行政院及所屬各機關出國報告
（出國類別：會議）

ASC-TRM-04-01-001

參加
「美國飛安基金會五十六屆飛安年會」
報告書

服務機關：行政院飛航安全委員會
出國人職　　稱：飛航安全官
姓　　名：任靜怡

出國地區：美國華盛頓
出國期間：民國九十二年十一月九日至十二日
報告日期：民國九十三年元月二十日

ASC-TRM-04-01-001

行政院及所屬各機關出國報告提要　　系統識別號 C09205117
出國報告名稱：參加「美國飛安基金會第五十六屆飛安年會」報告書
頁數：52 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： 任靜怡
服務機關：行政院飛航安全委員會
職　　稱： 飛航安全官　　電　話：(02) 2547-5200 分機 167

出國類別：□1 考察□2 進修■3 研究□4 實習□5 其他

出國期間：民國九十二年十一月九日至十二日

出國地區：美國華盛頓

報告日期：民國九十三年元月二十日

分類號/目

關鍵詞：操控撞地、跑道入侵、機坪安全、機務適職性、超長程飛行、免責報告

內容摘要：

行政院飛安委員會派飛安官任靜怡前往美國華盛頓參加「第五十六屆美國飛安基金會年會(Joint meeting of the FSF 56th Annual International Air Safety Seminar (IASS))」。該年會係為紀念萊特兄弟首次升空百年擴大舉行，而本次年會亦主要以回顧這些年來飛安之改善與挑戰。

年會四天議程計有六個專題二十二篇專題報告：

一、全球飛安現況

二、運航議題

三、環境與科技

四、適航與工程

五、人為因素/安全文化

六、緊急情況

會議專題中除報告各飛安工作小組之工作進度外，同時對目前飛安基金會新增加之飛安改善重點項目包括飛安資訊之法律保障及機坪安全說明。

飛安現況統計說明起降失事仍為飛安改善重點，也因為 CFIT ALAR 訓練指導原則雖早已公布，但藉由年會宣導各區域在執行之實務作法不但可當作飛安資訊交流，亦可為他山之石。

新科技之主要專題集中在預防跑道入侵事件預防裝備上，而其他主要專題亦針對年度重大飛安事故如寒冷天氣、維修、人為誤失預防及系統管理機制為主。

本文電子檔已上傳至出國報告資訊網

行政院及所屬各機關出國報告審核表

出國報告名稱：參加「美國飛安基金會第五十六屆飛安年會」報告書
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：任靜怡
職稱：飛航安全官
服務單位：行政院飛航安全委員會

出國計畫主辦機關審核意見：

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

層轉機關審核意見:

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

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貳、會議重點摘要

一、2003 年飛安現況回顧

依 2003 年飛安現況回顧顯示：操控撞地事件有增加趨勢，而起飛降落階段事故仍是主要風險所在。

各分項統計如下：

(一)商用機(大於 60000 磅)年度內至十月止計發生十一件全毀失事。

(二)商用機包括西方製（大於 60000 磅）1993~2003 十年內失事率有逐漸下降。

(三)商用機（小於 60000 磅）年度內至十月止計發生十件全毀失事。

(四)商用直昇機（十四人座以上）年度內計發生二十四件全毀失事。

(五)操控撞地事件在大於 60000 磅商用機年度內計發生七件全毀失事。

(六)商用機（包括西方製）1993~2003 十年內，自 1998 年發生九件失事事件後，各方即積極推動防撞設備及 CFIT 相關訓練手冊，而失事率亦隨之逐漸下降，惟自 2002 年五件至今年發生七件失事事件，似有逐漸增多現象。

(七)年度內發生八件起降事故，佔所有失事事件 70%，此亦顯示起降事件仍為主要風險及失事預防重點項目，而天氣、不穩定進場及未及時重飛是其主要失事原因。

根據以上事故統計，未來業界之主要挑戰，除技術面亦包括非技術面，諸如：

(一)安全資訊之保護：在目前各種預防性飛安資訊繁多，但多缺乏法令程序保障，如 FOQA、LOSA、調查訪談資料、自動報告等。目前國際上有二種不同之法制系統：羅馬法及通用法，其不僅適用之區域不同，對法官之授權及咎責亦有差異，而此種現象亦可能會造成飛安資訊交流阻礙。

(二)對人為誤失之切入：實務及理想派對人為誤失之解讀不同，理想派認為人為誤失既然無法完全根除，應於故意或不當違法時才應咎責，這種理論與很多在人為誤失發生後之實務上之作法自有差異，此可由各國對人為誤失處理之態度驗證。國際民航組織 ICAO 對人為誤失已有相關之指導原則，然而目前僅紐西蘭、加拿大、歐盟、美國、丹麥具備有保障自動報告、FOQA 或 CVR 之相關法律條文 。有鑑於此，美國飛安基金會已出函國際民航組織提出要求，建議在 2004 年修法保障上述之飛安資訊。

二、拉丁美洲安全工作小組在預防起降失事上之努力

拉丁美洲包括 47 區，138 家航空公司及近 20,000 名飛航組員，安全工作小組成員包括墨西哥、南美、加勒比海、巴西、南美之飛航組員及管制員等。

工作小組推動預防起降失事之方式是以推動小組成員擔任種子教官，接受起降失事預防之相關訓練，包括五小時課授、二篇專題、錄影帶、海報、教師手冊及授證。推動小組成員於完成訓練後即分別至各航空公司作說明及簡報。目前包括墨西哥、巴西、古巴、哥倫比亞等國均已經或準備將此起降訓練指導原則納入法規，未來亦將陸續針對跑道入侵、單引擎操作及自我安全評估等持續做類似宣導。目前已接受此種訓練之飛航組員包括航管員亦多持正面回應態度，咸認為持續之年度複訓有其必要性。拉丁美洲針對起降訓練指導原則務實做法，有目標之推動方式，除可提昇區域安全並可建立共識，值得我民航主管機關效法。

三、商用機安全工作小組（CAST-Commercial; Aviation Safety Team）年度工作報告

CAST 小組包括 JAA、ICAO、IATA 及 FSF、飛行員協會及業者，其工作目標以至 2007 年降低 80%失事率，工作項目包括八項研究計劃及四十六個強化項目。如依其預估達成預估降低失事率之目標後，預估業界年度成本可節省 6 億 2 仟萬美元。

該小組作業均依据數據，發展出安全計劃強化飛安策略，根據安全基本分佈圖找出強化目標、事故肇因及績效指標。系統運作方式主要以風險管理為概念，根据可能影響或造成重大失事之主要

風險，建立商用機主要風險表，並依不同情況適時修正。(例如工作小組在 2000 年阿拉斯加 FLT 261 失事調查中發現適航及維修是主要風險，2001 年即已將此納入適航工作小組項目內)。

46 個強化分項中目前已完成 22 分項，而美國政府及業者在其中扮演負責及主導飛安之主要角色，1997 年美國總統柯林頓發佈飛安及保安宣言，要求美民航局及業者改善飛安並發展降低失事率之策略計劃。1998 年美國 FAA 即發佈名為「安全天空」之策略計劃，其中針對商用機、普通航空業及空艙安全列出飛安改善重點：包括商用機之操控撞地、失控、跑道入侵、天氣、壞氣流、引擎失效、滋擾旅客、安全帶使用、機上手提行李、兒童約束等。FAA 策略與 CAST 小組之工作項目經合併後分別納入分析、實施及績效評估分組。

20 個已完成之強化重點摘要如下：

安全文化：必要之安全資訊應納入手冊，查核員可自由運用航務手冊內容，而高階主管應具体給予支持。

維修程序：FAA 發佈有關委外合約商監控，MEL 中應包括重覆缺點，安全主管應以內部問卷確認員工均遵守程序。

政策程序：業界應發展風險管理工具，並告知必要安全資訊，強化組員專業及技術並與 FAA 共同發展失控之標準操

作程序。

設計：FAA 發佈持續商用機航行指導原則及重要系統維修及自動駕駛間之檢查表，修正新系統在顯示及警告系統之改善建議，其他包括新機納入垂直狀態顯示器，FAA JAA 共同針對未備可氣化 evaporative 防冰系之機型建立適航規範，製造廠在新機設計時納入類似安全框防護系。

跑道入侵：強化機場監控、標準操作及訓練。

精確進場：FAA 及業界發展儀器穩定進場之程序及訓練、降低最低落地標準、建立未備儀器進場時之水平垂直指導進場路徑。

已完成之研究計劃則主要針對操控撞地、增進組員目視天氣能力、與 FOQA 有關之分析、起降事故預防、防冰、航管員針對跑道目視能力之強化及自動化研究、器材失效時儀表偵測、儀器進場有關之人為因素、組員未遵程序之基本原因、未裝防冰系統之偵測方法等。

依上所述歸納出之主要趨勢為：

(一)空地間衛星自動化系統之引進。

(二)有關機種、組員操作能力、軟硬體轉換、航太、空地以及航太支援系統之發展及其及時性。

(三)因航空業快速發展及安全限制降低所產生更多及更高之要求、空中隔離減少及未來可能增加在惡劣天候運作之頻率。

(四)確保妥善之機務維修：因委外維修機率增加，航機軟硬體更趨複雜。合格專業之機務維修人員減少，突顯機務維修之重要性。

展望未來可能之重大趨勢改變有四：

(一)全球空地航太系統。

(二)組員自動化之互動。

(三)一般共通性問題。

(四)全自動化駕駛艙因未具傳達監控人角色所產生之影響。

四、歐洲聯合安全策略小組 JSSI（Joint Safety Strategy Initiative）年度工作報告

歐洲聯合安全策略小組 1998 年起以改善安全体系及降低失事率而努力，該組織與 CAST 之差異在於：CAST 係以事故統計分析為改善之基準，JSSI 則以安全系統改變所衍生之影響為基準。JSSI 主要工作集中在十一大項，其在與航務相關之分析上與 CAST 之間並無太大差異，亦多集中在操控撞地、起降失事、失控、職災及生還因素、設計、跑道安全及天氣等。例如其中與設計相關之分析包括發動機故障、爆胎、機務與驗證及異常事件預

警因子之統計分析等，上述項目目前均由 FAA JAA 協同包括英國 CAA 共同研議中。

安全系統之迅速改變，必先掌握因改變所產生之影響，找出可控因素並先期消弭危險因子才可能達到失事預防之目的。

策略小組篩選出二十個主要改變項目：

(一)對駕駛艙自動化之過度依賴。

(二)航太系統新科技。

(三)組員因新科技所衍生未知之人為因素。

(四)複雜及性能各異之廣體機大量出廠。

(五)空地在未來發展及實施上之差距。

(六)航空界之迅速擴充。

(七)航管因新科技所衍生之未知人為因素。

(八)軟硬體間之複雜差異性。

(九)老舊電子、發動機、電機機械及結構。

(十)機務素質降低。

(十一)減少隔離。

(十二)機務維修委外之壓力。

(十三)各機型間有關駕駛艙控制、操作及自動化系統之標準化。

(十四)空中防撞責任由航管轉至組員。

(十五)與決心下達有關資訊卻未公平傳達情況日益增加。

(十六)對飛航操作主動性要求之成長。

(十七)必需在低高度及惡劣天候操作之航機迅速增加。

(十八)先進航機對精細機務維修之要求。

(十九)空地間對 CNS 系統發展配合之差距。

(二十)機務專業之不足。

JSSI 未來之主要工作以認清問題，提供可行之改善建議為目標，由於 2003 年新歐洲航空安全組織之成立（EASA），JAA 對預測分析及提供改善建議之工作將移交其完成。

五、減少跑道入侵風險之標準操作程序

自 1997 年發生重大跑道入侵案後，跑道入侵事故率仍持續增加，原因之一即是目前國際上並未有防止跑道人侵之最佳指導原則，即使已有部份業者發展出相關之標準操作程序，但少見針對機場地面作業環境之詳細操作程序。

有鑑於此，CAST 工作小組完成有關操作程序指導原則，參與單位及人員包括駕駛員、航管員、ATA、業者及專家，經二年後完成，目前該原則應可一体適用於世界各地及不同機型。

操作程序文件包括以下七大部份：(一)標準操作程序。(二)航管訓練。(三)航管程序。(四)目視指導之加強及自動化。(五)航管之

狀況警覺技巧。(六)駕駛員訓練。(七)航機及地面車輛裝備之改善。

該文件目前 AC120-74A 於 2003 年發出，並包含有 737 767 之標準作業範本，業者可依機型或實際作業調整或修改並納入檢查表。如滑行前加入滑行路線簡報、強調檢視機場圖、共同監控航管通話並對疑慮澄清、靜默駕艙規定、落地對跑道、滑行道及空橋之檢視之重要性。未來包括如低能見度滑行、滑行視線、跑道灯視程均會納入。

美國國內包括如美國航空公司已將本標準作業程序納入 FOM，並發佈 20 個相關之 SOP，US AIRWAY 亦同。FAA 查核員及工會成員亦已接受並密切注意業者施行狀況。

國內在跑道入侵之重大失事亦值得民航主管機關及業者之重視，尤其是飛航組員與航管人員之警覺性訓練，在數次飛航事故後僅在檢查表中納入確認跑道項目仍有不足，此標準作業程序應可做為業者及民航主管機關之參考。

六、組員在超長程操作之警覺

超長程之定義為超 7700 海浬 或 9000 英里之 16 至 20 小時飛行。超長程可能導致組員疲勞而影響操作品質亦可預期。本次飛安年會由於未來引進新機指日可待，而這些因飛行時間過長而衍

生的問題也在本次會議中引起廣泛討論。

本議題之研究小組包括製造廠、FSF、業者代表及主管機關等，研究主題包括組員警覺性之影響、組員輪休、班表安排、組員休息設施、全球法制化、組員搭配、時差、生理時鐘。其他如針對組員休息設施，包括通氣、過濾、溫度、溼度、噪音、灯光等均納入討論。例如在班表設計上，工作小組以飛越太平洋、大西洋兩條航線觀察組員生理時鐘對操作上之影響，在實驗過程中證明年齡或輪休時段可能對操作有影響，其他如 FOQA LOSA 表現、職責交接、行前班表安排、待命時間、提早或延誤、外站休時、換組員或組員運用休息方式、節食、壓力管理或組員資源管理對操作影響亦均在研究範圍內。

工作小組在數次會議並與學者專家討論後，得到基本結論為：要保障超長程之飛行安全，必先對可能危安因子有因應對策，包括對應之法規、人性化之班表安排、建立對休息品質及疲勞對警覺性之影響研究。

在 2002 年相關文件中即已建議國際民航組織在 ICAO ANNEX 6 在組員有關飛時休時 、工時之 SARP 規定中應考量超長程操作之不同規定，而在 2004 年起即將使用超長程之業者亦接受策略小組建議，納入上述觀察重點，並建議以六個月為期試行，包括

完成相關訓練、記錄航程中可能疲勞時段、針對不同項目列出風險值、對超出及異常觀察部份予以呈報、研議最佳輪值方式、研議具体可行改善機制、主管機關定期查核、以具體數據驗證及推廣不具名報告機制等。

國內在組員飛時休時以及疲勞可能之影響在業者、工會、民航主管機關中雖已召開數次會議，修正法規，但在勞資雙方仍難建立共識，而專家在此方面涉入亦少，雖國內較少可能做此研究投資，惟在國際航線已幾符合超長程飛行定義之業者仍應密切注意相關發展，並以符合人性化班表派遣保障飛行安全。

七、飛航記錄器之成敗及其改善

飛航記錄器是失事調查作業中重要的一環，國際民航組（ICAO）在法規中要求重大飛航事故後立即解讀之重要性。

近年來美運安會 NTSB 依其飛航事故調查經驗法則，發現及時飛航記錄之取得及解讀在事故調查中扮演了非常重要的角度，然而在許多成功解讀的案例之外，亦有很多座艙通話記錄器的解讀結果不佳，其原因多屬內部資料錯誤或流失，雖然駕駛艙內均裝置拔除 CVR 斷電器，然而或因遺漏或資料蓋過 30 分鐘，以致解讀的是無效資料。以上這些缺點均未在組員航行缺點記錄簿或機務缺點記錄簿中出現，有些甚至是因為記錄器功能不佳但未發

現。

美運安會（NTSB）在 2002 年即針對此點發布飛安改善建議 002-024-025，要求 FAA 監督業者在飛行前每日檢查中納入，要求在固態式二小時之 CVR 中亦有不同檢查方式，同時也要求 FAA 與業者共同討論何時是發生異常事件但未確定事件屬性時拔除斷電器之最佳時機。

在飛航資料記錄器之狀況亦同，老舊的記錄仍有業者繼續使用，此既不符國際民航組織公約標準或業界需求，更甚者，目前仍存在使用無效數據或資料不全的 FDR 業者，在美運安會 2000 年事故調查中，因為業者仍使用老舊僅 5 個參數 FDR，致造成調查費時費力。

運安會在過去針對 FDR 維修品質不佳而造成之許多問題，提請重視，包括建議應有單獨電源，擴充強制數據、納入 CNS ATM 資料及建立駕艙錄影系統。

本會在歷次年度記錄器普查中亦發現類似問題，並已函請民航局要求業者改善，惟目前不論機務或飛航組員是否已將此列入行前檢查項目，包括飛航事故拔除斷電器之主動性及時機都有待討論及建立制度及強制性要求。

八、防撞問題之解決之道

2004 的今日，撞山之事故率與 30 年前相較，雖已明顯降低但是在亞洲南美非洲地區仍為主要風險項目，1992 年美飛安基金會與其他民航組織開始成立操控撞地之工作小組，同時在世界先近國家中預防成效卓著，但或因為資訊傳遞不足，世界上仍有許多地區未接獲工作小組所傳達有關防撞預防訊息及訓練手冊，過去 10 年內因 EGPWS 之引進，大型商用機操控撞地之事故率明顯下降，追溯 1974 年波音及 FAA 將 GPWS 納入裝備器材即迅速有效改善事故率，然而 PART135/ 91 下之業者則並未有相同之效果。事故率之降低與航管系統之改善，廣域雷達之使用亦相關，但遺憾的是螺旋槳機之事故率仍居高不下，而航管人員對此類事件預防較無參與意願，而同樣的第三世界國家限於經費而無法有效訓練或加裝設施，而南美洲小型貨機更是主要風險，未來 FAR 135 業者應於 2005 年 3 月前需加裝 EGPWS。

業界自 1991 年對操控撞地之預防行動包括 1992 年成立工作小組，1996 年起成立降低事故工作小組，在此期間因 FAA 排除區域螺旋槳機加裝條款，造成 1974 至 1994 年之同類型事故有 50 件之多，此亦促使 FAA 要求業者加裝 GPWS，19 96 年 Cali767 重大失事再次喚起世人對 CFIT 事故預防之重視，在此其間，防撞設備之科技日新月異，而 ATC 雷達涵蓋之擴充亦對預防多所

助益，這也包括有色航路圖之改善。1974 年汎美航空首先購置 GPWS 並自行發展撞山前改正之模擬機程序。但是由於如相關訊傳遞未及時，工作小組召集不易，雖然自 1996 年 EGWS 之軟體一再更新，廠家對軟體更新是免費，但部份業者或未能及時更換或未更新模擬機軟體以致更新設備在部份區域成效不彰。

九、機務員之能力驗證（適職性）

「適職」的標準以往一直很難界定，英國針對此發展了一套機務適職標準，此方法目前並經試用在訓練單位。2003 JAR 145 律定維修人員之適職基本要求，包括在職訓練及職前要求，該規定對人為因素方面亦僅要求具備訓練，但未要求訓練細項及評估，其中對適職及能力評估方式可經由督導或考核員綜評方式為之。適職指針對有能力完成特定工作並符合標準。美國家技術委員會 NSSB 針對技術標準，分為業務操作及知識技術面，而針對知識技術又分為學理，能力及專業技術等。

針對機務工作的八大評分項目包括：設計發展及規範、準備技巧程序、製造及過程、安裝、維修、符合及測試、機務支援及風險管理、個人發展。所有評分都必須有具體觀察為依據，針對表現在工作場所知識及理解度為之，可以口試或測驗為之，JAR66 僅針對具有執照機務人員要求，並未規範機務員及技師，至於評

估過程則應由品保單位驗證，而機務員職責之架構依重要性包括了正直、專業、判斷、準備、溝通、方法、分析、領導團隊，接受度及自我發展等。

目前國內因機務維修素質降低致造成多起與維修有關之飛航事故，而機務人員之培訓標準與適職要求應值得業者與主管機關之共同重視。

十、機坪安全

依美飛安基金會統計，機坪造成損失每年近 4 百萬美金，如果再加上間接損害則可能超過 5 百萬美金。長久以來，因機坪事故之損害層出不窮，支出有增無減，最近十年來，美飛安基金會針對 CFIT ALAR 失控及人為疏失成立研究及預防計劃，而基於人為疏失是失事肇因之大宗，包括 FOQA，免責報告，疲勞、機坪安全等陸續加入。

美飛安基金會開始預防地面事件工作小組是以資料蒐集，分析至研究預防工作並施行，尤其是對缺失之研究，工作小組同時納入所有機坪工作單位。

依過去一年內呈報 274 件有關之機坪事件之支出計算，每件事件支出平均 25 萬，而 95 %以上機坪事件多在平均值之下，如果由改善間距著手，可減少約 2%事件，依數據看來車輛是造成地面

事件之最大宗，同時航機損害之部位多以機翼尖端及翼緣為主，同時一個組織對委任之重視性會影響事故率，此可由杜邦公司地面事故率相較其他者甚低證明。未來美飛安基金會地面事件預防工作小組會依計劃逐漸實施有效具體之預防措施以減低事故率。

十一、歐洲之免責報告法律障礙問卷

歐洲組織會員（PRC），主要目的以整合歐洲為主之 ATM 系統，包含涵蓋 2000 個國際單位，以發展歐洲航管及國家主管機關單位軍方，民間，機場，業界，職業團體及相關歐洲單位之行動方案。

PRC 行政體系有 12 個獨立單位，各有主管，2 年為期，其下有績效評估組，PRC 自行評估，ATM 提出報告及評論供研究及提供改善建議。

免責報告之成功在於各方之即時呈報及互信，關鍵在保密性，自動報告應加密免責，但免責不包括故意或行為，僅限人為疏失中可供借鏡及預防部分，而其中是否能在有具體法條保障呈報人免責是其關鍵。

2001 至 2002 年有關此項目之研究報告以問卷方式，對法律限制、內部如管理文化、對報告意願並重。

1. 報告人所在地如無免責保障甚或有資訊法限制則無報告意

願。

2. 所有參與問卷者均贊成建立免責保障。

3. 合併會產生之不良影響。

4. 主管之專業能力，觀念錯誤影響報告數。

大部分歐洲地區受心理及文化影響、團隊精神、安全文化也會影響呈報的意願，而在法庭上對事故肇因是否朔及企業責任，未對報告保密等均會對免責報告意願產生負面影響，值得警惕。

參、與會心得

56 屆飛安基金會與往年略有不同，因為適逢人類飛行百年紀念，因此會議地點回到飛安基金會之會址華府，而會議主題與引言人亦多著墨於年來的改善與成就。

美飛安基金會成立宗旨即在致力於區域及國際上失事預防及國際飛安資訊交換。成立迄今，經歷任主席主導會務運作，惟成效卓著，主要原因在於結合了業界精英主動提供專業諮詢及主動參與工作小組，而其下委員會與董事會成員亦能以宏觀角度提出具體改善飛安之預劃。

參會者來自近 52 國之 400 餘人，不同之專業、不同之國籍、不同的工作但都對目前飛安改善之努力持肯定的態度，同時對未來之改善方案充滿信心。看到飛安從業人員在會議中專注的態度，休息時急切的交流，討論時熱烈的發言，讓心深深感受到飛安無國界的真實性。

參加此類會議視參會者的態度而決定其所得，業者主管想知道目前新預防策略發展進度、科技新知或技術性的經驗交流，主管官署或想知道國際上在法規上最新的進度與做法上之差異性，飛安從業人員想獲得最新飛安資訊，第三世界國家參會者想藉此呼籲先進國家提供資訊與支援。無論其目的為何，只要主動積極均會

達成目標。

會議中宣佈大陸為下一屆年會主辦單位，同時大陸民航總局亦派出包括適航驗證副司長及安技中心主管擔任主講人。報告適航驗證作業現況與民航總局發展，此亦顯現海峽對岸開始積極參與國際飛安事務之決心。

我國在歷屆年會中向來是參會人數不容忽視之團隊，不論民航局、軍方或業者均派員參會，惟觀察國際上在失事預防之先進做法，身為成果接受者，如果尚不能以他山之石態度，檢討目前作業缺失並納入改善策略，分享飛安資訊則枉費參會者長途跋涉的經費與精神。

正如年會主題「飛安挑戰永無止境」，無論是在技術或非技術面，吾等應深自慶幸業界有如此多熱心專家學者對飛安的投入與貢獻，對失事預防在方法及科技的努力，讓其他人只要聽其言並起而行即可達成改善飛安之目標，而更重要的是如何有效將資訊傳至未參會者，方能達成派員參加類似會議之效益。

肆、建議事項

一、建議民航主管機關密切注意國際飛安組織對安全資訊保障法條之發展。

二、建議民航局參考國際上對 CFIT ALAR 以成立推動小組宣導方式做法，有目標的推動類似失事預防計劃或訓練指導手冊。

三、建議民航局與業者參考CAST已完成之安全強化重點及研究計劃內容中相關者，納入國內飛安改善重點執行。

四、建議民航局與業者重視並先期因應未來維　人員品質與專業不足可能產生之飛安問題。

五、建議主管機關密切注意未來衛星及自動化系統引進後在空地程序、配合、發展及實施之差異性及可能產生之人為因素。

六、建議業者參考已完成之減少跑道入侵標準操作程序並納入SOP。

七、建議民航主管機關修訂法規要求業者建立 FDR/CVR 維修及檢驗程序（包括共同研討飛航事故後拔除 CVR 之時機）。

八、建議學界、民航主管機關、工會與業者共同正視長程飛行可能產生之疲勞現象對飛安影響並研擬改善方案。

伍、附錄

一、2003 年飛安統計

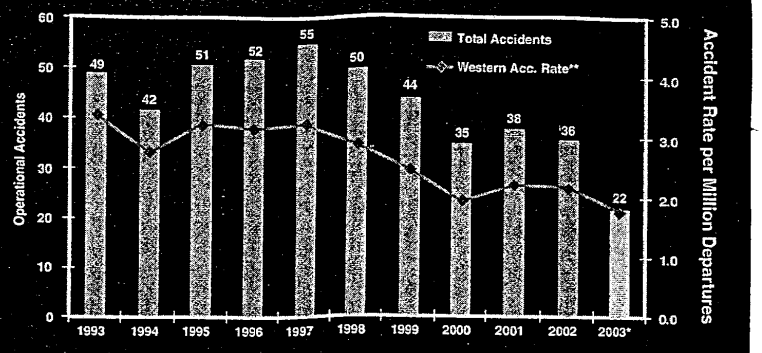
二、Standard Operating Procedures（Runway Incursion）

三、NTSB（National Transportation Safety Board）Safety Recommendations of CVR/FDR

四、CFIT Accidents Commercial Aircraft 15 Years（1988~2002）

五、A competency Framework for Licensed Aircraft Maintenance Engineers

All Operational Accidents
Worldwide Commercial Jets (>60,000 lbs)
1993–2003



Source: Airclaims, AvSoft

* Data through Oct. 1
**Worldwide departure/rate data not available for Eastern-built Aircraft

Hull-loss Accidents
Worldwide Commercial Jets* (<60,000 lbs)
Jan. 1, 2003 through Oct. 1, 2003

Date	Operator	Aircraft	Location	Phase of Flight	Total Fatal
Jan. 4	Columbus SA	Premier 1	Santo Domingo, DR	Landing	0
March 15	Dancing Wind Aviation	Citation 501	Hailey, ID USA	Descent	3
April 1	Grand Aire Express	Falcon 20	St. Louis, MO USA	Approach	0
April 4	Grand Aire Express	Falcon 20	Swanton, OH USA	Approach	3
June 24	Eurojet Italia	Learjet 45	Milan, Italy	Takeoff	2
July 2	Tango Corporation	Citation 525	Nr. Coupeville, WA USA	Climb	0
July 27	Cruz da Malta Taxi Aereo	Citation II	Sorocaba, Brazil	Landing	1
Aug. 4	Air East	Learjet 35	Nr. Groton, CT USA	Approach	2
Sept. 13	Ameristar Jet Charter	Learjet 25B	Del Rio, TX USA	Landing	1
Sept. 20	Star Flite Aviation	HS-125-700A	Nr. Beaumont, TX USA	Approach	3

Source: Airclaims

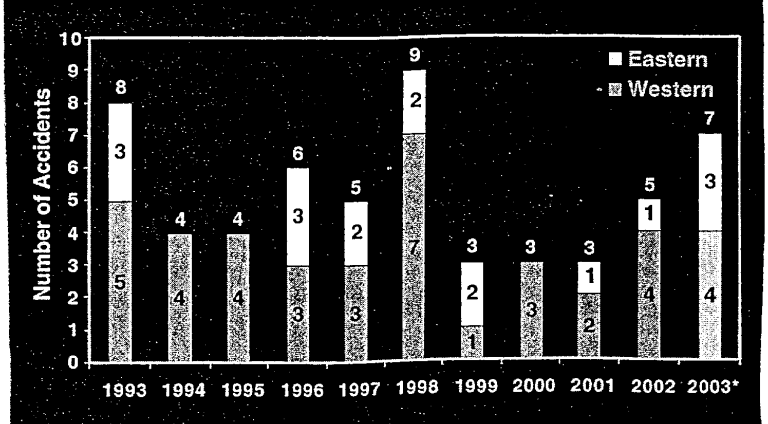
* Business, Corporate, or Executive Jet Operations

Controlled-flight-into-terrain Hull-loss Accidents
Worldwide Commercial Jet Airplanes (> 60,000 lbs)
Jan. 1, 2003 through Oct. 1, 2003

Date	Operator	Aircraft	Location	Phase of Flight	Total Fatal
Jan. 5	Turkish Airlines	Avro RJ100	Diyarbakir, Turkey	Approach	75
Jan. 8	TANS	F28	Chachapoyas, Peru	Approach	46
Jan. 25	VASP	B737-200	Rio Branco, Brazil	Approach	0
Jan. 31	Euro Asia Aviation	IL-76	Baucau, East Timor	Approach	6
Feb. 19	Iranian Revolutionary Guard	IL-76	Sirach Mts, Iran	Descent	276
May 25	UM Air	Yak-42D	Nr. Macka, Turkey	Approach	74
June 22	Brit Air	CRJ-100	Brest, France	Approach	1

Source: Honeywell (Don Bateman), Boeing, Russian Federation IAC, Airclaims

Controlled-flight-into-terrain Hull-loss Accidents
Worldwide Commercial Jet Airplanes (>60,000 lbs)
1993–2003*



Source: Honeywell (Don Bateman), Boeing, Russian Federation IAC

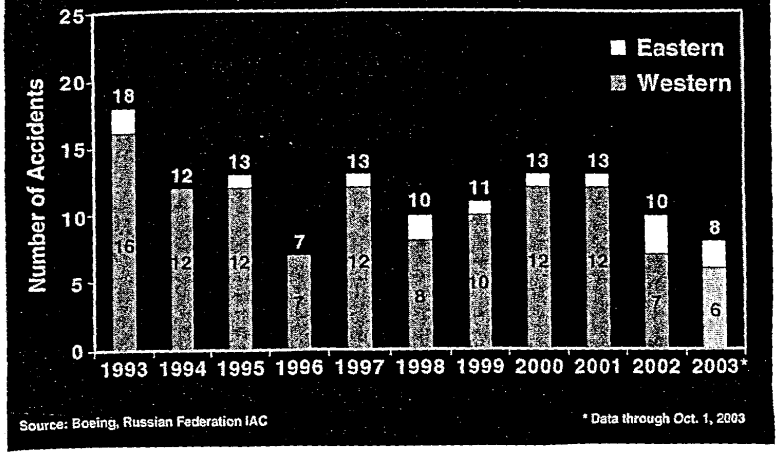
*Data through Oct. 1, 2003

Approach-and-landing Hull-loss Accidents
Worldwide Commercial Jets (<60,000 lbs)
Jan. 1, 2003 through Oct. 1, 2003

Date	Operator	Aircraft	Location	Phase of Flight	Total Fatal
[illegible]	Turkish Airlines	Avro RJ100	Diyarbakir, Turkey	Approach	75
[illegible]	AVIANCA	F28	Chachapoyas, Peru	Approach	46
[illegible]	VASP	B737-200	Rio Branco, Brazil	Approach	0
[illegible]	Pro-Asia Aviation	IL-76	Baucau, East Timor	Approach	6
[illegible]	Western Airlin	DC-9	Brazzaville, Congo	Landing	0
[illegible]	[illegible] DM AF	Yak-42D	Nr. Macka, Turkey	Approach	74
[illegible]	Brit Air	CRJ-100	Brest, France	Approach	1
July 8, [illegible]	Sudan Airways	B737-200	Port Sudan, Sudan	Approach	116

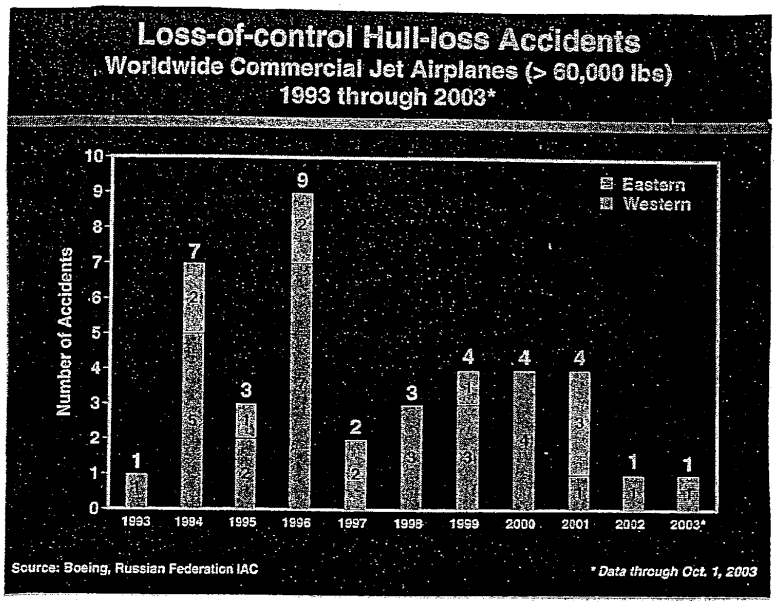
Source: Boeing, Russian Federation IAC, Airclaims

Approach-and-landing Hull-loss Accidents
Worldwide Commercial Jet Airplanes (>60,000 lbs)
1993 through 2003*



Source: Boeing, Russian Federation IAC

* Data through Oct. 1, 2003


Loss-of-control Hull-loss Accidents
Worldwide Commercial Jet Airplanes (> 60,000 lbs)
1993 through 2003*
Number of Accidents
Eastern
Western
1
7
3
9
2
3
4
4
4
1
1
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003*
Source: Boeing, Russian Federation IAC
* Data through Oct. 1, 2003

Hull-loss Accidents

Worldwide Commercial Turboprops (> 14 seats)

Jan. 1, 2003 through Oct. 1, 2003

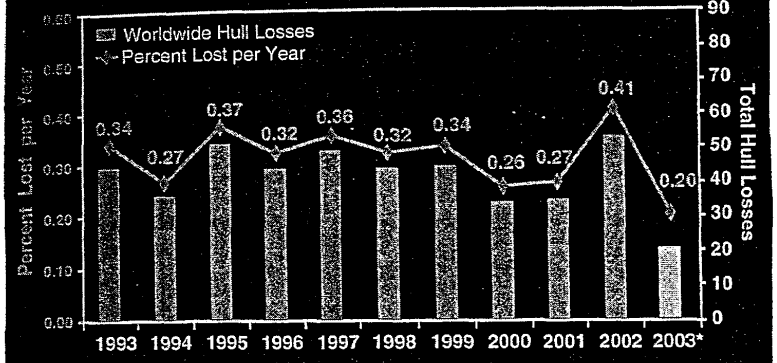
Date	Operator	Aircraft	Location	Phase of Flight	Fatalities
Jan. 8	Air Midwest	Beech 1900	Charlotte, NC USA	Takeoff	21
Jan. 17	Aerocom	AN	Nr. Ndjolé, Gabon	Enroute	4
Jan. 24	African Commuter Services	Gulfstream 1	Busia, Kenya	Takeoff	5
Feb. 10	Enimex	AN-28	Tallinn, Estonia	Takeoff	1
March 1	FLARF	LET-410	Barkl, Russia	Climb	11
March 27	PT Air Regional	DHC-6	Gunung Mulia, Indonesia	Climb	0
April 9	Sky West Enterprises	Shorts 330-200	Du Bois, PA USA	Approach	2
April 15	Trans Int Air	BAC Viscount	Zaire	Takeoff	6
April 23	Transwest Air	Beech 99	Prince Albert, Canada	Approach	0
April 25	Unconfirmed	AN-24	Beni, Zaire	Landing	24
April 28	PT Air Regional	DHC-6	Gunung Mulia, Indonesia	Landing	0
April 29	Avirex	Beech 1900	Kinshasa, Zaire	Landing	0
May 27	Showa Air	AN-12	Goma, Zaire	Landing	10
June 5	Ministry of Natural Resources	DHC-6	Nr. Hornepayne, Canada	Maneuvering	0
July 13	Ruiban and Duran C.A.	LET-410	Nr. San Cristobal Venezuela	Descent	4
July 16	Air Spray	Lockheed L188	Cranbrook BC, Canada	Maneuvering	2
July 19	Ryan Blake Air Charter	Metro II	Mount Kenya, Kenya	Cruise	14
Aug. 24	Tropical Airways	LET-410	Nr. Cap Haitien, Haiti	Climb	21
Aug. 26	Colgan Air (US Airways Express)	Beech 1900D	Nr. Hyannis, MA USA	Climb	2
Sept. 17	European Executive Express	Jetstream 32 EP	Luleå-Kallax Airport, Sweden	Landing	10

Source: Airclaims, News Reports

Percent of Fleet Lost

Worldwide Commercial Turboprops (> 14 seats)

1993–2003



Source: Airclaims
Data through Oct. 1

Appendix 1

Standard Operating Procedures

1. Captains will give a pre-taxi/departure briefing that includes the expected taxi route and restrictions.
2. Both pilots will monitor the frequency when initial taxi clearance is called for to ensure that both pilots hear the taxi clearance.
3. After taxi clearance has been received, the crew will agree on the runway assigned, any restrictions and the taxi route. If not in agreement, seek clarification from Air Traffic Control (ATC).
4. Observe "sterile cockpit," especially while taxiing.
5. Both pilots should have the airport diagram out, available and in use. Crosscheck HSI, airport diagram and airport signage to confirm aircraft position while taxiing.
6. Fixed navigation lights (red, green and white) must be on whenever the airplane is in motion.
7. Both pilots will monitor the appropriate tower frequency when anticipating a clearance to cross or taxi onto an active runway.
8. When approaching an entrance to an active runway, both pilots will ensure compliance with hold short or crossing clearance by discontinuing non-monitoring tasks (e.g., Flight Management System (FMS) programming, Airborne Communications Addressing and Reporting System (ACARS), company radio calls, etc.).
9. Prior to crossing or taxiing onto any runway, verbally confirm ATC clearance with other crewmember(s) and visually scan the runway and approach area.
10. Read back all clearances/instructions to enter a specific runway, hold short of a runway, and taxi into "position and hold," including the runway designator.

    Note: Do not merely acknowledge the foregoing instructions/clearances by using your call sign and saying "Roger" or "Wilco." Read back the entire instruction/clearance including the runway designator.

11. When entering a runway after being cleared for takeoff, or when taxiing into "position and hold," make your aircraft more conspicuous to aircraft on final behind you and to ATC by turning on lights that highlight your aircraft's silhouette.
12. Be especially vigilant when instructed to taxi into "position and hold," particularly at night or during periods of reduced visibility. Scan the full length of the runway and scan for aircraft on final approach when taxiing onto a runway either at the end of the runway or at an intersection. Contact ATC anytime you have a concern about a potential conflict.

    a. In instances where you have been instructed to taxi into "position and hold" and have been advised of a reason/condition (wake turbulence, traffic on an intersecting runway, etc.) or the reason/condition is clearly visible (another aircraft that has landed on or is taking off on the same runway), and the reason/condition is satisfied, you should expect an imminent takeoff clearance, unless advised of a delay.

    b. If landing traffic is a factor, the tower is required to inform you of the closest traffic that is cleared to land, touch-and-go, stop-and-go, or unrestricted low approach on the same runway when clearing you

to taxi into "position and hold." Take care to note the position of that traffic and be especially aware of the elapsed time from the "position and hold" clearance while waiting for the takeoff clearance.

ATC should advise you of any delay in receiving your takeoff clearance (e.g., "expect delay for wake turbulence") while holding in position. If a takeoff clearance is not received within a reasonable time after clearance to "position and hold," contact ATC. Suggested phraseology: *(call sign) holding in position (runway designator or intersection).* **Example, "American 234 holding in position Runway 24L" or "American 234 holding in position Runway 24L at Bravo."**

Note: FAA analysis of accidents and incidents involving aircraft holding in position indicate that *two minutes* or more elapsed between the time the instruction was issued to "position and hold" and the resulting event (e.g., landover or go-around). Pilots should consider the length of time that they have been holding in position whenever they *have not* been advised of any expected delay to determine when it's appropriate to query the controller.

13. To signal intent to aircraft downfield **turn on landing lights when cleared for takeoff.**

14. As part of the approach briefing, review the airport diagram and anticipated taxi route.

Caution

A potential pitfall of pre-taxi and pre-landing planning is setting expectations and then receiving different instructions from ATC. Flightcrews need to ensure that they follow the clearance or instructions that are actually received, and not the ones they expected to receive, from ATC.

Recommended Practices and Techniques

1. State your position whenever making initial contact with any tower or ground controller, regardless of whether you have previously stated your position to a different controller.
2. Write down non-standard or complex taxi instructions.
3. To signal intent to other pilots, consider turning on the taxi light when the aircraft is moving or intending to move on the ground, and turning it off when stopped or yielding, or as a consideration to other pilots or ground personnel.
4. At night, use edge lights to distinguish between taxiways (blue) and runways (white).
5. Minimize "heads-down" activities, such as entering data into the FMS, while the aircraft is moving. Advise the pilot taxiing whenever heads-down activity is required.
6. When visually scanning the runway and approach area, flight crewmembers should verbally confirm scan results with each other (e.g., "clear right," "clear left").
7. When holding in position for takeoff, actively monitor the assigned tower frequency or the Common Traffic Advisory Frequency (CTAF) for potential conflicts involving your runway.
8. If unsure of position and on a runway, immediately clear the runway and notify ATC. Always notify ATC if you are unsure of your position; consider requesting "progressive taxi."
9. When taxi visibility is low, crews should perform heads-down tasks (e.g., programming the FMS, calculating takeoff data) while the aircraft is stopped or while taxiing straight ahead on a taxiway without complex intersections.

10. To confirm proper runway or taxiway selection, verify that the compass heading approximately matches the runway heading and taxiway orientation.

11. Some cockpit displays of traffic information (such as some implementations of TCAS) have the capability and sufficient resolution to enable the display of traffic behind you. When holding in position, consider displaying traffic landing behind you to increase your awareness of the traffic situation.

12. When holding in position at night, consider lining up slightly to the left or right of centerline (approximately three feet) to better enable a landing aircraft to visually differentiate the holding aircraft from runway lights.

13. When on final approach, actively monitor the assigned tower frequency (or CTAF) for potential conflicts involving your runway.

14. Do not accept last minute turnoff instructions from the tower unless you clearly understand the instructions and are certain that you can comply.♦

Most Wanted Transportation Safety Improvements

Automatic Information Recording Devices

Importance

In order to effectively and efficiently determine the factors related to an accident, the Safety Board's investigators must have as much information as possible. Automatic information recording devices have proven to be very useful in gathering pure factual information. The fact that this information is recorded immediately prior to and during the accident sequence often gives investigators the ability to quickly determine and correct a problem.

Safety Recommendations

A-98-54 (FAA)
Issued July 10, 1998
Status: Open—Acceptable Response
Require maintenance checks for all [flight data recorders] FDRs of aircraft operated under 14 CFR Part 121, 129, 125, and 135 every 12 months or after any maintenance affecting the performance of the FDR system, until the effectiveness of the proposed advisory circular and new FAA inspector guidance on continuing FDR airworthiness (maintenance and inspections) is proven; further, these checks should require air carriers to attach to the maintenance job card records a computer printout, or equivalent document, showing recording data, verifying that the parameters were functioning properly during the FDR maintenance check and require that this document be part of the permanent reporting and recordkeeping maintenance system. (Source: *Fine Airlines, Inc. Crash After Take Off at Miami International Airport in Miami, Florida, August 7, 1997)*

A-99-16 (FAA)
Issued March 9, 1999
Status: Open—Unacceptable Response
Require retrofit after January 1, 2005, of all cockpit voice recorders (CVRs) on all airplanes required to carry both a CVR and an FDR with a CVR that (a) meets Technical Standard Order (TSO) C123a, (b) is capable of recording the last 2 hours of audio, and (c) is fitted with an independent power source that is located with the digital CVR and that automatically engages and provides 10 minutes of operation whenever aircraft power to the recorder ceases, either by normal shutdown or by a loss of power to the bus. (Source: A safety recommendation letter dated March 9, 1999, based on the lack of complete cockpit and flight data in the September 2, 1998, crash of Swissair Flight 111, into the waters near Peggy's Cove, Nova Scotia)

A-99-17 (FAA)
Issued March 9, 1999
Status: Open—Unacceptable Response
Require all aircraft manufactured after January 1, 2003, that must carry both a cockpit voice recorder (CVR) and a digital flight data recorder (DFDR) to be equipped with two combination (CVR/DFDR) recording systems. One system should be located as close to the cockpit as practicable and the other as far aft

as practicable. Both recording systems should be capable of recording all mandatory data parameters covering the previous 25 hours of operation and all cockpit audio including controller–pilot data link messages for the previous 2 hours of operation. The system located near the cockpit should be provided with an independent power source that is located with the combination recorder, and that automatically engages and provides 10 minutes of operation whenever normal aircraft power ceases, either by normal shutdown or by a loss of power to the bus. The aft system should be powered by the bus that provides the maximum reliability for operation without jeopardizing service to essential or emergency loads, whereas the system near the cockpit should be powered by the bus that provides the second highest reliability for operation without jeopardizing service to essential or emergency loads. (Source: A safety recommendation letter dated March 9, 1999, based on the lack of complete cockpit and flight data in the September 2, 1998, crash of Swissair Flight 111, into the waters near Peggy's Cove, Nova Scotia)

A-99-18 (FAA)
Issued March 9, 1999
Status: Open—Unacceptable Response
Amend Title 14 CFR Parts 25.1457 (cockpit voice recorders) and 25.1459 (flight data recorders) to require that CVRs, FDRs, and redundant combination flight recorders be powered from separate generator buses with the highest reliability. (Source: A safety recommendation letter dated March 9, 1999, based on the lack of complete cockpit and flight data in the September 2, 1998, crash of Swissair Flight 111, into the waters near Peggy's Cove, Nova Scotia)

A-99-28 (FAA)
Issued April 16, 1999
Status: Open—Unacceptable Response
Require that each 737 airplane operated under 14 CFR Parts 121 or 125 that currently has a flight data acquisition unit be equipped, by July 1, 2000, with a flight data recorder system that records, at a minimum, the parameters required by the FAA Final Rule 121.344, 125.226 dated July 17, 1997, applicable to that airplane plus the following parameters: pitch trim, trailing edge flaps, leading edge flaps, thrust reverser position (each engine), yaw damper command, yaw damper on/off discrete, standby rudder on/off discrete, and control wheel, control column, and rudder pedal forces (with yaw damper command, yaw damper on/off discrete, and control wheel, control column, and rudder pedal forces sampled at a minimum rate of twice-per-second). (Source: A safety recommendation letter dated April 16, 1999, based on the September 8, 1994, crash of USAir Flight 427, Boeing 737 at Aliquippa, Pennsylvania [NTSB/AAR-99-01])

A-99-29 (FAA)
Issued April 16, 1999
Status: Open—Unacceptable Response
Require that all 737 airplanes operated under 14 CFR Parts 121 or 125 not equipped with a flight data acquisition unit be equipped, at the earliest time practicable, but no later than August 1, 2001, with a flight data recorder system that records, at a minimum, the parameters required by FAA Final Rule 121.344, 125.226 dated July 17, 1997, applicable to that airplane plus the following parameters: pitch trim, trailing edge flaps, leading edge flaps, thrust reverser position (each engine), yaw damper command, yaw damper on/off discrete, standby rudder on/off discrete, and control wheel, control column, and rudder pedal forces (with yaw damper command, yaw damper on/off discrete, and control wheel, control column, and rudder pedal forces sampled at a minimum

rate of twice-per-second). (Source: A safety recommendation letter dated April 16, 1999, based on the September 8, 1994, Crash of USAir Flight 427, Boeing 737 at Aliquippa, Pennsylvania [NTSB/AAR-99-01])

A-99-59 (FAA)
Issued February 8, 2000
Status: Open—Acceptable Response
Incorporate the European Organization for Civil Aviation Equipment's proposed standards for a crash-protective video recording system into a technical standard order. (Source: A safety recommendation letter dated April 16, 1999, based on the October 8, 1997, Crash of a Cessna 208B Operated by the Department of Interior, Which Collided with Terrain at the 9,900-foot level on the Uncompahgre Plateau, About 18 Nautical Miles [nm] Southwest of Montrose, Colorado)

A-99-60 (FAA)
Issued February 8, 2000
Status: Open—Unacceptable Response
Require, within 5 years of a technical standards order's issuance, the installation of a crash-protective video recording system on all turbine-powered nonexperimental, nonrestricted-category aircraft in 14 CFR Part 135 operations that are not currently required to be equipped with a crashworthy flight recorder device. (Source: A safety recommendation letter dated April 16, 1999, based on the October 8, 1997, Crash of a Cessna 208B Operated by the Department of Interior, Which Collided with Terrain at the 9,900-foot level on the Uncompahgre Plateau, About 18 Nautical Miles (nm) Southwest of Montrose, Colorado)

A-00-30 (FAA)
Issued April 11, 2000
Status: Open—Unacceptable Response
Require that all aircraft operated under title 14 CFR Part 121, 125, or 135 and currently required to be equipped with a cockpit voice recorder (CVR) and digital flight data recorder (DFDR) be retrofitted by January 1, 2005, with a crash-protected cockpit image recording system. The cockpit image recorder system should have a 2-hour recording duration, as a minimum, and be capable of recording, in color, a view of the entire cockpit including each control position and each action (such as display selections or system activations) taken by people in the cockpit. The recording of these video images should be at a frame rate and resolution sufficient for capturing such actions. The cockpit image recorder should be mounted in the aft portion of the aircraft for maximum survivability and should be equipped with an independent auxiliary power supply that automatically engages and provides 10 minutes of operation whenever aircraft power to the cockpit image recorder and associated cockpit camera system ceases, either by normal shutdown or by a loss of power to the bus. The circuit breaker for the cockpit image recorder system, as well as the circuit breakers for the CVR and the DFDR, should not be accessible to the flight crew during flight. (Source: A safety recommendation letter dated April 16, 1999, prompted by the lack of valuable cockpit information during the investigations of several aircraft incidents and accidents, including USAir Flight 105 on September 8, 1989 [NTSB/AAR-90-04], ValuJet Flight 592 on May 11, 1996 [NTSB/AAR-97-06], SilkAir Flight 185 on December 19, 1997, Swissair Flight 111 on September 2, 1998, and EgyptAir Flight 990 on October 31, 1999 [NTSB/AAB-02-01])

A-00-31 (FAA)
Issued April 11, 2000
Status: Open—Unacceptable Response
Require that all aircraft manufactured after January 1, 2003, operated under Title 14 CFR Part 121, 125, or 135 and required to be equipped with a cockpit voice recorder (CVR) and digital flight data recorder (DFDR) also be equipped with two crash-protected cockpit image recording systems. The cockpit image recorder systems should have a 2-hour recording duration, as a minimum, and be capable

of recording, in color, a view of the entire cockpit including each control position and each action (such as display selections or system activations) taken by people in the cockpit. The recording of these video images should be at a frame rate and resolution sufficient for capturing such actions. One recorder should be located as close to the cockpit as practicable and the other as far aft as practicable. These recorders should be equipped with independent auxiliary power supplies that automatically engage and provide 10 minutes of operation whenever aircraft power to the cockpit image recorders and associated cockpit camera systems ceases, either by normal shutdown or by a loss of power to the bus. The circuit breaker for the cockpit image recorder systems, as well as the circuit breakers for the CVR's and the DFDR's, should not be accessible to the flight crew during flight. (Source: A safety recommendation letter dated April 16, 1999, prompted by the lack of valuable cockpit information during the investigations of several aircraft incidents and accidents, including USAir Flight 105 on September 8, 1989 [NTSB/AAR-90-04], ValuJet Flight 592 on May 11, 1996 [NTSB/AAR-97-06], SilkAir Flight 185 on December 19, 1997, Swissair Flight 111 on September 2, 1998, and EgyptAir Flight 990 on October 31, 1999 [NTSB/AAB-02-01])

Recommendation # A-02-024 | **Overall Status** OAAA | **Priority**

The National Transportation Safety Board recommends that the Federal Aviation Administration: Require that all operators of airplanes equipped with a cockpit voice recorder (CVR) revise their procedures to stipulate that the CVR be deactivated (either manually or by automatic means) immediately upon completion of the flight, as part of an approved aircraft checklist procedure, after a reportable incident/accident has occurred. These procedures must also ensure that the recording remains preserved regardless of any subsequent operation of the aircraft or its systems. Any doubt as to whether or not the occurrence requires notification of the National Transportation Safety Board must be resolved after the steps have been taken to preserve the recording.

FAA	Open - Acceptable Alternate Action

12/12/2002 Addressee

Letter Mail Controlled 12/17/2002 6:01:51 PM MC# 2021031 The Federal Aviation Administration (FAA) agrees with the intent of this safety recommendation and will take the following alternate action. The FAA will issue a notice advising air carriers to add a checklist line item stipulating that the CVR be deactivated (either manually or automatically) immediately upon completion of a flight having a reportable incident/accident. The new checklist line item will be the last item on the checklist that the aircrew conducts prior to departing an aircraft. Additionally, if the CVR is deactivated, the expanded checklist procedures will include flightcrew notification of maintenance personnel SO the CVR data will not be lost on 2 subsequent flight. It is anticipated that the notice will be issued by the end of December 2002. The notice will be issued to principal operations inspectors of all air carriers directing them to deliver a copy of the notice to their respective air carriers. A record of delivery will be recorded by the FAA. I believe that this alternate action meets the full intent this safety recommendation. I will provide the Board with copy of the notice as soon as it is issued.

The Safety Board acknowledges the FAA's positive action to ensure that securing the CVR is an appropriate checklist item. In addition, we ask that the expanded checklist procedures specify that the flight crew secure the CVR without waiting for a specific decision from the operator's management as to whether the occurrence is reportable to the Safety Board. As stated in the forwarding letter and the last portion of the recommendation, the CVR must be deactivated at least temporarily whenever there is doubt as to whether the occurrence is reportable. If the incident is subsequently determined to be nonreportable, the CVR can be reactivated. Pending issuance of the referenced notice and incorporation of the issue regarding "when in doubt, secure the CVR" as outlined above, Safety Recommendation A-02-24 is classified "Open–Acceptable Alternate Response."

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Recommendation Report

Issue Date 08/29/2002

The Safety Board has had longstanding concerns about the availability of cockpit voice recorder (CVR) information following reportable accidents or incidents. The CVR can be one of the most valuable tools used for accident investigation. Unfortunately, an increasing number of the Board's safety investigations are being hampered because of a lack of CVR data. Our audio laboratory regularly receives CVRs with missing or irrelevant data. Two primary issues cause these recordings to be deficient: (1) the tape or memory has been overwritten by events subsequent to the incident, or (2) the recording system was malfunctioning or inoperative at the time of the incident. These issues are discussed below and solutions are recommended to address them.

Recommendation # A-02-025 **Overall Status** OAA **Priority**

The National Transportation Safety Board recommends that the Federal Aviation Administration: Require that all operators of airplanes equipped with a cockpit voice recorder (CVR) test the functionality of the CVR system prior to the first flight of each day, as part of an approved aircraft checklist. This test must be conducted according to procedures provided by the CVR manufacturer and shall include, at a minimum, listening to the recorded signals on each channel to verify that the audio is being recorded properly, is intelligible, and is free from electrical noise or other interference.

FAA	Open - Acceptable Response

12/12/2002 Addressee

Letter Mail Controlled 12/17/2002 6:01:51 PM MC# 2021031 Currently, 14 CFR 23.1457 and 25.1457 require the equipment be capable of performing an aural and visual preflight check of the recorder for proper operation. The equipment as designed, certificated, and installed does not have the capability of performing the type of tests outlined in this safety recommendation. The FAA recognizes the merits of the recommendation and proposes to address the safety issue as follows. The FAA will survey current maintenance practices of both air carrier and general aviation aircraft to determine if corrections to the respective operators' maintenance programs are necessary to ensure expected recorder reliability. Because the scope of this type of evaluation would involve all FAA flight standards district offices and hundreds of air carriers and corporate operators, the FAA projects' completion of the evaluation and attendant program revisions by October 2003. I will keep the Board informed of the FAA's progress on this safety recommendation.

01/16/2003 NTSB

The Safety Board appreciates the FAA's willingness to initiate the maintenance survey, but the Board is concerned that a maintenance survey addresses only one part of the CVR reliability problem. The Board's recommendation letter stressed that it is the operational crew's responsibility to check the CVR for proper operation each day prior to flight; consequently, we encourage the FAA to include maintenance procedures and crew checklist operational procedures in its survey.

The Safety Board is concerned that the FAA may have misunderstood the portion of the recommendation concerning a daily test of the equipment. As stated by the FAA, current regulations (14 Code of Federal Regulations 23.1457 and 25.1457) require this equipment to have "an aural or visual means for preflight checking of the recorder for proper operation." Safety Board staff is unaware of any CVR installations that do not have the ability to monitor the audio using a headphone jack in the cockpit. The intended minimum for the daily test outlined in this safety recommendation would be similar to the procedures outlined in FAA Order 8300.10 Airworthiness Inspectors Handbook, Chapter 143, "Monitor Cockpit Voice Recorders." Among other items, this chapter specifies to "check all channels to ensure that the quality of the reproduction has not deteriorated below an optimal audible level."

An example of a required daily check was in FAA Flight Standards Information Bulletin for Airworthiness 99-04 (enclosed). It outlined that the Raytheon (Beech) 1900C Airplane Flight Manual included a preflight inspection by the flight crew, including monitoring the area microphone.

The Safety Board urges the FAA to ensure that similar checks are required before the first flight of the day in all aircraft equipped with a CVR. Pending full implementation of this requirement, Safety Recommendation A-02-25 is classified "Open–Acceptable Response."

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NTSB experience indicates a press to test function is not sufficient to detect all anomalies.

3. Inspections of FDR and CVR systems

3.1 Prior to the first flight of the day, the built-in test features on the flight deck for the CVR, FDR and Flight Data Acquisition Unit (FDAU). when installed, should be monitored.

3.2 Annual inspections should be carried out as follows:

a) the read-out of the recorded data from the FDR and CVR should ensure that the recorder operates correctly for the nominal duration of the recording;

b) the analysis of the FDR should evaluate the quality of the recorded data to determine if the bit error rate is within acceptable limits and to determine the nature and distribution of the errors;

c) a complete flight from the FDR should be examined in engineering units to evaluate the validity of all recorded parameters. Particular attention should be given to parameters from sensors dedicated to the FDR. Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;

d) the read-out facility should have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals:

e) an annual examination of the recorded signal on the CVR should be carried out by re-play of the CVR recording. While installed in the aircraft, the CVR should record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards; and

f) where practicable, during the annual examination, a sample of in-flight recordings of the CVR should be examined for evidence that the intelligibility of the signal is acceptable.

3.3 Flight recorder systems should be considered unserviceable if there is a significant period of poor quality data, unintelligible signals, or if one or more of the mandatory parameters is not recorded correctly.

3.4 A report of the annual inspection should be made available on request to the State's regulatory authority for monitoring purposes.

3.5 Calibration of the FDR system:

a) the FDR system should be re-calibrated at least every five years to determine any discrepancies in the engineering conversion routines for the mandatory parameters, and to ensure that parameters are being recorded within the calibration tolerances; and

b) when the parameters of altitude and airspeed are provided by sensors that are dedicated to the FDR system, there should be a re-calibration performed as recommended by the sensor manufacturer, or at least every two years.

Correlation document is not addressed

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Appendix

Table A
CFIT Accidents (66) Commercial Jet Aircraft
15 Years (1988 Through 2002) (Excludes Eastern-built Aircraft)

Operation	Year	Place	Aircraft Type	Comments	Fatalities
Cargo	2002	Tallahassee, Florida	B-727-200F	Hit 0.6NM short of Rwy 9	– of 3
Scheduled		Tunis, Tunisia	B-737-500	Hit ridge 4.1 nm from rwy	18 of 62
Scheduled		Pusan, Korea	B-767-200 ER	Hit hill during circling turn to base	130 of 167
Scheduled		Tulcan, Ecuador	B-727-100	Hit volcano during maneuvering letdown	92
Cargo	2001	Port Harcourt, Nigeria	B-747-200	Hit short by 2NM	1 of 14
Scheduled		Zurich, Switzerland	BAe RJ-100	Hit 3NM short	24 of 33
Cargo		Dundo, Angola	B-727-100	Hit 200 feet short	1 on ground
Cargo	2000	Mwanza, Tanzania	B-707F	Hit lake 2NM short	– of 5
Scheduled		Davao, Philippines	B-737-200	Hit 4NM short into hill	131
Scheduled		Bahrain	A320	Hit 1-1/2 NM circling	143
Cargo	1999	Kathmandu, Nepal	B-727-200	Hit terrain on departure	5
Scheduled	1998	Baku, Azerbaijan	B-727	Hit obstacle during missed approach	–
Scheduled		Melilla, Spain	BAe-146	Hit mtn on approach	38
Charter		Andoas, Peru	B-737-200	Hit 2-1/2NM short NDB	75 of 87
Scheduled		Bogota, Colombia	B-727-200	Hit mtn on departure	53
Scheduled		Kabul, Afghanistan	B-727-200	Hit mtn initial approach	45
Scheduled		Chicago, O'Hare, U.S.	B-727-200	Hit 0.1NM short ILS	– of 121
Scheduled		Cagayan de Oro, Philippines	DC-9-30	Hit mtn 27NM short	104
Scheduled		Esfahan, Iran	F-100	Hit 6NM short	– of 104
Scheduled	1997	Sylhet, Bangladesh	F-28	Hit 2NM short	0 of 89
Scheduled		Medan, Indonesia	A-300/B4	Hit mtn 20NM short	234
Scheduled		Agana, Guam	B-747-300	Hit 3-1/2NM short	230 of 254
Cargo	1996	Port Harcourt, Nigeria	DC-8-55	Hit 4NM short	– of 5
Scheduled		LaGuardia, New York	MD-80	Hit 200 ft short	– of 63
Cargo		Lima, Peru	DC-8	Hit pylon 2NM short	– of 6
Charter		Dubrovnik, Croatia	B-737-200	Hit mtn 2 NM north	35
Scheduled		Arequipa, Peru	B-737-300	Hit 3-1/2NM short	123

Operation	Year	Place	Aircraft Type	Comments	Fatalities
Scheduled	1995	Cali, Colombia	B-757	Hit mtn 20NM short	160 of 164
Scheduled		Windsor Locks, CT, U.S.	MD-80	Hit ridge 2NM short	– of 72
Scheduled		San Salvador, El Salvador	B-737-200	Hit mtn 20NM short	65
Scheduled		Monrovia, Liberia	DC-9-31	Hit short	– of 82
Scheduled		Cartagena, Colombia	DC-9-16	Hit 27NM short	52
Scheduled	1994	Van, Turkey	B-737-400	Hit 4NM short	58 of 76
Cargo		Coventry, U.K.	B-737-200	Hit 1NM short	5
Charter		Tamanrasset, Algeria	BAC1-11	Hit 1-1/2NM short	4
Scheduled		Vigo, Spain	DC-9/32	Hit 0.2NM short	–
Scheduled	1993	Urumqi, China	MD-82	Hit 1-1/4NM short	12 of 92
Scheduled		Mokpo, Korea	B-737-500	Hit 4-1/2NM short	68 of 110
Scheduled		Sorong, Indonesia	F-28	Hit 0.6NM short	41 of 43
Scheduled		Medellin, Colombia	B-727-100	Hit 30NM short	132
Cargo		Abijian, Ivory Coast	B-707-320	Hit short	–
Cargo	1992	Kano, Nigeria	B-707-320	Hit 8-1/2NM short	–
Scheduled		Kathmandu, Nepal	A300-B4	Hit mtn 9-1/2NM short	167
Scheduled		Kathmandu, Nepal	A310	Hit mtn 24NM past	113
Cargo		Cruzeiro do Sol. Brazil	B-737-200	Hit 7-1/3NM short	3
Cargo		Athens, Greece	B-707-320	Hit 4NM short	7
Cargo		Kano, Nigeria	DC-8	Hit 9NM short	–
Scheduled		Strasbourg, France	A320	Hit 10-1/2NM short	87 of 96
Scheduled	1991	Imphal, India	B-737-200	Hit 19NM short	69
Scheduled		Santa Barbara, Venezuela	DC-9/30	Hit mtn 40+ short	43
Cargo	1990	Nairobi, Kenya	B-707-320	Hit short	10
Scheduled		Zurich, Switzerland	DC-9/30	Hit hill 5-1/4NM short	46
Positioning		Unakleet, Alaska	B-737-200	Hit hill 6-2/3NM short	– of 4
Scheduled	1989	Hulien, Taiwan	B-737-200	Hit mtn on departure	54
Scheduled		Tegucigalpa, Honduras	B-727-200	Hit mtn 5-3/4NM short	131 of 146
Scheduled		Tripoli, Libya	DC-10/30	Hit 0.6 NM short	75 of 199
Scheduled		Paramaribo, Surinam	DC-8/62	Hit 2NM short	175 of 183
Cargo		Kuala Lumpur, Malasia	B-747	Hit 8-1/2NM short	4

Operation	Year	Place	Aircraft Type	Comments	Fatalities
Charter		Santa Maria, Azores	B-707-320	Hit mtn 5NM short	144
Scheduled	1988	Ahmedabad, India	B-737-200	Hit 1.4NM short	139 of 141
Scheduled		Rome, Italy	B-707-300	Hit 2-1/2NM short	32 of 52
Cargo		Lagos, Nigeria	B-707-320	Hit 8-1/2NM short	6
Scheduled		Posadas, Argentina	MD-81	Hit 1.7NM short	23
Scheduled		Cucuta, Colombia	B-727-100	Hit mtn 12-1/2NM departure	143
Positioning		Ercan, Cypress	B-727-200	Hit mtn 8NM short	15
Positioning		Izmir, Turkey	B-737-200	Hit mtn 19NM short	16

Table B
Partial List of U.S. Part 135 Turbine-powered Aircraft CFIT Accident Losses
1982 to 1993 (No GPWS on Any of These Aircraft)

Date	Place	Aircraft Type	Comments	Fatalities
01 Dec 1993	Hibbing, MN	BAe 31	LOC B/C 13	18 Fatalities
25 May 1993	Santa Fe, NM	SA-227	Circle 15	4 Fatalities
08 Jun 1992	Anniston, AL	Be-C99	LOC 5	3 Fatalities out of 53
Jan 1992	Saranac Lake, NY	Be-1900C	ILS 23	2 Fatalities out of 4
15 Mar 1991	Brown Field, CA	HS-125	Departure 8L	10 Fatalities
04 May 1990	Wilmington, NC	GN-24	B/C Loc 16	2 Fatalities
15 Jan 1990	Elko, NV	Metro III	VOR-A	4 Serious Injuries out of 16
26 Dec 1989	Pasco, WA	BAe 31	ILS 21R	4 Fatalities
21 Aug 1989	Gold Beach, OR	Be-C90	34	3 Fatalities
26 Apr 1989	Jacksonville, FL	SA-226	I. WU	–
28 Oct 1989	Molokai, HI	DHC-6	En route	20 Fatalities
04 Oct 1988	East Sound, WA	Be-99	Departure	– Out of 4
17 May 1988	Little Rock, AK	AC 690	Visual 22	1 Fatality
19 Feb 1988	Raleigh-Durham, NC	Metro III	Departure 23	12 Fatalities
19 Jan 1988	Durango, CO	Metro III	VOR-DME 20	8 Fatalities out of 17
08 Jan 1988	Monroe, LA	GLS-36	ILS 04	2 Fatalities
05 Feb 1987	Florence, SC	SA-226	I. WU 36	–
28 Aug 1986	Lander, WY	Ce-441	Departure 21	7 Fatalities
13 Mar 1986	Alpena, MI	EMB-110	ILS 1	3 Fatalities out of 9
22 Oct 1985	Juneau, AS	LJ-24	LDA 8	4 Fatalities
16 Oct 1985	El Paso, TX	MU-2	En route	1 Fatality

Date	Place	Aircraft Type	Comments	Fatalities
11 Oct 1985	Homer City, PA	DHC-6	En route	1 Fatality
23 Sep 1985	Shenandoah Valley, VA	Be-99	ILS 4	14 Fatalities
25 Aug 1985	Lewiston, MA	Be-99	ILS 4	8 Fatalities
20 Aug 1985	Gulkana, AK	LJ-24	VOR/TVOR 14	3 Fatalities
07 Aug 1985	Dallas, TX	SA-226	J. WU	--
07 April 1985	Williston, ND	SA-227	I.WU	--
22 Mar 1985	Los Angeles, CA	SA-226	I. WU 25 SR	1 Serious Injury
12 Mar 1985	Barter Island, AK	DHC-6	Go-around	2 Serious Injuries
14 Mar 1984	Myrtle Beach, SC	Be-99	I. WU	--
30 Jan 1984	Terre Haute, IN	SA-226	Departure	3 Fatalities
06 Apr 1983	Indianapolis, IN	L-35A	ILS	--
12 Jul 1982	Pueblo, CO	Metro III	Departure	2 Fatalities

Table C
Cargo CFIT Accidents/Serious Incidents, 1994–2002

Date	Place	Aircraft Type	Comments	Fatalities	GPWS
17 Dec 02	Rockford, IL	Ce-208	Hit short by 2NM during ILS 07 approach	1	No
03 Dec 02	Nr. Albuquerque, NM	Ce-421C	Hit 9,000 foot mtn en route – night	1	No
23 Oct 02	Spanish Fort, AL	Ce-208	Descent into water at night during climb	1	No
26 Jul 02	Tallahassee, FL	B-727-200F	Hit 0.6 NM short on visual at night	0 of 3	Yes – No warning
18 Jul 02	Columbus, IN	PA-60	Hit Rwy 23 in fog during ILS Rwy 23 approach	1	No
01 Jun 02	George, South Africa	HS-748	Hit mtn during missed approach. GPS database problem?	3	Yes – short
12 Apr 02	Palma de Mallorca, Spain	Metro III	Hit short on final approach Rwy 24L night 05:12	2	No
14 Mar 02	Broadway, NC	PA-32R-300	Hit a tower flying into the sun on initial visual approach	1	No
04 Feb 02	Nr. Chevak, AK	Ce-206	Flew into snow-covered terrain en route to Chevak VMC into ZNC	1	No
14 Jan 02	Bilbao, Spain	EM-120	Hit mtn on initial approach	3	No
01 Dec 01	Bessemer, AL	Ce-208	Hit short of Rwy 05 in IMC, night, during LOC DME approach	2	No
27 Nov 01	Port Harcourt, Nigeria	B-747-200	Hit 2NM short on VOR DME 21 approach	1 of 14	Yes
10 Oct 01	Bethol, AK	EMB-120	Hit short by 3-1/2 NM at night poor visibility during LOC/DME approach to Rwy 36	0 of 2	No

Date	Place	Aircraft Type	Comments	Fatalities	GPWS
05 Aug 01	Nararsuag, Greenland	Dassault Falcon 20	Hit mtn during NDB DME-1 approach 10 NM short	3	No
01 Aug 01	Hilton Head, SC	MU-2B	Hit 1NM short Rwy 3 landing into sun	1	No
17 Jul 01	Milwaukee, WI	Ce-310R	Hit short by 2NM - Night	1	No
05 May 01	Steamboat Springs, CO	Ce-208	Hit mtn on a VOR-B approach to Rwy 32	1	No
08 Mar 01	Cour d'Alene, ID	Ce-206	Hit 445' below summit of Mica Peak (5,205') during initial approach VMC into IMC	1	No
31 Jan 01	Yobal, Colombia	DC-6	Hit short on NDB approach, poor visibility/rain. Distraction with landing gear.	3 of 6	No
23 Jan 01	Unalaska, Alaska	DC-3	Hit mtn at 1,500' level at night during climb, 4-1/2 NM from airport.	2	No
11 Jan 01	Vandriver, AL	Ce-206	Hit top of Penitentiary Mtn (1,400') en route to Bessmer	1	No
05 Jan 01	Dundo, Angola	B-727-100	Hit 200' short then hit Rwy Threshold	0 of 10 1 fatal on ground	?
09 Oct 00	Grants, NM	Ce-182	Hit terrain at night	1	No
09 Oct 00	Lummi Island, WA	Ce-206B	Enroute from Bellingham to Orcas Is, WA, hit terrain during "visual contact" flying	1	No
24 Mar 00	Kadirana, Philippines	AN-12	Hit short on third approach	6 of 8	No
21 Feb 00	Kotzebue, Alaska	PA-31	Hit 4nm short on GPS approach IMC fog/snow	1 serious	No
21 Feb 00	Lewiston, Idaho	MU-2B-60	Hit short by 1-1/2 nm at night	1	No
03 Feb 00	Mwanza, Tanzania	B707F	Hit flat 2nm short of Rwy 12 at night on approach	0 of 5	?
27 Jan 00	Columbia, Montana	Ce-310R	Hit terrain during missed approach	1 serious	No
27 Jan 00	Fayetteville, Arkansas	SA-227	Unintentional wheels-up	0 of 2	No
10 Nov 99	Montantas, Colombia	DC-3	Flew into mtn at 11,000' level en route	5	No
14 Oct 99	North Las Vegas, Nevada	PA-31-350	Hit mtn during night departure at 5,200' trying to keep below Class B airspace, awaiting IFR clearance	1	No
17 Aug 99	Lubotu, Zaire	DHC-6/300	Hit 1-1/2nm short in poor visibility	0 of 2	No
07 Jul 99	Kathmandu, Nepal	B-727-200	Hit mtn during departure, after missing procedure turn. GPWS warning of 33 seconds, but performance limited.	5	MK 7
02 Jul 99	Sittwe, Myanman	F-27	Hit 900' hill during approach to Rwy 29, 8 nm short	8	No

Date	Place	Aircraft Type	Comments	Fatalities	GPWS
19 Mar 99	Davis Inlet, Canada	DHC-6	Hit 4nm short during missed approach in poor wx	1 and 1 serious	No
12 Feb 99	Bishop, California	Be-99C	Hit White Mtn at 9,500' MSL in IMC	1	No
13 Jan 99	Victoria, BC, Canada	DC-3	Hit 900' ridge on Mayne Island at night en route to Victoria VMC into IMC — missed NDB course turn.	2	No
25 Nov 98	Wavri, Nigeria	Ce-208	Hit short 2nm from rwy	0 of 1	No
24 Nov 98	Victoria, BC, Canada	Ce-208	Hit Mt. Tuam during initial approach VMC @2,230' Rwy 08	2	No
28 Jul 98	Barcelona, Spain	Metro III	Hit 1 nm short at night to Rwy 25	2	No
17 Jul 98	Asmara, Eritrea	IL-76	Hit hillside on approach 5½ nm at night	10	No
16 Jun 98	Helena, Montana	AC-680FL	Hit a mtn inbound while on localizer	1	No
07 Apr 98	Bismarck, North Dakota	Ce-208B	Hit 1 nm short of ILS 31 in IMC	1	No
02 Jan 97	Edenton, NC	Ce-208B	Hit short into power lines at night on NDB approach	2	No
06 Dec 96	Gander, Newfoundland	LJ-36	Hit 1/2 nm short of ILS Rwy 2B	2	No
27 Nov 96	Abakan, Siberia	IL-76	Hit 2,000' mtn during climbout	29	No
24 Jun 96	Cafunto, Angola	AN-26	Hit short at night	9	No
27 Apr 95	Alice Springs, Australia	1A1-1124	Hit ridge 5-1/2 NM short at night	3	No
22 Mar 95	Reno, Nevada	Ce-208B	Hit mtn 9¼ nm short of rwy 16R	1	No
29 Jan 95	Manaus, Brazil	DC-8-62	Hit 1 nm short on ILS 10 managed a missed approach	0 of 4	MK II
30 Dec 94	Melbourne, Australia	MU-2	Hit short on ILS – Poor visibility	1	No
04 Nov 94	Kebu, Nabire, New Guinea	DHC-6	Hit hill on approach	4	No
29 Oct 94	Ust-Ilimsk, Russia	AN-12	Hit short by ½ nm at night	21	No
09 Mar 94	Australia	SA-226	Hit short on approach	1	No
14 Jan 94	Sydney, Australia	AC 690	Flew into sea 10 nm short of Rwy 34 at night	1	No

Table D
Some Positive EGPWS Incidents

Since 1996, EGPWS has demonstrated its safety value. Some examples are:

Juneau	B-737	Training at night (ASRS report)
Ketchikan	B-737	Navigation database error during missed approach
San Jose, CA	B-737	Incorrect altitude during vectoring
Bogota	B-757	Radar vector for wrong aircraft
Tegucipala	B-757	Visual circling night poor visibility
Rio de Janeiro	B-777	Erroneous glide slope signal ILS
Aalborg, Denmark	MD-80	Landing short NPA
Santiago, Chile	B-757	Premature descent clearance
Fiji	B-737	Incorrect vectoring
Salta, Argentina	B-737	Landing short NPA
Tucson	B-737	Premature descent visual approach
Tucson	A320	Premature descent visual approach
San Juan, Costa Rica	B-737	Incorrect radar vectors
Busan	B-73	Circling
Guayaquil	A300-600	1-1/2 degree shallow instrument approach procedure
Cordoba, Argentina	B-737	Initial approach radar vector
Angeles (Clark AFB)	A300-600	Premature descent radar vectors
Faro, Portugal	A300-600	Premature descent radar vectors
Las Vegas	B-737	SID departure and clearances (ASRS report)
Mexico City	MD-80	Initial approach in weather (ASRS report)

There are many others, including ones not reported.

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Appendix
A Competency Framework for Licensed Aircraft Maintenance Engineers

A **Competency Framework** is a description of **personal qualities.** It describes behaviors (or capabilities) exhibited by a person who is regarded as highly effective in their job. Unlike standards of performance, which describe what people ***do***, competencies describe what they need to ***be,*** in order to perform competently.

In 2000, the author of this paper conducted a research project to establish a Competency Framework for licensed aircraft maintenance engineers (LAMEs).[4] A consultation workshop of "industry experts," comprising maintenance managers, quality assurance engineers, trainers, regulators and trade union representatives, produced the Competency Framework, shown below.

The framework was validated by the completion of questionnaires by a wide range of practicing LAMEs and by "managers," other than those who created the framework (i.e. maintenance managers, quality assurance staff and CAA officials etc). Questionnaire respondents were given the opportunity to comment on the content, structure and wording of the Framework. A summary of their contributions is shown in the paper.

Each "competency" is supported by a descriptor *(in italics)* and a list of between five and seven behaviors that would indicate possession, by a LAME, of that competency.

1 **Decision taking and judgment making** *(Acting decisively to resolve issues satisfactorily)*

a) Does not jump to conclusions, but bases decisions soundly on factual evidence, using all available information,

b) Anticipates problems in advance and takes action to deal with them,

c) Weighs up alternative options and chooses the most practicable for the circumstances,

d) Ensures that their decisions are realistic, workable and permissible,

e) Does not allow personal preconceptions and opinions to cloud their views and arrives at objective judgments, and

f) Follows through decisions but remains open to persuasion and reappraisal.

2 **Professionalism** *(Inspiring confidence in others of one's capabilities and soundness of judgement)*

a) Assesses accurately and objectively their own strengths and limitations, seeking advice when out of their depth or unsure,

b) Accepts responsibility for health and safety and accountability for their own actions and decisions,

c) Resists the temptation to give "popular" responses and to lower standards when under pressure,

d) Explains, with conviction, the consequences of decisions and the implications of actions to customers so that they understand the risks involved, and

e) Remains calm, efficient and objective when under pressure.

3 **Integrity** *(Not sacrificing high standards for immediate gains)*

a) Understands the implications of commercial imperatives,

b) Maintains consistently high standards of work, loyalty, honesty and commitment,

c) Never cuts corners or jeopardizes the safety of others by taking "the soft option,"

d) Stands by their decisions and principles even in the face of strong opposition or threats,

e) Has the courage and strength to admit mistakes and weaknesses and to act on them, and

f) Diligently pursues work to the end to ensure the optimum service to internal and external customers.

4 **Adaptability** *(Being flexible with change)*

a) Accepts the need to adapt and face change positively,

b) Learns from their mistakes and those of others,

c) Considers a problem from all aspects and improvises resourcefully yet systematically when dealing with unfamiliar situations,

d) Alters their approach, attitude and methods of working to deal with new and changing situations,

e) Regularly makes constructive suggestions for continuous improvement to processes,

f) Consistently exhibits a positive and constructive attitude.

5 **Leadership** *(Inspiring teams and individuals to better performance)*

a) Does not wait to be told what to do but energetically gets on with the job in hand, needing little or no supervision,

b) Actively encourages others to achieve or exceed their objectives, guiding them through challenging situations and difficult problems and publicly applauding their efforts and successes,

c) Motivates others by setting a role model to others through exemplary behavior and quality of work,

d) Is not afraid to ask for help when needed and accepts advice constructively, and

e) Takes personal responsibility for ensuring that tasks are fully completed.

6 **Teamworking** *(Collaborating positively with others for mutual benefit)*

a) Puts team considerations before their own individual needs,

b) Shows respect to all team members at all levels by treating them with equal courtesy and consideration and exemplifies corporate culture and values,

c) Understands the effects of their actions and words on other people and modifies their behavior to achieve results,

d) Minimizes conflict and takes active steps to relieve tension and stress within the team, exhibiting rapport and compassion to build effective working relationships,

e) Offers support and help to others beyond what is required,

f) Coaches and trains less experienced colleagues and shares ideas, information and solutions for the team's benefit, and

g) Considers the needs of other people beyond their own team.

7 **Self-development** *(Growing with the job by keeping up to date with individual skills, knowledge and business practices)*

a) Recognizes the need to keep their skills and knowledge up to date,

b) Takes personal responsibility for developing themselves and their career,

c) Accepts criticism constructively and takes action to correct areas of personal weakness,

d) Keeps abreast of wider technical, business and commercial developments which might affect the team's and the company's work,

e) Seeks to understand the business environment and the financial implications of their decisions and actions,

f) Is mindful of costs and seeks to work efficiently and economically, and

g) Asks for opportunities to take on new challenges in order to develop their personal and social skills.

Communication *(Ensuring clear and common understanding on both sides)*

a) Listens actively and carefully to what others are saying and appreciates their point of view, even when it contradicts their own,

b) Checks to ensure that they have correctly understood what is being communicated,

c) Structures what they want to communicate and expresses themselves clearly, concisely and assertively to non-technical people so that they can understand the implications of an issue,

d) Adapts their style, expression and choice of words according to the audience to ensure clarity of understanding,

e) Negotiates diplomatically and seeks to find compromises and mutually acceptable solutions in disagreements, and

f) Shares information openly with others to ensure lessons are learned for future benefit.

9 **Methodical** *(Planning and organizing to maximize the resources available)*

a) Systematically draws up plans and distinguishes urgent from other priorities, juggling tasks and priorities to meet deadlines,

b) Allocates clearly roles and responsibilities within the team as a whole,

c) Sets personal goals and targets to keep on top of their own work,

d) Organizes work logically so as to make the best use of time, people and equipment available to complete the task on time,

e) Completes the necessary documentation accurately,

f) Refers to manuals and instructions when necessary and does not rely on memory, and

g) Makes back-up plans to allow for scheduled and unscheduled maintenance, contingencies and any unforeseen situations.

10 **Accuracy and thoroughness** *(Ensuring consistency, completeness and quality of work)*

a) Is conscientious in taking responsibility for ensuring that their work is consistently of the highest quality possible,

b) Patiently takes time to think things through to ensure every angle of a problem is addressed, even when under pressure,

c) Meticulously attends to detail in every aspect and exercises self-discipline in double-checking their work,

d) Uses every piece of information available from others to solve a problem and ensures they are thorough in giving information to others to enable them to do the same,

e) Maintains accuracy and attention to detail, even when under pressure, and

f) Sees tasks through to the logical conclusion and to the required standards.

11 Analytical *(Getting to grips with the essence of the problems)*

a) Does not take what is presented at face value and challenges information when in doubt,

b) Takes a systematic approach to fault finding and identifies accurately the requirements of a task,

c) Spots the links between different pieces of information and emerging patterns,

d) Draws conclusions only when they can be supported by evidence,

e) Recognizes negative or gradually deteriorating situations easily and alerts others promptly to the need to take urgent preventive action,

f) Considers all the information available and sifts out the surplus to consider only what is relevant to an issue, and

g) Reasons through a problem, thinking creatively and looking at the whole problem rather than focusing on one part of it.

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