行政院及所屬各機關出國報告
（出國類別：會議）

參加
第十九屆國際客艙安全研討會
報告

服 務 機 關：行政院飛航安全委員會
出國人姓名 ：戎　凱、方粵強、任靜怡
出國人職稱 ：執行長、調查官、飛安官

出 國 地 區：美國加州 環球城
出 國 期 間：民國九十一年三月三日至九日
報 告 日 期：民國九十一年五月十五日

行政院及所屬各機關出國報告提要

系統識別號 ：C09101052

出國報告名稱：參加第十九屆國際客艙安全研討會報告

頁數：41 **頁**

含附件：是 F

出國計畫主辦機關：行政院飛航安全委員會

聯絡人：鄧嵐嵐

電 話：(02) 2547-5200ex.175

出國人員姓名：戎 凱/ 方粵強 / 任靜怡

職 稱：執行長/ 調查官 / 飛安官

服務機關：行政院飛航安全委員會

電 話：(02) 2547-5200ex.111/167/164

出國類別：□1 **考察**□2 **進修**□3 **研究**□4 **實習**☑5 **其他**

出國期間：民國九十一年三月三日至九日

出國地區：美國加州

報告日期：民國九十一年五月十五日

分類號/目：H2 **航空**

關鍵詞：客艙安全、航機失事、意外事件、客艙組員、駕駛員、人員傷亡、安全帶、生還因素、失事調查

摘要：

一、 行政院飛航安全委員會派遣戎執行長凱、方調查官粵強及任飛安官靜怡等三人前往美國加州環球城（Universal City**）參加「第十九屆國際客艙安全研討會」（**The 19th International Cabin Safety Symposium**）。該研討會之目的為透過交換心得及發表客艙安全論文以促進飛航安全。**

二、 本次研討會中，戎執行長應邀發表「台灣天空客艙安全」專題報導；方調查官發表「由新航 006 **失事調查所獲生還因素之經驗」。任飛安官負責收集客艙安全資訊及與各國與會代表交換心得。**

三、 建議

（一） 明年繼續派員參加此一會議，以維本會有關調查人員深入客艙安全之各項議題，有助本會人員對未來客艙安全之深入調查。。

（二） 繼續提出發表有關客艙安全論文。

（三） 保持與各國代表之聯繫，加強客艙安全資訊交流。

行政院及所屬各機關出國報告審核表

出國報告名稱:參加第十九屆國際客艙安全研討會報告
出國計畫主辦機關名稱: 行政院飛航安全委員會

出國人姓名：戎　凱、方粵強、任靜怡
職　　稱：執行長、調查官、飛安官
服務單位:行政院飛航安全委員會

出國計畫主辦機關審核意見:

☑1.**依限繳交出報告**
☑2.**格式完整**
☑3.**內容充實完備**
☑4.**建議具參考價值**
☑5.**送本機關參考或研辦**
☐6.**送上級機關參考**
☐7.**退回補正**,**原因**:
　☐(1)**不符原核定出國計畫**
　☐(2)**以外文撰寫或僅以所蒐集外文資料為內容**
　☐(3)**內容空洞簡略**
　☐(4)**未依行政院所屬各機關出國報告規格辦理**
　☐(5)**未於資訊網登錄提要資料及傳送出國報告電子檔**
☐8.**其他處理意見：**

層轉機關審核意見:

☐**同意主辦機關審核意見**
☐**全部**　☐**部份**_____(**填寫審核意見編號**)
☐**退回補正**,**原因**:_____(**填寫審核意見編號**)
☐**其他處理意見**:

參加第十九屆國際客艙安全研討會報告目錄

壹、目的

過去國內民航失事調查，著重於航、機務及氣象、航管等因素，對客艙安全調查則應付厥如。而國際間對客艙安全之調查已行之有年，並提出各種改善建議。如新型民航機客艙座椅承受正前方之 g 力之適航認證標準，已由 9g 提升至 15g。

有鑑於此，行政院飛航安全委員會(以下簡稱飛安會)為加強「客艙安全」，特派戎執行長、方失事調查官、任飛安官等三人參加此十九屆國際客艙安全研討會(The 19tht International Cabin Safety Symposium)。會中戎執行長應邀發表「台灣天空客艙安全」專題報導，方調查官發表「由新航 006 失事調查獲致生還因素經驗談」。兩人之演講均獲極大肯定。

本次會議共有八位來自台灣之代表參加，計有資深客艙組員及教師如中華航空公司范守天、長榮航空公司薛成珍、譚淑鈞、立榮航空公司劉良華、復興航空公司楊哲宜等五人與本會代表三人等。

圖（一）與會之航空公司代表與本會代表合影

貳、會議日程

本次國際客艙安全研討會由美國南加州安全學院（Southern California Safety Institute）主辦，於九十一年三月四日至七日間在美國加州環球城喜來登飯店大會議堂舉行。研討會共發表多篇論文，發表會後並有即席問答。研討會議日程表如下。

三月四日 （星期一）	會議主持人	演講人	題目
	Joan Strow		
0845		Allan McArtor	致開幕詞
0930		Bob Sutton/Penny Neferis	全球航空資訊網 客艙安全大要
1030		Susan Rice	新航空公司及新機種 組員訓練心得
1100		Lisa Juenger/Jim Walters	美國 FAA 客艙安全標準 及 ISO 9000
1200-1300	午餐		
1300	Barbara Dunn	James Fang	新航 006 失事生還因素 調查經驗談
1330		Peterlyn Thomas	曼谷機場 QF-1 緊急疏散
1400		Sunshine McCarthy	失事後人人生還之好消息
1430		John Purvis	解決今日問題- 促進明日安全
1530		Kay Young	台灣天空客艙安全

三月五日 （星期二）	會議主持人	演講人	題目
	Dietrich Langhof		
0830		世界黑帶協會	客艙組員防身術
0900		Pasion Delgado	客艙組員防身訓練
0930		Sam Holoviak	保護未來鐵門後的駕駛艙
1030			組員安全訓練
1100		Steve Waltrip	警覺性
1200-1300	午餐		
1130		Linda Connell	ASRS 客艙安全報告經驗談
1300	研習營 1	Ron Schleede	國際圓桌會議
1445	研習營 2	Tove Finstad	CPR 訓練

三月六日 （星期三）	會議主持人	演講人	題目
	Francis Wokes		
0830		John Lauber	A380 安全與緊急疏散
0900		Robert Shaffstal	現代客艙安全檢視
0915		David Pamerton	失事後生還研究

1015		Mac McLean	第三類逃生門疏散研究
1100		Cynthia Corbett	懷抱嬰兒之疏散研究
1200-1300	午餐		
1300		Kenoth Larcter	747 航機客艙研究
1330		Hermit Jungermann	起飛前準備疏散研究
1430	研習營 3	Ben Van Errict	不守規矩乘客處理方式訓練
1530	研習營 4	Frank Poliafice	空中緊急醫療

三月七日（星期四）	會議主持人	演講人	題目
	Akemi Inukai		
0830		Akiko Tsuda	空中急救與紅十字會訓練
0900		Benvan-Errich	現代客艙安全急救
0930		Judith Murewski	對客艙噴灑消毒藥
1030		Sara Reda	駕駛員失能
1100		Frank Polia Pico	空中醫療服務
1130		Erica Sheward	空中食物安全

參、心得與建議

一、澳航（Qantas）波音 747-400 客機於曼谷機場衝出跑道失事有關客艙安全之省思

本專題報告由澳洲運輸安全委員會（ATSB）代表就澳航波音 747-400 於曼谷機場失事提出客艙安全專論。澳航 QF1 班機之波音 747-400 於 1999 年 9 月 23 日曼谷時間 16：47 落地時衝出跑道，機上載有 3 名前艙組員，16 名後艙組員及 391 名乘客。事件發生後，泰國民航局授權澳洲運輸安全委員會展開調查。

該機之緊急疏散程序於落地後 20 分鐘始啟動，16 名客艙組員中，僅 6 名依程序呼叫防撞（Bracing Position）口令，機長曾二度試圖以客艙廣播系（PA）通知狀況，但均未成功；至於客艙組員間，亦曾試圖使用機內通話系聯絡，但亦有困難。機長請副駕駛至客艙通知旅客留在座位上等候指示，副駕駛回報並告知無火警跡象。有二位客艙組員因傳達座艙長與駕駛艙之通話而離開任務區。當時相關之資訊包括 3 號引擎異常及地板隆起之資訊，未自客艙傳達至駕駛艙。前段客艙組員發現異味，副駕駛勘查異味後反應並無此異味。此時機場外之救援人員無法與機內溝通。

機長最後下達預防性質（Precautionary）之疏散（Evacuation）命令後，組員最初僅利用右邊兩個門執行緊急疏散；而因機尾翹高而未打開 5 號門；同時前段一客艙組員不知緊急逃生已開始實施；部分旅客攜帶手提行李；客艙組員強制執行方式亦有很大差異；組員對離機之乘客未給予明確指示。

依 Reason 模式針對客艙通話系統、組員啟動緊急逃生指令之考量及前後艙溝通等加以說明：

1.客艙通話系失效造成客艙組員聯絡困難，無替代通訊設備。

2.通訊失效造成客艙組員工作困難，公司亦未建立替代程序，資訊無法交換或傳達，完全靠座艙長擔任聯絡工作，在實務作業及工作負荷上均有困難。因此，對這方面的訓練及程序更形重要；當然，現有之程序及訓練方式無法涵蓋所有可能情況，但是站在提供安全作業環境的立場，平日應儘可能給予完整及有效之訓練。

3.澳航在程序中並未明確界定何者為預防性的緊急疏散，同時對組員疏散之啟動，預防性疏散及其實施方式均無明確說明。但在實施預防性疏散的過程中，如何依程序掌控旅客之行動及其強制性要求，均應予加強重視。

該機組員在評估安全狀況的過程中，對可能的盲點如外界資訊，風險之衍伸變化等均未完整考量，尤其是評估預防性疏散之過程。

針對以上重點，澳洲運安會提出以下客艙安全改善建議：

*建立適當有效之前後艙通訊辦法

*建立通訊系統失效之聯絡方式

*建立系統化之問題辨識及評估程序

*建立客艙組員於緊急狀況時之團隊領導及協調

*掌握乘客提供之安全資訊

*確定有效之命令語句，導引及掌控旅客之逃生行動。

二、新航 SQ006 事件生還因素調查經驗談

本講演由調查 SQ006 失事之生還因素小組長方調查官擔任。其報告內容詳如附錄一。

遺憾的是新加坡代表不但於會前多方阻擾本會之講演，在未被大會主席接受後，堅持由專題主持人 Ms. Barbara Dunn 公開代表宣讀嚴重抗議聲明書一份，其聲明主要在陳述新加坡代表對本會發表專題之反對立場，並企圖尋求與會者之支持。但本會方調查官仍秉承資訊分享之立場，完整呈現整個已公開之事實簡報。

新航事件生還因素之專題報告重點以緊急疏散、緊急裝備、機場緊急應變為主。該報導說明死亡率達 46%係因航機撞擊後大火，造成油箱附近座位嚴重傷亡。機尾部份幸好受火災影響較小，機尾乘員無人死亡。調查發現事件中之緊急逃生滑梯均無法正常使用。組員緊急逃生程序中包括未使用手提麥克風，缺少標準呼叫程序。其他如緊急聯絡之替代程序、旅客防煙面罩、逃生滑梯在強風影響之正常開啟功能等均有實情報導。又專題報告中另對中正機場緊急應變作業等事實，包括對傷者後送處理、醫療協調程序、權責劃分等事實均做扼要說明。

該報告內容雖僅以事實報告方式呈現，但基於與會者之資深實務經驗，應仍可自報告中引申出他山之石及預防改進之方向。在專題報告及會後之問答中，與會者均熱烈提出問題討論，本會方調查官及專題主持人除妥切解答外，並告知有關分析，結論及改進建議仍需俟最終報告公佈後方可公開討論。

三、台灣天空客艙安全

由本會執行長戎凱提出專題報告。其報告內容詳如附錄（二）。戎執行長將台灣歷年來所發生有關客艙安全事故作一系列報導，深獲與會代表之熱烈迴響，會後有許多發問者爭相提出問題。

四、人之意識狀態與顏色

專題報告指出，人在不同階段下對事務之認知，可以五種顏色代表--白、綠、黃、紅、黑。

白色--指無意識或處平靜狀態，如睡眠、看書、電視，而對週遭事物變化不甚記憶。

綠色—指主動需完成某一項任務，如打電腦、完成檢查表，登機時帶位等，必須要注意週遭事物。

黃色—指積極的尋找重要資訊，如飛行組員處理異常情況發生聲響，找尋解決方案，並且已完全掌握假設性的解決方案。

紅色—指被動體能反應，如緊急程序啟動，此時因為注意力過度集中於某些區域，而常常忽略環境其他提示。

黑色—此時人的反應是完全沒有反應，或因驚嚇過度而反應。

另在不同狀況對認知差異之導因及特徵，以顏色區分如後：

白色：導因—疲勞、工作負荷、缺乏激勵、用葯、　習慣。

特徵—對週遭環境不自覺、無反應、無意識。

綠色：導因—激勵、刺激、充足睡眠、適度壓力下

特徵—保持警覺、注意力集中、準備充分

黃色：

導因—感官敏銳、好奇、具備第六感

特徵—高度警覺、尋求資訊、可預見並解決問題、善於研究、記憶及練習

紅色：導因—高度威脅意識，開始有求生意識

特徵—直覺性、保護性的反應、慣性反應為主、開始有視覺障礙、思考能力降低，身體戒備本能反應增加，必須以命令句溝通

黑色：導因—記憶喪失、感官過度負荷、無法正確偵測問題、喪失狀況控制能力、驚訝

特徵—呆滯、無法反應、困惑、驚慌、發抖、反應不全、沮喪、無法有效溝通

結論：在了解人類不同階段之意識狀態後，重要的是如何了解自己在正常及

異常時的意識狀態，並能有效管理，同時更重要的是能對你周圍的人，處於何種狀態能有正確的認知，尤其是當自己或同事異常狀況時，所滯留於白　至黑區，但即便是能妥善將自己置於綠區的人，因狀況的變化，亦必須能妥善處理心理及生理上的壓力，而且轉換成黃色階段，以便能更有效處理及解決問題。而利生死存亡間的紅區，所有求生反應均已啟動，但在體力及精力上的消耗大量增加後，多為本能反應而少有思考，但相較於黑色區，則是大多未存活者的導線，應儘可能避免。

以生存者的角度來看不同意識狀況認知階段，藉著知己知彼，自我調整意識、警覺，尤其是在異常狀況下之反應，儘量避免自己平時或遭遇異常事件時，處於白色或黑色之階段，應該強迫自己在不同時段能有最佳及正確反應以助於提高生還機率。

五、國際民航主管機關客艙安全資訊交流

由加拿大運輸部（Transport Canada）客艙安全處長 Ms. Francis Wokes 擔任主席。參加人員包括南非、美國、英國、德國、加拿大、新加坡等國之民航機關主管人員，本會由任飛安官代表參加。

議題如下：

（一）近期因 911 事件後各民航業者設立之空中安全警衛（Air-marshal），因與美聯邦航空總署（FAA）官方安全檢查員有混淆之處。有時空中安全警衛於上機後自表身份，容易誤讓客艙組員認為是官方代表。因此加拿大民航局將於近期發布有關通告，以正視聽。

（二）建議向國際民航組織（ICAO）提案並建立民航主管機關客艙安全聯絡網，利用客艙安全年會召開之機會，舉辦主管機關客艙安全討論會以交換資訊，本議題將交由加拿大運輸部向國際民航組織提出。

（三）各國民航主管機關客艙安全查核員交換意見後，發現各國查核之制度，程序，手冊、人員訓練標準各有不同。其中加拿大客艙查核員訓練及手冊較為完整，包括階段性的初訓，安全觀念訓練，客艙查核員手冊介紹及簡報。

（四）各國對業者客艙安全年度訓練計劃之核准方式亦有不同，部分國家一旦發出民航運輸業許可證（Air Operator Certificate, AOC）後，二年內不必再陳報訓練計劃，但新加坡，加拿大及南非之業者，則需每年申請，至於加拿大及美國作業方式則以除非違反法規，方予撤銷。訓練計劃應依年度發生之客艙異常事件而有所調整重點則已有共識。

（五）各國民航主管機關目前對其監理角色已有共識，從以往之線上查核轉型為以監理系統為主，其查核機制係以找出系統缺失，而不負責指引如何修正方向。

（六）建議國際民航組織（ICAO）正視客艙安全，尤其是客艙安全操作標準，同時開始考量客艙組員是否應予給證。

（七）各國民航主管機關客艙安全查核員之薪資系統結構有甚大差異，這也是常造成主管機關各專業查核員之比較心態及階級意識。如加拿大客艙查核員之薪資則低於航務查核員與機務查核員，雖然薪資依年資調整，已造成極大心理分歧。

（八）各民航主管機關普遍認為各航空公司之飛安客艙部門主管，普遍對其安全角色扮演，及如何與民航主管機構溝通聯絡，缺乏正確認知。這也是民航主管機關於管理時碰到最大困難。未來如何建立良好互動，掌握系統安全與客艙安全，即時資訊交換應為推動工作重點。

（九）與會人員熱烈交換資訊，並認為此型態之座談會，應以更正式及有更多單位參與之方式持續舉行，方能消除各國客艙安全法規上之不協調，透過資訊充分交換而讓執行及監理更趨一致。

六、加拿大運輸部客艙安全作業

加拿大運輸部（Transport Canada）在客艙安全處長 Ms.Frances Wokes 之率領下派出十人參加本研討會。在特設之櫃檯上，除派專人以書面資料介紹加拿大之客艙安全處，並分送說明其客艙安全光碟片。

加拿大運輸部對客艙安全之廣義解釋為包含機身之耐撞毀性(Crash-worthiness)、客艙作業（Cabin Operation)、人因（Human Factor)、心理（Psychology)、生理(Physiology)、人體工學(Ergonomics)及教育(Education)等範圍。加拿大運輸部認為加強客艙安全之目的是為減少失事後之傷亡，並提供乘客與組員於航機運作時有一個之安全環境，包括客艙結構、出入口、座位排列、設備及人員之協助疏散等。

加拿大運輸部客艙安全處設立於六〇年代中期，目前已建立客艙安全查核員制度，監督全加拿大國內外之客艙安全作業。現有 20 位客艙安全查核員。按航空法(Aeronautics Acts)及加拿大航空規則(Canadian Aviation Regulations)針對 13,000 位客艙組員、 1,000 個國內商用及私人航空業者來執行客艙安全查核作業。另外，查核員亦根據 ICAO 之標準及建議 SARP（Standards and Recommended Practices）來監督外籍航空公司在加拿大境內之客艙安全作業。

加拿大之客艙安全工作是講求專業水準、服務、尊重及整體合作。分別由三個單位執行，即客艙安全標準小組，客艙作業小組及外籍航空查核小組。

對查核項目之優先次序，該處採取危機管理(Risk management)之法則，以爭取最大效益。以乘客較多之航空器列為優先檢查對象(加拿大航空法規第 705 條)，而私人航空器(加拿大航空法規第 604 條)有客艙組員在機上之波音 727、Hawker Siddley 748、Cavair 580、Dash 8 等為次要檢查之對象。載客在十九人以下之通勤機種，如有客艙組員則屬再次檢查對象(加拿大航空法規 704 條)。其餘載客在九人以下或普通航空業(加拿大航空法規 703 條)更屬再次一檢查對

象。

七、如何抱嬰兒由滑梯安全疏散

本論文由德國柏林大學人體工學教授 Helmut Jungermann 提出，其重點在如何安全地懷抱嬰兒使用疏散滑梯。曾經試驗挑選 32 位成人，分別抱玩具嬰兒溜下滑梯測試，提出各人心得看法，希望藉此找出最快疏散方式及如何避免嬰孩頭部足部創傷之姿勢。詳如圖七之一、二。

圖七之一　部分實驗代表

圖七之二　　實驗代表跳下與坐下滑梯

進行實驗之人員抱嬰兒疏散之姿態有以下不同方式：

1. **直抱、坐姿下滑梯**
2. **直抱、跳下滑梯**
3. **橫抱、坐姿下滑梯**
4. **橫抱、跳下滑梯**

結論：

1. **各類可顧及嬰兒之懷抱方式均可接受**
2. **以跳至滑梯方式溜下去較快**
3. **與抱嬰兒人員之緊急應變能力有密切關係**
4. **抱嬰兒人員上梯疏散前應有正確之動作指導**

八、供實驗用之實體 747 客艙使用報導

該模擬客艙（如下圖八之一）與波音 747 **航機尺寸相同，產權經數度易主後現屬美國** FAA。

747AERF AS IT APPEARS TODAY

圖八之一　　客艙模型機

該客艙模型機有以下功能

（一）供研究與實驗用：

1. **緊急疏散研究**
2. **滑梯伸展研究**
3. **客艙內各項程序研究**
4. **客艙燈光研究**
5. **客艙樓梯研究**

（二）實務用途方面：

供消防人員在實際大小客艙進行演練

（三）計畫性研究工作

1. **模擬機內外火燒之研究**
2. **電氣走火研究**
3. **模擬噪音研究**
4. **全機機內通話音質、音量研究**
5. **機體結構振動源研究**
6. **可移動式上層客艙樓梯研究**

（四）已完成及研究中之計畫

1. **電磁研究—由波音與美空軍共同研究**
2. **跑道目視距離—FAA 研究**
3. **客艙空氣品質研究—FAA 研究**
4. **亂流檢測與客艙安全—由 NASA 與美國航空公司共同研究**

九、影響第 III 類疏散出口之因素

英國克蘭飛爾大學飛安研究部門進行對第 III 類出口之安全疏散研究。FAA 據 FAR 25.813（C）資料提供資助，並藉以回應 NTSB 對第 III 類出口之改善建議。第 III 類出口如圖九之一、二。

圖九之一 第 III 類出口疏散作業

圖九之二 第 III 類出口作業程序圖例

報告指出影響疏散流速之因素共有以下數項：

1. **客艙座位排列密度、走道寬度、緊急出口數目與燈光指示。**
2. **疏散程序—與組員之經驗與訓練有密切關係。**
3. **環境因素—起火位置、火勢、是否產生毒害氣體、天候、晝夜、停機位置及航機姿態。**

4.**人之因素—疏散人員之年齡、性別、體力、教育背景、經驗及緊急應變能力等。**

所進行研究之特點說明如下：

1. **是有始以來最大規模之疏散研究**
2. **執行** 48 **次疏散演練，共檢測** 2,544 **事項**
3. **發覺有** 192 **項因素促使必須開啟該類疏散門**
4. **共耗時** 13 **週**
5. **數十人參與此一計劃**
6. **在英國** Cranfield **大學進行研究如圖九之三。**

圖九之三 疏散實驗簡報於 Cranfield **大學園區進行**

結論：

（一）人性因素影響疏散之速度最明顯：在不同動機之下，將影響疏散速度。例如在疏散實驗中，雖每次給參與疏散實驗者一定酬勞，但如另給最先逃出者加倍酬勞，會導致在不同動機下，形成爭先恐後之態勢，必會造成出口擁塞。如圖九之四。

圖九之四　　出口擁塞情況

（二）腰圍、年齡、性別影響疏散流量：經過實驗得知，肥胖年老之女性，最會影響疏散速度。腰圍量測如圖九之五。

圖九之五　　腰圍量測

（三）若與人性因素影響疏散速度相比，第 III 類出口各類尺寸對疏散速度之影響輕微。

（四）若與人性因素影響疏散速度相比，第 III 類出口操作之難易影響輕微。

（五）若與人性因素影響疏散之速度相比，第 III 類出口附近通道亦影響不大。

十、建議

參加研討會之人員，係來自世界各航空公司客艙安全之管理人員及資深客艙組員為主。另各國民航主管機關或調查機關亦派代表參加。此外亦有不少有關企業參與並提出客艙安全新產品。合計共有超過 200 人參加，詳如附錄四。美國、加拿大、英國等國之民航主管機關及失事調查機關均派客艙安全代表參加。

建議事項如下：

（一）明年繼續派員參加此一會議，以維本會有關調查人員深入客艙安全之各項議題，有助本會人員對未來客艙安全之深入調查。。

（二）繼續提出發表有關客艙安全論文。

（三）保持與各國代表之聯繫，加強客艙安全資訊交流。

四、附錄

附錄一、新航 006 失事調查生還因素經驗談

LESSONS LEARNED FROM THE SQ006 ACCIDENT INVESTIGATION IN SURVIVAL FACTOR ASPECTS

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And
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Note: Due to the ongoing investigation of SQ006, this presentation will be based on the factual information only. The final investigation report will be published in April 2002.

Forward

This paper presents the factual information collected and reported by the survivor factors group of the SQ006 investigation. Although only factual information are presented here, it is our belief that valuable lessons to improve aviation safety can be learned from these factual information.

Synopsis

On October 31, 2000, at 2317 Taipei local time, a Singapore Airlines (SIA) Flight SQ006, Boeing 747-400 aircraft, took off from a partially and temporarily closed runway at CKS Airport. The taxi route from Tower controller was: "Singapore Six, taxi to Runway zero five left, via taxiway Sierra Sierra, West Cross, and November Papa.'' "The route was shown as Figure 1 below.

（圖略）

Heavy rain and strong winds affected by northeast monsoon flow and typhoon prevailed at the time of the accident. Typhoon was centered about 360 kilometers south of CKS Airport around the time of the accident. Maximum wind speed of the storm was 36 knots gusting to 50 knots. The pressure of the storm center was 965 hpa.

The aircraft was destroyed by its collision with construction equipments and pits on Runway 05R, and by subsequent fire damage. Construction equipments and pits were shown as Figure 2 below.

（圖略）

Post-Crash

Fuel Spillage after the impact

There were 140,000 Kilogram of take off Jet A1 fuel for this TPE-LAX direct flight. The fuel spilled from broken fuel tanks was ignited immediately after the impact. The soot of fire burning on ground could be seen from Figure 3 below.

（圖略）

Wreckage Distribution

The accident aircraft fuselage was severed into two parts at row 49, just at the rear of the center wing tank box after the impact. Wreckage and debris distribution were shown as Figure 4 and 5 below.

（圖略）

（圖略）

Fire & Smoke

. The intense fuel tank leak fire engulfed the forward and mid section of fuselage with the prevailing of gust wind and heavy rain. Smoke was found in the main deck and upper deck cabin immediately after the impact. Fire was under the control in 15 minutes and fully compressed in 40 minutes. The tail section severed with the forward and mid section after the impact and stopped at 150 feet away. There was a fireball rushing into the tail section cabin and a small fire at the outer surface of tail area. The fire fighters put off the tail section fire immediately.

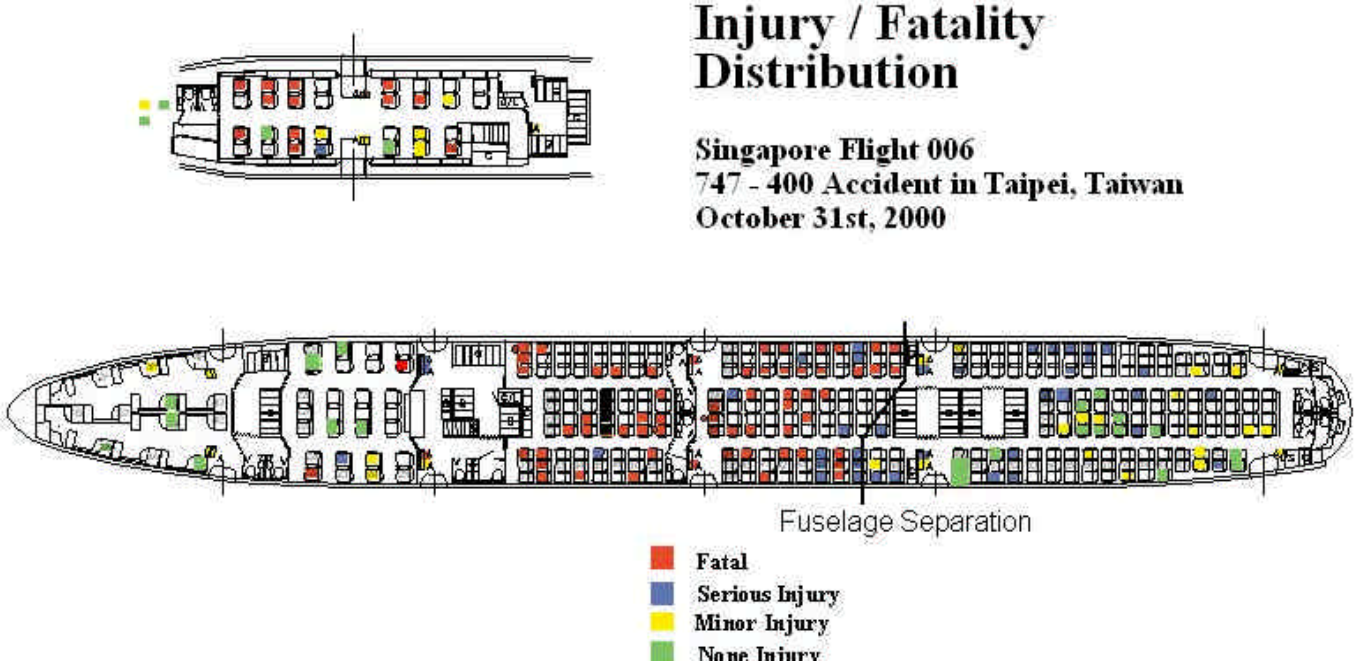
A passenger in an aircraft of other airlines taxing along a taxiway at a distance of 300 feet away took fire burning pictures of the forward and mid fuselage of SQ006 about 30 seconds after the impact. The picture of burning was shown in Figure 6 below.

（圖略）

Injury Table

Injuries	Flight crew	Cabin Crew	Passengers	Other	Total
Fatal	0	4	79	0	83
Serious	0	4	35	0	39
Minor	1	9	22	0	32
None	2	0	23	0	25
Total	3	17	159	0	179

Injury Distribution



Post Crash Injury

Most of the survivors said they suffered from smoke inhalation during evacuation.

The fatality rate of this accident was 46%. The serious injury rate was 22%. The minor injury rate was 18%. The no injury rate was 14%

Sixty-four out of 76 passengers including 3 infants did not survive in the mid-section of the main deck (row 31 to 48) due to fuel tank explosion and subsequent intense fire.

Post-Crash damage and injury to Tail Section

The tail section, containing passenger seat Rows from 49 through 64, severed from the main section at row 48.It stopped 150 feet away from the forward and mid section fuselage with a 90 degrees CCW roll to the left side fuselage.
All occupants survived in this tail section due to less fire damage. They evacuated through the fracture opening. No abnormalities were found in constraints of passengers' seat belts, seats and floor tracks. Some tail section overhead bin tie rods were found broken due to over stress of impact during the accident.

Evacuation

After the aircraft came to a full stop, flight crew tried to initiate evacuation with PA but PA was failed. No Alternate procedures of PA failure were used by the crewmembers. During evacuation some cabin crew used affirmed and loud call out to order evacuation.. Megaphone was not used in this particular accident evacuation.

By the time CM1 reached the upper deck exit areas, he noticed both UDL and UDR exits were already opened. There was intense fire on starboard. CM1 evacuated by grabbing the half- burned slide and then jumping down to the ground.

CM2 did not see the slide and decided to use the left upper deck door to evacuate. Since no one took any action to evacuate, he decided to evacuate first and shout to the people at the left upper deck door, "stay here, stay here, I will jump first, I will jump first". After jumped to the ground, he shouted to those who were standing at the left upper deck door to start jumping. One by one the passengers jumped out of the cabin.

CM3 left cockpit first and saw smoke and thick flying dust in the upper deck cabin. He could only see 2-3 evacuating path lights ahead. He found the upper deck left exit was already opened and there was an extensive fire outside. He remembered there were several people including a cabin crewmember (male) in front of the upper deck right side exit (UDR) trying to open the UDR exit. Passengers were still staying in the upper deck cabin at that time. Initially, he wanted to go to the main deck cabin, but the stairwell area was filled with smoke. He then turned back and saw the left hand outside fire starting to diminish and passengers jumping down through the UDL exit. CM 3 did not see CM-1 at that time, but he saw a female cabin crew in shock near the left side exit. The CM-3 instructed this cabin crewmember to jump out. After this cabin crewmember, CM-3 climbed down the burned slide/raft from UDL exit. CM-3 claimed that he was the last one to exit the aircraft. When on the ground, he noticed that CM-2 was already there.

The upper deck galley cabin crewmember of the upper deck galley was facing backward. Because the galley lamp couldn't be dimmed due to malfunction of the light switch, this crewmember could clearly see the items in the galley bounced forward to him during impact. After the aircraft stopped, he did not hear any evacuation instruction, he un-buckled his seat belt and shouted to the passengers to un-buckle their seat belt. By that time, he felt there was hot air from different directions and smoke surging upward from main deck. He passed a towel to the main cabin 2R cabin crew who ran upstairs to dodge the fire and smoke of the main deck. The upper deck galley cabin crew saw several upper deck passengers running down the stairs and jumping out the aircraft through 2L door. This upper deck galley cabin crew went downstairs as

well and jumped out of that exit.

According to the interview of the survived upper deck passengers and cabin crew, the Crew-In -Charge (CIC) went upstairs after the first impact. The CIC did not contact with CM-1 or other flight crew and did not issue an evacuation command. The CIC did not survived in this accident.

The 1L cabin crew said he did not receive any evacuation instruction after the accident. After checking the outside conditions of the aircraft he opened the 1L exit and pushed the slide/raft out of the aircraft. He heard an air leaking sound of the 1L slide/raft. After considering the height of exit of 1.5 meters above ground, noticing the smoke emanating from the backward of the cabin, he directed 8 passengers (including 3 from business class) to evacuate from 1L exit. Cabin visibility was about 1 meter. Fire and heavy smoke came in the cabin intermittently. He mentioned that there was no passenger in sight. Under such circumstances, he then evacuated from the 1L exit.

The 1R cabin crew monitored the conditions outside of 1R exit and saw intense fire after the accident occurred. She did not open the 1R exit. She then shouted to the passengers to unbuckle their seat belts. Together with the 1L cabin crewmember, she directed the passengers to evacuate from 1L exit.

The 2L outboard cabin crew heard two big bang sounds from the right wing. Her seat was facing backward. She saw fire burning in the mid section of aircraft. Without receiving any evacuation instruction; she unbuckled her seat belt and moved to the left forward aisle and ran upstairs to upper deck. This cabin crew used a towel that was handed to her by UDG crew to cover her nose and then returned to the main deck again and evacuated from 2L exit.

The 2R outboard crewmember saw flames entering the cabin from both sides of the ventilation ducts of the sidewall. He went upstairs to avoid the fire. He then returned to the main deck. He noticed there was intense fire on the right side of the aircraft so he didn't open the 2R door. He opened the 2L exit and pushed the slide/raft out. He heard the slide/raft inflate, but soon heard the leaking sound. He didn't hear any evacuation instruction, nor did he command an evacuation. He opened that 2L exit door and evacuated from there.

Crewmembers seated at 3L and 3R did not survive in this accident.

The tail section cabin crew and passengers all evacuated from the fractured opening of the aircraft.

During observation of the SIA emergency training, it was found that the flight crew played as passenger role in practicing the evacuation drill.

SIA' s procedure required cabin crew to confirm other safety exits before his/her redirection. Crew could not acquire other available exits information when interphone and PA were failed.

One female cabin crew reported that her sandals were missing during evacuation. The Safety Council noted that SIA had introduced new footwear for female cabin crew. For takeoff and landing sandal are replaced with shoes, which afford greater protection and grip now.

A piece of the lower part of the skirt that belonged to a cabin crew was found stuck in the inlet of the 4R slide air blower.

Emergency Equipment

Doors and Slides were described as below:

Doors	Status	Opened By Crew of	Slide Condition
UDL	Open	UDR	Deployed and burnt
UDR	Open	UDR	Not found
1L	Open	1L	Partially deployed
1R	Closed		Minor burn damage, not deployed
2L	Open	2R (outboard	Partially deployed
2R	Destroyed by fire		Not found
3L	Partially open	Unknown	Moderate burn damage, not deployed
3R	Destroyed by fire		Not found
4L	Closed		In package
4R	Closed		Uncommanded deployed in cabin
5L	Closed		In package
5R	Closed		Uncommanded deployed in

			cabin

The dense smoke made breathing difficult to the survivors during the evacuation. There were no regulations regarding the preparation of smoke protection devices for passengers to use in emergency.

（圖略）

Most of survivors seated in tail section described that the emergency lights were obscured or invisible during evacuation. ASC verified these emergency lights were functional in a post accident examination. The 4R emergency lights illuminated after the accident were shown as the figure 7 below.

（圖略）

The torchlight was located next to each of crewmember seat. There were one flight crew and one cabin crew carried onboard torchlight during evacuation. One flight crew used his personal torchlight.

The lateral G forces associated with the accident produced an unexpected self-inflation of the 4R and 5R slides in cabin. The respective cabin crew at the door side was pinned on the wall by the slide inflated in cabin.

The L1, L2 and R4 slides were sent to manufacturer for inspection on February 15, 2001.A further examination of the damage of all the slides were inspected on November 09,2001 at the slide storage container of CKS airport.

During the examination the investigation team found no abnormalities of the slide/raft operation during the SQ006 accident as compared to manufacturer's specifications. The investigation team found soot and fire damage located at the inlet of the aspirators of R4 slide as figure 8 below.

（圖略）

The fire damage of R4 slide was found from inner surface of the slide. The fire damage of the rest of the other slides was found from outer surfaces as the figure 9 below.

.

（圖略）

Airport Emergency Response

The CKS Airport's aerodrome category for airport rescue and fire fighting

(ARFF) is 9. According to ICAO Annex 14 SARPs, Vol I, Paragraph 9.2.19:

> "*Recommendation. - The operational objective of the rescue and fire fighting service should be to achieve response times of two minutes, and not exceeding three minutes, to the end of each runway, as well as to any other part of the movement area, in optimum conditions of visibility and surface conditions.*

The ARFF of CKS Airport had 64 fire fighters in service in 24 hours. Such manpower status of CKS Airport was less than that of the same level international airports. For Example; Chek-Lap-Kok Airport of Hong Kong had 220 fire fighters in service and Changi Airport of Singapore had 160 fire fighters including sea rescuers.

After the accident, the first 10 survivors were sent to hospital by airport's ambulances directly without proper triage procedure. There was no contingency procedure for medical treatment and rescue in adverse weather conditions at CKS Airport.

According to the witness statement of injured passengers who rode the emergency vehicle; the emergency vehicle took seriously injured passengers (two on stretchers and six sitting) to Chang-Gan Hospital in Linko (30 km away) were not examined by anyone before rushed to the hospital. There were no medical personnel attending the injured passengers during the entire 30-minute ride. The ARFF rescue vehicles took passengers from the runway and sent them to hospital in the same way.

The doctor of Min-Shen Hospital was responsible and was designated as an emergency medical treatment coordinator. He did not receive coordinator training and was not aware the location of the emergency medical facilities.

Others

There was no alcohol and drug testing of the three flight crewmembers of SQ006 after the accident.

The Department of Forensic Pathology Institute of Forensic Medicine, Ministry of Justice conducted a total of 7 autopsies. Out of the 7 autopsies conducted, 6 died from severe burnt and one died from impact injury.

Conclusion

In view of the facts described in this presentation regarding crew performance of evacuation procedures, emergency equipments usage and airport emergency response activities, we may find lessons for those who had responsibilities and interests in cabin safety aspects to learn.

附錄二、戎執行長專題報導「台灣天空客艙安全」

Cabin Safety Related Issues in Taiwan

-- Efforts by Aviation Safety Council (ASC) --

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Aviation Safety Council
Taiwan, ROC
March, 2002

- Since its birth in May, 1998 ASC has investigated a total of 18 aircraft accidents and serious incidents.
  - 11 accidents (5 helicopters), 7 serious incidents
  - Claimed 95 life
    - 83 from SQ006 (B747-400)
    - 3 from CI642 in Hong Kong (MD11)
    - 1 from B7873 Explosion due to DG (MD90)
    - 1 from CI681 Captain incapacitation
    - 7 from helicopters
  - 6 cases involved Survival Issues

China Airlines CI 642 Accident

UNI Air B7 695 Accident

Daily Air B55531 Accident

Singapore Airlines SQ006 Accident

UNI Air B7 695 Accident

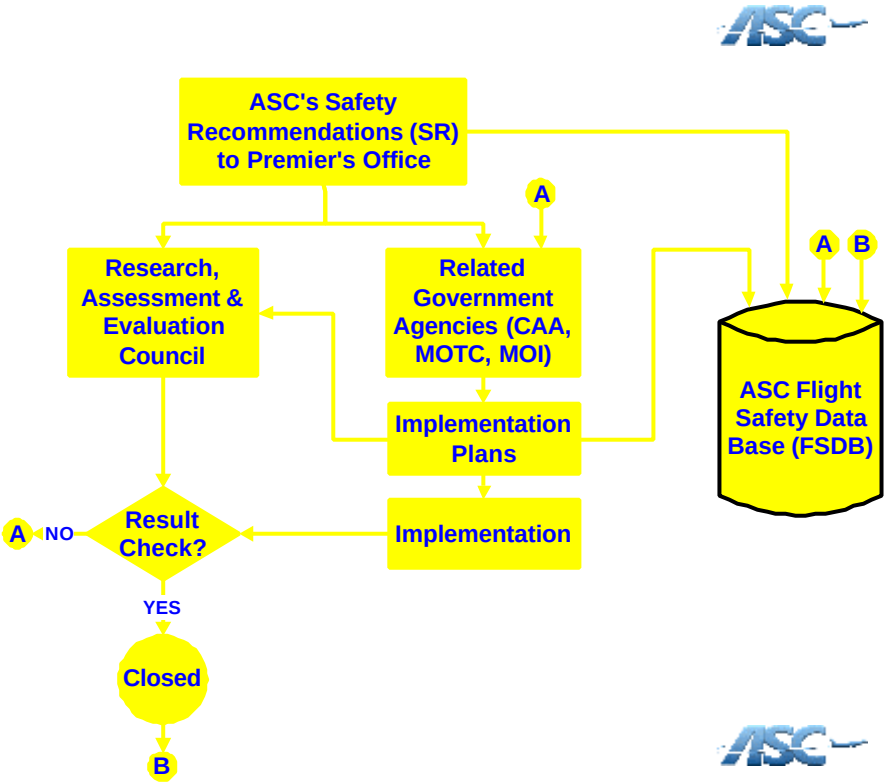
- Completed 12 investigation reports.
  - SQ006 final report will be published in April, 2002.
  - CI642 has been investigated by CAD, Hong Kong.
  - 4 other cases being investigated.
- Issued a total of 24 safety bulletins, 108 safety recommendations. (not including SQ006)
  - 18 recommendations related to cabin safety/ARFF, and post accident medical handling.

Issues Related to Cabin Safety & Other Survival Factors

- Seat Installation and Maintenance
- Use of Seat Belt (Oriental culture / education)
- Emergency evacuation equipment
  - PA system / cockpit-cabin communication
  - Emergency lights (dimmed)
  - Mega phone / in-cabin communication equipment
  - Slides (high wind/ 25 knots spec, lateral G force 1.5g, fire resistance)
  - Smoke protection
  - Uniform / footwear

- Emergency evacuation procedures and training
  - Very hostile environment (severe impact force break up aircraft, strong wind, heavy rain, fire, smoke)
  - Evacuation command
  - Communication between cockpit / ground, cockpit / ATC, ATC / ground
  - Gathering of passengers
  - Training
  - Human factors (crew members and passengers)

- Fire and rescue (manpower, procedures, regulations, training)
- Emergency medical handling (manpower, procedures, regulations, training)
- Carry-on luggage (especially smaller carriers for off-shore island operation)
- Autopsy (cultural issue?)



- ASC assess the viability of the implementation plan
- Research & Evaluation Council is the official oversight agency for Premier's office
- ASC provides technical assistance in the evaluation process (ASC does not have oversight function)
- FSDB (Flight Safety Data Base) tracks the entire process and results.

Accomplishment (?) this far

- Ensure both the government agencies are (1) aware of, (2) implement, (3) track the ICAO SARP.
- Ensure follow up procedures are being drawn
- Improving training procedures and methodology
- In the process of signing MOU with MOJ & MOI for autopsy and evidence preservation
- Raise issues to enhance international awareness (equipment, procedure regulations)

- Making both the industry and government agencies pay more attention to safety, especially in Survival Factors.
- Change of mind set.
- Safety culture of the oriental society