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Misleading Communication vs. Effective Aviation Management

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Abstract

In this paper some of the important problems and issues such as human and communication errors in safety and civil aviation management are presented. The problems arise from misleading information from different sources. To avoid the above problems, a centralization of the information is proposed here. To centralize the information for Air Traffic Management (ATM), a mining data routing system called SCADA (Supervisory Control and Data Acquisition) system is suggested in this study. The utilization of SCADA system will helps to capture air traffic information and aircraft data via satellite technology and transfer it to data mining center and then to central organization. The stored digital data will exchange the information between different organizations and will be used by management systems. The stored reliable information helps to make an appropriate decision in the Air Traffic Management system.

Keywords: Communication Errors, Civil Aviation, Civil Aviation Management, SCADA System

1. Introduction

Aircraft is considered as the easiest way for transportation in the world. It is being used as a major transportation facility between cities and countries. Therefore the effect of aviation safety on human life is significantly important. It is also very important to pay attention and be aware of any conditions that might affect the safety issue in the field of aviation. From the past accidents, it is obvious that many aviation disasters have been occurred within different situations and reasons.

One of the major issues in aviation disaster is communication errors. Ricard [1] pointed out that the Air Traffic Management (ATM) operational procedures are based on technologies introduced in 1950's. Since 1950 Air Traffic Management (ATM) has been performed on voice exchanges between pilot and flight controller [1]. The most important factors that might be involved in communication error are due to errors involving humans. Consequently, misunderstanding [2], lack of sharing ideas and lack of clarity in design briefs [3], technology and organization failures [4], are some of many problems in communicating within the aviation industry.

Despite the importance of the above problems in aviation disasters, one problem which is common in many aviation disasters is a lack of sharing information and knowledge. Therefore, in this paper it is attempted to identify most important factors that are more likely to affect sharing information and data exchange. That is a review of communication errors including revision in lack of sharing information, inadequate knowledge and incorrect information exchanges between the pilot and the cockpit. Also a review of the factors that are likely to occur in many communications along with the relation between the safety issues is presented.

In this paper, some of the most important problems and factors which contribute to aviation disasters and managing and Air Traffic management (ATM) are reviewed. Also, to minimize the risk of any disaster, a SCADA system is presented for data mining and data exchange.

2. Communication Errors

In the safety issue of aviation, reliable communication is required and necessary. In recent radio telephony survey it was found that 80% of Radio Frequency Transmissions (RFT) by pilots were incorrect [5]. Surprisingly, some statistics from the air traffic controller showed that 30% of all incidents occurred due to communication errors and rising to 50% in airport environments and hence, there are many reasons for making communication errors in different situations [5]. Also, some of the important factors to produce errors could be lack of information [3], mishearing or misunderstanding of information [2], sign confusion and Language problems [5].

2.1. Misunderstanding

Misunderstanding is a common type of communication error. According to Krivonos [2], from the past accidents the reasons of many aviation disasters are due to misunderstanding or hearing wrong information. He also indicated that usually in many cases, people hear what they expect to hear rather than what is actually said; conesquently this expectation is not always correct. In this situation, it is believed that when people make assumptions from their own expectations, they interpret the message from the actual mean and what is supposed to hear [2].

Another error that could cause many accidents and disasters is the incorrect verbal communication between the pilot and the controller. Communication between pilot and the air traffic controller are possible due to transferring of information in data link (digital data or analog information) and radio. The link of data reduces the chance of misunderstanding information between the air traffic controllers and pilot however; the radio allows the air traffic controller to check the pilot's understanding and in case of hearing wrong information, the instruction will be transmitted in a different form [6].

2.2. Lack of Sharing Information and Knowledge

It is likely that not having sufficient and correct information could affect the ability of organizations to deal with problems and disasters. As indicated in a study by Pidgeon and O'Leary [4], there are many difficulties in large-scale accident to point out the aviation problem. One of the problems is due to the resistance of organizations to giving correct information and lack of sharing data and knowledge. It indicates that learning from past accidents and mistakes is difficult. Pidgeon and O'Leary [4] showed that the barriers of learning from previous disasters are difficulties in accessing information and blaming of organizational policies in handling information. There has been some notable progress and some feedback during that time but it is accepted that the aviation industry is not a sharing industry to some extent [7]. It is shown that many disasters are preventable if the lessons from past incidents and accidents have been learned. It also indicated that not only sharing information but also viewing and learning from incident are also extremely important [7].

There are many solutions to the lack of information being shared. Lawson [3] suggested that one possible solution is peer review; this is the sharing of information technology, professional knowledge and opportunities to verify the achieved data and to improve ideas. Likewise, peer review leads to improved safety and performance due to recognition, sharing and learning in different views of professionals and operating staff [3].

3. Air Traffic Management and Satellite Technology

Information and integrated data is very critical for Air Traffic Management (ATM). Currently due to the volume of data and system availability and the overcrowding of the VHF band and the breakup of the ATM system, this issue is still very important in the European countries [1]. Therefore the way forward for 2020 Air Traffic Management system is to introduce reliable data exchange as the primary means of communication between pilots and control centers. With the growth in air traffic it is required to develop additional air to ground communication means and management.

Studies by Pouzet and Fistas [8], suggest it is necessary to utilize a reliable system as one of the new technologies for data transfer and exchange of information in Air Traffic Management. Morlet *et al*. [9] proposed the utilization of new technologies such as satellite systems for data transfer and communication in aviation. They pointed out that the satellite communications will produce great success in transport operators such as planes, ships, and trains. Kim *et al*. [10] introduced using broadband satellite communication system for service in crews of aeronautical environments. Giambene *et al*. [11] mentioned that satellite systems are a valid alternative to cover wide areas on the earth and to provide broadband communications to mobile and fixed users. Radzik [12] proposed a system design for providing access in aeronautical applications using the same satellite links as instantaneous motivation of satellite communications for ATC (Air Traffic Control).

The satellite system allows sharing of information in the aviation system. Therefore, air traffic controllers can receive greater insight into management, while pilots are responsible for staying out of the way of other aircraft [6]. Pouzet and Fistas [8] addressed some key issues for a potential application of satellite aeronautical communications in the future. They pointed out that using different technologies for different flight phases is necessary in future. Therefore, based on the previous studies, a recommendation is suggested for improvement of aviation system management.

4. Recommendation for Improvement

As a result using a system to exchange the information and data between the aircraft and controller is necessary in future development. Using the satellite communication and a Supervisory Control and Data Acquisition (SCADA) system is required for data mining and sharing of information. The SCADA system with centralized control will help to store all digital information and be able to transfer data and information to different organizations (**Figure 1**). The digital information then can be processed for further decision in Air Traffic Management. As more sufficient and correct information is used for processing, the best decision will be made.

SCADA is a system that collects data and information from various sources. In this situation sensors could be installed in every airplane to translate all data to a central location or computer for management and mining of important data. The greatest advantage of SCADA is that it will work automatically without human interference thereby reducing the risk of human error. SCADA increases the efficiency of receiving data. This will decrease the amount of risk that an airplane might be in risk of. It enables to collect data automatically and ensure the correct information being shared and helps to reduce the number of incorrect information that might be shared by any aviation company.

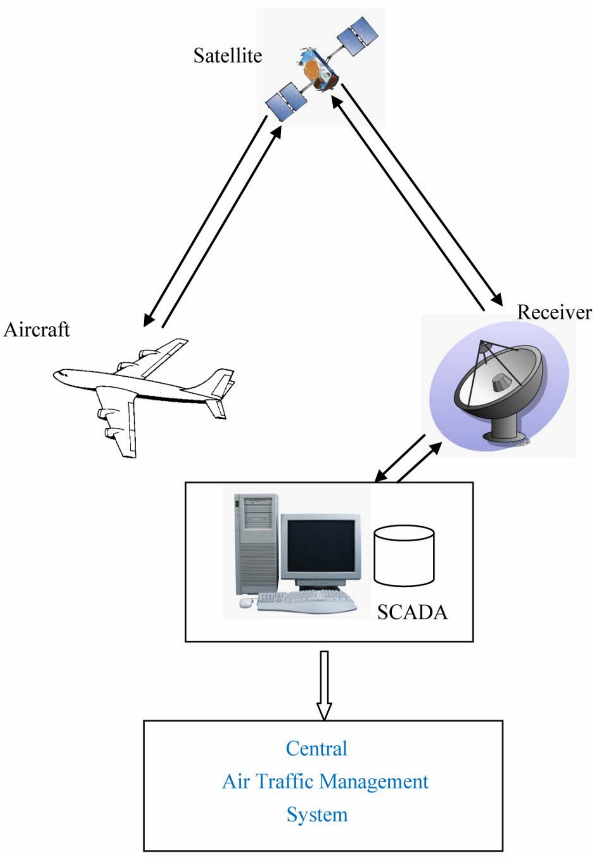

Figure 1. A schematic diagram of the digital information system.

The SCADA system efficiently reduces the cost of collecting data and has the ability to behave as a discrete sensor. Therefore, the operator or controller will be notified if there is any problem such as a technical problem on an aircraft. This alarm condition will make it possible to respond to any problem in that situation and reduce the amount of risk that makes airplanes unsafe. The mining of reliable information from airplane will help the investigators if a disaster occurs. Thus, the appropriate action will be made to reduce the possibility of the occurrence in future.

5. Conclusions

From the past accidents and disasters it can be learned that communication and human errors play an important role in aviation. There are different types of communication errors including misunderstanding, and lack of sharing ideas, self designing, lack of clarity in design briefs, technology and organization failures. In this paper, the impact of the most common communication errors including misunderstanding of information and lack of sharing information and knowledge were discussed and a SCADA system and utilization of satellite technology are presented as a solution to these problems. SCADA enables information and data from aircraft to be collected mined and transferred to different organizations. As there is no human interference in the SCADA system, reliable information can be stored. The reliable information then can be used to make an appropriate decision. This system will help improve Air Traffic Management systems and reduce the risk of disasters in civil aviation.

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