Study Of Aviation Psychology and Its Impact on Human Factors to Substantially Reduce Human Error Through Crew Resource Management.

Dr.Lizy Kalaga

Managing Director of IIAAM

Abstract: Aviation is unquestionably one of the practical areas where psychological research has had the most impact. One of the aeronautical industry's current strengths in reducing aircraft accidents is the examination and study of human factors. While aviation psychology draws heavily on other disciplines of psychology, those other disciplines also owe much to aviation psychology for many of their advances, particularly in the field of applied psychology. This is mainly due to the historical links of aviation psychology with military aviation. Aviation industry, and pilots in particular - has always been a major concern for the military. Training military pilots is a long and expensive process, so many efforts have been made since World War I to improve the selection of these individuals to reduce training failures: provenance of personnel and the psychology of training. Similarly, the high cost of aircraft and their loss to accidents have contributed to the development of engineering psychology and human factors. Human interaction with automated systems, now a major concern in the computer age, has been studied in aviation for decades, starting with the introduction of flight direction systems and, in recent years, glass advanced cockpits. Much of the research developed in an aerospace environment for these advanced systems is equally relevant to the advanced displays and controls soon to appear in cars and trucks. Furthermore, studies on the interaction of crew members in aircraft cockpits and on the problems that arise when one of the other crew members does not clearly indicate that he understands a potentially dangerous situation have led to the development of a series of crew resource management (CRM) training. After a series of catastrophic accidents, the CRM concept and techniques were developed by the National Aeronautics and Space Administration (NASA) and the aviation industry to ensure that a crew operates effectively as a team. Building on this research foundation from aviation psychology, CRM has been adapted for other environments, such as air traffic control centres, medical operating rooms, and military command and control teams. Crew resource management (CRM) programmes have been one of the most effective solutions for addressing what is known as "human error" since their introduction in 1979. This paper provides a brief overview of the development of such training programmes, which stand as one of the pinnacles of applied psychology.

Key words: Human factors, Aviation psychology, Human error, Applied Psychology, Crew Resource Management

I. INTRODUCTION

Psychology has played a significant role in the development of aviation into one of the fundamental pillars of social life and economic activity. We can define aviation psychology as the study of individuals engaged in aviation-related activities. Thus, the goal of aviation psychology is to understand and predict the behaviour of individuals in a flight environment. Being able to predict behaviour has significant advantages. By accurately predicting how a pilot will react (behave) to an instrument reading, we can reduce pilot error by designing instruments that are easier to interpret and do not lead to false reactions. Predicting how a service technician will behave when given a new set of instructions can lead to an increase in productivity by reducing the time needed to complete a maintenance action. Predicting how the length of rest breaks will affect an air traffic controller facing a traffic conflict can lead to improved safety. Finally, predicting the outcome of corporate restructuring based on an organization's safety culture can identify areas where conflicts are likely to arise and areas where safety is likely to suffer.

From this general goal of understanding and predicting the behaviour of individuals in the aviation environment, we can identify three more specific goals: first, to reduce human error in aviation environments; second, increase productivity; and third, to increase the comfort of both employees and their passengers. Achieving these goals requires the coordinated activities of many groups of people like pilots, maintenance personnel, air traffic controllers, aviation organization managers, baggage handlers, tanker drivers, caterers, meteorologists, dispatchers, and cabin crew.

II. HISTORY

Psychology was first applied to the aviation industry during World War I, with a primary focus on the identification of the "ideal" aviator's characteristics. Psychological aptitude and personality tests were developed during this initial phase, with the goal of determining which specific qualities pilots should possess. These early studies and works combined psychological aspects with aspects closer to physiology.

Researchers lost interest in the application of psychological science to the armed forces, particularly the air force, during the time between the two world wars when the urgency of selecting pilots vanished.

Because of how difficult it became for aviators to adjust to faster, more complex machines during World War II, psychological research on the selection and training of pilots advanced. Training evaluations were implemented, and a shift from focusing on more cognitive and motor aspects to motivational ones was observed. The research's goal drastically changed after the fighting ended, shifting from a specifically wartime setting to one where civilian research dominated. Consequently, the first psychologists were hired by major airlines in 1949.

An event occurred toward the end of the 1970s that would fundamentally alter the relationship between psychology and aviation. The Cockpit Resource Management (CRM) concept first emerged as a training program for air crews at a meeting sponsored by the National Aeronautics and Space Administration of the United States (NASA), and it has since progressed through several stages of development to become the current crew resource management. CRM was a new way for air crews to work together as a team. It basically meant how to use aircraft technology, flight crew, passenger cabin, air traffic control, navigation aids, etc. to their best advantage.

III.   CRM-OVERVIEW

CRM can be defined as the optimal use, by an air crew, of all available resources (information, material equipment, and human resources) for the achievement of safe and efficient flight operations (Lauber, 1984). It was designed to reduce mistakes and increase the effectiveness of air crews. It is the formal recognition by the aeronautical industry of the significance of the study of human factors in the optimization of air operations and flight safety. It includes a set of behaviours and strategies that the flight crew possesses and must follow.

CRM is a global program of evidence-based preparation and training in management skills and abilities that is used in both commercial and military aviation. It is designed to improve team members' communication, decision-making, and adaptability in critical situations and a tool to prevent accidents that are caused by poor teamwork in the cockpit. According to the Federal Aviation Administration's (FAA) 2012 report, the program's objective is to combine human and technical skills in order to achieve safer and more effective air operations.

It is a method that uses people, technology, and processes to solve problems in order to improve performance by reducing the impact of human error (Marshall, 2010). Marshall himself (2010) provided a more in-depth definition of the program based on three fundamental pillars, which we summarize below:

- A security system approach that emphasizes the inherent nature of error, encourages a non-punitive culture, and emphasizes specific and standardized work procedures.
- A comprehensive system that is operational and based on practice and aims to proactive apply human factors to boost team performance.
- A system that is distinguished by:
  1) making the crew a standard training unit rather than just an individual;
  2) focusing on the ways in which crew members' attitudes and actions affect safety;
  3) utilizing a method of active and hands-on training that emphasizes participation and mutual learning;
  4) such as team management, work skills, and methods of leadership;
  5) encouraging the formation of participative work teams while maintaining authority and the communication chain; and,

    (6) providing individuals and teams with the chance to evaluate their own performance and make necessary adjustments. In recognition of the fact that human behaviour is prone to error, CRM software programs place an emphasis on the nature of error. Work procedures that are clearly defined are created in order to reduce errors to the greatest extent possible. Additionally, crews are provided with methods by which they can freely report errors without being penalized. By establishing "barriers to error" prior to their occurrence, these communications contribute to the development of a proactive performance improvement system. The program aims to modify attitudes and establish real work teams in which the participants can analyze their own performance and implement relevant improvements in order to optimize performance and achieve safer flight operations without compromising the chain of command. It does this by taking the team as the unit of action and employing a practical methodology based on active participation and mutual learning.

Preparing programs in CRM are, so, a key device made to work on the exhibition of a group determined to lessen the impact of what is known as "human error" and upgrading execution using every single accessible asset. The development of CRM marked a significant turning point in the relationship between psychology and aviation. It also brought about a fundamental shift in the study of aviation security. As a result, psychological science has emerged as a crucial supporter of the aviation industry in the creation of training programs aimed at reducing human error and increasing flight crew efficiency.

IV.   ELEMENTS OF CREW RESOURCE MANAGEMENT (CRM):

Many elements of Crew Resource Management (CRM) are designed to identify, avoid, capture and manage threats and errors. The 6 popular elements of Crew Resource Management (CRM) are:

1) Communication
2) Management
3) Team work
4) Workload management
5) Situation awareness
6) Planning and decision making

1) Communication

Ability to communicate (transmit and receive) information, ideas and feelings verbally (oral, written) or non-verbally. "The ability to understand and be understood by others without ambiguity"

2) Management

Skills to lead, supervise, lead and support a team to achieve defined goals and objectives."Ability to promote, engage and maintain crew cooperation and accountability"

3) Team work

Skills to work in any role in a team to ensure the execution of joint tasks; they include coordination, cooperation and conflict resolution. Sometimes combined with the "communication" theme in the CRM system. "Teamwork is the ability to work as a team to achieve a shared vision, even when that vision becomes extremely unclear."

4) Workload management

Even when everything is going according to plan, load management skills are important. In some cases, unexpected things happen. Workload management capabilities allow crews to prepare for the unexpected and constantly evaluate the best course of action should something happen. "Clarify priorities, organize task distribution and task termination according to available resources and circumstances"

5) Situation awareness

Develop and maintain a dynamic awareness of situations and risks in the activity based on gathering information from multiple sources in the mission environment, understanding its meaning, and using it to think about what might happen next. "Know and understand the condition of the aircraft, its conditions and surroundings, the condition of its crew and the effect of these factors on the flight."

6) Planning and decision making

The main purpose of CRM is to ensure high-quality decision-making across the spectrum of aircraft operations. In such cases, a comprehensive pre-flight plan will not only provide a yardstick against which in-flight decisions are made, but will also enable all crew members to successfully perform their specific responsibilities. Knowledge of the plan also allows crew members to participate in in-flight decision-making in the most effective manner. "Assess situations, make judgments, choose appropriate decision-making strategies and break the chain of errors"

V.   CREW RESOURCE MANAGEMENT (CRM) TRAINING:

In general, Crew Resource Management (CRM) is a global training program standard consisting of different modules designed to address key concepts covering three main work areas: Teams (management of teams, communication processes and decisions, work climate and team organization) and resource management. in critical situations (resource management, workload and situational awareness).

Crew Resource Management (CRM) training concepts have been adapted for use in a wide variety of activities (except aviation) that require people to make dangerous, time-sensitive decisions. These areas include air traffic control, ship handling, fire-fighting and medical operations rooms.

Therefore, CRM was developed within the realm of psychology and is one of the success stories of contemporary psychology and cognitive engineering (Cooke & Durso, 2007) as well as an essential prevention tool in the current aviation industry (Maurino, 1999). According to Salas & Cannon-Bowers (2001), CRM strategies are currently utilized with the intention of enhancing safety, reducing human error, and providing crews with the necessary training to enable them to make use of all of the resources at their disposal.

Based on a design that incorporates three major areas of work, CRM programs currently include various modules that address key concepts: Leadership (management, work environment, and team organization), command (direction), and resource management (management of resources, workload, and situation analysis) are all examples of command.

The various airlines and air force units of the Armed Forces offer introductory CRM courses, which typically last between two and five days and are led by psychologists and pilots who collaborate in their development. Lectures, practical exercises, role-playing, case studies, accident recreation videos, and other work techniques are some of the teaching methods (O'Connor & Flin, 2003). In spite of the fact that there is no normalized system for their turn of events (Salas, Fowlkes, Scout, Milanovich, and Sovereign, 1999), the courses ordinarily address subjects like collaboration, administration, situational mindfulness, direction, correspondence and individual constraints (Flin and Martin, 2001), despite the fact that there is huge changeability in this regard, mostly because of the way that their plan is adjusted to the necessities of the air administrator that completes them.

VI.   EVOLUTION AND GENERATIONS OF CRM:

Training on CRM and all its variants began in June 1979 (FAA, 2012; Helmreich et al., 1999; Marshall, 2010; McKeel, 2012), notably at a NASA-sponsored event entitled "Resources on the Flight Deck Management" (Alkovs). , 1989; Cooper, White and Lauber, 1980; (2006) Helmreich). The National Transportation Safety Board (NTSB) organized the event in part in response to the crash of United Airlines Flight 173 in December 1978. The captain's inability to follow the instructions of his crew and their distrust were the main causes of accidents (NTSB, 1978). The incident clearly illustrates the poor management of cockpit human resources and poor teamwork in the face of aircraft system failures, mainly due to the flight captain's authoritarian management style. At the meeting, NASA presented the results of a study on the factors contributing to aircraft accidents. These findings suggest that most aircraft accidents are caused by human error, such as errors in interpersonal communication or management control and decision-making. It was during this time that the term CRM began to be used to describe emergency programs aimed at reducing pilot error based on better use of HR in the cockpit.

Originally, the term "Cockpit Resource Management" was shortened to "CRM", which stood for "Crew Resource Management". Soon after, in the late 1980s, the term "cockpit resource management" was changed to "crew resource management". This shift shifts the focus from the pilot as an individual component to the aircrew as part of a team or work team. Since the 1980s, a structured CRM training program for civil aviation became possible due to research into the causes of aviation accidents (Helmreich, 2006). United Airlines developed the first CRM-specific training program in January 1981 (Helmreich et al., 1999). Australia's KLM and Ansett later followed suit in Europe (Helmreich, 2006). CRM programs (sometimes under different names) have been developed and implemented by the nation's leading carriers, Air Force, Army, Navy, and Coast Guard (Alkov, 1989). These training programs continued to spread, first in the United States and then around the world. They have been used in various other fields, including medicine (Gordon, Mendenhall, & O'Connor, 2013), surgery (Helmreich, 2006), oil rigs (O'Connor and Flin, 2003), railways (Sebastián, 2002, 2009). , underwater forces (Acua, 2013) and military divers (O'Connor & Muller, 2006).

CRM has evolved through a series of stages, each with its own set of characteristics, over the course of its history. We can distinguish six major stages in the development of CRM training programs, each based on the successes and lessons learned from the previous

stage, following Helmreich (2006) and Marshall (2010). Below, we provide a synopsis of the most significant psychological considerations at each stage, incorporating the concepts of the cited authors wherever possible.

First Generation CRM: The first CRM project was launched by United Airlines in 1981. The program itself is quite psychological in nature, with an emphasis on general concepts such as psychometric testing and management. There is also a lot of focus on improved interpersonal behavior, but unfortunately this interpersonal behavior does not promote any kind of cockpit behavior.

Second Generation CRM: In the second generation, CRM programs began to deal with aviation concepts related to flight operations and were also more modular. Training includes tasks such as team building, briefing tactics, situational awareness and stress management.

Third-generation CRM: Currently, CRM training reflects the specifics of the aviation system, with a greater emphasis on organizational culture and automation. Training has also begun to extend to other groups within the airline, such as flight attendants, dispatchers and maintenance workers.

Fourth Generation CRM: Beginning with the Federal Aviation Administration's (FAA) Advanced Qualification Program in 1990, major changes were made to aircrew training qualifications. This makes CRM an integral part of flight training and operators must provide CRM training to all crew members along with route oriented flight training (LOFT).

Fifth Generation CRM: The realization that errors cannot be completely prevented in the aviation environment has led to the development of the threat and error management concept. In short, identify and catch errors or manage errors before they occur.

Sixth Generation CRM: Management of errors and the threat posed by the operational environment. The current situation of CRM training programs has continued to evolve, primarily as a result of aviation-related events and the growth of psychological science over the past few years. The importance of CRM preparing in the functional setting is early stage (Maurino, 1999) and, right now, the proof on the adequacy of CRM preparing is great, albeit noticeably flawed (Salas et al., 2001). We can affirm, following Helmreich (2006) and Marshall (2010), that we are in the sixth generation of CRM training programs.

This generation has emerged as a logical continuation of the previous generation and reflects the fact that air crews now face external threats from the field of operation in addition to human error (Helmreich, 2006). A greater awareness of the contextual risks that must be managed is the fundamental characteristic of this stage. Flight crews now have to deal with threats to flight safety that come from the operating environment, that is, the work environment as a whole (for example, airline personnel miscalculating fuel at the time of refueling or an air traffic controller communication error).

As a result, the focus is no longer solely on the pilot, as in the first generation of trainings, nor is it solely on the crew, as in the second and subsequent generations, nor is it solely on the specific training in the use of automation and the leadership role of aircraft commanders, as in the third generation. It even goes beyond the fifth-generation error management strategy, which built on the fourth-generation AQP training strategy. The development of air operations now encompasses a much broader area of threat management and security management.

VII. OBJECTIVE OF CRM MEHTODOLOGY:

The current goal of CRM methodology is not only to identify and address systemic threats to aviation security but also to eliminate, stop, or reduce errors. The awareness of a new aspect, the external threat, that presents new challenges for psychological science applied to aviation, is the qualitative leap that occurred between the fifth and sixth generations.

However, despite the substantial progress that has been made, there is still a great deal of work to be done because the training provided by various businesses varies. Even though CRM training became required for all airlines in 1998 (International Civil Aviation Organization, ICAO, 1998), not all flight crews had received it up until recently (FAA, 2012). We must also add that CRM does not cover important aspects that may be necessary to assist crews in their work and further reduce air accidents (Muoz-Marrón, in progress; (Muoz-Marrón, Gil, and Lanero, currently in progress) On the other hand, despite the fact that action procedures or checklists are a very useful and effective tool for routine flight situations, system failures, and low-danger aerial emergencies, their use in situations of extreme danger that are novel, low-likelihood, and unpredictable has been questioned because it may require crew members to lose initiative in order to make good decisions (Muoz-Marrón, Gil, & Lanero, in progress). The relationship between CRM and the increase in aviation security is tenuous or not very evident (Maurino, 1999), possibly for this reason or due to the lack of evidence to support the idea that CRM training is having a direct effect on the accident rate (O'Connor, Jones, McCauley, & Buttrey, 2012).

VIII. LIMITATIONS:

Due to the small sample sizes of the various studies, it is currently not possible to establish a direct correlation between CRM training and reduced aircraft accidents. It is currently impossible to establish a direct relationship between CRM training and the reduction of aerial accident rates due to the small sample size of the various studies. This lack of evidence is primarily caused by the low (thankfully) rate of air accidents that occur today.It is simple to comprehend the advantages and disadvantages of CRM training programs. It is evident that the fundamental reason for human factors training is just as strong as it was when the term CRM was first coined (Helmreich, 1999). It is essential to emphasize that "CRM is not and will never be the mechanism to eliminate error and assure safety in a high risk undertaking such as aviation" (Helmreich, et al., 1999, p. 30), and it deserves to be emphasized that it is currently the most effective tool available to air operators for training in human factors. It is constantly evolving in its development; It is becoming increasingly comprehensive and sophisticated, incorporating aspects of a rapidly expanding industry and benefiting from contributions made by other fields of science, such as psychology, in the never-ending effort to reduce air accidents. The unavoidable repercussions of the human loss of life caused by air accidents necessitate the aerospace industry's ongoing efforts, to which psychology as a discipline is no longer foreign.

IX. CONCLUSION:

The issues that CRM addresses are numerous, with the following being particularly noteworthy: initiative, HR the executives, cooperation, correspondence, relational abilities, preparing and instruction, direction and compelling administration of the mistake or viable execution. The entire field has its roots in social psychology, specifically in the pioneering works of Lewin (1940, 1945,

1947) and collaborators (Lewin, Lippitt, & White, 1939) on leadership and the study of group management, with all of the interpersonal issues that come with teamwork and the need to study in greater depth the interpersonal skills that come into play when working in this manner. The subject's objective is always to attempt to achieve an effective performance or execution to avoid errors and, as a result, accidents.

CRM programs have unquestionably made the most significant contribution that psychology has made to the aviation industry. The pilots were initially unimpressed by the introduction of psychologists into the world (Helmreich et al., 1999), which was started with the main goal of preventing human error. The emergence of psychologists like Lauber, Blake, Mouton, or Helmreich himself and his team of collaborators at the University of Texas, as well as NASA's Ames Research Centre's initial interest in developing this aspect, which at the time was almost unexplored in aviation, led to the creation of a branch of applied psychology with tremendous potential for the future: aviation psychology or aeronautical psychology

It is reasonable to anticipate that psychology will continue to hold the same significance as it has up until this point given that the goal of CRM has been clearly defined and that the process is moving in the right direction to achieve a higher level of aviation security based on a decrease in human error. Given the crucial role that these qualities play in putting into practice effective behaviour in emergency situations and the evidence of the gap that exists in the current training on these matters, we could even assume, without the slightest hint of exaggeration, that the contribution that psychology will make to further research will be even greater, with a special focus on the improvement of the training of all airline personnel (an aspect that began in the fourth generation, as it included the entire crew in the training programs) and the selection, preparation, and training of crews in areas like flexibility and creativity, given that these qualities are crucial for putting effective behavior into action in emergency situations and that there is a lack of training on these topics.

X.   BIBILOGRAPHY:

1. Alkov, R. A. (1989). The Naval Safety Center's aircrew coordination training program. In E. Salas, K. A. Wilson & E. Edens (Eds.), Critical essays on human factors in aviation: Crew Resource Management (pp. 3-7). Hampshire, UK: Ashgate.
2. Barcelona, Spain: Labor. Birnbach, R. & Longridge, T. (1993). The regulatory perspective. In E. Wiener, B. Kanki, & R. Helmreich (Eds.), Cockpit Resource Management (pp. 263-282). San Diego, CA:
3. Academic Press.
4. Blake, R. & Mouton, J. (1964). The Managerial Grid: The key to leadership excellence. Houston, TX: Gulf Publishing Co.
5. Blake, R. & Mouton, J. (1985). The Managerial Grid III: The key to leadership Excellence. Houston, TX: Gulf Publishing Co.
6. Cooke, N. & Durso, F. (2007). Stories of modern technology. Failures and cognitive engineering successes. Boca Raton, FL: CRC Press.
7. Cooper, G. E., White, M. D. & Lauber, J. K. (Eds.) (1980). Resource Management on the flightdeck: Proceedings of a NASA Industry Workshop (NASA CP-2120). Moffett Field, CA: NASA-Ames Research Center.
8. Federal Aviation Administration (1997). Aviation safety action programs. Advisory Circular 120-66. Washington, DC: Autor.
9. Helmreich, R. L. (1997). Managing human error in aviation.
10. Scientific American, 276(5), 62-67.
11. Helmreich, R. L. (1999). Building safety on the three cultures of aviation. Proceedings of the IATA Human Factors Seminar (pp. 39- 43). Bangkok, Thailand, August 12, 1998.
12. Helmreich, R. L. (2006). Red alert. Flight Safety Australia, September-October, 24-31.
13. Helmreich, R. L. & Foushee, H. C. (1993). Why Crew Resource Management? Empirical and theoretical bases of human factors training in aviation. In E. Wiener, B. Kanki & R. Helmreich (Eds.), Cockpit Resource Management (pp. 3-45). San Diego, CA: Academic Press.
14. Helmreich, R. L., Merritt, A. C. & Wilhelm, J. A. (1999). The evolution of Crew Resource Management training in commercial aviation. International Journal of Aviation Psychology, 9(1), 19-32.
15. International Civil Aviation Organization (1989). Human Factors Digest Nº2: Flight crew training: Cockpit Resource Management (CRM) and Line-Oriented Flight Training (LOFT)
16. (Circular 217-AN/132). Montreal, Canada: Autor.
17. International Civil Aviation Organization (1998). Human factors training manual (Doc. 9683-AN/950). Montreal, Canada: Autor.
18. J. (Eds.), Crew Resource Management (pp. 445-466). San Diego, CA: Academic Press.
19. O'Connor, P., Jones, D., McCauley, M. & Buttrey, S. E. (2012). An evaluation of the effectiveness of the crew resource management program in naval aviation. International Journal of Human Factors and Ergonomics, 1(1), 21-40.
20. O'Connor, P., Muller, M. (2006). A novel human factors training curriculum for U.S. Navy diving. Paper presented at the Undersea and Hyperbaric Medical Society Meeting, Orlando, FL.
21. Orlady, H. W. & Foushee, H. C. (1987). Cockpit resource management training (Technical Report NASA CP- 2455). Moffett Field, CA: NASA-Ames Research Center.
22. Turner, T. P. (1995). Cockpit resource management: The private pilot guide. U.S.A.: McGraw-Hill.
23. Wiener, E. Kanki, B. & Helmreich, R. (Eds.) (1993). Cockpit resource management. San Diego, CA: Academic Press.
24. Flight-crew human factors handbook, CAP 737, UK Civil Aviation Authority.
25. ICAO DOC 10002, Cabin Crew Safety Training Manual.
26. Human Factors in Aviation: CRM (Crew Resource Management) , Daniel Muñoz-Marrón.
27. Crew Resource Management, A Paper by The CRM Standing Group of The ROYAL Aeronautical Society.
28. Crew Resource Management Improves Decision Making, By JERRY MULENBURG.