SELECTED ASPECTS OF AVIATION COMMUNICATION

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Abstract: The article refers to the selected aspects of conducting aviation communication by aviation personnel during daily activity. The characteristic of aviation communication was made by defining its kinds, types, and functions. The qualities required from aviation personnel engaged in the communication process were pointed out to, as well as the consequences of the failures in communication. It was emphasized that compliance with the principles of aviation communication by aviation personnel is one of the essential conditions for the success of any aviation mission. It was also noted that training in the field of aviation communication should be treated as a continuous process, regardless of the experience possessed by aviation personnel.

Keywords: aviation safety, aviation communication, communication functions

1. INTRODUCTION

Communication has been treated as one of the most critical issues in all aspects of aviation and aviation safety, from the cockpit-to-controller interface to coordination in the cockpit-to-cockpit, and cockpit-to-cabin interaction to, finally, the management of safety and creation of a safety culture. This fact is clearly confirmed in the statistics of aviation accidents. According to a NASA survey, Aviation Safety Reporting System (ASRS) database identifies the causes of approx. 80% incidents or accidents as incorrect or incomplete communication between pilot and controller or pilot and another crew member. The main factors affecting aviation communication were found to be: incorrect communication – 80% of reports, absence of communication – 33% of reports, correct but late communication – 12% of reports. The same survey revealed which modus of communication is affected: listening – 45%, speaking – 30%, and reading or writing 25% [13]. Similar conclusions were reached by J.B. Sexton, R.L. Helmerich [8] and M. Krifka, S. Martens and S. Schwartz [7], who argue that factors associated with interpersonal communication underpinned about 70%-80% of aviation accidents over the past twenty years. They also believe that the high level of competence in the field of aviation technology is not a sufficient antidote that could prevent the catastrophic consequences of poor communication.

So what is the communication, what are the types of communication and what factors have a major impact on the communication quality in a complex aviation mission environment? Is it right to say, that the maintaining an effective communication, characterized by a high level of communicative quality, between members of the aviation personnel, with particular emphasis put on cabin crew, is essential for maintaining an acceptable level of safety during their operational activity? Among other things, a reader should find the answers to these questions in the article.

2. TYPES AND FUNCTIONS OF AVIATION COMMUNICATION

Communication is a form of exchanging information, thoughts and feelings. It should be done in legible manner, clear to understand. It is conducted in the two-way relationship between e.g. pilot and flight crew, cabin crew, air traffic controllers or ground handling staff. However, we should not forget about the important fact, that the pilot performs among others a communication process by means of a reception and entering specific data from instruments and other onboard equipment (e.g. systems). These devices are for him/her a source of essential information about the condition of the aircraft, the task environment, the status of an air mission etc. What should be recognized as particularly important is the correct process of information exchanging in the relationships described above. It should be treated as an essential condition for maintaining an acceptable level of situational awareness by aviation personnel.

Taking into consideration the way of the transfer/ exchange of information, we can distinguish the following types of communication:

1. Written communication. Usually, it is one-way communication for a pilot in which he/she acts as a recipient, for example: checklists, manualops, letters, memos etc. The advantages of this type of communication are undoubtedly the speed and range of distribution, as well as the possibility of making quick changes to the content of the message, and its re-distribution. However, that type of communication is characterized by a number of negative traits and the impersonal nature. Moreover, the rule of one-way communication significantly limits the opportunity to confirm the correctness of its understanding. Therefore, the information in written form shall be evolved in accordance with the specified structure, applicable to the specified aviation messages. They should be written using easy language and adhering to phrases and expressions used by aviation specialists.

2. Communication through visual perception. To put it simply, this process involves collecting images from the task environment (external and internal) and processing them into the information necessary to achieve an acceptable level of situational awareness. Human sensors and the linked systems of perception receive signals (including vision, hearing, taste, smell) as a result of the implementation of multiple physiological processes which allow us to receive a number of information items in real time. This information is one of the essential elements necessary for us to perform our activity in the task environment. At the same time, it should be emphasized that the process is complex and it functions in a manner not fully clear to us.

Taking into account the research in this area, it became clear that we can sometimes see the world in not an appropriate manner (real manner) [...]. Previous experience of pilots, their expectations, motivations and requirements may significantly affect the interpretation of their perceived "images" of the task environment. H.S. Smallmanand St. John [9] described the process of perception of the task environment as follows: "imperfect interpretation (pictures acquired from the environment) which in effect gives imperfect approximation of the real state (task environment)."[3]

Therefore, a pilot who is working out a "snapshot" of the aircraft at a particular stage of the task should remember that each of the developed images of thetask environment state is imperfect. Therefore, that status should be verified by using of his/ her knowledge in a given area.

3. A special type of visual perception is the so-called "body language". The fundamental methods of communication relating to the body language include: eye contact, facial expression, touch, body structure and posture, and physical distance between the communication participants.

It should be remembered that the arrangement of seats in the most of general aviation aircraft, transport aviation, and military aircraft(seats are located side by side or one after the other), is not favorable to conduct this type of communication.

4. Verbal communication - interpersonal communication, whose medium is the spoken language. Verbal communication is often accompanied by non-verbal communication (body language and perception communication). It finds particular application in aviation activities. Such factors as accent and speech modulation play a key role in verbal communication. They have a major influence on the reaction of an interlocutor, degree of spoken fluency or the content of expression. In this case the resource of the specialist content is based on the universally accepted language of aviation phraseology and related fixed phraseology phrases, as well as vowel production understood as the reduction or extension of the time in which a given word is spoken.. Special trainings in telecommunications and aviation phraseology are devoted to this type of communication. It should be emphasized that the way in which verbal communication is conducted is very important for the receiving party, for example the speed of speech, the height of tone or voice level may indicate the level of the sender's emotions. A factor which is essential for the proper transmission/ reception of verbal information by the participants of the correspondence is the level of mental load. As a rule the greater the mental load on one or both of the participants of verbal communication, the greater is the likelihood of error, which in turn may lead to an undesirable air event. Verbal communication consists of two main components which are applicable for the sender as well as for the recipient, i.e. listening and verbal response. It is estimated that every person spends about 40% of the daily time on listening, a similar situation occurs with aircraft crews. Therefore, it is believed that listening is one of the essential skills which determine the desired level of communication quality during the air mission execution, regardless of who a participant in that process will be. It should be also remembered that listening does not always mean hearing and understanding. Another element which is essential for the communication quality is an active response.

This division was presented to indicate that the communication process is extremely complex. In practical operation onboard the aircraft it is difficult to imagine a situation in the process of building the desired state of knowledge about the aircraft, in which the pilot would be using one of these types of communication, skipping the others. Practically, during the entire process of preparation and execution of the air tasks, the pilot/aircraft crew is using all forms of communication in parallel. In fact, they are complementary and constitute one of the key factors for achieving and maintaining the desired state of situational awareness by the pilot.

3. COMMUNICATION'S FUNCTIONS

W. B. Kanki and M. T. Palmer described a structure of communication functions in aviation and aviation safety, especially as it affects crew performance, as follows [6]:

1. *Communication as a source of information* – the lack of information, incomplete or incorrect information can be one of the essential causes of undesirable flight-related events from the point of view of the situation on board an aircraft. Therefore, providing timely information is essential in situations considered as normal/ predictable, as well as those critical from the point of view of safety and effective air mission execution.

As a result of the analysis of the pilot's decision-making process, we can conclude that solving problems related to achieving an acceptable state of situational awareness by the pilot, as well as the implementation of the pilot decision-making process, including the implementation of the decision taken, is largely based on the collection and exchange of information relevant from the point of view of solving the decision problem [14]. However, when we are talking about collecting and exchanging of any information, we should have in mind not just verbal communication, but also those nonverbal forms of communication mentioned above. We can find numerous sources of internal and external information in the cockpit of a modern aircraft, necessary for the proper execution of an aviation task, including, but not limited to, aircraft crew members, aviation services members, instruments, tools and onboard systems, onboard documentation, etc.

2. *Communication as the factor which establishes interpersonal relationships* – communication also has a social role, which is particularly important from the point of view of any aviation activity. It helps to create and improve areas connected with the board crew relationship, to improve the interpersonal relationships and the atmosphere among the crew members, which has a major impact on the quality and effectiveness of executing the tasks. Because of this fact that factor of communication can be considered as one of the essential factors for building the desired level of social climate within the air crew that encourages its members to share their knowledge/information in terms of preparation as well as performance of air missions. In addition, it is worth to point out that the manner of the verbal communication conducted by the crew commander can have a major impact on the efficiency of managing the crew of the aircraft. R. G. Ginetts presents in his report a number of determinants of the effective leadership in relation to the style of communication used by the leader of the group/aircraft crew commander, who should clearly confirm during the pre-flight briefing the creation of such safety elements as: the procedures, principles, norms, and task limitations which constitute the normative organizational model of the task execution. He/She should also establish clear rules of leadership in the crew as well as every crewmember's own technical, social and management competencies[4] .

3. *Communication as a factor which establishes predictable behavior patterns*. The crew of an aircraft who perform their tasks in a particularly complex and dynamically changing task environment must meet particularly high requirements. These include, among others, the need to integrate the actions of aircraft crew members in an organized manner, taking into account specific time constraints and maintaining an acceptable level of situational awareness at each stage of the task execution. This in turn allows them to maintain the required level of predictability of their aviation activities. One of the tools to support this goal is the coordination of actions between flight crew members, which in turn is accomplished through the use of the so-called Standard Operating Procedures (SOP).The correct implementation of communication by the flight crew is an important element supporting the SOP. For example in the so-called checklists, communication allows the crew to determine what tasks should be performed, who should perform them, in what order they should be performed, and what is their purpose. [2]. Furthermore, a high level of formalism in the way aviation information is transmitted allows the flight crew members to anticipate how and when the information will in fact be transmitted and thus a large proportion of flight crew behavior can be predictable. Another important factor in the establishment of behavior schemas by the flight crews is the time they spend together in preparation and tasks execution, regardless of whether it is the time spent in the flight preparation room, the simulator or the practical execution of aviation tasks.

Spending time together allows the aircraft crews to improve their ability to participate in common activities and to better understand how to communicate (verbally and non-verbally) and thereby it reduces the likelihood of misunderstanding the content being transmitted.

In conclusion, the achievement of the common way of communication that is acceptable by all crew members enables the on-board team to improve the air mission execution at a high level of safety and efficiency.

Thus, these actions become more predictable than they would be in the case of air crews who still begin flying together. [5]:

4. Communication maintains attention to executing the task and monitoring – communication process which is correctly conducted by the air crew allows full engagement of all crew members in the execution of the task. This requires the crew to be fully focused on assessing the situation on the basis of verbal and non-verbal communication, data and information received, and on making decisions based on that, enabling them to execute the air mission in accordance with the previously developed flight plan. Obtaining that data and information is possible by continuously monitoring onboard and external sources of information, and in the event of their being insufficient in quantity or doubts as to their validity, the air crew are forced to actively acquire data and information, supplement it or confirm the proper understanding thereof. Furthermore, keeping the attention of the crew members focused at a level which is from the perspective of the air mission execution stage allows the air crew to take corrective or emergency actions within the time limit which can be defined as the required response time. Furthermore, such behavior and conduct of the air crew is conducive to maintaining an acceptable level of situational awareness by all its members, and thus to remaining in constant readiness for making decisions relevant to situations arising on board the aircraft. In conclusion, in terms of communication, the crew is interested in how the mode of communication will promote maintaining the focus of the individual crew members continuously on the task, the effective monitoring of the task environment, and the maintenance of the desired situational awareness regardless of the situation on board the aircraft.

5. Communication is a management tool – communication is one of the essential tools which support the proper management of resources at the disposal of aircraft crews, including technical assets and onboard equipment and systems, airport equipment, ground navigation equipment, etc., as well as non-technical resources such as personnel, crew, air traffic and airport services, time, mental load, etc. This happens no matter whether the task is executed by a single aircraft crew, or the mission execution is assisted by other parallel components (e.g. air traffic services) that are focused on accomplishing the same task. All their activities must be subordinated to one objective, namely the efficient and safe execution of the air task. The proper coordination of the onboard crew and/or the support teams without a properly functioning communication process is hard to imagine.

A good air crew commander/manager knows when to take a complete control over the actions being taken on board and when to let crew members/support teams carry out activities in accordance with the situation. In other words, when to manage and when to monitor the situation onboard the aircraft.[5]:

It should be stressed that the crew resource management in a mission environment which is extremely complex and dynamically changing, with the ever increasing complexity of the missions themselves, is a task that demands high levels of competence from all crew members. A particular role in this team is played by the air crew commander, that is why his experience in the execution of air missions is so important.

In the area of communication, the essential role of the aircraft commander is to coordinate the activities of the crew, as well as to establish appropriate interpersonal relationships being the condition for the accomplishment of the desired multi-crew cooperation (MCC) level. These abilities should be constantly developed by attaching great importance to the quality of conducting verbal and non-verbal communication. This is especially important in the 21st century, when air crews are dealing with increasingly modern technologies. On the one hand, these technologies allow for executing increasingly complex air missions under environmental conditions critical from the point of view of aviation technology of the last century. On the other hand, these technologies are taking over more and more human performed tasks onboard the aircraft, which should also be considered as an advantage. However, in emergency situations, the crew of the aircraft must face challenges unprecedented in everyday flights. In this case, the achievement of the expected result in relation to air mission execution depends on the quality of the tasks performed by the entire air crew. Therefore, the knowledge and skills presented by the crew commander and other crew members in the areas related to communication have a major impact on the decisions and actions taken in order to prevent the risk of an undesirable flight-related event.

To sum up, in the 21st century, it is difficult to imagine the performance of aviation tasks at the desired quality and safety level. The key questions facing today's researchers dealing with broadly understood aviation communication is what factors determine the achievement of the desired level of communication by air crews.

4. SELECTED ASPECTS RELATED TO ENSURING THE DESIRED LEVEL OF VERBAL COMMUNICATION EFFECTIVENESS WITHIN AIR CREW

In the reference literature, we can also find the assertion that effective communication is one of the essential factors supporting error control. [12] The concept of communication skills expresses both social and interpersonal skills. According to K. Balawajder [1], communication is the transfer of information between any type of system/systems and the environment. If these systems are social, we talk about verbal/interpersonal communication, and if we talk about communication with the task environment (e.g. Earth atmosphere, weather, climate, equipment and technical systems, etc.), we speak about nonverbal communication. Regardless of the communication type, it should be treated as a process in which ten characteristic elements can be distinguished (Fig.1.).
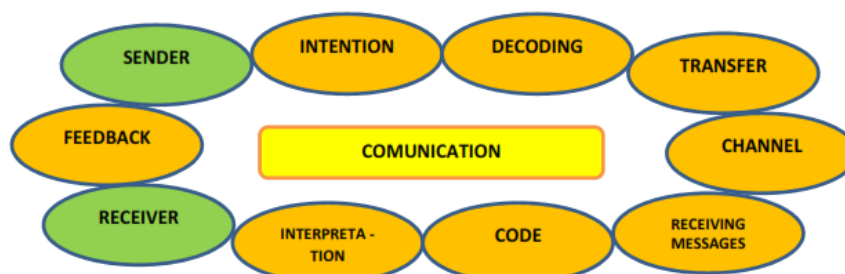

FIG.1. Characteristic elements related to interpersonal communication. Source: Author's own work, developed on the basis of: K. Balawajder, *Komunikacja, konflikty, negocjacje w organizacji,* UŚ, Katowice 1998.

No matter in which task environment we may be, those elements can be divided into two basic groups:

1. A group of elements that determines the emergence of communication (information transfer): the originator (sender), acting as a source of information, and the recipient acting as the addressee of the information.

2. A group of elements that allow for the characterizing/describing the information transfer medium, subject, efficiency and quality of the transfer, intention - treated as an objective, thought, feeling; information transfer code - translating intention, thought or feeling into information transfer in linguistic form, visualization, etc.; message - data, information transmitted in the form of a specific signal form such as speech, script, gesture, touch, image; physical channel: air, paper, electronic media, technical equipment, etc., reception of signals - active reception of data or information; decoding - translating the received signals into content and assigning them a specific meaning; interpretation - received data, information provided by the sender as understood by the recipient; feedback - recipient's response to the sender's message.

Onboard the aircraft, pilots need to maintain an effective level of data and information exchange at each stage of the mission execution. It should be emphasized that effective communication at a high quality level is the process of sending information in such a manner that the meaning of information received by the recipient is as close as possible to the intention of its sender. However, the effectiveness of communication depends not only on the sender but also on the recipient's competence to receive and understand the message. The reception of information is not equal to understanding it.

According to Z. Nęcki, the effectiveness of communication is dependent on such factors as:

- *the level of the recipient's awareness* of the sender's true intentions;

- *discrepancies between verbal and nonverbal communication* presented by the sender/recipient or both participants – differences in gestures and words;

- *lack of clearly defined purpose of communication* consisting in e.g. sudden change of the topic in a long-lasting correspondence between the sender and the recipient;

- *message code mismatch* - using a language that is too difficult or unfamiliar to the recipient, such as aviation communication codes which are country specific (e.g. Great Britain);

- *differences in perceiving (perception)* e.g. the same task situation by the communication participants;

- *differences in knowledge and skills* possessed by the sender and the receiver - the use of professional vocabulary or language (e.g. standard aviation phraseology) which is unfamiliar to one of the parties;

- *too difficult environmental conditions* that prevent effective communication
  – noise, lighting level, traffic density etc.;

- *excessive agitation* of the sender / receiver or both participants in the communication process - excessive agitation usually leads to stressful situations leading in turn to distortion of perception of reality and situation assessment, and thus it negatively affects rational thinking;

- *the tendency to over-interpretation* - searching for additional information and hidden meanings in the received message, information and/or data;

- *lack of mutual trust* between participants in the communication process or in one of them - creates uncertainty as to the quality of the data or information received and thus it evokes doubts about the applicability of that data or information, e.g. in the decision-making process.

The above-mentioned factors are particularly important when the sender, recipient or both of them perform tasks in a task environment subject to rapid changes, and the time that is at their disposal when making subsequent decisions is limited. As a rule, such is the task environment flight personnel has to deal with in their day-to-day operations. Regardless of the above, it should be stressed that in order to ensure that the information has been understood properly by the recipient, the recipient should confirm this each time. This should be done in a way assuring the sender that the recipient has received the information correctly, and what is more that the received information may be taken into account in the subsequent activities (Fig.2). The principles mentioned above are binding both in verbal and in non-verbal communication.
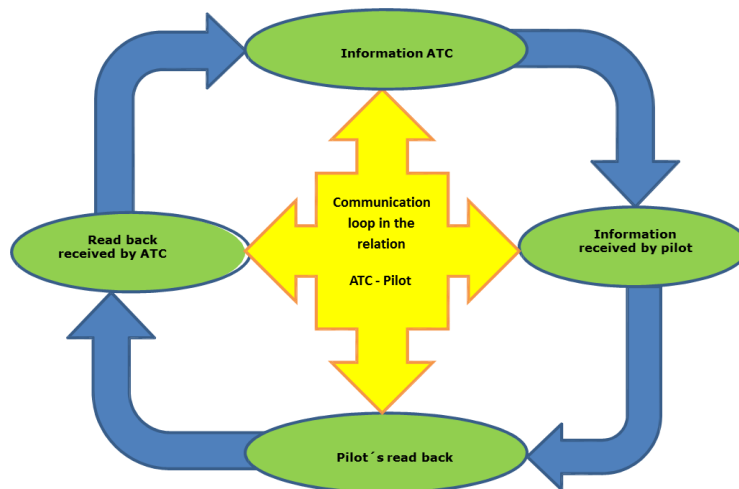

FIG. 2. The cycle determining the desired communication level exemplified by verbal communication in a pilot-air traffic controller relationship. Source: Author´s own work.

J. Stewart [1], in turn, defined three essential barriers in verbal communication, namely:

1. ***Judgment,*** which can be expressed through such forms as: criticism (of the sender or the sender's opinions), interruption of the sender's communication, making a diagnosis with respect to the opinions presented, praising connected with the assessment of the interlocutor.

2. ***Giving a solution***, which in the communication process is considered to be commanding, moralizing, asking too many questions, asking questions irrelevant to the message, unwarranted counseling.

3. ***Low involvement in addressing the problem being the subject of communication*** by diverting the attention from the point, lack of response to logical argumentation, lack of desire to pacify/rationalize the discussion.

The consequence of the emergence of this type of barriers in verbal communication can be the underlying factor for the lack of agreement among air personnel; create an atmosphere of anger and frustration, and, in extreme cases, create negative interpersonal relations, conflicts, misunderstandings, etc. What's worse, as a rule, they lead to a very low communication level, the result of which may be the misrepresentation in the information transmission or the lack of information transmission.

Taking into consideration the conclusions coming from the above communication theories and those resulting from the the analysis of the reference literature [11], we can distinguish a number of characteristics of the air personnel, which determine the desired level of communication in interpersonal relations, i.e. the relations among the air personnel members:

- *can communicate information clearly and in the manner easy to understand;*
- *communicates information when the participants in the communication process are ready to receive it;*
- *is aware of the fact that only receiving full information creates the conditions for its full understanding;*
- *is not afraid to ask questions;*
- *lets other participants in the communication process know his thoughts and feelings;*
- *presents the qualities of a good listener;*
- *presents the desired abilities to prevent conflicts in the cockpit, and once the conflict has arisen, he/she can solve it;*
- *presents the desirable ability to express and accept constructive criticism.*

Furthermore, air personnel involved in communication should be aware of their own strengths and weaknesses in that respect; pay attention to the little things; take into account the fluidity of the interlocutor's attention; not make premature evaluations; present willingness to admit own errors; take into consideration the feelings of the other person; not disregard any question; take into account that differences of opinion may be beneficial; try to take the listener's perspective, show respect to the partner in communication and speak in a clear and kind manner; they should avoid behavior that focuses too much on what one wants to say, and thus ignore what others want to say.

Taking into consideration the above, it should be stressed that only the knowledge of and the compliance with the above principles on the part of the air crew, combined with the presentation of the required level of expertise in aviation communication is a prerequisite for maintaining the desired state of situational awareness. Fulfillment of this condition is one of the essential elements which allow the air personnel to carry out the decision-making process properly and to implement its outcome correctly.

CONCLUSIONS

The fact that air personnel perform their tasks in an extremely complex and dynamically changing task environment causes a properly conducted process of verbal and/or nonverbal communication to often determine an air mission success. Therefore, air personnel, regardless of their function and tasks to accomplish, should be well prepared to carry out this process. Because of the degree of complexity and the aviation regulations, only systematic improvement of these skills may ensure the constant inflow of information and data that condition the correct air mission execution. Therefore, training in communication, both verbal and nonverbal, should be a continuous process independent of the professional experience of air personnel. That communication should become a specific part of the air safety culture. As is the case with safety rules in aviation, getting acquainted with them is not enough. They should be understood and willingly applied in everyday air operations. Otherwise, disruption in mission execution may cause an undesirable flight-related event.

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