Journal of Industrial Mechanics

e-ISSN: 2582-1067
Volume-5, Issue-2 (May-August, 2020)

www.matjournals.com

http://doi.org/ 10.5281/zenodo.3839210

Information Technology in Aerospace Engineering

Aayush Bhattarai
Assistant Professor,
Department of Mechanical and Aerospace Engineering
Pulchowk Campus, Institute of Engineering (IOE), Tribhuwan University, Pulchowk, Kathmandu, Nepal

*Corresponding Author: aayush@pcampus.edu.np

ABSTRACT

This report investigates the currently utilized information technology tools, information resources that are used in an Aerospace industry. A brief description of the information technology and use of information technology in aerospace industry is initially outlined. Various benefits and problems that are related to information technology are analyzed. The discussion then focuses on the information tools currently utilized by these companies and organizational transformation because of technology adoption is discussed in this report.

Keywords-- Aerospace Engineering; Information Technology; CAD; Aircraft Design Process; Innovation Management

INTRODUCTION

Information technology is a mixture of both communication and a computer technology that gives proper information, it is a technology that helps in processing of data analysis, synthesis, testing, communication, exhibition and Retrieval of information in a quick, error-free as well as proper-way. Information technology is used by everyone these days directly or indirectly, from a small printed bus ticket to big industry that is manufacturing state of the art technology. Every individual these days depends on information technology, 24 hours automatic Teller Machine well known as ATM machines that can be found in almost every street these days are also the part of IT system, long queues are reduced in banks since ATMs are able to provide services like checking balance of an individual's account, deposit, withdraw and transfer of money can be done very conveniently and easily. These services are also provided through online, although withdrawal or deposit of money is not available through online service, but opening a new bank account and many other services are provided through online services.

Aerospace engineering is mainly concerned with designing, testing and manufacturing of spacecraft and aircraft. Aerospace is mainly divided into two sub branch, Aeronautic and Astronautic engineering. Aeronautical engineers are responsible for designing, testing of an aircraft that operates below the earth's atmosphere but astronautical engineers are responsible for the design and testing of spacecraft that operates beyond the earth's atmosphere like rocket, satellite and shuttle station. Both of these branches are co-related to each other, since they both follow the same principle. That is Aerodynamics, material and structure, propulsion and stability.

The designers in aerospace industry must have a good knowledge of the aircraft components, the load pattern of these components and materials that should be used for the parts and many more things. Since aircrafts comprise of thousands of parts and each part plays an important role for the safety of aircraft. Therefore, it is important for engineers that they design each component carefully.

INFORMATION TECHNOLOGY IN AEROSPACE ENGINEERING

The information technologies are developed so effectively that it has replaced human intervention for a lot of process. Aerospace industry in two decades has a tremendous amount of improvement due to the development of information technology and is almost dependent in computer system in every single process involved in manufacturing of an aircraft. This has led to the improvement of the performance of the aircraft by enabling better control, improved transmission of signal and efficient systems. Planning, designing, and production time for an aircraft has been drastically reduced with the help of information technology. Better software's for design, calculation, and mechanization of the manufacturing process has helped in reducing the cost of manufacturing as well as time and manpower consumption with accuracy. This is where information systems or technology come in place, as IT plays an important role in isolating the time consumption and better assurance in meeting quality standards, so human errors are reduced and inaccuracy is reduced by a large extent, due to which, planes are considered as the safest means of transportation. In this modern world, the evolution of information technology helps engineers in designing the major components of an aircraft not only in two dimensions but also in three-dimensional platform. Design tools like

e-ISSN: 2582-1067
Volume-5, Issue-2 (May-August, 2020)
www.matjournals.com
http://doi.org/ 10.5281/zenodo.3839210

CAD/CAM helps in designing each component installed in the aircraft, and even analyses the performance of these components. Stress calculation and engine performance can easily be done with the help of information technology tools like NASTRAN (finite element analysis).

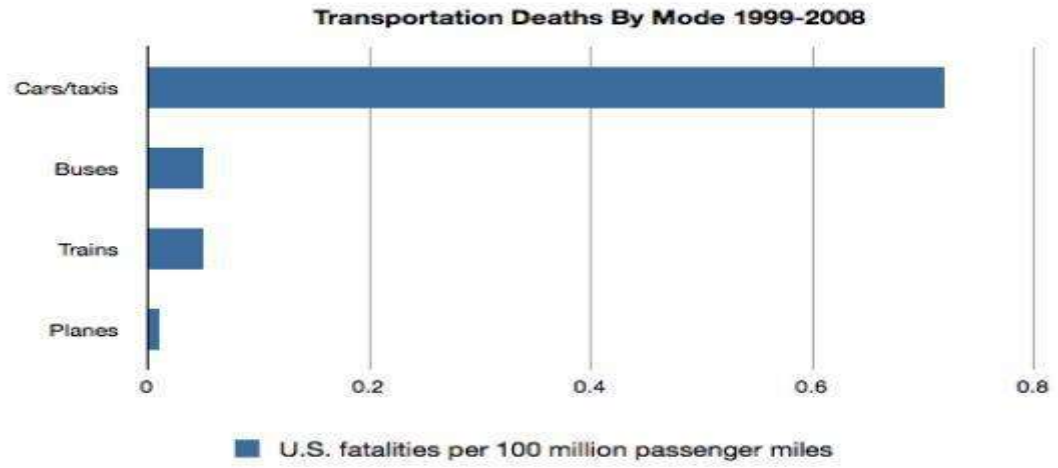

Figure 1: *U.S fatalities per million passenger miles (Washington post 2013).*

Development of information technology has not only reduced risk and errors but it has also helped in huge cost reduction, which in turn has reduced the cost of flight fares and made the journey affordable to the customers. Travel charges are lowered because the manufacturing cost is reduced by the help of information technology adaptation in the aviation industry.

DISCUSSION

Aircraft Designing Process

Aircraft designing process is revolutionized by the widely spread uses of information technology. The role of information technology in the process of aircraft design is that, it provides the detailed information to make a quick decision at low cost and time. In detail, an information technology is used to simulate the behavior of a complex system which is beyond the limit of analytic theory. It is also used to design the information in given time, it provides an ability to the engineers to perform a wide range of designs and easily optimize the cost for design and production Aircraft designers mostly use these technology to apply control, propulsion, structure, aerodynamics as well as the mission profiles in the design phase rather than using an individual methods.

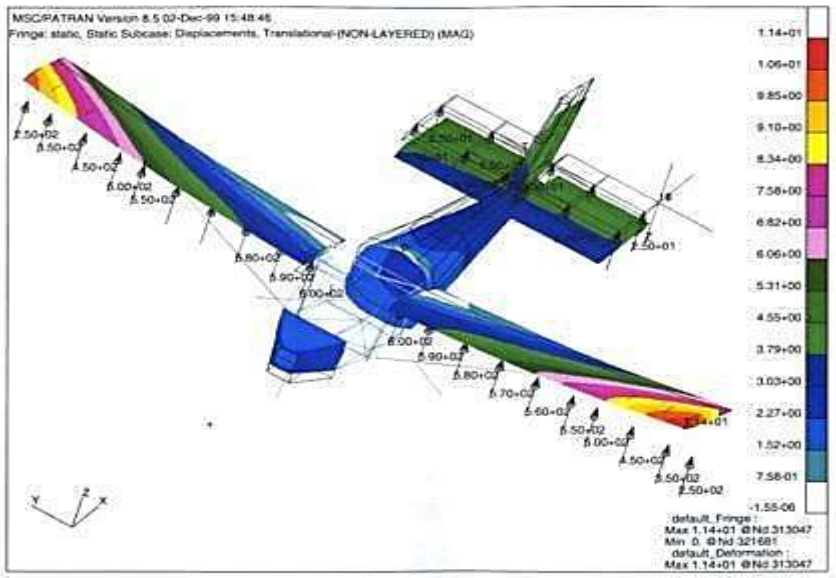

Figure 2: *Structural stress calculation using analysis software*

Information technology for the aviation for analysis of the structure has reached to very high level of maturity and many software packages that consolidate this technology are used throughout

e-ISSN: 2582-1067
Volume-5, Issue-2 (May-August, 2020)
www.matjournals.com
http://doi.org/ 10.5281/zenodo.3839210

aviation industry for the analysis of structural stress in linear as well as nonlinear areas. Any structure analysis software is equipped with the numerical method of calculation that solves the structural equation. This method of numerical calculation can be used in optimization of the shape of a structure.in the design of an aircraft, a design engineer is mostly focused in weight of the structure and performance of structures which are likely to bear the load of the aircraft (fuselage, wings, and empennage). Design of the linear as well as the nonlinear control system in an aircraft is also greatly benefited due to the appearance of an IT This system could be the components of an aircraft like actuators to the systems that controls the altitude and speed of the aircraft which is mainly used for the takeoff/landing systems or the autopilot systems.

Technology Adaptation and Organizational Transformation

The contribution of new information technology in an industry can only be realized after the technology is diffused in the company. The diffusion of the IT appears as a slow and continuous process. New technology adoption could be the process of starting the technology to the system or it can also be the replacement of the old system located in the company with the new ones. When any organization adopts information technology, firstly they face many difficulties calculating its cost and the benefits, as this new implementation is filled with imperfect information and many uncertainties. These organizations can decide to use the technology immediately or, it may start by gathering all information that is required before the new technology adoption. The adoption of new technology in the company can be characterized by the cost factor that is caused by the irreversible process, the opportunity to postpone or delay, and uncertainty of profit in future coming into final decisions before adopting technology.

Information technology is used not only used in designing the aircrafts, it is also used in the aircraft to do almost everything to keep the aircraft airworthy and make the aircraft safe. The advancement of the auto flight systems is the result of the advancement of the information technology. Increasing numbers of software in critical flight application and software growth has raised many challenges in the certification, design and operations. The paper-based flight systems are all transformed into electronic documentation systems. The paper-based emergency checklist has now been changed to the electronic check lists in the new aircrafts. All the alerting systems in the aircraft have helped in in immediate decision making to the pilots. Information technology has a substantial role for improving the safety, affordability, efficiency and capability of the aircraft for the increasing number of consumers and their demands for the aircrafts. Aviation industry is facing a serious challenge in terms of financial stability, system capacity as well as environmental impacts due to the noise produced and gases emitted from them. But aviation is also facing substantial opportunities in creating environmentally friendly aircrafts, this emerging opportunities is developed due to the information technology. It is also widely used in air traffic controller, the most important information technology tools in air.traffic are mostly surveillance, navigation, decision support and sharing of the information. The air traffic controller uses the information technology tools to guide the aircraft to take off or land safely to the ground. Without the information technology tools the landing of an aircraft would be almost impossible.

In a structural design company, due to the improvement in software as well as the connectivity of the machine to these software's, fabrication tasks and analysis can be integrated closely for transfer of data and the products efficiently. Design software has improved in these days, reliable user interface, and high computational capabilities with simpler and efficient integration of building codes. Information technology applied in structural engineering has made a lot of progress; increasing numbers of technologies are applied successfully in construction projects, for a better, faster and cheaper engineering services results. Strong connections among engineering software suppliers and the researchers will lead to safe, efficient and constantly improvising technology.

Electronic ticket system in an aviation industry is one of the examples of technology adoption. Due to the technology of using an electronic ticket, it has not only saved a lot of money of the government but also saved the loss of time of each passenger. Electronic tickets were first introduced in August 1994. Before this technology, paper tickets used to cost 10 US Dollars, but after the technology adoption, the cost of the ticket system is reduced to 1 US Dollar which ultimately results in an annual profit of approximately 3 billion US Dollars.(Fact Sheet: Concluded StB projects 2013) E-ticketing is easier in handling if the itinerary changes. It also removes the problems of the lost tickets. This system of e-ticket provides the bypassing of both the manned reservation counter and a travel agent, this leads to further cost reduction in airline cost.

Technology adoption can often be expensive for various reasons, new technology should be purchased, quality training is to be implied to the employees in order to use the technology efficiently and updates of the new software or the machines as well as replacement are required frequently, the installation cost and many more. During these processes, the production lines needs to be shut down which can lead to huge of money to the company. Due to this reason even if the industry who understands the benefit of the technology adoption, it might not be logical to adopt these technologies. So, the adoption should be delayed till the benefit is more than the cost.

CONCLUSION

Information technology is widely used in any fields or any industries these days. Information technology can not only be the reason for the growth of an industry, it can also be the reason to fall down or bankrupt the industry. New technology implemented in the industry not only reduces the cost of manufacturing but also reduces the manpower requirement within the industry and further results in reducing the cost of production. The produced products are very accurate to the design with the help of information technology. In aviation, if there were no presence of information technology tools, it would have never come to this stage of advancement where the flights are safer than cars, buses or any other means of transportation. Since the aircrafts use highly efficient information technology tools for the control, simulation and optimization of the flight performance, it has made aircrafts efficient and safe. But implementation of expensive information technology tools can also be disastrous to the industry if sufficient research is not done before the implementation. The transformation of the old technology to the newer technology should be done very carefully. The implementation cost should always be less than the profit obtained after the implementation. If it is more, the company could go into various financial problems including bankruptcy. The major mistakes done by many industries after the implementation of new technology, in order to cut the cost, they decrease the number of manpower that is working for the industry. But the industry needs to understand that even after the implementation of the new technology, a good training is required. Having less staff in the industry with various new kinds of equipment and tools, these staffs gets overwhelmed and they can be stressed, leading in failure to do the job efficiently.

REFERENCES

1. Brynjolfsson, E. & Hitt, L.M. (2000), “Beyond Computation: Information Technology, Organizational Transformation and Business Performance”, *Journal of Economic Perspectives*, volume 14, Issue 4, pp. 23-48., Available at https://www.aeaweb.org/articles?id=10.1257/jep.14.4.23
2. Ezra Klein (2013), “Why you shouldn’t fear flying, in one graph”,Available at https://www.washingtonpost.com/news/wonk/wp/2013/07/07/why-you-shouldnt-fear-flying-in-one-graph/
3. Electronic Ticketing (ET), simplifying the Business 2020, <https://www.iata.org/en/programs/stb/e-ticketing/>.
4. Galang, R.M.N. (2012), “Government efficiency and international technology adoption: The spread of electronic ticketing among airlines”, *Journal of International Business Studies*, Volume 43, Issue 7, pp.631-654, Available at https://link.springer.com/article/10.1057/jibs.2012.20
5. Hansman, R. (2005), 'The Impact of Information Technologies on Air Transportation', *43rd AIAA Aerospace Sciences Meeting and Exhibit*, (p.1), Available at https://doi.org/10.2514/6.2005-1
6. Lanzolla, G. & Suarez, F.F. (2012), “Closing the Technology Adoption–Use Divide: The Role of Contiguous User Bandwagon”, *Journal of Management*, volume. 38, Issue. 3, pp. 836-59, Available at https://journals.sagepub.com/doi/abs/10.1177/0149206310369938
7. Malagas, K.N., Kourousis, K.I., Baxter, G., Nikitakos, N. & Gritzalis, S. (2013), “The Introduction of Innovative Services in a State Owned Airline: A Case Study of an IT Migration Project”, *Journal of technology management & innovation*, volume 8, pp. 74-83, Available at https://www.jotmi.org/index.php/GT/article/view/art306
8. Rammant, J.-P. & Smith, (1999), “Integrated Information Technology for Structural Engineers”, *Structural Engineering International*, volume 9, Issue 1, pp. 54-6, Available at https://doi.org/10.2749/101686699780482168
9. Roderburg, A., Klocke, F. & Koshy, P. 2011, 'Principles of technology evolutions for manufacturing process design', *Procedia Engineering*, volume 9, pp. 294-310, Available at https://doi.org/10.1016/j.proeng.2011.03.120