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## BACKGROUND OF THE DECISION MAKING IN AVIATION

### VLIVY NA ROZHODOVACÍ PROCES V LETECTVÍ

#### Abstract

While there are people in operator positions in aviation (crews, air traffic controllers, engineers, managers) human errors will occur at times. The implementation of tools can reduce these errors. Tools can include, for example, a Safety Management System (SMS), Crew Resource Management (CRM), Threat and Error Management (TEM) and Behavioural Markers (BM). Part of the CRM tool is the Decision-Making process (DM). CRM is not and it will never be a mechanism for elimination errors and assure safety in a high-risk environment such as aviation. Error is a result of the natural limitations of human performance. CRM is one of the tools that organizations can use to lower and manage errors. The aim of this article is to point out the complexity of the decision-making process and the number of influences that affect it. The key factor is the right composition of the team in cockpit, generally in the whole company.

#### Abstrakt

Dokud budou v letectví lidé na pozicích operátorů (posádky, řídící letového provozu, technici, manažeři), pak občas dochází k jejich chybování. Implementace různých nástrojů může tyto chyby snížit. Mezi tyto nástroje patří například Safety Management System (SMS), Crew Resource Management (CRM), Threat and Error Management (TEM) a Behavioral Markers (BM). Součástí nástroje CRM je i proces rozhodování (DM). CRM není a nikdy ani nebude mechanismem pro eliminaci chyb a zajištění bezpečnosti, ve vysoce rizikovém prostředí, jakým je letectví. Chyba je výsledkem přirozených omezení lidské výkonnosti. CRM je však jedním z nástrojů, které mohou organizace použít ke snížení a řízení lidských chyb. Cílem tohoto článku je poukázat na složitost procesu rozhodování, a na množství vlivů, které jej ovlivňují. Klíčovým faktorem je správné složení týmu v kokpitu, obecně v celé společnosti.

#### Keywords

CRM, Decision Making, Behavioral Markers, Aviation, Leadership

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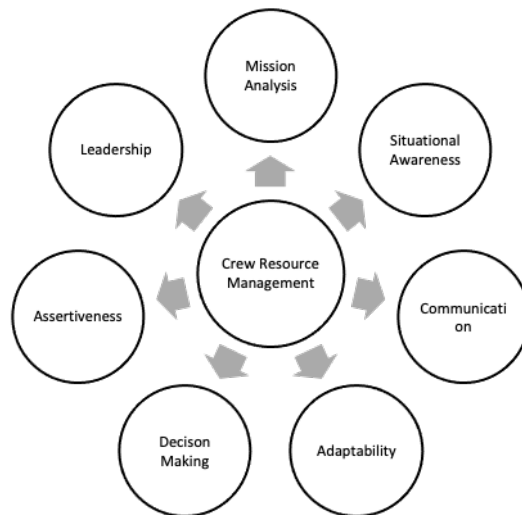
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# 1 INTRODUCTION

CRM involves the application of the human factor in aviation. The original name for CRM was Cockpit Resource Management. Training was focused only on crews (pilots, navigators, engineers on board). Training was extended to ground persons afterwards (cabin crew, ATCs, engineers on ground, etc.)

The name was changed to Crew Resource Management. CRM is a part of team works training today (police officers, doctors, soldiers). CRM as the Company Resource management is a company concept which supports the right and safe decisions of their employees.



**Fig. 1.** Parts of CRM [1]

Communication and decision-making skills - this group of skills includes behaviours related to communication and decision-making by the crew.

Management of work distribution and situational awareness - skills related to situational awareness, planning, and managing stress and workload.

## **Principles for good CRM:**

- Effective performance is based on technical knowledge and interpersonal skills
- Main purpose of CRM is good teamwork
- Members of team are flight crews (pilots and cabin crews) ATCs etc.
- CRM is focused on attitudes and behaviour of crew
- Good CRM includes all crew members. It is not only the captain's responsibility. All crew members are responsible for available resources
- CRM skills are not only theoretical. They should be exercised in a simulator in real-based scenarios
- CRM training should be part of general training including initial and recurrent ones

## **2 CRM TRAINING**

CRM involves complex training helping a crew to work together. Skills of pilots can be divided into two groups, the first comprising technical skills, the second being nontechnical.

Technical skills include:

- Aircraft control - the control and monitoring of aircraft systems, communication, and navigation
- Procedural skills - performing standard, non-standard and emergency procedures
- Information knowledge - the use of information required to perform safe control of an aircraft in areas such as aviation regulations, aircraft limits and weather

These skills are essential to the control of today's modern aircraft, but they are not in themselves sufficient to ensure safe operation. In other words, these skills must be combined with other skills to ensure safe air traffic. For example, each member must master not only technical skills, but also communicate effectively with the rest of the crew and pass on information. A crew member who tends to ignore information from other members can be dangerous to the rest not only in normal situations, especially in crisis situations. For this reason, technical skills must be integrated with the skills contained in CRM training.

The first area of CRM skills includes effective communication and decision making. The three basic elements of this area of CRM are communication, assertiveness and decision making. [2]

### **Communication**

One of the most important variables related to crew performance is the flow of information in the cockpit, between the cockpit and other stations. Effective information transfer is a complex process and requires that information be transferred at the right time. Furthermore, to be transmitted clearly and efficiently and to be properly processed by the person receiving the information. In the event of crosstalk, this information needs to be clarified to the listener.

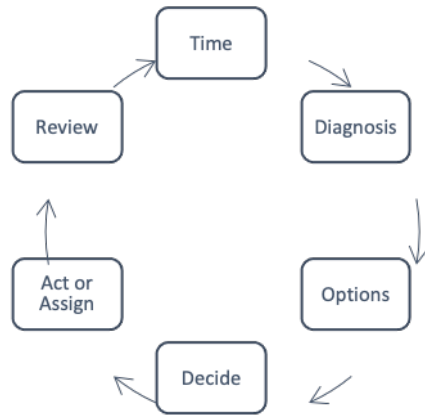
In general, therefore, effective communication should meet the following criteria:

- Information is communicated clearly, concisely
- Advocacy and suggestions are clear and assertive
- Confirmation of communication
- Providing information as needed
- Repeating of information
- Ask for an explanation if necessary
- Constructive solutions to problems

## **3 DECISION MAKING PROCESS**

Flight crew decision making is a group process. It clearly points to the collective nature of the whole CRM. A flight crew member who makes decisions regardless of the consideration of contributions from other flight crew members is much more likely to make a mistake in making his decision.

Although flight crew decision making is based on aeronautical knowledge, it is often difficult to describe how to make decisions in individual situations during flight. It was generally assumed that the right decisions could only be made based on practical experience. However, research has shown that the crew can learn to make the right decisions through training. [3]



**Fig. 2** Decision making loop [2]

The decision-making process can be divided into the following five steps:

1. Recognition and identification of the problem - There is a problem that needs solution?
2. Gathering information to assess the situation - This step requires determination what information is needed, who requires the necessary information and if the information is verified by other crew members.
3. Identification and evaluation of alternative solutions - This step assesses the advantages and disadvantages of the alternative solution and the selection of the optimal variant.
4. Making a decision - This step involves making a decision and providing feedback on actions from the rest of the flight crew
5. Reviewing the consequences of the decision - Assessing the consequences of the decision and amending the decision if the result is not what was requested.

Some decisions that must be made in a very short time and under extreme pressure should be made based on the pilot's experience and intuition. In these cases, there is insufficient time to gather all the necessary information or to evaluate alternative solutions. The intuitive solution needed for this is based on previous experience and pilot training. Fortunately, these emergencies are relatively rare. In most situations, there is enough time for an analytical assessment of the situation and subsequent decisions. [3]

## 4 TEAM BUILDING

Team chemistry in the flight crew is a very important factor. In general, people in a team who work together without problems, there is no rivalry between them, form a better team as a result. They then solve the problems faster and more efficiently. The following factors influencing the result belong to the team creation.

- Team building and maintenance of skills focuses on human interactions and skills associated with leading and following orders, maintaining a favourable climate in the work team.
- The first introduction and use of psychological tests dates to the Second World War. Most airlines, whether large airlines or small carriers, use the services of aviation psychologists. Large companies often have their own team, which is part of HR department.
- Part of psychological testing is a test where one question is usually asked several times, the system is known as a liar test. The output of this test may be, for example, a tendency to alcoholism, disrespect for authorities, a tendency to gamble, an inability to work in a team.

- Next in line is sort of an IQ test, a series of images where something is added or rotated. The time required to complete several tasks is greater than the time available to candidates. This puts them under pressure, and he is forced to work under stress.
- The last part is an interview with a psychologist, trying to find out the candidate's motivation and some personal questions.

A sad case may be the example of a German Wings 9525 flight, when the co-pilot locked himself in the cockpit, and under the weight of mental problems from a possible loss of employment, he decided to kill himself and 149 other people on board. German wings are a subsidiary of Lufthansa, which owns its own training facility. Pilots should undergo through the psychological screening several times during training.

## Behavioural Markers

Behavioural markers can be used in any domain where behaviour relating to job performance can be observed. However, they are expensive to develop and utilise given the level of training and calibration required for users. At present, they tend to be found in occupations where safety is prime and high-fidelity simulators are used for training and assessment. [1]

The use of a behavioural marker system in a formal assessment of non-technical aspects of performance presents significant challenges. The behavioural marker system must capture the context in which the assessment is made (e.g., crew dynamics and experience, operating environment, operational complexity). For example, in a team endeavour, the behaviour of one crew member can be adversely or positively impacted by another, resulting in a substandard or inflated performance rating. Behavioural marker systems should be designed to detect and record such effects. [1]

E	Excellent	All of BM present
A	Average	Most of BM present
B	Below Average	Only some of BM present
F	Failed	None or minimum BM present
N	Not Observed	Not evaluated

**Tab.1** Behavioural Markers grading

This kind of table should be part of forms for technical and non – technical training. Table is filled by ground or flight instructor.

## 5 LEADERSHIP

Leadership - Instead of leadership, it would be more appropriate to use the term leadership / following. Leadership is a mutual process in which it is necessary to follow certain behaviour. The relationship between the leader and the follower must be respected here to ensure an effective solution to the problem. The leadership is not just up to the captain. All crew members must hold a senior position in certain situations. Furthermore, leadership is not a one-way process, but requires both the action of the commander and an effective response from the crew. Understanding leadership requires an understanding of what leaders do. Effective leaders perform four basic functions:

1. Controls the flow of information - the commander must regulate and control the flow of information, ideas, and suggestions in the cockpit or between the cockpit and external sources. This feature includes:
  - Flight information communication
  - Ask for opinions, suggestions, but also give opinions and suggestions
  - Clarifying communication and providing feedback
2. Management and coordination of crew activities - the commander must act as a crew manager and provide orientation, coordination, and direction for group performance. This feature includes:
  - Managing and coordinating crew
  - Performance monitoring and evaluation
  - Planning
  - Setting of priorities
  - Task distribution
3. Motivating flight crew members - The commander must maintain a positive climate to promote good crew relations and fully involve them in operations related to the safe conduct of the flight. This includes:
  - Creating a pleasant climate in cockpit
  - Keeping the cockpit atmosphere open - everyone has a right to express their ideas freely without fear
  - Conflict resolution / prevention
  - Maintaining positive relationships
4. Decision-making - the commander is ultimately responsible for decision-making. This feature includes:
  - Taking responsibility for decisions
  - Information evaluation
  - Formulation of the decision
  - Making decision
  - Feedback providing

## **6 ECONOMICAL BACKGROUND**

The task of the airline is to make a profit unless it is a special case of an aircraft purely for the owner's needs. The profit is generated by the transport of passengers or cargo from point A to point B.

To illustrate, the company owns an aircraft whose hourly lease is 6,000 USD. The passenger wants to fly a five-hour flight. After deducting the cost of the flight, the profit is for example, \$ 15,000. The weather at the destination is poor and forecast to remain bad, but the customer insists that he will not fly to any other destination than this one. This puts the crew under pressure. The current situation on the labour market will not calm the crew down. This can result in the crew trying to complete the flight at all costs.

The crew of the owner's aircraft, or military crew may be exposed to a similar pressure. Failure to fulfil a wish/order is understood as a personal failure. One example in recent history is the accident of the Polish government's Tu-154 with the president on board in Smolensk in 2010. The crew was given a direct order to land at the airport with NDB approach only in very low visibility. An extreme example is low-cost carriers, which are under the scrutiny of authorities across continents. They mostly operate medium-sized aircraft with a consumption of 6000 litres of kerosene per hour. The price of one litre of JET A1 is about 1 USD, i.e. saving 200 litres on one flight saves \$ 200. The plane undertakes three to four flights a day. You have, for example, 500 of these aircraft in your fleet, and each fly about 300 days a year. The company's benevolence to allow the captain to take more fuel than the minimum amount before the flight, given the weather forecast, is almost nil.

## CONCLUSIONS

The Best Safety Device in any Airplane is a Well-Trained Crew – this is the motto of a famous aviation training facility. It is highly recommended to implement all available safety tools to facilitate the process of decisions. Decisions should always be cool and rational, regardless of personal gain, company profit, the desire of a crew to return home and other factors. Aviation is a dynamic industry whose current high level of safety is redeemed during 116 years of operation by the blood of several thousand crew members, not to mention passengers and victims on the ground.

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