

Human Error and Management Information Systems in Aviation Safety

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Introduction

The Resource Management Department heavily manages and rules the aviation department. This department can be accredited as one of the most important and significant components of aviation and flight management since even the slightest error in their manipulation can cost them hefty costs or even human lives. This lays a very sensitive and critical job on the shoulders of the Information Management (IM) department to work efficiently and effectively to the greatest extent with the optimized use of resources.

Even though the IM department seems to be working on the techniques and strategies to work more effectively, it is still being hit by the growing ratio of problems and issues. The IM department is heavily criticized and attacked by the American concerned authorities for not being able to eliminate or at least reduce the possibility of human-induced errors resulting in monstrous accidents and disturbing incidents. Some of the most common allegations laid over the IM department include landing of the aircraft on the unplanned, unknown, or simply wrong runway; mistaken landing or entrance of the aircraft within the premises of an unknown or unplanned country; the striking of the aircraft over the pilings during its final attempt; despite of the implementation of the high definition technology, the probability of the aircraft to dive into the mountainous area or the range, etc.

Under this scenario, the fact must not be ignored that the IM department is trained in the latest simulation-based teaching aids. Furthermore, they are constantly work-shopped over the latest technologies, programs, and implementation techniques to enhance their effectiveness, yet they tend to make such errors that result in the classic incidents of aviation as described above. To ensure precision, reliability, and efficiency in the operations and processing of Information Management Departments, the respective paper proposes the implementation of a custom-built IMS for aviation.

Problem Statement

In aviation, there is no chance of negligence and ignorance. Any imprecision and mismanagement in information dissemination can create significant threats and risks with hundreds of lives at stake. Therefore, the aviation department needs a system that can ensure precision as well as credibility when it comes to decision-making and information sharing.

Proposed Resolution

To ensure integrated precision and reliable decision making through secure information sharing, IMS can be implemented that will ensure data engineering as well as Corporate Intelligence.

Lack Of Precision And Possibility Of High Error Rate By IM Department

The induction of the IM department in the aviation domain is often termed a successful and beneficial enhancement in the aviation management systems since it contributes towards the enhancement of the efficiency of the crew and provides them with well-documented and planned training sessions (Helmreich & Wilhelm, 1991). IM department has the potential to fail to address and manage the human errors that exist within the aviation management systems. Furthermore, regardless of the vigilance of the crew, it is difficult to overrule the possibility of human error and negligence.

Fig: Aviation Operations that require IMS-based Efficiency and Security

It is a well-known fact that human beings are not perfect creatures. They are bound to make mistakes, specifically in situations of overloaded work and fatigue. To support that, it may be taken into account that the majority of the job posts in the aviation departments are extremely stressed, overloaded, and caused by the fatigue of the human brains that start malfunctioning in any such case, thus resulting in an unintentional error or the mistake.

Parallel to the concept of vulnerability of the human mind, this fact must also be kept in mind that the majority of the accidents and the disasters, as reported and investigated by the aviation department, were the results of the failure or malfunctioning of the so-called high technology-based systems; here the reasons are often more than one, i.e., the presence of ONLY human errors is the very less probability (Maurino, Reason, Johnston, & Lee, 1995). In the research and observation conducted by Reason (1997), it is clearly evident that the multidimensional latent features and factors were developed due to several organizational contexts that resulted in the production of the combo of the reasons for the occurrence of aviation disasters.

This also protects the IM department's training programs against the allegations being laid on them for failed training sessions and ignoring human factors in aviation accidents. The blame must also be given to the erroneous definition of the IM developments by several concerned aviation authorities. It has further been reported that they define the criteria of judgment for the IM department in such a way that it even includes personal and private details, including marital status and any incidents of sexual harassment. Engulfed in such controversial definitions, the IM department loses the vision of its actual goals and objectives while being intermingled between multiple unnecessary details. Critically analyzing the above-stated issues, the IM department can be stated as an underdeveloped

tool that needs to be improved for enhanced team skills and capabilities.

The causes and the reasons that motivate the occurrence of the errors are often multifaceted and multidimensional. They can even leave scars and push the highly trained, experienced, motivated, and committed crew to their jobs. Such instances occur not mainly due to human error but also due to the natural incapability, vulnerability, and incompetency of the human mind that can malfunction and hinder due to fatigue, sleep deprivation, workloads, systematic errors, etc. The systematic errors of another aviation department, such as air traffic control, can also induce the possibility of human errors to occur in another aviation department. Other than that, there is always a chance of the unfortunate, unexplainable events that are often termed as the result of human error but are not. "Posed against these challenges is an array of defenses and weaknesses that can deflect or exacerbate latent errors or permit them to pass through unhindered. These include the positive and negative aspects of national culture, the strengths and failings of the organizational and professional cultures, and the nature and quality of training the organization provides" (Helmreich & Meritt, 2000). Other than that, there is also a minor chance of the personal attitude and mood of the crew members affecting their efficiency at the workplace and thus resulting in human error. Following is a brief figure that describes several factors that contribute to the occurrence of human errors in various aviation departments.

Fig: The Causes of Error Inducing Agents and the Possible Defenses Against Them (Helmreich & Meritt, 2000)

Furthermore, "The observable outcomes of the flow of errors through the defense line of the organization are the behaviors of the flight crews as they reflect the concepts taught in CRM and reinforced (or ignored) by management and role models such as instructors and evaluators" (Helmreich & Meritt, 2000). Following is a brief figure that showcases the positive as well as the negative behaviors of the aviation crew. It is clearly evident from the diagram that sticking firmly to the underlying objectives and goals of the CRM will enhance the possibility of safe aviation processes, while the chances of unsafe aviation processes are enhanced if the CRM concepts are ignored.

Fig: Dependency of the Chances of Error over the Personal Behaviors of the Crew (Helmreich & Meritt, 2000)

Identification Of The Nature And Causes Of The Errors In Aviation

One of the major requirements to reduce the future possibilities of the errors in the aviation departments within the organizational context is the ability of the concerned authorities to investigate the incident till the roots and know the ultimate cause of the error that might have triggered the chain reaction of the errors leading to the incident. The investigation must include the situations of the complacency and must regardless of the significance of the aviation processes. It must be kept in

mind that “One of the things we know about pilots as a group is that they are of above-average intelligence and not likely to show sub-standard performance when their certification is at stake during formal evaluation” (Helmreich & Meritt, 2000).

Therefore, the aviation authority has composed the list for the essential components of the error management that includes: trust, non-punitive policy inclined towards the error, commitment to dig out the causes of the error, essential flight data, high-tech training in simulated environment explaining the error management strategies, specialized evaluators and trainers, etc. (Helmreich & Meritt, 2000).

Other essential strategies are Line audits, Incident Reporting Systems, Constant research and development of the strategies, Error Avoidance Techniques, Error Tapping, in- range checklist, Error Mitigation, Error Exacerbation, etc.

If these strategies and components are to be generalized and customized by the top aviation authorities in respect to their customs and culture, the error investigation and reduction in the rate of future errors is sure to drop down. Furthermore, the CRM will be now more enabled and committed to work by precisely concentrating on their defined goals and objectives. Following is the conclusive diagram that describes the response of the crew to the human errors.

Fig: Human Induced Error and the Response from the Crew

Benefits Of Implementing MIS

One of the best and most important benefits of implementing an integrated and purpose-built IMS system for the aviation is efficient data engineering that ensures precise data management, information sharing, secure storage, etc.

Organizational structure in aviation is the hierarchal setup of the staff of the organization by their posts and jobs. The organizational structure holds a very important position in maintaining and developing a firm foundation amongst the competitors. It affects the internal processes, such as the time management of the project, monitoring of the project teams and communication with the clients, of the organization in such a way that the organization gets the maximum production from its employees.

The organizational structure needs to have three basic qualities to gain the best out of their employees. These qualities are flexibility, focus and streamlining (Vladimir Collak 2007).

As we have already discussed the data acquisition by the HR Department of the company, this article will progress ahead to know how important is the bonding between the group's members of this department to acquire and analyze the best possible data. People often discuss the character and the personality traits of the employees needed to work as a unit team however very few pay attention to

the organizational structure (Sandal 1999).

In the process of the data acquisition, the basic element of the organizational structure that effects is the flexibility of the organizational structure. The structure should show the flexibility to allow their HR Department to collect the data from various dimensions to get the best and the most accurate data that will be valid for the long term.

To convert the information into the knowledge, the fundamental element needed is the “focus” and then “streamlining.” The team will be focused only when the authorities will be focused enough. In other ways, we can say that the teams are the reflection of the authorities and they together make a focused structure of the organization. The more focused the HR team will be the more centered and to-the-point information they will skim out of the data. Focused information means the foundation of the authentic knowledge.

Streamlining an organizational structure makes it more effective and responsive regarding the output (Transforming Organizational Structure). A streamlined organizational structure will cut down the HR Department only to the most relevant and competent employees. These employees are more likely to work out and evaluate the information in the best possible way to give the maximum benefit to the organization. The carefully analyzed information by the competent HR experts will result in the best possible ‘knowledge’ form for the authorities.

Conclusively it can be said that the organizational structure of the company should be very well organized to focus on their tasks in the best possible way to give the company most relevant benefits. A well-constructed organizational structure will streamline the processes and the tasks within the organization by giving an increased focus and the adoptive nature (Adnanman 2006).

Importance Of Data Management Through Integrated MIS

From the organization’s point of view, the data is the representation of the organizational facts and the values of the results obtained (Bellinger, 2004). Further, the relationship between the data and other tasks and relationships going around has the capacity and power to represent the valuable information (Bellinger, 2004). Similarly, in the organizational setup, the traced patterns that represent the relationship of the data with the information make the capacity to represent the Knowledge about various factors for the organization (Bellinger, 2004). The continuum of the data, information and the knowledge is hence; very important for the organization, however, the inherent limitations by each one these do exist within the structure. These inherent limitations also put their influence on the decision-making processes of the organization.

The data collected for the purpose of specifically accounting and sometimes for general use is not absolute or the concrete base. This makes the data extremely vulnerable and sensitive. To handle

this, the data has to be collected and evaluated with considerable judgments, precise estimations, and intense care. One has to wait before actually passing on the data and labeling it as the complete. The time factor, resources and the authenticity of the sources have to be evaluated to collect the reliable data or else it can all be a blunder.

Similarly, the Information acquisition is the system that grabs the information for the organization. Their main concern has to be only the way in which they can effectively turn in the accurate information rather than from where and when the information can be extracted (Vitez, 2009). Some of the other factors that act as the inherent limitations of the information acquisition process can be the expense allocated for the information management (Vitez, 2009). This can be one of the most crucial strategies. The employees have to be trained in a very planned and efficient manner as this is a critical part of information management (Vitez, 2009). “The length and depth of the training may vary, making it difficult to estimate the cost of this training. Management will also have to account for the lost productivity during this training period” (Vitez, 2009).

The third factor of this continuum is the ‘Knowledge’ for the organizational use. Similar to the data and the information related inherent limitations; the knowledge also faces certain limitations that can affect the decisions of the organization. Knowledge is the fact that depends greatly on the experiences and the external sources influencing the respective fields of the organization. Precisely it can be said that the broader the vision of the organization, the more accurate knowledge they will gain that will be of high accuracy and will remain authentic for a long term in the future.

Collectively, we can evaluate that the following factors are the basic inherent limitations that affect the continuum of the data acquisition, information, and the knowledge:

1. Human Judgmental Skills;
2. Evaluation Skills and Tricks;
3. Time Factor;
4. External Resources;
5. Focus of the Concerned Team;
6. Expenses;
7. Employee Training;
8. Organizational Vision.

These inherent limitations apparently are for the continuum of the data, information, and knowledge; however, it has very deep impacts on the decisions making policies of the organizations. The limitations can put forth the serious problems in the decisions made by the organizations by pulling the “incorrect or inadequate information” for the organizational use (Vitez, 2009). This can ultimately result in the wastage of time, money and resources. This may require another episode of reviewing the whole system that may add to the cost and the capabilities of the organization.

Recommendation: Information System Design

Infrastructure

The following are the basic components of the infrastructure of the “Aviation Management System” Project. As we know that the project is intended to design a project that simulates a system for the Aviations.

Hardware Platforms

No system can be run without having defined its specifications. Specifications of the project are the requirements for the project that are the minimum to be run on. For example, we will have to specify the basic hardware specifications for the project so that it can run on it with its complete features working efficiently.

For this very project, we have defined our hardware specifications as following:

1. Core2Duo Processor
2. VGA card installed with full graphics support
3. JAVA enabled the system.

Accounts/Permission Control

We are designing our project in such a way that it is divided into sections allowing specific access to the specific people depending upon their levels. Following are some of the basic Control and Permission Features of the Aviation Management Project:

- Only one administrator who has access to all the data of and information of all the members that have signed into the Aviation Management System;
- Senior Aviations: these are the Aviation s that have been actively working with the volunteers and have excelled other members by their performance. These members will be assigned some management task s of the system.
- New Aviation has to register in the member areas by submitting their personal information. They will have permission only to access their information and data on the system.

Server Platforms

To run the system efficiently, the proper server platform is needed. This server platform should be capable of performing the tasks at high speed and support the multiple clients at the best multi-tasking speeds. Following is our server platform.

12-core Opteron 6100 processor: it works on the clock speeds that range from 1.7 to 2.3 GHz. This speed is quite a lot to support a full fledged and complex system. This has the capability of solving the problem of the multitasking to support thousands of the clients at a time.

Environments For Build/Test/Deploy

- Building: The 'Aviation Management System' needs to be built in a specific environment to create the correct sense of making it. The recommended environment will be a software house where we are provided with the latest and the best stimulation modules to check the validity of the project.
- Testing: The project will be tested in a real-time scenario where the test cases will be allocated and encouraged to work as an Aviation online temporarily. This testing phase will last for few months to check the possibility of any errors.
- Deployment: It is recommended that the 'Aviation Management' project is deployed at the hospitals, universities and the high schools to attract a large number of Aviation s. All of this will be connected to a cloud computing environment.

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