行政院及所屬各機關出國報告
（出國類別：其他）
ASC-TRM-01-02-002

參加美華航太工程師協會年會、國際航機客艙安全研討會、及參訪波音飛機製造公司報告

服務機關：行政院飛航安全委員會
出 國 人 職　　稱：執行長
姓　　名：戎　凱

出國地區：美國
出國期間：民國九十年二月八日至二月十六日
報告日期：民國九十年三月七日

行政院及所屬各機關出國報告提要　　系統識別號

出國報告名稱：參加美華航太工程師協會年會、國際航機客艙安全研討會及參訪波音飛機製造公司報告

頁數：____頁含附件：是否

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) 2547-5200 分機 175

出國人員姓名：戎　凱

服務機關：行政院飛航安全委員會

職稱：執行長　　　電話：(02) 2547-5200

出國類別：□1 考察□2 進修□3 研究□4 實習□5 其他

出國期間：民國九十年二月八日至二月十六日

出國地區：美國

報告日期：民國九十年三月七日

分類號/目

關鍵詞：美國,美華航太工程師協會,SCAAE,波音,國際航機客艙安全研討會,Society of Chinese American Aerospace Engineers,International Aircraft Cabin Safety Symposium

內容摘要：(二百至三百字)

此次參訪美國，主要行程有三：

一、　應邀參加美華航太工程師協會(Society of Chinese American Aerospace Engineers – SCAAE)之年會及專題演講。此年會於二月十日在洛杉磯鄰近之喜瑞多市(Cerritos)舉行。

二、　應邀參加第十八屆國際航機客艙安全研討會(International Aircraft Cabin Safety Symposium)，為第二天會議之開場主講人。此會議於二月十二~十五日於洛杉磯鄰近之科斯達眉沙市(Costa Mesa)舉行。

三、　於二月十五~十六日參訪西雅圖波音公司，與該公司飛安人員交換資訊並參觀該公司之波音 747、767、777 組裝廠房。

本文電子檔已上傳至出國報告資訊網

行政院及所屬各機關出國報告審核表

出國報告名稱: 參加美華航太工程師協會年會、國際航機客艙安全研討會及參訪波音飛機製造公司報告

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

職稱：執行長

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:

目　　錄

壹、 參訪行程

二月七日	起程(台北時間)
二月七日	抵美國洛杉磯(當地時間)
二月八日	抵喜瑞多市
二月九日	與美華航太工程師協會理事討論大會事宜並與南加州安全學院院長 Dr. Peter Gardiner 共進午餐
二月十日	參加美華航太工程師協會年會並提供專題演講
二月十一日	抵科斯塔眉沙市
二月十二~十四日	參加國際航機客艙安全研討會並提供專題演講
二月十五~十六日	抵華盛頓西雅圖並參訪波音飛機製造公司
二月十七日	返回台北

貳、 心 得

此次參訪美國之首站為美國西岸離洛杉磯市區約 40 公里之喜瑞多市(Cerritos)，美華航太工程師協會之年會每年均於該市之喜來登(Sheraton)飯店舉行。美華航太工程師協會是由美國華僑航太工程師所組成，會員共八百多人，包括加州洛杉磯，灣區，華盛頓州西雅圖，德州休士頓、達拉斯，及科州丹佛等地之美裔華人航太工程師。其主要目的為提供美華航太工程師之資訊交流，及提昇在美航太界華人之

地位。本人在來台前亦為該協會之理事之一，今仍擔任該協會在台灣之聯絡人。

本人應邀於二月十日下午之學術研討會中提供專題演講，演講題目是「台灣飛安之近況」。演講完畢並有一座談會(Panel Discussion)，座談的有田長焯(田長霖之兄，前波音高級主管，已退休)，柯如甦(前台翔總經理)，林坤源(華盛頓州立大學教授)，及黃啟鵬(美空軍衛星系統主任及美華航太協會理事)。演講完後座談會之討論非常熱烈，與會者對新航 SQ006 之事倍感興趣。會後本人並接受世界日報記者之訪問(報導見附錄一)。另一專題演講為美微軟公司(Microsoft)中國分公司總經理高群耀博士，講題為「如何切入中國高科技市場」，我和高博士為舊識，他對中國之民航界亦有相當的了解，會後交換不少兩岸如何交流的意見。

大會於當日晚上六時半於同飯店舉行酒會，並邀請中研院院士馮元禎教授演講「Aerospace Engineers in the New Century of Biology」。馮教授原為著名之航太工程師，後專攻人體基因(DNA)，他很巧妙地將如何以一流體力學的專家轉換成基因方面之研究，並對今日人體基因工程之發展及將來作一深入淺出之解說，極獲好評，另一場演講為美波音 717 計劃之總工程師 Mr. Tom Corslin 講述波音 717 計劃之發

展過程及前景。大會並頒獎給本人及高群耀博士，並安排各種娛樂節目，參加此次會近四佰人，可謂是相當成功的一次年會了。

訪美的第二站亦在洛杉磯大都會區的柯斯塔眉沙市(Costa Mesa)。柯市在洛杉磯城中心約七十公里處。第十八屆國際航機客艙安全研討會在柯市的希爾頓飯店舉行，此一研討會由南加州安全學院(Southern California Safety Institute - SCSI)主辦，共有四十個國家，三百餘人報名參加，是全球在民航機客艙安全領域最具權威性的研討會。我國除本人外，其他各大航空公司(華航、長榮、立榮、復興、華信、遠東)共有十一人參加此一盛會(附錄二)。其中另外值得一提的是蘇俄聯合國協的州際民航委員會(Interstate Aviation Committee – 相當於美國的FAA)派出一團六人，由該會的副主席 Dr. Rudolf Teymourazov 帶隊，其中包括 Dr. Vladimir Kofman，是俄協專司失事調查的主席(Aviation Transportation Accident Investigation Committtee - ATAIC)。

大會為期三天半，由二月十二日上午開始至二月十五日中午結束。議程如下(附錄三)：

第一天兩會期

會　期 1：Cabin Safety Regulatory Roundtable

會　期 2：Occupational Health and Safety

第二天一個會期及三個研習會

會　期：Unruly Passengers

研習會 1: Responding to Challenging behavior and Verbal Abuse

研習會 2： Crisis Communication

研習會 3： New Approach to First Aid Training

第三天一個會期及三個研習會

會　期：Education Procedures and Training

研習會 1： International Roundtable

研習會 2： In-Flight Telemedicine

研習會 3： Personal Safety Responding To Physical Provocation

第四天上午 一個會期

會　期： Lesson Learned From Accidents

大會共發表二十七篇論文(附錄四)，並在各研習會中另有相關的專家報告，與會人員的反映非常熱烈，大家一至公認為民航機客艙安全中交換資訊最成功的一個研討會。

本人的專題演講排在第二天(二月十三日)的開場演講，講題是「Improve Aviation Safety Through Accident and Serious Incident

Investigation – The Taiwan Way」(附錄五)。除了主講此一專題外，並被邀請於 International Roundtable 中和俄協代表一起發表論點，本人就此次新航 SQ006 失事有關客艙逃生、救護，及立榮 UIA873 兩案向大會報告。因新航失事案記憶猶新，聽眾的反應及問題也非常的多。

在所有的報告中，記憶最深的是美國家運輸安全委員會(NTSB)最近做的一個客艙安全研究，是由 NTSB 的 Dr. Robert Molloy 主講"Recent NTSB Evaluation Study"。提到根據 NTSB 十年來的統計，逃生梯(Slides)有 37%的機率在一件飛安事故中有問題，這個統計數字和新航 SQ006 逃生梯的情形有極大相似之處。是非常值得注意的。

大會並同時有各項有關客艙安全的展示(Exhibits)，參加展示的約十餘家(包括加拿大民航局)，在展示中亦收集了不少資料(附錄六)。

本人於二月十五日赴位於西雅圖的波音公司飛安室交談，與會的有 Mr. Ron Hindenberger(飛安室主任)，Mr. Jim Hamilton，Mr. Rick Howes，Mr. Dick Breuhaus(均為飛安室調查員)，及 Dr. Curtis Graber(波音人因工程部門主任)。會中交換如何使飛安會人員能更進一步了解波音航機的辦法，包括波音同意將整套的航機手冊(Aircraft

Manual – 717, 737, 757, 767, 747, 777)提供給本會。並同意飛安會人員參加國內航空公司在波音換裝訓練，以便對波音之航機有更進一步的了解。Dr. Curtis Graber 並提出由波音研發的一套協助人因飛安事故調查的工具 PEAT(Procedural Event Analysis Tool)，利用人類資訊處理之過程來分析事故原因進而提出改善，是滿值得我們做更進一步探討的。(附錄七)

第二天二月十六日，由 Mr. Jim Hamilton 陪同參觀位於 Everet 的波音 747，767 及 777 的組裝廠房，該廠房於 1979 年即開始運作，於 1989 年為波音 777 做全新的策劃，獨立廠房佔地 800 畝(單一屋頂)。參觀時有三架 747，四架 767，四架 777 在組裝。747 的出廠速度為每八天一架，777 為每四天一架，767 因銷路沒有 747 及 777 好，沒有一定的時數。整個廠房全部自動控制，尤其是 777 的生產線，已達到 everything just on-time 的要求了。美國國家之強大，由此亦可見一般了。

進入廠房時，外面已開始飄雪，三個小時出廠房時戶外已是一片雪茫茫，結果當天下了 8 吋的雪，是西雅圖五年來的第一次大雪，正值碰上，也是不巧有偶了。

參、 論與建議

(1) 國外華人對我國之飛安狀況極表關切,政府應盡量利用機會多做宣導。

(2) 國外當地代表處對接待及參加酒會等不遺餘力但對實際之內容並不了解亦不關心,而對交通一項並無單位負責,似有改善之餘地。

(3) 國際客艙安全研討會是一極良好與國際交換資訊及學習之機會,我各航空公司均派人參與,是可喜可賀的。但會中並未見民航局代表參加,值民航局打算成立客艙安全查核之時,建議以後能積極參與。

(4) 在大會中宣讀之論文,廣受好評,亦是做國際關係及宣導我國在飛安上努力的一個很好的管道,應鼓勵積極性的參與(如主持會議,或宣讀論文等)。

(5) 與波音公司因此參訪而對該公司有更進一步的了解,並增進今後互助之協議。

肆、 附　　錄

一、　洛杉磯世界日報報導美華航太工程師協會年會

二、　國際航機客艙安全研討會出席人員名單

三、　國際航機客艙安全研討會議程

四、　國際航機客艙安全研討會論文發表書冊

五、　專題演講「Improve Aviation Safety Through Accident and Serious Incident Investigation – The Taiwan Way」

六、　國際航機客艙安全研討會展示資料

七、　波音飛機製造公司人因飛安事故調查工具簡介

附錄一

洛杉磯世界日報報導美華航太工程師協會年會

台灣飛安不佳 失事率6.6%
高出美國13倍．人為因素大

【記者張菁芳喜瑞都市報導】台灣的飛行安全環境並不理想，過去三年的失事率為百分之六點六，是美國的十三倍。國府行政院飛航安全委員會執行長戎凱，十日在美華航太工程師協會的年會座談中的報告，引起與會人士關切。

美華航太工程師協會日前在喜瑞都市喜來登飯店舉行二〇〇一年年會，並在下午舉行兩場座談，由國府飛安委員會執行長戎凱主講「飛行安全」，及微軟駐中國大陸公司總裁高群耀主講「中國大陸的高科技投資及企業家機會」。

戎凱提到台灣飛安情況時表示，目前台灣兩家飛國際航線的航空公司華航及長榮，再加上四家國內航線遠東、復興、立榮及華信，共有一百七十八架飛機在台灣上空飛行，最擁擠的時候，松山機場一天有七百架次飛機起降。

回顧過去十年台灣的飛安紀錄，失事率高達百分之五點九，相較於全世界的百分之一點五、美國的百分之零點五及中國大陸的百分之二點三，失事率非常高，目前全世界飛機失事率最高的地方在非洲，達百分之十，另外中南美洲及亞洲國家菲律賓、台灣、韓國、泰國等飛安紀錄都不好。

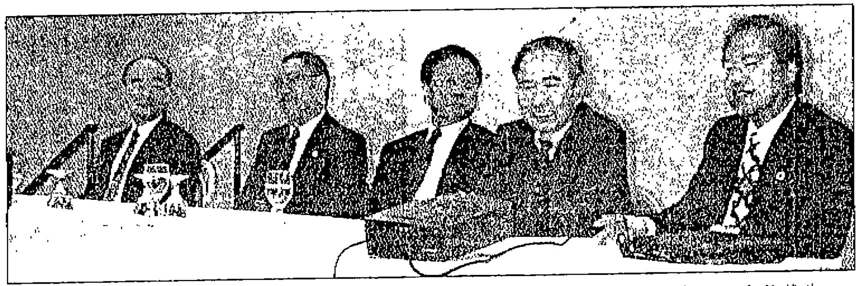
根據國際民航組織多年的調查發現，一個國家的飛安情況，也反映該國飛安環境的健康程度，主管機關等人為因素須負很大責任。過去台灣一旦發生空難，均由民航局作失事調查，通常矛頭指向航空公司，最後結果常常不了了之。戎凱表示，失事調查的主要目的是要改善飛行安全，而不是要找誰的錯。

由於台灣空難頻傳，台灣在一九九八年五月成立獨立的飛安調查機構「飛航安全委員會」，與國科會、青輔會等組織一樣，隸屬行政院。該委員會除了負責飛安調查外，也提出改善建議，直接對行政院長負責。飛安委員會同時與美加法澳等國際飛行失事調查組織有密切合作關係。

戎凱表示，飛安委員會共有十七人，包括五名委員、七名調查員及五名工程師，雖是一支融合實務操作及工程技術的專業團隊，但剛成立時對飛安調查都沒有經驗，經過這兩年大小空難的慘痛磨鍊後，飛安委員會現在的工作成績已是洋洋灑灑，目前該委員會成立僅一年多的黑盒子實驗室，已在亞洲國家居翹楚地位。

美華航太工程師協會當晚年會也邀請美國國家工程研究院院士、加州大學聖地牙哥分校榮譽教授馮元楨演講「航太工程師在生物工程新世紀的角色」，波音公司七一七客機計畫首席工程師 TOM CROSLIN 也在會中介紹波音公司的新型區間客機。會中同時頒獎給戎凱與高群耀。

年會中也進行美西分會及全美總會新年度會長及理事交接，美西分會新年度會長由賴英政接任，理事長為沈方楠。全美總會新年度會長為歐陽小平，理事長由西北分會的田長焯擔任，秘書長李全伶。



美華航太工程師協會在年會活動中，舉行飛行安全座談，參與座談者由左至右為：戎凱、田長焯、柯如鼪、林坤源、黃啟鵬。（記者張菁芳攝）

飛安問題涉及層面廣
積習深 難立竿見影

【記者張菁芳喜瑞都市報導】國府飛行安全委員會執行長戎凱，日前在美華航太工程師協會的年會座談中表示，飛行安全不是馬上就能立竿見影的事，除了主管機關外，也與文化及訓練息息相關。去年底發生的新航空難，目前已完成事實資料蒐集，事實報告將在兩星期後出爐。

戎凱在飛安演講中以新航空難為例，藉失事現場飛機殘骸的幻燈片，解說當時飛機滑錯跑道的情況，引起在場航太工程師熱烈討論。戎凱表示，就失事調查員的立場，要知道的不只是飛機滑錯跑道等表象的失事原因，還要找出為什麼。

他說，失事調查是很複雜的過程，目前飛安委員會剛完成事實資料蒐集，事實報告將在兩週後出爐。在這之前，戎凱不願多談報告內容。不過，他表示，調查報告要瞭解人為因素在空難事件中所占的比例有多少，是新航機師循機場跑道綠燈而出事，還是塔台誤導？

在提到飛機在天候不佳撞山的例子時，他表示，這種失事情況百分之百是人為因素，肇因於駕駛員壓力大、對天候、風速等資訊不夠，以致失去對環境的認知判斷力。

九二年自航太公司回台灣發展的戎凱，回台後曾任國科會太空計畫室副主任、台揚科技研發部副總經理、成功大學航太系教授，九八年飛安委員會成立後，從成大被借調至飛安委員會任職。

回台八年，戎凱曾在產業界、學術界及政府機構任職，對台灣航太工業及飛行安全的觀察及感觸很多，此間航太工程師常問他回台發展後的感想，他表示，美國與台灣的思考及做事方式不同，回台學人須有準備，不過縱使做過準備，還是會有無法預期的事發生。

他說，台灣企業界活力很高，這是台灣成功的主因，政府部門現在也在進行改造，雖然目前大環境不穩定，但民眾的韌性與潛力很強，只要給予好的環境，就能有很好的發揮。為此，他希望利用在飛安委員會任職期間，為台灣的飛行安全建立好的環境。

不過，他也提到，飛行安全不是馬上就能立竿見影，幾十年的積習，無法期待在一夕間改變，這與文化及訓練都有關係。他說，成立獨立的飛行安全調查機構在世界各國已成趨勢，包括埃及、葡萄牙及新加坡，目前都準備成立獨立的飛安調查組織。

飛安委員會雖是成立不到三年的新組織，不過該委員會的黑盒子實驗室已超過日本，獨步亞洲國家。國際飛安調查員協會年會明年九月在台北召開，將由飛安委員會主辦，也是一項肯定飛安委員會成績的表現。

附錄二

國際航機客艙安全研討會出席人員名單

Registration List for
All People and Company Registrants

Registrant Name	Registrant Address

Event: 18th Annual International Cabin Safety Symposium 02/12-15/01

Booth Attendees at Hilton Costa Mesa at Hilton, Costa Mesa

1	Angelo Liberatore	AirSep Corporation
2	Jonathan Crivon	Airline Safety And Protection
3	Danny Emmet	Airline Safety And Protection
4	Lance Ettinger	Airline Safety And Protection
5	Philip Baum	Aviation Security International
6	Bill Alder	CAMTECH
7	Bob Earp	CAMTECH
8	Ron Schutz	CAMTECH
9	George Byer	DME Corporation
10	David Gay	DME Corporation
11	Craig Randolph	EVAS Worldwide
12	John Wells	EVAS Worldwide
13	Julie Allen	FlightSafety International
14	Carter Braxton	FlightSafety International
15	Colette Hardy	FlightSafety International
16	Stephen Halliday	International SOS
17	Robert Liddell	International SOS
18	Marc Ashton	MedAire, Inc.
19	Cynthia Massey	MedAire, Inc.
20	Linda Young	MedAire, Inc.
21	Angela Perez	Medical Care Concepts, Inc
22	Kevin Stack	Medical Care Concepts, Inc
23	Linda Del Monte	Medtronic Physio-Control
24	Linda Goodrich	Medtronic Physio-Control
25	Marcelo Abello	RPTechnologies/IJT Holding Company
26	Barbara Abello	RPTechnologies/IJT Holding Company
27	Nick Guard	RPTechnologies/IJT Holding Company
28	Kate Murphy	Remote Diagnostic Technologies, Ltd
29	Melanie Reeves	Remote Diagnostic Technologies, Ltd
30	Bruce Bartovick	Safety Training Systems, Inc
31	Jim McGowan	Safety Training Systems, Inc
32	Mike Wilson	Safety Training Systems, Inc
33	Phil Hardy	Securicare International, Ltd
34	Andrew McKenzie-James	Securicare International, Ltd
35	Colin Pollard	Securicare International, Ltd
36	George Brown	Transport Canada
37	Carolina Cudahy	Transport Canada
38	Frances Wokes	Transport Canada

Registration List for
All People and Company Registrants

Registrant Name		Registrant Address
39	Barbara Goguen	Transport Canada
40	Susan Greene	Transport Canada
41	Diane Holmes	Transport Canada
42	Karen Smith	Transport Canada
43	Tom Kingsbury	Transport Canada
44	Luc Mayne	Transport Canada
45	Jean Soucy	Transport Canada

Symposium Committee at Hilton, Costa Mesa

1	Peter Budd	
2	Barbara Dunn	
3	Toni Ketchell	
4	Gale Braden	Aviation Safety Consultant
5	Peterlyn Thomas	Bureau of Air Safety Investigation
6	Allan Tang	CAA Singapore,Airworthiness-Flt Stds.
7	Elaine Parker	Canadian Regional Airlines
8	Dietrich Langhof	Condor Flugdienst GmbH
9	Nora Marshall	NTSB
10	Peter Gardiner	SCSI
11	Richard Wood	SCSI
12	Joan Strow	TWA
13	Jeanne Elliott	Teamsters Airline Div. NW
14	Frances Wokes	Transport Canada
15	Jim Burnett	Transportation Consultant
16	Nicholas Butcher	United Kingdom CAA

18th Annual International Cabin Safety Symposium Exhibitors at Hilton, Costa Mesa

1	AirSep Corporation	AirSep Corporation
2	Airline Safety And Protection	Airline Safety And Protection
3	Aviation Security International	Aviation Security International
4	CAMTECH	CAMTECH
5	DME Corporation	DME Corporation
6	EVAS Worldwide	EVAS Worldwide
7	FlightSafety International	FlightSafety International
8	International SOS	International SOS
9	MedAire, Inc.	MedAire, Inc.
10	Medical Care Concepts, Inc	Medical Care Concepts, Inc
11	Medtronic Physio-Control	Medtronic Physio-Control
12	RPTechnologies/IJT Holding	RPTechnologies/IJT Holding Company
13	Remote Diagnostic Technologies,	Remote Diagnostic Technologies, Ltd
14	Safety Training Systems, Inc	Safety Training Systems, Inc
15	Securicare International, Ltd	Securicare International, Ltd
16	Transport Canada	Transport Canada

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
	18th Annual International Cabin Safety Symposium Gen. Assemb at Hilton, Costa Mesa	
1	Peter Budd	
2	Barbara Dunn	
3	Lynn Elise Jacobs	
4	Toni Ketchell	
5	Jerry Lederer	
6	Audrey Rushforth	AFA-Hawaiian Airlines
7	Elfi Stoddard	AFA-Hawaiian Airlines
8	Mike Mass	ALPA
9	Lonny Glover	APFA
10	Kathy Lord-Jones	APFA
11	Debbie Maitland-Roland	APFA
12	Nikolay Ustimenko	AVISCO Insurance Co.
13	Frances Breen	Aer Lingus
14	Ray Yeates	Aer Lingus
15	Juergen Grubbe	Aero Lloyd Airline
16	Alexander Riethausen	Aero Lloyd Airline
17	Petra Schaefer	Aero Lloyd Airline
18	Richard Chan	Aero Mock-ups, Inc.
19	Diane Disley	Air 2000 Limited
20	Sue Graysmark	Air 2000 Limited
21	Dave Lattimore	Air New Zealand
22	Francine Desjardins Lafond	Air Transat
23	Angelo Davelaar	AirALM
24	Astrid Den Hartog	AirALM
25	Wladimir Domitilia	AirALM
26	Sharine Minguel	AirALM
27	Angelo Liberatore	AirSep Corporation
28	Uwe Holzmueller	Airbus Industries
29	Jonathan Crivon	Airline Safety And Protection
30	Danny Emmet	Airline Safety And Protection
31	Lance Ettinger	Airline Safety And Protection
32	Simon Reilly	Airservices Australia
33	Rick Hoaglund	Alaska Airlines
34	Mitsuko Tanakamaru	All Nippon Airways Co, Ltd
35	Chisato Yamazaki	All Nippon Airways Co, Ltd
36	Ed Horton	Allied Pilots Association
37	Sherri Kelly	America West Airlines
38	Linda Campbell	American Airlines
39	Sergio Sales	American Airlines
40	Peter Zografos	American Airlines
41	Angela Adair	American Eagle Airlines

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
42	Vickie Foster	American Eagle Airlines
43	Hillarie Hoffrogge	American Eagle Airlines
44	Vanessa Roberts	Amiri Flight
45	Laurie Ferguson	Association of Flight Attendants
46	Fidel Gonzales	Association of Flight Attendants
47	Melissa Madden	Association of Flight Attendants
48	Gaby Enne	Austrian Airlines
49	Thomas Heinrich	Austrian Airlines/Austria
50	Gale Braden	Aviation Safety Consultant
51	Kay Yong	Aviation Safety Council
52	Philip Baum	Aviation Security International
53	Clare Ishmael	B.W.I.A. West Indies Airways
54	Michele Letellier	Bomardier, Inc.
55	Martin Berntsen	Braathens
56	Tove Finstad	Braathens
57	Bente Myklebust	Braathens
58	Fiona Pittard	Britannia Airways Ltd.
59	Valerie Robertson	Britannia Airways Ltd.
60	Debbie Sansome	Britannia Airways Ltd.
61	Terry King	British Airways
62	Ann McDowall	British Airways
63	Richard Norsworthy	British Airways
64	Bridget Quirke	British Airways
65	Elisabeth Woodhart	British Airways
66	Kathy Bryan-Smith	British Mediterranean Airways
67	Michele Evans	British Mediterranean Airways
68	Peterlyn Thomas	Bureau of Air Safety Investigation
69	Allan Tang	CAA Singapore,Airworthiness-Flt Stds.
70	Bill Alder	CAMTECH
71	Bob Earp	CAMTECH
72	Ron Schutz	CAMTECH
73	Xavier Janssens	CUPE Canadian Airline
74	Elaine Parker	Canadian Regional Airlines
75	Salvor Th. Sverrisson	Cargolux Airlines International
76	Erica Sheward	Castle Kitchens Exclusive Catering Ltd.
77	Joseph Cheung	Cathy Pacific Airways Ltd
78	Piya Forsythe	Cathy Pacific Airways Ltd
79	Barbara Lewis	Cathy Pacific Airways Ltd
80	Chun Pong Lawrence Ng	Cathy Pacific Airways Ltd
81	Yu-Wei Chou	China Airlines
82	Chun-Sheng Wang	China Airlines
83	Shih Lu	China Airlines Employees Union
84	Tsu-Kuang Hung	China Airlines Employees Union

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
85	Linda Cele	Civil Aviation Authority So. Africa
86	Judith Goodison	Civil Aviation Authority, Jamaica
87	Abgaryan Araik	Civil Aviation of Armenia
88	Dietrich Langhof	Condor Flugdienst GmbH
89	Frank Petro	Condor Flugdienst GmbH
90	Tomas Chlupac	Czech Airlines
91	Eva Zatkova	Czech Airlines
92	George Byer	DME Corporation
93	Diann Rattner	DME Corporation
94	Oliver Merk	DaimlerChrysler Aviation GmbH
95	Genevieve Louis	Delta Air Lines, Inc.
96	Sheldon Murphy	Department of National Defense
97	Michael Nickel	Draeger Aerospace GmbH
98	Patsy Junker	EG&G Technical Services
99	Craig Randolph	EVAS Worldwide
100	John Wells	EVAS Worldwide
101	Israel Lifshitz	El Al Israel Airlines
102	Hisham Nabi	Emirates Airline
103	Beata Knyz	EuroLOT SA
104	Monika	EuroLOT SA
105	Gerd Ritter	Eva Air
106	Minna Tan	Eva Air
107	Yi-Wen Wang	Eva Air
108	Linda Findlay	Excel Airways
109	James Whinnery	FAA
110	Holly VanZant	FAA-NWA-CMO
111	Ching-Wen Chang	Far Eastern Air Transport Corp
112	Chih-Feng Chiang	Far Eastern Air Transport Corp
113	Paivi Eerola	Finnair
114	Heikki Lukka	Finnair
115	Sami Sieva	Finnair
116	Petri Wallden	Finnair
117	Ann Marie Chassie	First Air
118	Tony Hicks	First Air
119	Wendy Johann	First Air
120	Cathy Maedel	First Air
121	Egon Kohlhammer	Flight Attendants Assoc. of Australia
122	Viacheslav Bakaev	Flight Scientific Institute
123	Julie Allen	FlightSafety International
124	Carter Braxton	FlightSafety International
125	Colette Hardy	FlightSafety International
126	Lori Harvey	FlightSafety International
127	Karen Henry	FlightSafety International

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
128	Gwen Kennedy	FlightSafety International
129	Pam Tucker	FlightSafety International
130	Claude Cottyn	Forces Armees
131	Franky De Coninck	Forces Armees
132	Bernard Masuy	Forces Armees
133	Sergey Kofman	GE Aircraft Engines
134	David Obeng-Adjei	Ghana Civil Aviation Authority
135	Paul Osei-Mensah	Ghana Civil Aviation Authority
136	Sally Greer	Gulf Stream Aerospace
137	Ann Holmes	Gulf Stream Aerospace
138	Cilicia Laboy	Hawaiian Airlines, Inc.
139	Slavica Vlahovich	Health Canada
140	Laurel Rogin	ISASI
141	Nikolay Talikov	Ilshyn Aviation Complex
142	Stephen Halliday	International SOS
143	Robert Liddell	International SOS
144	Tatyana Anodina	Interstate Aviation Committee
145	Vladimir Kofman	Interstate Aviation Committee
146	Rudolph Teymourazov	Interstate Aviation Committee
147	Rei Fukuoka	JALFIO-JAL
148	Meg Vesty	JMC Airlines
149	Gregory Janelle	Janelle & Associates
150	Naomi Murooka	Japan Air System Co., Ltd.
151	Kiyohito Fujishima	Japan Airlines Cabin Safety Promotion
152	Lodenyk Oosthoek	KLM Royal Dutch Airlines
153	Jan Van De Maat	KLM Royal Dutch Airlines
154	Jochem Weeink	KLM SPL/OX-SEP
155	Lim Byung-Soo	Korean Air
156	Woon-Seob Kim	Korean Air
157	Petra Fodinger	Lauda Air
158	Gerd Jurdzik	Luftfahrt-Bundesamt (LBA)
159	Frank Ciupka	Lufthansa Flight Training
160	Barbara Foese	Lufthansa Flight Training
161	Henning Uhlemann	Lufthansa Flight Training GmbH
162	Lovisa Falpskog-Johansson	Malmo Aviation
163	Anna Ljungdahl	Malmo Aviation
164	Marc Ashton	MedAire, Inc.
165	Frank Barr	MedAire, Inc.
166	Jill Martinez	MedAire, Inc.
167	Cynthia Massey	MedAire, Inc.
168	Tyson Myers	MedAire, Inc.
169	David Streitwieser	MedAire, Inc.
170	Linda Young	MedAire, Inc.

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All People and Company Registrants

Registrant Name		Registrant Address
171	Angela Perez	Medical Care Concepts, Inc
172	Kevin Stack	Medical Care Concepts, Inc
173	Edgar Buehrle	Medifan
174	Frank Oberle	Medifan
175	Linda Del Monte	Medtronic Physio-Control
176	Linda Goodrich	Medtronic Physio-Control
177	Raymond Bond	Ministry of Defence UK
178	Vladimir Rudakov	Ministry of Transportation of Russia
179	John Hammerschmidt	NTSB
180	Roy Malloy	NTSB
181	Nora Marshall	NTSB
182	Anne Dorrance	Northwest Airlines
183	Malcolm Bow	Peel Regional Police
184	Maria Barbara Aragon	Philippine Airlines
185	Francis Cabel	Philippine Airlines
186	Susan Konyot	Phillips Alaska
187	Patti O'Brien	Phillips Alaska
188	Marcelo Abello	RPTechnologies/IJT Holding Company
189	Barbara Abello	RPTechnologies/IJT Holding Company
190	Nick Guard	RPTechnologies/IJT Holding Company
191	Rebecca Chute	Raytheon/NASA Ames
192	Kate Murphy	Remote Diagnostic Technologies, Ltd
193	Melanie Reeves	Remote Diagnostic Technologies, Ltd
194	Abdusatar Ernazarov	Republic of Uzbekistan Flight Safety Oversight
195	Solange Leite Fortes	Rio-Sul Airlines
196	Eliana Queiroz	Rio-Sul Airlines
197	Cristiane Guilhem Yashiro	Rio-Sul Airlines
198	David Davenall	Royal Air Force
199	David Hutchinson	Royal Air Force
200	Michelle Webber	Royal Airlines
201	Les Bennett	Royal Military College of Canada
202	Brent Lewis	Royal Military College of Canada
203	Marianne Larson	SAS
204	Lena Lindberg	SAS
205	Susanne Schibbye	SAS
206	Annika Schild	SAS
207	Christine Soudah	SAS
208	Marie Siegrist	SAS Commuter
209	Kim Stage	SAS Commuter
210	Kenneth Bernhardsson	SAS Flight Academy
211	Claes Brostrom	SAS Flight Academy
212	Tue Ronn Hansen	SAS Flight Academy
213	Marlene Foulk	SCSI

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
214	Peter Gardiner	SCSI
215	Sharon Morphew	SCSI
216	Gary Morphew	SCSI
217	Amber Mortensen	SCSI
218	R. Gary Mucho	SCSI
219	John Richardson	SCSI
220	Jessica Richardson	SCSI
221	Ron Schleede	SCSI
222	Richard Wood	SCSI
223	Lionel Jenkins	SCSI-Australia
224	Bruce Bartovick	Safety Training Systems, Inc
225	Jim McGowan	Safety Training Systems, Inc
226	Mike Wilson	Safety Training Systems, Inc
227	Mohammed Malatani	Saudi Arabian Airlines
228	Mohammed Sawaf	Saudi Arabian Airlines
229	Phil Hardy	Securicare International, Ltd
230	Andrew McKenzie-James	Securicare International, Ltd
231	Colin Pollard	Securicare International, Ltd
232	Abdul Rashid Bin Abdul Rahim	Singapore Airlines Ltd.
233	Natashe de Pooter	Skyservice Airlines, Inc.
234	Shawna George	Skyservice Airlines, Inc.
235	Carolyn Gordon	Skyservice Airlines, Inc.
236	Marlene Dippenaar	South African Airways
237	Linda Horn	South African Airways
238	Themba Nkenene	South African Airways
239	Linley Sharp	South African Airways
240	Mary Ann Ozanne	Southwest Airlines
241	Margarita Lopez Diaz	Spanair
242	Paz Sanchez Murcia	Spanair
243	Zurab Tchankotadze	Supervisory Council of Sakaeronavigatsia
244	Timothy Crowch	SwissAir
245	Ursula Heer	SwissAir
246	Antonio Oliveira	TAP Air Portugal
247	Maria Luisa Pereira	TAP Air Portugal
248	Christian Kaufer	TFC GmbH
249	Joan Strow	TWA
250	Jeanne Elliott	Teamsters Airline Div. NW
251	Susan Farmer	Teamsters Canada/Air BC
252	Johanna Stewart	Teamsters Canada/Air BC
253	Prateeb Sirisuwannakul	Thai Airways Int'l Public Co. Ltd.
254	Sooppaganya Chandvirach	Thai Airways International
255	Yu-Hui Chen	TransAsia Airways
256	Yi Tsou	TransAsia Airways

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
257	Rick van den Heuvel van Varik	Transavia Airlines
258	Kelly Babin	Transport Canada
259	Jackie Brederlow	Transport Canada
260	George Brown	Transport Canada
261	Chris Buick	Transport Canada
262	Shelley Chambers	Transport Canada
263	Carolina Cudahy	Transport Canada
264	Frances Wokes	Transport Canada
265	Barbara Goguen	Transport Canada
266	Louise Graham	Transport Canada
267	Susan Greene	Transport Canada
268	Diane Holmes	Transport Canada
269	Karen Smith	Transport Canada
270	Jennifer Johnston	Transport Canada
271	Tom Kingsbury	Transport Canada
272	Luc Mayne	Transport Canada
273	Jacques Servant	Transport Canada
274	Jean Soucy	Transport Canada
275	John Vincent	Transport Canada
276	Jim Burnett	Transportation Consultant
277	Vivan Lo	Uni Air
278	Nicholas Butcher	United Kingdom CAA
279	Vania Batisita	Varig Airlines
280	Silesia Heizer Macedo	Varig Airlines
281	Luiz Maia	Varig Airlines
282	Jacqueline Mundell	Virgin Atlantic Airways
283	Linda Porter	Virgin Atlantic Airways
284	Cindy Pawluk	WestJet Airlines
285	Lisa Puchala	WestJet Airlines
286	Jennifer Smith	WestJet Airlines
287	Elisabeth Banks	Wideroe's Flyveselskap ASA
288	Hege Berg	Wideroe's Flyveselskap ASA
289	Gerd-Tove Mathisen	Wideroe's Flyveselskap ASA
290	Nikolay Dolzhenkov	Yakovlev Design Bureau

Proceedings February 12-15, 2001 at Hilton, Costa Mesa

1	Erica Sheward	Castle Kitchens Exclusive Catering Ltd.
2	Linda Findlay	Excel Airways

Speaker at 18th Annual Int'l Aircraft Cabin Safety Symposium at Hilton, Costa Mesa

1	Lynn Elise Jacobs	
2	Mike Mass	ALPA
3	Lonny Glover	APFA

Registration List for
All People and Company Registrants

	Registrant Name	Registrant Address
4	Kathy Lord-Jones	APFA
5	Debbie Maitland-Roland	APFA
6	Diane Disley	Air 2000 Limited
7	Sue Graysmark	Air 2000 Limited
8	Sergio Sales	American Airlines
9	Kay Yong	Aviation Safety Council
10	Philip Baum	Aviation Security International
11	Fiona Pittard	Britannia Airways Ltd.
12	Debbie Sansome	Britannia Airways Ltd.
13	Terry King	British-Airways
14	Ann McDowall	British Airways
15	Elisabeth Woodhart	British Airways
16	Elaine Parker	Canadian Regional Airlines
17	Piya Forsythe	Cathy Pacific Airways Ltd
18	Barbara Lewis	Cathy Pacific Airways Ltd
19	Linda Cele	Civil Aviation Authority So. Africa
20	Dietrich Langhof	Condor Flugdienst GmbH
21	James Whinnery	FAA
22	Holly VanZant	FAA-NWA-CMO
23	Colette Hardy	FlightSafety International
24	Laurel Rogin	ISASI
25	Vladimir Kofman	Interstate Aviation Committee
26	Gregory Janelle	Janelle & Associates
27	David Streitwieser	MedAire, Inc.
28	Edgar Buehrle	Medifan
29	Frank Oberle	Medifan
30	John Hammerschmidt	NTSB
31	Roy Malloy	NTSB
32	Malcolm Bow	Peel Regional Police
33	Maria Barbara Aragon	Philippine Airlines
34	Francis Cabel	Philippine Airlines
35	Slavica Vlahovich	Radiation Protection Bureau of Health
36	Kate Murphy	Remote Diagnostic Technologies, Ltd
37	Les Bennett	Royal Military College of Canada
38	Brent Lewis	Royal Military College of Canada
39	Ron Schleede	SCSI
40	Phil Hardy	Securicare International, Ltd
41	Andrew McKenzie-James	Securicare International, Ltd
42	Themba Nkenene	South African Airways
43	Timothy Crowch	SwissAir
44	Frances Wokes	Transport Canada
45	Louise Graham	Transport Canada
46	Jacques Servant	Transport Canada

Registration List for
All People and Company Registrants

Registrant Name	Registrant Address

415 Total Number of Registrants For this Event

415 Total Number of Registrants

PARTICIPANT LIST
18th Annual International Cabin Safety Symposium Gen. Assemb
Hilton, Costa Mesa
February 12, 2001

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Cumulative Participant Count: 9

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Cabin Safety Inspector
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附錄三

國際航機客艙安全研討會議程

Southern California Safety Institute

PROGRAM OF THE 18TH ANNUAL
INTERNATIONAL AIRCRAFT CABIN SAFETY SYMPOSIUM

FEBRUARY 12 - 15, 2001

HILTON COSTA MESA HOTEL - COSTA MESA, CA

TABLE OF CONTENTS

Welcome to the Symposium!

As President of SCSI, I want to welcome you to the 18th Annual International Aircraft Cabin Safety Symposium. Now in its eighteenth year, this symposium was the first of its kind when established to focus on Aircraft Cabin Safety. I hope when you look at this program and see what is in store for you this year, you will be as excited about this Symposium as I am.

Each year the Symposium Executive Committee sets out with a goal of making the Symposium as informative, relevant and current as possible. In looking at this program, I believe we have met this goal.

General Assembly and Workshop speakers at this Symposium consist of the top representatives and the foremost authorities from almost every sector in the aviation industry. Topics range from regulatory to investigative and from research to first hand experiences. Included are papers from regulators, investigators, researchers, pilots, law enforcement, and cabin crew members who have dealt first hand with hijackings and unruly passengers. We are especially pleased with the international character of this years symposium, presenters, and delegates.

We give a special welcome to those of you joining us for the first time. We also extend a warm welcome to the delegates from the Commonwealth of Independent States who are joining this Symposium for the first time. The chance to hear and discuss the most current information on timely topics and to network with others is what makes this Symposium a tremendous resource and such a valuable experience.

Now I invite you to do your part. Have fun and learn! Take this opportunity to gain as much information as you can about what is important to you. Ask questions, take notes, and feel welcome to actively participate in all aspects of this Symposium. This is your Symposium. We want you to get the most out of it you can. If you have questions, please ask me, the SCSI staff, or any member of the Symposium Executive Committee.

On a final note, I would like to thank everyone who makes this Symposium what it is. This includes the Executive Committee for their advice and hard work, the exhibitors for displaying valuable aviation resources, the presenters for taking time to share their knowledge and experiences with us, and all of the delegates for their participation.

Sincerely,

Peter C. Gardiner, Ph.D.
Symposium Chairman and
President and CEO, SCSI

APPRECIATION

We wish to express our appreciation to this year's exhibitors and also to the Symposium Executive Committee members who so graciously volunteered to help with all aspects of the Symposium. Not only were the Committee members instrumental in identifying speakers and subjects of interest, but they also perform important roles and tasks during the symposium.

And, finally, we also thank you, the delegates, for your continued support of this Symposium. This is truly your forum. Without the contributions of time, effort, critiques, advice and attendance from the many organizations and individuals over the years, we would not be here.

DISCLAIMER

The sponsors of the International Aircraft Cabin Safety Symposium are administrators only and do not necessarily endorse any of the statements made or ideas presented at the Symposium.

SYMPOSIUM ADMINISTRATION

This annual Symposium is hosted and administered by the Southern California Safety Institute, Inc. (SCSI). The SCSI administration consists of:

Peter C. Gardiner	-	Symposium Chairman
Marlene Foulk	-	Symposium Manager
Amber Mortensen	-	Symposium Registrar
John Richardson	-	Video and Computers
Lionel Jenkins	-	Video and Computers
Brian Fisher	-	Audio
Jessica Richardson	-	Administration
Sharon Morphew	-	Administration
Gary Morphew	-	CD Proceedings
Christine Schmitz	-	Publications

SYMPOSIUM EXECUTIVE COMMITTEE

The International Aircraft Cabin Safety Symposium is guided year-to-year by an Executive Committee. Each member of the Executive Committee also helps to conduct the symposium while it is in session. The members of the Symposium Executive Committee are (in alphabetical order):

Gale Braden
Aviation Safety Consultant

Captain Peter Budd

Jim Burnett
Transportation Safety Consultant, former three-term Chairman, NTSB

Nicholas J. Butcher
Head, Flight Operations Cabin Safety Office, CAA UK

Barbara M. Dunn
Flight Attendant and Symposium Co-Founder

Jeanne M. Elliott
Director, Regulatory/Legislative Affairs, Northwest Airlines - Teamsters Local 2000

Toni Ketchell
Cabin Safety Specialist and Symposium Co-Founder

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Peterlyn Thomas
Cabin Safety Investigator, Australian Transport Safety Bureau

Frances M. Wokes
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Richard H. Wood
Aviation Safety Consultant President Emeritus, SCSI

Registration and General Information

Registration: Registration is in the hotel main lobby. The registration desk will be open for answering questions and administrative support Monday through Wednesday.

General Assembly Sessions: All General Assembly Sessions will be held in the main Symposium meeting room.

Exhibit Hall: The exhibit hall is next to the General Assembly meeting room.

Exhibit Hours: The exhibit room will be open at 0700 Monday through Wednesday. The exhibit hall will close at different times depending on symposium events that are scheduled for the exhibit hall. The exhibit hall will close Wednesday afternoon.

Breakfast and Lunch: Continental breakfasts will be served daily during the symposium. Buffet lunches will be served Monday, Tuesday, and Wednesday. These are all included in the Symposium registration fee.

Sunday Night Reception for First Time Attendees: There will be a reception Sunday night for all those who are attending the symposium for the first time. This reception will provide an opportunity to meet with members of the Symposium Executive Committee and to learn about the symposium and how it operates.

Monday Night Reception: There will be a hosted reception Monday night for all attendees. Music will be provided by The Mike Walker group.

Tuesday Night Banquet: The symposium banquet will be held on Tuesday night in the General Assembly room. Dress for the symposium banquet will be casual (this is California!). The banquet will be served buffet style. The menu for the banquet is listed in this program. There will be a cash bar for wine or other alcoholic beverages or soft drinks. Immediately prior to the banquet there will be strolling musicians and during the banquet the 66 Piece Orchestra from the Palos Verdes Peninsula High School will perform light classics and show tunes.

Tuesday Night "Live Karaoke": Following the banquet, there will be live Karaoke provided by Mike Walker at the piano. You are invited to grab a microphone and sing. Solos, duets, trios, and "choruses" are welcome.

Optional Video Tape Viewing: There will be an opportunity to play and view video tapes during the symposium. Check with Marlene to find the exact location for this event.

The Symposium Proceedings: This year the Symposium Proceedings have been distributed on CD as part of the registration fee. All papers presented, workshop abstracts, and powerpoint presentations available at the time of CD preparation have been included. If you would like to purchase a "hard copy" binder version of the symposium proceedings, you may do so. A limited number will be available Sunday for immediate purchase. Additional copies can be made available for purchase during the symposium or to be mailed out after the symposium.

Message Center: There will be a message board near the registration desk. If messages are received for those attending the symposium, they will be posted on the message board. If you are expecting messages, please make sure you check the message board.

Symposium Evaluation: Please fill out the symposium evaluation form. This is your symposium and we read every evaluation to see how we might improve it for you. Almost every year we make "fine tuning" adjustments in response to suggestions or comments received on the evaluations. We are particularly interested in any suggestions you have for topics at next year's symposium.

Award of Excellence in Cabin Safety: The Award of Excellence will not be presented this year.

Symposium Program Schedule

Sunday (11 February)

1545 Exhibitor Set Up (Pacific III and IV)
1700-2100 Registration (Main Lobby)
1830-1930 Hosted Reception for First Time Symposium Attendees
& Introduction of Members of the Symposium Executive Committee (The Bristols)

Monday (12 February)

0700-0830 Registration (Main Lobby)
0730-0830 Speaker Briefing (Pacific I and II)
0730-0830 Hosted Continental Breakfast in Exhibit Area (Pacific III and IV)
0830-0845 Symposium Opening (Pacific I and II)
0845-0915 Symposium Keynote Address:
"The Flight Safety Level in the CIS: Problems and Solutions." Dr. Vladimir D. Kofman
Chairman, ATAIC, Interstate Aviation Committee, Commonwealth of Independent States
0915-0930 Q&A

Panel: Cabin Safety Regulatory Roundtable
Moderator: Allan Tang, CAA Singapore
0930-1000 "Cabin Crew Licensing in South Africa" Linda Cele, CAA South Africa,
and Mr. Themba Nkenene, Cabin Safety Manager, SAA
1000-1030 Refreshment Break in Exhibit Hall
1030-1100 "Cabin Safety In Canada," Frances Wokes, Chief, Cabin Safety Standards, Transport Canada.
1100-1130 Holly Van Zant, FAA Inspector Program developed using ATOS system Safety ~~Program~~ Attribute
1130-1200 Q & A
1200-1300 Hosted buffet lunch in the Exhibit Hall

Panel: Occupational Health and Safety
Moderator: Joan Strow, TWA
1300-1330 "Transport Canada's Aviation Occupational Health and Safety Program" Louise Graham,
Aviation OHS Officer, Transport Canada, and Jacques D. Servant, Chief of Aviation OHS Program,
Transport Canada.
1330-1400 "Canadian Studies on Cosmic Radiation Exposure to Aircrew" Professor Brent Lewis
and Professor Les Bennett, Royal Military College of Canada
1400-1430 "Health Implications of the Canadian Studies on Cosmic Radiation Exposure of Aircrew"
Dr. Slavica Vlahovich, Medical Advisor, Radiation Protection Bureau
1430-1500 "Automated External Defibrillation at British Airways." Elisabeth G. Woodhart, Aviation Medical Training,
British Airways, UK.
1500-1530 Refreshment break: Exhibit Hall
1530-1600 "Occupational Health and Safety." Diane Disley, Safety Training Manager, and Sue Graysmark,
Air 2000, Ltd., UK
1600-1630 "Blood-borne Pathogens in the Cabin Environment." David Streitwieser, M.D., FACEP,
Medical Director, MedAire, Inc.
1630-1700 Q&A
1700-1800 Break
1800-1900 Hosted Reception for all attendees, Exhibit Hall

Tuesday (13 February)

0700-0800 Speaker Briefing (Pacific I and II)
0700-0800 Hosted Continental Breakfast in exhibitor area
0800-0820 Dr. Kay Yong, Managing Director, Aviation Safety Council, Taiwan (ROC)
0820- 0830 Q&A

Panel: Unruly Passengers
Moderator: Frances Wokes, Transport Canada

0830-0900 "Hijacking: From Dawsons Field to Kandahar" Phillip Baum, Editor, Aviation Security International, UK

0900-0930 "Police Response to Unruly Passengers" Sgt. Malcom Bow, Peel Regional Police, Canada.

0930-1000 "Challenging Behavior-- A Journey to the Breaking Point." Andrew McKenzie-James, Securicare International. UK.

1000-1030 Refreshment Break, Exhibit Hall

1030-1100 "Managing Conflict through People, not Conflict Management" Chris Goscomb, easyJet, UK

1100-1130 "Terror at 6,000 Feet," Barbara Aragon, Manager, Inflight Systems and Standards, and Francis Cabel, Training & Development Specialist, Philippine Airlines

1130-1200 Q&A

1200-1300 Hosted Buffet Lunch in the Exhibit Hall

1300-1415: Workshop Sessions (Emerald I and II)

1300-1415 **Workshop 1.** Responding to Challenging Behavior and Verbal Abuse: A look at best practice in procedures, strategies and crew responses to aggressive behavior. Backed up by information from the Institute of Conflict Management, which is a recently formed UK government endorsed organization, which is in the process of creating national standards in this subject. Chaired by Mr. Phil Hardy, Chairman of the Institute of Conflict Management.

1300-1415 **Workshop 2:** Crisis Communication-How to talk to your employees during a Crisis. Manager, supervisors and union representatives will find this workshop useful as a practical "How To" guide to communicating with employees during a crisis.
Moderator: Jeanne M. Elliott, Director-Regulatory/Legislative Affairs, Teamsters Airline Division Presented by: Greg Janelle, Janelle & Associates

1415-1530: Workshop Sessions

1415-1530 **Workshop 3:** New Approach to First Aid Training. Edgar Buehrle, MD, Emergency Physician, Medical Director, MEDIFAN, Institute for applied Emergency Medicine, Freiburg, Germany. Frank Oberle, M.D. Former Paramedic, Training, MEDIFAN. Limited to 24 people. Practical, hands on training using real aircraft seats provided by Aero Mock-Ups.

1415-1530 **Workshop 4:** International Roundtable. An opportunity to meet with the CIS delegation to discuss Cabin Safety. CIS Delegates and other symposium attendees. Moderator: Ron Schleede

1530-1600 *Refreshment Break (Exhibit Hall)*

1600-1715: Workshop Sessions

1600-1715 **Workshop 5:** In-Flight Telemedicine-A Practical Session to enable flight crew to assess for themselves how useful telemedicine can be in assisting them during in-flight medical incidents. This session will give delegates the chance to experience first had the use of telemedicine on board an aircraft. Kate Murphy, Executive Director, Remote Diagnostic Technologies Limited

1600-1715 **Workshop 6:** Personal Safety Responding to Physical Provocation. This workshop will practically involve the delegates in skills, which are currently proving extremely successful in raising the confidence levels of cabin crew in many UK Airlines. Chaired by Andrew McKenzie-James, Securicare International.

1300-1715: (Pacific I and II)
Combined Corporate and Regional Airline Cabin Safety Issues
Breakout Session
Moderators:
Elaine Parker, Canadian Regional Airline & Colette Hardy, Cabin Attendant Program Manager, Flight Safety International

Objective: Provide an opportunity to discuss Cabin issues that are specific to smaller aircraft, airline operators with route structures involving more and shorter segments, and non-commercial operations.

Outline: Panel speakers will give short presentations on issues confronting these operators to all attendees of the session. After a break the participants will be able to select one of the subject areas and go with that speaker for a smaller discussion session. After these discussion sessions all participants will reform in a general session and the cumulated ideas and solutions will be used to summarize and wrap up.

The subject areas and speakers are:

- Large airline procedures that just don't fit a small operator. Lynn Jacobs, flight attendant Dash 8 and Fokker F28 aircraft.
- Single flight attendant concerns. TBC
- Smaller airports, remote locations, ground support. TBC
- Part 91 Cabin staffing and training requirements. TBC

1715-1815 Video Viewing

1830-1930 No Host Reception, Exhibit Hall

1930-2030 Banquet (Casual Dress) (Pacific I and II)

2030-2300 After Banquet Entertainment and Sing-along / Live "Karaoke"

WEDNESDAY (14 FEBRUARY)

0700-0800 Speaker Briefing, Continental Breakfast in Exhibit Area
0800-0820 "Cabin Safety Research: Defining the Pathway to the Future" Dr. James Whinnery, Manager, Research, Aeromedical Division, FAA Civil Aeromedical Institute (CAMI)
0820-0830 Q & A

Panel: Evacuation Procedures and Training
Moderator: Nick Butcher, CAA UK
0830-0900 "Active Learning." Terry King, Manager, SEP Training, British Airways, UK
0900-0930 "Emergency Evacuation and the Cultural Barrier," Sergio Sales, American Airlines
0930-1000 "Improving Cockpit and Cabin Crew Coordination During Flight Safety Training," Captain Dietrich Langhof, Safety Coordinator, Condor Flugdienst, GmbH. Germany
1000-1030 Refreshment Break in the Exhibit Hall
1030-1100 "CRM in Cathay Pacific." Barbara Lewis, CRM Facilitator, In-flight Services Manager, and Piya Forsythe, CRM Facilitator, Senior Purser, Cathay Pacific Airways, Hong Kong
1100-1130 "Recent NTSB Evacuation Study", Co-Author Robert Molloy, Ph.D., Safety Studies Division, NTSB
1130-1200 Q&A
1200-1300 Hosted buffet lunch in Exhibit Hall

1300-1415: Workshop Sessions (Emerald I and II)

1300-1415 **Workshop 1.** Responding to Challenging Behavior and Verbal Abuse: A look at best practice in procedures, strategies and crew responses to aggressive behavior. Backed up by information from the Institute of Conflict Management, which is a recently formed UK government endorsed organization, which is in the process of creating national standards in this subject. Chaired by Mr. Phil Hardy, Chairman of the Institute of Conflict Management.
1300-1415 **Workshop 2:** Crisis Communication-How to talk to your employees during a Crisis. Manager, supervisors and union representatives will find this workshop useful as a practical "How To" guide to communicating with employees during a crisis. Moderator: Jeanne M. Elliott, Director-Regulatory/Legislative Affairs, Teamsters Airline Division Presented by: Greg Janelle, Janelle & Associates

1415-1530: Workshop Sessions

1415-1530 **Workshop 3:** New Approach to First Aid Training. Edgar Buehrle, MD, Emergency Physician, Medical Director, MEDIFAN, Institute for applied Emergency Medicine, Freiburg, Germany. Frank Oberle, M.D. Former Paramedic, Training, MEDIFAN. Limited to 24 participants. Hands on training using real aircraft seats provided by Aero Mock-Ups.
1415-1530 **Workshop 4:** International Roundtable. An opportunity to meet with the CIS delegation to discuss Cabin Safety. CIS Delegates and other symposium attendees. Moderator: Ron Schleede

1530-1600 *Refreshment Break in Foyer*

1600-1715: Workshop Sessions

1600-1715 **Workshop 5:** In-Flight Telemedicine-A Practical Session to enable flight crew to assess for themselves how useful telemedicine can be in assisting them during in-flight medical incidents. This session will give delegates the chance to experience first-hand the use of telemedicine on board an aircraft. Kate Murphy, Executive Director, Remote Diagnostic Technologies Limited
1600-1715 **Workshop 6:** Personal Safety Responding to Physical Provocation. This workshop will practically involve the delegates in skills, which are currently proving extremely successful in raising the confidence levels of cabin crew in many UK Airlines. Chaired by Andrew McKenzie-James, Securicare International.
1715+ Networking

THURSDAY (15 FEBRUARY)

0700-0800 Speaker Briefing in Pacific I and II, Continental Breakfast in Foyer

Panel: Lessons Learned from Accidents
Moderator: David Evans, Editorial Director, Aviation Group, Phillips International, Inc.
0800-0845 "Aircraft Crash Axe Performance Standard" and "The ALPA Activity in Cabin Safety," Captain Mike Maas, ALPA
0845-0915 "Britannia Airways Incident: The Cabin Manager's Account," Debbie Sansome, Cabin Crew

	Training Course Manager and Fiona Pittard, Cabin Manager, Britannia Airways.
0915-1000	"ISASI Investigation Guidelines" Laurel E. Rogin, ISASI, and Debbie M. Roland, APFA, and "Should it Happen to You." Kathy-Lord Jones, National Safety Coordinator and Lonny Glover, National Safety Committee, APFA.
1000-1030	Refreshment Break in Foyer
1030-1100	"The Lesson Learned from a Line Incident - What went right and why? SwissAir SR 283, August 11, 2000." Captain Timothy Crowch, SwissAir.
1100-1130	"Evacuation of Very Large Transport (VLTA)." Melissa J. Madden, AFA, AFL-CIO.
1130-1200	Q&A
1200	Closing Remarks: John Hammerschmidt, Board Member, NTSB
1220	Adjourn

Exhibitors

Transport Canada

We are Transport Canada. We are Civil Aviation's Cabin Safety and Aviation Occupational Health and Safety Teams. We are here for aviation safety. We recognize that aviation safety begins with effective communications. We are here to promote our shared commitment to enhancing aviation safety. That is why we are proud to share some of our safety publications and promotional items and give you an opportunity to order others on-line. Drop by, visit our booth, and let us know what you think are the most important Cabin Safety and Aviation Occupational Health and Safety issues.

Safety Training Systems, Inc.

Safety Training Systems, Inc. is a custom engineering and manufacturing company that for 22 years has provided the commercial airline community with a broad mix of hands-on training devices. Products include Cabin Emergency Evacuation Trainers, Cabin Service Trainers, Emergency Exit Trainers, Door Trainers and related mockups.

AirSep Corporation

Airlife oxygen concentrators providing therapeutic oxygen for airline passengers.

Flight Safety International

The world's largest aviation training company, FlightSafety International has extended its scope of services to include cabin attendant training as a compliment to pilot and technical training programs. The FAA approved Cabin Attendant Training Program provides the knowledge and skills necessary to handle any situation. FSI's training curriculum emphasizes hands on operationally oriented training in emergency equipment, procedures, drills and role-playing scenarios. All training takes place in the classroom, cabin simulator, cabin fire simulator and other training devices. Contact the Atlanta Learning Center for more details: 800 889 7916 or 678 365 2700

MedAire, Inc.

MedAire, Inc. is the leading provider of global emergency telemedicine for airlines that want to bring peace of mind to customers and employees isolated from their primary source of medical care. Medical resources include a direct hotline to board-certified emergency room physicians, flight crew training, medical kits and defibrillator solutions. MedAire, Inc. Expert care everywhere.

DME

DME Corporation specializes in aircraft interior advisory signs, emergency lighting, survival first aid equipment and LED lighting products as well as child restraint devices and other cabin related safety equipment.

CAMTECH

Camtech Industries Ltd. is a consortium that has the knowledge and experience to design, engineer and manufacture cabin crew training systems. Our custom designed systems are sophisticated yet robust, utilizing the highest standards of workmanship. We offer full customer support. The Camtech team is well experienced in aerospace engineering, electrical and electronic systems and aircraft manufacturing. Our facilities are located in Campbell River, BC, Canada.

EXHIBITORS

INTERNATIONAL SOS

International SOS, the world's largest medical assistance company and leading provider of remote site medical services, employs 3,000 dedicated professionals in our Alarm Centers, International Clinics and remote medical facilities on five continents. International SOS provides assistance to our clients and members wherever they might be, 24 hour a day.

SECURICARE INTERNATIONAL

How to handle disruptive behavior for ground staff, cabin crew and flight deck crew. Interactive CD Rom training (CBT) multi media. The latest, simplest and most effective disruptive passenger restraint equipment available.

RPTECHNOLOGIES/IJT HOLDING COMPANY

Cabin Crew Training systems for door operation, cabin safety/emergency evacuation and cabin service. RP Technologies/IJT Holding Company offers a complete service including training needs analysis, design, manufacture, installation and support. Its innovative, modular training simulators are customized to individual airline requirements and range from simple, floor standing door to a fully replicated cabin and flight deck on a motion system.

AVIATION SECURITY INTERNATIONAL

Publishers of Aviation Security International, the bi-monthly journal of airport and airline security addressing topics such as Hijack Management, Unruly Passenger Behavior, Airport Screening and Crew Security.

REMOTE DIAGNOSTICS TECHNOLOGY, LTD

Tempus 2000 - the first remote medical monitoring device specifically designed for non-expert use during any medical incident on-board aircraft. Tempus 2000 uses an in-built modem to send a patient's blood pressure, pulse rate, temperature, EKG and blood oxygen level via in-flight phone system to ground based doctors. It also includes integrated voice line and still camera.

ASAP SECURITY, LTD

Airline Safety And Protection (ASAP) is a leading provider of tailor-made specialist control, restrain and confrontation management courses specifically designed to provide airline cabin-crew with the skills required to avoid and diffuse confrontation and if necessary defend themselves, passengers and the aircraft from unruly passenger behavior. ASAP can provide in-flight security marshals to your airline on a permanent or emergency basis. ASAP in-flight security marshals are trained in all aspects of modern aviation security and protection including hijack management, passenger screening and profiling, control and restraint and first aid.

MEDTRONIC PHYSIO-CONTROL

Medtronic Physio-Control, the world's largest provider of external defibrillators to hospitals, emergency medical services, targeted responders and other trained providers who rely on our LIFEPAK products. We offer an unbeatable line of defibrillation devices - combining leading-edge technology with an unrivaled reputation for innovation, reliability and service.

EVAS WORLDWIDE

EVAS WorldWide provides the solution to the hazards of heavy and continuous smoke in the cockpit period. If a pilot is unable to see that pilot cannot fly the aircraft. The EVAS safety system is the only system of it's kind tested, certified and approved by the FAA.

MEDICAL CARE CONCEPTS

What is SafetyDerm®: SafetyDerm® is a specially formulated skin antiseptic hand wash containing a broad-spectrum antimicrobial ingredient in a lotion that forms a polymeric film on healthy skin unlike alcohol-based gels. SafetyDerm® is persistent. It significantly reduces the incidence of bacteria on skin between regular hand washings. SafetyDerm® is in full compliance with the FDA. Medical Care Concepts has evaluated and laboratory tested every step in the SafetyDerm® production process d has resulted in the most effective broad-spectrum antimicrobial product available of its kind.

Countries Represented At This Year's Symposium

Armenia
Australia
Austria
Belgium
Brazil
Canada
Curacao
Denmark
Finland
Germany
Ghana
Georgia
Hong Kong
Ireland
Jamaica
Japan
Korea
Luxembourg
Netherland Antilles
New Zealand
Norway
Philippines
Poland
Portugal
Russia
Saudi Arabia
Singapore
South Africa
Spain
Sweden
Switzerland
Taiwan
Thailand
The Netherlands
The Czech Republic
United Arab Emirates
United Kingdom
United States
Uzbekistan
West Indies

Companies & Organizations Represented At This Year's Symposium

AFA, AFL-CIO
AFA Hawaiian Airlines
Allied Pilots Association
ALPA
APFA
ASAP Protection
Aer Lingus
Aero Lloyd Airline
Aero Mock-Ups, Inc.
Air Transat
AirALM
Airbus Industries
AirSep Corporation
Air 2000 Ltd.
Alaska Airlines
All Nippon Airways
American Eagle
America West
American Airlines
Austrian Airlines
Australian Transportation Safety Board
Aviation and Aerospace Insurance Company, Russia
Aviation Safety Council, Taiwan
Aviation Security International
Belgian Air Force
Bombardier, Inc.
Braathens
Britannia Airways, Ltd.
British Airways
British Mediterranean Airways
CUPE Canadian Airline
Canadian Regional Airline
Cargolux Airlines International
China Airlines
China Airlines Employees Union
Civil Aviation, Armenia
CAA Ghana
CAA Jamaica
CAA Singapore
CAA South Africa
CAA UK
Castle Kitchens Executive Catering
Cathay Pacific
Condor Flugdienst GmbH
Czech Airlines
Department of National Defense, Canada
DME Corporation
DaimlerChrysler Aviation GmbH
Division for Flight Safety, Ministry of Transportation, Russia
Draiger Aerospace GmbH
EADS Airbus Germany
easyJet Airline Company Limited
EG&G Technical Services
Emirates Airline
EuroLOT, S.A.
Eva Air
EVAS Worldwide
Excel Airways
FAA Civil AeroMedical Institute
FAA
Far Eastern Air Transport Corp.
Finnair
First Air
Flight Attendants Association of Aust
Flight Safety International
Flight Safety Oversight, Republic of Uzbekistan
Flight Scientific Institute, Russia
Gulf Stream Aerospace
Health Canada
Interstate Aviation Committee, Commonwealth of Independent Sta
ISASI
Japan Air System Company
JALFIO-JAL
JMC Airlines
KLM Royal Dutch Airlines
KLM SPL/OX-SEP
Korean Air
Lauda Air
Luftfahrt Bundesamt Deutschland
Lufthansa Flight Training GmbH
Malmo Aviation
MedAire, Inc.
Medical Care Concepts, Inc.
Medifan
Medtronic Physio-Control
Ministry of Defense, UK
National Transportation Safety Board
North Island College
Peel Regional Police
Philippine Airlines
Phillips Alaska
RPTechnologies/IJT Holding Compa
Raytheon/NASA Ames
Remote Diagnostic Technologies, Lt
Rio-Sul Airlines
Royal Air Force, UK
Royal Airlines
Royal Military College of Canada
SAS
SAS Commuter
SAS Flight Academy
Saudia
SCSI
Safety Training Systems, Inc.
Securicare International, Ltd.
Singapore Airlines Ltd.
Skyservice Airlines, Inc.
South African Airways
Southwest Airlines
Spanair
Supervisory Council of Sakaeronaviga Georgia
Swissair
TAP Air Portugal
Teamsters Airline Div. NW
Thai Airways International Public Co,
TransAsia Airways
Transavia
Transport Canada
Uni Air
Varig Brazilian
Virgin Atlantic Airways
WestJet Airlines
Wideroe's Flyveselskap ASA
Yakovlev Design Bureau

Registered Delegates to the 18th Annual International Aircraft Cabin Safety Symposium from the Commonwealth of Independent States

Dr. Tatyana G. Anodina - Chairperson of the Interstate Aviation Committee (IAC)

Rudolf A. Teymourazov - Vice Chairman of the Interstate Aviation Commission (IAC), Commonwealth of Independent States

Dr. Vladimir D. Kofman - Chairman of the Air Transport Accident Investigation Commission (IAC)

Vladimir A. Rudakov - Head of the Supervision Division for Flight Safety of the Ministry of Transportation of Russia

Nikolay N. Dolzhenkov - the First Deputy of Director General of the Yakovlev Design Bureau

Viacheslav M. Bakaev - Director of the Flight Scientific Institute

Abdusatar Ernazarov - Deputy Head of the State Inspection of the Republic of Uzbekistan for Flight Safety Oversight;

Nikolay P. Ustimenko - President of the Joint-Stock Company of Aviation and Aerospace Insurance (AVICOS).

Zurab Tchankotadze – Chairman, Supervisory Council of Sakaeronavigatsia, Georgia

Araik Abgaryan -- First Deputy Director General of Civil Aviation of Armenia

Banquet Menu

The following is the menu for Tuesday night's Award Banquet.

Fresh Tossed Greens with Jalapeno Ranch and Cilantro Vinaigrette
Red Skin Potato Salad with Sun-dried Tomatoes
Creamy Cucumber Dill Salad
Marinated Mushrooms with Tomato Onion Salsa
Fresh Sliced Fruit and Seasonal Berries
Corn Bread Muffins and Assorted Rolls with Sweet Butter

Roast Prime Rib of Beef au Jus with Creamed Horseradish
(Carved to Order)
Breast of Chicken with Pasilla Chili BBQ Sauce and Cilantro Pesto
Shrimp Scampi
Fire Roasted Fresh Vegetables
Wild Rice
Roasted Redskin Potatoes
Garlic Mashed Potatoes

Mexican Flan, Rice pudding with Fresh Berries and
Kahlua Chocolate Cake

Freshly Brewed Regular, Decaffeinated Coffee,
Hot Herbal Tea and Iced Tea
A no host bar for wine or other alcoholic beverages or soft drinks will also be available.

During the Banquet the 66 Piece Orchestra from the Palos Verdes Peninsula High School will perform light classics and show tunes.

Immediately After dinner, there will be "live Karaoke" featuring Mike Walker at the Piano.

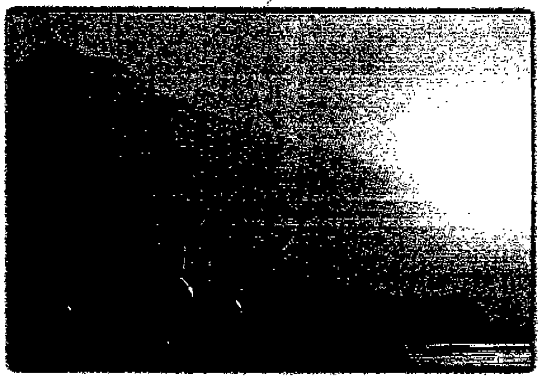
About the Sponsor

The Southern California Safety Institute (SCSI) is a private, non-affiliated aviation safety training company established in 1987. SCSI has trained over 5,000 aviation safety professionals. SCSI is the aviation safety trainer for the United States Air Force (and has been for the past seven years), and has trained professionals from the Belgian Air Staff, the Canadian Armed Forces, the Ecuadorian Air Force, Norwegian Ministry of Defense, Saudi Arabia Ministry of Defense, Republic of Singapore Army and Air Force, and the U.S. Navy and Coast Guard. SCSI has also developed two certificate programs -- Aviation Safety Management and Aircraft Accident Investigation -- which have attracted professionals from industry, commercial aviation, and governments.

SCSI accident investigation training features "hands on" experience in the world's largest aviation crash lab, the latest in Human Factors for accident investigators featuring a comprehensive human factors analysis and classification system (HFACS), and an Investigation Management Course. The Aviation Safety Management certificate features a series of courses built upon an operational risk management approach to safety. Any SCSI course can be taken as offered on the SCSI training schedule or it can be arranged with SCSI to bring the course to a location of your choosing. SCSI will also develop a new course to meet your training needs.

SCSI is the on-going sponsor of the Annual International Aircraft Cabin Safety Symposium and offers selected courses in Cabin Safety including courses in open water survival and all weather survival.

Lead by a management team and instructors who are experts in their fields, and guided by a Board of Advisors who are well and widely known aviation safety professionals, SCSI is now recognized as a global leader in the design, development, and delivery of excellence in aviation safety training.


SOUTHERN CALIFORNIA SAFETY INSTITUTE, INC.

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800.545.3766 (USA) - 310.517-8844 - 310.540.0532 FAX

WWW.SCSI-INC.COM

附錄四

國際航機客艙安全研討會論文發表書冊

Proceedings of the 18th Annual International Aircraft Cabin Safety Symposium

12 - 15 February 2001
Costa Mesa, California

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Papers Presented

"Canadian Studies on Cosmic Radiation Exposure
to Aircrew" Professor Brent Lewis and Professor Less Bennett
Royal Military College of Canada

"Health Implications of the Canadian Studies on Cosmic
Radiation Exposure of Aircrew" Dr. Slavica Vlahovich
Medical Advisor, Radiation Protection Bureau

"Automated External Defibrillation at British Airways"
Elisabeth G. Woodhart, Aviation Medical Training, British Airways,

"Occupational Health and Safety" Diane Disley,
Safety Training Manager and Sue Graysmark, Air 2000 Ltd.

"Blood-borne Pathogens in the Cabin Environment"
Dr. David Streitwieser, MedAire, Inc.

Dr. Kay Yong, Managing Director, Aviation Safety Council
Taiwan (ROC)

"Hijacking: From Dawsons Field to Kandahar" Phillip Baum
Editor, Aviation Security International, UK-No Paper

"Police Response to Unruly Passengers" Sgt. Malcolm Bow,
Peel Regional Police, Canada-No Paper

"Challenging Behavior-A Journey to the Breaking Point."
Andrew McKenzie-James, Securicare International, UK

"Managing Conflict through People, not Conflict Management"
Chris Goscomb, EasyJet, UK-No Paper

"Terror at 6,00 Feet", Barbara Aragon, Manager, Inflight Systems
and Standards and Francis Cabel, Philippine Airlines

"Cabin Safety Research" Defining the Pathway to the Future"
Dr. James Whinnery, Manager, Research,
Aeromedical Division, FAA, CAMI-No Paper

"Active Learning" Terry King, Manager,
SEP Training, British Airways, UK

"Emergency Evacuation and the Cultural Barrier"
Sergio Sales, American Airlines

"Improving Cockpit and Cabin Crew Coordination
During Flight Safety Training" Captain Dietrich Langhof
Safety Coordinator, Condor Flugdienst, Gmb, Germany

"CRM in Cathay Pacific" Barbara Lewis, CRM Facilitator
In-Flight Services Manager and Piya Forsythe, CRM Facilitor
Senior Purser, Cathay Pacific Airways

"Recent NTSB Evacuation Study", Co-Author Robert Molloy, Ph.D.
Safety Studies Division, NTSB-No Paper

"Aircraft Crash Axe Performance Standard" and
"The ALPA Activity in Cabin Safety"
Captain Mike Mass, ALPA-No Paper

"Britannia Airways Incident-The Cabin Manager's Account".
Debbie Sansome and Fiona Pittard, Britannia Airways

"Should it Happen to You" Kathy-Lord Jones,
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Lonny Glover, National Safety Committee, APFA

"ISASI Cabin Safety Investigation Guidelines" Laurel E. Rogin,
ISASI and Debbie M. Roland, APFA

"The Lessons Learned from a Line Incident"-
what went right and why? Swissair SR 283 – August 11, 2000
Captain Timothy Crowch

"Evacuation of Very Large Transport Aircraft"
Melissa J. Madden, AFA, AFL-CIO

Workshops Abstracts

Workshop1: Responding to Challenging Behavior and Verbal Abuse: Phil Hardy Institute of Conflict Management

Workshop 2: Crisis Communication-How to talk to your employees during a Crisis.
Greg Janelle, Janelle & Associates

Workshop 3: New Approach to First Aid Training
Dr. Edgar Buehrle, MD and Dr. Frank Oberle, Medifan

Workshop 4: International Roundtable. Ron Schleede

Workshop 5: In-Flight Telemedicine-A Practical Session. Kate Murphy, Remote Diagnostic Technologies Ltd.

Workshop 6: Personal Safety Responding to Physical Provocation. Andrew McKenzie-James

Corporate and Regional Aircraft Session

Elaine Parker, Canadian Regional Airline and Colette Hardy, Cabin Attendant Program Manager Flight Safety International

Welcome to the Symposium!

As President of SCSI, I want to welcome you to the 18th Annual International Aircraft Cabin Safety Symposium. Now in its eighteenth year, this symposium was the first of its kind when established to focus on Aircraft Cabin Safety. I hope when you look at this program and see what is in store for you this year, you will be as excited about this Symposium as I am.

Each year the Symposium Executive Committee sets out with a goal of making the Symposium as informative, relevant and current as possible. In looking at this program, I believe we have met this goal.

General Assembly and Workshop speakers at this Symposium consist of the top representatives and the foremost authorities from almost every sector in the aviation industry. Topics range from regulatory to investigative and from research to first hand experiences. Included are papers from regulators, investigators, researchers, pilots, law enforcement, and cabin crew members who have dealt first hand with hijackings and unruly passengers. We are especially pleased with the international character of this years symposium, presenters, and delegates.

We give a special welcome to those of you joining us for the first time. We also extend a warm welcome to the delegates from the Commonwealth of Independent States who are joining this Symposium for the first time. The chance to hear and discuss the most current information on timely topics and to network with others is what makes this Symposium a tremendous resource and such a valuable experience.

Now I invite you to do your part. Have fun and learn! Take this opportunity to gain as much information as you can about what is important to you. Ask questions, take notes, and feel welcome to actively participate in all aspects of this Symposium. This is your Symposium. We want you to get the most out of it you can. If you have questions, please ask me, the SCSI staff, or any member of the Symposium Executive Committee.

On a final note, I would like to thank everyone who makes this Symposium what it is. This includes the Executive Committee for their advice and hard work, the exhibitors for displaying valuable aviation resources, the presenters for taking time to share their knowledge and experiences with us, and all of the delegates for their participation.

Sincerely,

Peter C. Gardiner, Ph.D.
Symposium Chairman and
President and CEO, SCSI

APPRECIATION

We wish to express our appreciation to this year's exhibitors and also to the Symposium Executive Committee members who so graciously volunteered to help with all aspects of the Symposium. Not only were the Committee members instrumental in identifying speakers and subjects of interest, but they also perform important roles and tasks during the symposium.

And, finally, we also thank you, the delegates, for your continued support of this Symposium. This is truly your forum. Without the contributions of time, effort, critiques, advice and attendance from the many organizations and individuals over the years, we would not be here.

DISCLAIMER

The sponsors of the International Aircraft Cabin Safety Symposium are administrators only and do not necessarily endorse any of the statements made or ideas presented at the Symposium.

SYMPOSIUM ADMINISTRATION

This annual Symposium is hosted and administered by the Southern California Safety Institute, Inc. (SCSI). The SCSI administration consists of:

Peter C. Gardiner	-	Symposium Chairman
Marlene Foulk	-	Symposium Manager
Amber Mortensen	-	Symposium Registrar
John Richardson	-	Video and Computers
Lionel Jenkins	-	Video and Computers
Brian Fisher	-	Audio
Jessica Richardson	-	Administration
Sharon Morphew	-	Administration
Gary Morphew	-	CD Proceedings
Christine Schmitz	-	Publications

Symposium Executive Committee

The International Aircraft Cabin Safety Symposium is guided year-to-year by an Executive Committee. Each member of the Executive Committee also helps to conduct the symposium while it is in session. The members of the Symposium Executive Committee are (in alphabetical order):

Gale Braden
Aviation Safety Consultant

Captain Peter Budd

Jim Burnett
Transportation Safety Consultant, former three-term Chairman, NTSB

Nicholas J. Butcher
Head, Flight Operations Cabin Safety Office, CAA UK

Barbara M. Dunn
Flight Attendant and Symposium Co-Founder

Jeanne M. Elliott
Director, Regulatory/Legislative Affairs, Northwest Airlines - Teamsters Local 2000

Toni Ketchell
Cabin Safety Specialist and Symposium Co-Founder

Captain Dietrich Langhof
Safety Coordinator, Condor Flugdienst GmBH

Nora Marshall
Acting Chief, Survival Factors Division, NTSB

Akemi Nakajima
Manager and Instructor, In Flight Service Training, All Nippon Airways

Elaine Parker
Director of Safety, Canadian Regional Airlines, Ltd.

Joan H. Strow
Manager, Cabin Health and Safety TWA

Allan Tang
Flight Operations Manager, CAA Singapore

Peterlyn Thomas
Cabin Safety Investigator, Australian Transport Safety Bureau

Frances M. Wokes
Chief, Cabin Safety Standards, Transport Canada

Richard H. Wood
Aviation Safety Consultant President Emeritus, SCSI

Registration and General Information

Registration: Registration is in the hotel main lobby. The registration desk will be open for answering questions and administrative support Monday through Wednesday.

General Assembly Sessions: All General Assembly Sessions will be held in the main Symposium meeting room.

Exhibit Hall: The exhibit hall is next to the General Assembly meeting room.

Exhibit Hours: The exhibit room will be open at 0700 Monday through Wednesday. The exhibit hall will close at different times depending on symposium events that are scheduled for the exhibit hall. The exhibit hall will close Wednesday afternoon.

Breakfast and Lunch: Continental breakfasts will be served daily during the symposium. Buffet lunches will be served Monday, Tuesday, and Wednesday. These are all included in the Symposium registration fee.

Sunday Night Reception for First Time Attendees: There will be a reception Sunday night for all those who are attending the symposium for the first time. This reception will provide an opportunity to meet with members of the Symposium Executive Committee and to learn about the symposium and how it operates.

Monday Night Reception: There will be a hosted reception Monday night for all attendees. Music will be provided by The Mike Walker group.

Tuesday Night Banquet: The symposium banquet will be held on Tuesday night in the General Assembly room. Dress for the symposium banquet will be casual (this is California!). The banquet will be served buffet style. The menu for the banquet is listed in this program. There will be a cash bar for wine or other alcoholic beverages or soft drinks. Immediately prior to the banquet there will be strolling musicians and during the banquet the 66 Piece Orchestra from the Palos Verdes Peninsula High School will perform light classics and show tunes.

Tuesday Night "Live Karaoke": Following the banquet, there will be live Karaoke provided by Mike Walker at the piano. You are invited to grab a microphone and sing. Solos, duets, trios, and "choruses" are welcome.

Optional Video Tape Viewing: There will be an opportunity to play and view video tapes during the symposium. Check with Marlene to find the exact location for this event.

The Symposium Proceedings: This year the Symposium Proceedings have been distributed on CD as part of the registration fee. All papers presented, workshop abstracts, and powerpoint presentations available at the time of CD preparation have been included. If you would like to purchase a "hard copy" binder version of the symposium proceedings, you may do so. A limited number will be available Sunday for immediate purchase. Additional copies can be made available for purchase during the symposium or to be mailed out after the symposium.

Message Center: There will be a message board near the registration desk. If messages are received for those attending the symposium, they will be posted on the message board. If you are expecting messages, please make sure you check the message board.

Symposium Evaluation: Please fill out the symposium evaluation form. This is your symposium and we read every evaluation to see how we might improve it for you. Almost every year we make "fine tuning" adjustments in response to suggestions or comments received on the evaluations. We are particularly interested in any suggestions you have for topics at next year's symposium.

Award of Excellence in Cabin Safety: The Award of Excellence will not be presented this year.

Symposium Program Schedule

Sunday (11 February)

1545	Exhibitor Set Up (Pacific III and IV)
1700-2100	Registration (Main Lobby)
1830-1930	Hosted Reception for First Time Symposium Attendees & Introduction of Members of the Symposium Executive Committee (The Bristols)

Monday (12 February)

0700-0830	Registration (Main Lobby)
0730-0830	Speaker Briefing (Pacific I and II)
0730-0830	Hosted Continental Breakfast in Exhibit Area (Pacific III and IV)
0830-0845	Symposium Opening (Pacific I and II)
0845-0915	Symposium Keynote Address: "The Flight Safety Level in the CIS: Problems and Solutions." Dr. Vladimir D. Kofman Chairman, ATAIC, Interstate Aviation Committee, Commonwealth of Independent States
0915-0930	Q&A

Panel: Cabin Safety Regulatory Roundtable
Moderator: Allan Tang, CAA Singapore

0930-1000	"Cabin Crew Licensing in South Africa" Linda Cele, CAA South Africa, and Mr. Themba Nkenene, Cabin Safety Manager, SAA
1000-1030	Refreshment Break in Exhibit Hall
1030-1100	"Cabin Safety In Canada," Frances Wokes, Chief, Cabin Safety Standards, Transport Canada.
1100-1130	Holly Van Zant, FAA Inspector
1130-1200	Q & A
1200-1300	Hosted buffet lunch in the Exhibit Hall

Panel: Occupational Health and Safety
Moderator: Joan Strow, TWA

1300-1330	"Transport Canada's Aviation Occupational Health and Safety Program" Louise Graham, Aviation OHS Officer, Transport Canada, and Jacques D. Servant, Chief of Aviation OHS Program, Transport Canada.
1330-1400	"Canadian Studies on Cosmic Radiation Exposure to Aircrew" Professor Brent Lewis and Professor Les Bennett, Royal Military College of Canada
1400-1430	"Health Implications of the Canadian Studies on Cosmic Radiation Exposure of Aircrew" Dr. Slavica Vlahovich, Medical Advisor, Radiation Protection Bureau
1430-1500	"Automated External Defibrillation at British Airways." Elisabeth G. Woodhart, Aviation Medical Training, British Airways, UK.
1500-1530	Refreshment break: Exhibit Hall
1530-1600	"Occupational Health and Safety." Diane Disley, Safety Training Manager, and Sue Graysmark, Air 2000, Ltd., UK
1600-1630	"Blood-borne Pathogens in the Cabin Environment." David Streitwieser, M.D., FACEP, Medical Director, MedAire, Inc.
1630-1700	Q&A
1700-1800	Break
1800-1900	Hosted Reception for all attendees, Exhibit Hall

Tuesday (13 February)

0700-0800	Speaker Briefing (Pacific I and II)
0700-0800	Hosted Continental Breakfast in exhibitor area
0800-0820	Dr. Kay Yong, Managing Director, Aviation Safety Council, Taiwan (ROC)
0820- 0830	Q&A

Panel: Unruly Passengers
Moderator: Frances Wokes, Transport Canada

0830-0900	"Hijacking: From Dawsons Field to Kandahar" Phillip Baum, Editor, Aviation Security International, UK
0900-0930	"Police Response to Unruly Passengers" Sgt. Malcom Bow, Peel Regional Police, Canada.
0930-1000	"Challenging Behavior-- A Journey to the Breaking Point." Andrew McKenzie-James, Securicare International. UK.
1000-1030	Refreshment Break, Exhibit Hall
1030-1100	"Managing Conflict through People, not Conflict Management" Chris Goscomb, easyJet, UK
1100-1130	"Terror at 6,000 Feet," Barbara Aragon, Manager, Inflight Systems and Standards, and Francis Cabel, Training & Development Specialist, Philippine Airlines
1130-1200	Q&A
1200-1300	Hosted Buffet Lunch in the Exhibit Hall

1300-1415: Workshop Sessions (Emerald I and II)

1300-1415 **Workshop 1.** Responding to Challenging Behavior and Verbal Abuse: A look at best practice in procedures, strategies and crew responses to aggressive behavior. Backed up by information from the Institute of Conflict Management, which is a recently formed UK government endorsed organization, which is in the process of creating national standards in this subject. Chaired by Mr. Phil Hardy, Chairman of the Institute of Conflict Management.

1300-1415 **Workshop 2:** Crisis Communication-How to talk to your employees during a Crisis. Manager, supervisors and union representatives will find this workshop useful as a practical "How To" guide to communicating with employees during a crisis.
Moderator: Jeanne M. Elliott, Director-Regulatory/Legislative Affairs, Teamsters Airline Division Presented by: Greg Janelle, Janelle & Associates

1415-1530: Workshop Sessions

1415-1530 **Workshop 3:** New Approach to First Aid Training. Edgar Buehrle, MD, Emergency Physician, Medical Director, MEDIFAN, Institute for applied Emergency Medicine, Freiburg, Germany. Frank Oberle, M.D. Former Paramedic, Training, MEDIFAN. Limited to 24 people. Practical, hands on training using real aircraft seats provided by Aero Mock-Ups.

1415-1530 **Workshop 4:** International Roundtable. An opportunity to meet with the CIS delegation to discuss Cabin Safety. CIS Delegates and other symposium attendees. Moderator: Ron Schleede

1530-1600 *Refreshment Break (Exhibit Hall)*

1600-1715: Workshop Sessions

1600-1715 **Workshop 5:** In-Flight Telemedicine-A Practical Session to enable flight crew to assess for themselves how useful telemedicine can be in assisting them during in-flight medical incidents. This session will give delegates the chance to experience first had the use of telemedicine on board an aircraft. Kate Murphy, Executive Director, Remote Diagnostic Technologies Limited

1600-1715 **Workshop 6:** Personal Safety Responding to Physical Provocation. This workshop will practically involve the delegates in skills, which are currently proving extremely successful in raising the confidence levels of cabin crew in many UK Airlines. Chaired by Andrew McKenzie-James, Securicare International.

1300-1715: (Pacific I and II)
Combined Corporate and Regional Airline Cabin Safety Issues Breakout Session
Moderators:
Elaine Parker, Canadian Regional Airline & Colette Hardy, Cabin Attendant Program Manager, Flight Safety International

Objective: Provide an opportunity to discuss Cabin issues that are specific to smaller aircraft, airline operators with route structures involving more and shorter segments, and non-commercial operations.

Outline: Panel speakers will give short presentations on issues confronting these operators to all attendees of the session. After a break the participants will be able to select one of the subject areas and go with that speaker for a smaller discussion session. After these discussion sessions all participants will reform in a general session and the cumulated ideas and solutions will be used to summarize and wrap up.

The subject areas and speakers are:

Large airline procedures that just don't fit a small operator. Lynn Jacobs, flight attendant Dash 8 and Fokker F28 aircraft.

Single flight attendant concerns. TBC

Smaller airports, remote locations, ground support. TBC

Part 91 Cabin staffing and training requirements. TBC

1715-1815	Video Viewing
1830-1930	No Host Reception, Exhibit Hall
1930-2030	Banquet (Casual Dress) (Pacific I and II)
2030-2300	After Banquet Entertainment and Sing-along / Live "Karaoke"

Wednesday (14 February)

0700-0800 Speaker Briefing, Continental Breakfast in Exhibit Area

0800-0820 "Cabin Safety Research: Defining the Pathway to the Future" Dr. James Whinnery, Manager, Research, Aeromedical Division, FAA Civil Aeromedical Institute (CAMI)

0820-0830 Q & A

Panel: Evacuation Procedures and Training

Moderator: Nick Butcher, CAA UK

0830-0900 "Active Learning." Terry King, Manager, SEP Training, British Airways, UK

0900-0930 "Emergency Evacuation and the Cultural Barrier," Sergio Sales, American Airlines

0930-1000 "Improving Cockpit and Cabin Crew Coordination During Flight Safety Training," Captain Dietrich Langhof, Safety Coordinator, Condor Flugdienst, GmbH. Germany

1000-1030 Refreshment Break in the Exhibit Hall

1030-1100 "CRM in Cathay Pacific." Barbara Lewis, CRM Facilitator, In-flight Services Manager, and Piya Forsythe, CRM Facilitator, Senior Purser, Cathay Pacific Airways, Hong Kong

1100-1130 "Recent NTSB Evacuation Study", Co-Author Robert Molloy, Ph.D., Safety Studies Division, NTSB

1130-1200 Q&A

1200-1300 Hosted buffet lunch in Exhibit Hall

1300-1415: Workshop Sessions (Emerald I and II)

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1530-1600 *Refreshment Break in Foyer*

1600-1715: Workshop Sessions

1600-1715 **Workshop 5:** In-Flight Telemedicine-A Practical Session to enable flight crew to assess for themselves how useful telemedicine can be in assisting them during in-flight medical incidents. This session will give delegates the chance to experience first-hand the use of telemedicine on board an aircraft. Kate Murphy, Executive Director, Remote Diagnostic Technologies Limited

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1715+ Networking

Thursday (15 February)

0700-0800 Speaker Briefing in Pacific I and II, Continental Breakfast in Foyer

Panel: Lessons Learned from Accidents

Moderator: David Evans, Editorial Director, Aviation Group, Phillips International, Inc.

0800-0845 "Aircraft Crash Axe Performance Standard" and "The ALPA Activity in Cabin Safety," Captain Mike Maas, ALPA

0845-0915	"Britannia Airways Incident: The Cabin Manager's Account," Debbie Sansome, Cabin Crew Training Course Manager and Fiona Pittard, Cabin Manager, Britannia Airways.
0915-1000	"ISASI Investigation Guidelines" Laurel E. Rogin, ISASI, and Debbie M. Roland, APFA, and "Should it Happen to You." Kathy-Lord Jones, National Safety Coordinator and Lonny Glover, National Safety Committee, APFA.
1000-1030	Refreshment Break in Foyer
1030-1100	"The Lesson Learned from a Line Incident - What went right and why? SwissAir SR 283, August 11, 2000." Captain Timothy Crowch, SwissAir.
1100-1130	"Evacuation of Very Large Transport (VLTA)." Melissa J. Madden, AFA, AFL-CIO.
1130-1200	Q&A
1200	Closing Remarks: John Hammerschmidt, Board Member, NTSB
1220	Adjourn

EXHIBITORS

TRANSPORT CANADA

We are Transport Canada. We are Civil Aviation's Cabin Safety and Aviation Occupational Health and Safety Teams. We are here for aviation safety. We recognize that aviation safety begins with effective communications. We are here to promote our shared commitment to enhancing aviation safety. That is why we are proud to share some of our safety publications and promotional items and give you an opportunity to order others on-line. Drop by, visit our booth, and let us know what you think are the most important Cabin Safety and Aviation Occupational Health and Safety issues.

SAFETY TRAINING SYSTEMS, INC.

Safety Training Systems, Inc. is a custom engineering and manufacturing company that for 22 years has provided the commercial airline community with a broad mix of hands-on training devices. Products include Cabin Emergency Evacuation Trainers, Cabin Service Trainers, Emergency Exit Trainers, Door Trainers and related mockups.

AIRSEP CORPORATION

Airlife oxygen concentrators providing therapeutic oxygen for airline passengers.

FLIGHT SAFETY INTERNATIONAL

The world's largest aviation training company, FlightSafety International has extended its scope of services to include cabin attendant training as a compliment to pilot and technical training programs. The FAA approved Cabin Attendant Training Program provides the knowledge and skills necessary to handle any situation. FSI's training curriculum emphasizes hands on operationally oriented training in emergency equipment, procedures, drills and role-playing scenarios. All training takes place in the classroom, cabin simulator, cabin fire simulator and other training devices. Contact the Atlanta Learning Center for more details: 800 889 7916 or 678 365 2700

MEDAIRE, INC.

MedAire, Inc. is the leading provider of global emergency telemedicine for airlines that want to bring peace of mind to customers and employees isolated from their primary source of medical care. Medical resources include a direct hotline to board-certified emergency room physicians, flight crew training, medical kits and defibrillator solutions. MedAire, Inc. Expert care everywhere.

DME

DME Corporation specializes in aircraft interior advisory signs, emergency lighting, survival first aid equipment and LED lighting products as well as child restraint devices and other cabin related safety equipment.

CAMTECH

Camtech Industries Ltd. is a consortium that has the knowledge and experience to design, engineer and manufacture cabin crew training systems. Our custom designed systems are sophisticated yet robust, utilizing the highest standards of workmanship. We offer full customer support. The Camtech team is well experienced in aerospace engineering, electrical and electronic systems and aircraft manufacturing. Our facilities are located in Campbell River, BC, Canada.

EXHIBITORS

INTERNATIONAL SOS

International SOS, the world's largest medical assistance company and leading provider of remote site medical services, employs 3,000 dedicated professionals in our Alarm Centers, International Clinics and remote medical facilities on five continents. International SOS provides assistance to our clients and members wherever they might be, 24 hour a day.

SECURICARE INTERNATIONAL

How to handle disruptive behavior for ground staff, cabin crew and flight deck crew. Interactive CD Rom training (CBT) multi media. The latest, simplest and most effective disruptive passenger restraint equipment available.

RPTECHNOLOGIES/IJT HOLDING COMPANY

Cabin Crew Training systems for door operation, cabin safety/emergency evacuation and cabin service. RP Technologies/IJT Holding Company offers a complete service including training needs analysis, design, manufacture, installation and support. Its innovative, modular training simulators are customized to individual airline requirements and range from simple, floor standing door to a fully replicated cabin and flight deck on a motion system.

AVIATION SECURITY INTERNATIONAL

Publishers of Aviation Security International, the bi-monthly journal of airport and airline security addressing topics such as Hijack Management, Unruly Passenger Behavior, Airport Screening and Crew Security.

REMOTE DIAGNOSTICS TECHNOLOGY, LTD

Tempus 2000 - the first remote medical monitoring device specifically designed for non-expert use during any medical incident on-board aircraft. Tempus 2000 uses an in-built modem to send a patient's blood pressure, pulse rate, temperature, EKG and blood oxygen level via in-flight phone system to ground based doctors. It also includes integrated voice line and still camera.

ASAP SECURITY, LTD

Airline Safety And Protection (ASAP) is a leading provider of tailor-made specialist control, restrain and confrontation management courses specifically designed to provide airline cabin-crew with the skills required to avoid and diffuse confrontation and if necessary defend themselves, passengers and the aircraft from unruly passenger behavior. ASAP can provide in-flight security marshals to your airline on a permanent or emergency basis. ASAP in-flight security marshals are trained in all aspects of modern aviation security and protection including hijack management, passenger screening and profiling, control and restraint and first aid.

MEDTRONIC PHYSIO-CONTROL

Medtronic Physio-Control, the world's largest provider of external defibrillators to hospitals, emergency medical services, targeted responders and other trained providers who rely on our LIFEPAK products. We offer an unbeatable line of defibrillation devices - combining leading-edge technology with an unrivaled reputation for innovation, reliability and service.

EVAS WORLDWIDE

EVAS WorldWide provides the solution to the hazards of heavy and continuous smoke in the cockpit period. If a pilot is unable to see that pilot cannot fly the aircraft. The EVAS safety system is the only system of it's kind tested, certified and approved by the FAA.

MEDICAL CARE CONCEPTS

What is SafetyDerm®: SafetyDerm® is a specially formulated skin antiseptic hand wash containing a broad-spectrum antimicrobial ingredient in a lotion that forms a polymeric film on healthy skin unlike alcohol-based gels. SafetyDerm® is persistent. It significantly reduces the incidence of bacteria on skin between regular hand washings. SafetyDerm® is in full compliance with the FDA. Medical Care Concepts has evaluated and laboratory tested every step in the SafetyDerm® production process d has resulted in the most effective broad-spectrum antimicrobial product available of its kind.

Countries Represented At This Year's Symposium

Armenia
Australia
Austria
Belgium
Brazil
Canada
Curacao
Denmark
Finland
Germany
Ghana
Georgia
Hong Kong
Ireland
Jamaica
Japan
Korea
Luxembourg
Netherland Antilles
New Zealand
Norway
Philippines
Poland
Portugal
Russia
Saudi Arabia
Singapore
South Africa
Spain
Sweden
Switzerland
Taiwan
Thailand
The Netherlands
The Czech Republic
United Arab Emirates
United Kingdom
United States
Uzbekistan
West Indies

Companies & Organizations Represented At This Year's Symposium

AFA, AFL-CIO
AFA Hawaiian Airlines
Allied Pilots Association
ALPA
APFA
ASAP Protection
Aer Lingus
Aero Lloyd Airline
Aero Mock-Ups, Inc.
Air Transat
AirALM
Airbus Industries
AirSep Corporation
Air 2000 Ltd.
Alaska Airlines
All Nippon Airways
American Eagle
America West
American Airlines
Austrian Airlines
Australian Transportation Safety Board
Aviation and Aerospace Insurance Company, Russia
Aviation Safety Council, Taiwan
Aviation Security International
Belgian Air Force
Bombardier, Inc.
Braathens
Britannia Airways, Ltd.
British Airways
British Mediterranean Airways
CUPE Canadian Airline
Canadian Regional Airline
Cargolux Airlines International
China Airlines
China Airlines Employees Union
Civil Aviation, Armenia
CAA Ghana
CAA Jamaica
CAA Singapore
CAA South Africa
CAA UK
Castle Kitchens Executive Catering
Cathay Pacific
Condor Flugdienst GmbH
Czech Airlines
Department of National Defense, Canada
DME Corporation
DaimlerChrysler Aviation GmbH
Division for Flight Safety, Ministry of Transportation, Russia
Draiger Aerospace GmbH
EADS Airbus Germany
easyJet Airline Company Limited
EG&G Technical Services
Emirates Airline
EuroLOT, S.A.
Eva Air
EVAS Worldwide
Excel Airways
FAA Civil AeroMedical Institute
FAA
Far Eastern Air Transport Corp.
Finnair
First Air
Flight Attendants Association of Australia
Flight Safety International
Flight Safety Oversight, Republic of Uzbekis...
Flight Scientific Institute, Russia
Gulf Stream Aerospace
Health Canada
Interstate Aviation Committee, Commonwealth Independent States
ISASI
Japan Air System Company
JALFIO-JAL
JMC Airlines
KLM Royal Dutch Airlines
KLM SPL/OX-SEP
Korean Air
Lauda Air
Luftfahrt Bundesamt Deutschland
Lufthansa Flight Training GmbH
Malmo Aviation
MedAire, Inc.
Medical Care Concepts, Inc.
Medifan
Medtronic Physio-Control
Ministry of Defense, UK
National Transportation Safety Board (US)
North Island College
Peel Regional Police
Philippine Airlines
Phillips Alaska
RPTechnologies/IJT Holding Company
Raytheon/NASA Ames
Remote Diagnostic Technologies, Ltd.
Rio-Sul Airlines
Royal Air Force, UK
Royal Airlines
Royal Military College of Canada
SAS
SAS Commuter
SAS Flight Academy
Saudia
SCSI
Safety Training Systems, Inc.
Securicare International, Ltd.
Singapore Airlines Ltd.
Skyservice Airlines, Inc.
South African Airways
Southwest Airlines
Spanair
Supervisory Council of Sakaeronavigatsia, Geor...
Swissair
TAP Air Portugal
Teamsters Airline Div. NW
Thai Airways International Public Co, Ltd.
TransAsia Airways
Transavia
Transport Canada
Uni Air
Varig Brazilian
Virgin Atlantic Airways
WestJet Airlines
Wideroe's Flyveselskap ASA
Yakovlev Design Bureau

Registered Delegates to the 18th Annual International Aircraft Cabin Safety Symposium from the Commonwealth of Independent States

Dr. Tatyana G. Anodina - Chairperson of the Interstate Aviation Committee (IAC)

Rudolf A. Teymourazov - Vice Chairman of the Interstate Aviation Commission (IAC), Commonwealth of Independent States

Dr. Vladimir D. Kofman - Chairman of the Air Transport Accident Investigation Commission (IAC)

Vladimir A. Rudakov - Head of the Supervision Division for Flight Safety of the Ministry of Transportation of Russia

Nikolay N. Dolzhenkov - the First Deputy of Director General of the Yakovlev Design Bureau

Viacheslav M. Bakaev - Director of the Flight Scientific Institute

Abdusatar Ernazarov - Deputy Head of the State Inspection of the Republic of Uzbekistan for Flight Safety Oversight;

Nikolay P. Ustimenko - President of the Joint-Stock Company of Aviation and Aerospace Insurance (AVICOS).

Zurab Tchankotadze – Chairman, Supervisory Council of Sakaeronavigatsia, Georgia

Araik Abgaryan -- First Deputy Director General of Civil Aviation of Armenia

Banquet Menu

The following is the menu for Tuesday night's Award Banquet.

Fresh Tossed Greens with Jalapeno Ranch and Cilantro Vinaigrette
Red Skin Potato Salad with Sun-dried Tomatoes
Creamy Cucumber Dill Salad
Marinated Mushrooms with Tomato Onion Salsa
Fresh Sliced Fruit and Seasonal Berries
Corn Bread Muffins and Assorted Rolls with Sweet Butter

Roast Prime Rib of Beef au Jus with Creamed Horseradish
(Carved to Order)
Breast of Chicken with Pasilla Chili BBQ Sauce and Cilantro Pesto
Shrimp Scampi
Fire Roasted Fresh Vegetables
Wild Rice
Roasted Redskin Potatoes
Garlic Mashed Potatoes

Mexican Flan, Rice pudding with Fresh Berries and
Kahlua Chocolate Cake

Freshly Brewed Regular, Decaffeinated Coffee,
Hot Herbal Tea and Iced Tea
A no host bar for wine or other alcoholic beverages or soft drinks will also be available.

During the Banquet the 66 Piece Orchestra from the Palos Verdes Peninsula High School will perform light classics and show tunes.

Immediately After dinner, there will be "live Karaoke" featuring Mike Walker at the Piano.

About the Sponsor

The Southern California Safety Institute (SCSI) is a private, non-affiliated aviation safety training company established in 1987. SCSI has trained over 5,000 aviation safety professionals. SCSI is the aviation safety trainer for the United States Air Force (and has been for the past seven years), and has trained professionals from the Belgian Air Staff, the Canadian Armed Forces, the Ecuadorian Air Force, Norwegian Ministry of Defense, Saudi Arabia Ministry of Defense, Republic of Singapore Army and Air Force, and the U.S. Navy and Coast Guard. SCSI has also developed two certificate programs -- Aviation Safety Management and Aircraft Accident Investigation – which have attracted professionals from industry, commercial aviation, and governments.

SCSI accident investigation training features "hands on" experience in the world's largest aviation crash lab, the latest in Human Factors for accident investigators featuring a comprehensive human factors analysis and classification system (HFACS), and an Investigation Management Course. The Aviation Safety Management certificate features a series of courses built upon an operational risk management approach to safety. Any SCSI course can be taken as offered on the SCSI training schedule or it can be arranged with SCSI to bring the course to a location of your choosing. SCSI will also develop a new course to meet your training needs.

SCSI is the on-going sponsor of the Annual International Aircraft Cabin Safety Symposium and offers selected courses in Cabin Safety including courses in open water survival and all weather survival.

Lead by a management team and instructors who are experts in their fields, and guided by a Board of Advisors who are well and widely known aviation safety professionals, SCSI is now recognized as a global leader in the design, development, and delivery of excellence in aviation safety training.

INTERSTATE AVIATION COMMITTEE

Flight Safety in CIS

Inter view

of

Interstate Aviation Committee

(Real situation. Facts. Problems and Solutions)

1

Member-States of the Agreement on Civil Aviation&Use of Air Space

Parties to the Agreement

Republic of Azerbaijan	Republic of Moldova
Republic of Armenia	Russian Federation
Republic of Belarus	Republic of Tajikistan
Republic of Georgia	Turkmenistan
Republic of Kazakhstan	Republic of Uzbekistan
Republic of Kyrgyzstan	Ukraine

Observers

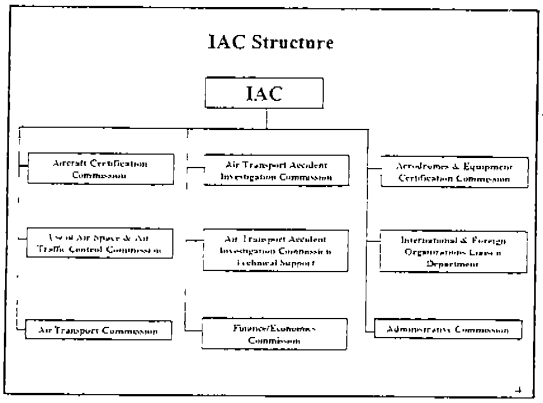
Republic of Latvia	Republic of Estonia

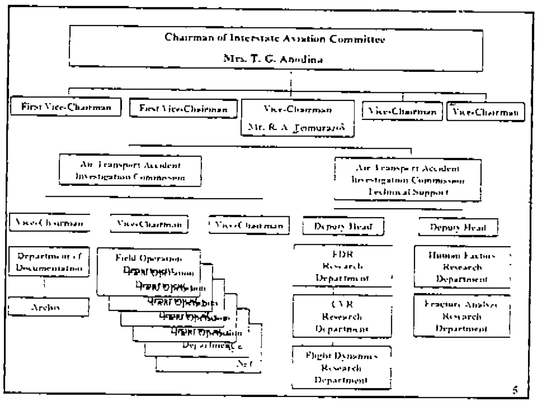
2

IAC Areas of Operation and Major Functions

- *development of rules and procedures for civil aviation and personnel Functions*
- *Aircraft and aircraft manufactures certification system*
- *Investigation of aircraft accidents*
- *Coordination of ATC system and facilities development*
- *Coordination in the areas of air space use and ATC*

3

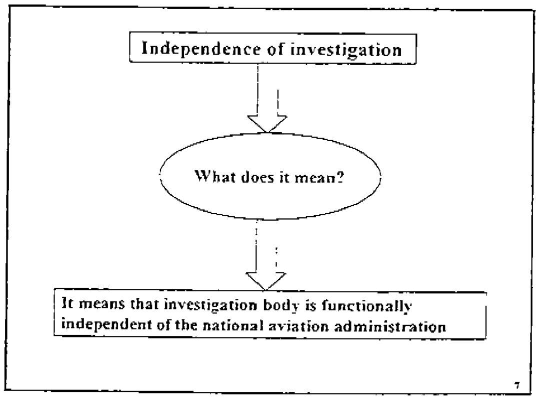




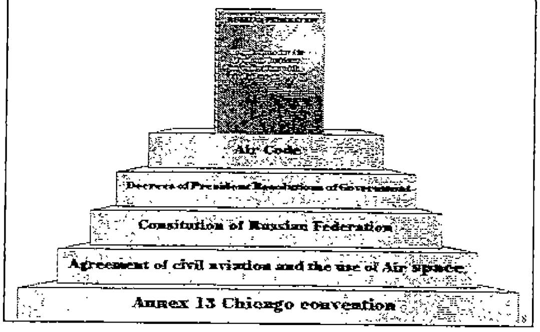
ATAIC Functions

- *Development rules (investigation, classification, registration)*
- *Investigation of aircraft accidents*
- *Participation in investigations abroad*
- *Maintaining an integrated data Base*
- *Flight Dynamic problems*
- *Operational Factors problems*
- *Human Factors problems*
- *Training of investigators*

6



Regulation for Air Accident/Incident Investigation



8

EVENTS

Accidents	Serious incidents	Incidents
Investigations are conducted by IAC	*Investigations are conducted by state authority of civil aviation*	

9

Accident investigation

Investigation in charge - IAC

Participants:
- *state authority of civil aviation*
- *state of manufacture/design*
- *state of operations*
- *state of registry*
- *state, whose citizens died in Accident*

10

Accident Abroad

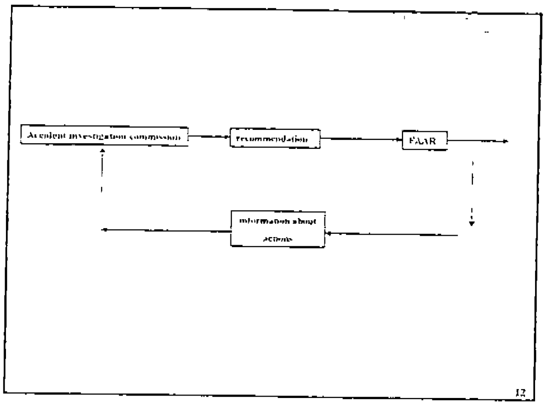
Russian build aircraft

Accredited representative designed by IAC
Advisers – state authority of civil aviation aviation industry

Non-Russian build aircraft

Accredited representative designed by IAC
Advisers – aviation industry

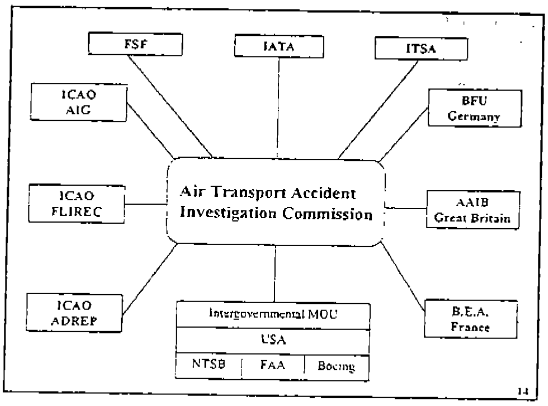
11



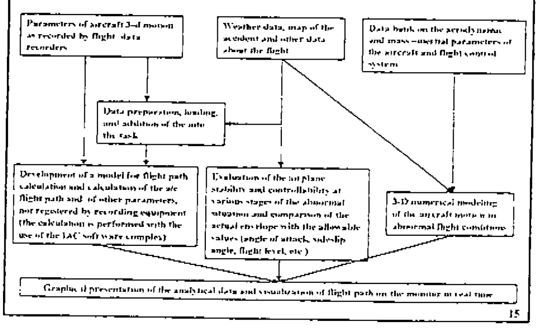
Joint work on aviation accident/incident investigation

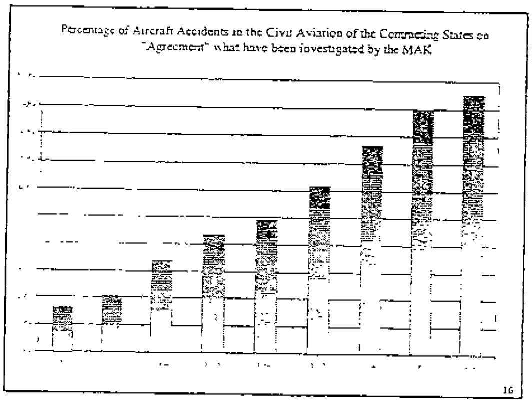
Angola	Guinea	Norway
Canada	Haiti	Republic of South Africa
China	India	Somalia
Cuba	Indonesia	Sri Lanka
Ecuador	Iran	Turkey
England	Italy	United Arab Emirates
Equatorial Guinea	Liberia	USA
Ethiopia	Macedonia	Venezuela
France	Malaysia	Vietnam
Germany	Mozambique	Yugoslavia
Greece	Nigeria	Zaire

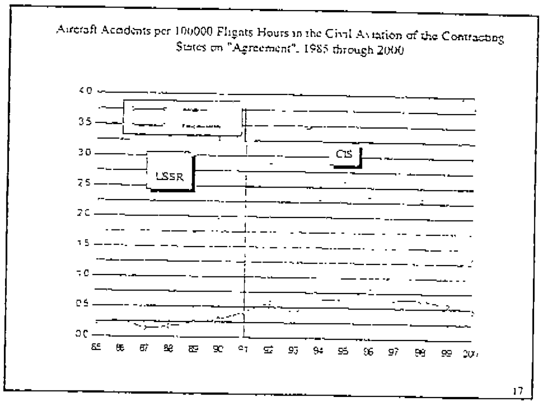
13

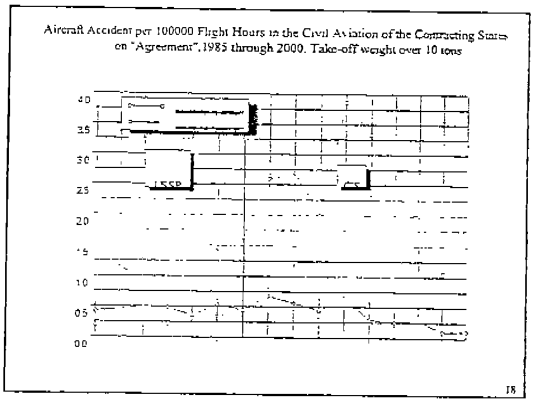


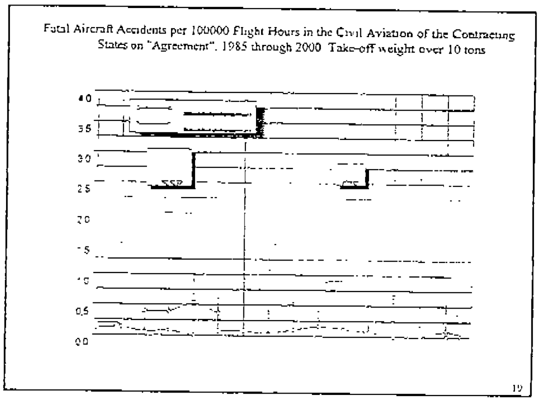
Flight path analysis the techniques of comprehensive modeling



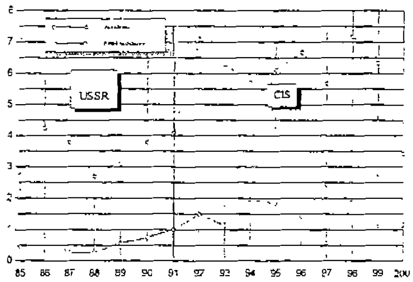

Percentage of Aircraft Accidents in the Civil Aviation of the Contracting States on "Agreement" what have been investigated by the MAK
16


Aircraft Accidents per 100000 Flights Hours in the Civil Aviation of the Contracting States on "Agreement", 1985 through 2000
CIS
17


Aircraft Accident per 100000 Flight Hours in the Civil Aviation of the Contracting States on "Agreement", 1985 through 2000. Take-off weight over 10 tons
18

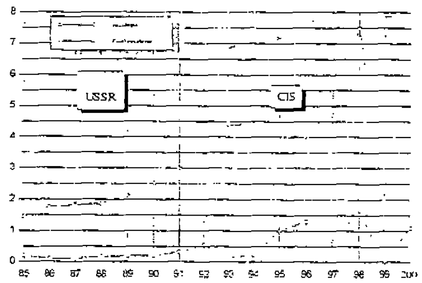

Fatal Aircraft Accidents per 100000 Flight Hours in the Civil Aviation of the Contracting States on "Agreement", 1985 through 2000 Take-off weight over 10 tons

Aircraft Accidents and Fatal Aircraft Accidents per 100000 Flight Hours in the Civil Aviation of the Contracting States on "Agreement",1985 through 2000. Helicopters



20

Aircraft Accidents and Fatal Accidents per 100000 Flight Hours in the Civil Aviation of the Contracting States on "Agreement". 1985 through 2000. Light Airplanes



21

Over-Loaded Aircraft Accidents

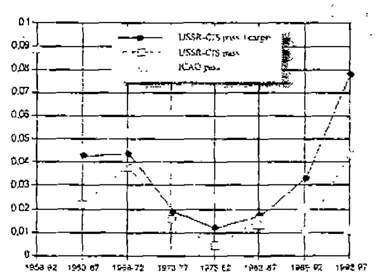
One of the most frequent casual factor
1992-2000

Accidents - 23
Fatal accidents – 11
Fatalities – 225

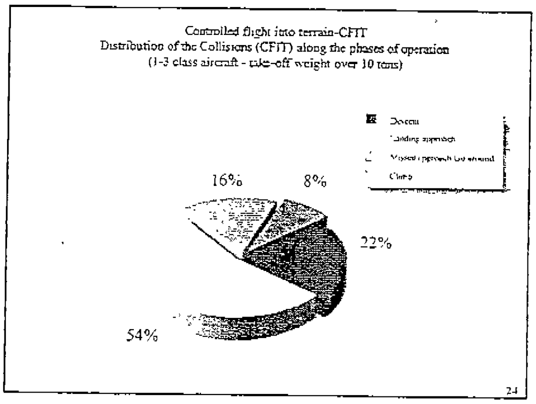
More than 90% accidents were occurred in non-scheduled and cargo flights.
More than 40 safety recommendation/

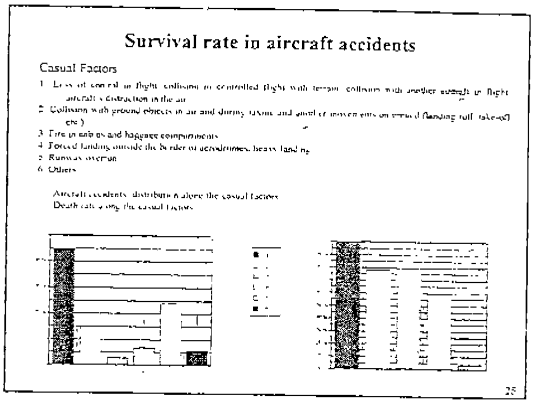
22

Controlled flight into terrain-CFIT
Number of Collisions (CFIT) over 100,000 Hours of Flight
(1-3 class aircraft - take-off weight over 10 tons. During 5-years periods from 1958 to 1997)



23


Controlled flight into terrain-CFIT
Distribution of the Collisions (CFIT) along the phases of operation
(1-3 class aircraft - take-off weight over 10 tons)
Descent
Landing approach
16%
8%
22%
54%
24


Survival rate in aircraft accidents
Casual Factors
4 Forced landing outside the border of aerodromes
6 Others
25

Dr. Vladimir D. KOFMAN is the Chairman of the Air Transport Accident Investigation Commission (ATAIC), which is part of the Interstate Aviation Committee, located in Moscow, Russia.

The Interstate Aviation Committee represents broad aviation safety interests of the 12 countries of the Commonwealth of Independent States (CIS), including Russia. The ATAIC is responsible for the investigation of civil aircraft accidents that occur in the CIS Member States, including accidents involving foreign operated and foreign manufactured aircraft. The ATAIC also represents the CIS Member States, in accordance with Annex 13 to the Convention on International Civil Aviation, for accidents involving CIS operated and manufactured aircraft that occur in other countries.

Dr. Kofman has been working in the field of aircraft accident investigation and prevention since 1970.

For 17 years he worked in the State Scientific and Research Institute of Civil Aviation of the former USSR as Chief of the Investigation Department. Later, he became the Deputy Director of the Scientific Research Laboratory of the GOSAVIANADZOR, which was, until 1991, the independent civil aircraft accident investigation agency of the USSR. When the Interstate Aviation Committee was formed in 1992, he was appointed as the Deputy Chairman of the Commission on Aircraft Accident Investigation.

Dr. Kofman is a member of the International Society of Air Safety Investigators (ISASI), and a member of the joint Russian-American Working Group on Accident Investigation and Prevention that was formed in 1989.

Dr. Kofman received his education at the Moscow Civil Aviation Academy. He is a senior research worker and lecturer on technical issues related to aviation safety. He as authored of over 100 scientific works, and has presented technical papers at many international conferences.

Cabin Crew Licensing in South Africa

Linda Cele and
Themba Nkenene
South Africa

Introduction

This paper aims to describe the paths, processes and procedures we followed when licensing of cabin crew was initially introduced in South Africa. SA CAA has been on the ground for about 2 years. Previously there was no licensing procedure. All matters relating the cabin crew were not of priority within the Directorate Civil Aviation (DCA). As a result there was no focus on cabin crew until the new government came into power in 1994 then there was transformation of the Civil Aviation Movement. This was when there was consideration for matters relating to standards and regulation relating to cabin crew matters. The South African Civil Aviation Authority officially came into operation in 1998 as a para-statal organization and its **vision is to promote global excellence in aviation through partnerships.** The Mission of CAA is:

> "Ensuring an aviation industry, which is safe, high quality, compliant with international standards and which contributes to the economic and social growth and sustainability of the Southern African Region".

The mission stated above is self-descriptive and resonates with the need to develop licensing procedures for the cabin crew.

Guiding Principles and Values for the Process

Professionalism
Integration
Integrity
Non-discrimination
Effectiveness and efficiency
Consistency
Transparency
Collaboration and partnership
Accountability
Equity
Quality assurance

The objectives

The objective of licensing was to:

1. introduce professionalism within the cabin crew system. Professionalism should be understood to entail recognition of skills and competencies and being licensed to operate as crew members.
2. set standards and possibly change the mindset of the public. The tendency has been that of seeing the cabin crew as a low ranking labor force with no particular skill other than that of serving tea and coffee on board. The objective of the exercise was to change this view so that the cabin crew begins to be seen as part of skilled manpower with specific competencies instead of viewing them as stewards and waitresses.
3. align the skill and competency of the cabin crew.
4. bridge the gap between the two groups of pilots and cabin crew into one entity.
5. incorporate the crew to be part of the technical staff and thereby being recognized as skilled labor, thereby ensuring close partnership in ensuring safety and quality service.
6. ensure that the defined syllabi for and qualifications of cabin crew members are aligned with standards of the National Qualification Forum[1], which aims at increasing global competitiveness.

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[1] The National Qualifications Framework is policy that was adopted by the South African Government in 1994 that sets boundaries and guidelines which provide a vision and a philosophical base and an organizational structure for construction of a qualifications system for every sector.

Standards

The vision to introduce licensing of cabin crew had been held since the establishment of the CAA. Therefore one of the activities of the Cabin Safety Department of the (CAA) was first to establish the standards for licensing the Cabin Crew.

The following process was undertaken:

➡ As a starting point ICAO became our minimum point of reference to look at .We undertook a benchmarking exercise and looked at the standards, regulations and recommendations of organizations such as FAA, CAA, TRANSPORT CANADA and JAA. This was a big initiative and it required a serious buy-in of the local aviation industry. Transforming the cabin crew system meant that the local aviation industry will be monitored and no ad-hoc procedures would be applied willy-nilly by any organization without scrutiny and without having to account to the CAA. This process also meant that for once cabin crew members would have certain rights which they were denied before and therefore would have to be treated more fairly.

➡ The next stage was that of developing standards. In order to achieve that it was important to get the expert guidance. Through the dedication and exert input of an organization called Aviation Industry Education and Training Board (AIETB) under the leadership of Mrs. Gaiyle Newby, a stakeholders forum was born. It was important to establish the stakeholder forum in order to establish consensus for the process, commitment as well as stake-holder buy-in for the process. The forum worked on the standards for two full years. The standard that were developed by this forum are now in full use. The AIETB was disbanded after the completion of the task.

➡ The forum was made of representatives from the following partners in the civil aviation industry: CAA, all local passenger airlines, safety practitioners, safety instructors, labor organizations, aviation medical organizations, dangerous goods licensed specialists, aviation security specialists, South African Airforce and other interested parties. A chairperson who was supported by a secretariat was appointed to lead and direct the meetings.

➡ Problems and challenges faced in the process were ernomous, ranging from differing visions, disagreements about principles, power dynamics, etc. Each time we reached a bottleneck a neutral facilitator was invited to workshop the deadlock topic .It took almost two years to come up with a final product. I believe it was worth it.

Cabin Crew Profile

You will agree with me that cabin crew are critical to the safety of aviation. The ICAO's definition states that: **safety is a critical function which covers activities where uncorrected**

errors have an immediate and a negative effect. The profile of the cabin crew is important and is influenced by factors such as culture, taste of the organization, age and educational background. In light of this we believe medical fitness cannot be ignored. At the moment we are faced with the problem of HIV and the inoculation of crew. I want to believe that this is an international dilemma that will have to be discussed at that level and benchmarked against the best practice to be implemented.

Instructor Standards

Presently we do not have any legislated standard for the instructors. We are planning on developing these with the relevant stakeholders so that we come up with the best standards that will be compulsory to all operators who will be the custodians of this exercise. They must submit their training manuals for reviewing to our offices. What we have presently in this regard is legislation[2] for the safekeeping of training records.

In order to safeguard our training standards we adopted ICAO annexure 6 that requires that all cabin crew follow an initial and annual recurrent training program, which must be approved, by the state. The training program should include at least the following elements:

- Emergency procedures
- Use of emergency and life saving equipment
- Effects of lack of oxygen and associated procedures
- Crew coordination
- Dangerous goods training as required by Annex18
- Aviation security as required by Annex 17
- Human performance and limitations. (We have not initiated this at the moment, the regulation and standard has since been submitted to Parliament for approval. We are hoping that this will be implemented by mid-year.)

This is the requirement that is also being followed in South Africa.

Training facilities

We also looked at training facilities, ideally a basic classroom should have as a minimum: audio/video systems, ventilation, adequate lighting, and space, emergency equipment approved fire-fighting facility, ditching facility and the aircraft cabin as per ICAO minimum standard requirements.

If the cashflow is good, a simulator is also a convenient facility and computer based training is another option.

Some of our operators are looking at using computer-based training for Dangerous Goods and Avmed. Our large operators (like SAA) are doing joint training of flight deck and cabin crew training in the simulators which is proving to be working so far because it's bridging the gap

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[2] Flight Crew Member Training Records Part 121.

between the crews and help each crew member to appreciate the other crew members responsibility in-flight.

Aircraft Safety Equipment

In this area we were guided by the ICAO training standard. I should point out here that there is currently no legislation on the use of defibrillators, because most of our operators are doing short sectors.

Scheduling

In 1995, ICAO adopted a standard that requires States to establish flight time and duty time limitations for cabin crew. The computerization of crew scheduling by operators helps us to monitor crew FDP easily during audits. Also the labor movement helps in monitoring the scheduling of cabin crew. We have regulation in place that compels operators not to roster cabin crew after sickness until they are certified by an AME (Aviation Medical Expert) as fit to fly.

Senior Cabin Crew Member

We believe that the senior cabin crewmember is a critical member in the safety chain, (of course after the Pilot in Command.) Operators are required to establish procedures for the selection of the senior cabin crew. We are currently looking at the syllabus and training of this cabin crew. South African Airways has developed a good syllabus and I am informed that they have also established a forum for their senior crew members called the Purser's forum.

The benefits

We now have a high caliber of cabin crew, as a result of having regulations and standards in place. We have confidence in sure the quality of training through our audit checks and training inspections and as a result we do not have a problem with freelance crew at this stage. It becomes the responsibility of the operator to see to it that freelance crew is adequately trained and current when they are employing them.

Licensing has helped in the reduction of incompetence, short training on safety and concentrating more on service issues.

It forces the operators to focus now on safety officer's role: making the role of cabin crew to be more defined in aviation safety. It has helped to increase the **responsibility** in the cabin crew side that safety comes first service second otherwise they might loose their license if they compromise safety.

Quality Control System

The way that we ensure that Quality Control Systems are maintained is by surveillance inspections, safety inspections and audits. From the operator's side they must be able to show the reports of their internal audits and check flights on cabin crew. They must show us the mechanism that they have in place to deal with non -compliance or rectification. They must appoint a responsible person as their quality control manager.

Conclusion

Transforming the system for cabin crewmembers is a challenging but very important process. What we have demonstrated through our activities is the fact that it can be done if there is stakeholder commitment and participation. It is also possible to achieve much if there is political-commitment. From our experience thus far, it is evident that licensing has empowered our cabin crew in realizing that they are not just boys and girls at the back but part of technical and safety officers onboard the aircraft. It has made life easier for us in ensuring quality control systems and safe operation because all the stakeholders are aware of the regulations and standards that they must comply with and these standards are in line with international requirements.

THANK YOU.

Resume of Themba Nkenene

I began my carrier in 1977 in Nigeria at Nigeria Civil Aviation School .I Graduated in Aircraft Maintenance training school. Joined Air Zimbabwe in 1980 as an Aircraft Maintenance Engineer. Appointed Flight safety officer Air Zimbabwe in 1989. Joined South African Airways in 1994 as manager Safety and Emergency Procedures Training School.

LINDA CELE – RESUME

I started my aviation career in 1994 as a flight attendant with South African Airways. Two year later I was appointed as a Purser(InCharge Flight Attendant later Cabin Crew Liason Officer where I was looking at the well-being of flight attendants at SAA.

I joined South African Civil Aviation in 1999 as a Cabin Safety Inspector my main responsibilities at the moment are drafting of cabin safety regulations and standards, evaluation of training and the general cabin safety regulatory duties.

Cabin Safety in Canada

Frances M. Wokes
Chief, Cabin Safety Standards, Transport Canada
Ottawa, Ontario, Canada

Abstract

Cabin safety is an essential component of flight safety. The term "cabin safety" has many different meanings to different people. It has been used interchangeably with "passenger safety", or often used to describe the function of a cabin crewmember or flight attendant. This paper defines cabin safety and offers a description of how Canada exercises its regulatory oversight responsibilities with respect to Cabin Safety.

Objective

Current cabin safety issues in no particular order of priority include: medical emergencies, emergency medical equipment, unruly or disruptive passengers, child restraint devices, smoking, carry-on baggage, common language, cross cultural issues, portable passenger electronic devices, evacuation tests, exit design, reporting relationships of cabin crew within companies, absence of a clear link with the flight operations department, unattended cabins, flight crew safety training, aging passengers, crew exchanges, mega mergers, perception of conflict between safety and service, evacuation initiation, cabin crew training philosophy and passenger education to name just a few. Each of these issues is worthy of a paper on its own merit. Therefore, given the time limitations, the focus of this paper will be to describe what cabin safety is, what cabin safety is not, and provide an overview of how Canada exercises its regulatory oversight responsibilities in this area.

Aviation Safety

What is aviation safety and how is it achieved? The aviation safety focus has historically been on the reduction or elimination of accidents. The aircraft manufacturers have taken steps to ensure redundancy in systems to prevent accidents from occurring. Regulatory bodies have established defenses against failure in the system to prevent accidents from occurring. Investigating agencies seek to determine the cause of accidents and disseminate the lessons learned from the accident with a view to preventing further similar accidents.

Field, Not a Function

Cabin safety is a field, not a function. For most of the positions in the aviation business, the job title describes a function. Maintenance describes a function; you can maintain an aircraft. Pilot describes a function; you can pilot an aircraft. Licensing describes a function; you can license a person or license an aircraft. You can't Cabin Safety someone or something. Cabin safety is a field that covers a wide range of areas such as: Crashworthiness, Operations, Human Factors, Psychology, Bio-dynamics, Physiology, Ergonomics, and Pedagogy, to name only a few. As a field, rather than a function, the lines of demarcation of responsibility or interest are nebulous and overlap into many areas in the aviation industry. There are cabin safety implications in all aspects of the aviation industry including aircraft design, configuration, operations, inflight service, maintenance, flight crew training etc.

Working Definition

Our working definition at this point in time is: "Cabin Safety is a field that reduces fatalities and injuries resulting from an accident and provides a safe environment for passengers and crew members in and around an aircraft, prior to and during the boarding and deplaning phases, while the aircraft is on the airport apron with people on board, and during the operation of the aircraft. It includes the aircraft cabin, it's exits, it's configuration, it's furnishings, it's equipment, and it's people".

Goal of Cabin Safety

Our goal is not to prevent accidents, that is the domain of others. Our goal is totally unlike our partners, the engineers who build and approve the designs of aircraft, the aircraft maintenance engineers who ensure the maintenance of the aircraft, the pilots and civil aviation operations inspectors who ensure the safe operation of the aircraft; their goal is to prevent the accident from ever occurring.

Our goal is to reduce the effects of an accident and to increase the survival rate. That goal assumes a failure in the system. It assumes that someone or something is going to get hurt.

The Accident Picture

When examining the accident statistics over the last 12 years, a number of conclusions can be drawn.

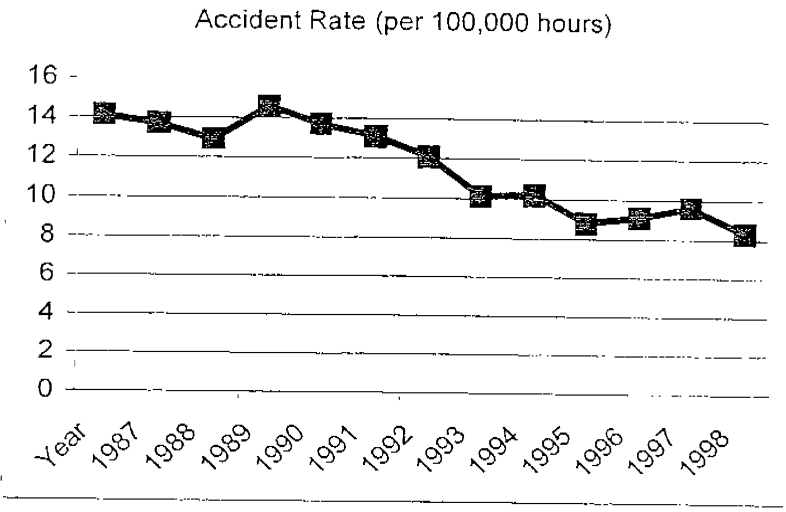
Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of Accidents	472	497	482	498	453	434	422	380	390	342	356	384	340
Fatal accidents	55	50	60	47	64	47	48	33	52	44	36	31	35
Fatalities	103	95	155	91	373	80	102	80	107	71	77	83	67
Serious Injuries	72	52	90	60	55	64	63	36	54	38	69	48	43
Accident Rate	14.1	13.7	12.9	14.6	13.7	13.1	12.1	10.1	10.2	8.8	9.1	9.6	8.3

Table 1

Source: Transportation Safety Board of Canada

The number of accidents (table 1) [i,ii] is on a downward trend. Even more encouraging is the knowledge that while the numbers of accidents have been decreasing, the total enplaned and deplaned revenue passengers at all Canadian reporting airports grew at an average rate of two percent per year from 1982 (49.4 million passengers) to 1994 (65.8 million passengers).[iii] That increase in passengers resulted in an increase in the flying hours, which has led to the decrease in the accident rate (figure 1).

Figure 1



The traffic is forecast to continue to grow by 3.5% to 2009 (104 million passengers).[iv]

Aviation Safety Relationship

A reduction in the number of accidents, an elimination of accidents, and a reduction in the accident rate are important and necessary. However, as an industry, we do ourselves a disservice by using a reduction in accidents as the sole criterion of aviation safety. Sooner or later, the laws of gravity intersect with the laws of averages and the inevitable accident occurs.

There is little those in the cabin safety field can do to help achieve that stated aviation safety goal of a reduction or elimination of accidents. Granted, there are some instances where the actions of the cabin crew member can help or could have helped to prevent an accident, but these instances are isolated and on a day to day basis, there is little that those involved with cabin safety can do to prevent accidents. What we can do is decrease the number of fatalities and increase the number of survivors. In order to do that effectively, we need information and data. We need to know specifically what worked and what didn't work in an accident.

Each time there is an accident, if the focus of the investigation effort is solely on accident cause and prevention, we run the risk of losing the opportunity to disseminate information and valuable lessons learned on what went right as well as what needs to be improved. That can be prevented by incorporating the Cabin Safety checklist developed by the International Society of Air Safety Investigators into the investigation process and by providing access to the information gained during the course of the investigation.

Scope of aviation industry in Canada

Before describing the Cabin Safety Inspection Program we have in Canada, I should give you an idea of the scope of the aviation industry in Canada. Being the size of country that it is (9,970,610 km^2), it is considered to be a fairly large country, and as a result of it's size and the vast distances between communities, supports a sizable aviation industry. From a geographic perspective, the majority of the country is not accessible by any means other than air travel.

As a result, Canada has the second largest civil aviation aircraft fleet in the world with 28,110 registered aircraft. Of these, 22% are commercial aircraft, 77% are private and the remaining 1% are state aircraft. There are approximately 2229 domestic and foreign air operators who operate in Canadian airspace. Of the domestic operators, 52 operate aircraft of a size that require cabin crewmembers.

There are approximately 63,236 pilot licenses or permits, and 12,000 flight attendants.

The Cabin Safety Inspection Program

History

Transport Canada has long recognized the importance of cabin safety; beginning with the first inspector dedicated solely to the cabin safety specialty who was hired in the mid sixties and continuing through to today with a mature cabin safety inspection program that includes 23 Civil Aviation Safety Inspectors – Cabin Safety (hereafter referred to as Cabin Safety Inspectors) across the country in five geographic regions, two operational divisions headquartered in Ottawa and the standards division in Ottawa.

Background of inspectors

Our Cabin Safety Inspectors are not cabin crew or flight attendants nor are they required to be. They do not operate flights as a crewmember, nor would that be necessary in order to fulfill their responsibilities. This is unlike the Civil Aviation Safety Inspector – Flight Operations (Pilot Inspectors) who maintain pilot qualifications and actively fly aircraft as a flight crew member either on Transport Canada's own fleet of aircraft or through an industry exchange or line flying program.

The entry requirements for a Cabin Safety Inspector include a requirement for operational and management experience with an air operator in addition to extensive knowledge and skills in their specialty area. While that operational experience is that of a cabin crew or cabin crew supervisor, that is only one small facet of the required experience. Experience in Training Program Development, Design of Procedures, Instructional Techniques, and Supervision are essential requirements for a credible inspector. Once hired, the inspector undergoes extensive additional formal training as well as guided on the job training and is generally not fully qualified for a period of two years.

Role of inspectors

The Cabin Safety Inspectors are also not Cabin Crew Inspectors or Flight Attendant Inspectors. The field of Cabin Safety encompasses safety and emergency equipment carried on board an aircraft, on-board safety procedures as well as crewmember safety and emergency procedures and training. Passengers are carried in all manner of aircraft, including those that do not have a cabin crewmember as a part of the crew. Yet, at the same time, those passengers must still be transported safely and have a right to cabin safety. The safety and emergency equipment that is carried on board is just as essential on aircraft that do not require cabin crew. Crewmember safety and emergency procedures training is just as necessary on aircraft that do not carry cabin crew. Cabin crew adherence to on-board safety and emergency procedures is just one aspect of Cabin Safety. The purpose of our inspections is to isolate system faults, not individual crewmember inadequacies, and as such, we incorporate a systems approach to the way in which we conduct business.

Perception vs. reality of CSI

One of the more common perceptions of a Cabin Safety Inspector is that of a person with a clipboard in hand, walking up and down the aisles of an Boeing 747 or Airbus 340 winging it's way to a tropical clime, checking to see if the cabin crew have done the job the way it's described in their cabin crew manuals.

The reality of their work is far less appealing. When not in the office, reviewing documentation for approval and all the other tasks associated with working for a government, because passengers are carried on a wide range of aircraft, you can just as easily find a Cabin Safety Inspector bundled up in parka, windpants, and arctic boots, on a windswept ramp, dodging airplanes & baggage carts, breathing airplane exhaust, climbing a ladder to get into an ancient DC-3 loaded with cargo down one side and passengers on the other or slogging through mud to get to a float base, while swatting at the hordes of blackflies & mosquitoes. Their work finds them in hangars, in cargo bays of airplanes with main deck cargo compartments checking the fire fighting equipment, and in a wide variety of airplanes, helicopters and even (on the very odd occasion) hot air balloons.

Components of program

There are essentially three components of the Cabin Safety Inspection Program; Regulation, Certification and Inspection and these three components are the shared responsibility of the standards division and the operational regions and divisions.

Role of Standards

The role of the Standards Division is to develop and maintain regulations, standards, policy and guidance and to provide functional direction to the operational divisions and regions. The scope of the program includes safety and emergency equipment on board any aircraft that carry passengers, passenger safety related operational procedures for all types of aircraft, cabin crew training and cabin crew manuals. The Standards Inspectors draft regulations, standards, guidance material, establish policies and procedures, establish the inspection criteria, conduct Quality Assurance Reviews, participate in National Audits and National certifications for standardization purposes, provide cabin safety input into the certification of aircraft and associated master minimum equipment lists including supplements and provides operational support to the regions. The Standards Division deals with the aviation industry such as associations and unions on a national basis rather than the individual operators.

Role of Operations

The operational Cabin Safety Inspectors are charged with implementing the program. They conduct the necessary reviews and provide oversight during the certification of air operators and private operators, they do the necessary regulatory approvals, conduct the inspections to ensure the oversight activity, participate in regional and national audits and deal with the individual air operators. The operational Cabin Safety Inspectors are employed in the five geographic regions as well as the Foreign Inspection Division and the Airline Inspection Division headquartered in Ottawa.

Certification

During the certification of air operators, they review and approve safety and emergency procedures outlined in flight operations manuals, the air operator's minimum equipment lists, the safety and emergency equipment on board aircraft, the cabin crew manuals and cabin crew training programs including cabin emergency evacuation trainers.

Oversight

Once an air operator is certificated, oversight is achieved through a continuous inspection program consisting of aircraft inspections, pre-flight (ramp) inspections, in-flight cabin inspections, training inspections, audits, and base inspections.

Priority of inspections

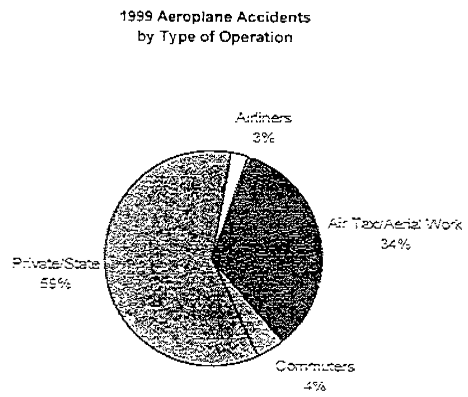
In recognition of finite resources we have, using risk management principles, focused our inspection efforts where the greatest benefit can be achieved.

The greatest numbers of passengers are carried on commercial aircraft in the airline category (CAR 705) and therefore that is our top priority. That is not to say that the other categories are ignored. The next priority is for private (corporate) operations that, due to the aircraft size (such as Boeing 727, HS-748, Convair 580, Dash 8), require cabin crew on board, followed by those commuter category operations which voluntarily choose to put a crew member on board their 19 seat or less aircraft for passengers. Other commuter operations follow, with the air taxi operations (up to 9 passenger seats) next and flight training units and general aviation last.

Where are we going next?

To date, the focus of our efforts has been in those areas where the greatest number of passengers are carried. We currently have a stable or decreasing accident rate with an increasing number of passengers being carried by the operators of smaller aircraft. Figure 2 provides a graphic representation of where the accidents are occurring. When you examine the accident picture by type of operation, you find that the majority of accidents are in private (general aviation) or state aircraft followed by the air taxi/aerial work category. Given that the majority of accidents – and thus the majority of injuries and fatalities are in these two general areas, we have undertaken a project to attempt to improve cabin safety in those cabins that are unattended.

Figure 2



The Unattended Cabins Project will provide that part of the aviation industry with training and tools to help educate and assist in these areas. This project will involve the development of inspection criteria and training specifically targeted to the air taxi and commuter size aircraft.

Closing

Let me close by emphasizing that while the reduction of accidents is a goal we as an industry must strive for, at the same time we must not lose sight of the other goal of reducing fatalities and injuries. Every one of us in the aviation business comes to work every day to try to make a safe system safer. We try to prevent crashes and try to minimize the results if there is a crash because it's our people on those airplanes and our reputations as safety professionals that suffer every time passengers die or are injured when there was something one of us could have done to prevent it.

Passengers put their trust in the aviation system. They trust that their crewmembers will not crash the aircraft, but if they do crash the aircraft, they trust their crewmembers will get them out of it safely. Passengers put a lot of trust in the system and each time that trust is betrayed, it reflects badly on our entire industry.

I started out by saying that I wanted to describe what Cabin Safety is, and to describe the cabin safety program in Canada. I have probably spent more time describing what cabin safety is not, but what I hope you leave with is the knowledge of what cabin safety is and how it fits into your part of the aviation industry be it regulator, researcher, manufacturer, investigator, or operator.

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[i] Transportation Safety Board of Canada, TSB Statistical Summary, Aviation Occurrences 1998

[ii] Transportation Safety Board of Canada, Preliminary Statistics, Air, 1999

[iii] Statistics Canada, Air Carrier Traffic at Canadian Airports

[iv] Transport Canada, Challenge 98, (1997)

Biography

Frances M. Wokes

Frances Wokes is the Chief, Cabin Safety Standards in the Commercial & Business Aviation Branch of Civil Aviation with Transport Canada.

Ms. Wokes has an aviation career spanning twenty seven years, the last sixteen years of which have been with Transport Canada Aviation in various Passenger Safety or Cabin Safety positions in both Ottawa and the Western Region.

Prior to joining Transport Canada in 1984, she was employed in the aviation industry as a Chief Flight Attendant in the private sector working for smaller regional type airlines in northern Manitoba where she was responsible for the management of all aspects of in-flight service including, but not limited to: the design and production of Flight Attendant Manuals, cabin safety and service procedures, Flight Attendant Training Courses, Flight Crew Emergency Procedures Courses including Physiology Training, and recruitment and supervision of the air carrier's flight attendants.

Ms. Wokes is a member of the Minister's Advisory Committee on Accessible Transportation, the Canadian Society of Air Safety Investigators, the Society of Automotive Engineer's S-9 Cabin Safety Provisions Committee and the Executive Advisory Board of the International Aircraft Cabin Safety Symposium of the Southern California Safety Institute.

AVIATION OCCUPATIONAL HEALTH AND SAFETY IN TRANSPORT CANADA

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A-OHS web site: **www.tc.gc.ca/aviation/osh-sst**

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1. Purpose

The purpose of this paper is to discuss a subject that is not often addressed as a distinct topic at aviation safety symposiums, that is, the value of a comprehensive Occupational Health and Safety Program for crew members working on-board aircraft. By contrast, we often discuss topics such as emergency planning procedures, aircraft maintenance and the like. On the other hand, major topics such as air rage may be on the agenda of the day, but others such as sanitation, potable water and personal protective equipment are not recognized as belonging to the vast realm of Occupational Health and Safety.

There is however a common thread with all these concerns that are raised from time to time by flight attendants or pilots or that make the front page of a national newspaper or aviation magazine. The common thread to these concerns is a comprehensive Occupational Health and Safety Program.

This paper will provide you with an overview of the Aviation Occupational Health and Safety Program in Transport Canada with the hope that it may contribute to enhance aviation safety within your own country or organization wherever it may be. Having said that though, we do not pretend that the Canadian experience is the panacea to all crew members' concerns. However, over the years, it has revealed itself to be a worthwhile tool by which both employers and employees are able to enhance employee health and safety on-board aircraft.

2. Background

Human Resources Development Canada-Labour Program is the federal government department in Canada that deals with labour related matters in the federal jurisdiction. It was established in the late 1890s under a different name and has been continually restructured to meet the changing needs of the Canadian workforce. Labour Canada was created after the Postmaster-General read an article urging the improvement of the wretched conditions in sweatshops. As a result, he introduced Canada's first federal labour legislation: The Fair Wages Resolution. Later on, the Conciliation Act established conciliation boards to aid in the settlement of labour disputes. The Department of Labour was also established and its main function was to publish statistical information on labour standards.

Labour Canada's role has changed through the years. During the Great Depression, for example, the department administered unemployment relief, vocational training and rehabilitation programs, and set up employment offices. Some of the programs were disbanded when the emergency conditions passed.

In response to the polarized, unstable labour relations scene in the 1970's, characterized by strikes, lockouts and government intervention, the department developed the Quality of Working Life and Labour Education programs. Recently, Labour Canada has placed more emphasis on occupational health and safety and on the protection of human rights through labour standards legislation.

In 1984, the Canadian Parliament amended Part II of the *Canada Labour Code* to include the modes of transportation: aviation, rail, marine and pipelines.

In 1987, the transportation portfolio was delegated to Transport Canada because of the expertise residing in the department. It is in this context, that a Memorandum of Understanding (MOU) was developed and implemented between Human Resources Development Canada-Labour Program and Transport Canada Safety and Security. It is by virtue of this MOU that Transport Canada Civil Aviation administers, implements and enforces Part II of the *Canada Labour Code* that deals essentially with Occupational Health and Safety while Part I deals with Labour Relations and Part III with Labour Standards.

In the fall of 2000, the federal government amended Part II of the *Canada Labour Code* after many years of negotiations with both employer and employee representatives under federal jurisdiction. This latest amendment's main purpose is to call attention to what is more commonly known as the Internal Responsibility System. This system provides employers and employees with the proper tools for resolving issues internally by setting out a mechanism for addressing complaints (policy and work place committees and health and safety representatives) and a clear-cut process for resolving these complaints.

In brief, Aviation Occupational Health and Safety is a program administered by Transport Canada, on behalf of the Minister of Labour, to protect employees working on-board aircraft in operation.

Aircraft in operation is defined as "from the time the aircraft first moves under its own power for the purpose of taking off from any Canadian or foreign place of departure until its first destination in Canada". It is important to note that the *Canada Labour Code* pertains to Canadian registered aircraft and to Canadian crew and its main purpose is to prevent accidents and injury to health arising out of, linked with, or occurring in the course of employment.

3. Who we are

We are a small organization within Transport Canada's Civil Aviation Directorate.

Chart 1

CIVIL AVIATION – HEADQUARTERS
ORGANIZATIONAL STRUCTURE

As illustrated in the chart above, we are part of the Commercial and Business Aviation Branch. It was moved to this Branch in 1995 from Regulatory Services so that it could be administered more effectively by being closer to its client base largely composed of flight attendants and pilots. Commercial and Business Aviation is a branch within the Civil Aviation Directorate that deals on a daily basis with a multitude of operational issues originating from around the country.

Chart 2

Commercial and Business Aviation Organizational Structure

There are approximately 20,000 flight attendants and commercial pilots in Canada. Flight attendants are represented by the Canadian Union of Public Employees (Airline Division); the

Teamsters (Airline Division) and the Canadian Auto Workers (Airline Division). Commercial pilots are represented by the Airline Pilots Association Canada (ALPA Canada) and the recently formed Air Canada Pilots Association (ACPA). Employers also are represented by various organizations. The largest one perhaps is the Air Transport Association of Canada (ATAC) representing major Canadian air operators such as Air Canada, Canadian Airlines International, Canada 3000, Royal Aviation, Air Transat, Sky Service, First Air, etc. There are also smaller organizations that represent specialized groups of employers such as the Helicopter Association of Canada (HAC), the Northern Air Transport Association (NATA), the Canadian Business Aircraft Association (CBAA), etc.

The Aviation Occupational Health and Safety Program's Headquarters are located in Ottawa, Ontario and there are five regional offices across Canada.

Regional Office	Region
Moncton	Atlantic
Montréal	Québec
Toronto	Ontario
Winnipeg and	Prairie &
Edmonton	Northern
Vancouver	Pacific

4. What we do

(a) In Headquarters

The administration and implementation of the Occupational Health and Safety Program is overseen from Transport Canada Headquarters who are responsible for:

- developing regulations and policies related to Occupational Health and Safety on-board aircraft;
- developing and conducting initial an recurrent training for Civil Aviation Safety Inspectors-Occupational Health and Safety (CASI-OHS for short);
- conducting research and development projects as the need arises. A good example is the ongoing Research Project on Cosmic Radiation conducted by the Royal Military College of Canada for Transport Canada;
- participating in national audits of air operators as well as conducting Quality Assurance Reviews of the Regional Offices on a cyclical basis. Audits are a means of measuring compliance with legislative requirements and Quality Assurance Reviews are a form of

evaluation for ensuring that programs are being implemented adequately and consistently across the country;

- participating in working groups and committees pertaining to Aviation-OHS to amend existing regulations and to develop new ones as the need arises. This is done in conjunction with employee and employer representatives; and

- providing advice and guidance to CASI-OHS, employee and employer representatives and senior management.

(b) In the Regions

If Headquarters' main role is to develop regulations, policies, guidelines while overseeing the sound administration of the program, the Regions' main responsibilities are to:

- respond to and investigate refusals to work, hazardous occurrences and complaints. This is the first and most important duty of a CASI-OHS. They must respond immediately to a refusal to work or a hazardous occurrence;

- enforce Part II of the *Canada Labour Code* and its pursuant Regulations. CASI-OHS conduct scheduled inspections to ensure compliance with the Code;

- implement policies issued by Headquarters;

- participate in regional audits of air operators;

- promote and educate both employees and employers on the *Canada Labour Code* and its pursuant Regulations.

It is important to note that CASI-OHS are empowered to enter workplaces and to cease operations when they observe a situation that constitutes a danger.

5. Statutory Authority

The *Canada Labour Code*, Part II

As mentioned earlier, the *Canada Labour Code*, Part II deals with occupational health and safety specifically and its main purpose is to prevent accidents and injury to health arising out of, linked with or occurring in the course of employment in the Canadian federal jurisdiction. The Code focuses on several themes but its main thrust is the Internal Responsibility System that will be described in the following paragraphs.

(a) Duties of employers

Employers have the primary obligation of exercising due diligence in order to ensure the health and safety of their employees in the work place. Duties include: providing first aid facilities, health services, sanitary and personal facilities and potable water; investigating, recording and reporting accidents, occupational diseases and other hazardous occurrences; providing information, training and instruction; ensuring that employees are informed of known or foreseeable hazards in the work place; providing training to managers, supervisors, policy and work place committee members and health and safety representatives on health and safety matters and on their role and responsibilities; developing hazard prevention programs and measures for the prevention of violence in the work place.

(b) Duties of employees

Employees must first and foremost ensure their own health and safety in the work place. They are required to: use safety materials, equipment, devices and clothing provided by the employer; follow procedures and comply with instructions; report all contraventions of the Code to their employer.

(c) Powers and duties of health and safety officers

Health and safety officers are designated as such by the Minister of Labour. In Transport Canada Civil Aviation, they are called Civil Aviation Safety Inspectors-Occupational Health and Safety as mentioned earlier. In carrying out their duties, they may enter any work place at a reasonable time to: conduct examinations, tests, inquiries, investigations and inspections; take or remove, for analysis, samples of any material or substances; take or remove, for testing, material or equipment; direct the employer not to disturb a place or thing pending an examination, test, inquiry, investigation or inspection; direct the employer to produce documents and information; conduct interviews in the course of an investigation; direct the employer or employee to cease a contravention under the Code.

(d) Internal responsibility system

The internal responsibility system is an underlying principle in the Code that commits employers and employees to the joint responsibility of ensuring health and safety in their work place. The major elements of the internal responsibility system include prevention programs, internal complaint resolution, that we will address later, policy and work place committees and health and safety representatives.

(i) Policy health and safety committees

Policy committees must be established in companies that have 300 employees or more. However, nothing prevents a smaller company from establishing a policy committee or a large company from establishing more than one policy committee for a specialized group of employees, for example. The policy committee is formed at the corporate level to deal with general health and safety matters for the well being of the whole company.

The policy committee's principal role is to participate in the development of health and safety policies and programs with the employer and in the planning of the implementation and in the implementation of changes that may affect occupational health and safety. Policies and programs include the prevention of hazards in the work place, the education of employees in health and safety matters and the provision of personal protective material.

(ii) Work place health and safety committees

Every work place with 20 employees or more is required to have a work place committee. A company that has many work places where 20 or more employees work at one time must each have a work place committee. This committee: considers and disposes of complaints relating to the health and safety of employees; participates in the development, implementation and monitoring of a prevention program for hazards unique to the work place; participates in all inquiries, investigations, studies and inspections pertaining to the health and safety of employees; inspects each month all or part of the work place so that every part of the work place is inspected at least once a year.

(iii) Health and safety representatives

Health and safety representatives are appointed in companies where there are fewer than 20 employees, unless a work place committee has been established, or where an employer is not required to establish a work place committee (when an employer is exempted from the requirement to establish a committee). Health and safety representatives enjoy the same powers as the members of a work place committee and work directly with the employer on health and safety matters.

(e) Internal Complaint Resolution Process

The internal complaint resolution process mentioned earlier lets employers and employees resolve complaints together with little or no intervention from the health and safety officer. If a complaint remains unresolved, a health and safety officer is called upon to investigate the matter and take appropriate action.

(f) The right to refuse dangerous work

The right to refuse dangerous work is one of three basic rights that employees enjoy under the *Canada Labour Code*, Part II: the right to know (about hazards in the work place); the right to participate (as a member of the work place committee or a health and safety representative); and the right to refuse dangerous work. This right is invoked when an employee has reasonable cause to believe that the use or operation of a machine or thing, working in a place or performing an activity constitutes a danger to the employee or to another employee.
When the process has been followed and despite all efforts, a health and safety officer is called in to investigate a continued refusal to work, the officer will assess the situation and render a decision as to whether or not a danger exists. If there is a danger, the health and safety officer will issue a direction to the employer directing him or her to rectify the situation and if there is no danger, the

officer will render a decision of "no danger" and the employee must return to work. The direction or decision of "no danger" may be appealed to an appeals officer under the Code.

(g) The right of redress

An employer who believes that an employee wilfully abused the rights associated to a refusal to work may take disciplinary action against that employee. The employer must demonstrate that the employee has wilfully abused his or her rights.

(h) Appeals and review process

As mentioned earlier, a health and safety officer may issue a direction to an employer or employee directing him or her to cease a contravention. In cases of refusal to work, a health and safety officer may render a decision of "no danger". The direction or decision of "no danger" may be appealed to an appeals officer under the Code. The appeals Officer reviews directions issued by health and safety officers upon request. Following the review, the appeals officer may confirm, vary or rescind a direction. The appeals Officer who holds all the powers and duties of a health and safety officer may issue a direction to the employer if he or she decides to overturn the decision of "no danger" in the case of a refusal to work. The appeals officer's decision is final and is not to be questioned or reviewed in any court.

(i) Pregnant and nursing employees

In addition to the right to refuse dangerous work, a pregnant or nursing employee has the right to protect herself, the foetus or child against any hazards that could affect their health and safety. When she becomes aware that she is pregnant, the employee must inform her employer of her wish to cease to perform her job. She must then consult a physician to determine whether or not there is a risk to the employee, foetus or child and if the risk exists, the employee may be reassigned to other duties for the remainder of the pregnancy or nursing period or continue to receive the wages and benefits that are attached to her job for the period during which she does not perform the job.

(j) Offences and punishment

Fines ranging from $15,000 to $100,000 are imposed for general offences, from $25,000 to $100,000 for specific offences and on conviction on indictment, a maximum fine of $1,000,000 or imprisonment for a term of not more than two years, or both.

The Aviation Occupational Safety and Health Regulations

The A-OSH Regulations were first promulgated in 1987 following the 1984 decision of the Canadian Parliament to include in the Code all modes of transportation: air, marine, rail and pipelines. The regulations are made pursuant to the *Canada Labour Code*, Part II and are specific to small and large air operators. There are eleven parts to the Aviation Occupational Safety and Health Regulations as follows:

Part I	General
Part II	Levels of Sound
Part III	Electrical Safety
Part IV	Sanitation
Part V	Hazardous Substances
Part VI	Safety Materials, Equipment, Devices and Clothing
Part VII	Appliances and Machine Guards
Part VIII	Materials Handling
Part IX	Hazardous Occurrence Investigation, Recording and Reporting
Part X	First Aid
Part XI	Lighting

6. Conclusion

We hope that this overview of the Aviation Occupational Health and Safety Program in Transport Canada has shed some light on the little known subject of occupational health and safety and that it may contribute to enhance aviation safety within your own country or organization.

Introduction for A-OHS Presentation

Mr. Jacques Servant holds a Master's degree in Political Science and a Graduate Diploma in Public Administration. He started working for the Public Service in 1977. He has been Chief of the Aviation Occupational Health and Safety Program in Transport Canada since March 1995.

Mrs. Louise Graham received an honours B.A. in Translation in 1981 and has been with Transport Canada for 19 years. She joined the program in April 1996.

Mr. Servant and Mrs. Graham will make a joint presentation on the Aviation Occupational Health and Safety Program in Transport Canada.

Mrs. Graham received an honours B.A. in Translation in 1981 and started working at Transport Canada as a Research Terminologist in February 1982. She actively participated in the development and publication of lexicons and glossaries of standardized terminology that was adopted nationally and internationally. In 1996, she decided that it was time for a career change and delved into the world of Aviation Occupational Health and Safety. She has contributed to the achievement of many undertakings including the revision of the Aviation Occupational Health and Safety Regulations and the publication of various Transport Canada Commercial and Business Aviation Advisory Circulars on topics such as Unruly Passengers and Aircraft Disinsection.

Mr. Servant holds a Master's Degree in Political Science and a Graduate Diploma in Public Administration. He worked in the Federal Provincial Relations Office from 1977-1980, after which he was hired as a Security Analyst in the Airport Services and Security Branch, Transport Canada. In 1982 he became National Superintendent of Disaster/Emergency Planning, and subsequently he became Senior Site Disaster/Emergency Planning Officer in 1986. As an emergency planner specialist he assisted various airports in the world in developing their emercency plan (in Barbados, the Yemen Arab Republic, Thailand, Mongolia). He also lectured on the subject in Hong Kong, Brunei and Fiji for the International Civil Aviation Organization. He was promoted Chief, Safety and Emergency Planning in 1987 and Acted as Director of Airport Security Services in Transport Canada Headquarters in Ottawa from September 1990 to June I993. Because of his expertise, he was seconded to the Dryden Implementation Group from June 1993 to December 1994 (the Task Force that implemented the Recommendations of the Commission of Inquiry into the Air Ontario Crash at Dryden, Ontario). As an Airport Security specialist, he worked in Madagascar for the World Bank. Since 1995, Mr. Servant is the Chief of the Aviation Occupational Safety & Health Program in Transport Canada Headquarters, Ottawa, Canada.

Canadian Studies on Cosmic Radiation Exposure of Aircrew

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Royal Military College of Canada

Abstract

As a result of the recent recommendations of the ICRP-60, and in anticipation of possible regulation on occupational exposure of Canadian-based aircrew, an extensive study was carried out by the Royal Military College of Canada over a one-year period to measure the cosmic radiation at commercial jet altitudes. A tissue equivalent proportional counter was used to measure the ambient total dose equivalent rate on 62 flight routes at various altitudes and geomagnetic latitudes. These data were successfully compared to other experimental work at the Physikalisch Technische Bundesanstalt and to predictions with the LUIN computer code. A model was derived from these data to allow for the interpolation of the dose rate for any global position, altitude and date. Through integration of the dose-rate function over a great circle flight path, a computer code was further developed to provide an estimate of the total dose equivalent on any route worldwide at any period in the solar cycle.

Introduction

Jet aircrew are routinely exposed to levels of natural background radiation from galactic cosmic rays which are significantly higher than those present at ground level. In 1990, the International Commission on Radiological Protection (ICRP) recommended that aircrew be classified as occupationally exposed.[1] They also recommended a reduction in the occupational exposure (i.e., from 50 to 20 mSv/yr averaged over 5 years, with not more than 50 mSv in a single year) as well as a reduction in the general population exposure (i.e., from 5 to 1 mSv/yr).[1] Recent studies of major Canadian airlines have determined that the exposure to most aircrew is comparable to those recorded in the Canadian National Dose Registry (Table 1).[2,3] As a result, many countries around the world may have to develop regulatory policy in light of the ICRP recommendations requiring some form of exposure monitoring of aircrew. For example, the revised European Union (EU) Basic Safety Standard Directive, published in May 1996 (BSS96), requires that radiation protection measures for aircraft crew be incorporated into the national legislation of EU member states before 13 May 2000.[4] In the United States, the Federal Aviation Administration (FAA) has formally recognized that aircrew members are occupationally exposed to radiation and should be subject to the same radiation protection policies practised by all other federal agencies.[5] Consequently, in 1994, the FAA published an advisory to the commercial air carriers outlining an educational program that should be implemented to inform crewmembers of the nature of their radiation exposures and the associated health risks.[6] In Canada, an advisory circular by Transport Canada is being developed and will be issued shortly to recognize the occupational exposure of aircrew.[7]

Table 1: Average Annual Occupational Exposures in Canada[a]

Category	Occupation	Annual Exposure (mSv)
Nuclear Power	Nuclear fuel handler	4.73
Industry and Research	Industrial radiographer	2.90
Uranium Mining	Underground uranium miner	2.04
Medicine	Nuclear medicine technologist	1.44
Airline	Aircrew (pilots and flight attendants)	~1 to 6

a. Based on information in Refs. 2 and 3 (Preliminary analysis of 1998 occupational exposure).

Monitoring of the occupational exposure of aircrew could take several forms, such as with personal passive dosimetry (as in the nuclear industry) or by area monitoring with fixed instrumentation on board the aircraft. Alternatively, since the cosmic radiation exposure is relatively constant, a computer prediction program, based on either theory or on an experimental database, could be used to predict the aircrew exposure with an estimate of the route dose and a knowledge of the flight frequency.

The effect of solar cycle, latitude and altitude on aircrew radiation exposure is discussed in this paper. Within this context, a method is detailed for the collecting and analyzing of radiation data from numerous worldwide flights using a tissue equivalent proportional counter (TEPC) and other active and passive instrumentation which are able to characterize the complex cosmic radiation field.[8] The current measurements are further supported and successfully compared to other results that are derived from: (i) a similar measurement program conducted at the Physikalisch Technische Bundesanstalt (PTB) with different instrumentation to measure separately the low and high linear energy transfer (LET) components of the mixed-radiation field at altitude,[9,10] and (ii) a theoretical treatment with a transport code.[11] It is further shown how measurements at the Royal Military College of Canada (RMC) can be encapsulated into a semi-empirical model/computer code to calculate the radiation dose for any flight in the world at any period in the solar cycle. Thus, this experimentally-based code could find application for aircrew monitoring in light of possible regulatory requirements in various countries around the world.

Radiation Field Characteristics at Jet Altitudes

The radiation that is found at jet aircraft altitudes (~6.1 to 18 km) is produced from the interaction of primary galactic cosmic ray (GCR) particles with the Earth's atmosphere. The GCRs consist of ~90% protons, 9% alpha particles and 1% heavy nuclei typically ranging from carbon to iron.[12] Most of these particles have energies between 100 MeV and 10 GeV, which can extend up to 10^{20} eV.[12] The sun is also a sporadic source of X-rays and charged particles (i.e., mainly protons, some alpha particles and a few heavy nuclei) as a result of magnetic energy release in solar flares. These solar particle events (SPE) are much more frequent during the active phase of the solar cycle and can occur over hours to days with maximum particle energies of between 10 to 100 MeV, possibly reaching up to 10 GeV once in a decade.[13] Although the effect of GCRs to aircrew exposure is generally much greater than the occasional SPE, a rare solar event could lead to a significant dose at supersonic altitudes, e.g., it is estimated that an event on February 23, 1956 yielded a dose equivalent rate of ~10 mSv/h at 20 km.[14]

The charged GCRs will be deflected by the solar magnetic field. The solar magnetic field is characterised by a heliocentric potential, U, whose time dependence (i.e., with the solar cycle) can be determined from particle flux measurements on balloons and spacecraft, as well as from ground-level measurements on Earth with neutron monitors.[15-18] When solar sunspot activity is at a maximum (approximately every eleven years), the increased solar field acts to screen out low-energy GCRs. Thus, cosmic ray intensities also vary in a cyclical pattern, but in a manner anticoincident with the solar activity (Fig. 1).

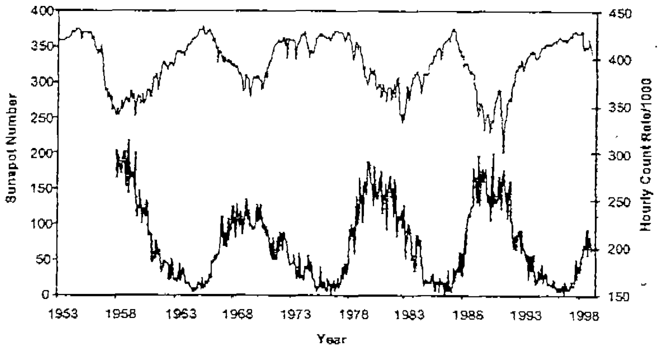

Figure 1. Plot of neutron count rate and sunspot number versus date.[19,20]

The GCRs that are not deflected by the solar magnetic field now encounter the magnetic field of the Earth, which can provide an effective shield against lower-energy particles. These charged particles are deflected by the magnetic field in which their trajectories have a curvature of radius $r = R_p/B_p$.[15] Here B_p is the component of the Earth's magnetic field perpendicular to the direction of the motion and R_p is the so-called magnetic rigidity, which is related to the particle's momentum (p) and charge (q),

$$R_p = \frac{pc}{q} \qquad [1]$$

where c is the speed of light.[21] The penetrating ability of these particles is dependent on their angle of incidence and rigidity. A particle can enter the Earth's atmosphere if its magnetic rigidity, R_p, is greater than the vertical cutoff rigidity of the Earth's magnetic field, R_c, at its point of entry. The vertical cutoff rigidity (in GV) has been derived by Shea et al. and is related to the geomagnetic latitude, B_m, (in radians):[22]

$$R_c = 16.237\left(\frac{r_e}{\cos^2 B_m}\right)^{-2.0353} \qquad [2a]$$

where r_e is the distance from the Earth's dipole centre (in units of Earth radii) defined by

$$r_e = \left(\frac{1}{a}\right)\left\{\frac{b}{\sqrt{1-\varepsilon^2\cos^2 B_m}} + A\right\} \qquad [2b]$$

b (= 6357 km) is the minimum (polar) radius of the Earth, ε (= 8.20×10^{-2}) is the eccentricity, a (= 6372 km) is the average radius of the Earth, and A (≈ 11 km) is the typical altitude of the aircraft. Equation (2) is a best-estimate composite expression for three epochs from 1955 to 1980. The geomagnetic latitude, B_m, in turn, can be calculated from the geographic latitude and longitude (λ,ϕ) according to:[23]

$$\sin B_m = \sin\lambda \sin\lambda_p + \cos\lambda\cos\lambda_p\cos(\phi - \phi_p) \qquad [3]$$

where λ_p = 79.3°N and ϕ_p = 289.9°E (the position of the geomagnetic north pole). A higher value of the cutoff rigidity R_c indicates a reduced penetration at the given global position. Consequently, at jet aircraft altitudes, the galactic radiation is 2.5 to 5 times more intense at the poles than at the equatorial regions.[24] Above approximately 50°N in Canada or 70°N in Siberia, a "geomagnetic knee" exists where the radiation levels are constant with increasing latitude.

The GCRs are subject to further shielding by the atmosphere, where these particles interact with the nitrogen and oxygen nuclei. In each collision, a proton loses on average ~50% of its energy, which results in a production of secondary particles like protons, neutrons, and π and K mesons.[15] The target nuclei can also produce protons, neutrons and alpha particles by evaporation. Particles generated by successive interactions with the primary and/or secondary particles therefore produce a cascade of hadrons in the atmosphere. These secondary particles also decay radioactively. The charged mesons form muons that provide the greatest contribution to the ground exposure. The muons can also decay into electrons, while the neutral pions may decay into photons which, by pair production, can further result in a formation of electrons and positrons.[15,25] The buildup of these secondary particles competes with their reduction through energy loss and further interactions with other atmospheric nuclei. This competition results in dose rates which vary with altitude, reaching a maximum level at about 20 km above sea level, known as the Pfotzer maximum. Calculations of the propagation of cosmic rays through the atmosphere can be evaluated with either the LUIN or FLUKA code (see Figs. 2(a) and (b)).[26-29] These code calculations are in reasonable agreement except for the proton contribution where the FLUKA code predicts a greater particle fluence rate by a factor of two.

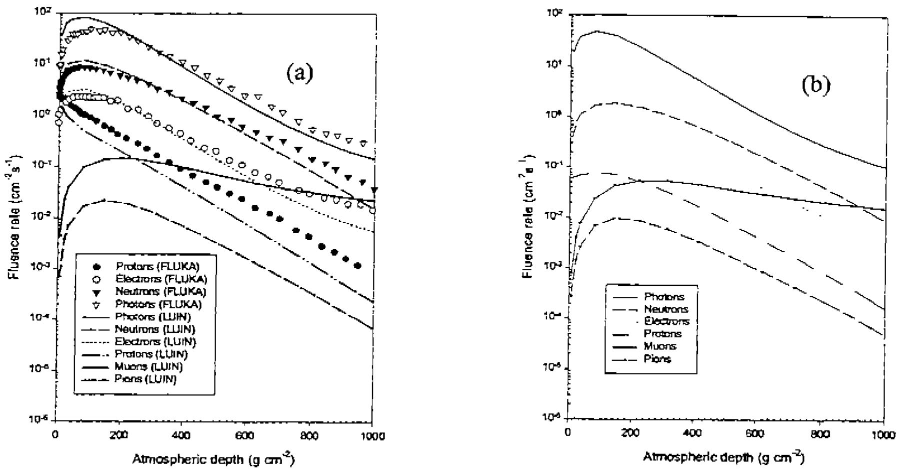

Figure 2. Integrated fluence rate versus atmospheric depth for different particles.
(a) Comparison of the fluence rate as calculated by FLUKA and LUIN during solar minimum with no geomagnetic shielding. (b) The fluence rate as calculated by LUIN during solar minimum at the equator.

Experimental Procedure

The only single instrument for a complete measurement of this mixed-radiation field is a tissue equivalent proportional counter (TEPC). It provides not only an indication of the total dose equivalent (with a simulation of a tissue-equivalent site with a diameter of 2 μm), but also the microdosimetric distribution of the radiation as a function of the lineal energy. The lineal energy can be used as a surrogate measurement of the linear energy transfer (LET) for the cosmic radiation spectrum.[2] The TEPC had a 5"-diameter detector built by Far West Technology, and was designed by Battelle Pacific Northwest National Laboratories to be an extremely portable instrument (Fig. 3). This instrument fits into any overhead bin and is powered by batteries which last up to five days of operation. It is simple to operate (off/on switch only) and stores a microdosimetric spectrum every minute.

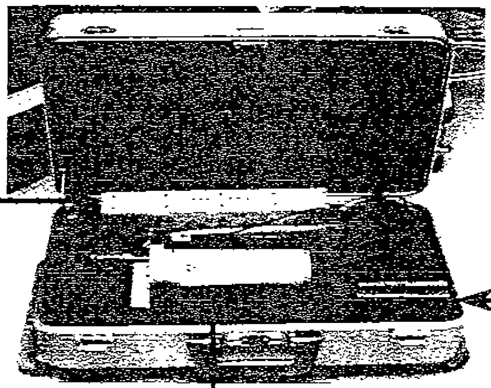

Figure 3. Arrangement of TEPC components in the carry-on case.

For the majority of the in-flight measurements, aircrew turned on the TEPC prior to takeoff and off after landing, and provided positional data consisting of the flight course and altitude history. Since the TEPC has its own internal clock, the TEPC measurements could then be correlated to the aircraft position (geomagnetic latitude and altitude). The stored data were downloaded at the laboratory to provide an output of absorbed dose rate, $\dot{D}$, and dose equivalent rate, $\dot{H}$. In addition to these outputs, the raw spectral TEPC data could also be output as a microdosimetric dose distribution to provide an estimate of the average quality factor, $\bar{Q}$, of the radiation field.[30-32]

In addition to the portable TEPC, different types of passive and active detectors were also used on several scientific flights to measure the individual low-LET (ionizing) and high-LET (neutron) components of the mixed-radiation field (which can be appropriately summed for comparison to the TEPC results). The various portable instruments used in this study included: (i) temperature-compensated neutron bubble detectors (BD-PND) from Bubble Technology Industries (BTI); (ii) a battery-powered Eberline FHT 191 N ionization chamber (IC); (iii) aluminum oxide (Al_2O_3) thermoluminescent detectors (TLD's); (iv) a Siemens Electronic Personal Dosemeter (EPD); and (v) a passive dosemeter box assembled by the National Radiological Protection Board (NRPB) in the United Kingdom, which contained 30 TLD's and 24 polyallyldiglycol carbonate (PADC) track-etch detectors.

At-Altitude Measurements

The TEPC was used on board 62 worldwide flights flown at altitudes between 4.5 and 12.4 km from September 1998 to October 1999. A typical dose distribution spectrum for a trans-Atlantic flight is shown in Fig. 4. Plotted in Fig. 4 are the absorbed dose distribution *yd(y)* and dose-equivalent distribution *yh(y)* (which accounts for the quality of the different particle types) as a function of the energy deposition density (or lineal energy *y*). In particular, the *yh(y)* plot reveals the high-quality characteristics of the cosmic radiation field at jet altitude. Thus, as shown in Fig. 5, the aircraft environment is dominated by radiation with a higher *Q* value, for which there is a greater uncertainty in the biological risk coefficient.[33] In contrast, most terrestrial occupational exposures are dominated by radiation with a lower deposition energy, for which $Q \sim 1$, and the risk coefficients are better known.

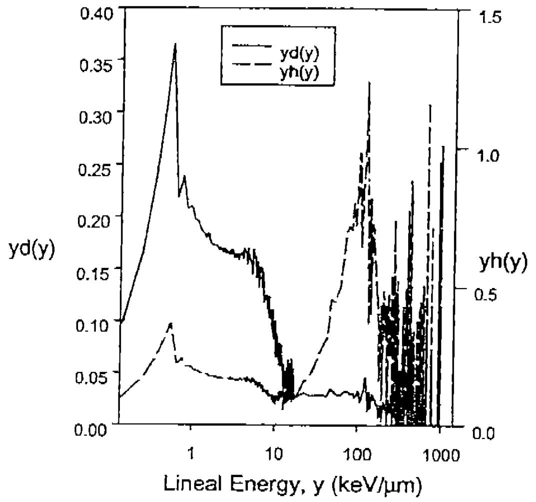

Figure 4. Microdosimetric absorbed dose and dose equivalent distributions on a 7-hour flight between Toronto and Zurich at an altitude of 11.2 km.

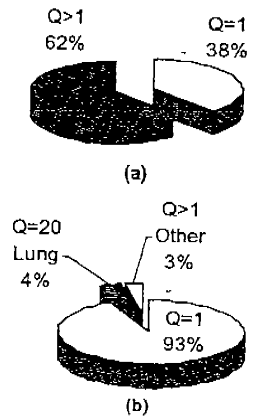

Figure 5. Quality factor of radiation exposures for: (a) aircrew on board a trans-Atlantic flight at 11.2 km (based on the data in Figure 4), and (b) U.S. atomic radiation workers (based on NCRP Report 93).

The microdosimetric quantities of the frequency-mean lineal energy, $\bar{y}_F$, the dose-mean lineal energy, $\bar{y}_D$, and the average quality factor, $\bar{Q}$, (as defined in the Appendix of Ref. 2), which result from a spectrum like Fig. 4, are listed in Table 2 for various flights. The $\bar{Q}$ values are greater than 1 and the $\bar{y}_D$ values are greater than 10 keV/μm, which also indicate a significant high-LET (> 10 keV/μm) contribution to the radiation field.

In addition to the TEPC, radiation levels were also monitored with various pieces of instrumentation that are sensitive to different components of the mixed radiation field on several representative flight routes (see Table 3). The dose equivalent arising from the neutron (i.e., high-LET) component of this field was measured using BDs or the PADC detectors of the NRPB box. In addition, on some flights, the dose equivalent arising from the non-neutron (i.e., mainly low-LET) component was measured independently using either an IC, TLDs or an EPD. Both the TLDs and NRPB box correspond to integrated values over several flight legs. Table 3 also shows different methods for estimating the total dose equivalent with various combinations of instrumentation.

An estimate of the low-LET dose equivalent can also be obtained from the TEPC by including only those data points at lineal energies less than 10 keV/μm. The TEPC gamma measurements in Table 3 are always ~10-15% lower than that measured by the IC. This systematic discrepancy suggests that the IC is responding to ionizing particles with higher lineal energy values as well. The EPD readings are also consistently lower than the IC measurements by at least 20%. This result suggests that the EPD (as normally used in the nuclear industry for ionizing dose assessment) cannot be directly used for aircrew exposure assessment (unless the EPD measurements are suitably scaled to an instrument with an improved response for the more penetrating ionizing particles of higher energy and charge). The low-

Table 2: Microdosimetric Quantities Measured on Canadian-based Flights

Global Flight Region	Routes Covered[a]	$\bar{y}_F$ (keV/μm)	$\bar{y}_D$ (keV/μm)	$\bar{Q}$
Trans-Atlantic	YYZ-LHR (return) YYZ-FRA (return) YYZ-ZRH (return) YUL-LHR LHR-YVR	0.358	14 ± 2	2.3 ± 0.4
Trans-Canada	YYZ-YVR (2) YVR-YYZ (3)	0.359	15 ± 2	2.3 ± 0.4
Caribbean	YYZ-BGI BGI-YYZ	0.340	13 ± 2	2.2 ± 0.4
Trans-Pacific	YVR-KIX KIX-YVR	0.334	15 ± 2	2.2 ± 0.4

a. Airport codes are YYZ-Toronto International; LHR-Heathrow, London, UK; FRA-Frankfurt, Germany; ZRH-Zurich, Switzerland; YUL-Dorval, Montreal; YVR-Vancouver; BGI-Bridgetown, Barbados; KIX-Osaka, Japan.

LET dose equivalent (from the IC or TLD's) can be summed to the high-LET (neutron) value to obtain an estimate of the total dose equivalent. The data in Table 3 show that this procedure results in a value which is ~90% of that measured by the TEPC. This slight discrepancy can be related to the fact that the IC and TLD's are referenced to a photon-equivalent field (i.e., with a mean quality factor $\bar{Q} = 1$), and therefore do not take into account an enhanced quality factor for those ionizing particles actually present in the cosmic spectrum with lineal energies greater than 10 keV/μm (such as protons). As mentioned above, the data indicate that the IC is indeed detecting such particles. In fact, ~18% of the absorbed dose from the non-neutron component can be attributed to protons, although this fraction is somewhat dependent on altitude and latitude.[34,35] A mean quality factor of 1.5 has been proposed to account for the enhanced proton contribution such that:[34]

$$H_{IC,TLD} = \{[1\times(1-0.18)] + [1.5\times0.18]\} D_{IC,TLD} \approx 1.1\, D_{IC,TLD} \qquad [4]$$

where H is the corrected ambient dose equivalent for the non-neutron component and D is the absorbed dose as measured with either the IC or TLD's. Thus, the IC and TLD measurements should be multiplied by a correction factor of 1.1 in order to account for the dose equivalent effect from protons. This proton component is already appropriately weighted with the use of the Q(LET) relationship for the TEPC.[2] If the IC and TLD measurements are multiplied by this correction factor, the BD and IC measurements will sum to be about 95% of the TEPC one, which is well within the measurement uncertainty. However, even this small discrepancy can be somewhat attributed to the under response of the BDs to neutrons of very high energy.

In conclusion, the summed results from the various independent equipment are self-consistent with the TEPC results, providing further confidence in the use of the TEPC data for model development presented in the next section.

Table 3: Summary of Results from Fully Instrumented Flights

Flight Route	Date	Total Flight Time [min]	Neutron Dose Equivalent [µSv]		Non-Neutron Dose Equivalent[b] [µSv]					Total Dose Equivalent [µSv]		
			BD[a]	NRPB PADC	TEPC Gamma	IC	TLD	EPD (H_P)	NRPB TLD	TEPC	BD + (IC or TLD)	NRPB Box
A. Domestic Flights												
YYZ-YVR	Feb 99	310	11 ± 1		11 ± 1					30 ± 5		
YVR-YYZ	Feb 99	229	15 ± 2		10 ± 1					29 ± 4		
YVR-YYZ	Mar 99	235	9 ± 1		8 ± 1					19 ± 3		
YTR-YWG	Oct 99	128	5 ± 2		4.8 ± 0.5	5.6 ± 0.6		5		12 ± 2	11 ± 2	
YOW-YVO	Jul 99	43	0.3 ± 0.3		0.22 ± 0.02	0.26 ± 0.03	-	-		0.8 ± 0.1	0.6 ± 0.3	
YVO-YFB		140	5.4 ± 0.9		3.7 ± 0.4	4.4 ± 0.4	-	-		10 ± 2	10 ± 1	
YFB-YSR		97	1.6 ± 0.9		1.6 ± 0.2	1.8 ± 0.2	-	-		4.7 ± 0.7	3.4 ± 0.9	
YSR-YFB		99	3.1 ± 0.9		1.9 ± 0.2	2.1 ± 0.2	-	-		5.1 ± 0.8	5.2 ± 0.9	
YFB-YOW		153	6 ± 2		5.0 ± 0.5	5.7 ± 0.6	-	-		14 ± 2	12 ± 2	
Total Trip		**532**	**16 ± 5**		**12 ± 1**	**14 ± 1**	**9 ± 5**	**9**		**35 ± 6**	**31 ± 5**	
B. Trans-Atlantic Flights												
YYZ-LHR	Oct 98	395	13 ± 2	-	12 ± 1		-		-	33 ± 5	-	-
LHR-YYZ		453	15 ± 2	-	13 ± 2		-		-	37 ± 6	-	-
Round Trip		**848**	**28 ± 4**	**28 ± 13**	**25 ± 3**		**26 ± 2**		**28 ± 2**	**70 ± 11**	**54 ± 4**	**56 ± 13**
YYZ-FRA	Feb 99	414	16 ± 2		17 ± 2					43 ± 6		
FRA-YYZ	Feb 99	544	19 ± 4		21 ± 2					50 ± 8		
YUL-LHR	Mar 99	380	15 ± 2		15 ± 2					37 ± 6		
LHR-YVR	Mar 99	560	22 ± 2		23 ± 3					57 ± 8		
YYZ-ZRH	Jun 99	436	19 ± 2		17 ± 2	20 ± 2				45 ± 6	39 ± 3	
ZRH-YYZ	Jun 99	487	20 ± 3		19 ± 2	23 ± 2				50 ± 7	43 ± 4	
YTR-RMI	Oct 99	449	22 ± 2	~24	17 ± 2	19 ± 2		14	~13	43 ± 6	41 ± 3	~37
RMI-EINN	Oct 99	154	-		4.0 ± 0.4	4.6 ± 0.5		-	-	10 ± 2	-	-
EINN-YOW		382	-		13 ± 1	15 ± 1.5		-	-	33 ± 5	-	-
YOW-YTR		35	-		0.07 ± 0.01	0.10 ± 0.01		-	-	0.35 ± 0.05	-	-
Total Trip		**571**	**21 ± 2**	**~24**	**17 ± 2**	**20 ± 2**		**16**	**~13**	**43 ± 7**	**41 ± 3**	**~37**
C. Trans-Pacific Flights												
YVR-KIX	Mar 99	611	20 ± 4		20 ± 2					50 ± 7		
KIX-YVR	Mar 99	512	18 ± 2		16 ± 2					35 ± 5		
YVR-HNL	Oct 99	340	6 ± 1		7.5 ± 0.8	8.8 ± 0.9		6		16 ± 2	15 ± 1	
HNL-YWG	Oct 99	393	11 ± 2		12 ± 1			9		~28 ± 4		

Flight Route	Date	Total Flight Time [min]	Neutron Dose Equivalent [μSv]		Non-Neutron Dose Equivalent[b] [μSv]					Total Dose Equivalent [μSv]		
			BD[a]	NRPB PADC	TEPC Gamma	IC	TLD	EPD (H_P)	NRPB TLD	TEPC	BD + (IC or TLD)	NRPB Box
D. Caribbean Flights												
YYZ-BGI	Apr 99	270	7 ± 2		7 ± 1		-			17 ± 3	-	
BGI-YYZ		330	11 ± 2		10 ± 1		-			23 ± 4	-	
Round Trip		600	18 ± 4		17 ± 2		21 ± 2			40 ± 7	39 ± 4	
E. Equatorial Region												
HNL-NZAA	Oct 99	512	7 ± 2		10 ± 1	11 ± 1		8		21 ± 3	18 ± 2	
NZAA-HNL	Oct 99	476	6 ± 1		9.4 ± 0.9			8		18 ± 3		

a. The error quoted on the bubble detector readings represents the standard deviation (σ) on the reading of six different detectors.
b. Based on a mean quality factor of 1

Model Development (for Route-Dose Prediction)

The raw TEPC output from the flights (corresponding to about 20 000 lineal energy spectra) can also be processed to provide a dose equivalent rate (every minute). These data can be summed over five-minute intervals and then smoothed using a Savitzky and Golay method[36] to reduce the relative error in the data to approximately 18%. This method of data treatment was applied to the TEPC spectral data obtained from 36 flights (i.e., a sub-set of the original 62 flights) that was used specifically for model development. This analysis resulted in the dose equivalent rate data plotted as a function of altitude and geomagnetic latitude as shown in Fig. 6. This figure shows a consistent symmetry between altitude curves, which is due to the shielding effect of the atmosphere. The altitude A (in km) can also be related to an atmospheric depth h (in g/cm^2) (or atmospheric pressure p (in mbar)) in accordance with the relation:[37]

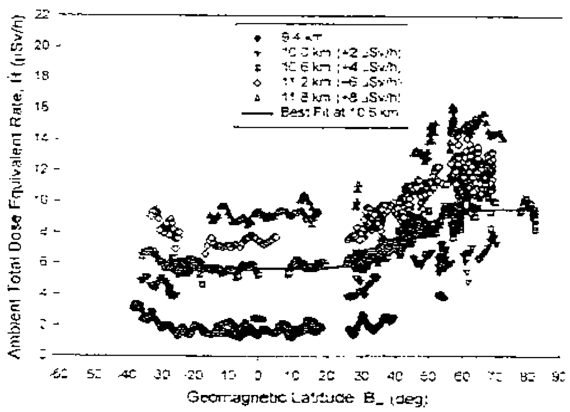

Figure 6. Experimental dose rate data versus geomagnetic latitude for various altitudes. (The curves are displaced for improved clarity by the values given in the figure).

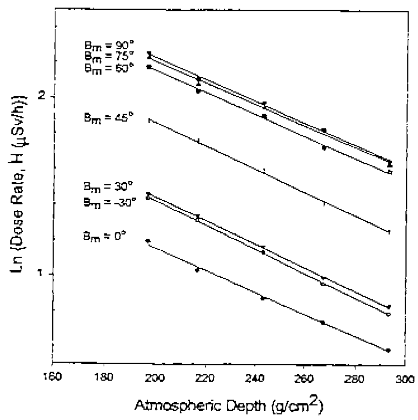

Figure 7. Plot of ln($\dot{H}$) versus atmospheric depth at various global positions.

$$h=\frac{p}{0.98}=\begin{cases}1.02p_o[1-0.0227A]^{5.26}, & A\le 10.9\\ 0.2276p_o\exp\{-0.1587(A-10.94)\}, & A>10.9\end{cases} \qquad [5]$$

where p_o = 1013.25 mbar. In fact, if the dose equivalent rate data are plotted in a semi-logarithmic fashion versus the atmospheric depth, h, a linear relationship results (see Fig. 7) (as also suggested in Fig. 2 for the given range of atmospheric depth). The slope of the resulting line corresponds to an effective relaxation length for the given particles in the atmosphere, ξ_s. An average slope of the resulting lines yields a value of ξ_s = 0.0062 cm^2/g, which is in excellent agreement with other literature values.[38,39]

This relaxation length (valid over the altitudes 9.4 to 11.8 km) can be used to normalize the data in Fig. 6 to a specific altitude. In particular, the dose rate at 10.6 km (i.e., h_o = 243 g/cm^2) can be derived from the dose rate at any atmospheric depth according to the scaling function:

$$\frac{\dot{H}(h)}{\dot{H}_o}=e^{-\xi_s(h-h_o)}\,. \qquad [6]$$

Normalizing all data from various altitudes to 10.6 km in this manner yields Fig. 8.

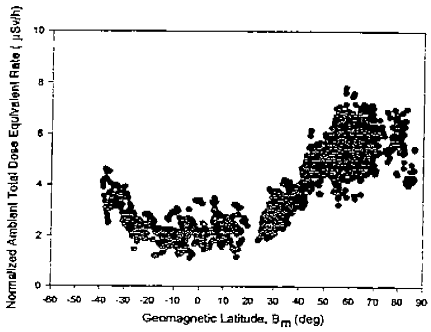

Figure 8. Dose rate (normalized to 10.6 km) versus geomagnetic latitude.

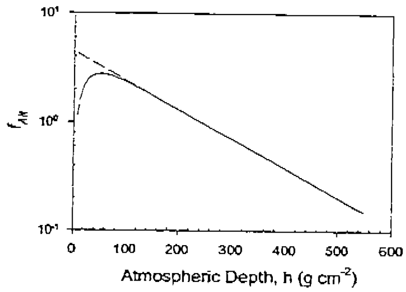

Figure 9. Comparison of the altitude correction function given in Eqs. (6) and (7).

Unfortunately, Eq. (6) cannot be extrapolated to altitudes near or above ~20 km because of the effect of secondary particle buildup (see Fig. 2). However, a more general function can be derived from mass balance considerations for the loss of primary particles and the formation of secondary particles in the atmosphere, such that:[40]

$$f_{Alt}(h)=\frac{I_s(h)}{I_s(h_o)}=e^{-\xi_s(h-h_o)}\left[\frac{1-e^{-(k_o-\xi_s)h}}{1-e^{-(k_o-\xi_s)h_o}}\right]. \qquad [7]$$

Here the parameter k_o accounts for the attenuation of primary particles in the atmosphere which is fitted to provide a maximum value of the function at the Pfotzer maximum (i.e., at an altitude of 20 km or atmospheric depth of ~ 60 g/cm^2), yielding a value of k_o = 0.043 cm^2/g. This result is consistent with the

LUIN calculations of Fig. 2(a) which show a greater relaxation length for the primary protons near the top of the atmosphere. Equations (6) and (7) are compared in Fig. 9, which reveals that the term in square brackets in Equation (7) is equal to unity over the range of atmospheric depths in Fig. 7. A more complete transport calculation indicates that the Pfotzer maximum is somewhat dependent on latitude and the type of particle involved. However, as a first approximation, Eq. (7) is able to account for the main features observed in Fig. 2 for the secondary particles including a maximum due to their buildup and an approximate exponential loss in the lower part of the atmosphere

To account for solar cycle effects, a normalizing function for the heliocentric potential was found using the CARI 5E transport code. About 1350 CARI 5E runs were compiled for 23 flights worldwide at six-month intervals over a 28-year period at 10.6 km. The effective dose of each flight was normalized to a heliocentric potential of 650 MV. A correlation was developed to allow for interpolation of U for values from 400 to 1500 MV, where it is observed that there is also a slight dependence on the geomagnetic latitude B_m (in degrees) (which is more pronounced at higher latitudes), such that:

$$f_{Helio}(U,B_m)=\begin{cases}\left[\dfrac{f_2-f_1}{25}\right]|B_m|+f_1, & 0\le|B_m|<25\\ f_2, & |B_m|\ge 25\end{cases} \qquad [8a]$$

where f_1 and f_2 are explicit linear functions of U (in MV):

$$f_1(U)=-1.494\times10^{-4}U+1.1026 \ \ and \qquad [8b]$$
$$f_2(U)=-3.992\times10^{-4}U+1.2696\ .$$

Here f (as well f_1 and f_2) are normalized to a value of unity at 650 MV.

On further examination of the symmetry around the equator in Fig. 8 (with a mirroring of data), it was seen that the north to south symmetry was not exact. This lack of symmetry is due in part to the 10.7° offset of the spin axis of the Earth with respect to the magnetic dipole axis, which gives rise to deviations in the magnetic field (in particular, the South Atlantic Anomaly). As well, the collected data do not span the full range of geomagnetic coordinates, which limits the ability of the correlation as a reliable method for interpolating the dose rate for any flight worldwide. To allow for the asymmetries of the earth's magnetic field, the data can be plotted instead as a function of the vertical cutoff rigidity (Fig. 10).

Figure 10 shows that the experimental data from the 36 flights cover all possible values of vertical cutoff rigidity (R_c) from 0 to 16 GV. A correlation of the global dose rate as a function of R_c is therefore possible for a given global position (i.e., geomagnetic latitude B_m). Symmetry was verified by differentiating data collected north of the equator with that south of the equator. The two sets of data overlapped, showing that the relationship of dose rate and R_c (within experimental uncertainties) is symmetrical around the equator and is in fact a better representation than a plot of dose equivalent rate versus B_m. A best-fit polynomial to the data in Fig. 10 provides the normalized dose rate $\dot{H}_o$ (in µSv/h) (at 650 MV and 10.6 km) as a function of the vertical cutoff rigidity R_c (in GV):

$$\dot{H}_o=3.474\times10^{-5}R_c^5-1.599\times10^{-3}R_c^4+2.741\times10^{-2}R_c^3-0.1956R_c^2+0.1630R_c+5.784\ . \qquad [9]$$

Equation (9) is used for the code development to allow for dose rate prediction for any global position, with corrections for the effects of altitude and solar cycle via Eqs. (7) and (8), respectively, where it can generally be written:

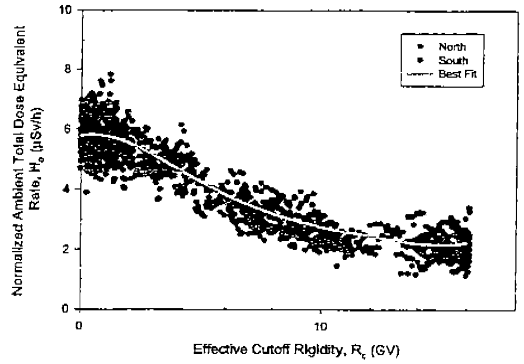

Figure 10. Plot of dose rate $\dot{H}_o$ (normalized to U = 650 MV and 10.6 km) versus effective vertical cutoff rigidity, R_c (GV). The R_c values were calculated from the Smart-Shea model of Eq. (2).

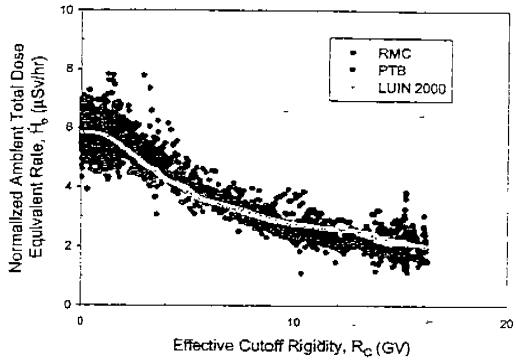

Figure 11. Comparison of the experimental data at RMC and PTB (normalized to U = 650 MV and 10.6 km) with the LUIN 2000 code predictions. The vertical cutoff rigidity values are based on the IGRF 1995 table values for a 5° × 5° world grid.

$$\dot{H}(R_c, h, U; B_m) = \dot{H}_o \cdot f_{Alt} \cdot f_{Helio} \cdot \qquad [10]$$

Comparison to PTB Measurements

At the PTB in Germany, concurrent measurements have been conducted. In the PTB analysis, measurements with a neutron monitor and an ionization chamber were summed to produce a total dose equivalent rate (similar to that performed with the bubble detectors and ionization chamber in Table 3). The instrumentation was flown on 39 flights worldwide.[9,10] The PTB data can be compared to the RMC data set by similarly normalizing the former data to 10.6 km and 650 MV (using the previous methodology) and plotting the dose equivalent rate versus R_c. As seen in Fig. 11, both studies are in excellent agreement where the best fit curves for each of the data sets agree within 5%.

Comparison to LUIN Transport Code Calculations

The RMC and PTB data were also compared to calculations with the radiation transport code LUIN 2000. [11,41,42] The code provides for a calculation of the atmospheric cosmic-ray angular fluxes, spectra, scalar fluxes and ionization, and these quantities are then used to calculate the absorbed dose in a semi-infinite 30-cm slab phantom (which provides a simplified representation of the human body in an aircraft). The absorbed dose data at each depth are obtained by integrating the scalar energy spectrum multiplied by the flux-to-dose conversion factors at that depth. Absorbed dose data at various depths are then used to construct absorbed doses for bilateral isotropic exposure.[43] The equivalent dose to bone marrow and skeletal tissue is also calculated at a depth of 5 cm in ICRU tissue. In addition, LUIN is able to provide an output in terms of an ambient dose equivalent (H*(10)), using the ICRP-60 *Q*(LET) relationship.

In the present analysis, the RMC flights in the experimental database were first simulated for a constant altitude of 10.6 km and 650 MV providing an ambient dose equivalent rate along the entire flight path of each flight (Fig. 11). In addition, the actual flight paths were simulated with LUIN and the correlations of Eqs. (7) and (8) for altitude and heliocentric potential effects were subsequently applied in order to test the given normalization procedure, which yielded similar results to that shown in Fig. 11. For these comparisons, the data are plotted against the latest vertical cutoff rigidity calculations for the International Geomagnetic Reference Field (IGRF) of 1995. There is again excellent agreement between the experimentally-based model and the theoretical (H*10) LUIN code predictions (i.e., within 7%). The LUIN 2000 curve is practically identical to the best-fit polynomial for the proposed curve in Fig. 10.

Code Development and Validation

A Predictive Code for Aircrew Radiation Exposure (PC-AIRE) was developed, in a Visual C++ platform, from the data analysis and the equations produced therein.[44] This code was written to be user-friendly and requires minimal time for data input, calculation and data storage. The code requires the user to input the date of the flight, the origin and destination airports, the altitudes and times flown at those altitudes. Look-up tables produce the latitude and longitudes of origin and destination, as well as the heliocentric potential. A great circle route is produced between the two airports, and the latitude and longitude are calculated for every minute of the flight.[44] The vertical cutoff rigidity is calculated from either Eqs. (2) and (3) (which provide for a 3-epoch average), or interpolated from IGRF-1995 tabulated data for the given geographical coordinates along the flight path. The dose rate is then integrated along the great circle path at one minute intervals using the model of Eq. (10), which is based on the normalized correlation in Eq. (9) (Fig. 10), and unfolded to the actual altitude flown (Eq. (7)) and the heliocentric potential for the date of the flight (Eq. (8)). The code outputs the total ambient dose equivalent for the total flight route. The PC-AIRE code was validated against the remaining 26 flights from the original data set collected with the RMC TEPC (i.e., these validation data were independent of the 36-flight data used for model development). As shown in Fig. 12, the PC-AIRE predictions of the validation flights are in very good agreement with the TEPC measurements for those flights. Here the measured TEPC data have a relative error of ~18%, while the code, based on a sensitivity analysis, has a predictive error of about 20% (which accounts for the uncertainty due to deviations in the flight path from a great circle route as well as uncertainties in the scaling functions for the altitude and heliocentric potential).

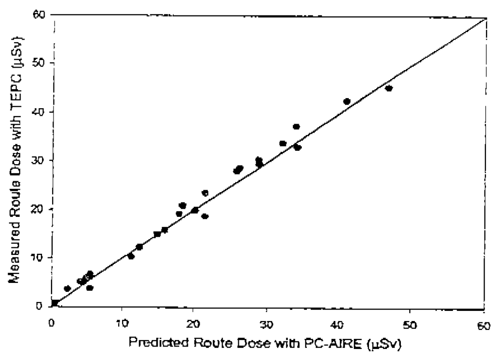

Figure 12. Plot of measured TEPC results versus PC-AIRE Code predictions of flight dose.

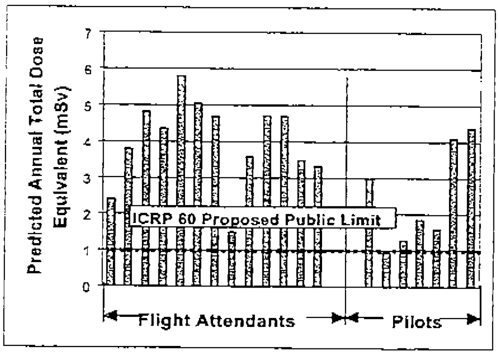

Figure 13. PC-AIRE prediction of aircrew annual exposure.

Table 4: Route Doses from the PC-AIRE Code

Grouped Global Flight Region	Sample Route	Scheduled Flight Time	PC-AIRE Route Dose (μSv per flight)
Trans-Pacific	PEK-CYVR	10h 40min	55
Trans-Atlantic	CYVR-LHR	9h 6min	52
Trans-Canada	CYYZ-CYVR	4h 26min	24
Caribbean	CUN-CYYZ	3h 37min	15
Northwest/Yukon Territories	CYOW-CYFB	2h 50min	15
Pacific	MNL-HKG	1h 43min	3.3

A PC-AIRE prediction of route doses (in units of the ambient total dose equivalent) is shown in Table 4 for representative flights which cover various global flight regions, assuming an altitude of 10.6 km (i.e., atmospheric depth of 243 g/cm^2) and a heliocentric potential of 500 MV (i.e., close to a recent minimum in the solar cycle or a maximum galactic situation). For the non-equatorial regions, these calculations yield a typical dose equivalent rate of ~5.4 μSv/h. The ability of the code to extrapolate to supersonic altitudes can be determined with the use of the proposed scaling function in Eq. (7). For instance, at 18.2 km (73 g/cm^2), Eq. (7) (or Fig. 9) indicates a factor of f_{Alt} = 2.7, yielding an augmented dose rate via Eq. (10) of ~15 μSv/h. This extrapolated value is in good agreement with the calculations of O'Brien et al.[45] which indicate an equivalent dose rate to the bone marrow and skeletal tissue of ~16 μSv/h, and a dose equivalent rate of ~19 μSv/h as suggested by Reitz[24] for data collected at 55° geomagnetic latitude (during solar minimum conditions). In addition, an extensive measurement campaign was undertaken using the passive dosimetry boxes of the NRPB on 96 return flights (London to New York) on the British Airways Concorde, which yielded an average H*(10) total dose equivalent rate of ~11 μSv/h at 16.1 km (102 g/cm^2).[46] This latter value is also in good agreement with a predicted PC-AIRE value of ~12 μSv/h at this slightly lower altitude. Thus, there is some confidence in the ability of the model to extrapolate to supersonic altitudes. This capability is expected considering the well characterised relaxation length in Fig. 7, and the essentially simple exponential behaviour of the dose rate as a function of atmospheric depth (Figs. 2 and 9) over the given range of altitude for these various types of commercial flights.

Aircrew Annual Exposure Prediction

The PC-AIRE code was further used to simulate flights actually taken by selected aircrew in Ref. 2 to provide a prediction of the annual aircrew exposure, assuming an average altitude of 10.6 km and a heliocentric potential of 500 MV (corresponding to the average value for the study period). As shown in Fig. 13, all but one aircrew member surpassed the proposed ICRP-60 public limit of 1 mSv/y, whereas all crewmembers are well below the proposed occupational limit of 20 mSv/y. These data, in conjunction with Table 1, demonstrate that there is a valid requirement to monitor the radiation exposure of aircrew, perhaps using such predictive tools as that developed in this work.

The PC-AIRE code provides a route dose in units of ambient dose equivalent, whereas legal regulation limits are generally given in terms of effective dose. For typical terrestrial situations, the ambient dose equivalent is a reasonable surrogate for the effective dose since it is a more conservative quantity. However, the ambient dose equivalent may no longer be a conservative estimate of the effective dose for the complex high-energy cosmic spectrum, primarily due to the enhanced weighting factor of

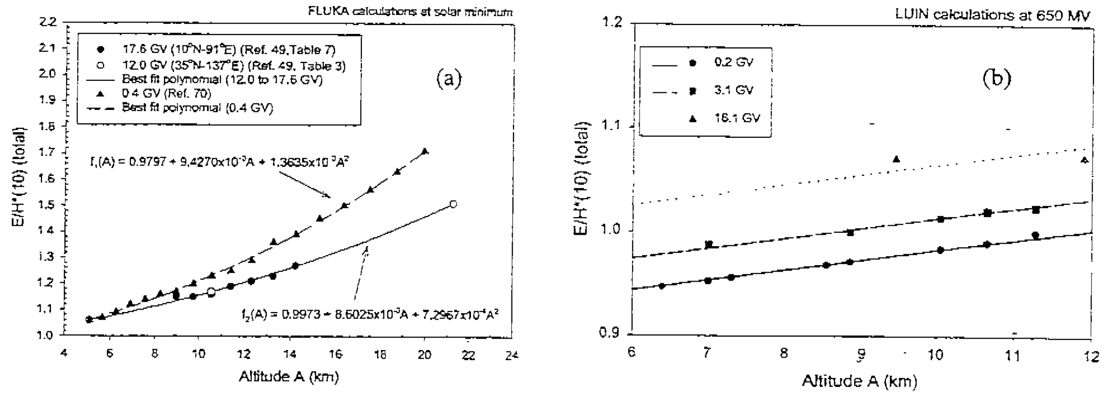

Figure 14. Conversion factor from ambient dose equivalent to effective dose as derived from (a) FLUKA and (b) LUIN calculations. The lines in (b) are derived from Eq. (11b).

five for the protons.[35] This result can be clearly seen in Fig. 14(a), where the ratio of effective dose (E) to ambient dose equivalent (H*(10)) is greater than unity based on the FLUKA analysis.[35,47] On the other hand, the current LUIN calculations in Fig. 14(b) suggest that E/H*(10) is typically closer to unity as a consequence of the lower proton fluence rate in Fig. 2(a). Consequently, in the PC-AIRE code, an effective dose calculation is performed where the user has a choice of scaling function as depicted in Figs. 14(a) and (b), such that

$$f_{E/H^*(10)}^{FLUKA}(A, R_c) = \begin{cases} \dfrac{(f_2 - f_1)}{12} R_c + f_1, \; 0 \le R_c < 12 \\ f_2, \quad R_c \ge 12 \end{cases} \qquad [11a]$$

where $f_1 = 0.9797 + 9.427\times10^{-3}A + 1.3635\times10^{-3}A^2$ and $f_2 = 0.9973 + 8.6025\times10^{-3}A + 7.2967\times10^{-4}A^2$, and

$$f_{E/H^*(10)}^{LUIN}(A, R_c) = 9.901\times10^{-3} A + f_3(R_c) \qquad [11b]$$

where $f_3 = -4.170\times10^{-4} R_c^2 + 1.188\times10^{-2} R_c + 0.8816$. In Eqs. (11a) and (11b), A is the altitude in km and R_c is the vertical cutoff rigidity in GV. These correlations correspond to conditions near a solar minimum. Thus, the ambient dose equivalent rate in Eq. (10) is multiplied by the chosen conversion function in Eqs. (11a) or (11b) to yield an effective dose, where Eq. (11a) will yield the more conservative estimate (i.e., by ~20% at subsonic altitudes). As a caveat, the LUIN predictions of ambient dose equivalent have been validated against two independent data sets in Fig. 11 based on an extensive series of in-flight measurements. However, as mentioned in the derivation of Eq. (4), the proton contribution will result in only a small (i.e., approximately 10%) enhancement of the dose equivalent from the absorbed dose value if one employs a standard Q(LET) relationship in such calculations. As such, the ambient dose equivalent estimates of FLUKA and LUIN should not vary significantly, although further investigation is clearly warranted to improve upon the effective dose calculation in order to reduce the observed discrepancy in Fig. 14 between the two codes. This further investigation is important since an overly conservative estimate of effective dose could result in undue restrictions if such theoretically-based tools are used to manage the aircrew exposure.

Conclusions

1. A tissue equivalent proportional counter (TEPC) was utilized to conduct an extensive in-flight measurement program to investigate aircrew radiation exposure at jet aircraft altitudes over a one-year period. Over 20 000 total (ambient) dose equivalent rate data were collected on 62 worldwide flights, spanning altitudes up to 12.4 km, and geomagnetic latitudes from 50° south to 85° north that cover the complete cutoff rigidity of the earth's magnetic field. This database compared extremely well to other data collected by the PTB on different flights, utilizing different instruments and a contrasting research methodology (where ionization chamber and neutron remmeter data were summed to yield the same total dose equivalent). The current data were also successfully compared to theoretical transport calculations with the LUIN 2000 computer code. Thus, these experiments provide for a validation of the deterministic LUIN code for a prediction of the total (ambient) dose equivalent received by aircrew. On the other hand, the results from the two independent laboratories can be used to produce a single (experimentally-based) function (item 2), which can be easily adapted as a practical code (item 3) for aircrew radiation exposure assessment.

2. A semi-empirical model was developed to relate the measured total (ambient) dose equivalent rate to the vertical cutoff rigidity (which is a function of the latitude and longitude). This correlation was obtained by relating the dose rate data to specific positional information as a function of time along the flight path of the aircraft. The TEPC data were summed and smoothed to minimize the data uncertainty (~ 18% relative error) without an undue loss of data. Physically-based functions were developed to scale the dose rate data as a function of altitude (using a measured relaxation length of 0.0062 g/cm^2) and heliocentric potential (based on a theoretical analysis with CARI 5E). The current model therefore provides for an estimate of the total (ambient) dose equivalent rate for any global flight path and time in the solar cycle.

3. The model was developed into a computer code, PC-AIRE, for global dose prediction using a great circle route calculation (e.g., between various waypoints or the departure and arrival airport locations) by summing the dose rates over the given flight path. The code methodology was directly validated against an independent set of TEPC route-dose measurements on 26 flights. An effective dose calculation is also possible with PC-AIRE using conversion functions developed from an analysis with LUIN and FLUKA, however further work is needed to improve upon the discrepancy of ~20% for the ratio of the effective dose to ambient dose equivalent as obtained between the two transport codes.

4. An assessment of the annual exposure of Canadian-based aircrew was performed with the PC-AIRE code using actual flight frequency information. From this analysis, most aircrew will exceed the annual ICRP-60 public limit (1 mSv/y), but are well below the proposed ICRP-60 occupational limit (20 mSv/y).

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Biography

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Health Implications of Canadian Studies on Cosmic Radiation Exposure of Aircrew

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INTRODUCTION

The purpose of this paper is to discuss the health implications of the Canadian data on cosmic radiation exposure of aircrew. As a background to this discussion, a brief overview of the framework for radiation protection and how it relates to cosmic radiation exposure will be provided.

Since the publication in 1991 of the recommendations of the International Commission on Radiological Protection (ICRP) there has been a resurgence of interest in cosmic radiation exposure of aircrew (Reitz 1993, International Workshop 1998, International Conference 1999). ICRP Publication 60 stated that there should be a requirement to include exposure to natural sources as part of occupational exposure in the operation of jet aircraft (ICRP 1991). Aircrew are flying at higher altitudes on longer flights, often over polar regions. This has resulted in increasing exposure to aircrew. ICRP also recommended lowering the annual radiation dose limit to members of the public. With this reduction, the exposure of some categories of aircrew may be higher at work than the recommended public dose limit.

Cosmic radiation is a component of the natural background radiation to which we are all exposed. During flight, aircrew are exposed to increased levels of cosmic radiation which consists mainly of neutrons and gamma rays. The dose rate depends primarily on altitude and geomagnetic latitude and to a lesser extent on solar activity. From the equator towards either pole the dose rate increases up to about 50 degrees and thereafter remains fairly constant. Thus, Canadian domestic flights will largely be at latitudes where the dose rate is highest. In 1996, the Canadian Aircrew Radiation Environment Study was initiated to document route-specific doses on domestic and international flights. The analysis of the data shows that most Canadian based domestic and international aircrew will exceed the 1 millisievert (mSv) recommended annual public dose limit but will remain well below the 20 mSv annual average occupational dose limit (Lewis 1999).

BACKGROUND

From the earliest days of its discovery, it was apparent that ionizing radiation was harmful in large doses and at relatively high dose rates to biological systems. It was found that exposure of humans could lead to the induction of cancer and possibly to hereditary defects in their offspring. Very large doses could lead to severe organ malfunction and death, so that some way of controlling exposures was required in order to reap the benefits that might accrue from radiation use, while at the same time minimizing the harmful effects.

Since the main use of ionizing radiation at the time was in medicine, the International X-ray and Radium Protection Committee was formed in 1928 to provide guidance to medical practitioners on the safe use of radiation. However, with the advances in radiation device utilization in medicine and industry and the widespread use of radioactive materials in all fields since that time, the Committee needed to broaden its scope and provide guidance on all aspects of radiation use which might affect workers or the general public. In 1950 it was restructured and renamed the International Commission on Radiological Protection.

Over the last few decades, the rationale of radiation protection has undergone development and change. Initially it was felt that control of exposure could be adequately achieved through compliance with the established dose limits. Although the concept of keeping doses as low as possible was current, it was not applied in any systematic way. However, this concept has developed latterly into the ALARA principle, which is described as keeping doses "as low as reasonably achievable, economic and social factors being taken into account". The net effect of the application of the ALARA principle has been to lower average doses to workers and the general public, and to place less reliance on the dose limits as a control measure.

The three principles upon which the philosophy of radiation protection is currently based are: justification, optimisation and dose limitation. The principle of justification states that no practice involving radiation exposure of humans should be introduced unless it produces sufficient benefit to exposed individuals or society to offset the detriment it might cause. The principle of optimisation is a formulation of the above ALARA concept, and states that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposure where this is are not certain to occur, should all be kept as low as reasonably achievable, economic and social factors being taken into account. This optimisation process may well involve imposing constraints on individual dose which are lower than the dose limit, or on the risks to individuals in the case of potential exposures, so as to limit any inequity that might result from economic and social judgements. The principle of dose limitation states that exposure of individuals from all sources in all practices should be subject to dose limits, or in the case of potential exposures, to some control of the risk of exposure. The objective here is to ensure that no individual is subject to unacceptable radiation risks in the course of normal operation of a practice. It should be noted, however, that not all sources of exposure lend themselves to such control.

RECOMMENDATIONS OF THE ICRP

The dose limits for workers and the general public have tended to be reduced as more information on the deleterious effects of ionising radiation has accumulated and have culminated in ICRP Publication 60 (ICRP 1991). The reduction of dose limits in ICRP Publication 60 arose in part because of a reconsideration of the contribution made by the neutron component to the radiation exposure of the Japanese atomic bomb survivors. This population of exposed persons is the major source of information on radiation risks.

The previous dose limit was 50 millisieverts (mSv) per year for those occupationally exposed, and 5 mSv per year for the general public. In ICRP Publication 60 the dose limit was reduced to 100 mSv over five years or an average annual dose limit of 20 mSv for workers, and 1 mSv for the public. However, a dose of up to 50 mSv may be tolerated in any one year for workers, provided the annual average over five years does not exceed 20 mSv. The ICRP dose limit translates into a cumulative dose of 1000 mSv (1 Sv) for a worker exposed at the annual limit for the whole of his working life (50 y). This is equivalent to an excess lifetime risk of fatal cancer of about 4% for workers.

With this reduction in the annual dose limit, the exposure of some categories of aircrew may be higher at work than the public dose limit, and this would place them in the category of being occupationally exposed, even though they are exposed incidentally and do not utilize radiation in the performance of their duties. Classification as a member of an occupationally exposed group is generally determined by the probability of exceeding the recommended annual public dose limit. The conventional definition of occupational exposure is "exposure incurred at work". This definition is not appropriate for radiation protection purposes because in some occupations workers are exposed to natural sources of radioactivity for which no control is possible. The ICRP has therefore limited this definition to "exposure incurred at work as the result of situations that can be reasonably regarded as being the responsibility of operating management". ICRP Publication 75 (ICRP 1997) specifically states that exposure of jet aircrew to cosmic rays should be treated as occupational exposure. Some measure of control is possible by limiting flying time or rostering.

ICRP Publication 60 has made specific recommendations for pregnant workers. Once pregnancy has been declared, the conceptus should be protected by applying a supplementary equivalent dose limit of 2 mSv to the surface of the abdomen for the remainder of the pregnancy. ICRP Publication 75 provides further interpretation by stating that the working conditions of pregnant workers, once pregnancy has been declared, should be such that additional equivalent dose to the conceptus would not likely exceed about 1 mSv during the remainder of the pregnancy.

ICRP dose limits are expressed in terms of effective dose, with the additional specification of equivalent dose to the fetus or surface of the pregnant woman's abdomen. The effective dose is a risk-related quantity which applies to the human body. It is used for radiation protection purposes, but cannot be directly measured. In this paper, the term "dose" will be used to mean "effective dose", unless otherwise stated. Both effective dose and equivalent dose are expressed in units of millisieverts and for the purpose of this paper can be considered to be numerically the same. Another term used in this paper is the "absorbed dose", which is expressed in milligray (mGy). These terms are explained later in the text but a detailed discussion of dosimetric units used in radiation protection is beyond the scope of this paper.

CANADIAN STANDARDS

In Canada, while an aircraft is in operation, the aircrew is subject to Part II of the Canada Labour Code and the Aviation Occupational Safety and Health Regulations. The term aircrew is intended to include flight deck crew and cabin crew. Although there are no regulations under the Canada Labour Code or the Aeronautics Act pertaining to occupational exposure to cosmic radiation a Commerical and Business Aviation Advisory Circular (CBAAC) has been developed and is being reviewed by labour and management organizations. The CBAAC recommends actions to control the cosmic radiation exposure of aircrew.

There is more than one organization in Canada responsible for setting radiation protection standards. The federal department of health, Health Canada, has the responsibility for setting radiation protection standards for federal employees. The Canadian Nuclear Safety Commission (CNSC) sets radiation protection standards for activities arising from nuclear facilities or the use of radioactive materials, while provincial regulatory authorities set standards for x-ray use.

The standards developed by Health Canada are often referenced in the Canada Labour Code or adopted by provincial regulatory authorities. Traditionally, Health Canada has adopted the recommendations of the ICRP. The standards which relate to x-ray exposure specify an annual dose limit of 20 mSv per year for workers. For pregnant workers the specified dose limit is 2 mSv for the remainder of the pregnancy, measured at the surface of the abdomen. In the case of x-rays, the fetus receives roughly one half of the dose measured at the surface of the abdomen. This is expected to provide the fetus with a level of protection broadly comparable to the general public.

The CNSC has specified an occupational dose limit of 100 mSv in 5 years, with a maximum of 50 mSv in one year in its Radiation Protection Regulations under the Canadian Nuclear Safety and Control Act. For pregnant workers the specified dose limit is 4 mSv, which includes radiation from both internal and external sources.

COSMIC RADIATION EXPOSURE OF AIRCREW

In the 2000 Report to the General Assembly by the United Nations Scientific Committee on the Effects of Atomic Radiation, the annual average dose to aircrew on long-haul flights is given as 3-5 mSv per year compared to 2.7 mSv for measurably exposed workers at nuclear power plants (UNSCEAR 2000). In Canada, the annual average dose to aircrew has not been determined. However, Canadian studies of cosmic radiation exposure of aircrew indicate that annual doses are likely to be in the1-5 mSv range (Lewis 1999). The annual average dose to measurably exposed nuclear workers in Canada is about 2.2 mSv (Health Canada 1999). The annual average risk of fatal cancer associated with the above levels of cosmic radiation exposure is in the order of 1 in 10,000 - a level of risk usually found in "less safe" occupations. Industries that would normally be regarded as "safe" will have risks of less than 1 in 100,000 per year (Sinclair 2000). Therefore, the cosmic radiation exposure of aircrew should not be ignored.

While the level of exposure of aircrew to radiation is similar to that of some ground-based workers there are some differences from a health perspective. In ground-based practices the exposure is usually intermittent while cosmic radiation exposure is always present. Even though there is variation in the dose rate depending on geomagnetic latitude, altitude and phase of the solar cycle, no sudden large increases in dose rate are expected at subsonic altitudes. The dose rate is an important determinant of the magnitude of risk.

In ground-based practices the radiation field is less complex than at aircraft altitudes. Radiation workers are exposed primarily to low energy radiations while a substantial part of the radiation exposure of aircrew is due to high energy radiations. We know a great deal about low energy radiation health effects at high doses, but there is significant controversy regarding effects at lower doses due to the lack of adequate statistically significant data. Some argue that there may be a threshold below which biological responses do not occur, but for radiation protection purposes it is assumed that radiation may initiate damage even at low doses. With regard to high energy radiation health effects, there is some biological data at high doses and extemely limited information at low doses. To determine the health significance of chronic low level exposure to cosmic radiation during air flight we must extrapolate from laboratory or clinical experience with radiations of low energy and the limited data on the effects from radiations at high energy.

Solar particles events (SPE), which are bursts of energetic particles from the sun, can produce exposures at aircraft altitudes. Fortunately, SPEs are not a significant radiation hazard for aircrew of subsonic aircraft. However, repetition of the worst SPE ever recorded (February 1956) might deliver a dose to passengers on long distance high altitude flights of several mSv (Goldhagen 2000). SPEs are more of a concern for supersonic aircraft, but on-board radiation monitors will permit the pilot to take evasive action by descending to a lower altitude.

Before discussing the health effects it is useful to put the doses of cosmic radiation received by aircrew into some context. In addition to receiving radiation exposure directly due to work, aircrew are also exposed to natural and man-made sources of radiation. Table 1 shows the worldwide annual average radiation dose from natural sources. All living organisms are exposed to ionizing radiation. The sources of that exposure are cosmic rays that come from outer space and from the surface of the Sun, terrestrial radiation from naturally-occurring radioactive materials in the Earth's crust, in building materials and in air, water and foods and in the human body itself. Some of the exposures are fairly constant and uniform for all individuals, while others vary depending on location. For example, cosmic rays are more intense at high ground elevations.

Table 1. Average radiation dose from natural sources (UNSCEAR 2000)

Source	Worldwide average annual effective dose (mSv)	Typical range (mSv)
Cosmic rays	0.4	0.3-1.0
Terrestrial gamma rays	0.5	0.3-0.6
Inhalation (mainly radon)	1.2	0.2-10
Ingestion	0.3	0.2-0.8
Total	2.4	1-10

Table 2 shows the worldwide annual average radiation dose from natural and man-made sources. Releases of radioactive materials to the environment have occurred from a wide range of practices and have resulted in exposures to human populations. By far the greatest contribution to exposure comes from natural background radiation. This is followed by diagnostic medical radiation procedures. In Canada, the annual average radiation dose from natural sources is probably close to 2.4 mSv, while from diagnostic medical procedures it has been estimated at 1.1 mSv (ACRP 1997).

Table 2. Annual per caput effective doses in year 2000 from natural and man-made sources (UNSCEAR 2000)

Source	Worldwide annual per caput effective dose (mSv)
Natural background radiation	2.4
Diagnostic medical examinations	0.4
Atmospheric nuclear testing	0.005
Chernobyl accident	0.002
Nuclear power production	0.0002

RADIATION HEALTH EFFECTS

Risk of cancer is the principal health concern associated with long-term occupational exposure to ionizing radiation. Radiation exposure has the potential to cause hereditary disorders in the offspring of exposed individuals. However, hereditary effects have not been observed in exposed human populations, although they are known to occur in other species (UNSCEAR 2000). The health effects arising from pre-natal radiation exposure will be discussed in a later section of this paper.

Ionizing radiation consists of electromagnetic waves or particles that can ionize, that is, remove an electron from an atom or molecule of the medium through which it passes. In living matter the process of ionization may result in the death of a cell or in a modification that can affect normal function. When sufficient numbers of cells are killed there will be observable damage to organs or tissues. This kind of damage requires very high doses of radiation, much more than will ever be received by aircrew from cosmic radiation. If a cell is not killed but only modified, the damage is usually repaired. However, when repair is imperfect the modification can be transmitted to daughter cells which can eventually result in cancer. The minimum latent period for cancer development following an acute exposure is about 2 years for leukemia and 10 years for solid tumours. If the cells are concerned with transmitting genetic information to descendants of the exposed individual, hereditary disorders may arise. Effects such as cancer or hereditary effects may arise as a result of damage to a single cell. Damage to chromosomal DNA (deoxyribonucleic acid) in the nucleus of a cell is the main initiating event by which radiation causes long-term harm to organs and tissues of the body. The more cells that are damaged the greater the probability that an adverse outcome will result.

Units used to measure radiation dose reflect the damage that the exposure may cause to tissues or organs. There are three important factors that determine how much damage a given radiation exposure causes. The first is the amount of energy the radiation deposits in the tissue. This is known as the absorbed dose. The second is the type of radiation that is depositing the energy. When the absorbed dose is multiplied by a "radiation weighting factor" it is known as the equivalent dose. The third is the susceptibility of different tissues to radiation-induced cancers or hereditary disorders. To allow for the difference in harmful effects from the same equivalent dose a set of "tissue weighting factors" have been developed. The tissue weighting factors take into account the probability of cancer induction, the relative ease with which the cancer can be cured, the probability that radiation will cause serious hereditary disorders in the offspring, and the years of normal life expectancy lost or seriously impaired due to all these effects. When the absorbed doses in various tissues are multiplied by both the radiation weighting factor and the tissue weighting factor the result is the effective dose.

ESTIMATES OF LIFETIME FATAL CANCER RISK

Risk coefficients have been developed to allow us to estimate the lifetime fatal cancer risk in populations exposed to ionizing radiation. The estimates of risk have been derived from populations in whom individual radiation doses can be reasonably estimated. These populations include the survivors of the atomic bombings, medically irradiated patients, occupationally exposed persons, individuals exposed to radioactive materials released into the environment and people exposed to elevated levels of natural background radiation. The most important of these is the atomic bomb survivor population because of its large size (over 86,000), the wide distribution of doses and the full range of ages. Even in such a large population a significant increase in fatal cancer risk is only detectable at acute doses above about 100 mSv.

ICRP has estimated a lifetime fatality probability coefficient of about 4% per sievert (1000 mSv) for the sum of all malignancies for workers exposed to chronic low level radiation (ICRP 1991). For example, if aircrew were exposed to 6mSv annually for thirty years (6 mSv is the action level of the 1996 European Radiation Protection Directive (CEC1996)). the increase in lifetime fatal cancer risk would be 0.7%. Canadian cancer statistics indicate that about 25% of Canadians will eventually die of cancer from all causes. This means that the risk to Canadian aircrew would increase from about 25% to 25.7%.

It should be noted that most aircrew would not be exposed at this level and a cumulative dose in the order of 100 mSv would be more likely. The level of risk associated with a cumulative dose of 100 mSv (ie., 0.4%) would not be detectable using epidemiologic methods. Besides low statistical power, there are other issues of concern in epidemiological studies of aircrew: comparison groups may not be valid since aircrews possess characteristics and lifestyles that differ appreciably from the general population; there is a potential for confounding related to other occupational or lifestyle factors; and, there may be difficulties in estimating cumulative exposure.

Nevertheless, there are reports in the scientific literature of increased levels of some cancers in epidemiologic studies of aircrew. A recent review of the literature concludes that there is little consistent evidence linking cancer with radiation exposures from air travel. Further study which is on-going may help dissect the contributing components of risk (Boice 2000).

HEALTH EFFECTS FROM PRE-NATAL RADIATION EXPOSURE

The fetus is known to be more sensitive to the effects of radiation than the adult, hence the more restrictive limits to pregnant workers. The dose limit for a pregnant worker is intended to keep the dose to the fetus at a level comparable to the dose received by members of the public from practices, that is, about 1 mSv. Due to the penetrating nature of cosmic radiation, the dose to the fetus will be effectively the same as that measured at the surface of the mother's abdomen. As already mentioned, Canadian exposure estimates indicate that most aircrew in Canada would exceed an annual dose of 1 mSv. However, there has been insufficient assessment of doses received by pregnant aircrew to know how much the fetus would typically receive from this source of exposure.

The potential health effects from pre-natal radiation exposure include: hereditary disorders in the offspring, physical and mental developmental abnormalities, childhood cancer and adult cancer. Hereditary disorders have not been observed in exposed human populations and will not be discussed further in this paper. Developmental abnormalities are not expected to occur from cosmic radiation exposure because the thresholds for these effects will not be exceeded during gestation. A short discussion of these effects is nevertheless included in this paper because of the relatively high "background" incidence of such abnormalities and the concern expressed by pregnant women about such effects.

The impact of cell killing in a developing embryo or fetus is greater than in an adult. Not only will it take fewer damaged cells to produce an effect but different effects may occur, depending on the stage of development at the time of irradiation. For example, in the first 7 days following conception, radiation can cause an "all or none" effect - that is, a spontaneous abortion or a completely normal outcome. It has been suggested that the incidence of spontaneous abortions may be as high as 30-50% (Brent 1983). During implantation, 10-14 days following conception, the embryo is more resistant to the lethal effects of radiation but transient intrauterine growth retardation may result from irradiation during this period. Irradiation during the period of major organ development, about 8-15 weeks following conception, may result in death, major organ malformation, or growth retardation because of the critical cellular activity and the sensitivity of the cells to radiation. Effects on the brain and sex cells may continue throughout gestation. Approximately 3-10% of live births have "spontaneous" malformations or congenital malformations. As in the adult, cell killing effects are associated with thresholds, albeit at much lower doses. Irradiation of the fetus at doses below 50 mGy has not been observed to cause congenital malformations or growth retardation (Brent 1983). Thresholds for most effects are well above 100 mGy (A milligray is the unit used to express the absorbed dose in the fetus. While it is not the same as the equivalent dose, or the effective dose, the numerical value should be considered the same for the purpose of this discussion). Since aircrew will not receive doses this high during the course of gestation, developmental effects attributed to radiation exposure need not be of concern to aircrew.

There is some uncertainty in establishing a risk estimate for childhood cancer following pre-natal exposure to radiation. There are studies which show an increased risk but no such excess was observed in the studies of Japanese atomic bomb survivors irradiated *in utero*. The most signficant study showing an effect comes from the Oxford Survey of Childhood Cancers (Doll 1997). There was evidence for an increased risk of about 40% for childhood leukemia and solid cancers with radiation doses in the order of 10-20 mGy. In absolute terms a 40% increase in risk does not represent a large number of cases because the spontaneous risk of childhood cancer is low. The estimated absolute risk coefficient was approximately 6% per Gy. If the spontaneous incidence of childhood leukemia is about 2 in1000 live births, a 40% increase would mean about one additional case.

The risk of cancer expressed in adulthood following pre-natal radiation exposure is more difficult to evaluate. The atomic bomb survivors who were exposed *in utero* are now in their mid-50s and will need to be followed much longer before reasonable risk estimates can be made. This is important because the relative risk appears to increase with decreasing age at exposure. However, if the dose to the fetus is kept low, the risk will also be low.

CONCLUSIONS

The current knowledge about radiation risk suggests that there should be no significant adverse health outcome due to cosmic radiation exposure of aircrew, at the doses now received. Further study of aircrew is needed to determine whether cosmic radiation, in combination with other occupational factors, is contributing to the observed cancer excesses in some studies.

Because of the uncertainty in quantifying the risk of childhood cancer following in pre-natal radiation exposure, the cosmic radiation exposure of pregnant aircrew should be kept as low as reasonably achievable.

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AUTOMATED EXTERNAL DEFIBRILLATION
(A.E.D. commonly called DEFIB or DEFIBRILLATOR).
at BRITISH AIRWAYS (BA)

Background

British Airways provides the largest international a transportation service, for up to 40 million commercial passengers annually.

They are people of all ages with varying levels of health travelling in a pressurised cabin at altitude for periods of up to 11hours at any one time.

Within BA, reported medical incident ratio is 1: 11,000 travellers. The most common medical problems are gastrointestinal (diarrhoea and vomiting), vasovagal (fainting), asthma, cardiac(heart conditions) and head injuries. Over the years our statistics show the number of reported medical incidents that occur on board are relative to the number of passengers carried.

Last year there were 431 diversion of which 52 (12.06%) were for medical reasons. The most common medical reason for diversion is for cardiac problems. Despite the disruption, inconvenience and financial cost it should also be remembered it could be lifesaving.

Training Responsibilities

As the duty training manager, my role is to ensure the provision of a service that reflects and meets the needs of the airline and legal requirement dictated by European laws (Joint Aviation Regulations (JAR-OPS).

We have a responsibility to empower crew with confidence and ability to deal with medical problems that they may encounter, utilising the resources available to them, in the unique and remote environment they work.

The medical equipment available to crew on board every aircraft, is over an above the legal requirement and unrivalled in the airline business. It includes.

Medical kit
First aid kit
Resuscitation equipment
Survival Kit
Automated External Defibrillator
MedLInk

Biolog
To be installed on every longhaul aircraft over the next 18 months

topic - BA experience with AED's
purpose - talk for SCSI
author - Lis Woodhart
85 date - January 2001

DEFIBRILLATORS

At the moment it is not a Joint Aviation Recommendations (JAR Ops) requirement for European Airlines to carry the defib, however, there is much discussion on this matter.

The American Heart Association (AHA) and the European Resuscitation Committee (ERC) endorse the concept of early defibrillation as the standard of care, with defibrillation considered a Basic Life Support (BLS) skill for rescuers both in and out of the hospital setting.

WHICH DEFIBRILLATOR

BA were not the first and certainly wont be the last to install this valuable piece of equipment on board the aircraft.

BA has chosen the Lifepak 500 this is a fully Automatic External Defibrillator (Medtronic Physio-Control Corporation, Redmond, WA). It is simple to use, with clear audio instructions.

The defibrillators have been installed on board every aircraft (356) and training of all 14,500 cabin crew commenced 2 years ago. As such it is part of the Safety equipment and all crew will be trained, to ensure the same safety Standard throughout the airline. Trained crew, and not a medically qualified volunteer on board, have full responsibility, in a medical situation.

DEFIBRILLATOR INCIDENTS

Since mid 1999, we have had 4 saves in total. This reflects 1:4.5 incidents They have occurred on longhaul routes.

Our first save was an 83 year old lady in Dec 1999. She collapsed in her seat and was moved to the floor for resuscitation. The doctors on board had given her up for dead, when crew applied the defib and successfully shocked her.

Of the non saves, we know from the downloads (which are the recordings from the defibs applied) that crew continued resuscitation for a minimum of 30 minutes.

One of the non successes on board, was a drug addict who injected himself with Pethidine (a morphine substance). He was found unconscious and unresponsive in the toilet. The defib was applied, there was no shock advised and crew moved him to the floor and continued resuscitation. We saw from the download of the defib there was no electrical activity and no chance of survival, however crew followed procedure giving him every chance of survival. This is just one example of a non success, the most common cause is pre-existing heart problems.

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MEDICAL TRAINING FOR ALL CREW

Cabin crew must successfully complete an intensive 5 day medical training course when they join the airline. This course encompasses the management of medical conditions and life saving procedures using the appropriate medical equipment available to them on board the aircraft. Flight crew attend a 1 day aviation medical training course with the emphasis on responsibilities and resources available.

Under JAR regulations cabin crew return annually. They attend a 4 hour refresher as part of Safety Emergency Procedures and must achieve 80% pass mark. The content of this annual training session reflect the needs of the airline and includes a selection of problems crew have encountered in the past 12 months. The defib and life saving procedures are now integral part of every training session

Defib training is incorporated into the new entrant training and there is an initial 3 hour training session for existing crew.

DEFIBRILLATOR TRAINING

As with all our training defib training provides "hands-on" practice with the equipment in an environment similar to the aircraft. The initial defib training group ratio is 1 trainer to 6 crew for every 3 hour session in an aircraft mockup.

We have developed our own training video and currently working with MedAire, developing a computer based training refresher programme

As in all safety training crew work together as a team .
They are trained to look for the recognition features of the casualty.
Where the casualty is unconscious the defib is called for immediately- they do not require permission from the captain
If the casualty is assessed and there is no sign of life application of the defib is

immediate - in the seat, toilet, flight deck
correct - electrodes in position
safe - move others close by, ideally from row in front and behind
from then on crew continue to follow the defib promts

However, if the defib is not immediately available crew will then move the casualty to the floor and commence resuscitation until it is.

They will also contact MedLink (MedAire) via the flight crew and Satellite communication (SATCOM) or radio system.

MedAire is an organisation where doctors attached to the accident and emergency room in the Good Samaritan Centre in Phoenix Arizona can give instant expert advise to crew and medical volunteer. They have up to date lists of airports suitable for diversion and can arrange for appropriate medical facilities such as ambulance and hospital. The captain will follow MedAire's advise over that of any medical volunteer on board.

If there is a continuous 'no shock advised' crew will initiate resuscitation for minimum of 30 minutes, unless otherwise instructed by MedLink. In all circumstances where the defib is used the aircraft should be diverted.

Information from the activated AED is accessed by Physio Control Medtronic once the aircraft has returned to its base. The information is then passed to myself, Dr Nigel Dowdall (BA Health Services) and Professor Chamberlain (BA consultant cardiologist and European Resuscitation Council Committee).

Once I have the information of the crew involved they are contacted by telephone and letter for a detailed report of the incident and debrief.

THE FUTURE

The next stage will be the introduction of the Biolog (Cardiac monitors) which will be on board all longhaul flights in the next 18 months. This is a diagnostic piece of equipment. It reads and records the electrical activity of the heart of a conscious person who is for example complaining of chest pain. The recording can then be transmitted by satellite communication to MedAire who can give their expert advise on whether a diversion is necessary

BA Aviation Medical Training and MedAire are in the final stages of producing a medical manual and training package which is specifically focused on Aviation Medicine and will be available from October this year.

BA is passionately committed to excellence and to the highest levels of customer service. Aviation Medical Training's goal is to continue to provide training and resources that will equip all BA cabin crew with the ability and confidence to manage any medical situation which occurs in flight thereby supporting BA's commitment to customer service.

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After training at the Royal Prince Alfred Hospital, Sydney Australia, she has followed a varied career in Occupational Health and Medical Training in the Television Industry and Aviation with British Airways.

For the past 3 years she has been responsible for the aviation medical training program production, mainly for cabin and flight crew. This includes the production, delivery, trainer assessment, continuous monitoring through feedback and evaluation for the New Entrant and Defibrillation training programs.

Following her promotion to duty manager, her responsibilities have expanded to include the day to day management of 50 trainers delivering a training service to 18,000 crew annually.

Due to her specialised interest she is continuously involved in the publicity for defibrillation training.

Her talk today will focus on the training and practical issues surrounding the introduction of the Automated External Defibrillators to British Airways.

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Occupational Health and Safety

Diane Disley and Sue Graysmark

Air 2000 Ltd.

Air 2000 Company Profile

Air 2000 was launched on 11 April 1987 with the remit to build a new kind of leisure airline combining exceptional value for money with unprecedented levels of service, reliability and performance. The airline is now a wholly owned subsidiary of First Choice Holidays PLC and has its corporate base is in the United Kingdom.

In its thirteen year history, Air 2000 has established itself as a leading leisure airline by listening to its customers and introducing innovative practices ahead of its competitors.
For the company's first season, two new Boeing 757-200's were operated, enabling the airline to undertake some 35 flights per week from its Manchester base to 12 popular Mediterranean destinations.

By 1990, the fleet grew to eight 757's plus a single 148-seat Boeing 737-300.
Air 2000 was flying an intensive series if inclusive tour services from Manchester and Glasgow to the Mediterranean and Orlando, Florida. The carrier also added Gatwick as one of its UK departure points. Other long-haul routes were soon added including Kenya, Mexico and the Caribbean.
A successful application to the UK CAA resulted in the grant of a licence to operate scheduled flights to Larnaca and Paphos in Cyprus and in 1992, four Airbus A320's configured, with 180 seats, were added for use on short-haul European charters.

Some two-thirds of Air 2000's passengers are from the First Choice Travel Group with more than 120 other tour operators and groups making up the balance.
The airline's growth has been consistent and steady currently employing 400 pilots and 1,600 cabin crew. The fleet now has a total of 27 aircraft including four Boeing 767-300's, fourteen 757-200's, Five Airbus A321's & four A 320's.

Air 2000 is now the second largest UK leisure airline, operating 30,000 flights a year. We fly from fifteen regional airports in the UK and Ireland - carrying nearly seven million passengers - to more than fifty destinations around the world.
At Air 2000, operational safety is our main priority and takes precedence over all other areas of the company's business.

Our staff are highly trained individuals and each department, from Cabin Service to Engineering, has safety as their primary concern. This is reflected in a number of ways, from the extensive Safety Training all our Cabin Crew and Flight Deck undergo, to the high level of detail applied to aircraft maintenance and operation.
We ensure that we meet the highest levels of safety and comply with all regulatory standards in order to maintain the confidence and trust of our passengers.

Air 2000 recognises that our greatest investment for the future is our people. We want to provide them with an environment where they can develop both personally and professionally.

Air 2000 Occupational Health & Safety

Introduction

Air 2000's Safety Training Department first became involved in Occupational Health and Safety in 1996 with the introduction of its Conflict Management training programme.
The introduction of this initiative heightened the departments awareness to other aspects of health and safety which we felt should be developed and this subsequently resulted in the inclusion of a range of new specialist training programmes. These new initiatives included separation skills, personal safety, drug awareness, manual handling and ramp safety.

Although not mandatory we believe that the inclusion of these new training strategies has supported and enhanced our overall crew training programme. The feedback from the crews undertaking this new training has been very positive with a greater understanding, ability and confidence being displayed in their daily operational duties. In addition to the corporate benefits it has become very clear that individuals participating in these training programmes see advantages of there new found skills in their personal lives with a greater overall awareness and personal confidence being displayed.

Air 2000 places a tremendous value onto its in-house training departments. Each member of the Safety Training team is qualified to Instructor level in areas of occupational health and safety in addition to the mandatory regulations required by JAA in Safety and Emergency Procedures. These range of specialist in-house training skills are utilised not only for the airline operation but also within other areas of the First Choice Holiday Group. For example tour reps, resort mangers etc.

Conflict Management

"The cabin environment is a microcosm of society and we should not expect that society's good or bad are not brought on board the aircraft"

From the summer of 1996 Air 2000 began to notice an increase in Pilot and Cabin Crew reports relating to unacceptable behaviour on board, more commonly known as disruptive passengers. We believe that this increase in incidents directly related to the introduction in November 1995 of our 'No Smoking' policy. It then became immediately apparent that there was a specific need for the specialist training of our flight crews on how to deal with these difficult and confrontational situations.

Working in association with a third party training organisation Air 2000 developed a progressive training policy designed to prevent any escalation of a potentially volatile situation on board our aircraft. The training involved a set of principles based upon recognised psychological techniques of verbal & non-verbal communication. These techniques included space, stance/positioning, mirroring, eye contact, voice pitch, listening skills, confidence, attitude & concession.
This became known as our 'Conflict Management Action Plan'.

A 3-day instructor training programme was completed by our safety training team to ensure they were confident in their own ability to facilitate this information with the belief that it would support and benefit the crew.

We initially introduced the Conflict Management programme into our recurrent training season of 1996 with 1 day being devoted to this subject.
Our syllabus included: -

- ⇔ The aim of conflict management.
- ⇔ How volatile situations can develop.
- ⇔ Recognition of anger, aggression and violence.
- ⇔ Recognition of physical and psychological effects of anger and fear.
- ⇔ Basic rules of personal safety.
- ⇔ Communication - How to handle a situation with professionalism and dignity.
- ⇔ Techniques for defusing and dealing with anger and aggression.
- ⇔ Aviation law (Tokyo Convention and United Kingdom Air Navigation Order).

The response from the crew was immediate and very positive, they found the information extremely valuable and expressed great interest. A condensed training programme is now completed on a recurrent basis every 12 months for pilots, cabin crew and ground crew.

In addition and to complement our action plan we have introduced a Disruptive Passenger Pack (DPP) on board each of our aircraft.
It's contents include:-

- ⇔ In-flight Incident Form (crew witness form for the police)
- ⇔ Captain's Formal Warning Letter
- ⇔ Disruptive Passenger Incident Report Form (for government statistics)
- ⇔ General Disruptive Passenger Report Form (advising future carriage or refusal)
- ⇔ Witness Report Form
- ⇔ Evidence Collection Bags
- ⇔ Camera
- ⇔ Disruptive Passenger Envelopes

The Disruptive Passenger Pack was collated after consultation with the Airport Police authorities in the United Kingdom. During our discussions it became apparent that errors or omissions in the collection of relevant documentation and evidence whilst on board the aircraft could jeopardise a successful prosecution once the aircraft had returned to the UK. The introduction of the Disruptive Passenger Pack was intended to guide the crew through an incident on board and prompt the collection of all relevant data therefore increasing the number of successful prosecutions.

With the introduction of Conflict Management training, we have seen a reduction of 33% in our disruptive passenger incidents.

It is accepted that society today is more violent. Within our industry, employees can be at risk of verbal or physical assault. It is now our responsibility and duty of care, as an employer, to provide necessary training and set procedures in place to provide a safe working environment.

Separation Techniques

The majority of incidents involving disruptive passengers can be handled effectively using the Conflict Management Action Plan and associated techniques.

However, should these non confrontational techniques prove ineffective and the incident involve a passenger becoming physical, it may be necessary to adopt separation techniques. These skills are designed to help reduce the risk of escalation during the initial stages of physical confrontation and to 'breakaway' from a grab or hold using proven techniques that involve body mechanics, as apposed to strength, but still maintain a low-key level of intervention.

This type of training helps the crew to remain calm and builds their confidence, which are two critical factors in managing this type of situation. Once separation is achieved, options are now offered to both parties involved allowing for further negotiation and creating more opportunities for de-escalation.

Introduced in August 1997, the separation techniques training includes: -

⇔ One handed & two handed grabs
⇔ Clothing grabs
⇔ Hair pulls
⇔ Strangulation
⇔ Personal protection positions
⇔ Minimum force hold

Most of these situations are known to have occurred on board a flight at some time, fortunately not on a daily basis !

Training for the Instructors involves an initial 4-day programme with an annual 1-day refresher course conducted by a specialist company.
Crew training in separation skills involves an initial 1-day course with an annual ½ day refresher.

To support the practical training we have produced a series of short video programmes which show the various techniques as demonstrated during training. The videos are available at each of our operational bases and can be removed for home study at any time enabling the crew to refresh themselves.

These techniques are not only relevant to our working environment but they are in fact, 'life skills' that can be used by a crew member at any time they are confronted with a physical situation, where they feel their personal safety is in danger.

Personal Safety at Work

Personal safety is a shared responsibility between employer and employee. No policy or precaution can guarantee an individual's safety. Personal safety is everyone's responsibility.

The airline industry, by the nature of it's business, sends employees to destinations and cultures they may not necessarily be familiar with. Air 2000 introduced in 1997 personal safety guidelines which were designed to empower the crew to live their working/personal life to the full and not to be constrained by fears and anxiety about their safety.

The key aspects of personal safety are to: -

⇔ Trust Instinct
⇔ Avoid risks where possible
⇔ Assess risks where appropriate
⇔ Develop confidence
⇔ Never assume it will not happen to you!

Our training includes: -

⇔ Safe travel – walking, driving, using public transport (taxis, trains, buses).
⇔ Hotel /building safety
⇔ Home & personal safety
⇔ Cultural awareness

Initial crew training is approximately 3 hours. For recurrent training we update this information and recently we have introduced 'drug rape' awareness training. This includes the use of drugs such as Rohypnol and Gamma Hydroxybutyrate, known as GHB. This training is delivered to both cabin crew and pilots.

We also complete training on general drug awareness. This includes physical recognition of drugs, signs of use, abuse and the law relating to drug use. This heightens crew awareness to any problems on board that may be drug related.

Manual Handling

Training in effective manual handling began in order to follow the guidelines under the European Directive 90/269 E.E.C (1992), and the Health and Safety at Work Act 1974.

Employer's responsibility
".. to ensure that as far is reasonably practicable, the health, safety and welfare at work of all employees…"

" to provide such information, instruction, training and supervision as is necessary to ensure, as far as is reasonably practicable, the health and safety at work of his /her employees.."

Employee's responsibility
" .. it is the duty of every employee, whilst at work to take reasonable care of the health and safety of him /herself and of other persons who may be affected by his /her acts or omissions…."

" … to co-operate with the employer to enable him /her to comply with his /her health and safety duties.

Initially, our Instructors attend a 4-day course (which is updated every two years), to become qualified in the general mechanics of moving and lifting. These techniques then had to be adapted to an aircraft environment, which is restrictive and therefore creates its own unique difficulties.

Working closely with a consultant we completed risk assessments on all tasks and duties involved in the day to day routine of a crew member. The risk assessments allowed us to identify areas of potential injury.

A training programme was then designed for our crew, incorporating the following: -

⇔ Spinal awareness
⇔ Causes of back pain/muscular skeletal injuries
⇔ Avoidance of manual handling
⇔ Assessment of risks – task, load, working environment and individual capability
⇔ Effective movement
⇔ Manual handling techniques on board the aircraft
⇔ Reporting of injuries
⇔ Self care exercises

We were concerned that there may be a feeling of scepticism from the crew regarding the practicalities of utilising these techniques on board the aircraft. It was felt they may believe the new guidelines would have a detrimental impact on the time it would take them to complete their everyday tasks. In order to overcome this anxiety, we designed the course to highlight the injuries that could be incurred by an incorrect movement, be it at home or in a working environment.
It was important to stress that it took the same amount of time to develop a good habit as it did to develop a bad habit!

To aid the crew in a practical sense we reviewed the equipment carried on-board the aircraft and decided that a number of refinements could be made to assist the crew in manual handling tasks. 'Medi-slings' and 'Dragging sheets' have been placed on-board to assist crew in the movement of disabled or incapacitated passengers in the event of a medical emergency.

Initial crew training on manual handling techniques is ½ day.
Recurrent training includes lifting techniques and updating the crew on amendments to risk assessments.

To support the practical training we have produced a video which demonstrates the practicalities of on-board manual handling techniques. These videos are available at each of our operational bases and can be removed on short term loan for private study and revision.

Safe manual handling is not just a question of strength. It is about common sense and a commitment to lifting and moving correctly. We consider it extremely important to educate each of our crew members on how best to preserve your back. Back injuries account for a large proportion of lost working days due to sickness absence within the airline industry.

Ramp Safety

Every year staff throughout the world are fatally injured or their health is seriously effected due to hazards on the ramp. There is a higher incident rate on the ramp than in the construction, mining & all heavy industry.

Working on or around the ramp is now considered to be one of the most dangerous places to work.

Air 2000's Ramp Safety policy is as follows: -

'Air 2000 is committed to ensuring that in all of our activities, whether in flight, on the ramp, or elsewhere, all reasonable practicable measures will be taken to safeguard the health and safety of our passengers, our employees, and others who may be affected by our actions.

Furthermore, everyone involved in the airside operation has a responsibility for ensuring that our third party suppliers do not operate in a way that may put themselves or others at risk'.

For our policy to be effective, the involvement and commitment of all staff is vital.

Numerous hazards on the ramp can be positively identified and these include :-

⇔ Engine Blast
⇔ Engine Suction
⇔ Being hit or run over by part of an aircraft
⇔ Noise
⇔ Vehicle movements

Although the hazards associated with aircraft operations are potentially serious, they give rise to few accidents for ramp staff because the hazards are easy to recognise. Most accidents on the ramp are caused by other agents such as: -

⇔ Vehicles (* see note below)
⇔ Manual handling
⇔ Foreign object debris (FOD)
⇔ Adverse weather
⇔ Fuel
⇔ Smoking airside
⇔ Spillage's/Dangerous goods
⇔ Inexperienced contractors
⇔ Drink and drugs

* Approximately 30 vehicles are involved in the average aircraft turnaround process these include : GPU, de-icer, fuel bowser, potable water truck, engineering, caterers, cleaners, baggage loaders, cargo loaders, tug, airbridge, steps, ambulift and marshallers.

All flight crew undertake ramp safety familiarisation during initial and recurrent training. Ground operations staff receive more specific training to there particular duties.

Initial crew training on ramp safety is 3 hours.
Recurrent training includes an update of approximately 1 ½ hours.

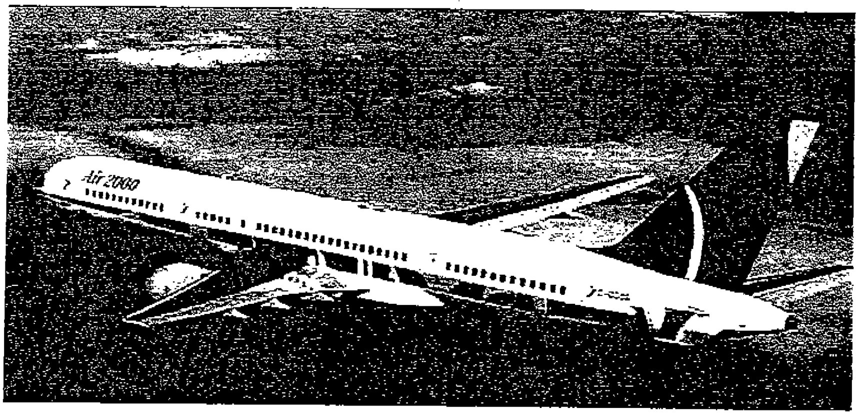
As part of its Health and Safety policy Air 2000 provides personal hearing protection and high visibility clothing for all its operational staff.

Summary

The most valuable asset of any employer is it's employees. The aviation industry is no exception with enormous sums of money being spent every working day on flight crew training. Most of this training is of a technical nature with pilots completing expensive operational flight training and cabin crew completing cabin safety procedure courses.
It therefore makes good commercial sense to complete this training by providing comprehensive Occupational Health and Safety familiarisation to protect your valuable asset.

In order to provide 24hr support for our crews both in the air and on the ground Air 2000 has implemented a comprehensive crew support system.
Whilst on the ground the crews have access to a 24hr telephone help line. In the air, an HF radio link provides essential medical care support from Scottish Medicine – First Call telemedicine. In addition Safety Incident updates provide the crew with valuable feedback on a range of safety related issues.

Air 2000 has very successfully implemented a range of occupational health and safety initiatives for all its crews with very positive results. The corporate benefits are wide and varied from a confident crew attitude to even a reduction in the airlines insurance premiums. As a forward thinking airline Air 2000 will continue to respond to the changing environment that we now live and work in by providing our crews with the best and most effective training.



Diane Disley – Safety Training Manager, Air 2000 Ltd
18th January 2000

Blood-Borne Pathogens in the Cabin Environment

David Streitwieser, M.D., FACEP
Medical Director. MedAire, Inc.

Diseases spread primarily through contact with infected blood are known as blood-borne pathogens (BBP). Over the last thirty years the world has seen an epidemic rise in the incidence of three viral BBPs: Hepatitis B, Hepatitis C and HIV. Each of these diseases can cause life-long infection with debilitating consequences and even death. Occupational exposures in the healthcare industry have transmitted all three of these BBP to previously healthy healthcare workers. Today, with advancements in technology, airline personnel may assume the role of caregiver to ill passengers, and currently receive training to prepare them to act in this role. This training includes life-saving techniques when no other options are available. As more passengers infected with BBP fly, occupational contacts with BBP for airline personnel will likely increase. Consider the following scenarios:

1. A flight attendant helps restrain a violent passenger who bites her forearm forcefully enough to break the skin and draw blood. He then announces to everyone that he has AIDS.
2. A maintenance worker reaching into a seatback pocket accidentally punctures his hand with a hypodermic needle. Further inspection of the needle shows that there is dried blood within the bore of the needle.
3. A flight attendant assists a physician during an inflight emergency. The flight attendant accidentally sustains a needlestick from a needle used to start an intravenous line. The ill passenger happens to be a diabetic on hemodialysis for kidney failure
4. A passenger develops a severe nosebleed inflight. While assisting the passenger a flight attendant gets blood on her forearm and hand for several minutes.

Each of these scenarios presents different risks and treatment considerations. This paper reviews the current knowledge of disease transmission and management of possible exposures to BBP, and will recommend measures to minimize exposures. This information is intended to assist airline occupational health departments in educating airline personnel to reduce their exposures to BBP as their involvement in the medical management of ill passengers increases. Much of the information presented comes from the healthcare industry, which is still adapting to the special needs of healthcare workers dealing with BBP and with current governmental requirements for protection of healthcare workers.

Although the Blood-borne pathogens are primarily transmitted by exposure to blood, other body fluids can also be infectious. Any body fluid contaminated with blood should be considered contagious. Saliva is infectious for Hepatitis B, but not for Hepatitis C or HIV. Amniotic fluid (usually present during emergency childbirth) can contain all three viruses, but there are no known cases of transmission to healthcare workers. Other body fluids, such as pleural (chest), peritoneal (abdominal), synovial (joint) and spinal fluid, semen and vaginal secretions, can contain HIV, but are unlikely to be sources of exposure to airline personnel. The following substances will not transmit BBP: tears, sweat, urine, or feces- unless any of these are blood-contaminated.

Hepatitis B virus (HBV) was the first of the common Blood-borne pathogens to have epidemic spread, predating the current epidemics of Hepatitis C and HIV by thirty years. Currently the incidence of HBV infection worldwide is 3-5%, and much higher in parts of Asia and Africa. There are 12,000 infected healthcare workers with 200-300 deaths annually from HBV. People most at risk to have HBV infection include IV drug users, kidney hemodialysis patients, homosexual men, and people who live in areas of high incidence (such as southeast Asia). Although HBV is the least damaging of the three BBP, consequences of HBV infection can be serious. Twenty-five percent of people who are infected with HBV will develop acute hepatitis, which ordinarily lasts 4-6 weeks, and is characterized by symptoms of fatigue, nausea, jaundice and lassitude. A small number of individuals rapidly suffer severe liver failure. However, 6-10% of those infected will develop chronic hepatitis, 2-3% go on to develop cirrhosis (permanent scarring of the liver often associated with excessive alcohol use), and 0.5% eventually die from consequences of liver cancer or liver failure.

The risk of contracting HBV after a needlestick ranges from 2% for a random source (the blood source individual and therefore the infectiousness of the blood is unknown), up to 40% if the blood has a highly contagious form of HBV. The risks from other types of exposures, such as mucous membrane exposure (mouth, nose, and eyes), are less than for needlestick exposures. However, the risks associated with HBV can be completely prevented by proper vaccination. Unlike Hepatitis C and HIV, there is a safe and effective vaccine against HBV. The safety of the vaccine is unquestioned: it has been a part of the primary vaccination series for newborns for almost 10 years. Most adults have not been vaccinated, unless they have occupational risks for HBV exposure. The key to proper vaccination against HBV is to document an appropriate antibody response. The purpose of any vaccination is to induce the immune system to produce antibodies to a specific pathogen, which will help fight future exposures to that pathogen. A person's antibody response should be checked 4-6 weeks after the third HBV vaccination, and if the response is inadequate, 4th and even 5th injections can be given. Persons who are over the age of 50, smoke, or are overweight are less likely to have an adequate antibody response after three vaccinations. Successful vaccination, as proven by an adequate antibody response, is 100% effective at providing life-long protection to HBV. OSHA requires employers to make HBV vaccination available to healthcare workers at no cost.

Treatment guidelines for possible HBV exposure have been published by several organizations, but are a bit vague. Treatment should be considered not only for needlesticks, but also for other exposures, such as prolonged (several minutes) contact between blood and broken skin or mucous membranes. Unlike post-exposure treatment for HIV, treatment for HBV exposure is non-toxic and without significant side-effects. Treatment is based upon the vaccination status of the exposed person:

1. Never vaccinated- Hepatitis B immune globulin (HBIG- not gamma globulin), and vaccination series.
2. Vaccinated, no measurable antibodies: Hepatitis B immune globulin injections 30 days apart (author had this), or HBIG plus re-vaccination.
3. Vaccinated, AB response to vaccination unknown, HBIG plus one dose of vaccine.

Hepatitis C Virus (HCV) now represents the most dangerous BBP in terms of consequences of exposure to blood. There are four million infected Americans, and ten thousand die annually from liver failure or cancer. Unlike HBV infection, a very high percentage (up to 85%) of those infected with HCV develop chronic liver inflammation, 10-20% develop cirrhosis, and up to 5% get liver cancer. Forty percent of those infected do not know they have the disease! Current groups at higher risk of having HCV include: IV drug users and anyone with history of blood transfusion (especially prior to 1990, current blood supply risk is one in sixty thousand units).

The risk of acquiring HCV after a needlestick to source blood known to have HCV is about 2%. The problem is that there is no known effective treatment to prevent HCV infection after exposure. There is no vaccine, and gamma globulin, which contains antibodies to other types of hepatitis, is ineffective against HCV. If HCV infection occurs, and progresses to chronic inflammation, treatment with interferon injections may be used. Eventually, however, many of those infected with HCV require a liver transplant, or die of liver cancer or liver failure.

HIV is an epidemic in progress and eventually 1% of people worldwide will be infected. The primary risk groups have been IV drug users, people who received blood products before 1985 (current transfusion risk is around 1 in 1 million units) and homosexual men. However, heterosexual transmission is increasing, so that persons with multiple sex partners are also at risk. Only 25% of persons with HIV know they have the disease or are symptomatic.

Transmission risk has been estimated from data involving healthcare workers for different types of blood exposure. Needlestick (hypodermic hollow bore type needle) risk is one in three hundred if the blood is HIV positive. The risk increases if there is visible blood on the needle or if there is a deep puncture. Wearing gloves reduces the volume of blood transmitted by at least half, and should therefore substantially reduce the transmission rate. Mucous membrane exposures, such as blood contacting eyes or mouth, require a relatively large volume of blood (more than a few drops), or prolonged contact (more than a few seconds), and even then, the transmission rate is lower: one in one thousand. A splash of blood on intact skin does not transmit HIV unless the skin is cut, abraded, or otherwise compromised. Human bites have rarely been demonstrated to transmit HIV. If a bite results in blood exposure, post-exposure follow-up should be performed. Overall, approximately 120 healthcare workers are suspected to have acquired HIV infection through workplace exposure.

Post-exposure prophylaxis (PEP) recommendations for possible exposure to HIV are based on limited information, and the effectiveness of the treatment is largely unknown. Treatment recommendations are based upon the type of exposure, and when possible, the HIV status of the source blood. Many airline exposures will be to blood of either unknown source (used needle left in trash), or to passengers of unknown HIV status at the time of the exposure. Exposures with negligible risk of transmitting HIV require no PEP. Examples of this type of exposure include blood contact with intact skin or exposure to non-bloody body fluids. If the source blood is known or later found to be HIV positive, exposures are graded into three risk categories:

Low risk: Mucous membrane or compromised skin, few drops of blood, short duration.

Medium risk: Mucous membrane or compromised skin with a large blood splash or prolonged duration, or needlestick involving a solid needle or superficial scratch.

High risk: Hollow needle, deep puncture, blood visible on needle.

Low risk exposures may require PEP if the source blood is highly contagious for HIV. Otherwise the toxicity of the treatment may outweigh any theoretical benefits, and discussion with an expert in this field is recommended. Medium risk exposures to HIV positive blood generally call for the "basic" regimen, which involves taking two drugs active against HIV for four weeks. Most healthcare worker exposures are in this category. Medium risk exposures to highly contagious blood, or high risk exposures to any blood with HIV call for an expanded drug regimen involving three drugs. When the HIV status of the blood is not known, medium and high risk exposures may be treated with the basic drug regimen.

The major problem with HIV PEP involves the toxicity of the drugs. If the treatment were as benign as the post-exposure treatment for hepatitis B, we would put everyone exposed on a three drug regimen. However, the drugs used to fight HIV all have side effects. In fact, one third of healthcare workers discontinued their treatment due to symptoms caused by the drugs. Minor side effects include fatigue, nausea, and diarrhea. Major side effects include kidney stones and low blood counts. An important point is that experimental evidence suggests that starting the drugs within a few hours of exposure may reduce disease transmission, although treatment can be initiated even weeks after exposure. This means that in many circumstances where the exposure risk is unclear, it may be prudent to take an initial dose of two anti-HIV drugs as soon as possible after an exposure (the author would do this). Treatment can subsequently be discontinued, and there should be little risk associated with a single dose of these drugs. Assistance is available to clinicians managing possible HIV exposure 24 hours a day through several national hotlines.

Immediate treatment after an exposure may also reduce the risks of developing infection from any of the three BBP. Wounds should be washed with soap and water. There is no evidence that washing with alcohol, bleach, caustics, or other antiseptics is effective (although there may not be any harm, either). Mucous membranes should be flushed with non-irritating fluids (usually plain water). Do not put bleach, peroxide, iodine, or any harsh chemical in the eyes. Peroxide can be used in the mouth. Lancing a wound and attempting to pump or squeeze blood out of it is also not recommended. Testing blood from a source needle is unreliable.

An exposed worker should be tested for antibody to HBV (from prior vaccination or exposure to the disease), antibody to HCV (have the disease and don't know it), baseline liver function tests, and baseline HIV testing. When possible, the person who is the source of the blood involved in the exposure should be tested for the presence of HBV, HBC, and HIV. There are additional tests that can show if HIV positive blood is highly contagious. Most exposed workers who go on to develop an infection, show evidence of HCV and HIV infection within six months, although delayed cases have occurred. Although some states allow HIV testing of source blood without consent of the patient, many states prohibit such testing if the source patient refuses.

Reducing exposure to BBP is critically important, since there is no treatment available to prevent HCV infection, and HIV treatment is toxic. Proper training of airline personnel who may possibly contact BBP is essential. Personnel should wear gloves and eye protection when contact with blood is possible. Pocket masks should be used during rescue breathing to reduce exposure to bloody saliva. Washing of hands should always be encouraged after contact with an ill passenger (also reduces transmission of other germs). Finally, needles used during emergency treatment of a passenger should not be recapped- this is the number one source of healthcare worker's needlestick exposures. All blood contaminated equipment and materials should be disposed of in appropriate containers, needles in specially designed rigid puncture-proof containers. Finally, the aircraft should be properly decontaminated. It is highly recommended that airlines follow the lead of the healthcare industry in providing rapid access to persons knowledgeable in the medical management of exposures in the event a possible exposure occurs. This will ensure not only that post-exposure treatment is rational and proper, but will also help allay unnecessary fears of exposed personnel, especially when an exposure appears to be low risk.

Summary points:

1. Wear protective equipment, use pocket masks during CPR, do not recap needles.
2. Wash exposed skin with soap and water, use water or eye wash for eyes.
3. Blood contact on intact skin requires no further treatment.
4. All other exposures may require treatment for HIV- test source passenger when possible.
5. Become vaccinated to HBV, and measure antibody response to the vaccination.
6. Post-exposure treatment for HBV is safe and effective- but should be unnecessary.
7. There is no post-exposure treatment for HCV
8. Post-exposure treatment for HIV is individualized based upon the type of exposure and HIV status of source blood. Consider starting drug treatment within hours of higher risk exposures (can be discontinued later). Drugs are toxic, benefits are uncertain, weigh against risk of acquiring HIV.
9. Consider providing immediate access to expert advice in the event a possible exposure to BBP occurs.

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David Streitwieser MD Biography

Doctor David Streitwieser is the Medical Director of MedAire, a company which has provided emergency medical assistance to commercial and corporate airlines for 15 years. He is board-certified in emergency medicine and is the chairman of the section of emergency medicine at Good Samaritan Regional Medical Center in Phoenix, Arizona. He has personally handled several thousand emergency airline calls, and has reviewed over ten thousand aircraft medical incidents.

Philip D. Baum

Managing Director, Green Light Ltd.
Editor, Aviation Security International

Following his military service Philip Baum was a liaison officer between the peacekeeping forces serving on the border between Israel and Egypt and the Israel Airports Authority. On returning to the UK, he joined Trans World Airlines' security subsidiary. From Duty Manager at London Heathrow he moved to TWA's International Division HQ where he ultimately became Manager of Security Training and Auditing, until he left in February 1996 to establish Green Light Ltd.

In addition to airport security consultancy and the drafting of National Aviation Security Programmes and Airport and Airline Security Programmes, Green Light specialises in the airline security auditing and training. The company's trainers instruct a wide range of courses, the most popular of which are Passenger Profiling and Hijack Management for aircrew.

In 1997 Philip was appointed Editor-in-Chief of Aviation Security International, the bi-monthly journal of airport and airline security. Green Light then bought the publication in 1999. Philip is a commentator for CNN, BBC and Sky News on aviation security issues.

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"A Journey to the breaking point"
Andrew McKenzie-James

There are many issues surrounding the problem of disruptive behaviour in the aviation industry. Incidents continue to be reported every month, some are cause for huge concern to everyone who travels by air or works in this industry. Airports, authorities and airline companies must develop and promote a consistent approach to preventing and managing these incidents if these problems are to be adequately reduced or ultimately eliminated.

It is vital that both ground and cabin crew are aware of how other services integrate with the airline when an incident does occur. For example the role of the police or security and how they are summoned, and what information they may require. It has proved a useful tool to know that offenders will be dealt with effectively, and whilst this acts as a deterrent, it will not in itself prevent incidents occurring.

There are hundreds of factors that can contribute to an incident occurring. Many are beyond the control of airport or airline staff. I do not intend to try to explain the social or inherent influences on people's behaviour that contribute to this process. However the every day frustrations that effect all of us from time to time are more obvious and easier to relate to. They are the small things that happen daily, that when compounded cause irritation, anger and in some people aggression or even violence.

These common, and in isolation, trivial events are likely to have occurred before we meet the customer.

Understanding people and how they are affected by events and other people's attitudes, actions and behaviour are a vital part of any strategy designed to prevent and manage potentially disruptive passengers.

Crew being able to recognise early and deal positively with challenging behaviour is primarily about them understanding people and their behaviours. It is also crucial that crew understand their own emotions and thus control their own responses and actions. A knowledge of their role in the organization, the strategies and procedures in place for managing events that escalate beyond customer service is also necessary.

At this stage the need to have the backup of the organization and the authorities, in terms of strategies and procedures for dealing with offenders and for effective personal support after the event is paramount.

The strategy for dealing with aggressive or violent passengers must be integrated with crew awareness of product knowledge; of legislation; of operational procedures; of service issues; customer expectations and a knowledge of behavioural definitions e.g. being able to recognise an escalation in, or an abnormal or dysfunctional form of behaviour.

When interacting with the general public it is important for crew to understand people. It is important to understand the factors that affect and influence them and what is an appropriate response that is likely to result in a positive outcome of the incident.

Included in this training should be a section on understanding ourselves.

Part of any training programme should try to help crew be aware of how they are perceived and what impact this could have when interacting with passengers who may already be stressed.

Many of the factors that effect behaviour are both generic and industry specific. They influence people's lives, in some cases in a very negative way. This knowledge will help crew identify potential disruption before it becomes a serious risk to safety.

The problem of disruptive behaviour is now documented worldwide and is recognised as an issue that causes much concern. The statistics continue to be paraded before us in industry publications and in the national press.

Some incidents are more serious than others. Some are concerned with possible fire risk, some of rowdy behaviour, some of domestic arguments that embroil the crew and other passengers. Sometimes it is just the ill mannered, bad tempered rudeness of travellers that escalates to personal verbal abuse toward the crewmember.

Most are dealt with adequately without endangering the safety of the aircraft. However all cause stress for the crew and the passengers involved in the vicinity of the occurrence. Some of this added pressure and stress have short and long term repercussions upon health.

For crew these incidents are unpleasant and have an extremely negative effect upon their morale and well being.

For the airlines or organizations involved there is the economic consideration of how much additional absenteeism and additional recruitment adds to the HR Budget every year.

In the UK in 1999 over 90 million working days were lost because of stress related illness. This was equated to £4.5 billion in lost production. $6.75 Billion

In addition to the health and safety implications, the question of customer loyalty must be raised. Airlines spend an enormous amount of money attracting new customers and retaining their current ones by using numerous reward schemes. How much loss in revenue does each passenger represent should you lose their custom because of a disruptive passenger incident.

These losses could be enormous and preventing this happening is crucial to all airlines.

Consider also the additional important issues that appertain to incidents that escalate to violent behaviour.

We must consider that in rare circumstances the need for physical and mechanical restraint may occur. In these instances it is vital that cabin crew are familiar and well trained in the application of the airlines chosen strategy or restraint device. However it must be pointed out that some supplier organisations in their haste to sell 'magical restraint equipment' to the aviation industry will try and promote equipment that will make the job "easy to achieve". Anyone who has ever had to restrain a persistently violent person will tell you this will never be easy, not until it is possible to immobilise a person instantly and without risk to health.

Until that time a realistic approach to serious incident management is the only sensible option.

If you are a crewmember or a passenger who has been involved on a flight where there was major disruption you will know how terrifying and difficult to handle these situations are. Perhaps where the assailant has attacked the pilot in the flight deck and the aircraft could have been lost is the ultimate nightmare.

In the aftermath and de-briefs the realisation of how bad it could have been for everyone on board and the organisation involved should help everyone focus on how we might prevent the incident occurring again.

The answers to the problems lie, not in more and more extreme punishments of offenders, but in a common sense and planned approach from crew, on the ground and in the air. Many of the most serious incidents have involved perpetrators who had previously attracted attention and could have been prevented from boarding.

Prevention is dependent upon the implementation of practical and workable strategies, procedures, action plans and appropriate training for all levels of personnel. (Ground, Cabin and Flight deck crew)

Training should be about managing people. To be effective it is necessary for the communication and interpersonal skills to be associated with a sound knowledge of their individual roles within the organization.

Andrew McKenzie-James & Phil Hardy
February 2001

Andrew McKenzie-James

He has been a Director of SecuriCare International since 1994 and specializes in training and consultancy in all areas of understanding and dealing with challenging behaviour.

His field of operation is in the study of ways to respond to angry, provocative, aggressive or violent behaviour in a safe and controlled manner. His experience in this area has been gained over the last 28 years. Initially in the Royal Marines, followed by posts working with organizations in industries as diverse as Healthcare, Custodial Services and Government Agencies.

He is one of the founders and a director of the UK's Institute of Conflict Management. The institute is a Government endorsed organization that is dedicated to setting and maintaining National Standards in all industries where staff encounter, and are required to handle aggressive behaviour.

He is actively involved in the UK Governments Committee (ICVS) looking into ways of reducing violence to staff in all sectors

He is currently also working closely with safety professionals in the aviation industry and after much consultation, programmes instigated by many UK and European registered airlines have been instrumental in reducing incidents of disruptive behaviour.

Terror at 6,000 feet

Barbara Aragon
Manager - Inflight Systems and Standards
Francis Cabel
Training & Development Specialist
Philippine Airlines

During the last few years, the airline industry has seen an increase in reported disruptive and/or unruly passengers creating disturbances. The term disruptive/unruly covers a variety of situations including disagreements regarding carry-on baggage or seat assignments, non-compliance with an airline's smoking policy, alcohol related problems non-adherence to crew instructions and most disruptive of all - - - verbal abuse and physical attacks.

Yearly as we gather for this symposium the subject on "Air Rage", "Unruly Passengers", "Disruptive Behavior" and the like seem to threaten the very skies we fly at each passing day. As flight crewmembers it has become part of our daily activity that we may come face to face with passengers who unknowingly possess innate challenging behavior.

Mark Stienberg a Phychologist, Renee and Michael Sheffer advocates of "Skyrage" were guests during last years symposium according to them fear, anger, hostile, abusive or threatening behavior is a major contributing factor which causes in-flight hostilities or violence.

Months after the hijacking incident of Philippine Airlines domestic flight PR 812 from Davao to Manila and saved 292 passengers. Francis Cabel recalls those intense moments before he became an accidental hero.

The problem began at 3:15 pm, when Philippine Airlines flight PR812 was about to descend at the Centennial Airport in Manila. The passenger at seat 28G, identified in the manifest as Augusto Lakandula but who turned out to be Reginald Chua, walked up the aisle and drew back the curtain separating the passenger cabin and the forward galley.

The 90-minute flight which left Davao at 2pm was at an end, and flight attendant Margaret Bueno and cabin crew trainer Ida Besnasconi were seated at the forward galley in preparation for landing. Bernasconi was conducting a briefing for Bueno. The topic ironically, was standard operating procedures during a hijacking situation. It was a hypothetical discussion, and they went through the hypothetical steps calmly and in order.

Suddenly, Chua (the hijacker) was at Bueno's side, pointing a gun at her. "This is a stick-up" he said. He ordered her to stand and dragged her inside the flight deck, so he could issue his demands to the flight deck crew.

Bernasconi rushed down the aisle to the rear of the plane, where the senior flight attendant, 32-year-old Francis Cabel was stationed. The two were former flight attendants who have been promoted as Training and Development Specialists with Philippine Airlines in-flight services training department. They were to conduct a routine flight competency check on the eight cabin crew trainees on board.

Recounts Cabel: "When I saw Ida's face as she ran towards me, I knew there was an emergency situation." He had seen similar panic-stricken face way back in 1994, when the plane he was on had an emergency: the cockpit windshield had cracked because of wind pressure.

Upon reaching the aft of the cabin, Ida Bernasconi whispered to Cabel, "We have a hijacker on board, with a gun and a grenade." It was a tense moment. Says Cabel, " I had, like, a five-second freeze. I could not believe what I heard. My initial reaction was to reject the very idea. It could not happen to me, to this flight. *Impossible, no.*"

But he quickly recovered his wits. Gathering the crew at the rear, he broke the news and told them not to panic. He also instructed them not to let anyone use the mobile phone. Inside the flight deck, he saw Chua pointing a gun at Captain Heneroso. Also in the flight deck were Capt. Nadurata who was navigating and First Officer Meri. The Captain in command was then Capt. Heneroso who was conducting a license check on Capt. Nadurata during the flight.

"At the flight deck door, I saw Chua and he saw me, " Cabel remembers. "He poked his gun against my forehead and said, 'Mamamatay tayong lahat' (we will all die). My five-second freeze extended to two minutes. It's really different when you're in an actual situation." Cabel could not see Chua's face, which was covered with a ski mask. Whether the mask was greenish black, dark blue or olive green, Cabel has difficulty remembering now. But one thing he is certain of even today: "His eyes were sharp. He meant business."

Right then and there, Cabel thought of his three children, his parents, his brother and two sisters. "I pitied them." The feeling of helplessness promptly gave way to anger. "We were hovering over Metro Manila. I saw Makati, City, the airport and Quezon City. So near and yet so far, you know the feeling. It seemed like just a little more time and the pilot in command could land the plane. I was so angry." But he knew he had to keep his feelings to himself. He could see Chua's left hand holding the grenade, without its pin on, and the right hand waving a gun about.

It was then that Cabel, spoke to Chua in Cebuano (a Philippine dialect), guessing it was the hijacker's mother tongue: "Brother, don't let anything bad happen to our flight. Tel me your problem and I'll help you." Chua replied that his problem was money.

"If that's your problem, I'll help you," said Cabel, who took out his wallet, plucked out all his cash and handed them over to Chua. "Here, this is my children's tuition money but I'll give it to you."

Cabel then announced to the other passengers over the PA system that someone on board needed money. The cabin attendants collected "voluntary contributions" from passengers. The word "hijack" was not at all used, and money collection was made calmly. While the money was being collected, Chua demanded that the plane fly back to Davao. Capt. Nadurata told him that they had barely 45 minutes of fuel left.

Chua then asked the crew to get the black backpack he had left on his seat. He discarded its contents: jeans, a pair of slippers, and several t-shirts. The bag turned out to be a homemade parachute. He asked the crew to don it on him.

"He was intoxicated," recalls Cabel. "I could smell liquor on him. He was still threatening us with a gun and the grenade. At this point he accidentally pulled the trigger and the gun went off. Only the flight deck door was hit and we were telling ourselves, 'We're alive! We're alive!"

But Chua had changed his mind and demanded to be flown to Samar. The pilot maneuvered the plane towards the Antipolo area and said we are at Samar. "Land the plane here", Chua ordered. But the pilot told him that it was not possible because they were in a mountainous area. "The hijacker knew what he was doing," says Cabel. "First he demanded we go down to 10,000 feet. And then he instructed us to level off at 7, 000 feet. We ended at 6,000 feet. He then wanted the rear door to be opened. I'd say it was a planned move. He brought along a parachute. He intended to jump."

Someone had to open the rear door. "Of the four crewmembers in the flight deck, the three pilot and myself, I was the lease important person," rues Cabel, who had to do it.

After he made a PA announcement that the rear door be prepared, Cabel began what he describes as the longest walk of his life: down the aisle from the flight deck area to the rear of the plane, with Chua's left hand slung over his neck and clutching his grenade, while his right hand pinned a gun against Cabel's right ribs. The passengers were instructed to bend down and not to look at the two.

Since he joined Philippine Airlines (PAL) in 1993, Cabel has never come across any procedure where the rear door – or any plane door or window, for that matter – would be opened during the flight. To do so would endanger cabin pressure, and throw the whole plane into a fit of imbalance. Whoever did so would get sucked out of the aircraft because of what is called "pressure differential."

At the rear cabin attendant station, Cabel pressed the interphone. When he said, "Captain permission to open the door," Captain Nadurata replied, "open door when ready." Cabel was stupefied. "I thought, 'Oh my God, he means business.' *Talagang pabubukas sa akin* (he will really make me open the door)."

It was the toughest decision of his life. "It was a gamble I had to make. If I do not do it, we would all die." But opening the door would pose substantial risk to himself. "And so at gunpoint, I grabbed the door operating handle, pulled it open and closed my eyes." He initially thought of opening the door while sitting on the cabin attendant seat with his shoulder harness and seatbelt fastened for fear of getting sucked out. But that was not physically possible. As a graduate with a degree on Electrical Engineering, once he opens the rear door, the strong wind pressure would slam the door right back inside. Which is what indeed happened. Had he been seated on the cabin attendant crew station, he would have been squashed to death.

Cabel instead stood by the other wall and hang on to a shoulder harness. When he opened the rear door, the aircraft was cruising at 230 knots at 6,500 ft – roughly 450 km per hour on land. The wind swept Cabel off his feet and found himself flying in the rear passageway, held in position only by the shoulder harness he was clinging on to. A flight attendant strapped on the crew seat nearby grabbed his belt to keep him from flying off. He was half a meter from the door ledge.

When the wind pressure inside the cabin had stabilized, Cabel realized that Chua had rushed back to the passengers cabin. "He was surprised. He did not expect me to open the door. So I told him, "The door is open. *Talon na!* (Jump!)", and he run back to the rear of the aircraft, by the door. The door was now jammed against doorframe in a particular way, scooping air inside the plane. Chua went behind the door, where there was less wind pressure, and craned his neck outside the plane. He was instantly blown away by the wind in such a way that his face and chest was slumped against the outside wall of the plane while the rest of his body from the waist down was pressed inside the plane.

"He had left his gun but he was still clutching the grenade. When I saw that, I feared it might explode. So I pushed his hand and he fell off the plane. It was a split-moment decision. It was a choice between 1 life or 292 lives aboard that flight."

Cabel then staggered back to a safe cabin passageway and gave a thumbs-up sign to the other crewmembers. "Nobody said a word," he recalls. "No one screamed or cried in relief. There was just a stunned silence. I was numb."

The plane was still not out of danger. Was there enough fuel for the aircraft to fly back to Manila (its final destination) and land there? Yes, there was. The one-hour ordeal was over.

Francis Cabel confesses, he was himself stunned at what he did. "I could not believe what happened," he recalls. "In a crisis situation," he says now, months after the incidents, "There is only one thing to do – get rid of the problem."

On that fateful afternoon of May 25 last year, he did just that, and quite literally, too.

It is important to remember that when dealing with human behavior, it is impossible to predict and impose a set of solutions for every case. The objective in setting these guidelines on Hijacking is to assist in identifying the areas that should be addressed and to provide successful techniques used by other carriers operating in a diverse cultural environment.

Philippine Airlines has developed this set of guidelines in dealing with disruptive behavior particularly focusing on HIJACKING.

HIJACKING PROCEDURES FOR CABIN ATTENDANTS

The acronym METHODICAL is used during a hijacking situation as a guideline in dealing with this type of emergency.

M – ETHODICAL pass word used in case of a hijacking incident
E – NGAGE in a friendly conversion with the hijacker
T – YPE, identify the type of weapon used
H – YSTERIA must be avoided

O – BEY the hijacker
D – ENY entry to the flight deck
I – NSTRUCT passengers to fasten their seatbelts
C – OMMUNICATION must be done with the opposite sex
A – VOID irritating the hijacker
L – ANGUAGE Barrier Cards may be used to communicate with hijacker

BARBARA A. ARAGON and FRANCIS CABEL

Barbara Aragon works with Philippine Airlines. Sixteen years ago, she started her employment with the company as a Domestic flight attendant flying the islands of the Philippines and after two years she was upgraded to flying International routes. Seven years as an International flight attendant on her eighth year she join the In-flight Training and Development Department and became a safety and service instructor of cabin attendants.

She spent five years training and developing safety and service skills of cabin attendants after which she got promoted as Manager for In-flight Systems and Standards. She is now in charge of creating, developing and revising the cabin attendants safety and service manuals is accordance with safety regulations and industry standards and practices.

Francis Cabel, was a flight steward for 10 years. Currently he is now with the In-flight Training and Development Department as an instructor teaching both safety and service modules. Francis got involved in a Hijacking incident few months back. Since then as a cabin crew instructor he has stressed the importance of in-flight safety procedures and open communication between and among flight deck and cabin crew.

Active Learning

Terry King

British Airways

Training to Learn

How much learning really goes on during training ?
How does the student learn versus how the Instructor Instructs
Are we giving the student information because it's there ?
Does the student know why they need the information ?

Are we often only satisfying the Instructors ego trip of knowledge without focusing on the real end product, that is the students expected behaviour during a real emergency ?
With ever changing regulatory requirements and standards to meet, together with the dynamics of an airline business, changes in how and what is trained is inevitable.

Getting the commercial balance right can be a threat to idealistic training.
Extra time spent in training can be costly to the airline, sometimes with very little improvement in the students performance.
Using the time more effectively can help but what is more effective training ?

Recognising that Safety Training is a shared responsibility between the student and the source of learning the training establishment is a good start.

The learning process starts to take shape when the student proactively looks for answers without the Instructor promulgating the questions.
This can be done by encouraging the students to discover what they don't know and then help them to actively explore and find the answer in the safe training environment, this then starts the natural transfer of knowledge and behaviours from the students own experience.

The success in stimulating the student and getting them to take ownership of their own learning, is affected by the relationship between practical and theoretical training.

For instance showing an experienced crew during recurrent training how to fit a smoke hood, followed by checking each one in turn and then finally making them enter a smoke filled cabin fire simulator, assumed a lot about the students abilities and in some instances put fear into them as they entered a cabin full of smoke.
Its affect was to switch students off who could do it and make it less of an enjoyable (and thus learning) experience.

It failed in a practical memorable way to allow the student to determine when they needed to fit a smokehood, the difficulties associated with fitting, finding and communicating in a smoke filled environment.
These items where normally covered by the Instructor by talking to the group as a whole.
As the students were being talked to as a group there could be clearly seen a reduction in their interest and responsiveness, this continued in the decline the longer the talk continued.

So a change in direction was needed.

Situational Learning

A situation was set up where the students had to react - but without any initial support or help from the Instructor.
They were allowed to learn through experience by being part of the smoke scenario.
With no clear direction from the Instructor, they had to make decisions on when and how they would fit a smokehood.

Very quickly they had to be more responsive and find out for themselves and learn why.

During the scenario the Instructor only corrected student after they had got it wrong.
It also gave them a chance to face up to the problems of communication and crowd control.

They learnt by experiencing the situation and having to actively use the equipment and procedures to address and contain it.
During further exercises later in the day there was a clear indication that a lot more had been retained than on previous occasions when the 'tell' mode of training was used, equally as important the students for the first time enjoyed the experience.

Reducing the 'teaching' or tell mode of training and replacing it with more facilitation together with encouraging ownership, has helped the student to be actively involved in the way they learn.
These students involved in Safety training showed they could retain and recall a lot more by personally experiencing an event as against just being instructed in it.

The use of just one training method (because it has been successful during one part of the day) doesn't mean it can be used for every training event during the day.
The students reacted more favourably with a variation of environment and activity their learning behaviours needed to be constantly challenged and explored.

When this was achieved it re vitalised the students quest for learning while at the same time raising their enjoyment of the training experience.
Enjoying and participating in the training increased their capacity for learning.

With this in mind areas in Recurrent Training were identified where the student wasn't naturally participating and therefore had slowed down their learning process.

Personal Learning

The introduction of CBT on recurrent training helped to provide the variation in training activity that was required to stimulate the student again.
It provided a consistency of training data in order to match the high volume of student throughput.
Some Instructor styles affect the amount of useful information passed to the student in an allotted amount of time, using CBT to replace this activity stabilised the elapsed time and most importantly challenge each student's standard against what was expected, on an individual basis and not as a group.

Personal Learning

The CBT programme lasting approximately 30 minutes provided this.

Some saw it as a recap others as a gentle reminder, but as it was never planned as an ab initio package, the pace was deliberately fast to quickly expose gaps in the students knowledge and for them to self rectify or seek guidance.

Again the student was encouraged to use the learning experience to identify their shortfalls - this achieved a higher retention rate as the student only focused on their needs and not the needs of the group, it also achieved an overall reduction in time spent on this particular training activity.

Overall active participation showed a retention and understanding of the training.

Future Learning Experiences

In the future the students will be able to experience different scenarios on an individual basis using a full size crew environment but fed with supplementary computer driven displays.
These will change as the situation, based on the students initial actions, changes.

It will be like virtual reality but without the headgear.

What they learn individually by actively experiencing a situation can then be applied during the day on a Cabin Simulator with a complete complement of crew.

With concerns over crew complacency, and with no real substitute for experience, consideration over what part training can play in trying to closely replicate the experiences becomes even more important in the future.

Terry King - Manager SEP Training British Airways

I started my British Airways life in Aircraft Engineering and was later involved in the initial services of Concorde, supervising a team of Engineers.

During that time I developed an interest in flying and acquired my PPL when I was 19. Since then I have experienced working as a Flight Engineer, a 'flying spanner' based in the Middle East and with a Middle East carrier.

On my return to British Airways I moved into Engineering Training and while temporarily based in Seattle saw the introduction of the 737 and 757 into BA service.
Later I went on to manage the operation and recruitment of Engineering Apprentices and Graduates.

After another short break from British Airways, during which I developed my own business, I returned and launched myself into Flight Training.

At present I manage the SEP Training Business which trains all British Airways crews (18,500) in the equipment and procedures surrounding the safe operation of the aircraft including, fire, ditching, decompression, evacuation procedures and restraint training.

Above all I believe an enjoyable training environment adds value to the students' training experience.

Active Learning

How much learning really goes on during training ?
Are we giving information because it's there ?
Does the student know why they need the information ?
Are we often only satisfying the Instructors ego trip of knowledge without focusing on the real end product, that is the students expected behaviour during a real emergency ?

We have recognised that Safety Training is a shared responsibility between the student and the source of learning - training establishment.

The learning process actively starts when the student proactively looks for answers without the Instructor promulgating the questions.

We have found by stimulating the students own quest for understanding during training, that a natural transfer of knowledge and behaviours into the working environment takes place.

The success in stimulating the student and getting them to take ownership of their learning lies with the relationship between practical and theoretical training and using technology where necessary to provide high volume consistency.

Cabin Evacuation

- Cabin Evacuation is influenced by:
  - Configuration
  - Environment
  - Procedures
  - Behavior

Cabin Evacuation

- Passenger Behavior
  - Psychological Attributes
  - Biological Attributes
  - Cultural Attributes

Cabin Evacuation

- Crew Behavior
  - Psychological Attributes
  - Biological Attributes
  - Cultural Attributes
  - Crew Communication
  - Crew Training
  - Experience

Cabin Evacuation

Communication

&

Decision Making

IMPROVING COCKPIT CABIN CREW COORDINATION DURING FLIGHT SAFETY TRAINING

Captain Dietrich Langhof

Flight Safety Coordinator, Condor Flugdienst, GmbH

Introduction

In the recent years I had the chance to talk to many of you about issues concerning flight safety training during the Symposiums. This has been a wonderful opportunity to share experience. Many of us present here today have common goals and work hard to improve flight safety training. This time it is my turn and I appreciate very much the opportunity to share our experience and what we did to:

IMPROVE COCKPIT – CABIN CREW COORDINATION DURING FLIGHT SAFETY TRAINING

As a result of world wide investigation of incidents regardless of their outcome – non-fatally or even fatally – the aviation industry conceded that there was an important factor missing:

Crew Resource Management

With 70% of all air incidents attributed to human factor problems, Crew Resource Management (CRM) is now a vital part of airline training around the world and is even mandatory in Europe under JAR Ops. Thus a magic abbreviation is circling around the globe now:

CRM

Many of us did a great job in the recent years to improve the CRM-training for cockpit crews and cabin crews. But most of the time we separate training for cockpit and cabin crews. As there are normal, abnormal and emergency situations where cabin and cockpit crews have to act together. Therefore is a potential need to train both parts of the crew on common situations. The best solution would be if we could offer a joint CRM and flight safety training.

Then, the question is: What can be done to improve cockpit - cabin crew coordination in flight safety training?

But before I start, let's have an impression, who we are and where we are.

Condor History

Condor is a member of the Lufthansa Group and operates 49 aircraft in one of the world youngest and most modern fleets. The fleet is comprised of 9 Boeing 767-300ER, 15 Boeing 757-200, 13 Boeing 757-300 and 12 Airbus 320.

Total seating capacity of the fleet is about 11,300. Our fleet mix allows Condor to serve individual markets and ranges to suit passenger demands. During peak seasons, Condor offers nearly 650 holiday flights a week to 76 destinations from the main base Frankfurt and other German airports. Our services include short-range flights to the Mediterranean, medium-range flights to the Canaries and long-range flights to the Caribbean, Africa, the United States and to the Middle and Far East. In 1996, Condor became the launch customer for the B 757-300, the delivery started in January 1999.

An extensive fleet renewal phase began in the early 1990s. Condor's growth has been dramatic, rising from 3.2 million passengers to over 11 million in 2000. At present time we employ 580 pilots and about 2000 cabin crew members for our 49 aircraft.

IMPROVE COCKPIT – CABIN CREW COORDINATION DURING FLIGHT SAFETY TRAINING

Today's technology is playing an increasing role in our life. Thus, it is possible to use virtual reality simulation in flight crew training, cabin evacuation, crew coordination and communication training?

Condor was looking for new ways of using these modern technology to improve cockpit- and cabin crew skills during flight safety training. For cockpit crews we established **L**ine **O**rientated **F**light **T**raining (LOFT) some years ago.

> *"Line Orientated Flight Training that is the use of the flight simulator and a highly structured script or scenario to simulate the total line operational environment. During the LOFT mission problem solving skills are practised by introducing a developing situation and allowing the crew to follow it through to its conclusion without any comments or instructions from the instructor."*

That is exactly what we were looking for – something similar to LOFT for cockpit and cabin crew flight safety training. 3 years ago, when we started to evaluate future ways of flight safety training, we had to order a new **C**abin **E**mergency **E**vacuation **T**rainer (CEET) for our airline. So we took the chance to specify the new CEET according to our vision for the new safety training.

Also, we received a little help from the Joint Aviation Authorities (JAA), i.e. the European Civil Aviation Authority.

JAR OPS requires:

CRM-Training should address the following matters:

- the importance of effective coordination and two-way communication between cockpit and cabin crews in various normal, abnormal and emergency situations,
- combined cockpit and cabin crew training should, wherever practicable, include joint practice in airplane evacuations and discussions of emergency scenarios

During initial training, cabin and cockpit crews receive an intensive CRM-training. But what we were missing was a real joint CRM-training. We wanted to have more practical training including CRM and flight safety training.

There is an old chinese proverb saying:

> *"Tell me, and I will forget – show me, and I will remember – include me, and I will understand."*

or:

> *"What I read, I forget – what I see, I may remember – what I practise, I am able to do."*

Finally, when we finished the concept phase of our project together with cockpit-, cabin-, flight safety- and CRM instructors, we recognized that what we created should be called, "Line Orientated Flight **Safety** Training".

Today, LOFST is our new joint training with cockpit and cabin crews.

Before you receive more details about Line Orientated Flight Safety Training, I'd like to give you a short overlook on our one-day recurrent emergency training. A typical recurrent flight safety training event will include the following items:

One-Day Recurrent Flight Safety Training

A one-day recurrent emergency training with cockpit and cabin crew members at Condor will be held in out training facilities.

Recurrent Flight Safety Training

At Condor, recurrent Flight Safety Training has always been a joint training with cockpit and cabin crews since the beginning.

Revision

The day starts with checking the latest revisions of the FSM (Flight Safety Manual).

Briefing

The instructors give a short briefing about Incident- and Flight Reports.

Review

For a review we use a magnetic board and a special virtual walk-around, designed by our in-house specialists.

The virtual walk around enables the instructor to show every section of our aircraft and equipment without actually being on the aircraft.

Hands-On Training

The importance of hands-on training should never be underestimated.

We are using different hands-on training stations: for life-vests, oxygen-masks, smoke-hoods, fire-extinguisher and for training with our survival equipment.

Door-Training

Afterwards we continue on our CEET (Cabin Emergency Evacuation Trainer) with door- and exit training as well as the pilot-seat handling for pilot incapacitation.

Next training event is door opening "in flight" condition, and associated commands and procedures.

Baggage Handling

For handling of carry-on baggage, our instructors use real baggage to demonstrate the associated problems in the cabin.

Security

How to cope with bomb warnings, and –search, as well as hi-jacking and airport-security problematic is reviewed with a CBT-program and additionally shown on video.

After a lunch break, we continue with dangerous goods and cabin smoke- and fire training on the CEET.

So far, there are 2 hours training time left from an 8 hours training event. This is the time to start with the Line Orientated Flight **Safety** Training.

Cabin Emergency Evacuation Trainer (CEET)

As I mentioned earlier, we needed a new Cabin Emergency Evacuation Trainer (CEET) for real time training.

In 1999 we began to install our new CEET at our safety training facility in Frankfurt.

We introduce some details about our magic emergency flying machine now.

Overview CEET

The cabin trainer represents the Boeing 757-200, -300, Boeing 767 and Airbus 320.

Doors

The CEET offers three doors:
- a B757 main door 1L
- a B767 main door 1L and
- a A320 main door 1R

For each type one over-wing "plug type" exit and one B757 emergency escape door is installed.

Slides

The trainer is fitted with two slides; a single aisle type slide from the B757 and a twin aisle from the B767.

Cockpit

It is very important for us to have a cockpit section now, which is divided into two sides to represent a B757 cockpit on the left hand side and a A320 cockpit on the right hand side. For Pilot Incapacitation Training, we have one B757 and A320 seat in the cockpit.

The CEET has been installed on a three-axis motion base. We have one altimeter and a time indication for the pilots, to check the remaining flying time and the aircraft height.

Full face oxygen masks with fully functioning intercom are installed in the cockpit to allow communication with the cabin crew. For passenger calls or announcements by the captain a passenger address system is fitted, thus allowing a very good combined cabin - flight deck communication training, something we value very highly. In addition a smoke source to simulate smoke in the cockpit and one camera on the cockpit ceiling is installed.

Smoke And Fire

Smoke and fire are the most dangerous situations for a crew, so we installed various fire and smoke sources in our CEET. Smoke and fire in the lavatory incl. a hot lavatory door, smoke and fire in one overhead bin and in the video entertainment area, hot smoke and fire in the galley, smoke behind the wall, smoke in the cockpit and smoke in the air-conditioning system.

These sources are controlled from the instructors position by a touch screen allowing to keep the crews very busy.

Equipment

We installed the emergency equipment in the cabin as closely as possible to their actual location in the real aircraft, i.e. we have every equipment starting from fire extinguisher, smoke hood up to the life-raft and entertainment system on board.

Cameras

We have eight cameras installed giving us the opportunity to monitor and record all phases during the training. Cameras are positioned in the cockpit, in the lavatory, in the galley, in all door areas and outside over-wing.

Thus the instructors can follow the training mission precisely on the video system and use the replay later during de-briefing.

Visual System

Perhaps the most unique feature of our trainer is its visual system, which reproduces a realistic impression of the outside environment. There are two projectors, installed on the outside right hand side of our trainer which project the image onto a screen that runs nearly the full length of the CEET.

The manufacturer "TFC" has developed a database that includes scenes at the gate, pushback, taxiing, take-off, take-off aboard, cruise, landing and ditching. Different take-off and landing situations can be simulated, for example:

- the right wing with the engine running normally or on fire
- smoke condition

is projected onto the screen.

The whole system is integrated into the motion system so that our crews can actually feel the movement they see outside the cabin windows. The motion is very sensitive, allowing different levels of movement to be felt from taxiing to take-off, turbulence and different landing scenarios. Aircraft specific noises are reproduced over a sound system.

Emergency landings with fire or collapsed gear and other scenarios can therefore be simulated. With motion, sound and visuals all linked together, the flights become very realistic.

With these capabilities to train even more different disaster scenarios more realistically, the CEET is more a simulator rather than a cabin mock-up.
For joint cockpit- and cabin training we are now able to simulate a flight in a real time scenario, as it could actually happen during a flight.

Let us now take a closer look at some details of a typically Line Orientated Flight Safety Training mission LOFST.

TO IMPROVE COCKPIT – CABIN CREW COORDINATION DURING FLIGHT SAFETY TRAINING

At first some vital rules of LOFST:

1. Normal, abnormal and emergency situations should be as realistic as possible.

2. All phases of flight must be flown in real time.

3. CRM- and Flight Safety Instructors will assume the role of various resources, i.e. ground personal, handling, operations and air traffic control (ATC).

4. During LOFST the instructors will not give any help to the crew, they are only allowed to act as an observer, communicator and scenario coordinator.

5. For crew confidence, the video tape will be erased immediately after debriefing.

The LOFST Mission

When the mission starts, unlike a briefing before an actual flight, the crew will be provided with the complete briefing package, i.e. for the cockpit:

- flight plan
- weather data
- aircraft status etc.

and for the cabin crew:

- passenger information
- special notes
- cabin status etc.

Situations we used to design a mission are:

- Operational problems:
    - air-traffic slots
    - fuelling problems
    - bomb warning
    - cargo etc.

- Passenger problems:
    - passenger missing
    - child and infants seating
    - seating problems with passengers
    - unruly passengers
    - carry-on baggage
    - dangerous goods

    - medical problems etc.

- Equipment problems:
    - while aircraft still on ground:
        - emergency equipment
        - MEL (Minimum Equipment List)
    - while aircraft in the air:
        - lavatory, galley
        - air-conditioning
        - smoke or fire
        - decompression etc.

- Crew problems:
    - incapacitation
    - workload
    - duty-times etc.

Still we have some more options to design a mission depending on the training objectives.

Sample Mission

Duration from initial briefing until end of feedback: about 2 hours

1. Briefing:
   - cockpit and cabin crew is provided with the mission papers by the flight safety instructor
   - passengers are briefed about specials, unruly or medical problems etc. by the CRM instructor
   - 15 min.

2. Boarding:
   - passenger boarding with unruly drunken passenger
   - 10 min. closing doors

3. Engine start and taxi:
   - video-system problem used for passenger briefing; normal DEMO
   - 6 min. at the runway

4. Flight-phase:
   - again problem with video-system; after a short time, smoke coming out of the system
   - depending on the decision, return to the airport
   - 6 to 10 min

5. Pilot returns to the airport:
   - smoke and/or fire, prepare passengers if possible
   - return between 5 to 7 min. until landing

6. Evacuation:
   - heavy smoke in cabin after landing, unconscious passenger in cabin
   - 5 min.

7. Debriefing:
   - crew, passengers, safety-instructor and CRM-instructor
   - 50 min.

8. Feedback:
   15 min.

Objectives of LOFST

Improve cockpit- and cabin crew member's ability to recognise and rectify situations before a breakdown in communication and crew coordination occurs.

Improve coordination and two-way communication between cockpit and cabin crew in various normal, abnormal and emergency situations.

Improve organised **TEAMWORK** that uses the medium of communication, to acquire thorough, detailed and thus efficient decision-making during normal operations.
The following factors contribute to the performance as a team:

- Forward planning
- Emphasise the issue
- Delegation
- Communication
- Time management
- Use of specific knowledge of others
- Practicality
- Helping each other

Improve CRM by using the "F O R – D E C" Model as a strategy to optimise the solution of problems.
"F O R – D E C" is a made-up word to symbolise six different phases of the decision making process:

Facts, Options, Risk & Benefit – Decision, Execution, Check

Facts (What is actually going on here?):

- recognize the need for a decision
- analyse the situation: collect relevant facts
- define possible outcome and set priorities accordingly

Options (What are the choices we've got?):

- sift through applicable procedures
- gather the various ways of dealing with it

Risks and Benefits (Weighing up the pros and cons):

- estimate the benefits
- estimate the risks involves
- assess the uncertainty

Decision (So, what shall we do after all?):

- choose option with the lowest risk and factor and highest chance of success
- if necessary have the choice of a back up option
- re-check if the assessment is still valid

Execution (Who shall do what, when , and how?):

- Precise planning and co-ordinated carrying out of the chosen option

Check (Is everything still all right?):

- control of the actions carried out
- critical comparison of actual effect with the expected result
- have events been overtaken in the meantime?
- have we taken the best course of action? If necessary go back to "Facts" and start again

Improve the use of our **CRM QUICK REFERENCE LIST**.

CRM Quick Reference List

The CRM Quick Reference List is part of the CRM seminar and should be used in the simulator, flight safety refresher training, in initial training and in the daily work routine.
It can be used as a base for discussion when holding debriefing as well as help for self-analysis.

The most important motive in using CRM should come from the crews themselves, as they are the ones affected by incidents and accidents. Therefore the use of the CRM list in our daily working life is paramount.

Before we start, we make sure that all crew members have their pocket-card, with the CRM Quick Reference List on one side and "F O R – D E C" on the other side.

The CRM Quick Reference List consists of the following items:

- effort to make a positive impression
- listen to others
- ask other's opinion
- use of knowledge accordingly
- support reasonable views on subject
- support others
- accept criticism/objection
- give feedback
- voice doubts
- discuss differences
- reduce the human error factor
- use of all sources of information
- search for options
- evaluate pros and cons delegate sensibly
- analyse decisions
- set yourself gates
- advance planning
- avoidance of time-pressure
- defeat distraction
- structured conclusion

F O R D E C

Facts
Options
Risks & Benefits
-
Decision
Execution
Check

C R M

Discipline
Engagement
Social competence
Kooperation

A detailed description of the CRM Quick Reference List, "F O R – D E C", TEAMWORK, Briefing and Debriefing is published in our Flight Safety Manual within Chapter 1 ›Crew Resource Management (Crew Coordination and Communication)‹.

Does anyone of you remember what I said earlier?

"What I read, I forget – what I see, I may remember – what I practise, I am able to do."

"Here we have the opportunity to practise what they can read and see, so we have the chance that our crewmembers will use it during their daily flight operation."

LOFST Debriefing

1. The crew debriefing will be a critique by the crewmembers providing feedback using their own observations.

   The following items should be considered when contemplating a debriefing:
   - a debriefing should be a matter of course
   - a debriefing should take place immediately after flight
   - a debriefing should take place in private
   - both Captain and the Purser should be responsible for initiating the debriefing
   - all concerned should be involved
   - positive performance should be mentioned before negative and blame should be avoided
   - feedback should be given to both peers and those in higher ranks
   - ones own behaviour should be analysed, other options taken into consideration
   - the result of a debriefing should be used as a means of working together better
   - for the future
   - praise should be given as a means of motivation

   After the crew on duty of the training mission has completed their debriefing, the rest of the cockpit and cabin crew members acting as passengers join the debriefing.

2. The Flight Safety Instructor concentrates his debriefing on safety issues and standard procedures.

3. The CRM Instructor's role is to manage the critique, not to "teach" right solutions or test the crew member. To focus those areas of the LOFST mission, where the principles of CRM could have helped the crew in handling the problems.

Feedback

Cockpit and cabin crew participants are asked for detailed feedback.

On the basis of the detailed feedback of our participants and the inputs of our instructor team, we are able to modify and improve our LOFST mission. Since we started this training, we have received excellent feedback from our crews.

Here is what they appreciated most of the Line Orientated Flight Safety Training.

1. To act as a team, we now have the chance to train together and know more of what is going on either side of the cockpit door.
2. Now we are able to practise what we have learned in theory about leadership, delegation, crew coordination and communication.
3. Having the chance in the debriefing to talk to each other about the problems observed during the mission.

Conclusion

An FAA Advisory Circular from 1991 already stated that:

> *"Aircraft crew personal are 'on-the-scene' team members working together, who are best able to determine their situation and needs for information. These personnel must initiate and process the required communication in order to make and execute decisions that lead to positive and safe conclusion."*

Now it is up to us, to give our crews a chance for better training.

Some airlines introducing more and more CBT programs for recurrent flight safety training. CBT training can be of great value, however it should not be used as a substitute for recurrent emergency training, but as a supplement.

Our crews have to deal with people, because our payload are human beings, and they must have the chance for more practical training to improve their skills.

Let's spend money in modern technology (but not only in computers), invest in more realistic Cabin Emergency Evacuation Trainers and your crews will thank you for having a better opportunity for training.

In recent years I took a lot of good information and inspirations from the Cabin Safety Symposiums. So at home I could bring all this in, to create together with our instructors from the cockpit, cabin and emergency training department the Line Orientated Flight Safety Training LOFST.

Nobody is perfect, but we believe that this is the way, how we are able to:

IMPROVE COCKPIT – CABIN CREW COORDINATION DURING FLIGHT SAFETY TRAINING

by using Line Orientated Flight **Safety** Training

Finally the most important thing for all of us involved in training is that we have to do something and not to wait and read about what we could do, how it should be done, and what the recommendations are!

By adding LOFST to the training of our crews, we influence and create a more positive atmosphere within the cockpit - cabin team, and that will finally result in a safer and more professionally conducted flight.

Thank you for your attention.

Information and Inspiration has been obtained from:

Annual International Aircraft Cabin Symposiums

The International Flight Safety Strategy Seminar
Mauritius in 1994

DLH, Condor CRM seminar

Condor Flight Safety Manual

Hörmann, H.J. (1994). FOR-DEC: A prescriptive model for aeronautical decision making

Biography for Capt. Dietrich Langhof

Capt. Langhof started his flying career in the German Navy in 1972.

During his time as an aircraft commander and instructor pilot on the Breguet Atlantic, a maritime patrol aircraft for long range surveillance and search and rescue, he has been in charge for the safety and survival training in his navy squadron. In 1989 he retired as Lt. Cdr. from the navy and joined the AERO LOYD charter airline in Frankfurt as training captain on the MD-80 and flight safety instructor.

In 1992 he hired at CONDOR and is now a captain on B757-200, -300 and B767-300ER. He is in charge for Flight Safety Standards at CONDOR as a Flight Safety Coordinator and the Head of the Flight Safety Department.

CRM IN CATHAY PACIFIC

Traditionally cabin crew competencies have been viewed primarily as service-based, with regulatory requirements for safety training as a back up for the rare event of an accident. Evidence suggests that recent change in the roles of cabin crew, particularly those caused by the range of passengers and their expectations, have led to a merging of these two crucial functions {service and safety}. Increasingly, cabin crew deal with difficult and stressful situations which need lateral thinking skills. It is therefore essential for us to propose these competencies for future education and training development.

In recent years, the Kegworth and Dryden accidents have graphically demonstrated the role of cabin crew as one of the last lines of defense against a catastrophic situation. These accidents highlight the poor integration of cabin crew as a vital component of aircraft safety.

Initially

Therefore, in direct recognition that cabin crew are an essential part of the aircrew team, we, at Cathay Pacific Airways were amongst the pioneering airlines in Asia to introduce combined CRM for the cabin and flight deck crew. In being different and special in so many ways from perhaps other airlines, we recognized the need to develop a programme, from its infancy, to suit our needs and environment. The material was directed at improving communication, providing a better understanding of each other's jobs and leading to effective team building. Amendments were made in our training to overcome various cultural, organizational, social, physical and behavioural barriers. The transition from FTM {flight deck team management}to CRM was made prior to any formal requirements by CAD {Civil Aviation Dept.}, JAR ops. and AOC requirements.

We are very pleased to be with you, sharing and presenting our "big picture". We begin with a brief history of crew resource management (CRM). Cabin crew facilitators were recruited and trained by facilitators from the flight deck.

The atmosphere was informal, friendly and relatively unstructured. Our cabin and flight deck staff, although considered by most to be amongst the best in the world, had very little interaction with each other. In dealing with so many influencing factors, we decided to keep it simple, pioneering the first venue as a meeting ground for two teams- cabin and flight deck crew. These gatherings were revolutionary in themselves as being the first time ever that interaction was encouraged, not criticized, in a formal layout

Reasons for Integration

The advent of integrated CRM, we believe, was to reduce the effects of cultural differences e.g. negative connotations attached in many Asian cultures to women fraternizing with men, natural gender differences, fear of ostracism from the sub group {groups within the cabin crew structure} etc.

Contributing factors to this great separation between flight deck and cabin crew teams could be listed as:

- continual environmental changes and demands that derived from them,
- flight deck and cabin crew on different flight duty patterns,
- change in management style and agenda due to market forces
- the subsequent lowered morale and stress from these changes,

- great disparity in level of CRM knowledge between the two team.
-

Taking a closer look, another important factor that came to light was that, a large barrier existed between the flight deck and cabin which seemed to be attitudinal. Not only was there a wall between the flight deck and cabin, but unbeknownst to the pilots, one sometimes existed between the cabin crew themselves.

Reasons included:

- Administrative barriers – ISD {inflight services dept.} and Flt. Ops. Seen as two separate teams.
- No meeting place for interaction
- Seniority hierarchy: old school of thought, 'us and them approach', hindering two way communication
- Asian culture: respect to elders, different comfort levels of English
- Different Asian nationalities fraternizing with their own nationalities
- Great disparity in income and lifestyle
- Lack of team identity and spirit
- A good safety record {complacency}
- Poor situational awareness in job description, supporting roles, work environment
- Reticence or prohibition in communication .

And so, integrated classes began with some icebreaker exercises to facilitate basic interaction, without prior need of course information. This was done in recognition of the great disparity of knowledge between the two groups. A viewing of an accident enactment video with key questions for discussion was also used.
Thus began the gradual process of airing grievances, dispelling misconceptions, dissolving animosity and relaxing into the concept of an "Air crew team" and culture. With an increased situational awareness of each other's jobs, came appreciation and understanding. The flight deck and cabin crew began recognizing their role in giving and requesting support from each other when needed.

New programmes were produced by us each year, including ice breaker exercises, two in-house videos, group activities, experiential exercises, elements of CRM, Drug and alcohol abuse [as advised by HK CAD], unruly passengers, LOSA {line oriented safety audit}, LOFT, CFIT avoidance, sleep and fatigue counter measures.

Evolution of our CRM product

1995

Relatively unstructured meeting ground for both teams, to facilitate basic interaction – through ice-breakers, videos, general discussion.

Result

- An eye opening introduction of C.R.M. to cabin crew
- Opportunity for cabin and flight deck crew to interact.
- Creating awareness;
- that lack of team spirit and identity between flight deck and cabin crew,
- reticence in sharing or asking for information and
- pooling collective resources,- were contributing factors that led to air accidents.

- Cabin crew were encouraged to call flight deck directly {without referring to the Inflight Services Manager} and immediately with valuable, unusual information for pilots.
- As a result, number of incidents were avoided by this procedure

1996

- Tale of two teams- addressing issues such as social, physical, organizational barriers between two teams and various ways of overcoming them.
- "I like it when"- relevance of effective communication to express appreciation, dispel misconceptions and bridge the gap.

Result

- Participants had a chance to voice their feelings without fear of retribution
- Increase in CRM awareness
- Improved communication amongst the crew

1997-the year Hong Kong's sovereignty was handed over to China from Britain
With the move to the new airport imminent, our recommendations were introduced into the design of the crew briefing area and sign on procedure to facilitate interaction and the feeling of belonging to the "same dream team " ambience.

- Presonality bingo
- An in- house video show leading to increased job awareness—
- Managing stress

Result

The 1997 hand over of Hong Kong to China and the uncertainty of the future was distressing to many participants. Joint discussion reduced stress level and increased team spirit.

1998 CAD requirements for annual license renewal for cabin crew now included mandatory CRM.
Move to the new airport at CLK

- Picture cards
- A sequel to the in-house product
- Situational awareness

Result

- Both pilots and cabin attendants became more aware of each other's job and work load and appreciate at a deeper level
- Dissolving of physical barriers and introduction of new sign-on policy at our new home
- Modification and amendment of 'cabin ready' signal procedure
- Assertive message recommended for cabin crew.

1999

- Table Top.

Results

- C.L.E.A.R. model as problem solving tool.
- A valuable opportunity for both team to practice their CRM skills through an enactment of a real life situation

2000 This year the format changed to a combined CRM session every three years for the pilots in conjunction with LOFT and CFIT avoidance

- After having completed five years of combined CRM experience, it was decided, that the way ahead was to recognise and address the special needs these two groups had within their team structure..
- Alcohol and drug abuse as directed by CAD and run by cockpit facilitator and Cathay Pacific doctor for pilots
- Sleep and fatigue counter measures
- Awareness on drug abuse for cabin crew
- A combined exercise (Black out exercise) with cabin crew, described as an emotion simulator

Results

Succeeding with CRM

- include improved morale
- better crew performance
- reduced overhead cost

As safety is directly related to profit and reduced insurance cost, we are happy to accept our fair share and responsibility for increased profit.

2001 and beyond

Our proposed future model will address the following:

- Presentations on sleep and fatigue countermeasures for cabin crew
- Awareness on alcohol
- Cosmic radiation for cockpit and cabin crew {due to intention to fly across poles}
- Ongoing modification of LOFT
- C.R.M. in transition training
- Line operational safety audits (LOSA)

Succeeding with CRM

A smooth flow of communication between flight deck and cabin crew has allowed improved team spirit and performance inflight.

We, as facilitators, deal with rostering difficulties, {reticence} in interdepartmental communication, time and budget constraints, initial lack of recognition for cabin crew facilitators, etc. Being the new kid on the block, we deal with normal but no less painful growing pains. Luckily, resilience is our middle name. That, with a sense of humour will see us into corporate structuring and continued progress and growth.

Future

CRM is about giving people the tools to resist and resolve accidents.

These tools will help our valuable assets, the crew, counter fatigue, manage stress, develop healthy work habits, reduce sickness and increase morale.

From this it must follow, that ours is a continual and ongoing story. The combined programme is feedback sensitive and user friendly. In being driven by participants' needs and their environment, the contents are constantly updated, sometimes on a weekly basis.

Our vision of a 'safety culture' can only be successful when its ideology is embraced and practiced by all departments of our airline. This would be the basis of all future concepts.In this way, a blanket of 'corporate safety' gives ownership and responsibility to all concerned. A sense of community and belonging facilitates better CRM.

The 'take care programme' is to be introduced this year. The concept of this programme is based on the lines of the crew taking care of each other, first and foremost. This develops a sense of community and allows everything else to follow naturally, i.e. passengers, service, organisation, etc.

In conjunction with "take care", we are initiating "threat recognition" and its management. This encourages our crew to develop situational awareness, so they may anticipate threats to safety and avoid imminent incidents. Threat recognition and error management models conceptualize where CRM, with its associated behavioural markers, contribute to strengthening the defenses for safer flight operations.

Hand in hand, our Corporate Safety department intends to initiate "risk assessment" for all departments. Benefits of accident prevention are two fold; humanitarian- where people are recognized as the most important asset in any organization, and economic- where cost reduction plays a vital role in the decision making process for most organizations. This system ensures a responsible management role in safeguarding work environments, by maintaining safe work practices and rectifying systemic errors.

Tomorrow

Changing attitude is an ambitious goal, which we hope to achieve, not by revolutionary tactics, but by creating a gradual awareness and a positive change in the people involved. Tomorrow, we wish to move away from a "blame culture", recognize human nature and work with it.

This is part of the process of the 'no blame culture'. In the age of modern aircraft reliability, humans and human error are a causal factor in air accidents. In recognizing errors as a natural part of human nature, the emphasis then, is placed on successfully recovering from them. Information from this will be shared for data accumulation and future reference of other operators. Learning through transparency and confidential reporting will be our higher calling.

CRM intends to safeguard human nature and increase human efficiency. Behavioral markers include increased lateral thinking, resourcefulness and awareness leading to increased productivity and safety..

To conclude, we are looking into developing an inhouse Cathay campus, with a website, library, lecturers visiting regularly and interested people having the opportunity to study at various institutes of human factors. This will help us keep up with academic information for practical application and maintaining the best course toward our goals..

ABSTRACT

In recent years, the Kegworth and Dryden accidents have graphically demonstrated the role of cabin crew as one of the last lines of defense against a catastrophic situation. These accidents highlight the poor integration of cabin crew as a vital component of aircraft safety.

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Biography: Captain Mike Maas
2000

Mike is a Captain on the Embraer 145 Regional Jet for a major U.S. airline, and holds FAA Airline Transport Ratings on the EMB-145, ATR 72, ATR 42 and SD-3 aircraft, and has served as Captain on each.

Mike is Regional Safety Coordinator for the Air Line Pilots Association (ALPA) in the Southern Great Lakes Region. He also serves on ALPA's Accident Survival Committee, which consists of Air Line Pilot Association members who volunteer their time to represent ALPA in air safety matters relating to aircraft crashworthiness, accident survivability, and aircraft rescue and fire fighting.

Mike has participated as a member of the Aviation Rulemaking & Advisory Committee on Emergency Evacuation Issues. He participates in airport and air traffic control safety issues as an ALPA airport liaison representative in the Great Lakes Region. He is a member of the International Society of Air Safety Investigators, and has participated in NTSB accident investigations.

Title of presentation: Aircraft Crash Axes Performance Standard
Summary: The crash of a Emb-120 in Carrollton Georgia in 1996 resulted in NTSB identifying that the crash ax required under Part 121 needs to be able to meet a minimum standard. We are working with the SAE to develop standards for their design, and guidance on their use.

Title of presentation: The ALPA Activity in Cabin Safety
Summary: ALPA has several specific projects underway that are intended to improve safety in the aircraft cabin. Our work on Crew Protective Breathing and Vision Equipment is intended to establish realistic test standards for this equipment, so it can be counted on to work when it is needed. Another project on Cargo Compartment Smoke Detectors is intended to improve safety by requiring smoke detectors in all cargo compartments (which has been achieved) and also to reduce false alarms (which could become a hazard in itself). Several projects focused on airport aircraft rescue and fire fighting (ARFF) services also can affect aircraft cabin safety. We are seeking to have crash-activated ELTs on air carrier aircraft to improve emergency notification in low visibility conditions and also to increase the capabilities of ARFF units, in response times and agent quantities.

Britannia Airways Incident – The Cabin Manager's Account.

Val Robertson – Cabin Crew Safety Manager.
Britannia Airways Ltd.

On the 14th September 1999, a Boeing 757 (registration G-BYAG) with 233 passengers and 3 infants on board was flying from Cardiff in South Wales to Gerona, a holiday resort airport in Northern Spain. The aircraft was configured with 235 economy seats and the crew complement was 2 pilots and 7 cabin crew. The aircraft was due to land in Gerona around midnight, the weather at Gerona was torrential rain with thunder and lightning.

Due to the weather, the seatbelt signs were put on early to allow the crew to secure the cabin, galleys, and secure themselves for landing. The aircraft made an initial approach to Gerona, but did a 'go around' before making a second attempt to land. The First Officer advised the cabin crew via the interphone that if they were not successful on the second approach it was probable that they would divert to Barcelona.

The approach was very turbulent. Cabin Crew described the first touchdown of the aircraft as a heavy landing, which was followed by a second much heavier impact, during which some overhead lockers opened. The main interior lights failed at the second touchdown, but the emergency lighting illuminated in all cabin sections.

Considerable floor and seat disruption had occurred and some cabin overhead equipment had been displaced, but all of the cabin occupants remained conscious and without incapacitating injury. Externally it was dark and raining heavily. Evacuation commenced by the light of the emergency lighting system, with assistance being required by some passengers in the areas of disruption. Difficulty was experienced in opening some of the cabin doors; three of the eight available exits could not be opened.

Evidence from the passengers and crew indicated that the aircraft had been evacuated rapidly without external assistance. Rescue and Fire Fighting Services had difficulty locating the aircraft and reaching the site. They arrived on the scene about 20 minutes after the accident, and spent a further 50 minutes in recovering the occupants to the terminal. Forty-four persons, including the aircraft commander, received hospital treatment.

For the purpose of this presentation, the Cabin Manager, Fiona Pittard, gave the audience an unscripted account of her experience of the landing, evacuation and the scene outside the aircraft prior to the emergency services arriving.

What have we learnt from this incident?

1] Our evacuation procedures worked extremely well and crew made no recommendations for change.

2] It is important to train Cabin Crew to use the procedures as guidelines and adapt them to suit the situation.

3] The importance of encouraging Cabin Crew to review evacuation procedures during take off and landing.(30 second review)

4] Team work and leadership skills were required of all the Crew members.

The full AAIB Bulletin can be found on:-
http://www.open.gov.uk/aaib/jan00htm/gbyag.htm

Introduction

I would now like to introduce Debbie Sansome and Fiona Pittard who are representing Britannia Airways.

Debbie has eighteen years experience in the commercial aviation industry, operating as cabin crew and for the last seven years within Britannia's Cabin Crew Training Department.
Debbie's current role is Cabin Crew Training Course Manager

Fiona has operated as cabin crew for several airlines including DanAir, Virgin Atlantic and Air Europe.

Fiona has spent the last ten years with Britannia, five of those years operating in the senior position of Cabin Manager.

Should it Happen to You

Kathy Lord–Jones, National Safety Coordinator
Lonny Glover, National Safety Committee

Association of Professional Flight Attendants (APFA)

Aviation accidents are unpredictable. Whenever one occurs, the emotional impact that it has on anyone associated with the accident either directly or indirectly is indescribable. When one first hears of a disaster like this, a gut wrenching feeling overcomes them. People never seem to be prepared to deal with horrible circumstances. Once it has occurred, it may be too late to address the issues at hand, unless you are prepared. The National Safety Department of the Association of Professional Flight Attendants (APFA) the union which represents the more than 23,000 cabin crew members at American Airlines made the decision to prepare themselves and its membership, should it ever happen to them.

The last major accident with loss of life that had occurred involving APFA flight attendants at American Airlines happened on May 25, 1979. Flight #191 a DC10 aircraft crashed on takeoff after departing the Chicago O'Hare International airport. All 258 passengers, 10 flight attendants and 3 cockpit crewmembers perished on that ill fated flight. Over 20 years would pass before we would encounter another major accident involving flight attendants from our organization. Although the accident rate remains relatively low, the statistical reality is that due to the increase in airline activity, airline accidents will increase. We are all aware that the possibility does exist that any of our affiliations could be impacted by an aviation disaster at any given moment.

Following the devastating crash of Trans World Airlines 800 on the evening of July 17, 1996, the APFA's National Health Coordinator and National Safety Coordinator traveled to New York. They spent several exhausting days assisting the fellow union leaders of the International Federation of Flight Attendants (IFFA) at TWA and their flight attendants in dealing with this accident. The lessons learned from their experiences underscored the necessity to update the Accident Preparedness Program of the APFA Safety Department and the Critical Incident Debrief program of the Health Department.

For over 18 months, a team of five flight attendants involved in APFA's Safety and Health Departments, reviewed and expanded the accident response program and the role of the union in investigating an incident or accident. In 1992, a significant change was made to the aircraft accident investigation rules. The Occupational Safety and Health Administration (OSHA) developed a rule designed to protect investigators from bloodbourne pathogens. In 1994, the Federal Aviation Administration (FAA) adopted and imposed this rule for all aircraft accident investigators. It was imperative that this recent rule change be included and instituted into the development of APFA's new safety program. The goal was to increase the knowledge and training of the union representatives that are needed to assist fellow crewmembers that were involved in an incident or accident. If any accident was to occur and the union was provided party status, those trained professionals would also be able to assist in an aircraft accident investigation. The development of APFA's accident investigation "Go Team" was beginning to evolve.

An Accident Preparedness Manual was developed to provide guidelines and checklists for union representatives to follow when dealing with any incident/accident. The manual encompasses the investigation process, incident/accident response checklist, critical incident stress debrief (CISD) guidelines and information regarding the role the union representative will assume. This manual was sent to 18 union chairs and vice chairs, to be used as a tool to aid them if an event should occur.

The APFA Safety Departments objective was to formulate an accident investigative "Go Team". Many hours of training are necessary to provide a team with a level of efficiency and expertise, which would enable them to assist the National Transportation Safety Board (NTSB) at an accident site. The team took extensive training courses that were concentrated in the areas of cabin safety and survival factors. They received aircraft accident investigation training at the Transportation Safety Institute (TSI) in Oklahoma City. This course is designed by the FAA and provides participants with several days of investigative techniques and knowledge. A retired Boeing 747 aircraft is used during the course and gives individuals the opportunity to use their training and apply it by documenting simulated aircraft interior damage. The APFA "Go Team" has also successfully completed bloodbourne pathogen training and attends a yearly recurrent course. In addition, each member has completed the Hepatitis A and B series of shots. The APFA exposure plan was developed and is on file with the FAA. The team also attends the International Society of Air Safety Investigators (ISASI) conferences, Southern California Safety Institute (SCSI) International Aircraft Cabin Safety Symposiums annually. Team members regularly attend the Civil Aeromedical Institute (CAMI).

The group remains actively involved in various cabin safety working groups with the FAA and NTSB. These groups concentrate on improving and addressing issues regarding child infant restraints, turbulence, carry-on luggage and passenger assaults. The "Go Team" members have additionally developed a strategically plan and checklist which is to be utilized in the event they are needed to respond to aircraft accident. "Grab and Go" team bags are packed and ready. They contain items that would aid the "Go Team" members in investigating an accident. Boots, coveralls, bio hazard suits, disposal cameras, voice activated tape recorder, first aid kits, insect repellant, snake bite kits, sun screen and lots of pain reliever are just a few of the many items contained these bags. The "Go Bag" content list was drawn from several sources including TSI and ALPA's Safety Team, but was tailored to suit our teams specific needs.

Another area that our team felt the need to address dealt with flight attendant training. Airlines traditionally train cabin crewmembers to respond immediately to the emergency situation they face. Most training is focused on responsiveness to medical situations, cabin fires, hijackings, evacuations and other events. Flight attendants normally are not provided post accident training or given information on what will happen at the conclusion of an event. What happens next?

A pamphlet, "Should it Happen to You", was developed by the safety team to assist flight attendants that have been involved in an incident/accident. It was distributed to all American Airlines flight attendants. American Airlines Emergency Procedures and Training personnel reviewed the pamphlet and later incorporated similar information into the flight attendants safety manual. The pamphlet provides information relating to:

- Immediate Self Care
    1. Evaluate Your Well Being
    2. Make No Statements to the Press
    3. Stay Together and Safe
    4. Notify APFA Safety Department
    5. Contact Your Family
- Post Incident/Accident
    1. Role of the Safety Team
    2. Alcohol and Drug Testing
    3. Interview Guidelines
    4. CISD

- NTSB Definitions
  1. Incident/Accident
  2. Classification of Accidents
     a. Major
     b. Serious
     c. Injury
     d. Damage

- Rights of Crewmembers

- NASA Aviation Safety Reporting System (ASRS)

It is impossible to cover every type of occurrence and we recognize that each incident or accident is different. The safety team's primary purpose for developing this pamphlet is to prepare and provide the flight attendants with specific information pertaining to who does what and goes where in order to expeditiously and efficiently address their needs after an event. It is important that the flight attendants involved in a serious situation understand that many different individuals are working collectively to assist them. Representatives will aid them in addressing their immediate physical needs such as: personal amenities, clean/dry clothes, food/beverage and phone calls to family members. Trained representatives from our organization will be made available to address the crewmembers emotional needs.

Individuals who have been through an incident or accident may experience feelings of frustration, helplessness, loneliness, withdrawal, guilt, rage or other associated symptoms. Critical incident stress is a normal reaction to an abnormal event. Each person and his/her response to and recovery from the event varies. What is most needed, according to these flight attendants, is someone with whom they can have an informal discussion about the feelings and emotions brought about by an incident/accident. The APFA and American Airlines have jointly formed the Critical Incident Stress Debrief (CISD) Program which will provide trained APFA and Employee Assistance Program (EAP) Representatives to assist flight attendants. The CISD is a service provided to our members who have experienced a particularly stressful event at work. A CISD will be scheduled if one of the following occurs:

- Death in flight or on a layover
- Aircraft accident/air disaster
- Severe Turbulence
- Flight Attendant assaulted during flight or layover
- Security/Bomb threat
- Hijacking
- Actual evacuation with use of escape slides

The CISD is a special kind of debrief, which will address emotional well being. Other situations may arise which may warrant a CISD. Local EAP and APFA representatives will be consulted before scheduling a CISD in these circumstances. Training debriefs will be scheduled separately and conducted by the Flight Service and Training departments. Everything said at a CISD is confidential and will not be shared with anyone else. The employee has an opportunity to talk about what happened and how they feel about what occurred. Useful information will be provided about what one may expect after a stressful incident and how to make the best use of ones own unique coping skills. Those who have participated in a CISD have found it to be a worthwhile and interesting experience.

Since the development of the new APFA Safety Program, it unfortunately has been utilized several times. Several incidents have warranted safety team involvement. The APFA "Go Team" has been activated 4 times to assist in an accident investigation. Two of these accidents resulted in loss of life and the most recent involved a flight attendant. On the evening of June 1, 1999 every facet of the APFA Accident Preparedness Manual was tested. The National Safety Coordinator of the APFA activated the "Go Team" to respond to the crash of American Airlines flight #1420. The McDonald Douglas Super 80 aircraft veered off the runway and crashed in Little Rock, Arkansas. The accident resulted in 11 deaths of which one was the captain of the flight, 45 serious injuries, which included three cabin crewmembers and the first officer. There were 65 minor injuries associated with this accident.

Learning from our experiences, actions and observations during an incident or accident is a vital part of the investigative process. Prevention is the ultimate goal of an investigation. Although no incident or accident is alike, the insight and knowledge we gain ultimately prepares us for any future occurrence. Be prepared, "Should it Happen to You".

Bio

Lonny Glover has been a flight attendant for American Airlines for 18 years. He currently works the Purser position on International routes. He is a member of the Association of Professional Flight Attendants (APFA) National Safety Committee and also a member of the Accident Investigation "Go Team" and has assisted in several incident and accident investigations. He has been involved in several cabin safety working groups focusing on passenger assaults and carry-on luggage. He has been a training instructor, teaching Emergency Procedures, Recurrent Ditching, Security and International Flight Service.

KATHY LORD-JONES BIOGRAPHY

Kathy Lord-Jones is the National Safety Coordinator for the Association of Professional Flight Attendants, the union representing over 23,000 flight attendants of American Airlines. She has held this position since 1994.

After receiving her Bachelor of Science degree from the University of Colorado at Boulder, Colorado in 1987, she did graduate work in Counseling Psychology at Illinois Benedictine College after she began her career with American Airlines.

Ms. Lord-Jones was hired by American in 1987 ans is currently a qualified domestic and international flight attendant. She serves as the secretary of the Cabin Safety Working Group in the International Society of Air Safety Investigators, of which APFA is a corporate member. Along with her on-going training in all facets of flight-related safety, she has worked with the FAA/NTSB at the Transportation Safety Institute in the development of the Aircraft Accident Cabin Safety Investigation course, she was instrumental in the development of the American Airlines and APFA Assault Task Force, and she acts as an Aviation Rulemaking Advisory Committee participant.

ISASI Cabin Safety Investigation Guidelines

Laurel E. Rogin
International Society of Air Safety Investigators-ISASI

Debbie M. Roland
Association of Professional Flight Attendants-APFA

The International Society of Air Safety Investigators (ISASI) is a society formed to promote air safety by the exchange of ideas, experiences and information about aircraft accident investigations and to otherwise aid in the advancement of flight safety. The Society was founded in the United States in 1964. With the establishment of the Canadian and Australian Societies' and over 100 individual members from 35 countries, the international nature of the society was recognized in 1977. (ISASI web site site: www.isasi.org)

The Cabin Safety Working Group (CSWG) was formed at the 1996 ISASI Seminar in Paris France, as a proactive approach to improving cabin safety. In accordance with the ISASI International Council policy, Appendix 2, the purpose of the CSWG is to promote the best possible standard of safety by:

- promoting professional incident and accident investigation concerning cabin safety;
- promoting the exchange of significant cabin safety data;
- promoting constructive co-operation related to cabin safety between interested parties in the aviation community; and

- educating the ISASI membership and the aviation community on the need to adequately address cabin safety operations; and cabin safety and survival aspects.

The CSWG consists of aviation safety professionals from many countries and represent various airlines, professional organizations and unions, civil aviation authorities and accident investigation boards. Ms. Nora Marshall of the U.S. National Transportation Safety Board currently chairs the group.

Globally, airline activity is expected to double over the next 15 years. If the current low accident rate is maintained, the statistical reality is that the number of airline accidents will increase. Given that safety is everyone's priority, the challenge for us is to find innovative ways to counter this trend by lowering the accident rate even further. The CSWG would like to see a reduction in the number of injuries and fatalities when these accidents occur.

One of the ways that improvements can be made is to share information. Safety information systems need to become integrated and accessible in order to conduct more sophisticated analysis with a view to targeting safety interventions that can reduce the numbers of injuries and fatalities. We believe that information on cabin safety investigations is not always collected in a way that allows early intervention.

As safety is a shared responsibility, the CSWG agreed to seek out and strengthen the cooperative relationships needed to promote our respective safety goals. During the October 1997, ISASI Seminar in Anchorage, Alaska, the CSWG decided to develop the cabin safety investigation guidelines. Our goal was to develop guidelines that could be used by any organization that wished to document cabin safety information from incidents and accidents. The CSWG completed the guidelines and distributed the document at the 1999 ISASI Seminar in Boston. Ms. Nora Marshal and Ms. Debbie Roland presented the guidelines at the 2000 ISASI Seminar in Shannon, Ireland.

The theme of this year's panel is "Lessons Learned from Accidents." Since one of the objectives of CSWG's is to promote a high standard of safety through incident and accident investigation, we thought it was appropriate to share with you the fruits of our labor. Improving cabin safety, like improving any aspect of safety, requires a foundation of well-documented factual information that can support suggested changes and improvements. These guidelines were designed to help investigators document that factual information.

The guidelines can provide air safety investigators or operational personnel with a tool that can be used to investigate and document the survival aspects of incidents and accidents. Guidance is provided to assist investigators in documenting damage to the cabin interior and its equipment, and to guide investigators in conducting interviews of flight attendants and passengers. The guidelines can be used for many types of occurrence, including turbulence, evacuations, or an event that involves water contact.

The information that is gathered using these guidelines can assist an organization in gathering information that can be used proactively by many groups to improve cabin safety.

Ms. Debbie Roland was one of the authors of the guidelines and she will share her experience about developing the guidelines and her experience working with the NTSB on a major U.S. accident.

This section of the paper will illustrate how the Cabin Safety Investigation Guidelines can be used as an invaluable tool while investigating incidents/accidents. I will also share a personal experience as a Go-Team member for the Association of Professional Flight Attendants (APFA) during the National Transportation Safety Board's (NTSB) investigation of American Airline's Flight 1420, a McDonald Douglas MD-82 that crashed at the end of the runway in Little Rock, Arkansas on June 01, 1999.

As previously mentioned, on October 01, 1997 at the ISASI meeting in Anchorage Alaska, members of the Cabin Safety Working Group set out to develop a Cabin Safety Investigation Guidelines. A sub-group, coordinated by Laurel Rogin, International Brotherhood of Teamsters, Northwest Airlines, began the task of collecting incident and accident guidelines from the NTSB, ICAO, and Transport Canada Safety Services (TCSS). Several months of extensive telephone calls and a meeting in Chicago resulted in a draft format for the guidelines.

The draft guidelines were sent to various accident investigators for comment. Responses were collected and compiled and universal language was inserted.

On behalf of the ISASI Cabin Safety Working Group, it is a great pleasure to present the ISASI Cabin Safety Investigation Guidelines to the 18th Annual Aircraft and Cabin Safety Symposium.

The Guidelines have the following sections:

1). General Information- Typically documented in every incident/accident

2). Damage to the Cabin Interior-

Cabin Attendant and passenger seats,
seatbelts and shoulder harnesses,
stowage compartments,
carry-on luggage,
communication equipment
exits,
evacuation slides and/or slide/rafts,
emergency equipment,
equipment for accidents involving water contact

3). Interviews-Cabin Crew and Passengers

I would like to discuss several incident and accident investigations that illustrate problems in the cabin. If the cabin had not been documented, useful information may have been overlooked and safety improvements may not have been suggested.

On December 20, 1995, Tower Air Flight 41, a Boeing B-747, veered off the left side of runway 4L during an attempted takeoff at John F. Kennedy International Airport (JFK), New York. Of the 468 occupants on board (451 passengers, 12 flight attendants, 3 flight crew and 2 cockpit jump seat occupants), 24 passengers sustained minor injuries, and 1 flight attendant was seriously injured. The aircraft sustained substantial damage. During the accident, an ice cart and beverage cart came loose from the aft galley and struck the R4 flight attendant seated on the aft-facing jump seat at door R4. The flight attendant sustained a broken right shoulder. The NTSB recommended that the FAA develop '..certification standards for the installation of secondary galley latches; then use those standards to conduct an engineering review of secondary galley latches on all transport-category aircraft. ' *(Source: NTSB Aircraft Accident Report PB96-910404 NTSB/AAR-96/04)*

On July 9, 1998, American Airlines flight 574, an Airbus 300B4-605R, experienced an engine fire as the flight climbed through 3,100 feet shortly after take-off from San Juan, Puerto Rico. The aircraft turned around and made an emergency landing at San Juan. All 243 passengers, 7 flight attendants and 2 flight crewmembers successfully evacuated the airplane. Twenty-eight passengers received minor injuries during the evacuation. The aircraft received minor fire damage in the area of the No. 1 engine and No.1 pylon. The left wing and flap in the area of the No. 1 engine were also damaged. The airframe experienced heat damage that included wrinkling and blistering of the pylon and flap actuating fairing surfaces.

During the emergency evacuation, four of the eight exits were not used because of their proximity to the engine fire or the placement of the airport rescue and fire fighting vehicles on the left side of the airplane. Flight attendants attempted to open the four right-side exits, however two of those exits (1R and 3R) did not operate as intended. Exits 2R and 4R opened normally, but the 4R slide/raft was blown on its side by the wind and could not be used until a person on the ground stabilized it.

The NTSB was concerned that of the four emergency exits that the flight attendants attempted to use during the evacuation, two (1R and 3R) did not function as intended and another door (1L) did not function as intended when partially opened to assess conditions. *(Source: NTSB Safety Recommendation Letter A-99-99 through 103/ incident MIA98IA195)*

On August 7, 1997, a Delta Air Lines Lockheed L-1011 executed a rejected takeoff in Honolulu, Hawaii. After the airplane came to a stop, a wheel/brake fire occurred in the left main landing gear, and an evacuation was initiated. All 296 passengers and 13 crewmembers were evacuated.

During the evacuation, one passenger sustained a serious injury, 56 passengers and 2 flight attendants sustained minor injuries. Two (2R and 4R) of the airplane's eight floor-level exits, did not function properly and could not be used. Further, two of the remaining exits (3L and 4L) were not used because of the location of the fire on the left side of the airplane. *(Source: NTSB Safety Recommendation Letter A-99-99 through A-99-103)*

Based on these and several other incidents, the NTSB issued safety recommendations A-99-99 through A-99-103 to the FAA concerning the reliability of Emergency Evacuation Systems. The recommendations include:

1. Discontinue the practice of allowing inadvertent and actual slide or slide/raft deployments to be used as a method of demonstrating compliance with an air carrier's FAA approved maintenance program

2. For a 12-month period, require all operators of transport-category aircraft to demonstrate the on-airplane operation of all emergency evacuation systems on 10% of each type of airplane

3. Revise the requirements for evacuation system operational demonstrations and maintenance procedures in air carrier maintenance programs to improve the reliability of evacuation systems on the basis of an analysis of the demonstrations recommended in Safety Recommendations A-99-100.

4. Establish an effective method of identifying recurring or potentially recurring failure modes and ensuring that those failures are adequately addressed by issuing airworthiness directives or taking other appropriate actions.

5. Ensure that all personnel accomplishing any installations, repairs, or inspections of emergency evacuation systems receive training to ensure that they have proper knowledge of the operation and installation of the systems. *(Source NTSB Safety Recommendations A-99-99 through A-99-103)*

After spending many hours on the development of the ISASI Cabin Safety Investigation Guidelines, the opportunity arose for me to implement these guidelines in an actual accident investigation and verify their effectiveness in the cabin safety area.

On June 1, 1999, at 0110 EDT, a phone call from APFA's National Safety Coordinator, Kathy-Lord Jones, broke the silence of the evening with news of an American Airlines accident. American Airline's Flight 1420, a McDonnell-Douglas MD-82 had slid off the runway in Little Rock, Arkansas. There were thunderstorms and heavy rain in the area. The airplane departed the end of the runway, went down an embankment, and impacted approach light structures. Of the 139 passengers, 4 flight attendants and 2 flight crewmembers on board, ten passengers and the captain were killed in the accident. There were 45 serious injuries, including 3 flight attendants and the first officer, and 65 minor injuries.

In the early hours of that morning preparations were made to leave for an unknown period of time. Packed in my suitcase were the necessary amount of clothes and the final draft copy of the ISASI Cabin Safety Investigation Guidelines.

June 1st seemed endless. While our National Safety Coordinator was establishing our command center in Little Rock, the remainder of our Go-Team met at our Texas Headquarters, gathered our equipment and flew to Little Rock that afternoon. We arrived at the site and viewed the damaged aircraft. The aircraft rested in a muddy area, not far from the river. The plane had broken into several sections. There was evidence of fire, broken seats, and a passenger seat lay outside the aircraft.

The APFA Go-Team set out to accomplish our job, to assist the NTSB Survival Factors Group in investigating this accident. Our team split, some stayed at the site and assisted with the cabin documentation and some went to a hotel and various hospitals to conduct the necessary flight attendant and passenger interviews.

It was a hot and humid summer day, with temperatures in the mid 90's. Cabin documentation would prove to be a challenge.

The interviews were difficult and at times quite emotional. The NTSB Survival Factors Group interviewed 56 passengers and 4 flight attendants. Questionnaires were sent to all surviving passengers and approximately 109 passenger questionnaires were returned.

When interviewing the aircraft occupants, the NTSB suggests that they be allowed to tell their story. However, these stories may not include all the detailed information needed for the investigation. At that time I realized how fortunate I was to have a copy of the guidelines with me. These guidelines helped me to understand what information is vital when conducting cabin safety investigations. For example, one of the focal points of this accident was to document occupant seats, seat attachment points and restraints. The passenger interviews provided information on the status of their seat belts and documentation gave insight on the condition of that seat and it's attachment points.

For example, according to the NTSB Survival Factors Group Chairman's report, the passenger seated in 3B stated that during the impact, things were crashing and striking him. He thought he landed on his hands and knees outside the airplane with the seat strapped on his back. He looked over his left shoulder and he could see the airplane and it looked like it was still moving. His seat was still attached to his back. He began to crawl away from the airplane. Within 30 seconds he saw people walking by. He released his seat belt, and got out of the seat. This passenger's seat was found on the left side of the fuselage approximately 90 feet from its original location in the cabin. The seat cushion had separated from the seat and was found 35 feet from seat 3B, and 55 feet from its original location in the cabin. The lap belts were intact and attached to the seat frame. The forward and aft seat frame tubes were separated at the center of the seat pin. Both seat legs were displaced aft and inboard, and the aft track fittings were intact. The aft track fitting lock ring was separated.

Another focal point of the investigation was documentation of the emergency exits and occupant evacuation. Passenger and flight attendant interviews provided information about the condition of the exits after impact and which exits or breaks in the fuselage that they used.

Three (1L, 1R and 2L) of the four door exits could not be opened and the aft tail cone exit was difficult to open. Four over wing exits were operated by passengers.

The 1L door was displaced downward and the forward portion was twisted inboard and aft. The 1L door handle was found in the 10 O'clock position and could not be moved. The 1R door hinge covers were displaced aft exposing the door hinges. The 1R door handle was found in the 2 O'clock position and investigators were unable to move it. Four Type III exits located over the wing were opened by passengers from inside the cabin. The 2L door, located in the aft galley, was damaged by impact with a vertical support column from the approach lighting system and could not be opened. The aft cabin bulkhead door (that provides access to the tail cone exit) was damaged by fire at its left upper corner and the left and right vertical doorframe members were bowed inboard. The tail cone was intact and resting on the ground. There was a gap between the airplane and the tail cone that measured 18 inches at the widest point.

Many passengers exited through the window exits. The passengers in the first class area exited through a rip in the left side of the fuselage extending from the forward coat closet to the bulkhead separating main cabin and coach. Many passengers were able exit the aircraft through the fuselage break, just forward of the wings. A rip in the fuselage located between rows 7 and 8, left hand side, and a rip between rows 11 and 12, right hand side, provided additional egress for a few coach passengers.

Although the conclusions, probable cause, and recommendations. for this accident have not been issued by the NTSB, I am confident that the thorough documentation of the cabin safety issues has been useful to the NTSB and other organizations. Many of you may never work with an official investigative group, such as the NTSB. Keep in mind however, significant safety improvements are often made outside of official investigations. Crewmember associations, airlines, and manufacturers all have the opportunity to look at incidents and work to improve cabin safety without participating in official investigations. Anyone or any organization that would like to improve cabin safety needs to be able to acquire information that can be used to suggest improvements. When making suggestions to crewmember associations, airlines, a manufacturer, a regulatory or investigative organization, the suggestions must be based on a solid foundation of factual evidence. These guidelines can help you build that foundation.

The information collected through the use of these guidelines and in conjunction with information gathered by other groups can help in determining the cause of injuries and aid in developing recommendations or strategies to minimize injury in future incidents or accidents. Information collected during cabin safety investigations can be used in the areas of education, research, safety promotion, and accident and injury prevention. Comprehensive reports and the global exchange of cabin safety information can only enhance flight safety worldwide *(Source: ISASI Cabin Safety Investigation Guidelines)*

BIOS:

Laurel E. Rogin is employed with Northwest Airlines, Inc. as a flight attendant, and is a member of the International Brotherhood of Teamster's (I.B.T.) critical incident stress management team. She began her flying career in 1978, and currently flies international trips to Asia. Ms. Rogin has been involved at various levels with her union's safety and health committee for the past twenty-two years. She was instrumental in developing an emergency response team for I.B.T., and writing an accident investigation manual.

Debbie M. Roland has been a Flight Attendant for American Airlines since 1976 and is a member of the Association of Professional Flight Attendants (APFA) National Safety Committee. Ms. Roland is a participant in the FAA's CAST JSAT & JSIT Turbulence and various ARAC working groups. She is currently a member of the APFA Go-Team and has been involved in the investigation of several incidents and accidents.

CABIN SAFETY INVESTIGATION GUIDELINES

The attached Cabin Safety guideline was developed by the ISASI Cabin Safety Working Group. The purpose of the working group is to promote a high standard of safety through incident and accident investigation.

The guideline can provide Air Safety Investigators and other operational personnel with tools to investigate the survival aspects of incidents and accidents. Guidance is provided for documenting damage to the cabin interior and its equipment, and flight attendant and passenger interviews. The guideline is adaptable to any type of occurrence whether it is a turbulence incident, an evacuation with fire and smoke, or an event that involves water contact. The guideline is easily adaptable to those operations without cabin attendants.

The information collected can be used in conjunction with information gathered by other groups (medical, human factors, operations, ARFF) to determine cause of injuries and to develop recommendations or strategies to minimize injury in future accidents or incidents. Information collected during cabin safety investigations can be used in the areas of education, research, safety promotion and accident and injury prevention. Comprehensive reports and the global exchange of cabin safety information can only enhance flight safety worldwide.

DOCUMENT AND REPORT THE FOLLOWING INFORMATION:

GENERAL INFORMATION

- Name of operator and aircraft type/model.
- Location, date, and time, of occurrence.
- Weather conditions.
- List of cabin crewmembers.
- Passenger manifest with names and seat assignments of occupants (including lap-held infants).
- Cabin crewmember manual (used to determine emergency procedures, cabin layout, and emergency equipment location.)
- Cabin crewmembers training records (initial, transition, and recurrent).
- Safety briefing card.
- Engineering drawing of interior that depicts seat layout, seat pitch, galleys, lavatories and emergency exit(s).

DAMAGE TO CABIN INTERIOR

Document overall condition of cabin (e.g. intact, broken apart, fire damaged) and location of debris such as galley equipment, seats, luggage, and areas with indication of fire or smoke damage. Use photographs to supplement written report.

CABIN ATTENDANT AND PASSENGER SEATS

- Manufacturer, model No., serial No., date of manufacture and, rated loads.
- Evidence of impact
- Description of the integrity of tie-downs and rails
- Measurements and description of the deformation/separation of seats and tie-downs.
- Note location of child restraint systems (CRS), seat loaded cargo, stretchers, and bassinets

SEAT BELTS AND SHOULDER HARNESSES

- Note seat belt manufacturer, model No., serial No., date of manufacture and, rated loads.
- Note condition of seatbelts and seat belt extensions (e.g. damaged, detached, intact, cut)

STOWAGE COMPARTMENTS

- Describe damage to storage areas, such as overhead bins, closets, and compartments.
- Note condition of latching mechanisms for storage areas.

CARRY-ON LUGGAGE

- Note location of carry-on luggage found in cabin (e.g. overhead bins, underseat storage, closets, piled near exits)

COMMUNICATION

- Conduct functional check of the PA system
- Conduct functional check of the interphone system
- Describe the positions of switches for emergency evacuation alarm systems (cockpit and cabin)
- Describe the positions of switches for the emergency lighting systems (cockpit and cabin)
- Describe the content of the pre-departure safety briefing and how the information is conveyed to passengers (PA system, recording, or video demonstration)
  - In what language(s) was the briefing conducted?
- Describe the airline's procedures for exit row briefing.

EXITS

- Describe the location of all exits (cockpit and cabin). Were they open or closed?
- Describe the location of emergency exit hatches.
- Describe the deployment of ropes, tapes or inertia reels.
- Describe the damage to exit and surrounding fuselage.
- Describe the position of arm/disarm lever or girt bar.
- Describe the position of exit opening handle.
- Describe the condition of power-assist device (record pressure, if appropriate).
- Describe the assist space available at exit
- Measure the height of the exit sills above the terrain if the aircraft has an unusual attitude.

EVACUATION SLIDES and/or SLIDE/RAFTS

- Record the position of the device (deployed, stowed, inflated, deflated, removed from aircraft).
- Record the name of manufacturer, date of manufacture, model No., serial No., Technical Standard Order (TSO) No., and date of last overhaul.
- Describe any damage to the slide

EMERGENCY EQUIPMENT

Using a cabin attendant manual as a guide, document the location and condition of emergency equipment in the cabin.

- Flashlights;
- Megaphones;
- Fire extinguishers;
- Protective breathing equipment (PBE);
- Crash axe/pry bar;
- Portable oxygen bottles;
- First aid kits;
- Medical kits;
- Defibrillator;
- Emergency locator transmitters (ELT);

- Protective gloves;
- Smoke barriers;
- Smoke detectors;
- Lavatory waste bin automatic extinguishers; and
- Emergency lights;

ACCIDENTS INVOLVING WATER CONTACT

In addition to information above, document the condition and location of:

- Life rafts or slide/rafts;
- Life vests;
- ELT;
- Water conditions at time of accident (wave height. swell height, and temperature);
- Survival kits.

INTERVIEWS

Each person should be given an opportunity to describe (without interruption) what happened to him or her. Follow-up questions should be asked to determine additional information as required. An aircraft diagram (with seat rows, exits, galleys, and lavatories) is a useful tool to orient a person during an interview.

CABIN CREWMEMBER

General information

- Name, business address, and phone number.
- Gender, age, height, and weight.
- Operational experience on the accident aircraft type in hours or years.
- Work category-cabin crewmember, purser, lead crewmember, etc.
- Number of different aircraft types/models that cabin crewmember is qualified on.
- Medical history and medication taken at the time of the event.
- Current medical condition and medication taken at time of the interview
- Experience as a cabin crewmember (in years) with current carrier/previous carrier.
- Flight and duty schedule 72 hrs prior to the event.
- Food and beverages consumed during the 24-hrs period before the occurrence.
- Sleep/wake cycle for the 7 day period before the occurrence.
- Commute time to airport.
- Were you injured? Describe your injuries. When and how were you injured?

Pre-flight / In-flight activities

- Describe the pre-flight crew briefing. What was covered? Who was present? Who conducted the briefing?
- Describe any cabin system(s) that was unserviceable at the beginning of, or during, the flight?

- Describe observations of, or interaction with, maintenance, ground service personnel, and flight crew that may be pertinent to the investigation.
- Describe the location of passengers with special needs/children travelling alone.
- Describe the location of infant/child restraint system(s).
- Describe the location of passengers with disabilities.
- Describe the passenger safety briefing. Were passengers attentive to the briefing?
- Describe the amount and stowage of carry-on baggage.
- Describe your pre-departure cabin activities.
- Was alcohol served before/during the flight? If yes, approximately how many drinks did you serve?
- When did you prepare your emergency exit(s) for departure?
- Where were you seated for take-off and landing?
- Describe the type of seat restraint system used at your jumpseat.

Occurrence Information

- Describe if and how you were informed of a problem. If briefed by the captain, what information were you given? If briefed by another crewmember, what information were you given?
- Describe your location during occurrence.
- Describe if and how the passengers were informed of a problem? What was their reaction?
- Describe the pre-occurrence preparations (i.e. type of warning, cabin preparation).
- Describe the occurrence.
- Describe the impact.
- Describe the emergency commands you used, if any.
- Describe the passenger reaction to your commands.
- Describe the passengers' brace positions.
- Describe your brace position.
- Describe the security of cabin furnishings in your area.
- Describe any difficulties you may have had with your seat/seatbelt/shoulder harness.
- Describe any safety or emergency equipment you used: Why and how did you use it? Was it effective?
- Describe your view of the cabin. If your view was obstructed, please explain.

Evacuation

- How did you decide to evacuate?
  - Captain's order?
  - Personal judgement?
  - Evacuation alarm?
  - PA announcement?
  - Firefighter's order?
- Describe the evacuation.
- Which exit(s) did you open?
- What was your assigned exit(s)?

- If you did not open an exit, explain why.
- Did you have a direct view of your primary/secondary exits from your jumpseat?
- Did you assess the conditions? How?
- Were there any difficulties assessing outside conditions? Opening the exit? Deploying or inflating the evacuation slide? If yes, please describe.
- Did the emergency lights operate? Which emergency lights did you observe?
- Describe the illumination inside/outside the aircraft.
- Describe passenger reactions during the evacuation (calm, panic, etc.).
- Did the passengers attempt to take carry-on baggage during the evacuation?
- Did you have passenger assistance at your exit? How did passenger assist?
- Describe any problems with the passengers during the evacuation.
- Describe any difficulties with passengers with special needs or children travelling alone.
- Approximately how long did the evacuation take? What is the estimate based on? (Note: time estimates are unreliable if the estimate can not be verified by empirical data)
- Did you see other cabin crewmembers evacuate the aircraft? Which exits did they use?
- Did you take emergency equipment with you? Which equipment? How was it used?
- Describe the flight deck crew activities outside the aircraft.
- Describe the rescue/fire fighting activities.
- Were you injured? Describe your injuries and how they were sustained.
- Were you transported to a hospital or medical facility?
- Approximately how long did the rescue efforts take?
- Describe your clothing and its suitability for the evacuation.

Training

- Describe your initial and annual emergency/safety training.
- Did your training include basic instructions in aerodynamics and aircraft performance?
- When was your last evacuation drill? Describe the drill. How often is the drill conducted?
- When was your last door drill? Describe the drill. How often is the drill conducted?
- Describe your fire fighting training.
- Describe your initial and annual ditching training.
- Do you participate in a wet ditching drill? Describe the drill .
- Describe your practical training with respect to the use of emergency/safety equipment.
- Did you participate in crew resource management training with pilots or other members of your company? Explain.
- Did your training prepare you for what happened?

Additional Comments

- Based on your experience, can you suggest any improvements to procedures or equipment?
- Do you have any further information that you think may assist in the investigation of this occurrence?

IF THE EVENT INVOLVED THE FOLLOWING CONDITIONS, DOCUMENT THE FOLLOWING INFORMATION:

Turbulence

- Describe your company's crew communication procedures for turbulence.
- Describe the crew communication procedure used in this event.
- Were you warned before you experienced the turbulence? How?
- Was the seatbelt sign on? If yes, for how long?
- Were passengers seated when the seat belt sign was on?
- Were you seated at your cabin crewmember assigned seat? If you were not seated, why not?
- Where were you when the turbulence occurred?
- What announcements were made regarding the turbulence? Were passengers instructed to remain seated? When were the announcements made?
- Were there problems with stowing equipment before or after the turbulence event?
- Were you injured? Describe your injuries. Were you able to assist others following the turbulence?
- Describe injuries that you observed in other crewmembers or passengers.

Smoke/Fire/Fumes

- When did you become aware of smoke, fire, or fumes?
- Where did you first observe smoke or fire? Describe what you saw and/or smelled (color, density, and odor).
- Where were you when you first became aware of fumes?
- Did the conditions increase, decrease or change during the occurrence?
- Did you have difficulty breathing? Did you use PBE or other protection?
- Did you have problems communicating with other crewmembers or passengers? If yes, describe the problems.
- Did you use fire-fighting equipment? Describe.

Ditching/inadvertent water landing

- Were there any problems deploying, inflating or boarding the slide/rafts or life rafts?
- Did you move a slide/raft or life raft from one location to another? Describe any difficulties.
- What type of personal flotation device did you use? From where did you obtain it?
- Did you have any problems obtaining it or using it?
- What personal flotation devices did passengers use?
- Did passengers have any problems obtaining or donning their life preservers? (adults/infants/children)
- Who commanded the lift raft or slide/raft that you boarded? Were there other crewmembers in that raft?
- Describe the rescue operation.
- Describe sea survival procedures that were used.
- Did you retrieve an ELT? If yes, from where? Was the ELT used?

PASSENGER INTERVIEW

Personal data

- Name, gender, age, height, and weight.
- Address.
- Phone number.
- Occupation.
- Seat number and location.
- Aviation experience.
- Any disability that could impair egress from the aircraft.
- Languages spoken.
- Were you injured? Describe your injuries. When and how were you injured?

Pre-flight preparations

- Describe the weight, size and stowage of your carry-on baggage.
- Describe the clothing and footwear that you were wearing when the accident occurred.
- Was there a pre-departure safety briefing? How was it provided (i.e. pilot, cabin crewmember, video or other means)? Did you understand the safety briefing?
- Did you read the safety card?
  - Did you understand the information on the safety card?
- Did you note the locations of more than one exit near your seat?
- Were you seated adjacent to an emergency exit?
  - Were you briefed prior to departure on the operation of the exit? If yes, by whom?
- Describe the observations of maintenance, ground service personnel (de-icing), or flight crew that might be pertinent to the investigation.

Occurrence information

- How and when did you first become aware of a problem? Where were you when you first became aware of a problem?
- How did the crew prepare you for the emergency? Were you given instructions over the PA system? By an individual crewmember? Shouted instructions?
- Did you hear any shouted commands? If yes, what did you hear? Did the information help you?
- Did you brace for impact? Describe your brace position.
- Were you traveling with infants/children? How were they restrained? Were there any problems?
- How tightly was your seatbelt fastened? Did you have any problems releasing your seatbelt? If yes, describe them.
- Did you remove your shoes? Why? If you did not remove them, did they stay on during the impact and evacuation?
- Describe the impact sequence. What happened to you during the impact sequence?
- Did anything happen to your seat during impact?
- Did you remain seated until the aircraft stopped?

Evacuation

- Which exit did you use? Why?
- Did you encounter problems reaching your exit? If yes, describe.
- Did you attempt to take anything with you when you left the aircraft? If yes, what did you take?
- Did you assist anyone during the evacuation?
- Did anyone assist you?
- Did you open an exit? If so, which one? Did you experience difficulty operating or using the exit?
- Did you notice any lights on in the cabin? Where?
- Approximately how long did it take you to evacuate the aircraft? What is your estimate based on?
- What did you see when you got out of the aircraft?
- Did help arrive quickly? Describe the rescue efforts.
- Did a rescuer assist you? How?
- Did you sustain an injury? If yes, please describe your injury and, if known, its cause.

IF THE EVENT INVOLVED THE FOLLOWING CONDITIONS, DOCUMENT THE FOLLOWING INFORMATION:

Turbulence

- Where were you when the turbulence occurred?
- Was your seatbelt fastened? If not, why not?
- Was the seatbelt sign on?
- Did you hear any announcement regarding seatbelts? If yes, describe what you heard.
- Who do you think made the announcement(s)? Flight deck crew and/or cabin crewmember(s)?
- Were you injured? Describe your injuries. Were you given first aid by a cabin crewmember or passenger?
- If you were traveling with an infant/child, what happened to the infant/child? How were they restrained?

Smoke/fire/fumes

- When did you become aware of smoke, fire, or fumes?
- Where did you first observe smoke or fire? Describe what you saw and smelled. (color, density, odor)
- Where were you when you first became aware of fumes?
- Did the conditions increase, decrease or change during the occurrence?
- Did you have difficulty breathing? If yes, what action did you take to protect yourself?
- Did you observe fire-fighting procedures? Describe.

Ditching/inadvertent water contact

- What types of flotation devices were available?
- Did you obtain a life preserver?

    - Where was it stored?
    - Did you have a problem retrieving it?
    - Did you put it on?
    - When did you inflate it?
    - Did it work properly?
    - If you were travelling with an infant or child, was a life preserver provided for the child?
- Did you use the seat bottom cushion as a flotation device? Describe how the cushion was used and its effectiveness.
- Did you board a life raft or slide/raft?
- Were there any difficulties?
- Describe the type of raft you boarded.
- What equipment in the life raft (slide/raft) was used?
- How many people were in the life raft?
- Describe the water conditions.
- Describe any sea survival procedures that were used.
- Describe the weather conditions.
- Describe the rescue effort.

Additional comments

- Based on your experience, can you suggest any improvements to procedures or equipment?
- Do you have any further information that you think may assist in the investigation of this occurrence?

ATTACHMENTS

- Reports of follow-up component tests
- Photographs
- Written statements

The Lessons Learned from a Line Incident - what went right and why?

Swissair SR 283 – August 11th 2000

Captain Timothy Crowch

Background

On July 25th 2000, a Concorde with the callsign AF4590 departed Charles de Gaulle airport in Paris on a charter flight to New York. Shortly after V1, a mass of flame was seen emanating from the aircraft and trailing far behind. The crew was informed by ATC but they were committed to continue the take-off. The Concorde crashed 1 1/2 minutes later at Gonesse. All 109 persons on board were tragically killed. At the time of writing the causes of this accident appear to be a piece of metal on the runway that had fallen off another aircraft puncturing a main gear tyre, this being ingested into the No.2 engine which failed as a result. This was then further compounded by a partial failure of engine No.1 and an inability to retract the gear. The investigation is still open.

The Technical Story

The return flight to Zurich for the crew had already been delayed by 24 hours as a result of a catering truck having damaged the planned aircraft for the day before. With a weekend ahead with the usual summer plans everyone was keen on finally heading home. Among those plans, the Captain should have already been on holiday, two of the crew were due at a wedding, fortunately not their own, and others had commitments with friends and family, typical of that time of year.

SR283 was the daily MD11 night return flight to Zurich departing Johannesburg at 2200. The flight was planned with the customary full load of passengers and the flight crew, as usual were wrestling with exact take-off calculations in the hope of squeezing in every last kilo of payload the maximum take-off weight would allow.

The flight pushed-back on schedule for the 10 hour flight and at this time of night there was little traffic departing enabling a short taxi time to JNB's longest 4400 metre runway, 21R.

For the take-off, the Captain and one of the First Officers occupied their normal stations on the flight deck whereas the second F/O was seated in one of the crew seats in the front row of the Business Class on the right side.

The take-off roll always seems to last for an eternity in Johannesburg as a result of the maximum take-off weight and the 1,800 metre (5,500 feet) elevation. The calculated rotation speed was 172 knots and just as that speed was reached, a slight pull to the left was noticed by the Captain who was at the controls. Just as the rotation started there were two loud explosions emanating from the number 1 (left) engine accompanied by bright flashes of flame that illuminated the left side of the runway and the and the area between it and the parallel runway. The rotation continued and as the aircraft started to climb away somewhat lethargically because of the weight and altitude, the gear was retracted and the climb continued to the standard clean-up altitude at which the aircraft could be accelerated and the flaps and slats retracted. This was a mere 1,500 feet above the Johannesburg suburb of Sandton, an area recognisable to the crew as this is where their hotel is located.

Having informed the air traffic control of our predicament, clearance was obtained to proceed to a designated area to dump what would be 70 tonnes of fuel and climb to 16,000 feet to help guard against the risk of a second engine failure.

The first question to answer was, "What do we do with the damaged engine?" It had been throttled back to idle where now all instrument indications were normal other than the N1 overspeed which remained highlighted in amber. After what I had heard and seen, I called for the Emergency Checklist for Severe Damage and subsequent shut-down of the engine but my two colleagues had a different opinion. Why not leave it running as it was powering all its respective systems and, who knows, we have seen that it is still capable of producing power and should another engine start misbehaving then at this weight we may just need it. This was a very valuable input on their part so the engine remained in idle, nevertheless I shall return to this matter later.

The official fuel dumping area is located some 60nm. to the northeast of the airport. A large three minute holding pattern was created in the Flight Management System (FMS) and the dumping procedure was commenced. The reason for the large pattern was to eliminate the risk of flying through our dumped fuel.

About half way through, ATC asked us to confirm whether or not we had sustained gear damage as they had found a considerable amount of rubber and metal on the runway. A quick look at the landing gear system page on the respective screen indicated no overheated brakes and all tyres showing normal pressure. There was, however, the possibility that we had shed rubber from a tyre or tyres while the main structure had remained intact explaining the equal pressures. However, this raised several questions – how many tyres were involved and where had all the metal come from, gear doors, slats, flaps or some other part of the structure? The approach would probably shed some light on the extent of the damage though what would be the likely aerodynamic consequences on the aircraft's performance, if any?

This new information led to a logical re-evaluation of our predicament. No longer did I wish to land at our maximum landing weight but nor did I wish to dump to the minimum required fuel because if we did encounter control difficulties during the approach, then a go-around might be necessary and any subsequent waiting time to enable further analysis and preparation would require a substantial amount of fuel. A compromise was reached, 12 tonnes during approach giving a landing weight of about 188 tonnes (max. 199.6 tonnes).

Some 10 minutes before we had completed the fuel dumping procedure, we informed ATC of our readiness to return and radar vectors and a descent clearance were received. Slats and flaps were extended early and functioned normally. 12 nm. before touchdown, the gear was extended and nothing untoward was found there, either.

Finally, after 1.03 hours, we landed back in JNB on runway 21L, the only one with a functioning ILS that night, the fire service was standing by at strategic points along the runway but, apart from debris collection, were thankfully not needed. Even with the wind blowing lightly from the left, a soft landing, right gear first was performed with the entire 3400 metre runway being used to stop.

The taxi to the apron was long, lasting some 15 minutes and it was soon very obvious that something was indeed wrong with the gear. Once on the parking stand, it was not long before our ground engineers were on the flight deck providing detailed answers to all outstanding questions with an excitement that only engineers can exude!

It soon became very clear that we had more or less repeated the events in Paris some 17 days before. Suspected FOD, the metal parts, had caused one of our tyres to delaminate and the Number 1 engine had sucked in all the debris causing severe damage to the engine fan and part of the structure behind in the by-pass duct. Pieces of rubber had already been found in the engine and the intake area was blackened by the tyre parts. The underside of the wing and flaps had sustained severe impacts but due to their robust structure had withstood the blows. It was not until daylight the next morning that other traces of rubber damage became evident and the realisation of how close an aircraft in the DC10/MD11 configuration can come to a double power loss.

So much for the technical background to this case. I should now like to use the rest of my time to study the human aspects to such an incident concentrating on the differences in perception depending on where people were seated in the aircraft and their respective roles.

<u>The Crew</u>

At the first realisation that something was wrong, exactly at the moment that the aircraft was being rotated, the reality hit me as the pilot flying and the aircraft's Commander that there was no escape – you are faced with a situation <u>now</u> and you have to start responding <u>now</u>, there is no time to wait or go off somewhere and discuss your options with a friend. This is Friday evening, this cannot wait for the "Monday morning quarterback".

This is what generated most personal fear, this and the fact that my body was instantly showing symptoms that I never expected with all my training and experience and, what is more, was powerless to control. I was going to have to live and function "normally" with a racing pulse, icy cold hands and beads or perspiration everywhere.

It seemed an age before I reacted, though it was not. Outside the flight deck windows I had seen the night briefly disappear in yellow light, my ears had registered the explosions and now I had to find the exact words – and this was the first time in my 30 years flying that I gave thanks to the designers of simulators and the talented instructors who operate them. Procedures – endlessly drilled standard operating procedures came to my rescue. I called out my first commands and the solution to the problem was already underway.

Within seconds was not only the second F/O on the flight deck but, more importantly, so was my Cabin Chief, standing behind my seat watching what was happening and awaiting my facility to communicate with her. Now I also realised that I was not necessarily the only person on this aircraft displaying the same physiological symptoms. It was not until we had the aircraft safely under control and headed where we wanted that my horizon opened up to include factors beyond my immediate working environment.

I explained to my Cabin Crew Chief, what had happened. Her station was right adjacent to the engine meaning that she had heard the same as I had and her station area had also lit up with the flame flashes. It was only after we returned to the hotel that I realised that neither First Officer had seen these flashes as both had been sitting on the other side of the aircraft! <u>"Different positions mean different perceptions"</u>. As we were under no time pressure, my first priority was to inform the passengers but as I had no capacity for this I had to delegate this initial task to the Cabin Chief. So what do we tell them? Enough to calm fears and reduce the anxiety but not too much that you only exacerbate the situation. The vital point, though, is prompt, competent and informative communication. The contents were kept simple:

- tell them that we have had a problem with the Number 1 engine,
- tell them what our intentions are,
- attempt to establish a time frame,
- finally, say that I shall address them as soon as time and workload permit.

Show the passengers respect by offering some specific technical information, answer that next burning question, ".... what's going to happen?" and the next "......when are we going to land?". With this factual but nevertheless sparing information you have gone a long way to:

- calming not only the passengers but also the cabin crew team who are naturally scattered throughout the aircraft
- showing the passengers that you know what has happened and are doing something about it
- that certain critical operational decisions have been made, conveying the image that the situation is under control
- that the fears and apprehension sensed by the passengers are being taken seriously by the crew

- the passengers are being cared for
- and just as important you, in the cabin, through these actions are making your job considerably easier.

After making her public address and assessing the general response of the passengers, she returned to the flight deck to inform me and also to tell me exactly what she had said. This is critical as the information that I was to include in my PA had to tally with hers word for word otherwise you open up areas of serious doubt and distrust among your audience. Never forget, all these people are now watching your every move and hanging on your every word. Under these tense conditions one small slip can create a disproportionate amount of difficulty – difficulty that is almost impossible to undo. You cannot blame the passengers for they are innocent by-standers, you, after all, are the trained professionals.

As soon as time allowed I addressed the passengers as promised; remember, keep that promise or, as cabin crew, see that it is kept. However, in the meantime, the incident scenario for us had changed somewhat. It was in the middle of the fuel dumping process that Air Traffic Control had informed us about the quantities of rubber and metal that had been found on the runway and requested confirmation that we had also suffered gear damage. Still with the frighteningly dramatic pictures of the Paris accident in my mind, I decided not to mention the suspected gear trouble to our guests. What purpose would it have served? They already knew we had trouble and were returning to Johannesburg and having stated that the damaged engine was still running, albeit only in idle, to try and play down the situation, there was little sense in raising another alarm as the similarities to Paris were causing me enough concern of my own.

However, the situation for us did take on a different complexion. We decided to dump more fuel to protect the gear, we requested the fire services to station themselves at each third of the runway as if one or more tyres were to burst on landing directional control problems could be anticipated. This was the worst-case consideration; personally I expected nothing more than heavy vibration and this is what my cabin crew had been briefed to expect. I wanted them to be mentally prepared without unsettling the passengers.

As most of you probably know, the only way for a heavy jet to reduce its weight quickly is to dump fuel if the aircraft is so-equipped. For those who have never witnessed this procedure, it is quite dramatic. As a crew member it is well worth a look as fuel is pumped out of the trailing edge of both wings at rates ranging from 2-3 tonnes per minute. However, passengers will most likely view this from a very different perspective and if the procedure and its purpose are not explained adequately, it can become an unexpected cause for alarm. Do not forget, even at night this can be seen by passengers, particularly in the rear half of the aircraft in the glow of the wing lighting. They must be prevented from interpreting this as a part of the damage to the aircraft and it is our combined duty to ensure that this normal procedure does not create unnecessary concern.

For the rest of the flight it is important to bear in mind that any other operation that may deviate from the way things are normally done on normal flights should be explained, time permitting, as passenger senses will be working on a sensitivity setting of "extra high" until long after they have left the aircraft.

Throughout the flight all communication between the Cabin Chief and the flight crew took place face to face. I had never given this aspect of crew management much thought until afterwards but this is by far the better method rather than using the interphone. Workload levels vary in the flight deck and call chimes can prove an unwelcome interruption to procedures and thought processes. Each time she appeared in person I was aware that she either had information for me or expected to hear something from me and as soon as the time was appropriate, we managed to talk. Remember, communication is more that just spoken words, her presence helped assure me that all was well in the cabin, she could also transfer a similar impression of our work to her colleagues.

The Passengers

As with the crew, depending upon where the passengers were seated, each had a different perspective of what had happened. For example, those on the right of the aircraft had not seen the flames, those toward the rear of the cabin had surprisingly not heard the explosions (neither had some of the crew), those in the rear right of the cabin had probably sensed little or indeed nothing at all. This demonstrates how important it is to inform everyone promptly and accurately so that the critical initial information emanates from the professional crew and not from a panic-stricken individual. Hence the requirement that this information be broadcast as soon as possible. The same applied later to the fuel-dumping process; those forward of the wings would notice nothing, while those seated behind would have a very different picture.

Early information has a remarkably calming effect, even if in a situation such as this the first words do not come from the flight crew. My message is that the first words must come from the crew.

As already mentioned, in an instant the passengers' expectations from the cabin crew have risen a hundred fold. The cabin crew are on display now and will be closely scrutinised. Passengers are desperate to believe in someone and at this moment it is the crew – you cannot afford to let them down.

Among them there will be elderly people, unwell people, unaccompanied children, passengers who embarked in a happy frame of mind, those who are tragically sad and depressed. There will be businessmen under enormous stress of work and those who do not understand any of the many languages a crew like ours can speak. In other words, several may require individual attention. This individual attention may be directed at one person but it is worth noting that the manner of this help will spread to the neighbouring passengers and have a beneficial effect on them too. It is an extremely difficult stage on which to perform – and it is the "Opening Night". Somehow you have to suppress your own feelings and fears and this is not all that difficult as long as duty calls, however be prepared to suffer the consequences of this professional self-control in the hours following the conclusion of the event. I shall return to this point at the end.

Passengers will not consider your age, gender or experience. They expect you all to perform as one, to one standard and to one doctrine, namely their interest.

Our passengers generally remained very calm throughout the one-hour flight but tension was still noticeable after the landing. For example, we had to wait for a few minutes before crossing the parallel runway to the apron for no other reason than another aircraft was departing, but an explanation here was offered and considered necessary.

This is the kind of flight whereupon arriving at the gate the passengers cannot expect to get out of their seats immediately and disembark. You have now become a non-scheduled flight with all that that entails with station personnel, airport authorities, accommodation and ground transport. Our passengers ended up having to remain on board for up to 50 minutes – not that long you might think especially when considering that the cabin crew continued our typical Swiss hospitality by opening up the galleys and offering our guests some of what they were not able to enjoy while flying around Johannesburg.

As Captain, I was suddenly required everywhere and this brought me into direct contact with some of our guests for the first time. The difference in reactions amazed me. A few smiled shyly and offered a polite "well done", some just stared and, with several, the pent up emotions and fears started to bubble over. This being kept on board was suddenly judged by some a disgrace, as the station personnel could offer little immediate information, the target of the frustration became the cabin crew, those same young people who only moments earlier they had been looking up to as they were accompanied through this fearful event. While getting out of the aircraft to consult our maintenance team and the fire department I was grabbed and shouted at by two people whose greatest concern was that they were missing their connection out of Zurich for the States the next morning.

My first reaction to this outburst was disbelief but later I took it as a compliment to my cabin crew. They had obviously handled their tasks so supremely that these troubled passengers probably never realised – and never will realise – what they had been through! The message here is that the job is not over until the very last passenger has been accommodated somewhere. Your skills are called upon as much after the event as during as these days, with third-party ground handling at many stations, you are those most identifiable with the airline that has "caused" all this inconvenience.

The Lessons Learned

- I am convinced that the seeds of success in this incident were sewn in Swissair's policy of combined Safety/Emergency training and CRM training with Flight Crews and Senior Cabin Crew Members. From the very first moment that trouble struck, we both had a well-informed impression of what the other team was doing and what it required. Now was not the time to start this learning process, now was the time to put these drilled lessons and procedures into practice.

- Swissair operates with a relatively flat hierarchical structure. The channels of contact and communication between Flight and Cabin crews are generally very open. The practices are well-harmonised between the two groups and the requirements of each group are generally well-known to the other if not from training then from crew briefings or other professional and social contacts.

- A Company philosophy of standardising abnormal and emergency procedures across the entire fleet, irrespective of aircraft type, does assist in firmly establishing standard drills that can be called on almost instinctively.

- Attempts should be made to avoid altering these basis procedures and drills as there is always the risk of reversion to former procedures when under extreme pressure.

- Communicate whenever possible face-to-face and always with the same person. Fortunately we were under little time pressure so this was possible. Time-critical situations may not always allow this but an unanswered interphone call to the flight deck for lack of hands or ears is also a waste of precious time.

- Communication under pressure and levels of fear is not the same act as in normal life. Take time to say what you mean to say and ensure that the communication partner has no doubts about your intentions. Insist on reporting back upon completion of tasks thereby closing the loop.

- Under pressure, it is known that no two people share the same perception of time. Cabin crews should not be afraid to tell the flight crew of their requirements and to request regular time-to-go checks so that work at both ends of the aircraft is running along the same time scale. Only so will all members of the team be equally prepared for the landing whenever and however it comes.

- The only lapse in communication was my failure to describe clearly to both my First Officers <u>all</u> the symptoms of the engine damage that I had perceived. It seems that only once back in the hotel following our de-briefing, when asked why I was so determined to shut down the engine, that I ever mentioned seeing flashes of flame!

- Following such an event, probably the best form of psychological support to the crew is other members of the crew. Many of the deep personal reactions to the incident did not manifest themselves until what was left of the nights and days following the event. It is vitally important that the whole crew remains together or at least in contact because the reluctance to discuss feelings with others in the team is much lower than initially with anyone else.

- With this in mind, the event has to be brought to a conclusion with the help of an open and thorough defusing and debriefing session with <u>everyone</u> present. Ideally this should be led by the Captain but maybe someone else in the crew may be better qualified. Whoever leads it, please do not forget that that person will be in need of some help and caring too.

- Airlines must be prepared to offer additional defusing after the crew has returned home as many post traumatic stress symptoms may be delayed in presenting themselves. Swissair does so and intends to prevent any crew involved in such an incident from operating home – they will be returned as passengers and post-incident assistance will continue to be offered as long as the individual feels he/she requires it. Professional counsellors are always available for consultation within the Company and, more specifically, within the Safety Department itself.

[1]Conclusion

In my view, this incident can in no way be classified as serious. The crew was never under any time pressure and the control of the aircraft was never in doubt. However, equally, that is just the reason that I consider it an ideal example for study as it falls into the category of everyday line operation. It could happen to any aircraft, with any crew at any time during any take-off.

It is only by studying such incidents in depth that we are able to monitor our operational philosophies and procedures with the aim of confirming their viability of perceiving a need to change.

This case highlighted the strengths and weaknesses of a very young and relatively inexperienced crew. This lack of age and experience therefore places the standard of the training in the spotlight. Personally, I was extremely impressed with what they achieved and have been forced to re-evaluate my view of this combination of youth and lack of experience. The cabin crew age averaged 31 years and their experience just 6 years.

Before the crew left the parking gate to return to the hotel, I insisted that they all view the damage that we had sustained. It was later fed back to me that a few had found my insistence to be somewhat macabre. For me there were two reasons for my decision; firstly I wanted them to see what can happen at anytime thus adding some reality to all the classroom and mock-up training and secondly, as they surveyed the damage, they could simultaneously gain confidence from seeing what they had experienced and survived.

For the next time they will be older .... and so much wiser.

Introduction Biography

Capt. Tim Crowch has been flying for 30 years and is currently a senior captain with Swissair flying MD11s. A childhood dream has led him through almost every branch of civil aviation from bush flying in the Bahamas, his original home, through corporate flying to pioneer aviation under the name of Freddie Laker and a national carrier. His Safety work started 16 years ago in investigation and while serving with numerous safety groups he founded "Mayday – accident prevention techniques" in 1995 specialising in accident prevention strategies in the aviation and maritime industries. He lists his recreational activities as sailing, flying a Lake Buccaneer around the lakes of Finland with his family.

Evacuation of Very Large Transport Aircraft (VLTA)

Presented by Melissa J. Madden
For the Association of Flight Attendants, AFL-CIO

The panel this morning has been discussing "Lessons Learned from Accidents." While we have heard a great deal of good information from the other panelists, I am going to take you in a somewhat different direction, that is, "What we can do to prepare before an accident occurs."

Two years ago, our organization spoke extensively at this conference about "Airplane Evacuation Certification" and the changes that were made to the regulatory performance test regarding evacuation demonstrations. Evacuation demonstrations are, in a sense, the training ground for an accident. This test demonstration was how the government determines the number of people allowed to fly on a given airplane and the procedures for getting the occupants out in an emergency. In 1998, the policy enforcing the regulatory requirement for full-scale evacuation demonstrations was changed to favor the use of analysis in lieu of the demonstration. The Association of Flight Attendants (AFA) does not support this change in policy.

Over the years, AFA has been advocating the development of requirements that would protect people from injury in aircraft accidents. Today we continue that goal, except that we will be talking about a new "breed" of aircraft. We would like to discuss another aspect of evacuation, that is our future challenge as flight attendants when it comes to Very Large Transportation Aircraft or VLTA. I will also be discussing some of the current "procedures" being used in today's aircraft for evacuations, which we believe could jeopardize the lives of our flight attendant members and the flying public.

Very Large Transport Aircraft (VLTA)

My first focus here today is that of very large aircraft. These aircraft have the capacity of carrying more than 500 passengers. Proposals for building these airplanes are now being developed, and we must look forward into concepts that are not yet on the production schedule. Double or triple passenger decks, extreme wide bodies, extra long stretch aircraft, flying wings, and other yet-unimagined approaches fall into this category. Our comments apply to these as-yet-unknown approaches, as well as to the design and operation of "just a bigger airplane." While we would build on experience and existing regulatory requirements, we should also plan to develop and apply new concepts and technology to this unique new generation of very large airplanes. Although we are concerned with all aspects of safety, including designing an aircraft so the occupants are adequately protected in survivable crashes, I will restrict my remarks today to the aspects of flight attendant procedures during an emergency evacuation.

Flight attendant procedures have been and continue to be an important part of the certification and approval of the emergency evacuation system. The procedures that are used during the full-scale evacuation demonstration or as part of the analysis become the evacuation procedures for that aircraft. And it is those procedures that need to be looked at when we discuss the VLTA. Flight attendants need to be in on the development stage of these "new" procedures. After all, we will be the ones asked to implement these procedures; in essence, to make them work. We will be the ones dealing with the emergency on the aircraft. We will be the ones directing the passengers during an emergency evacuation. Yet, we have not yet been asked for our opinions or help with flight attendant training in this area. And I find that very disconcerting.

New aircraft are being developed which will have the potential to fly between 20 and 24 hours with the minimum number of flight attendants, ie, safety professionals. These same aircraft are being designed, as mentioned, to carry over 500 passengers. We can expect, as a result, that the stress and fatigue experienced by flight attendants will increase exponentially as a result of increased flight times and passenger management responsibilities. This is going to be a real challenge in terms of physiological and physical stresses.

Yet what happens when those flight attendants—now fatigued from dealing with the long flight hours, three inflight medical situations, and three meal services, just to name a few examples of what an average flight on a VLTA may be like—encounter an emergency on landing?

One of the things we need to start thinking about now is the basic concept of communication. How are flight attendants going to effectively communicate on a normal basis on an aircraft that has two separate levels? Now add the emergency scenario. Remember that flight attendants at most carriers are trained on "planned and unplanned" evacuations. So there are two scenarios that need to be addressed; the situation where a cabin prep is accomplished, and one that we affectionately refer to as a "quick and dirty", that is, one where an accident occurs on landing, takeoff or during flight. Each of these will present their own unique set of communication problems that need to be addressed.

How will the information to evacuate be relayed to flight attendants when the flight crew makes the determination to evacuate? How will the flight attendants notify the flight crew that they have made a decision to evacuate? Remember that flight attendants can, and do, make the decision to evacuate in certain situations.

Once the decision to evacuate has been made, how are flight attendants in the aft lower section of the aircraft going to communicate with the upper deck forward section to deal with the evacuation? Are there certain exits that should or shouldn't be used, depending on the nature of the accident? How is that information going to be relayed to the flight attendants? An effective communication method must be determined when dealing with cabin preps, as well as the evacuation itself.

A couple of years ago, I posed this communication problem at a VLTA conference to the "experts". They responded that they were considering using portable microphones at each jumpseat location for communication purposes. During an emergency, the flight attendants would don their microphone headset to communicate. Now, you have 18 flight attendants, each with their headset securely on, with a microphone located somewhere near their mouth, shouting evacuation commands to passengers and also trying to relay information about the status of their doors to the other flight attendants. If you haven't figured it out, that is a whole lot of "communication," going on over these microphones. Perhaps a better word would be "mis-communication" or just plain "noise". When this problem was pointed out, the experts said they may need to figure a way to make only one microphone "hot," or work, at a time. So, the flight attendants would never know if their "communication" had actually been "communicated."

Now you have the classic dispatch problem, 18 people relaying information simultaneously, yet how do you know that your information went out across the wire? Don't forget you are still trying to do all this while you shout commands, maintain passenger flow at your exit, manage any aggressive behavior to exit through your door, and take carry-on baggage from the passengers that want to take it down the slide with them. And of course, you're trying to protect yourself from being thrown out of the aircraft.

Actually, I find the whole microphone idea a little humorous. I teach aerobics on my days off, and yes, I wear one of those microphone headsets. My instructions are clear, and, on a good day, my microphone is working, yet the students are still not doing the moves that I have cued! I can only conclude that the use of microphones doesn't guarantee communication. Well, I probably don't need to tell you the rest. Who is to say this type of communication system will still be available if we crash this aircraft? Evacuation scenarios are dynamic. Door status can change at any minute. Fire outside the aircraft can spread, making a formerly safe exit unsafe. All this information needs to be relayed to others. The communication of this information needs to be simple, reliable, and fail-safe.

Now we need to think about how we are going to get two levels of passengers out of an aircraft during a real emergency evacuation of the VLTA. Think about this, you are the flight attendant in the upper deck of a double deck aircraft and you need to evacuate the passengers. The upper deck cabin is filled with smoke, you can hear voices shouting the "COME THIS WAY" command but you don't know exactly where the voices are coming from. They may be coming from upper deck doors 3 and 4 or they may be coming from the lower deck. Yet you don't know, and more importantly, you can't actually tell if there are any obstacles between you and those doors. You notice the stairs are smoke free. Now, do you send the passenger down or to the voice in the back of the aircraft? As flight attendants, not only will you need to think about dangers on one single level, but now you will need to think about the dangers on two levels. Then there is the question, what do you do with the passengers that adamantly refuse to jump from the upper deck because of the extreme height and angle of the slide?

As the number of passengers increases, the incidence of passengers who "panic" during an emergency will also increase. If this panic spreads among the passengers, the prospect of facing an "unruly mob" during an evacuation must be considered. Flight attendants are neither prepared nor trained to act as riot police.

One of the other major issues regarding evacuation is that of passenger flow control.

Passenger Flow Control

Flight attendant procedures and actions have been and continue to be one of the most important variables affecting passenger survival in emergency escape from aircraft. In order to facilitate passenger egress from aircraft during an emergency evacuation, I was trained, as are all flight attendants, to use a procedure called "passenger flow control." Flight attendants use flow control when they direct passengers to come toward an exit and thereby accomplish maximum use of that exit. If an assigned exit cannot be opened, flight attendants must once again practice flow control by directing passengers to another exit. In addition, flight attendants use flow control when an opened exit ceases to be usable during an evacuation. In this case, they also direct passengers to another exit. Many times flight attendants exercise flow control by moving to the area between two exits located across from each other on either side of the fuselage. They direct passengers to the most useable exit and try to maximize the use of each exit. Most of these procedures have been a part of airline flight attendant manuals and training for at least 30 years.

In the past, use of flow control was based primarily on the flight attendant's assessment of post-crash events, which included the damage to the airplane and the dynamics of the evacuation itself. Recently, "flow control" has been incorrectly equivocated to "exit by-pass" by a manufacturer attempting to make up for configuration problems in an evacuation demonstration. I will go into greater detail on this concern in a few minutes. But first, let me discuss more about the general concept of flow control. A brief examination of past evacuations and experience reveals that flight attendants have used flow control in various forms in almost all actual aircraft evacuations.

For example, on March 1, 1978, a DC-10 operated by Continental Airlines overran the departure end of Runway 06R after the captain aborted the takeoff. The flight attendants were aware that the take-off was aborted. The flight attendant at the 3L door was aware of fire outside the exit before the aircraft came to a stop. She yelled to the flight attendant at exit 3R that the aircraft was on fire. Since 3L was made unusable by the outside fire, she directed passengers toward the 3R exit. However, the passenger in seat 18A grabbed the emergency door handle of 3L and opened this door, ignoring the flight attendant's continued commands not to open the door. After 3L was opened she blocked the unusable exit and continued to direct passengers toward exit 3R. However, exit 3R slide was not functioning properly because of the tilt of the aircraft and wind gusts. She heard an in-flight supervisor in the aft cabin directing people forward. She then also began to direct passengers forward toward the front of the aircraft. Presumably, she did this to avoid overloading the 3R exit which was experiencing problems with the slide. This flight attendant practiced flow control by redirecting passengers from an unsafe exit to safe exits.

The catastrophic United Airlines accident in Sioux City, Iowa, provides several examples of flight attendants practicing flow control during an accident where some people would say there was no possibility of an aircraft evacuation. On July 19, 1989, a United Airlines DC-10 experienced an uncontained engine failure during cruise. As a result of the uncontained engine failure, parts of the engine damaged the hydraulic lines. That caused the flight crew to have great difficulty controlling the airplane. The airplane crashed during an attempted emergency landing at the Sioux City, Iowa, airport. During the ground impact sequence, the airplane broke apart and portions burned. There were 296 passengers and crew aboard at the time. One hundred and eighty five survived the accident including seven flight attendants and three cockpit crewmembers. One flight attendant reported that she had difficulty releasing her seat belt and getting out of her seat. She could feel heat from the fire. When she finally released her seat belt she fell to the floor and landed on her hands and knees. She saw light and remembered telling people, "There's an opening, come this way." Another flight attendant helped passengers out of the airplane and directed them to safety. Passengers reported that flight attendants redirected them away from fire and to the back of the area where there was an opening for exiting the aircraft. These are all examples of flight attendants practicing flow control.

These flight attendants used their training on passenger flow control when it was appropriate and needed the most. These procedures are an integral part of the evacuation system of an aircraft. Flight attendant procedures are not only a critical part of the success or failure of an actual evacuation, they are also an important part of the certification and approval of the emergency evacuation system. However, it appears that more and more often the airline industry may not be effectively considering problems with the system. Our particular concern is the trend to prescribe unrealistic and potentially hazardous flight attendant procedures to compensate for design deficiencies in other parts of the system. Failure to realistically examine the total system not only puts the flight attendants at additional risk, but may also contribute to the passenger risk.

Now, let me again take you back to the VLTA and the numerous problems that flight attendants may face during an evacuation. Do we really want to add potential aircraft system "failures" to the mix?

The procedures that were used either during the full-scale evacuation demonstration or as part of the analysis are incorporated into the Flight Standards Board (FSB) Report for that aircraft, and become part of the standard for flight attendant qualification for that aircraft.

The evacuation system is designed to meet the certification requirements of the FAA regulations. The most significant of these requirements is that the aircraft must be shown by actual demonstration (old policy) or by analysis based on tests (new policy) to be capable of full evacuation of all occupants in 90 seconds or less. The artificial conditions established for the demonstration/analysis have led to aircraft interior designs and flight attendant procedures that may be effective under those artificial conditions, but unrealistic and possibly dangerous in a real emergency evacuation.

As a flight attendant, I may not know how, or why, the procedures for a given airplane were developed. However, I have been trained to use passenger flow control procedures in general, and specific flow control procedures for specific airplanes. In addition, some airlines may develop additional procedures for an airplane and incorporate these procedures into their evacuation system for that airplane. Airlines may do this providing they can demonstrate the efficacy of the procedure during a partial evacuation demonstration. Some airlines have established procedures where flight attendants were given the responsibility of leaving floor level exits to go to window exits and either open the exits or assist with the passenger flow in this area.

However, in most actual accidents, flight attendants stay in the vicinity of the floor level exits. There is a recent notable exception where the flight attendant, following that airline's procedures, left the floor level exit, went toward the window exits, and died trying to get to that flight attendant's assigned secondary exit location at the over-wing exits.

Many times during the last few years flight attendant procedures have been used during the certification of the evacuation systems to compensate for what appear to be design configuration problems. No one disputes the importance of flight attendant procedures; nevertheless these procedures are part of a system. Unrealistic flight attendant procedures should not be used to unrealistically compensate for a problem with another part of the system.

One example of using flight attendant procedures to compensate for another problem is provided by the procedures developed for an airplane that is not equipped with exits in the back. This airplane has floor level exits in the front and exits over the wings. The airplanes are operated with two flight attendants. In this airplane, one flight attendant is located at the forward doors. This is quite logical. Now where is the other flight attendant located? Logic would dictate that this flight attendant be located near the over-wing exits in a passenger seat converted to meet the requirements of a flight attendant seat in the exit row. A flight attendant seated in this location would be able to assist in opening the exits and could direct passengers to use the best available exits.

But, this is not where the second flight attendant is located. The second flight attendant is located all the way aft in the cabin. One reason given for this was that the flight attendants could see all the passengers and not have passengers behind them. This excuse seems to ignore the fact that the flight attendant in the front of the cabin can see all the passengers, and would provide the necessary oversight. The aft seated flight attendant is supposed to climb over the seat backs to get to the over-wing area and at the same time give oral commands for passengers to come this way. It is obvious that the only way the airplane could pass its evacuation demonstration tests was to put a flight attendant in the back who could "push people" forward and thus maximize the use of the overwing exits.

Possibly the most common use of flight attendant procedures to compensate for a configuration problem is provided by the case of what could be termed the varying cabin seating configuration problem. There are many configurations of airplanes with very low density seating in the first cabin followed by higher density seating in the second cabin. Flight attendant procedures have been used in the evacuation demonstration to optimize the flow out the forward door of the lower density-seating, forward cabin. Flight attendants are asked to "split" the passenger flow. As passengers arrive at the useable exit in the second cabin they are directed forward to the door in the next cabin toward the front of the airplane, thus maximizing the flow out that forward exit. This maneuver has been used in both evacuation demonstrations and also when the approval of the aircraft evacuation system has been accomplished through analysis. Of course, the procedure is manipulated so it works and works quite well in both the demonstration and the analysis. However it is highly artificial. It is doubtful that flight attendants would be able to "split" affinity groups, let alone family groups as they arrive at useable exits. This would be especially true since by leaving a loved one or friend, a passenger would be moving into a cabin where another exit might not be visible. In addition, this practice puts the flight attendant at risk since passengers may become aggressive when rejecting flight attendant directions.

A similar problem exists in another airplane design where the exits are placed so that the only way to meet the certification time limit is to force passengers seated just behind an operational over wing exit to turn around and stand in a queue to go out the aft exit. This was proposed even though accident data are available to prove that the overwhelming number of passengers successfully evacuating an airplane in a real emergency go through the exit nearest their seated position.

The practice of "splitting" the passenger flow, sometimes called exit by-pass, is very useful in analysis since the person doing the analysis can assume that the flight attendant is able to spit the passenger flow and therefore achieve maximum use of all the exits. It was used in the certification of the aircraft evacuation system of the MD-11. One airline presently operating this airplane actually requires flight attendants to brief passengers before take-off on exit by-pass. Some passengers are told they must not use the nearest exit, but must proceed to the next cabin and go through that cabin to the forward-most exits. The effect these instructions could have on passenger behavior following an accident can only be imagined. Yet the people responsible for the certification of the evacuation system on the airplane decided this procedure is "necessary". It is probably "necessary" only because the passenger seats are not evenly distributed by the design of the aircraft—not because flow control as used by flight attendants in the past was deficient. There is a configuration problem. Exit by-pass and its various permutations are probably not workable in a real world accident. Problems that could be solved on a designer's computer should not become problems that must be solved by a flight attendant during a life threatening emergency. The use of a procedure to compensate for a design deficiency could have disastrous results.

As an aside, I was in my dentist's office a few weeks ago waiting for him and was practicing this speech. He came in and asked me what I was working on and I told him. I then ran the scenario of an accident by him and asked him what he would do if he got to an exit and was told he could not use this exit and was directed to another exit. He told me point blank, "I'd use that exit, no matter what." I believe that most passengers would do the same.

Again, is it realistic to be training flight attendants on a procedure that in most likelihood is not going to work or be followed by passengers? Is it possible to actually train a flight attendant to force a passenger to do something contrary to normal behavior in real life-threatening emergencies? Considering the inadequacies in emergency training today, can we assume that this training is going to be effective and adequate enough to enable flight attendants to accomplish this very difficult task?

As bad as exit by-pass is, it does not pose as much of a threat to the flight attendants as is posed by the procedure promulgated by one manufacturer. As part of the certification process for a new type of aircraft, this manufacturer proposed that the 9th flight attendant, that would be located in the back of the airplane, move 12 rows forward into the cabin of the airplane in order to maximize flow control. Twelve rows could be as much as 40 feet. The manufacturer stated that moving 12 rows forward would not pose a problem for the flight attendant because the passengers will be moving forward. The manufacturer assumed that the passengers would be going toward the door they entered, even though we now know that most passengers exit through the nearest exit in an emergency. Further, the manufacturer stated that this procedure is needed since the passengers will move forward and the use of the aft doors will not be maximized. The manufacturer assumed that if a flight attendant moved forward, that flight attendant would be able to direct the flow of passengers by turning the passengers around. This would certainly make certification and approval by analysis much easier since it could be shown that the use of the aft exits would be maximized. This maneuver may work in a well-controlled, non-emergency, full-scale evacuation demonstration since passengers are much more likely to use the forward exit through which they entered the airplane for the demonstration. In an actual accident, many variables enter into the passenger exit use. These include the absence or presence of light, the presence of fire, fuselage deformation, flight attendant commands and actions of other passengers. Passengers could perceive that the fact the flight attendant is moving forward is a sign that forward is the direction they should also move.

While it is true that in the past flight attendant procedures have required flight attendants to leave floor level exits to go to assist passengers at window exits, there is a difference. In this case, thirteen rows forward of the aft exits, there are a pair of floor level exits with a flight attendant stationed at each exit. The 9th flight attendant would not be going toward an unmanned exit in order to ensure that passengers have opened the exit and to impose flow control procedures at that exit. The only purpose for the 9th flight attendant moving into the aft cabin would be to direct passenger flow. Any procedure which asks a flight attendant to leave a useable floor level exit is dangerous not only for the flight attendant, but for passengers that could come to the formally manned or guarded exit and need help from a flight attendant. However, the procedure of requiring a flight attendant to move forward toward floor level exits that are already manned by flight attendants is beyond dangerous. It is ridiculous and is just downright unsafe, and could prove to be deadly. In addition to endangering the life of the flight attendant, it could contribute to the general panic of the passengers.

Some people regard flight attendant briefing passengers to use doors other than those that are the closest to them as just a refinement of the management of passenger flow control that flight attendants have used for years. They regard the movement of flight attendants into a cabin for the sole purpose of managing passenger flow as another refinement of flow control. However, there is an important difference. Passenger flow control as used until recently was a procedure that was based largely on the flight attendant assessment of conditions **following** the crash. The example of exit by-pass and entering the cabin to turn people around are procedures that a flight attendant would use prior to fully assessing conditions. For example, the pre-take off briefing given to passengers about which exit to use is given before there is even the threat of a crash. At its very best, this pre-takeoff briefing would be confusing to passengers, even if they paid attention to it. The primary concept underlying passenger survival has always been to get the passenger to go to the closest exit. Only then flight attendants, based on their assessment of post crash conditions, would redirect passengers, if necessary. Once again, passenger flow control as used until recently, was a procedure that was based largely on the flight attendant assessment of conditions following the crash. Now again, please consider the VLTA. What new "procedures" may the flight attendant be asked to perform in order to maximize the use of up to 18 exits, and evacuate an aircraft carrying well over 500 passengers?

We should not be in a position where the industry uses flight attendant procedures to ensure that the evacuation system passes its tests regardless of suspected problems with configuration. It is the 21st century, and as flight attendant safety professionals, we need to lead the way toward the use of the best techniques for approval of all aspects of new aircraft. This should include approvals of any changes to the interior configurations of aircraft cabins

Conclusion

The VLTA presents various aspects of safety for cabin crew, that includes the hazards of flight as well as the hazards of crashing and post-crash emergency evacuation. We believe that the issues of flight attendant requirements, training, crew levels, duty cycles and rest must be reconsidered if they are to operate as cabin crew in very large airplanes. Operations under normal conditions as well as emergency conditions will differ from experience obtained with existing narrow and wide bodied airplanes.

Flight attendants are the front line employees who most often are confronted when a passenger has a concern or problem. At the very least, the bigger the aircraft, the more responsibilities flight attendants will need to deal with. We can expect to see increases of the incidence of those problems we now experience from inflight medical emergencies, turbulence, and unruly disruptive passengers, just to name a few. And that means that we need to think more about training, not only for an emergency situation, but for the everyday situation that may occur on the VLTA.

Airline evacuation systems must not include flight attendant procedures that are not realistic and put flight attendants and passengers at risk. It is time to put a stop to the use of flight attendant procedures to compensate for or mask other problems with the evacuation system. We must stop the use of any procedures that require flight attendants to leave a useable floor level exit to go into the cabin to direct passenger flow. These procedures have already had deadly results and their continued use, especially to advance the certification of airplane evacuation systems, will establish a dangerous precedent. Their use must be stopped.

In addition, it is our understanding that analysis is being considered as the certification tool for the VLTA in lieu of the full scale evacuation. If used, as we said two years ago, "This does not mean that we will never witness another full scale evacuation demonstration. Except now the volunteer test subjects will be replaced by fare-paying passengers, and the urgency will be dictated by a life threatening emergency, not a safely controlled experimental design." We do not want to run this risk.

WORKSHOP ABSTRACTS

Workshop1. Responding to Challenging Behavior and Verbal Abuse: A look at best practice in procedures, strategie and crew responses to aggressive behavior. Backed up by information from the Institute of Conflict Management, whic is a recently formed UK government endorsed organization, which is in the process of creating national standards in th subject. Chaired by Mr. Phil Hardy, Chairman of the Institute of Conflict Management.

Workshop 2: Crisis Communication-How to talk to your employees during a Crisis. Manager, supervisors and unio representatives will this workshop useful as a practical "How To" guide to communicating with employees during a cr sis. Moderator: Jeanne M. Elliott, Director-Regulatory/Legislative Affairs, Teamsters Airline Division Presented by Greg Janelle, Janelle & Associates

Workshop 3: New Approach to First Aid Training. Edgar Buehrle, MD, Emergency Physician, Medical Directo MEDIFAN, Institute for applied Emergency Medicine, Freiburg, Germany. Frank Oberle, M.D. Former Paramedic Training, MEDIFAN

Workshop 4: International Roundtable. An opportunity to meet with the CIS delegation to discuss Cabin Safety. CI Delegates and other symposium attendees. Moderator: Ron Schleede

Workshop 5: In-Flight Telemedicine-A Practical Session to enable flight crew to assess for themselves how usefu telemedicine can be in assisting them during in-flight medical incidents. This session will give delegates the chance t experience first had the use of telemedicine on board an aircraft. Kate Murphy, Executive Director, Remote Diagnosti Technologies Limited

Workshop 6: Personal Safety Responding to Physical Provocation. This workshop will practically involve the dele gates in skills, which are currently proving extremely successful in raising the confidence levels of cabin crew in man UK Airlines. Chaired by Andrew McKenzie-James, Securicare International.

Workshop: 1

Responding to Challenging Behavior and Verbal Abuse

Phil Hardy, Chairman
Institute of Conflict Management

A look at the best practice in procedures, strategies and crew responses to aggressive behavior. Backed up by information from the Institute of Conflict Management, which is a recently formed UK government endorsed organization, which is in the process of creating national standards in this subject.

Workshop: 2

"Crisis Communications – How To Talk To Your Employees During A Crisis"

Greg Janelle
Janelle & Associates

Anywhere, anytime, anyplace...the aviation industry, to a greater extent than perhaps any other business in the world, has learned to operate within an ever-present cloud of vulnerability to crisis. Protocols for crisis management abound, and it is a rare organization these days that does not have a contingency plan in place to deal with sudden calamity.

But having a crisis plan is one thing – actually making it work is another. Aviation employees must not only cope with the crisis at hand, but also keep the operation running smoothly, in the face of seemingly endless media attention, public scrutiny and official investigation. Rumours, myths and gossip are the by-products of any crisis situation and even the best-laid crisis plans can come apart at the seams if fiction becomes paramount over fact.

The solution? *Effective crisis communications*. The ability of organizations to inform and respond to their own people effectively is critical to the successful resolution of a crisis in the workplace. Managers, supervisors and union representatives alike will find this workshop useful as a practical "How To" guide to communicating with employees during a crisis. Topics include:

- Defining a Crisis / Stages of Crisis
- Crisis Assessment
- Effective Communication as a Process
- "Why Aren't They Listening? – Typical Communication Barriers
- Crisis Communication Guidelines, Techniques and Tips
- Union/Management Relations During Crisis
- Dealing With Individuals
- Critical Incident Stress Management

BIOGRAPHY

Gregory Janelle

Gregory Janelle is a communications consultant and a former airline executive with AirBC/Air Canada Regional. Educated in business management, he holds additional training endorsements from the International Critical Incident Stress Foundation (ICISF), Inc., and has trained hundreds of personnel and Mental Health professionals from both public and private sector organizations. As well, he is a frequent guest speaker and lecturer on the topic of critical incident stress and crisis communications, throughout North America and overseas.

Mr. Janelle is credited with being the chief architect and motivating force behind the award-winning and internationally recognized AirBC CISResponse critical incident stress management program. He has been associated with that program as founder and principal educator since 1988. Although he officially retired from AirBC in 1999 he continues to contribute his time and energies as the airline's international representative for CISResponse.

Greg's aviation career spanned fifteen successful years and included the rank of cabin crew, instructor, supervisor, and senior manager as Director of Inflight Service for AirBC. Greg currently provides his full-time professional services to industry and government worldwide through the firm Janelle & Associates Consulting Ltd., specializing in crisis communications, critical incident stress management and Aviation Disaster Family Assistance training programs.

In recognition of his achievements, Greg Janelle received the prestigious SCSI Award of Excellence in Cabin Safety at the 16th Annual International Cabin Safety Symposium.

Gregory Janelle
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Workshop 3:

New Approach to First Aid Training

Edgar Buehrle, M.D. Emergency Physician, Medical Director MEDIFAN, Institute for applied Emergency Medicine, Freiburg, Germany
Brigitte Danzeisen-Buehrle, RN, Transaction Analyst, Quality Supervisor, CRM-Trainer, MEDIFAN
Frank Oberle M.D. Former Paramedic, Trainer MEDIFAN.

Medifan provides First AID-Training for Lufthansa. Condor and many other European Airlines. MEDIFAN has 14 years experience with Emergency Medical Training for Emergency Physicians. Hospital staff, General Practitioners and their staff and many others.

The workshop is limited to 24 attendants.

First Aid can be taught in many different ways. Usually it is taught by giving theoretical lectures in a classroom with some practical training. Some companies have already improved their training by recognising that more practical First Aid Training will lead to excellent assistance of ill passengers. Two years ago the JAA, Joint Aviation Authorities of Europe, described the content of the First Aid Training more detailed. Since then more efforts have to be taken to improve the skills of Flight attendants in First Aid Training.

Our goal always has been to prepare Cabin Crews to assist ill passengers onboard with or without the help of a medical doctor or any other medical trained person, using all methodical, didactically useful possibilities.
In this workshop we will give a survey of our teaching techniques: Learning by Doing, Try and Error, Skill Drill and simulate some emergency procedures with the attendants of the workshop.

CRM is part of our training. As we consider communication to be the most essential tool of teamwork besides practical skills, we involve CRM-Tools in First Aid Simulation.
We also demonstrate different possibilities of using a CBT, Computer Based Training during First Aid Training.

We involve the attendants in practical demonstrations by simulating Emergency situations and so experiencing how interesting and breathtaking First Aid Training can be.
The Competency of the trainer is important. Therefore the career of an Airline Medical Trainer is shown, by demonstrating his abilities as an actor, CRM-tutor, medical expert and esteemed interlocutor. We also show how these skills are maintained and improved.
Finally we give a survey on a complete Initial and Recurrent First Aid Training, including some of the described methods.

Workshop: 4

International Roundtable

Moderator: Ron Schleede

An opportunity to meet with the CIS delegation to discuss Cabin Safety. CIS Delegates and other symposium attendees.

Workshop: 5

In-flight Telemedicine – A Practical Session

Kate Murphy, Executive Director
Remote Diagnostic Technologies Limited

Introduction

Cabin crews handle over 35,000 in-flight medical incidents every year, ranging from the minor cut that can easily be handled by a crew member with little assistance, to the major coronary or pulmonary incident requiring immediate expert medical help. With more people travelling greater distances and to a greater age, these numbers are on the increase.

This workshop will address the practicalities of using telemedicine to assist the aviation industry in the handling of in-flight medical incidents.

It will include a demonstration of a simulated in-flight medical incident using telemedicine, to enable delegates to see what is now feasible for aviation telemedicine.

There will then be an opportunity for the delegates to gain hands-on experience using a telemedicine device during a simulated in-flight medical incident. Delegates will be able to see for themselves how telemedicine can offer genuine support during almost any on-board medical incident.

Workshop: 6

Personal Safety Responding to Physical Provocation

Andrew McKenzie-James, Securicare International.

This workshop will practically involve the delegates in skills, which are currently proving extremely successful in raising the confidence levels of cabin crew in many UK Airlines.

SCAAE 2001 Convention - Technical Program

Date: Feb.10, 2001
Time: 2:00 PM to 4:30 PM
Place: Cerritos Sheraton Hotel
12725 Center Court Drive, Cerritos
(562) 809-1500
Co-Sponsor: Chinese-American Computer Association
Co-Chair: Dr. Louis Huang & Mr. Albert Lin

Program Schedule

2:00 - 2:30 Presentation: "***Aviation Safety***" By Dr. Kay Yong, Director General, Aviation Safety Council, Taiwan, ROC

2:30 - 3:00 Panel Discussion (Dr. Kay Yong, Prof. Kuen Lin, Mr. Chang-Chio Tien, Dr. Denny Ko, Prof. Michael Niu)

3:00 - 3:20 Break (Social)

3:20 – 3:50 Presentation: "***High Tech Investment & Entrepreneur Opportunities in China***" By Dr. Jack Gao, President, Microsoft (China)

3:50 - 4:30 Panel Discussion (Dr. Jack Gao, Dr. Denny Ko, Mr. Jason Fan, Dr. David Liu, Mr. Jim Cheung)

SCAAE 2001 CONVENTION
FEBRUARY 10, 2001
SHERATON CERRITOS HOTEL

Program

6:00 Registration and Social Hours
6:45 Dinner
7:15 Installation of 2001 Officers/Directors
West Chapter
National Chapter
7:45 Introduction of Keynote Speaker
7:50 Keynote Speech
"Aerospace Engineer in the New Century of Biology", by **Dr. Yuen-Cheng Fung,**
Awards of Presidential National Medal of Science,
National Academy of Engineer, Professor Emeritus,
University of California at San Diego
8:20 Introduction of Special Guest Speaker
8:25 Special Guest Speech
"**Boeing 717**", by **Mr. Tom Croslin**, 717-Program Chief Engineer, Boeing Long Beach Division.
8:35 Special Award Presentataion to
Dr. Jack Gao and **Dr. Kay Yong**
8:45 Entertainment
- Dance Exhibitions
  Ball Room - Dr. & Mrs. Yuan Jen
  American Morden - Miss Christine Chen
- Vocal Music Exhibitions
  Ming Yuan, Jay Lee, Cathy Chao
- Chinese Lion Dance

9:25 – 12:00 Karaoke/Dance

Agenda

Kay Yong
Managing Director of Taiwan Aviation Safety Council
Visit to Boeing

Thursday, February 15th

11:15	Arrive at 10-16 building from airport by Boeing Transportation John Hamilton – Host (425-237-8525 or –8408)
11:15-12:15	Lunch at River Rock (Maplewood Golf Course)
12:30-2:00	10-16 building room 71V4 Discussions on How Boeing can assist ASC in investigations, How we can help train ASC Investigators, and work together. Discussion of how we work with our Taiwan customers
2:00 – 4:00	Discussion of SIA 006 and human Factors
4:30	Boeing Transportation to Embassy Suites Tukwila 15920 West Valley Rd., Tukwila, WA 98188, phone 425-227-8844
6:10	Boeing Transportation from Embassy Suites to Salty's Alki restaurant (dinner at 6:30 under "Hamilton")
9:30	Boeing Transportation back to Embassy Suites

Friday, February 16th

8:00	Boeing Transportation to 40-23 building in Everett
9:00	Tour of Everett Final Assembly with John Hamilton
11:00-12:00	Lunch
12:00	Depart for Airport

Contact Numbers:
Boeing transportation: 253-657-9955
John Hamilton cell: 206-930-0116

附錄五

專題演講

「Improve Aviation Safety Through Accident and Serious Incident Investigation – The Taiwan Way」

Improving Flight Safety Through Accident/Incident Investigation, The Taiwanese Way

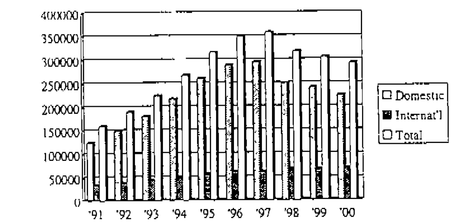
By Kay Yong, Ph D
Aviation Safety Council
February, 2001

- Taiwan's Civil Aviation Environment
- Responsibilities and Organization of Aviation Safety Council
- What we have done
- Conclusion

The Civil Aviation Environment of Taiwan

- Two International Airlines (China Airlines, EVA)
- Four Domestic Airlines (Far Eastern, TransAsia, UIA, Mandarin)
- Seven GA operators
- Total Registered Airplanes – 178
- Types of Aircrafts
  - B747-400, -200, B737, B757, B767, MD11, MD80, MD90, A340(in Spring, 2001), A320, Fokker-50, -100, Dash8, ATR72, Helicopters

Taiwan's Civil Aviation Number of Take Offs (1991~2000)



Statistics in the Last Decade (1991~2000)
(Accidents Only)

Year	No of Accidents		No of Fatalities	Type of AC	Operators Involved
	Passenger / Cargo	GA			
91	1	1	6	B742, UH-12E	CAL, Yun-Hsin
92	1	0	2	BN-2A	Taiwan
93	3	0	6	DO-228, MD82, B744	Yun-Hsin, FAT CAL
94	2	1	264	AB6 HU-12E, Learjet35	CAL, Yun-Hsin, Golden Eagle
95	1	2	5	ATR-72,Bell-206, Schweizer300C	Transasia, Asia Pacific, Taipei
96	1	0	6	DO-228	Formosa
97	1	1	16	Bell-206, DO-228	Asia Pacific, Formosa
98	2	1	219	AB6,Saab340,Bell-412	CAL Formosa Daily
99	3	2	7	MD11, MD90,UH-12E, BK117 B747SP	CAL(2), UIA, Daily, EPAir
00	1	1	83	B744 Bell-430	SIA, Daily
Total	16	9	614	AB6(2),B742,B744 MD11, MD90 MD82, DO228(3), Saab340, BN-2A, ATR-72, Learjet35 Helo(8)	CAL(6) TransAsia(1) SIA(1) Formosa(3) UIA(1), Yun-Hsin(3), Daily(3), Others (7)

- Average Accident Rate in the Past Decade ≅5.9 per million T.O. (PAR 121 only)
- Average Accident Rate in the Past Three Years ≅6.6 per million T.O. (PAR 121 only)

Responsibilities & Organization of Aviation Safety Council - ASC -

In The Past

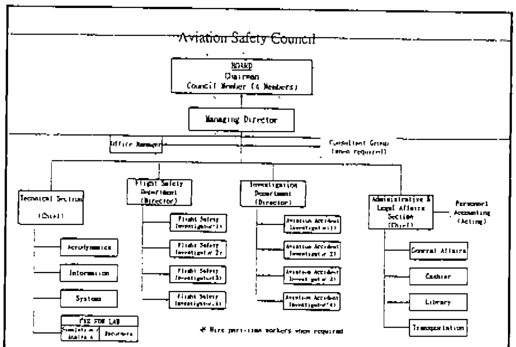
- CAA (FSD) handled all accident investigations, and paid virtually no attention to any kind of "incident" investigation.
- Even in the investigation of accidents, investigators were part time with little training, and usually was handled by one person.
- There were no data base of any kind to provide information for improvement.
- The purpose of the investigations then was to find the guilty party, not to improve safety.
- Paid little attention to the Human Factors, especially organizational safety issues
- Cabin Safety very seldom a safety issue

After the CAL Tauyuan accident (AB6), people recognized that in order to improve air safety, an independent aviation accident/incident investigation organization was necessary.

- Hence, the birth of ASC (in May 25, 1998)

Responsibilities

- An independent government organization responsible for all aircraft accident and serious incident investigation
- Flight safety improvement recommendations directly to the Premier and follow ups.
- Collaboration with international flight safety organizations on accident / major incident investigation and flight safety improvements.
- Pro-active (preventive) measures for safety improvement.



Total of 18 staff members

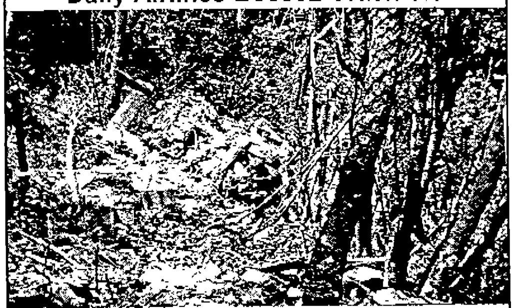
What We Have Done

The Track Records

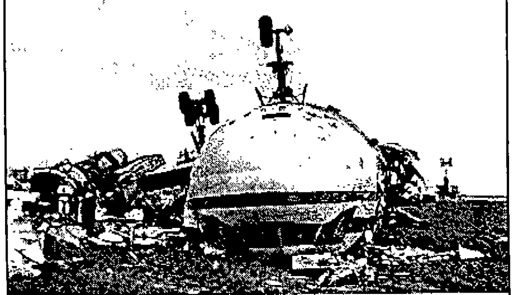
- Sept 2, 1998 Swiss Air #111 as an observer
- April 21, 1999 Daily Air Helicopter (SK117) CFIT near Taipei (report published)
- August 22, 1999 China Airlines CAL642 (MD11) accident in Hong Kong Cip-Lap-Kwok Airport
- August 24, 1999 UNI Air UIA873 (MD90) explosion on landing roll in Hualien Airport. (report published)
- Sept 2, 1999 China Airlines B747-SP training-run off runway after landing. (report published)
- Oct 31, 2000 Singapore International Airlines B747-400 accident at CKS International Airport, Taiwan (under investigation).
- Jan 15, 2001 UNI Air Dash8-300 accident at Gin-Man Airport (under investigation).
- Plus 3 GA accidents (helicopters), 4 serious incident investigations, and one state aircraft

Published 6 reports and issued 65 recommendations.

Daily Airlines B55502 Crash Site

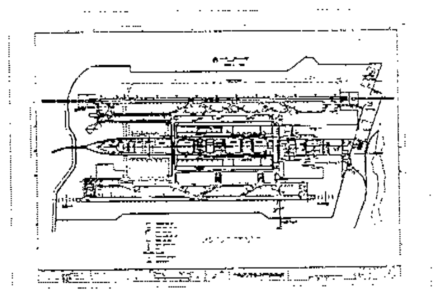


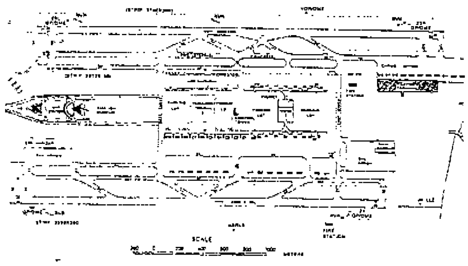
China Airlines CAL642 Crash Site



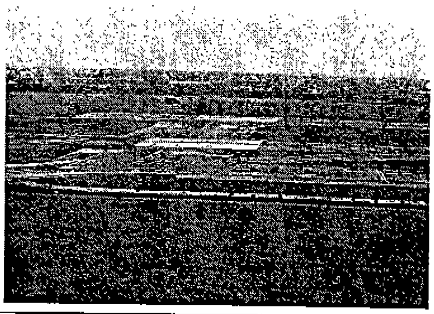
UNI Air UIA873 Accident Site

CKS GROUND MAP

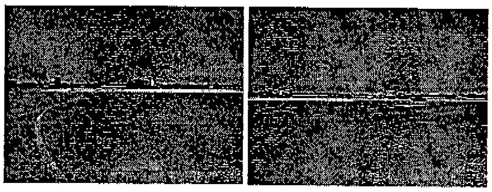




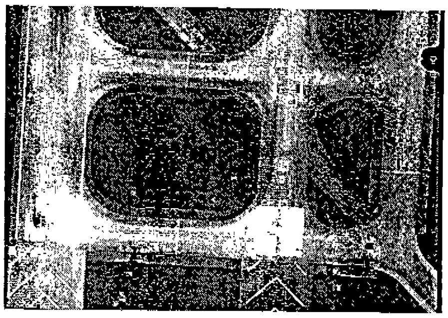
NP→N1→05R GROUND PHOTO



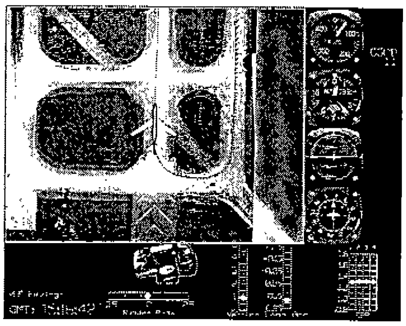
View of entrance into Runway 05R/23L from taxiway N1



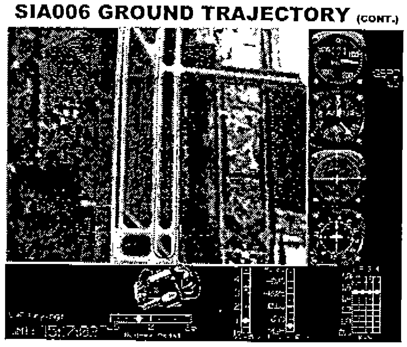
NP→N1→05R AERIAL PHOTO



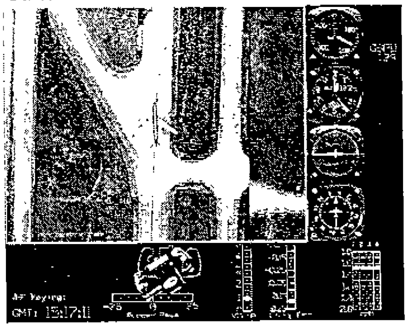
SIA006 GROUND TRAJECTORY



SIA006 GROUND TRAJECTORY (CONT.)

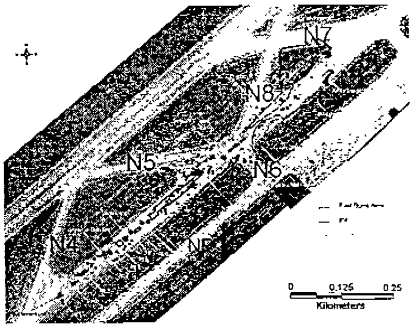


SIA006 GROUND TRAJECTORY (CONT.)

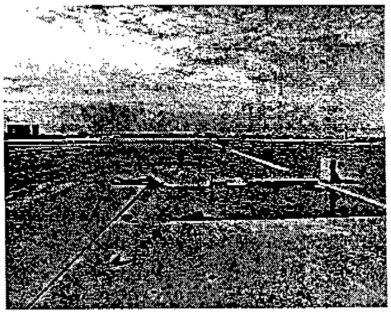


SIA006 GROUND TRAJECTORY (CONT.)

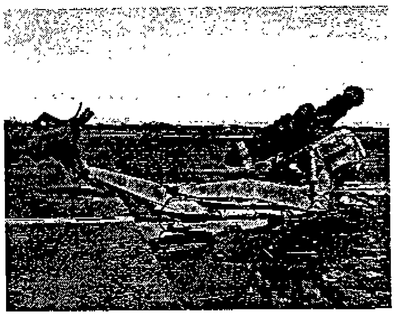
AERIAL VIEW OF MAIN WRECKAGE



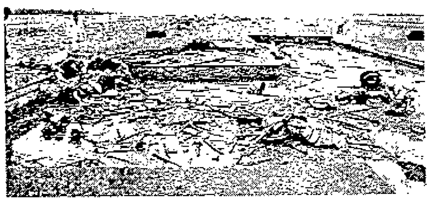
1ST JERSEY BLOCK



1ST EXCAVATOR IN NO.5 PIT



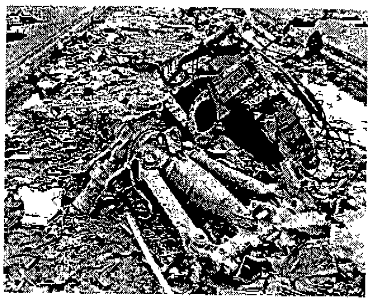
WRECKAGE & GROUND EQUIPMENT IN NO.4 PIT



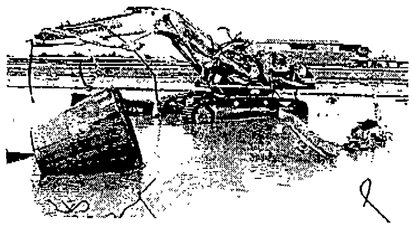
WRECKAGE & GROUND EQUIPMENT IN NO.11 PIT

WRECKAGE IN NO.11 PIT

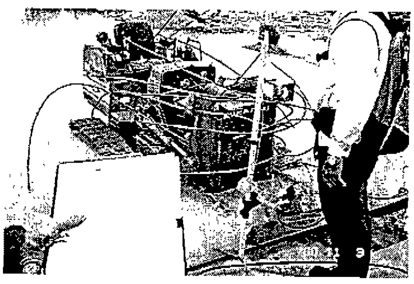
WRECKAGE (NOSE GEAR) & GROUND EQUIPMENT IN NO.11 PIT



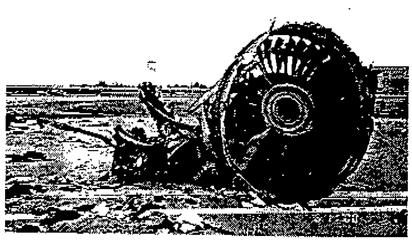
WRECKAGE & GROUND EQUIPMENT IN NO.11 PIT



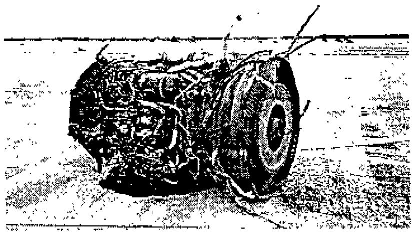
BULLDOZER IN NO.11 PIT



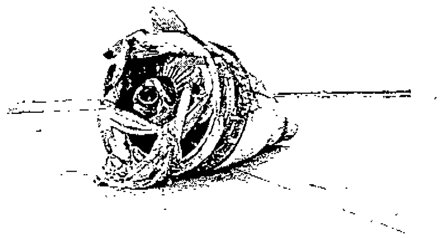
NO.1 ENGINE



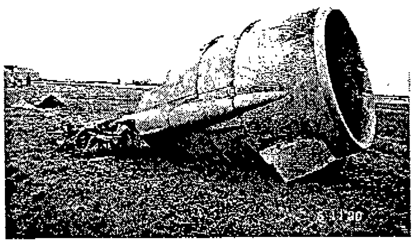
NO.2 ENGINE



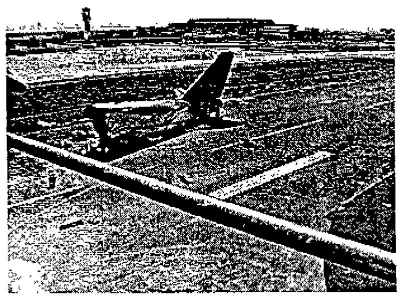
NO.3 ENGINE



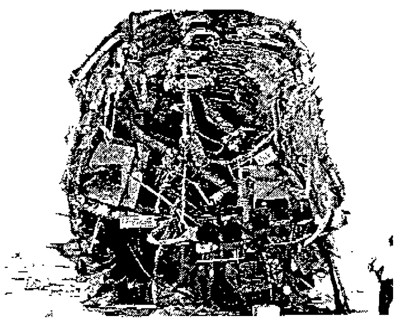
NO.4 ENGINE



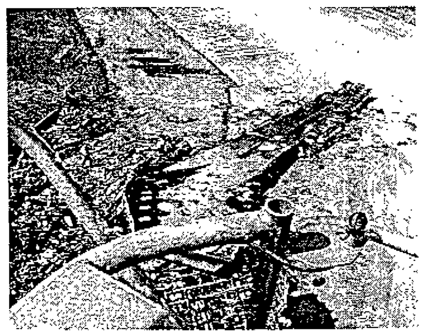
REAR PORTION OF THE FUSELAGE



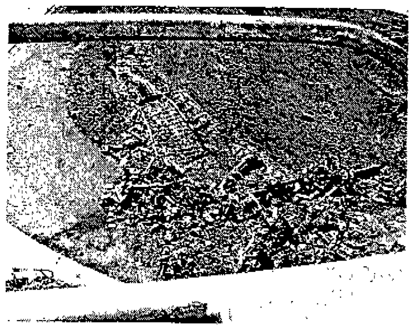
REAR PORTION OF THE FUSELAGE



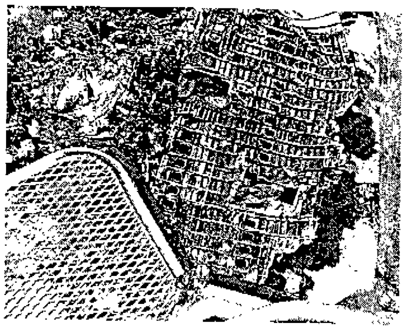
LEFT WING



RIGHT WING



FRONT FUSELAGE



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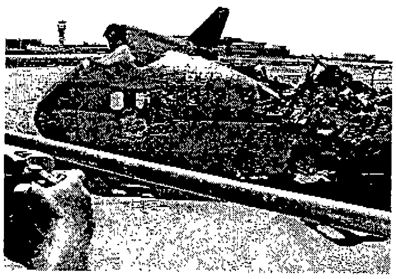


Establishment of Capability

In Accident Investigation

- FDR,CVR readout laboratory and analysis (operational since August 10, 1999)
  - 12 different cases this far.
- Training programs for accident investigators
  - NTSB,FAA,Cranfield,ATSB, SCSI Courses.
- Active collaboration with international accident investigation organizations
  - NTSB (U.S.A.) - TAB (Canada) - ATSB (Australia)
  - BEA (France) - AAIB (U.K.)

Establishment of Capabilities (Cont')

Pro-Active Flight Safety Improvement

- Confidential Aviation Safety Reporting System since Feb, 2000(TACARE) – Have received 33 reports.
- Accident,incident and anomaly Date Base and Flight Safety Trend Analysis (FSDB, August, 1999)
- Applied research in Human Factor
  - CRM and Management Culture
- Aviation Safety Information System/Library (Jan, 2000)
- International and domestic flight safety conferences (May 29~30, 1999, December 4~5, 2000), include a Cabin Safety session in the December conference.
- Held two Cabin Safety Discussions at ASC to emphasize the importance of this ignored issue.
- Will host 2002 ISASI conference in Taipei (Sept, 2002)

Conclusion

- Serious Incident investigation is even more important than accident investigation from safety improvement prospective. Must share information to the community as quickly as possible.

- Timely dissemination of data/information of a government investigation is vitally important.

- Investigation should be done in a transparent environment, should not be held as the event of a secret society.

- Must elevate the importance of the cabin crew in safety prevention and training. Prevention is always more important and effective than re-active post-accident investigation.

附錄六

國際航機客艙安全研討會展示資料

Course Modules And Contents

FlightSafety's CabinSafety Training program at the Savannah Learning Center consists of eight hours of training delivered in two four-hour modules. Module One, Emergency Situation Training, introduces emergency situations, equipment, and procedures in the Learning Center's multi-media equipped classroom. Module Two, General Emergency Drill Training, utilizes the Corporate Cabin Trainer, On-Water Egress Trainer, and other training devices to provide individualized, hands-on practice with emergency equipment within the context of realistic scenario-based training.

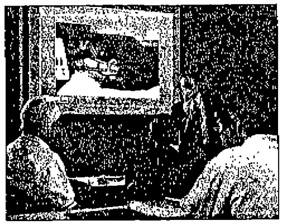
Emergency Situation Training/Equipment Review – 4 hours

- Crew Coordination
- Aircraft Fires
- Illness, Injury, and Basic First Aid (if applicable)
- Ground Evacuation
- Ditching
- Previous Aircraft Accidents/Incidents
- Crew Member Incapacitation
- Sea Survival
- Decompression

Emergency Drill Training – 4 hours

- Ditching (if applicable)
- Emergency Evacuation
- Fire Extinguisher and Smoke Control
- Operation and Use of Emergency Exits
- Crew and Passenger Oxygen
- Life Rafts (if applicable)
- Life Vests (if applicable)

PROFESSIONAL ENVIRONMENT. FlightSafety's CabinSafety Training Program is provided through special facilities within the Savannah, Georgia, Learning Center, a major simulator equipped pilot training center.



ADVANCED CLASSROOM TECHNOLOGY. Training in the Corporate Cabin Trainer is complemented by technology-aided classroom instruction and hands on training exercises.

ACCESSIBLE LOCATION. The Savannah location makes CabinSafety Training readily accessible from major cities with direct service, including New York, Chicago, Dallas, and other major hubs

For further information, please contact:

FlightSafety International
301 Robert B. Miller Road
Savannah, Georgia 31408

(800) 625-9369
Tel: (912) 644-1000
Fax: (912) 644-1096

www.flightsafety.com

FlightSafety International

FlightSafety International

CABINSAFETY TRAINING

Emergency Skills for Pilots

Underlying the conception and development of FlightSafety's CabinSafety Training Program is the premise that pilots are responsible for the safety of their passengers. And, further, that responsibility isn't limited to proficiency in flying the aircraft. It applies equally to preparedness for emergency situations in the aircraft cabin, where the passengers who place their trust in the pilots are seated.

Accordingly, CabinSafety is a course designed to prepare pilots for outside-the-cockpit emergency situations and the effective operation of emergency equipment.

So consider rounding out your training repertoire with CabinSafety Training. It is delivered with the same high degree of professionalism and detail as our flight training. And it offers the same essential benefit – help in being prepared for the unexpected.

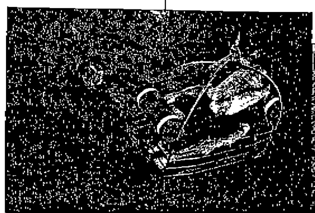
LIFE RAFT LAUNCH Pilots are trained to deploy the life raft in the pool at Savannah's CabinSafety Training Center

REALISTIC CONDITIONS. With the raft fully deployed, participants experience water evacuation procedures under realistic conditions, including rain on helicopter hoist exercises

Safety Beyond the Cockpit

Geared toward corporate pilots, FlightSafety International's CabinSafety Training Program extends the concept of on-board training beyond the cockpit to the cabin. Offered at FlightSafety's Savannah Learning Center, the intensive program prepares pilots and crew members to function in the safest and most effective manner possible during an on-board emergency. The course of training emphasizes the factors involved, as well as the actual procedures to be followed, when emergency situations occur.

The CabinSafety Training Program consists of eight hours of training offered in two four-hour modules. The modules include the full range of emergency situations, with topics that address such issues as illness and injury, ground evacuation, ditching, sea survival, and decompression.



ON WATER SCENARIOS Ditching exercises and helicopter rescue operations are simulated in the emergency training pool

EVACUATION TECHNIQUES Pilots practice evacuation techniques on the motion equipped Corporate Cabin Trainer

Effective Training Methodology

The training methodology employs hands-on, operationally oriented exercises in the effective use of emergency equipment and in prescribed emergency procedures. Course participants learn through repeated drills and role-playing scenarios in the classroom as well as through utilization of the Corporate Cabin Trainer and other custom training devices.

Sophisticated Technology

The Savannah Center's full-scale, motion-based Corporate Cabin Trainer is a significant training asset that – like a flight simulator – facilitates highly efficient and effective training. With its smoke, motion, and audio capabilities, the trainer provides a realistic environment in which to simulate a range of emergencies for which pilots can master the prescribed procedures. On-water egress training is conducted in the center's dedicated CabinSafety training pool with the use of a seven-seat egress trainer, which simulates evacuation from a sinking aircraft. Air rescue operations are replicated using a helicopter rescue hoist with a downwash system.

Acknowledging the role of pilots as the final on-board authorities, the CabinSafety program provides the emergency skills essential to a position of command beyond the cockpit.

SMOKE FILLED ENVIRONMENT. Experienced instructors guide pilots through the use of standard emergency equipment in the cabin mock up, which has the capacity to replicate smoke hazards.

RAPID EVACUATION. Course participants receive thorough training in the operation and use of emergency exits.

DEPRESSURIZATION DRILL A variety of emergency situations is simulated from the instructor station in FlightSafety's advanced Corporate Cabin Trainer.

Other Enrichment Opportunities

Other FlightSafety Professional Enrichment Courses include RVSM, High Altitude Training, International Procedures, Crew Resource Management (CRM), Weather Awareness, and Cold Weather Operations, among others. If you are interested in professional development opportunities, please contact any FlightSafety Learning Center to find out where our various Professional Enrichment Courses are offered.

Course Modules And Contents

FlightSafety offers three different levels of Flight Attendant Training at the Savannah Learning Center.

Initial Flight Attendant Training
(40 hours/5 days)
This course provides basic instruction on both safety and service procedures and includes modules on the following topics:

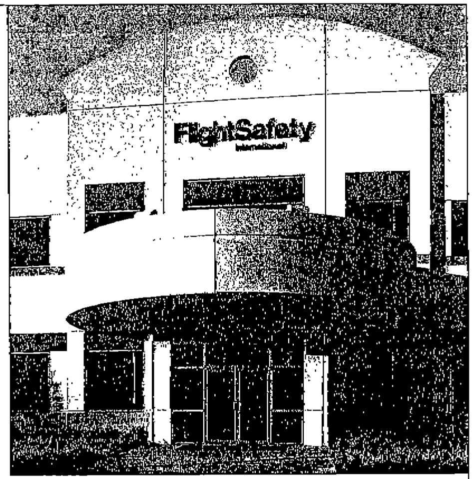
- Ground School/Aircraft-Specific Training
- General Emergency Training (Equipment, emergency situations, fire fighting, ditching, and Corporate Cabin Trainer drills)
- HAZMAT Recognition Training
- Introduction to Business Protocol and Service Procedures.

Recurrent Flight Attendant Training
(16 hours/2 days)
The recurrent course reviews the material taught in Initial Training safety modules and does not address service procedures.

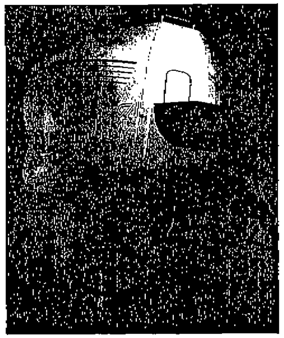
Advanced Service Procedures (1 day)
This course, which can be taken in conjunction with Recurrent Flight Attendant Training, expands on knowledge gained in the service module of Initial Training. It covers the following topics:

- Food Preparation
- Menu Planning
- Wine and Champagne Service (includes a wine tasting course taught off-site)

FlightSafety International's initial and recurrent training programs meet the regulatory requirements of Part 91 and can be modified to meet 135 requirements.



PROFESSIONAL ENVIRONMENT. FlightSafety's Flight Attendant Training Program is provided through special facilities within the Savannah, Georgia, Learning Center, a major simulator equipped pilot training center.



A DEDICATED AVIATION TRAINING FACILITY
Both pilots and flight attendants can gain proficiency at the Savannah Learning Center, which houses advanced training devices for all crew members

ACCESSIBLE LOCATION The Savannah location makes CabinSafety Training readily accessible from major cities with direct service, including New York, Chicago, Dallas, and other major hubs.

For further information, please contact:

FlightSafety International
301 Robert B. Miller Road
Savannah, Georgia 31408

(800) 625-9369
Tel: (912) 644-1000
Fax: (912) 644-1096

www.flightsafety.com

FlightSafety International

FlightSafety International

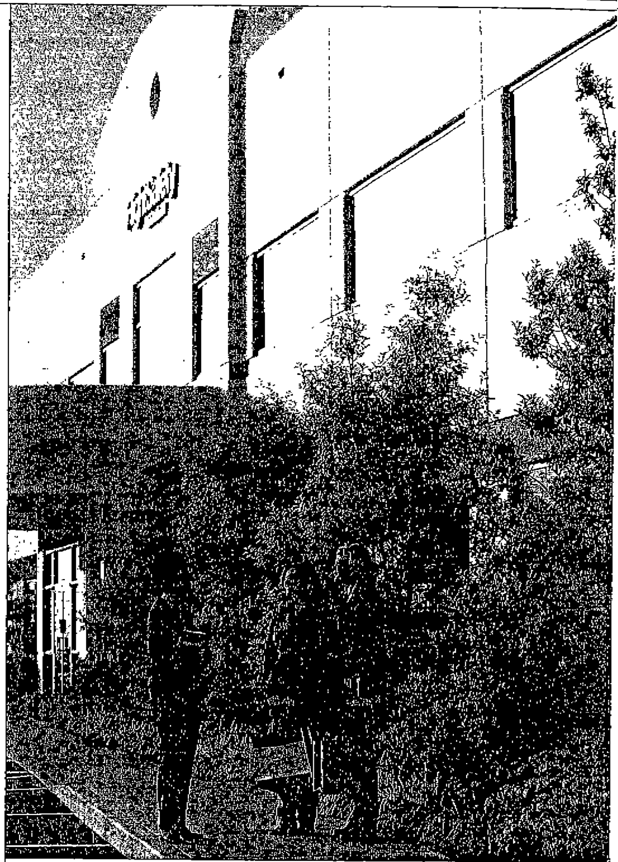
FLIGHT ATTENDANT
· T R A I N I N G ·

SAFETY AND SERVICE SKILLS FOR CORPORATE OPERATIONS

FlightSafety: The Leader In Training

For nearly 50 years, FlightSafety International has been the world leader in aviation training. At 42 sites throughout the world, 65,000 customers use FSI-built and administered training devices and programs each year, mastering the safe and proficient operation of complex, sometimes high-risk equipment. Interactive classrooms and realistic simulators prepare customers to handle any situation that comes their way. Whether pilots, ship's officers, or maintenance technicians, customers never expect the status quo – FlightSafety is constantly improving and upgrading its programs by adding more sophisticated Learning Centers, more advanced training technology, and more experienced instructors.

FSI's Flight Attendant Training programs meet the same standard of excellence. Tailored to meet flight attendants' needs, they address both safety and service. Hands-on experience on specially designed training devices reinforces knowledge gained in lively classroom sessions. With the dual responsibilities of flight attendants in mind, the Savannah Learning Center hosts both an on-water aircraft escape trainer and a fully operating corporate jet galley for food preparation and presentation by students. Courses are available at initial, recurrent, and advanced levels, and the result of the training program is proficiency at every level – from business etiquette to the handling of in-flight emergencies.



CAMPUS-LIKE SETTING. The Savannah Learning Center is a dedicated corporate aviation training facility where pilots, flight attendants, and even frequent passengers receive professional, comprehensive instruction on cabin safety.

PROGRAM MANAGER BETH GANLEY has over 11 years of corporate and commercial experience.

A Word from Beth Ganley

Professionalism defines corporate flight attendants. From the poise needed for serving wine to the confidence necessary for directing emergency evacuations, preparation is the key.

At FlightSafety's Flight Attendant Training Program, we understand the dual needs of safety and service. We offer initial training for beginners, and also offer recurrent training that builds on previous knowledge. Through interactive classroom sessions and hands-on use of realistic training devices, our courses reinforce and refine flight attendants' skills.

And it all takes place in a great environment. The Savannah Learning Center provides a comfortable, professional setting where flight attendants can focus solely on receiving the most effective and efficient training.

If you choose to complete your training at FlightSafety, I think you'll find our program professional and comprehensive, and the knowledge gained useful throughout your career.

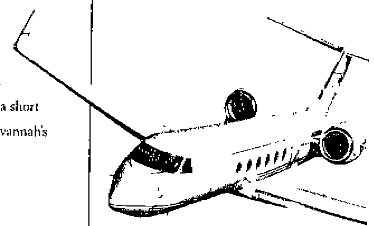
–Beth Ganley

Welcome to the Savannah Learning Center

FlightSafety's Savannah Learning Center is dedicated to business aircraft training. It serves as one of the prime Gulfstream training sites and is located next to the aircraft's headquarters and production facility, which ensures that pilots and maintenance technicians have access to the latest information. The emphasis on accuracy is also seen in the Flight Attendant program – by using the most realistic equipment available, FlightSafety provides the most effective training.

The Savannah Learning Center includes the following equipment and amenities: full-motion Corporate Cabin Trainer with audio, motion, and smoke capabilities, On-Water Egress Trainer; Galley Trainer; dedicated classrooms; experienced instructors; workout facilities; cafeteria; business center with Internet access, fax, and copy machines; salon; and library. The Learning Center is also just a short distance away from hotels and Savannah's historic district.

FULL-SERVICE FACILITIES Conveniences such as a business center and workout room allow customers to maintain their daily schedules as they train



ON SITE CAFETERIA. The Savannah Learning Center's cafeteria is just one of the amenities that make for a pleasant training experience

Professional, high-quality service is the mark of a corporate flight attendant. Beyond the duties of assuring passenger safety lie the nuances of business protocol and service procedures. To address this need, FlightSafety's Flight Attendant Training Program provides cabin attendants with comprehensive instruction and hands-on practice in business relations, visual poise, the operation of a corporate jet galley, and the presentation of food and wine. Keeping with FSI's emphasis on interactive training in a realistic environment, the Savannah Learning Center offers a fully operating galley, where customers gain proficiency in the preparation and presentation of food and beverages. With both initial and advanced training courses, FSI introduces new skills and polishes existing ones.

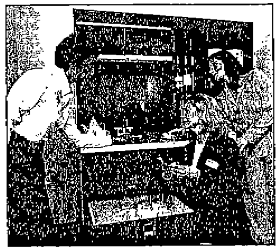
ETIQUETTE AND PRESENTATION The Savannah Learning Center's Galley Trainer has the same equipment as most corporate aircraft, which means flight attendants practice preparing and presenting hors d'oeuvres and meals they could duplicate in their own facilities.

SERVICE RESPONSIBILITIES Initial and Advanced Training courses provide instruction on food presentation and business etiquette.

Initial Service Training

The initial in-flight service procedures training module introduces flight attendants to a variety of dining services and techniques, as well as in-flight duties and responsibilities, etiquette and protocol, grooming, and time management. In this course, topics include food handling, table settings, garnishing, plate presentation, wine and champagne presentation, and caviar service. With the rise of the global marketplace, both initial and advanced courses also address cultural and religious awareness.

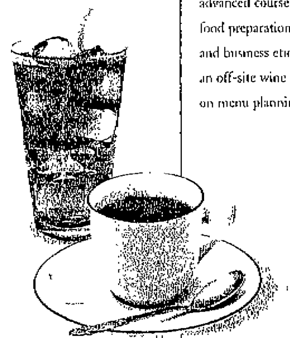
WINE SERVICE Both Initial and Advanced Training courses teach the proper form for wine and champagne presentation. The second class includes wine tasting, which allows flight attendants to expand their menu planning skills.



GALLEY TRAINING Through hands-on experience, flight attendants become familiar with the operations of a corporate jet galley and learn time management skills.

Hands-On Experience

At the heart of quality in-flight service is familiarity with equipment and procedures. To that end, training in food preparation and presentation utilizes a new Galley Trainer, which replicates the facilities available on most corporate aircraft, including counter-top skillets and a microwave oven.



COLLEGIAL ATMOSPHERE Interacting with other corporate flight attendants and sharing experiences serves as an important component of FSI training.

Advanced Service Training

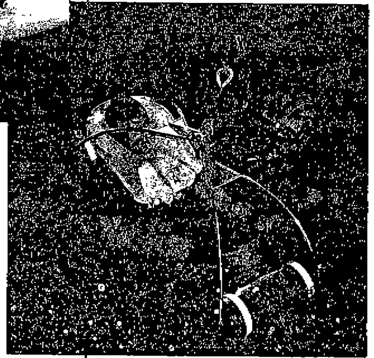
Since many of the flight attendants entering the program have years of professional experience, FlightSafety's advanced training builds on customers' knowledge in order to address the finer points of service. Along with reviewing the topics covered in initial training, the advanced course expands the knowledge of food preparation, dining service, wine service, and business etiquette procedures. It includes an off-site wine tasting course and instruction on menu planning.

Underlying the conception and development of FlightSafety's Flight Attendant Training Program is the premise that flight attendants are responsible for not only the comfort but also the safety of their passengers. While excellent service skills may be called upon on a daily basis, the ability to assess and address in-flight emergencies is of equal – if not greater – importance.

The second part of FSI's training program is therefore designed to prepare flight attendants for the unexpected. In both initial and recurrent training sessions, participants receive instruction on handling emergency situations and equipment in the classroom, and then reinforce their knowledge through hands-on practice in real-life scenarios. The resulting familiarity with procedures creates confidence in handling a full range of emergency situations.

ON-WATER EVACUATION Flight attendants practice crew coordination as they deploy the life raft in the Savannah Learning Center's pool.

REALISTIC CONDITIONS Rain simulation on helicopter hoist exercises provides a realistic environment for practicing water evacuation



Preparing for the Unexpected

The safety portion of FSI's Flight Attendant Training Program emphasizes the different factors involved, as well as the actual procedures to be followed, when emergency situations occur. In both Initial and Recurrent Training, modules address the full range of emergency scenarios, from passenger illness and injury to aircraft fires, hazardous materials, ground evacuation, ditching, sea survival, hypothermia, and decompression. The course also focuses on crew coordination in order to ensure a quick and efficient handling of any emergency.

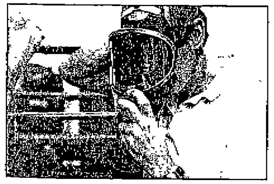
OVER THE-WING CABIN EGRESS. Customers practice evacuation techniques on the life-sized, motion-equipped Cabin Trainer

ON WATER SCENARIOS Through hands on practice, flight attendants become familiar with the use of flotation equipment and the procedures for water survival

CABIN DOOR TRAINING Experienced instructors guide flight attendants through emergency exit door operation in the cabin mock up before moving on to other ground evacuation procedures

Training Methodology

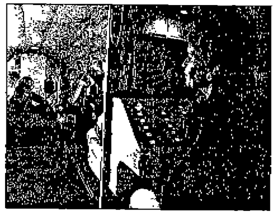
FSI's training system follows the belief that familiarity and repetition create proficiency. FlightSafety thus employs hands-on, operationally oriented training in emergency equipment and procedures. Through repeated drills and role-playing scenarios in the classroom as well as utilization of the cabin simulator and other training devices, customers gain the knowledge and experience necessary to address any unexpected scenario while on board.



REAL EQUIPMENT Through various role-playing scenarios, flight attendants practice using actual emergency gear, such as Personal Breathing Equipment

Sophisticated Technology

Realism is the key to effective safety training at FlightSafety. The Savannah center's full-scale Corporate Cabin Trainer – with smoke, motion, and audio capabilities – creates a lifelike environment for simulating a range of emergencies and provides flight attendants with efficient instruction. The seven-seat ditching trainer, which simulates evacuation from a sinking aircraft, provides on-water egress training, and air rescue operations are replicated using the helicopter rescue hoist.



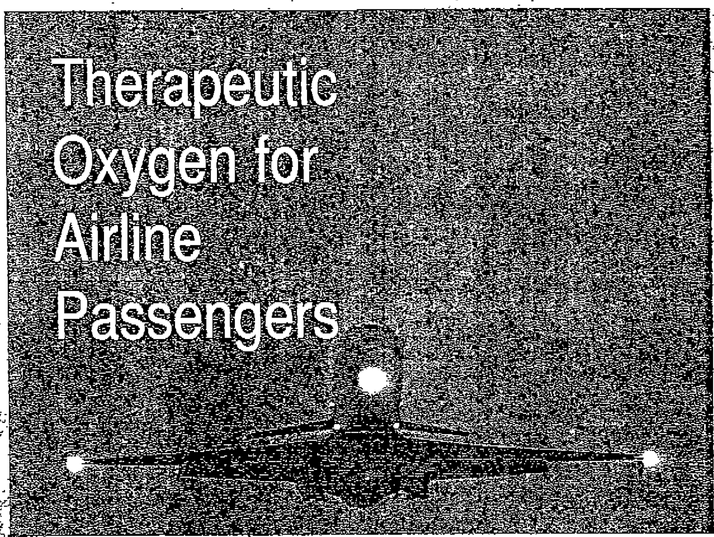
COMPREHENSIVE EMERGENCY TRAINING A variety of emergencies – including cabin depressurization – can be simulated from the instructor station in the Corporate Cabin Trainer

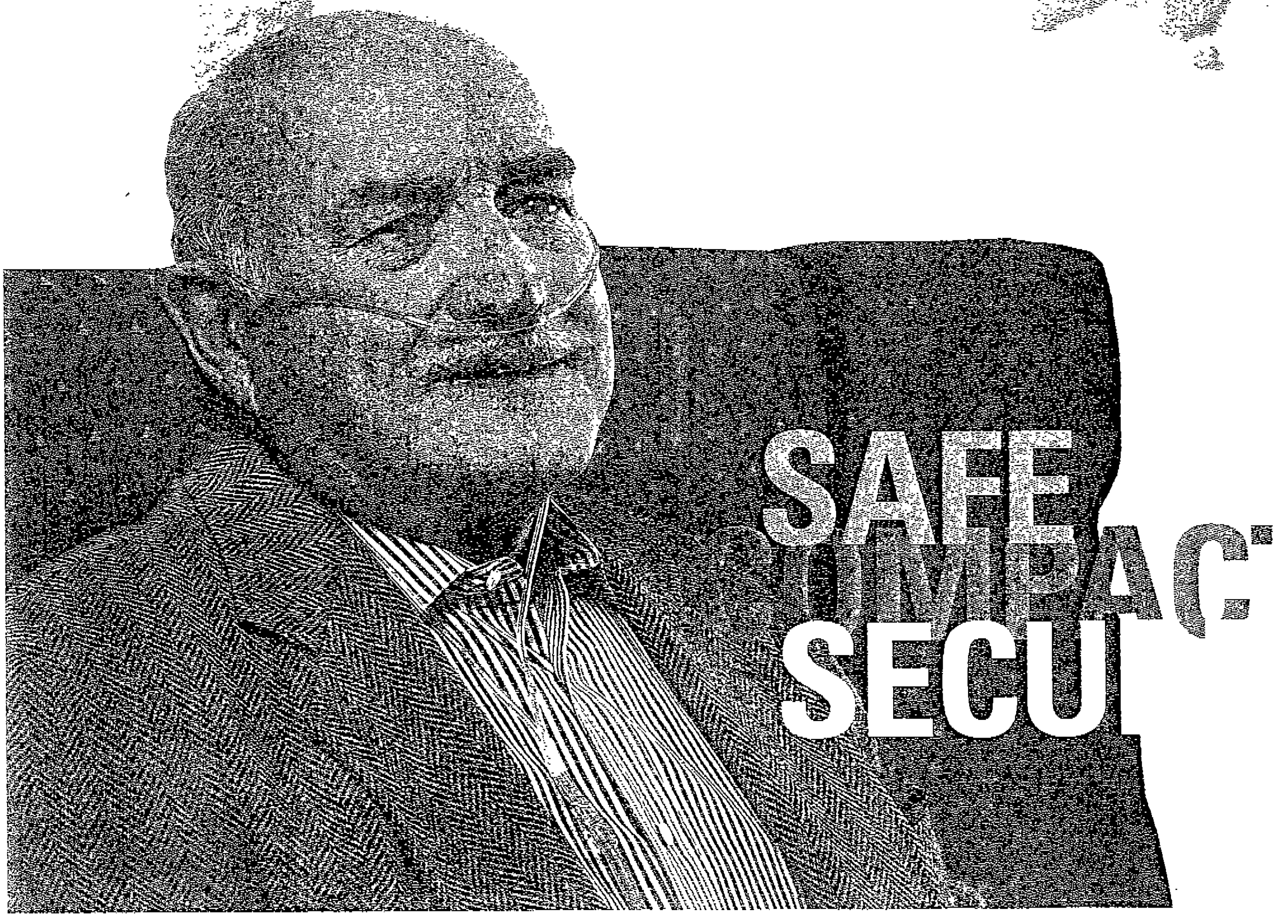
HANDS-ON PRACTICE. Participants in the training program learn first aid skills and become familiar with the procedures to follow in case of illness or injury

FIRE FIGHTING. After reviewing the equipment in the classroom, course members put it to use in controlled environments.

Oxygen Concentrators

AIRLIFE





In-Flight Oxygen from AirLife™

ON BOARD OXYGEN

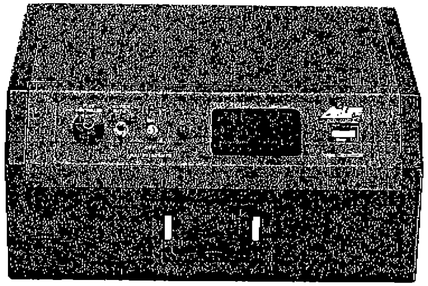
AirLife by AirSep®

o more hazardous
/linders with AirLife's
ygen-on-demand
oncentrators.

The AirLife unit can also provide aerosolized medication nebulizer treatments.

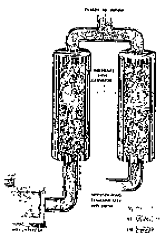
Therapeutic Oxygen for Airline Passengers

Every airline is confronted with difficult decisions about providing oxygen to passengers with chronic lung conditions or other diseases that require continuous oxygen in flight. In the past, many airlines have declined to provide this service, but increasingly, public expectations and legislative measures around the world are making it unacceptable or illegal to discriminate against passengers disabled by lung diseases.



Compressed oxygen cylinders are a cumbersome and costly choice to meet these requirements. For extended flights, several portable cylinders or one large fixed cylinder (sometimes more) is needed. The time required to install these cylinders in the cabin, transport them as dangerous cargo before and after use, service, and recharge them is considerable. Some installations block out revenue-generating seats, and all represent a safety hazard from compressed oxygen.

The AirLife™ Oxygen Concentrator overcomes these difficulties in a compact device — designed and constructed specifically for airline use. It is built to the highest aircraft standards by AirSep® Corporation, the largest manufacturer of medical and industrial oxygen concentrators in the world.



Using aircraft electrical power, AirLife continuously provides oxygen at up to 5 liters/minute, and is backed by a 3-year – 3,000-hour warranty.

Advantages of AirLife

Flexibility

- AirLife units need minimal maintenance and no recharging. Therefore, they can be located at airports without oxygen-servicing facilities.
- Can be safely stored in airport terminals and conveniently carried onto aircraft when required.
- Can be powered from standard 110 VAC; transformers available if operated on 220-240 VAC.

Easy Installation

- AirLife units can be slid under an economy seat from the front or rear.
- Installation and testing take less than 5 minutes.
- Trained ground staff, other than aircraft engineers, may install AirLife units.
- Minimum disruption for airline staff and passengers during tight turn-arounds.

Secure, Safe, Unobtrusive

- No loss of revenue-generating seats or overhead storage.
- Can be secured to seat tracks independently of seat.
- Unobtrusive/protected from inadvertent damage by seat structure.
- Less than 1 liter of oxygen in the unit at any time.
- Maximum pressure in unit is less than 30 psi.

Quality Service for Passengers

- Discrete supply for passengers requiring oxygen.
- 1–5 lpm oxygen for all therapeutic oxygen requirements.
- Nebulizer setting for passengers who require inhaled medication.
- Flow rates are easily adjustable by passenger or crew in flight.
- Unit operates continuously despite delays and prolonged transit stops — passenger feels secure that oxygen cannot run out.
- May be used with electronic ventilators if necessary.

AirLife concentrators fit under economy seats with safe and easy installation.

AirLife's compact design allows ease of handling to and from the aircraft.

AirLife™ Specifications

Size:
8.5 in. H x 19.0 in. W x 14.0 in. D
(21.6 cm H x 48.3 cm W x 35.6 cm D)

Weight:
42 lbs (19.1 kg)

Power consumption:
350 watts (average)

Power supply:
108–132 VAC, 40–480 Hz

Environmental conditions:
Demonstrated to meet the following DO –160C Conditions:

Temperature and Altitude: CAT. A1

Crash Safety: Full Compliance

Magnetic Effects: CAT. C

Voltage Spikes: CAT. A

Emission of RF Energy: CAT. Z

Operating temperature range:
50–100°F (10–38°C)

Oxygen outlet:

Flow	Purity
1–3 lpm	92% min.
4 lpm	90% min
5 lpm	80% min.

Altitude range:
Normal: 0–15,000 ft

Rapid depressurization:

8 K ft to 25 K ft in 5 seconds

8 K ft to 40 K ft in 20 seconds

Unit continues to operate with no effect on performance below 15,000 ft

Alarms:
Audible alarm for:

Power supply failure/disconnect

Internal air temperature > 125°F (52°C)

Low oxygen output pressure

Protection:
Re-setable mill-spec circuit breaker

Shutdown if motor temperature > 185°F (85°C)

Operation
AirLife is a twin-bed molecular sieve oxygen concentrator: Cabin air is compressed and directed by a solid-state controlled solenoid valve to one of two low pressure cylinders (beds) containing an inert ceramic material called molecular sieve. Molecular sieve selectively adsorbs nitrogen from air, leaving oxygen and a small percentage of inert gases. When the sieve bed is saturated with nitrogen, the bed is depressurized and purged with a portion of the oxygen to regenerate the bed. The remaining oxygen is supplied as product. Two sieve beds operate alternately for continuous operation. Molecular sieve never needs replacing, and there is no effect on cabin oxygen levels.

Maintenance
Recommended Maintenance:

Every 500 hours:
- Check oxygen purity and flow
- Check internal security
- Replace internal battery if required
- Wash foam inlet filter if required

Every 10,000 hours:
- Replace bacteria filter
- Overhaul compressor

Hand held oxygen purity sensors and flowmeters available.
Compressor overhaul service available.

Warranty
AirLife Oxygen Concentrators have a 3-year/3,000-hour parts and labor warranty from AirSep® Corporation. Details available upon request.

Approvals:	Eligibility:
STC	B767 – 200/300
FAA-PMA	B747 – 200/400

AIRSEP®

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AirSep Corporation
401 Creekside Drive
Buffalo, NY 14228-2085 USA
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Fax: (716) 691-4141
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HEALTHWATCH™
Commercial Aviation
January/February 2001

Liability Plan Tackles In-Flight Medical Concerns

Over the past four years MedAire statistics are showing a gradual decline in the availability of onboard medical volunteers during an in-flight medical emergency. Whether they are afraid of getting sued or just simply feel that it is not their duty to be on call 24-7, not all medically trained personnel will come forth in a medical emergency.

In fact, on two recent flights doctors who were onboard as passengers refused to assist fellow passengers who were in need of medical attention.

So, should a medically trained crewmember or passenger feel comfortable assisting in a medical emergency? More importantly, if they do, is there any liability protection available to help ease that decision?

The answer to both questions is yes, provided that the crewmember and/or passenger are acting under the direction of a MedLink® physician.

MedAire offers protection against potential legal and financial liability under its comprehensive Professional and General Liability Insurance Program. The liability coverage states:

Any licensed medical personnel assisting with a medical emergency onboard, acting at the direction of MedLink's physicians will be covered by MedLink's professional liability insurance, except where the onboard provider is found to have been grossly negligent or to have committed an illegal act or intentional tort.

(Continued Next Page)

Safety Spotlight

Knowing When to Divert an Aircraft

Actual Situation: A 61-year-old male passenger is traveling from Japan to London when he begins vomiting, sweating and complaining of abdominal pain. The flight crew calls MedLink.

An onboard doctor, who does not speak English, comes forward to help. Speaking through an interpreter, MedLink and the physician analyze the situation and recommend an I.V. fluid and medication.

The flight crew then consults with MedLink about a possible diversion to nearby St. Petersburg, Russia. MedLink advises against diverting to that area due to a lack of adequate medical resources. MedLink identifies that Helsinki would be a more suitable diversion destination, but recommends re-evaluating the passenger before making a decision to divert.

Result: After receiving the fluids and medication, the passenger's condition stabilized and the flight continued to London. MedLink coordinated medical response to meet and evaluate the passenger upon arrival. The passenger was transported to a local hospital where he was treated and released for dehydration.

MedAire® Advice: Don't be concerned about language barriers when enlisting the help of volunteers. If a qualified medical professional is available, MedLink has the resources to translate any language.

If a medical diversion is necessary, be sure proper medical resources are available on the ground. Sometimes the closest diversion point is not necessarily the best and the passenger may be better off continuing to another destination.

Cabin Air

Many passengers, particularly in winter, become sick after flying. Often the blame is attributed to plane ventilation. But does circulated cabin air really put passengers in danger of catching a cold, flu or some other infection? According to the December issue of the *UC Berkeley Wellness Letter*, the answer is no – with a more likely cause being fellow passengers.

More and more people are flying, and MedAire statistics show more and more sick people are getting on planes. Passengers can get ill by breathing what other passengers are sneezing or coughing, but percentages go up when hand-to-hand contact is involved.

The *Wall Street Journal* recently tested the air on flights of 11 different carriers.

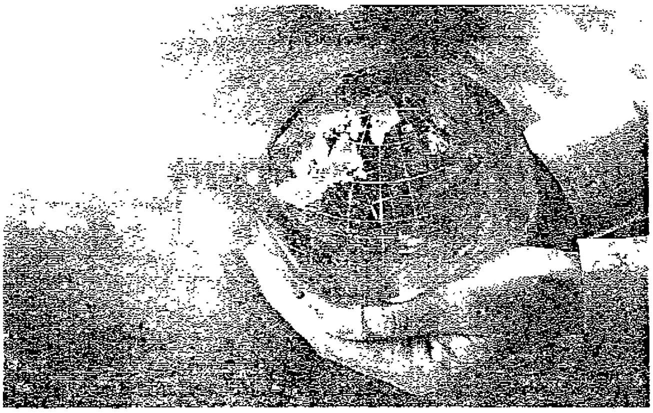
(Continued Next Page)

HEALTHWATCH™
A SERVICE OF MEDAIRE INC. -- 1301 E. McDowell Rd. Suite #204 -- Phoenix, Arizona 85006
Telephone: (602) 452-4300 -- Fax: (602) 252-8404 -- E-mail: info@medaire.com -- www.medaire.com

Expert care, everywhere.™

MedAire Commercial Training

Airline instructors will learn the information and skills necessary to effectively teach CPR, safely use the automated external defibrillator and to train additional crew about managing inflight medical emergencies.



For more than 15 years, MedAire has trained thousands of flight personnel who have consistently provided positive training feedback.

Aviation Based Experience – MedAire. Inc. was the first ever to create a manual for managing inflight illness and injuries and has played a key role in providing expert information to the FAA's Civil Aeromedical Institute (CAMI). MedAire's recent contract to train United Airlines' 26,000 flight attendants in AED use and CPR illustrates the company's ability to consistently arrange, coordinate and deliver its training in multiple locations – domestically and internationally. An elite core of instructors with an average of 10 years critical care background and teaching experience are the heart and soul of the training department.

Train the Trainer & Flight Attendant Courses – MedAire provides both Train the Trainer and Flight Attendant Training courses for instruction in the following:

- Automated External Defibrillators
- Assessment
- Bloodborne Pathogens
- Management of Inflight Illness and Injury

Real Life Scenarios

MedAire engages flight attendant interest and attention by incorporating actual inflight medical situations into its information. These real case histories come from the company's Emergency Telemedicine Hotline – but MedAire can also utilize experiences from your airline's flights as well.

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www.medaire.com

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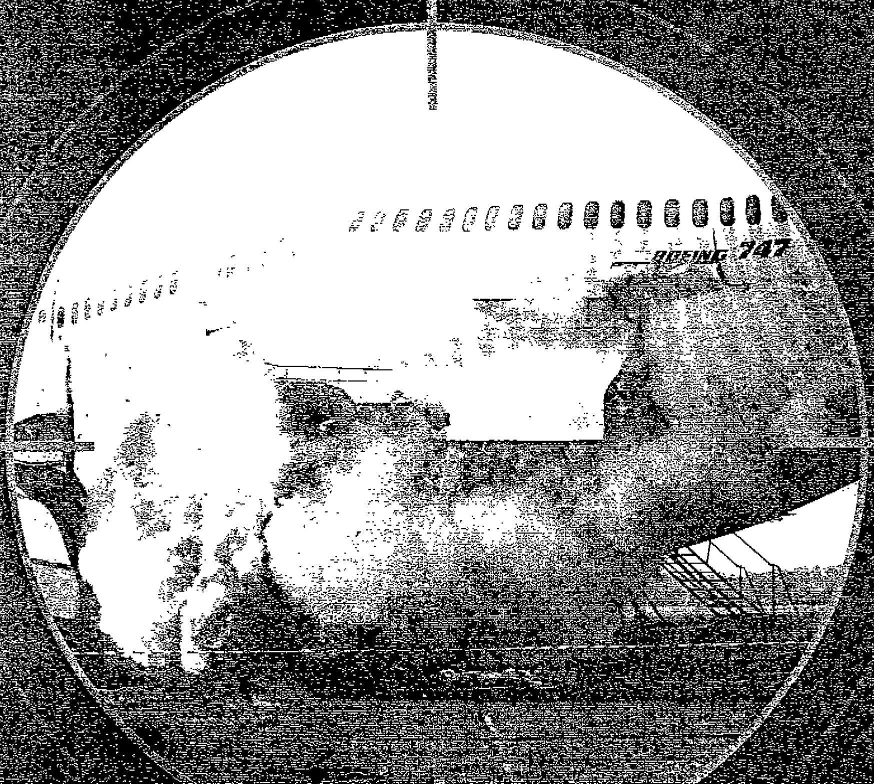
AVIATION security international

The Journal of Airport & Airline Security



Human Cargo: trafficking by air

Annex 17: security standards

Aircraft Hardening: advances and prospects

Airport Policing: training issues and challenges

AVIATION SECURITY AWARDS: The Winners

DECEMBER 2000
VOLUME 6 ISSUE 6

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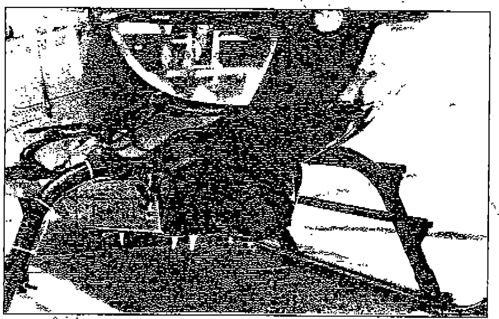
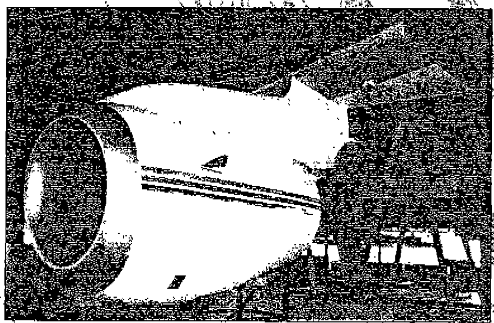
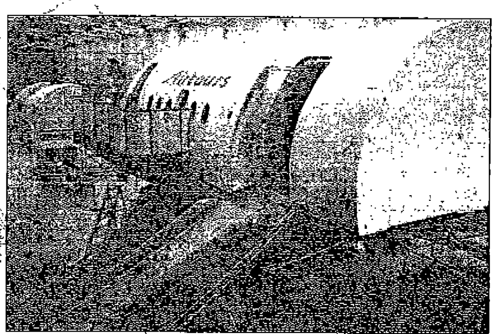
design & manufacture of engineered composite components and assemblies



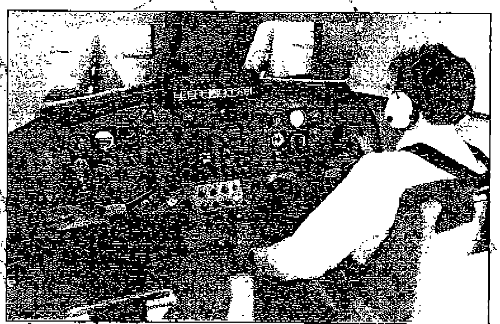
carbon fibre underbelly cowling for Eurocopter EC135 helicopter



glass fibre replica of BAe 146 engine pod



cabin evacuation trainer under assembly



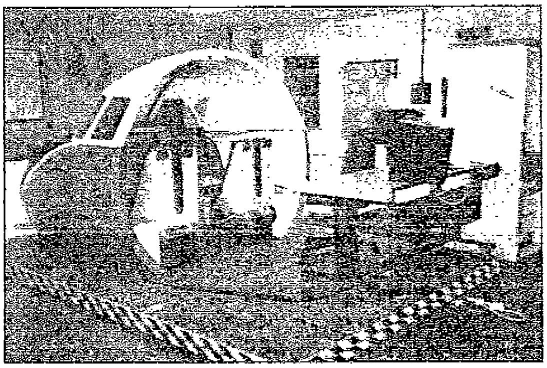
RAF Astazou T Mk 1 Jetstream instrument trainer

TECHNOLOGIES

COCKPIT FABRICATION

RP Technologies Plc is an established. UK based technology company focussed on delivering high quality solutions to the aviation training systems market. The company recognises that many flight simulator manufacturers seek innovative and cost effective solutions for replica aircraft cockpits for which RP Technologies has developed a unique capability RP Technologies has supplied replica cockpits to the major flight simulator manufacturers for both civil and military applications.

JETSTREAM 31 INSTRUMENT TRAINER



SCOPE

In 1996, RP Technologies was selected by Farnborough based Data Sciences Ltd to supply the following main hardware components to the Royal Air Force Jetstream Instrument Trainer programme:

- J31 cockpit structure and associated plinth
- Instrument panel overlays, flying controls and seating
- Digital and analogue interface hardware
- Cockpit sound and intercom system
- Off-board instructor console

KEY FEATURES

- Full size GRP cockpit moulding taken from actual aircraft
- Fully functional flight controls with PC based closed loop digital force feedback system
- Detachable cockpit panels to facilitate wider student observation
- Highly realistic instrument panel overlays to match the curvature of the CRT's simulating the left and right main flight instruments. Panels were fitted with colour-matched bezels, appropriately placed knobs, switches and lights coupled with an appropriate electrical interface
- Mountings and wiring for two 25" visual system monitors
- Accurate, plastic covered, photographic representation of non-functioning panels and controls
- Refurbished, fully functioning aircraft seats
- Highly realistic sound distribution for simulated equipment and aircraft noises
- Ergonomic and easy to use mobile instructor console

TECHNOLOGIES

PRESS RELEASE

For immediate release

RP Technologies' A330 Cabin Crew Training Simulators Enter Service with British Midland Airways Ltd

Two high specification A330 Cabin Crew Training Simulators designed, developed and manufactured by RP Technologies entered service with British Midland this month. They were installed at British Midland's prestigious new training centre at London Heathrow and will provide the backbone of the practical training required in preparation for the new transatlantic service launching summer 2001.

The A330 Cabin Service Simulator is a seventeen metre section of fuselage with a high fidelity replica cabin interior comprising three fully operational galleys, seating for up to fifty passengers configured in two cabin classes and a main entry door. Functional systems include lighting, public address and passenger service units. An on-board instructor's console provides full control of the device including a closed circuit video monitoring system for crew debriefing.

The A330 Door Simulator is a five metre half section of fuselage comprising a main entry door and high fidelity replica cabin with functional attendant seats, attendant panels and passenger seating. It is mounted on a steel platform and has a permanently inflated slide enabling both door operation and slide emergency egress training. The door, operational in all modes, is a purpose designed replica with a unique computer control system enabling simple insertion of training malfunctions and ensuring high reliability, simple maintenance and improved training management. A second slide was also provided for wet drill training.

The simulators entered service on schedule following a very short design and manufacture period. This success was achieved through the close working partnership between the British Midland and RP Technologies teams.

RP Technologies offers innovative modular systems for all types of cabin crew practical training ranging from a floor standing door simulator to a fully replicated cabin/ flight deck on motion.

For further information
please contact info@rp-technologies.com
or visit www.rp-technologies.com

26 Jan 2001

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RP TECHNOLOGIES

Cabin Crew Training Solutions

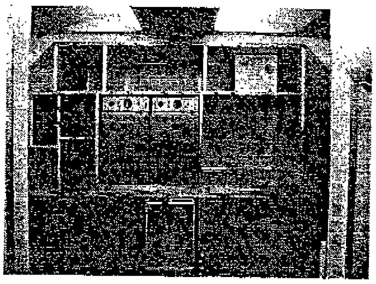
Whatever your practical training needs........

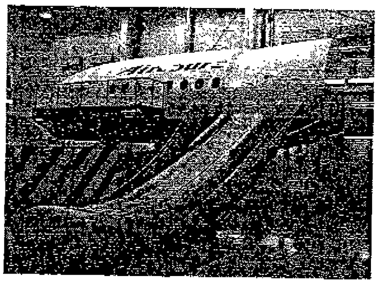
- Door operation and slide egress
- Cabin safety and emergency evacuation
- fire fighting
- operation in a smoke environment
- flight crew incapacitation
- crew resource management
- galley operation and cabin service

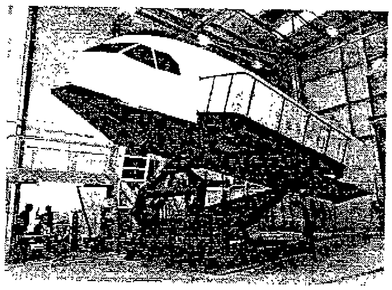
........RP Technologies offers you a choice of innovative, modular training simulators ranging from a simple, floor standing, door to a fully replicated cabin and flight deck on a motion system.

We utilise some of the latest fabrication techniques and have developed a unique computer driven door control system to maximise training transfer and ensure low cost of ownership.

Above all, we customise these robust engineering systems to deliver **training solutions** specific to your organisation's needs.







Visit RP Technologies on Booth #10 at the SCSI Aircraft Cabin Safety Symposium, 12-15 February 2001

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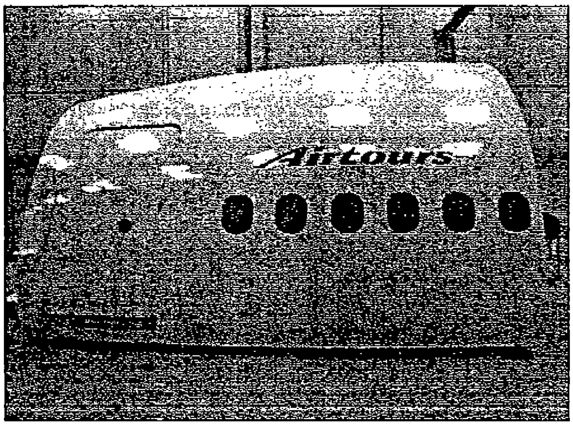
DOOR TRAINERS

RP Technologies Plc is an established, UK based technology company focussed on delivering high quality solutions to the aviation training market. The company recognises that quality and safety conscious airlines seek a cost effective approach to emergency evacuation training, for which this low cost door trainer has been developed. The door trainer complements RP Technologies' range of modular evacuation training systems.



TRAINER SCOPE

The training requirements fulfilled by RP Technologies' Door Trainer include:

- Internal and external door operation in manual, electric and emergency modes
- Use of cabin attendant's seats and panels
- Emergency evacuation drills

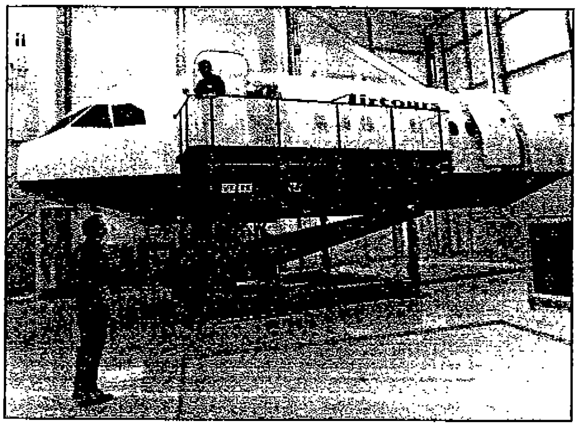
KEY FEATURES

- Fully computerised digital closed loop servo-mechanism controlling both door hinge and handle control movement
- Software door model providing accurate forces to the servo mechanism to aid/oppose user input and produce realistic feel under all normal operating and malfunction conditions
- Door interior and exterior handles, up latch lock and door assist handles, door armed indicators, door arming mechanisms and manual slide inflation handles
- Aural cue on slide deployment
- Cabin sections with an accurate fuselage profile painted in the buyers' livery and highly realistic internal fittings, including passenger and attendants seating, emergency equipment stowage, passenger service units, overhead stowage bins, cabin lighting, emergency and escape path lighting, as required
- Cabin attendants panels with functional door operation controls, as per aircraft type
- Full digital computer control and malfunction simulation

TECHNOLOGIES

EVACUATION TRAINING SYSTEMS

RP Technologies Plc is an established, UK based technology company focussed on delivering high quali solutions to the aviation training market. The company recognises that quality and safety conscious airlin seek a cost effective approach to cabin evacuation training, for which a new, modular training system ha been developed. High fidelity interior replication and unique computer controlled door systems provide realistic environment to maximise training transfer.



TRAINER SCOPE

The training requirements fulfilled by RP Technologies range of Evacuation Training Systems include:

- Cabin familiarisation training
- Door operation
- Emergency evacuation drills
- Smoke training
- Flight crew incapacitation training

The trainers are of a modular design enabling the configuration to be selected to meet specific airline training requirements. One trainer may be constructed to serve multiple aircraft types, if required.

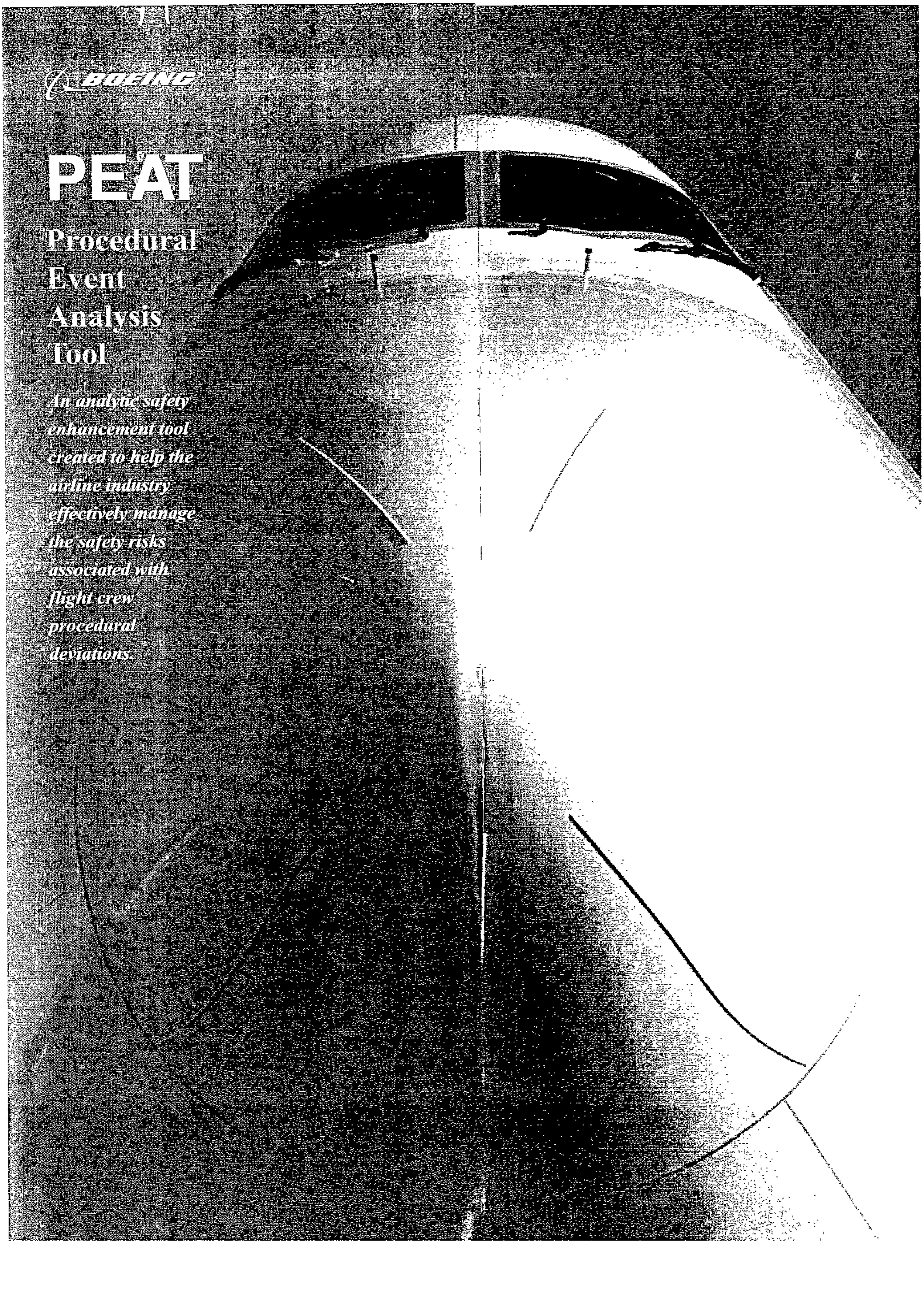
KEY FEATURES

- Full size cockpit and cabin section with realist fuselage profile in buyer's livery
- Highly realistic internal fittings, including sc furnishings, passenger seating, passeng stowage bins, emergency equipment stowag passenger service units, and cabin lighting
- Functional attendants seats and harnesses
- Fully functional passenger and emergen doors, as required, fitted with a computeris digital closed loop servo-mechanism und software control to provide realistic door hin and handle movement
- Software controlled door malfunctions
- Galleys, lavatories and partitions
- Emergency and escape path lighting ar luminescent strips
- Fully functional PA and interphone systems
- Air conditioning
- Smoke generation and extraction system
- CCTV monitoring
- Optional motion system

附錄七

波音飛機製造公司

人因飛安事故調查工具簡介



BOEING

PEAT

Procedural Event Analysis Tool

An analytic safety enhancement tool created to help the airline industry effectively manage the safety risks associated with flight crew procedural deviations.

"It is unacceptable to conclude an event with the statement: 'If only the flight crew or maintenance crew had done what they were supposed to do'."

Phil Condit
Chairman & Chief Executive Officer,
The Boeing Company

BACKGROUND

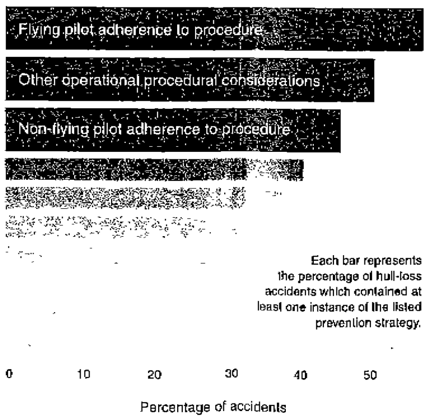
In 1991, Boeing began an effort to review commercial airplane accidents and develop accident prevention strategies. A few vital, high-payoff prevention strategies were identified. Results of the effort showed that the prevention strategy that could have prevented the greatest number of accidents proved to be one involving flight crew adherence to established procedures. The results also indicated that more than 50 percent of all hull-loss accidents could have been prevented by following this strategy. Unfortunately, the reasons behind flight crews deviating from procedures are poorly understood.

While accident analysis has provided some benefit in preventing certain types of accidents, this approach has not led to a significant decrease in the overall hull-loss accident rate over the past 20 years. Today, procedurally-related incidents occur at a much higher rate than accidents. The sheer number of incidents provides a greater opportunity for investigation and increased safety.

Though experts in aircraft operation are skilled at investigating operational or system-related incidents, they often lack the knowledge to address human errors and their contributing factors. Fundamental to the concept of Procedural Event Analysis Tool (PEAT) is the belief that procedural errors are seldom random; instead, they can be traced to causes and contributing factors that can be identified and eliminated.

PEAT was developed and validated with the participation of a multi-cultural team comprising representatives of eight airlines in Asia, Europe, and North America as well as Boeing and the International Federation of Air Line Pilots Association

ACCIDENT PREVENTION STRATEGIES



Each bar represents the percentage of hull-loss accidents which contained at least one instance of the listed prevention strategy.

A New Safety Tool

PEAT

PEAT is made up of three components:

- A process
- Data storage
- Analysis

The process consists of a sequence of steps that guides the airline safety officer through an investigation. Incident information (data) is captured and stored on the PEAT form. The contents of this form are then electronically entered into a Microsoft Windows-based PEAT database application for future trend analysis.

Boeing developed PEAT to address the human performance factors that must be considered during the investigation of a serious incident. It is designed to be used by a trained safety officer. The application of PEAT will assist with the investigation of specific types of incidents (e.g., those involving non-adherence to procedures.) Unlike other available tools the PEAT process focuses on key event elements and identifies key underlying cognitive factors that contributed to the procedural deviation. The objective of the process is to help the investigator to arrive at valid, effective recommendations aimed at preventing the occurrence of similar types of procedural deviation.

PEAT has been designed to significantly change how incident investigations are conducted. It relies heavily on the investigative philosophy that professional flight crews very rarely fail to comply with a procedure intentionally, especially if doing so is a safety risk. Effective implementation of PEAT requires airlines to explicitly adopt a non-jeopardy approach to incident investigation. In other words, the flight crew is not subject to punishment or disciplinary action unless they act recklessly. Using PEAT shifts the focus of the investigation away from who caused the event and toward why the event occurred.

IMPLEMENTATION

Boeing will make PEAT available to the airline industry in 1999. Effective adoption and application of the PEAT process and software requires hands-on training. Training and implementation will be conducted on a "first come, first served" basis at airlines and can be coordinated through Boeing Flight Technical Services (address on back), each airline's Boeing Field Service representative or Flight Operations Engineering. This will allow airlines to reserve specific training slots throughout the year. As part of the implementation plan, airline senior management will be offered an overview of the PEAT philosophy and process, the organizational support required, and a model for successful implementation. To encourage flight crew cooperation, airlines may also include pilot representatives in the overview. The training of airline personnel will include the effective application of PEAT process and software for data collection, storage, and analysis

THE PEAT PROCESS

Event occurs

Investigation reveals procedural deviation event

Interview the responsible crew members:
- Find contributing factors
- Get ideas for process improvement

Follow up to obtain additional contributing factors and information

Add event to PEAT database

Make process improvements based on contributing factors:
- In this event
- In the analysis of data for multiple events

Provide feedback to all organizations affected by process improvements

FEATURES

By using PEAT, the investigation of flight crew procedural-related incidents can offer airlines:

- Structure for a systematic approach to the investigation.
- Consistency in application and results.
- Visibility of incident trends and risk areas.
- Reduction or elimination of procedural-related incidents or accidents.
- Improved operational safety.
- Improved economic efficiencies.
- Communication and sharing of relevant information between organizations both internal and external to the airline.
- Compatibility with other existing industry safety tools.


Boeing Commercial Airplanes Group
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P.O. Box 3707, MC 20-89
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FAX: (206) 662-7812

More information will be available on the
Boeing PEAT web site in January 1999 at:
https://www.boeing.com/news/techissues/peat/

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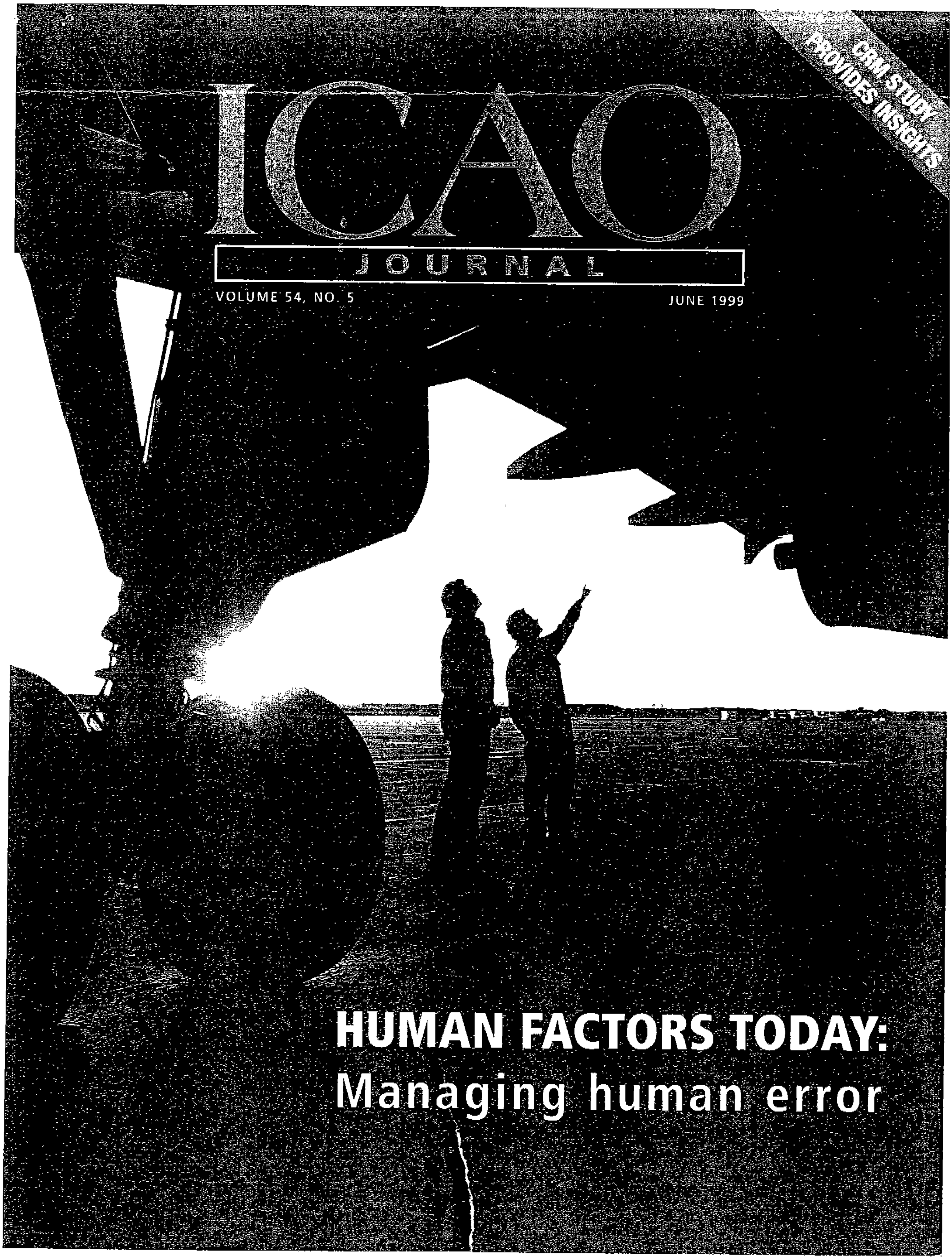

ICAO
JOURNAL
VOLUME 54, NO. 5
JUNE 1999
CRM STUDY PROVIDES INSIGHTS
HUMAN FACTORS TODAY:
Managing human error

Tools developed by aircraft builder designed to help airlines manage human error

Boeing's latest human factors analysis tool, to be released to the industry later this year on a no-cost basis, focuses on flight crew compliance with procedures.

R. CURTIS GRAEBER
THE BOEING CO.
(UNITED STATES)

HELP for efforts to resolve human factors issues is available from aircraft manufacturers, and Boeing in particular has identified several ways in which a manufacturer can play a supportive role. For example, Boeing is working to develop and provide pilot training aids and to supply tools for managing human error and mechanisms for feedback, and is also conducting human factors research. The company supports initiatives in the human factors area by ICAO and the International Air Transport Association (IATA).

Many readers will be familiar with the training aid designed to prevent controlled flight into terrain (CFIT) accidents; developed by a task force formed by ICAO and the Flight Safety Foundation (FSF), the training aid was produced by Boeing. A more recent joint effort that involved manufacturers has culminated in the development of the upset recovery training aid. These recent examples of training aids bear considerable similarity to the development of the wind shear avoidance training aid in the mid-1980s.

A manufacturer can help in capitalizing on human factors to achieve a significant reduction in the accident rate. This is accomplished by developing and providing methods and tools to manage human error more effectively. Over the past several years, our human factors specialists have been focusing on the fact that human error is inevitable. While all of us can do our best to prevent its occurrence, we can never be certain it will not occur. Consequently, we must enhance our ability as an industry to manage error in order to mitigate its consequences and to learn what systematic factors contribute to its occurrence.

Error management tools

Aviation has traditionally relied on selection, training, licensing and detailed written procedures to assure safety. While these are important barriers to human error, this emphasis ignores the very real contributions that design, environment, and other factors make to human performance. An over-reliance on discipline to make the system work well characterizes many government authorities as well as air carriers. The phrase "blame and train" probably best describes the predominant attitude towards those who err and are caught. As a result, human performance issues are often not given the systematic level of analysis they deserve in order to prevent their future occurrence.

Yet, there has always been an implicit assumption that the trained pilot or mechanic can always be counted on to remain sufficiently flexible and creative to fill the gaps in the system to maintain safe performance. Given the often unpredictable nature of the aviation operating environment, there is no doubt that this uniquely human ability has been a major factor in making aviation as safe as it is today. So why are errors often blamed on negligence or incompetence without looking more broadly at the system and the way it supports (or doesn't support) human performance? Even when more serious incidents and accidents occur, it is rare to see a thorough human factors analysis conducted.

If the aviation industry is to make the human performance gains necessary for dramatic reductions in the accident rate, it needs more extensive and reliable feedback on how humans interact with technology in the real world. The industry needs to foster further development of human factors tools, databases and support policies across all sectors of the industry, not just for flight crews. Of course, the biggest challenge will be the political and legal frameworks needed to encourage honest reporting when human error occurs.

In 1991 Boeing initiated an effort to shift the focus of accident analysis away from primary cause to the development of accident prevention strategies. This was accomplished by reviewing and analysing commercial jet aeroplane accidents over a 10-year period (1982-91).

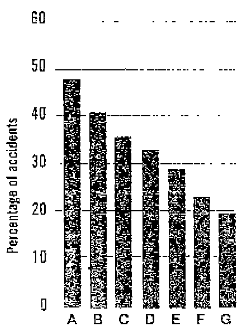


Figure 1.
Bars represent percentage of hull loss accidents from 1982-91 in which the identified strategy could have prevented an accident. *Accident prevention strategies are (A) flying pilot adherence to procedure; (B) other operational procedural considerations; (C) non-flying pilot adherence to procedure; (D) embedded piloting skills; (E) design improvement; (F) captain/instructor pilot exercise of authority; and (G) maintenance or inspection action.*
Boeing data

and identifying all strategies that could have prevented each hull loss. From this review a few vital, high payoff prevention strategies were identified. The accident prevention strategy that could have prevented the greatest number of accidents involved adherence with the established procedures by the pilot flying. Almost 50 per cent of all hull-loss accidents could have been prevented in this way (see *Figure 1*). The potential benefit of flight crew adherence to procedures may actually be higher than 50 per cent if the impact of additional accident prevention strategies are taken into consideration.

If the industry is to significantly improve adherence to procedures to prevent future accidents, it must advance beyond the traditional disciplinary approach. We need to understand why crews do not comply. Such knowledge requires timely operational feedback and in-depth human factors analysis. A major impediment is that violations of procedures are often not reported because of the fear of being reprimanded. As a result, procedural violations are usually not discovered until a bad outcome occurs. The story is not much different when it comes to operational errors among maintenance personnel.

For these reasons, Boeing has developed two human factors tools which are designed to help airlines manage human error and learn how to make systematic improvements for safety. Both of these operate according to the philosophy that airline staff, whether pilots or mechanics, do not make errors on purpose. Instead, errors are usually due to contributing factors. In order to prevent errors, it is necessary to identify these contributing factors and to try to eliminate or modify them.

The first of these tools is the maintenance error decision aid (MEDA), which is intended to help airlines shift from blaming mechanics for making errors to trying to systematically understand the factors contributing to such errors. Maintenance errors affect both cost and safety. Furthermore, it is well recognized that mechanics do not make errors on purpose. MEDA provides the first-line supervisor with a structured method for analysing and tracking the contributing factors leading to maintenance errors.

Since MEDA's inception in 1994, Boeing has provided free on-site training to over 100 organizations worldwide on how to implement a MEDA programme. A variety of operators have not only witnessed substantial safety improvements, but have also experienced significant economic benefits in terms of reduced departure delays. Some airlines have also reported that using MEDA helped them to change their disciplinary culture by halting the blame cycle and placing the investigative focus on *why* an event took place.

The second tool, the procedural event analysis tool (PEAT), has just completed software development and will be released to the industry on a no-cost basis later this year. It focuses on flight crews and their adherence to procedures. While failure-to-follow-procedure is not an uncommon finding in incidents and accidents, the industry currently lacks insight into why flight crews make such errors. In part, this is due to the lack of a systematic and consistent industry tool for investigating such incidents. The reasons behind flight crew non-compliance may range from ambiguously written or poorly understood procedures to inadequate training, design issues, incompatible air traffic environments, unexpected operational situations, or bad judgement. However, because the crew members involved are available to share their experience and insights, we cannot afford to waste the unique opportunity these incidents offer us to significantly improve the way we operate aircraft.

Thus, it is not surprising that in its 1996 report[1] the U.S. Federal Aviation Administration (FAA) human factors team recognized the importance of this issue. It recommended that:

> *The FAA should assure that analyses are conducted to better understand why flight crews deviate from procedures, especially when the procedural deviation contributes to causing or preventing an accident or incident.*

The report, signed by the FAA, Joint Aviation Authorities (JAA) and by researchers, goes on to point out that "simply listing flight crew procedural deviations as a contributory factor, without determining whether there were more fundamental reasons for the procedural deviations, inappropriately implies that exhorting flight crews to always follow procedures will prevent these accidents or incidents. In the presence of more systemic problems, such a strategy is destined to fail." Instead, the system must be improved, and that requires that we identify and come to understand the deficiencies by thoroughly assessing the reasons behind these deviations.

Within the limitations of the available data, the FAA also recommended that cases should be studied where procedural deviations prevented or otherwise had a *beneficial* effect on the outcome of

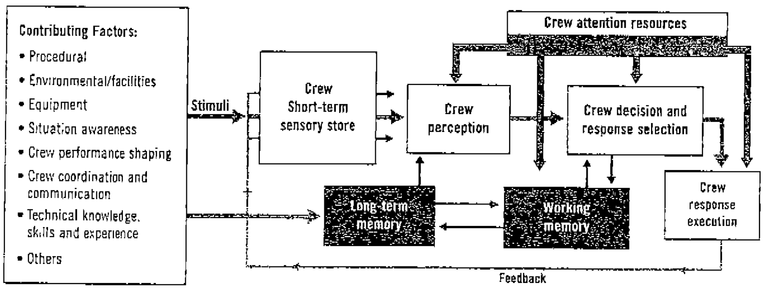


Figure 2. Model of human information processing (adapted from *Engineering and Human Performance*, by C.D. Wickens, 1984.)

an accident or serious incident. Unfortunately, the latter approach is rarely exercised in incident investigations, resulting in a mostly negative view of flight crew performance when procedures aren't followed. Together we consistently fail to consider the number of accidents that may have been prevented because the crew did deviate from the procedures.

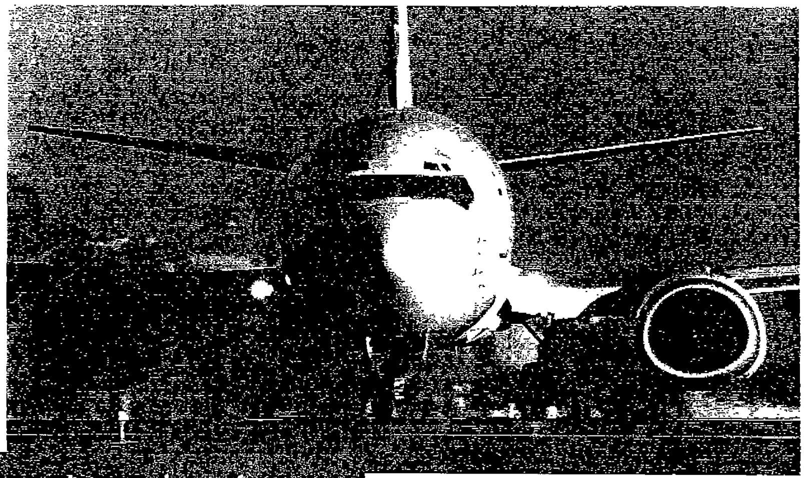
PEAT is similar in design to MEDA and likewise assumes that there are reasons the pilot either failed to follow the procedure or made an error in following it — that is, the error was not malicious. This allows the analyst to interview the pilot involved and document the error and the reasons behind it. Both tools take advantage of what we know about the cognitive or decision-making aspects of procedure adherence, and they offer an inventory of the types of procedural errors that might occur and the factors that can influence human use of procedures.

Development of PEAT

Boeing first tried to develop a better understanding of non-adherence with procedures by returning to the accidents that had been analysed for its accident prevention strategies study, and applying an analysis that focused on the cognitive factors that could be responsible. Despite repeated attempts to apply the analysis across various accidents, however, Boeing finally concluded that the disparity in accident report quality, their inconsistency in addressing human factors issues, and the inability to interview crew members made it impossible to achieve a reliable result.

Boeing then turned its attention to serious operational incidents. As a result, PEAT has developed into a structured, in-depth analytic tool based on a cognitive approach. It is designed to facilitate incident investigations and to aid in the development of countermeasures. While the initial accident-oriented effort was accomplished within the structure of the U.S. Air Transport Association (ATA) Human Factors Committee, industry involvement has been expanded to include a multi-cultural team in order to adapt PEAT into an incident analysis tool that meets global needs. The industry team consisted of eight airlines from the United States, Europe, and Asia, working together with Boeing and the International Federation of Air Line Pilots' Associations (IFALPA). The team participated in an eight-month field validation using preliminary paper versions of PEAT to investigate their own incidents involving significant non-adherence to procedures, and to adapt PEAT to better meet their requirements.

The software version of PEAT has been designed to facilitate a paradigm shift in how incident investigation is conducted. PEAT is based on a philosophy which acknowledges that professional flight crews rarely fail to comply with a procedure intentionally, especially if it is likely to result in an increased safety risk. It therefore requires the airline to explicitly adopt a non-jeopardy approach to incident investigation. In other words the flight crew is not subject to punishment or disciplinary action unless they were deliberately neglectful or acted in a reckless manner. Within this framework, the crew's professional input is sought to improve the overall understanding of what happened and to gain insight as to why it happened. PEAT provides the



For some time now, human factors specialists have been focusing on the fact that human error is inevitable.

methodology for guiding the collection of this input along with other relevant facts and data.

In contrast to the wide variability in current airline investigation methods, PEAT provides consistency in application and results. The PEAT form, designed to be used by a trained safety officer, can facilitate the investigation of specific types of incidents, i.e. those involving non-adherence to procedures. As such, it addresses all the pertinent analysis elements. The Boeing-industry team found that by asking such questions they obtained information that substantially expanded their ability to understand the incident.

The adoption of the PEAT philosophy by the safety officer also facilitates the shift of the investigation focus away from *what* happened and *who* is responsible to why it happened by focusing on the key contributing factors. As stated above,

1. Federal Aviation Administration. *Human Factors Team Report on the Interfaces Between Flight Crews and Modern Flight Deck Systems*, Washington D.C. 1996

flight crews rarely make procedural errors intentionally; however, there are circumstances and factors that affect crew decisions and can contribute to such errors. Therefore, the desired change in crew behaviour can only be accomplished by objectively addressing why the incident occurred.

A model of human information processing, depicted in *Figure 2,* emphasizes this point. Crew actions are the consequence of complex mental operations that are characteristic of human cognition and that are clearly influenced by available information and the surrounding environment, including airline policies and culture as well as regional culture.

As pointed out by the FAA, some procedural deviations have produced desirable outcomes for safety. Therefore, it is important to obtain a balanced perspective on flight crew adherence to procedures. PEAT's structure enables operators to do just that. Its format is structured so that it can be used to help understand what contributed to a flight crew's correct decision regarding intentional deviation. This type of information may eventually prove valuable in training and in modifying existing standard operating procedures.

If the industry is to make dramatic reductions in the accident rate, it needs more extensive and reliable feedback on how humans interact with technology.

By implementing more effective data collection and consistent analysis over time, PEAT can make incident error trends more visible. This trend information can provide more obvious opportunities for early intervention both within the airline and potentially across the industry. This is also one reason why Boeing has sought to enable PEAT results to be readily integrated with those from less serious incidents. PEAT analytic outcomes can be readily entered into industry safety bases existing today which are typically used to track incidents that do not require a formal investigation, and which are often reported by crews themselves. Thus, PEAT can be used in conjunction with other available industry safety tools to compare different types of information on similar or related incidents and offer an opportunity to spot potential risk areas.

Finally, PEAT provides a mechanism for feedback and data sharing. PEAT facilitates the communication of relevant information to various departments, both internal and external, to the airline organization. For example, if an investigation reveals the need for improvement in the area of procedural development, the relevant information can be readily shared with both the flight standards and training departments. If maintenance has been identified as a contributing factor, the pertinent information may be shared internally with airline maintenance, and externally with the manufacturer.

A manufacturer needs to know when a crew interface design may have contributed to a procedural deviation. PEAT will enable Boeing to improve future product design by furthering our understanding of such critical incidents. PEAT also can foster the data sharing of "best practices" among operators, should airlines wish to share this information. The software has built-in security features designed to provide strict control over the storage of data, access to data and the nature of data shared. While airlines are encouraged to share PEAT data among themselves and with Boeing, such sharing is not required.

Perhaps the industry team's comments after the field evaluation provide the most concise summary from the user's viewpoint about PEAT's value to an operator. According to the team members, PEAT legitimizes the depth of the inquiry; provides a systematic approach to the investigation; raises questions not usually asked (thus expanding the scope of the investigation); encourages questions no one dared to ask before; and helps move investigators away from the "blame and train" mindset. Feedback also indicated that PEAT is flexible enough to support airline-unique needs.

PEAT implementation

Boeing Flight Technical Services will be responsible for worldwide industry implementation of PEAT starting in 1999. Effective adoption and application of the PEAT process and software requires hands-on training. Training and implementation of PEAT at customer airlines will be coordinated through the customer service representatives for each carrier. In this manner, operators can reserve specific training slots throughout the year. As part of the implementation plan, airline senior management will be provided with an overview of the PEAT philosophy, process, required organizational support, and a model for successful airline implementation. To facilitate crew cooperation, airlines may also want to include pilot representatives in such briefings. This will be followed by the training of safety officers for effective application of the PEAT process, and the training of analysts in the use of the PEAT software database and analysis capabilities.

Conclusion

Today's air transportation system is very safe, and many safety professionals have played a role in making that happen. However, there is still a significant amount of work ahead as the industry

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Human factors tool

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attempts to discover ways to make this system even safer. The industry is accepting that challenge, both worldwide and regionally.

Addressing the most serious safety problems — CFIT, approach-and-landing and loss-of-control accidents — can provide high leverage for accident prevention, and there are many interventions available for use today, including those focusing on human factors.

Although safety practitioners represent a very small portion of the worldwide flight operations community, each individual can play a large role within his or her airline and geographic region. It's up to each to do his part and to carefully consider and implement the appropriate safety interventions if the industry is to positively contribute to the worldwide safety story. □