Making the Cabin Safer

A Study of Crew Resource Management Training for Cabin Crew

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Abstract

Crew Resource Management (CRM) is a widely implemented strategy in the aviation community as a training countermeasure to human error. The two most accessible criteria for CRM training evaluation are behaviour on line operation and attitudes showing acceptance or rejection of CRM concepts. The purpose of this research is to investigate CRM training effectiveness for cabin crew, achieved by assessing cabin crew's attitudes toward CRM and their performance during a the training drill.

A questionnaire was created for assessing attitudes toward CRM and CRM training from the flight attendants' perspective at Air New Zealand. Comparing attitudes prior to and post the training suggested that the joint CRM training had a positive effect. The joint CRM training improved cabin crew's confidence in safety operation and commitment to their safety role.

As some factors, such as job position, gender, age, work-year, aircraft type were likely to affect crewmembers' attitudes toward CRM, the survey also tried to test and finally disclosed that at least job position and gender had an effect on cabin crew attitudes.

A series of behavioural markers were developed to measure cabin crew performance during a fire fighting drill. The observation results showed such behavioural markers were useful for assessing flight attendants' CRM skills and indicating the strength and weakness of cabin crew CRM skills showed in the fire fighting drills.

In general the study suggests the overall CRM training in Air New Zealand is successful. It is advised that joint SEP/CRM training needs further concern about the balance of CRM and SEP training. It is also suggested which kinds of CRM skills are critical for cabin crew emergency control.

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Introduction

1.1 Background

In 1989, 24 people were killed when an Air Ontario F-28 crashed on take-off from Dryden, due to an accumulation of ice on the wing. Before the take-off, a flight attendant noticed the wet snow building up on the wings but did not inform the cockpit crew because she felt that pilots did not welcome operational information from cabin crew and also believed that the pilots would be aware of the situation (Monshansky, 1992, cited in Chute & Wiener, 1996).

Also in 1989, a B737 airplane crashed at Kegworth in England because the pilots turned off the right engine of the airplane by mistake while the left engine was out of function due to a fire. In fact, after the pilot broadcasted to the cabin that they had turned off the right engine on the cabin address system, some cabin crew and passengers saw signs of fire on the left engine but no one reported the discrepancy to the rest of cabin or cockpit crew (Air New Zealand, 2003a).

Both catastrophic accidents were marked by a deficiency in communication between the cockpit and cabin. What factors explain why the two crews behaved in isolation? How could the two crews have avoided communication failure?

Captain Al Haynes, who survived a fatal accident because of the integrated team performance of his air crewmembers, answered these questions based upon his own experience. He recognized that Crew Resource Management (CRM) training was one of the most important ingredients in his crew's successful performance (Lauber, 1993).

CRM is inherent in Human Factors (HF) training in the aviation industry. In the beginning, CRM training was regarded as a valuable tool for improving the aircrew's

non-technical skills and team synergy (Helmreich, Merritt & Wilhelm, 1999). The training was intended to improve the "soft skills" of pilots, like communication, decision-making, situation awareness, problem solving, and team building (Koonce, 1999).

Over its thirty years' development, CRM training has shifted its main focus from individual performance to team performance and overall operational system performance. Safety is not only related to the aircrew's operation; in fact it is "one positive outcome of the system's health" (Maurino, 1999, p.218). CRM training has extended its realms to a much wider world, which includes the whole aviation operational environment. CRM training for cabin crew stems from the extension of the scope of CRM training to meet the requirement of enforcement in the whole aviation operation environment.

In order to formulate and unify CRM training, many civil aviation authorities of different nations, such as the International Civil Aviation Organization (ICAO) (ICAO, 1989), the Civil Aviation Authority of New Zealand (CAA NZ) (CAA NZ, 2004), the Federal Aviation Authority of America (FAA) (FAA, 2003), the Civil Aviation Authority of United Kingdom (CAA of UK) (CAA of UK, 2003), the Civil Aviation Safety Authority of Australia (CASA) (CASA, 2002), the Civil Aviation Administration of China (CAAC) (CAAC, 1999), and the Joint Aviation Authority of Europe (JAA) (JAA, 2004), set clear requirements for cabin crew CRM training.

Following the civil aviation authorities' requirements, many flag airlines, like Air New Zealand (ANZ) (ANZ, 2003d), Australian Airlines (Baker & Frost, 1994), Qantas, Air Canada, Cathy Pacific (Hayward, 1994), Delta Airlines, Southwest Airlines (Kaye, 1994), American Airlines (Chidester & Vaughn, 1994), Northwest Airlines (Amundson, 1995), USAir (Young, 1994), Garuda Indonesia (Astuti, 1997), have built up their CRM training programmes for flight attendants.

Among the airlines' diverse CRM training programmes, joint training, uniting cabin and flight crew is a practical means to improving communication and coordination between

crews in some airlines, such as ANZ (ANZ, 2004; ANZ, 2005), Qantas (Hayward, 1994), Australian Airlines (Baker & Frost, 1994), American Airlines (Chidester & Vaughn, 1994), Northwest Airlines (Amundson, 1995), Delta Airlines and Southwest Airlines (Kaye, 1994).

Although a large amount of research has examined CRM and CRM training, there is not much from the flight attendant perspective, especially with regard to the evaluation of training effectiveness. This study aims to take a small step towards remedying the deficiency.

1.2 A short review of HF in aviation

As CRM training is an important component of HF training, firstly it is necessary to look at HF in aviation.

1.2.1 Introduction of HF in aviation

Safety is paramount for all airlines. All efforts contribute to flight safety but cannot stop incidents and accidents from happening. Hawkins (1993) suggested, "since 1940, data have been published periodically showing that three of four aircraft accidents apparently result from performance of the human component in the aircraft man-machine system." (p.10). This statement predicts that HF are the main causal factors of aviation incidents and accidents. The definition of HF is as follows:

> Human factors in aviation are involved with the study of the human's capabilities, limitations, and behaviours and the integration of that knowledge into the systems we design for them with the goals of enhancing safety, performance, and the general well-being of the operators of the systems (Koonce, 1979, cited in Koonce, 1999, p. 3).

HF in aviation is a multidisciplinary field which consists of research of the interface

between the environment and human factors, as well as the application of that research in the aviation industry. It aims to optimise the relationship between the overall aviation environment and all airline staff involved in flight operations. Its two objectives are safety and efficiency (ICAO, 1991).

From a historical view, HF in aviation originated in World War Ⅱ. In its early years, HF psychologists and engineers were devoted to optimising aircraft design, pilots' selection and training, especially for military purposes. In the jet and new technology era of aviation, more and more researchers and organisations became involved in HF research, promoted largely by the development of computer technology and automation (Hawkins, 1993).

Now HF have come to be concerned with the diverse elements of the aviation system, including human behaviour and performance, decision-making and other cognitive processes, the design of controls and displays, flight deck and cabin layout, communication and software aspects of computers, maps, charts and documentation, and the refinement of staff selection and training (ICAO, 1991, p5). For further understanding of HF in aviation, the SHELL model may help demonstrate the main issues of HF.

1.2.2 The SHELL model

The SHELL model (Figure 1), modified by Hawkins (1993), clarifies the scope of HF and facilitates people to understand HF in aviation. The SHELL concept is named after the initial letters of its components: Software, Hardware, Environment, and Liveware. Using the SHELL model may explain the different HF issues from the aircraft cabin crew's perspective.

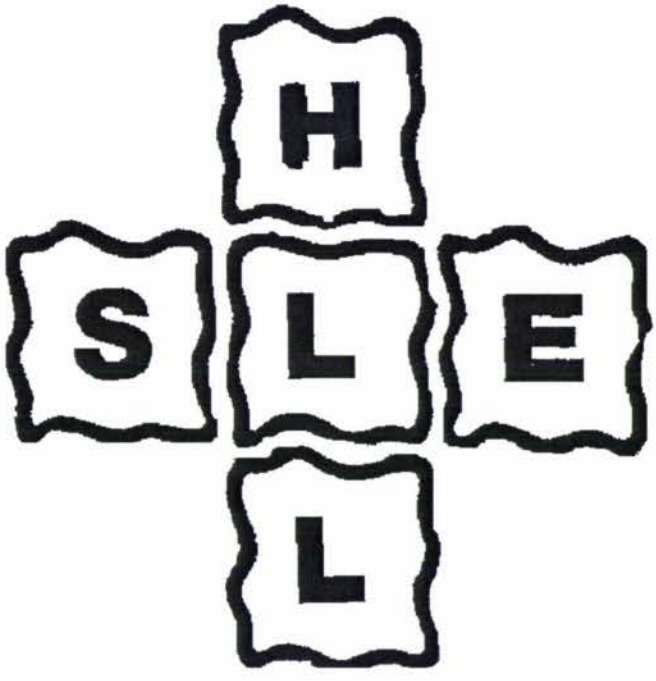

Figure 1: SHELL model (Source: ICAO, 1991, p9)

Based on the interpretation of SHELL from ICAO (1989), in respect to human factors in the aircraft cabin, *Software* refers to procedures and symbology; *Hardware* refers to cabin service and safety equipment and devices; *Environment* refers to the aircraft cabin and the situation in which the software, hardware and liveware reside; *Liveware* refers to cabin crew, passengers, flight crew and no-flight personnel.

Liveware is the hub of the model and the remaining components must be adapted and matched to this central component. As Liveware is the most flexible and valuable component in the model, for a sound understanding of the SHELL model, it is necessary to know the characteristics of Liveware (Hawkins, 1993).

Physical size and shape. In the design of any workplace and most equipment, body measurements and movement are essential factors to be considered. This varies from ethnicity, age and gender (Hawkins, 1993). As Bartley discussed (1997), gender differences in factors such as listening, communication, assertiveness, familiarity and conflict resolution, are significant in the way pilots act in a team situation, what their beliefs about behaviour on the job are and how they exercise leadership and followership.

Fuel requirements. In order to function properly, humans need energy supplies like food, water and oxygen. Deficiencies in those supplies can affect a person's performance and perception (Hawkins, 1993).

Input characteristics. Humans are equipped with various sensory systems namely sight, hearing, smell, taste, touch, and movement. These sensors help individuals to respond to external events and perform the required tasks. Besides, humans also have other channels to perceive pain, temperature, pressure, orientation and motion so as to interact with the surroundings (Hancock & Chignell, 1995).

Information processing. Many human errors occur in information processing because information processing capabilities have severe limitations. When a person receives simultaneous inputs a problem arises (Edwards & Edwards, cited in Astuti, 1997). Factors like stress or a mind-set such as expectation, fear, wish, prejudice, etc, may influence the effectiveness of the human system (Hawkins, 1993).

Output characteristics. Speech and complicated muscular activity are involved in the output of information processing (Hawkins, 1993). Characteristics of efficient verbal communication and the control of movement are vital components. This is especially so for flight and cabin crew communication.

Environmental tolerance. Temperature, pressure, humidity, noise, time-of-day, light and darkness are all reflected in the performance of the liveware. For instance, in the aircraft cabin, the temperature and humidity will affect the cabin crew's performance and the

passenger's comfort (Orlady & Orlady, 1999).

In conclusion different human characteristics may affect the interaction between humans and the other components of the SHELL system. Some of the effects, once they have been properly identified, can be controlled in practice through selection, training and the application of standardized procedures (Hawkins, 1993).

The extent to which human characteristics of age and gender have an effect on a cabin crewmember's acceptance of CRM knowledge and concepts will be explored in this research.

1.3 CRM training development

The commercial aviation industry relies on advanced technology, and requires high levels of qualification and training in its personnel. Training has a long tradition in aviation. From the age of pioneer flying machines to the new era of two-pilot jet, aviation training has experienced a transformation from a focus on machine-control to emphasis on the interaction between the flight environment and the operational aircrew. CRM training is aimed to optimise the interaction for the safety and efficiency of the flight (Pohlman & Fletcher, 1999).

1.3.1 Historical review of CRM training

From a historical perspective, CRM training progressed through 30 years of development over five generations (ICAO, 1998).

The first and second generations focused on individual attitude, leadership and communication. The training objective was to prevent accidents through improved crew performance. The second generation extended the training subject, by including situation awareness, error chain, stress management and decision making (Maurino, 1999).

In the third generation, CRM training was aimed at improving overall system performance. Some other aviation operational personnel, like the flight attendant, were included in the CRM training. Also in this generation, safety was viewed as the consequence of a healthy system and its effective performance; it was considered to be a proactive rather than a reactive endeavour. Some international carriers included national culture as part of CRM training and so customised their programmes to achieve harmony with their own culture (Helmreich, Merritt, & Wilhelm, 1999).

In the fourth generation, CRM extended its realm to include maintenance, air traffic control and dispatch. CRM training aimed at improving the overall system performance of the aviation organization. Safety was one positive outcome of the system's health. In line with CRM culture research, the perceptions of Company Resource Management and Organisational Resource Management (ORM) emerged and developed quickly (Maurino, 1999).

In the fifth generation, described as threat and error management CRM (Helmreich, Wilhelm, Klinect, & Merritt, 2001), CRM is seen as a set of error countermeasures with three lines of defence (Figure 2). The first is the avoidance of error; the second is trapping incipient errors before they are committed; the third is mitigating the consequences of those errors which occur and are not trapped (Helmreich, Merritt, & Wilhelm, 1999).

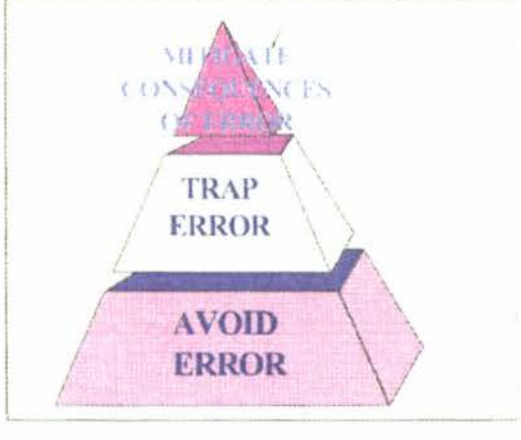

Figure 2: The error troika (Source: Helmreich, Merritt, & Wilhelm, 1999, p26)

1.3.2 New generation of CRM training

The premise for the new generation of CRM is that human errors are inevitable, but also a valuable source of information (Helmreich, 1997). To gain acceptance of the error management approach, organizations must communicate their formal understanding that errors will occur and should adopt a non-punitive approach to error (Helmreich, Merritt, & Wilhelm, 1999).

Error management becomes the primary focus of CRM training, which stresses the fact that effective threat and error management is the hallmark of effective crew performance and well-managed errors are indicators of effective performance (ICAO, 1998, p2-2-6).

Training now focuses on communicating the nature of cognitive errors and slips as well as upon empirical findings demonstrating the deleterious effects of stressors such as fatigue, work overload, and emergencies (Helmreich, Merritt, & Wilhelm, 1999).

The new generation of CRM training continues to have its own place in initial and recurrent training. Referring to the new techniques of new CRM training, briefing is recommended as a basic threat and error management technique; joint training of cabin and cockpit crews is viewed as extending the scope of error management to all employees in a safety culture (ICAO, 1998).

Along with CRM training exported from western countries to non-western countries, as well as its expansion from flight crew to other aviation personnel like flight attendant, it has been proved that the need to properly take cross-cultural issues into account is necessary when developing CRM training (Maurino, 1999).

Cross-cultural research in aviation was categorized into national culture, regulatory culture, and organizational culture (Orlady & Orlady, 1999). Helmreich and his colleagues' theory became influential for culture researchers (Maurino, 1999). They believed there were three cultures affecting CRM, in terms of the professional cultures of

the pilots, the cultures of organizations, and the national cultures surrounding individuals and their organisations (Helmreich, Wilhelm, Klinect, & Merritt, 2001).

Moreover, different subcultures within the aviation organization have been identified to have an influence on the safety and efficiency of the whole flight operation system (Gill & Williams, 2001).

Subcultures can be shaped by the tasks each performs. For example, the different subcultures of the flight crew and cabin crew, differing tasks and backgrounds lead to different perceptions of aviation safety culture and different operational styles between the flight crew and cabin crew (Chute & Wiener, 1995; Chute & Wiener, 1996).

Meanwhile, the existence of subcultures can also be identified within the different work positions within a flight crew (Reid, 2000).

Those subcultures sometimes are not in harmony with each other, therefore they need to communicate and coordinate well between each other. CRM training can set up a bridge between subcultures and produce positive outcomes for active communication (Westrum & Adamski, 1999).

To study the influence of cabin safety culture and which factors differentiating subcultures affect cabin crew's attitude toward CRM may provide suggestions on how to improve CRM training effectiveness and contribute to overall flight safety.

1.4 Researches in cabin safety culture and CRM training for cabin crew

As cross-cultural issues are so critical for developing CRM training (Marino, 1999), it is necessary to look at cabin safety culture first, and then enter the area of CRM training research for cabin crew.

1.4.1 Cabin safety culture

Cabin safety culture, can be viewed as one important component of in-flight culture. In-flight culture is defined as the following:

> A time-pressed and task based in-flight interaction within the aircraft, organized around an airline's culture and its management systems and practices and the beliefs, attitudes, values and behaviours of the aircrew as well as the demands and needs of passengers from a wide range of backgrounds, making it unique, measurable, and subject to empirical investigation. (Gill & Williams, 2001, p93).

Cabin safety culture captures the interaction between software (regulations, policies, duties, procedures), hardware (cabin systems, equipments, service and emergency devices), and liveware (flight crew, cabin crew and passengers) in the territory of the cabin.

According to the study of Gill and Williams (2001), in-flight culture is the outcome of four inputs. They are: airlines culture (management systems and styles); human resources (flight and cabin crew); cabin and its functions; passengers' needs and demands (Figure 3).

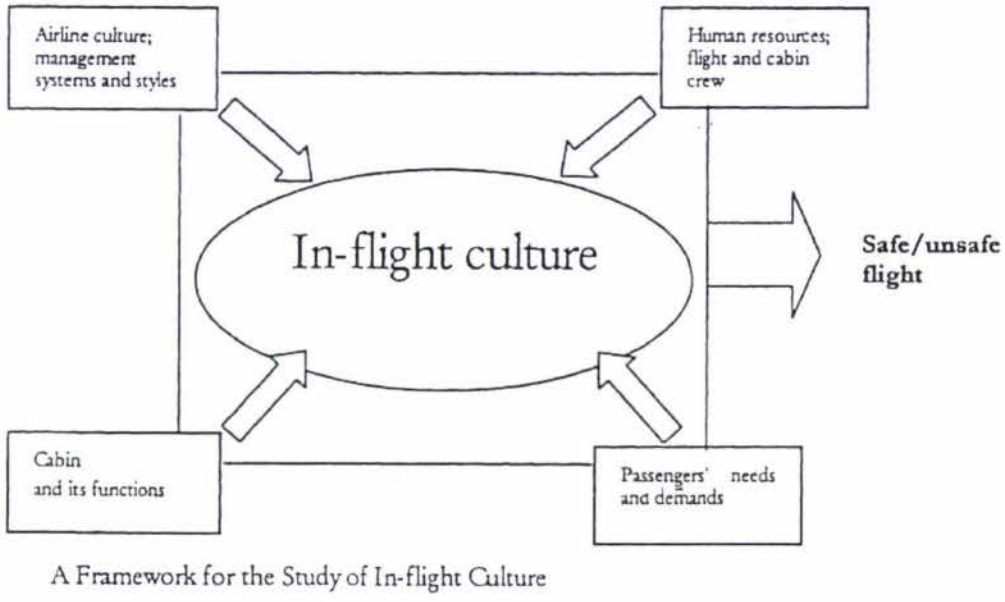

Figure 3: A Framework for the Study of In-flight Culture (Source: Gill & Williams, 2001, p95)

Following this framework, to detect the cabin safety culture in different areas may be beneficial for the identification of the issues that influence CRM training for cabin crew.

1.4.1.1 Airlines' culture

Airlines' culture is a kind of organizational culture, which shares unified values and beliefs; those values and beliefs interact with the airline's structures and control systems to produce behavioural norms (Reason, 1997). It tells all airline personnel what is important, how things work, and in general the way to do things.

Airlines' culture implies two components: good safety attitudes in people and good safety management established by aviation license participants (Merritt & Helmreich, 1995). From this point of view, first of all, crewmembers' safety attitude may reflect the value of

airline's safety culture, and then airline management would maintain and enforce its culture by means of educating staff. Moreover, the airline would prefer to select people who "fit" the company culture (Taylor, 1997).

Four factors were identified to be the most influential for an airline's safety management. They are positive safety practices, safety education, implementation of safety policies and procedures, individual safety responsibilities (Gill & Shergill, 2004).

As one important component of safety education, CRM training is included to provide a bridge to connect crewmembers' safety attitudes and airline management (Merritt & Helmreich, 1995). It has been viewed as a practical tool to improve the positive safety attitude of crewmembers. It can also enforce crewmember responsibility of safety roles. Furthermore, implementation of aviation authorities and airlines' policies and procedures can also upgrade an airline's safety management (Gill & Shergill, 2004).

1.4.1.2 Flight crew and cabin crew

As mentioned earlier in this chapter, liveware is central to the aviation system. Flight and cabin crew interface is a main component of cabin safety culture, a significant part of CRM, as well as a difficult and complex problem for airline management (Orlady & Orlady, 1999).

The most important issues of the interaction between the two crews are communication and cooperation (Orlady & Orlady, 1999; Chute, Wiener, Dunbar, & Hoang, 1995; Chute, & Wiener, 1995; Chute, & Wiener, 1996; Chute, 2002; Young, 1994; Chidester & Vaughn, 1994). Better communication and coordination tends to solve the conflict between these two subcultures.

Orlady and Orlady believe that the two crews are the products of separate cultures that must interface effectively and such interface is affected by a set of factors, such as separate briefing task, the cabin-cockpit door militating against ongoing interchanges,

contrasting attitudes towards each other, and the problem and period of the sterile cockpit rule (1999).

From 1995, Chute and her colleagues have continually explored the differences and defined the subcultures of flight and cabin crew (Chute, Wiener, Dunbar, & Hoang, 1995). They suggested that inclusive of briefing the flight and cabin crew would greatly benefit from good communication and team cooperation. They advised that briefing is a basic instrument for preventing misunderstanding among crewmembers and avoiding errors for both flight and cabin crew.

Finally they invented the Information Transfer Model (also named as the Five Factor Model) to describe one way to view the factors that were affecting communication between flight crew and cabin crew (Chute, Wiener, Dunbar, & Hoang, 1995; Chute, & Wiener, 1995; Chute, & Wiener, 1996; Chute, 2002).

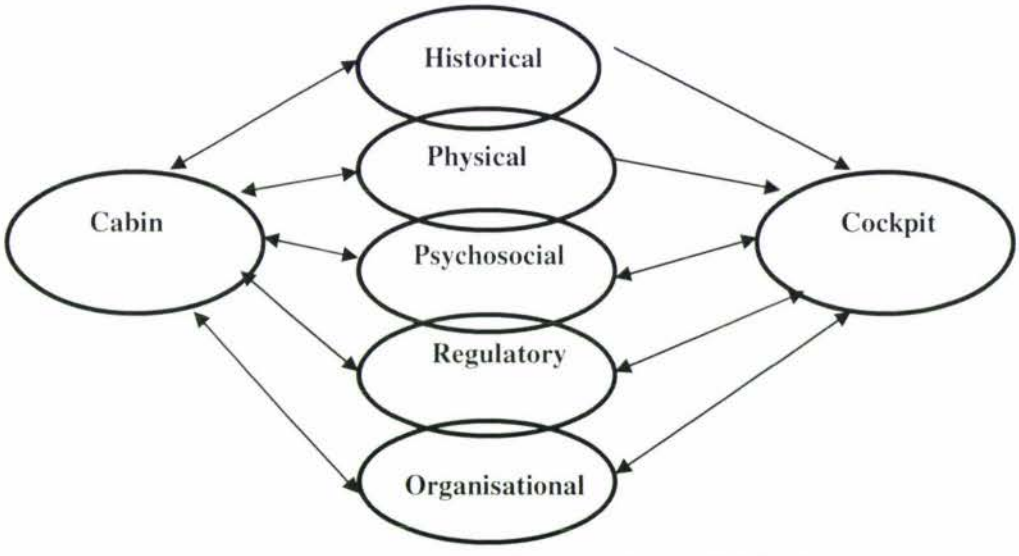

Figure 4: Information transfer model (Source: Chute, 2002, p9)

This model (Figure 4) comprises the historical, organizational, environmental, psychosocial and regulatory factors that have led to misunderstandings, problematic attitudes, and sub-optimal interactions between the cockpit and cabin crew.

The historical factor describes the two crews' development since the first flight. In the beginning the two crews were supposed not to have any conversation at all with each other. The pilots were the dominant part whereas the attendants should be submissive. Traditionally pilots were male and the flight attendants were female. It is possible that this gender separation colours the communication.

The physical factor illustrates the physical separation of the two groups in the aircraft. The cockpit door works as a barrier between the two crews' settings, removing the important visual references, making the workloads, duties and responsibilities invisible to each crew.

The psychosocial factor explores age, gender, attitudes and so on. There exists a personality difference between pilots and flight attendants as a way of understanding the differences between the two cultures. Normally pilots are task-oriented, performing a cognitive style of problem-solving based on logic and systems-orientated reasoning, while flight attendants prefer an affective cognitive style and orientation to decision making (Chute, Wiener, Dunbar, & Hoang, 1995).

The regulatory factor is about civil aviation regulations, and one of the regulations is the Sterile Flight Deck regulation. This regulation is, even before the locked cockpit door was conceptualised, a factor that makes the communication between cockpit crew and cabin crew sometimes overcautious. As such regulation is regarded as an important issue influencing the cooperation between pilots and flight attendants, it is now a significant issue taken into account when developing CRM training for cabin crew.

The organizational factor points at differences the two segregated departments inevitably create, such as dissimilarities between the two crews' manuals, procedures, training and the contractual differences that the two unions have for their members, which in turn possibly lead to more psychosocial incongruity.

Furthermore, Chute and associates also identified that most flight attendants were not

armed with sufficient technical knowledge and advised that CRM training was a good opportunity to add technical knowledge training for F/A. That knowledge includes the sterile cockpit rule, smoke detection, APU torching, theory of flight, aircraft systems and procedures, and aircraft components (Dunbar, Chute, & Jordan, 1997).

Moreover, Chute also studied the synergy between cockpit and cabin under an emergency situation (Chute, 2001). She emphasized that stress affected human performance and communication cognitively and physiologically; then she recommended that three elements needed to be integrated into initial and recurrent training, briefing, and daily operation: knowledge, management of expectations, open communication and practice.

In a recent study, Chute characterized the different features of crew interaction before and after September 11, 2002 (Chute, 2002). Before September 11, the goal of communication was to integrate the two groups into one crew. After September 11, the goal tended to be more difficult to achieve because the two crews were separated into two different groups by the locked cockpit door and strict security regulations. She recommended that the cabin crew should be more self-reliant and less isolated. More trust and responsibilities should be allocated to them, and airlines should provide more tools to help cabin crew to manage effectively in the cabin. The flight crew should actively encourage trust and solicit communication and the airline management should support the flight and cabin crew teamwork both off and on aircraft.

Chute and her colleagues have conducted many studies into the difference and interaction between flight crew and cabin crew, and the subcultures of cabin crew as described above. These studies indicate that cabin crew show different attitudes and reactions to flight safety operation, and these differences may partly shape their attitudes to CRM. Therefore, these studies also are the main source for designing the questionnaires in the attitude survey utilised by the present study.

1.4.1.3 The cabin and its functions

Aircraft cabins of the past were typically designed to accommodate the needs of just the passengers and crew. Today, the definition of the cabin end user has expanded to include a variety of factors, including airline operating economics, new regulations, and the need to avoid flight delays (Kovarik, Graeber, & Mitchell, 1999). Nevertheless, the live-ware is still the centre of all of this and functions in the cabin must meet the demands of the characteristics of human capabilities and limitations.

The cabin is not only the work place for flight attendants, but also the rest area for inactive passengers. Conflict is always possible within the cabin because there exist two different requirements at the same time - passengers need their comforts while the cabin crew must also maintain cabin safety (Hawkins, 1993).

Meanwhile, the cabin is such an environment that is not only concerned with the more obvious environmental factors such as noise and temperature, but also with the less commonly recognized ones such as time zone changes (Hawkins, 1993). People in the cabin are influenced by noise, temperature, humidity and pressure, as well as the circadian and time zone effects. Therefore, on the one hand cabin crew need to address the interfaces between the environmental factors and themselves; on the other hand, they may also have to counter and solve the problems arising from the same interface between the environmental factors and the passengers.

Today new changes have occurred in the cabin as a result of September 11 events. Once the cockpit door is locked, the cabin crew is isolates from the flight crew and lack of situation awareness (Chute, 2002). Moreover, the threat of a more serious terrorist attack during flight has increased. Therefore, the cabin crew has to be more self-reliant. They have to apply more resources when making decisions. They have to improve teamwork and enhance the information transfer between flight deck and cabin.

There also come the new demands of cabin communication technology and skills. The old communication system like interphone and public address system no longer meet the new demand of monitoring cabin activities during flight (Chute, 2002). Cabin video

monitor in cockpit may be a practical tool to help crewmembers attain adequate information before making a decision. New intra-crew communication technologies have been introduced into the aircraft to meet the new challenges of flight safety and security. In this situation, the cabin crew not only has to learn more about those new technologies but also has to improve their communication skills by using those new technologies.

In conclusion, as the main work environment for flight attendants, the cabin plays an important role for in-flight operation. It will be necessary to examine whether the different features of different aircraft types have an effect on cabin crew attitudes toward CRM.

1.4.1.4 Passengers' needs and demands

As passenger issues turned into a significant factor affecting in-fight safety, more and more studies focused on passenger management in the cabin (Hawkins, 1993; Gill & Williams, 2001; Anonymous & Thomas, 2001; Hunt, 2001; Chute, 2002).

After boarding the aircraft all passengers ask for safe transport and good service. Verbal and non-verbal communication skills are both critical because most of the communication between cabin crew and passengers is at a much more personal level (Hawkins, 1993). Language difficulties, illiteracy and lack of attention to the safety briefing have given the cabin crew barriers to communication.

Under special circumstances, like serving physically handicapped passengers or intoxicated passengers, cabin crew have another sort of difficulty in communication. This kind of situation may be known as air rage. Anonymous and Thomas (2001) described that a type of behaviour that was abnormal, aberrant, or abusive happening in the aircraft was air rage. They also disclosed the actual number of air rage cases, which had brought potential threat to flight safety especially to cabin safety, to be closer to ten thousand per year.

Air rage may arise from different sources. Alcohol or drug consumption is associated with a higher incidence of air rage than any other causal factor (Anonymous & Thomas, 2001). Consequently onboard alcohol service is a double-edged sword for airlines. It is a primary source of air rage as well as a great source of revenue. Moreover, mental illness or psychiatric disorder, like fear of flying, is another important contributing factor.

There are many problems associated with the advent of "cattle class", including DVT (deep-vein thrombosis), heavy carry-on baggage, and air quality in the cabin (Anonymous & Thomas, 2001). These conditions may contribute to air rage when hundreds of passengers are gathered in the tiny aircraft cabin for more than 10 hours. Some passengers appear irritated or out of control. It is easy to blame the airlines for poor service, but other entities, including government agencies and passenger themselves, are also responsible for this problem.

Although air rage events happen so frequently, air rage reports to the public are rare because aircrew members were often discouraged by airlines from reporting cases of air rage in an effort to keep an aircraft as close to schedule as possible (Anonymous & Thomas, 2001).

Therefore, Anonymous and Thomas (2001) suggested that the airline management and government agencies should encourage and give aircrew members guidelines for identifying and reporting instances of air rage. They also argued that in order to avoid the failure of crew management, airlines should make an effort to enforce air rage treatment training for both aircrew and ground staff.

Hunt (2001) had conducted research into passenger related issues in two airlines with different cultural backgrounds. She found that communication strategies were the most frequently used strategy to resolve difficult situations by the cabin crew. Three most important strategies used to deal with a cabin event or incident by the flight attendants were to give explanation, to reassure distressed passengers and to be assertive.

Hunt (2001) also pointed out that the stress generated by serious incidents, like air rage events, appeared to be disregarded by airline management. Flight attendants were given inadequate training in passenger management. Therefore, airlines need to consider their training strategies and recurrent training polices for cabin crew in the area of passenger management.

Chute also addressed new problems and difficulties that have been brought into cabin operation, such as passenger unruly behaviour or over-reaction, assaulting crewmembers and the terrorism trend (2002). Considering these new changes, Chute proposed higher requirements of teamwork, information transfer and adequate resources for crew collaboration.

In general, the problems relating to passenger issues may be categorised into communication problems, air rage reporting, and deviant passenger management. All those issues can lead to the conclusion that the cabin crew needs more passenger management training to cope with the new changes of interaction between crew and passengers in the cabin.

Therefore, cabin safety culture can be influenced by the factors, including airline organizational culture and management, flight crew and cabin crew occupational culture, passenger requirements and cabin environmental issues. The cabin crew are viewed as the core of cabin safety culture, and these issues may influence their overall attitudes toward cabin safety management. CRM training can provide a good chance for cabin crewmembers to build up the positive attitudes, and can also arm them with management skills to deal with conflicts and problems relating to these factors.

1.4.2 CRM training for Cabin Crew

Good training enables aircrew to provide a high level of service and safety competency, as well as to promote a positive safety attitude (Pohlman & Fletcher, 1999). Evidence has shown that CRM training for cabin crew has improved crew cooperation and

communication (Baker, 1994; Kaye, 1994; Hayward, 1994; Young, 1994; Chidester & Vaughn, 1994; Amundson, 1995).

Although there are only few studies in CRM training from a cabin crew perspective, research on pilot CRM training is a valuable resource for cabin crew CRM training design, delivery and evaluation.

In CRM training progress, three phases can be identified, namely awareness, practice and feedback, and reinforcement (Telfer, Bent, & Dowd, 1997).

Most airlines have done great job in the first phase. They have set up CRM training programmes and enrooted CRM concepts and behavioural norms in flight crewmembers' mind.

In the second phase, crewmembers gain experience in applying CRM techniques and interpersonal skills (Telfer, Bent, & Dowd, 1997). This typically occurs by means of pre-Line Oriented Flight Training (LOFT) preparation, LOFT session, and debriefing.

In the reinforcement phase, CRM is integrated with line flights, check flight, and simulator session for flight crew (Telfer, Bent, & Dowd, 1997). It enlarges the scope of CRM training to the entire operation environment.

As discussed earlier in this chapter, many flag airlines have set up their own CRM training programmes for cabin crew. Airlines have implemented CRM training for cabin crew, normally including three training programmes, namely the initial training, recurrent training and upgrade training. Initial CRM training normally gives the cabin crew the awareness of CRM norms and shapes their attitude in relation to co-operation and team management. Recurrent training reinforces the cabin crew's acceptance of CRM concepts and skills; it also requires training feedback, whereby flight attendants identify their strengths and weaknesses in the CRM learning and skilling. The up-grade CRM course focuses on leadership, systematic problem solving skills, team decision making and all

other management skills required by a leading cabin crew position.

The cabin crew CRM course may focus on communication, decision-making, interpersonal relations, crew coordination and leadership (FAA, 2001). When airlines design CRM training, it is necessary to consider how to make CRM concepts and skills adhere to their own standard operation procedures (SOPs).

The training delivery for cabin crew is similar to that implemented in pilot training. Ground school/classroom training and practical training in a simulator (mock-up) are the two basic means of dissemination (FAA, 2001).

Classroom training methods employed are presentation, group discussion, video observation, role-play exercise, and case study. Presentation introduces the basic CRM principles and teaches flight attendants different methods for working on crew problems, which easily equip cabin crew with the fundamental awareness of CRM principles.

Group work/discussion is a good way for trainees to identify and clarify any areas of misunderstanding, and also provides the ideal opportunity to review and discuss experiences (Macleod, 2002).

Video observation is common method used in CRM training (Hayward, 1994). Video products can be the reconstruction of a flight accident/incident or a good/bad example of aircrew performance. For instance, the video of the Dryden Accident has been used in some airlines, like Qantas, ANZ, Air Canada, and Southwest Airlines. Normally such training videos reconstruct relevant components of the accident from an HF/safety system perspective, and are used to stimulate discussion amongst training participants in relation to their own operation environment and experience (Hayward, 1994).

Case studies may also be used in CRM training. From an in-depth description of case, trainees can assess whether the case fits particular knowledge and skills, or determine what makes this case superior/inferior/different to other cases (Page & Meyer, 2000).

From CRM training perspective, the case could be any accident/incident or team behaviour, and crewmembers could learn from the case assessing by implementing CRM knowledge.

Practical exercises either in the classroom or in a mock-up, like role-play, have been implemented in many CRM courses (FAA, 2001). These give trainees the chance to practice their CRM skills and enforce CRM learning. The scenarios may simulate either the flight operation environment or other situations relating to team management. At the same time CRM facilitators/instructors supervise flight attendants' performance and then conduct a proper debriefing.

Simulator or mock-up training allows the cabin crew to practice the CRM skills and provide feedback in realistic situations. It is important to train the cabin crew in groups assisted by a trained facilitator. All practices are preferably videotaped and the performance is viewed and analysed by the participants themselves with the guidance of a facilitator (FAA, 2001).

Some new issues have occurred along with the new development of CRM training. According to the data collected from a Line Operations Safety Audit (LOSA), airlines need to enforce threat and error management in the CRM programme (Helmreich, Klinect, & Wilhelm, 1999). Therefore, there is a trend of designing the CRM curricula for cabin crew with the orientation of CRM as a countermeasure against threat and error.

Moreover, because current CRM training has been developed from traditional management training towards a more operational and real world centred training, evaluation of CRM training will be more connected with a more line-simulated situation. For example, pilot CRM training evaluation must be clearly linked to LOFT (Macleod, 2001).

In summary, CRM training for cabin crew mostly has put into place three training programmes, initial CRM, recurrent CRM, and up-grade CRM courses, implementing

five main delivery methods, presentation, group work/discussion, case study, role-play, and practical exercises in mock-up. Usually the cabin crew recurrent CRM training integrates recurrent safety emergency procedure (SEP) training, combined with flight crew.

As this research is conducted in the joint SEP/CRM recurrent training at ANZ, it is necessary to look at the joint flight crew and cabin crew CRM training programme that is integrated with the recurrent SEP training.

1.4.3 Flight and cabin crew joint CRM training

The origin of the joint training design was based on investigation of the airlines' experience of CRM training and LOFT programmes. Researchers recommended that leading or senior flight attendants should participate in LOFT or simulator training in the second and third phases, in order to improve the mutual understanding of each part's workload and to improve communication and co-operation between flight and cabin crew (Kaye, 1994; Amundson, 1995).

Flight and cabin crew joint HF/CRM training commenced in the early 1990s in Australia and America (Baker & Frost, 1994; Kaye, 1994; Chidester & Vaughn, 1994; Amundson, 1995). The main purpose of such joint CRM training is to build up a mechanism to diminish communication barriers and enforce team synergy between the flight and cabin crew.

Joint CRM training can be conducted both in the awareness and reinforcing phases of CRM training. For example, Southwest Airlines in United States used joint training in its pilots' initial CRM training as well as the captain upgrade programme (Kaye, 1994). Some other airlines, like ANZ and Qantas, utilized joint training as recurrent CRM training for both flight and cabin crew (ANZ, 2004; ANZ, 2005; Hayward, 1994).

When joint CRM training is integrated with recurrent training, it has different themes for

each year (Baker & Frost, 1994; Kaye, 1994). A well-designed joint CRM training plan can make all the necessary CRM concepts to be covered within a training time frame.

Normally training time for the joint CRM course is only half-day; and the training subjects always include communication, coordination, workload management, fatigue, information flow, and the review of on-line incidents (Baker & Frost, 1994; Kaye, 1994; Chidester & Vaughn, 1994).

It is evident that joint CRM training is a valuable tool for improving aircrew communication and enhancing team synergy (Baker & Frost, 1994; Kaye, 1994; Chidester & Vaughn, 1994; Young, 1994). A very important benefit for the cabin crew is the improvement of confidence and commitment to their safety role for both flight and cabin crew. Moreover, joint CRM training is also an opportunity to create an environment of trust and support where information flows from mutual part of the aircrew (Chidester & Vaughn, 1994; Amundson, 1995).

Airlines' training experience has shown that joint training can enforce crewmembers' commitment to the safety role in different emergency situations, and improve practice CRM skills in emergencies, like crowd control techniques (Baker & Frost, 1994). It can emphasise their awareness of the workload of each crew at different work stages or in emergencies (Kaye, 1994). It can obviously increase the mutual understanding of safety duties and procedures, and improve communication and coordination between the two crews under normal and abnormal situations (Young, 1994).

Joint CRM training can implement all the delivery methods utilized in other CRM programmes. Among those methods, two things are particularly significant for joint training.

Firstly, CRM training always utilises practical exercises in different simulated scenarios to meet the requirements of CRM skill practice and assessment (Kaye, 1994). It is quite important to design practical drills to reflect potential emergency situations and also to

pursue any concerns raised from on line incidents.

Secondly, a common training method implemented in CRM training, debriefing, always happens at end of each training module (Dismukes, McDonnell, Jobe, & Smith, 2000). CRM facilitators should be more like moderators in debriefing because in fact crewmembers debrief themselves. Facilitators need to do everything possible to foster crewmembers' self-criticism and self-evaluation in debriefing session and avoid lectures about what is right and what is wrong. It is in debriefing when trainees really learn and benefit from the training.

There are special requirements for CRM training facilitation. Some airlines, like USAir utilise both facilitators and instructors for delivery of CRM in the classroom. Both of them work together not only to maintain, but also to improve the CRM programme currently in use (Kaye, 1994). Moreover, facilitators in CRM training must be a focal point for ongoing training in CRM skills, and can use line incidents to effectively illustrate CRM concepts and further enhance teamwork between flight and cabin crews (Young, 1994).

In respect to assessment of the joint CRM training, written assessment for CRM knowledge and practical assessment for CRM skills demonstrated in practical drills were used in some airlines, like Australian Airlines (Baker & Frost, 1994). Unfortunately no further explanation about how to assess cabin crew's CRM skills can be found in relevant research reports.

Recently joint CRM training has been viewed as extending the scope of error management to all employees in a safety culture (Helmreich, Merritt, & Wilhelm, 1999; Westrum & Adamski, 1999). Therefore, personnel from dispatch, maintenance, air control and ground service department, are going to be included into the joint training programme. This will be a new issue for future study in CRM training.

As such joint CRM training has an orientation towards SEP training initiatively, it is

critical to make good balance between SEP and CRM training, or find a way of integrating these two orientations. It needs to reconsider that whether SEP procedures implemented in joint training are consistent to CRM percept and skills (Baker & Frost, 1994).

Furthermore, training scenarios should produce an operationally realistic environment, which provides the crew with an opportunity to combine CRM and technical skills applied under emergencies (Hamman, Seamster, & Edens, 1995). All simulated scenarios development must focus on the CRM and SEP objectives integrated with the overall crew training.

As validation and evaluation of training practice can provide constructive suggestions for modification and renewal of CRM training programme (Macleod, 2001), this research aims to evaluate cabin crew CRM training effectiveness, particularly for the joint CRM training in ANZ.

1.4.4 CRM training for cabin crew in ANZ

As the research was conducted in ANZ, it is necessary to review ANZ's CRM training programmes for cabin crew. Three cabin crew CRM training programmes, namely the initial CRM training ("exposition"), recurrent CRM training, and upgrade HF training are implemented in practice (ANZ, 2002; ANZ, 2003a; ANZ, 2003b; ANZ, 2003c; ANZ, 2003d; ANZ, 2004; ANZ 2005). CAA NZ has approved both initial and upgrade CRM courses.

In ANZ, cabin crew CRM training commenced in 1998 with a one-day initial course, CRM exposition training (ANZ, 2005). This course is run as a workshop and aims to educate the flight attendants in skills associated with teamwork, effective communication and general HF issues. It covers four major areas, including effective and ineffective teamwork, personal and team decision-making, communication styles and methods, and barriers to communication (ANZ, 2003b, p2).

Before the initial CRM course begins, a pre-course booklet is distributed to flight attendants to give trainees some CRM background information and arouse their interest in CRM training (ANZ, 2003c).

The up-grade CRM course supplies the trainees with more HF concepts and managerial skills. The training mainly consists of decision-making, information processing, situation awareness, and management skills required by leading flight attendant positions (ANZ, 2002).

Recurrent CRM training for cabin crew started from 2000, which was a joint training effort combined with pilots (ANZ, 2005). The relevant finding of LOSA last year can provide topics for new recurrent CRM training design. For example, one of LOAS findings in 2003 was about interruptions/disruptions from cabin crew during pre-departure, which indicated the communication problem between flight and cabin crew. Therefore, the main objectives of 2004 recurrent CRM training were to reinforce good communication procedures and techniques, and to practice effective communication (ANZ, 2004).

In addition to these three CRM course, ANZ integrates CRM perceptions into all flight attendant training course and aims to enhance flight attendant' CRM attitude and skills in every training effort.

All ANZ CRM training programmes have been designed and revised on a philosophy of viewing CRM as a countermeasure against threats and error since ANZ adopted the concept of "threat and error management from 2000 (ANZ, 2003d). Now the principles of threat and error management are part of ANZ operation culture. Therefore, the title CRM has been changed into "company resources management".

CRM training presenters are required to function as facilitators rather than instructors, applying presenting techniques rather than instructing techniques when delivering

training (ANZ, 2003b). Four educational methods are recommended to presenters, they are team decision exercises, observation of videos, group discussion, and case studies.

ANZ has generated two unique CRM models from its own safety culture perspective. The teamwork/problem-solving model, SADIE, forms the basis of good aircrew team management (ANZ, 2003a); the communication styles model has been found to be useful in teamwork and problem solving (ANZ, 2003a). Aircrew members are encouraged to use these two instruments for better communication, decision-making, problems solving, and team building.

SADIE (Figure 5) is named after the initials of five fundamental problem-solving steps which are basic to successful teamwork. They are: (1) sharing information; (2) analysing information; (3) developing solutions; (4) implementing decisions; (5) evaluating performance. This SADIE approach to teamwork forms the basis of good aircrew team management (ANZ, 2003a).

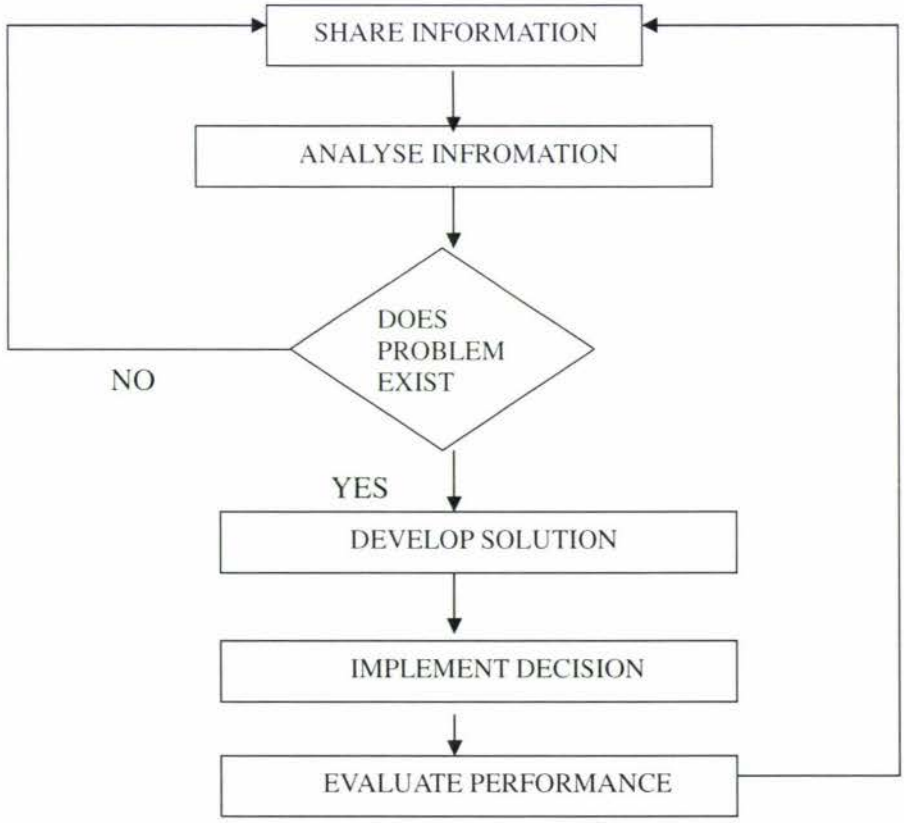

Figure 5: SADIE flow diagram (Source: ANZ, 2003a, p17)

The communication style model (Figure 6), explains four fundamental styles people use when communicating with others are identified. "A" behaviour is a style which focuses on people's own needs rather than those of others, while "S" behaviour focuses on the needs of others in preference to people's own needs (ANZ, 2003a).

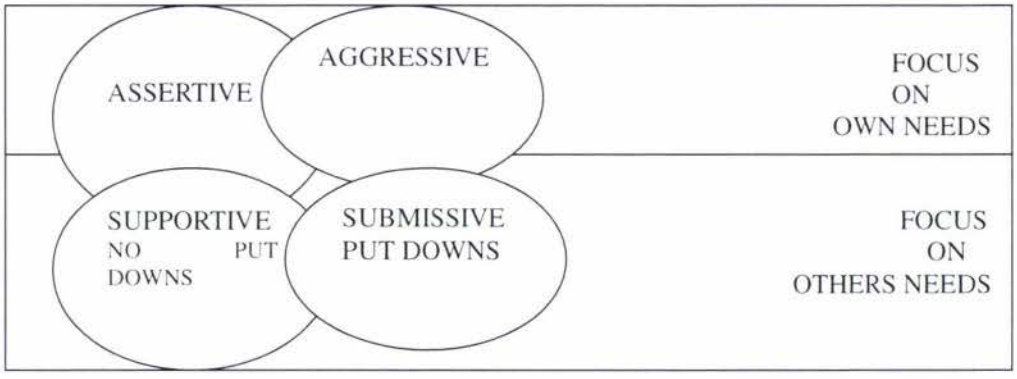

Figure 6: Communication style model (Source: ANZ, 2003a, p30)

People use assertive style (A1) to state their own needs and feelings in a way that doesn't usurp the rights of others, and use aggressive style (A2) to state their needs in a way that intrudes on the personal space of others. Supportive style behaviour (S1) makes people to diminish their own rights and abilities in communication, and submissive style behaviour (S2) diminishes people's own worth. Therefore, A2 and S2 styles undermine teamwork, while A1 and S1 styles contribute to good communication (ANZ, 2003a).

In 2005, recurrent CRM training for cabin crew was a half-day CRM module in the annual SEP recurrent course, also combined with flight crew (ANZ, 2005). It especially emphasised the realism of simulated environment, in which flight attendant could practice their CRM skills. Both SEP instructor and HF facilitator worked together to facilitate air crewmembers refreshing their CRM learning and reinforcing their CRM skills.

1.5 CRM training effectiveness evaluation

To measure aviation training effectiveness, there are two concepts: validation and evaluation (Macleod, 2001). In the case of validation it is trying to see if the course allows the trainees to achieve the objectives. Evaluation is intended to identify if the course allow the trainees to become productive. Five levels are involved in the measurement of effectiveness. *Reaction* and *learning* can be seen as aspects of validation, while *behaviour*, *results*, and *benefit* are considered as evaluation.

In CRM training, measuring reaction of the trainees is an important tool for seeking the trainees' attitude towards training design and delivery. This is often done using a "Happiness Sheet", an end-of-course feedback sheet comprising a questionnaire and comments section (Will, 1994). Airlines, like ANZ, apply this form of evaluation to seek training feedback in their CRM training (ANZ, 2002; ANZ, 2003a; ANZ, 2005).

Measurement of learning can be divided into three categories: those assessing knowledge acquired, those assessing attitude, or attitude change, and those assessing behaviours (CAA of UK, 2003).

Measuring acquisition of knowledge has limited effectiveness. It can be achieved by using various testing methods, including the exams and performance tests. The closed test is the most common style of knowledge tests and usually takes the form of Multiple Choice Objective Question (MCOQ). Another implementation for knowledge test is open-ended test (Macleod, 2001). For performance tests, trainees may be required to perform relative behaviours in a simulated environment.

Attitude measures have proven to be a useful indicator of whether CRM training is likely to be effective, in particular if they are measures of attitude change prior to and post CRM training (Rollins & Angelcyk, 1995; Reid, 2000).

In some airlines attitude measures are also done from crew reporting system. When the organizations adopt the reporting system to collect crew performance data on-board, a

"blame-free" environment for reporting and investing "near misses" without retribution is created simultaneously (CAA of UK, 2003).

Professor Robert L. Helmreich and his Human Factors Research Project team at the University of Texas (UT) conduct continuing research on CRM training evaluation. One significant contribution of their project is the assessment tools, Flight Management Attitude Questionnaire (FMAQ), measuring crewmembers' attitudes regarding issues of communication, coordination, leadership and personal capabilities (Whilelm, Merritt, & Helmrich, 2003).

The Flight Attendant Safety Questionnaire (FASQ) is a branch of the FMAQ series. Using FASQ in two major United States airlines, survey result has outlined possible implications to flight attendants CRM training (Klinect, 1998). For instance, it has measured four issues concerning with cabin safety culture: organizational climate, safety attitudes and perceptions, quality of pilot/flight attendant interactions, and preferred and typical leadership style. Klinect has also identified the advantage of a strong professional culture of cabin crew, addressed time pressure and compliance with pre-flight safety checks, and advised that flight attendant training need to focus attention on teamwork between gate staff and flight attendants. This research has drawn two conclusions: to listen to and incorporate flight attendants' needs (in terms of safety), and to stress the significance of cabin crew CRM and CRM training.

Behaviour measurement is another important means for CRM training evaluation in addition to attitudes measurement. Behavioural markers are widely used measuring tool for observing crew's or individual crewmember's non-technical behaviours that contribute to superior or substandard performance (Klampfer, Flin, Helmreich, Häusler, Sexton, Fletcher, Field, Staender, Lauche, Dieckmann, & Amacher, 2001).

While error and threat management was classified as the hallmark of CRM, the behavioural markers also evolved from a sole performance assessment tool to focus on threat and error management (CAA of UK, 2003).

There exist two different behavioural marker systems, NOTECHS behavioural markers (non-technical skills) and UT's behavioural markers. While these two systems were designed for different purpose, the fundamental behavioural components for them are similar (Klamper, & et al, 2001).

The purpose of developing NOTECHS behavioural markers (Table 1) is to assess the flight crew's CRM skills required by JAR OPS amendment 2. Such assessment can provide feedback to the individual and serve to identify retraining; and also can be used to improve the CRM training system (Flin, Geoters, Hörmann, & Martin, 1998).

The NOTECHS Behavioural Markers evaluate four categories of pilots' CRM skills, two of social skills (co-operation, leadership and managerial skills), and two of cognitive skills (situation awareness, decision making). Each category is then further subdivided into three or four. In addition, a number of positive and negative examples are included for each element. The example behaviours are phrased as generic rather then specific activities. It implements a five rating scale to rate the performance (Flin, & et al, 1998).

The NOTECHS system has been tested by European airlines and organizations and received by aviation professionals. It was found to be a useful assessment method for pilots either in simulator or on standard route flights (CAA of UK, 2002).

Table 1: The NOTECHS Behavioural Markers (Source: CAA of UK, 2003, Appendix 11 p7)

Categories	Elements	Example Behaviours
Co-operation	Team building and maintaining	- Establishes atmosphere for open communication and participation
	Considering others	- Takes condition of other crew members into account
	Supporting others	- Helps other crew members in demanding situation
	Conflict solving	- Concentrates on what is right rather than who is right

Leadership & Managerial Skills	Use of authority & assertiveness	- Takes initiative to ensure involvement and task completion
	Maintaining standards	- Intervenes if task completion deviates from standards
	Planning and co-ordinating	- Clearly states intentions and goals
	Workload management	- Allocates enough time to complete tasks
Situation Awareness	System awareness	- Monitors and reports changes in systems states
	Environmental awareness	- Collects information about the environment
	Anticipation	- Identifies possible/ future problems
Decision Making	Problem definition / diagnosis	- Reviews causal factors with other crew members
	Option generation	- States alternative courses of action - Asks other crew member for options
	Risk assessment / Option choice	- Considers and shares risks of alternative courses of action
	Outcome review	- Checks outcome against plan

Rating Scale

Very Poor	Poor	Acceptable	Good	Very Good
Observed behaviour directly endangers flight safety	Observed behaviour in other conditions could endanger flight safety	Observed behaviour does not endanger flight safety but needs improvement	Observed behaviour enhances flight safety	Observed behaviour optimally enhances flight safety and could serve as an example for other pilots

UT's behavioural markers (Table 2) were originally designed to evaluate the effectiveness of CRM training as measured by observable behaviours of flight crew. It has been continually used in Line Operations Safety Audit (LOSA), non-jeopardy observations of crews conducting normal line flights. The markers, then known as Line/LOS Checklist, became the indicators of crew performance and their value as a component of CRM

training (CAA of UK, 2003).

Table 2: UT's behavioural markers (Source: CAA of UK, 2003, Appendix 11 p9)

			Phase
SOP Briefing	The required briefing was interactive and operationally thorough	- Concise, not rushed, and met SOP requirements - Bottom lines were established	P-D
Plans Stated	Operational plans and decisions were communicated and acknowledged	- Shared understanding about plans - "Everybody on the same page"	P-D
Workload Assignment	Roles and responsibilities were defined for normal and non-normal situations	- Workload assignments were communicated and acknowledged	P-D
Contingency Management	Crew members developed effective strategies to manage threats to safety	- Threats and their consequences were anticipated - Used all available resources to manage threats	P-D
Monitor / Crosscheck	Crew members actively monitored and cross-checked systems and other crew members	- Aircraft position, settings, and crew actions were verified	P-T-D
Workload Management	Operational tasks were prioritised and properly managed to handle primary flight duties	- Avoided task fixation - Did not allow work overload	P-T-D
Vigilance	Crew members remained alert of the environment and position of the aircraft	- Crew members maintained situational awareness	P-T-D
Automation Management	Automation was properly managed to balance situational and/or workload requirements	- Automation set-up was briefed to other members - Effective recovery techniques from automation anomalies	P-T-D
Evaluation Of Plans	Existing plans were reviewed and modified when necessary	- Crew decisions and actions were openly analysed to make sure the existing plan was the best plan	P-T
Inquiry	Crew members asked questions to investigate and/or clarify current plans of action	- Crew members not afraid to express a lack of knowledge - "Nothing taken for granted" attitude	P-T

Assertiveness	Crew Members stated critical information and/or solutions with appropriate persistence	- Crew members spoke up without hesitation	P-T
Communication Environment	Environment for open communication was established and maintained	- Good cross talk - flow of information was fluid, clear, and direct	G
Leadership	Captain showed leadership and coordinated flight deck activities	- In command, decisive, and encouraged crew participation	G

Rating Scale

1	2	3	4
Poor Observed performance had safety implications	**Marginal** Observed performance was barely adequate	**Good** Observed performance was effective	**Outstanding** Observed performance was truly noteworthy

A European project, Group Interaction in High Risk Environments, worked on the comparison of these two sets of behavioural markers and finally drew the conclusion of the behaviour markers systems:

> Behavioural marker systems have demonstrated value for training, understanding of performance in high-risk environments, and research into safety and human factors.
> Behavioural marker systems can contribute to safety and quality in other work environments, as well as in high-risk settings.
> Concepts are continuously evolving as a result of co-operation between practitioners and researchers.
> Researchers, practitioners, and regulatory authorities must work congruently in order to realize the ultimate goal of improved safety (Klampfer, & et al, 2001, p17).

As CRM training has been largely implemented in airlines, discussion on the regression of HF skills has emerged. Research discovered that acceptance of basic concepts may

decay over time, even with recurrent training (Helmreich, & et al., 1999).

Besides, Gill advised that crewmember's work behaviour may or may not be influenced by individuals' attitudes and values rather than be governed by their beliefs about various situational contingencies (Gill, 2004). Employees can learn ideal beliefs from formal means, like training, SOPs, etc; they can also learn or modify their beliefs through interaction with others against situational contingencies (Gill, 2001).

There was another interesting finding from Rollins and Angelcyk (1995). They found that no discernable difference existed in acceptance of CRM concepts between two groups of pilots, while one group's CRM training programme in terms of the training time and content, was as twice as much the other group.

Therefore, it is important for airlines to have recurrent CRM training to rebuild the ideal beliefs of crewmembers. It is also necessary to regularly evaluate the attitudes of crew toward CRM to spot any signs of regression.

Unfortunately, little attention has been paid to cabin crew's attitudes and CRM skill measurement, or surveys for particularly detecting cabin crew culture that could benefit the cabin crew CRM training. This research will take this opportunity to measure cabin crew' attitude toward CRM and CRM training, and to assess their behaviours in a simulated working environment.

1.6 Authorities' CRM training requirement for cabin crew

As this research is conducted in ANZ, it also includes the research issue required by the company, a comparison of the aviation authorities' requirements and recommendations (rules, manuals, and advisory circulars) for cabin crew CRM training.

CRM training has experienced five generations with an evolution history of thirty years (Maurino, 1999). The development of CRM has always been accompanied by regulation reformation that authorized agencies have made in their regulation system.

Since ICAO included HF training into pilot licensing requirement in ICAO Annex 1, Personal Licensing, ICAO has published a series of digests that address various aspects of HF technology and their impacts on flight safety (ICAO, 1991).

ICAO has also developed manuals and advisory circulars to formulate HF training requirements. These documents provide an essential guide for both the national aviation authorities and the airlines industry to set up their own rules of HF (CRM) training for aviation professional qualification and training design (ICAO, 1989; ICAO, 1998). The implication of cabin crew CRM normally embeds in the area of live-ware interaction, communication and co-operation between flight crew and cabin crew.

Although there is no single document particularly describing the requirements for cabin crew CRM training among ICAO documentation, most aviation authorities, like JAA, FAA, CASA, CAA NZ, CAA of UK, describe the requirements for cabin crew CRM training designing, evaluation, assessment, trainer's qualification, simulator instruction, and training program audition. They also define the different CRM core elements that should be delivered at an appropriate level for different type of CRM training course.

1.6.1 CAA NZ

CAA NZ is tasked with establishing standards to ensure safe aviation operations. In respect of CRM training for cabin crew, there are some relevant prescriptions in three subparts of Civil Aviation Rule (CAR) Part 121, namely in Subpart J, M, and I (CAA NZ, 2004).

Subpart I, Training, "prescribes rules governing the establishment and operation of a training programme for crew members" (CAA NZ, 2004, p68). The training programme is categorized into four segments, they are: introduction training, transition training, upgrade training and recurrent training. CRM training for cabin crew is only required in the upgrade training segment by CAR Part 121. Rule 121.563, Crewmember upgrade

segment, sets a general requirement for all crewmembers' upgrade training. Flight attendants who will be upgraded to a senior F/A position must acquire training for HF, CRM, and supervisory skills (CAA NZ, 2004).

In addition to Subpart I that directly formulates CRM training for crewmembers, Subpart J provides a reference for F/A CRM training content. Rule121.611, Flight attendant crewmember competency requirement, requires that any person who will act as a flight attendant must be competent in safe cabin operation (CAA NZ, 2004). Such competency implicates some CRM skills and knowledge, for instance, the authority of the pilot-in-command, PAX handling, and supervising ability for the senior F/As and their deputies.

As adding an additional choice, Subpart M, Advanced Qualification Programme, provides an option for those airlines that may not comply with Subpart I to set another kind of CRM training programmes. Subpart M prescribes rules governing the establishment and operation of an advanced qualification programme for qualifying, training, certifying, and otherwise ensuring competency of crew members and other personnel (P90).

Rule 121.917, Crew resource management requirement, requires that the CRM training shall be included into each crew position's training curriculum. This rule specifies the training must include the use of each crewmember's CRM skills, evaluation of the skills and proficiency of each person being trained. Although Air NZ has not established such a programme, this subpart may provide an essential benchmark for CRM training programme establishment.

Generally speaking, in respect of CRM training requirement, there are few requirements for cabin crew in NZ CAA regulation system. New Zealand airlines are only required to provide CRM training in upgrade training segment for the cabin crew.

1.6.2 CASA

As there is a close relationship between CAA NZ and CASA, studying relevant CASA rules may help to predict the future development of CRM training requirement of CAA NZ's civil aviation regulations (CAR).

The Civil Aviation Safety Regulation (CASR) Part 121A, Air Transport Operations - Large Aeroplanes, is still in the approving progress (CASA, 2002). In the process of re-developing this part of CASR, CASA has adopted Joint Aviation Requirements (JAR-OPS 1) but adapted them to the Australian situation and legal framework. New regulations need to meet two main objects, in terms of minimising the differences between charter and Regular Public Transport (RPT) operations and satisfying the criteria established for the development of CASR.

One of the most significant changes of CASR Part 121 is to enhance training and checking requirements for crewmembers, particularly in the case of cabin crewmembers, including Crew Resource Management (CRM) training (CASA, 2003).

CASA AC 121A-09 (0), Human Factors and Crew Resource Management Training, provides general information and guideline for HF and CRM training (CASA, 2003). Comparing with the CAR of NZ CAA, CASR gives much more detailed and instructional suggestions in CRM training.

AC 121A-09 (0) believes that threats and human errors management is one primary goal of CRM (CASA, 2002). The objective of CRM training is "to enhance communication, teamwork, and threat and error management competence" (p2). It advices that CRM assessment can be made by evaluating trainees' competence, in terms of assessment of the specification of knowledge and skill, and the application of that knowledge and skill. Behavioural markers are one proposed assessment tool.

AC 121A-09 (0) clarifies the qualifications of different CRM training personnel, including CRM course designer, CRM course trainer, CRM simulator trainer conducting

simulator instruction for flight or cabin crew, and CRM examiner. All the personnel are required to complete the basic courses, such as instructional principles and methods course, a theoretical HF course, and a CRM training course. Furthermore, the different personnel need to meet additional requirements in accordance with their positions, for instance, CRM examiners need to complete the company's initial CRM training course, a CRM examiner's course, and be supervised when conducting specific CRM exam sessions until deemed competent. Moreover, all CRM training course personnel must have appropriate operational experience.

According to AC 121A-09 (0), CRM training for cabin crew can be conducted as distinct modular courses, or be integrated into different training programmes. In either case it should be address the equivalent operational phases of initial, conversion, command/upgrade, and recurrent training (CASA, 2002, p7).

CRM assessment of cabin crew is required to evaluate (by means of observing, recording, and interpreting) the individual knowledge and performance against a required standard. Well-defined behavioural markers should be used to identify and assess the CRM objectives where CRM training is integrated into other courses. A flight attendant should be evaluated and feedback provided throughout all CRM training on their performance relative to specified CRM competency standards (CASA, 2002, p7).

A different requirement from other aviation authorities' rules is that all cabin crew must complete a HF course designed to provide knowledge of HF relevant to cabin operations prior to completion of the operator's initial CRM training program. CASA also strongly advises a combined CRM training including the briefing and debriefing for flight crew and cabin crew should be conducted.

1.6.3 FAA

According to FAA regulation (FAR) Title 14 of the Code of Federal Regulations (14 CFR) PART 121, Operating Requirements: Domestic, Flag, and Supplemental Operations, all

part 121 operators are required to provide CRM training for pilots and flight attendants, and other aviation professionals (FAA, 2003).

Part121 rules that formulate the CRM training for F/A consist of the following regulations. Regulation 121.404 requires that from 19 March 1999 all F/A must complete initial CRM training. Regulation 121.421 requires that the initial and transition training for F/A must include the approved CRM initial training. Regulation 121.427 requires that the recurrent training for flight attendants must include the approved recurrent CRM training. There is no requirement for flight attendants upgrade training subject to part 121.

FAA describes the detailed CRM requirement in its advisory circular (AC) 120-51D, Crew Resource Management, which presents detailed guidelines for developing, implementing, reinforcing, and assessing CRM training for aviation personnel essential to flight safety (FAA, 2004, p1).

Comparing with CASR, FAR describes the three components of CRM training progress rather different than CRM training segments (FAA, 2004). It advises that the CRM training must consist of three components, namely the initial indoctrination/awareness, the recurrent practice and feedback, and the continual reinforcement. The requirement coincides with the CRM training philosophy that concludes CRM training progress into three phases, namely awareness, practice and feedbacks, and continual reinforcement (Telfer, Bent & Dowd, 1997).

Moreover, FAA believes that each component of CRM training should be continually renewed at every stage of training. It emphasises the practice with taped feedback when conducting CRM training.

Like CASA, FAA stresses the joint training between the flight and cabin crews. Although joint training is not required by FAA regulations, FAA strongly recommends its implementation and outlines the specific topics (FAA, 2004). For enhancing the

communication and coordination between cockpit and cabin crew, FAA suggests including the cabin crew as participants during LOFT, scheduling month-long pairings of pilots and flight attendants, and providing experienced pilot to teach new-hire F/A orientation classes.

Furthermore, FAA has set up the guidance for building up a further developed program, Advanced Crew Resource Management training program (ACRM). CRM procedures, instructor and evaluator training, crew training and assessment, and the ongoing implementation of ACRM form the essential elements of ACRM (FAA, 1998, P4). ACRM wants to integrate the CRM performances or procedures into the airline's SOPs for the flight crew.

Although it does not have direct impact on the cabin crew CRM training program, the overall changes of CRM program design and implementation may predict the future development of cabin crew CRM training, for instance, to integrate normal or emergency operation procedures with the essential CRM elements.

1.6.4 JAA and CAA of UK

JAA generally regulates the CRM training for cabin crew in JAR-OPS 1 Subpart O, cabin crew, and its appendices (JAA, 2004). JAR-OPS regulation 1.1000 requires that F/A shall complete the integrated CRM training in senior cabin crew course; JAR-OPS 1.1005 asks that all F/A shall complete the operator's CRM training and aeroplane type specific CRM.

Appendix 1 to JAR-OPS 1.1005 requires that all flight attendants must complete an introductory CRM course before being first assigned to operate as a cabin crew. Appendix 1 to JAR-OPS 1.1010 asks that all flight attendants must complete the operator's CRM training before undertaking subsequent aeroplane type specific CRM and/or recurrent CRM training. Those introductory CRM courses shall be conducted by at least one cabin crew CRM instructor. Appendix 1 to JAR-OPS 1.1015 requires that the

recurrent CRM training must be covered within a three-year cycle.

Appendix 2 to JAR-OPS 1.1005/1.1010/1.1015 indicates the elements of CRM shall be included in each type of training. The types of CRM training include the introductory CRM course, operator's CRM training, aeroplane type specific CRM, annual recurrent CRM training, and senior cabin crew course.

JAA Administrative & Guidance Material Section Four Part Three, Leaflet No. 6 (Crew Resource Management - Cabin Crew) clearly addresses that the objective of CRM for cabin crew is to enhance the communication and management skills of crewmembers. To this end, cabin crew CRM training should reflect the scale and scope of the operation together with associated operating procedures and areas of operation that produce particular difficulties (JAA, 1998). This leaflet also clarifies the training contents from four different perspectives including: the perspective of an individual crewmember, the perspective of the cabin crew team, the perspective of the whole aeroplane crew, AND the perspective of the operator and the aeroplane crew.

Compared with other authorities' requirements, the aeroplane type specific CRM of JAA is a unique requirement for cabin crew. This CRM module focuses on specifics related to aeroplane types, flight crew and cabin crew composition and number of PAX. Moreover, the operator's CRM training reflects the perspective of the operator and organization, which look for the organizational culture, communication and co-ordination with all operational personnel, and cabin incident and accident reporting participation.

CAA of UK has published CAP737, Crew Resource Management Training, to provide a comprehensive guidance document on CRM. It mainly contains or references all the information that flight crew, CRM instructors, and CRM instructor-examiners need to know concerning CRM (CAA of UK, 2003). With respect to cabin crew CRM, it also encompasses the requirement for the cabin crew CRM instructors in anticipation of the amendment to JAR OPS 1 subpart O. In addition, CAP737 Appendix 9 & 10 explains the facilitation skills and the examination skills for CRM training.

1.6.5 Conclusion

In summary, authorities' regulations for cabin crew CRM training are similar in general but distinguished in detail (Table 3). Normally CRM training needs to be experienced in three phrases, the initial/awareness, the recurrent practice and feedback, and the continual reinforcement.

CRM training for cabin crew usually consists of several segments or types, including the initial, conversion, recurrent, and upgrade course. CRM training could be conducted separately or integrated into other courses and different CRM course has different delivery means (Table 4).

The qualification of CRM training personnel requires those personnel possess appropriate HF, CRM, a training/facilitating/examining qualification and relevant operational experience. It is important that all CRM instructors and examiners are well prepared and standardized.

Assessment of cabin crew's CRM competency includes CRM knowledge, attitude and behaviour (Table 5). Attitude survey and behavioural markers are two effective tools to assess cabin crew attitudes toward CRM and cabin crew CRM skills.

For optimal assessment, data on crewmembers' attitude and behaviour should be collected before CRM indoctrination and again at intervals after the last component of CRM training to determine both initial and enduring effects of the programme.

Joint CRM training is a vastly implemented CRM module that focuses on teamwork, communication and co-operation between the cockpit and cabin crew, or between aircrew and other aviation personnel, like maintenance, dispatchers and other ground staff.

Practical exercises in mock-up are effective for developing strategies for dealing with

simulated events or scenarios and enable analysis of behaviours shown while dealing with them. Video camera is often used to tape the crewmembers' performances in such a practice; it facilitates analysing crewmembers' behaviours and providing feedback to the trainers and trainees. Briefing and debriefing are significant tools used in CRM training.

The training time varies from authorities. FAA does not have any time requirement for cabin crew. CASA asks for two days' initial CRM training and a maximum period of 3 years for covering all the CRM training core elements in recurrent training.

Regarding the CRM training elements, the aviation authorities have the similar requirements, which are concluded in the table below (Table 6).

Lastly, advises for ANZ to develop their F/A CRM training based on the studies of authorities' requirements for F/A CRM training. As discussed earlier in this section, CAA NZ and CASA maintain close relationship. If CAA NZ follow CASA's CRM training requirements, ANZ would need to change its CRM training for cabin crew in the following areas: 1) provide HF knowledge relevant to cabin operation in or prior to initial CRM training, and this might request an extension of initial CRM training time; 2) enhance the assessment of CRM competencies, especially for F/A performance, i.e., using behavioural markers; 3) recurrent CRM training should cover all the core CRM elements within a time frame, i.e., a maximum period of 3 years; 4) integrate CRM core elements with conversion course.

Table 3: Comparison of the CRM training requirement of NZ CAA, CASA, FAA (cont.)

Aviation authorities	Rules & Advisory circular	Personnel Qualification	Training categories: training contents, time, evaluation/assessment (Could be distinct course or integrated into other programmes)					Combined training with pilots	Others
			HF training	Initial CRM	Conversion course CRM	Upgrade course CRM	Recurrent CRM		
CAA NZ	CAR121	No requirement	No requirement	No requirement	No requirement	Include training on HF, CRM, supervisory skills	No requirement	No requirement	No requirement
CASA	CASR121A, AC1219-09	CRM course designer; CRM course trainer; CRM simulator trainer; CRM examiner.	Provide knowledge of HF relevant to cabin operation.	All applicable core elements are integrated into the initial CRM, conversion and upgrade course.			Elements of CRM are integrated into all appropriate phase of recurrent training every year.	Conducting the combined training including the briefing and debriefing for flight crew and cabin crew	The F/A should be assessed in the operational role as competent to apply CRM practices to the task of safely operating the aircraft during all periodic checks.
			Prior to completion of the operator's initial CRM training program.	Provide both knowledge & application of HF relevant to cabin operation.			Module CRM training covers all the core elements over a maximum period of 3 years.		
				Recommend training time: a minimum of 2 days.					
			No particular requirement for assessment.	On the completion of the training course, the F/A should be assessed in the operational role as competent to apply CRM practices to the task of safely operating the aircraft.					
				Assessment of CRM competencies: observing, recording, and interpreting individual knowledge and performance (using behavioural markers).					

	Rules & Advisory circular	Personnel qualification	Training categories: training contents, time, evaluation/assessment (Being distinct course or integrated into other programmes)			Combined training with pilots	Others
			Initial Indoctrination/ Awareness	**Recurrent practice & feedback**	**Continuing reinforcement**		
FAA	FAR121 AC120-51E	CRM instructor, Supervisor, course designers must be skilled in all areas related to the practice and assessment of CRM.	Focuses on communications and decision-making, interpersonal relations, crew coordination, leadership, adherence to SOPs, etc.	Being included as a regular part of the recurrent training requirement, to review and amplify CRM components.	Be embedded in every stage of training, and CRM concepts should be stressed in line operations as well.	Topics: pre-flight briefing; post incident/accident procedure; sterile cockpit procedures; notification procedures; procedures for turbulence and other weather; security procedures; PAX-handling procedures; in-flight medical problems; smoke-fire procedures; PAX-related regulations; authority of PIC.	No requirements for F/A upgrade training.
			Consists of classroom presentation, audiovisual presentations, and discussion groups, role-playing exercises, computer-based instruction, and videotaped examples of good and bad team behaviour.	Include classroom/brief-room refresher training followed by practice and feedback exercises (e.g. LOFT, role-play) preferably with taped feedback.	Be accomplished in many areas, such as joint training: its objective is to improve the effectiveness and safety of the entire operations team as a working system.		
			Assessment of the training program includes observation and feedback by program administrators and self-reports by participants. Crewmembers' attitudes and behaviour can be assessed. The emphasis in the assessment process is on crew performance: communications, decision-making, team building and maintenance, workload management, and situation awareness.				

Table 4: Training delivery methods

Delivery methods	Initial CRM	Recurrent CRM	Up-grade CRM	Joint CRM
Classroom presentation	√	√	√	√
audiovisual presentations	√	√	√	√
discussion groups	√		√	
Case study	√	√	√	√
computer-based instruction		√		√
practice and feedback exercises (e.g., role-play) preferably with taped feedback	√	√	√	√
Briefing and debriefing	√	√	√	√

Table 5: F/A CRM competency assessment

Assessment Method	Explanation	Implementation
Exam	Assess F/A's CRM knowledge, such as the principles, facts and skills which need to be understood and absorbed by F/A.	Mostly used in initial, recurrent, upgrade CRM training.
Attitude survey (questionnaire)	Evaluate F/A's attitude towards CRM; normally make comparison prior- and post- CRM training.	Mostly used in initial CRM training.
Observing performance (behavioural markers)	Observe F/A's non-technical (CRM) behaviours that contribute to effective or ineffective performance.	Used in all types of CRM training (when F/A role-playing under particular simulated scenarios in mock-up).

Table 6: CRM training elements for cabin crew

	Training elements
Individual perspective	Information processes, communication techniques, crew self-critique, conflict resolution, situation awareness, decision making, stress and stress management, fatigue and vigilance, threat and error management, leadership and followership, PAX

	management, etc.
Aircrew team perspective	Group climate, shared situation awareness, information processing, effective communication and coordination between cabin crew and flight crew, flight crew's workload and responsibilities, PAX management, team building and maintenance, the subculture of cabin crew and flight crew, etc.
Organisational perspective	Company safety culture, SOPs, organisational factors, effective communication and coordination with other operational personnel and ground services, participation in cabin safety incident and accident reporting, etc.

1.7 Defining the research questions

As discussed in the beginning of this thesis, this research hopes to take a small step to contribute to cabin crew CRM training, especially in the area of training effectiveness evaluation. There are two steps to achieve such a purpose in this research: to test cabin crew attitudes change using an attitude survey instrument; to assess cabin crew CRM skills using behaviour markers.

This research also aims to investigate whether selected demographic and organisational factors have any effect on cabin crew attitudes toward CRM. As discussed earlier in Section 1.4, age, gender, job position, and national culture background may affect crewmember's perception and attitudes, the extent to which human or organisational characteristics have an effect on a cabin crewmember's acceptance of CRM knowledge and concepts will be explored in the study. Although there are no evidence that aircraft, work experience, and initial CRM training time will have an effect on cabin crew CRM training, this study also attempt to explore the possibility whether those factors influence crew's attitudes toward to CRM.

Finally, this research also looks at cabin crew suggestions for improving cabin safety and CRM training, which may hopefully provide a supplementary consideration for CRM training evaluation as well as for the airline's CRM training team.

The following hypotheses are created and will be tested in this research in order to answer the research problems:

Hypothesis one: there is a positive attitude change after CRM joint training for cabin crew.

Hypothesis two: gender may have an effect on cabin crew's attitudes toward CRM and CRM training.

Hypothesis three: cabin crew job position may have an effect on cabin crew's attitudes toward CRM and CRM training.

Hypothesis four: age may have an effect on cabin crew's attitudes toward CRM and CRM training.

Hypothesis five: working experience may have an effect on cabin crew's attitudes toward CRM and CRM training.

Hypothesis six: the initial CRM time may have an effect on cabin crew's attitudes toward CRM and CRM training.

Hypothesis seven: aircraft (narrow-body aircraft and wide-body aircraft) may have an effect on cabin crew's attitudes toward CRM and CRM training.

Hypothesis eight: cultural background (represented by first and second languages) may have an effect on cabin crew's attitudes toward CRM and CRM training.

This chapter has outlined the range of literature discussing human factors in cabin, cabin safety culture, CRM training development, CRM training for cabin crew, and CRM training evaluation, as well as the different civil authority requirements for cabin crew CRM training. The next chapter will focus on the methodology used in this study.

Chapter Two

Method

This research has been conducted in ANZ, under the co-supervision of the Human Factors Programme team of ANZ. It includes two parts. One is to use an attitude survey to obtain primary data of flight attendants' attitudes toward CRM and CRM training. The other is to observe the flight attendants' performance in fire fighting drills by developing and implementing behavioural markers to rate their CRM skills required in the emergency.

2.1 Subjects

The subjects are drawn from the entire population of current ANZ flight attendants based in New Zealand. The total number of flight attendants is 1703 (including all active and temporary flight attendants). The subjects are self-selected.

Participants were flight attendants who entered recurrent SEP training this year and all took part in the survey voluntarily. All cabin crew positions were represented within the sample. Cabin crew positions included In-flight Service Director (ISD), In-flight Service Coordinator (ISC), Purser (PS) and regular flight attendant (F/A). Table 7 represents the distribution of the final sample of 232 participants in the survey. More detailed information about demographic characteristics of the subjects is provided in Chapter 3, Results.

Table 7: Distribution of subjects in survey

	ISD	**ISC**	**PS**	**Regular F/A**	**Others**	**Total**
Sample	25	25	41	138	3	232
Percentage of	18.7%	15.8%	7.3%	15.9%		14%

population						

2.2 Apparatus

This section presents the research instruments used for the collection of data: the attitude survey questionnaire and the CRM skills behaviour markers.

As there was no particular survey instrument for cabin crew CRM attitude survey, two questionnaires (see Appendix 1 and 2) were created to investigate the cabin crew's safety management attitude and their reaction to CRM training. The questionnaire consists of four parts.

The first part is about the demographic information that divides the flight attendants into different groups by work position, age, gender, and experience.

The second part has thirty questions that explore the flight attendant's safety management attitudes and opinions towards CRM. The third part asks about CRM training satisfaction and consists of 11 questions.

The third part asks for flight attendants' satisfaction with the CRM training, and consists of 11 questions. The same Likert scale was used to rate the level of cabin crew's feedback for training satisfaction.

The fourth part has two open questions and asks for the top three suggestions in improving cabin safety and CRM training.

A Likert scale is used to rate the respondent's level of agreement with CRM related statements in these two parts. The scale range is from 1 (strongly agree) to 5 (strongly disagree).

All questions in Parts two and three were developed using three sources, the Flight Management Attitudes Questionnaire (FMAQ) produced by the NASA/UT/FAA Aerospace Research Project of the University of Texas at Austin, the Flight Attendant Safety Questionnaire (FASQ) created by the same project, and literatures researching in the areas of cabin HF, cabin safety culture, and cabin crew CRM training.

After the questionnaire was drafted by the researcher, it was sent to the supervisors for their approval. Two supervisors (from Aviation School of Massey University and from Human Factors Programme Team of ANZ) gave detailed suggestions on research questions and writing problems. As a result this questionnaire was revised six times before it was presented to ANZ.

Since no any behavioural markers designed for evaluating cabin crew's performance were available from the literature, a range of behavioural markers (see Appendix 3) was created to assess individual flight attendant's performance when they participated in fire fighting. Both the NOTECHS behavioural markers (non-tech skills) and UT's behavioural markers were used as the resource for producing these markers.

The format of the behavioural markers was taken from NOTECHS markers. In total nine elements were included into the behavioural markers and each element was clarified by using different behaviour examples. Elements except Debriefing were drawn from the CRM skills and behaviours required by emergency handling, and then carefully modified by choosing the most practical actions needed in a real situation. A Likert scale was used to rate the flight attendant's level of performance. The scale range was from 1 (very poor) to 5 (very good).

In the process of designing behaviour markers, both supervisors advised on which CRM skill elements and behaviours would be necessary parts of the markers from CRM perspective. They also provided modification in terms of writing and format

revision. Behaviour markers were redrafted through seven versions before being finalised.

2.3 Procedures

This section explains the data collection methods: an attitude survey and an observation.

Before the research commenced, the researcher, the supervisor, the co-supervisor and a CRM expert from the Human Factors Programme team of ANZ met to discuss research procedure so as to implement the research in a practical way.

2.3.1 Survey

The survey investigated flight attendants' attitudes toward CRM and their reaction to CRM training. The responses were voluntary and anonymous, other than basic demographic data. Participants were asked for an identification code for confidentiality.

Data was gathered via two questionnaires, which were distributed to cabin crew both electronically and manually. The pre-training questionnaires were available from both the ANZ website and the training centre. Copies of the post-training questionnaire were stored in the classroom and the SEP instructors assisted in handing them out to the flight attendants. Instructions were given on the procedure for completing the questionnaire.

Flight attendants were required to complete the questionnaire twice, before and after the CRM training module. When completing the questionnaires, participants were asked to return the completed questionnaires to a secure box placed in the classroom. If any flight attendant failed to return the completed questionnaire into the secure box,

they could post the questionnaire to the aviation school's post box indicated in the survey cover letter.

2.3.2 Observation

A naturalistic observation was conducted to evaluate the cabin crew's CRM skills to deal with the fire and smoke in the B747 cabin mock-up.

During observation, the observer conducted a naturalistic observation, observing participants' performance while they were carrying out the fire fighting drill in the mock-up. The observer watched and then scored their performance by using the behavioural markers. Notes and summaries of good or inappropriate behaviours were taken when it was necessary.

Only one observer observed and rated the flight attendant's performance by using the behaviour markers designed by the observer herself, thus there was no problem with inter-rater reliability. Meanwhile, as the observer did not participate in the training, there was no form of interruption or consultation with the flight attendant from the observer in the observation.

Chapter three

Results

This chapter reports the results from the analysis of the data received from the survey and observation.

3.1 Survey

This section is divided into two subsections in terms of questionnaire response and open-ended question response. The first subsection describes the results from the questionnaire response, which mainly assesses the cabin crew's attitudes toward CRM and their satisfaction with CRM training. The second subsection explains the results from open question response, which shows cabin crew's suggestions particularly for improving cabin safety and CRM training.

The Statistical Package for the Social Science (SPSS) for Windows was used to examine and analyse data collected in the survey. Raw data was recoded in order to keep all data in the same direction and consistent with the change of the scale, namely higher scores reflecting a more positive response.

First, factor analysis was undertaken to identify a small number of CRM management and training factors that were conceptually related.

Secondly, Multivariate analysis of variance (MANOVA) was used to test the simultaneous effects of training time (prior to and post training), gender, and job position on cabin crew's attitude toward CRM and CRM training. A Multivariate Analysis of Covariance (MANCOVA) was also conducted, using age, work-year, initial CRM training time, and aircraft as the covariates. For statistical analysis, the test with $p < .05$ as the level of significance was adopted.

Thirdly, content analysis was used to summarise the categories of suggestions for improving CRM training and cabin safety management.

The demographic data indicated that more female cabin crew (59.1%) participated in the survey than male cabin crew (40.9%). Most of them were more than 30 years old (85%), and the majority of the participants (86.1%) had worked for more than five years as flight attendants.

With regard to each respondents work position 59.5% were regular flight attendants (F/A); 17.7% were Purser; In-flight Service Director (ISD) and In-flight Service Coordinator (ISC) had the same participant rating at both 10.8%. Participants working in the wide-body aircraft (Boeing 747 & Boeing 767) were greater than those working in the narrow-body aircraft (Boeing 737 & Airbus 320), 62.9% and 36.6% respectively.

Data also showed that almost all cabin crewmembers (99%) had been through the initial CRM training programme. Half of them (50%) had the initial training at least three years ago, more than a quarter of them (26.2%) had this training within the last 2 years, and about one fifth (21.1%) had it less than a year ago.

Almost all participants were English native speakers (94.8%). People who spoke a second language (28.4%) were far fewer than those who didn't speak any second language (71.6%). For the second language, there were at least 6 languages but all formed only a small proportion. Chinese as a second language had the biggest number of speakers but only at 9%.

3.1.1 Factor analysis results

Factor analyses were undertaken to reduce a large number of variables down to a

smaller number of factors (Spicer, 2005). Here, the purpose was to combine certain variables into a smaller number of factors and then could use the summarised means of extracted factors in further hypotheses tests.

The 41-question-questionnaire was divided into two parts: the first set of variables (Part two) investigating cabin crew's attitudes toward CRM; the second set of variables (Part three) asking for cabin crew's reaction to CRM training. Factor analyses were undertaken separately for these two sets of variables. As Page and Meyer (2000) suggested, "as a rule of thumb, there should be at least five observations for every variable considered in a multivariate analysis" (p197), this condition was satisfied for this research because it had more than 41x5=205 observations.

Prior to the principal component analysis, data was evaluated for appropriateness for a factor analysis. Cronbach's alpha was tested firstly. As Cronbach's alpha should preferably exceed 70 per cent before a factor analysis (Page & Meyer, 2000), Cronbach's alpha for the second set of variables (Training reaction) was 0.792, indicating that a factor analysis could be performed on the data. Moreover, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (= .778) and the Bartlett's test of sphericity (965.9; p=. 000) both suggested that the data was appropriate for a data analysis (Tabachnick, & Fidell, 1996, suggest that values $\geq$ .6 are required for a good factor analysis).

Although Cronbach's alpha for the first set of variables (CRM attitudes) was only 0.541, the KMO measure of sampling adequacy = .691, and the Bartlett's test of sphericity (1448.3; p=. 000) indicated that the data was still marginally appropriate for data analysis.

A principle component analysis followed by a varimax rotation of the Training reaction items produced the following results. First, the results for training reaction

data are explained.

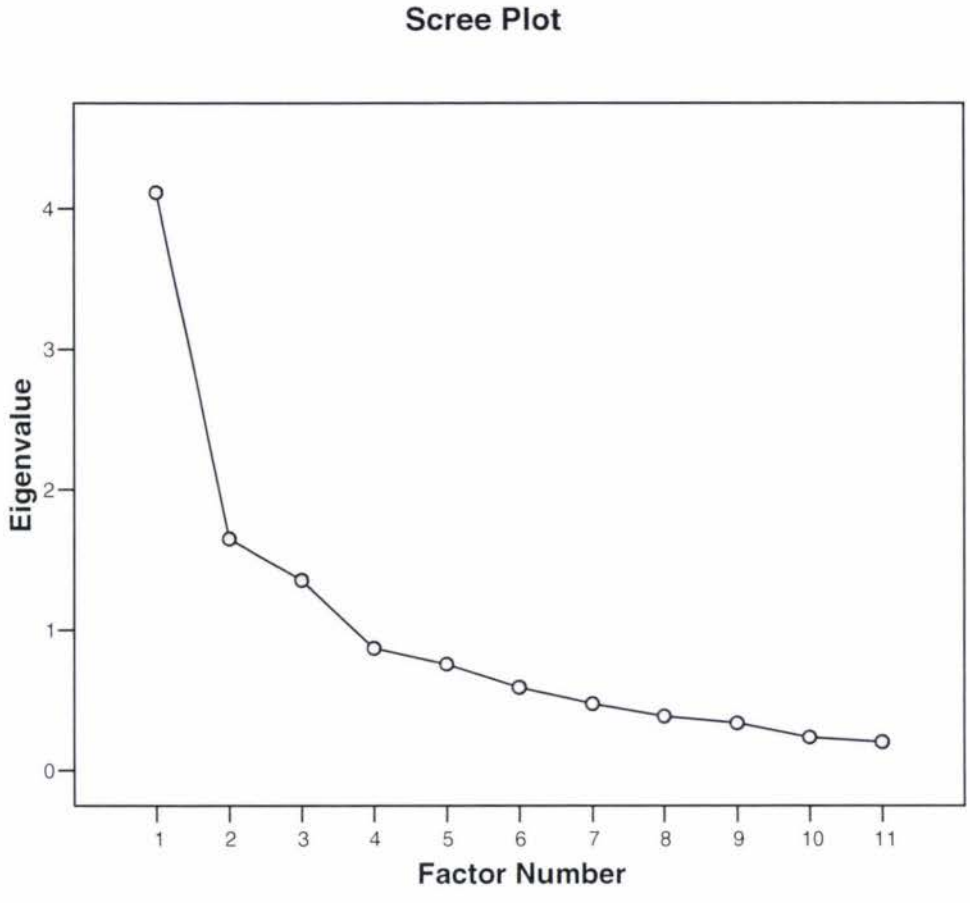

Figure 7: Scree plot (Training reaction)

Figure 7 illustrated that only three factors should be sufficient. These three factors could explain 64.8% of the variation in the data. These three factors then were labelled in accordance with the content of variables of each factor. Table 8 reflected the loadings of extracted factors. Although some researchers believed that only loading of more than 0.5 or less –0.5 should be considered (Page & Meyer 2000), it was decided to retain variables with a factor loading $\geq$.40 in this study. This is in line with Astuti (1997).

Factor analysis for CRM attitudes applied exactly the same procedures and principles but produced slightly different result. As suggested by the Scree plot (Figure 8), four

factors should be sufficient. The four factors could only explain 35% of the variation in the data. Some items had very low communalities and were cut off because the goal of factor analysis here was dimension reduction (Page & Meyer, 2000). Therefore it was not worth trying to find more factors and the four-factor solution was accepted.

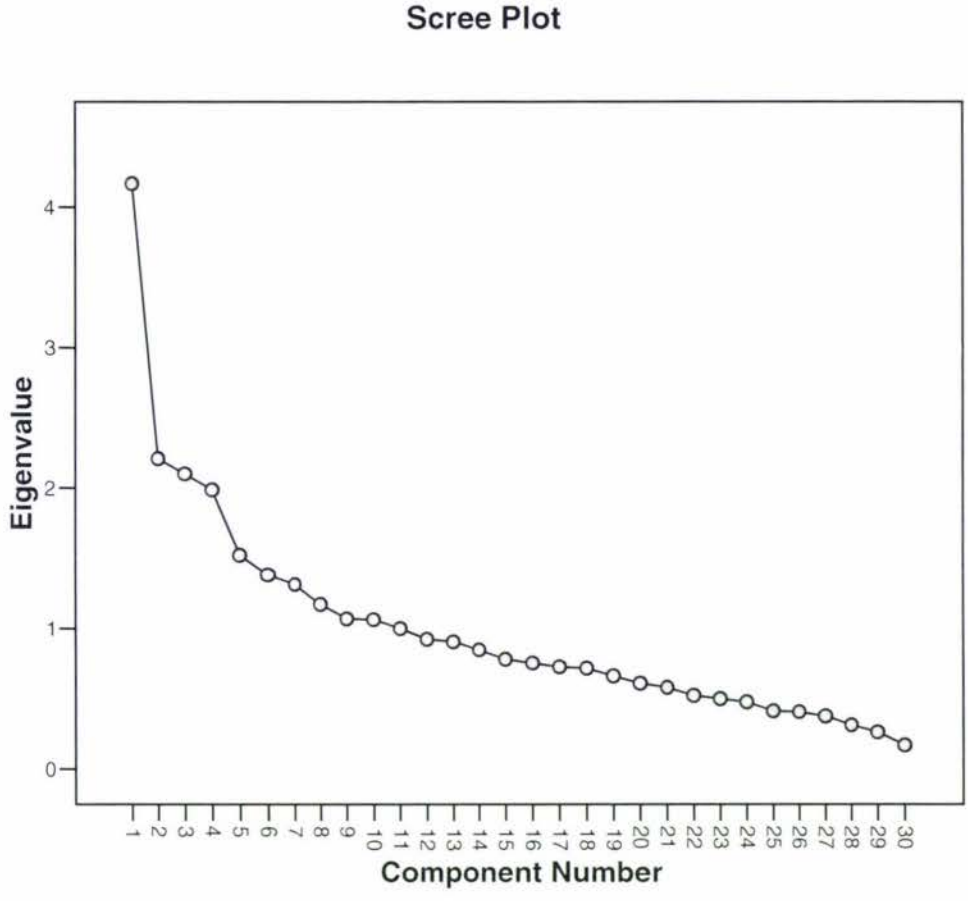

Figure 8: Scree plot (CRM attitudes)

In Table 8, complex items that cross-loaded were assumed to load on the factor on which they had the highest loading. Although it was decided to retain variables with factor loading $\geqslant$.40, some items like Item 9, 5, 2, 8, 13, 17, and 4 (all less than .40), were still retained as they fitted sensibly into the factor.

Table 8: Principle Component Analysis of Cabin Crew Attitude toward CRM and CRM Training

Training reaction			
Sorted rotated factor loadings **Items**	Factor 1	Factor 2	Factor 3
35 From my own experience, CRM training is useful for improving communication.	.755	.00	.00
36 From my own experience, CRM training is useful for improving cockpit & cabin crew coordination.	.696	.00	.306
32 Joint training is a valuable way to improve pilot-F/A cooperation.	.673	.00	.00
31 F/A CRM training should be treated the same as pilot CRM training.	.465	.00	.00
38 From my own experience, CRM training is useful for improving team building.	.522	.490	.00
41 From my own experience, CRM training is useful for improving stress management.	.00	.814	.00
37 From my own experience, CRM training is useful for improving fatigue management.	.00	.669	.00
39 From my own experience, CRM training is useful for improving leadership.	.412	.637	.00
40 From my own experience, CRM training is useful for improving decision-making.	.464	.574	.00
34 In terms of safety, training has sufficiently prepared me for the line.	.00	.00	.625
33 I am confident in my ability to assess potential hazards to safety.	.00	.00	.529

CRM Attitudes				
Sorted rotated factor loadings **Items**	Factor 1	Factor 2	Factor 3	Factor 4
23 I feel quite confident when I need to deal with smoke/fire in the cabin.	.856	-.074	-.019	-.009
25 I feel quite confident when I need to deal with PAX evacuation/ditching.	.796	-.117	.032	-.047
21 I feel quite confident when I need to deal with cabin pressurization problems.	.771	-.025	-.028	.053
24 I feel quite confident when I need to deal with hypoxia resulting in mask deployment.	.726	.092	-.006	-.115
22 I feel quite confident when I need to deal with dangerous goods in the cabin.	.666	.011	-.050	.000
20 I feel quite confident when I need to deal with PAX medical emergencies.	.587	.074	-.093	.040
19 Under time pressure, I sometimes ignore some steps of the pre-flight checks in order to avoid delay.	.126	.565	.043	-.048
9 I can rely on the individual ability of the senior F/A more than on other F/A teamwork in emergency.	-.100	.360	.089	.019

5 I might be viewed as unprofessional by the pilots when I report a potential safety issue that turns out to be non-important.	.187	.290	-.026	.129
2 The "cabin crew assess to flight deck" regulation makes me hesitate to interrupt the cockpit crew during critical phases of flying.	.179	.243	.026	.104
16 The senior F/A should act as a role model for other F/A at all times.	.077	.015	.579	.093
6 I know that it is a normal responsibility for F/A to participate in cabin safety incident/accident report.	-.059	.072	.443	.041
10 It is important for F/A to understand pilots' workload in different flying phases.	-.099	.032	.396	-.110
8 If the cabin crew is experienced, a pre-flight briefing is not necessary.	.023	.217	.352	-.033
13 F/A should mention their stress or physical problem to other crew before or during a flight.	-.060	-.170	.330	.045
27 Safety issues that do not directly affect the cabin are not F/A's responsibility.	.001	.156	.019	.463
30 F/A are only responsible for cabin safety.	.160	.185	-.002	.463
3 Airlines' written procedures can advise F/A how to react under all in-flight situations.	-.015	-.053	-.020	.390
17 F/A can only challenge the actions of captain or senior F/A when they threaten the safety of the flight.	-.074	.207	.040	.389
4 F/A can't break the regulations even when they believe it is in the best interest of aircraft.	.101	-.099	.319	.351

The above factor analysis suggested that training reaction were assessed in terms of three dimensions:

- Factor 1, Team management training;
- Factor 2, Personal management training;
- Factor 3, Safety management training.

CRM attitudes were assessed in four dimensions, which coincided with the four issue findings of cabin safety culture (Klinect, 1998):

- Factor 1, Safety management;
- Factor 2, Personal management;
- Factor 3, Team management;
- Factor 4, Company management.

Cronbach alpha coefficient was calculated to test the internal consistency of the items making up the same factor. According to Page and Meyer (2000) the satisfaction with those CRM attitudes and CRM reaction scales had good internal consistency, with a Cronbach alpha coefficient reported of .70. In the current study the Cronbach alpha coefficients were: Team management training, .76; Personal management training, .79; Safety management training, .54; Safety management, .87; Personal management, .42; Team management, .52; Airlines management, .51. Some of the Cronbach values were less than .70, which indicated the consistency of those scales were not ideally high, and this probably because the scales were too short (less than ten items for each scare) (Pallant, 2001).

Seven new variables were computed, which represented the means for variables correlated to the same factor (Table 9). All seven variables would be used in the next step of data analysis, MANOVA and MANCOVA for hypotheses tests.

Table 9: Descriptive statistic for different categories of CRM and CRM training

	N	Minimum	Maximum	Mean	Std. Deviation
Average mean for attitude 1 (safety management)	230	1.50	5.00	3.8851	.58168
Average mean for attitude 2 (personal management)	232	1.50	5.00	3.6519	.65945
Average mean for attitude 3 (team management)	232	1.40	5.00	4.0808	.50670
Average mean for attitude 4 (company management)	232	1.80	5.00	3.6110	.58622
Average mean for training reaction 1 (team management training)	229	1.60	5.00	3.9419	.59667
Average mean for training reaction 2 (personal management training)	229	1.50	5.00	3.3483	.68917
Average mean for training reaction 3 (safety management training)	229	2.50	5.00	4.1310	.47095

3.1.2 Hypotheses tests

MANOVA is distinctive in analysing the effects of multiple independent variables on multiple dependent variables (Spicer, 2005). It can fulfil the requirement of this study, which aims to test whether the training affected cabin crew attitudes toward CRM and CRM training.

MANCOVA, which provides statistic control of variables that may confound the main and/or interaction effects of the factors and to enhance power by reducing individual differences on the dependent variables (Spicer, 2005, p178), can be used to reduce systematic bias and within groups error by means of controlling some demographic variables' influence on cabin crew attitudes.

Therefore, hypotheses tests were accomplished by MANOVA followed by MANCOVA, and the traditional acceptance level of 5% for a *P*-value was used in this study.

3.1.2.1 MANOVA results

MANOVA was conducted for testing whether the *training* (using training time as fixed factor: prior to and post the training), *gender*, and *job position* (fixed factors) affect cabin crew attitudes toward CRM and their reaction to CRM training, using seven summarised means as dependent variables.

Cabin crew attitudes toward CRM

Multivariate tests for CRM attitudes (Table 10) showed that the means on the dependent variables were only different for job position and training time. This is interpreted as that job position, and the interaction of training time and job position had an effect on cabin crew attitudes toward CRM.

Table 10: MANOVA results showing the effects of different factors on F/A attitudes toward CRM

Effect	Wilks's Lambda	F	Sig.
Time	.984	.857(a)	.491
Gender	.986	.742(a)	.564
Job position	.900	1.856	.037
Time*Gender	.984	.869(a)	.483
Time* Job position	.888	2.116	.015
Gender* Job position	.950	.891	.556
Time*Gender* Job position	.944	1.005	.442

According to tests of between-subjects effects, cabin crew attitudes toward team management were significant different between different job position, F (3, 211) = 3.34, p = .020. Estimated marginal means tests indicated that cabin crew working in the three senior F/A positions had similar attitudes toward team management (means were all above 4.2) while regular flight attendants had a lower score (mean was less than 4) (Figure 9).

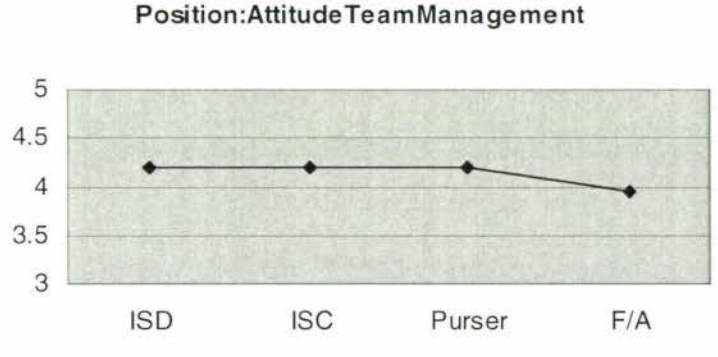

Figure 9: MANOVA – job position affecting F/A attitudes toward Team management

Data also indicated that the interaction of training time and job position influenced

cabin crew attitudes toward safety management, F (3, 211) = 4.51, p = 004. ISDs had little change in their attitude toward safety management. Both ISCs and regular F/As had positive change in their attitudes while Pursers had a negative change after the joint CRM training (Figure 10).

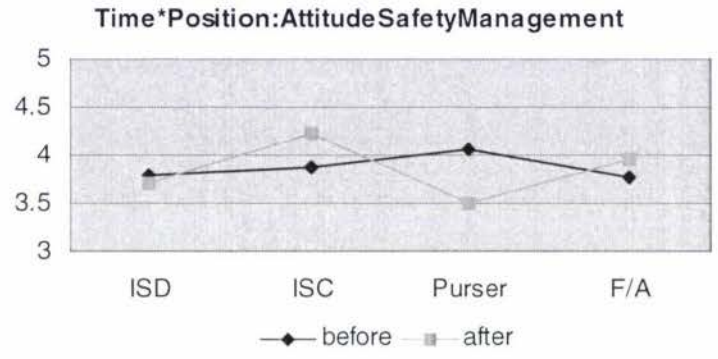

Figure 10: MANOVA –job position affecting F/A attitudes toward Safety management

Cabin crew reaction to CRM training

Multivariate tests for CRM attitudes (Table 11) showed that the means on the dependent variables were only different for job position and gender. This could be interpreted as that only job position and gender had an effect on cabin crew reaction to CRM training.

Table 11: MANOVA results showing the effects of different factors on F/A reaction to CRM training

Effect	Wilks's Lambda	F	Sig.
Time	.994	.423(a)	.737
Gender	.992	.549(a)	.649
Job position	.920	1.967	.041
Time*Gender	.987	.944(a)	.420
Time* Job position	.959	.987	.449

Gender* Job position	.901	2.451	.010
Time*Gender* Job position	.955	1.078	.378

The follow-up analysis of variables suggested that job position had an effect on cabin crew reaction to personal management training, F (3, 210) = 3.37, p = .019; male and female had statistically different reactions to team management training, F (3, 210) = 5.92, p = .001.

From Figure 11, the overall score of cabin crew reaction to personal management training were relatively low, and especially ISCs showing slightly a negative reaction. ISDs had the highest score, and Pursers had the second highest, while regular F/A had slightly lower scores comparing with the other two positions.

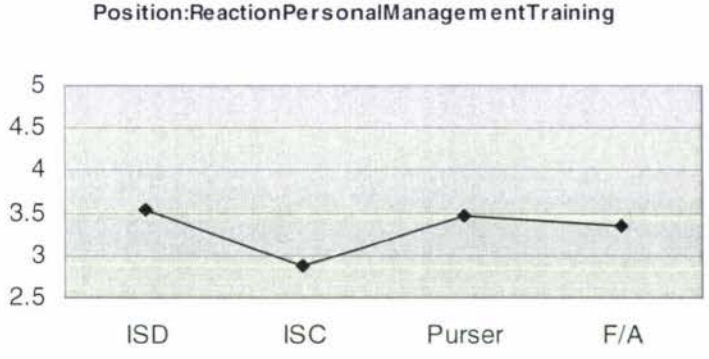

Figure11: MANOVA – job position affecting F/A reaction to personal management training

Figure 12 indicated that female ISDs and F/As had a more positive reaction to team management training than male counterparts, while male ISCs and Pursers had a more positive reaction than female counterparts. Both male and female cabin crew reflected quite a positive reaction to team management training (scores ranging from 3.6 to 4.2).

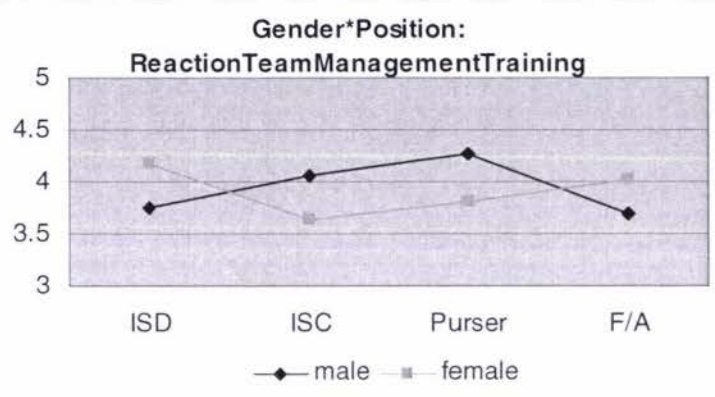

Figure12: MANOVA – interaction of gender and job position affecting F/A reaction to team management training

Hypotheses tests results (MANOVA)

According to MANOVA analyses discussed above, the following conclusion are derived:

1 Hypothesis one is partially supported. The joint training changed cabin crew attitudes toward CRM, particularly for their attitudes toward safety management, and such changes are associated with job position. Unfortunately the change was not completely positive because only ISCs and regular F/As had positive attitudes change.

2 Hypothesis two is supported. Gender had an effect on cabin crew reaction to team management training, and this effect interacted with job position. Female ISDs and F/As had a more positive reaction to team management training than male counterparts, while male ISCs and Pursers had a more positive reaction than female counterparts. In additions the studies showed that gender had no effect on cabin crew attitudes toward CRM.

3 Hypothesis three is supported. Job position had an effect on cabin crew attitude toward CRM, particularly for their attitudes toward team management. Leading flight

attendants (ISD, ISC, and Purser) showed more positive team management attitudes than regular flight attendants. It also had an effect on attitudes toward safety management, which effect interacted with training time. Meanwhile, job position had an effect on cabin crew reaction to personal management training; it also had an interacted effect with gender on crew reaction to team management training as discussed above.

3.1.2.2 MANCOVA results

The objective of using MANCOVA was to test the effect of the *training time*, *gender*, and *job position* (fixed factors) on cabin crew attitudes toward CRM and their reaction to CRM training, while controlling for any effect of some other demographic variables, such as *age*, *work-year*, *initial training time*, and *aircraft* (covariates).

Because of the imbalanced sample size for first and second language speakers, it was decided to no test hypothesis eight (which was about cultural background - the first and second language) in this research.

Cabin crew attitudes toward CRM

Multivariate tests showed that only the interaction of training time and job position had an effect on cabin crew attitudes toward CRM (Table 12). The follow-up analysis of variables suggested that such interaction had an effect on cabin crew attitudes toward: safety management, F (3, 202) = 4.23, p = .006; personal management, F (3, 202) = 2.96, p = .033.

Table 12: MANCOVA results showing the effects of different factors on F/A attitudes toward CRM

Effect	Wilks's Lambda	F	Sig.

Age	.992	.380(a)	.823
Work-year	.993	.375(a)	.826
Initial CRM training time	.975	1.270(a)	.283
Aircraft	.970	1.565(a)	.185
Time	.984	.799(a)	.527
Gender	.990	.524(a)	.718
Job position	.921	1.390	.166
Time*Gender	.985	.767(a)	.548
Time* Job position	.879	2.189	.011
Gender* Job position	.954	.788	.663
Time*Gender* Job position	.936	1.119	.342

From figure 13, both ISCs and regular F/As had positive change on safety management attitudes while ISDs and Pursers had a negative change after the joint CRM training. ISCs had great improvement in their attitudes while Pursers had the greatest decrease (cf. Figure 10).

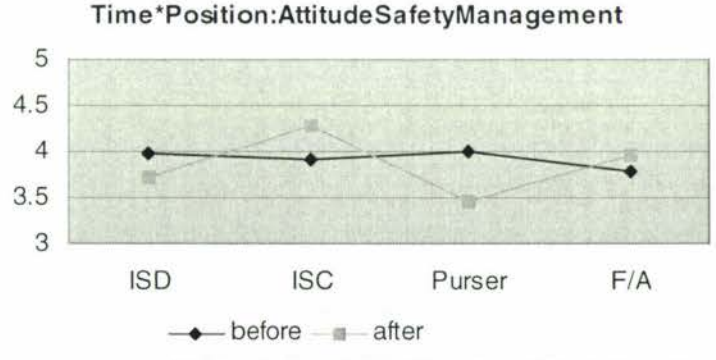

Figure 13: MANCOVA – interaction of training time and job position affecting F/A attitudes toward safety management

Figure 14 indicated a slightly different trend comparing with Figure 13. ISCs had great positive change on their attitudes toward personal management while ISDs had a big negative change after the joint CRM training. Both ISCs and regular F/As had a

tiny change, a little decrease in their attitudes.

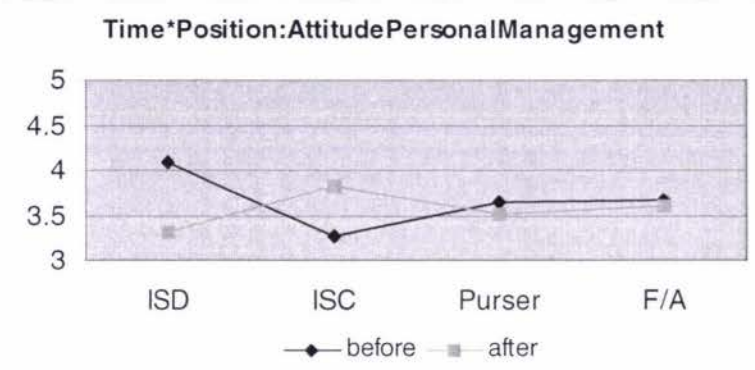

Figure 14: MANCOVA – interaction of training time and job position affecting F/A attitudes toward personal management

Although multivariate tests showed no significant differences between different aircrafts or between job positions (not interacting with other demographic variable), some trends were apparent in the group mean comparison (the tests of between subjects effects in MANCOVA indicated that there were significant differences for aircraft and job position).

For aircraft, F (1, 202) = 4.87, p = .028, there was significant difference for aircraft groups. Data suggested that cabin crew working on narrow-body aircrafts had more positive attitudes toward personal management training than those working on wide-body aircrafts (Figure 15).

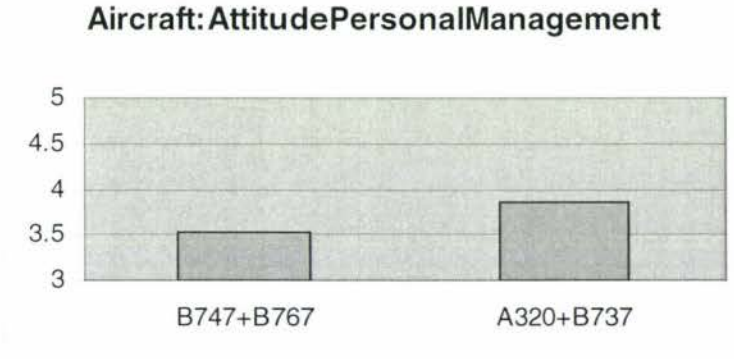

Figure 15: Aircraft affecting F/A attitudes toward personal management

For job position, F (3, 202) = 3.26, p = .023, there was significant difference for position groups. Data suggested that (Figure 16) leading flight attendants (including ISD, ISC, and Purser) had more positive attitudes than regular flight attendants, and this result was similar to the result of MANOVA (cf. figure 9).

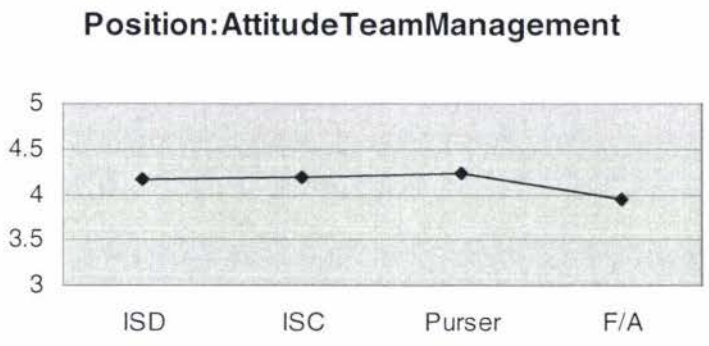

Figure 16: MANCOVA-Job position affecting F/A attitudes toward team management

Cabin crew reaction to CRM training

Multivariate tests (Table 13) showed that the means on the dependent variables were different for job position, as well as the interaction of gender and job position. This could be interpreted as that only job position and gender had an effect on cabin crew reaction to CRM training.

Table 13: MANCOVA results showing the effects of different factors on F/A reaction to CRM training

Effect	Wilks's Lambda	F	Sig.
Age	.975	1.679(a)	.173
Work-year	.991	.576(a)	.631
Initial CRM training time	.982	1.231(a)	.299
Aircraft	.995	.314(a)	.815

Time	.996	.279(a)	.840
Gender	.995	.301(a)	.825
Job position	.918	1.919	.047
Time*Gender	.985	1.017(a)	.386
Time* Job position	.962	.854	.567
Gender* Job position	.905	2.253	.018
Time*Gender* Job position	.953	1.085	.372

The follow-up analysis of variables suggested that job position had an effect on cabin crew reaction to personal management training, F (3, 201) = 2.74, p = .045; the interaction of gender and position also had an effect on cabin crew reaction to team management training, F (3, 201) = 5.50, p = .001.

Figure 17 showed that the overall score of cabin crew reaction to personal management training was slightly positive (means score ranging from 3 to 3.6) and the difference between positions was small. ISDs had the highest score, Pursers had the second highest, regular F/A had the third highest, while ISCs had the lowest score (cf. Figure 11).

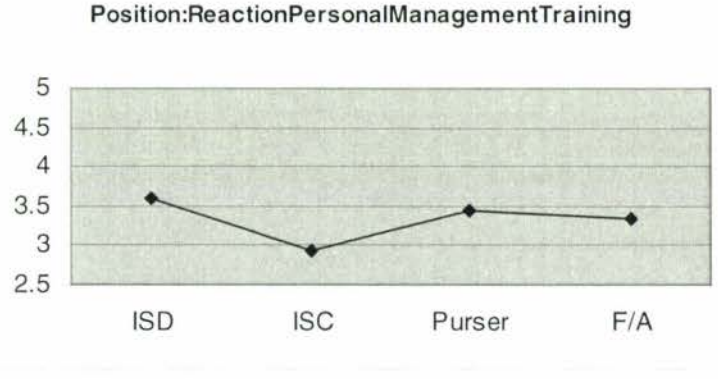

Figure 17: MANCOVA – job position affecting F/A reaction to personal management

Figure 18 indicated that the overall score of cabin crew reaction to personal management training was quite positive (score ranging from 3.6 to 4.2). The trend for

male and female scoring was different: male ISC and Purser had higher scores than the other two positions, while female ISD and regular F/A had the higher scores than the others (cf. Figure 12).

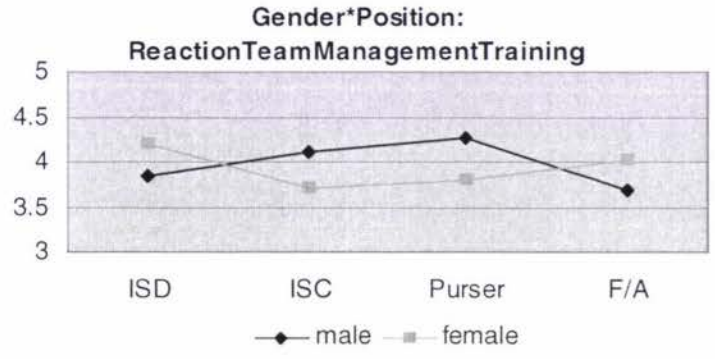

Figure 18: MANCOVA – interaction of gender and job position affecting F/A reaction to team management

Although the multivariate tests showed no significant age difference for cabin crew reaction to CRM training, the tests of between subjects effects showed that there was significant differences between different age groups for safety management training reaction, $F(1, 201) = 5.09$, $p = .025$. Data suggested that such reaction would be more positive as age increased.

Figure 19: Age affecting F/A reaction to safety management

Hypotheses tests results (MANCOVA)

According to MANCOVA analyses discussed above, the following conclusions are derived:

1 Hypothesis one is partially supported. The joint training changed cabin crew attitudes toward safety management and personal management, and such effect was associated with job position. Both ISCs and regular F/As had positive change on safety management attitudes; ISCs had great positive change on their attitudes toward personal management. Unfortunately the change was not completely positive because some positions (ISD and Purser) had not shown positive attitudes change.

2 Hypothesis two is supported. Gender had an effect on cabin crew reaction to team management training, and this effect interacted with job position. The two highest scores belonged to ISC and Purser for the male while the female ISD and regular F/A had the highest scores among the four female positions. In additions the studies showed that gender had no effect on cabin crew attitudes toward CRM.

3 Hypothesis three is supported. Job position had an effect on cabin crew attitudes toward safety management and personal management, and such changes interacted with training time. Job position also had an effect on cabin crew reaction personal and team management training. The overall scores of cabin crew reaction to personal management training were positive, and the difference between positions was small. ISDs had the highest score while ISCs had the lowest score.

4 Hypotheses four, five, six and seven could not proved to be supported.

3.1.2.3 Comparison and conclusion

According the analysis discussed above, it seemed that the tests results for MANOVA and MANCOVA were quite similar. Here, to compare the two analyses results was

aimed to see whether the covariates acted as confound in the study.

First, Job position proved to have an effect on cabin crew attitude toward CRM and CRM training by both MANOVA and MANCOVA. Figure 20 and 21 further indicated that job position had almost the same effect when controlling the demographic variables. Therefore, the covariates were not acting as confound for job position since they made very little difference whether they were controlled or not.

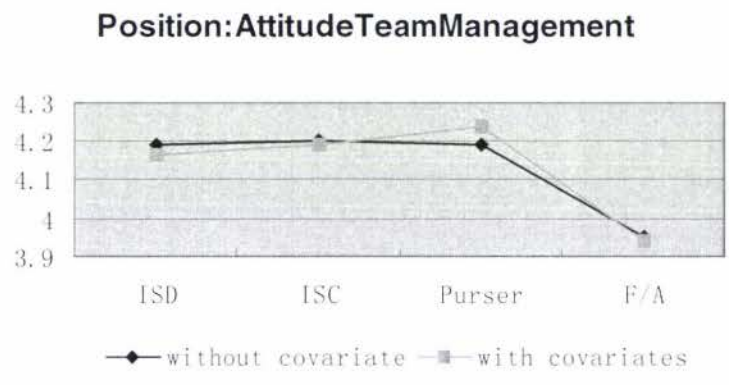

Figure 20: Comparison – job position affecting F/A attitudes toward team management

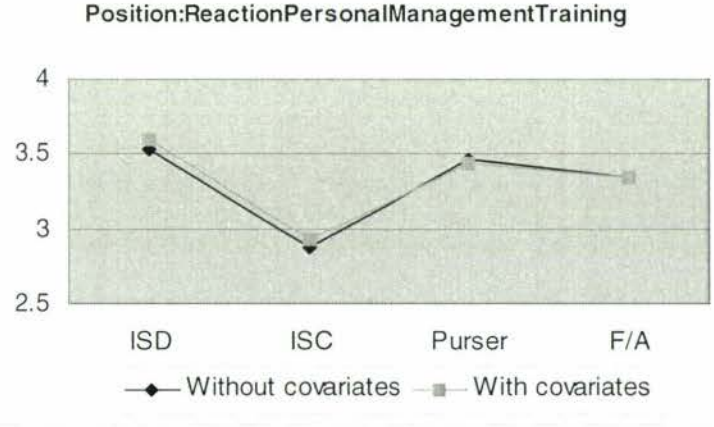

Figure 21: Comparison – job position affecting F/A reaction to personal management training

Secondly, the interaction of gender and position proved to have an effect on cabin

crew reaction to CRM training. When comparing the position means computed in MANOVA and MANCOVA (Figure 12 & Figure 18), the results were almost the same. This comparison suggested that the covariates had no effect on cabin crew reaction to team management training as a moderating factor for gender and position.

Thirdly, as job position proved to have an effect on cabin crew attitude toward team management in MANOVA result while no effect was proven in MANCOVA result, the covariates seemed to have an effect on cabin crew attitudes toward CRM by moderating the effect of job position.

Fourthly, MANOVA suggested that the interaction of training time and job position had an effect on cabin crew attitudes toward safety management, while MANCOVA suggested that this interaction had an effect on both safety and personal management. This indicated that the covariates also affected cabin crew attitude by moderating the effect of training time and position.

Lastly, the following graphs showed some different groups' means, which yielded quite interesting trends.

Figure 22 showed that cabin crew only increased their overall attitudes toward safety management after the joint CRM training. All cabin crew showed quite positive attitudes toward CRM, especially for team and safety management. Both male and female had positive change for safety management, and males also increased their attitudes toward personal management.

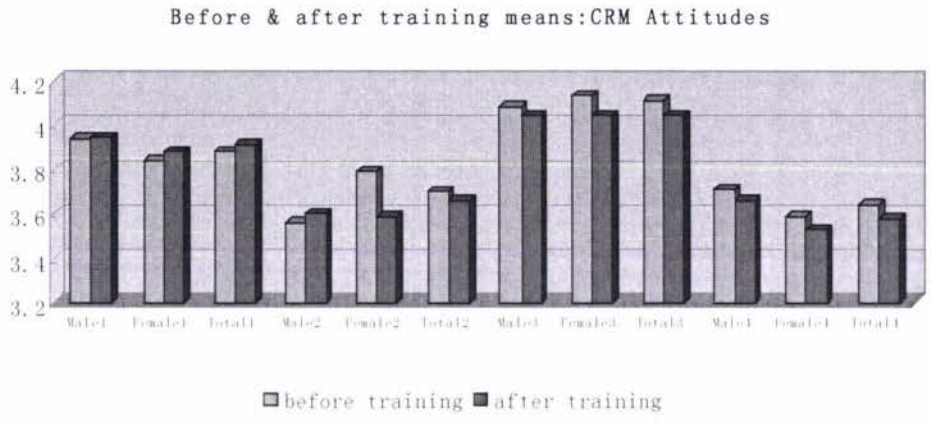

Figure 22: Comparison – gender group means before and after training

Note: 1=safety management, 2=personal management, 3=team management, 4=airline management.

Figure 23 indicated different positions had different attitude changes after the joint CRM training. ISDs had a negative attitude change toward CRM, while ISCs had a positive change; Pursers only had a positive change for team management, while regular F/As had positive changes for safety and company management. All positions reflected positive attitudes toward CRM, especially for team and safety management.

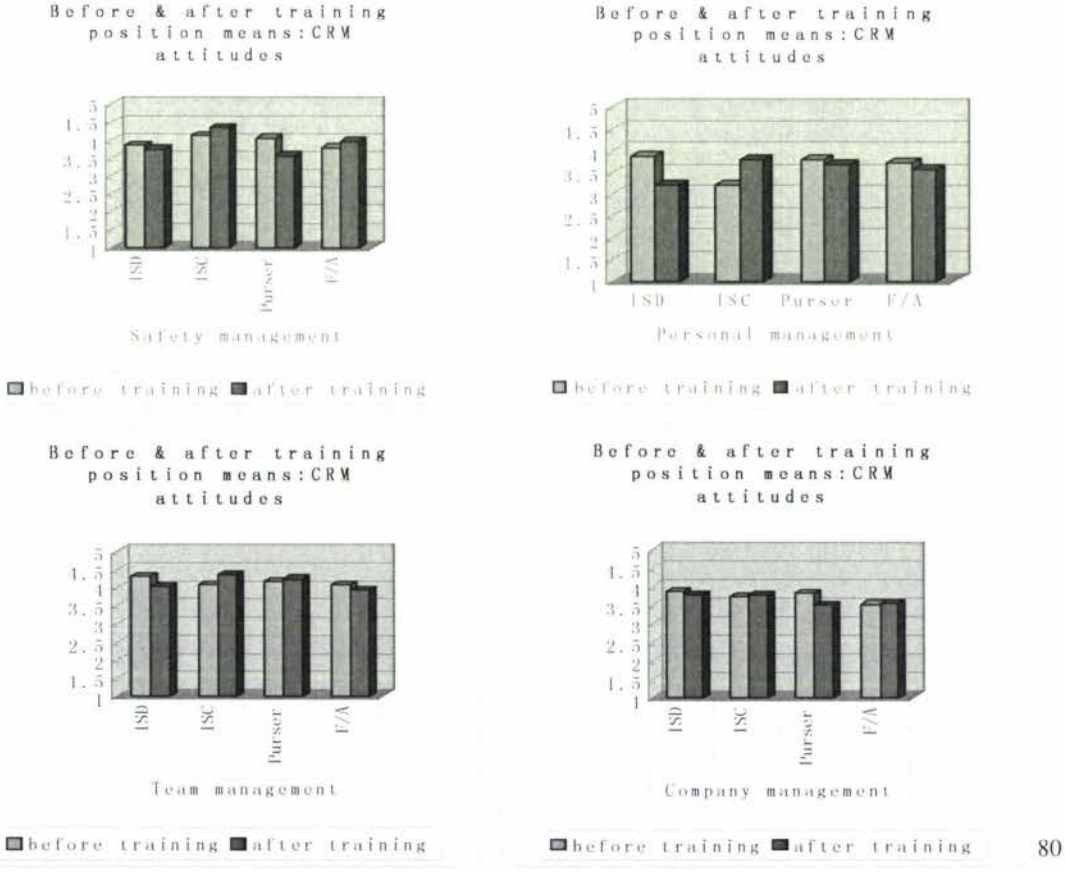

Figure 23: Comparison – position group means before and after training

Figure 24 suggested cabin crew increased their reaction to overall CRM training after the joint training. They had highest scores in safety management training, second highest in team management training, and the lowest in personal management training. Male flight attendants showed positive change for all CRM training while females showed no clear trend of change for CRM training.

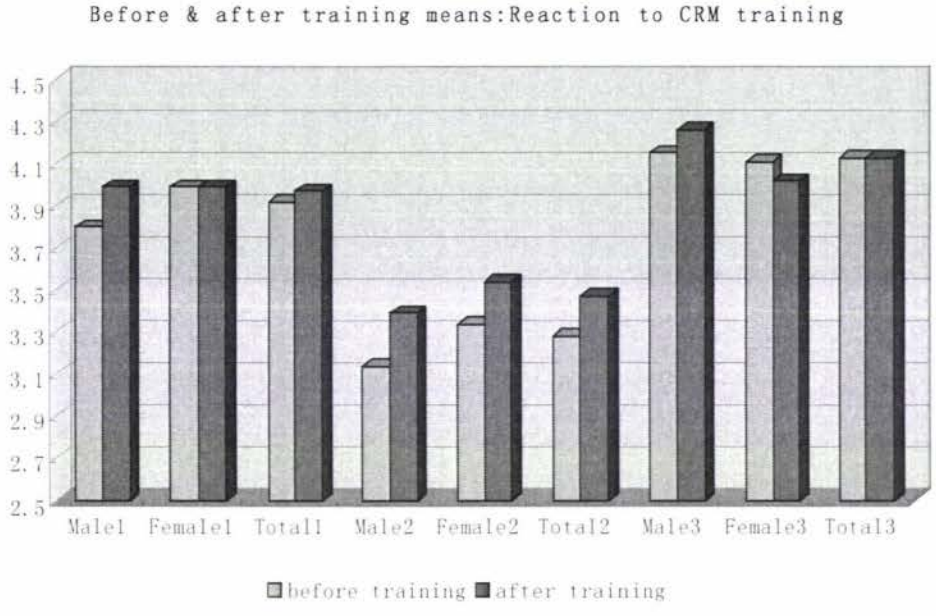

Figure 24: Comparison – gender group means before and after training

Note: 1=team management, 2=personal management, 3=safety management.

Figure 25 showed the same trend as Figure 24 did. Safety management training had the highest scores; team management training had the second highest; personal management training had the lowest. Regular flight attendants had positive changes in their reaction to overall CRM training after the training, while the other three leading positions show vague trends in their reactions to CRM training. All cabin crew showed quite positive reactions to CRM training.

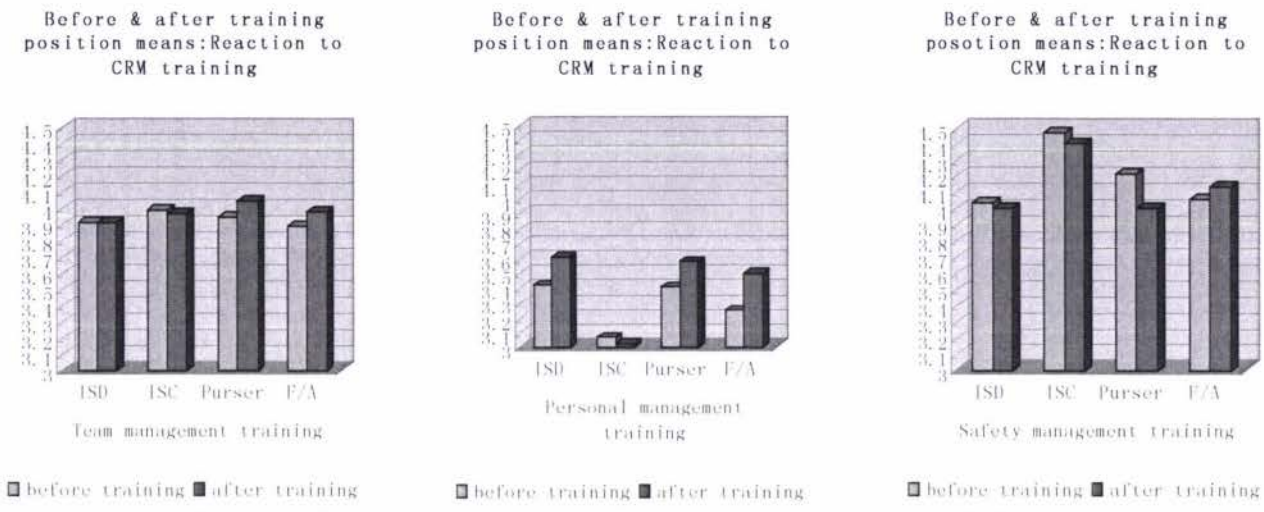

Figure 25: Comparison – position group means before and after training

In summary, cabin crew all showed positive CRM attitudes. They gave safety management the highest score, team management the second and personal management the lowest. Only attitude toward safety management had positive change after the training for both male and female. Flight attendants showed different trend of attitude change based on different positions.

In respect with reaction to CRM training, the overall reaction had increased after the training. Cabin crew always showed positive reaction, scoring the safety management training the highest, and team management training the second highest. Flight attendants reflected different change of reaction to the training based on their positions, and only regular flight attendants showed positive change after the training.

In conclusion, the result of hypotheses tests included the following:

1 Hypothesis one was partially supported. There were attitudes changes for safety and personal management after the training, such that ISCs and regular F/As showed positive change on safety management attitudes, and ISCs had great positive change on their attitudes toward personal management.

2 Hypothesis two was supported. Gender proved to have effect on cabin crew reaction to team management training, and this effect interacted with job position. It showed different trend for male and female cabin crew positions: male ISCs and Pursers had higher scores than the other two male positions; female ISDs and regular F/As had the higher scores than the other two female positions. In additions the studies showed that gender had no effect on cabin crew attitudes toward CRM.

3 Hypothesis three was supported. Job position had an effect on cabin crew attitudes toward team management, safety management and personal management, and these effects interacted with training time and gender. Leading cabin crew positions (ISD, ISC, and Purser) showed much more positive attitude toward team management than regular F/A. ISCs and regular F/As showed positive change on safety management attitudes after the joint CRM training, and ISCs had positive change on their attitudes toward personal management after the training. Job position also had an effect on cabin crew reaction to personal and team management training. ISCs showed relatively low scores on reaction to personal management training, while the other positions (ISD, Purser, and regular F/A) showed higher scores. Effect on cabin crew reaction to team management training interacted with gender and was presented in the previous paragraph.

4 Hypothesis four could not prove to be supported statistically. There was a trend indicating that reaction to safety management training would be more positive as age increased.

5 Hypothesis five was rejected. Work experience had no effect on cabin crew's attitudes toward CRM and CRM training.

6 Hypothesis six was rejected. The initial CRM training time had no effect on cabin crew's attitudes toward CRM and CRM training.

7 Hypothesis seven could not prove to be supported statistically. There was a trend indicating that cabin crew working in the narrow-body aircrafts had more positive attitudes toward personal management.

8 Hypothesis eight was not appropriate for testing in this study because the responses of first and second language speakers were imbalance.

Although hypothesis 4, 5, 6, and 7 could not prove to be accepted statistically, there was evidence that one or more demographic factor(s) could have an effect on cabin crew team and personal management attitudes, by moderating the effect of job position and training time.

3.1.3 Open ended question responses

Content analysis involved analysing text with respect to its content, with the factors of interest most often relating to meaning (Page & Meyer, 2000). An informal content analysis was used in this study to identify the different categories of suggestions collected from open questions in the survey.

The responses were carefully recorded and categorised into different types. The first step was to copy the answers for each question and establish response categories. Categories were taken from the actual responses with as little inference as possible in order to maintain the integrity of the data. With the categories established, comments were transformed into one or more of the categories.

Four answers were not recognisable because of the crabbed handwriting. Those responses were ignored because the amount was very small (4/200=2%).

Totally 84 flight attendants replied to the open ended questions and contributed nearly two hundred suggestions relevant to cabin safety management and CRM training for

cabin crew.

Suggestions for improving CRM training were finally categorised into seven groups (Figure 26), including *joint training design, training contents, participants' attitude, training delivery, training devices, training material,* and *training instructor.*

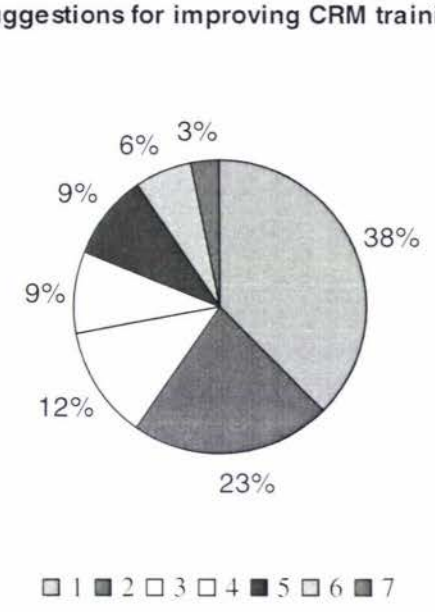

Figure 26: Categories of suggestions for improving CRM training

Note: 1=Joint CRM training design (38%); 2=Training contents (23%); 3=Training delivery (12%); 4= Participants' attitude (9%); 5=Training devices (9%); 6= Training material (6%); 7=Instructor (3%).

With respect to advices on cabin safety improvement (Figure 27), the most significant issues were *crew fatigue, cabin luggage, cabin crew and flight crew communication, PAX related safety issues, pre-flight work pressure, and airline management.* Some other issues were also important for improving cabin safety, such as *crew briefing and debriefing, turbulence, duty free goods, online check and audit, cabin facilities and maintenance, cabin operation procedures,* and *crew uniform.*

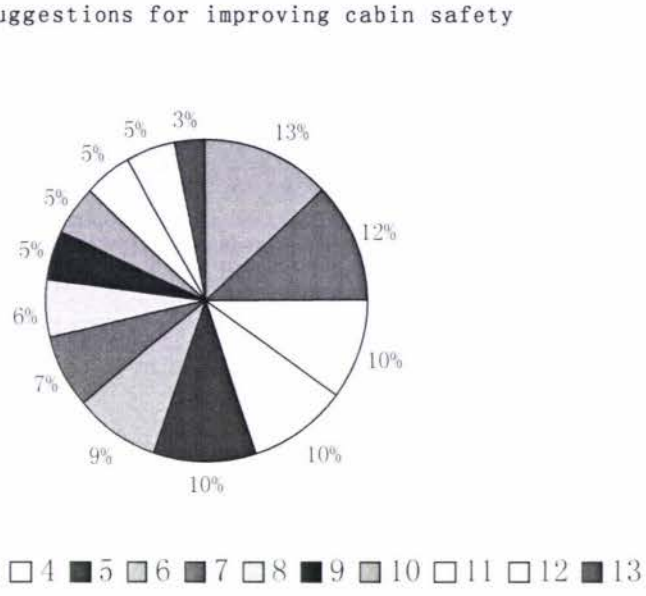

Figure 27: Categories of suggestion for improving cabin safety

Note: 1=crew fatigue (13%), 2=cabin luggage (12%), 3=cabin crew and flight crew communication (10%), 4=PAX related safety issues (10%), 5=pre-flight work pressure (10%), 6=management (9%), 7=briefing and debriefing (7%), 8=turbulence (6%), 9=duty free goods (5%), 10=online check and audit (5%), 11=cabin operation procedures (5%), 12=cabin facilities and maintenance (5%), 13=uniform (3%).

Detailed explanation for the different categories of suggestions for improving CRM training and cabin safety will be explained in the following chapter, Discussion.

3.2 Observation

In total 165 flight attendants were observed and the raw data collected from observation were recorded and analysed using Microsoft Excel. The average level for each skill and element was calculated to see whether such element/skill was present during fire fighting. The level (percentage) of different elements were compared by each fire fighting position, namely Primary fire fighter (P), Back-up fire fighter (B), Communicator (C), in order to learn which kinds of CRM skills were demanded most in emergency for the different fire fighting roles.

The scores utilised in behavioural markers had five rating levels, 1 referring the lowest level (Very poor) of CRM skill, 2 referring Poor, 3 referring Competent level, 4 referring Good, and 5 referring the highest level (Very good). Another three letters, A, B, and C, were also included into the scales, which stood for three different situations: A, observer could not see the participant's behaviour in some cases (i.e. very dense smoke in mock-up); B, observer had no time to observe the participant's behaviour; C, the CRM skills were not applicable for the particular scenario.

3.2.1 Critical CRM skill elements for fire fighting

The results of observation showed that most CRM skills (elements) listed in the behaviour markers were present for fire fighting for all fight attendant roles. These elements included: *being proactive, advocacy, communicating clearly and precisely, keeping information flowing sufficiently, performing self-control and self-protection, ensuring SEP compliance, co-operation, setting and keeping priority, time management,* and *debriefing*. Although another two skills, *Commanding* and *Inquiry*, did not show high percentage of implication for all fire fighting positions, they were also acceptable for rating cabin crew CRM skills in fire fighting.

Being proactive. In total more than half participants demonstrated good competence. All positions in the fire-fighting group showed the highest percentage on the score of "Good". P had the highest score among all positions (Figure 28).

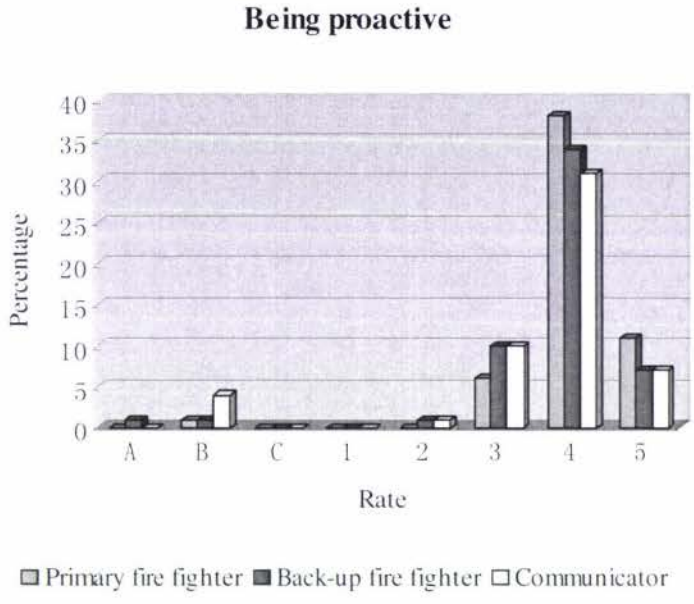

Figure 28: Critical CRM skills for fire fighting – being proactive

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Advocacy. In fire fighting drill, almost 55% of observed flight attendants showed good skill of advocacy, no matter which position they occupied. P and B both demonstrated better competence in advocacy than C (Figure 29).

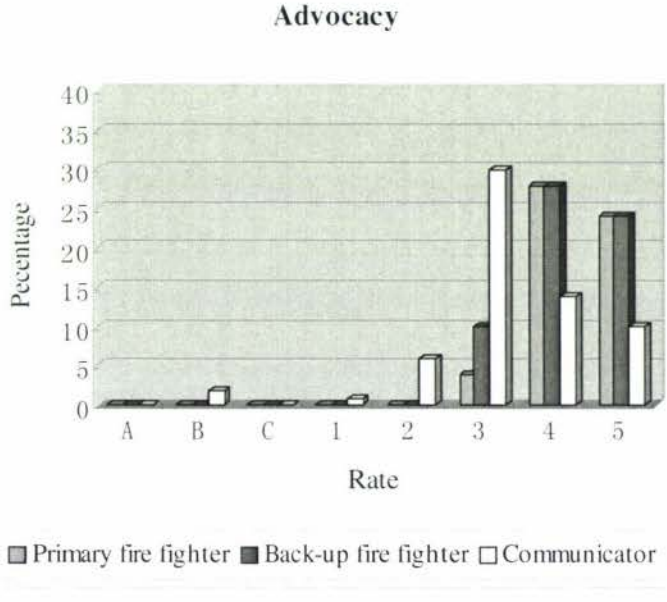

Figure 29: Critical CRM skills for fire fighting – advocacy

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Commanding. Observation showed that most participants did not utilise commanding in fire fighting (Figure 30). Only P took more chances for commanding and showed relatively good competence (6% for "Good" and 21% for "Very good") among the three positions. The other two positions had high scores in Not Applicable, which suggested that B and C had little chance to use command skills in fire fighting drill.

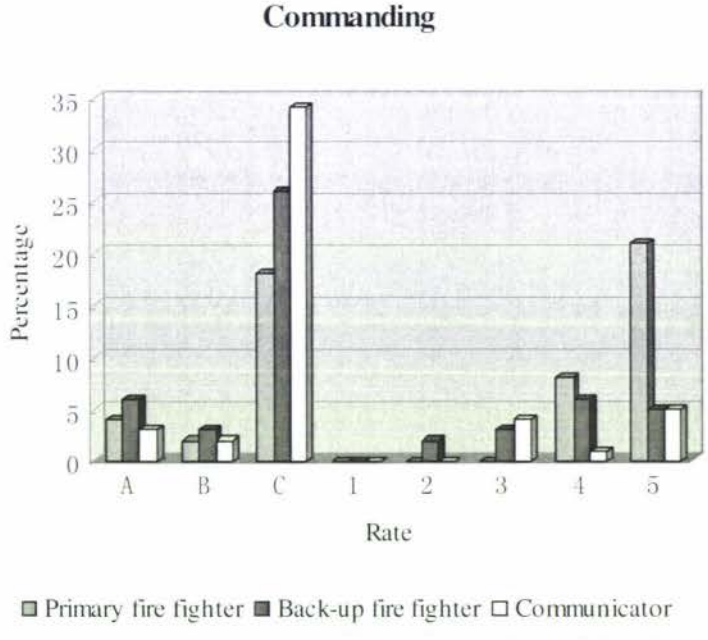

Figure 30: Critical CRM skills for fire fighting – commanding

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Clear and precise communication. Totally 49% of P, 39% of B, and 48% of C, won good competence in communicating clearly and precisely (Figure 31). Both P and C

showed the highest percentage for the score of "Good" (26%), and the second highest for "very good" (15%).

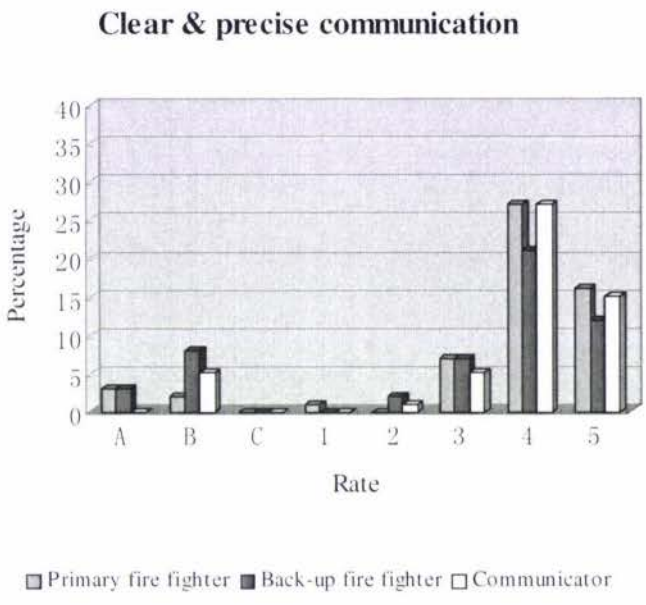

Figure 31: Critical CRM skills for fire fighting – clear & precise communication

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Sufficient communication. Most observed flight attendants showed good competence in communicating sufficiently (Figure 32). C had the highest scores for this skill.

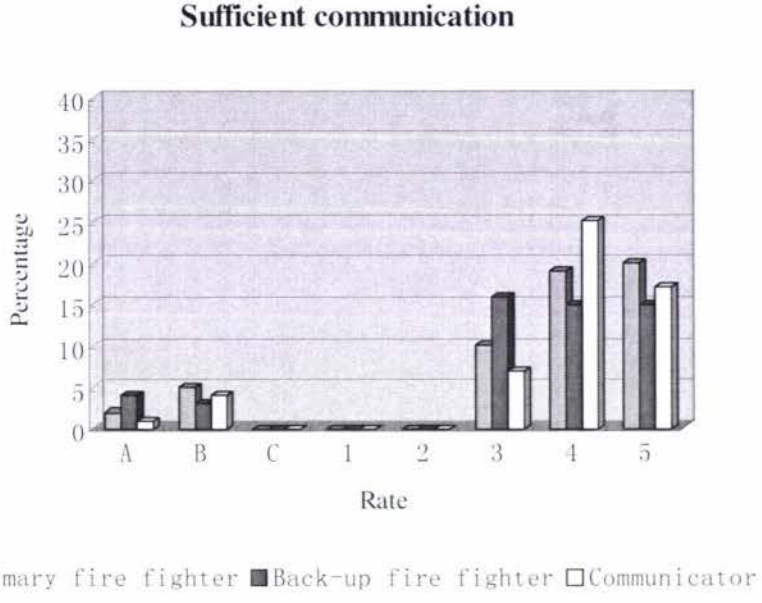

Figure 32: Critical CRM skills for fire fighting – sufficient communication

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Inquiry. Nearly half participants showed competent skills of inquiry. B and P had high scores in Not Applicable (20% and 14%) and both showed low percentage in good competence (Figure 33). C showed the highest percentage for both "Good" and "Very good" scores with a percentage of 30% (12% for Good and 17% for Very Good).

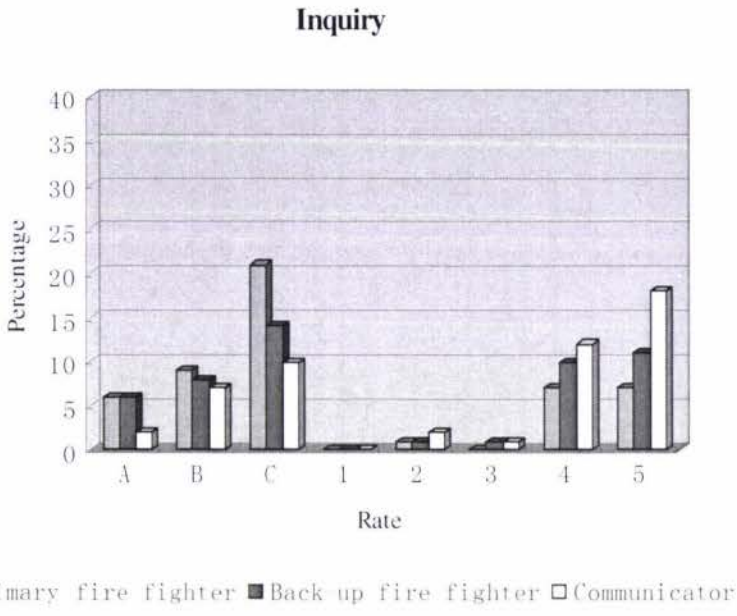

Figure 33: Critical CRM skills for fire fighting – inquiry

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Self-control. All positions showed approximately the same good level competence in this skill (Figure 34).

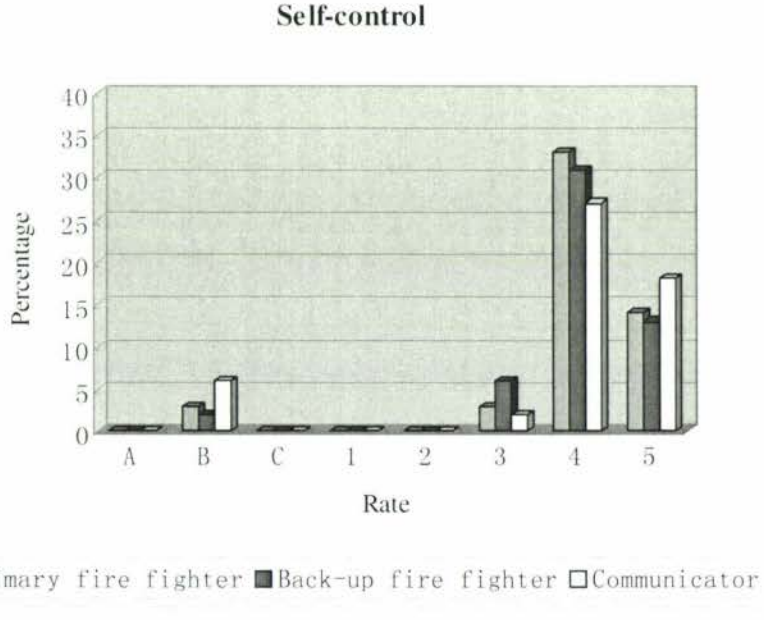

Figure 34: Critical CRM skills for fire fighting – self-control

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Self-protection. P and B both showed the same good skills of self-protection. Correspondently they had 45% and 43% for good and very good competence. It seemed self-protection was not so critical for C (Figure 35).

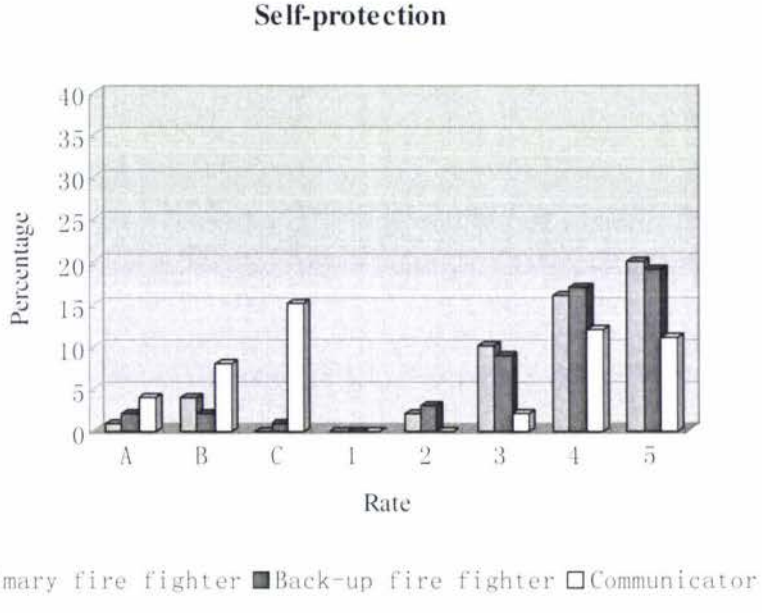

Figure 35: Critical CRM skills for fire fighting – self-protection

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

SEP compliance. P (47%), B (45%), C (37%) had scores ranging from Competent to Very good, which indicated most of the observed flight attendants showed good skills in complying with SEP (Figure 36).

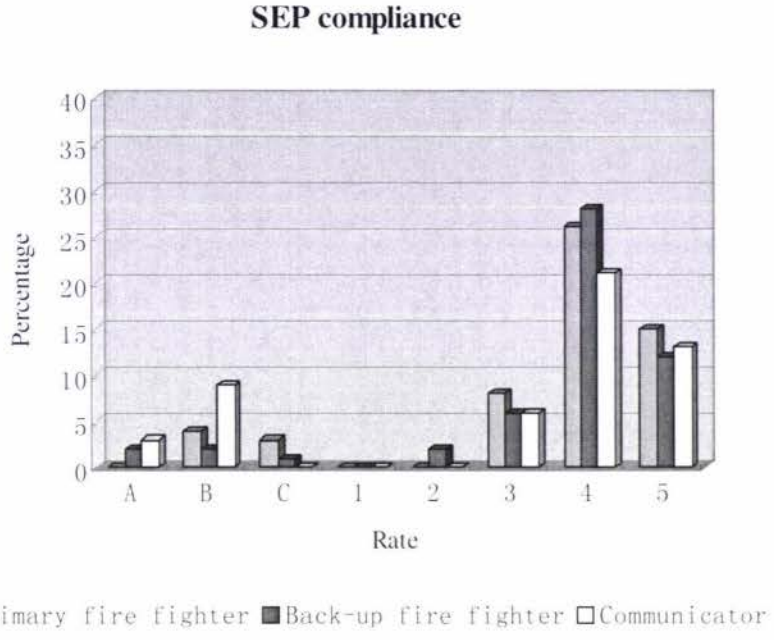

Figure 36: Critical CRM skills for fire fighting – SEP compliance

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Co-operation. All participants showed high percentages in Good and Very Good scores. The three positions had similar scores in this skill (Figure 37).

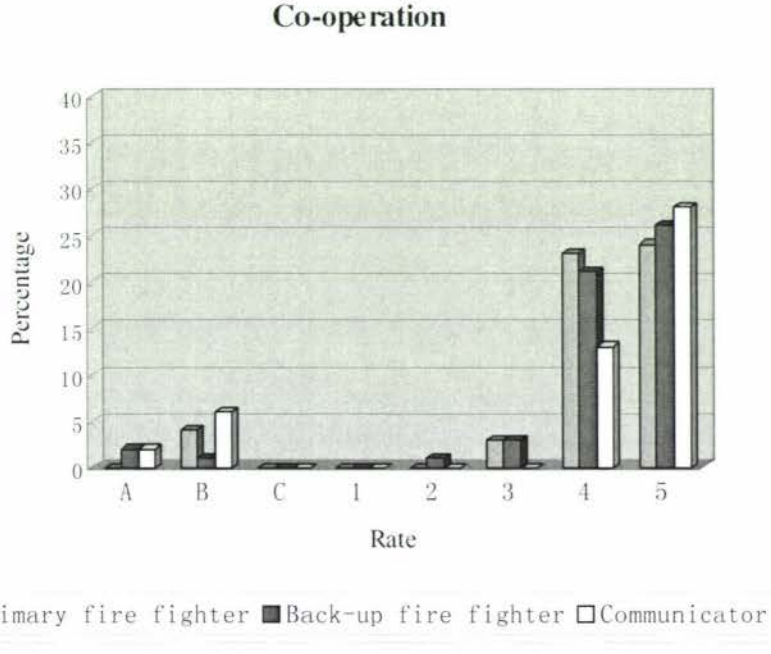

Figure 37: Critical CRM skills for fire fighting – co-operation

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Priority. P showed the highest percentage for Competent/Good/Very Good scores (respectively 5%, 25%, and 18%). B and C had quite similar scores (40% in total) for Competent/Good/Very Good (Figure 38).

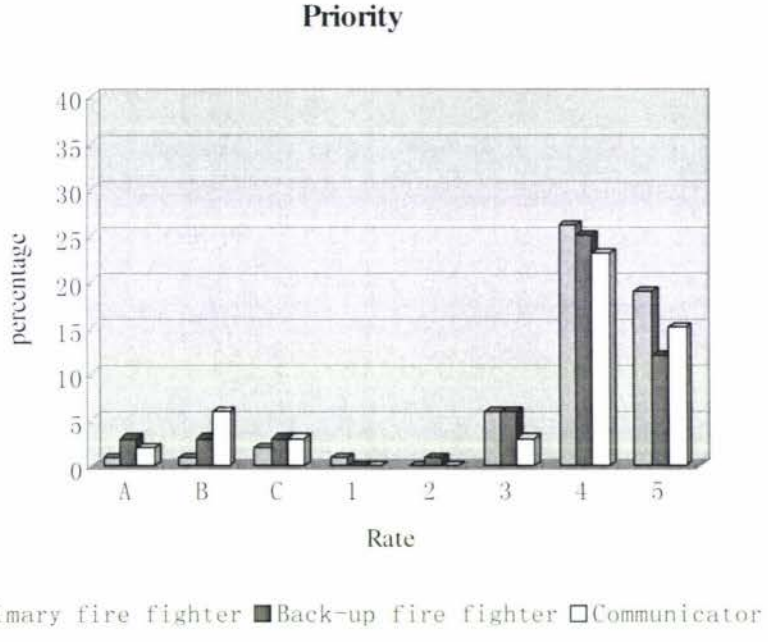

Figure 38: Critical CRM skills for fire fighting – priority

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Time management. P showed the highest percentage in good competence, followed by B, and C the last. P had 40% in total for Competent/Good/Very good; B, 37% for Competent/Good/Very good; C, 30% for Competent/Good/Very good (Figure 39).

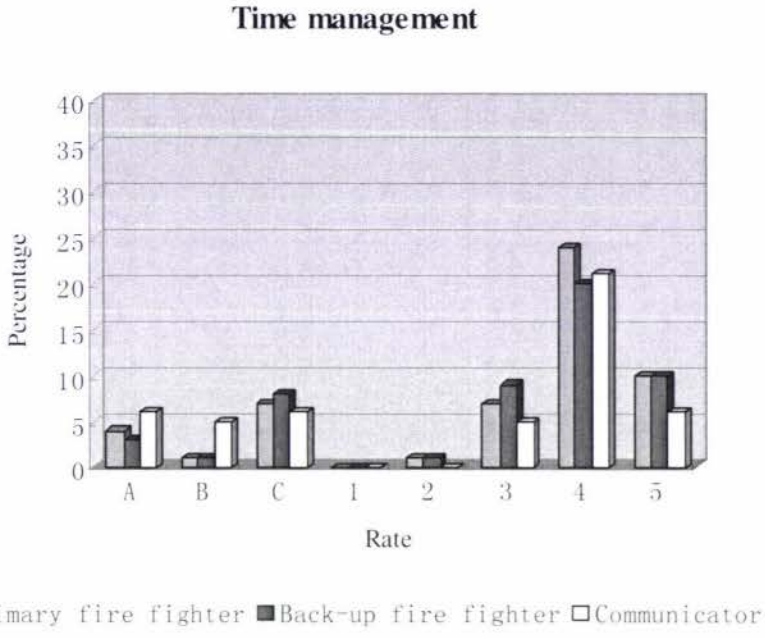

Figure 39: Critical CRM skills for fire fighting – time management

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

Debriefing. Debriefing was not included in the fire fighting skills, but was very important for CRM training, especially in practical exercises. More than half flight attendants commented on their own and other F/A's performances. All positions show high percentages on Competent and Good scores. In addition, more than 5% participants showed low level (Poor) in debriefing (Figure 40).

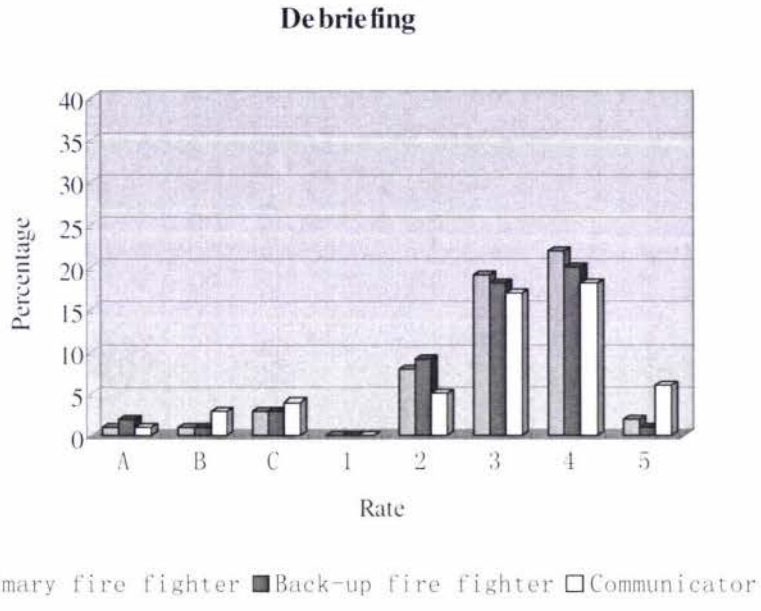

Figure 40: Critical CRM skills for fire fighting – debriefing

Note: A=observer cannot see the participants' behaviour, B=observer has no time to observe the participants' behaviour, C=CRM skills which are not applicable for the particular scenario, 1=Very poor, 2=Poor, 3=Competent, 4=Good, 5=Very good.

3.2.2 Other CRM skill elements

Observation results also showed that in fire fighting drill flight attendants showed little flexibility because each fire fighter had explicit job to do as required by ANZ's SEP procedure. Therefore, CRM skill elements in terms of *Intervene*, *Delegation*, and *Flexibility* proved to be largely not applicable at most situations in fire fighting drills (Figure 41).

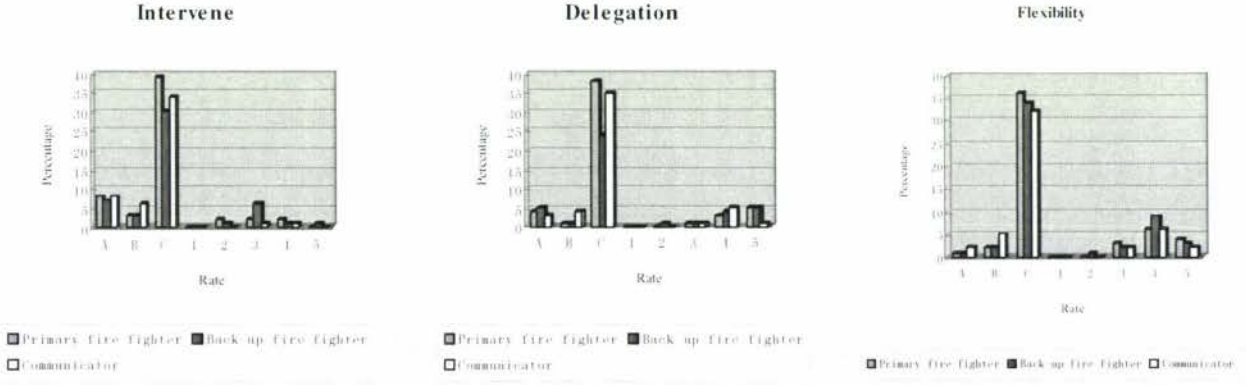

Figure 41: Other CRM skills for fire fighting – intervene, delegation, flexibility

3.2.3 Conclusion

Data recorded by behavioural markers indicated that the overall level of CRM skill for the different fire fighting positions (primary fire fighter, back-up fire fighter, communicator) were quite similar and acceptable (Figure 42). Scores of CRM skill elements were almost all above 3.5 and more than half of the scores were above 4, which meant the participants' performance could be viewed as above "competent" or "good" (Figure 42).

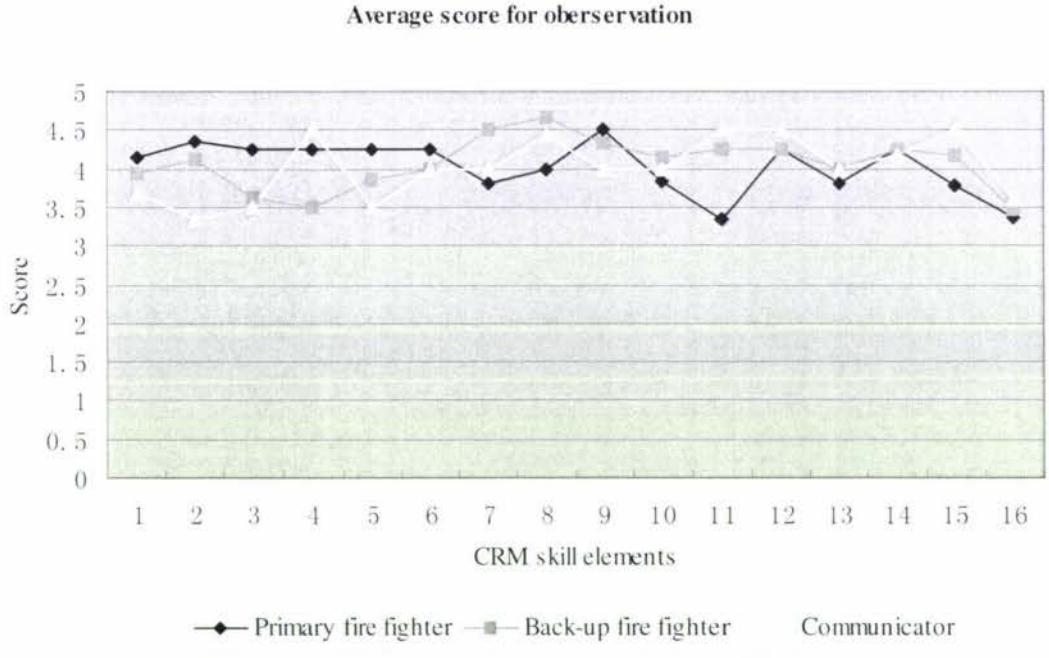

Figure 42: Average scores for CRM skill elements

Each position reflected their own strengths in particular CRM skills (elements). P showed higher level of performance in being proactive, assertiveness, information flow and SEP compliance; B had greater competence in self-management, standard maintaining and co-operation; C had good communication skills, co-operation, prioritising and adapting. All positions had the same competence in time management

and debriefing.

In summary, participants showed quite competent CRM skills in fire fighting. The overall scores of CRM skills were quite acceptable (Figure 43). Participants showed very good CRM skills in simulated fire fighting scenarios, especially for communication, self-management, SEP compliance, co-operation, prioritising and time management. It also recommended that participants should further improve their decision-making, advocacy, leadership, information flowing, and debriefing skills.

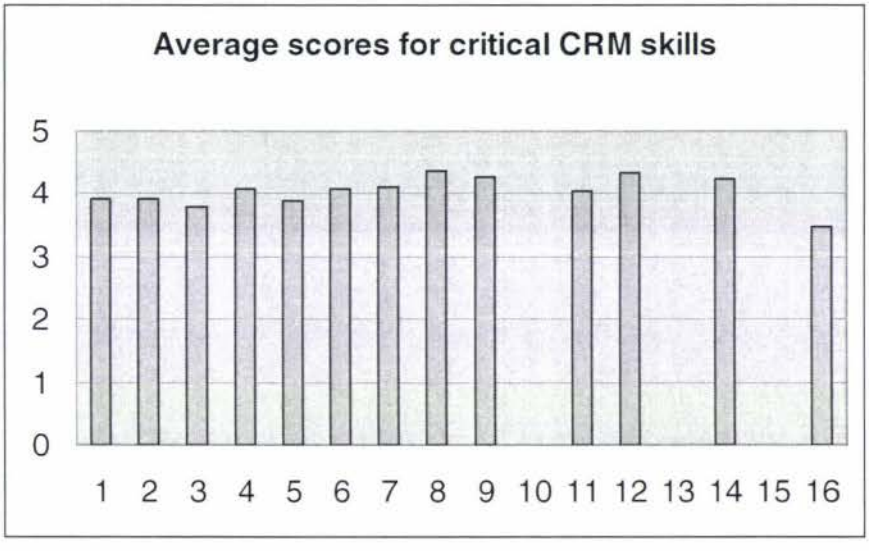

Figure 43: Average score for critical CRM skills

Note: 1=Being proactive, 2=Advocacy, 3=Commanding, 4=Communication skill, 5=information flow, 6=Inquiry, 7=Self-control, 8=Self-protection, 9=Standard compliance, 10=Intervene, 11=Crew co-operation and co-ordination, 12=Prioritising, 13=Delegation, 14=time management, 15=Flexibility, 16=Debriefing.

This part has presented the overall research findings of survey and observation, applying both quantitative and qualitative data analysis methods. The following chapter presents a discussion of the results and a discussion of the limitation of the study and suggestions for future research.

Chapter four

Discussion

This chapter presents the implications of the study, the limitations and recommendations for future research.

The main purpose of this study was to evaluate training effectiveness of CRM training in terms of the joint training for cabin crew. This was achieved by two steps: first, to compare cabin crew's attitudes toward CRM prior to and post the training using an attitudes survey instrument; secondly, to rate their CRM skills in practical exercise using behavioural markers. Meanwhile this study also investigated whether some demographic factors had an effect on CRM training in terms of the cabin crew's attitudes toward CRM.

4.1 CRM attitude survey

Reliability and factor analysis were conducted as preliminary studies for the survey data. Factor analysis suggested there were four categories of CRM and three categories of CRM training for cabin crew. The average means for each category was calculated and then used for comparing different groups of means in the hypotheses tests.

A set of hypotheses was created to predict how cabin crew attitudes change after the training, and identify which demographic factors would affect their attitudes. MANOVA and MANCOVA results suggested that the joint CRM training as well as job position and gender had effect on training effectiveness.

An informal content analysis was conducted for analysing response to open ended questions. Suggestions for improving CRM training and cabin safety management in ANZ were categorised into different groups.

4.1.1 Categories of CRM and the joint CRM training

The results from the principal component analysis yielded four CRM categories, *Safety management, Personal management, Team management,* and *Company management*; and three categories of joint CRM training for cabin crew, *Team management training, Personal management training,* and *Safety management training*.

Klinect (1997) conducted an attitude survey for cabin crew and made the conclusion, which suggested that cabin safety culture could be measured from four dimensions, the organisation, safety attitudes and perception, interaction between pilots and flight attendants (team), and leadership style (personal). Meanwhile, according to the studies of civil aviation rules, CRM training could be viewed from three perspectives, the individual, team and organisational perspective (Table 6). These findings supported the factor analysis result that indicated four factors of CRM in this research.

All participants demonstrated positive attitudes toward all four CRM categories and positive reaction to CRM training (Table 9).

Safety management involved in CRM could be interpreted as crewmembers' joint belief in the importance of safety and their shared understanding of safety culture of the airlines (Merritt & Helmreich, 1995). It reflected how crewmembers were committed to their safety roles and their confidence and ability when dealing with safety issues. From the survey data, cabin crew in ANZ revealed quite a high confidence level in safety control (mean=3.89).

Personal management included social and cognitive skills from an individual perspective, such as decision-making, fatigue and stress management, communication, leadership, followership, PAX management, and professionalism (ICAO, 1991). It also comprised self-recognition of the cabin crew's contribution as well as the duties

and tasks required in their job position. In this research, cabin crew in ANZ showed positive personal management attitudes (mean=3.66).

Team management was an important aspect of CRM and viewed as the heart of the CRM training programme. It consisted of team building, co-operation and coordination, team communication, shared situation awareness, and subculture of cabin crew and flight crew. These team management skills and abilities required all team members to view the team as a whole, sharing and committing to a common aim (ICAO, 1989). Survey results indicated that cabin crew had the highest commitment to team management (mean=4.01).

Company management reflected airlines' culture, as airlines culture implied safety attitudes in people and safety management established by the company (Merritt & Helmreich, 1995). Here company management had the implementation of safety policies and procedures, and individual safety responsibilities (Gill & Shergill, 2004). It included SOPs, effective communication and coordination with other operational personnel and ground services. Survey data revealed that cabin crew had a positive commitment to their safety responsibilities and good understanding of airline regulation and procedures (mean=3.61).

For CRM training reaction, company management training reaction was not included because such joint CRM training could hardly assess the implementation of safety policies and procedures or coordination between different operation personnel especially the ground services by the means of training feedback. Moreover, some of organisational management issued were involved into other categories, such as crew safety responsibilities, cabin crew participating cabin accident and incident reporting.

Cabin crew reactions to CRM training were all positive (Table 9). Reaction to *Safety management training* was the highest (mean=4.13), followed by *Team management training* (mean=3.94), and finally Personal management training (mean=3.35). This

result coincided with Baker and Frost's findings (1994), which suggested such joint CRM training could improve crewmembers' ability, confidence and commitment to their safety role. It also reflected the fact that team management training was the core of CRM training.

4.1.2 Cabin crew attitude change after the joint CRM training

According to the overall statistical result of the survey, cabin crew attitudes toward CRM and CRM training were quite positive both before and after the joint training (Figure 22 & 24). This indicated that CRM concepts and behaviour norms had been enrooted in all crewmembers' mind to some extent in ANZ.

Survey results suggested that cabin crew changed their attitudes toward safety and personal management after the training, but only the attitude toward safety management proved to be a positive change (Figure 22).

The reason for such a positive change could be explained with its orientations. Since the joint CRM training was integrated with SEP refresher training, it naturally had two orientations, SEP and CRM training. Therefore, it could benefit the crewmembers' ability to deal with emergency, confidence and commitment to their safety role (Baker & Frost, 1994).

Survey results also showed that there was no positive change toward personal management, team management and company management after the joint training (Figure 22).

These conclusions could result from a main feature of the joint CRM training design: as one of the training modules of the recurrent SEP course, the SEP orientation was stronger than CRM orientation; the training tight was quite tight. This reflected the difficulty of finding a good balance between SEP training and CRM training for an integrated CRM and SEP training.

As discussed previously, because the joint CRM training was quite short and tightly arranged, the design of the training could result in slippage in the acceptance of CRM perception. Meanwhile, it could restrain the range of scenario design which was critical for CRM skills demonstration in the exercise. It could also limit the time and opportunity for cabin crew to practise their skills. The scenarios in the fire fighting drills were invariable and designed with the SEP orientation; thus the training practice focused on cabin crew's demonstration of fire fighting skills and could not cover all CRM skills applicable to emergency control.

In reference to training delivery, the allocated briefing time was short and sometimes facilitation in debriefing was not so efficient; therefore, in some situations crewmembers could not fully discuss or comment on the weakness and strength of their own performance.

Furthermore, one more reason that could account for non-positive change of CRM attitudes was the fact that acceptance of basic CRM concepts could decay over time, even with recurrent training. The reasons for the decay in attitudes were possibly a lack of management support to reinforce its practice and the loss of the original goal of CRM training that was to avoid human errors (Helmreich, & etc., 1999). This weak point could also be reflected on the problem of training design.

With respect to cabin crew reaction to CRM training, statistical analysis results showed there was no significant difference after the joint training. The general trend of feedback to CRM training showed that the reaction was always positive (Means raging from 3.34 to 4.13, Table 8), and the scores rose after the joint CRM training (Figure 24).

To reiterate participants gave safety management training the highest score; team management training the second; and personal management, the third. This result was

similar to the overall cabin crew CRM attitude scores (Table 9).

In summary, comparing cabin crew attitudes toward CRM and CRM training before and after the joint CRM training, the overall attitudes were positive, and cabin crew attitudes toward safety management had a positive change after the training. Therefore, the joint CRM training could increase cabin crew's ability to deal with emergencies, and enhance confidence and commitment to safety roles.

Meanwhile, the survey result also exposed the problem of training design. It indicated that a better balance of CRM and SEP training in the joint training programme needed to be made. This could be achieved by strengthening the CRM orientation, extending the CRM training module, making the training scenarios more flexible, implementing CRM in practical exercises, and conducting trainees centred facilitation in debriefing.

4.1.3 Factors affecting CRM training effectiveness

Hypotheses test results showed that both gender and job position had an effect on cabin crew attitudes toward CRM and CRM training. Some other demographic characteristics (i.e., age, aircraft) might have a moderating influence on crew attitudes.

Firstly, job position proved to be a main influencing factor because it affected the cabin crew attitudes in two ways, as a single factor and association with other demographic factor. It had an effect on cabin crew attitudes toward team management, safety management, and personal management; it also had an effect on cabin crew reaction to personal and team management training.

Secondly, gender proved to have an effect on team management training reaction, and was associated with job position. Male ISD and ISC positions ranked it lower than the Purser but higher than the regular F/A. Thus, among the three leading positions (ISD,

ISC, and Purser), the higher the rank the lower the allocated score. The trend for females differed. Female ISDs gave team management training the highest score, while ISCs gave the lowest; and regular F/As rated it higher than Pursers. Comparing male and female flight attendants, the difference appeared on the lowest and the highest positions in terms of regular F/As' and ISDs' (Figure 12 and 18).

The job position having an effect on male leading flight attendants by supported by the findings of pilot CRM training, which suggested that Captains (higher position) were less accepting of CRM principles than First Officers (lower position) (Rollins & Angelcyk, 1995). Such a trend could be explained by senior crewmembers having a dominant learning-by-doing strategy. Moreover, their expertise would make them firstly adapt to former management strategies rather than new ones (Pélegrin & Maho, 1995).

The effects of gender in terms of the female cabin crew being more likely to perceive team management perceptions and skills coincided with the findings of gender difference studies in aviation. Research in gender difference of pilots suggested that female pilots would be much receptive to the airlines' organisational culture (McCarthy & McGinn, 1995). Furthermore, studies in gender difference influencing leadership in the cockpit found that female captains and first officers placed more concern on "listening" and "communication". They were deemed to function more successfully in the soft skills than males (Bartley, 1997).

There was an interesting conflict in statistical results when analysing how demographic factors influence the test. On the one hand, as the multivariate tests results of MANCOVA suggested there were no significant relationship between the covariates in terms of *Age, Work-year, Initial CRM training time,* and *Aircraft*, and the dependent variables (Table 13), it is difficult to say which covariate(s) had the moderating effect on cabin crew attitudes. On the other hand, according to the comparison result (MANOVA vs. MANCOVA) discussed in section 3.1.2.3, the

covariate(s) seemed to have an effect on cabin crew attitudes toward team management and personal management by moderating the effect of job position and training time. Such conflicting findings demanded further study in which demographic factor(s) had such a moderating effect and how did it (they) influence attitudes.

Although statistical results suggested that these covariates had no significant effect on cabin crew attitudes, there were some interesting trends revealed.

First, cabin crew reaction to safety management training was more positive when age increased. This trend differentiated from accepted wisdom that age would function as a negative factor in the learning progress. Two findings of Pélegrin and Maho (1995) could explain this result. The first suggested that older crewmembers expertise would not decrease in their learning ability due to age. The second addressed that managerial strategies could be more easily transferred than technical know-how. Therefore, in CRM training, age performed a complex role and could not be simply viewed as a negative influential factor as traditional learning progress theories believed.

Secondly, cabin crew working on narrow-body aircraft had more positive attitudes toward personal management than those working on wide-body aircraft. According to Gill and Williams (2001), the difference between this two types at least resided in three areas, different aircraft cabin environment, different passengers needs and different aircrew resource.

Narrow-body aircrafts normally mean a more uncomfortable environment, more unexpected turbulence, a short flying time but more take-offs and landings, less aircrew members, more flying logs, simple in-flight service, and more pressure on in-time departure. On the contrary, wide-body aircrafts meant more space in the cabin, more cabin chaos, longer flying times with night flights, more complex passenger demands, more air rage, more aircrew members, more communication, and heavier

fatigue and stress during the duty period.

Under such different cabin environment, flight attendants working on different aircraft would meet different PAX needs, and need to perform different tasks; they must apply different CRM skills to meet the different requirements. For example, fatigue management technique should be different. Therefore, as a further consideration, it would be necessary to figure out the different requirement for CRM skills on different aircraft (narrow-body and wide body) and lines (short haul and long haul) in CRM training.

4.1.4 Cabin crew suggestions

Suggestions for improving CRM training and cabin safety are explained separately in the two following subsections.

4.1.4.1 Suggestions for improving CRM training

Joint CRM training design was the main concern about improving the joint CRM training for cabin crew, and such concern supported the findings of cabin crew responses to Likert scale questionnaire discussed in Section 4.1.2.

Cabin crew stated that joint CRM training should have two orientations, one towards the flight attendant perspective, and the other toward CRM. They suggested such training might be allocated more time, more resources and higher training frequency (every six months).

Traditionally CRM training focused on flight crew rather than any other aviation personnel and as such the trend had a deep influence on CRM training design and delivery. In fact the joint CRM training had shifted the focus successfully and built up a cabin crew centred programme. Unfortunately, the tradition of being pilots-centred

occasionally emerged in the training, for instance, some pilots liked to dominate the debriefing session and leave less chance for cabin crew to debrief themselves.

An enforcement of CRM orientation was demanded because the joint CRM training was more oriented toward SEP training. The main purpose of this recurrent training course was to refresh cabin crew emergency procedures and practice their emergency control techniques; at the same time, some CRM skills and behavioural norms were implicated in the training.

From the training design perspective, it would be important to attain a good balance between SEP and CRM training. This purpose was difficult to achieve because the joint CRM training was usually limited to reviewing some CRM topics, like communication and co-operation.

Moreover, cabin crew asked for more practical exercises with pilots together in the mock-up, and suggested making the scenarios more realistic and based upon actual ANZ experiences.

They also proposed including some other department staff into the joint CRM training, like delivery managers and gate agency. Some people believed that it was a good idea to separate long haul and short haul flight attendants or type of aircraft based CRM training. This idea reflected the similar thinking of considering the different requirement for CRM skills between narrow-body and wide-body aircrafts or between long haul and short haul flights as discussed in section 4.1.3.

Training content was another area identified as needing improvement. It included four issues, workload (including duties and work procedure), teambuilding, communication, and technical knowledge.

Cabin crew suggested that the two crews should know more about the duties and

workload (work procedure) of the other in a situation (i.e., different fires happening in the cabin). In the joint CRM training, because flight crew always introduced their work procedure when a cabin fire happened, cabin crew was getting familiar with their job and understanding how to cope with it. In some fire fighting drills, flight attendant or pilot had not proposed this topic, and as such the topic would be ignored during the training. Therefore, it is necessary to put this topic into the must-do-list of training themes.

Cabin crew believed that pilots also needed to understand cabin crew's duties and workload (work procedure), especially in the situation of turbulence or in critical phase. Some pilots should learn more about economy class duties and workload, and coordinate with flight attendants positively.

Cabin crew also suggested strengthening team synergy for flight and cabin crew together, particularly the relationship between senior crew and junior crew. The followership was critical because there was a request for teaching new flight attendants how to respect leading flight attendant and senior crewmembers.

Communication was a hot topic for CRM training. The survey results showed that there was improvement in cabin crew communication while flight attendants believed that flight crew should take initiative in communication. For instance, pilots should let cabin crew know what was happening in delays, or introduce themselves initially. This was particularly so for domestic flights because there were a lot of crew changes.

The last was about technical knowledge learning. Flight attendants believed that they had a lack of technical knowledge and demanded more instruction in this area. For example, basic explanations of process for common aircraft failures, like loss of flaps, engine failures. This could help to diminish misinterpretation for cabin crew when under these situations.

Training delivery focused on practical exercise and debriefing. CRM training often utilised the practice exercises simulating the real working circumstance, and then crew members could learn and remember CRM perceptions and behavioural norms positively and in-depth when they participated and analysed their own performance (Dismukes, Jobe, & McDonnell, 2000).

Flight attendants suggested that both flight and cabin crew should participate in the exercises, and the scenarios should highlight and rehearse how emergency situations were perceived and handled by all crewmembers. For example, the exercise would highlight limitations in communication and the demands of using a common language. They also advised that crewmembers should more seriously participate in role-play, and CRM facilitators should use video and worksheet in the training.

It was suggested that debriefing needed more discussion and interaction between regular F/A and leading F/A (ISD, ISDC, Purser), between flight crew and cabin crew, clarifying what the job each part would do in emergency situations.

Participants' attitude in training had two concerns, one for pilots and one for cabin crew. It was suggested that pilots should be more positive about their attendance and participation in training, i.e., speaking more clearly and slowly, clarifying details, eliminating flight jargon, and providing more personal experience of CRM at work. On the contrary, some pilots talked too much and there was a tendency for them to dominate the conversation. For cabin crew, they were advised to express opinion more confidently and enquire without embarrassment during the training.

Training devices were stressed because some devices (i.e. interphone) in the mock-up were not same as on the plane, which made participants confused in the role-play. They hoped the training could utilise real devices found in the plane, and use more training tools, such as camera and videotape in practical exercises.

Training material needed improvement on two points. One concerned the amendments of the paper training manual; another was about that pre-course material. It would be an improvement if the scenarios were based on actual accidents, especially ANZ experience.

Training instructor was the last concern. Some cabin crew believed that the instructors should have more credibility, preferably, with a solid background in effective communication.

There were two more suggestions. Firstly, cabin crew advised more research and review of CRM training because the attitude survey and review of training centre/techniques could benefit from evaluating training effectiveness and receiving feedback for training improvement. Secondly, they advised that cabin crew, especially ISD and ISC should participate in pilots' simulation checks or sit in the cockpit during takeoff and landing, which could help flight attendants understand pilot workload.

4.1.4.2 Suggestions for cabin safety management

Suggestion for improving cabin safety management was not in the remit the evaluation of CRM training effectiveness in this research. The purpose was only to provide a practical reference for ANZ.

Fatigue contained two correlated issues. Cabin crew believed that it was necessary to decrease duty time and increase rest time. Or the company needed to make better roster arrangements, i.e., allocating more flight attendants on short haul flights; banning working twice in one day; ensuring no more than 1 new flight attendant per flight; reviewing pacific airline rosters (as it started too early and might hinder safety). It was also necessary to provide a better rest area for crew on long haul flights.

Cabin luggage was a common topic for cabin safety. Cabin crew asked that airline

management think more and ground staff do more about this problem. For instance, ground staff to take more responsibility for monitoring big and excessive baggage (size and weight) on the ground; airlines should strictly limit business PAX and Gold Elite PAX's carry on luggage.

Cabin crew and flight crew communication was critical for in-flight safety. It should encourage more opportunity for communication, both on and off the lines. They should listen to each other more and support each other; flight crew should introduce themselves in person to all crew members on each flight; there must be less pressure from pilots when a flight was delayed to leave on time; pilots to keep cabin lights on full brightness for take off and landing regardless of time of day. These suggestions supported the finding of "The Three I's" (Chute & et al, 1995), namely "to be Informed", "Introduce yourself", and "don't Ignore me".

PAX related safety issue was a new but significant topic for in-flight safety. Cabin crew suggested that it was important to educate PAX by way of TV programmes or booklets given out with tickets advising them of cabin safety and how they could contribute. They also believed it necessary to revise some airline policies, like stop pampering Gold elites and VIP PAX, setting harsher or harder rules about the use of electronic devices during flight, and standardising procedures for reporting unruly PAX. They all believed co-operation with ground staff was important for diminishing such a safety risk. It was suggested that ground staff should monitor drunk or disorderly PAX and stop boarding them.

Reduce time pressure during pre-flight phase (on time departure) was critical for cabin safety. Flight attendants suggested the allocation of more time for pre-flight preparation, more time between aircraft turn around, allowing for enough time to conduct much properly the pre-flight safety check. Cabin crew pointed out a need for more communication and co-operation with ground staff before PAX boarding; they also hoped the ground staff would stop pressuring them when they were doing the

safety check.

Airline Management would influence in-flight safety and there were some areas requiring change. It was critical for airline management to find a good balance between safety issues and service delivery, setting priorities of safety over service. This could be interpreted in an increased turn-around time and cut off on time departure pressure. Airlines should encourage crewmembers to report and write up all safety issues, including fatigue. Airlines should also recruit more flight attendants and allocate each flight with a qualified purser rather than a purser on the day. Pilots and F/A should share the same hotels overseas to create more chance for mutual communication.

Briefing and debriefing should be stressed for all crewmembers not only for pilots. It was proposed that there should be combined briefings for cabin crew and pilots, and flight attendants answering EP questions at briefing. Debriefing must be conducted after an on board incident.

Turbulence was usual for flying but a potential safety risk for in-flight safety. In order to improve in-flight turbulence management, there must be cabin turbulence guidelines that were consistent for all crewmembers. Sometimes ISDs used their own discretion to continue service but that sometimes made pilots feel unsafe; whilst pilots used common sense it viewing an unfair for ISD to insist on continuing the service. It would be useful to put a notice in the in-flight magazine that the cabin service will not commence or continue service during turbulence. Cabin crew should be seated at all times while the seatbelt sign was on.

Duty free goods might contribute to in-flight fire. Therefore cabin crew suggested restricting or banning duty free alcohol being brought into the cabin, even banning the selling of duty free alcohol in the cabin.

On-line check and audit should be expanded to keep the high level of cabin operation. Cabin crew suggested more F/A1 to F/A online checks throughout the year and more online auditing of individual F/A.

Procedures should be consistent in everything the flight attendants did on board. They must keep everything simple, easy to understand and refrain from changing procedure around (i.e. "sudden emergency command"). More SOPs were requested so cabin crew could know exactly what they should be doing in a situation.

Cabin facilities/devices and maintenance should be kept in good order and at level at all times, and all safety equipment should be visible and easy to access (i.e., relocate the fire extinguisher behind 3J/K on B747). Old faulty equipments must be replaced (i.e., defective trolley), letter the tea and coffee pots, and provide more hand holds in galley.

Uniform was the last concern. Cabin crew believed that uniform must be more comfortable when working onboard, no tie on uniform, no stockings for females (as it might cause fire). Females should be allowed to wear flat shoes on board, and name badges should be compulsory for pilots on aircraft.

4.2 Observation

Results of observation using behavioural markers have disclosed the different level of cabin crew's CRM skills, and also predicted which soft skills and elements are critical for flight attendants in an emergency situation. CRM skills proven to be critical in fire fighting are discussed separately below.

4.2.1 Decision-making

All aircrew members must learn to make appropriate decisions under both normal and

abnormal situations. They should assess the problem, identify the risks, collect necessary information, and then select the best action. Although the term "decision making" did not appear in the behaviour markers, the requirements of this skill were integrated in the "be proactive" and "assertiveness" elements.

Be proactive meant cabin crew could envision the fire fighting goals and process, and make a quick decision to cope with the situation. Among the three fire fighting positions, P had the highest scores (Figure 28). This skill was very important for Primary fire fighter because she or he was the centre of the fire-fighting group. They needed to foresee the development of the fire and react to the change correctly and promptly on the front line; they also needed to disseminate the fire fighting development information to other flight attendants.

4.2.2 Assertiveness

Crewmembers must show assertiveness in dealing with different situations, especially in emergencies. It contained two sub-skills, Advocacy and Command. Cabin crew demonstrated good competence in Advocacy while showed low chances of utilising Command in fire fighting drills.

Advocacy meant cabin crew must advocate their own positions; it had a different requirement for different fire fighting positions. P needed to identify the fire/smoke and got the appropriate fire extinguisher and other devices to fight the fire quickly; B needed to obtain supplementary fire fighting devices and monitored P and the fire-fighting process; C needed to contact the flight deck and sought feedback from the captain during the whole fire fighting. All three flight attendants must exchange ideas and information with each other, expressing themselves firmly.

Unfortunately some flight attendants showed hesitation in making judgement of the fire/smoke, i.e., the location, the resource, or couldn't know how to open the panel on

the cabin wall. Such problems not only reflected that they had a lack of advocacy but also reflected their weakness in technical knowledge and situation awareness.

Command meant cabin crew should take command of other crewmembers and passengers directly and properly if the situation required. It was also a leadership skill. When commanding, they should make clear introductions and take feedback in time. Because in a fire fighting drill, three positions worked cooperatively and there was no team leader, most cabin crew did not demonstrate leadership skills. P had the highest score for commanding skill while the other two positions seldom did commanding (Figure 30). In fact, as P acted as the centre of the fire-fighting team, he or she needed to show the leadership skill in some situations, such as controlling the fire fighting, and demanding support from other flight attendants or passengers.

4.2.3 Communication

Communication was one of the core items of CRM skills, and critical for all flight attendants. Crewmembers must demonstrate a positive attitude of open communication, and exhibit clear and effective use of language and responsiveness to feedback. Communication barriers must be resolved efficiently and then information would be exchanged accurately and smoothly.

In an emergency, stress could cause communication decrements, and these decrements could be diminished by appropriate communication techniques (Chute, 2001). It included three elements in the behavioural markers.

Communicate clearly and precisely meant cabin crew must use simple, clear and unambiguous language to communicate. For example, when only a white vapour appeared in the cabin, flight attendant could only mention it "smoke", not "flames". Moreover, flight attendant should avoid using negative and conditional commands, slow down their speech rate, and decrease pitch in emergencies.

Keep information flowing means information flows efficiently among all people on board, including flight attendants, pilots and passengers. Communication barriers must be removed and feedback must be taken into account in a timely manner. Flight crew should encourage cabin crew to report any safety concern and cabin crew must be confident to speak up. Making an announcement was a powerful way to inform passengers of the situation and instruct passenger how to act under an emergency.

In emergencies, stress would result in "tunnelling" which could cause crewmember to completely miss information (Chute, 2001), such as to miss loud warning-horns or forget to make an announcement. Keeping ongoing communication could remedy to "tunnelling".

Inquiry was a good technique to resolve ambiguity or misunderstanding. As the fire fighting drill was short, cabin crew should concentrate on own action compliance to fire fighting procedure. Most time participants got the information directly through observation, especially for P and B; more than half of the participants had not used inquiry with flight attendants in the drills. Comparing the three positions, C had the highest score in this skill (Figure 33), which reflected the significant role of communication. C acted as the communication centre of the team, exchanging information between flight crew and cabin crew, receiving feedback form both, and informing the passengers of the fire fighting progress.

4.2.4 Self-management

Cabin crew must exercise self-control and self-protection under pressure. This was very important skill for cabin crew because they were professionals to whom passengers could only rely on in emergencies.

Self-control was a critical skill for cabin crew, maintaining their capability of reacting

and behaving competently under abnormal situations. In an emergency, they should maintain a cool head and concentrate on tasks, moving around with purposes and in a controlled fashion.

Self-protection was quite important for flight attendants (P and B) standing on the first line of fire fighting. P and B had showed the same good skills of self-protection (Figure 35). They could take protection devices when necessary and always demonstrated good awareness of self-protection when investigating and putting out the fire. For communicator, it seemed that they had little chance for applying self-protection as P or B because most of the time they were away from the fire or smoke.

4.2.5 Standards maintenance

Maintaining standards required crewmembers to comply with the policies and procedures set by the airlines. This could be achieved by ensuring SEP compliance and intervention when deviation occurred.

SEP compliance meant that cabin crew must take proper action to put out the fire/smoke following SEP and apply the fire fighting precautions. They should follow the communication procedure and comply with PAX management requirements under emergencies.

It was not a problem for cabin crew to comply with flight attendants' SEP. Some flight attendants said they needed to know more about flight crew's standard operation procedures (SOPs) under emergencies, and then they could do a better job of coping with flight crew's work.

Intervene proved to be not necessary in fire fighting drill because there were few chances for flight attendants to intervene in each others' performance (Figure 41).

4.2.6 Co-operation

Co-operation was one of the most important CRM skills, which made crewmembers understand other members' tasks and be supportive to each other. Crewmembers should encourage and consider accepting others' suggestions and support, offering assistance at appropriate time, and coordinating with others to complete a task safely.

Unfortunately a few teams demonstrated a less cooperative manner in the beginning of the drill. For instance, two flight attendants would do the same role (C) and no one conducted another role (B). Such a problem could be solved if the flight attendant informed others in a loud voice which role she/he was taking in the first place. Furthermore, as discussed before, a better acknowledgement of flight crew's SOPs for cabin crew could contribute to a better co-operation between these two crews.

4.2.7 Workload management

Cabin crew should manage their workload efficiently, keeping all members in a positive and supportive working environment. This could be achieved by prioritising and delegating effectively to maintain focus on primary tasks, and practising good time management.

Set and keep priority meant cabin crew should prioritise primary and secondary fire-fighting tasks and allocate resources consistent with priorities. In fire fighting, the priority was to put out the fire. Every crewmember must make a choice about which was the most urgent situations to deal with, and which was the first, second and the following actions to be taken. It was important that cabin crew should prioritise the fire-fighting tasks and allocate resources consistent with priorities all the time.

Delegation meant cabin crew would allocate their own tasks to others, other flight attendants and even passengers, so that they could be free to concentrate on the main

task and accomplish other tasks by means of utilising any possible resources. This was an important skill of leadership. As discussed before, in the fire fighting drill, the three roles had different tasks and cooperated with each other, but they didn't show many attempt to delegate task to other (Figure 41).

Time management was important because normally crewmembers had very limited time to deal with the changeable situations under an emergency (Figure 39). Cabin crew should always consider time factors when planning and performing the tasks. Such consideration should be reflected in all fire-fighting stages.

4.2.8 Flexibility

As so many factors (i.e. human, aircraft, weather, etc) could influence the flight, crewmembers should adapt to any changing situation during the flight, making new decision and immediate reaction to cope with the changes, and being ready for any new problem solving. As the scenarios of fire fighting drill were fixed, and flight attendants were required to perform compliance with the SEP in a tight time frame, it seemed that flight attendants didn't need to act any flexibility in the drill (Figure 41).

4.2.9 Debriefing

Debriefing was not critical for fire fighting but an important method for CRM training.

Debriefing was a critical part of practical exercise for aviation training, the last phase in which cabin crew could learn and remember more when critically analysing their own performance (Dismukes, Jobe, & McDonnell, 2000). In the debriefing session of the fire fighting drill, crew members were given time to discuss two main issues, making comments on cabin crew's performance and contributing to good understanding and co-operation between cabin crew and flight crew.

In the fire fighting drills, more than half of the flight attendants and pilots could comment on participants' performance, and shared their own experience and knowledge with others. The atmosphere was open, encouraging and dynamic. Most debriefing could achieve the purpose of self-criticism especially concerning the co-operation between cabin and cockpit, for example, better understanding flight crew's reaction and work procedure required in a cabin fire.

Unfortunately, in some situations, the debriefing failed to fulfil the purpose of self-evaluation and self-learning from CRM perspective because some flight attendants could not use analytical skills to analyse and discuss their own performance. There were also some other insufficiencies in the briefing. Some crewmembers were inactive in their responses in debriefing and seldom commented on their own performance or contributed suggestions to others. Sometimes a few pilots occupied too much time in debriefing so that there lacked mutual communication between cabin crew and flight crew. Occasionally, a few tutors/facilitators had spent a long time commenting or explaining some situations and failed to guide the discussion or re-allocate time to the quiet participants.

4.2.10 Observation conclusion

The observation had two results, evaluation of cabin crew's CRM skills and testing of the behavioural markers. In summary, the observed flight attendants showed good competence in CRM skills in the fire fighting drills, while different position demonstrated different strength in particular CRM skills. Meanwhile, the behavioural markers proved to be useful for evaluating CRM skills in training.

Participants showed very good CRM skills in different simulated fire fighting scenarios, especially in communication, self-management, SEP compliance, co-operation, prioritising and time management. It also recommended that

participants should further improve their decision-making, advocacy, leadership, information flowing, and debriefing skills.

Additionally, the observation results also disclosed the weakness of the practice of using behavioural markers. First of all, the set of CRM skills and elements needed further modification to make them more general and practical for measuring CRM skills implicated in cabin emergency control. For example, a few elements were not so applicable in practice, such as intervening, delegation, and flexibility.

Secondly, using such behavioural markers demands more observers and markers so that they could make a more reliable observation, and could also diminish personal bias with group work (discussion and evaluation). In this research there was only one observer, who could not watch the participants' performance completely and would ignore some behaviours, which would limit the validity of the evaluation by using behavioural markers.

Thirdly, using videotape devices to record participants' performance and re-observe the record can make observation and marking more convenient and reliable. Furthermore, asking participants to do self-evaluation on the recorded performance in debriefing may make for better self-learning.

Therefore, such behavioural markers attempted to find a way to create practical behavioural markers to measure how cabin crew's performance contributed to successful and unsuccessful outcomes, and give feedback on performance of an individual flight attendant or cabin crew team. Further study on these markers should aim to provide higher validity, reliability, sensitivity, transparency and usability (Klampfer & et al, 2001).

Meanwhile, the observation results also reflected some flaws of the joint CRM training.

Firstly, the fire fighting drill was too tight and the scenarios lacked variety. In the drill, mostly flight attendants were required to demonstrate fire fighting skills following the SEP procedures in a few minutes. The fixed scenarios could not provide additional chances for participants to demonstrate CRM skills, for example, leadership skills, inquiry techniques, and passenger management.

Secondly, in debriefing, sometimes participants could not discuss and comment upon their behaviour sufficiently, some were too silent while others were too talkative; some problems were ignored, for example, PAX management (i.e., some teams forgot to make any announcement to inform the passengers), and some behaviour questionable (i.e., some flight attendants would use the front interphone which the instructor used to demonstrate rather than a much convenient one which was near her/his position and also near the fire site).

Thirdly, some other factors could lower cabin crew's competence in CRM skills. The weakness in technical knowledge and insufficient understanding of flight crew's duties, workload and SOPs under emergencies would create barriers for flight attendants to cope with pilots' work and then degraded the co-operation between the two crews.

4.3 Conclusions and recommendations

This study aimed to investigate the evaluation of CRM training effectiveness with attitude survey and observation. A couple of hypotheses were tested intending to assess cabin crew's attitudes toward CRM as well as to check whether some demographic factors had an effect on their attitudes. Behavioural markers were created and implemented to assess cabin crew's CRM skills in the fire fighting drills.

Survey results disclosed that generally cabin crew had quite positive attitudes toward

CRM and CRM training, which suggested that the overall CRM training in ANZ was successful.

The joint SEP/CRM training course (2005) proved to have a positive effect on cabin crew's safety management attitudes. It was evident that flight attendants increased their confidence in their safety operation abilities and commitment to their safety roles after the training.

Job position could influence cabin crew's attitudes toward safety management, team management, and personal management, as well as their reaction to personal and team management training. Position effects were mostly conjunct with effects of training time or gender.

Comparing cabin crew attitudes prior to and after the joint CRM training, ISC and regular F/A had positive attitude changes toward safety management while Purser and ISD had negative changes. ISC showed positive attitude change on personal management, while ISD and Purser showed negative changes. Among the four positions, leading flight attendants (ISD, ISC, and Purser) gave higher scores on team management training than regular F/A.

Gender affected cabin crew's reaction to team management training, and this effect was integrated with the job position's effect. Generally female flight attendants showed more positive reactions to team management training than male flight attendants.

An interesting tendency for male leading flight attendants (ISD, ISC, and Purser) showed that the higher the position, the lower the score for their reaction toward team management training.

Some other factors, like age, work-year, initial CRM training time, and aircraft, could

not efficiently prove to have an effect on cabin crew attitudes. On one hand, MANCOVA test results suggested they had no effect on the attitudes. On the other hand, when comparing MANOVA and MANCOVA results, it seemed these factor(s) might have moderating effects. This conflict indicated a need for future research.

Response to open questions in the survey suggested that the joint CRM training could be improved by giving more attention to training design, training content and training delivery. This advice coincided with the findings of the survey, which suggested that the joint CRM training had a request for extending training time, finding a better balance between SEP and CRM training, and conducting a more effective debriefing.

Cabin crew also contributed advice on improving cabin safety management. In total thirteen safety issues had been promoted. Crew fatigue, cabin luggage, communication between flight and cabin crew, PAX related safety issues, pre-flight work pressure were the most significant issues for cabin safety management.

Observation suggested two results, evaluating results of cabin crew's performance in CRM skills and the testing of the behavioural markers.

In general, observed flight attendants showed good competence in CRM skills. Meanwhile, observation also showed a few flaws of the joint CRM training. First, the practice exercise was too tight, and scenarios should be more variable and realistic, with more implications for CRM. Secondly, it is necessary to improve debriefing efficiency. Thirdly, weakness in technical knowledge, and insufficient understanding of flight crew's workload and procedures under emergencies lowered the cabin crew's competence in CRM skills.

Behavioural markers proved to be usable for measuring cabin crew's performance. Observation also revealed some problems when using behavioural markers. Firstly, seven CRM skills proved to be critical for cabin crew in fire fighting, which included

decision-making, assertiveness, communication, self-management, maintaining standards, co-operation, and workload management. Twelve elements under these skills were significant; they were being proactive, advocacy, command, clear and precise communication, sufficient communication, inquiry, self-management, self-protection, SEP compliance, co-operation, prioritising, and time management. Three elements, intervention, delegation, and flexibility, prove to be not so critical for fire fighting. Secondly, the evaluation result would be more reliable if there were more observers and utilising videotape devices to record the behaviour were utilised.

Therefore, according to the findings of survey and observation, there existed some areas of improvement for the joint CRM training.

Firstly, it should be necessary to create a better balance between SEP and CRM training, setting a stronger CRM orientation for the joint CRM training. This could be achieved in several ways. First of all, add more CRM themes, especially personal and team management topics; set up a cycle of CRM training topics, perhaps a three-year-timeframe, to include all CRM topics. Secondly, develop more realistic and flexible scenarios with more implications for CRM skills under emergencies, such as leadership and stress management. Besides, take account of the different strength of CRM skills for different work role when developing such training scenarios. At last, extend the CRM training time, especially for CRM practice exercises and debriefing sessions.

Secondly, conduct a better debriefing, from both facilitator and trainees' perspective. On the one hand, enhance facilitation in debriefing. Facilitators should provide more CRM topics for discussion, more encouragement and more guidance for improving self-evaluation. On the other hand, cabin crew should practice more on commenting their own and others' performance, introducing the workload and procedures of both cabin and flight crewmembers. Moreover, utilise videotape devices to record participants' performance and use the record for self-evaluation and self-learning in

debriefing.

Thirdly, some issues should be considered in training design and delivery: the differences between male and females' perception of CRM; male senior flight attendants having reluctance to perceive and utilise new managerial strategy and skills; age's influence on safety management training.

Fourthly, it would be necessary to enhance PAX management, technical knowledge and analytical technique training for cabin crew in other training courses. Moreover, it would be necessary to put some concerns on pilots' training, to improve their understanding of flight attendants' workload, and encourage them to take more initiative to communicate with cabin crew on board.

Lastly, two advices would be valuable for developing and utilising behavioural markers. Behavioural markers needed further modification to make them more general and practical for measuring CRM skills implicated in cabin emergency control by means of changing a few elements and make them more applicable in practice. When using such behavioural markers, it should have more observers and examiners, and utilise videotape devices to record participants' performance.

4.4 Limitation and future research

This section discusses a number of limitations that need to be acknowledged. Based on the acceptance of these limitations, suggestions for future research are made in the following.

4.4.1 Limitations of the study

The results generated by this study should be interpreted with caution due to a number of limitations that need to be acknowledged in the survey.

No funding supported this research and the subjects were all busy flight attendants of ANZ. The response rate was relatively low (14%) probably because the flight attendants were unlikely to spend time filling out this 6-page-questionnaire, which required more than ten minutes to complete the multiple-choice questions and approximately twenty minutes for both multiple-choice and open-ended questions.

There were four statistical problems that would limit the reliability of factor analysis.

First of all, the sample size was not big enough as ideally appropriate for a factor analysis. As Tabachnick and Fidell (1996) suggested the minimum number of sample size for a factor analysis should be 300 cases, and Nunnally (1978) recommended a 10 to 1 ratio (10 cases for each item to be factor analysis), the sample size of this study (n=232) was smaller than such minimum requirements. Fortunately, the sample size requirements were reducing over the years. Page and Meyer (2000) suggested a 5 to 1 ratio for sample size, which was discussed in Section 3.1.1. Moreover, the result of KMO measuring of sampling adequacy suggested this data set was suitable for factor analysis.

Secondly, the extracted four factors for CRM attitude response could only explain 35% of the variance in total, which did not meet the requirement that factors should explain at least 60 per cent of overall variation for studies in the social sciences (Page & Meyer, 2000). No further factors were extracted because although extracting more factors would increase the variance (i.e., 11 factors explaining variance accounting for 63%), the pattern of matrix of loading would become hard to interpret.

Thirdly, a few items with low loading values were retained with the factors. This could lower the reliability because the loading showed the associations between each item and each factor, and lower loading value suggested less reliability and noteworthiness of those items (Spicer, 2005). The reason for keeping these items was

because they were meaningful for the relative factors.

Fourthly, in the test for internal consistency of the items under extracted factors, some Cronbach values were statistically low which indicated the scales of safety management training reaction, personal management attitude, team management attitude, and airline management attitude did not have the ideal consistency.

Moreover, problems with data collection would limit the data reliability. For optimal assessment, data on crewmembers' attitude should be collected before CRM indoctrination and again at intervals after the last component of CRM training to determine both initial and enduring effects of the programme (FAA, 2004). As the joint CRM training module was very short (half day), survey data were collected before and on the second day of the training. Furthermore, the two groups' data were not equal (before=140, after= 89).

The last limitation was about the measure instruments implemented in this study.

The use of English might raise the problem of generalisability to participants because the researcher was a non-English-native-speaker. Some of the language used was not straightforward enough for the respondents to understand. As a result, some respondents might have misinterpreted a few questions.

Since the behavioural markers were developed and used in the fire fighting drill, this raised a question of whether the instrument was applicable for other situations, like hazardous goods control.

4.4.2 Areas for future research

Based on the findings and limitations of this study, a set of further research in CRM training evaluation must be stressed.

The first interest can be a continual study of the demographic factors in terms of age, aircraft, working year, aircraft and national background. Whether these factor(s) have an effect on and how they affect the CRM training effectiveness. For instance, what would be the difference between male and female perception to CRM, and how would gender interact with job position and influence crewmembers' attitudes toward CRM? Moreover, it will be necessary to identify the differences between narrow-body and wide-body aircraft, and figure out how cabin crew can apply different CRM skills to cope with those differences?

The second area is to perfect the cabin crew attitude survey instrument, making the items of questionnaire more consistent, and to examine cabin crew CRM attitudes more exactly.

Thirdly, attempts to conduct behavioural evaluation of on line operation. Further research needs to continue developing the behavioural markers which aims to make the markers more practical, general and observable, and applicable for the situation. It will be also interesting to develop behaviour markers for other situations, like emergency evacuation.

Finally, explore the training needs for a joint cabin crew and ground staff (i.e., gate agent and customer service staff) CRM training, and build up such a course to improve the mutual understanding and co-operation between them.

Reference

Air New Zealand. (2002). *Flight Attendant CRM Upgrade Course.* Auckland: Air New Zealand.

Air New Zealand. (2003a). *Flight Attendant Company Resource Management.* Auckland: Air New Zealand.

Air New Zealand. (2003b). *Company Resource Management Programme Training Manual (Leader's Guide).* Auckland: Air New Zealand.

Air New Zealand. (2003c). *Flight Attendant Company Resource Management Pre-course Booklet.* Auckland: Air New Zealand.

Air New Zealand. (2003d). *Training Reference Manual (Part 1).* Auckland: Air New Zealand.

Air New Zealand. (2004). *Combined Tech Crew/Flight Attendant CRM Training.* Auckland: Air New Zealand.

Air New Zealand. (2005). *Joint SEP/CRM Recurrent Training.* Auckland: Air New Zealand.

Amundson, J. M. (1995). Line Oriented Flight Training (LOFT) to Improve Cockpit-cabin Communications. In N. Johnston, R. Fuller, & N. McDonald (Eds.), *Aviation Psychology: Training and Selection.* Aldershot: Ashgate.

Anonymous, & Thomas, A.R. (2001). *Air Rage, Crisis in the Skies.* Amherst, N.Y. : Prometheus Books.

Astuti, D.W. (1997). *Human Factors as a Corporate Culture.* Palmerston North: Massey University.

Baker, R., & Frost, K. (1994). Australian Airlines Pilot/Flight Attendant Integrated Crew Training. http://s92270093.onlinehome.us/CRM-Devel/resources/crmadvocate/94_1/94_1.htm#2. Retrieved 2 February 2005.

Bartley, B.M. (1997). *"This is your captain speaking": Gender and representation of Leadership in Aviation.* Palmerston North: Massey University.

CAAC. (1999). *CCAR-121FS: 公共航空运输承运人运行合格审定规则.* CAAC: Beijing.

CAA NZ. (2004). *Part 121: Air Operations – Large Aeroplanes.* CAA: Wellington.

CAA of UK. (2002). *CAA PAPER 2002/05 Methods used to Evaluate the Effectiveness of Flightcrew CRM Training in the UK Aviation Industry.* Http://www.caa.co.uk. Retrieved 2 September 2004.

CAA of UK. (2003). *CAP737 Crew Resource Management (CRM) Training.* Http://www.caa.co.uk. Retrieved 2 September 2004.

CASA. (2003). *AC 121A-09 (0): Human Factors and Crew Management Training.* http://rrp.casa.gov.au/drafts/DRAFTac121A-09(0)_Dec03_v10a.pdf. Retrieved 2 September 2004.

CASA. (2002). *Notice of Proposed Rule Making Air Transport Operations – Large Aeroplanes.* http://rrp.casa.gov.au/casrcreate/121.asp. Retrieved 2 September 2004.

Chidester, T., & Vaughn, L. (1994). Pilot/Flight Attendant Coordination.

http://s92270093.onlinehome.us/CRM-Devel/resources/crmadvocate/94_1/94_1.htm#6. Retrieved 2 February 2005.

Chute, R. D. (2001). Synergy in an Emergency: The Interface Between Flight-Deck and Cabin Crews. As Presented at the 13th Airbus Human Factors Symposium, July 5, 2001, Toronto, Canada. http://www.raes-hfg.com/CabinCrewForum.htm. Retrieved 27 September 2004.

Chute, R. D. (2002). Cabin/Cockpit Communication: Post 9/11. Presented at the Assault and Hi-jacking Workshop sponsored by the Human Factors Group of the Royal Aeronautical Society. April 10, 2002, London Heathrow. http://www.raes-hfg.com/CabinCrewForum.htm. Retrieved 27 September 2004.

Chute, R.D., & Wiener, E.L. (1995). Cockpit/Cabin Communication: I. A Tale of Two Cultures. *The International Journal of Aviation Psychology.* http://www.raes-hfg.com/CabinCrewForum.htm. Retrieved 27 September 2004.

Chute, R.D., & Wiener, E.L. (1996). Cockpit/Cabin Communication: II. Shall We Tell the Pilots?. *The International Journal of Aviation Psychology.* http://www.raes-hfg.com/CabinCrewForum.htm. Retrieved 27 September 2004.

Chute, R.D., Wiener, E.L., Dunbar, M.G., Hoang, V.R. (1995). Cockpit/Cabin Crew Performance: Recent Research. *The Proceedings of the 48th International Air Safety Seminar, Seattle WA, November 7-9, 1995.* http://www.raes-hfg.com/CabinCrewForum.htm. Retrieved 27 September 2004.

Dismukes, R. K., McDonnell, L. K., Jobe, K. K., & Smith, G. M. (2000). What is Facilitation and Why Use It? In R. K. Dismukes, & G. M. Smith (Eds.). *Facilitation and Debriefing in Aviation Training and Operations.* Aldershot: Ashgate.

Dismukes, R. K., Jobe, K. K, & McDonnell, L. K. (2000). Facilitating LOFT Debriefings: A Critical Analysis. In R. K. Dismukes, & G. M. Smith (Eds.). *Facilitation and Debriefing in Aviation Training and Operations.* Aldershot: Ashgate.

Dunbar, M.G., Chute, R.D., & Jordan, K. (1997). Evaluation of Cabin Crew Technical Knowledge. The *Proceedings of the 9th International Symposium on Aviation Psychology.* http://www.raes-hfg.com/CabinCrewForum.htm. Retrieved 27 September 2004.

FAA. (1998). *Developing ACRM Crew Training.* http://www.hf.faa.gov/docs/508/docs/DACRMT.pdf. Retrieved 2 September 2004.

FAA. (2003). *14 CFR Part 121 Operating Requirements: Domestic, Flag, and Supplemental Operations.* http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=81240a15138c5a549bdad1782cecd345&rgn=div5&view=text&node=14:2.0.1.4.19&idno=14. Retrieved 2 September 2004.

FAA. (2004). *AC: 120-51E Crew Resource Management Training.* http://www1.faa.gov. Retrieved 20 December 2004.

Flin, R., Geoters, K.-.M., Hörmann, H.-J. & Martin, L. (1998). Ageneric Structure of Non-Technical Skills for Training and Assessment. Paper presented at the 23rd Conference of the European Association for Aviation Psychology.

Gill, G. K., & Shergill, G. S. (2004). Perception of Safety Management and Culture in the Aviation Industry in New Zealand. *Course Material: Management in Aviation System.* Massey University: Palmerston North.

Gill, G.K., & Williams, A. (2001). Implications for Safety and Efficiency in Ultra

Long Haul Flights: A Preliminary Study of the New Generation Airbus Industrie A380. In M. J. W. Thomas, & G. J. F. Hunt (Eds.). *Enhancing Professionalism in Aviation.* Massey University: Auckland.

Hamman, W. R., Seamster, T. L., & Edens, E. S. (1995). LOFT/LOE in Air Carrier Training. In N. Johnston, R. Fuller, & N. McDonald (Eds), *Aviation Psychology: Training and Selection.* Aldershot: Ashgate.

Hancock, P. A. & Chignell, M. H. (1995). On Human Factors. In J.Flach, P.Hancock, J.Caird, & K,Vicente. (Eds). *Global Perspectives on the Ecology of Human-Machine System.* Hillsdale, NJ: Lawrence Erlbaum.

Hawkins, F. H. (1993). *Human Factors in Flight* (Sec. Eds.). Aldershot: Ashgate.

Hayward, B. (1994). The Dryden Accident: A Training Video for Pilots and Flight Attendants. http://s92270093.onlinehome.us/CRM-Devel/resources/crmadvocate/94_1/94_1.htm#2. Retrieved 2 February 2005.

Helmreich, R.L. (1997). Managing human error in Aviation. *Scientific American.* http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=11536800&dopt=Abstract. Retrieved 2 February 2005.

Helmreich, R. L., Klinect, J. R., & Wilhelm, J. A. (1999). Models of threat, error, and CRM in flight operations. In *Proceedings of the Tenth International Symposium on Aviation Psychology (pp. 677-682).* Columbus, OH: The Ohio State University.

Helmreich, R. L., Merritt, A. C., & Wilhelm, J. A. (1999). The Evolution of Crew Resource Management Training in Commercial Aviation. *International Journal of Aviation Psychology, 9(1), 19-32.*

Helmreich, R. L., Wilhelm, J. A., Klinect, J. R., & Merritt, A. C. (2001). Culture, Error, and Crew Resource Management. In E.Salas, C.A. Bowers, & E. Edens (Eds.), *Improving Teamwork in Organizations (pp.305-331).* Hillsdale, NJ: Erlbaum.

Hunt, L. M. (2001). Passenger Management. Paper Presented Is the Massey-Royal Aeronautical Society Air Transport Course. Albany: Massey University.

ICAO. (1989). *Human Factors Digest No.2 Flight Crew Training: Cockpit Resource Management (CRM) And Line-Oriented Flight Training (LOFT).* ICAO, Montreal. Canada.

ICAO. (1991). *Human Factors Digest No.3 Training of Operational Personnel in Human Factors.* Montreal, Canada: ICAO.

ICAO. (1998). *Human Factors Training Manual.* Montreal, Canada: ICAO.

JAA. (1998). JAA Administrative & Guidance Material Section Four: Operations, Part Three: Temporary Guidance Leaflets (JAR-OPS), Leaflet No. 6: Crew Resource Management - Cabin Crew. http://s92270093.onlinehome.us/crmdevel/resources/jaropslf/Leaflet6.htm. Retrieved 21 February 2005.

JAA. (2004). *JAR OPS1.* http://www.nvlt.org/JAR/jar-ops1.pdf. Retrieved 21 February 2005.

Kaye, J. (1994). Interviews with Industry: CRM & LOFT 94/95. http://s92270093.onlinehome.us/CRM-Devel/resources/crmadvocate/94_1/94_1.htm#2. Retrieved 21 February 2005.

Klampfer, B., Flin, R., Helmreich, R. L., Häusler, R., Sexton, B., Fletcher, G., Field, P., Staender, S., Lauche, K., Dieckmann, P., & Amacher, A. (2001). *Enhancing Performance in High Risk Environment: Recommendations for the use of Behavioural Markers*. http://www2.hu-berlin.de/GIHRE. Retrieved 2 February 2005.

Klinect, J. R. (1998). Exploring the Flight Attendant Culture: Results from the Line. http://www.psy.utexas.edu/psy/helmreich/nasaut.htm. Retrieved 2 February 2005.

Koonce, J. M. (1999). A Historical Overview of Human Factors in Aviation. In D. J. Garland, J. A. Wise, & D. V. Hopkin (Eds.). *Handbook of aviation Human Factors.* Mahwah, NJ: Lawren Erlbaum.

Kovarik, L. E. Graeber, R.C. & Mitchell, P.R. (1999) Human Factors Considerations in Aircraft Cabin Design. In D. J. Garland, J. A. Wise, & D. V. Hopkin (Eds.). *Handbook of aviation Human Factors.* Mahwah, NJ: Lawren Erlbaum.

Lauber, J. K. (1993). Forward. In E. L. Wiener, B. G. Kanki, & R. L. Helmreich. (Eds.). *Cockpit resource management.* San Diego: Academic Press.

Macleod, N. (2001). *Training Design in Aviation.* Aldershot: Ashgate.

Maurino, D. E. (1999). Crew Resource Management: A Time for Reflection. In D.J. Garland, J. A. Wise, & D. V. Hopkins (Eds), *Handbook of Aviation Human Factors.* Mahwah, NJ: Larwence Erlbaum.

McCarthy, E., & McGinn, A. (1995). Organisational Culture, Job Satisfaction and Work Stress: the case of Irish women pilots. In N. McDonald, N. Johnston, & R. Fuller (Eds.), *Application of Psychology to the Aviation System.* Aldershot: Ashgate.

Merritt, A., & Helmreich, R. L. (1995). *Creating and sustaining a safety culture:*

Some practical strategies. Paper presented at the Applied aviation psychology: Achievement, change and challenge. Proceedings of the Third Australian Aviation Psychology Symposium.

Nunnally, J. O. (1978). *Psychometric Theory*. New York: McGraw-Hill.

Orlady, H. W. & Orlady, L. M. (1999). *Human Factors in Multi-crew Flight Operations*. Aldershot: Ashgate.

Page, C. & Meyer, D. (2000). *Applied Research Design for Business and Management*. Sydney: McGraw-Hill.

Pallant, J. (2001). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows (Version 10 and 11)*. Buckingham: Open University Press.

Pélegrin, C., & Maho, V. (1995). Pilot Age and Training Performance. In N. Johnston, R. Fuller, & N. McDonald (Eds), *Aviation Psychology: Training and Selection*. Aldershot: Ashgate.

Pohlman, D. L., & Fletecher, J. D. (1999). Aviation Personnel Selection and Training. In D. J. Garland, J. A. Wise, & D. V. Hopkins (Eds), *Handbook of Aviation Human Factors*. Mahwah, NJ: Larwence Erlbaum.

Reason, J. (1997). *Managing the risks of organizational accidents*. Aldershot: Ashgate.

Reid, S. E. (2000). The Attitudes of KC-10 Aircrew Members at Travis AFB Toward crew Resource Management. http://quasarsvc.bizland.com/research_papers/grps/reid.doc. Retrieved 10 Octomber, 2004.

Rollins, M. L., & Angelcyk, J. J. (1995). A Descriptive Study of Crew Resource Management Attitude Change. In N. Johnston, R. Fuller, & N. McDonald (Eds), *Aviation Psychology: Training and Selection.* Aldershot: Ashgate.

Spicer, J. (2005). *Making Sense of Multivariate Data Analysis.* Thousand Oaks: Sage.

Tabachnick, B. G., & Fidell, L. S. (1996). *Using Multivariate statistics* (Third Eds.). NY: Harpet Collins.

Taylor, L. (1997). *Air Travel: How Safety Is It?* (Sec Eds.). Cambridge, Massachusetts: Blackwell Science.

Telfer, R., Bent, B., & Dowd. (1997). Human Factors Training in Airlines. In G.J.F. Hunt (Eds). *Design Instruction for Human Factors Training in Aviation.* Aldershot: Avebury Aviation.

Westrum, R., & Adamski, A. J. (1999). Organisational Factors Associated with Safety and Mission Success in Aviaition. In D.J. Garland, J. A. Wise, & D. V. Hopkins (Eds). *Handbook of Aviation Human Factors.* Mahwah, NJ: Larwence Erlbaum.

Wilhelm, J. A., Merritt, A. C., & Helmreich, R.L. (2003). Which FMAQ is right for you? Technical report 2003-1. http:// http://homepage.psy.utexas.edu/homepage/group/HelmreichLAB/Aviation/FMAQ/Which%20FMAQ.html. Retrieved 18 January 2005.

Will, M. (1994). Managing the Training Process: Putting the Basics into Practice. *Journal of European Industrial Training, Vol.18 No.6.*

Young, L. B. (1994). Communications and Pilot/Flight Attendant Crew Performance.

http://s92270093.onlinehome.us/CRM-Devel/resources/crmadvocate/94_1/94_1.htm#5. Retrieved 18 January 2005.

Appendix 1: Flight attendant CRM survey (Pre-training questionnaire)

Background – This survey investigates flight attendants' safety management attitude and their reaction to CRM training. It explores the area of design and evaluation of CRM training effectiveness. Its main purpose is to provide constructive and practical suggestions on F/A CRM training to Air New Zealand. The research project is conducted by Julia Zhu, a postgraduate student of Massey University under the co-supervision of the Human Factors Programme team of Air New Zealand.

This project has been approved by Air New Zealand management and the F/A unions. It also has the approval of the Massey University Human Ethics Committee, and has been recorded on the Low Risk Notification Database which is reported in the Massey University Human Ethics Committee Annual Report.

What we are asking of you – The survey takes about 15 minutes to complete. You are requested to complete the survey twice: Once before the annual recurrent training and again before the end of the training. Please bring the first completed form to your first training day. You will be provided with the second copy after the first training day and will be asked to return the second completed form on the second day. All completed questionnaires must be returned to the "F/A CRM Survey Questionnaire Returns" box in the classroom. Please keep in mind that it is very important that you give your honest and open opinion.

Participation in this survey is strictly voluntary. All replies will be handled confidentially. Responses will be anonymous, i.e., no identifying information (other than for statistical purposes) will be collected. The completed forms will be destroyed after results have been recorded.

As an added incentive there is a price draw (involving good food and wine) after the second survey. If you want to participate, please tear off the indicated portion of the last page of the second survey and write down your name and contact details. You are invited to put this piece of paper into a separate box labeled "Lucky Draw".

Thank You - I realise that you lead very busy lives and I offer my sincere thanks to you for making this research project possible.

If you have any questions or concerns at any stage, please do not hesitate to contact me or one of my supervisors (contact details below).

Best regards

Julia Zhu

Contact Details

Researcher	**Julia Zhu** [redacted] [redacted] Mailing Address: c/o Massey University School of Aviation, Private Bag 102904, NSMC, AUCKLAND
First Supervisor	**Dr. Bernie Frey,** Sen. Lecturer, BAvMan Prog. Coordinator Phone (DDI): 441 8155 Email: b.f.frey@massey.ac.nz Mailing Address: Massey University School of Aviation, Private Bag 102904, NSMC, AUCKLAND
Second Supervisor	**Bob Henderson**, Human Factors Programme Manager [redacted] [redacted]

Flight Attendant CRM Survey

You are completing this questionnaire
☐before
☐after
the Emergency Procedure recurrent training.

To enable us to match your pre-training response with your post-training response, please provide an identification number. This should be your first initial (or some other letter) plus a 4-digit PIN number (e.g., J 2 3 4 5). <u>You will be asked to provide the same identification number on the second questionnaire, so please make sure to remember it.</u>

Your ID: ☐ ☐ ☐ ☐ ☐

Part 1 Background Information

1 What is your age?

☐——☐——☐——☐

Under 20 20-30 30-40 Above 40

2 What is your gender? ☐Male ☐Female

3 What is your crew position?

☐ISD ☐ ISC ☐Purser ☐F/A

4 How many years have you worked as an F/A in total?

☐——☐——☐——☐

Under 1 year 1-2 years 2-5 years Above 5 years

5 How long has it been since you attended your initial CRM training course?

Never Attended Less than 1 year 1-2 years 2-3 years 3 or more years

6 What kinds of aircrafts are you operating?

☐B747 ☐B767 ☐A320 ☐B737

7 What is your first language?

☐ Chinese
☐ English
☐ French
☐ German
☐ Japanese
☐ Korean
☐ Other (Please specify): _____

8 What is your second language?

☐ None
☐ Chinese
☐ English
☐ French
☐ German
☐ Japanese
☐ Korean
☐ Others (Please specify):_____ _____

Part 2 F/A Safety Management Attitudes & Opinions

Please answer the following items by writing your response number beside each item using the following scale.

1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree

____1 It is difficult to co-operate with F/As from different cultural backgrounds.

____2 The "cabin crew access to flight deck" regulation makes me hesitate to interrupt the cockpit crew during critical phases of flying (e.g., during take-off and landing).

____3 Airline's written procedures can advise F/As how to react under all in-flight situations.

____4 F/A cannot break the regulations even when they believe it is in the best interest of aircraft.

____5 I might be viewed as unprofessional by the pilots when I report a potential safety issue that turns out to be non-important.

____6 I know that it is a normal responsibility for F/A to participate in cabin safety incident/accident reporting.

____7 I always feel confident when working with inexperienced F/A.

____8 If the cabin crew is experienced, a pre-flight briefing is not necessary.

____9 I can rely on the individual ability of the senior F/As more than on other F/As teamwork in emergency.

____10 It is important for F/As to understand pilots' workload in different flying phases.

____11 Gate agents in the cabin interfere with my pre-flight work before take-off.

____12 I let other F/As know when my workload is becoming excessive.

1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree

____13 F/As should mention their stress or physical problems to other crew before or during a flight.

____14 PAX-safety-related-issues (e.g., unruly PAX) excessively increase my workload and work-complexity.

____15 The senior F/As are getting respect both from F/As and pilots.

____16 The senior F/A should act as a role model for other F/As at all times.

____17 F/As can only challenge the actions of Captain or Senior F/A when they threaten the safety of the flight.

____18 I believe that the leading F/A should be a leader who consults with F/As before making decisions and listens to advice, but nevertheless make the final decision by him/herself.

____19 Under time pressure, I sometimes ignore some steps of the pre-flight checks in order to avoid delay.

20-25 I feel quite confident when I need to deal with:

____20 PAX medical emergencies;

____21 Cabin pressurization problems;

____22 Dangerous goods in the cabin;

____23 Smoke/fire in the cabin;

____24 Hypoxia resulting in mask deployment;

____25 PAX evacuation/ditching.

____26 I believe that the company's "in-flight turbulence" procedure really protects both F/A and PAX's safety on route.

____27 Safety issues that do not directly affect the cabin are not F/A's responsibility.

1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree

____28 On long-haul flights, fatigue or stress often leads to errors and mistakes.

____29 I am always aware of any changes in terms of cabin devices and equipment.

____30 F/As are only responsible for cabin safety.

Part 3 F/A CRM Training Satisfaction

____31 F/A CRM training should be treated the same (in terms of resource allocation) as pilot CRM training (e.g. all pilots are required for 3-day initial CRM training, and their CRM skills are assessed in simulator and line training).

____32 Joint training is a valuable way to improve pilot-F/A cooperation.

____33 I am confident in my ability to assess potential hazards to safety.

____34 In terms of safety, training has sufficiently prepared me for the line.

35-41 From my own experience, CRM training is useful for improving:

____35 Communication;

____36 Cockpit & cabin crew coordination;

____37 Fatigue Management;

____38 Team building;

____39 Leadership;

____40 Decision-making;

____41 Stress Management.

Part 4 Brief Recommendations

Please list your top three suggestions (if any) **to improve cabin safety** at Air New Zealand.

1. _____

_____

2. _____

_____

3. _____

_____

Please list your top three suggestions (if any) to **improve CRM training for F/A**:

1. _____

_____

2. _____

_____

3. _____

_____

Appendix 2: Flight attendant CRM survey (Post-training questionnaire)

Thanks again for your participation. As this survey investigates flight attendants' safety management attitude and their reaction to CRM training, it is important to determine whether there were any changes in your opinions and attitudes as a result of the training. Comparing the results of "before" and "after" will make this possible.

Please make sure to complete the second survey form after you have completed the first day of your recurrent training. Again, it should take you about 15 minutes of your time. Please place the completed form into the "F/A CRM Survey Questionnaire Returns" box in the classroom during the second day of your training.

As mentioned I would like to show my appreciation for your participation by conducting a price draw. If you would like to participate, please tear off the indicated portion of the last page of the survey form and write down your name and contact details. You are invited to put this piece of paper into a separate box labeled "Lucky Draw".

Thanks again for your time. If you have any questions or concerns at any stage, please do not hesitate to contact me or one of my supervisors (contact details below).

Best regards

Julia Zhu

Flight Attendant CRM Survey

You are completing this questionnaire
☐before
☐after
the Emergency Procedure recurrent training.

Please enter your ID. This must be the same as the one used in the pre-training questionnaire. If you have not completed the first questionnaire, do not answer this question.

Your ID: ☐ ☐ ☐ ☐ ☐

Part 1 Background Information

1 What is your age?

Under 20 20-30 30-40 Above 40

2 What is your gender? ☐Male ☐Female

3 What is your crew position?

☐ISD ☐ ISC ☐Purser ☐F/A

4 How many years have you worked as an F/A in total?

Under 1 year 1-2 years 2-5 years Above 5 years

5 How long has it been since you attended your initial CRM training course?

Never Attended Less than 1 year 1-2 years 2-3 years 3 or more years

6 What kinds of aircrafts are you operating?

☐B747 ☐B767 ☐A320 ☐B737

7 What is your first language?

☐ Chinese
☐ English
☐ French
☐ German
☐ Japanese
☐ Korean
☐ Other (Please specify): _____

8 What is your second language?

☐ None
☐ Chinese
☐ English
☐ French
☐ German
☐ Japanese
☐ Korean
☐ Others (Please specify):_____ _____

Part 2 F/A Safety Management Attitudes & Opinions

Please answer the following items by writing your response number beside each item using the following scale.

1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree

____1 It is difficult to co-operate with F/As from different cultural backgrounds.

____2 The "cabin crew access to flight deck" regulation makes me hesitate to interrupt the cockpit crew during critical phases of flying (e.g., during take-off and landing).

____3 Airline's written procedures can advise F/A how to react under all in-flight situations.

____4 F/A cannot break the regulations even when they believe it is in the best interest of aircraft.

____5 I might be viewed as unprofessional by the pilots when I report a potential safety issue that turns out to be non-important.

____6 I know that it is a normal responsibility for F/A to participate in cabin safety incident/accident reporting.

____7 I always feel confident when working with inexperienced F/A.

____8 If the cabin crew is experienced, a pre-fight briefing is not necessary.

____9 I can rely on the individual ability of the senior F/A more than on other F/A teamwork in emergency.

____10 It is important for F/A to understand pilots' workload in different flying phases.

____11 Gate agents in the cabin interfere with my pre-flight work before take-off.

____12 I let other F/A know when my workload is becoming excessive.

1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree

____13 F/A should mention their stress or physical problems to other crewmember before or during a flight.

____14 PAX-safety-related-issues (e.g., unruly PAX) excessively increase my workload and work-complexity.

____15 The senior F/A are getting respect both from F/A and pilots.

____16 The senior F/A should act as a role model for other F/A at all times.

____17 F/A can only challenge the actions of Captain or Senior F/A when they threaten the safety of the flight.

____18 I believe that the leading F/A should be a leader who consults with F/A before making decisions and listens to advice, but nevertheless makes the final decision by him/herself.

____19 Under time pressure, I sometimes ignore some steps of the pre-flight checks in order to avoid delay.

20-25 I feel quite confident when I need to deal with:

____20 PAX medical emergencies;

____21 Cabin pressurization problems;

____22 Dangerous goods in the cabin;

____23 Smoke/fire in the cabin;

____24 Hypoxia resulting in mask deployment;

____25 PAX evacuation/ditching.

____26 I believe that the company's "in-flight turbulence" procedure really protects both F/A and PAX's safety on route.

____27 Safety issues that do not directly affect the cabin are not F/A's responsibility.

1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree

____28 On long-haul flights, fatigue or stress often leads to errors and mistakes.

____29 I am always aware of any changes in terms of cabin devices and equipment.

____30 F/A are only responsible for cabin safety.

Part 3 F/A CRM Training Satisfaction

____31 F/A CRM training should be treated the same (in terms of resource allocation) as pilot CRM training (e.g. all pilots are required for 3-day initial CRM training, and their CRM skills are assessed in simulator and line training).

____32 Joint training is a valuable way to improve pilot-F/A cooperation.

____33 I am confident in my ability to assess potential hazards to safety.

____34 In terms of safety, training has sufficiently prepared me for the line.

35-41 From my own experience, CRM training is useful for improving:

____35 Communication;

____36 Cockpit & cabin crew coordination;

____37 Fatigue Management;

____38 Team building;

____39 Leadership;

____40 Decision-making;

____41 Stress Management.

Part 4 Your Recommendations

Please only answer this section if you have changed your mind about the answers you have given in the first questionnaire.

Please list your top three suggestions to **improve cabin safety** at Air New Zealand.

4. ____

____

5. ____

____

6. ____

____

Please list your top three suggestions to **improve CRM training for F/A**.

1. ____

____

2. ____

____

3. ____

____

✂- -

To qualify for the Price Draw, please enter your name and contact details. Tear off this section and place into the separate box labelled "Lucky Draw".

Name: ______________________________

Contact Details (e.g., phone number): ______________________________

Appendix 3: Checklist for Flight Attendant CRM Training in Fire-fighting Scenario

(Behavioural Markers for evaluating F/A CRM skills in fire fighting drill)

This checklist will be used to assess F/A's CRM skills when observing their performance in fire-fighting drills. The observation is part of a research project that aims to evaluate the CRM training effectiveness for F/A. The research project is conducted by Julia Zhu, a postgraduate student of Massey University under the co-supervision of the Human Factors Programme team of Air New Zealand.

In the observation, F/A's performance will be scored, and some behaviours will be described in tail for further study if necessary. All recorded data will be handled confidentially. Participation in this survey is strictly voluntary.

I am very appreciating for your agreement about my observation. I offer my sincere thanks to you for making this research project possible.

If you have any questions or concerns at any stage, please do not hesitate to contact me or one of my supervisors (contact details below).

Best regards,

Julia Zhu

Contact Details

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F/A's CRM Performance in Fire-fighting Scenario

Observe F/A Position		Observe fire scenario	

very poor	poor	competent	good	very good
1	2	3	4	5
Performance directly endangers safety and is not acceptable.	Performance may endanger safety and there is ample room for improvement.	Performance benefits fire fighting, but needs improvement.	Performance enhances the fire-fighting effectiveness, but falls short of ideal performance.	Performance can serve as a model for other F/A.

Elements	Example Behaviour Groups	Score			Specific Description/Comments
		P	B	C	
Being proactive	Envisions both process and goals during the emergency, and makes quick decisions to cope with the situation.				
Assertiveness	Advocates own position and behave assertively.				
	Takes command when necessary.				
Communication	Communicates clearly and precisely.				

	Keeps information flowing sufficiently between aircrew member and PAX.				
	Inquires from other crewmember when necessary.				
Self-Management	Performs self-control.				
	Takes self-protection.				
Standard Maintaining	Ensures SEP compliance.				
	Intervenes if other F/A's performance is questionable.				
Co-operation	Considers & supports other F/A, cooperates with other F/A to achieve task goal together.				
Workload Management	Sets & keeps priorities for tasks.				
	Delegates own task to other F/A or PAX.				
	Considers time factor when planning and performing tasks.				
Flexibility	Adapts to any changing circumstances.				
Debriefing	Makes constructive comment frankly and actively.				

Note: P=Primary fire fighter B=Back-up fire fighter C=Communicator

N/A=Performance not applicable ?=Performance can't be seen /= Performance-no-time-to-observe

Examples of Behaviours & Performance Rating

Being Proactive

F/A envision the fire-fighting goals and process, and make quick decision to cope with the situation.

Score	Performance Description
1	Passive, takes no action or takes inappropriate action by showing no awareness of fire-fighting exposure & development – e.g., doesn't understand the fire-fighting development, makes wrong decision on further action to deal with fire-fighting exposure and development, performs behaviour which doesn't contribute to fire-fighting, etc.
2	
3	Makes proper decision and takes appropriate action to deal with developed situation in some occasions, which shows understanding the fire-fighting situation.
4	
5	Collects and shares information with other crew members, makes quick & proper decision and takes appropriate action when necessary, which shows envisioning the fire-fighting development at all the time.

Assertiveness

Advocates own position

P: Identify the fire/smoke (fire category/smoke concentrate, the location, source & severity of fire/smoke, etc.) and get suitable fire extinguisher and other devices (PBE, gloves, axe, etc.) to put it out; express own idea firmly.

B: Obtain additional fire-fighting devices to support P, monitor fire-fighting and P; express own idea firmly.

C: Contact with the flight deck (fire/smoke, the location, resource & severity of fire/smoke, fire-fighting progress, etc.) by using the most convenient interphone (or in person) and seek feedback/commands from captain during the whole fire-fighting; express own idea firmly.

Score	Performance Description
1	Doesn't take the initiative in making decision or action, own position not recognisable – e.g., doesn't take action required by own position, perform delayed action, behave disorderly, etc.
2	

3	Reacts and behaves assertively in some situations, but fail to take the initiative in acting occasionally.
4	
5	Takes immediate and assertive actions in response to exposure and development of cabin smoke/fire, without any delay or disorder in action.

Take command

F/A take command to other F/A & PAX directly and positively if situation requires, make clear introduction and take feedback (e.g. prepare for supplementary devices, ready for change role, PAX protection, etc.).

Score	Performance Description
1	Fails to take command when situation requires.
2	
3	Takes command in some situations, but fails to command appropriately occasionally – e.g., doesn't instruct fully or clearly, pays little attention to feedback, etc.
4	
5	Gives command directly and positively to other F/A & PAX at appropriate time and instruct clearly, monitor and reacts to any feedback and response.

Communication:

F/A consult & inform other F/A clearly and precisely (e.g., fire category, location, the source of fire/smoke, severity, fire-fighting progress, assistance, feedback, etc).

PA announcement should be performed with a calm and even tone and the addressed information is clear and appropriate.

C: Inform cockpit and PAX of fire fighting progress and seek feedback from them (pay attention to communication protocol).

Communicates clearly and precisely

Score	Performance Description
1	Doesn't exchange information with other F/A, or always gives inadequate or wrong information.
2	
3	Uses clear words to communicate, and demonstrates a positive attitude of open communication in some situation, but fails to give adequate or concise information occasionally.
4	

5	Uses clear and precise words to communicate timely, and demonstrates a positive attitude of open communication.

Keeps information flowing

Score	Performance Description
1	Doesn't report or exchange further information – e.g., doesn't report any information to other crewmember when situation has changed.
2	
3	Informs and exchanges information with other crewmembers & PAX when situation changes, but fails to give adequate information occasionally or has failure to inform timely.
4	
5	Keeps informing and exchanging information with other crewmembers & PAX during the whole fire-fighting period (especially when situation changes), and seeks feedback from them.

Inquiry

Score	Performance Description
1	Doesn't inquire other crewmember when there is no adequate information or any new information.
2	
3	Inquires other crewmember & PAX when communication is unclear, makes confirmation of the feedback in some situations, but fails to get sufficient information or fails to pay enough attention to feedback occasionally.
4	
5	Inquires other crewmember & PAX when necessary, and makes confirmation of the feedback.

Self-management

F/A perform calm self-control under press.

Score	Performance Description
1	Doesn't perform controlled behaviour during fire-fighting or communicating – e.g., moves around with no purpose, can't concentrate on own task, ignores other's F/A's communication, etc.
2	

3	Concentrates on own task and behaves with purpose, but sometime fails to maintain a cool head or behaves disorderly.
4	
5	Maintains a cool head and concentrates on own task, moves around with purpose and in a controlled fashion.

F/A take good self-protection in emergency.

Score	Performance Description
1	Doesn't take any self-protection during fire-fighting – e.g., doesn't don PBE or wear gloves when necessary, doesn't apply fire-fighting precautions to prevent self from injury, etc.
2	
3	Takes self-protection if situation requires, but fails to perform effective self-protection occasionally – e.g., ignores gloves/PBE when time is tight, etc.
4	
5	Takes effective self-protection when necessary and always shows good awareness of self-protection when dealing with emergency situation.

Standard Maintaining

Ensure SEP compliance:

F/A act different roles to put out the fire/smoke required by SEPs and apply fire-fighting precautions;

Follow the communication procedure in emergency (maintain quick and effective communication between cabin and cockpit, properly use interphone & standard protocol/expression, etc.);

Comply with the PAX management requirement under emergency (inform PAX, protect PAX, comfort PAX, etc.).

Score	Performance Description
1	Doesn't comply to SEPs – e.g., doesn't follow required communication procedure, uses wrong methods to put out fire (e.g. opens toilet door totally to put out fire, etc.), don't use protection devices when fighting fire, etc.
3	Follows SEP's requirement but fails to ensure SEP compliance occasionally –e.g., ignore fire-fighting precautions, etc.
5	Follows SEPs' requirement in all situations.

Intervene:

F/A intervene other F/A when deviation occurs and suggest correction of wrong behaviour.

Score	Performance Description
1	Doesn't intervene in case of deviations from standards by other F/A.
2	
3	Intervenes in case of deviations from standards by other F/A, but fails to intervene when necessary occasionally.
4	
5	Intervenes if other F/A's performance is questionable – e.g. stops deviated action and gives suggestions to correct inappropriate behaviour.

Co-operation

F/A understand other F/A's task and be supportive to other crewmembers;

Encourage and consider accepting other F/A's suggestion and supports;

Offer assistance at appropriate time (provide suggestions and back-up, etc.);

Cooperate with others to complete task together safely.

Score	Performance Description
1	Only concentrates on own task and ignores other F/A's performance or request, no involvement of other F/A to complete tasks.
2	
3	Understands other F/A's task and offers assistance sometimes, accepts other F/A's suggestion & support, and shares task with others in some situations, but fails to coordinate with other F/A occasionally – e.g., can't response to other F/A's requirement timely, etc.
4	
5	Understands other F/A's task and offers assistance at appropriate time, encourages and accepts other F/A's suggestion & support, shares task with other F/A and completes the task safely.

Workload Management

Set and keep priorities

F/A prioritise primary and secondary fire-fighting tasks (fire-fighting, communication, back-up, etc.) and allocate resources (crew, time, fire-fighting devices, etc.)

consistent with priorities.

Score	Performance Description
1	Doesn't priories tasks, takes action or allocates resource without consideration of fire-fighting priorities – e.g., keeps doing less critical job rather than does fire-fighting/ back-up / communication job, etc.
2	
3	Prioritises fire-fighting tasks but fails to allocate resource consistent with priorities occasionally – e.g., sometimes sticks on less critical work rather than provides immediate back-up to fire-fighting when situation requires.
4	
5	Prioritises fire-fighting tasks (fire-fighting, communication) and allocates resources (crew, time, fire-fighting devices, etc.) consistent with priorities all the time.

Delegation:

F/A allocate own task to other F/A or PAX when necessary (e.g., fire-fighting, PAX management, etc.).

Score	Performance Description
1	Never delegates.
2	
3	Sometimes delegates, but fails to delegate occasionally.
4	
5	Always delegates when appropriate.

Time management

F/A always consider time factors when plan and perform the task (put out fire within time-limit, provide back-up or inform other crew members/PAX in time, etc.). Time factors consideration should be reflected in all cases of fire fighting.

Score	Performance Description
1	Demonstrates delayed action or doesn't complete tasks timely.
2	
3	Reacts and completes tasks quickly in some situation, but sometimes fails to react & perform timely.

4	
5	Allocates enough time to achieve tasks and completes tasks quickly and timely.

Flexibility

F/A adapt to any changing situation, make new decision and immediate reaction (e.g., prepare for emergency evacuation);

Be ready for new problem-solving (PAX chaos, cabin damage, crew member incapacitation, etc.).

Score	Performance Description
1	Doesn't adapt to any changing circumstance - e.g., has no further reaction or sticks on original task when situation changes, etc.
2	
3	Reacts appropriately to new changes in some situations, but has failure to adapt to some other changing circumstances – e.g., sticks on original task when situation changes, etc.
4	
5	Makes decision and demonstrates immediate reaction properly to adapt to any changing circumstances.

Debriefing

F/A debrief frankly and completely, make comments and suggestions to themselves or F/A technical & CRM skills based on own and other F/A's performances (e.g., self-evaluation, comment on other F/A's performance), and provide advices about management/training issues (fire-fighting procedure, communication among whole aircrew members, crew co-operation, PAX administration in emergency, SEP & CRM training, etc).

Score	Performance Description
1	Doesn't debrief – e.g. doesn't provide any advice, closes channels of discussion, etc.
2	
3	Partially debriefs – e.g., one-way communication, debrief given but no opportunity for discussion, explanation, etc..
4	
5	Debriefs fully and openly – e.g., gives opportunity for feedback and discussion, listens actively, summaries appropriately, etc.