Optimizing flight attendants' retention of safety knowledge and skills can enhance crew resource management.

Joint Cognitive Systems

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BY ZAKARIA BANI-SALAMEH, MERZA ABBAS AND LINA BANI-SALAMEH

If airline crewmembers on the flight deck and in the cabin see themselves as "locked out" of each other's domains not only by a fortified door, but also by differences in their cognitive tasks and professional cultures, safety of flight can be threatened. Accidents have occurred, for example, in situations in which pilots discouraged reports of aircraft technical irregularities from the cabin and in which flight attendants hesitated or failed to report to the cockpit possible threats they observed.

Although worldwide praise for cabin crew performance has followed some high-profile accidents — especially the January 2009 landing of

US Airways Flight 1549 on the Hudson River in New Jersey, U.S. (p. 24) — studies and safety articles citing other events had noted deficiencies in the ability of some flight attendants to handle onboard emergencies and called for modifying various details of training. The in-flight safety assurance model we propose is a step toward modeling flight attendant cognition for enhancing safety-related performance through continuous professional development (CPD).

The most-cited accidents and incidents have involved cabin crew reluctance to report threats such as smoke or airfoil ice because they assumed flight crews knew about them; unwillingness to speak up for fear of a rebuke from the captain if the issue was reported incorrectly or not judged to be serious; inadequate or no preflight information, leaving flight attendants insufficiently prepared for known potential threats; and inadequate information conveyed to cabin crew during emergencies. Accident reports and safety studies we reviewed mentioned cognitive task performance deficiencies in a fragmented way, however, or did not focus on how flight attendants should develop and retain professional expertise.

Cognitive task design today enables innovative solutions to such problems. Crew resource management (CRM), one of the most familiar examples of cognitive task design, originated partly from the idea that flight attendants should function as extra eyes and ears for two-pilot flight decks.

Yet such a narrow view of the cabin crew — as simply an external input to a joint cognitive system (JCS) that researchers would label the *pilots–flight deck* — constrains the cabin crew's potential effectiveness. JCS in this context basically means a system in which humans interact with machines and each other to maintain control of a safety-critical activity. This type of cognition is distinct from how the industry considers the knowledge, thought processes or goals of individuals.

Studying the entire activity requires macro-cognition, awareness of the "system of systems" in which all the JCSs interact. In reality, therefore, the *flight attendants–cabin* also constitutes a JCS and, at the system level, should have a relationship to the pilots–flight deck like that of widely recognized JCSs such as the air traffic service provider, the airline, the civil aviation authority and the meteorological service.[1] We have called this approach *extended JCS*.

Our in-flight safety assurance model is one way to help determine how the industry can ensure an expert flight safety schema for flight attendants in the extended JCS. This type of schema, or cognitive frame of reference and organization of experience, means the individual and collective ability to accurately perceive what is occurring, similar to situational awareness in CRM training. Moreover, CPD becomes the major strategy to overcome professional cultural differences between the cockpit and the cabin, achieving a more unified culture of professionalism.

These concepts flowed from our study of the perceptions of 249 flight attendants and supervisors at two de-identified international airlines (Table 1, p. 46) in 2009. The survey captured opinions about the effectiveness of acquiring and retaining safety knowledge and skills (SKS) in relation to normal learning opportunities depicted in the in-flight safety assurance model.[2]

Our findings, especially the participants' low agreement with survey-item statements that each learning factor in the model had been effective for them, showed that the quality of engagement and the residual effects of each factor over time can lead to deterioration in SKS and self-confidence.

Extended JCS

In the past decade, human cognition and interaction on the flight deck have been studied extensively. The role of the cabin crews, despite its prominence in CRM training, often has been ignored or downplayed. For example, one compilation of analyses — essentially explaining flight operations as integrated JCSs that strive to achieve safe flights — surprisingly overlooked the flight attendants–cabin. Erik Hollnagel of the University of Linköping, Sweden, edited and contributed to this compilation. Airlines were one of several examples of applying perspectives of cognitive task analysis and cognitive task design to various industries. In his chapter and those of others, the basic JCS of interest was called the "pilot–cockpit" and comprised all the human, technological and procedural resources of the flight deck.

Our literature review came up empty with respect to content, quality and effectiveness of flight attendant training and the system-level safety contribution of the cabin crew. A 2008 study concurred, noting, "Ironically, the safety role of cabin crew (flight attendants) receives no attention in the academic literature. Given that cabin crew take responsibility for millions of passengers annually, it is argued that the quality of the training delivered to enable them to undertake their safety role effectively is an important consideration for all air transport passengers and airline personnel."[3] Other researchers made similar observations more than 10 years ago.

Extended JCS and our model could help ensure that decision making by airlines and civil aviation authorities considers flight attendants' cognitive task model as well as that of pilots. How flight attendants deal with turbulence encounters, for example, should more deeply consider factors such as preflight briefings, in-flight supervisor decisions, line experience with and without handling actual emergencies, crew demographics, standard operating procedures (SOPs) in the cabin, CRM, JCS interactions and recurrent training.

Increasingly, aspects of training and SKS retention that may warrant scientific research come to light through nonpunitive, voluntary reporting systems. A good example of training issues was a 2008 study on retention of SKS for first aid, cardiopulmonary resuscitation and automated external defibrillators.[4]

The researchers found a significant decline in these skills between training sessions. They attributed this to the instructional techniques employed, variations in program delivery and the length of time between training and re-assessment. In some cases, cabin crewmembers also may not have had adequate training to properly manage a sudden cardiac arrest (*ASW*, 5/10, p. 42). The report recommended further investigation and modification of training methods, including frequent brief SKS reviews, ideally performed before preflight briefings; updated training technologies that improve retention; and refresher training at intervals of less than 12 months.

Enhancing Expertise

In current instructional systematic design (ISD) and applications, *experts* means workers who mentally generate abstract representations of internalized factors in dealing with

SKS Retention and Expertise Development Among Flight Attendants, 2009

Survey Item Subject	Findings	Research Team Comments
Effectiveness of basic safety training, preflight briefing, in-flight experience and recurrent training	Overall, there was low confidence in factors in the IFSA model diagram (p. 47). PFBs were disliked by flight attendants; supervisors reported having higher alertness than other cabin crewmembers.	Except for PFBs and RT, participating flight attendants had minimal SKS reinforcement other than the cabin safety manual.
Correlation of BST, PFBs, RT, normal in-flight experience, self-perceived expertise and problem-solving ability with self-assessed performance	Differences among flight attendant and supervisor perceptions were significant only for PFBs and normal in-flight experience.	Flight attendants highly rated PFBs as important to emergency preparedness; supervisors rated normal in-flight experience as a key factor in enhancing competence.
Effectiveness of self-study of cabin safety manual between recurrent training classes	Flight attendants who had hands-on experience of emergencies highly rated expertise gained from the manual and mental rehearsal.	Overall, experience was the most effective reinforcement of initial SKS mastery, retention and practice of SOPs.
Differences of perception by job description, gender, age, work experience and level of education	Flights attendants and supervisors with 12–16 years of experience highly rated BST and normal in-flight experience.	Perceptions of importance of PFBs were highest among flight attendants with 12–16 years of experience.
Level of confidence in recalling BST and SKS to perform normal duties and emergency tasks	Flight attendants and supervisors had no widely held opinion of what factors, other than PFBs, benefit SKS retention.	RT was rated low overall for enhancing SKS and SKS retention.
Effects of personal experience in abnormal events and emergencies on developing expert flight safety schema	Flight attendants who only had observed responses to emergencies credited BST more than others.	PFBs were most meaningful and appreciated among flight attendants who had hands-on experience of in-flight emergencies.

BST = basic safety training; IFSA = in-flight safety assurance; PFBs = preflight briefings; RT = recurrent training; SKS = safety knowledge and skills; SOPs = standard operating procedures

Note: From a random sample of 600 recipients at two de-identified major airlines, 53-question surveys were completed by 249 flight attendants and supervisors.

Source: Zakaria Bani-Salameh, Merza Abbas, Muhammad Kamarul Kabilan, Leong Lai Mei and Lina Bani-Salameh

Table 1

reality, and make decisions based on in-depth understanding of workplace situations.[5] Models are well suited to demonstrating how people can be transformed into experts from non-experts, those who do their normal work by learning facts and following rules.[6]

Our in-flight safety assurance model (Figure 1) suggests that desired outcomes result from direct and indirect interactions, or cause-and-effect relationships, among specific modifiable factors. It takes a holistic view, connecting key developmental opportunities over time. Basic safety training, pre-flight briefings and recurrent training are the primary inputs; routine in-flight operating competence and expert flight safety schema are the outputs.

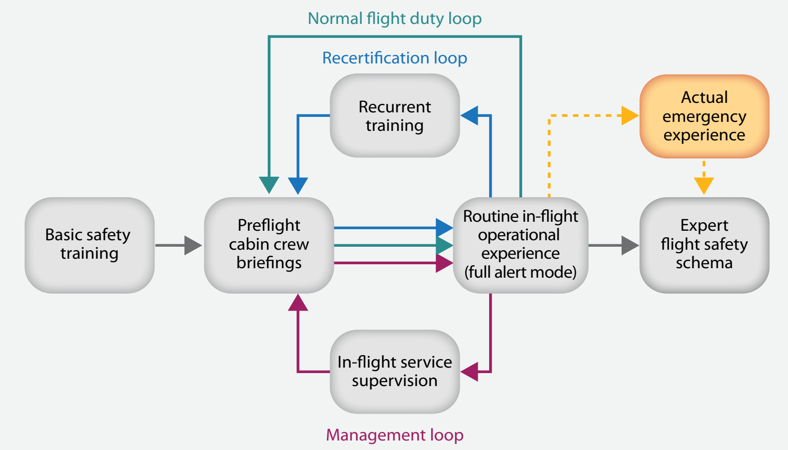
The normal flight duty loop in the diagram represents the dominant flow of cognitive tasks; flight attendants enter this loop only after demonstrating initial mastery of SKS, and with the airline's cabin safety manual at hand as their guide to SOPs and emergency procedures. The normal flight duty loop and routine experience also represent the state of in-flight preparedness; they are a "standby mode" in which flight attendants are expected to be fully alert and vigilant.

As safety practitioners, flight attendants also are expected to continually read their manuals and rehearse the emergency procedures in their minds, too often without adequate learning support except for the recurrent training.

For continuous safety improvement, we recommend adding more frequent, intensive refresher exercises using computer-based training — simulating recollection and application of SKS under stress — especially for dealing with emergency situations that require error-free performance.

Zakaria Bani-Salameh, a flight attendant since 1996, conducts research in educational technology applications to aircraft cabin safety and in the field of English for specific purposes under a doctoral fellowship program at the School of Education, University of Science of Malaysia (USM). Merza Abbas, Ph.D., is director of the Centre for Instructional Technology and Multimedia, USM. Lina Bani-Salameh, Ph.D., is a faculty member in the School of Education at Yarmouk University in Jordan.

In-Flight Safety Assurance Model



Source: Zakaria Bani-Salameh, Merza Abbas and Lina Bani-Salameh

Figure 1

Notes

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