

Human Resource Management Training and Accident Prevention in the Airline Industry

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The airline industry functions under intricate and high-risk situations, and, accident prevention is at the core of airline operations. Research findings on the past two decades in aviation indicate that over 70 percent of aircraft accidents and incidents are directly linked to human error. These facts draw light on the necessity to identify and understand human error, in order to minimize it and, in turn reduce aircraft accident frequency. Perhaps one of the most effective and yet, complex means to prevent aircraft mishaps, is professional pilot training. Indeed, pilot skills required and enhanced through training are multi-faceted, and, go beyond the knowledge or ability required to fly an aircraft.

In fact, the increase in air travel demand throughout the 1970s and, the augmented automation in aircrafts led aerospace agencies to realize that teaching a pilot “how to fly” was no longer sufficient to meet the industry safety demands and requirements. Eventually, new strategies and programs were implemented to cater to this new philosophy. Incorporated in this revolution of training perspective came the understanding of the importance and impact of human error on accident prevention. Indeed, in 1979, the National Aeronautics and Space Administration (NASA), created a workshop called ‘Resource Management on the Flight Deck’. In this practicum, NASA presents findings that reveal the pivotal role of pilot error or ‘human error’ in air accidents or incidents. The main focus revolves around training pilots on the reduction of crew error, and, optimizing human resources and

performance in the cockpit. This NASA initiative opened the door to a whole new type of aviation training that not only deals with technical issues but also addresses human error in relation to aircraft mishaps. This training was later identified by Crew Resource Management (CRM). In our research, we closely inspect errors behind aircraft accidents and incidents, in order to analyze the evolution of Crew Resource Management training in relation with the reduction of particular types of pilot errors.

Section 1: The Evolution of Crew Resource Management

In the 1979 NASA workshop on ‘Resource Management on the Flight Deck’, John K. Lauber, a psychologist member of the National Transportation Safety Board (NTSB), defined CRM as “using all available sources—information, equipment, and people—to achieve safe and efficient flight operations”. Referring to Seamster, Boehm-Davis, Holt, & Schultz (1998), CRM is the development of crew performance vis-à-vis the more cognitive and managerial aspects of flying. This further encompasses skill training with respect to technical issues associated with the more psychomotor aspects. CRM includes a wide range of knowledge, skills, and attitudes such as communication, situation awareness, problem solving, decision-making, and teamwork, along with all

the relative sub-disciplines which each of these areas involves. In sum, CRM training uses human resource management knowledge, skills and attitudes to perform and run aircraft operations, and, to entirely

amalgamate these techniques throughout every facade of the airline culture, in order to ultimately prevent incidents and possible accidents (Driskell, & Adams 1992). The CRM training evolution was divided into several phases that were identified by the ‘CRM Generations’ (Helmreich, 1996).

Section 1.1: The first 3 CRM Generations

Following the 1979 NASA initiative, United Airlines created the first inclusive aviation human resource-training program in 1981. As the first building block of CRM training in airlines, this was referred to as the ‘First Generation’ CRM. Facts acquired after the 1978 United Airlines crash, led the organization’s management to be at the root of the decision taken to implement these types of seminars. Analysis of the crash, demonstrates the captain’s lack of resilience, situational awareness and cooperation skills, which led him to disregard the co-pilots warnings of an abnormal flight situation, and, ultimately resulted in the unfortunate crash of the airplane. Accordingly, seminars (generic non-industry related discussion sessions) and tutorials (games and assignments) that illustrate managerial efficiency concepts such as resilience, assertiveness and situational awareness were the main focus of this ‘First Generation’ CRM training.

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In 1986, researchers from Delta Airlines started developing what is now known as the 'Second Generation' CRM. Essentially, this 'Second Generation' was based on the managerial efficiency concepts originated in the 'First Generation', along with some changes in the content and structure of the program. The seminars have now a modular structure and an increased industry-specific context. In addition, the training now deals with issues such as: team building, stress management and decision-making. The modular structure of this 'Second Generation' CRM training made it a more comprehensive and structured program, which inspired the trainees towards it. However, regardless of the efforts in the 'Second Generation', the relevancy to the aviation industry was yet to be established.

Eventually, the constant need to have a CRM training that is particularly related to aviation, paved the way for a 'Third Generation' CRM (1990 to 1993). The structure of this Generation courses was similar to the previous one, nevertheless, the content was specifically oriented towards the aviation industry. Indeed, it incorporates all aviation systems' features in the courses modules. Further, the training began focusing on human factors (enhancing the interaction between crew members and avionic systems in the cockpit). It was now offered to any airline employee with a role in flight safety including flight attendants, dispatchers and mechanics etc. In fact, in major U.S. carriers, the 'Third Generation' was characterized by a joint cockpit / cabin CRM training. Also, the 'Third Generation' started to relate CRM with technical training, hence, enabled trainees to have a better application of training in their every day tasks. Eventually, the enhancements created in the 'Third Generation' triggered the need within the U.S. aviation community for the CRM training to be in the hands of an official agency. Further, it was undeniably apparent by this stage, that Crew Resource Management should be incorporated into all aspects and phases of technical aviation training and operations.

Section 1.2: The 4th Generation CRM

In 1990, the FAA created the Advanced Qualification Program (AQP). This program is a complete crew training plan that is designed to ensure the integration of CRM and technical skills with all other flight procedures required by specific flight conditions. It offers systematic training including Line Oriented Flight Training (LOFT), where trainees apply CRM principles in full mission simulators and are being monitored and assessed throughout the exercise.

In 1994, with the effective implementation of the AQP, the FAA has helped developing what is known as the 'Fourth Generation' CRM. Despite the fact that, the 'Fourth Generation' CRM is based on the previous generation principles, a major shift in training is highlighted by two distinct characteristics of the AQP. The first one is the incorporation of CRM principles into the Standard Operating Procedures of flight (SOP). The second one is the initiation of an innovative CRM full flight simulation training for pilots, instructors and evaluators (one that trains on every aspect of CRM and on the newly developed SOPs). In order to fully understand the importance of

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this training development, it is vital to scrutinize the characteristics presented in the 'Fourth Generation' training.

The 'Fourth generation' developed new flight procedures in a manner which emphasizes specific CRM elements by incorporating these elements into old SOPs. These 'new and improved' SOPs aid crewmembers by facilitating overall crew communication, by developing a consistent pattern of crew coordination. As a continuous reminder to the importance of CRM within the operational environment, this fourth generation training further serves as a reminder to pilots with regards to the importance of consistent procedure adherence. In addition, the new checklists incorporate CRM in a manner where crew decision-making was enhanced and prepared for possible difficulties

or errors prior to their occurrence (Helmreich, 1996). For instance, during lower levels of workload, takeoff procedures now require the crew to address situational awareness aspects relevant to a takeoff, which ultimately serve to enhance decision-making during takeoff. This prepares the crew to quickly undertake correct decisions in case any difficulty is encountered after the plane has taken off the ground. As well, some SOPs now identify the crewmembers' roles and ask them to back each other up with decisions. The new procedures also require a constant communication among the crew, they remind of the necessity of teamwork and encourage the crew to ask questions and clarify doubts and concerns. Clearly, those reengineered SOPs aim at enhancing crew coordination by reducing the captain's assertiveness while specifying its necessary role, and, by encouraging communication and teamwork. In addition, the new procedures can ameliorate the decision-making process in the cockpit, by requiring crew members to make decisions as part of a team and not individually. Conversely, the 'Fourth Generation' utilizes the flight simulator to practically apply and incorporate all the knowledge obtained from the CRM course material, by putting flight crew members under specific conditions within the simulator cockpit. The CRM simulation training enables crewmembers to obtain feedback on their performance throughout different flight situations that pose different threats and obstacles. The feedback received from subordinates, superiors and instructors further educates pilots on improving communication, coordination and decision-making within diverse flight situations.

Section 2: Results

Taking into account all leading causes of accidents/incidents within major U.S. carriers between 1990 and 1999 (a sample of 655 NTSB accident investigation sheets), our research classify accidents/incidents that were triggered by human error into four identifiable categories, which are then assessed. These categories are constructed in accordance with the 4th generation CRM training characteristics, in order to determine whether the shift between the 3rd to

4th generations was indeed effective in significantly increasing flight safety. The four chosen categories comprise: Pilot 'crew coordination' Error, Pilot 'decision-making' Error, Pilot 'Standard Operating Procedure adherence' Error and the 'Error of professionals outside the cockpit'. Our results demonstrate that when the 4th generation CRM training was initiated in the industry pilot 'crew coordination', 'decision-making' and 'SOP adherence' error drops (see figure 1). Taking into consideration that CRM training is the most commonly recognized program to be directed at decreasing the latter types of human error in the industry, it is noteworthy to observe that a positive impact has occurred on the reduction of these types of errors within the investigated time increment. Conversely, as seen in figure 1, unlike the error rates for pilots, the error pattern of 'professionals outside the cockpit' demonstrates a constant trend spanning the examined periods; with no significant change (downwards or upwards) witnessed after the 1994 shift year. In this paper, the error of 'professionals outside the cockpit' is used as a control variable. In fact, within the shift from the 3rd to 4th generation CRM training, although the manner in which flight crews were trained was altered, there was no significant development in the CRM education for professionals outside the cockpit. A significant change in the error of 'professionals outside the cockpit' rate between the two assessed periods would indicate that a factor other than CRM training is having an impact on human error in the aviation industry.

Section 3: Implications and the Future of CRM Research

Most of the previous research in the field evaluates CRM by interviewing pilots in order to gauge and profile perception on training. Our study proposes an assessment of CRM from a different perspective, that of a close inspection of particular error trends. It does not portray on its own the evolution of CRM training, however, a research that combines both the results obtained here, and those of trainee perceptions, provides a highly reliable analysis of CRM training evolution. One that assesses the progression from two different perspectives: the decrease/increase of particular error trends, and, the perception of trainees on training techniques' quality and pilot qualifications. Conversely, this research examines CRM training as a whole, hence, an in depth analysis of separate components of CRM training is important for future research in this area. Further, the effect of factors such as the culture of an airline, the size of the air carrier, the exact number of pilots who took the training and the industry training investment must be looked upon in prospective assessments of the CRM program. On the other hand, the research findings of this study can be directly applied towards enhancing student perception of CRM training. The error rates assessed, concern all pilots in the industry, and, by demonstrating the effectiveness of the 4th generation in reducing these types of errors, this research enables airline companies to increase trainee confidence in the CRM curriculum. Alternatively, Helmreich and Merritt

are introducing new concepts and principles in CRM training, paving the way for an adaptable 5th generation CRM to cater to the needs of both the U.S. and international aviation community. 5th generation CRM training principles remains greatly unchanged from the 4th, however, adapts a more direct focal point on the Error Troika (preventing the error from occurring through three lines of defense). This should create a proactive organizational culture, one that encourages airline employees to report any encountered incident, hence, offering a wider range of data to use in accident prevention work. With this focus, emerges a need to tackle the cultural barriers faced by the exportation of CRM, and thus, the assimilation and further acceptance of CRM principles amongst international carriers. Once the 5th generation CRM is to be fully integrated within major national and international airlines, an evaluation and comparison with the 4th generation should be conducted. Such as those analyzed in this study, for future research directions, particular error rate development between the 4th and 5th generational CRM training curriculums should be assessed.

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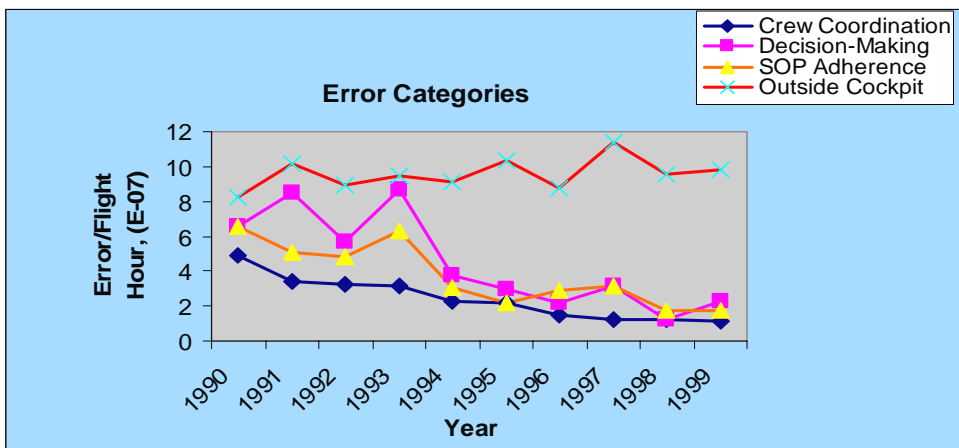


Figure 1: The Effect of the 4th Generation CRM on Human Error in Airlines