行政院及所屬各機關出國報告
（出國類別：進修）
ASC-TRT-02-10-002

赴美參加南加州飛安學院
失事調查訓練課程
報　　告

服務機關：行政院飛航安全委員會
出國人職　　稱：調查官，副工程師
姓　　名：張文環，梁　群

出國地區：美國
出國期間：民國九十一年八月十七日至九月十五日
報告日期：民國九十一年十月廿日

行政院及所屬各機關出國報告提要　　系統識別號 C09104578
出國報告名稱：赴美參加南加州飛安學院失事調查訓練課程報告
頁數：50 頁含附件：是

出國計畫主辦機關：行政院飛航安全委員會
聯絡人：黃佩蒂　　電　話：(02) 2547-5200 分機 154

出國人員姓名：張文環、梁　群
服務機關：行政院飛航安全委員會
職稱：調查官、副工程師　　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：民國九十一年八月十七日至九月十五日
出國地區：美國新墨西哥州阿柏克基市

報告日期：民國九十一年十月廿日

分類號/目

關鍵詞：失事調查、訓練、南加州飛安學院

內容摘要：（二百至三百字）

本項課程提供學者對航空事故調查所須具備之基本知識；除調查所需基本準備工作外，授課內容尚包括飛航作業、空氣動力學、實用航空動力學等飛航系統之專業。另航空心理、航空生理及人為因素等與飛航有關之因素亦列入授課內容，對一具備航空專業經驗而進入飛安調查工作之入門者而言，為一極具助益之入門課程。於各階段課程中，學員除美籍人士外，尚有來自英、荷蘭、挪威、丹麥及韓國等地之學員，除授課外，還能有機會了解除美國之外國家的飛安調查運作情形，使調查知識之觸角能延伸至美國以外之地區。另外授課之教官除一位係長期於飛機公司（波音）任職外，其餘清一色均為美軍方現役或除役之人員，足見美軍方長期培養出許多飛安調查之專業人才且能於除役後持續於飛安領域發展，對整體飛航安全之貢獻助益極大。

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: 赴美參加南加州飛安學院失事調查訓練課程報告
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：張文環、梁　群
職稱：調查官、副工程師
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、目的

本次赴美南加大飛安學院受訓之目的：

- 接受飛安專業調查基本訓練，獲取飛安調查基本知識。
- 瞭解國際飛安調查技術之發展及現況，提昇本會飛安調查之能量。

貳、過程

本次受訓原預計於五月三十一日起至六月二十八日止共計四周，因受華航611於五月二十五日於澎湖外海發生空難而延至八月，有關受訓行程如下：

8月16日　啟程

8月17日　到達美國新墨西哥州

8月19日　航空器失事調查訓練班次開始

8月31日　航空器失事調查班次結束

9月3日　人為因素調查班次開始

9月7日　人為因素調查班次開始

9月9日　調查管理班次開始

9月13日　調查管理班次結束

9月14日　返程

9 月 15 日　抵台北

2.1 受訓情形說明

2.1.1 受訓學院及環境

本次受訓單位為美南加州飛安學院（Southern California Safety Institue），受訓地點位於美國中部新墨西哥州（New Maxcio）阿帕克奇市（Albuquerque），當地夏日天氣炎熱，日平均溫度介於華氏 85 度至 95 度間。受訓教室使用當地 Sheraton 旅館之會議室舉行，除第一門課之會議室較擁擠外，其餘情形良好。

2.2 航空器失事調查課程

授課內容

本班次授課期程計兩週、共完成失事調查介紹（Investigation）、科技簡介（Technology）、照相技術（Photograph）、航空藥理調查（Aeromedical）及人為因素（Human Factor）等五門課程，共計 88 小時。詳細之課表如表一：

Aircraft Accident Investigation
Course 02-3
19 - 30 August 2002

SCSI
Southern California Safety Institute

19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug
8:00 Welcome SCSI 9:00 INV 1 Morphew 10:00 INV 2 Morphew 11:00 INV 3 Morphew 12:00 LUNCH 1:00 INV 4 Morphew 2:00 INV 5 Morphew 3:00 INV 6 Morphew 4:00 INV 7 Morphew	8:00 INV 8 Morphew 9:00 INV 9 Morphew 10:00 INV 10 Morphew 11:00 INV 11 Morphew 12:00 LUNCH 1:00 TECH 1 Hausenfleck 2:00 TECH 2 Hausenfleck 3:00 TECH 3 Hausenfleck 4:00 TECH 4 Hausenfleck 6:00 AAI Videos Morphew (Optional)	8:00 INV 12 Morphew 9:00 INV 13 Morphew 10:00 INV 14 Morphew 11:00 INV 15 Morphew 12:00 LUNCH 1:00 TECH 5 Hausenfleck 2:00 TECH 6 Hausenfleck 3:00 TECH 7 Hausenfleck 4:00 TECH 8 Hausenfleck 6:00 Dinner on Us Garduno's 10551 Montgomery NE	8:00 TECH 9 Hausenfleck 9:00 TECH 10 Hausenfleck 10:00 TECH 11 Hausenfleck 11:00 TECH 12 Hausenfleck 12:00 LUNCH 1:00 INV 16 Morphew 2:00 INV 17 Morphew 3:00 INV 18 Morphew 4:00 INV 19 Morphew	8:00 TECH 13 Hausenfleck 9:00 TECH 14 Hausenfleck 10:00 TECH 15 Hausenfleck 11:00 TECH 16 Hausenfleck 12:00 LUNCH 1:00 PHO 1 Snapp 2:00 PHO 2 Snapp 3:00 PHO 3 Snapp 4:00 PHO 4 Snapp	7:15 Bus Departs 8:00 LAB 1 Morphew/Snapp 9:00 LAB 2 Morphew/Snapp 10:00 LAB 3 Morphew/Snapp 11:00 LAB 4 Morphew/Snapp 12:00 LUNCH 1:00 LAB 5 Morphew/Snapp 2:00 LAB 6 Morphew/Snapp 3:00 LAB 7 Morphew/Snapp 4:00 Bus Departs For Hotel	
26-Aug	**27-Aug**	**28-Aug**	**29-Aug**	**30-Aug**	**31-Aug**	**1-Sep**
8:00 HF 1 Anglemyer 9:00 HF 2 Anglemyer 10:00 HF 3 Anglemyer 11:00 HF 4 Anglemyer 12:00 LUNCH 1:00 AERO 1 Kennedy 2:00 AERO 2 Kennedy 3:00 AERO 3 Kennedy 4:00 AERO 4 Kennedy	8:00 AERO 5 Kennedy 9:00 AERO 6 Kennedy 10:00 AERO 7 Kennedy 11:00 AERO 8 Kennedy 12:00 LUNCH 1:00 HF 5 Anglemyer 2:00 HF 6 Anglemyer 3:00 HF 7 Anglemyer 4:00 HF 8 Anglemyer 6:00 AAI Videos Morphew (Optional)	7:15 Bus Departs 8:00 LAB 8 Morphew 9:00 LAB 9 Morphew 10:00 LAB 10 Morphew 11:00 LAB 11 Morphew 12:00 LUNCH 1:00 LAB 12 Morphew 2:30 LAB 13 Morphew 3:00 LAB 14 Morphew 4:00 Bus Departs For Hotel	8:00 INV 20 Morphew 9:00 INV 21 Morphew 10:00 INV 22 Morphew 11:00 INV 23 Morphew 12:00 LUNCH 1:00 HF 9 Anglemyer 2:00 HF 10 Anglemyer 3:00 HF 11 Anglemyer 4:00 HF 12 Anglemyer	7:15 Bus Departs 8:00 LAB 15 Morphew/Snapp 9:00 LAB 16 Morphew/Snapp 10:00 LAB 17 Morphew/Snapp 11:00 LAB 18 Morphew/Snapp 12:00 LUNCH 1:00 LAB 19 Morphew/Snapp 2:00 LAB 20 Morphew/Snapp 3:00 LAB 21 Morphew/Snapp 4:00 Graduation Morphew/Snapp Bus Departs For Hotel		

INV - Investigation; LAB - Crash Lab; HF - Human Factors; TECH - Technology; PHO - Photography; AERO - Aeromedical

表 1 航空器失事調查課程（8 月 19-30 日）

失事調查部分之課程內容包括飛安失事之背景介紹、相關法規介紹、失事調查之準備工作、調查安全注意事項、調查相關細節及注意事項；如蒐證、人員訪談及證詞、飛航軌跡、飛機殘骸及撞擊點之判

斷等。同時介紹調查之分工及專業；如飛機系統、人機介面、飛行作業、維修作業、飛機結構、電器系統、火燒軌跡、電器系統、儀表、發動機及飛航紀錄資料之簡介等。並對飛機失事重要影響因素如風切、失速、積水跑道、飛機結冰等現象均有重點介紹。

科技簡介部分之重點在說明航空各項專業如空氣動力、飛機升阻力之形成、高攻角飛行、飛行負載、飛機震顫、結構疲勞、飛機安定性及控制等對飛安之影響及關係。

照相技術部分之重點則在介紹調查照相之目的、照片存證之重要性、相機種類介紹、拍照前之準備工作、照相之相關注意事項、拍照技巧、照相機之選擇及照片之處理等。

航空藥理調查之教學重點在說明對空難人員之認證方式、飛航環境影響評估、酒精及藥物測試、人員遺體檢驗及分析等，課程內容中亦針對調查過程中可能遭遇之傳染病等作重點介紹。

人為因素部分課程之重點為介紹人為因素於失事調查之重要性、飛行員及維修人員易犯之錯誤、督導人員易犯之錯誤、人為因素調查之方式、組員資源管理及人為失事肇因模式分析等。

本班次於課程進行中安排有實地殘骸調查實習課程，於實際飛機殘骸存放區將學員編成不同分組進行實地調查訓練工作。使用之飛機殘骸計有 A-10、T-38、UH-1H、B-1、F-16 及 F-15 等飛機殘骸。此

外針對飛機照相部分亦有教官指導拍照部分之實習工作。人為因素部分於課堂中教官亦備有飛安調查案例共學員討論及練習，同時於課堂中亦配合教學內容撥放影片供學員觀看及討論。

教官背景

本班次授課之教官共計五員；依失事調查（Invesigation）、科技簡介(Technology)、照相技術(Photograph)、航空藥理(Aeromidical)及人為因素(Human factor)等五門課程，分別為；Gray R Morphew、Charles Hausenfleck、Frank Snapp、E.JohnKennedy 及 Richard Anglemyer 等，均為美軍除役之飛航人員，具豐富之飛安調查、管理及授課之教學經驗。

2.3 人為因素調查課程

授課內容

本課程包括了人員訪談技巧（Witness Interviewing）、人為因素分析及分類系統介紹（HFACS）、航空醫學調查（Aeromedical Investigation）以及另一門人為因素與事故調查（Human Factors for Accident Investigation）等四門課。課表安排如表 2。

人員訪談技巧（Witness Interviewing）課中探討了進行訪談前以及訪談時該有的準備工作和應注意的細節，並在課堂中讓學員練習互相訪談，一方面直接將學習到的技巧馬上應用，另一方面也從中發

現自己的缺失。

人為因素分析及分類系統（Human Factor Analysis and Classification System, 簡稱 HFACS）係 Dr. Shappell 及 Dr. Wiegmann 延伸 Reason's Model 所發展出來的一套分析工具，該系統維持 Reason's Model 的架構及精神，將事故調查中的調查結果做適當分類，以更具體而易懂的方式表達調查調結果和人為因素的關係。

航空醫學調查（Aeromedical Investigation）一課對航空生理及醫學做了一個很完整的介紹，譬如各種高空缺氧症的原因和影響、空間迷向試驗等，另外對於調查人員在現場可能會遇到的危險也有一些簡單的說明。

最後一門課人為因素和事故調查（Human Factors in Accident Investigation）因為原定教官 Gary Mucho 不克前來，故由 Gary Morphew 代課，大致和前週所上的課程類似，但在最後一個個案練習中，教官則讓學員們利用 HFACS 來探討大溪地一失事之調查結果，具體將 HFACS 運用在調查案例中，體會一下 HFACS 的優點。

Human Factors for Accident Investigators
Course 02-3
3 - 7 September 2002

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUN
2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep
	8:00 INT 1 Dillinger	8:00 HFACS 1 Shappelle/Wiegmann	8:00 AERO 1 Gibbons	8:00 AERO 5 Gibbons	8:00 INV 13 Mucho	
	9:00 INT 2 Dillinger	9:00 HFACS 2 Shappelle/Wiegmann	9:00 AERO 2 Gibbons	9:00 AERO 6 Gibbons	9:00 INV 14 Mucho	
	10:00 INT 3 Dillinger	10:00 HFACS 3 Shappelle/Wiegmann	10:00 AERO 3 Gibbons	10:00 AERO 7 Gibbons	10:00 INV 15 Mucho	
	11:00 INT 4 Dillinger	11:00 HFACS 4 Shappelle/Wiegmann	11:00 AERO 4 Gibbons	11:00 AERO 8 Gibbons	11:00 INV 16 Mucho	
	12:00 LUNCH	12:00 LUNCH	12:00 LUNCH	12:00 LUNCH	12:00	
	1:00 INV 1 Mucho	1:00 HFACS 5 Shappelle/Wiegmann	1:00 INV 5 Mucho	1:00 INV 9 Mucho	1:00	
	2:00 INV 2 Mucho	2:00 HFACS 6 Shappelle/Wiegmann	2:00 INV 6 Mucho	2:00 INV 10 Mucho	2:00	
	3:00 INV 3 Mucho	3:00 HFACS 7 Shappelle/Wiegmann	3:00 INV 7 Mucho	3:00 INV 11 Mucho	3:00	
	4:00 INV 4 Mucho	4:00 HFACS 8 Shappelle/Wiegmann	4:00 INV 8 Mucho	4:00 INV 12 Mucho	4:00	

INV - Investigation; INT - Witness Interviewing; HFACS - Human Factors Analysis and Classification; AERO - Aeromedical

表 2 人為因素調查課程（9 月 3-7 日）

教官背景

TRACY DILLINGER, PH. D.

美國空軍飛航安全中心航空心理主任，亦為空軍航空事故人為因素分析專家，曾為美國空軍著作「調查人員訪談指導原則」，在訪談技巧方面有傑出表現。美俄亥俄大學學士及碩士，芝加哥專業心理學學院博士。

SCOTT A. SHAPPELL, PH. D

現任美國航空總署航醫中心人為因素研究室主任，進行的研究主題包括了先進航管系統、飛航組員行為分析等，另外和美國國家航太

總署及美國海軍亦有一些針對軍民航失事統計研究專案在進行。美萊特州立大學心理學學士，德州大學心理醫學博士。

DOUGLAS WIEGMANN, PH. D.

現任美國海軍安全中心人為因素心理學專家，曾歷北佛羅里達大學助理教授、美國國家運輸安全局人為因素心理學家、海軍航醫中心航空心理博士後研究及其研究實驗室航空心理學家，1992 年 Teas Christian 大學實驗心理學博士。

HARRY L. GIBBONS, M.D., MPH

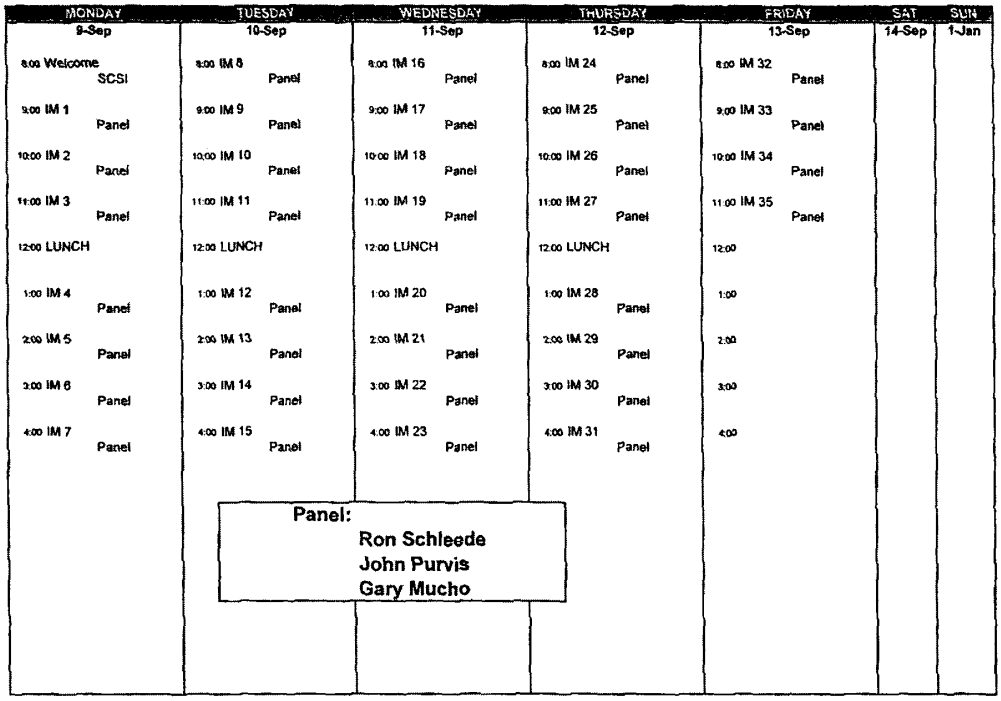
現為塩湖城高山健康醫療中心臨床醫師，專長為航空醫學，曾任民航中心航醫研究室主任，美國聯邦航空總署西南區航醫及美航醫協會主席。Utah 大學醫學士及 Harvard 大學大眾健康學士。

2.4 調查管理課程

授課內容

本課程講授範圍包括調查前準備工作之注意事項、事故公告程序、調查人員派遣、調查組織編成、現場調查、殘骸管理、進度會議及報告撰寫等內容，對公聽會之舉辦及與記者周旋之技巧億多所著墨。其課表安排如表 2。因本課程係由兩位教官於課間同一時間任教，所以穿插許多實際生動之案例，使上課者印象深刻。

Investigation Management
Course 02-3
9 - 13 September 2002



MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT	SUN
9-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	1-Jan
8:00 Welcome SCSI	8:00 IM 8 Panel	8:00 IM 16 Panel	8:00 IM 24 Panel	8:00 IM 32 Panel		
9:00 IM 1 Panel	9:00 IM 9 Panel	9:00 IM 17 Panel	9:00 IM 25 Panel	9:00 IM 33 Panel		
10:00 IM 2 Panel	10:00 IM 10 Panel	10:00 IM 18 Panel	10:00 IM 26 Panel	10:00 IM 34 Panel		
11:00 IM 3 Panel	11:00 IM 11 Panel	11:00 IM 19 Panel	11:00 IM 27 Panel	11:00 IM 35 Panel		
12:00 LUNCH	12:00 LUNCH	12:00 LUNCH	12:00 LUNCH	12:00		
1:00 IM 4 Panel	1:00 IM 12 Panel	1:00 IM 20 Panel	1:00 IM 28 Panel	1:00		
2:00 IM 5 Panel	2:00 IM 13 Panel	2:00 IM 21 Panel	2:00 IM 29 Panel	2:00		
3:00 IM 6 Panel	3:00 IM 14 Panel	3:00 IM 22 Panel	3:00 IM 30 Panel	3:00		
4:00 IM 7 Panel	4:00 IM 15 Panel	4:00 IM 23 Panel	4:00 IM 31 Panel	4:00		

Panel:
Ron Schleede
John Purvis
Gary Mucho

IM - Investigation Management

As Of: 2:20 PM 7/9/2002

表 3 調查管理課程（9 月 9-13 日）
調查管理課程為期一週

教官背景

RONALD L. SCHLEEDE

曾任職於美國空軍，為一戰機飛行員，除役後於美 NTSB 任職長達 27 年，處理國際調查事務有 15 年之經驗，現已退休並自行開設一家飛安顧問公司，曾協助我方調查及處理星航事件國際視聽部分及相關報告之撰寫，失事調查經驗豐。

JOHN W. PURVIS

為大型飛機之知名調查專家，於美波音公司服務長達 41 年，於

1999 年退休，其中有 17 年於調查部門擔任主管工作，期間處理及支援國際間之飛機失事調查案件多達 2,500 件，經驗豐富。

參、心　　得

3.1 航空器失事調查

本項課程提供學者對航空事故調查所須具備之基本知識；除調查所需基本準備工作外，授課內容尚包括飛航作業、空氣動力學、實用航空動力學等飛航系統之專業。另航空心理、航空生理及人為因素等與飛航有關之因素亦列入授課內容，對一具備航空專業經驗而進入飛安調查工作之入門者而言，為一極具助益之入門課程。

3.2 人為因素調查

3.2.1 訪談技巧

訪談是一件需要技巧、費時的工作，也是一件結合了運氣、藝術的工作，目的是在得到與事故有關的更多事實資料和細節，澄清、確認或是排除某些資訊，除了基本的訪談技巧要先了解外，多加練習是成為一個傑出訪談者的不二法門。

在訪談前訪談者應預先對訪談內容和資料有最好的蒐集和涉獵，對於訪談時間、地點的安排、環境的設置、訪談者人數、穿著、記錄方式、預設問題等皆應有所準備，以下針對一些基本技巧和準備工作做更詳盡的介紹。

- 資料和資訊

訪談前對於已蒐集的事故證據要有一定的準備，一方面能較

適當的安排自己要問的問題，一方面能對訪談者所述內容有較正確的判斷。相關可蒐集的資料因情形對象而異，一般包括了事故基本資訊、人員背景資料、之前的訪談記錄（如果有的話）、其它訪談記錄等，訪談前準備的資料是讓訪談者更能言之有物，不是為了讓訪談者去反駁受訪者的證詞，如果受訪者所說的證詞與資料不符時，訪談者不需打斷或糾正受訪者的話，事後在整理記錄時再行判斷比較其正確性和真實性即可。

- 地點

對於地點的選擇，受訪者應考慮清楚，如果受訪者仍在醫院，此時進行訪談是否適當？但有時為了及早獲得受訪者的證詞，甚至因為有時證詞可能會隨受訪者往生而消失，此時就要詢問醫護人員、家屬和受訪者本人的意願，詳細判斷在醫院進行必要的訪談了。

在受訪者住所訪談是否恰當？在訪談者辦公室訪談是否恰當？這些有關地點的選擇，有時要考慮受訪者的情緒是否會因而受影響，有時要考慮是否訪談會因地點關係而進行困難，因此訪談者在進行談訪時，對於地點也應要有所考量。

- 環境設置和訪談者人數

如果所營造的訪談環境能讓受訪者覺得放鬆而不被干擾，這

對訪談的進行是一個大大的加分。因此在訪談進行時茶水的準備、手機關機、不要有電話的干擾、空調等等，都是可以預先設想到的，如果能讓所獲得的證詞更為完整和正確，這些小細節都應事前就想好。

最好的訪談人數不要超過三人，訪談者更不應有和受訪者有工作隸屬關係以及會造成受訪者壓力的人加入，這和上述的環境設置有一樣的目的，為了讓受訪者能真正的放鬆不被影響，主持訪談的人應有所認知。

- 穿著

讓受訪者能夠因訪談者的穿著而馬上認識你的角色並對你產生信任，那就是最好的穿著，太過隨便會讓人覺得不放心，太過嚴肅又會使人拘束而有所保留。所以穿著要能顯出一位專業調查員的角色，不過可能有時要因文化上差異而有所遷就。

- 記錄

訪談進行時最好能有當場的記錄，像是有打字員馬上打字，速記員馬上記下對談內容，如果無法當場記錄，就應詢問受訪者是否可進行錄音或錄影，一般在對受訪者說明錄音目的是為了記錄而非關責任追究，並且有了抄本記錄後會馬上洗掉錄音記錄時，受訪者都會願意進行錄音。

- 訪談者情緒控制

訪談者不可太過情緒化，也不應預設立場而太過敵意、恐懼、防衛、或親密。

- 發問技巧

一般訪談時最重要的就是如何發問，要儘量以開放性的問題代替選擇性的問題，另外一些要點要注意的如下：

  - 要有良好的開場白，介紹自己和訪談的目的，引導受訪者進行當時的情境。
  - 準備適當的問卷供訪談者使用，以免遺漏某些資訊。
  - 避免意外的問題，會讓受訪者不知所措，因而影響他的思緒。
  - 不可說謊、套問題、無故打斷。
  - 如果出現沉默不需要太緊張，沉默在對話當中是正常的，也許是對方在思考，也許是在回憶，所以不要太在意而刻意的打斷沉默。
  - 不要一直的接話，會讓受訪者不能完整表達自己的意思。
  - 最後有良好的結束，適當的重覆受訪者所述內容，確認受訪者所說的和你所認知的一樣。
  - 若對此次訪談有需要釐清、確認或更多衍生的問題，可進

行另一次的訪談。

在這次的課程當中，還探討了男性和女性的不同在訪談中可能產生不同的心理狀態和情緒反應，這是一個尚未成熟的議題，只不過在進行訪談的時候，訪談者不妨多想想對方的感受，也許能得到受訪者更多的信任。

沒有人是天生的訪談者，也不是說知道了有那些該注意的事情後就能順利的進行訪談，還是那句老話，唯有練習才是能為一個好的訪談者的不二法門。

3.2.2 人為因素分析及分類系統（Human Factors Analysis and Classification System）

飛航如同其它任何一個生產系統，飛航事故會發生，或者我們說系統會崩潰，通常為一連串的錯誤所造成，而非單一的因素，因此 Dr. Reason 提出了起司模型（圖 1），說明各個環節所發生的錯誤或疏失加在一起，就像骨牌一般，才會造成最後的失事，這樣的一個精神和概念，成了爾後飛航事故人為因素調查的基準，也使後來的事故調查更加的慎密和完整。

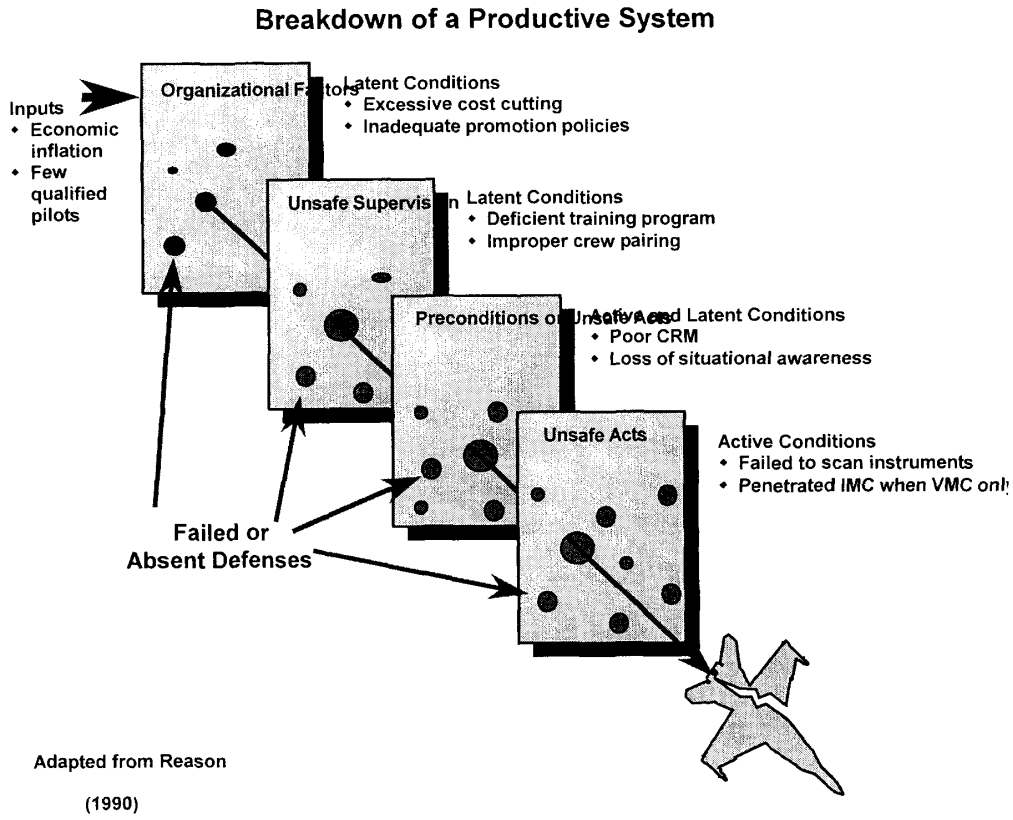


圖 1 Reason's Model

HFACS 延伸了此一概念，將事故調查中有關人為因素的各種調查結果，如駕駛員疏失、人因設計、組織因素、組員資源管理、醫學與病理等，更進一步地歸納成表 1 中的 17 項類別，使得人為因素調查有了一個更清楚的架構，我們也可藉由此一系統的 17 項因子做為人為因素事故調查檢查表，更有系統地、全面地來探討人因的問題。

表 1 HFACS 架構

Human Factors Analysis and Classifications System (HFACS)			
-	Organizational Influences	Resource Management	01
		Organizational Climate	02

		Organizational Process		03
	Unsafe Supervision	Inadequate Supervision		04
		Planned Inappropriate Operations		05
		Failed to Correct Problems		06
		Supervisory Violations		07
	Preconditions for Unsafe Acts	Standard Conditions of Operators	Adverse Mental States	08
			Adverse Physiological States	09
			Physical and Mental Limitations	10
		Standard Practices of Operators	Crew Resource Management	11
			Personal Readiness	12
	Unsafe Acts	Errors	Decision Errors	13
			Skill-Based Errors	14
			Perceptional Errors	15
		Violations	Routine	16
			Exceptional	17

HFACS 主要由不安全行為、不安全行為的潛在因素、不安全監督及組織因素等四大層面開始分述起：

不安全行為主要又分為兩大項：違規行為及錯誤行為，其中違規行為包括了常態性違規及惡性違規；而錯誤行為又分成決定下達錯誤、技術性錯誤、感知錯誤等。

不安全行為的潛在因素則包括了操作者狀態及實際操作兩大項，其中操作狀態包括不適當心理狀態、不適當生理狀態及身體及心理限制等三類；而實際操作包括了組員資源管理及人員敏捷性兩類。

不安全監督包括了不正當監督、未及時改正問題、違規監督及計畫中不適當作業。

組織因素包括了組織文化、資源管理及組織作業。

詳細的 HFACS 介紹可參考附錄一兩位教師所著 FAA 參考文件的內容。

另一方面，兩位講師也相當地強調 HFACS 對於預防失事發生可以發揮的功用，他們利用過去十年來美國海軍、空軍、民航界及普通航空業四個領域中所發生的失事，將所有調查報告中的調查結果以 HFACS 的 17 項因子重新分類，統計出在各個領域中事故發生的主要原因為何，是違反規定呢？決定下達錯誤呢？還是組織的問題呢？進而可以決定何者才是最急須改善的環境因子，該如何投資經費，才能最有效的改善飛安。

HFACS 其實是一個分析的方法和統計的工具，不僅可以用在操作分析方面，在維修、航管等方面只要做些修正亦可適用，利用此一科學的方式找出事故的原因，以改善工作環境並預防事故發生，正是 HFACS 的主要目的。

因為本身對於人為因素的基本知識涉獵不深，看到 HFACS 會覺得這是一個很炫很有系統的程式，而兩位講師也即將要出版他們的書，但是如何將 HFACS 實際運用在調查案中，卻是一個值得商榷的問題，教授課程的講師著重在利用過去已調查完畢的案子，以其現有的調查結果套用在 HFACS 上，對於如何找出這些調查結果卻不是 HFACS 的功勞，充其量而言，也許可以將 HFACS 當成是人為因素

調查的檢查表之一吧。

無論如何 HFACS 是目前人為因素調查的一套很有用的工具，提供給會內相關人員這方面的資料，讓本會將此一工具吸收為本身的能量是刻不容緩。

3.2.3 航空醫學調查

由於飛行環境具低空氣密度、低氣壓、低溫度等不同於陸地的特性，因此人類生理狀況會隨之產生不適應問題，在此一課程中，講師介紹了高空缺氧症、藥物、酒精、毒物問題、快速減壓、G 力導致失去知覺及空間迷向等一些航空方面的生理現象及症狀，也舉出了很多航空醫學在調查案例中的應用，對於生理醫學方面的調查有更進一步的說明。

高空缺氧症（Hypoxia）分為以下四類：

Hypoxic：因高度問題所造成的缺氧現象

Stagnant：由於 G 力及震波，造成血管口徑變化而產生的缺氧現象

Hypemic：由於血液含氧能力降低所產生的缺氧現象

Histotoxic：由於血紅素量減少所產生之缺氧現象

因此除了高度本身帶來的高空氧氣含量減少為高空缺氧之主要原因外，由於 G 力作用使得血液無法到達腦部、一氧化碳中毒等使

得血紅素本身含氧能力降低或是酒精等因素使得紅血球量減少亦為高空缺氧的原因之一。

快速減壓則會造成兩類症狀：

一類是空氣堵塞（Trapped Gas），會造成耳朵鼻竇等的堵塞、以及牙痛、胃腸痛等問題，另外在爬升時千萬不要憋氣，以免肺泡因壓力不均而有破裂的危險。

另一類是氣泡形成（Evolved Gas），此類症狀較為危險，可能產生手肘痛、肩關節痛、暈眩、抽筋等，嚴重時會造成潛水夫症。

另外有些化學物質可能產生的影響，如一氧化碳、二氧碳等，當量過多的時候，往往都會造成生理上的不適，甚至可能產生毒性。例如在一次貨機意外事件中，就是因為機艙內載有大量乾冰，昇華後造成空氣中二氧化碳濃度過高，使得機組人員產生暈眩、不適等症狀而必須及時回航，調查前原本以為組員是一氧化碳中毒的症狀，後來才了解二氧化碳濃度過高也會如此。

另外一個主要的問題是所謂的空間迷向，空間迷向大致可分為三個類別：

第一個是駕駛員不自知之空間迷向，此類迷向通常來自於人類的感官，如視覺和外在事故的互動所產生的幻覺。

第二個是駕駛員自知的空間迷向，這是由於人類平衡感的被破

壞，造成無法"說服"自己改變的情形，像是不自覺傾斜（Possible Lean）、墳墓式迴旋（Graveyard Spiral）、以及 G 力不適應等現象，在課堂上我們還做了一個迴旋椅（Barany Chair）的試驗，親身感受了這種迷向的滋味，當迷向產生時真的會讓人摸不著自己的姿態，另外有一個不能解釋的巨人之手（Giant Hand）現象，會讓駕駛員有一種明知該做動作，卻無法操作的情形。

酒精和藥物被視為另一個航空醫學的議題，當然比較和調查相關的重點就在於是否能在事故一發生，就即時針對駕駛員做酒精濃度及藥物檢測，以確保能掌握很快會隨時間消逝的證據。

航空醫學的調查在一個調查案中可能扮擔極重要的角色，尤其是所謂的普通航空業，很容易有高空缺氧、空間迷向等的這些問題，事實上在美國空軍的失事調查中，仍有 15%的調查案是懸而未決的，若談及有重大傷亡的調查案，更有 40%的調查案是未發現原因的，因此如果把航空醫學當成是調查工作的一項重要環節，或許有可能會有更多有別於過去的發現，因此充實航空醫學的知識對於一個調查人員而言確實相當重要。

3.3 調查管理

調查管理課程主要在提供學者如何於飛航事故中扮演好調查管理者之角色，諸如事故查證程序、調查前之整備、人員編組、人力安

排、現場調查、專業支援、安全規定及與媒底互動及發言指引等，對資深調查人員而言，係擔任主任調查官之進階甚佳之訓練課程。

3.4 綜合心得

於各階段課程中，學員除美籍人士外，尚有來自英、荷蘭、挪威、丹麥及韓國等地之學員，除授課外，還能有機會了解除美國之外國家的飛安調查運作情形，使調查知識之觸角能延伸至美國以外之地區。

另外授課之教官除一位係長期於飛機公司（波音）任職外，其餘清一色均為美軍方現役或除役之人員，足見美軍方長期培養出許多飛安調查之專業人才，且能於除役後持續於飛安領域發展，對整體飛航安全之貢獻助益極大。

肆、結論與建議

4.1 結論

「航空器失事調查」課程整體的安排，讓學員對於失事調查這個領域有基本的認識，也提供了一個殘骸實驗場，讓學員體驗現場檢視殘骸的環境，因此初階的調查人員在這樣的一個訓練課程中，確實能馬上得到該有的一些調查知識和別人的經驗。

「人為因素調查」之課程涵蓋面包括航空生理及心理，對具備飛航北警之學員而言，並非新知，但其有一門海軍發展之人為因素模式，令人覺得耳目一新。

調查管理課程部份則顯得相當有趣而切合需求，尤其是 Ron Schleede 和 John Purvis 兩位教師分飾政府及製造廠的調查人員，講授如何在一個調查案中相互配合，進而講授目前國際民航組織的規則，國際調查案的一些慣例和作法，對一位新進人員而言，這樣的授課方式可以使他很快的了解「調查」是怎麼一回事，而對準備身為主任調查官的人來說，這更是今後他們馬上要面對的問題，因此這樣一個課程對我而言，是非常有幫助而基本的，也破除了很多以前那種一知半解的情形。

在這個課程之後，另外有一些和課程內容不相關的有感而發，對於會內的訓練業務和發展或許有些幫助。

1. 實際而言「航空器失事調查」和最後一個「調查管理」兩個課程是設計得比較充實而對新進調查人員有比較切身的幫助，「人為因素調查」則顯得重複性過高，也不夠充實。

2. 在這一個月的訓練中，看到 SCSI 課程的行政安排相當簡單而節省人力，在會場唯一的工作人員是 Sherry Morphew，而且大部份時間她是不在教室的，這跟會裡辦訓練課程時總是出動大批人馬大不相同，因此有些 SCSI 舉辦課程的行政經驗是可以讓我們學習的。

3. 會內調查官其實已有能力擔任教師的資格，因此參考 SCSI 安排課程的模式，會內其實可以自行舉辦調查課程，對象包括了會內新進人員外，亦可包括航空公司、民航局、以及其它如法醫研究所、國防部、航警等配合單位，當然這不僅是一種訓練，也是對失事調查的一個推廣。

4. 認識到許多國外的飛安界朋友，了解別人的調查是在做些什麼事情，對於這次出國受訓而言，這也是另一項重要的收獲。

4.2 檢討與建議

1. 建議會內若再有人員至 SCSI 受訓，可考慮先上兩個禮拜的「航空器失事調查課程」，再選擇「調查管理」課程。如此受訓人

員不會一下子一個月都不在會內而和原本的業務疏遠，另外會內的經費運用也會比較容易安排。

2. 若今後仍有會內人員前往 Albuquerque 受訓，事前詢問當地的汽車旅館和租車公司，經訪價後通常可以得到不錯的價格，對於緊縮的出國預算而言，這些資訊對於經費的節省不無小補。

3. 針對 SCSI 的課程安排行政經驗，有些可以參考的地方如下：

   - 事前和所有教師協調好上課的方式。教師本身即可控制整個課堂上課、下課的節奏。
   - 一個小時休息十分鐘是比較好的時間分割。
   - 學員午餐自行負責，不需準備學員便當，這樣可以節省很多訂便當、收垃圾等的人力，也不會讓上課的地方品質變低。

伍、附　　錄

附錄一　The Human Factors Analysis and Classification System

附錄二　Aircraft Accident and Incident Investigation

附錄一 The Human Factors Analysis and Classification System-HFACS

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The Human Factors Analysis and Classification System–HFACS

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16. Abstract

Human error has been implicated in 70 to 80% of all civil and military aviation accidents. Yet, most accident reporting systems are not designed around any theoretical framework of human error. As a result, most accident databases are not conducive to a traditional human error analysis, making the identification of intervention strategies onerous. What is required is a general human error framework around which new investigative methods can be designed and existing accident databases restructured. Indeed, a comprehensive human factors analysis and classification system (HFACS) has recently been developed to meet those needs. Specifically, the HFACS framework has been used within the military, commercial, and general aviation sectors to systematically examine underlying human causal factors and to improve aviation accident investigations. This paper describes the development and theoretical underpinnings of HFACS in the hope that it will help safety professionals reduce the aviation accident rate through systematic, data-driven investment strategies and objective evaluation of intervention programs

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THE HUMAN FACTORS ANALYSIS AND CLASSIFICATION SYSTEM–HFACS

INTRODUCTION

Sadly, the annals of aviation history are littered with accidents and tragic losses. Since the late 1950s, however, the drive to reduce the accident rate has yielded unprecedented levels of safety to a point where it is now safer to fly in a commercial airliner than to drive a car or even walk across a busy New York city street. Still, while the aviation accident rate has declined tremendously since the first flights nearly a century ago, the cost of aviation accidents in both lives and dollars has steadily risen. As a result, the effort to reduce the accident rate still further has taken on new meaning within both military and civilian aviation.

Even with all the innovations and improvements realized in the last several decades, one fundamental question remains generally unanswered: "Why do aircraft crash?" The answer may not be as straightforward as one might think. In the early years of aviation, it could reasonably be said that, more often than not, the aircraft killed the pilot. That is, the aircraft were intrinsically unforgiving and, relative to their modern counterparts, mechanically unsafe. However, the modern era of aviation has witnessed an ironic reversal of sorts. It now appears to some that the aircrew themselves are more deadly than the aircraft they fly (Mason, 1993; cited in Murray, 1997). In fact, estimates in the literature indicate that between 70 and 80 percent of aviation accidents can be attributed, at least in part, to human error (Shappell & Wiegmann, 1996). Still, to off-handedly attribute accidents solely to aircrew error is like telling patients they are simply "sick" without examining the underlying causes or further defining the illness.

So what really constitutes that 70-80 % of human error repeatedly referred to in the literature? Some would have us believe that human error and "pilot" error are synonymous. Yet, simply writing off aviation accidents merely to pilot error is an overly simplistic, if not naive, approach to accident causation. After all, it is well established that accidents cannot be attributed to a single cause, or in most instances, even a single individual (Heinrich, Petersen, and Roos, 1980). In fact, even the identification of a "primary" cause is fraught with problems. Rather, aviation accidents are the end result of a number of causes, only the last of which are the unsafe acts of the aircrew (Reason, 1990; Shappell & Wiegmann, 1997a; Heinrich, Petersen, & Roos, 1980; Bird, 1974).

The challenge for accident investigators and analysts alike is how best to identify and mitigate the causal sequence of events, in particular that 70-80 % associated with human error. Armed with this challenge, those interested in accident causation are left with a growing list of investigative schemes to chose from. In fact, there are nearly as many approaches to accident causation as there are those involved in the process (Senders & Moray, 1991). Nevertheless, a comprehensive framework for identifying and analyzing human error continues to elude safety professionals and theorists alike. Consequently, interventions cannot be accurately targeted at specific human causal factors nor can their effectiveness be objectively measured and assessed. Instead, safety professionals are left with the status quo. That is, they are left with interest/fad-driven research resulting in intervention strategies that peck around the edges of accident causation, but do little to reduce the overall accident rate. What is needed is a framework around which a needs-based, data-driven safety program can be developed (Wiegmann & Shappell, 1997).

Reason's "Swiss Cheese" Model of Human Error

One particularly appealing approach to the genesis of human error is the one proposed by James Reason (1990). Generally referred to as the "Swiss cheese" model of human error, Reason describes four levels of human failure, each influencing the next (Figure 1). Working backwards in time from the accident, the first level depicts those *Unsafe Acts* of Operators that ultimately led to the accident[1]. More commonly referred to in aviation as aircrew/pilot error, this level is where most accident investigations have focused their efforts and consequently, where most causal factors are uncovered.

[1] Reason's original work involved operators of a nuclear power plant. However, for the purposes of this manuscript, the operators here refer to aircrew, maintainers, supervisors and other humans involved in aviation.

After all, it is typically the actions or inactions of aircrew that are directly linked to the accident. For instance, failing to properly scan the aircraft's instruments while in instrument meteorological conditions (IMC) or penetrating IMC when authorized only for visual meteorological conditions (VMC) may yield relatively immediate, and potentially grave, consequences. Represented as "holes" in the cheese, these active failures are typically the last unsafe acts committed by aircrew.

However, what makes the "Swiss cheese" model particularly useful in accident investigation, is that it forces investigators to address latent failures within the causal sequence of events as well. As their name suggests, latent failures, unlike their active counterparts, may lie dormant or undetected for hours, days, weeks, or even longer, until one day they adversely affect the unsuspecting aircrew. Consequently, they may be overlooked by investigators with even the best intentions.

Within this concept of latent failures, Reason described three more levels of human failure. The first involves the condition of the aircrew as it affects performance. Referred to as *Preconditions for Unsafe Acts*, this level involves conditions such as mental fatigue and poor communication and coordination practices, often referred to as crew resource management (CRM). Not surprising, if fatigued aircrew fail to communicate and coordinate their activities with others in the cockpit or individuals external to the aircraft (e.g., air traffic control, maintenance, etc.), poor decisions are made and errors often result.

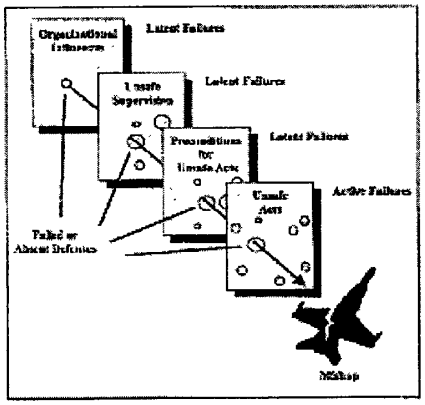

Figure 1. *The "Swiss cheese" model of human error causation (adapted from Reason, 1990).*

But exactly why did communication and coordination break down in the first place? This is perhaps where Reason's work departed from more traditional approaches to human error. In many instances, the breakdown in good CRM practices can be traced back to instances of *Unsafe Supervision*, the third level of human failure. If, for example, two inexperienced (and perhaps even below average pilots) are paired with each other and sent on a flight into known adverse weather at night, is anyone really surprised by a tragic outcome? To make matters worse, if this questionable manning practice is coupled with the lack of quality CRM training, the potential for miscommunication and ultimately, aircrew errors, is magnified. In a sense then, the crew was "set up" for failure as crew coordination and ultimately performance would be compromised. This is not to lessen the role played by the aircrew, only that intervention and mitigation strategies might lie higher within the system.

Reason's model didn't stop at the supervisory level either; the organization itself can impact performance at all levels. For instance, in times of fiscal austerity, funding is often cut, and as a result, training and flight time are curtailed. Consequently, supervisors are often left with no alternative but to task "non-proficient" aviators with complex tasks. Not surprisingly then, in the absence of good CRM training, communication and coordination failures will begin to appear as will a myriad of other preconditions, all of which will affect performance and elicit aircrew errors. Therefore, it makes sense that, if the accident rate is going to be reduced beyond current levels, investigators and analysts alike must examine the accident sequence in its entirety and expand it beyond the cockpit. Ultimately, causal factors at all levels within the organization must be addressed if any accident investigation and prevention system is going to succeed.

In many ways, Reason's "Swiss cheese" model of accident causation has revolutionized common views of accident causation. Unfortunately, however, it is simply a theory with few details on how to apply it in a real-world setting. In other words, the theory never defines what the "holes in the cheese" really are, at least within the context of everyday operations. Ultimately, one needs to know what these system failures or "holes" are, so that they can be identified during accident investigations or better yet, detected and corrected before an accident occurs.

The balance of this paper will attempt to describe the "holes in the cheese." However, rather than attempt to define the holes using esoteric theories with little or no practical applicability, the original framework (called the *Taxonomy of Unsafe Operations*) was developed using over 300 Naval aviation accidents obtained from the U.S. Naval Safety Center (Shappell & Wiegmann, 1997a). The original taxonomy has since been refined using input and data from other military (U.S. Army Safety Center and the U.S. Air Force Safety Center) and civilian organizations (National Transportation Safety Board and the Federal Aviation Administration). The result was the development of the Human Factors Analysis and Classification System (HFACS).

THE HUMAN FACTORS ANALYSIS AND CLASSIFICATION SYSTEM

Drawing upon Reason's (1990) concept of latent and active failures, HFACS describes four levels of failure: 1) Unsafe Acts, 2) Preconditions for Unsafe Acts, 3) Unsafe Supervision, and 4) Organizational Influences. A brief description of the major components and causal categories follows, beginning with the level most closely tied to the accident, i.e. unsafe acts.

Unsafe Acts

The unsafe acts of aircrew can be loosely classified into two categories: errors and violations (Reason, 1990). In general, errors represent the mental or physical activities of individuals that fail to achieve their intended outcome. Not surprising, given the fact that human beings by their very nature make errors, these unsafe acts dominate most accident databases. Violations, on the other hand, refer to the willful disregard for the rules and regulations that govern the safety of flight. The bane of many organizations, the prediction and prevention of these appalling and purely "preventable" unsafe acts, continue to elude managers and researchers alike.

Still, distinguishing between errors and violations does not provide the level of granularity required of most accident investigations. Therefore, the categories of errors and violations were expanded here (Figure 2), as elsewhere (Reason, 1990; Rasmussen, 1982), to include three basic error types (skill-based, decision, and perceptual) and two forms of violations (routine and exceptional).

Errors

Skill-based errors. Skill-based behavior within the context of aviation is best described as "stick-and-rudder" and other basic flight skills that occur without significant conscious thought. As a result, these skill-based actions are particularly vulnerable to failures of attention and/or memory. In fact, attention failures have been linked to many skill-based errors such as the breakdown in visual scan patterns, task fixation, the inadvertent activation of controls, and the misordering of steps in a procedure, among others (Table 1). A classic example is an aircraft's crew that becomes so fixated on trouble-shooting a burned out warning light that they do not notice their fatal

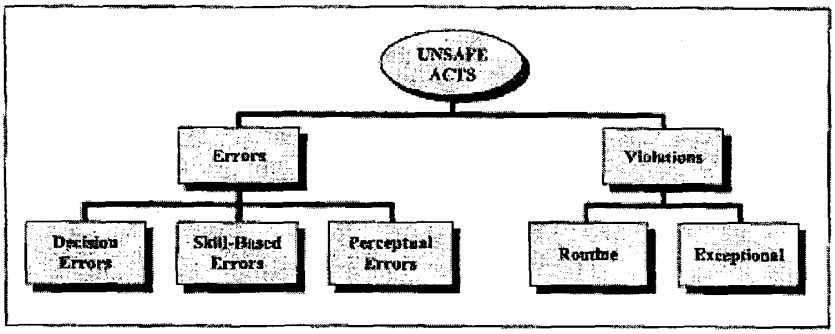

Figure 2. *Categories of unsafe acts committed by aircrews.*

TABLE 1. Selected examples of Unsafe Acts of Pilot Operators (Note: This is not a complete listing)

ERRORS	VIOLATIONS
Skill-based Errors	Failed to adhere to brief
Breakdown in visual scan	Failed to use the radar altimeter
Failed to prioritize attention	Flew an unauthorized approach
Inadvertent use of flight controls	Violated training rules
Omitted step in procedure	Flew an overaggressive maneuver
Omitted checklist item	Failed to properly prepare for the flight
Poor technique	Briefed unauthorized flight
Over-controlled the aircraft	Not current/qualified for the mission
Decision Errors	Intentionally exceeded the limits of the aircraft
Improper procedure	Continued low-altitude flight in VMC
Misdiagnosed emergency	Unauthorized low-altitude canyon running
Wrong response to emergency	
Exceeded ability	
Inappropriate maneuver	
Poor decision	
Perceptual Errors (due to)	
Misjudged distance/altitude/airspeed	
Spatial disorientation	
Visual illusion	

descent into the terrain. Perhaps a bit closer to home, consider the hapless soul who locks himself out of the car or misses his exit because he was either distracted, in a hurry, or daydreaming. These are both examples of attention failures that commonly occur during highly automatized behavior. Unfortunately, while at home or driving around town these attention/memory failures may be frustrating, in the air they can become catastrophic.

In contrast to attention failures, memory failures often appear as omitted items in a checklist, place losing, or forgotten intentions. For example, most of us have experienced going to the refrigerator only to forget what we went for. Likewise, it is not difficult to imagine that when under stress during inflight emergencies, critical steps in emergency procedures can be missed. However, even when not particularly stressed, individuals have forgotten to set the flaps on approach or lower the landing gear – at a minimum, an embarrassing gaffe.

The third, and final, type of skill-based errors identified in many accident investigations involves technique errors. Regardless of one's training, experience, and educational background, the manner in which one carries out a specific sequence of events may vary greatly. That is, two pilots with identical training, flight grades, and experience may differ significantly in the manner in which they maneuver their aircraft. While one pilot may fly smoothly with the grace of a soaring eagle, others may fly with the darting, rough transitions of a sparrow. Nevertheless, while both may be safe and equally adept at flying, the techniques they employ could set them up for specific failure modes. In fact, such techniques are as much a factor of innate ability and aptitude as they are an overt expression of one's own personality, making efforts at the prevention and mitigation of technique errors difficult, at best.

Decision errors. The second error form, decision errors, represents intentional behavior that proceeds as intended, yet the plan proves inadequate or inappropriate for the situation. Often referred to as "honest mistakes," these unsafe acts represent the actions or inactions of individuals whose "hearts are in the right place," but they either did not have the appropriate knowledge or just simply chose poorly.

Perhaps the most heavily investigated of all error forms, decision errors can be grouped into three general categories: procedural errors, poor choices, and problem solving errors (Table 1). Procedural decision errors (Orasanu, 1993), or rule-based mistakes, as described by Rasmussen (1982), occur during highly structured tasks of the sorts, if X, then do Y. Aviation, particularly within the military and commercial sectors, by its very nature is highly structured, and consequently, much of pilot decision making is procedural. There are very explicit procedures to be performed at virtually all phases of flight. Still, errors can, and often do, occur when a situation is either not recognized or misdiagnosed, and the wrong procedure is applied. This is particularly true when pilots are placed in highly time-critical emergencies like an engine malfunction on takeoff.

However, even in aviation, not all situations have corresponding procedures to deal with them. Therefore, many situations require a choice to be made among multiple response options. Consider the pilot flying home after a long week away from the family who unexpectedly confronts a line of thunderstorms directly in his path. He can choose to fly around the weather, divert to another field until the weather passes, or penetrate the weather hoping to quickly transition through it. Confronted with situations such as this, choice decision errors (Orasanu, 1993), or knowledge-based mistakes as they are otherwise known (Rasmussen, 1986), may occur. This is particularly true when there is insufficient experience, time, or other outside pressures that may preclude correct decisions. Put simply, sometimes we chose well, and sometimes we don't.

Finally, there are occasions when a problem is not well understood, and formal procedures and response options are not available. It is during these ill-defined situations that the invention of a novel solution is required. In a sense, individuals find themselves where no one has been before, and in many ways, must literally fly by the seats of their pants. Individuals placed in this situation must resort to slow and effortful reasoning processes where time is a luxury rarely afforded. Not surprisingly, while this type of decision making is more infrequent than other forms, the relative proportion of problem-solving errors committed is markedly higher.

Perceptual errors. Not unexpectedly, when one's perception of the world differs from reality, errors can, and often do, occur. Typically, perceptual errors occur when sensory input is degraded or "unusual," as is the case with visual illusions and spatial disorientation or when aircrew simply misjudge the aircraft's altitude, attitude, or airspeed (Table 1). Visual illusions, for example, occur when the brain tries to "fill in the gaps" with what it feels belongs in a visually impoverished environment, like that seen at night or when flying in adverse weather. Likewise, spatial disorientation occurs when the vestibular system cannot resolve one's orientation in space and therefore makes a "best guess" — typically when visual (horizon) cues are absent at night or when flying in adverse weather. In either event, the unsuspecting individual often is left to make a decision that is based on faulty information and the potential for committing an error is elevated.

It is important to note, however, that it is not the illusion or disorientation that is classified as a perceptual error. Rather, it is the pilot's erroneous response to the illusion or disorientation. For example, many unsuspecting pilots have experienced "black-hole" approaches, only to fly a perfectly good aircraft into the terrain or water. This continues to occur, even though it is well known that flying at night over dark, featureless terrain (e.g., a lake or field devoid of trees), will produce the illusion that the aircraft is actually higher than it is. As a result, pilots are taught to rely on their primary instruments, rather than the outside world, particularly during the approach phase of flight. Even so, some pilots fail to monitor their instruments when flying at night. Tragically, these aircrew and others who have been fooled by illusions and other disorientating flight regimes may end up involved in a fatal aircraft accident.

Violations

By definition, errors occur within the rules and regulations espoused by an organization; typically dominating most accident databases. In contrast, violations represent a willful disregard for the rules and regulations that govern safe flight and, fortunately, occur much less frequently since they often involve fatalities (Shappell et al., 1999b).

While there are many ways to distinguish between types of violations, two distinct forms have been identified, based on their etiology, that will help the safety professional when identifying accident causal factors. The first, routine violations, tend to be habitual by nature and often tolerated by governing authority (Reason, 1990). Consider, for example, the individual who drives consistently 5-10 mph faster than allowed by law or someone who routinely flies in marginal weather when authorized for visual meteorological conditions only. While both are certainly against the governing regulations, many others do the same thing. Furthermore, individuals who drive 64 mph in a 55 mph zone, almost always drive 64 in a 55 mph zone. That is, they "routinely" violate the speed limit. The same can typically be said of the pilot who routinely flies into marginal weather.

What makes matters worse, these violations (commonly referred to as "bending" the rules) are often tolerated and, in effect, sanctioned by supervisory authority (i.e., you're not likely to get a traffic citation until you exceed the posted speed limit by more than 10 mph). If, however, the local authorities started handing out traffic citations for exceeding the speed limit on the highway by 9 mph or less (as is often done on military installations), then it is less likely that individuals would violate the rules. Therefore, by definition, if a routine violation is identified, one must look further up the supervisory chain to identify those individuals in authority who are not enforcing the rules.

On the other hand, unlike routine violations, exceptional violations appear as isolated departures from authority, not necessarily indicative of individual's typical behavior pattern nor condoned by management (Reason, 1990). For example, an isolated instance of driving 105 mph in a 55 mph zone is considered an exceptional violation. Likewise, flying under a bridge or engaging in other prohibited maneuvers, like low-level canyon running, would constitute an exceptional violation. However, it is important to note that, while most exceptional violations are appalling, they are not considered "exceptional" because of their extreme nature. Rather, they are considered exceptional because they are neither typical of the individual nor condoned by authority. Still, what makes exceptional violations particularly difficult for any organization to deal with is that they are not indicative of an individual's behavioral repertoire and, as such, are particularly difficult to predict. In fact, when individuals are confronted with evidence of their dreadful behavior and asked to explain it, they are often left with little explanation. Indeed, those individuals who survived such excursions from the norm clearly knew that, if caught, dire consequences would follow. Still, defying all logic, many otherwise model citizens have been down this potentially tragic road.

Preconditions for Unsafe Acts

Arguably, the unsafe acts of pilots can be directly linked to nearly 80 % of all aviation accidents. However, simply focusing on unsafe acts is like focusing on a fever without understanding the underlying disease causing it. Thus, investigators must dig deeper into why the unsafe acts took place. As a first step, two major subdivisions of unsafe aircrew conditions were developed: substandard conditions of operators and the substandard practices they commit (Figure 3).

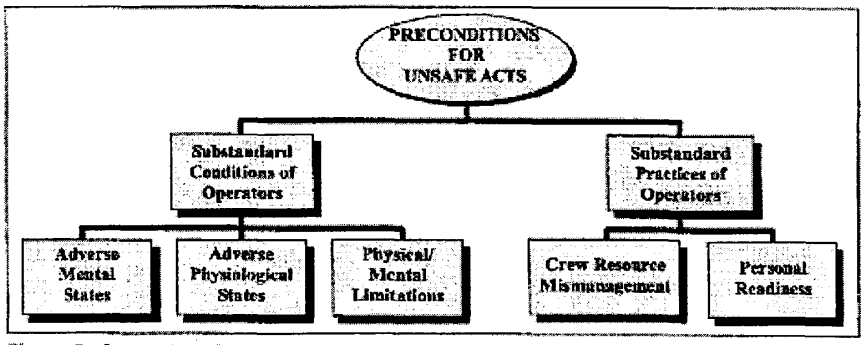

Figure 3. *Categories of preconditions of unsafe acts.*

Substandard Conditions of Operators

Adverse mental states. Being prepared mentally is critical in nearly every endeavor, but perhaps even more so in aviation. As such, the category of Adverse Mental States was created to account for those mental conditions that affect performance (Table 2). Principal among these are the loss of situational awareness, task fixation, distraction, and *mental* fatigue due to sleep loss or other stressors. Also included in this category are personality traits and pernicious attitudes such as overconfidence, complacency, and misplaced motivation.

Predictably, if an individual is mentally tired for whatever reason, the likelihood increases that an error will occur. In a similar fashion, overconfidence and other pernicious attitudes such as arrogance and impulsivity will influence the likelihood that a violation will be committed. Clearly then, any framework of human error must account for preexisting adverse mental states in the causal chain of events.

Adverse physiological states. The second category, adverse physiological states, refers to those medical or physiological conditions that preclude safe operations (Table 2). Particularly important to aviation are such conditions as visual illusions and spatial disorientation as described earlier, as well as *physical* fatigue, and the myriad of pharmacological and medical abnormalities known to affect performance.

The effects of visual illusions and spatial disorientation are well known to most aviators. However, less well known to aviators, and often overlooked are the effects on cockpit performance of simply being ill. Nearly all of us have gone to work ill, dosed with over-the-counter medications, and have generally performed well. Consider however, the pilot suffering from the common head cold. Unfortunately, most aviators view a head cold as only a minor inconvenience that can be easily remedied using over-the-counter antihistamines, acetaminophen, and other non-prescription pharmaceuticals. In fact, when

TABLE 2. Selected examples of Unsafe Aircrew Conditions (Note: This is not a complete listing)

SUBSTANDARD CONDITIONS OF OPERATORS	SUBSTANDARD PRACTICES OF OPERATORS
Adverse Mental States	**Crew Resource Management**
Channelized attention	Failed to back up
Complacency	Failed to communicate/coordinate
Distraction	Failed to conduct adequate brief
Mental fatigue	Failed to use all available resources
Get-home-itis	Failure of leadership
Haste	Misinterpretation of traffic calls
Loss of situational awareness	**Personal Readiness**
Misplaced motivation	Excessive physical training
Task saturation	Self medicating
Adverse Physiological States	Violation of crew rest requirement
Impaired physiological state	Violation of bottle-to-throttle requirement
Medical illness	
Physiological incapacitation	
Physical fatigue	
Physical/Mental Limitation	
Insufficient reaction time	
Visual limitation	
Incompatible intelligence/aptitude	
Incompatible physical capability	

confronted with a stuffy nose, aviators typically are only concerned with the effects of a painful sinus block as cabin altitude changes. Then again, it is not the overt symptoms that local flight surgeons are concerned with. Rather, it is the accompanying inner ear infection and the increased likelihood of spatial disorientation when entering instrument meteorological conditions that is alarming - not to mention the side-effects of antihistamines, fatigue, and sleep loss on pilot decision-making. Therefore, it is incumbent upon any safety professional to account for these sometimes subtle medical conditions within the causal chain of events.

Physical/Mental Limitations. The third, and final, substandard condition involves individual physical/mental limitations (Table 2). Specifically, this category refers to those instances when mission requirements exceed the capabilities of the individual at the controls. For example, the human visual system is severely limited at night; yet, like driving a car, drivers do not necessarily slow down or take additional precautions. In aviation, while slowing down isn't always an option, paying additional attention to basic flight instruments and increasing one's vigilance will often increase the safety margin. Unfortunately, when precautions are not taken, the result can be catastrophic, as pilots will often fail to see other aircraft, obstacles, or power lines due to the size or contrast of the object in the visual field.

Similarly, there are occasions when the time required to complete a task or maneuver exceeds an individual's capacity. Individuals vary widely in their ability to process and respond to information. Nevertheless, good pilots are typically noted for their ability to respond quickly and accurately. It is well documented, however, that if individuals are required to respond quickly (i.e., less time is available to consider all the possibilities or choices thoroughly), the probability of making an error goes up markedly. Consequently, it should be no surprise that when faced with the need for rapid processing and reaction times, as is the case in most aviation emergencies, all forms of error would be exacerbated.

In addition to the basic sensory and information processing limitations described above, there are at least two additional instances of physical/mental limitations that need to be addressed, albeit they are often overlooked by most safety professionals. These limitations involve individuals who simply are not compatible with aviation, because they are either unsuited physically or do not possess the aptitude to fly. For example, some individuals simply don't have the physical strength to operate in the potentially high-G environment of aviation, or for anthropometric reasons, simply have difficulty reaching the controls. In other words, cockpits have traditionally not been designed with all shapes, sizes, and physical abilities in mind. Likewise, not everyone has the mental ability or aptitude for flying aircraft. Just as not all of us can be concert pianists or NFL linebackers, not everyone has the innate ability to pilot an aircraft – a vocation that requires the unique ability to make decisions quickly and respond accurately in life threatening situations. The difficult task for the safety professional is identifying whether aptitude might have contributed to the accident causal sequence.

Substandard Practices of Operators

Clearly then, numerous substandard conditions of operators can, and do, lead to the commission of unsafe acts. Nevertheless, there are a number of things that we do to ourselves that set up these substandard conditions. Generally speaking, these substandard practices of operators can be summed up in two categories: crew resource mismanagement and personal readiness.

Crew Resource Mismanagement. Good communication skills and team coordination have been the mantra of industrial/organizational and personnel psychology for decades. Not surprising then, crew resource management has been a cornerstone of aviation for the last few decades (Helmreich & Foushee, 1993). As a result, the category of crew resource mismanagement was created to account for occurrences of poor coordination among personnel. Within the context of aviation, this includes coordination both within and between aircraft with air traffic control facilities and maintenance control, as well as with facility and other support personnel as necessary. But aircrew coordination does not stop with the aircrew in flight. It also includes coordination before and after the flight with the brief and debrief of the aircrew.

It is not difficult to envision a scenario where the lack of crew coordination has led to confusion and poor decision making in the cockpit, resulting in an accident. In fact, aviation accident databases are replete with instances of poor coordination among aircrew. One of the more tragic examples was the crash of a civilian airliner at night in the Florida Everglades in 1972 as the crew was busily trying to

troubleshoot what amounted to a burnt out indicator light. Unfortunately, no one in the cockpit was monitoring the aircraft's altitude as the altitude hold was inadvertently disconnected. Ideally, the crew would have coordinated the trouble-shooting task ensuring that at least one crewmember was monitoring basic flight instruments and "flying" the aircraft. Tragically, this was not the case, as they entered a slow, unrecognized, descent into the everglades resulting in numerous fatalities.

Personal Readiness. In aviation, or for that matter in any occupational setting, individuals are expected to show up for work ready to perform at optimal levels. Nevertheless, in aviation as in other professions, personal readiness failures occur when individuals fail to prepare physically or mentally for duty. For instance, violations of crew rest requirements, bottle-to-brief rules, and self-medicating all will affect performance on the job and are particularly detrimental in the aircraft. It is not hard to imagine that, when individuals violate crew rest requirements, they run the risk of mental fatigue and other adverse mental states, which ultimately lead to errors and accidents. Note however, that violations that affect personal readiness are not considered "unsafe act violation" since they typically do not happen in the cockpit, nor are they necessarily active failures with direct and immediate consequences.

Still, not all personal readiness failures occur as a result of violations of governing rules or regulations. For example, running 10 miles before piloting an aircraft may not be against any existing regulations, yet it may impair the physical and mental capabilities of the individual enough to degrade performance and elicit unsafe acts. Likewise, the traditional "candy bar and coke" lunch of the modern businessman may sound good but may not be sufficient to sustain performance in the rigorous environment of aviation. While there may be no rules governing such behavior, pilots must use good judgment when deciding whether they are "fit" to fly an aircraft.

Unsafe Supervision

Recall that in addition to those causal factors associated with the pilot/operator, Reason (1990) traced the causal chain of events back up the supervisory chain of command. As such, we have identified four categories of unsafe supervision: inadequate supervision, planned inappropriate operations, failure to correct a known problem, and supervisory violations (Figure 4). Each is described briefly below.

Inadequate Supervision. The role of any supervisor is to provide the opportunity to succeed. To do this, the supervisor, no matter at what level of operation, must provide guidance, training opportunities, leadership, and motivation, as well as the proper role model to be emulated. Unfortunately, this is not always the case. For example, it is not difficult to conceive of a situation where adequate crew resource management training was either not provided, or the opportunity to attend such training was not afforded to a particular aircrew member. Conceivably, aircrew coordination skills would be compromised and if the aircraft were put into an adverse situation (an emergency for instance), the risk of an error being committed would be exacerbated and the potential for an accident would increase markedly.

In a similar vein, sound professional guidance and oversight is an essential ingredient of any successful organization. While empowering individuals to make decisions and function independently is certainly essential, this does not divorce the supervisor from accountability. The lack of guidance and oversight

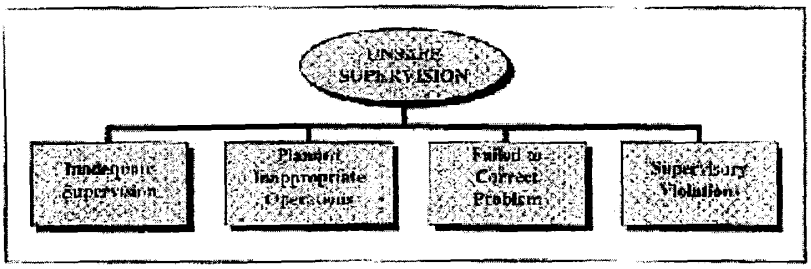

Figure 4. *Categories of unsafe supervision.*

has proven to be the breeding ground for many of the violations that have crept into the cockpit. As such, any thorough investigation of accident causal factors must consider the role supervision plays (i.e., whether the supervision was inappropriate or did not occur at all) in the genesis of human error (Table 3).

Planned Inappropriate Operations. Occasionally, the operational tempo and/or the scheduling of aircrew is such that individuals are put at unacceptable risk, crew rest is jeopardized, and ultimately performance is adversely affected. Such operations, though arguably unavoidable during emergencies, are unacceptable during normal operations. Therefore, the second category of unsafe supervision, planned inappropriate operations, was created to account for these failures (Table 3).

Take, for example, the issue of improper crew pairing. It is well known that when very senior, dictatorial captains are paired with very junior, weak co-pilots, communication and coordination problems are likely to occur. Commonly referred to as the trans-cockpit authority gradient, such conditions likely contributed to the tragic crash of a commercial airliner in to the Potomac River outside of Washington, DC, in January of 1982 (NTSB, 1982). In that accident, the captain of the aircraft repeatedly rebuffed the first officer when the latter indicated that the engine instruments did not appear normal. Undaunted, the captain continued a fatal takeoff in icing conditions with less than adequate takeoff thrust. The aircraft stalled and plummeted into the icy river, killing the crew and many of the passengers.

Clearly, the captain and crew were held accountable. They died in the accident and cannot shed light on causation; but, what was the role of the supervisory chain? Perhaps crew pairing was equally responsible. Although not specifically addressed in the report, such issues are clearly worth exploring in many accidents. In fact, in that particular accident, several other training and manning issues were identified.

Failure to Correct a Known Problem. The third category of known unsafe supervision, Failed to Correct a Known Problem, refers to those instances when deficiencies among individuals, equipment, training or other related safety areas are "known" to the supervisor, yet are allowed to continue unabated (Table 3). For example, it is not uncommon for accident investigators to interview the pilot's friends, colleagues, and supervisors after a fatal crash only to find out that they "knew it would happen to him some day." If the supervisor knew that a pilot was incapable of flying safely, and allowed the flight anyway, he clearly did the pilot no favors. The failure to correct the behavior, either through remedial training or, if necessary, removal from flight status, essentially signed the pilot's death warrant—not to mention that of others who may have been on board.

TABLE 3. Selected examples of Unsafe Supervision (Note: This is not a complete listing)

Inadequate Supervision	**Failed to Correct a Known Problem**
Failed to provide guidance	Failed to correct document in error
Failed to provide operational doctrine	Failed to identify an at-risk aviator
Failed to provide oversight	Failed to initiate corrective action
Failed to provide training	Failed to report unsafe tendencies
Failed to track qualifications	**Supervisory Violations**
Failed to track performance	Authorized unnecessary hazard
Planned Inappropriate Operations	Failed to enforce rules and regulations
Failed to provide correct data	Authorized unqualified crew for flight
Failed to provide adequate brief time	
Improper manning	
Mission not in accordance with rules/regulations	
Provided inadequate opportunity for crew rest	

Likewise, the failure to consistently correct or discipline inappropriate behavior certainly fosters an unsafe atmosphere and promotes the violation of rules. Aviation history is rich with by reports of aviators who tell hair-raising stories of their exploits and barnstorming low-level flights (the infamous "been there, done that"). While entertaining to some, they often serve to promulgate a perception of tolerance and "one-up-manship" until one day someone ties the low altitude flight record of ground-level! Indeed, the failure to report these unsafe tendencies and initiate corrective actions is yet another example of the failure to correct known problems.

Supervisory Violations. Supervisory violations, on the other hand, are reserved for those instances when existing rules and regulations are willfully disregarded by supervisors (Table 3). Although arguably rare, supervisors have been known occasionally to violate the rules and doctrine when managing their assets. For instance, there have been occasions when individuals were permitted to operate an aircraft without current qualifications or license. Likewise, it can be argued that failing to enforce existing rules and regulations or flaunting authority are also violations at the supervisory level. While rare and possibly difficult to cull out, such practices are a flagrant violation of the rules and invariably set the stage for the tragic sequence of events that predictably follow.

Organizational Influences

As noted previously, fallible decisions of upper-level management directly affect supervisory practices, as well as the conditions and actions of operators. Unfortunately, these organizational errors often go unnoticed by safety professionals, due in large part to the lack of a clear framework from which to investigate them. Generally speaking, the most elusive of latent failures revolve around issues related to resource management, organizational climate, and operational processes, as detailed below in Figure 5.

Resource Management. This category encompasses the realm of corporate-level decision making regarding the allocation and maintenance of organizational assets such as human resources (personnel), monetary assets, and equipment/facilities (Table 4). Generally, corporate decisions about how such resources should be managed center around two distinct objectives – the goal of safety and the goal of on-time, cost-effective operations. In times of prosperity, both objectives can be easily balanced and satisfied in full. However, as we mentioned earlier, there may also be times of fiscal austerity that demand some give and take between the two. Unfortunately, history tells us that safety is often the loser in such battles and, as some can attest to very well, safety and training are often the first to be cut in organizations having financial difficulties. If cutbacks in such areas are too severe, flight proficiency may suffer, and the best pilots may leave the organization for greener pastures.

Excessive cost-cutting could also result in reduced funding for new equipment or may lead to the purchase of equipment that is sub optimal and inadequately designed for the type of operations flown by the company. Other trickle-down effects include poorly maintained equipment and workspaces, and the failure to correct known design flaws in existing equipment. The result is a scenario involving unseasoned, less-skilled pilots flying old and poorly maintained aircraft under the least desirable conditions and schedules. The ramifications for aviation safety are not hard to imagine.

Climate. Organizational Climate refers to a broad class of organizational variables that influence worker performance. Formally, it was defined as the "situationally based consistencies in the organization's treatment of individuals" (Jones, 1988). In general, however, organizational climate can be viewed as the working atmosphere within the organization. One telltale sign of an organization's climate is its structure,

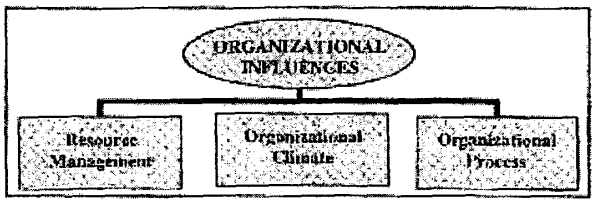

Figure 5. *Organizational factors influencing accidents.*

TABLE 4. Selected examples of Organizational Influences (Note: This is not a complete listing)

Resource/Acquisition Management	**Organizational Process**
Human Resources	Operations
Selection	Operational tempo
Staffing/manning	Time pressure
Training	Production quotas
Monetary/budget resources	Incentives
Excessive cost cutting	Measurement/appraisal
Lack of funding	Schedules
Equipment/facility resources	Deficient planning
Poor design	Procedures
Purchasing of unsuitable equipment	Standards
Organizational Climate	Clearly defined objectives
Structure	Documentation
Chain-of-command	Instructions
Delegation of authority	Oversight
Communication	Risk management
Formal accountability for actions	Safety programs
Policies	
Hiring and firing	
Promotion	
Drugs and alcohol	
Culture	
Norms and rules	
Values and beliefs	
Organizational justice	

as reflected in the chain-of-command, delegation of authority and responsibility, communication channels, and formal accountability for actions (Table 4). Just like in the cockpit, communication and coordination are vital within an organization. If management and staff within an organization are not communicating, or if no one knows who is in charge, organizational safety clearly suffers and accidents do happen (Muchinsky, 1997).

An organization's policies and culture are also good indicators of its climate. Policies are official guidelines that direct management's decisions about such things as hiring and firing, promotion, retention, raises, sick leave, drugs and alcohol, overtime, accident investigations, and the use of safety equipment. Culture, on the other hand, refers to the unofficial or unspoken rules, values, attitudes, beliefs, and customs of an organization. Culture is "the way things really get done around here."

When policies are ill-defined, adversarial, or conflicting, or when they are supplanted by unofficial rules and values, confusion abounds within the organization. Indeed, there are some corporate managers who are quick to give "lip service" to official safety policies while in a public forum, but then overlook such policies when operating behind the scenes. However, the Third Law of Thermodynamics tells us that, "order and harmony cannot be produced by such chaos and disharmony". Safety is bound to suffer under such conditions.

Operational Process. This category refers to corporate decisions and rules that govern the everyday activities within an organization, including the establishment and use of standardized operating procedures and formal methods for maintaining checks and balances (oversight) between the workforce and management. For example, such factors as operational tempo, time pressures, incentive systems, and work schedules are all factors that can adversely affect safety (Table 4). As stated earlier, there may be instances when those within the upper echelon of an organization determine that it is necessary to increase the operational tempo to a point that overextends a supervisor's staffing capabilities. Therefore, a supervisor may resort to the use of inadequate scheduling procedures that jeopardize crew rest and produce sub optimal crew pairings, putting aircrew at an increased risk of a mishap. However, organizations should have official procedures in place to address such contingencies as well as oversight programs to monitor such risks.

Regrettably, not all organizations have these procedures nor do they engage in an active process of monitoring aircrew errors and human factor problems via anonymous reporting systems and safety audits. As such, supervisors and managers are often unaware of the problems before an accident occurs. Indeed, it has been said that "an accident is one incident too many" (Reinhart, 1996). It is incumbent upon any organization to fervently seek out the "holes in the cheese" and plug them up, before they create a window of opportunity for catastrophe to strike.

CONCLUSION

It is our belief that the Human Factors Analysis and Classification System (HFACS) framework bridges the gap between theory and practice by providing investigators with a comprehensive, user-friendly tool for identifying and classifying the human causes of aviation accidents. The system, which is based upon Reason's (1990) model of latent and active failures (Shappell & Wiegmann, 1997a), encompasses all aspects of human error, including the conditions of operators and organizational failure. Still, HFACS and any other framework only contributes to an already burgeoning list of human error taxonomies if it does not prove useful in the operational setting. In these regards, HFACS has recently been employed by the U.S. Navy, Marine Corps, Army, Air Force, and Coast Guard for use in aviation accident investigation and analysis. To date, HFACS has been applied to the analysis of human factors data from approximately 1,000 military aviation accidents. Throughout this process, the reliability and content validity of HFACS has been repeatedly tested and demonstrated (Shappell & Wiegmann, 1997c).

Given that accident databases can be reliably analyzed using HFACS, the next logical question is whether anything unique will be identified. Early indications within the military suggest that the HFACS framework has been instrumental in the identification and analysis of global human factors safety issues (e.g., trends in aircrew proficiency; Shappell, et al., 1999), specific accident types (e.g., controlled flight into terrain, CFIT; Shappell & Wiegmann, 1997b), and human factors problems such as CRM failures (Wiegmann & Shappell, 1999). Consequently, the systematic application of HFACS to the analysis of human factors accident data has afforded the U.S. Navy/Marine Corps (for which the

original taxonomy was developed) the ability to develop objective, data-driven intervention strategies. In a sense, HFACS has illuminated those areas ripe for intervention rather than relying on individual research interests not necessarily tied to saving lives or preventing aircraft losses.

Additionally, the HFACS framework and the insights gleaned from database analyses have been used to develop innovative accident investigation methods that have enhanced both the quantity and quality of the human factors information gathered during accident investigations. However, not only are safety professionals better suited to examine human error in the field but, using HFACS, they can now track those areas (*the holes in the cheese*) responsible for the accidents as well. Only now is it possible to track the success or failure of specific intervention programs designed to reduce specific types of human error and subsequent aviation accidents. In so doing, research investments and safety programs can be either readjusted or reinforced to meet the changing needs of aviation safety.

Recently, these accident analysis and investigative techniques, developed and proven in the military, have been applied to the analysis and investigation of U.S. civil aviation accidents (Shappell & Wiegmann, 1999). Specifically, the HFACS framework is currently being used to systematically analyze both commercial and General Aviation accident data to explore the underlying human factors problems associated with these events. The framework is also being employed to develop improved methods and techniques for investigating human factors issues during actual civil aviation accident investigations by Federal Aviation Administration and National Transportation Safety Board officials. Initial results of this project have begun to highlight human factors areas in need of further safety research. In addition, like their military counterparts, it is anticipated that HFACS will provide the fundamental information and tools needed to develop a more effective and accessible human factors accident database for civil aviation.

In summary, the development of the HFACS framework has proven to be a valuable first step in the establishment of a larger military and civil aviation safety program. The ultimate goal of this, and any other, safety program is to reduce the aviation accident rate through systematic, data-driven investment.

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附錄二：Aircraft Accident and Incident Investigation

TABLE OF CONTENTS

ATTACHMENTS

FOREWORD

Historical background

Standards and Recommended Practices for Aircraft Accident Inquiries were first adopted by the Council on 11 April 1951 pursuant to Article 37 of the Convention on International Civil Aviation (Chicago, 1944) and were designated as Annex 13 to the Convention. The Standards and Recommended Practices were based on recommendations of the Accident Investigation Division at its First Session in February 1946 which were further developed at the Second Session of the Division in February 1947.

The Fourteenth Session of the Assembly (Rome, August–September 1962) considered the subject of aircraft accident investigation and adopted Resolutions A14-22 and A14-27, Appendix P.* The first of these:

1) *directed* "the Council to:

"a) study the possibility of initiating a uniform procedure to be used by States to make available promptly the reports of aircraft accident investigations and inquiries, particularly when related to large modern transport aircraft, so that the dissemination of such reports by all Contracting States may be improved;

"b) study whether it is practicable to establish procedures by which the State of Manufacture or the State that first certificated the aircraft type, would, in appropriate cases and upon invitation, make available competent experts for advice or consultation in the investigation of accidents, and in the light of the results of such study:

"i) determine the most practicable means of ensuring that the fullest possible advantage will be taken of the specialized knowledge of such experts and notify all Contracting States accordingly, and

"ii) urge all Contracting States to co-operate in the use of such experts so as to contribute to the safety of air navigation;"

and

2) *urged* "all Contracting States to provide timely notification of aircraft accidents, especially those involving large modern transport aircraft, to the State of Manufacture or the State that first certificated the aircraft type, whenever it is considered that such action would be appropriate."

In addition, by Resolution A14-27, Appendix P, the Assembly resolved that, "in respect of accident investigation, that it is of great importance for the general improvement of the safety of air navigation that, to the greatest practicable extent, a Contracting State in which an accident has occurred involving aircraft other than of its manufacture communicate to the State of Manufacture as soon as possible any pertinent information which results from the inquiry and which may reflect on the airworthiness of the aircraft type or its equipment, or which might be used to effect improvement in safety."

Table A shows the origin of subsequent amendments together with a list of the principal subjects involved and the dates on which the Annex and the amendments were adopted by the Council, when they became effective and when they became applicable.

Applicability

While the Annex has been adopted pursuant to the provisions of Article 37 of the Convention, Aircraft Accident Inquiry is itself the subject of Article 26 of the Convention. This Article imposes an obligation on the State in which the aircraft accident occurs to institute an inquiry in certain circumstances and, as far as its laws permit, to conduct the inquiry in accordance with ICAO procedure. However, Article 26 does not preclude the taking of further action in the field of aircraft accident investigation and the procedures set forth in this Annex are not limited solely to an inquiry instituted under the requirements of Article 26, but under prescribed circumstances apply in the event of an inquiry into any "aircraft accident" within the terms of the definition herein. In order to maintain the correct relationship between the provisions of Article 26 and those of the Annex, the following principles have been observed:

a) Article 37 of the Convention is the Controlling Article in the development of an Aircraft Accident Inquiry Annex, but nothing in the Annex must contravene the express terms of Article 26, or any other Article of the

* The Fifteenth Session of the Assembly (Montreal, June–July 1965) subsequently adopted Resolution A15-8, Appendix P, which consolidated and superseded resolving clause 2 of Resolution A14-22 and Resolution A14-27, Appendix P.

Convention, nor should it contain any provision which would do violence to the spirit and intent of the Convention.

b) Subject to a) the Annex may deal with any relevant matter whether or not expressly dealt with by Article 26 or by any other Article of the Convention. For instance it is not a contravention of the Convention for the Annex to deal with the rights or obligations of States other than the State of Registry and the State in which the accident occurred; similarly the Annex may deal with the privileges to be accorded to observers entitled by Article 26 to be "present" at the inquiry. These are matters upon which Article 26 is silent. The Annex may also deal with accidents of a kind which do not fall within the provisions of Article 26.

Relationship between Annex 13 and Article 26 of the Convention

In order to clarify the relationship between the provisions of Article 26 and those of the present Annex the Council, at the 20th meeting of its Twelfth Session on 13 April 1951, adopted the following additional resolution:

"*Whereas* Article 26 of the Convention provides that a State in which an accident to an aircraft occurs within the terms of the Article, 'will institute an inquiry into the circumstances of the accident in accordance, in so far as its laws permit, with the procedure which may be recommended by the International Civil Aviation Organization'; and

"*Whereas* the Council, at the 18th meeting of its Twelfth Session on 11 April 1951, adopted Annex 13 on Aircraft Accident Inquiry;

"*The Council recommends* the Standards and Recommended Practices for Aircraft Accident Inquiry contained in Annex 13 to the Convention, as the procedure to be followed by Contracting States for inquiries into accidents involving death or serious injury and instituted in accordance with the provisions of Article 26;

"*It being understood:*

"1) that States may in accordance with Article 38 of the Convention, deviate from any provision of Annex 13, except that, with respect to accidents covered by terms of Article 26 of the Convention and pursuant to this Article, 'the State in which the accident occurs will institute an inquiry', 'the State in which the aircraft is registered shall be given the opportunity to appoint observers to be present at the inquiry' and 'the State holding the inquiry shall communicate the report and findings in the matter to that State'; and

"2) that the procedure here recommended is not applicable when an accident to an aircraft not involving death or serious injury 'indicates serious technical defect in the aircraft or air navigation facilities', in which cases and until ICAO recommends a procedure to this effect, the inquiry shall be conducted in accordance with the national procedure of the State concerned, subject to the obligations deriving from the provisions of Article 26."

The accredited representative and the advisers referred to in the Annex together comprise the observers that are given the right to be present at an inquiry under Article 26.

Action by Contracting States

Notification of differences. The attention of Contracting States is drawn to the obligation imposed by Article 38 of the Convention by which Contracting States are required to notify the Organization of any differences between their national regulations and practices and the International Standards contained in this Annex and any amendments thereto.s Contracting States are invited to extend such notification to any differences from the Recommended Practices contained in this Annex and any amendments thereto, when the notification of such differences is important for the safety of air navigation. Further, Contracting States are invited to keep the Organization currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. A specific request for notification of differences will be sent to Contracting States immediately after the adoption of each amendment to this Annex.

Attention of States is also drawn to the provisions of Annex 15 related to the publication of differences between their national regulations and practices and the related ICAO Standards and Recommended Practices through the Aeronautical Information Service, in addition to the obligation of States under Article 38 of the Convention.

Use of the text of the Annex in national regulations. The Council, on 13 April 1948, adopted a resolution inviting the attention of Contracting States to the desirability of using in their own national regulations, as far as is practicable, the precise language of those ICAO Standards that are of a regulatory character and also of indicating departures from the Standards, including any additional national regulations that were important for the safety or regularity of air navigation. However, the Standards and Recommended Practices of Annex 13 while of general applicability will, in many cases, require amplification in order to enable a complete national code to be formulated.

Status of Annex components

An Annex is made up of the following component parts, not all of which, however, are necessarily found in every Annex; they have the status indicated:

1.— *Material comprising the Annex proper:*

a) *Standards* and *Recommended Practices* adopted by the Council under the provisions of the Convention. They are defined as follows:

Standard: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38.

Recommended Practice: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interests of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention.

b) *Appendices* comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council.

c) *Provisions* governing the applicability of the Standards and Recommended Practices.

d) *Definitions* of terms used in the Standards and Recommended Practices which are not self-explanatory in that they do not have accepted dictionary meanings. A definition does not have an independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.

2.— *Material approved by the Council for publication in association with the Standards and Recommended Practices:*

a) *Forewords* comprising historical and explanatory material based on the action of the Council and including an explanation of the obligations of States with regard to the application of the Standards and Recommended Practices ensuing from the Convention and the Resolution of Adoption.

b) *Introductions* comprising explanatory material introduced at the beginning of parts, chapters or sections of the Annex to assist in the understanding of the application of the text.

c) *Notes* included in the text, where appropriate, to give factual information or references bearing on the Standards or Recommended Practices in question, but not constituting part of the Standards or Recommended Practices.

d) *Attachments* comprising material supplementary to the Standards and Recommended Practices, or included as a guide to their application.

Selection of language

This Annex has been adopted in six languages — English, Arabic, Chinese, French, Russian and Spanish. Each Contracting State is requested to select one of those texts for the purpose of national implementation and for other effects provided for in the Convention, either through direct use or through translation into its own national language, and to notify the Organization accordingly.

Editorial practices

The following practice has been adhered to in order to indicate at a glance the status of each statement: *Standards* have been printed in light face roman; *Recommended Practices* have been printed in light face italics, the status being indicated by the prefix **Recommendation**; *Notes* have been printed in light face italics, the status being indicated by the prefix *Note*.

The following editorial practice has been followed in the writing of specifications: for Standards the operative verb "shall" is used, and for Recommended Practices the operative verb "should" is used.

Any reference to a portion of this document which is identified by a number includes all subdivisions of that portion.

Throughout this Annex, the use of the male gender should be understood to include male and female persons.

Table A. Amendments to Annex 13

Amendment	*Source(s)*	*Subject(s)*	*Adopted* *Effective* *Applicable*
1st Edition	First and Second Sessions of the Accident Investigation Division	—	11 April 1951 1 September 1951 1 December 1951
1 (2nd Edition)	Assembly Resolutions A14-22 and A14-27, Appendix P Third Session of the Accident Investigation Division	New definitions; rights and obligations of the State of Manufacture; initial and subsequent notification of an accident; attendance of representatives of the operator; report on the inquiry; summary of the Report and its format.	24 November 1965 24 March 1966 25 August 1966
2	Third Session of the Accident Investigation Division	Communication procedures for sending aircraft accident notification.	5 December 1966 5 April 1967 24 August 1967
3	Personnel Licensing/ Training Practices/ Medical Divisional Meeting (1970)	Autopsy of victims of aircraft accidents and reporting of the results.	27 March 1972 27 July 1972 7 December 1972
4 (3rd Edition)	Air Navigation Commission study	Notification of all accidents to multi-engined aircraft of over 2 250 kg (5 000 lb); notification and exchange of information on incidents.	12 December 1972 12 April 1973 16 August 1973
5 (4th Edition)	Accident Investigation and Prevention Divisional Meeting (AIG/1974) Committee on Unlawful Interference	Change of title; deletion and addition of definitions; objective of an investigation; use of flight recorders and privileged status to be granted to certain investigation records; action to be taken by a State receiving safety recommendations; responsibility of the State of Registry to participate in the investigation of certain accidents when requested, to provide flight recorders under certain circumstances and to request participation of the State of Manufacture when the former State conducts the investigation and matters of airworthiness are involved; rights and obligations of the State of Manufacture to participate in certain investigations; rights and entitlement of the State having special interest in an accident by virtue of fatalities to its citizens; the Accident/Incident Data Reporting (ADREP) system; Investigator-in-charge to inform aviation security authorities, when necessary.	18 December 1975 18 April 1976 12 August 1976
6 (5th Edition)	Accident Investigation and Prevention Divisional Meeting (AIG/1974)	Addition of the words "on the basis of his qualifications" in the definitions of accredited representative, adviser and investigator-in-charge; new definition and specifications regarding the State of the Operator in the case of aircraft leased, chartered or interchanged; responsibility of the State of Registry for sending accident notification any time that State institutes the investigation; coordination between investigator-in-charge and judicial authorities; elimination of reference to number of engines; new specification for publication of the Final Report.	24 November 1978 24 March 1979 29 November 1979
7 (6th Edition)	Accident Investigation and Prevention Divisional Meeting (AIG/1979)	Addition, in the definition of accident, of injuries inflicted by parts of an aircraft or by jet blast; strengthening of the general specification concerning the conduct of the investigation; strengthening of the specification regarding disclosure of records; strengthening of the specification for consultation on the Final Report; deletion of the specifications regarding a "Summary of the Final Report" and references thereto; change of the specification concerning the forwarding to ICAO of the Final Report; expansion of the specification on publication of the Final Report or related documents; new chapter on accident prevention measures; new attachment regarding exchange of Final Reports between States and a list of Final Reports available in States.	24 November 1980 24 March 1981 26 November 1981

Amendment	*Source(s)*	*Subject(s)*	*Adopted* *Effective* *Applicable*
8 (7th Edition)	Air Navigation Commission	Addition, in the definition of serious injury, of exposure to infectious substances and injurious radiation; new attachment regarding disclosure of records; editorial changes.	22 January 1988 22 May 1988 17 November 1988
9 (8th Edition)	Accident Investigation Divisional Meeting (AIG/1992)	Change of title; new or revised definitions of causes, investigation, serious incident, State of Design, State of Manufacture, and State of the Operator; strengthening of the specifications concerning applicability and the objective of the investigation; strengthening of the specifications concerning the responsibilities, rights and entitlements of the State of Design and the State of Manufacture; new specifications concerning the notification and investigation of serious incidents; strengthening of the specifications concerning notification of accidents and serious incidents; new specification concerning assistance by States nearest to an accident in international waters; new specification concerning the separation of any judicial or administrative proceedings to apportion blame or liability from an accident investigation; strengthening of the specifications concerning the use and read-out of the flight recorders; strengthening of the specifications concerning autopsy examinations and coordination with the judicial authorities; strengthening of the specifications concerning disclosure of records and deletion of the related attachment; strengthening of the specifications concerning the responsibility of other States to provide information and their rights of participation; new specification concerning organizational information and strengthening of the specifications concerning the participation of the operator; strengthening of the specifications concerning the entitlement of accredited representatives and a new specification concerning their obligations; strengthening of the specification concerning participation of States having suffered fatalities or serious injuries to its citizens; strengthening of the specifications concerning the ADREP preliminary report and the accident/incident data report; strengthening of the specifications concerning consultation, publication and dissemination of the Final Report; new and strengthened specifications concerning accident prevention measures; new sub-paragraph and changes to the format of the Final Report in the Appendix; updated notification and reporting checklist in Attachment B; list of examples of serious incidents as a new Attachment D.	23 March 1994 25 July 1994 10 November 1994
10 (9th Edition)	Accident Investigation and Prevention (AIG) Divisional Meeting (1999)	Changes to the notification of an accident or serious incident and new provisions to acknowledge receipt of the notification; new provisions to provide details of dangerous goods; widening the provisions for responsibility to initiate, conduct and delegate the investigation; new provisions for medical examinations; aligning the rights and obligations of the State of Registry and the State of the Operator with those of the State of Design and the State of Manufacture; strengthening of the provisions of participation of States having suffered fatalities to its citizens; new title for Chapter 6 which contains the provisions related to the Final Report; strengthening of the consultation procedure and inclusion of the operator and the manufacturer; new provision for interim reports; new title for Chapter 7 which contains the provisions for ADREP reporting; strengthening of the provisions on mandatory incident reporting systems; new provisions on voluntary incident reporting systems and non-punitive environment; strengthening of the provisions on database systems, analysis of data and preventive actions; new provision on exchange of safety information; updating of Attachment B; deletion of Attachment C; new Attachment on guidelines for flight recorder read-out and analysis.	26 February 2001 16 July 2001 1 November 2001

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

CHAPTER 1. DEFINITIONS

When the following terms are used in the Standards and Recommended Practices for Aircraft Accident and Incident Investigation, they have the following meaning:

Accident. An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

a) a person is fatally or seriously injured as a result of:

— being in the aircraft, or
— direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
— direct exposure to jet blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which:

— adversely affects the structural strength, performance or flight characteristics of the aircraft, and
— would normally require major repair or replacement of the affected component,

except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) the aircraft is missing or is completely inaccessible.

Note 1.— For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.

Note 2.— An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

Accredited representative. A person designated by a State, on the basis of his or her qualifications, for the purpose of participating in an investigation conducted by another State.

Adviser. A person appointed by a State, on the basis of his or her qualifications, for the purpose of assisting its accredited representative in an investigation.

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Causes. Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident.

Flight recorder. Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

Note.— See Annex 6, Parts I, II and III, for specifications relating to flight recorders.

Incident. An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

Note.— The types of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies are listed in the Accident/Incident Reporting Manual *(Doc 9156).*

Investigation. A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

Investigator-in-charge. A person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation.

Note.— Nothing in the above definition is intended to preclude the functions of an investigator-in-charge being assigned to a commission or other body.

aximum mass. Maximum certificated take-off mass.

erator. A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

eliminary Report. The communication used for the prompt dissemination of data obtained during the early stages of the investigation.

fety recommendation. A proposal of the accident investigation authority of the State conducting the investigation, based on information derived from the investigation, made with the intention of preventing accidents or incidents.

rious incident. An incident involving circumstances indicating that an accident nearly occurred.

Note 1.— The difference between an accident and a serious ident lies only in the result.

Note 2.— Examples of serious incidents can be found in achment C of Annex 13 and in the Accident/Incident porting Manual *(Doc 9156).*

ious injury. An injury which is sustained by a person in an accident and which:

a) requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or

b) results in a fracture of any bone (except simple fractures of fingers, toes or nose); or

c) involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage; or

d) involves injury to any internal organ; or

e) involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or

f) involves verified exposure to infectious substances or injurious radiation.

State of Design. The State having jurisdiction over the organization responsible for the type design.

State of Manufacture. The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

State of Occurrence. The State in the territory of which an accident or incident occurs.

State of the Operator. The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

State of Registry. The State on whose register the aircraft is entered.

Note.— In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in Policy and Guidance Material on the Economic Regulation of International Air Transport *(Doc 9587).*

CHAPTER 2. APPLICABILITY

2.1 Unless otherwise stated, the specifications in this Annex apply to activities following accidents and incidents wherever they occurred.

Note.— The application of this specification with respect to accidents or serious incidents occurring in the territory of a non-Contracting State, in an area of undetermined sovereignty or on the high seas is addressed in 5.2 and 5.3.

2.2 In this Annex the specifications concerning the State of the Operator apply only when an aircraft is leased, chartered or interchanged and when that State is not the State of Registry and if it discharges, in respect of this Annex, in part or in whole, the functions and obligations of the State of Registry.

CHAPTER 3. GENERAL

Note.— Guidance material relating to the rights and obligations of the State of the Operator in respect of accidents and incidents involving leased, chartered or interchanged aircraft is provided in Attachment A.

OBJECTIVE OF THE INVESTIGATION

3.1 The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

PROTECTION OF EVIDENCE, CUSTODY AND REMOVAL OF AIRCRAFT

RESPONSIBILITY OF THE STATE OF OCCURRENCE

General

3.2 The State of Occurrence shall take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of an investigation. Protection of evidence shall include the preservation, by photographic or other means of any evidence which might be removed, effaced, lost or destroyed. Safe custody shall include protection against further damage, access by unauthorized persons, pilfering and deterioration.

Note 1.— Control over the wreckage is dealt with in 5.6.

Note 2.— Protection of flight recorder evidence requires that the recovery and handling of the recorder and its recordings be assigned only to qualified personnel.

Request from State of Registry, State of the Operator, State of Design or State of Manufacture

3.3 If a request is received from the State of Registry, the State of the Operator, the State of Design or the State of Manufacture that the aircraft, its contents, and any other evidence remain undisturbed pending inspection by an accredited representative of the requesting State, the State of Occurrence shall take all necessary steps to comply with such request, so far as this is reasonably practicable and compatible with the proper conduct of the investigation; provided that the aircraft may be moved to the extent necessary to extricate persons, animals, mail and valuables, to prevent destruction by fire or other causes, or to eliminate any danger or obstruction to air navigation, to other transport or to the public, and provided that it does not result in undue delay in returning the aircraft to service where this is practicable.

Release from custody

3.4 Subject to the provisions of 3.2 and 3.3, the State of Occurrence shall release custody of the aircraft, its contents or any parts thereof as soon as they are no longer required in the investigation, to any person or persons duly designated by the State of Registry or the State of the Operator, as applicable. For this purpose the State of Occurrence shall facilitate access to the aircraft, its contents or any parts thereof, provided that, if the aircraft, its contents, or any parts thereof lie in an area within which the State finds it impracticable to grant such access, it shall itself effect removal to a point where access can be given.

CHAPTER 4. NOTIFICATION

Note 1.— Attachment B provides a notification and reporting checklist.

Note 2.— A list of addresses of aircraft accident and incident investigation authorities can be found in the Manual of Aircraft Accident and Incident Investigation, *Part I —* Organization and Planning *(Doc 9756) and on the ICAO/AIG web site when it becomes available.*

ACCIDENTS OR SERIOUS INCIDENTS IN THE TERRITORY OF A CONTRACTING STATE TO AIRCRAFT OF ANOTHER CONTRACTING STATE

RESPONSIBILITY OF THE STATE OF OCCURRENCE

Forwarding

4.1 The State of Occurrence shall forward a notification of an accident or serious incident with a minimum of delay and by the most suitable and quickest means available to:

a) the State of Registry;

b) the State of the Operator;

c) the State of Design;

d) the State of Manufacture; and

e) the International Civil Aviation Organization, when the aircraft involved is of a maximum mass of over 2 250 kg.

However, when the State of Occurrence is not aware of a serious incident, the State of Registry or the State of the Operator, as appropriate, shall forward a notification of such an incident to the State of Design, the State of Manufacture and the State of Occurrence.

Note 1.— Telephone, facsimile, e-mail or the Aeronautical Fixed Telecommunication Network (AFTN) will in most cases constitute "the most suitable and quickest means available". More than one means of communication may be appropriate.

Note 2.— Provision for the notification of a distress phase to the State of Registry by the rescue coordination centre is contained in Annex 12.

Format and content

4.2 The notification shall be in plain language and contain as much of the following information as is readily available, but its dispatch shall not be delayed due to the lack of complete information:

a) for accidents the identifying abbreviation ACCID, for serious incidents INCID;

b) manufacturer, model, nationality and registration marks, and serial number of the aircraft;

c) name of owner, operator and hirer, if any, of the aircraft;

d) name of the pilot-in-command, and nationality of crew and passengers;

e) date and time (local time or UTC) of the accident or serious incident;

f) last point of departure and point of intended landing of the aircraft;

g) position of the aircraft with reference to some easily defined geographical point and latitude and longitude;

h) number of crew and passengers; aboard, killed and seriously injured; others, killed and seriously injured;

i) description of the accident or serious incident and the extent of damage to the aircraft so far as is known;

j) an indication to what extent the investigation will be conducted or is proposed to be delegated by the State of Occurrence;

k) physical characteristics of the accident or serious incident area, as well as an indication of access difficulties or special requirements to reach the site;

l) identification of the originating authority and means to contact the investigator-in-charge and the accident investigation authority of the State of Occurrence at any time; and

m) presence and description of dangerous goods on board the aircraft.

Note 1.— The 4-letter designator "YLYX" in association with an ICAO 4-letter location indicator forms the 8-letter addressee indicator for messages sent over the AFTN to authorities responsible for aircraft accident and serious incident investigations. For messages sent over the public telecommunication service the addressee indicator cannot be used and a postal or telegraphic address must be substituted.

The 8-letter addressee indicators and the corresponding postal and telegraphic addresses, when notified to ICAO, are published in the Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services *(Doc 8585).*

Note 2.— The Manual of Aircraft Accident and Incident Investigation, *Part I* — Organization and Planning *(Doc 9756) contains guidance material concerning the preparation of notification messages and the arrangements to be made for their prompt delivery to the addressee.*

Language

4.3 The notification shall be prepared in one of the working languages of ICAO, taking into account the language of the recipient(s), whenever it is possible to do so without causing undue delay.

Additional information

4.4 As soon as it is possible to do so, the State of Occurrence shall dispatch the details omitted from the notification as well as other known relevant information.

RESPONSIBILITY OF THE STATE OF REGISTRY, THE STATE OF THE OPERATOR, THE STATE OF DESIGN AND THE STATE OF MANUFACTURE

Information — Participation

4.5 **Recommendation.—** *The State of Registry, the State of the Operator, the State of Design and the State of Manufacture should acknowledge receipt of the notification of an accident or serious incident (4.1 refers).*

4.6 Upon receipt of the notification, the State of Registry, the State of the Operator, the State of Design and the State of Manufacture shall, as soon as possible, provide the State of Occurrence with any relevant information available to them regarding the aircraft and flight crew involved in the accident or serious incident. Each State shall also inform the State of Occurrence whether it intends to appoint an accredited representative and if such an accredited representative is appointed, the name and contact details; as well as the expected date of arrival if the accredited representative will travel to the State of Occurrence.

Note 1.— In accordance with 5.18, the State of Registry, the State of the Operator, the State of Design and the State of Manufacture have the right to appoint an accredited representative to participate in the investigation.

Note 2.— In accordance with 5.22, the attention of the State of Registry, the State of the Operator, the State of Design and the State of Manufacture is drawn to their obligation to appoint an accredited representative when specifically requested to do so by the State conducting the investigation of an accident to an aircraft over 2 250 kg. Their attention is also drawn to the usefulness of their presence and participation in the investigation.

4.7 Upon receipt of the notification, the State of the Operator shall, with a minimum of delay and by the most suitable and quickest means available, provide the State of Occurrence with details of dangerous goods on board the aircraft.

ACCIDENTS OR SERIOUS INCIDENTS IN THE TERRITORY OF THE STATE OF REGISTRY, IN A NON-CONTRACTING STATE OR OUTSIDE THE TERRITORY OF ANY STATE

RESPONSIBILITY OF THE STATE OF REGISTRY

Forwarding

4.8 When the State of Registry institutes the investigation of an accident or serious incident, that State shall forward a notification, in accordance with 4.2 and 4.3 above, with a minimum of delay and by the most suitable and quickest means available, to:

a) the State of the Operator;

b) the State of Design;

c) the State of Manufacture; and

d) the International Civil Aviation Organization, when the aircraft involved is of a maximum mass of over 2 250 kg.

Note 1.— Telephone, facsimile, e-mail or the Aeronautical Fixed Telecommunication Network (AFTN) will in most cases constitute "the most suitable and quickest means available". More than one means of communication may be appropriate.

Note 2.— Provision for the notification of a distress phase to the State of Registry by the rescue coordination centre is contained in Annex 12.

RESPONSIBILITY OF THE STATE OF THE OPERATOR, THE STATE OF DESIGN AND THE STATE OF MANUFACTURE

Information — Participation

4.9 **Recommendation.—** *The State of the Operator, the State of Design and the State of Manufacture should acknowledge receipt of the notification of an accident or serious incident (4.1 refers).*

4.10 Upon receipt of the notification, the State of the Operator, the State of Design and the State of Manufacture shall, upon request, provide the State of Registry with any relevant information available to them regarding the flight crew and the aircraft involved in the accident or serious incident. Each State shall also inform the State of Registry whether it intends to appoint an accredited representative, and if such an accredited representative is appointed, the name and contact details; as well as the expected date of arrival if the accredited representative will be present at the investigation.

Note 1.— In accordance with 5.18, the State of the Operator, the State of Design and the State of Manufacture have the right to appoint an accredited representative to participate in the investigation.

Note 2.— In accordance with 5.22, the attention of the State of the Operator, the State of Design and the State of Manufacture is drawn to their obligation to appoint an accredited representative when specifically requested to do so by the State conducting the investigation of an accident to an aircraft over 2 250 kg. Their attention is also drawn to the usefulness of their presence and participation in the investigation.

4.11 Upon receipt of the notification, the State of the Operator shall, with a minimum of delay and by the most suitable and quickest means available, provide the State of Registry with details of dangerous goods on board the aircraft.

CHAPTER 5. INVESTIGATION

RESPONSIBILITY FOR INSTITUTING AND CONDUCTING THE INVESTIGATION

ACCIDENTS OR INCIDENTS IN THE TERRITORY OF A CONTRACTING STATE

State of Occurrence

5.1 The State of Occurrence shall institute an investigation into the circumstances of the accident and be responsible for the conduct of the investigation, but it may delegate the whole or any part of the conducting of such investigation to another State by mutual arrangement and consent. In any event the State of Occurrence shall use every means to facilitate the investigation.

5.1.1 **Recommendation.—** *The State of Occurrence should institute an investigation into the circumstances of a serious incident. Such a State may delegate the whole or any part of the conducting of such investigation to another State by mutual arrangement and consent. In any event the State of Occurrence should use every means to facilitate the investigation.*

Note 1.— The above provision does not exclude other already existing types of investigation of incidents (serious or not) by other organizations.

Note 2.— When the whole investigation is delegated to another State, such a State is expected to be responsible for the conduct of the investigation, including the issuance of the Final Report and the ADREP reporting. When a part of the investigation is delegated, the State of Occurrence usually retains the responsibility for the conduct of the investigation.

ACCIDENTS OR INCIDENTS IN THE TERRITORY OF A NON-CONTRACTING STATE

State of Registry

5.2 **Recommendation.—** *When the accident or the serious incident has occurred in the territory of a non-Contracting State which does not intend to conduct an investigation in accordance with Annex 13, the State of Registry or, failing that, the State of the Operator, the State of Design or the State of Manufacture should endeavour to institute and conduct an investigation in cooperation with the State of Occurrence but, failing such cooperation, should itself conduct an investigation with such information as is available.*

ACCIDENTS OR INCIDENTS OUTSIDE THE TERRITORY OF ANY STATE

State of Registry

5.3 When the location of the accident or the serious incident cannot definitely be established as being in the territory of any State, the State of Registry shall institute and conduct any necessary investigation of the accident or serious incident. However, it may delegate the whole or any part of the investigation to another State by mutual arrangement and consent.

5.3.1 States nearest the scene of an accident in international waters shall provide such assistance as they are able and shall, likewise, respond to requests by the State of Registry.

5.3.2 **Recommendation.—** *If the State of Registry is a non-Contracting State which does not intend to conduct an investigation in accordance with Annex 13, the State of the Operator or, failing that, the State of Design or the State of Manufacture should endeavour to institute and conduct an investigation. However, such a State may delegate the whole or any part of the investigation to another State by mutual arrangement and consent.*

ORGANIZATION AND CONDUCT OF THE INVESTIGATION

Note.— The Manual of Aircraft Accident Investigation *(Doc 6920) contains guidance material for the organization, conduct and control of an investigation.*

RESPONSIBILITY OF THE STATE CONDUCTING THE INVESTIGATION

Note.— Nothing in the following provisions is intended to preclude the State conducting the investigation from calling upon the best technical expertise from any source.

General

5.4 The accident investigation authority shall have independence in the conduct of the investigation and have unrestricted authority over its conduct, consistent with the provisions of this Annex. The investigation shall include:

a) the gathering, recording and analysis of all available information on that accident or incident;

b) if appropriate, the issuance of safety recommendations;

c) if possible, the determination of the causes; and

d) the completion of the final report.

When possible, the scene of the accident shall be visited, the wreckage examined and statements taken from witnesses.

5.4.1 **Recommendation.**— *Any judicial or administrative proceedings to apportion blame or liability should be separate from any investigation conducted under the provisions of this Annex.*

Investigator-in-charge — Designation

5.5 The State conducting the investigation shall designate the investigator-in-charge of the investigation and shall initiate the investigation immediately.

Investigator-in-charge — Access and control

5.6 The investigator-in-charge shall have unhampered access to the wreckage and all relevant material, including flight recorders and ATS records, and shall have unrestricted control over it to ensure that a detailed examination can be made without delay by authorized personnel participating in the investigation.

Flight recorders — Accidents and incidents

5.7 Effective use shall be made of flight recorders in the investigation of an accident or an incident. The State conducting the investigation shall arrange for the read-out of the flight recorders without delay.

5.8 **Recommendation.**— *In the event that the State conducting the investigation of an accident or an incident does not have adequate facilities to read out the flight recorders, it should use the facilities made available to it by other States, giving consideration to the following:*

a) the capabilities of the read-out facility;

b) the timeliness of the read-out; and

c) the location of the read-out facility.

Note.— The requirements for the recording of radar data and ATS communications are contained in Annex 11, Chapter 6.

Autopsy examinations

5.9 The State conducting the investigation into a fatal accident shall arrange for complete autopsy examination of fatally injured flight crew and, subject to the particular circumstances, of fatally injured passengers and cabin attendants, by a pathologist, preferably experienced in accident investigation. These examinations shall be expeditious and complete.

Note.— Guidance material related to autopsies is provided in detail in the Manual of Civil Aviation Medicine *(Doc 8984) and the* Manual of Aircraft Accident Investigation *(Doc 6920), the former containing detailed guidance on toxicological testing.*

Medical examinations

5.9.1 **Recommendation.**— *When appropriate, the State conducting the investigation should arrange for medical examination of the crew, passengers and involved aviation personnel, by a physician, preferably experienced in accident investigation. These examinations should be expeditious.*

Note 1.— Such examinations may also determine whether the level of physical and psychological fitness of flight crew and other personnel directly involved in the occurrence is sufficient for them to contribute to the investigation.

Note 2.— The Manual of Civil Aviation Medicine *(Doc 8984) contains guidance on medical examinations.*

Coordination — Judicial authorities

5.10 The State conducting the investigation shall recognize the need for coordination between the investigator-in-charge and the judicial authorities. Particular attention shall be given to evidence which requires prompt recording and analysis for the investigation to be successful, such as the examination and identification of victims and read-outs of flight recorder recordings.

Note 1.— The responsibility of the State of Occurrence for such coordination is set out in 5.1.

Note 2.— Possible conflicts between investigating and judicial authorities regarding the custody of flight recorders and their recordings may be resolved by an official of the

judicial authority carrying the recordings to the place of read-out, thus maintaining custody.

Informing aviation security authorities

5.11 If, in the course of an investigation it becomes known, or it is suspected, that an act of unlawful interference was involved, the investigator-in-charge shall immediately initiate action to ensure that the aviation security authorities of the State(s) concerned are so informed.

Non-disclosure of records

5.12 The State conducting the investigation of an accident or incident shall not make the following records available for purposes other than accident or incident investigation, unless the appropriate authority for the administration of justice in that State determines that their disclosure outweighs the adverse domestic and international impact such action may have on that or any future investigations:

a) all statements taken from persons by the investigation authorities in the course of their investigation;

b) all communications between persons having been involved in the operation of the aircraft;

c) medical or private information regarding persons involved in the accident or incident;

d) cockpit voice recordings and transcripts from such recordings; and

e) opinions expressed in the analysis of information, including flight recorder information.

5.12.1 These records shall be included in the final report or its appendices only when pertinent to the analysis of the accident or incident. Parts of the records not relevant to the analysis shall not be disclosed.

Note.— Information contained in the records listed above, which includes information given voluntarily by persons interviewed during the investigation of an accident or incident, could be utilized inappropriately for subsequent disciplinary, civil, administrative and criminal proceedings. If such information is distributed, it may, in the future, no longer be openly disclosed to investigators. Lack of access to such information would impede the investigation process and seriously affect flight safety.

Re-opening of investigation

5.13 If, after the investigation has been closed, new and significant evidence becomes available, the State which conducted the investigation shall re-open it. However, when the State which conducted the investigation did not institute it, that State shall first obtain the consent of the State which instituted the investigation.

RESPONSIBILITY OF ANY OTHER STATE

Information — Accidents and incidents

5.14 Any State shall, on request from the State conducting the investigation of an accident or an incident, provide that State with all the relevant information available to it.

Note.— See also 5.16.

5.15 Any State, the facilities or services of which have been, or would normally have been, used by an aircraft prior to an accident or an incident, and which has information pertinent to the investigation, shall provide such information to the State conducting the investigation.

RESPONSIBILITY OF THE STATE OF REGISTRY AND THE STATE OF THE OPERATOR

Flight recorders — Accidents and serious incidents

5.16 When an aircraft involved in an accident or a serious incident lands in a State other than the State of Occurrence, the State of Registry or the State of the Operator shall, on request from the State conducting the investigation, furnish the latter State with the flight recorder records and, if necessary, the associated flight recorders.

Note.— In implementing 5.16, the State of Registry or the State of the Operator may request the cooperation of any other State in the retrieval of the flight recorder records.

Organizational information

5.17 The State of Registry and the State of the Operator, on request from the State conducting the investigation, shall provide pertinent information on any organization whose activities may have directly or indirectly influenced the operation of the aircraft.

PARTICIPATION IN THE INVESTIGATION

Note.— Nothing in this Annex is intended to imply that the accredited representative and advisers of a State have to be always present in the State in which the investigation is conducted.

PARTICIPATION OF THE STATE OF REGISTRY, THE STATE OF THE OPERATOR, THE STATE OF DESIGN AND THE STATE OF MANUFACTURE

Rights

5.18 The State of Registry, the State of the Operator, the State of Design and the State of Manufacture shall each be entitled to appoint an accredited representative to participate in the investigation.

Note.— Nothing in this Standard is intended to preclude the State that designed or manufactured the powerplant or major components of the aircraft from requesting participation in the investigation of an accident.

5.19 The State of Registry or the State of the Operator shall appoint one or more advisers, proposed by the operator, to assist its accredited representative.

5.19.1 **Recommendation.—** *When neither the State of Registry, nor the State of the Operator appoint an accredited representative, the State conducting the investigation should invite the operator to participate, subject to the procedures of the State conducting the investigation.*

5.20 The State of Design and the State of Manufacture shall be entitled to appoint one or more advisers, proposed by the organizations responsible for the type design and the final assembly of the aircraft, to assist their accredited representatives.

5.21 **Recommendation.—** *When neither the State of Design nor the State of Manufacture appoint an accredited representative, the State conducting the investigation should invite the organizations responsible for the type design and the final assembly of the aircraft to participate, subject to the procedures of the State conducting the investigation.*

Obligations

5.22 When the State conducting an investigation of an accident to an aircraft of a maximum mass of over 2 250 kg specifically requests participation by the State of Registry, the State of the Operator, the State of Design or the State of Manufacture, the State(s) concerned shall each appoint an accredited representative.

Note 1.— Nothing in 5.22 is intended to preclude the State conducting an investigation from requesting the State that designed or manufactured the powerplant or major components of the aircraft to appoint an accredited representative whenever the former State believes that a useful contribution can be made to the investigation or when such participation might result in increased safety.

Note 2.— Nothing in 5.22 is intended to preclude the State conducting an investigation from requesting the State of Design and the State of Manufacture to give assistance in the investigation of accidents other than those in 5.22.

PARTICIPATION OF OTHER STATES

Rights

5.23 Any State which on request provides information, facilities or experts to the State conducting the investigation shall be entitled to appoint an accredited representative to participate in the investigation.

Note.— Any State that provides an operational base for field investigations or is involved in search and rescue or wreckage recovery operations may also be entitled to appoint an accredited representative to participate in the investigation.

ENTITLEMENT OF ACCREDITED REPRESENTATIVES

Advisers

5.24 A State entitled to appoint an accredited representative shall also be entitled to appoint one or more advisers to assist the accredited representative in the investigation.

Note 1.— Nothing in the above provisions is intended to preclude a State participating in an investigation from calling upon the best technical experts from any source and appointing such experts as advisers to its accredited representative.

Note 2.— Facilitation of the entry of the accredited representatives, their advisers and equipment is covered in Annex 9 — Facilitation. *The carriage of an official or service passport may expedite the entry.*

5.24.1 Advisers assisting accredited representatives shall be permitted, under the accredited representatives' supervision, to participate in the investigation to the extent necessary to enable the accredited representatives to make their participation effective.

Participation

5.25 Participation in the investigation shall confer entitlement to participate in all aspects of the investigation, under the control of the investigator-in-change, in particular to:

a) visit the scene of the accident;

b) examine the wreckage;

c) obtain witness information and suggest areas of questioning;

d) have full access to all relevant evidence as soon as possible;

e) receive copies of all pertinent documents;

f) participate in read-outs of recorded media;

g) participate in off-scene investigative activities such as component examinations, technical briefings, tests and simulations;

h) participate in investigation progress meetings including deliberations related to analysis, findings, causes and safety recommendations; and

i) make submissions in respect of the various elements of the investigation.

However, participation of States other than the State of Registry, the State of the Operator, the State of Design and the State of Manufacture may be limited to those matters which entitled such States to participation under 5.23.

Note 1.— It is recognized that the form of participation would be subject to the procedures of the State in which the investigation, or part thereof, is being conducted.

Note 2.— The collection and recording of information need not be delayed to await the arrival of an accredited representative.

Note 3.— Nothing in this Standard precludes the State conducting the investigation from extending participation beyond the entitlement enumerated.

Note 4.— The pertinent documents referred to in subparagraph e) also include documents such as the reports on examinations of components or studies performed within the framework of the investigation.

Obligations

5.26 Accredited representatives and their advisers:

a) shall provide the State conducting the investigation with all relevant information available to them; and

b) shall not divulge information on the progress and the findings of the investigation without the express consent of the State conducting the investigation.

Note.— Nothing in this Standard precludes prompt release of facts when authorized by the State conducting the investigation, nor does this Standard preclude accredited representatives from reporting to their respective States in order to facilitate appropriate safety actions.

PARTICIPATION OF STATES HAVING SUFFERED FATALITIES OR SERIOUS INJURIES TO ITS CITIZENS

Rights and entitlement

5.27 A State which has a special interest in an accident by virtue of fatalities or serious injuries to its citizens shall, upon making a request to do so, be permitted by the State conducting the investigation to appoint an expert who shall be entitled to:

a) visit the scene of the accident;

b) have access to the relevant factual information;

c) participate in the identification of the victims;

d) assist in questioning surviving passengers who are citizens of the expert's State; and

e) receive a copy of the Final Report.

CHAPTER 6. FINAL REPORT

6.1 **Recommendation.—** *The format of the Final Report in the Appendix should be used. However, it may be adapted to the circumstances of the accident or incident.*

RESPONSIBILITY OF ANY STATE

Release of information — Consent

6.2 States shall not circulate, publish or give access to a draft report or any part thereof, or any documents obtained during an investigation of an accident or incident, without the express consent of the State which conducted the investigation, unless such reports or documents have already been published or released by that latter State.

RESPONSIBILITY OF THE STATE CONDUCTING THE INVESTIGATION

Consultation

6.3 The State conducting the investigation shall send a copy of the draft Final Report to the State that instituted the investigation and to all States that participated in the investigation, inviting their significant and substantiated comments on the report as soon as possible. The draft Final Report of the investigation shall be sent for comments to:

a) the State of Registry;

b) the State of the Operator;

c) the State of Design; and

d) the State of Manufacture.

If the State conducting the investigation receives comments within sixty days of the date of the transmittal letter, it shall either amend the draft Final Report to include the substance of the comments received or, if desired by the State that provided comments, append the comments to the Final Report. If the State conducting the investigation receives no comments within sixty days of the date of the first transmittal letter, it shall issue the Final Report in accordance with 6.4, unless an extension of that period has been agreed by the States concerned.

Note 1.— Nothing in this Standard is intended to preclude the State conducting the investigation from consulting other States, such as those States which provided relevant information, significant facilities, or experts who participated in the investigation under 5.27.

Note 2.— Comments to be appended to the Final Report are restricted to non-editorial-specific technical aspects of the Final Report upon which no agreement could be reached.

Note 3.— When sending the draft Final Report to recipient States, the State conducting the investigation may consider using the most suitable and quickest means available, such as facsimile, e-mail, courier service or express mail.

6.3.1 **Recommendation.—** *The State conducting the investigation should send, through the State of the Operator, a copy of the draft Final Report to the operator to enable the operator to submit comments on the draft Final Report.*

6.3.2 **Recommendation.—** *The State conducting the investigation should send, through the State of Design and the State of Manufacture, a copy of the draft Final Report to the organizations responsible for the type design and the final assembly of the aircraft to enable them to submit comments on the draft Final Report.*

Recipient States

6.4 The Final Report of the investigation of an accident shall be sent with a minimum of delay by the State conducting the investigation to:

a) the State that instituted the investigation;

b) the State of Registry;

c) the State of the Operator;

d) the State of Design;

e) the State of Manufacture;

f) any State having suffered fatalities or serious injuries to its citizens; and

g) any State that provided relevant information, significant facilities or experts.

lease of the Final Report

6.5 In the interest of accident prevention, the State nducting the investigation of an accident or incident shall ease the Final Report as soon as possible.

6.6 **Recommendation.—** *The State conducting the estigation should release the Final Report in the shortest ssible time and, if possible, within twelve months of the date the occurrence. If the report cannot be released within lve months, the State conducting the investigation should ease an interim report on each anniversary of the urrence, detailing the progress of the investigation and any ety issues raised.*

6.7 When the State that has conducted an investigation) an accident or an incident involving an aircraft of a ximum mass of over 5 700 kg has released a Final Report, State shall send to the International Civil Aviation ganization a copy of the Final Report.

Note.— Whenever practicable, the Final Report sent to AO is to be prepared in one of the working languages of the anization and in the form shown in the Appendix.

ety recommendations

6.8 At any stage of the investigation of an accident or dent, the accident or incident investigation authority of the State conducting the investigation shall recommend to the appropriate authorities, including those in other States, any preventive action that it considers necessary to be taken promptly to enhance aviation safety.

6.9 A State conducting investigations of accidents or incidents shall address, when appropriate, any safety recommendations arising out of its investigations to the accident investigation authorities of other State(s) concerned and, when ICAO documents are involved, to ICAO.

Note.— When Final Reports contain safety recommendations addressed to ICAO, because ICAO documents are involved, these reports must be accompanied by a letter outlining the specific action proposed.

RESPONSIBILITY OF A STATE RECEIVING SAFETY RECOMMENDATIONS

Action on safety recommendations

6.10 A State that receives safety recommendations shall inform the proposing State of the preventive action taken or under consideration, or the reasons why no action will be taken.

Note.— Nothing in this Standard is intended to preclude the State conducting the investigation from making proposals for preventive action other than safety recommendations.

CHAPTER 7. ADREP REPORTING

Note 1.— Attachment B provides a notification and reporting checklist.

Note 2.— The provisions of this chapter may require two separate reports for any one accident or incident. They are:

Preliminary Report
Accident/Incident Data Report

Note 3.— Guidance for preparing the Preliminary Report and the Accident/Incident Data Report is given in the Accident/Incident Reporting Manual *(Doc 9156).*

PRELIMINARY REPORT

RESPONSIBILITY OF THE STATE CONDUCTING THE INVESTIGATION

Accidents to aircraft over 2 250 kg

7.1 When the aircraft involved in an accident is of a maximum mass of over 2 250 kg, the State conducting the investigation shall send the Preliminary Report to:

a) the State of Registry or the State of Occurrence, as appropriate;

b) the State of the Operator;

c) the State of Design;

d) the State of Manufacture;

e) any State that provided relevant information, significant facilities or experts; and

f) the International Civil Aviation Organization.

Accidents to aircraft of 2 250 kg or less

7.2 When an aircraft, not covered by 7.1, is involved in an accident and when airworthiness or matters considered to be of interest to other States are involved, the State conducting the investigation shall forward the Preliminary Report to:

a) the State of Registry or the State of Occurrence, as appropriate;

b) the State of the Operator;

c) the State of Design;

d) the State of Manufacture; and

e) any State that provided relevant information, significant facilities or experts.

Language

7.3 The Preliminary Report shall be submitted to appropriate States and to the International Civil Aviation Organization in one of the working languages of ICAO.

Dispatch

7.4 The Preliminary Report shall be sent by facsimile, e-mail, or airmail within thirty days of the date of the accident unless the Accident/Incident Data Report has been sent by that time. When matters directly affecting safety are involved, it shall be sent as soon as the information is available and by the most suitable and quickest means available.

ACCIDENT/INCIDENT DATA REPORT

RESPONSIBILITY OF THE STATE CONDUCTING THE INVESTIGATION

Accidents to aircraft over 2 250 kg

7.5 When the aircraft involved in an accident is of a maximum mass of over 2 250 kg, the State conducting the investigation shall send, as soon as practicable after the investigation, the Accident Data Report to the International Civil Aviation Organization.

Additional information

7.6 **Recommendation.—** *The State conducting the investigation should, upon request, provide other States with pertinent information additional to that made available in the Accident/Incident Data Report.*