Integrated Airline Organizational Frameworks and Crew Resource Management Effectiveness

Triant Flouris

INTEGRATED AIRLINE ORGANIZATIONAL FRAMEWORKS AND CREW RESOURCE MANAGEMENT EFFECTIVENESS

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It is only through well-designed and implemented Crew Resource Management being deeply rooted in an airline's organizational culture that an airline can achieve its highest possible standard of safety, by having the highest degree of operational efficiency. It is not Crew Resource Management training itself that contributes to well-trained crew members who implement Crew Resource Management principles in flight operations. Rather, it is a strong company organizational culture that contributes, ultimately, to the effectiveness of Crew Resource Management.

INTRODUCTION

Crew Resource Management (CRM) is based on the "effective management of a pilot's available resources."[1] The aviation community has come to the consensus that Crew Resource Management is a valid concept as several early studies on different aspects of CRM have demonstrated that causal links can be established between Crew Resource Management and flight safety[2]. Precisely, the analysis of several accidents in which the flight crew did not apply at all or did not apply Crew Resource Management concepts correctly are cited as Crew Resource Management related accidents[3]. Crew Resource Management is elusive as a concept and practice because it is multidimensional and its content is shaped by particular circumstances that arise in the air and on the ground. The aforementioned definition of Crew Resource Management as the effective management of a pilot's available resources is in itself problematic. What do we mean by effective, what by management, what is available and what is a resource?

The above questions are valid and effective[4] and Crew Resource Management training programs depend on they ways airlines define the above concepts.

This paper recognizes the elusiveness of Crew Resource Management as a concept and therefore the difficulty in teaching Crew Resource Management "effectively" in training programs. Therefore, this research proposes an alternative to maximizing the overall safety and operating efficiency benefits of Crew Resource Management training. Our approach borrows heavily from organizational behavior theory. The most salient criticism of Crew Resource Management programs is that, whilst they focus on a concept that has to do with enhancing communication and cooperation and as such maximizing the efficiency of available resources, as the definition tells us, they are heavily technical in nature. So, Crew Resource Management training programs are captive of a mistake, which has been made in training programs for many years,

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[1] Krause, Shari. Aircraft Safety: Accidents, Investigations, Analyses, and Applications. New York, NY: McGraw-Hill, Inc., 1996, 5.

[2] See, Caro, Paul "Flight Training and Simulation" in Human Factors in Aviation. Ed. Wiener, Earl and Davis Nagel. San Diego: Academic Press, 1988: 258-259; Chute, Rebecca and Earl Wiener. March 1995. "On a Collision Course?" Air Line Pilot: 20-25; Foushee, Clayton and Robert Helmreich "Group Interaction and Flight Crew Performance." Human Factors in Aviation. Ed. Wiener, Earl and Davis Nagel. San Diego: Academic Press, 1988: 189-227; Helmreich, Robert "Does CRM Training Work?" Air Line Pilot. May1991: 17-20; Negrette, Arthur. "Cockpit Communication Could Save Your Life." Rotor and Wing International. February 1987: 22-23; Viets, Jack. "Cockpit Resource Management and Airline Safety." San Francisco Chronicle. 15 January 1986: Aa9.

[3] Ibid.

[4] Effectiveness is defined as "utility maximization." We can argue in circles here if we get into a definitional debate because effective actually means the reduction of accidents. Given that establishing causation in accidents is a problematic task in itself, the definition of "effective" can be a major problem; so, this paper in its limited space will not address.

which they try to eliminate. That is, whilst Crew Resource Management training tries to create pilots with skills that go beyond technical skills, Crew Resource Management in itself is taught as a technical skill.

In this paper, we assume that Crew Resource Management is a non-technical, multidimensional, and elusive concept. Based on this assumption, we argue that Crew Resource Management should not be taught as a technical skill, but rather in non-technical and holistic ways to aid airlines in their Crew Resource Management training. This paper argues that the answer to maximizing the understanding and implementation of Crew Resource Management concepts in flight operations is the grounding of Crew Resource Management principles in a company's organizational culture. The just mentioned core argument of this paper suggests that, it is not Crew Resource Management training itself that contributes to well-trained crew members who implement Crew Resource Management principles in flight operations. Rather, it is a strong company organizational culture that contributes, ultimately, to the effectiveness of Crew Resource Management.

CREW RESOURCE MANAGEMENT: DEFINITION AND EVOLUTION

The concept of Crew Resource Management has proven so successful that many of the world's airlines have developed at least some form of Crew Resource Management training. The core of the program is to create teamwork and alleviate pilot error. Various techniques are designed to enhance management and leadership methods, emphasize decision-making and judgement skills, improve effective communication with others, and provide an overall productive work environment. The training also develops a keen insight into a person's behavior pattern during normal and emergency situations.

As early as 1976, NASA researchers studied the value of total crew involvement and teamwork. One simulated exercise involved 18 experienced Boeing 747 pilots. The test included a progressive emergency coupled with bad weather and numerous cockpit distractions. Several flight engineers abandoned their critical fuel-burn calculations to oblige flight attendants who had interrupted them with trivial matters. As a result, "NASA noted a number of gross operational errors, including one miscalculation of 100,000

pounds of fuel"[5]. "Although some captains resumed a leadership role and regained the flight crew's attention, others either never heard what the flight attendant asked for or did nothing to stop the second officer from discontinuing his duties"[6].

Although most of the professional flying community has accepted Crew Resource Management training as a viable asset to one's leadership style, the United States National Transportation Safety Board (NTSB) continues to document cases in which the cockpit is more like a demilitarized zone than a positive work environment. Usually being the more experienced airline pilot, the captain is most likely to dictate the objectives and priorities of the flight. Therefore, an underlying tone might be created that does not allow other crew members to speak freely or worse, to do their jobs. In those cases, Crew Resource Management training might be the only way crew members could form a bridge between conflicting viewpoints or personalities and achieve the mutual goal of ending the day without incident. This is the reason why it is imperative to hire pilots with personalities pre-disposed to substantively accept Crew Resource Management principles.[7]

It is important to note that a breakdown in Crew Resource Management can cause problems other than fatal accidents. These may include operational inefficiencies and errors such as fuel miscalculations, clearance misunderstandings, ATC instruction misunderstandings, poor crew coordination etc, but could also include incidents and non-fatal accidents. An example of such an incident is TWA 843 on 30 July 1992, a L1011, which caught fire after take-off at John F. Kennedy International Airport in New York[8].

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[5] Krause, Shari. Aircraft Safety: Accidents, Investigations, Analyses, and Applications. New York, NY: McGraw-Hill, Inc., 1996, 6. Also see, Foushee, Clayton and Robert Helmreich "Group Interaction and Flight Crew Performance." Human Factors in Aviation. Ed. Wiener, Earl and Davis Nagel. San Diego: Academic Press, 1988: 189-227.

[6] Krause 1996, 6. Krause, Shari. Aircraft Safety: Accidents, Investigations, Analyses, and Applications. New York, NY: McGraw-Hill, Inc., 1996.

[7] This point will be addressed and further explained later in the paper, when suggestions for a more effective implementation of crew resource management training are discussed.

[8] National Transportation Safety Board. Aircraft Accident Report: Aborted Takeoff Shortly After Liftoff, TWA 843 30 July 1992, Lockheed L1011, N11002, JFK International

The take off roll was uneventful until the captain called VR. The airplane had just lifted off when the first officer said, "Getting' a stall. You (the captain) got it." The captain replied, "Okay," and took the controls. Immediately thereafter, the first officer said, "Abort, get it on," quickly followed by the second officer's comment, "Get it off." The first officer and second officer then repeated their earlier comment. In the confusion, the captain asked, "What was the matter? To which the first officer replied, "Getting a stall." As the captain turned the airplane off the runway to avoid hitting the blast fence, the first officer replied, "Stay with it. Stay on the breaks, stay on the brakes." The airplane stopped in an open grass covered area[9]. "The NTSB cited "the inadequate crew coordination between the captain and first officer that resulted in their inappropriate response to a false stall warning" as the probable cause of the incident,[10] which produced no fatalities but caused an evacuation of the aircraft.

United Airlines, with the assistance of NASA's human factors division, pioneered one of the most respected Crew Resource Management programs in the world. A specialized team of psychologists, researchers, and pilots determined that effective Crew Resource Management training must incorporate three distinctive phases: awareness, practice and feedback, and continued reinforcement. Each phase is composed of several key elements, which when applied collectively, have been known to enhance the crew's overall work performance. According to documented statistics, since United began the Crew Resource Management training program, the airline's accident rate went from one hull loss per one million operations to one hull loss per 4.8 million operations[11]. The average for all United States carriers is still one hull loss per one million operations. Nevertheless, the progress of these managerial concepts and techniques can be measured only during the aftermath of an incident or accident.

Crew Resource Management training has changed dramatically since its inception. The original focus was on

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Airport, Jamaica, New York. July 30 1992. Washington DC, 31 March 1993.

[9] Ibid.

[10] Ibid.

[11] Krause, Shari. *Aircraft Safety: Accidents, Investigations, Analyses, and Applications*. New York, NY: McGraw-Hill, Inc., 1996.

the cockpit crew. As programs matured and evolved, their focus broadened to include cabin crews and other elements of the system in which crews' function. Crew Resource Management programs also became more operational in focus and began to concentrate on specific behaviors that enhance team functioning. Many of the later courses also began to address system issues and the influence of culture on team interaction.

ORGANIZATIONAL CULTURE AND ORGANIZATIONAL BEHAVIOR

Definitions of organizational culture vary, according to the academic discipline from which they originated. Business schools have the tendency to define organizational culture as phenomenon that can be managed. Sociologists and Anthropologists stress the uniqueness of individual organizations. This uniqueness is a historically derived subjective phenomenon that goes beyond simple management. Organizational psychologists with an empirical background believe that organizational culture can be broken down in its component parts and then studied part by part.

We define organizational culture as the values, beliefs, assumptions, rituals, symbols, and behavior that define an organized group, especially in relationship to other organized groups. The visible part of organizational culture consists of observable behaviors and recognizable manifestations such as members' uniforms, symbols and logos, organizational routines and rituals, and printed documents. The deep layer of culture consists of the values, beliefs, and the subconscious assumptions that provide the logic, which guides the members' behaviors.

The important aspect of organizational culture vis-à-vis Crew Resource Management effectiveness is the underlying culture or deep culture. The visible part of culture is only procedural and is based on an organizational symbology. An employee dissatisfied with his organization who is not performing his duties to high standards will still wear the company uniform to work. Therefore, in this scenario, the values, beliefs, and subconscious assumptions of the employee, vis-à-vis his organization are sub-optimal and yet, his appearance will appear normal.

The cultural strength of an organization has been defined by researchers in organizational management, sociology, and anthropology, in a variety of ways. It has been defined

as coherence[12], homogeneity[13], stability and intensity[14], congruence[15], and internalized control[16]. Cultural strength relates to whom and how many accept the dominant values, how strongly these values are held, and how long the values have been dominant[17]. The underlying concept to cultural strength is the way in which employees accept these values. That is, employees must substantively believe in their organizational culture.

To substantively believe in one's company's organizational culture an employee must be convinced of the superiority of that culture and that culture must conform to his personality and national culture. This discussion is further complicated for organizations that exist in multicultural states[18] and companies that rely on expatriate personnel, thereby bringing a multitude of people for diametrically different cultures, ethnicities, and nations under one organizational rubric. Does cultural strength actually have an impact on organizational performance? Using an operationalization of cultural strength[19], two longitudinal studies have shown that a strong culture is predictive of organizational performance as measured by

short-term profits and growth in assets[20].

It is obvious that we cannot make similar claims about the relationship between cultural strength, organizational behavior, adherence to Crew Resource Management principles, and flight safety. However, if the assumptions of this paper are correct vis-à-vis the relationship of organization behavior based on organizational culture and safety based on effective Crew Resource Management then, a careful study linking organizational behavior and safety will demonstrate the validity of our assumption. A research project as such will be valid and provide airlines with the evidence and procedures they will need to implement organizational behavior changes to aid their respective organizational cultures for the ultimate goal of safety.

CONCLUSION

There are several issues that airlines need to address in order to enhance their Crew Resource Management training by basing it on a strong organizational culture basis and thus, contribute to their overall safety and operational efficiency records. As a first step, clear organizational standards[21] and policies need to be set. These standards need to be clear enough so that they explicate the airline's goals and procedures. Company publications and other documents provide an opportunity to strengthen company culture by articulating the values and publishing the norms. Management needs to always send a "we" message in its intra company communications rather than a divisive "us and them" message. Multicultural and unicultural airlines alike should be explicit with their directives. Airlines should adopt a "best practices" approach to standards and procedures to allow all employees to focus on the important outcomes.

Airlines should also use systems and procedures, flight and ground training—as they do already—toward the achievement of effective Crew Resource Management and ultimately safety. Technical skills training should remain true to its core focal point, which are technical skills. The

[12] Deal, T. and A.. Kennedy. Corporate Cultures: The Rites and Rituals of Corporate Life. Reading, MA: Addison-Wesley, 1982.

[13] Ouchi, W. and R. Price. 'Hierarchies, clans and theory Z: A new perspective on organizational development,' Organizational Dynamics, 7, 25-44. 1978.

[14] Schein, E. Organizational Culture and Leadership, 2nd edn. San Francisco, CA: Jossey-Bass, 1992.

[15] Schall, M. 'A communication-rules approach to organizational culture', Administrative Science Quarterly, 28, 557-81. 1983.

[16] DiTomaso, N. 'Symbolic media and social solidarity: The foundations of corporate cultures', Research in the Sociology of Organizations, 5, 105-34. 1987.

[17] Gordon, G. and N. DiTomaso, "Predicting corporate performance from organizational culture," Journal of Management Studies 29 (1992): 783-98.

[18] That is really not a major problem because in culturally diverse states we still see the relevance of a national culture, which goes beyond cultural or ethnic diversity and unifies people under one national framework. The United States is a good example of such a case.

[19] Cultural strength was measured based on the consistency rather than the content of employee responses to survey items about organizational culture.

[20] Denison, D. R. Corporate Culture and Organizational Effectiveness. New York, NY: Wiley Publishers, 1990. Gordon, G. and N. DiTomaso, "Predicting corporate performance from organizational culture," Journal of Management Studies 29 (1992): 783-98.

[21] Such as Standard Operating Procedures (SOPs) on crew behavior, flight safety, intercultural sensitivity etc. that help achieve organizational standards, that is, company values and norms.

major mistake some airlines make is to assume that Crew Resource Management can be taught as a technical skill. Certain aspects of Crew Resource Management are helped by technical skills[22] but Crew Resource Management itself is a non-technical skill; rather it is a behavioral pattern, which can be enhanced through training in certain technical skills, which are part of it. In other words, Crew Resource Management is an attitude and crew members must be predisposed to accept this attitude and, through training and contemplation, help it flourish. We should not forget that, a good CRM pilot is one who knows how to fly his plane. CRM skills, in the absence of proficient technical skills are worthless. Though, proficient technical skills in the absence of CRM skills are one sided and dangerous. This study advocates that CRM is not a technical skill and should not be taught as a technical skill but at the same time it is imperative that it works in synergy with technical skills to achieve the overarching goals of safety and operational efficiency.

A major complication here is the reliance of many airlines on the military in terms of their pilot recruitment. Military pilots are groomed to be more self-reliant than civilian pilots[23]. They are also more used to a more regimented order of Standard Operating Procedures than a civilian pilot, an order that includes taking orders without questioning authority and giving orders expecting their authority not to be challenged. The above mentioned "military" attributes, though exaggerated and simplified, are not compatible with Crew Resource Management goals which include effective use of all available resources which is based on effective communication and cooperation. Airlines need to make sure not only that they hire

technically well qualified crew members but crew members with an open mind to accept Crew Resource Management principles and maximize their use in flight operations in a substantive and not a procedural way. In other words, new employees should be selected for their potential to be inter culturally sensitive, in addition to their technical competence.

How can an airline train crew members in the technical aspects of Crew Resource Management once it has recruited those pilots that it has identified as suitable to accept the principles of Crew Resource Management in their substance?[24] Simulator training and classroom training are both very effective ways if they are designed and conducted properly and by qualified instructors. Simulator training in particular can become a very effective and safe way to rehearse the company's standards and procedures. The inclusion of Air Traffic Controllers and non-cockpit personnel in Crew Resource Management training classrooms and simulators is very important and has been part of Crew Resource Management training programs for many airlines recently. It is important because through flight and non-flight crew interaction we can ensure mutual understanding when it comes to each group's roles and responsibilities in flight operations. We can also ensure that through interaction and mutual understanding the above mentioned groups could coordinate their actions effectively to deal with emergencies or to improve the overall efficiency of flight operations.

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[22] For example the use of specific codified language to describe certain situations and crew actions in an effort to minimize miscommunication based on linguistic misunderstanding.

[23] Especially those who served as fighter jet pilots and had to rely primarily on their own judgement to make all operating decisions that had to do with their aircraft. Coordination and communication with other pilots did not exist on operational issues in the same cockpit, even though many single pilot military operations do require effective communication skills. This is the primary reason why the military is placing more and more emphasis on Crew Resource Management Training. It the strong "individualism" attributes eclipse in one pilot military operations then, military pilots in the future will be more suitable to accept Crew Resource Management responsibilities in commercial operations.

[24] A very important question to be addressed here is how does an airline know which individuals are more suitable to be good Crew Resource Management candidates. The best method would be to subject them to more multi dimensional personality tests than the ones currently administered to gauge their potential for working effectively in-groups. Research has identified certain attributes as good predictors of communicative success; these include patience, maturity, stability, self-confidence, perseverance, problem solving, tolerance, professional commitment, and initiative. The problem here is how these above-mentioned qualities can be measured effectively given there are personality traits and as such hard to quantify. Personality traits are very important and should be stressed early on in pilot training. Student pilots should be trained on the technical aspects of training but also on the effective management of resources in flight operation, from the first day of their training. That would be necessary in terms of helping student pilots develop those personality characteristics, which will help them become effective professional pilots, early on in their careers.

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There is another form of non-technical training, which could also be considered, particularly by airlines with multi-cultural crews. Intercultural awareness and sensitivity training could be provided to expatriates, their families and host nationals[25]. This training will facilitate quicker adaptation to the new environment and stronger cooperation amongst employees. It is equally important, if not more important, to make sure that existing employees are not offended by new and alien practices and have a general attitude, which facilitates understanding of other people, especially when these people are different than them[26]. It is not only the old adage "when in Rome do as the Romans do" which is important here. As "Romans" we must accept that visitors may be different than we are and not well versed in our ways, so, we should exhibit an attitude of understanding other people's ways that do not conform to our accepted norms. As such we should be willing to give the "benefit of the doubt" to these people, at least in the short run, and help them adjust in their new realities.

The best-designed Crew Resource Management training programs can only achieve their potential impact if they are harmonized with an airline's national, professional, and organizational cultures. Figure One provides a graphical depiction (as a funnel) of the link between the existence of a strong and integrated organizational framework (the bond in the funnel), several employee groups (circles in the funnel) that are a part of that framework, Crew Resource Management training in which these groups participate (as well as Air Traffic Control), and operational safety.

Implementation of effective Crew Resource Management training, which is shaped by and in turn can shape an airline's organizational culture, depends on many very significant variables.

The history of the airline is very important in determining the shape and magnitude of its training programs. An old established carrier would have different demands than a new carrier. Whether an airline has been subject to a cohesive historical background rather than the product of mergers is also very important. Airlines that have come to exist as products of mergers have normally a harder time with the cohesion and implementation of procedures as, in a certain case, the airlines that merged may have had many managerial and other incompatibilities.

The size of an airline is also an important discriminating factor in the implementation of Crew Resource Management training programs. Small carriers have different needs than large carriers, which in many cases could outsource training instead of providing it in-house. The country of origin of an airline is also important due to regulatory frameworks and governmental involvement in the industry or even airline. Flag carriers owned and operated by governments often have structures that resemble civil service structures. Training must comply and be compatible with these realities and cater to the existing type and strength of the airline's organizational culture.

The point that there are not universally valid truths in Crew Resource Management training needs to be stressed. Something that works in Spain might not work in Singapore and vice-versa. Training programs must be culturally sensitive in addition to being tied to an organizational culture. This "cultural relativity" argument does not mean though that any Crew Resource Management program, as long as it is culturally sensitive, is a good program. Culturally sensitive programs with poor content are as ineffective as programs with good content that are culturally insensitive. The argument here is that training programs must be delivered differently to different constituencies and be structurally adapted to fit specific organizational cultures.

It is only through well-designed and implemented Crew Resource Management being deeply rooted in an airline's organizational culture that an airline can achieve its highest possible standard of safety, by having the highest degree of operational efficiency. Airlines need to start

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[25] Language training may also be important and serve as a facilitator to intercultural awareness, for, one cannot understand another culture if he/she does not understand the primary medium of verbal communication in that culture, which is its language. Native English speakers should also be trained on how to communicate simply and precisely with non-Anglo personnel when needed and to avoid, at any cost, the use of linguistic idioms in their communication. All pilots and other personnel should strive for the least ambiguous communication possible in the cockpit, between cockpit and non-cockpit crew, and between cockpit and Air Traffic Control.

[26] Airlines need to be careful though in this situation not to treat expatriate pilots "too" nice, as this would run the danger of creating a dual-class system structure of pilots within the company, which in turn could cause significant internal resentment within its pilot ranks. If local pilots think they are treated not as nicely as expatriate pilots then, serious blows to group cohesion and company organizational culture will ensue.

treating their employees as important members of a group with a common organizational identity. Properly trained and informed employees who are well treated—along with their families—by their airline have the potential to be happier and thus more productive. Establishing a family type relationship with employees, a relationship based on mutual understanding and sensitivity, should start before the employee is hired and continue until the employee retires.□

Triant Flouris holds a Ph.D. in International Economics from the University of South Carolina (1995). He is a commercial pilot and flight instructor with over 3000 total flight time. He joined the Aviation program at Auburn University in March 1998 after having worked for Victoria University of Wellington, New Zealand as a fellow for one year and Portland State University as an Assistant Professor for two years. His research includes European Union Economic and Industrial Policy, Production and Operations Management in Aerospace Manufacturing, Airline Operations Management, and more recently CRM. He has published a book (Communication in International Economic Negotiations) and several refereed and academic journal articles.

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REFERENCES

Deal, T. and A. Kennedy. Corporate Cultures: The rites and rituals of corporate life. Reading, MA: Addison-Wesley, 1982.

Denison, D. R. Corporate Culture and Organizational Effectiveness. New York, NY: Wiley Publishers, 1990.

DiTomaso, N. 'Symbolic media and social solidarity: The foundations of corporate cultures', Research in the Sociology of Organizations, 5, 105-34. 1987.

Foushee, Clayton and Robert Helmreich "Group Interaction and Flight Crew Performance." Human Factors in Aviation. Ed. Wiener, Earl and Davis Nagel. San Diego: Academic Press, 1988: 189-227.

Fuller, Ray, Neil Johnston, and Nick McDonald. Human Factors in Aviation Operations. Aldershot, UK: Ashgate Publishing Company, 1996.

Goffee, Rob and Gareth Jones. The Character of a Corporation: How Your Company's Culture Can Make or Break Your Business. New York: Harper Collins Publishers, 1998.

Gordon, G. and N. DiTomaso, "Predicting corporate performance from organizational culture," Journal of Management Studies 29 (1992): 783-98.

Helmreich, Robert and Ashleigh Merritt. Culture at Work in Aviation and Medicine: National Organizational, and Professional Influences. Aldershot, England: Ashgate Publishing Limited, 1998.

International Civil Aviation Organization. Accident Prevention Manual. Montreal, Canada.

International Civil Aviation Organization. Manual of Aircraft Accident Investigation. Montreal, Canada.

Jensen, Richard. Pilot Judgement and Crew Resource Management. Aldershot, UK: Ashgate Publishing Company, 1995.

Jreisat, Jamil. Public Organization Management: The Development of Theory and Process. Westport, CT: Quorum Books, 1997.

Krause, Shari. Aircraft Safety: Accidents, Investigations, Analyses, and Applications. New York, NY: McGraw-Hill, Inc., 1996.

Nadler, David. Champions of Change: How CEOs and Their Companies Are Mastering the Skills of Radical Change. San Francisco, CA: Jossey-Bass Publishers, 1998.

National Transportation Safety Board. Aircraft Accident Report: Aborted Takeoff Shortly After Liftoff, TWA 843 30 July 1992, Lockheed L1011, N11002, JFK International Airport, Jamaica, New York. July 30 1992. Washington DC, 31 March 1993.

Ouchi, W. and R. Price. 'Hierarchies, clans and theory Z: A new perspective on organizational development,' Organizational Dynamics, 7, 25-44. 1978.

Schall, M. 'A communication-rules approach to organizational culture', Administrative Science Quarterly, 28, 557-81. 1983.

Schein, E. Organizational Culture and Leadership, 2nd edn. San Francisco, CA: Jossey-Bass, 1992.

Tjosvold, Dean and Mary Tjosvold. Leading the Team Organization: How to Create an Enduring Competitive Advantage. New York, NY: Lexington Books, 1998.

Wells, Alexander. Commercial Aviation Safety. New York, NY: McGraw-Hill, Inc., 1998.

Wiener, Earl, Barbara Kanki, and Robert Helmrich. Cockpit Resource Management. San Diego, CA: Academic Press, 1993.

Wiener, Earl and David Nagel, eds. Human Factors in Aviation. San Diego, CA: Academic Press, 1988.

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FIGURE 1
Organizational Culture, CRM, and Safety[27]

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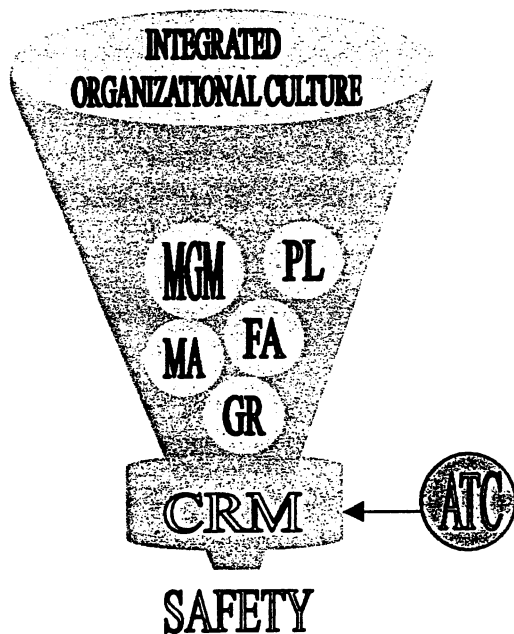
[27] MGM stands for Management; FA stands for Flight Attendants; PL stands for Pilots; MA stands for Maintenance; GR stands for Ground Services; ATC stands for air Traffic Control.