Synergy in an emergency: The interface between flight-deck and cabin crews

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Synergy between flight-deck and cabin crews is never more imperative nor challenging than during an onboard emergency. Should an evacuation become necessary, it is critical that the mechanisms in place to assist passenger egress operate quickly, efficiently, and without faltering. Emergency equipment inspections are routinely conducted during maintenance and before every flight to ensure that all emergency equipment is compliant with minimum operating requirements. However, in the case of the crew interface between pilots and flight attendants, no such review is required. In fact, there are no regulatory guidelines or industry standards for the crew interface at all.

Effective communication and coordination between pilots and flight attendants should not be taken for granted. In air carrier operations, establishment of a smooth operating relationship may be hindered by the fact that the crews may never have seen one another before boarding the aircraft and schedule constraints may limit the amount of interaction possible before a flight. The stress of an emergency complicates human interactions and reactions. Compounding those obstacles are misconceptions, assumptions, and stereotypes that discourage and distort communication. Given all of these impediments, it is easy to see that in a quickly unfolding onboard situation, one has a recipe for disaster.

In this paper, I examine communication between flight deck and cabin crews in abnormal and emergency situations. To determine the status of the crew interface, I review previous research on communication barriers between pilots and flight attendants in normal situations, the current literature on the effects of stress on communication and decisionmaking, and cite some accidents and incidents where the communication between the crews was degraded. Implications for increasing the likelihood of synergy between the crews during abnormal operations are discussed.

The Cockpit and Cabin Crew Interface

In previous research, Chute and Wiener (1995a, 1995b, 1996) proposed an Information Transfer Model (formerly called the Five Factor Model) of the barriers that exist which impede the flow of information between the cockpit and cabin. As an introduction to that model, we will examine the cockpit and cabin environments and the characteristics of the respective crewmembers. While crews share the same goals, the safety and efficiency, and productivity of the flight, a cursory analysis of the geography of the aircraft and demography of the crewmembers suggests contrasts in the overall experience of flight (see Table 1).

In fact, if one looks at almost any dimension, one can see dissimilarities, if not the polar opposite, in the other crew. One caveat: we are speaking here in generalities and in relative terms not absolutes. However, this comparison reveals striking differences that influence the perceptions and decisions of each crew.

Table 1. Crew differences by dimension.

Dimension	Cockpit	Cabin
Gender	Male (primarily)	Female (primarily)
Age	30-60 (primarily)	20-40 (primarily)
Workspace	Confined	Spacious
Physical Activity	Stationary	Active
Noise level	Quiet (relatively)	Noisy (relatively)
Terminal Workload	High	Low
Cruise Workload	Low	High
Cognitive Orientation	Technical	Social
Department	Flight Operations	Marketing/Sales

The Information Transfer Model.
An Information Transfer Model proposed by Chute and Wiener (1995a, 1995b, 1996) describes the barriers that inhibit cockpit and cabin crew interactions. Five factors have been identified which act as filters through which any decision to contact a member of the other crew must pass. See Figure 1 for a graphical representation of this model. Please note that the factors are not mutually exclusive and the focus is on bi-directional communication. A brief summary of each factor follows.

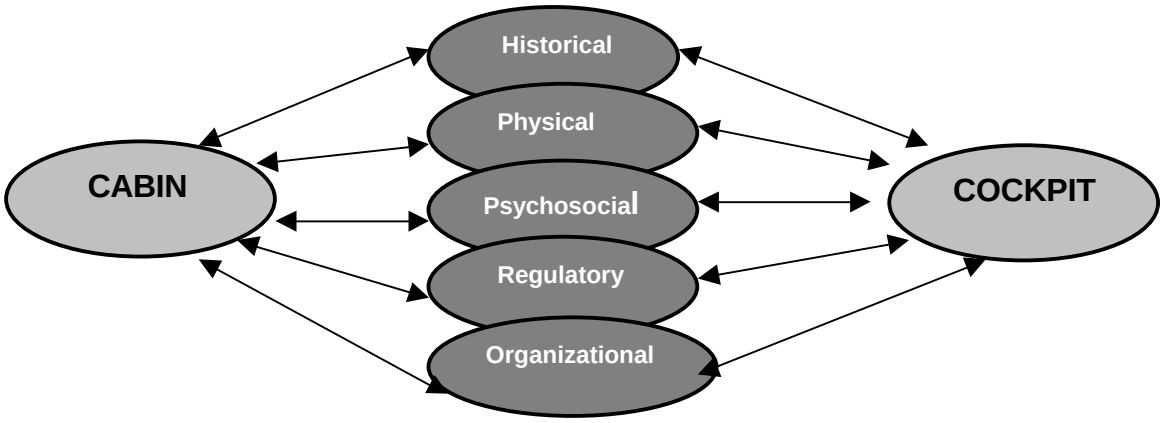

Figure 1. The Information Transfer Model.

Historical. In the 70-year history of commercial air carriers, traditions and roles have evolved which influence the crews of today. The original aviators were intrepid pilots who risked life and limb to deliver the mail. Despite primitive aircraft and the lack of

radio guidance, those independent, self-reliant fliers persevered. In contrast, the original flight attendants were nurses and were selected to be compliant and subservient. Therefore, two very different types of people were called upon to work together in close proximity to one another. A rigid chain of command was adopted from the military and maritime traditions. Additionally, the pilots and stewardesses were relegated to separate departments. Moreover, early flight manuals instructed crews not to converse (Mahler, 1991). Remnants of those policies are still in evidence today.

Physical. The cockpit door separates two completely different physical environments and prevents direct contact unless one crewmember enters the other's domain. On one hand, the cockpit is a confined environment, relatively quiet, and the personnel are stationary in the performance of their tasks. The cabin, on the other hand, is more spacious, relatively noisy, and the personnel there are active and socially interactive in the performance of their responsibilities. The differences in environments impact each crew's behavior and expectations and can contribute to conflicts when an individual projects his or her own perspectives on that of the other crew. The physical barrier of the cockpit door also exacerbates an unawareness of the workloads, duties, and responsibilities of each crew.

Psychosocial. The psychosocial factor incorporates such attributes as age, gender, attitudes (e.g. territoriality and mistrust), cognitive orientations, and cultural influences. Perhaps the most insidious example of the psychosocial barrier is that of labeling. Quite often, the term "flight crew" is used only when referring to the pilots. Therefore, what are the flight attendants? Are they not part of the flight crew? The employment of separate labels underscores the segregation and differences of the crews, rather than promoting one cohesive crew with the same goals of flight safety and efficiency.

Regulatory. The "sterile cockpit" regulation (FAR 121.542) which prohibits unnecessary conversation under 10,000 feet, is frequently misunderstood. Although it is a United States regulation, other countries have adopted similar regulations, and crews of foreign carriers must be in compliance when operating in US airspace. The regulation has resulted in another barrier which crews are loathe to surmount and risk a federal violation. Therefore, cabin crews often err on the side of caution and do not contact the pilots even when they have legitimate cause for concern and reason for contact.

Organizational The most visible organizational obstacle is the separation of crewmembers into two distinct departments, typically organized under two different vice presidents, at most carriers. In addition to differing departmental emphasis on service vs. safety, this segregation has resulted in discrepancies in manuals, procedures, and training between flight-deck and cabin crews. At several airlines, it was found that the flight attendants were trained that in the event of an emergency landing they would receive several pieces of critical information from the flight-deck crew (e.g., nature of the problem, time to brace, time until landing, and the brace signal). Unfortunately, the pilots at those airlines had never been trained to give the cabin crew any specific information. Because of this discrepancy a large disconnect in crew expectations in an emergency was created. The same situation was reported to exist at several other airlines, as well.

STRESS AND COMMUNICATION

Human performance, and communication in particular, is affected both cognitively and physiologically by stress. It is important to integrate the research on stress-related communication into the operational setting as the real-world occurrences are rare. Nevertheless, crews need to be fully prepared for those anomalies. As the literature on communication and stress reactions is vast, I will focus on those effects of stress most likely to affect information transfer and decisionmaking. Much of the information included

in this section comes from Stokes and Kite (1994) to which the reader is referred for a comprehensive examination of the subject.

Delivery of information. In conditions of high excitement or time pressure, speech becomes simplified and telegraphic. People use abbreviated sentences that sound rather childlike (e.g. Don't! Stop! No! Go there!) Individuals tend to revert to easy ways of communicating such as down-home dialects, cliches, and often imprecise or cryptic expressions. This type of verbal shorthand can easily result in misunderstandings and misinterpretations. Additionally, negative commands (e.g. Don't go that way) are often heard as positive commands to do the opposite (- Go that way).

A more rapid speech rate and increased pitch is another type of communication decrement caused by stress. These alterations in speech patterns can affect the intelligibility and interpretation of the intended message. Specifically, shrillness in the voice can result in discounting of the information as erroneous or trivial and dismissal of the sender as incompetent.

Phonetic change is another alteration in speech characteristics brought about by pressure. Individuals tend to slur vowel sounds making them all sound much the same. This tendency can further corrupt communication, particularly messages transmitted by low fidelity microphone or telephone.

Receptivity to information. The reception of information by individuals is also impacted by stress. A narrowing of attention and perception called "tunneling" can occur under stressful conditions that can lead to preoccupation with one task at the expense of others. Tunneling may cause individuals to completely miss information. In the aviation environment, whole crews have missed loud warning horns, as well as more subtle cues, due to this phenomenon. Additionally, pilots can become engrossed in solving a mechanical problem. In so doing, they may forget to make announcements to passengers or to pass information on to flight attendants who may be wondering what is happening and becoming more anxious with each passing minute of silence.

Stress affects the capacity and strategy of working memory. The capacity of working memory has been thought of as having a finite limit. Under stress, some of the capacity is diverted to dealing with less relevant issues therefore less capacity is available to deal effectively with the problem at hand. Working memory limitations induced by stress are another factor causing individuals to completely miss information.

One strategy for utilizing working memory under stress is called the simplification heuristic. Related to tunneling, and the counterpart of abbreviated speech, this coping strategy is triggered by physical and social (e.g. loss of "face") threats. The simplification heuristic creates a tendency to over-generalize, prefer stereotypes, and ignore important distinctions. In other words, subtle differentiation between reality and the stereotype in use is lost that may be critical to making the optimal decision. In the United Airlines Sioux City accident, a flight attendant reported a loud noise in the "back wing" (NTSB, 1989). One of the pilots proceeded to the wings but found no problem there. In actuality, the problem was with the horizontal stabilizer in the tail rather than the wings. In this particular situation, there were ample resources to correctly identify the location, but one can imagine a more time-critical situation where such simplification could be tragic.

Other manifestations. Stress may encourage riskier behavior. Prior research has found a speed/accuracy tradeoff in which an individual may attempt to maintain the speed of responses at the expense of accuracy. Additionally, humans tend to reduce the number of alternative options considered as pressure increases. Superior aviation decision-makers appear to be the ones who take their time under stress.

Research by Helmreich (1979) has shown that individuals under stress tend to be more obedient and supplicant to authority figures i.e. junior crewmembers become so passive and deferential that they fail to supply vital information to their superiors. This was apparent in the Air Ontario accident at Dryden in 1989. Although qualified passengers reported their concerns about wet snow building up on the wings, the flight attendants wanted to believe that the pilots were aware of all conditions and did not feel it was their place to pass those concerns on to the flight deck. (Moshansky, 1992). Weather considerations and earlier delays increased the pressure on the crew to press on. The aircraft crashed on takeoff and 21 people died, including both pilots and one flight attendant.

ACCIDENTS AND INCIDENTS

Anecdotal examples of errors have been documented which illustrate the convergence of the barriers in information transfer between cockpit and cabin crews and the anticipated stress-related effects on communication.

On July 9 1995, an ATR aft passenger door separated after take-off at an altitude of 600 feet (NTSB, 1995b). The flight attendant at the door, stated that she did not think of calling the cockpit when she heard the sound of the door leak before it separated, because the aircraft was under sterile cockpit conditions. When queried as to under what conditions she would call the cockpit when sterile, she responded that she would in case of fire or a problem passenger. Confusion over and rigid interpretation of the sterile cockpit rule is not unusual. (Chute & Wiener, 1996). She may also have experienced a stress-induced passivity that precluded giving the captain unwelcome or seemingly obvious news.

In December of 1995, a Tower Air 747 departed the runway at JFK while attempting take-off during a snowstorm. Although two flight attendants witnessed the #4 engine separate and skid down the runway neither reported it to the pilots (who were unaware). Additionally, the nose gear strut collapsed displacing the floor in First Class by approximately two feet. That was not reported to the flight-deck crew either. In later interviews, the flight attendants stated that they thought the cockpit crew would be aware of those problems (NTSB, 1996).

Dunbar (1997) found that flight attendants have not been trained adequately in aeronautical technical knowledge or reporting skills. This lack of training can be problematic when cabin crew are called upon to pass operational information to the pilots. That deficiency is indicated in the following report submitted to the NASA Aviation Safety Reporting System by a captain.

> *During engine start a mechanic opened the cabin door and told flight attendant there were flames from left engine tailpipe. Flight attendant then reports to cockpit 'left hand engine on fire' and immediately orders evacuation without waiting for captain's response. I (captain) shut down engines by placing condition levers in fuel off and pulling left fire 'T' handle. There were no cockpit indications of a fire but the internal temperature was as high as 998 degrees c. I realized there was no fire, only a start that went bad. I did not have time to stop flight attendant from starting evacuation*

> *since I was busy shutting the engines down. During this, (the) first officer asked if I want equipment and I said 'yes' since we have an uncontrolled evacuation that was not ordered and I did not know if anybody got hurt jumping out. Evacuation could have been prevented if flight attendant had only waited a few seconds for a response from me. It created a potential disaster with people jumping out not knowing if engines were shut down properly and with propellers still spinning (ASRS Accession #326914)*

The power of announcements and importance of clear, unambiguous usage was demonstrated in an MD-82 evacuation at La Guardia. The captain made an announcement to the passengers after the aircraft slid off the runway into the river that "We see no fire; be careful...go to the rear of the airplane... after you exit the aircraft." (NTSB, 1995a). Some passengers and flight attendants thought they heard that they should exit via the rear of the airplane. Consequently, a flight attendant inflated the slide in the tail cone that was pitched too high for the slide to reach the ground. All communication under stress should be distinct and succinct. The use of negative and conditional commands should be avoided.

And finally, the importance of creating a collective mindset by briefing the entire crew before a flight as to operational expectations cannot be overemphasized. The following incident illustrates this very well.

> *Lead flight attendant called during flap retraction to report smoke billowing out of the aft galley. I leveled the plane at 7000 ft and declared an emergency. Turned left after talking to ATC, elected to land runway 27R. About 800 ft AGL, the lead flight attendant returned to the cockpit to indicate the smoke was under control and we did not need to land. We elected to land. During rollout the lead flight attendant returned to the cockpit to say the cabin was filling with smoke. The copilot and I could see and smell smoke. Lead flight attendant was told to standby for evacuation. I pulled off of the runway at the high speed and stopped on the ramp. I called for the evacuation checklist and evacuated the aircraft.*
>
> *Callback conversation with reporter revealed the following info: The first officer complimented captain on preflight briefing technique. Before all of this happened the captain had assured the flight attendants that the sterile cockpit rule specifically applied to socializing and he had reviewed emergency procedures. He believes this influenced the flow of communication between the cabin and cockpit during the emergency and the successful outcome of this event. The lead flight attendant did not hesitate to inform the cockpit immediately after she was told of the smoke by the aft flight attendant. Aft flight attendant pulled the galley circuit breakers and all flight attendants donned personal breathing equipment. The captain continued flying the aircraft and the first officer handled the checklists and the communication with ATC and cabin crewmembers. Total time elapsed from B757's takeoff to landing was 6.5 minutes and the aircraft was evacuated in less than 2 minutes. (ASRS Accession #328796)*

CONCLUSIONS AND RECOMMENDATIONS

In this examination of the cockpit/cabin interface in abnormal and emergency situations, three elements have emerged which should be integrated into initial and recurrent training,

briefings, and daily operations: knowledge, management of expectations, open communication, and practice.

Knowledge of each crew's culture, environment, and duties can neutralize many potential conflicts. With the advent of the two-person cockpit, it has become increasingly important that flight attendants become more conversant in technical issues because there is no longer a third crewmember that can leave the cockpit to validate flight attendant reports. As we saw in the Sioux City accident, valuable time and personnel can be wasted when cabin crewmembers have not had the benefit of technical training. While no one is advocating that cabin crewmembers gain the level of expertise of pilots, a rudimentary introduction to the names of aircraft parts, system basics, engine numbering, and identification of various smells (e.g. electrical vs. chemical) and sounds could prove useful to crewmembers.

As indicated in the ASRS report of smoke in the galley and the subsequent evacuation, the crew worked smoothly together because they knew what to expect and what was expected of them. Management of expectations could include routine briefings, clarification of regulations such as the sterile cockpit, and standardization of procedures, manuals, and training.

Ongoing communications may be an effective strategy in reducing ignorance of conditions and workload in the other part of the aircraft (i.e. the physical barrier). It can also benefit by reducing anxiety in concerned passengers and crewmembers during abnormal situations. Cabin crewmembers may need to be reminded that speaking up with any concern is encouraged.

Communication decrements caused by stress can be diminished by rehearsal of appropriate behaviors. Flight attendants might benefit from regular opportunities during the year to learn and practice reporting skills. In the same way, all crewmembers could regularly practice positive commands and slowing down their speech. Additionally, a check might be instituted by taking a moment when making decisions in order to determine that one is not overlooking any viable alternatives.

Fortunately air transport is a very safe endeavor and crews are rarely called upon to perform in life-threatening or other dire circumstances. But aviation safety has always been built on the foundation of optimizing each and every flight. To this end, synergy between the flight-deck and cabin crews in anomalous, as well as normal, operations is one more critical piece of the puzzle.

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