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Human Factors and National Goals

Training individuals to work together as a team is central to safety in tomorrow's air transportation system.

by

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(Adapted from a paper presented during the U.S. Department Of Transportation open forum on Innovation and Human Factors at the James L. Knight Conference Center, Miami, Florida, U.S., August, 1989.)

Human factors. Cockpit Resource Management (CRM). Why have these subjects created so much attention in the last few years? Has the reason been that more than 70 percent of major aviation tragedies were not caused by technical proficiency, or equipment failures, and could possibly have been averted if the operating crew members had been trained to function more as a *team* than as highly trained *individuals*? In all too many of these accidents, the investigations revealed that significant breakdowns occurred involving human factors.

Even more disturbing is that improved technology, or better procedures and techniques, or more resources does not seem to ensure the elimination of these significant human factors breakdowns.

What we have discovered in the cockpits at Pan American is that, while each of these factors may be important, they do not substitute for individuals working effectively, with each other, as a team. We focus on human factors training as being equally as important as technology, policy and procedures, and crew member training. Flight crews are now trained as a team in addition to the usual skills required to fly and command a commercial jet aircraft.

The untapped potential for improved safety margins, through human factors efforts such as CRM, is enormous. Athletic teams *win* when they perform well as a team and not when they perform just as highly skilled individuals.

Why is human factors training becoming so critical now, and why must it be central in the development of U.S. National Transportation Policy? Let's look back a few years:

Effects of Deregulation

The lack of human factors awareness in commercial cockpits was being investigated and studied shortly after the U.S. Deregulation Act in 1978. The impact of that single legislative act is still reverberating throughout the aviation industry today. Freedom of entry and exit into markets and the elimination of complicated pricing regulations were the catalyst, but the final document created an environment different and more hostile than anything the authors could have imagined.

There could not have been a better time to begin to tap the reservoir of safety potential in human factors. The environment had changed drastically. Airlines, taking advantage of the entry and exit permissiveness of deregulation, increased and decreased city pairs at will. New airlines started with suspect fitness requirements, at low cost, and grew overnight into darlings of the industry

and darlings of the financial community. In the 1980s, airlines struggled financially; some went bankrupt and many merged.

Confusion reigned. The traditional order and predictability within the industry changed dramatically. Everyone became preoccupied with survival. Heterogeneous employee cultures were thrown together, at times to the detriment of standardization and discipline. It may have been good business, but it was poor human factors.

Many of us are concerned about the prospects for a blurred distinction between survival and safety. We have a complex series of problems that demand immediate attention.

Highly skilled crew members need, in addition to flying abilities, awareness and training in dealing with the psychological impact of deregulation, high-technology glass cockpits, crowded skies, new and inexperienced crew members, B-rates of pay and leveraged buyouts. Then there is the unknown reaction of different pilot cultures when forced together due to the merging of two or more airlines with entirely different levels and kinds of procedures and standardization.

Progress Is Being Made

Does it work? Will human factors training improve safety? Today, we are already seeing the rewards of human factors training.

A Boeing 747 en route from Honolulu experienced a structural failure of the forward cargo door latch that resulted in the separation of the door and a large part of the fuselage skin. There was an explosive decompression. In addition, two engines were shut down due to metal ingestion. The crew, functioning as a team, created, modified, and executed procedures developed through effective communication and teamwork during the emergency. They saved the plane and all passengers except those lost in the explosive loss of the door.

A Boeing 727, on a night takeoff at Boston's Logan International Airport, had a commuter aircraft cleared into position at the runway intersection 3,500 feet ahead. During the takeoff roll, the 727 crew saw the aircraft as they approached 80 knots. It was too late to stop. Functioning as a team, they effectively communicated and supported one another as they steered to the right, selected firewall thrust, rotated early and just cleared the commuter aircraft. Slight damage was done to the aircraft and it returned to Boston. During this short flight, the coordinated teamwork of this crew was of the highest level. It was a tribute to teamwork and human factors training.

A Lesson Becomes Clear

What can we learn from such recent experiences in aviation safety? We should learn that we need to pay a lot more attention to human factors training. Most advancement in aviation has centered around giant leaps in engineering technology. The by-product of space research has generated a great reservoir of aviation technology.

However, there has been relatively little emphasis on human factors research and how it applies to the new technology. It makes sense that if a majority of aviation accidents are directly related to human factors breakdowns, we should concentrate a large part of our safety efforts in this area.

Another lesson we can learn is the importance of an independent research arm to assist and guide us in developing and fine-tuning our training programs. Research is not just for product development, or for medicine, or for other aerospace technologies. Research is also useful for monitoring how we develop our own people as crews and work teams.

Like many, we have a tendency to slide back to tried and true techniques and ways of doing things. The research data and findings have definitely helped us stay on track to make changes in our human factors training where needed.

As a result of research findings by the U.S. National Aeronautics and Space Administration (NASA) and others, the U.S. Federal Aviation Administration (FAA) has considered CRM training to be an integral part of the advanced qualification program that is being introduced as a special federal aviation regulation for qualifying airlines. Pan American World Airways and United Airlines are two carriers that have current training programs incorporating many, if not all, of the ingredients of this new FAA program.

We are beginning to move in the right direction in human factors training. However, going from where we are now, to incorporating this crucial type of training into our National Transportation Policy will require definite, bold steps.

Where To From Here?

Perhaps I have a unique perspective on how to proceed. I have been the union leader of a pilot work force and am now a senior operations manager. I am also an active line pilot qualified on the Boeing 747. I speak from 30 years of active flying experience when I say our government needs to take the following actions:

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Pan Am and CRM – One Airline's Introduction

Human factors is not a new consideration at Pan American World Airways, but, like any new concept, implementation has sometimes been a bumpy road. When the airline introduced the Boeing 747 into international service in 1970, innovative concepts and procedures were required to manage systems and people into a coordinated team.

Pan American staff looked to the U.S. National Aeronautic and Space Administration (NASA) for guidance, specifically regarding their human factors and behavioral studies conducted for the Apollo space mission. What they found was an innovative management concept that suited all of our cockpit operational requirements. It was properly named "Crew Concept."

Crew Concept provided for the cross-checking of all critical information. It was an operational concept that tied together specific duties, responsibilities, and accountability, with full and complete coordination between the other crew members.

To many of us today, this may seem like common sense, but it represented a definite shift away from the "Clipper Skipper" concept, where the captain's edicts were never questioned or challenged. As a result, all aircraft operating and flight operations manuals were modified to establish this fundamental principle. It has become the foundation of Pan American's flight procedures and is reinforced during recurrent and transition training.

This year, except for new hires, we finished putting all of Pan Am's 2,000- plus pilots and flight engineers through a training program called Cockpit Resource Management. CRM is the enhancement of Crew Concept in today's complex and demanding aviation environment.

CRM is a comprehensive system for improving crew performance using the crew as the unit of training, not the individual. This training is a system which can be extended to all forms of crew member training. CRM focuses on crew member attitudes and behaviors along with an opportunity for self-analysis through role playing and video feedback.

It is active training that is self-convincing and hands-on, where the subjects experience, participate and reinforce new learning techniques in teamwork training. CRM training includes communication, situational awareness, stress management, inquiry, assertion, collaboration, interpersonal relationships, leadership, conflict resolution, decision-making and critique.

The Honorable John Lauber, member of the U.S. National Transportation Safety Board (NTSB), defines CRM as: "The effective utilization of all available resources — hardware, software and liveware — to achieve safe and efficient flight operations."

The first direct reference to CRM occurred in 1979, when the NTSB, researching a DC-8 accident, suggested that the FAA urge all carriers to indoctrinate their crew members in the principles of flight deck resource management "with particular emphasis on the merits of participative management for captains and assertiveness training for other cockpit crew members."

In June, 1988, the NTSB recommended that all major air carriers "review initial and recurrent flight crew training programs to ensure that they include simulator or aircraft training exercises which involve cockpit resource management and active coordination of all crewmember trainees, and which will permit evaluation of crew performance and adherence to those crew coordination procedures."

Pan American investigated CRM potential following the final DC-8 accident report, and we actually developed and implemented a CRM training segment as part of our recurrent training program in 1980 and 1981. Unfortunately, like many others, we felt this could be accomplished in a one-hour training presentation.

In 1984, after further research and study, we knew that a more innovative and research-based program was needed. We began CRM seminars for training and check airmen in 1985 and 1986. After extensive surveys of line check pilots, it became apparent that refinements were required in the existing program to the extent that it became obvious a new generation CRM program was necessary.

In 1988, this program was developed in association with William R. Taggart of Resource Management Associates, in Austin, Texas, U.S., and presented to Pan American crew members starting in May, 1988. It became an integral part of our training program later that year. As of August 1989, 2,259 Pan American airmen completed this training. Newly hired airmen will be trained in human factors awareness after flight training and line indoctrination.

Independent data collection of pre- and post-seminar surveys, by Professor Bob Helmreich at the University of Texas, under a NASA grant, has confirmed positive acceptance and attitude shifts in the Pan American airmen group.

— Robert Gould

Human Factors *(continued from page 2)*

- Take the lead in committing to a central role for human factors in the development of U.S. national transportation policy. Only government can do this; it is a proper role for government.

- Form meaningful partnerships with labor, business and the academic community to advance human factors training. We in the industry will share our experience and resources.

- Provide human factors eduction. There should be central quality guidance and encouragement.

- Require human factors impact studies to evaluate the safety of merging heterogeneous employee groups with diverse work cultures and current labor/management unrest.

- Sponsor human factors forums where we can all share information. So much is known by individual entities and so little is shared collectively within the industry.

- Keep politics out. This does not mix with safety. Mandating prematurely may appease a constituency, but it doesn't enhance safety.

As independent companies, there is one area that we should address as soon as possible and work on together with manufacturers and government agencies. This is digital flight data recorder (DFDR) monitoring. It is a valuable human factors tool used extensively by all major European airlines plus, I am told, several other carriers around the world — but not used at all in the United States.

Digital flight data recorder monitoring permits airline managements, crew members and their labor representatives to learn, in detail, how airplanes are flown and where to address corrective action.

The concept is attracting a lot of interest within the flight safety and operations disciplines among U.S. airlines, but has not gained the FAA's attention. A lot needs to be done to bring DFDR monitoring programs to fruition in the United States, and safeguards must be developed to assure that the data is only used for safety and operational purposes — not for crew discipline. I am very optimistic that we can accomplish this in the near future and that DFDR monitoring will add an important dimension to our understanding of human factors in airline operations.

Finally, we must have the courage to sponsor voluntary compliance and move away from punitive regulation. Most of us in the transportation industry strive to be safe — above all else. It is impossible for the government to monitor most things most of the time. A comprehensive level of surveillance is only achievable by a willing industry partner. The rewards for the public are extraordinary. ♦

About the Author

Robert L. Gould is senior vice president-operations at Pan American World Airways. He is responsible for flight operations, maintenance, engineering, materiel, logistics, purchasing and system control.

He joined Pan Am in 1965 as a navigator on the Boeing 707, after serving as a captain in the U.S. Marine Corps, flying attack aircraft. He is currently rated as captain on the 747. Gould has served in a number of operations and executive positions at the airline.

Gould has served as chairman of the Master Executive Council of the Air Line Pilot's Association, as chairman of the Employee Stock Ownership Plan and, from 1982 to 1985, as a member of the Board of Directors of Pan Am.

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