increased visibility of the intellectual and R&D output of the organization and long term digital preservation of scholarly publishing of NAL scientists.

VI. OBJECTIVES OF THE STUDY

- To determine the use patterns of 'Aerospace Open Access Journals' amongst the aerospace scientists and engineers of Bangalore.
- To ascertain whether the percentage of preference of the Use Patterns of 'Aerospace Open Access Journals' by the aerospace engineers and scientists are approximately the same.
- To study whether similar patterns exists (homogeneity) of use of 'Aerospace Open Access Journals' amongst these aerospace scientists and engineers of the 16 aerospace organizations in Bangalore.

VII. NULL HYPOTHESIS

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

VIII. MATERIALS AND METHODS

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. 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.

Table-1: Distribution of Source Data (Sample Size)

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%)

Geographical Boundary of the Study (16 Prominent Aerospace Organizations of Bangalore, INDIA).

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. shows the 'Frequency of Use of Aerospace Open Access Journals' graded on a scale of 0-4.

Table – 2: Frequency of Usage of Open Access Journals Graded on a Scale of 0 to 4.

	4 – daily,	3 – weekly,	2 – fortnightly,	1 – monthly,	0 – Never use
Name of the Journal	4	3	2	1	0
(1) ICAST, NAL Gateway of Free Journals	4	3	2	1	0
(2) Directory of Open Access Journals (DOAJ)	4	3	2	1	0
(3) General Science	4	3	2	1	0
(4) Technology and Engineering	4	3	2	1	0
(5) Earth and Environmental Sciences	4	3	2	1	0
(6) Physics and Astronomy	4	3	2	1	0

The analysis of the frequency of usage of 'Aerospace Open Access Journals' indicated in *Table 3*.

Table 3: Frequency Of Usage of Open-Access e-Journals

S N	Organizations	Mean and CV	Open Access Journals: Frequency of Usage					
			ICAST, NAL Gateway of Free Journals	Directory of Open Access Journals (DOAJ)	General Science	Technology and Engineering	Earth and Environmental Sciences	Physics and Astronomy
1	ADA	Mean	0.98	0.83	1.09	1.38	0.71	0.78
		CV	111.94	136.06	114.76	101.47	152.24	142.92
2	AFTC	Mean	0.53	0.67	0.73	0.87	1.00	0.80
		CV	171.65	156.98	166.75	136.99	125.36	143.30
3	ADE	Mean	1.58	1.08	1.58	1.75	1.25	1.00
		CV	62.92	91.96	68.44	81.27	97.23	95.35
4	ASTE	Mean	0.45	0.34	0.45	0.76	0.48	0.45
		CV	211.51	248.45	211.51	160.11	204.32	219.76
5	CABS	Mean	0.50	0.50	0.64	0.57	0.57	0.50
		CV	130.09	151.91	144.48	132.29	177.86	151.91
6	CEMILAC	Mean	0.41	0.66	1.55	0.72	0.69	0.62
		CV	177.09	164.57	105.59	160.44	164.89	179.68
7	C-MMACS	Mean	2.67	1.17	1.00	0.83	1.50	1.00
		CV	56.46	137.32	126.49	117.98	109.54	89.44
8	DARE	Mean	0.89	0.78	2.33	2.33	2.00	2.00
		CV	118.59	154.52	60.61	30.30	50.00	75.00
9	LRDE	Mean	1.50	1.50	2.50	3.00	1.50	2.00
		CV	141.42	141.42	84.85	47.14	141.42	70.71
10	GTRE	Mean	1.33	1.14	1.71	1.52	1.10	1.10
		CV	104.28	115.04	76.38	82.02	132.01	111.47
11	HAL	Mean	0.65	0.58	0.81	1.04	0.78	0.68
		CV	167.09	171.53	137.34	123.03	155.21	163.12
12	IAM	Mean	0.42	0.52	0.82	0.55	0.64	0.67
		CV	204.39	182.36	144.79	172.05	161.11	153.09
13	ISRO-ISTRAC	Mean	0.50	0.68	0.82	0.86	0.77	0.82
		CV	182.57	159.30	128.67	130.29	137.95	134.08
14	IISc	Mean	0.71	0.62	0.74	0.91	0.44	0.50
		CV	150.13	169.17	158.14	143.81	217.49	185.86
15	JNCASR	Mean	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
16	NAL	Mean	2.00	1.32	1.07	1.33	0.70	0.59
		CV	70.49	101.54	112.83	95.42	147.49	153.08
Mean Scores Obtained for Access and Usage of Open-Access Journals		Mean	1.09	0.85	1.00	1.12	0.75	0.69
		CV	120.67	138.32	123.11	113.42	149.79	151.28
P Values			0.000	0.000	0.000	0.000	0.041	0.019

Table 4. highlights some selected ‘Aerospace Open Access Journals’ of useful reference to the readers.

Table-4: Some Useful Resources of Open Access Journals Related to Aerospace Engineering

Sl. No.	URL	About the URL
1.	http://benthamsience.com/open/toaej/	The Open Aerospace Engineering Journal is an Open Access online journal, which research articles, reviews, letters and guest edited single topic issues in recent advances in aerospace engineering. The journal covers the

		topics related to aerodynamics, computational fluid dynamics, wind tunnel testing of buildings and structures, aerospace structures and materials, composite materials, dynamics and control, real-time data acquisition, space engineering and construction, lunar base construction, field and remote sensing and robotics.
2.	http://www.hindawi.com/journals/ijae/	International Journal of Aerospace Engineering aims to serve the international aerospace engineering community through dissemination of scientific knowledge on practical engineering and design methodologies pertaining to aircraft and space vehicles. Original unpublished manuscripts are solicited in all areas of aerospace engineering, including but not limited to mechanics of materials and structures, aerodynamics and fluid mechanics, dynamics and control, aeroacoustics, aeroelasticity, propulsion and combustion, avionics and systems, flight simulation and mechanics, and unmanned air vehicles (UAVs).
3.	http://omicsgroup.org/journals/jaaehome.php	Aeronautics & Aerospace Engineering deals with the study, design, and manufacturing of air flight capable machines, or the techniques of operating aircraft and rocketry within the atmosphere. The journal provides an open access platform in various fields of aeronautical sciences such as avionics aerodynamics, electrical engineering, mechanical engineering, rocket science, astronautical engineering, airships, aircraft and rocketry.
4.	http://www.mdpi.com/journal/aerospace	Aerospace is an international, peer-reviewed, open access journal (free for readers) devoted to the publication of original papers, review articles, short notes and communications related to all fields of aerospace science, engineering and technology, disclosing theoretical, fundamental and applied results linked to potential applications that are related to research, design, manufacture, operations, control and maintenance of aircraft and spacecraft.
5.	http://www.sciencepublishinggroup.com/journal/news.aspx?journalid=309	American Journal of Aerospace Engineering (AJAE) is a peer-reviewed open access journal published bimonthly in English-language, providing a broad coverage of the materials and techniques employed in the aircraft and aerospace industry. This journal publishes original papers, review articles and short communications, including two major and overlapping branches: aeronautical engineering and astronautical engineering.
6.	http://www.waset.org/journals/ijmae/	International Journal of Mechanical and Aerospace Engineering is a scholarly open access, peer-reviewed, interdisciplinary, monthly and fully refereed journal focusing on theories, methods and applications in Mechanical and Aerospace Engineering.
7.	http://www.scirp.org/journal/aast/	Advances in Aerospace Science and Technology (AAST) is an open access journal. The goal of this journal is to provide a platform for researchers and practitioners all over the world to promote, share, and discuss various new issues and developments in all areas of Aerospace Science and Technology.
8.	http://www.omicsonline.com/aeronautics-aerospace-engineering/	The OMICS journal of aerospace and aeronautical engineering deals with the latest studies in aerospace technologies covering airspace and aviation turbine fuels and the management of aircraft maneuvering. OMICS Publishing Group follows an Open Access Journal policy to enable free distribution of scientific literature in aerospace and aeronautical engineering with the latest

		concepts.
9.	http://journalseek.net/cgi-bin/journalseek/journalsearch.cgi?field=issn&query=1874-1460	The Open Aerospace Engineering Journal is an Open Access online journal, which publishes research articles, reviews, and letters on recent advances in aerospace engineering. The Open Aerospace Engineering Journal, a peer reviewed journal, provides the most complete and reliable source of information on current developments in aerospace research.
10.	https://globaljournals.org/GJRE/aerospace-sciences/menu-id-1239/	The Global Journal of Researches in Engineering-D: Aerospace Sciences (GJRE-D) is an international platform, providing facilities to Researchers, Engineers and Professionals to publish high quality, refereed papers. The GJRE-D comprises comprehensive frontier trends of engineering research. Aeroacoustics, Aerodynamics, Aeroelasticity journal etc. are priorities of International engineering journal.
11.	http://www.doaj.org/doaj?func=loadTemplate&template=about&uiLanguage=en <i>For More Aerospace Resources one could refer DOAJ</i>	The aim of DOAJ is to increase the visibility and ease of use of open access scientific and scholarly journals, thereby promoting their increased usage and impact. The DOAJ aims to be comprehensive and cover all open access scientific and scholarly journals that use a quality control system to guarantee the content. In short, the DOAJ aims to be THE one stop shop for users of open access journals.

Source: Various Aerospace URLs indicated in the Table

IX. RESULTS AND DISCUSSION

- Summary of Total Scores for Frequency of Access and Usage of Open Access e- Journal. The highest mean score of 1.12(CV=113.42) is represented by 'Technology and Engineering'. 'ICAST, NAL Gateway of Free Journals' occupies the next highest mean score of 1.09(CV=120.67). 'General Science' comes up with the third highest mean score of 1.00(CV=123.11). 'Directory of Open Access Journals (DOAJ)' represents itself with the next highest mean score of 0.85(CV=138.32). 'Earth and Environmental Sciences' occupies the next position with the second lowest mean score of 0.75(CV=149.79). Finally, 'Physics and Astronomy' represents itself with the lowest mean score of 0.69(CV=151.28).

- 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 Access and Usage of Open Access Journals'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores for, 'ICAST, NAL Gateway of Free Journals', 'Directory of Open Access Journals (DOAJ)', 'General Science', 'Technology and Engineering', 'Earth and Environmental Sciences' and 'Physics and Astronomy'

X. FINDING AEROSPACE OPEN ACCESS RESOURCES ON THE INTERNET

There are a larger number of web resources on 'Aerospace Open Access Journals'. Few of the selected resources which the authors felt would be of useful and of ready reference to the aerospace scientists and engineers are listed below in *Table 4*. These URLs are open access journals in Aerospace Science and Technology and allows an aerospace scientists or engineer to submit their articles with either nil or some marginal publication cost. The journal articles go through a rigid peer-review process and the article gets published online and are available instantly as "open access" for anyone to not only browse but also to download the full-text paper without any charges (except your connectivity to the Internet).

XI. CONCLUSION

The present research work has been carried out taking Bangalore City as its geographical boundary and the study is restricted to the selected 16 prominent aerospace organizations in Bangalore. Out of

the 630 questionnaires distributed, 612 were received back and finally 583 (89.7%) were selected for the study which were found suitable for the study.

The total population size of this research study is restricted to the 1220 aerospace scientists and engineers in Bangalore. Random sampling technique has been used for selection of the sample size.

It is interesting to note that significant studies on information seeking behavior of scientists have strongly indicated that researchers have a strong preference for obtaining information in the most convenient way possible, which generally means for free (they do not pay directly) and via electronic access. Researchers worldwide have become change agents, supporting new open access (OA) mechanisms for scholarly discourse and the sharing of new research. Today, the "OA" movement has ensured "digital access" to scholarly work at almost no charge.

Interesting studies in this direction have amply demonstrated that that open access also increases impact. Hitchcock's work [7], provides substantial evidence that work that is freely available is more often cited.

This research survey was conducted to analyze the 'Use Patterns of Open Access Journals' amongst Aerospace Scientists and Engineers of Bangalore. The focus of the study was to study which are the most significant Open Access Journals that are frequently referred and used by these aerospace scientists and engineers of the selected 16 aerospace organizations of Bangalore for their R&D pursuits. The study also looked into to see whether there was any 'homogeneity' in the use patterns with regard to access to these open access journals by the aerospace scientists and engineers of Bangalore.

The main conclusions that the authors would like to infer in this study are:

- 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 Access and Usage of Open Access Journals'.
- It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores for, 'ICAST, NAL Gateway of Free Journals', 'Directory of Open Access Journals (DOAJ)', 'General Science', 'Technology and Engineering', 'Earth and Environmental Sciences' and 'Physics and Astronomy'
- This implies that the percentage of preference of the Use Patterns of 'Aerospace Open Access Journals' by the aerospace engineers and scientists are not approximately the same.
- Finally, the study also reveals that there is heterogeneity in the Use Patterns of 'Aerospace Open Access Journals' among the aerospace scientists and engineers of Bangalore of the selected 16 aerospace organizations.

XII. FUTURE WORK

The future work that needs to be looked at in more detail are mentioned below:

(a) Proper digital conservation mechanisms with suitable metadata techniques to ensure that such large that is getting generated is properly archived, stored and most importantly being capable of being retrieved for immediate access. Most importantly the knowledgebase that gets generated should be available not only for the present but most importantly for the future.

(b) Implementation of appropriate statistical interfaces and dynamic analytics (e-journal hits, most popular downloads, most cited paper to enhance visibility to the intellectual depositor. Importantly links to web citation indexing tools like: (a) Web of Science, (b) Google Citations etc. for increased scientific visibility to the user community.

(c) Championed by democratic principles, innumerable possibilities and opportunities, deeper exploration of the Web 2.0 technologies and tools such as Social Networking Sites, Blogging, etc. needs to be inter-woven into the open access system. Increasingly growing platforms like Facebook, YouTube and Twitter needs to be linked into the open access system so that researchers could more aggressively contribute in this "participatory culture" of information sharing. Today, with the emergence of social media and the availability of social networking platforms, the scientists and engineers have enormous opportunity to leverage for 'connecting with the user community' and building a strong networked community of stakeholders across the life cycle of information creation to consumption.

(e) Tapping the power of cloud computing and mobile technologies and integration into the web-based open-access system enables better speed, better downloads and better storage of digital data. Added to this, some of the important global issues that are being discussed and deliberated are key factors to be taken into consideration in making the open-access system more versatile, stable and technologically viable. These are mentioned below:

XIII. FUTURE ISSUES OF IMPORTANCE

- “A *mixed economy* of open access and subscription publishing should co-exist tangentially before a steady transition to open access fully”.
- “As more and more digital content is created, it is important to reach out to the maximum, firstly as awareness that such digital content is available and then interact with it in new ways”.
- “Many opine that libraries have a natural role in the data world, and that their importance will only grow with the push to unlock the products of research”.
- “Barack Obama’s Administration Order: “to ensure that the public can access publications and data generated by federally funded research result in much greater appreciation and support for the need to preserve data and make it available for scientific use”
- A systematic data conservancy and data curation mechanisms needs to be in place to handle such volume of scientific data that gets generated through open access.
- “Until recently, data have been considered a second-class citizen in the science and publishing world, and that's all about to change”. [20, 21, 22].

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