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Section A: BACKGROUND

Accident Synopsis

On February 16, 2000, at 1951 Pacific Standard Time, a Douglas DC-8-71F, N8079U, operated by Emery Worldwide Airlines as flight 17, a cargo flight departing from Mather Field (MHR) in Rancho Cordova, California to Dayton International Airport (DAY) in Dayton, Ohio, crashed into an auto salvage yard while attempting an emergency return to MHR. The three crewmembers on board received fatal injuries, and the aircraft was destroyed.

This accident was the result of a disconnect and subsequent jam in the linkage of the pitch control system, which rendered the aircraft uncontrollable. Evidence and analysis indicates that the bolt which attaches the pushrod to the tab crank fitting for the right-hand (R/H) elevator control tab was not in place during most or all of the accident flight, and the R/H elevator control tab was jammed in the airplane nose up (ANU) position. During the takeoff roll, the aircraft rotated abruptly, and the flight crew instantly recognized that they had a significant pitch control problem, which they ascribed to an out-of-CG condition. The flight crew varied bank angle and engine thrust in an attempt to control the aircraft enough for an immediate return to MHR. The DC-8's lack of provisions for overcoming jams in the flight control system (commonly referred to as 'split controls') contributed to the flight crew's inability to command sufficient elevator to maintain aircraft control. Although the root cause for the loss of the bolt is unknown, the most likely scenario is that the bolt's locking hardware (castellated nut and cotter key) was either never or improperly installed after maintenance activity by Emery.

Elevator Control Disconnect Scenario

The accident aircraft (N8079U) underwent a D-Check by Tennessee Technical Services (TTS) and was returned to EWA in November 1999. A D-Check is the most extensive regular maintenance activity accomplished on transport aircraft, and typically involves significant inspection, refurbishment or replacement of system and structural elements. During this check, the elevators from N8079U were removed and a different, refurbished set was installed on the aircraft. Complete Controls Incorporated (CCI) supplied the refurbished elevators to TTS for installation. Approximately one week after N8079U's return to service, it was discovered that the right and left elevator dampers had been installed on the incorrect sides, and EWA corrected this at its DAY hub. Between the damper swap and the accident, EWA maintenance personnel conducted three (of a full cycle of four) phased B-checks on the aircraft. Portions of these phased B-checks did involve lubrication and/or inspection of the elevator and tabs.

Given the long history of EWA's maintenance difficulties, the vague and/or ambiguous work card and maintenance manual guidance, the sparse aircraft logbook write-ups, and the indeterminate testimony and witness statements regarding the both the damper reversal and the B-checks, it seems highly likely that the elevator system linkage was parted by EWA during one of those maintenance actions, and that locking hardware was either never or improperly reinstalled. Most of these issues are discussed in detail in this report. The table below provides a chronology of relevant elevator system maintenance activities.

N8079U Elevator Damper and B Check Timeline

DATE	HOURS Total (Interval)	ACTIVITY	LOCATION	MAINTENANCE ORGANIZATION
N/A		Elevators received at Tennessee Technical Services (TTS) from Complete Controls Incorporated (CCI)	KMQY	Complete Controls Incorporated (CCI)
N/A		Elevators installed on N8079U	KMQY	Tennessee Technical Services (TTS)
11/17/99	84050	"D" check completed. Aircraft released to EWA	KMQY	TTS
11/17/99	84052 (2)	Aircraft test flown and returned to service by EWA	KMQY to KDAY	EWA
11/25/99	84080 (28)	Log entry (page #8086-11) by flight crew: "Elevator requires more back pressure than normal to flare the Aircraft".	KDAY	- -
11/25/99	- -	Log book entry: " Found LH & RH Elevator Dampeners reversed, moved LT to RT side, RT to LT side. Ops. Check good, no defects noted".	KDAY	EWA
Nov 1999	- -	TTS detects a second set of elevators from CCI with reversed dampers	KMQY	CCI
11/30/99	- -	TTS issues Maintenance Inspection Alert regarding reversed dampers	KMQY	TTS
12/17/99	84180 (100)	Phased B Check, segment B-1	KDAY	EWA
12/20/99	N/A	Reversed dampers discovered during pre-flight of EWA DC-8 N873SJ	KMSY	- -
1/21/00*	84312 (132)	Phased B Check, segment B-2	KDAY	EWA
2/12/00	84428 (116)	Phased B Check, segment B-3	KAUS	EWA
2/17/00	84448 (20)	Aircraft N8079U destroyed in accident	KMHR	- -

*Note: Depending on source, date varies from January 20-22

Emery World Airways

ALPA activities prior to this accident, as well as the subsequent investigation of the accident, indicated that Emery was a troubled operation poised to have a fatal accident. There is overwhelming evidence that shows that Emery World Airlines lacked a functional or effective safety culture, and in fact was an organization which strongly prioritized keeping its aircraft and crews 'moving' over maintaining adequate or even FAA-minimum levels of safety. Intentionally or otherwise, EWA fell well short of operating its crews and equipment in a safety-oriented environment, and the FAA either did not recognize or was unable to positively alter this situation until shortly before the airline was forced to cease operations in 2001. Before delving into the specifics affecting the safety aspects of this airline, it would be useful to present a brief overview of the airline and its parent company, CNF.

CNF was the parent management company of its wholly-owned subsidiaries of Emery World Wide (EWW) and Emery World Airways (EWA). In 1999, CNF had approximately $5.6 billion in revenues. At the time of the accident, EWW was responsible for air and ocean freight, and related services. EWA was responsible for transportation services for the majority of EWW's (and therefore CNF's) airfreight. In other words, EWA was owned by its 'customer', CNF. Evidence indicates that CNF and EWW exerted significant influence over the daily operations of EWA. The FAA stated this quite clearly when they noted in an internal memo dated Jan 22, 1999 that:

> "The airline is still controlled and run by its own customer, Emery Worldwide.... Operational control issues are constantly challenged but are always controlled ultimately by the freight forwarders [EWW/CNF], and not the airline."

Both CNF and EWW were headquartered in California, while EWA's base of operations (and main hub) was in Dayton Ohio. Until November 1999, when it was moved to the FAA Flight Standards District Office (FSDO) in Cincinnati, the FAA Certificate Management Office (CMO) for Emery was located at the FSDO in San Jose California, even though EWA's base of operation was Dayton.

In 1999, Emery's fleet consisted of approximately 42 DC-8 aircraft, and Emery's route structure included both domestic US and international destinations. US Bureau of Transportation Statistics (BTS) data for 1999, the last complete year prior to the accident, indicate that Emery was operating a fleet of 42 DC-8 aircraft, and conducted 70,468 operations (flights) for a total of 108,564 hours of flight time. At the time of the accident, the average age of the Emery fleet was 31, with the youngest DC-8 28 years old and the oldest one 35. EWA did not purchase any of these aircraft new from the manufacturer; instead, EWA purchased them after they had been retired from passenger service or other cargo operators. At the time of the accident, EWA's DC-8 fleet was quite mixed, being comprised of four different variants and aircraft from at least seven different operators.

In many respects, EWA was a 'virtual airline', reminiscent of 1996-era Valujet. Despite the fact that EWA was a large airline, they had no maintenance hangars anywhere in its system, including its main operations hub in Dayton. Most of EWA's day-to-day maintenance was conducted at its domestic outstations by contract mechanics. The bulk of EWA's heavy maintenance was contracted out to several vendors. With the exception of those at the Dayton hub, the majority of EWA's loading personnel were also contract employees, and included a significant number of part-time personnel. In and of themselves, these conditions do not necessarily constitute an unsafe or undesirable situation. However, extensive use of contract employees without an effective oversight and audit program can adversely affect an organization's effectiveness and efficiency if it is not carefully managed. An organization with a large number of contract employees, particularly from several different companies, will be faced with greater challenges concerning regimentation and uniformity of processes and procedures. The parent organization will have little or no control over the selection, utilization and advancement of the individuals it 'employs.' Finally, these contract employees will not necessarily be imbued with a sense of *esprit de corps* or a strong allegiance to the parent

organization, which without an effective oversight and audit program, can lead to job performance difficulties.

All of these factors had a significant impact on the daily operations of EWA, the FAA's ability to oversee EWA, and the overall level of safety of the airline. In August 2001, EWA ceased flight operations due to FAA pressure to come into compliance with the FARS. At that time, EWA announced that it would resume flight operations within 60 days. However, in December 2001, it was announced that EWA was permanently ceasing flight operations.

Section B: MAINTENANCE

General

Emery's maintenance processes and programs were in such disarray, and ineffective enough, that the airline was continually plagued by excessive, repetitive mechanical problems with its aircraft, many of which resulted in air turn backs, serious incidents, and other operational difficulties. Since January 2000 (just prior to the accident), Emery had been under a heightened state of FAA oversight, and the FAA had conducted several special inspections of the airline, including one each in May and June of 2001. Between February and June 2001, the FAA proposed civil penalties regarding mechanical deficiencies against EWA totaling approximately $320,000. These collective inspections uncovered numerous violations of the Federal Aviation Regulations (FARs), including:

- Operation of unairworthy aircraft
- Improper/inadequate repairs
- Unapproved aircraft installations/alterations
- Numerous repetitive pilot write-ups (same problem on the same aircraft) over extended time periods
- Failure to distribute and use current manuals.
- Failure to follow the policies and procedures in the EWA manuals.
- Inadequate record keeping

On August 13, 2001, facing an ultimatum by the FAA to either cease flight operations or have its operating certificate suspended, Emery Worldwide Airlines signed an interim agreement with the FAA, stating that it would immediately cease operating its aircraft until Emery fully resolved these safety issues. This agreement also included a $1 million fine by the FAA. This interim agreement was valid for 30 calendar days. By the end of that period, EWA was to sign a final agreement detailing its plans for resumption of flight operations. However, EWA's safety problems (many of which were maintenance related) were so substantial that no final agreement was ever signed, and in December 2001 it was announced that EWA was permanently ceasing flight operations.

A detailed look at several aspects of EWA's maintenance operations will highlight the circumstances and problems which adversely affected the safety of the carrier, and which eventually caused the FAA to take definitive action against EWA in August 2001.

Maintenance Facilities

In 1999, EWA conducted approximately 1355 flights per week, which for its fleet of 42 DC-8s is an average of 32 flights per week per aircraft. Despite its large fleet of old aircraft being operated in a high utilization environment, EWA had no maintenance hangars either at its hub in Dayton or anywhere else in its system. The inconsistency here is that while the fleet size, age and utilization rates naturally dictated a high level of maintenance, EWA was ill-equipped to provide satisfactory facilities for such work, even though EWA performed line and heavy maintenance at its hub, and line maintenance at its outstations. Whether Emery's lack of hangar facilities was a factor in its maintenance problems or a reflection of the priority the corporation placed upon maintenance is undetermined; the crucial point is that this arrangement violated the basic principles of human factors regarding maintenance practices.

Hangars afford protection from the elements (cold, wind, rain, etc.) for maintenance crews, their equipment, tools, and manuals, as well as the aircraft and components that they are working on. Lack of such shelter (and its attendant amenities such as workstands, lighting, etc.) can have a significant adverse impact on both the comfort and ability of the mechanics to perform their tasks adequately. Adverse working conditions result in deferred maintenance, rushed jobs, distractions, and inattention to the assigned tasks, all of which lead to maintenance errors or maintenance-induced airworthiness problems. As the factual record indicates, Emery's aircraft had a significant history of maintenance problems.

Maintenance Organization

Pre-accident FAA inspections and post-accident NTSB interviews of EWA personnel highlighted numerous discrepancies between the EWA Operations Specifications ('Ops Specs'), the Maintenance Policy and Procedures Manual (MPPM, the EWA maintenance organization guidelines), the actual responsibilities of several key maintenance personnel, and the day-to-day operations of EWA. These discrepancies underscore EWA's poor attitude towards maintenance and FAR compliance. Another principle concern is the inordinately large span of control of certain individuals, often ranging across several distinct functions and disciplines.

A January 2000 RASIP found that EWA's management structure was in disarray, as manifested by discrepancies between the Ops Spec, the MPPM, and the way that the carrier was conducting its day-to-day business. These discrepancies made it unclear as to who actually was in charge, or what their areas of responsibility were. The FAA noted the following findings that delineated the problem areas:

- The individual identified as the Director of Maintenance in the Ops Specs was not the same as the one identified in the MPPM.

- The MPPM showed the Director of Maintenance position as being shared by the Director of Line Maintenance and the Director of Heavy Maintenance, which was in conflict with the Ops Spec and regulations. (Emery was operating as described in the MPPM, not as reflected in the Ops Specs).
- EWA was operating with a person in a position entitled 'Manager of Phase Maintenance', although there was no such position description either in the MPPM or the Ops Spec.
- The MPPM did not delineate any delegation of authority for either the Director of Maintenance or the Chief Inspector positions, meaning that there were no formal provisions to designate other responsible individuals in the event that either of these two incumbents was unavailable.

Eight months later, during an October 2000 RASIP, Emery's MPPM and Ops Specs were still not aligned with one another. The FAA noted its findings of the following discrepancies:

- The individual identified as the Director of Safety in the Ops Spec was not the same as the individual named in the MPPM.
- Neither the Ops Specs nor the MPPM identified the position or individual serving as Director of Maintenance.
- Neither the Ops Specs nor the MPPM correctly identified the individuals serving as the Vice President of Technical Services or the Director of Quality Control (Chief Inspector).

In 2001 and 2002, the NTSB interviewed, among others, Emery's Director of Quality Control and Director of Heavy Maintenance. During these interviews, continuations of the previously-noted discrepancies, as well as some new ones, came to light. Some of these included:

- The Director of Quality Control also held the position of Chief Inspector. Due to workload and conflict of interest considerations, good operating practice dictates these be separate and independent functions.
- From 1989 until April 2000 (two months after the accident), the Director of Quality Control was responsible for supervising both EWA's Quality Assurance (QA) and Quality Control (QC) sections, Again due to workload and conflict of interest considerations, good operating practice dictates these be separate and independent functions.
- The individual acting as Director of Quality Control was also responsible for the aircraft records section, maintenance reliability program and maintenance training. These functions should be separate from and independent of Quality Control.
- The Director of Heavy Maintenance (as listed in the Op Specs and the MPPM) in fact had no responsibilities in that area.

Emery's maintenance organization issues also adversely affected and placed additional burdens on its outside maintenance providers. Tennessee Technical Services (TTS) was one of the providers of heavy maintenance (including D checks) for EWA. At the May 2002 NTSB Public Hearing on this accident, the President of TTS testified about EWA's organizational and maintenance issues regarding parts acquisition, stating:

"Emery was the only maintenance customer I ever had that we provided a representative at Dayton to coordinate activity in the different departments at Emery. We found a significant problem between, I think they called it their inventory control group, which worked for a different director than purchasing, but had to approve everything before it went to purchasing. There were some communications issues and lines of responsibility and authority problems."

Maintenance Manuals

Aircraft mechanics rely upon appropriate and accurate maintenance manuals to accomplish their work safely and correctly, and the FARs require the mechanics to utilize these manuals. FAA RASIP findings, NTSB Public Hearing and interview testimony, and other factual information gathered during the course of the accident investigation clearly illustrate that EWA was incapable of maintaining its maintenance manuals to the standards required of a Part 121 air carrier.

EWA's maintenance manuals were variously cited (on a repeated basis over several years) as being out-of-date (Jan 2000 RASIP: "Several of the manuals have not been updated in over two years"), difficult to use, inaccurate (Jan 2000 RASIP: "All manuals need to be regularly reviewed for content and currency"), incomplete (Jan 2000 RASIP: "There is no system to revise the Manufacturers Maintenance Manual procedure, IPC or Wiring Diagram Manual after Maintenance Authorizations (MA) or Engineering Orders (EO) have been written."), and not approved by the FAA. Many of these problems were noted with the manuals at EWA's central Maintenance Control facility at the Dayton hub. The conditions at the outstations (EWA or contract) was apparently no better, and availability of accurate, detailed, current information at these outstations was significantly worse.

Emery Work Cards

Work cards are the primary documents used by aircraft mechanics and inspectors to delineate the specific tasks and task sequences necessary to ensure the complete and accurate accomplishment of their assignment. In concept, work cards are similar to flight crew checklists. Well-designed work cards will specifically enumerate the specific steps, hardware, methods and precautions necessary to complete a given task. The more detailed and clear the work card, the more likely that the mechanics and inspectors will properly conduct their maintenance activities. Conversely, vague or generic work cards will lead to errors and oversights in the maintenance and inspection processes. Factual information from the investigation, the Public Hearing, and interviews revealed the poor quality of Emery's work cards. Many were vague and generic, specifying only the most general, high-level steps for complex tasks. Most did not contain specific references to either the required hardware or proper maintenance manual pages, or provide appropriate shift-turnover procedures. Many required only one inspector sign-off for tasks which spanned several days and involved several mechanics. In short, Emery's work cards were seriously deficient, and were another indicator of either EWA's lack of understanding of, or attitude towards, good maintenance practices.

Elevator Damper Reversal

One possible cause for the elevator linkage disconnect stems from the Emery mechanics' rectification of the reversed elevator dampers on the accident aircraft. In related NTSB tests at the Pemco Dothan facility, it was noted that removal and reinstallation of the dampers was extremely difficult, if not impossible, to accomplish without first increasing the elevator's range of motion by disconnecting the elevator linkage. However, Emery's testimony on the accident aircraft damper changeout seem to be at variance with the Dothan observations. Based on Public Hearing and interview testimony, and other factual information, the changeout on the accident aircraft was primarily accomplished during the third shift, and completed at the beginning of the subsequent first shift. However, the specific maintenance actions accomplished for that activity at DAY are unknown. In April 2002, 17 months after the work, the first shift lead mechanic reported that he had observed that many access panels had been removed from the aircraft for this work, but he could not specifically remember which ones. Six months after that testimony, in a signed statement developed in coordination with the one or more EWA attorneys, this mechanic changed his recollection to state that "At no time did I see anyone remove or install any panels, other than the panel directly under the dampers…". In October 2002, 23 months after the work, and also in coordination with EWA legal counsel, a mechanic and mechanic's lead from the third shift variously reported that "no one broke into" the elevator control system and that the "rigging [was] never disturbed." These responses seem to be intended to deflect any EWA culpability regarding any actions which would compromise the integrity of the elevator control system.

Emery's inactions subsequent to the discovery of the reversed elevator dampers on aircraft N8079U provide additional evidence of EWA's lack of a proactive, safety-conscious attitude. Even though EWA mechanics corrected the reversed dampers, they did not re-rig the elevators, which would have been the prudent and conservative action to take. Furthermore, EWA did not conduct a one-time fleet inspection to ensure that none of its other DC-8 aircraft were similarly affected. EWA did not notify its flight crews either of this situation, or how to detect reversed dampers. In contrast, TTS alerted its employees, conducted an in-house audit, and did discover another set of reversed dampers. On 12/20/99, an EWA flight engineer discovered reversed elevator dampers on another EWA DC-8 (N873SJ) during his pre-flight inspection. Even after this second event, EWA did not conduct a one-time fleet inspection or notify its flight crews. Subsequent to this, ALPA did not become aware of any additional cases of reversed dampers.

Phased B-Checks

The elevator-related portions of the first and third B checks (B-1 & B-3) only involved lubrication, while the second and fourth (B-2 & B-4) called for inspection of the "security of attachment" of the elevators. One specific question at the NTSB Public Hearing was whether "security of attachment" required the removal of access panels, and inspection of the elevator control linkage, tabs, and their safety hardware. Witness testimony regarding this question yielded differences of opinion between EWA and TTS, and self-contradicting testimony by the EWA Director of Line Maintenance. Two EWA personnel (Director of Engineering and Director of Line Maintenance) originally testified that removal of access panels was not required,

but the latter contradicted his original statement later in his same testimony. In contrast, two TTS personnel testified that access panels should be removed for the B-2 inspection. This testimony provides another example of some of the confusion and inconsistencies prevalent in EWA's maintenance program.

FDR Calibrations

The control column position data from flight data recorder (FDR) of the accident aircraft did not correspond to the known system geometry or relationship to the elevator position, and for a portion of the accident investigation, these discrepancies masked an accurate evaluation of the aircraft's pitch control system functionality. In an effort to better understand the effects of and limitations imposed by the reversed elevator dampers, in May 2000 the NTSB conducted elevator system testing on an EWA aircraft which was undergoing normally scheduled maintenance at Pemco World Aviation Services in Dothan, Alabama. Part of that testing included using the FDR to record the control column and elevator positions. However, when this FDR data was examined, it exhibited the same problems that occurred on the accident aircraft's system. In April 2001, the NTSB conducted additional elevator system testing on an Emery sister ship to the accident aircraft, again using the aircraft's FDR to record test data. As was the case for the accident aircraft and the Dothan test aircraft, the FDR data for the control column position on this aircraft was erroneous. Together, these incidents illustrate another example of the problems attributable to EWA's poor maintenance program.

Aileron Re-rig Issues

Another example of maintenance related problems at EWA came to light during the Public Hearing testimony of the President of TTS. TTS mechanics inadvertently discovered that it was standard policy for EWA to re-rig the ailerons when each DC-8 was returned from major maintenance at TTS. This re-rig was the result of EWA and TTS utilizing two different rigging standards (one for 'faired ailerons' and one for 'drooped ailerons'). This in itself points to a significant communications and coordination breakdown on the part of EWA Maintenance.

The TTS mechanics who made this discovery were assisting EWA mechanics on an aircraft that had recently been re-rigged by EWA. The TTS President testified that when the mechanics "...opened the panels and on the ailerons, most of the safeties were loose, cotter keys were missing, safety wire was cut and jam nuts were loose…" illustrating both poor workmanship and poor quality control.

Repetitive Write-ups

Repetitive write-ups are recurring discrepancy reports on the same component or system on the same aircraft over a period of time. Repetitive write-ups show that the maintenance actions repeatedly failed to correct the noted deficiencies, and are direct results of an ineffective (whether inadvertent or intentional) maintenance program. Since maintenance troubleshooting

and corrective actions cannot always identify and eliminate discrepancies on the first attempt, a certain amount of repetitive write-ups is normal and can be expected. However, numerous or frequent repetitive write-ups are indicative of a flawed maintenance program, and possibly additional underlying organizational problems.

The ALPA database summary of the EWA 'Flight Debrief' forms (see discussion in subsequent section) clearly reveals a high prevalence of repetitive write-ups. The FAA noted EWA's repetitive write-up problems in its January 2000 RASIP by stating:

> "There are numerous repeat write-ups which seem to reoccur after they have been signed off as corrected. The ability to troubleshoot the write-ups and come up with a successful fix on the first occurrence of a problem is rare."

Finally, the FAA cited repetitive write-ups as one of the indicators warranting the Summer 2001 shutdown of EWA.

Pencil Whipping

Intentional falsification of aircraft maintenance records is known in the industry as 'pencil whipping'. This practice enables operators to expedite a component's or aircraft's release back into service by circumventing genuine maintenance activities and expenses; the underlying motives can be operational, financial or both. Detection of pencil whipping requires the careful examination and cross-comparison of certain documentation, including aircraft logbooks, maintenance records, maintenance employees' work records, vendor invoices, and the like. Repetitive write-ups can also be an indicator of pencil whipping. Such write-ups result when the original problem is not corrected, and it is easy to see how false maintenance entries (denoting maintenance activities that were not actually accomplished) could result in repetitive write-ups.

Although not directly related to this accident, a clear example of Emery's maintenance difficulties occurred on April 26, 2001, when a landing gear malfunction caused an Emery DC-8 to conduct a gear up landing in Nashville, TN. Subsequent NTSB investigation determined that a one-way check valve, instead of a restricted flow valve, was installed in the landing gear hydraulic lines. Contrary to the FARs and universal aircraft maintenance procedures, this incorrect valve did not have any identifying part number on it. The tag reportedly removed from the valve at installation contained an incorrect factory specification number. Furthermore, post-installation verification required an 'ops test' (functional check) of the affected system, and this was noted in the aircraft's maintenance records as having been satisfactorily completed. Clearly, this functional test could not have been satisfactorily accomplished, despite the maintenance entry to the contrary. The NTSB stated that the probable causes of this incident were:

> "The failure of company maintenance personnel to install the correct hydraulic landing gear extension component, and the failure of company maintenance inspection personnel to comply with proper post maintenance test procedures, resulting in the subsequent LMLG up landing. A factor in the accident was the improper identification tag marking on the replacement component, and no marking on the component itself."

Unapproved Parts

Evidence shows that Emery maintenance practices enabled or encouraged the acquisition and use of unapproved parts on its aircraft. Such parts can originate in a variety of ways, but none are technically airworthy, and are therefore not legal for installation on aircraft. The three principal means of origination are:

- The parts are genuine (i.e. manufactured by a certified original equipment manufacturer') aircraft components, but for certain reasons (not refurbished, improperly refurbished, lacking FAA required documentation, etc.) they are not airworthy, and yet they bear documentation that falsely denotes them as airworthy.
- The parts have either been manufactured with inferior materials or do not meet the certified specifications, yet they bear documentation that falsely denotes them as airworthy.
- The parts may or may not be genuine aircraft components, but they do not bear the required documentation (part numbers, airworthiness tags, etc.).

Various cases of these types of activity were repeatedly cited by the FAA in their inspections of EWA. Some such examples included:

DOCUMENT	FINDING #	FAA FINDING
June 1995 RASIP	2.06.03	Parts in Stores area* did not contain serviceability tags
February 1999 RASIP	2.11.03	End restraint fittings, roller tray and side restraint rail assemblies modified or not in accordance with manufacturers data
	2.11.03	Ball mat assemblies with no PMA data plates
October 2000 RASIP	2.03.12	Records of destruction/mutilation of condemned aircraft parts/component not maintained
	2.06.04	Hydraulic hoses in Stores area with no tags
	2.06.05	Unserviceable turbine disks stored in 'Serviceable Parts' area
	2.06.06	Repair kits (without tags), which are not approved for aircraft use, stored in Stores area
	2.06.08	Unrepairable parts stored in two Emery Maintenance storage areas without appropriate tags.
	2.06.10	Numerous unserviceable parts intermixed with serviceable parts. Also, unidentified parts also stored in Stores area.
	2.06.11	Elevator undergoing maintenance lacked appropriate paperwork.
	2.06.13	Parts authorized for return to service by inappropriate individual.
	2.06.14	Thrust reverser returned to service with unairworthy component.

* NOTE: 'Stores area' is used to hold airworthy parts for access and installation by maintenance personnel, yet these parts are not airworthy per FARs

Non-MEL Deferrals

An MEL (minimum equipment list) includes items of equipment on an aircraft related to airworthiness and operating regulations which the FAA deems may be inoperative while still maintaining an acceptable level of safety. In other words, the MEL allows the airline to systematically declare inoperative ('defer') certain equipment and still operate the aircraft. In direct conflict with the FARs and the underlying philosophy of the MEL, EWA independently developed and used what it referred to as "non-MEL deferrals" of components that directly affected the airworthiness of the aircraft.

Factual evidence indicates that EWA had been utilizing its "non-MEL deferrals" for several years, despite orders from the FAA to the contrary. As recently as April 9, 1999, the FAA informed Emery via registered letter to cease using the non-MEL procedures. However, at the time of the accident (ten months after the FAA letter), the formal revision to Emery's Manuals still had not been accepted by the FAA, and EWA was still utilizing this practice. In fact, the January 2000 FAA RASIP contains an entry which shows the lengths EWA went to in order to circumvent compliance with the FARs. FAA Finding 2.8.3 cites EWA's use of a "Maintenance Planning Discrepancy List", which is EWA's re-named "non-MEL deferral" list. Evidence indicates that this illegal practice had been implemented numerous, perhaps hundreds, of times. On one aircraft (N959R) EWA had illegally deferred four airworthiness items at the same time. Some examples of airworthiness items which had been illegally deferred per this practice (citations from the February 1999 FAA RASIP) included:

- An alternate static system.
- A main cargo door.
- A deteriorated wing inboard slot seal.
- An eroded rubber boot from an engine drain mast.
- Missing/removed half of a smoke curtain.

These violations of both the letter and spirit of the regulations clearly indicate EWA's cavalier attitude, ignorance, or both, regarding safety of flight, good operating practice, and compliance with the FARs.

Section C: SAFETY CULTURE

Corporate Safety Culture

The concept of best practices has been defined and adopted by the FAA (FAA Order 8400.10 Appendix 6). This concept can be defined as a philosophy or work ethic that sets forth standards above those imposed as minimum requirements. In the context of an organization, the same concepts and ideals are often referred to as 'culture.' Safety is a result of, and is only achievable, if there exists a corporate safety culture; that is, a mentality and structure that leads by example, and promotes exceeding the minimum standards and minimum compliance. Corporate commitment to safety is of prime importance for a carrier to maintain acceptable safety levels, or

to improve upon them. A key requirement for a robust safety culture is that the airline management must take a proactive role to ensure that compliance failures and safety failures are prevented, not merely dealt with as inconveniences when they are discovered. There is no doubt that safety at any carrier is significantly enhanced when management makes a genuine, proactive and realistic commitment to safe operations. In 1988, the Director of Flight Safety for United Airlines warned the industry that excessive internal politics could paralyze an airline's safety organization or culture for years. In 1990 the Flight Safety Foundation's Board of Governors suggested that strong safety obligations should be written into the job descriptions of airline management personnel.

Examination of the conditions, systems, problems, and by inference, the attitudes, at EWA indicate that EWA had a weak or non-existent corporate safety culture. This does not imply that certain individual or departments at EWA were not firm believers, strong advocates or superior workers when it came to furthering safety. What it means is that despite the concerted efforts of some individuals or departments, EWA's upper management prioritized moving the cargo and aircraft over creating and nurturing a functional safety culture, or operating its crews and aircraft in a safety-oriented environment. In certain circles inside and outside EWA, this has been referred to as the "moving metal" philosophy; EWA/EWW/CNF upper management placed the highest priority on keeping the aircraft flying, with little regard to the FARs, the airworthiness of the aircraft, and sometimes even the flight and maintenance personnel.

A year before the accident, the FAA determined that EWA had significant problems in this area. In an internal memo dated 1/22/99, the FAA certificate management team (CMT) for EWA noted that:

> "...the carrier and its parent company showed a continuing inability to manage properly the operation of Emery World Airlines and did not have the expertise necessary to maintain compliance with FAA regulations."

This memo further stated that:

> "...it was obvious that EWA's management representatives would rather spend their resources defending their decisions or denying that a compliance issue even exists. This gives the CMT reason for serious concern because [EWA's] view on compliance [with the FARs] appears to be extremely liberal. Liberal to the point that EWA acts as if they are an autonomous entity in the world of aviation."

These FAA and investigation findings are indicative of an airline without an effective or functional safety culture.

DOT Fitness Review

When an air carrier initially applies for its Department of Transportation (DOT) 'certificate of public convenience and necessity', the DOT scrutinizes the applicant's managerial, operational and financial fitness, as well as its 'compliance disposition'. In determining whether a new applicant is fit, the DOT assesses whether the applicant:

1) Has the managerial and operational ability to conduct the proposed operations
2) Has sufficient financial resources available to commence operations without undue risk
3) Will comply with its statutory and regulatory obligations under the law (referred to as 'compliance disposition')

In other words, the DOT is attempting to ensure that the air carrier will be resourced, staffed and organized to operate safely and in compliance with governing regulations. In a 1985 DOT investigation into the continued fitness of an operating carrier, the DOT observed that it regards

> "...compliance disposition as an important element in [its] fitness process and has not hesitated to act where there was substantial evidence of a [carrier's] lack of disposition to comply with the law and as a consequence, of an imminent risk to the public."

Although in this cited case the DOT was investigating an already-operating carrier, this is the exception, not the norm. Currently, although the DOT is responsible for ensuring a carrier's continued fitness, there are no provisions for any type of regularly scheduled, recurring fitness review once a carrier begins operation. Typically, once the operating certificate is granted, the DOT will not review a carrier's fitness unless certain extenuating or unusual circumstances are brought to the DOT's attention. The responsibility to detect such circumstances or safety related deficiencies resides within the FAA, but the FAA's ability to do so is occasionally limited or inadequate. Improved communications between the responsible FAA and DOT offices and personnel, combined with a requirement for regular, recurrent fitness queries (by the DOT to the FAA on a rotating-carrier basis) would add a layer of redundancy to the government oversight process. A DOT query to the FAA regarding Emery's fitness might have detected (and possibly corrected) many of the underlying organizational problems, processes and behaviors which eventually led to the crash of Emery Flight 017.

Emery Flight Debrief System

Emery had a reporting program which enabled flight crew members to file discrepancy reports that would be routed directly to certain company personnel and departments. This program was known initially as the "Flight Debrief/Line Report" and later as the "Flight Debrief and Tracking" system. This program had been in place at EWA at least since 1993, and was still in existence at EWA's demise. The primary reporting vehicle for the flight crews was EWA Company Form OF-524, and crews could use this form to report a variety of items, including aircraft airworthiness discrepancies, cargo loading problems, and a wide range of other concerns.

Reportedly, the information provided on these debrief forms was databased by the EWA Safety Department, and subsequently utilized by EWA to improve the safety, operational, and maintenance practices at the airline. ALPA has never been able to gain access to, or substantiate information about, this database. Despite ALPA's repeated requests for the NTSB to examine this EWA database, or to allow the interested parties access to this information as part of the accident investigation, to ALPA's knowledge this was never accomplished.

Since EWA ALPA safety personnel also received copies of approximately 500 of the OF-524 forms filed by the flight crew members, ALPA developed its own database of these reports. Electronic and paper copies of this database and the reports were forwarded to FAA Headquarters, the FAA CMO (CVG FSDO) and the NTSB. Cursory examination of the database quickly reveals a few notable trends, including repetitive write-ups, ineffective

maintenance, and non-MEL deferrals of airworthiness items. These findings correlate with and corroborate many of the findings reported in the FAA RASIP inspection reports of EWA.

Effectiveness of the EWA Corporate Safety Department

Although EWA policy and procedures stated that the pilots using the Flight Debrief system would receive direct feedback on the resolution of their respective discrepancies, most pilots indicated to ALPA that they rarely, if ever, received any feedback from the company. ALPA discussions with the EWA Director of Safety and his successor, the Vice President of Corporate Safety, as well as NTSB interviews, indicated that these individuals were only marginally aware of even the top-level reported concerns and problems. The continuing lack of communication between the safety office, management, and flight crews caused many crew members to abandon their belief in EWA's willingness or ability to make needed safety improvements. For these and other reasons, the EWA Safety Office was seen by many crew members as ineffective. As a result, EWA flight crew members, who for years had spent a great deal of time and effort submitting debriefs, began contacting the FAA and DOT Inspector General's offices directly, in attempts to bring the carrier into compliance with the FARs, and to improve the level of safety.

In combination, these facts about the EWA Flight Debrief system provide further evidence that EWA's safety processes were nowhere near as robust or effective as they could or should have been. ALPA believes that even if EWA had developed an improved safety reporting system, it would have been only minimally effective unless EWA, EWW, and CNF management made significant changes to the corporate safety mentality, including a genuine commitment to making safety improvements.

Previous NTSB Remarks on Corporate Culture

Corporate culture clearly affects the level of safety at a carrier, as the NTSB has also previously identified. In its report (AAR-94/04) on the 1993 crash of the American International Airways (AIA) DC-8 in Cuba, the NTSB made the following statements regarding corporate philosophy and safety, which contain notable parallels to the conditions observed at EWA:

> The individual managers/supervisors could not keep pace with the added responsibilities placed on them....This situation was evident whenever a problem area arose because management, the airline operation, or both, were constantly "behind the power curve" in planning or foresight. This was observed on a regular basis by the FAA POI and PMI, and was documented in the various inspection reports prepared by not only the local FAA inspectors, but by the inspectors involved in the FAA RASIP, NASIP, and special inspections.... AIA's underlying company philosophy with regard to taking corrective action on negative findings determine by these inspections was to solve the problem by "decree". And although changes were made or actions were performed to "correct" the discrepancies, the corrections were not always long term and became repetitive on follow-up inspections. The company's attempts to comply with FARs were described as "minimal", with an attitude of disregard to elevating the level of operation above the minimum standards set forth by the regulations.

> The information and concerns expressed by AIA employees to the Safety Board during the investigation suggested that a corporate attitude existed that placed more significance on economic factors than safety...
>
> FAA inspections found repetitive discrepancies in required paperwork, as well as airplane and flight operations manuals, that reflected either the lack of attention, a reduced priority, or the inability to perform the task because of other work priorities. Because of the repetition of discrepancies in these specific areas, and the lack of urgency on the part of the AIA management to take corrective actions, the POI sometimes resorted to unorthodox means to achieve change. One such action related to the out-dated aircraft operations and maintenance manuals. To effect a change by AIA, the POI threatened to delay the approval of the B-747 operation... [ALPA note: the FAA delayed the introduction of some of EWA's DC-10 aircraft into service for similar reasons]
>
> ...The lack of personnel in key positions (both operations and maintenance) that were capable of reducing the workload of the management staff, and the inability of supervisory staff to make and implement decisions without involving the highest levels of management, are just two of many examples that contributed to the management problems that compromised the safety of this operation.

Transport Canada's 'Safety Management System'

The Canadian government recognizes the importance of a safety-oriented corporate culture in aviation, and is in the process of formalizing and requiring this approach. Transport Canada (TC), the Canadian regulatory authority, will require every CAR 705 (analogous to FAR Parts 119/121) operator to have a Safety Management System (SMS) by March 2004. SMS will also subsequently be introduced into maintenance organizations, manufacturing organizations and airports in Canada. NAV CANADA, the air traffic service provider, has had an effective SMS program for a number of years.

SMS requires the integration of safety risk management with corporate planning and performance at all levels of the corporation. It includes the basic principle of the "accountable executive," as well as the need for risk management responsibilities and accountabilities, again at all levels within the corporation. SMS is characterized by the identification and analysis of hazards which could lead to unacceptable loss, and the establishment and measurement of safety goals to reduce operational risk. The "accountable executive" (the holder of the Air Operating Certificate, typically the CEO) is responsible for the establishment of SMS, and for providing the resources and training to ensure that regulatory requirements and corporate safety goals are achieved.

Essential elements of SMS include non-punitive reporting systems which improve the effectiveness of safety reporting and their subsequent investigations; clear responsibilities and accountabilities within the management structure for meeting safety goals; and widespread feedback on corporate safety priorities and decision making. The object of SMS is the establishment of a safety culture wherein safety goals and values are accepted and shared by management, and where suggestions for positive, safety-oriented change are encouraged. SMS reduces the need for regulatory oversight while improving the corporation's ability to effect

internal improvements. In most cases, the introduction of SMS has resulted in improved financial performance as well.

The circumstances surrounding the Emery accident and the previously cited AIA accident, when viewed against the background of the continuing history of accidents and incidents involving marginal carriers, show that these events are not unique, and that the existing practices and regulations do not necessarily result in the desired level of safety. When considered in combination with the FAA's limited ability to provide adequate and effective oversight, and the acknowledged benefits of a strong safety culture, it becomes clear that the implementation of a US system similar to the Canadian SMS is warranted.

Section D: FAA OVERSIGHT

General

There is strong evidence that some cargo airlines consistently fail to operate in compliance with the FARs. FAA RASIP reports and NTSB accident reports show that the existing FAA oversight process has not prevented some cargo operators from conducting maintenance, loading and flight operations at variance with established procedures and regulations. Part of this problem is likely because the air cargo industry differs from its passenger carrying counterparts in several significant aspects, and these characteristics result in the FAA's decreased ability to regularly, properly and effectively surveil cargo operators. The three primary factors are:

- Night-oriented operating schedules which compound the logistical difficulties of accomplishing adequate FAA oversight.
- The widespread distribution of airports served by cargo operators, and the fact that many of these airports are not those populated by the passenger carriers, compound the logistical difficulties of accomplishing adequate FAA oversight.
- Lack of adequate FAA personnel resources.

Furthermore, in Emery's case, for several years the large geographic separation between the FAA Certificate Management Office (CMO) for Emery (at San Jose, CA) and the Emery hub (at Dayton, OH) precluded any ability for the FAA to provide meaningful or effective oversight of that airline. The CMO was eventually moved to Cincinnati (CVG), but this was only two months prior to the accident.

FAA Oversight and CASS

Continuing Analysis and Surveillance System (CASS) is the system used to monitor the effectiveness of an air carrier's maintenance and inspection programs. CASS has been required since 1964, and provides a structured process for joint use by the carrier and the FAA. Together, CASS and routine surveillance enable the FAA to ensure a carrier's compliance with certain

FARs. The SJC CMT identified EWA failures to effectively utilize CASS and recommended modifications to Emery's Ops Spec. The following paragraphs outline the sequence of events.

In a January 12, 1999 internal memo from the San Jose Certificate Management Team (SJC CMT) to the manager of the San Jose FSDO, the CMT expressed its frustrations with Emery's CASS compliance. In part, this memo stated:

> "EWA has not conducted reliability meetings for at least three months. The CHDO has not received a maintenance reliability report for any month since August 1998, this is a direct violation of the Ops Specs, EWA manual procedure, and the FAR. The Continuing Analysis and Surveillance system (CASS) is not functional. The statement above is a major contributor to the inability of the CASS to function. Mr. Wood and other EWA personnel have indicated both in writing and verbally that personnel and resources that would normally be utilized to accomplish CASS functions, have been redirected to the DC-10 certification project".

This failure of the CASS system at Emery is yet another indicator of the company's unwillingness to place FAR compliance and safety above operational considerations (in this case, the expansion into DC-10 operations.) However, in addition, the FAA then failed in its oversight responsibilities when FAA Headquarters directly countermanded the recommendations of its personnel at the local level (San Jose FSDO.)

On March 18, 1999, the FAA (SJC FSDO) informed Emery that due to numerous FAR and safety deficiencies, the FAA was planning to rescind two articles of Emery's Ops Spec; D74 - Maintenance Reliability Program Authorization and D76-Short Term Escalation Authorization. This letter was sent to Emery eight months prior to the Certificate transfer from SJC to CVG. However, Emery stalled until the Certificate had been transferred to CVG to fully address this issue. Emery's legal counsel appealed the SJC FSDO's Ops Specs amendments, and on December 30 1999, EWA sent a letter to Nicholas Lacey (FAA Director of Flight Standards, AFS-1, FAA Headquarters), stating:

> "Additionally, we want to point out that since the time the letter was issued by the San Jose FSDO, the FAA transferred EWA's certificate from the San Jose FSDO to the Cincinnati FSDO, effective December 17, 1999. EWA intends to work closely with the receiving FSDO during the pendency of your review to reach a resolution that would be satisfactory to the receiving FSDO. If we are successful, we hope you will take into account such a resolution as you reach your decision on this petition."

ALPA views this as a calculated ploy by Emery to bypass its obligation to comply with the FARs. Emery was attempting to avoid having its fleet expansion and maintenance programs restrained by the SJC CMT by starting with "new" FAA personalities after the certificate transfer, bypassing both SJC & CVG CMTs, and corresponding directly with AFS-1 at FAA Headquarters in Washington DC.

On March 13, 2000, Emery's appeal succeeded. In a letter from Angela Elgee (Manager, Continuous Airworthiness Maintenance Division, AFS-300, FAA Headquarters) to Emery's legal counsel, she stated:

> "We have evaluated your December 31, 1999 request, submitted on behalf of Emery Worldwide Airlines (EWA), for reconsideration of certain San Jose Flight Standards District Office (FSDO) initiated Operations Specifications amendments. Along with the information provided in the February 2, letter it is our understanding that the Cincinnati FSDO and EWA have come to a resolution which resolves the need to amend the operations specifications of EWA."

This illustrates that CASS did not operate as intended, and the FAA circumvented its own processes. Further evidence indicates that FAA headquarters rendered its decision without consulting the FSDO (SJC) that initiated the recommendation to modify EWA's Ops Spec and halt EWA's fleet expansion. In July 2002, the NTSB interviewed the manager of the San Jose FSDO. In response to the NTSB's question about what happened after the CMT wrote the internal memo expressing its serious concerns about EWA, CASS, and its recommendation to amend EWA's Op Spec, the manager responded:

> "I don't know what happened right after. The next thing I received was by fax. It was a letter from Angela Elgee to Emery stating that they [the FAA] were not going to take action on the amendment to their [EWA's] operation specification".

Further questioning revealed that the SJC CMT requests to rescind EWA's reliability program and put a hold on the carrier's short term escalation (due to the extent of compliance and safety problems at EWA) was not only overridden by senior FAA management, but the FSDO was never even directly notified of FAA Headquarters' decisions. Regarding how the SJC manager was notified of FAA Headquarters decision, the manager stated:

> "I was not copied. It was sent to me as a courtesy from Cincinnati [the new CMO]. And I'm not sure who sent it. It didn't have a name on it, just showed up on our fax machine."

The correspondence and interviews clearly indicate how FAA oversight was deficient, and that some of its processes were circumvented or ignored.

DOT Inspector General's Report on CASS

For several years, both the NTSB and DOT Inspector General's office have been concerned with the CASS system of inspection. In December 2001 the DOT IG issued its *Report on Oversight of Aircraft Maintenance Continuing Analysis and Surveillance Systems. (AV-2002-066)* which detailed DOT's findings, and show that this problem is not limited to Emery.

This report points out many of the problems that occur with CASS, primarily the FAA's inability to conduct CASS in a comprehensive manner at certain carriers, and the FAA's inability to ensure that critical deficiencies are corrected. The DOT report cites CASS system failures that

paralleled the situation observed in Emery's case. At illustrated in the previous discussion of Emery's CASS problems, although inspectors did identify problems through their routine CASS surveillance inspections, these problems were not corrected through follow-up action. Two DOT report examples concerning airlines other than Emery illustrate this situation.

At one major air carrier, deficiencies in the carrier's CASS were identified in July 1996. The inspector concluded that the carrier's CASS policies and procedures were very weak, and the carrier was not effectively analyzing data from routine inspections or from critical aircraft data such as service difficulty reports. The same inspector found and documented similar problems during another CASS inspection in 1998. The inspector stated that, in his opinion, his managers did not support his efforts to correct the deficiencies. Instead, his managers suggested that the carrier had procedures, but they were not documented. These problems had still not been corrected when the FAA performed its National Program Review (NPR) in September 2000.

In another instance, a major air carrier was assessed a sizable civil penalty in July 1998 for violating aircraft maintenance and operating rules, problems that are related to the effectiveness of the air carrier's CASS. The FAA entered into an agreement with the carrier to reduce the penalty by half if the carrier made improvements to its maintenance program. However, in August 1999, FAA Flight Standards Service Headquarters officials made a decision to absolve the carrier of the remainder of the penalty because, in their view, the carrier had complied with the agreement. The local FAA office did not agree that the carrier had made sufficient progress in correcting the deficiencies. Local inspectors had identified 33 of 71 deficiencies relating to performance of maintenance procedures that the carrier had not addressed. The local inspectors believed that FAA's agreement to reduce the penalty amount left little incentive for the carrier to correct systemic problems in its maintenance program. The FAA's July 2000 NPR of this carrier substantiated this concern, when inspectors identified many of the same maintenance problems that the local office had identified prior to the settlement. This special NPR inspection determined that the carrier's CASS continued to operate ineffectively.

Though it is clearly the responsibility of the air carrier to ensure the safety of the maintenance and operation of its aircraft, the information garnered during this investigation shows that the FAA must be more effective in ensuring that problems identified by FAA inspectors are corrected.

Section E: AIRCRAFT ISSUES

Split Controls

Unlike newer transport aircraft, the left and right sides of the DC-8's pitch control system cannot be isolated from one another in the event of a jam or malfunction on one side. The DC-8 was certificated in 1959, while the FARs addressing control system problems (25.671) became law in 1964. These FARs were not retroactive; they did not apply to previously certificated designs. FAR 25.671(c)(1) and (2) tend to require redundancy or separation of flight control systems to maintain control after single and multiple failures, while 25.671(c)(3) requires the airplane to be capable of continued safe flight and landing after

"Any jam in a control position normally encountered during takeoff, climb, cruise, normal turns, descent, and landing unless the jam is shown to be extremely improbable, or can be alleviated. A runaway of a flight control to an adverse position and jam must be accounted for if such runaway and subsequent jamming is not extremely improbable."

In modern aircraft, compliance with this requirement has been accomplished through 'split controls', which are incorporated into the entire pitch control system, from column to elevator. If a jam occurs anywhere on one side of the system, breakouts have been provided to allow independent operation of the unaffected side. Mechanical means for providing breakouts include springs, shear bolts, or rivets, and all require higher-than-normal control forces for activation. Some aircraft designs provide unlock features for jam protection, where the pilot is required to pull a handle or lever to decouple the two sides of a split control system.

The DC-8 uses a tab-actuated pitch control system, whereby the control column is only connected directly to the control tabs, and not to the elevator. With the exception of a mechanical failure or disconnect, the two control columns cannot be moved independently of one another. This also applies to the two control tabs and the two elevator panels. If the FARs requiring split controls or their equivalent had been made to retroactively apply to the DC-8, this accident might not have occurred.

Dual Locking

Emery Flight 17 crashed as a direct result of the loss of a single fastener in a critical flight control link. In accordance with FARs applicable at the time the DC-8 was certificated, this fastener was secured with only one locking device. In 1970, in response to several accidents and eleven years after the DC-8 was certificated, the FAA modified the regulations to require two locking devices for critical fasteners. For convenience, this FAR is partially cited here:

§ 25.607 Fasteners.
(a) Each removable bolt, screw, nut, pin, or other removable fastener must incorporate two separate locking devices if -
(1) Its loss could preclude continued flight and landing within the design limitations of the airplane using normal pilot skill and strength; or
(2) Its loss could result in reduction in pitch, yaw, or roll control capability or response below that required by Subpart B of this chapter.

This FAR was not retroactive, and therefore did not apply to the DC-8, or any other aircraft certificated prior to 1970. It is possible that if FAR 25.607 was retroactive and applied to the DC-8, this accident would not have occurred, and the crew of Emery 17 would be alive today.

Elevator Position Indicators

It is imperative that flight crews be able to accurately ascertain full and correct flight control surface operation prior to each flight. When originally designed and certified, the DC-8 was not

equipped with any means to enable the flight crew to determine elevator position. As a result of several takeoff accidents, an Elevator Position Indicator (EPI) system was mandated for all DC-8 aircraft in 1977. The EPI gauge is quite small (approximately 1" in diameter) and since it was a post-production modification, its cockpit location varies somewhat. In the accident aircraft and most of Emery's other DC-8s, the EPI was located low and inboard on the First Officer's panel. This renders the gauge difficult for the First Officer, and essentially impossible for the Captain, to see

During the Airworthiness Group's Elevator checks in Dayton in April 2001, several other aspects regarding the utility and accuracy of the EPI system were noted. These included:

- The face of the EPI gauge does not have a graduated scale.
- For a given elevator/column displacement, the EPI indicator needle position varied significantly across the aircraft checked.
- There are no explicit go/no-go limits stated for, or marked on, the EPI.
- There is no requirement for post-installation calibration of the EPI system.

When the EPI system was added to the DC-8, certain flight control checks were mandated. The mandatory flight control checks required that, while parked or taxiing, the flight crew exercise the control column and utilize the EPI gauge to confirm a certain degree of elevator travel in each direction. When the aircraft is stationary (no airflow over the control and servo tabs), full motion of the control column will not result in full elevator travel. This check is known as the 'static' or 'taxi' check. However, since the DC-8 elevator system is not 'split' and is tab-driven (see discussions above), and since the EPI system only indicates the position of the elevator, the current EPI system does not enable flight crews to accurately verify the basic functionality and integrity of the DC-8 pitch control system.

Given the significance of properly functioning flight controls, it is imperative that the DC-8 be modified to provide flight crews with an accurate and reliable means to determine the basic integrity of the aircraft's elevator system. The geometry of this elevator system (tab-driven, no provisions for side-to-side isolation) dictates that there be provisions for a position indication for each of the control tabs. While this requirement might add some complexity to a control surface indicating system, ALPA does not believe it would be significant or prohibitive in terms of initial or recurring cost or reliability. Unless or until this type of indicating system is installed, the existing EPI system and procedures should be modified to:

- Be readily visible to and readable by both the Captain and the F/O.
- Contain a graduated scale and explicit go/no-go limits.
- Be checked for accuracy periodically.

80 Knot Check

In conjunction with the 1977 EPI installations, Douglas guidance also included the option of a check during the takeoff roll, whereby the crew would exercise the column at speeds between approximately 60 and 80 knots, and look for a commensurate pitch response from the aircraft.

This optional check is known as the '80 knot check', and was only recommended if the static check did not provide the desired results. (Refer to Douglas "Know your DC-8" Letter No. 53A, dated 5/25/77). Clearly, variations in speed, aircraft weight, aircraft CG and flight crew techniques will affect the response of the aircraft, making this check highly subjective. Furthermore, since the flight crew only moves the column through a small percentage of its travel during the 80 knot check, it provides very little useful information, and in fact does not constitute a definitive verification of the functionality of the pitch control system.

In conflict with the manufacturer's guidance, the EWA DC-8 Aircraft Operating Manual (AOM, Table 2-3-1, page 02-03-05) mandated the 80 knot check (regardless of the results of the static check) and mandated the use of the EPI gauge for this check. The location and size of the EPI gauge makes it very difficult for the F/O, and impossible for the Captain, to see. In practical terms, this renders use of the EPI gauge during the takeoff roll extremely difficult, regardless of whether the Captain or the F/O is the P/F. Nevertheless, apparently neither EWA nor the FAA seemed to have any concerns about the efficacy of or the potential hazards presented by this EWA procedure.

Based on findings from the accident and the Dayton tests, Boeing issued Flight Operations Bulletin (FOB) DC-8-01-02, dated 6/19/01. This FOB modifies previous manufacturer guidance by stating that the optional 80 knot check is not a valid substitute for a properly-conducted and satisfactory static check. Additionally, the FOB recommends that in the event of an unsatisfactory static check, the flight crew should conduct or arrange for an external visual check of the elevator system.

External Visual Indications of Tab Positions

Several factors affect the potential configuration and appearance of the elevator tabs during the visual walk-around inspection at MHR, and three possible scenarios are described below. Regardless of the specific scenario, the following items are known:

- The crew and aircraft had just arrived from RNO
- The flight was several hours behind schedule when it arrived at MHR.
- The flight was scheduled for a quick turnaround at MHR before leaving for DAY.
- Total ground time (including taxi in and out) at MHR was approximately 1 hour 20 minutes
- The sun had set approximately 45 minutes prior to the landing at MHR
- EWA guidance indicates that a through flight is one without a crew change.
- EWA guidance (Emery DC-8 AOM pages 1-01-4 and 1-01-5) permits the gust lock to be off when the aircraft is on the ground during a through flight.
- The DC-8 horizontal tail is approximately 20 feet above the ground.
- There were reports and photographs (reportedly in the possession of the NTSB) of mis-rigged EWA DC-8 elevator tabs.

Scenario A
With the gust lock off and little wind, the elevator would settle to its balanced position of trailing edge up (TEU) with the geared tabs trailing edge down (TED) and the control tabs TEU. If the

R/H control tab had fully disconnected from its linkage, it would likely have settled to the TED position instead.

Scenario B
Again with the gust lock off and the R/H control tab completely disconnected, if the wind was of sufficient speed and direction, it may have been enough to fair or partially fair the elevator and tab. This might have made the control tab alignment appear to be correct during the walk around. When considered in combination with reported Emery misrigging, this could further mask the disconnected tab.

Scenario C
With the gust lock either on or off, if there was sufficient friction to retain the rod end in the control tab clevis, the position of the control tab would have appeared correct or approximately so.

Although it was not recorded on the cockpit voice recorder (CVR), the static check was recorded on the FDR. Apparently the EPI indications were to the flight crew's satisfaction, or they would not have conducted the flight. Both the FDR and CVR data indicate that the 80 knot check was conducted satisfactorily. However, although the functionality of the elevator control system was severely compromised, the crew of Emery 017 properly conducted the required cockpit flight control checks and were satisfied with the results.

Section F: CARGO LOADING

Certification of Cargo Loading Organizations and Personnel

Although the safety of any cargo flight directly depends on the proper preparation and loading of that cargo, this aspect is only minimally regulated by the FAA. In fact, the personnel and organizations involved are not required to be licensed by the FAA. Additionally, there are no FAA requirements for any training or qualifications of these personnel or organizations. Many cargo preparation and loading jobs are minimum-wage, part time, high turnover positions. Historical information from Emery and other cargo operations indicates that these personnel receive minimal training, and are frequently only marginally (if at all) aware of the potential impact of their task performance on the safety of a flight. Furthermore, at many cargo operators (particularly at the outstations), the poor quality of the tools, procedures, and working conditions adversely affect the ability of these individuals to perform their tasks accurately. An ALPA 'White Paper' advocating improved safety standards for air cargo operators contained the following points:

- Many cargo airlines contract out the cargo preparation and aircraft loading activities to private organizations not affiliated with the airline.
- Frequently, these airlines utilize different cargo preparation and aircraft loading contractors at the different airports the airlines serve ('outstations').

- It is not unusual for the airlines and the FAA to exercise minimal or no oversight of these cargo preparation and aircraft loading contractors at the outstations.
- In its investigation of the Fine Air DC-8 accident in Miami, the NTSB stated that the loaders were "not aware of the potentially catastrophic consequences of misloading the airplane and failing to properly secure cargo." Evidence from previous cargo airline accidents and incidents clearly indicates that, for several reasons, this is a relatively common situation at many cargo airlines.
- Evidence from previous cargo airline accidents and incidents clearly indicates these loading personnel are frequently not well trained.
- Many cargo loaders perform their jobs in adverse and demanding physical conditions (e.g. at noisy, crowded airport ramps; outdoors in sometimes extreme weather conditions; during the evening, night and early morning; and under high schedule-driven pressure).

In combination, these factors form the basis for a system which permits or even promotes a 'weak link' in the air transportation system. There have been numerous incidents and accidents due to improperly loaded cargo, and this unnecessary risk exposure must be addressed and reduced or eliminated. Historically, efforts to rectify the safety deficiencies of this system have been piecemeal and ineffective, and it is clear that a comprehensive approach is warranted. A public hearing or forum on air cargo operations would provide vital information on the scope and depth of this problem, as well as enable the beginnings of appropriate solution methods.

Improper Cargo Loading Events

FAA inspections and numerous 'Flight Debrief' reports document a continuing history of improper aircraft loading by EWW, many of which posed threats to the safety of the flights. Examples of improper cargo loading events included:

- Rejected takeoffs due to aircraft controllability problems caused by improper loading
- Universal Loading Devices (ULDs) and pallets shifting in flight due to improper restraint.
- Cargo loaded aft of the allowable FAA limit.
- Improperly weighed cargo and/or recorded cargo weights.
- Exceedences of aircraft floor weight zone limitations.
- Cargo loaded on aircraft but not recorded on the aircraft load sheets.
- Excessive fuel consumption attributed to either improperly loaded cargo or incorrect cargo weights.
- Cargo flown in damaged ULDs.
- Improper or inadequate restraint of cargo.
- Improper loading of cargo ('build up') on pallets and ULDs.
- 'Cookie sheets' bowing (due to excessive cargo strap tightening) to the point of disengagement from the aircraft side rail restraints.

Improper Loading of Hazardous Materials

In addition to the cargo loading problems noted above, EWA also had problems with hazardous materials ('hazmat') shipments. These problems were serious enough and continued long enough that one EWA hazmat supervisor reported it to the media. The story subsequently appeared in the June 13, 1999 Dayton Daily News. In addition, between 1998 and July 2000, OSHA levied approximately $482,000 in fines against EWA, and in February 2001, the FAA proposed another $500,000 in hazmat fines against EWA. Some examples of violations include:

- Explosives shipped without crew knowledge or proper paperwork.
- Hazmat not loaded in the proper position on the aircraft to allow in-flight access, as required by the FAA/RSPA.
- Packages containing corrosives shipped laying on their sides instead of in the proper orientation.
- Shipment of severely damaged hazmat packages.
- Crew member illness in flight due to noxious fumes from cargo, including at least one post-flight hospitalization.
- Company Materials (COMAT) packages shipped in courier compartment without proper paperwork.

Section G: FINDINGS

1) This accident was the result of a disconnect and subsequent jam in the linkage of the pitch control system, which rendered the aircraft uncontrollable.
2) The bolt which attaches the pushrod to the tab crank fitting for the right-hand (R/H) elevator control tab was not in place during most or all of the accident flight, and the R/H elevator control tab was jammed in the airplane nose up (ANU) position.
3) The most likely scenario is that the bolt's locking hardware was either never or improperly installed after maintenance activity by Emery.
4) The DC-8's lack of provisions for overcoming jams in the flight control system (commonly referred to as 'split controls') contributed to the flight crew's inability to command sufficient elevator to maintain aircraft control.
5) EWA/EWW/CNF upper management placed the highest priority on keeping the aircraft flying, with little regard to the FARs, or the airworthiness of the aircraft and sometimes even the flight and maintenance personnel.
6) The existing FAA processes and resources were not sufficiently effective to permit the timely identification and correction of these discrepancies at EWA.
7) Emery was a large airline, wholly owned by a large, well-financed corporation, CNF.
8) Emery was owned by its 'customer', CNF.
9) Emery operated a large, mixed, and relatively old fleet of DC-8 aircraft.
10) Emery's maintenance processes and programs were in such disarray, and ineffective enough, that the airline was continually plagued by excessive, repetitive mechanical problems with its aircraft, many of which resulted in air turn backs, serious incidents, and other operational difficulties.
11) In several respects, Emery was a 'virtual airline'.
12) Emery had no maintenance hangars anywhere in its system, including its main operations hub in Dayton.
13) Most of Emery's day-to-day maintenance was conducted at its domestic outstations by contract mechanics.
14) With the exception of those at the Dayton hub, the majority of Emery's loading personnel were also contract employees, and included a significant number of part-time personnel.
15) Between February and June 2001, the FAA proposed civil penalties against Emery for numerous maintenance-related airworthiness violations.
16) Emery World Airlines lacked a functional or effective safety culture.
17) There were numerous discrepancies between the Emery Operations Specifications, the Maintenance Policy and Procedures Manual, the actual responsibilities of several key maintenance personnel, and the day-to-day operations of Emery.
18) Certain individuals at Emery had inordinately large spans of control, often ranging across several distinct functions and disciplines.

19) Emery's maintenance organization issues adversely affected and placed additional burdens on its outside maintenance providers.

20) The FAA cited (on a repeated basis over several years) Emery's maintenance manuals as being out-of-date, difficult to use, inaccurate, incomplete, and not approved by the FAA.

21) Emery's work cards were seriously deficient.

22) Emery's inactions subsequent to the discovery of the reversed elevator dampers on the accident aircraft were indicative of a lack of a proactive, safety-conscious attitude.

23) The FDR data regarding control column position on the accident aircraft was unreliable.

24) This FDR problem was not limited to the accident aircraft.

25) Aileron re-rigging practices and results were indicative of Emery's poor maintenance communication, coordination, workmanship and quality control.

26) The frequency and volume of Emery's repetitive maintenance write-ups were indicative of Emery's flawed maintenance program and additional underlying organizational problems.

27) 'Pencil whipping' could explain some of the maintenance difficulties that occurred at Emery.

28) Emery maintenance practices enabled the acquisition and use of unapproved parts on its aircraft.

29) In direct conflict with the FARs and the underlying philosophy of the MEL, Emery independently developed and used what it referred to as "non-MEL deferrals" of components that directly affected the airworthiness of the aircraft.

30) Emery's safety processes were nowhere near as robust or effective as they could or should have been.

31) Many Emery flight crew members viewed the Emery Safety Office as ineffective.

32) With regard to the FAA's limited ability to provide adequate and effective oversight, and the acknowledged benefits of a strong safety culture, existing industry practices and regulations do not necessarily or consistently result in the desired level of safety.

33) Night-oriented operating schedules, widespread distribution of airports served by cargo operators, and the fact that many of these airports are not those populated by the passenger carriers compound the logistical difficulties of accomplishing adequate FAA oversight.

34) The SJC CMT's recommendations were overridden by FAA superiors, without coordination or consultation with the manager of the CMT.

35) If the FAR (25.671) requiring split controls or their equivalent was retroactive and applied to the DC-8, this accident might not have occurred.

36) If the FAR (FAR 25.607) requiring dual locking fasteners was retroactive and applied to the DC-8, this accident might not have occurred.

37) The Elevator Position Indicator (EPI) does not enable flight crews to accurately verify the basic functionality and integrity of the DC-8 pitch control system.

38) The 80 knot check does not constitute a definitive verification of the functionality of the DC-8 pitch control system.

39) Although the functionality of the elevator control system was severely compromised, the crew of Emery 017 properly conducted the required cockpit flight control checks but did not receive any indication of a problem with the system.

40) The personnel and organizations responsible for cargo preparation and loading, a critical element directly affecting flight safety, are not certificated by the FAA.

41) Throughout the industry, there have been numerous incidents and accidents due to improperly loaded cargo.

42) There is a lengthy and well documented history of improper aircraft loading at Emery.

Section H: SAFETY RECOMMENDATIONS

As a result of this investigation, the Air Line Pilots Association offers the following safety recommendations.

To the National Transportation Safety Board:

1) Conduct a public hearing or forum on air cargo safety and operations to provide vital information on the scope and depth of safety problems, as well as to enable the beginnings of appropriate solution methods to address these problems.

To the Federal Aviation Administration:

2) Require that all aircraft certified under CAR 4b or FAR Part 25 be equipped with dual locking fasteners on all critical (where the loss of a fastener may result in a catastrophic single point failure) flight control system joints.

3) Require that all aircraft certified under CAR 4b or FAR Part 25 be equipped with devices or means to enable the flight crew to maintain control of the aircraft in the event of a flight control failure or jam.

4) Require that all DC- 8 aircraft be modified to provide flight crews with an accurate and reliable means to determine the basic integrity and functionality of the aircraft's elevator system.

5) Require (unless or until the DC-8 is modified in accordance with ALPA safety recommendation 4) that the existing EPI system and procedures be modified to:
   - Be readily visible to and readable by both the Captain and the F/O.
   - Contain a graduated scale and explicit go/no-go limits.
   - Be checked for accuracy periodically.

6) Require that all Part 119/121/135 airlines obtain and utilize consolidated maintenance manuals that are dedicated (from a configuration and equipment standpoint) to the specific aircraft in their fleet.

7) Require that all maintenance providers (e.g. certified repair stations, contract personnel, etc.) for Part 119/121/135 airlines utilize the respective operators' consolidated maintenance manuals that are dedicated (from a configuration and equipment standpoint) to the specific aircraft in their care.

8) Require that all Part 119/121/135 airlines obtain and utilize maintenance work cards which contain:
   - Tasks broken down into manageable increments
   - Procedures and provisions for shift or personnel changes
   - All necessary references or information
   - Line-by-line inspection signoff provisions

9) Require that all maintenance providers (e.g. certified repair stations, contract personnel, etc.) for Part 119/121/135 airlines utilize the operators' applicable maintenance work cards which contain:
   - Tasks broken down into manageable increments
   - Procedures and provisions for shift or personnel changes
   - All necessary references or information
   - Line-by-line inspection signoff provisions

10) Implement procedures to ensure that deficiencies in an operator's CASS system are corrected in a timely manner.

11) Develop and implement a system (similar to Transport Canada's Safety Management System) which would require every FAR Part 119/121/135 operator to integrate safety risk management, including responsibilities and accountabilities, into corporate planning and performance at all levels of the corporation.

12) Develop and implement a system (similar to Transport Canada's Safety Management System) which would require airline maintenance organizations, manufacturing organizations, airports, and air traffic service organizations to integrate safety risk management, including responsibilities and accountabilities, into corporate planning and performance at all levels of the organization.

13) Require that organizations and personnel directly responsible for loading of cargo aircraft be certificated by the FAA.

14) Require that air cargo operators provide flight crew members with procedures, strategies and training to identify and counteract CG-induced problems during takeoff and/or continued flight.

<u>To the Department of Transportation:</u>

15) Examine methods to improve communications between the FAA Certificate Management Offices and DOT office(s) responsible for continuing fitness reviews of all FAR Part 119/121/135 air carriers.

16) Evaluate the utility of a requirement for regular, recurrent fitness queries by the DOT to the FAA on a rotating-carrier basis for all FAR Part 119/121/135 air carriers.

17) Evaluate, and improve the effectiveness of existing DOT/FAA program(s) designed to identify and prosecute individuals or organizations accountable for intentional falsification of maintenance records.

18) Evaluate, and improve the effectiveness of existing DOT/FAA program(s) designed to identify and prosecute individuals or organizations accountable for the use and/or manufacture of unapproved parts.