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NTSB/AAR-98/02
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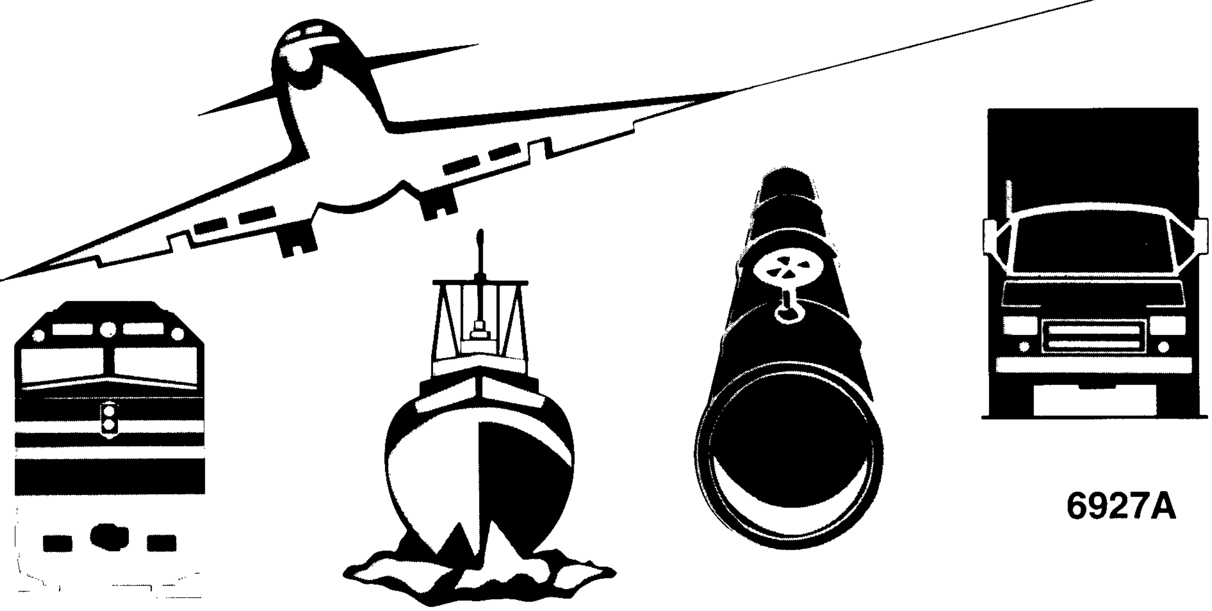
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

**UNCONTROLLED IMPACT WITH TERRAIN
FINE AIRLINES FLIGHT 101
DOUGLAS DC-8-61, N27UA
MIAMI, FLORIDA
AUGUST 7, 1997**



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AUGUST 7, 1997

Adopted: June 16, 1998
Notation 6927A

Abstract: This report explains the accident involving Fine Airlines flight 101, a Douglas DC-8-61, which crashed after takeoff from runway 27R at Miami International Airport, Miami, Florida, on August 7, 1997. Safety issues in the report include the effects of improper cargo loading on airplane performance and handling, operator oversight of cargo loading and training of cargo loading personnel, the loss of critical flight data recorder information, and FAA surveillance of cargo carrier operations.

CONTENTS

ABBREVIATIONS

ABX Air	Airborne Express
AC	advisory circular
ACMI	airplane, crew, maintenance, and insurance
Aeromar	Aeromar C por A
AMC	Air Mobility Command
AND	airplane nose down
ANDES	Aerolineas Nacionales del Ecuador
ANU	airplane nose up
AOA	angle-of-attack
AOM	aircraft operating manual
ARFF	aircraft rescue and firefighting
ASR	airport surveillance radar
ATC	air traffic control
ATC	Aero Transcolombiana de Carga
ATI	Air Transport International
ATOS	Air Transportation Oversight System
ATP	airline transport pilot
CAM	cockpit area microphone
CAS	continuing analysis and surveillance
CCP	control column position
CDL	crash debris line
CFR	Code of Federal Regulations
CG	center of gravity
CVR	cockpit voice recorder
DoD	Department of Defense
EPR	engine pressure ratio
FAA	Federal Aviation Administration
FDAU	flight data acquisition unit
FDR	flight data recorder
Fine Air	Fine Airlines Inc.
FOM	flight operations manual
FOQA	flight operations quality assurance
FSAW	Flight Standard Information Bulletin for Airworthiness
FSDO	flight standards district office
GAO	General Accounting Office
HBAT	handbook bulletin for airworthiness and air transportation
HBAW	handbook bulletin for airworthiness

MAC	mean aerodynamic chord
MIA	Miami International Airport
msl	mean sea level
NASIP	national aviation safety inspection program
PAI	principal avionics inspector
PMI	principal maintenance inspector
POFI	point of first impact
POI	principal operations inspector
PTRS	program tracking and reporting system
RASIP	regional aviation safety inspection program
SDQ	Santo Domingo, Dominican Republic
SJU	San Juan, Puerto Rico
SPAS	safety performance analysis system
SRN	subframe reference
STAN	Sum Total Aft and Nose
STC	supplemental type certificate

EXECUTIVE SUMMARY

On August 7, 1997, at 1236 eastern daylight time, a Douglas DC-8-61, N27UA, operated by Fine Airlines Inc. (Fine Air) as flight 101, crashed after takeoff from runway 27R at Miami International Airport, Miami, Florida. The three flightcrew members and one security guard on board were killed, and a motorist was killed on the ground. The airplane was destroyed by impact and a postcrash fire. The cargo flight, with a scheduled destination of Santo Domingo, Dominican Republic, was conducted on an instrument flight rules flight plan and operated under Title 14 Code of Federal Regulations Part 121 as a Supplemental air carrier.

The National Transportation Safety Board determines that the probable cause of the accident, which resulted from the airplane being misloaded to produce a more aft center of gravity and a correspondingly incorrect stabilizer trim setting that precipitated an extreme pitch-up at rotation, was (1) the failure of Fine Air to exercise operational control over the cargo loading process; and (2) the failure of Aeromar to load the airplane as specified by Fine Air. Contributing to the accident was the failure of the Federal Aviation Administration (FAA) to adequately monitor Fine Air's operational control responsibilities for cargo loading and the failure of the FAA to ensure that known cargo-related deficiencies were corrected at Fine Air.

Safety issues discussed in this report include the effects of improper cargo loading on airplane performance and handling, operator oversight of cargo loading and training of cargo loading personnel, the loss of critical flight data recorder information, and FAA surveillance of cargo carrier operations.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

UNCONTROLLED IMPACT WITH TERRAIN
FINE AIR FLIGHT 101
DOUGLAS DC-8-61, N27UA
MIAMI, FLORIDA
AUGUST 7, 1997

1. FACTUAL INFORMATION

1.1 History of Flight

On August 7, 1997, at 1236 eastern daylight time,[1] a Douglas[2] DC-8-61, N27UA, operated by Fine Airlines Inc. (Fine Air) as flight 101, crashed after takeoff from runway 27R at Miami International Airport (MIA) in Miami, Florida. The three flightcrew members and one security guard on board were killed, and a motorist was killed on the ground. The airplane was destroyed by impact and a postcrash fire. The cargo flight, with a scheduled destination of Santo Domingo, Dominican Republic (SDQ), was conducted on an instrument flight rules flight plan and operated under Title 14 Code of Federal Regulations (CFR) Part 121 as a Supplemental air carrier.

Flight 101 was originally scheduled to depart MIA for SDQ at 0915 using another DC-8 airplane, N30UA, to carry cargo for Aeromar C por A (Aeromar), a Dominican Republic corporation located at MIA. Flight 101's cargo was delivered to the Fine Air ramp between 0300 and 0400, according to Aeromar personnel.

After the cargo was delivered to the Fine Air ramp, Fine Air reported to Aeromar that N30UA had been delayed en route and would not arrive at MIA in time for its scheduled departure time. Aeromar requested another airplane, and Fine Air substituted N27UA for N30UA and rescheduled the departure for 1200. N27UA arrived at MIA at 0931 from San Juan, Puerto Rico (SJU), and was parked at the Fine Air hangar ramp. Offloading of the inbound cargo began at 0952, according to a video recording made by a surveillance camera[3] located at the Fine Air hangar. The first cargo pallet was loaded onto N27UA at 1030 and the last pallet was loaded at 1206, according to the camera recording.

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[1] Unless otherwise indicated, all times are eastern daylight time, based on a 24-hour clock.

[2] Boeing Commercial Airplane Group acquired the holdings of the Douglas Aircraft Company and McDonnell Douglas in 1997.

[3] The surveillance camera was not trained at all times on the accident airplane. Times represent observed changes in the loading status of the airplane based on elapsed time recorded on the tape.

The flightcrew was notified about 1000 to report for a 1200 departure, and the captain was the first crewmember to arrive at Fine Air operations,[4] where he reviewed the flight departure documents (load sheet, fuel load, weather, and dispatch papers). The flight engineer arrived about 30 minutes after the captain and went to the airplane to conduct his preflight inspection, which included systems checks in the cockpit, an outside walk-around inspection of the airplane, and the load. The first officer arrived about 30 minutes after the flight engineer. He reviewed the departure documents and went to the airplane. The surveillance camera recorded the cargo door being closed at 1211 and the cabin door being closed at 1222.

Fine Air's lead mechanic stated that the airplane's No. 3 engine was started at the ramp. He stated that the airplane was then towed from the Fine Air ramp to an area a short distance away, where the remaining three engines were started.[5]

The flightcrew called the Federal Aviation Administration (FAA) air traffic control (ATC) tower ground controller for taxi clearance at 1232:59 and was cleared to taxi to runway 27R, according to the airplane's cockpit voice recorder (CVR). During the approximately 1-minute taxi, the flightcrew also performed a flight control check, according to the CVR. The MIA tower controller cleared flight 101 for takeoff at 1234:31, and increasing engine sounds were recorded on the CVR at 1235:02.1. The flightcrew performed an elevator check at 80 knots (about 12:35:25), according to the CVR.[6] The sound of a thump was recorded at 1235:39.6, and the captain called V_1 (takeoff decision speed) at 1235:43.1. A second thump was recorded at 1235:47.3, and the captain stated "rotate" at 1235:49.9. About 2 seconds later, at 1235:51.5, the captain stated "easy, easy, easy, easy." The captain called out V_2 (takeoff safety speed) at 1235:55.6 and "positive rate" 1 second later at 1235:56.9. The first officer, the pilot flying,[7] was recorded by the CVR stating "gear up" at 1235:58.7, followed by "what's going on" at 1236:00. The sound of the stabilizer trim-in-motion warning horn tone[8] was recorded at 1236:01.8, and the sound of the stick shaker[9] was recorded at 1236:02.2.

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[4] Fine Air did not record exact report-in times for flightcrews.

[5] According to Fine Air's lead mechanic, the airplane "jumped" as it was being towed. He added that he thought the airplane bounced because it was "light" and the taxiway was bumpy. He stated that he considered the bounce to be normal for the airplane. At 12:31:06, about the time of the tow, the CVR recorded the captain as asking, "Sheez what is this guy doin down there."

[6] According to Fine Air's Aircraft Operating Manual (AOM), an elevator check is performed at about 80 knots to confirm proper elevator response with small up and down control inputs.

[7] Statements by the first officer and the captain recorded on the CVR indicated that the first officer was the pilot flying during the takeoff.

[8] According to Douglas documentation and the Fine Air AOM, a cable motion sensor connected to the stabilizer cable system "detects horizontal stabilizer motion at ½-degree intervals and commands the stabilizer warning horn, located in the flight compartment, to beep. Whenever the horizontal stabilizer moves in a continuous direction and while passing through every ½-degree of travel the cable motion sensor causes the stabilizer warning horn to beep for ½-second."

[9] The stick shaker, or control column shaker, is part of the airplane's electrically-powered stall warning system, which also includes a lift transducer and a lift computer. The lift transducer, located in the right

The CVR recorded the sound of the trim-in-motion tone again at 1236:02.8, at 1236:04.5, at 1236:05.6, at 1236:07.5, and at 1236:08.8. At 1236:12, the sound of the stick shaker stopped on the CVR, but it began 5.8 seconds later and continued to the end of the recording. The CVR recorded sounds similar to engine surges beginning at 1236:20.73, continuing until 1236:22.85. The airplane crashed at 1236:25.4. Ground scars and wreckage scatter indicated that the airplane impacted terrain in a tail first, right wing down attitude. The location of the first ground contact was 25° 48' north latitude and 80° 18' west longitude, or about 3,000 feet west of the departure end of runway 27R. Daylight visual meteorological conditions prevailed at the time of the accident.

1.1.1 Statements of Witnesses

A Fine Air DC-8 captain told Safety Board investigators that he observed the accident airplane's takeoff roll from outside a building near the departure end of runway 27R, and that the takeoff appeared to be normal. He stated that he then observed the airplane in "an extreme nose-up attitude" and that he could see "the top of both wings and fuselage." The airplane appeared to recover from the extreme nose-high attitude for about 3 seconds before continuing to descend, he stated. The Fine Air captain stated that Fine Air pilots often perform a two-step rotation maneuver after liftoff to minimize load shifts caused by high cargo deck attitudes. The procedure involved first rotating to about 8° nose-up pitch attitude, then increasing to a 15° nose-up attitude after attaining a positive rate-of-climb. He stated that the accident airplane's second rotation "was not smooth" and that "the tail seemed to jerk down." He added that he observed "continuous flames coming from the rear of the No. 4 [right outboard] engine."

Another witness, an FAA technician, stated in an interview with Safety Board investigators that he was in a vehicle near the departure end of runway 27R, and that he observed the accident airplane take off. He stated that the "attitude of the aircraft was wrong from the start. The rear of the aircraft was almost vertical in relation to the nose of the aircraft. It traveled at that attitude directly over me for about 1,800 feet. It then immediately pitched with the nose falling below the tail of the aircraft [then] quickly pitched above the aircraft's tail. At that point I saw the 2 right side engines had flames coming from them...when I saw the flames the aircraft pitched slightly to [the] right, cleared the tree line and almost dropped directly out of the sky and burst into flames."

An MIA tower controller stated that after rotation, the airplane continued to pitch up to an attitude of 70°. The controller stated that he saw the airplane impact tail first in a right wing low attitude. A witness on the northwest side of the airport stated that he heard "pop pop pop" noises when he observed the airplane in a steep nose-high attitude. Another witness who observed the takeoff through an office window in a building near the end of the departure runway, stated that the airplane rotated "sharply...snatched it off, it looked like a fairly high

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wing leading edge, is the sensing mechanism for the stall warning system. When activated, the lift transducer electrically stimulates the lift computer, which activates the shaker. An aerodynamic stall occurs when airflow over an airplane's wings and tail is sufficiently disrupted to result in loss of lift and control.

performance takeoff." He added that the pitch angle changed "very fast...up to about 30 or 40 degrees."

1.1.2 Cargo Weight Distribution Procedures

According to a "wet lease" agreement[10] between Aeromar and Fine Air, Aeromar was responsible for providing "fuel, loading and unloading at all stops." At 0255, an Aeromar employee faxed a cargo pallet loading form (see appendix F, exhibit 1) containing pallet weights and pallet identification letters to Fine Air for flight 101. Cargo weight on the Aeromar form was listed as 88,923 pounds. A Fine Air flight follower calculated, based on the use of N30UA, the airplane's weight and balance and faxed a weight distribution form containing pallet weights and cargo compartment position numbers back to Aeromar.[11] According to the plan for N30UA, pallet positions 2 and 17 were to be zero-weight (empty) locations in the 18-pallet capacity cargo area (see figure 1).[12] After the airplane and schedule change, a Fine Air flight follower who reported for duty at 0600 calculated the weight and balance for N27UA using the same weights and pallet positions used for N30UA (see appendix F, exhibit 2). The flight follower determined that because of the airplane change (N27UA was a slightly heavier airplane), 900 pounds of cargo needed to be removed from the shipment to comply with landing weight limits at SDQ.

The Fine Air flight follower also calculated the center of gravity (CG) for N27UA using the same cargo weight information. The result was a CG slightly more forward than pilots preferred (for handling reasons). The flight follower then adjusted the weight and balance to provide a more aft CG by relocating the cargo in pallet position 13 to pallet position 17 (see appendix F, exhibit 3). At 0700 the flight follower contacted Aeromar and advised Aeromar that the airplane change would require the removal of 1,000 pounds of cargo (the number was rounded up from 900 pounds). The flight follower stated that he spoke by telephone with an Aeromar security guard (a security guard on duty who was not assigned to N27UA), who said he would give this information to Aeromar's operations manager. The security guard stated that he contacted the operations manager at home, and that the operations manager instructed him to change the pallet loading form to reflect the 1,000-pound reduction, adding that he would issue an order to remove the cargo when he arrived at work. Pallet "G" was chosen by Aeromar for the weight reduction because at 6,950 pounds it was the heaviest pallet to be carried on the flight. The weight for pallet "G" was then changed to 5,950 pounds on the pallet loading form, which was faxed back to Fine Air, according to Aeromar personnel.[13] The Fine Air flight follower

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[10] See sections 1.17.1, 1.17.2, and appendix D.

[11] A copy of the pallet loading and weight distribution form for N30UA could not be located. The Fine Air flight follower told Safety Board investigators that he discarded the form for N30UA because it was no longer applicable. Details of the original load plan for N30UA were provided by the flight follower and loaders.

[12] According to an Aeromar operations manager, empty pallets, called "cookie sheets," were sometimes placed in the pallet position designated to be empty. Otherwise, the pallets on each side of an empty position were locked in place. He stated that each empty pallet weighs about 250 pounds.

[13] Although the weight for pallet "G" was corrected to reflect the 1,000-pound reduction, the total cargo weight was not changed on the form. The form was later corrected to reflect the cargo weight reduction.

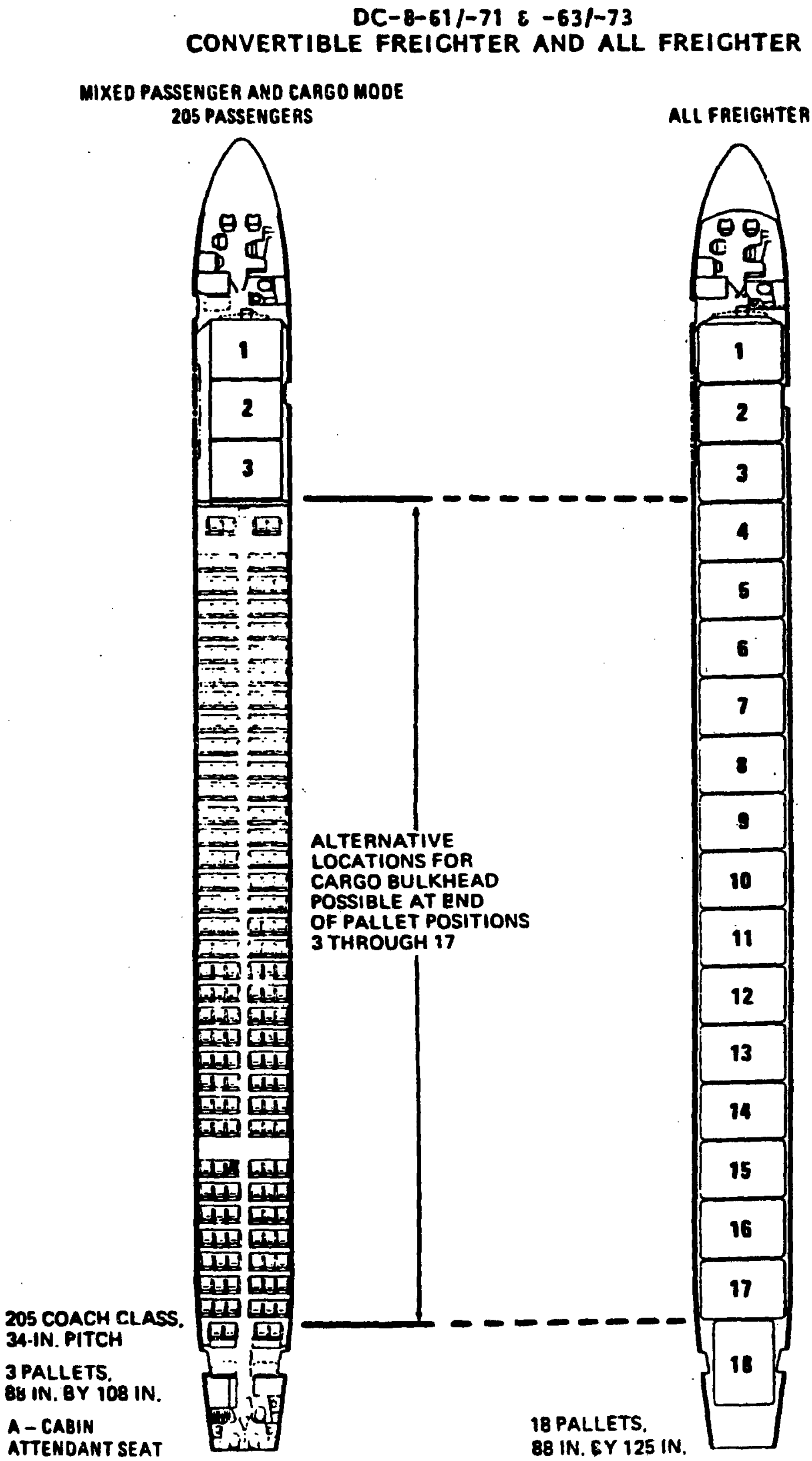

Figure 1.—DC-8-61 18-pallet cargo configuration diagram.

recalculated N27UA's weight and balance based on the revised pallet loading form and faxed the weight distribution form back to Aeromar.[14] The revised weight distribution called for zero-weight locations at pallet positions 2 and 13 and the 1,000-pound reduction of pallet "G" in pallet position 10. The Aeromar operations manager told Safety Board investigators that he forgot to issue the order to remove the 1,000 pounds from the cargo when he arrived at work at 1000, and that the weight was not removed.

1.1.2.1 Cargo Handling System

The airplane was equipped with a cargo handling system designed to accommodate and restrain 18, 88-inch x 125-inch pallets. Five guide floor tracks with encased ball rollers were installed in the cabin floor to move cargo pallets forward or aft of the main cargo door. Retractable pallet locks (Pemco 50044-1 pallet lock assemblies), or "bear traps," were installed in the cabin floor along the five guide tracks (aligned in a row) at 89-inch intervals (see figure 2). Each of the 85 pallet locks included a folding lock mechanism (to allow pallets to move over them during loading) comprising a forward and aft facing pawl. When raised, the pawls engage the edges of adjoining cargo pallets and prevent forward, aft, or vertical pallet movement (see section 1.16.3 on load testing). Rails were attached along the cabin walls to prevent cargo from striking the fuselage. According to the loading system design, pallet positions 1 through 17 are loaded in the 125-inch (lateral) x 88-inch (longitudinal) position. Pallet position 18, located in the tapering end of the aft fuselage was reversed, loaded in the 125-inch (longitudinal) x 88-inch (lateral) position.

1.1.3 Cargo Loading

The cargo for the accident flight was cut cloth (denim) trouser fabrics and accessories to be assembled in Santo Domingo and returned to the United States. The cargo was delivered to the Aeromar warehouse by a freight transfer agent. Shipping documents indicated that 89,719 pounds of cargo was delivered to Aeromar. The cargo was weighed after its arrival

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[14] The Fine Air flight follower, who began work at 0600, told Safety Board investigators that he had no further contact with Aeromar after he faxed the revised weight distribution form for N27UA. He stated that the Aeromar security guard sometimes picks up the form at Fine Air, but that the security guard did not do so during his shift at Fine Air on the day of the accident. During its investigation, the Safety Board obtained a copy of the revised weight distribution form for N27UA that appeared to have been faxed at 0736 on the day of the accident (fax machine date and time lines were located on the top of the form). It was not possible to determine from the document where it was sent or who received it. In an initial postaccident interview with Safety Board investigators, Aeromar's vice president stated that Aeromar faxed Fine Air flight followers pallet weight information and that Aeromar received faxes back from Fine Air containing the weights and position numbers for weight and balance. In a September 10, 1997, letter to Safety Board investigators responding to a request for copies of weight distribution forms documents from August 4, 1997, to August 8, 1997, the Aeromar vice president stated that "none of the weight distribution forms are in Aeromar's custody, possession or control. In the ordinary course of business, Aeromar's security person picks up the weight distribution forms from Fine Air immediately prior to the loading of a plane." In an October 27, 1997, letter to Safety Board investigators, the Aeromar vice president stated that the security guard "would have picked up the weight distribution form at Fine Air. It is neither customary nor usual for Fine Air to fax the weight distribution form to Aeromar or for Aeromar's security guards to pick up the weight distribution forms from Aeromar."

FINE AIRLINES, INC.

FLIGHT OPERATIONS MANUAL

RESTRAINT REQUIREMENTS AND TIE DOWN LIMITATIONS (CONT.)

4. Airplane Structural Limitations

The loads applied to the airplane structure, tiedown tracks and rings must not exceed the following:

A. Tiedown track loads for any direction must not exceed 5000 pounds at any one point, or in any 20 inch section of the track.

B. The tiedown rings, when installed on top of the side rail fittings of the multi-pallet loading system, have an allowable load of 2400 pounds in any direction.

5. Pallet Restraint Fittings Required

Based on strength requirements for shear as well as uplift, the quantity of end restraint fittings specified in Section 5-1 are required fore and aft for proper restraint of fully loaded pallets.

6. Pallet Edge Configuration Fittings Required

All commercial pallets used in cargo operations must conform to the restrictions shown in Figure 3, below. Specifically, the edges of pallets engaging the pawls of the end restraint fittings must have a full radius or a minimum bottom radius of .190 inch. In no case may the edge of a pallet be so configured that it extends into the shaded area shown in Figure 3.

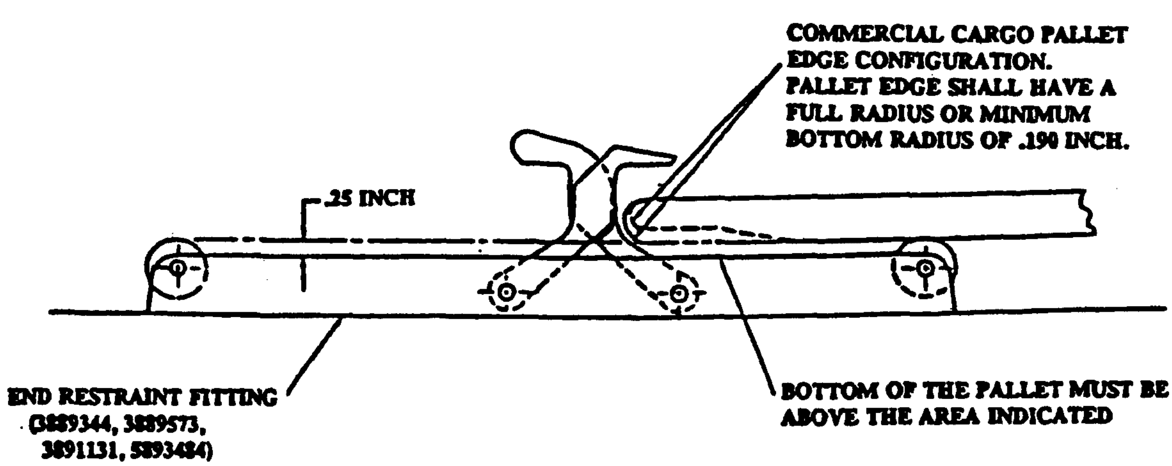

Figure 2.—Pallet edge configuration requirements.

at the Aeromar warehouse (confirming the total of 89,719 pounds listed on the waybill) and again after being palletized (88,923 pounds listed on Aeromar's pallet loading form).[15] About 39,012 pounds of cargo on the accident flight arrived in rectangular polyethylene containers called "big paks,"[16] according to shipping documents. The remainder of the cargo (about 50,707 pounds), which was in boxes, was loaded onto pallets at the Aeromar warehouse, according to Aeromar's vice president.[17] Four big paks were placed on the bottom of a pallet and two more were stacked on top. The cargo was then wrapped in black plastic and secured to the pallet with netting, which was tied with rope to the pallet's four corners, the Aeromar vice president stated. A cross-section scale model of the DC-8's cargo deck was used by Aeromar warehouse personnel to ensure that the pallets would fit. The pallets were then weighed on digital scales located at Aeromar's warehouse and the weights were written down manually, according to Aeromar's vice president. The vice president stated in a May 18, 1998, fax to the Safety Board that all of the cargo that was delivered by the freight transfer agent was placed on pallets for shipment on the accident airplane. He stated that the cargo weights listed on the pallet loading form did not include the weights of the metal pallets, netting, or covering.

A normal loading required at least four loaders, one supervisor, and a security guard, according to Aeromar's vice president (five loaders, a loading supervisor, and a security guard were assigned to the accident airplane). He stated that the Aeromar loading supervisor and a Fine Air supervisor "worked together as a team" to coordinate loading. The Aeromar loading supervisor told Safety Board investigators that he was responsible for the loading process and for ensuring that all pallet locks were in place (see section 1.18.6 for a complete job description). He said that the security guard assigned to the airplane marked the pallets with the position and told the loaders where to position them.[18] The security guard had the weight and balance information, according to the Aeromar loading supervisor.

A Fine Air loading supervisor told Safety Board investigators that he had assisted with the unloading of N27UA. He stated that when Aeromar personnel arrived to begin loading the airplane, the Aeromar loading supervisor asked the Fine Air loading supervisor to drive the

[15] The scale used to weigh incoming cargo at Aeromar produced a printed record of the weights for billing purposes. A second Aeromar scale used to weigh cargo and pallets for shipping did not provide a printed record of weights. Before the accident, Fine Air did not use scales to verify the weight of pallets delivered by Aeromar.

[16] Big paks, which measured 54 inches x 44 inches x 36 inches, were designed with interlocking pegs to secure containers stacked vertically.

[17] The Aeromar vice president's statements were made during a Safety Board deposition conducted November 19 and 29, 1997, in Miami, Florida. The Safety Board questioned 12 witnesses, including representatives of Aeromar, Fine Air, and the FAA.

[18] According to Aeromar's vice president, position numbers were not recorded on the pallets. An Aeromar security guard interviewed by Safety Board investigators stated that they numbered pallets on the ramp using the weight distribution and loading forms.

fork lift, and he agreed to assist the Aeromar loading crew.[19] According to Aeromar loaders, pallet position 17 was left vacant after position 18 was loaded.[20] Pallet locks were placed up in front of position 17, and subsequent pallets were loaded toward the front of the airplane.

According to the Aeromar loading supervisor, the locks were not latching because cargo extended over the sides and ends of the pallets, preventing the pallet ends from being positioned snugly against each other. He stated that this problem continued until pallet position 3 was loaded. He stated that the locks in front of pallet position 3 would not latch. He stated that he crawled back aft and determined that the locks were not engaged from positions 3 through 10. He instructed the loaders to remove three pallets. Two pallets were placed on the loading machine outside the airplane, and the third pallet was moved to the ball mat[21] at position 2.

The Aeromar loading supervisor stated that he asked the Fine Air loading supervisor how to solve the loading problem. The Aeromar loading supervisor stated that the Fine Air supervisor told them to "take over position 17, moving everything back." In addition, the Aeromar supervisor stated that the Fine Air supervisor instructed them that pallet 4 should be turned 90° and pushed back. The turned pallet (which occupied all of position 5 and part of position 4) was then tied down and secured with snap rings, and locks were engaged in front, according to the supervisor. Pallet position 2 remained empty. The Fine Air supervisor denied these statements during an interview with Safety Board investigators. According to the Fine Air supervisor, loading was halted at one point later in the loading process. "They said they were having trouble with a pallet. It wouldn't go in and I told them 'turn it around,'" the supervisor stated, demonstrating a 180° turn.[22]

The Aeromar loading supervisor stated that he crawled back aft to pallet position 18 and put up several locks. He stated that he was depending on other loaders to make sure locks were up between pallet positions 3 and 10. According to the supervisor, it was hot and difficult to breathe in the cabin.

After the cargo was loaded, the Fine Air supervisor stated that he saw that pallet 1 was not properly locked because a tie-down ring on the front prevented proper positioning of the pallet. He stated that the ring was moved and the pallet was secured. He stated that pallet 1 was secured by locks and that the locks in front of pallet 3 were in the up and locked position. The

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[19] Fine Air's director of operations stated that Fine Air employees did not monitor Aeromar loading operations. He stated, "Specifically, he's [a Fine Air loading supervisor] not there for that purpose...he is available if he is asked to go and assist and help. Not that he's assigned to it, but if he's asked, he would help."

[20] The Aeromar loading supervisor stated that the security guard instructed the loaders to leave position 17 empty.

[21] A ball mat is a floor-mounted device located at the cargo loading door containing roller balls that allow pallets to be rotated in any direction for loading longitudinally into the airplane.

[22] The Aeromar loading supervisor told Safety Board investigators that the Fine Air supervisor told him that he would inform Fine Air operations about the change and get approval for it. When the Fine Air supervisor did not return, the Aeromar supervisor stated that he was concerned about the change and tried to contact his superiors by telephone without success before the airplane departed.

Fine Air supervisor stated that he checks to make sure that the locks are up at pallet position 1 as a "safety" because it was the position the flight engineer could see, and if the flight engineer noticed that the locks were down in this position he might order the airplane to be reloaded.

1.1.4 Weight and Balance

The following information was listed on the Fine Air load sheet for flight 101 on August 7, 1997:

Basic Operating Weight: 145,949 pounds
Cargo Weight: 87,823 pounds
Zero Fuel Weight:[23] 233,982 pounds
Maximum Zero Fuel Weight: 234,000 pounds
Takeoff Fuel: 48,500 pounds
Gross Takeoff Weight: 282,482 pounds[24]
Maximum Takeoff Weight (Runway 27R): 315,400 pounds
Maximum Landing Weight: 252,000 pounds
Fuel Burn to SDQ: 31,875 pounds
Center of Gravity: 30.0 percent mean aerodynamic chord (MAC)
Aft CG Limit: 33.1 percent MAC
Stabilizer trim setting: 2.4 units
Takeoff Flap Setting: 15 degrees

The following takeoff speeds were listed on the load sheet (see appendix F, exhibit 4) based on a takeoff gross weight of 282,482 pounds:[25]

V_1 131 knots
V_R 147 knots
V_2 158 knots

Following the accident, Safety Board investigators determined that the Fine Air load sheet contained several errors before the accident, and that errors were also made by Fine Air when it was modified after the accident. According to data provided by Boeing Douglas Products Division, it was determined that the fuel loading/distribution scale on the printed load

[23] Zero fuel weight, as defined in Fine Air's AOM, is "the adjusted operating weight plus total load."

[24] According to the Fine Air flight follower, the maximum takeoff weight was restricted because of landing requirements at SDQ, resulting in a maximum takeoff weight (for landing) of 283,875 pounds.

[25] The gross weight listed on the Fine Air load sheet was 282,482 pounds. This was low by 100 pounds because the weight recorded for the pallet in position 17 was low by 100 pounds; this pallet weighed 5,960 pounds rather than the 5,860 pounds entered. Based on the information Fine Air flight followers had, a cargo weight of 87,923 pounds should have been listed, instead of the 87,823 pounds entered. In addition, because the Fine Air flight followers calculated the gross takeoff weight based on Aeromar having removed 1,000 pounds from pallet "G" in position 10, the airplane's gross takeoff weight, including the 100-pound error and the 1,000 pounds of cargo not removed, should have been listed as 283,582 pounds (with 88,923 pounds of cargo).

sheet was based on data for a different series DC-8 airplane (the -62 and -63 series). Because of this error, CGs would have been farther forward than those calculated by flightcrews. Using Douglas load sheet data for DC-8-61 airplanes, the accident flight CG was recalculated by the Safety Board. According to this Douglas data, the airplane's CG would have been 26.5 percent MAC if it had been loaded according to the load sheet plan, rather than 30.0 percent as calculated by Fine Air flight followers and entered on the accident flight's load sheet. Using the Fine Air load sheet revised after the accident, the calculated CG value was 25.3 percent, or in error by 1.2 percent.

The maximum allowable weight of 6,088 pounds listed on the printed load sheet for pallet position 18 was also incorrect. According to Douglas data, the maximum allowable weight for that position was 3,780 pounds. Typographical errors were also found in the trim data sheet provided to flightcrews. The errors, which resulted in incorrect trim setting guidance being listed in several cases, were not related to the accident airplane's trim setting.

1.2 Injuries to Persons

Injuries	Flightcrew	Cabin Crew	Passengers	Other	Total
Fatal	3	0	1	1	5
Serious	0	0	0	0	0
Minor	0	0	0	0	0
None	0	0	0	0	0
Total	3	0	1	1	5

1.3 Damage to Airplane

The airplane was destroyed by impact and postcrash fire. The estimated value of the airplane was about $10 million.

1.4 Other Damage

Airplane wreckage and the postcrash fire destroyed 12 vehicles parked in front of a warehouse and retail stores. The building front was damaged by fire but did not sustain impact damage from the airplane wreckage. Damage and clean-up costs were estimated at $900,000.

1.5 Personnel Information

1.5.1 The Captain

The captain, age 42, was hired by Fine Air on October 11, 1993. He held an airline transport pilot (ATP) certificate with type ratings in the DC-8, Cessna Citation (CE-500), Fairchild Metro (SA-227), and Learjet. He had a total of 12,154 hours of flying time, including 2,522 hours as a DC-8 captain at Fine Air. He had flown 25 hours, 100 hours, and 216 hours in the past 7, 30, and 90 days, respectively. The captain received his last line check on November 14, 1996. His most recent FAA first-class medical certificate was issued on February

20, 1997, with limitations requiring him to wear lenses that correct for distance and to possess glasses that correct for near vision. FAA records indicated that the captain was convicted for "misdemeanor drunk driving" in California in 1986 and convicted for "driving under the influence" in Arizona in 1994. In an April 17, 1995, letter the FAA asked the captain to provide more information about the incident, including an evaluation from a substance abuse specialist. An October 29, 1995, report from a psychologist to the FAA concluded that "it is clear from both written objective testing and subjective clinical interviews that [the captain] is not an alcoholic. It is also clear that he is not a habitual problem drinker." The FAA suspended the captain's pilot certificates and his first-class medical certificate for 30 days because of his failure to report the 1994 incident. The suspension was carried out in two 15-day periods in October and December 1995.

1.5.2 The First Officer

The first officer, age 26, was hired by Fine Air on August 15, 1994. He held an ATP and a flight engineer certificate. His first-class medical certificate was issued on June 10, 1997, with the limitation that he wear lenses that correct for distance vision. He had a total of 2,641 hours of flying time, of which 1,592 hours were with Fine Air in the DC-8. At Fine Air, the first officer had logged 614 hours as first officer and 978 hours as a flight engineer, all in the DC-8. He was not type-rated (nor was he required to be) in the DC-8 and held no other type ratings. He had flown 18, 65, and 173 hours in the last 7, 30, and 90 days, respectively. He received his last proficiency check on February 12, 1997. A search of records at the FAA and the company showed no FAA enforcement actions, accidents or incidents, or company disciplinary actions, and a search of records at the National Driver Register found no history of driver's license revocation or suspension.

1.5.3 The Flight Engineer

The flight engineer, age 35, was hired by Fine Air on September 17, 1996. He held a turbojet flight engineer certificate. He also held a commercial pilot certificate with airplane multiengine land and instrument airplane ratings. His second-class medical certificate was issued on December 20, 1996, with no limitations. A review of FAA records indicated that before successfully completing requirements for his certificates and ratings, the flight engineer had first failed the flight portion for the instrument rating, the oral practical examination for the commercial certificate, and the oral examination, flight check requirements, and preflight inspection for the flight engineer turbojet rating. A flight engineer examination failure report stated that the "candidate did not demonstrate satisfactory knowledge of DC-8-54 differences. Was also unable to decide if aircraft was in airworthy condition. Put no preflight discrepancies in logbook. Failed to detect numerous fuel leaks in N426FB." The flight engineer subsequently completed requirements for the certificate on May 10, 1996. He received his last proficiency check on January 21, 1997. He had logged a total of 1,570 flying hours, including 683 hours as a DC-8 flight engineer at Fine Air. He had flown 20, 70, and 184 hours in the last 7, 30, and 90 days, respectively. A search of records at the FAA and the company showed no FAA enforcement actions, accidents or incidents, or company disciplinary actions, and a search of records at the National Driver Register found no history of driver's license revocation or suspension.

1.5.4 Cargo Loading Personnel

According to Aeromar duty assignment records, six loading crewmembers, including a loading supervisor, were assigned to load N27UA before the accident flight. The loading supervisor was hired on April 25, 1997, after working previously as a supervisor for a construction company. It was the supervisor's first job in aviation. According to Fine Air records, the Fine Air loading supervisor who assisted in the loading of N27UA had worked as a loading supervisor at Fine Air for more than 3 years. He had previous dispatch, warehouse, and cargo loading experience before being hired as a supervisor at Fine Air, according to company records. Four other cargo loaders had worked as air cargo handlers and loaders (three with Fine Air) before being hired by Aeromar. The sixth loader assigned to the accident airplane had no previous experience in aviation before being hired by Aeromar. The loaders' tenure with Aeromar ranged from a hire date of November 27, 1996, to August 1, 1997. The loaders told Safety Board investigators that they worked in the Aeromar warehouse before being assigned loading duties on the ramp. They stated that they received on-the-job training on how to load airplanes from a supervisor and they demonstrated knowledge about cargo loading and locking procedures. The loaders stated that Aeromar did not conduct classroom training on airplane loading procedures.[26]

The security guard assigned to N27UA (and later killed in the accident) was hired by Aeromar on March 31, 1997. He had previously worked as a security officer for another aviation company. Aeromar records indicated that he arrived for work at 2000 on August 6, remained on duty throughout the night, and was on duty aboard the airplane at the time of the accident. Aeromar representatives stated that the security guard was responsible for guarding N27UA cargo at all times during his shift.

1.6 Airplane Information

1.6.1 General

N27UA, serial number 45942, was delivered new to Eastern Airlines on April 12, 1968. N27UA was received by Fine Air on July 24, 1993, and had accumulated 39,891 hours and 38,517 cycles.[27] At the time of the accident, the airplane had accumulated 46,825 total hours and 41,688 total cycles.

The Safety Board reviewed N27UA's logbook entries for the 90-day period before the accident. From June 12 to August 2, the No. 4 engine was written up six times by flightcrews who reported that they had to reduce thrust to maintain the engine's temperature limits. Between May 18 and July 30, 11 problems were noted about belly cargo doors. Problems with thrust

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[26] CFR Part 121.400 outlines requirements for the training of crewmembers and "other operations personnel," but does not specifically address training for cargo loaders or supervisors.

[27] A cycle is one complete sequence of engine start up, taxi, takeoff, climb, cruise, descent, landing, taxi, and shutdown.

reversers[28] were noted 16 times between May 14 and July 24.[29] All significant discrepancies during this period were logged on the return leg to Miami. The FAA principal maintenance inspector (PMI) assigned to Fine Air stated that he had "raised concerns [with Fine Air management] about them [flightcrews] having all their problems on final in Miami." The FAA principal avionics inspector (PAI) stated that "it's not like a hundred percent of the items are written coming into Miami, though I would admit the items that they have to fix are the ones usually written up overseas."[30]

According to 14 CFR Part 121.563, "Reporting Mechanical Irregularities," the pilot in command is required to "ensure that all mechanical irregularities occurring during flight time are entered in the maintenance log of the airplane at the end of that flight time." In addition, Part 121.563 states, "Before each flight the pilot in command shall ascertain the status of each irregularity entered in the log at the end of the preceding flight."

Fine Air had an FAA-approved continuing analysis and surveillance (CAS) program[31] to track the effectiveness of its maintenance program. The CAS program was monitored by the PMI and PAI.

1.6.2 Engines

N27UA was equipped with four Pratt & Whitney JT3D-3B engines. The No. 1 engine, serial number P669677, was installed on the accident airplane on January 6, 1997, and had accumulated a total of 40,705 hours and 16,257 cycles. The No. 2 engine, serial number P645400, was installed on April 17, 1997, and had accumulated 42,332 hours and 17,165 cycles. The No. 3 engine, serial number P632752, was installed on April 18, 1997, and had accumulated 54,159 hours and 16,550 cycles. The No. 4 engine, serial number P644989, was installed on April 14, 1995, and had accumulated 47,279 hours and 19,226 cycles.

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[28] A thrust reverser deflects efflux (exhaust) from a jet engine to reverse thrust and help slow the airplane after touchdown.

[29] Fine Air's director of quality control noted that the thrust reversers were "an old system...composed of several major components" and that reverser write ups often reflected problems and maintenance on different parts of the system and were not an indication of the same recurring problem.

[30] An FAA PMI based in Milwaukee, Wisconsin, who was a member of a national inspection team that conducted an inspection at Fine Air before the accident, stated that writing up maintenance discrepancies on return flights to a maintenance base "is common every day" practice. He stated, "I don't care if you're passenger or freight, that's standard. How do you [as an inspector] do something about it? When did it happen? They will have most of their write ups coming to the home base, or if you have multiple maintenance bases, to the maintenance base. We're always aware of that. We're always looking for that."

[31] CAS programs are designed to meet the requirements of CFR Part 121.373, "Continuing Analysis and Surveillance," which requires that certificate holders "establish and maintain a system for the continuing analysis and surveillance of the performance and effectiveness of its inspection program and the program covering other maintenance, preventive maintenance, and alterations and for the correction of any deficiency in those programs."

1.7 Meteorological Information

The METAR[32] routine weather observation report for MIA at the time of the accident was variable winds at 6 knots, visibility 10 statute miles, 3,000 feet scattered, 15,000 feet scattered, 25,000 feet scattered, temperature 32°C, dew point 24°C, altimeter 3005.

1.8 Aids to Navigation

No problems with navigational aids were reported.

1.9 Communications

No external communications difficulties were reported.

1.10 Airport Information

MIA is located about 8 miles northwest of Miami and is owned and operated by Dade County. It has an FAA-approved emergency plan and is certified as an Aircraft Rescue and Firefighting (ARFF) Index E[33] airport under 14 CFR Part 139. It has an elevation of 11 feet above mean sea level (msl). The airport has three asphalt runways with precision instrument markings: 9L/27R, 9R/27L,and 12/30. Runway 9L/27R is 10,502 feet long and 200 feet wide. The runway has high intensity runway lights, centerline lights, and a medium intensity approach lighting system with runway alignment indicators.

1.10.1 Emergency Response

Metro Dade County ARFF vehicles and personnel, located about a mile away from the accident site, responded after visually observing the accident and simultaneously receiving an alarm from MIA control tower personnel. About 2 ½ minutes after the alarm, four ARFF trucks, including a fire suppression vehicle (a water-equipped fire truck) and a battalion chief arrived on scene. Another 10 Metro Dade fire suppression vehicles and 9 rescue units arrived a few minutes later. In all, more than 100 emergency response personnel were involved. The fuel-fed fire was brought under control in about 15 minutes and was extinguished after about 30 minutes.

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[32] METAR is the International Civil Aviation Organization code for routine weather reports.

[33] Index E refers to ARFF requirements for airports used by air carrier aircraft of at least 200 feet in length. CFR Part 139 requires that Index E airports have a minimum of three ARFF vehicles carrying water and fire-suppressing chemical foam and that the total quantity of water for foam production is at least 6,000 gallons.

1.11 Flight Recorders

1.11.1 Flight Data Recorder

The airplane was equipped with a Loral model F800 flight data recorder (FDR), serial number 5283. It was designed to record 11 parameters, including airspeed, altitude, control column position (CCP), engine pressure ratio (EPR),[34] magnetic heading, longitudinal acceleration, pitch attitude, roll attitude, vertical acceleration, time, and very high frequency radio keying. Data were transcribed from the FDR magnetic tape to computer hard disk for readout in the Safety Board's laboratory. The transcribed data were converted from the recorded binary values (0s and 1s)[35] to engineering units (feet, knots, degrees) using conversions formulated by a private vendor obtained from data provided by Fine Air.[36]

Data were recovered and analyzed (also see section 1.16.2) from five parameters: altitude, CCP, longitudinal acceleration, magnetic heading, and time; data for the engines, pitch and roll attitudes, and heading were identical. A representative of an electronics company that evaluated the FDR told Safety Board investigators that if no data were inputted for the first three parameters, heading data would be recorded in their place, which indicated that information generated by the sensors was not being received by the FDR.

An examination of the transcribed FDR data indicated that the heading values on the tape produced a heading 180° opposite of the actual takeoff heading when the conversion formulas provided by Fine Air were applied. Previous flights retained on the FDR tape[37] were examined and were also determined to be off by 180° when compared with their flight plans. It was determined that the values recorded for the heading parameter were exactly opposite to actual headings, suggesting that the heading sensor was installed improperly or the FDR documentation was not correct.

A CCP conversion formula was derived by using DC-8 airplane control column limits provided by the Douglas Product Division. Maximum forward and aft control column

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[34] EPR is a measure of engine thrust, comparing total turbine discharge pressure to the total pressure of the air entering the compressor.

[35] The FDR records 64 separate 12-bit words of binary information on the tape every second. Each grouping of 64 words is called a subframe, 4 of which comprise a frame of data.

[36] N27UA's FDR originally recorded 6 parameters, and the retrofit expanded the capacity to 11 parameters. The retrofit was done by VGA Inc., a now-defunct company. A private vendor was not successful in formulating conversions for the FDR readout software based on the documentation produced by VGA. Fine Air then calibrated an aircraft to obtain the data required for the conversion formulas and provided them to the vendor. Most of the conversions used for transcribing the accident data were based on the formulas derived from data provided by Fine Air.

[37] About 25 hours of operational data are retained on the FDR tape and stored on six separate tracks of about 4 hours and 10 minutes each. The oldest data on the tape are erased and recorded over by the newest data.

range values were determined by examining previous flight control check data recorded on the FDR. The CCP conversion was determined by correlating the recorded FDR values with the full forward and full aft positions provided by the Douglas Products Division.

Fine Air maintenance records indicated that examination of N27UA's FDR was required during the airplane's last C check,[38] which was accomplished on April 21, 1997. Job card 5512 in Fine Air's maintenance manual requires that the FDR "must be downloaded into a computer capable of determining that all parameters are being recorded." The job card did not require this data to be documented, and there was no further information about this part of the FDR check. The job card indicated that the FDR was working properly. The FDR was overhauled and bench checked according to manufacturing specifications[39] by BF Goodrich Aerospace and returned to Fine Air on May 2, 1997. The FDR was installed on N27UA on July 25, 1997, and a functional check was performed.[40]

1.11.2 Cockpit Voice Recorder

The airplane was equipped with a Fairchild model A-100 CVR, serial number 5173. The CVR's exterior showed signs of minor denting and scratching, but no indications of fire or heat damage. The recording consisted of three channels of good quality audio information,[41] including the captain's, the first officer's, and the cockpit area microphone (CAM). The recording started at 12:05:30 and continued uninterrupted until 12:36:25, when the airplane impacted terrain. A transcript was prepared of the 32-minute recording (see appendix B).

1.12 Wreckage and Impact Information

Debris scatter and impact marks indicated that the airplane impacted the ground on a heading of 274° magnetic, with a crash debris line (CDL) extending 575 feet from the point of impact westward. Scrape marks from the right horizontal stabilizer were consistent with indications of ground impact about 3,000 feet from the departure end of runway 27R. Impact marks indicated that the aft fuselage collided with the ground on the CDL 16 feet past the point of first impact (POFI), about 28 feet to the right of the extended centerline of runway 27R. Impact marks also indicated that the outboard tip of the left horizontal stabilizer struck a fence

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[38] C checks at Fine Air are accomplished every 3,300 hours or every 36 months, whichever comes first.

[39] Checks of the FDR's manufacturing specifications did not include verification of proper functioning of the recorded parameters.

[40] Functional tests after the unit is installed check the fault light indicator on the unit and do not test the condition of the recorded parameters.

[41] The Safety Board ranks the quality of CVR recordings in five categories: excellent, good, fair, poor and unusable. Under recently revised definitions for these categories, in a recording of "good quality," most of the crew conversations could be accurately and easily understood, and the transcript developed from it may indicate several words or phrases that were not intelligible. Any loss in the transcript can be attributed to minor technical deficiencies or momentary dropouts in the recording system or to a large number of simultaneous cockpit/radio transmissions that obscure each other.

surrounding a building housing the airport middle marker facility[42] for runway 9L, about 91 feet past the POFI, and was embedded in the fence about 4 feet 6 inches above the ground. The tail skid and cargo flooring aft of pallet position 18 were also found at this location. The outboard tip of the right stabilizer separated and became embedded in the fence surrounding the middle marker building to the right of the CDL. The remaining section of the horizontal stabilizer was found leaning against the middle marker building fence about 106 feet past the POFI and to the right of the CDL. The left horizontal stabilizer jackscrew was found separated from the stabilizer structural mount.[43] The jackscrew measured 13 inches between the top flange stop and the mechanical stop above the jackscrew sprocket and drive nut,[44] which corresponded to about 1.44 units airplane nose down (AND). The right horizontal stabilizer jack screw was found attached to the stabilizer structural mount. The jackscrew also measured 13 inches between the top flange stop and the mechanical stop above the jackscrew sprocket and drive nut, and corresponded to 1.44 units AND. No evidence of foreign object damage or jamming was found in areas where the stabilizers and elevators meet.[45]

Impact marks indicated that the right wing tip struck the top of a 9-foot fence, separating the outboard portion of the aft wing tip 33 inches inboard of the wing tip. The aft fuselage bulkhead/cargo liner was located along the CDL about 274 feet past the POFI. The tail cone was located along the CDL about 319 feet past the POFI, and the vertical stabilizer, aft pressure bulkhead, rudder, and cargo pallet stations 12 through 18 were located along the CDL about 338 feet from the POFI. The right wing was located to the right of and 364 feet along the CDL. It had separated from the wing root and sustained severe impact, break up, and fire damage.

The cockpit separated from the fuselage in the area of the forward cabin door and came to rest on top of an inverted automobile along the CDL about 522 feet from the POFI and on a 340° magnetic heading. The forward fuselage separated from the center wing section forward of the wing leading edge and came to rest facing north in front of a warehouse. The

[42] The middle marker, a component of the instrument landing system, is located on the runway centerline, usually about 3,500 feet from the runway threshold.

[43] The left and right horizontal stabilizers are adjustable to provide longitudinal trim. The stabilizers are actuated by two jackscrews, which are driven by a primary hydraulic actuator, or an alternate electric actuator. The motor is actuated by dual trim handles located on the left side of the cockpit control pedestal or by dual switches on the outboard horn of each control wheel.

[44] According to Douglas maintenance specifications for DC-8-60 series airplanes, the measured distance between the top flange stop and the mechanical stop above the jackscrew sprocket on the threaded jackscrew is called "Dimension A."

[45] On September 8, 1970, a DC-8-63F operated by Trans International Airlines crashed shortly after taking off from JFK International Airport after rotating to a nose-high attitude of between 60° and 90° and entering an uncontrolled descent from about 500 feet. The Safety Board determined that the probable cause of the accident was "a loss of pitch control caused by the entrapment of a pointed, asphalt-covered object between the leading edge of the right elevator and the right horizontal spar web access door in the aft part of the stabilizer." See National Transportation Safety Board. 1971. *Trans International Airlines, Ferry Flight 863, Douglas DC-8-63F, N4863T, JFK International Airport, New York, September 8, 1970.* Aircraft Accident Report NTSB-AAR-71-12. Washington, DC.

forward fuselage, from the cockpit aft to the center wing section, was broken into small sections and destroyed by the postcrash fire. The nose gear separated from the main fuselage and was located in the retracted position. The middle part of the fuselage, including the center wing section and the main gear wheel well, came to rest in a parking lot (located between the highway and the warehouse) facing west and was damaged extensively by fire. The left and right main landing gear were found in the retracted position. The aft part of the fuselage separated just aft of the left and right wing trailing edges and was destroyed by the postcrash fire. Most of the cargo was located in the area of the center wing section and forward fuselage.

All four engines were found separated from the wings. The No. 1 engine separated from the left wing and was located straddling a southbound lane and roadway median, 437 feet along and to the left of the CDL. The No. 2 engine separated from the left wing and was located 495 feet along and to the left of the CDL. The No. 3 engine separated from the right wing and was located about 530 feet along and to the right of the CDL. The No. 4 engine separated from the right wing and was located on a northbound lane of a four-lane highway, 420 feet along and to the right of the CDL. Engine parts, including rotating fan, turbine blades, and cowlings were found in multiple locations around the accident site. Four parallel ground impressions, each measuring about 3 feet by 7 feet long, were found in the ground about 77 feet west of the middle marker building. The lateral separation of the indentations was consistent with the installed engine positions on the airplane. The engines had separated from the engine pylons by fracture of either the aft engine attach point or by tearing of the pylon structure. No evidence of penetration of the engine cases was found. No evidence was found that would be consistent with an in-flight engine fire or an uncontained engine failure.

Groups of fractured and deformed turbine blades were found in the vicinity of each depression, and there was evidence of bending and fracture on the turbine blades of all four engines. Examination indicated that all four engines had significant denting at the 6 o'clock position on the turbine nozzle case that intruded into the turbine blades' plane of rotation. Engine turbine rotors were found heavily damaged with missing blades and vanes. Blades remaining in the rotors were distorted and bent in the direction opposite of rotation. The fan, compressor, and combustion chamber cases on all four engines were found to have less severe damage than the turbines. Thrust reversers were found separated from all four engines. One thrust reverser was found partially intact and in a configuration consistent with being stowed at impact.

1.12.1 Pallet Lock Configuration, Cargo Flooring, and Pallets

Safety Board investigators recovered 60 (of the 85) pallet locks from the wreckage. Of these, 57 locks were found in an unlocked (down) position. Two locks were found in the locked (up) position in pallet and lock positions 18-1 and 18-4 (the locks are embedded in the five guide tracks installed in the floor). The preimpact position of a third recovered lock could not be determined because of extensive damage. Forty-nine of the 60 locks recovered were removed by Safety Board investigators for visual and subsequent fractographic examination (see section 1.16.3). No evidence was found of cracking on the pallet lock bases or of elongation at the flooring attach points. The other eleven pallet locks could not be removed from the cargo deck floor because of extensive fire damage.

The largest section of recovered cargo flooring contained locks for pallet positions 12 through 18. The section was found largely intact and had sustained minor burn damage. With the exception of the pallet 18-4 lock assembly, there was no indication on the recovered locks of impact damage from being contacted by pallets. The 18-4 pallet lock sheared in a forward direction. There was no indication of overload on the flooring tracks at the lock locations.

The center fuselage flooring was extensively damaged by fire. Ten pallet lock assemblies were recovered from this area, and all were found in the unlocked position. The forward fuselage section was largely consumed by fire. One lock assembly was recovered from this section in an unlocked position (pallet location 2/3). Eleven additional lock assemblies were recovered from the center/forward fuselage area in the area of pallet positions 6 and 7. Of these, 10 lock assemblies were found in an unlocked position. The lock for which its position could not be determined was also found in this area. There was no indication of cracking at the base of the lock assemblies.

All five lateral locks by the cargo door, designed to prevent cargo from shifting and contacting the cargo door, were recovered. Four of the locks were recovered in an unlocked position. Position 1, the most forward, was recovered in a locked position.

Six complete and six partial pallets were recovered. There was no indication of impact damage (from contact with the pallet locks) along the edges of the recovered pallets.

1.13 Medical and Pathological Information

Tissue samples from both pilots and the flight engineer tested negative for a wide range of drugs, including major drugs of abuse.[46]

1.14 Fire

A fuel-fed fire erupted on impact.

1.15 Survival Aspects

The accident was not survivable.

1.16 Tests and Research

1.16.1 Weight and Balance Scenarios

The Boeing Douglas Products Division developed several weight and balance scenarios based on information provided by the Safety Board to determine the CG for the

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[46] The five drugs of abuse tested in the postaccident analysis are marijuana, cocaine, opiates, phencyclidine, and amphetamines.

accident airplane under various conditions (see appendix G). Using the weight distribution form calculated by Fine Air flight followers for N27UA, a scenario was first developed to recreate (in reverse) the load originally calculated for N30UA. The Fine Air flight follower initially calculated the weight and balance for N27UA using the same weights and pallet locations originally calculated for N30UA, but relocated cargo in pallet position 13 to position 17 to move the CG aft slightly to improve aircraft handling. This resulted in 5,960 pounds of cargo being moved to position 17, leaving position 13 empty. Thus, to reverse the configuration, cargo was returned to position 13, leaving position 17 empty, as planned for N30UA.

Based on testimony from cargo loaders, N27UA was initially loaded with positions 2 and 17 empty, corresponding to the cargo positions designated for N30UA. This cargo configuration was the basis for additional scenarios in which the CG was calculated based on cargo loader testimony about pallet positions and pallet lock conditions determined from the wreckage (loader testimony indicated that the airplane was loaded consistent with the load plan drafted for N30UA). Based on this load configuration, a second scenario was generated that most resembled the accident flight (see scenario 4D, appendix G). The scenario assumed the following: N27UA was initially loaded according to the plan intended for N30UA; pallets from position 5 aft were pushed back one position; pallet 4 was turned 90° and pushed back into position 5, overlapping into part of position 4. The scenario also assumed 6,950 pounds on pallet G and locks in the unlocked (down) position. According to this scenario, the loading condition resulted in a CG of 32.4 percent MAC. When 275 pounds were added to each pallet to reflect pallet "cookie sheet" and packing weights (or a total of 4,400 pounds), this scenario resulted in a CG of 32.7 percent MAC. At 88,923 pounds of total cargo weight, moving the 13 pallets aft (and turning pallet four 90°) resulted in a CG change from 24.0 percent MAC (requiring 5.4 units airplane nose up [ANU] pitch trim) to 32.4 percent MAC (requiring 1.0 units ANU). At a cargo weight of 94,119 pounds, the CG would have changed from 24.0 percent MAC (requiring 5.4 units ANU) to 32.8 percent MAC (requiring 0.9 units ANU).

1.16.2 Airplane Performance and CVR Sound Spectrum Studies

Because six parameters (including engine data, airspeed, pitch and roll attitudes, and vertical acceleration) were not recorded by the accident airplane's FDR, the Safety Board's study of the airplane's performance was based on the following combined data and evidence: ground impact scars, damage/markings on surface structures, runway markings (indications of tail strikes or unusual tire marks), aircraft parts on the runway,[47] approach and airport surveillance radar (ASR) data, the five useable FDR data parameters (altitude, CCP, longitudinal load factor, heading, and time), and CVR information.

Ground impact scars and markings were used to estimate the airplane's flightpath and attitude at impact. An impact scar made by the right wing tip about 17 feet west of the damaged 9-foot high fence (see section 1.12) suggested that the flightpath angle of the wing tip (and the airplane) would have had to have been about -26° to create the ground scar in its

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[47] No unusual tire marks or airplane parts were found on the runway. See section 1.16.4 for details of the tail strike investigation.

measured location (based on evidence that the airplane struck the fence about 6 inches from the fence top).[48] The airplane's pitch angle and bank angle at impact were also estimated based on the flightpath angle value and other ground scars. A comparison of the locations of the right horizontal stabilizer scrape, the right wing tip scrape, craters created by the four engines and the airplane's estimated -26° flightpath angle, indicated that the airplane impacted at a 23° nose up pitch angle and a 20° right wing down attitude. Based on the airplane's right wing down attitude, its sideslip angle was estimated at between 0° and +10°, which indicated that the airplane's angle-of-attack (AOA)[49] was at least 49° at impact.

Pitch angle and AOA at several points during the flight[50] were estimated based on airplane velocity (and acceleration) trends derived from ASR data, the longitudinal load factor (G force) recorded by the FDR, and the impact point. The pitch and AOA estimates indicated that about 16 seconds after rotation, the airplane pitched up to an attitude in the range of 30°, with an AOA approaching 20°. Six seconds later (at 72 seconds elapsed time), pitch decreased to below 20° nose up and the AOA decreased to below 15°. At 76 seconds elapsed time, pitch had further decreased to below 15°, while the AOA increased to above 15°.

FDR data indicated that a control check was performed (during taxi) at subframe reference (SRN) 519 (12:33:54.4) on the parameter plot (see appendix C) and that the CCP[51] was deflected forward and then aft for a total deflection of 26°. Beginning 43 seconds later, the control column moved forward until it was deflected forward 13°. The CCP then moved aft about 5° during the next 31 seconds. Beginning at SRN 635 (12:35:50.4), the CCP indicated a 5° aft movement followed by a quick forward movement and aft movement, as longitudinal (G-force) acceleration and altitude started to increase. Shortly afterward, the CCP indicated an 11° forward movement.

According to the FDR data, between SRN 643 (12:35:58.4) and SRN 649 (12:36:04.4) the airplane climbed to an altitude of 180 feet. For about 2 seconds, 12:36:04 through 12:36:06 (SRN 649 through SRN 651), the data showed an altitude of 180 feet, followed by 195 feet, and then a decrease to 180 feet.[52] A slight heading variation occurred, and the airplane began climbing again, attaining a peak altitude of 554 feet at 12:36:14.4 (SRN 659).[53]

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[48] The flightpath angle is the acute angle of the airplane's trajectory in relation to a local horizontal and is a function of the velocity vector.

[49] AOA is the angle of the airplane wing to the relative wind.

[50] Radar, FDR, and CVR data were recorded with time information. To compare the data for this performance study, the Safety Board synchronized the time recordings to a single reference time, or elapsed time, equal to 0.0 at 12:35:00 Miami ATC time. CVR recordings are also referenced in Miami ATC time.

[51] Because there was insufficient documentation to convert the actual CCP from the FDR, actual CCP values could not be determined. Values presented are deflections from the previously recorded CCP.

[52] Altitudes were referenced to msl.

[53] This oscillation in altitude is consistent with readings caused by disruption of airflow around the static pressure ports that service the altimeter and FDR altitude sensor. Such airflow disruption, which causes the instruments to measure a lower pressure, is consistent with the effects of a high AOA or sideslip. FDR data

About 2 seconds before attaining peak altitude, the CCP showed an aft movement of 10°. A descent to an altitude of 242 feet was indicated from 12:36:15.4 to 12:36:21.4 (SRN 660 to SRN 666). The data continued for 4 more seconds, with the altitude parameter indicating a climb to 460 feet and longitudinal G-forces decreasing from .19 G to .01 G. The data ended at 12:36:25.4 (SRN 670).

FDR and CVR data were consistent with nose-down control inputs after rotation and nose-down trim inputs after rotation. The captain called "rotate" at 12:35:49.9, and the column began to move aft. At 12:35:51.5, 1.6 seconds after the rotate call out, the captain stated "easy easy easy easy." During this time, CCP had moved 2° aft. The CCP then moved an additional 3° aft. About 12:35:53, the FDR showed a forward movement of the control column of about 4° from its previous position. About 2 seconds after the start of the forward motion, the control column moved aft again. About 12:35:57, the control column moved forward and reached its forward limit about 12:36:01. These two aft control movements occurred during the 10-second period after rotation was called.

Safety Board investigators conducted a series of flight tests in a United Airlines DC-8 simulator[54] in Denver, Colorado, in February 1998 to evaluate the effects of various CG scenarios, stabilizer trim settings, and control inputs on airplane performance, handling, and recovery qualities.

Multiple takeoff attempts were simulated using aircraft weight, flap settings, and thrust values equivalent to the accident conditions and a range of CG values. At 33 percent MAC, the column inputs recorded on the accident airplane's FDR were sufficient to prevent the pitch up and stall. At 35 percent MAC, the simulator reached the stall condition more quickly than did the accident airplane. Adequate control power existed from the elevators and pitch trim to recover the airplane at 35 percent MAC, but successful recovery required an immediate and aggressive control input response (full forward column, which could be assisted by nose-down trim). At CG values aft of 35 percent, the airplane was increasingly subject to autorotation tendencies well before rotation speed and to tail strike on the runway, which did not occur during the accident.

Simulator flight tests could not replicate the accident flight precisely because of limitations inherent in the simulator and because of the limited FDR data available for the accident flight. For example, it was not possible to replicate precisely the flightcrew's control inputs that were recorded by the FDR because the CCP positions recorded by the accident airplane's FDR could only be represented as changes between relative positions and not actual

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indicating that the airplane was in a climb when the data ended is also consistent with disrupted airflow around the static pressure ports.

[54] The simulator was rated as a Level B simulator, which is approved by the FAA for "pilot recency of experience requirements and for specified flight operational task training requirements in transition, upgrade, recurrent and requalification training under Part 121 and Part 135," according to FAA Order 8400.10. Simulators are rated from "A" through "D" based on their level of sophistication; for example, a Level D simulator can be used for "all flight operational task training except for static aircraft training."

CCP values and could only be identified based on the control column movements made during checks of the flight control system during taxi.

A sound spectrum study of the CVR was also conducted to document engine speeds during the takeoff roll. The recording on the CAM channel contained tones that were identified as being produced by the airplane's engines. The recording was examined on a computerized spectrum analyzer that displays frequencies as colored traces, or signatures, on a video screen. Four distinct engine traces were identified during most of the initial takeoff roll and were most predominant when the engines were accelerating. Engine traces showed a continuous and smooth acceleration at the start of the takeoff roll from about 40 percent N_1[55] to a stabilized setting of about 96 percent N_1. During the acceleration, a momentary pause occurred at 65 percent N_1 for about 3 seconds. The traces remained at 96 percent N_1 until about 1236:03, when the speed of the engines increased from 96 percent N_1 to about 101 percent N_1. The engines remained at this high-power setting until 1236:12, when they decreased to about 96 percent N_1. At 1236:12, the engines increased back to the high-power setting of 101 percent N_1. The traces indicated that engine speeds remained at this setting until the end of the recording at 1236:25. The sound spectrum study could not determine which of the airplane's four engines were associated with the measured sound signatures. Only the rotational speed of the engines was measured, and the amount of thrust being generated by the engines could not be determined.

1.16.3 Lock Assembly Load and Fracture Tests

Three pallet lock assemblies (two factory examples provided by Pemco and lock 18-4 recovered in the wreckage) were forwarded to MMA Laboratories in Newton, Pennsylvania, for load and fractographic (fracture) testing. Load testing was performed on the Pemco-provided locks to determine whether the locking pawls would shear or disengage as a result of downward vertical load. Load testing was performed with the locks in the fully locked and partially locked positions. According to the test results, a lock assembly in the fully locked position was able to withstand 12,400 pounds of force until failure (breakage of the lock base) with no shearing or disengagement of the pawls and "with usage of the pallet lock assembly pawls still possible." In the partially locked position, the lock was able to withstand 4,800 pounds of force before failure (rounding and deformation of the pawl) with no shearing or disengagement of the pawls. A compressive vertical load test was also performed on the sample lock assembly previously subjected to the fully locked shear test. The lock assembly was placed inverted on a test platform in the fully locked position. According to the results, the assembly was able to withstand a compressive load of 4,000 pounds and "showed no breakage or disengagement of the locking pawls."

The fractographic examination of the failed lock recovered from the wreckage was performed visually and with a scanning electron microscope. The MMA test report stated that the examinations indicated that the "pawl failed due to an impact or overload event. Neither of the fractured surfaces examined exhibited...features that would be consistent with a fatigue

[55] N_1 is engine fan or low-pressure compressor speed. For the Pratt & Whitney JT3D-3B engines installed on the accident airplane, the 100 percent engine speed of the low-pressure rotor is 6,800 rpm.

type failure in aluminum." The report concluded that the fracture surfaces "did not exhibit features that would indicate a fatigue crack mechanism was active."

1.16.4 Tail Skid Examination

The recovered tail skid showed evidence of scrape marks and white paint. Safety Board investigators examined the departure runway but found no evidence of paint or scraping. Samples of white paint taken from the tail skid and from the 27R centerline were forwarded to the Metro Dade Police Department laboratory for analysis. An August 29, 1997, police laboratory report concluded that the "paint samples were different and did not share a common origin."[56]

Fine Air's lead mechanic stated that the accident airplane's tail stand post, which is positioned under the airplane's tail during loading to prevent it from tipping back, "was...very easy" to remove before engine start and pushback. He stated that the nose wheel strut extension appeared normal and that he observed "no problems" during taxi or turning.[57]

1.17 Organizational and Management Information

1.17.1 Fine Air

On November 10, 1992, the FAA authorized Fine Air to conduct supplemental cargo operations under CFR Part 119.21 and to operate under Part 121. The company, incorporated in Florida in 1989, provided air cargo services between the United States, Central America, and the Caribbean region. Fine Air's FAA-approved Operations Specifications listed 23 DC-8 type airplanes. Of these, 12 stage 2[58] airplanes were operated by Fine Air, and 11 stage 3 DC-8 airplanes were leased to Fine Air by Airborne Express (ABX Air) under the terms of an aircraft interchange agreement. By listing the ABX airplanes in its Operating Specifications, Fine Air was able to comply with stage 3 noise levels required in CFR Part 91 and CFR Part 36's noise standards for certification.[59] According to Fine Air, the company had 839 employees as of

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[56] According to the CVR, the flight engineer stated that he observed "about a quarter inch [of paint] missing on the skid" during his preflight walk-around inspection and asked a mechanic to repaint it. A Fine Air mechanic assigned to the accident airplane told Safety Board investigators that he examined the tail skid and "the paint was good." He added that he did not recall being asked to repaint the tail skid. A Fine Air flight engineer, who was a flightcrew member on N27UA on its return leg to Miami on the day of the accident, told Safety Board investigators that the tail skid was painted red and that "it was still red" when he checked it during a postflight inspection.

[57] According to the CVR, the captain, noting inbound landing traffic, stated that "we'll need to take it [the runway] rollin'...We're not that heavy anyway."

[58] Under noise standards classified by the FAA, a Stage 2 airplane has noise levels that exceed those of a Stage 3 airplane. Noise standards (measurement, evaluation, and limits) are prescribed in CFR Part 36 for the issuance of type certificates and airworthiness certificates.

[59] CFR Part 91 outlines compliance deadlines for air carriers to meet stage 3 noise level requirements. According to Part 91.867, "Phased Compliance for New Entrants," at least 50 percent of a new

June 1, 1997, including "114 flight operations personnel, 425 maintenance, technical and security personnel, 192 cargo handling personnel and 108 executive, administrative, sales and financial personnel." The company's services include scheduled cargo services, ACMI (airplane, crew, maintenance, and insurance)[60] services and ad hoc charters. In addition, the company operated FAA-approved repair stations that perform maintenance, repair, and overhaul services for DC-8 airplanes and Pratt & Whitney JT3D-3B engines. The company also had wet lease agreements[61] with several airlines and freight forwarders, including Aeromar. Aeromar was established in 1968 in the Dominican Republic and has offices in Miami and Santo Domingo, Dominican Republic. According to company records, Aeromar employed 54 employees in Miami and 87 employees in Santo Domingo at the time of the accident.

1.17.2 Wet Lease Agreement Between Fine Air and Aeromar

Fine Air and Aeromar signed a wet lease agreement on May 1, 1997 (see appendix D). Under the agreement, Fine Air agreed to provide ACMI services to transport Aeromar's freight.[62] Aeromar agreed to "provide fuel, loading and unloading at all stops, landing fees, duties, permits, over flights, taxes, parking fees...ground handling and all other flight related expenses." The agreement stated that "all flights covered under this Agreement shall be under the operational control of Fine."[63] A June 19, 1997, addendum to the agreement further states, "Fine shall maintain operational control of the aircraft at all times during operations conducted under this aircraft wet lease. In exercising operational control, Fine shall utilize Fine's flight crewmembers trained under Fine's FAA-approved training program; Fine's dispatch center; maintenance shall be performed under Fine's FAA-approved maintenance program; and servicing of the aircraft shall be done under the supervision of Fine's employees."

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entrant's fleet must comply with stage 3 noise level requirements after December 31, 1996. After December 31, 1998, at least 75 percent of the fleet must comply with stage 3 requirements.

[60] Under a typical ACMI (airplane, crew, maintenance, and insurance) contract, the company supplies the airplane, flightcrew, maintenance, and insurance either on a regularly scheduled or ad hoc basis, while the customer bears all other operating expenses, including fuel, landing and parking fees, and ground and cargo handling expenses.

[61] CFR Part 119.53 outlines requirements for wet leasing of aircraft and requires FAA approval of such agreements. Operational control is also defined.

[62] Under the terms of this agreement, Fine Air charged Aeromar based on a block hour amount for trips flown, not on total cargo weight.

[63] According to CFR Part 121.537, "Responsibility for Operational Control: Supplemental Operations," each certificate holder "conducting supplemental operations is responsible for operational control." The FAA POI assigned to Fine Air stated in a Safety Board deposition that operational control, as defined under Part 121, "has nothing to do with loading an aircraft...The airline has that responsibility for all aspects, but it was not defined by regulation." He stated that the regulations were being revised to specify that "exercising operational control will include such things as cargo loading and handling." He added that the wet lease provision that "servicing of the aircraft shall be done under the supervision of Fine's employees" also applied to loading. He stated that operational control, although not specifically defined, included supervising loading operations because the wet lease agreement called for the servicing of aircraft to be conducted under the supervision of Fine Air employees.

In an October 31, 1997, letter, the FAA informed Fine Air that a review of Fine Air documents labeled "wet leases" by FAA attorneys had determined that the agreements were not leases, but were instead "transportation agreements (perhaps even 'charters') from Fine to various foreign carriers or perhaps fixed price guarantees for certain possible cargo transportation services that Fine may be called upon to provide over the next couple of years." The letter added that even though the documents were not leases, the "fact that Fine intends to conduct the operations under 14 CFR Part 121...means that no aspect of operational control can be negotiated away to the foreign carrier or anyone else. For example, the loading of cargo as it relates to weight and balance requirements, cargo restraint requirements and hazardous materials requirements, is an aspect of operational control and must be under the control of, and be the responsibility of, Fine Air Services Inc. We expect that you will take our comments concerning operational control into account when you finalize these documents."[64]

1.17.3 Department of Defense Inspections of Fine Air

The Department of Defense's (DoD's) Air Carrier Survey and Analysis team conducted a survey of Fine Air's operations in Miami in September 1994 after Fine Air applied to provide cargo service for the Air Mobility Command (AMC).[65] The survey report concluded that Fine Air did "not meet the DoD Commercial Air Carrier Quality and Safety Requirements" in the following six operations areas:

Inadequate audit program.
General operations manual was not current.
Unsatisfactory flight and duty time program.
No crew resource management program.
Inadequate training hours for initial HAZMAT [hazardous materials] training.
Discrepancies in required flight documentation.

The survey report ranked Fine Air's management as "below average," its operations manual as "below average," its training and scheduling as "unsatisfactory," and its operational control as "below average." The report stated that "discrepancies were noted in four of six packages" of required flight documentation, including load manifests and that "One load manifest contained incorrectly totaled cargo weights. The error was on the safe side." The report added that Fine Air's maintenance program was satisfactory and that "all maintenance programs are run very efficiently."

The DoD conducted a second survey at Fine Air in January 1996 and ranked it "average" in most categories surveyed. The report concluded that Fine Air met the requirements to participate in the AMC program.[66] The report noted that in checking weight and balance and

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[64] Even without a wet lease agreement, Fine Air cargo operations were authorized under Part 121.

[65] DoD surveys of air carriers are part of a routine approval process for participation in the DoD air transportation program.

[66] According to a DoD representative, findings of DoD surveys are provided to the FAA.

load sheet documentation, discrepancies were found in load manifests. The report stated, "Checked six packages of required flight documentation—noted a discrepancy on three load sheets for DC-8-61 in one package."

1.17.4 FAA Oversight of Fine Air

The three FAA principal inspectors assigned to Fine Air were employees of the Miami Flight Standards District Office (FSDO) 19. The principal operations inspector (POI) and PMI told Safety Board investigators that they conducted en route inspections of Fine Air operations.[67] The PAI stated that he had not conducted any en route inspections of Fine Air in 1996 or 1997 because of other work priorities. None of the inspectors assigned to Fine Air had DC-8 training provided by the FAA, although all had extensive aviation backgrounds. The POI was type-rated in the B-727 and the DC-10. The POI stated that he "most assuredly" needed an assistant because he was responsible for another certificate in addition to Fine Air, and the PMI stated he needed at least one assistant to accomplish his assigned duties effectively.

The POI stated that his "biggest concern has always been where my specialty lies, and that's aircrew qualification, aircrew training...in monitoring classes, in recommending changes to training manuals, to ensuring that the check airmen were properly trained." He added, "I felt very, very strongly that if the pilots were properly trained, and properly managed their crew and available resources, that the company...[would] do very, very well in any inspection...by anyone that was to take a look at them."

The PMI assigned to Fine Air stated in the November deposition that "when I look at an aircraft, I'm looking at that aircraft with maintenance eyes. When he [the POI] looks at that aircraft, he looks at it with operational eyes."

In addition to routine surveillance inspections carried out in these areas, the FAA conducted two larger-scale team inspections of Fine Air before the accident—a regional aviation safety inspection program (RASIP) inspection in April 1995 and a national aviation safety inspection program (NASIP) inspection in April 1997. A second RASIP inspection was conducted after the accident in August 1997.[68]

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[67] The Fine Air PMI stated that he conducted about 8 to 10 en routes (each route is one way) a year, but should have conducted 12, adding that "budget restraints, and the requirements for approval for traveling, and getting visas and so forth, makes it difficult."

[68] According to deposition statements by FAA managers and principal inspectors, local FSDOs are informed of NASIP and RASIP inspection results through briefings and receive copies of the inspection reports. Local inspectors assigned to certificates are responsible for ensuring that any open deficiencies are corrected, according to FSDO managers and principal inspectors. The Safety Board has expressed concern about the process of closing deficiencies after NASIP inspection teams complete their work and file their reports. Following an April 28, 1988, accident involving an Aloha Airlines Boeing 737-200, the Safety Board issued Safety Recommendation A-89-65, which asked the FAA to integrate NASIP team leaders in the closeout of inspection team findings. The FAA responded in June 1991 that team leaders would be provided a copy of actions taken to resolve NASIP findings and that team leader comments would be considered. Based on this response, A-89-65 was classified "Closed—Acceptable Alternate Action."

1.17.4.1 Preaccident RASIP and NASIP Inspections

An eight-member RASIP team conducted operations and airworthiness inspections, including ramp inspections of four Fine Air DC-8 airplanes in April 1995. During the ramp inspections, the team found the following:

N57FB, DC-8-54

1. Three main landing gear wheels and tires found not secured in cargo bin.
2. Several loose rivets on forward outboard lower side of left wing.

N507DC, DC-8-51F

1. Excessive oil leak on #1 engine. Static drip very rapid creating large puddle on ramp.
2. Found newspaper folded and stuffed in #2 engine oil cooler inlet.

N427FB, DC-8-54

1. Excessive fuel leak noted on lower left wing leading edge seam. (Leak not coming from drip stick.)
2. Fuel leak noted on lower left wing just forward of left main landing gear. (Leak not from drip stick.)
3. Fuel leak from lower right wing drip stick seal. Fuel running length of wing to center fuselage area and dripping to ramp.
4. Main cargo "Lock-Unlock" placard not readable.
5. "No.1 Engine Door Open" caution light painted over.
6. Duct tape on entire frame of right aft cockpit window.

N27UA, DC-8-61

1. Thrust reverser sequence valves found with kinked pneumatic lines (deploy and retract lines). "B-nut" securing pneumatic lines not safety-wired. Three of the four engines on N27UA were found in this condition.

In a June 21, 1995, response letter to the Miami FSDO, Fine Air officials stated that all of the discrepancies on the four airplanes "were repaired prior to operation of the aircraft." The letter noted that the inspection was of "aircraft at the ramp and hangar that had not been released for service and...some of the items noted, especially the fuel leaks on N427FB were in work at the time the inspection team made their inspection. With regard to the items noted on thrust reverser sequence pneumatic lines and B-nuts on aircraft N27UA, this aircraft was in the hangar undergoing a heavy maintenance check."

The NASIP inspection in April 1997 also encompassed operations and airworthiness. The inspection team concluded that "the main concerns for the Air Carrier were identified in the areas of flight operations training (three engine ferry authorization), maintenance program and weight and balance. These areas of concern are known to the airline and corrected easily."

Among the weight and balance findings, the inspection team found that Fine Air had "no standards and schedules for the calibration of commercial scales used to determine cargo weights at Miami" and "loading schedules instructions...do not include instruction for calculation of weight and balance." The inspection team also determined that Fine Air manuals did not "include procedures for weighing aircraft required by 14 CFR Part 121.135 (b)(20)."

1.17.4.2 Postaccident FAA RASIP Inspection

Following the accident, an FAA RASIP team conducted an inspection of Fine Air's operations on August 20 through 27, 1997. The inspection team report stated that "problems found in the area of weight and balance control, to include ground handling, weighing of cargo, security of cargo on pallets, accuracy of individual pallet weights, and condition of pallets and nets used to restrain cargo has an impact on safety of flight." The report concluded the team's findings were "an indication of a systemic problem at Fine Airlines."

The RASIP team report identified problems with wet lease agreements with non-U.S. companies and found that Fine Air was "operating aircraft under these leases for operators who do not hold FAR Part 129 authority and for an operator that is not listed on section A-28 [of the Operations Specifications]."[69] The report also stated that "findings in the area of maintenance show problems with record keeping in the area of Airworthiness Directives and life-limited parts.[70] Adequacy of inspection by mechanics appears to be a problem also."

The report stated that Fine Air also conducted at least nine flights operating as Air Jamaica, using Fine Air airplanes and pilots, without a wet lease agreement and that Fine Air did "not hold operations specifications that authorize a wet lease agreement between" Air Jamaica and Fine Air.

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[69] Part 129 governs the operations of foreign air carriers in the United States. Under Part A, paragraph A-28 of Fine Air's Operations Specifications, the wet lease agreements between Fine Air and other carriers, including Aeromar, listed these carriers as holding Part 129 certificates, although some, including Aeromar's, had been revoked. A carrier with Part 129 authority involved in a wet lease would have been able to provide loading and unloading services and to accomplish weighing and load preparation, including pallets and netting. According to the RASIP report, Aeromar and Turks Air Ltd. did not hold current Part 129 authority when these agreements were made. When, after the accident, the FAA determined that these agreements were not wet leases, but charter operations, already authorized under Fine Air's Part 121 authority, the 129 requirement was no longer an issue. Because Aeromar did not hold Part 129 authority, operational control continued to rest with Fine Air during operations conducted under these agreements.

[70] An airworthiness directive is an FAA regulatory requirement for immediate, mandatory inspection and/or modification. Life-limited parts must be replaced after specified lengths of service.

During the course of its inspection, the RASIP team observed the unloading and loading of several Fine Air airplanes. For example, on August 26, unloading was observed from an airplane after its arrival at MIA.

> When the door was opened #2 pallet was found not secured by the side locks. There are 4 locks at the cargo door entry. The pallet was sitting on locks 1,2 and 4 and #3 was not engaged. The cargo on this pallet had shifted jamming the pallet which was not properly secured. The net and approximately ½ the cargo was removed to remove the pallet. The following was observed concerning the security of the cargo:
>
> - #3 pallet net frayed, broken and held together with yellow 'ski rope.'
> - #5 pallet net broken in several areas with rope securing the corners.
> - #6 pallet broken at 2 corners and net secured with yellow rope.
> - #7 pallet net frayed and broken.
> - #8 pallet net frayed and broken with the net secured at only 2 places on end of the pallet.
> - #9 pallet had 3 of 4 points of the net attached to the pallet.
>
> Observation of the forward lower cargo compartment revealed the flyaway kit[71] not secured. A main wheel and tire assembly had shifted aft in the compartment and a brake assembly had fallen out of its box and shifted aft in the compartment. Combined weight was approximately 750# [pounds].

Pallets from an arriving flight from Bogota, Colombia, were unloaded and weighed, and the actual weights were compared with those listed on the load sheet. The RASIP report stated that "although the total [weight] for freight witnessed by FAA [was] less than manifested, the individual pallets did not match the load plan, in some cases by more than a 1000# [pound] difference."[72]

Photographs taken of another flight being unloaded showed "approximately 90 percent of the cargo nets not properly secured to the pallets." Pallets being loaded onto another airplane "were observed to be in poor condition, with net ropes worn through and repaired with yellow nylon rope that is not authorized for use on aircraft...There was no apparent operational control of this operation [delivery and loading] by Fine."

[71] The flyaway kit includes spare parts and a supply of various lubricants. Its weight was listed as 442 pounds in Fine Air's AOM. A spare parts kit was also carried on the airplane, which included two main gear tires, two nose gear tires, and a brake assembly, with a total weight of 1,240 pounds. These weights were part of the airplane's calculated basic operating weight, which also included flightcrew weight estimates and crew baggage estimates.

[72] Some pallet weights were found to be more than manifested and some less than manifested.

According to the report, a Fine Air pilot reported on August 10, 1997, that cargo pallets "were loaded aboard his flight with no weights attached. He also discovered an error in the calculation of CG on the weight and balance forms. The flight was canceled."[73]

A ramp check was conducted on a Fine Air airplane (N30UA) that was undergoing an "A" check[74] on August 25, 1997. The RASIP report stated, "A walk through of the main cargo compartment showed the floor to be unserviceable. Several cracks and holes were present as well as patches that overlapped each other." The report also noted that "numerous areas of floor [were] very soft and giving way to any weight placed upon it." According to the report, FAA inspectors informed Fine Air's chief inspector and a maintenance supervisor about the flooring problems and advised them that repairs should be made. A records check the following day (August 26) showed that N30UA was flown shortly after the "A" check was completed. The report stated, "inspection/repair results were reviewed and showed only one repair and no mention of the soft floor." When N30UA returned to MIA the same day, an inspection "revealed the same discrepancies with the floor, soft with holes in various places. The aircraft was released to service with an unserviceable cargo floor." The RASIP team also determined that a Fine Air captain on August 10 had reported "numerous discrepancies of airworthiness items" on N30UA, including "under-inflated tires, leaking hazardous materials, broken cargo locks and cracks in the floor. The maintenance logbook was signed off with an airworthiness release for a 'transit' check[75] prior to discovery of these discrepancies by the flightcrew." Following the August 26 inspection of N30UA, the floor "was replaced due to numerous cracks, holes and improperly applied repairs," according to the RASIP report.

The RASIP team also investigated a Fine Air pilot report of a nose-heavy takeoff on August 18, 1997. The report stated that the "official company trip record that was provided contains a weight distribution and pallet position form that contained weights in pallet numbers 2 through 5, 8, 9, 14 through 18 that differed significantly from the weights of pallets used on a company weight and balance load sheet." According to the report, a Fine Air flight follower "produced a weight distribution form from his flight follower work copies and the pallet position weights agree with the load sheet computations." Fine Air's director of operations told FAA

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[73] The FAA PMI assigned to Fine Air stated that he discovered loading problems during an en route inspection in Santo Domingo one week before the accident. "I found that they were improperly loading the aircraft" and that there were "three pallets with nets that were not acceptable, and they had to replace them," the PMI stated. "There was a scale that was in a location that they couldn't weigh pallets, and they had to move them." On August 11, 1997, the PMI wrote a letter to Fine Air asking Fine Air to amend its work cards for "C" checks in the areas identified as deficient during the en route inspection, but no other direct action was taken by the PMI to correct the immediate problem. In addition, a Fine Air "Crew Report" dated August 2, 1997, stated that five children ages 15-17 and one adult unloaded and loaded the airplane during an outstation stop. The crew report added, "Upon inspecting cargo before departure...miscellaneous cargo was bulk loaded between pallets...Boxes were broken up because of this abuse."

[74] Under Fine Air's FAA-approved periodic maintenance program, "A" checks are conducted every 150 hours, or 6 calendar months, whichever comes first.

[75] According to Fine Air's FAA-approved maintenance manual, a transit check is required to be performed before each flight originating at a principal base, unless another transit check or more extensive check has been performed within the past 48 hours.

inspectors that he believed the captain was "nervous" after the accident involving flight 101 and "failed to properly trim the aircraft at rotation thus claiming a nose heavy condition." The RASIP report concluded that because two load sheets existed for this flight, Fine Air did not have "evidence that the aircraft is loaded according to an approved schedule that ensures that the aircraft center of gravity is within approved limits."[76]

1.17.4.3 FAA Management Reaction to Postaccident Inspection Findings

The POI assigned to Fine Air stated that the postaccident RASIP inspection was "a serious report." He added, "It's just terribly disappointing to me that there were problems there that had not previously been identified. If there is a problem in performance in planning, as an example, or in computing the weight and balance, then it's a training problem, and it's a problem that again is back in my area of concern. I didn't spend a lot of time in flight control. I didn't have any reason to be spending a lot of time there. I had no indicators that there was any kind of a problem in either preparing weight and balance, or in the loading."

The manager of FSDO 19 stated that oversight of Fine Air "was adequate....This is one of those situations where inspectors were concentrating their emphasis on other areas. Cargo operation is an area that there has been minimal guidance on." He added that after the accident, senior FAA management had expressed "concern that we're not proactive."

An Atlanta-based FAA Flight Standards division manager, whose region includes the Miami FSDO, stated that the "combination of older aircraft, younger, less experienced crews and management that is operating on, let's say, a smaller margin than the major carriers...are a concern." He stated that he believed that FSDO 19 inspectors should have found the problems cited in the postaccident RASIP inspection report and "should have been uncovered by the airline themselves. I think the focus of the earlier inspections were different and perhaps not as adequate as the focused [RASIP] inspection."[77] He added, "It's hard to define quality of surveillance. It's one of those things. I think you have to look at the individual finding...and make an educated guess whether that could have been discovered during normal surveillance, or whether it's very unlikely that it would be discovered by normal surveillance."

The division manager noted that the time of principal inspectors, during the course of their daily surveillance, "is used up doing things like adding aircraft to certificates, reviewing changes to manuals, reviewing changes to various programs that the airline has to have by regulatory requirements, so they don't have as much time to do [more] focused inspections. They actually do the routine daily certificate maintenance more than they do surveillance, and that's one of the problems."

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[76] See CFR Part 121.693(d), "Load Manifest: All Certificate Holders."

[77] The FAA PAI for Fine Air stated that he did not think inspectors "should be expected to ramp every departure or even 50 percent of their departures and arrivals, and we shouldn't be expected to do their inspections. I mean, their airline should be responsible for that, because one day another inspector finds a spongy floor or bear trap we didn't see, doesn't mean we haven't been ramping the aircraft and writing up discrepancies."

1.17.5 Consent Agreement

On September 12, 1997, Fine Air signed a consent agreement with the FAA under which it voluntarily agreed to cease all Part 121 operations until it demonstrated to the FAA that it was in compliance with all applicable regulations and conditions listed in the consent agreement.[78] Fine Air also agreed to pay the FAA $1.5 million for costs to "investigate, review, and re-inspect Fine Air and establish and ultimately enforce" the consent agreement. Under the terms of the agreement, Fine Air agreed to address deficiencies found in its cargo handling system, along with other problems found during the August RASIP and subsequent FAA enforcement inspections. Fine Air agreed to review and revise the following, as necessary:

> Cargo handling system and procedures that will ensure accuracy of cargo weights, restraint and loading for all flights under the operational control of Fine Air. This system will include but not be limited to, maintenance program for cargo pallets and cargo restraint devices, cargo pallet loading procedures, cargo weighing procedures, system for control of scales and maintaining calibration records for scales used for weighing cargo, aircraft loading procedures, aircraft weight and balance procedures.
>
> A training program for cargo handlers and other personnel responsible for cargo handling and aircraft loading.
>
> Crewmember and flight follower training to include cargo handling, aircraft loading procedures, and aircraft weight and balance and performance computations.
>
> A system to ensure all "wet leases" and interchange agreements are properly authorized in operations specifications prior to conducting any operations under the agreement.
>
> A maintenance and inspection program for aircraft cargo floors.
>
> The maintenance program for flight data recorders.

On October 28, 1997, the FAA authorized Fine Air to resume operations "following rigorous re-inspections and demonstration flights" that demonstrated that it complied with Federal safety regulations. The FAA stated that Fine Air had "improved its processes and procedures for handling cargo and has demonstrated to the FAA that it...meets the conditions of the September 12 consent agreement that are necessary to resume service." The FAA announcement added that it was continuing to "evaluate its overall inspection program for air cargo carriers."

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[78] Fine Air temporarily halted all operations on September 4, 1997, following FAA enforcement inspections.

1.18 Additional Information

1.18.1 Postaccident FAA Inspector Guidance for Surveillance of Cargo Operations

On September 5, 1997, the FAA issued two bulletins relating to cargo loading and weight and balance procedures and FAA surveillance of cargo loading operations on aircraft. Flight Standards Information Bulletin for Airworthiness (FSAW) 97-21, "Acceptable Means of Maintaining Cargo Containers, Pallets, and Netting Installed on Transport Category Aircraft" (Air Transportation Operations Inspector's Handbook), outlined the FAA's "national policy regarding the acceptable means of dealing with cargo containers, pallets, and netting installed in transport category aircraft."[79]

FSAW 97-21 stated that during routine surveillance FAA inspectors had "increasingly observed what may be unserviceable cargo containers, pallets, netting and other restraint devices loaded into air carrier aircraft." The bulletin added the following:

> In many cases, the restraint systems identified above and cargo loading personnel are provided by a freight forwarding company under a lease agreement. This has caused some confusion and concerns about who is responsible for the restraint systems and the training of the cargo loaders. Further, questions have arisen regarding the services provided by the freight forwarding company being considered contract maintenance.

According to FSAW 97-21, the airworthiness of an aircraft, as defined by CFR Part 121, "includes cargo containers, pallets, and any other restraint system installed on the aircraft." The bulletin stated that air carriers are "ultimately responsible for training their personnel to the requirements of their manual" and that "ground support equipment and cargo loading personnel should not be considered contract maintenance." FSAW 97-21 concluded that "principal inspectors should ensure that adequate procedures are in place in the operator's manual to ensure cargo restraint equipment conform to proper standards and are in condition to perform their intended function."

Joint Flight Standards Handbook Bulletin for Airworthiness and Air Transportation (HBAT) 97-12, "Special Emphasis Surveillance of Part 121 Air Carrier Cargo Loading Procedures," was issued to "reemphasize and expand current policy and guidance concerning weight and balance control procedures, cargo loading procedures and loading schedules and instructions" and to "validate compliance with those currently approved

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[79] The POI assigned to Fine Air stated in a November 1997 Safety Board deposition that the bulletins "give the inspector a lot more guidance in how to conduct a ramp inspection of cargo aircraft." He stated that before the accident, "the guidance was not there. It is now." The Fine Air PMI stated he "never had any guidance...on how to accept this, or not accept that" cargo loading, restraint, or pallet condition. "To us, cargo is cargo. How many strands can be broken on the net, how many hooks can be off the pallet? There was no guidance on that...We were not geared, and we don't get that kind of training...to look for pallets and nets. I never thought of it. Now if I go aboard that aircraft and I see a pallet, I'm going to look at it. And if a bear trap is off, I'm going to look at it."

procedures to include the surveillance of cargo loading operations aboard an aircraft." The bulletin called for "special emphasis" ramp checks to be carried out on all Part 121 carriers that conduct "any type of cargo loading operation, to include the loading of passenger bags or company material aboard any air carrier aircraft."

HBAT 97-12 stated that in addition to airplane load manifest procedures and requirements contained in Part 121.665,[80] "FAA policy is that the certificate holder must ensure that those individuals, who are not the certificate holder's employees, are directly supervised, during the performance of their duties, by an appropriately qualified supervisor employed by the certificate holder."

According to HBAT 97-12, all weight and balance control procedures used under the terms of wet lease agreements were to be reviewed and approved by FAA principal inspectors. The bulletin stated that "it is imperative that any outsourced personnel used for cargo loading are qualified and authorized by the certificate holder to perform these functions" and that they be supervised by qualified personnel employed by the certificate holder.[81]

1.18.2 Previous Fine Air Pitch-up Incident

A Fine Air captain told Safety Board investigators that he experienced a pitch-up incident on takeoff in a DC-8-54 series airplane on July 13, 1997, on a flight from Miami to El Salvador. The captain stated that it was a weekend flight and that the cargo was loaded by a freight forwarder contracted to load airplanes when Fine Air loaders were off duty. He stated that the takeoff was normal until the airplane reached V_1, and the nose wheel began to rotate off the ground. At V_R, the airplane rotated and became airborne without control inputs, he stated. The captain stated that he used forward pressure and trim to maintain V_2 plus 10 knots.

According to the captain, takeoff trim had been set at 3.4 units ANU before departure. The trim setting was minus 1.5 units (AND) after the trim changes during rotation, he stated. At V_2 plus 10 the airplane had reached the airport's eastern boundary and was at an altitude of about 200 feet, he stated. The captain stated that he had no difficulty controlling the airplane after the trim adjustments were made and elected to continue to his destination. He stated that the first officer later called the company dispatcher on the radio and complained about the loading, "something to the effect [of] 'what are you trying to do, kill us?'" The captain stated that he did not write an irregularity report, but that he discussed the event with the director of

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[80] Part 121.665 states, "each certificate holder is responsible for the preparation and accuracy of a load manifest form before each takeoff. The form must be prepared and signed for each flight by employees of the certificate holder who have the duty of supervising the loading of aircraft and preparing the load manifest forms or by other qualified persons authorized by the certificate holder."

[81] The POI assigned to Fine Air and the FSDO 19 manager stated that before the accident, freight forwarders were not included in routine oversight and inspections. The POI stated that before the accident, "I was not there to look at the loading process." The FSDO manager stated, "As a result of the accident, and the handbook bulletin that has come out, I think we have a collateral responsibility, if the carrier's utilizing them [freight forwarders] and they're at the aircraft...we can look at their operation there."

operations. The captain stated that the director of operations later discussed the event with the POI assigned to Fine Air and that the POI "was satisfied with the explanation."

1.18.3 Recent FAA Enforcement Actions Against Cargo Carriers

On December 24, 1997, Amerijet International, a Ft. Lauderdale, Florida-based cargo carrier, voluntarily ceased operations following a 3-day FAA inspection. According to an announcement of the consent agreement, the FAA inspection "revealed significant findings in Amerijet's cargo handling program, including weight and balance problems, unapproved weight and balance forms, improperly secured cargo, unapproved cargo loading equipment, and uncertified scales at several Caribbean outstations." The inspection also found that flightcrews "inadequately performed required pre-flight checks of the aircraft, including inspections of the loaded cargo holds." On December 30, 1997, the FAA authorized Amerijet to resume limited operations using airplanes from "Miami to international destinations it normally serves using only Amerijet personnel for aircraft loading and operation." Continued FAA surveillance focused on "cargo loading, securing, and all procedures concerning weight and balance and crew preflight procedures." The amended consent agreement stated that the FAA would continue to "oversee Amerijet's use of company manuals during cargo loading and flight operations, and will review company training records and quality control procedures." Amerijet operated 17 Boeing 727 airplanes between Miami and Caribbean and domestic U.S. destinations. The FAA stated that the Amerijet inspection was conducted as part of a nationwide review of cargo carriers ordered in September.[82]

On November 14, 1997, the FAA proposed a $495,000 fine against Aero Transcolombiana de Carga (ATC) for operating a DC-8-51 "over the weight limits set forth in its FAA-approved flight manual during 66 flights to and from the United States. ATC's load sheets from the period between June 14, 1996, and August 12, 1996, show that flights were operated when the aircraft was loaded in excess of its maximum permissible zero fuel weight of 173,500 pounds. Excess weight ranged from 269 pounds to 36,733 pounds."

On May 14, 1997, the FAA proposed a $285,000 fine against Aerolineas Nacionales del Ecuador (ANDES) after alleging that the airline operated a DC-8-53 cargo airplane "in excess of the maximum permissible zero fuel weight and maximum cargo pallet position weights." The FAA determined that "ANDES' failure to comply with weight limitations created a particularly unsafe condition in that, as a result, weight and balance and center of gravity computations could not be properly assured."

On April 28, 1995, the FAA suspended the operating certificate of Arrow Air Inc., a Miami-based Part 121 cargo and passenger carrier, after an inspection found evidence of serious violations of safety regulations. The FAA stated that it had found evidence of "untrue and inaccurate maintenance records" and that Arrow had failed "to maintain a required system

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[82] The FAA stated that the nationwide review of cargo carriers was ordered as a result of deficiencies found by the FAA's RASIP inspection team at Fine Air following the accident.

for continued analysis and surveillance of its maintenance program" for its Boeing 727 and DC-8 airplanes. The FAA stated that Arrow Air

- Did not follow maintenance manual requirements when performing maintenance on aircraft;
- Did not use inspectors that were properly certified, trained, qualified and licensed;
- Falsified maintenance records;
- Did not maintain a current listing of the functions inspectors were authorized to perform;
- Did not perform maintenance safety audits as required by regulation;
- Failed to record the maintenance, preventive maintenance, rebuilding and alteration of aircraft, airframes, engines, propellers, or component parts;
- Improperly reported corrosion levels on aircraft after repairs;
- Had discrepancies in pilot and personnel training records;
- Performed major repairs without FAA approval; and,
- Used undocumented aircraft parts with no traceable maintenance history.

On June 9, 1995, the FAA authorized Arrow to resume operations "after meeting extensive recertification requirements" and after making a $1.5 million remedial payment to the FAA to defray inspection and review costs.

Millon Air, another Miami-based cargo operator, voluntarily ceased operations on October 24, 1996, following an FAA inspection conducted after a Millon Air Boeing 707 freighter crashed in Manta, Ecuador, 2 days earlier on October 22, 1996.

1.18.4 Fine Air Cargo Inspection Procedures

Fine Air's AOM at the time of the accident described preflight inspection procedures for the cargo compartment and equipment. According to section 6-12-5, "Engineer's Preflight – Expanded," the flight engineer was required to inspect the following:

Cargo Door/Locks..CHECKED
Broken latches
Cargo Door actuator, for leaks
Cargo door liner intact
Cargo door lighting

Ball Mat.. ....CHECKED
Attachment, hardware undamaged
Floor metal condition
Missing Balls, ball retainer and springs

Floor rollers and slide rails..................................CHECKED
Missing rollers and hardware

Bent slide rails
Pallet/container locks stowed in floor

Bear Traps...CHECKED
A minimum of three bear traps per row must be used and locked.
No two adjacent bear traps may be inoperative.[83]

Side Restraints..CHECKED
All side restraint rails or rail assemblies are required.
One single side restraint fitting may be missing from any pallet position and not effect the gross capacity of a pallet.
Pallet position P-1 must be built so that the Flight Engineer will have access to visually inspect the door locking pins after closing and locking the cargo door.

1.18.4.1 Fine Air Outstation Load Planning and Inspection Procedures

Fine Air's Flight Operations Manual (FOM) outlined approved load planning procedures for outstation operations. Under "Load Planning," Section 14-3-1, the FOM stated the following:

> LOAD PLANNING PROCEDURES ARE AS FOLLOWS. (Excluding Home Base)
>
> 1. Sole responsibility rests with the captain
> 2. First Officer will direct the positioning of all cargo via weight and balance procedures. (As outlined in AOM Vol. I Chapter 2 Loading).
> 3. It will be a joint responsibility between the First Officer and Flight Engineer to ensure proper loading.
> 4. First Officer and Flight Engineer will report directly to the Captain for signature of weight and balance form and distribution approval.

Under "Weight and Balance Control," Section 14-3-2, the FOM stated the following:

> Weight and balance control of the DC-8F airplane requires the operator to maintain the Center of Gravity within defined limits. When the airplane is properly loaded within the Zero Fuel Weight Center of Gravity envelope, the airplane will remain within the balance limits from zero fuel through take-off

[83] Fine Air's director of operations testified during a Safety Board deposition that "it would be unusual" for the flight engineer or another crewmember to crawl back over pallets to the rear of the airplane to verify that the locks were up. Fine Air's chief operating officer testified that such a check "is a highly improbable situation" and that an element of trust existed between the loading supervisor and the flightcrew that the locks had been properly locked. "I believe that's the way it has been in this industry for a long time."

weight if the loading of fuel is in accordance with the specified schedule shown in the FAA-approved Flight Manual.

1.18.5 Cockpit Verification of Weight and Balance

Some cargo operators have installed an electronic system on their airplanes that allows flightcrews to verify the airplane's weight and balance before departure. The system, called STAN (Sum Total Aft and Nose), provides flightcrews with a digital readout in the cockpit of weight and balance values.[84] The system uses pressure transducers to convert main gear and nose gear shock strut air pressure to an electronic signal. The cockpit readout, on the flight engineer's instrument panel, provides the flightcrew with the airplane's gross weight and CG. The system computes the gross weight by adding the three weight signals from the gear transducers. The ratio of weight on the nose gear to the total weight is used to compute the CG. Flightcrews are advised by the manufacturer to resolve a discrepancy of more than 3 tons gross weight or 2 percent MAC between the STAN reading and the airplane's weight and balance manifest.

1.18.6 Job Descriptions for Aeromar Loading and Security Personnel

Cargo loading and unloading supervisors at Aeromar were responsible for the following duties, according to written company job descriptions:

1. Supervise the loading and unloading process.
2. Coordinate and check the loading and unloading equipment to be used in the operation (loader, fork lift, etc.).
3. Make sure that all personnel loading and unloading the aircraft [are] properly equipped with the necessary equipment to ensure safety and prevent physical accidents.
4. Supervise that all pallets are being loaded in the appropriate sequence in accordance with the weight and balance of the aircraft.
5. Supervise that all "bear traps" or pallet locks are properly secured.
6. Supervise the handling of the cargo.
7. Take any precautionary measures against weather conditions to ensure that the cargo is safe.
8. Is responsible to keep communication with personnel in our warehouse.
9. Supervise the loading process of restricted materials on board the aircraft.
10. Make sure that the aircraft has the tail post in the right positions at the time of loading the aircraft.
11. Make sure that the aircraft is properly balanced in reference to its center of gravity at the time of loading the main cabin and belly freight.

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[84] Miami-based freight operators Millon Air and Arrow Air had STAN systems installed on DC-8 and B-707 freighters. The now-defunct Pan American World Airways installed STAN systems on its B-707 freighters, and upgraded versions of similar systems are in use on L-1011s, MD-11s, and DC-10s operated by numerous carriers.

According to Aeromar records, cargo loading supervisors were required to have a "minimum of 6 months working in operations in a cargo airline and a minimum of 6 months of experience in cargo handling." In addition, loading supervisors were required to be fluent in English and Spanish and to have had experience "in the handling of heavy equipment such as loaders and forklifts."

According to Aeromar job description documents, the "job of cargo loader is as follows: Pallets are lifted by a forklift onto the loader, then moved into the plane, positioned into place, then locked into place with 5 locks, then so on. (If more details are needed we supply it.)"

Security guard responsibilities were detailed in an August 1, 1997, job description prepared by Aeromar's human resources department. The "Guidelines for Security Guards" stated the following:

1. The security guard who accompanies the aircraft, or is on duty in the warehouse is responsible for the custody of the airplane, the warehouse and the following procedures:

a.) Guarantee the communication between the warehouse and the plane.
b.) Authorize the opening of the plane (after making sure everything is cleared with customs and the head of the group which is going to work on the plane).
c.) In case Fine Air provides personnel and equipment to facilitate the job, communicate with and obtain authorization from the chief of operations, chief of security or general manager before beginning the operation.
d.) Coordinate and supervise that only Aeromar employees have access to the plane or warehouse.
e.) Coordinate the custody of the cargo from the ramp to the warehouse.

2. Submit the reports whether established by security or by the department of operations clearly stating the date, names and signatures and then turn into the department of human resources.
3. Control the checking of the crew, passengers, luggage and documentation and guarantee that everything is within norms established and if not hold the operation until all irregular situations have been [resolved].

1.18.7 Fine Air Job Descriptions for Ramp Supervisors and Cargo Loaders

Following the accident, Fine Air revised its FOM to include job descriptions for personnel involved in loading operations, including ramp managers, loading supervisors, cargo loading leads, and loaders. Before the accident, these job descriptions were on file in the personnel department and were not contained in the FOM, according to Fine Air representatives.

According to the revised FOM (14-3-3, Revision 51), cargo ramp managers are required to coordinate "the flow of pallets from the warehouse into the correct aircraft." The cargo ramp manager is responsible for the following:

- Maintaining a sufficient workforce.
- Being able to do all job functions of his subordinates and direct them accordingly.
- Ensuring that his subordinates are adequately trained.
- The maintenance of all cargo loading equipment.
- Assigning loading crews to each flight.
- The supervision of ACMI flights when applicable.
- Receiving cargo Load Plans from flight operations and assigning the specific positions to the pallets for a particular flight based on the Load Plan form.
- Certifying that aircraft have been loaded properly.
- Certifying that the pallet locks are in the up and locked position for each cargo laden flight that departs.

The FOM revision stated that cargo loading supervisors work under the direction of the cargo ramp manager and are responsible for the following:

- The inspection of aircraft cargo areas prior to loading for proper number, condition and operation of pallet locks, pallet transfer system, pallet restraint equipment and side rails.
- Checking the aircraft cargo areas for signs of cargo leakage and debris.
- Coordinating the removal of trash from within the aircraft prior to the installation of pallets.
- Contacting Flight Control and the Director of Safety's Office for suspected dangerous goods spills or leaks and initiating the Emergency Response by directing personnel away from the aircraft and area until relieved by superiors.
- Checking the cargo loading equipment to ensure proper function and operation.
- Checking the aircraft and ramp area for debris and potential hazards.
- Reporting potential hazards to the appropriate authorities, flight operations, or the captain.
- (When directed) affixing the pallet position on the pallet tag as depicted on the Load Plan form.
- Checking all pallets containing dangerous goods for leakage prior to loading into the aircraft.
- Certifying that dangerous goods shipments have been loaded correctly.
- Directing the installation of pallets in the aircraft according to proper methods and practices.
- Ensuring that the loaders safely and correctly install pallets in the aircraft in the assigned locations.
- Ensuring that all pallet locks are in the up and locked position for all cargo [loaded].

- Signing the Loading Certification Form certifying that the aircraft has been properly loaded and all pallet locks are in the up and locked position.[85]

In addition, the FOM stated that cargo loading leads were responsible for the following:

- Checking each pallet brought into aircraft for damage, improper construction, or leakage and bringing any of these to his immediate supervisor.
- Positioning each pallet correctly in the appropriate position and then installing it there by properly locking the pallet in place.
- Bringing to the attention of his supervisor any pallet end restraint fittings that are missing or not functioning properly.

The revised FOM described the position of loader as "labor intensive and limited in responsibilities. However, Loaders are a very important member of the loading 'team.' As they do the actual hands on work, they are in the best position to notice damage, leakage, improper function and missing equipment" (see section 1.18.8 for details of loader training changes). The FOM added that loaders are also responsible for the following:

- Bringing any irregularity to the attention of their immediate supervisor.
- Positioning each pallet on the aircraft according to instructions received, and pointing out to their immediate supervisor pallets that appear to be going into wrong position (such as a very heavy pallet going towards the tail section instead of going over the wing).
- Reporting any unsafe practices to the Director of Safety.
- Installing pallet end restraint fittings, pallet locks ('bear traps') in the up and locked position on installed pallets prior to retrieving another pallet for loading.

1.18.8 Postaccident Changes in Fine Air Cargo Loader Training

In response to the terms of the September 12, 1997, consent agreement with the FAA, Fine Air developed a new training program for cargo loaders and supervisors comprising 7 hours of classroom training with standardized curriculum areas covering basic aerodynamics, weight and balance for ground handlers, safe handling of aircraft cargo and pallet building, and loading and unloading (see section 1.18.7 for a detailed description of loading supervisor and

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[85] The "Loading Supervisor Certification" form, developed after the accident and written in English and Spanish, requires loading supervisors to sign a statement certifying that the airplane "was loaded in accordance with Fine Airlines loading requirements, and that all locks, in all pallet positions are properly installed, and in the pallet locked position."

cargo loader job descriptions). Dangerous goods training is also provided to shippers, packers, cargo agents (16 hours), and loading and warehouse personnel (8 hours).[86]

The new training program, incorporated into Fine Air's training manual, addressed a range of loading issues. The "Aerodynamics, Physics and Theory of Flight" section of the revised Fine Air Training Manual (revision: 47) covers a variety of subjects, including aircraft weight, lift, stalls, center of lift, and CG. In "Weight and Balance for Ground Handlers," subjects include "proper use of company weight and balance data" and "effects of improper weight distribution on flight characteristics." A section on pallet building outlines the "proper use of the warehouse load sheet," cargo and weight distribution, "legal ramifications if pallet weights are not correct, importance of correct weights on aircraft performance, [and] pallet weight certification." Proper cargo loading procedures and installation of pallet locks are also included in the curriculum.

1.18.9 Previous Cargo Flight Accidents

On January 11, 1983, a Douglas DC-8-54F, a regularly scheduled cargo flight operated by United Airlines crashed just after takeoff at Detroit Metropolitan Wayne County Airport.[87] According to witnesses, the takeoff roll and rotation were normal, but after rotation the airplane's pitch attitude steepened abnormally. The airplane climbed to an altitude of about 1,000 feet, then rolled to the right and descended rapidly to the ground. The airplane was destroyed by the impact and a postcrash fire, and the three flightcrew members were killed.

The accident investigation determined that the stabilizer trim was set at 7.5 units ANU at impact, which was the landing trim setting. The Safety Board concluded that the probable cause of the accident "was the flightcrew's failure to follow procedural checklist requirements and to detect and correct a mistrimmed stabilizer before the airplane became uncontrollable." The Safety Board accident report noted that simulations "conducted after the accident demonstrated that immediately after liftoff when nose-down elevator forces were applied, the rate of rotation slowed, giving the impression that it would be possible to arrest the rotation solely with forward control input. Recovery of the airplane at rotation was possible if immediate nose-down trim was applied along with full forward elevator input. However, once the airplane left the ground and started to accelerate, recovery was improbable."

On December 15, 1973, a Lockheed Super Constellation L-1049H operated by Aircraft Pool Leasing corporation as a cargo flight loaded with Christmas trees, crashed 1.25 miles east of MIA after taking off from runway 9L.[88] The airplane struck several homes and

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[86] Aeromar's vice president stated that Aeromar loaders attend the new Fine Air loader training along with Fine Air loaders.

[87] National Transportation Safety Board. 1983. *United Airlines Flight 2885, N8053U, Douglas DC-8-54F, Detroit, Michigan, January 11, 1983.* Aircraft Accident Report NTSB/AAR-83/07. Washington, DC.

[88] National Transportation Safety Board. 1974. *Aircraft Pool Leasing Corporation, Lockheed Super Constellation, L-1049H, N6917C, Miami, Florida, December 15, 1973.* Aircraft Accident Report NTSB/AAR-74/11. Washington, DC.

vehicles and killed six people on the ground and the three-member flightcrew. The Safety Board concluded that the probable cause of the accident was an over-rotation at liftoff that resulted in "flight in the aerodynamic region of reversed command,[89] near the stall regime, and at too low an altitude to effect recovery." The accident report noted that "the reason for the aircraft's entering this adverse flight condition could not be determined." Potential contributing factors included "improper cargo loading, a rearward movement of unsecured cargo resulting in a center of gravity shift aft of the allowable limit, and deficient crew coordination."

The accident report stated that cargo was not secured properly and that the "loading supervisor did not receive any guidance with regard to load distribution. He stated that the original intent was to load all of the trees on hand into the aircraft. When it was apparent that this could not be done, he was told to put as many on as possible."

A March 12, 1991, accident involving an Air Transport International (ATI) DC-8-62 cargo airplane[90] was also related to operational factors including gross weight, trim, and management oversight. The captain rejected the takeoff after determining that "the nose was extremely heavy" at rotation and that the "force on the control column was such that I could not let go with one hand until the nose was on the ground." The airplane was destroyed by fire after departing the right side of the runway and striking an airport facilities building. The three-member flightcrew and two cockpit jumpseat passengers escaped with minor injuries. The Safety Board determined that the probable causes of the accident were "improper preflight planning and preparation, in that the flight engineer miscalculated the aircraft's gross weight by 100,000 pounds and provided the captain with improper takeoff speeds; and improper supervision by the captain. Factors relating to the accident were an improper trim setting provided to the captain by the flight engineer, inadequate monitoring of the performance data by the first officer, and the company management's inadequate surveillance of the operation."

1.18.10 Previous Safety Board Oversight-related Recommendations

On May 11, 1996, a DC-9-32 airplane operated by ValuJet Airlines crashed into the Florida Everglades about 10 minutes after takeoff from MIA, killing all 110 people on board. The Safety Board determined that the probable cause of the accident was a fire in an airplane cargo compartment that was initiated by the activation of one or more oxygen generators being improperly carried as cargo. The investigation also revealed evidence of maintenance irregularities, including false maintenance logbook entries and poor FAA inspection oversight.

From the time of ValuJet's initial certification on October 21, 1993, until the date of the Everglades accident, ValuJet's activities, facilities, and programs underwent 1,471

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[89] The region of reversed command, or the back side of the power curve, refers to a condition in which a higher power setting is required to maintain a lower airspeed while holding altitude. In contrast, in the region of normal command, or the front side of the power curve, a decrease in airspeed results in a corresponding decrease in the amount of power required.

[90] See Brief of Accident, *JFK International Airport, New York, March 12, 1991, NYC91-FA-086.*

maintenance-related program tracking and reporting system (PTRS)[91] activity coded inspections by the FAA. In addition, ValuJet was the subject of RASIP and NASIP inspections in 1994 and 1995, respectively, and was under review by the FAA's Office of Aviation Flight Standards (AFS-330). A report later prepared by the Aircraft Maintenance Division (AFS-300), dated February 14, 1996, recommended that "consideration should be given to the immediate recertification of this airline," and that overall surveillance should be increased. The report noted that ValuJet had had a total of 46 regulatory violations since 1993, of which 20 remained open at the time the report was written. According to the report, the recommendation was made based "on such known safety related issues as the absence of adequate policies and procedures for...maintenance personnel to follow." The report concluded that its findings "clearly show some weakness in the FAA surveillance" of ValuJet and noted that "some critical surveillance activities did not receive much attention." The AFS-300 report was not provided to the Atlanta FSDO or ValuJet until after the accident.

As a result of its investigation of the December 20, 1995, runway departure during attempted takeoff of Tower Air flight 41, a Boeing 747-136, the Safety Board issued Safety Recommendation A-96-163 to the FAA.[92] This safety recommendation requested that the FAA develop, by December 31, 1997, standards for the enhanced surveillance of air carriers based on rapid growth, change, complexity and accident/incident history; then revise national flight standards surveillance methods, work programs, staffing standards and inspector staffing to accomplish enhanced surveillance that is identified by the new standards. Following the May 11, 1996, ValuJet accident, the Safety Board issued two additional surveillance-related recommendations to the FAA focusing on oversight of maintenance activities and repair stations.[93]

On February 25, 1997, the FAA replied to the Safety Board on A-96-163 and cited initiatives in progress; specifically a Surveillance Improvement Project that addressed revamping the FAA surveillance process, which had been recommended in a 90-day review of the FAA conducted following the ValuJet accident. The FAA Administrator had ordered the 90-day safety review to examine "areas of immediate concern to the agency, especially with respect to safety inspections." The review resulted in an internal FAA recommendation to devise a "new Flight Standards staffing model which...responds more timely to changes in workload and productivity and...expresses field office needs as a holistic requirement." In a January 23, 1998, followup response, the FAA stated that it was meeting the intent of A-96-163 by developing the new surveillance standards and programs and incorporating several of the recommendations from

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[91] The PTRS is a centralized, computerized recordkeeping system that lists for each "R" [required] item for certificated entities (such as airlines and repair stations) the date the item was "assigned" as an "R" [required] item, the date the inspection was completed, and the findings made during the inspection.

[92] National Transportation Safety Board. 1996. *Runway Departure During Attempted Takeoff, Tower Air Flight 41, Boeing 747-136, N605FF, JFK International Airport, New York, December 20, 1995.* Aircraft Accident Report NTSB/AAR-96-04. Washington, DC.

[93] Safety Recommendations A-97-68 and A-97-75, which asked the FAA to review the workload of inspectors of Part 145 repair stations doing maintenance for Part 121 carriers to ensure that inspectors have adequate time to perform surveillance.

the 90-day review. On February 23, 1998, the Safety Board responded that it would "monitor the FAA's progress in implementing these changes" and classified A-96-163 "Open—Acceptable Response."

In a March 3, 1998, memorandum, the FAA Administrator and the Department of Transportation's Inspector General reviewed the FAA's progress in implementing the recommendations from the 90-day review. The memorandum stated that the FAA had created an analytic unit of specialists "to evaluate air carrier safety risks, provide analytical support to FAA aviation safety inspectors, identify emerging aviation safety issues, improve the quality of FAA safety data and disseminate safety information to FAA inspectors and organizations outside the FAA." The memorandum noted that "corrective actions to address the most significant recommendations identified by the 90-day safety review task force are in-process." It added that the FAA is "integrating several of the recommendations into a new system to radically change its approach to aviation safety oversight. Therefore, much work remains to correct systemic problems with FAA's aviation safety inspection program."

According to the memorandum, significant recommendations are in progress to do the following:

- Create a national certification team of specialists to assist FAA offices with new air carrier certifications;
- Make FAA surveillance of air carriers more systematic and targeted to deal with identified risks, such as developing comprehensive annual surveillance plans tailored to each air carrier's operations and redirecting inspections throughout the year to risk areas identified by data trend analysis;[94]
- Develop air carrier partnership programs to generate improved safety information that may not otherwise be accessible to the FAA;
- Heighten the level of FAA surveillance for at least the first 5 years of an air carrier's operation;
- Devise new staffing standards to assigning FAA Flight Standards personnel; and,
- Design a new FAA Flight Standards pay system.[95]

The memorandum stated that implementation of changes related to the surveillance recommendation were expected by October 1999. It stated that guidance and training

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[94] Including better dissemination of PTRS data from the safety performance analysis system (SPAS). SPAS is an automated system that processes data from more than 25 databases and can compare the current-to-past performance of an air carrier to its own records or to the average performance of the entire industry segment in which the carrier is categorized. In addition, a January 15, 1997, FAA memorandum stated that changes were planned to improve geographic resource targeting, assigning geographic inspectors work based on "identified targeted inspection needs," and to "ensure overall certificate management goals are met."

[95] The pay system changes are designed to make it easier to lure highly experienced principal inspectors to certificates normally handled by inspectors at lower pay grades.

"to give inspectors a broader perspective on air carrier operations and to help them recognize and identify systemic deficiencies" was expected to be in place by December 1998.

The recommendation to make FAA surveillance more targeted and systematic resulted in a "comprehensive analysis of FAA's certification and surveillance processes" conducted by an FAA team and a team from Sandia National Laboratories, according to the memorandum. The memorandum stated that the findings of that analysis resulted in a decision to develop the Air Transportation Oversight System (ATOS).

FAA representatives involved with ATOS development and implementation told Safety Board investigators that the FAA/Sandia team concluded that under current oversight programs "system failures (Fine Air for example) are hard to detect" and that "data collection, analysis and corrective actions are not well focused." The FAA representatives stated that ATOS emphasizes the analysis of "system failures...as opposed to focus on random events" and will improve the reporting, evaluation, and dissemination of such failures and trends to inspectors. In addition, systematic analysis of data collected from inspections and other sources will be used for more aggressive intervention, according to the FAA. The ATOS system will be implemented at 10 major air carriers by October 1998, the FAA officials stated.

On February 16, 1995, a DC-8-63 operated by ATI was destroyed by ground impact and fire during an attempted takeoff from Kansas City International Airport, Kansas City, Missouri. The Safety Board determined that the probable cause of the accident was the loss of directional control by the pilot-in-command during a three-engine takeoff and his decision to initiate rotation below the computed rotation speed. In its findings from the accident, the Safety Board expressed concern about FAA oversight of the airline's operations. The Safety Board noted that the POI assigned to ATI "maintained that a lack of funding limited the number of oversight activities, such as en route observations, especially observations of international operations performed by ATI. While the company was expanding rapidly and hiring large numbers of new pilots, the POI was immersed in the administrative detail of merging two certificates." As a result of this finding, the Safety Board issued a safety recommendation to the FAA asking it to do the following:

> Evaluate the surveillance programs to ensure that budget and personnel resources are sufficient and used effectively to maintain adequate oversight of the operation and maintenance of both passenger and cargo carriers, irrespective of size. (Class II, Priority Action) (A-95-111)

In a February 12, 1996, response the FAA stated that "surveillance programs are reviewed on a continuous basis" and that adjustments are made "to target surveillance activities to those areas identified as needing a change in surveillance activity based on observed trends." The FAA response noted that "budget constraints have an impact on all programs," but added that the FAA had "evaluated the specific impact on flight standards surveillance programs and is satisfied that resources are properly allocated to maintain oversight at an acceptable level." The FAA response concluded that it had addressed the intent of A-95-111. The Safety Board, in a July 5, 1996, letter to the FAA, noted that the FAA Flight Standards National Field Office was "expanding its analytical capabilities, which the FAA states will further increase effectiveness and improve the reliability of all surveillance activities." Based on the FAA's response, the Safety Board classified A-95-111 "Closed—Acceptable Action."

1.18.11 Previous FDR-related Recommendations

The Safety Board has issued a series of recommendations related to a variety of FDR issues since the early 1970s.[96] On March 1, 1991, the Safety Board addressed the airworthiness of FDRs in two safety recommendations issued to the FAA. The Safety Board asked the FAA to develop permanent policy and guidance material for the continued airworthiness of FDR systems that required operators to maintain, as part of the aircraft records, specific information related to the make and model of the FDR, the make and model of the flight data acquisition unit (FDAU), and recorder parameters (Safety Recommendation A-91-23). The Safety Board also asked the FAA to require operators to maintain the current information for each unique digital FDR configuration in its inventory using a single, universally adopted format (Safety Recommendation A-91-24). On December 18, 1991, the FAA responded that it was "planning to develop an advisory circular (AC)[97] to address the installation and maintenance of digital [FDRs] and flight data acquisition units. The AC will reference the appropriate regulatory requirements and will contain the universal documentation format for each DFDR aircraft configuration and installation." On April 22, 1994, the Safety Board reclassified Safety Recommendations A-91-23 and -24 "Open—Unacceptable Response" because no progress had been made by the FAA on this proposal.

On January 16, 1997, the FAA approved Notice N8110.65, which provided guidance to FAA inspectors regarding checking for compliance with FDR requirements. The notice also addressed problems in FDR documentation.[98] The notice did not address specific FDR certification requirements or elements of an FDR maintenance program and expired on January 16, 1998.

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[96] For example, Safety Recommendation A-73-116 asked the FAA to require FDR readouts to ensure that the parameters required were being recorded within the ranges, accuracies, and recording intervals specified in Part 121.343 (A)(2), Appendix B. The Safety Board classified A-73-116 "Closed—Acceptable Alternate Action" on May 15, 1974, based on an FAA response that corrective action had been taken. Also in 1974, the Safety Board issued Safety Recommendation A-74-090, which asked the FAA to require a computer or analog readout of actual flight data for all parameters during prescribed maintenance checks of Lockheed Aircraft Service Company FDRs.

[97] An AC provides nonregulatory guidance to certificate holders for a means (but not necessarily the only means) to comply with Federal Aviation Regulations.

[98] The notice stated that required documentation included FDR make and model and registration number and parameter name, mnemonic code, source, parameter word location, subframe, assigned bits, range, sign convention, engineering unit, and discrete parameters. The notice also "defines a standardized electronic database for the documentation of flight data recorder system characteristics."

On May 22, 1997, the Safety Board wrote to the FAA following a spate of accidents and incidents that involved problems with FDR recordings.[99] In its investigation of these accidents, the Safety Board determined that these recording problems were especially prevalent for airplanes that were originally fitted with a six-parameter FDR and retrofitted to record five additional parameters in accordance with CFR 14 Part 121.343 (c).[100] In its recommendation letter to the FAA, the Safety Board stated that it had encountered problems in its investigations of accidents and incidents during a 2-year period involving four carriers and eight airplanes, and that it was concerned that "problems regarding the installation, maintenance and documentation of 11-parameter FDRs may exist with other carriers." In one accident involving a Millon Air DC-8F, the Safety Board found that the FDR's normal acceleration, longitudinal acceleration, altitude, EPR, and airspeed values were erroneous or inactive. "These deficiencies raised serious questions regarding the validity of the remaining parameters...and failed to yield critical data required by the Safety Board for reconstruction of the airplane motion and crew performance."

The May 1997 letter also stated that the need for long-term measures to ensure adequate FDR system documentation was illustrated by a November 12, 1996, incident involving an Express One B-727 that overran the runway during a landing in Orebro, Sweden. In attempting to readout the FDR for the Swedish government, the Safety Board was unable to obtain FDR documentation (including conversion equations and sampling rates) from the operator or from the company that performed the retrofit on the FDR. The letter stated, "Without the documentation specific to this FDR system...[the Safety Board had to use] generic information from the Board's laboratory archives for similar FDR configurations to read out the recorder and, therefore, cannot be certain that the data adequately reflect actual operating conditions."

The Safety Board concluded in its safety recommendation letter that "the issues of FDR installation, documentation, and maintenance need to be addressed beyond the [January 16,

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[99] In its recommendation letter to the FAA, the Safety Board listed a series of recent accidents and incidents in which malfunctioning FDRs were involved, including the October 22, 1996, accident involving a Millon Air B-707 (see section 1.18.3), and a May 28, 1995, accident involving a Millon Air DC-8. Other accidents include four accidents involving DC-9 airplanes operated by ValuJet in 1996; a February 16, 1995, accident involving an ATI DC-8; and a November 12, 1996, accident in Orebro, Sweden, involving an Express One B-727. Since the Fine Air accident, the Safety Board encountered yet another malfunction involving an 11-parameter retrofit, installed on an American Airlines Boeing 727 that landed short of runway 14R at O'Hare International Airport, in Chicago, Illinois, on February 9, 1998. Although the investigation is not complete, an initial readout of the accident airplane's FDR determined that data recorded on the elevator/pitch and longitudinal acceleration parameters were unuseable, resulting in the loss of data potentially critical to determining the cause of the accident. FDR system documentation indicated that the elevator position sensor might have been installed incorrectly, and that this was not discovered during a functional check conducted in 1997.

[100] Airplanes manufactured before May 26, 1989, that were type certificated before September 30, 1969, must meet the following requirements: 14 CFR 121.343 (b) requires digital recording of the following six FDR parameters: time, altitude, airspeed, vertical acceleration, heading, and time of each radio transmission. 14 CFR 121.343 (c), which became effective on May 26, 1995, requires the following additional parameters: pitch attitude, roll attitude, longitudinal acceleration, control column or pitch control surface position, and thrust of each engine.

1998] expiration date" (of FAA Notice N8110.65) and issued the following safety recommendations to the FAA:

> Take action within 180 days to ensure compliance of the U.S. carriers subject to 14 CFR 121.343 (c). Actions should include (a) performing a readout of each retrofitted airplane's 11-parameter flight data recorder (FDR) to determine that all required FDR parameters are being recorded and to verify that each parameter is working properly; and (b) reviewing the FDR system documentation to determine compliance with the range, accuracy, resolution, and recording interval specified in 14 CFR Part 121, Appendix B. (A-97-29)
>
> Complete the planned flight data recorder (FDR) advisory circular (AC) to define FDR certification requirements and FDR maintenance requirements, and incorporate the FDR documentation standards contained in notice N8110.65. The AC should be released no later than January 16, 1998. (A-97-30)

The Safety Board's May 22, 1997, letter also noted that incorporating the FDR documentation standards in Notice N8110.65 into the AC would satisfy the intent of Safety Recommendations A-91-23 and -24.

In its July 14, 1997, response letter to Safety Recommendation A-97-29, the FAA stated that it agreed with the recommendation's intent and said it would issue a flight standards information bulletin "to direct principal airworthiness inspectors to request that their assigned air carriers perform a readout of each retrofitted airplane's 11-parameter FDR, which has been modified from foil to solid-state recorders, to ensure that all required FDR parameters are being recorded and to verify that each parameter is working properly." The FAA letter stated that inspectors would be directed to accomplish this within 180 days of the bulletin's issue date.

Flight Standards Handbook Bulletin for Airworthiness (HBAW) 97-13B (Order 8300.10) became effective on December 15, 1997, to provide inspectors with "policy/guidance to ensure continued proper operation and recording of data" by FDRs. The bulletin stated that an FDR maintenance program "should define administrative procedures for scheduling, accomplishing, and recording of maintenance/inspection actions; identification of items to be inspected; establishment of time-in-service intervals for maintenance/inspections; and details of methods/procedures used." In addition, HBAW 97-13B stated that functional evaluation is defined as a "recorded data dump, conversion to engineering units and assessing that the DFDR is receiving, transcribing and decoding sensor information properly." According to the bulletin, the "initial DFDR system maintenance may be scheduled during the heavy maintenance or C check or equivalent period of time." The bulletin also stated that in the event that a deficiency in an airline's FDR maintenance program is discovered by a PAI, modifications "should be accomplished within 4 months from the date of issuance of this bulletin (April 15, 1998). In addition, PAI action should include air carrier operator readout of each airplane's DFDR to determine that all required DFDR parameters are being recorded, and to verify that each parameter is working properly." No specific timetable was attached to this action item.

In its July 14, 1997, response to Safety Recommendation A-97-30, the FAA also stated that it agreed "with the intent of this safety recommendation and will complete the [FDR certification and maintenance] advisory circular for FDR certification and maintenance requirements by January 1998."

1.18.12 General Accounting Office Survey of FAA Inspection and Enforcement

In a February 1998 report, the U.S. General Accounting Office (GAO) examined the FAA's inspection and enforcement process from 1990 through 1996.[101] The report, which analyzed FAA inspection and enforcement data for that period and the results of nationwide inspector surveys and interviews, concluded that the "impact of FAA's enforcement actions on compliance is difficult to assess because the FAA has not followed up on the aviation industry's implementation of corrective actions." According to the report, during the period studied, "nearly 96 percent of the 2 million inspections conducted by Flight Standards inspections resulted in no reports of problems or violations." The report noted that "many inspectors do not report all problems or violations they observe" and that "many inspections are not thorough or structured enough to detect many violations." The FAA's inspection tracking systems "do not distinguish major from minor violations," the report said. It concluded that the "FAA's information on compliance in the aviation industry is thus incomplete and of limited use in providing early warning of potential risks and in targeting inspection resources to the greatest risks." The GAO noted that the low enforcement rate reflected, in part, the FAA's "emphasis on gaining voluntary compliance," but added that inspectors often "do not initiate enforcement cases because doing so entails too much paperwork, especially for minor violations."

The GAO report recommended that the FAA Administrator to do the following:

- Revise FAA's order on compliance and enforcement to specify that FAA's inspection staff are required to report all observed problems and violations in their respective program office's database for tracking the results of inspections;

- Provide guidance to FAA's inspection staff on how to distinguish major from minor violations and to legal staff on how to identify major legal cases; and,

- Improve and integrate FAA's inspection and enforcement databases to (1) identify major violations and major legal cases; (2) target inspection and legal resources to the violations and enforcement cases with the greatest potential impact on aviation safety and security; and (3) link inspection and enforcement data so that violations can be tracked from their identification through their resolution.

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[101] General Accounting Office. 1998. *Aviation Safety: Weaknesses in Inspection and Enforcement Limit FAA in Identifying and Responding to Risks.* GAO/RCED-98-6. Washington, DC.

The FAA response included in the report stated that the GAO's conclusions were based on "the use of inappropriate performance measures and selectivity in reporting survey results." According to the FAA response, "the safety record of the air carriers transporting passengers and GAO's survey data on inspectors' assessments of their success in fostering compliance would be better measures of the industry's compliance than inspection results."

2. ANALYSIS

2.1 General

The three-member flightcrew was properly certificated and qualified in accordance with applicable Federal regulations and company requirements. There was no evidence that any medical, behavioral, or physiological factors affected the flightcrew on the day of the accident. Weather was not a factor in the accident.

The airplane was properly certificated, equipped, and maintained in accordance with Federal regulations and approved procedures (with the exception of the FDR system, which was not functioning properly at the time of the accident). There was no evidence that failures of the airplane's structures or flight control systems contributed to the accident. A postaccident examination of the airplane's engines and the results of a sound spectrum study of engine noises recorded on the CVR indicated that all four engines were developing power at impact. Popping noises and flames coming from one or more engines reportedly heard and seen by witnesses after takeoff, and engine performance data (engine fan or N_1 speed) derived by Safety Board investigators, were consistent with engine compressor surges[102] induced by extremely high AOAs. Because no evidence of preexisting engine damage was found and engine fan speeds remained high, the Safety Board concludes that the compressor surges, or stalls, were caused by the airplane's attitude before impact, that no significant loss of engine thrust occurred, and that engine performance was not a factor in the accident.

After considering the accident scenario, including the performance of the aircraft and flightcrew, this section evaluates the cargo loading procedures of Aeromar and Fine Air, the FAA's surveillance and oversight of cargo loading, and issues relating to the inadequacies of the FDR system of the accident airplane. The analysis concludes with an examination of the continuing airworthiness surveillance function of Fine Air.

2.2 Accident Scenario

The airplane departed controlled flight shortly after rotation, following an apparently normal taxi and takeoff roll. The Safety Board's correlation of data from the FDR and CVR determined that the stick shaker warning activated when the airplane was at an altitude of about 100 feet msl. According to the Board's performance study of the airplane's motion during the accident sequence, about 16 seconds after the start of rotation, at an altitude of about 300 feet msl, the airplane reached an extremely nose-high pitch attitude in the range of 30° and an AOA approaching 20°, which resulted in an aerodynamic stall (an AOA of 15° was sufficient to bring the airplane into the stall region). Subsequently, the AOA decreased toward 10°, and the pitch decreased to below 20°, resulting in a brief recovery from the stall, followed by another AOA increase into the stall region 5 seconds later (the stall warning stopped at 12:36:12 and resumed at 12:36:17).

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[102] An engine compressor stall, or surge, results from an interruption of normal airflow through the engine, which can be caused by an engine malfunction or reduction of inlet airflow at high angles of attack.

The ground scars and the airplane damage indicated that at impact, the pitch angle was about 23°, while the flightpath angle was about 26° down. This resulted in an AOA of at least 49° at the time of impact, consistent with the airplane being in a deep stall. A continued stall is also consistent with the stick shaker stall warning and engine surge sounds recorded on the CVR in the final moments of the flight and the witness statements about pitch attitude during flight and at ground impact. The performance study showed that once the initial stall was reached, full recovery was unlikely because of the airplane's low altitude and the airplane's rapidly decreasing performance. Thus, based on analysis of FDR, CVR, and postaccident airplane performance data and on witness statements, the Safety Board concludes that the airplane pitched up quickly into a stall, that it recovered briefly from the stall, that it stalled again, and that recovery before ground impact was unlikely once the stall series began.

2.2.1 Airplane Handling Characteristics

The weight and balance form provided to the flightcrew showed a calculated CG location at 30.0 percent MAC. However, the Safety Board and the Douglas Products Division calculated a CG of 32.8 percent MAC based on a loading scenario developed from information provided by Aeromar loaders, Fine Air flight follower testimony, pallet weight documentation, and postaccident communication with Aeromar representatives. The Safety Board also notes that a relatively small addition to and/or redistribution of cargo could have moved the airplane's CG beyond the aft limit of 33.1 percent MAC.

The succession of errors made by Fine Air and Aeromar in loading this flight and the deficiencies in the Aeromar and Fine Air loading procedures identified during postaccident FAA inspections (for a detailed discussion of cargo loading issues, see section 2.3.1) made it impossible to precisely determine the weight and CG from the data that were available following the accident. For example, the cargo destined for the accident airplane was listed as weighing 89,719 pounds when it arrived at Aeromar's warehouse in big pacs and boxes. After being put on pallets and secured with plastic covers and netting, the cargo was listed on the Aeromar pallet load sheet as weighing 88,923 pounds, or 796 pounds less than the cargo weighed at arrival. Pallets and netting added an additional 275 pounds per pallet (or about 4,400 pounds to the total cargo weight). Based on postaccident Aeromar statements that the entire cargo delivered to Aeromar was loaded onto pallets for shipment on the accident airplane, the actual cargo weight could have been at least 94,119 pounds. Thus, the weight of the cargo that Aeromar provided to Fine Air could have been 5,196 pounds more than listed on the pallet weight form (which resulted in the CG of 32.8 percent MAC). This additional weight could have had a significant effect on the CG of the airplane, depending on how it was distributed through the cabin.[103]

In February 1998, the Safety Board conducted a series of tests using a DC-8 full motion flight training simulator. Multiple takeoff attempts were simulated using aircraft weight,

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[103] Based on a payload weight of 94,119 pounds, the Safety Board calculated that the redistribution of 250 pounds from the front to the rear of the airplane could have resulted in a CG of 33.2 percent MAC. Redistribution of 1,200 pounds from the front to the rear could have resulted in a CG of 35 percent MAC.

flap settings, and thrust values equivalent to the accident conditions and a range of CG values. The simulator flight tests suggest that at 33 percent MAC, the column inputs recorded on the accident airplane's FDR might have been sufficient to prevent the pitch-up and stall. Further, at 35 percent MAC, the simulator reached the stall condition more quickly than did the accident airplane. Although adequate control power existed from the elevators and pitch trim to recover the airplane at 35 percent MAC, successful recovery required an immediate and aggressive control input response (full forward column, which could be assisted by nose-down trim). Pilots involved in the simulation reported that their immediate control inputs were successful for the conditions tested because they were anticipating the pitch-up at rotation.[104] At CG values aft of 35 percent, the airplane was increasingly subject to autorotation tendencies well before rotation speed and to tail strike on the runway, which did not occur during the accident. However, based on the loading information and the simulator tests, the Safety Board concludes that the CG of the accident airplane was near or even aft of the airplane's aft CG limit.

Statements by the flightcrew on the CVR show that the stabilizer trim was set during taxi-out at 2.4 units ANU, the value appropriate for the trim setting and CG of 30 percent MAC that the flightcrew had been given. The number of trim-in-motion tones recorded on the CVR during the recovery attempt and the full-nose-down trim setting found at impact were also consistent with the flightcrew having set 2.4 units during taxi.

The Safety Board considered the effects of different aircraft loadings on CG location and the associated pitch trim settings. The investigation found that 13 pallets had been moved farther aft than indicated on the loading sheet. At 88,923 pounds total cargo weight, moving the 13 pallets aft (and turning pallet four 90°) would have shifted the CG from 24.0 percent MAC (requiring 5.4 units ANU pitch trim) to 32.4 percent MAC (1.0 units ANU). Further, if the cargo weight were 94,119 pounds, the CG would have shifted from 24.0 percent MAC (5.4 units ANU) to 32.8 percent MAC (0.9 units ANU). Thus, pushing the 13 pallets aft shifted the CG farther aft by at least 8 percent MAC. Further, because the accident airplane's stabilizer trim setting was 2.4 units ANU, the Safety Board concludes that the CG shift resulted in the airplane's trim being mis-set by at least 1.5 units ANU (2.4 minus 0.9 units at 94,119 pounds).

Such a mistrim would cause a greater than expected nose-up pitching moment. This would be exacerbated by the lighter control column forces that result from an aft CG location. Consequently, the Safety Board concludes that the aft CG location and mistrimmed stabilizer presented the flightcrew with a pitch control problem; however, because the actual CG location could not be determined, the severity of the control problem could not be determined.

The simulator flight tests could not replicate the accident flight precisely because of limitations inherent in the simulator; for example, the aerodynamic data upon which the

[104] In its investigation of the 1993 accident involving a United Airlines DC-8-54F in Detroit (see section 1.18.9), the Safety Board found that "recovery of the airplane at rotation was possible if immediate nose-down trim was applied along with full forward elevator input." However, the Safety Board concluded that "once the airplane left the ground and started to accelerate, recovery was improbable."

simulator's performance was based may not accurately model the actual airplane's performance in ground effect (during rotation and initial climb) or when high-pitch rates are present near stall. Further, the simulator's performance characteristics become invalid in the stall region. Timing of the control column movements in the simulated takeoff attempts was also a factor. Evaluation of the simulator data showed that small differences in the timing of inputs produced dramatically different results 5 to 10 seconds later.

Unfortunately, it was also not possible to replicate precisely the flightcrew's control inputs because, due to insufficient documentation, the CCP positions recorded by the accident airplane's FDR could not be converted into precise position values but rather represented relative motion. The Safety Board could not determine with certainty the correlation between the CCPs recorded by the FDR and actual positions of the control column on the airplane. Thus, the simulator tests did not permit the Safety Board to determine precisely the response of the accident airplane to the flightcrew's control inputs.

2.2.2 Flightcrew Actions

Statements recorded on the CVR indicated that the flightcrew recognized a problem with airplane handling about the pitch axis immediately as the airplane rotated. At 12:35:51.5, 1.6 seconds after the "rotate" callout and about 1 second after the first officer began to move the control column aft, the captain began his "easy, easy, easy, easy" remark. Based on FDR data, it appears that the captain made his statement before the airplane's pitch attitude had rotated significantly nose up. The CCP moved aft a total of about 5°. About 2 seconds later (at 12:35:53.5), still during rotation, the FDR showed forward movement of the control column. The magnitude of the forward movement was about 4° from its most aft position; however, about 2 seconds after the start of the forward motion it was moved aft again. At 12:35:57, the control column was moved forward, and it reached its most forward position (presumed to be the full forward limit of the control column) at 12:36:01.

The first officer's continued aft column input for 2 seconds after the captain began his "easy, easy, easy, easy" remark exacerbated the pitch up that was developing from the mistrimmed stabilizer. However, the first officer's 2-second response time in responding to the captain was understandable in light of the physiological, neurological, and cognitive contributors to reaction time. Further, is not clear that the flightcrew would have recognized the need for abrupt, aggressive, and sustained action at the initiation of the pitch up.

Regarding the first officer's subsequent aft control column input (at 12:35:54.5), the Safety Board notes that flightcrews are trained to avoid rapid and excessive control inputs and to gauge the results of control inputs before making additional corrections. In moving the control column forward and aft, the first officer might have been attempting to judge what nose-down control column inputs were required to correct the airplane's developing pitch-up attitude. The Safety Board also notes that the application of immediate and forceful nose-down control inputs at rotation is counterintuitive and contrary to the training and experience of line flightcrews.

According to the CVR, the first trim-in-motion sound occurred a fraction of a second before the first aural stall warning (at 12:36:02), indicating that the trim inputs were not initiated until the accident airplane was already very close to a stall. Although aggressive nose-down trim inputs were made thereafter and until the trim reached its full nose-down position, about a 5-second delay occurred between the flightcrew's first attempt to control the pitch up with nose-down column inputs and the first inputs of nose-down trim.

If the first officer had chosen to trim the airplane in the first, critical moments during and after rotation, he would have obtained a greater nose-down pitching moment and might have been able to correct most, or all, of the mistrim condition, preventing the airplane from stalling. The Safety Board considered the possibility that a more experienced pilot, particularly one who had previously encountered an aft-loaded, out-of-trim condition on takeoff, might have assessed the situation more rapidly and engaged the airplane's powerful pitch trim more quickly to aid in the recovery attempt. For example, if the captain had been flying the takeoff, he might have more quickly recognized the need for and applied a trim correction.

Although the Safety Board was unable to determine precisely how far aft the CG was located and thus the extent to which the airplane was mistrimmed, the Safety Board concludes that the mistrim of the airplane (based on the incorrectly loaded cargo) presented the flightcrew with a situation that, without prior training or experience, required exceptional skills and reactions that cannot be expected of a typical line pilot. Although the unanticipated nature of the rapid pitch up was an important aspect of the situation, the Safety Board concludes that training for flightcrews in dealing with misloading, miscalculated CG, and mistrimmed stabilizers would improve the chances for recovery from such situations. However, there is no current FAA requirement for air carriers to provide flightcrews with training in identifying and responding to a rapid-pitch-up during rotation from a mistrimmed stabilizer. Therefore, the Safety Board believes that the FAA should require all 14 CFR Part 121 air carriers to provide flightcrews with instruction on mistrim cues that might be available during taxi and initial rotation, and require air carriers using full flight simulators in their training programs to provide flightcrews with Special Purpose Operational Training that includes an unanticipated pitch mistrim condition encountered on takeoff.

2.3 Cargo Loading

2.3.1 Cargo Document Preparation, Communications, and Ramp Delivery Procedures

In the hours before the accident flight, the exchange of airplanes required a series of significant cargo paperwork changes by Fine Air flight followers and Aeromar employees. Fine Air flight followers determined that the cargo weight would be 87,923 pounds and that the CG and trim would be 30 percent MAC and 2.4 units ANU if the airplane was loaded as directed. Fine Air flight followers refined the weight and balance calculations for N30UA, the originally assigned airplane, to accommodate weight limitations for N27UA and then defined the pallet sequence to produce a more aft CG of 30 percent MAC (moving the pallet in position 13 to position 17 and leaving position 13 vacant). Fine Air flight followers stated that these changes were communicated to Aeromar by fax and by direct telephone conversations. However, the fax communications were the subject of conflicting statements by personnel from both companies. Further, there was no evidence that the revised paperwork was picked up by the Aeromar security guard responsible for the accident flight's cargo.

Although the Fine Air flight follower told Aeromar to reduce the weight of pallet "G" by 1,000 pounds (reducing the total cargo weight to 87,923 pounds) because of the landing weight restrictions for N27UA, that weight was not removed by Aeromar. Therefore, the final load sheet provided to the flightcrew was in error by an additional 1,000 pounds. The mistake was missed by Aeromar and Fine Air. The Fine Air flight follower also improperly recorded the pallet weight in position 17 as 5,860 pounds on the final load sheet, rather than 5,960 pounds as recorded by Aeromar on the pallet loading form.

The Safety Board's investigation also revealed errors in the printed load sheet form. The form indicated that it was for a DC-8-61 airplane, but one part of the form that affected the CG calculation (the fuel distribution scale) was based on data for DC-8-62 and -63 airplanes. The printed Fine Air load sheet form also incorrectly listed the maximum weight allowable for pallet position 18 as 6,088 pounds, instead of the correct weight of 3,780 pounds, which resulted in pallet position 18 exceeding its weight limitation by 1,247 pounds on the accident flight. Calculations based on this form resulted in a computed CG that was farther aft than the actual CG. The proper loading form would have yielded a 26.5 percent MAC CG for 87,923 pounds rather than 30 percent MAC. The built-in CG errors could have accounted for reported flightcrew requests to Fine Air flight followers to provide more rearward CGs to improve the flying characteristics of their airplanes. However, moving the CG aft would not correct the mistrim but would lighten control forces somewhat.

Weight and balance errors were a persistent problem at Fine Air previously identified by two DoD inspections (in 1994 and 1996 respectively) and two FAA inspections (a preaccident NASIP inspection and a postaccident RASIP inspection). Shortly after the 1996 DoD inspection, Fine Air proposed redesigning its load sheet "as an interim measure until they automate weight and balance computations." However, this redesign was not accomplished before the accident and would likely not have revealed the fuel loading and pallet weight errors in the load sheet. Further, the Safety Board found during its investigation that Fine Air's load sheet, revised after the accident, also contained errors and discrepancies when compared to Douglas data, and that Fine Air's stabilizer trim setting data sheet also contained errors. The Safety Board notes with disappointment that Fine Air revised the load sheet form incorrectly after errors were found after the accident, and that FAA principal inspectors assigned to Fine Air failed to detect this mistake. Based on an examination of Fine Air and Aeromar loading documents and statements from Fine Air and Aeromar employees, the Safety Board concludes that procedures used by Fine Air and Aeromar to prepare and distribute cargo weight pallet distribution forms and final weight and balance load sheets were inadequate to ensure that these documents correctly reflected the true loading of the accident airplane. The Safety Board is concerned that similar problems may exist at other carriers. Therefore, the Safety Board believes that the FAA should conduct an audit of all CFR Part 121 supplemental cargo operators to ensure that proper weight and balance documents are being used, that the forms are based on manufacturer's data or other approved data applicable to the airplane being operated, and that FAA principal inspectors confirm that the data are entered correctly on the forms.

There was conflicting information about whether the Aeromar and Fine Air employees involved in the loading operation were aware of the airplane change and of the changes in the loading instructions for the accident airplane. Aeromar's vice president stated that a company security guard picks up loading paperwork at Fine Air "immediately prior to the loading of a plane" or when the security guard delivers the cargo to the Fine Air ramp. The Fine Air flight follower who calculated the original load for N30UA stated that the Aeromar security guard in charge of the cargo picked up the paperwork with the cargo before 0600 on the day of the accident. However, the flight follower who went on duty after 0600 stated that the security guard did not return to pick up the revised weight distribution form. Although Fine Air flight followers stated that they faxed updated weight distribution and loading information to Aeromar before the flight, Aeromar's vice president stated that such a practice was "neither customary or usual." Based on interviews with Aeromar employees, the security guard assigned to the flight's cargo would have already been on duty at the Fine Air ramp when Fine Air flight followers said that they faxed the load changes to Aeromar. Testimony by Aeromar loaders indicated that cargo pallets were arranged on the ramp for loading according to the weight distribution form calculated for N30UA. Therefore, the Safety Board concludes that the security guard was not aware of the airplane change, and that he instructed Aeromar loaders to load the airplane in accordance with the weight distribution form he possessed for N30UA.

2.3.2 Airplane Loading Operations

Although there were conflicting statements about several aspects of the loading process, Aeromar cargo handlers' descriptions of the initial loading were consistent with the planned weight and balance configuration for N30UA, with pallet positions 2 and 17 initially left vacant. However, Aeromar cargo handlers stated that pallets could not be secured with locks during the initial loading. A subsequent check by the Aeromar supervisor determined that pallet locks would not latch in the rear of the airplane because pallet edges were not positioned properly, preventing locks from engaging on each edge of adjacent pallets.[105] According to the statements of the loaders and supervisor, in an attempt to correct this, all pallets from position 5 aft were pushed back one position each, which resulted in pallet position 17 being filled and position 5 being emptied. Pallet 4 was turned 90° and pushed back, which resulted in the pallet occupying all of position 5 and part of position 4.[106] According to loader statements, pallet 3 was secured by locks on the front and back sides, which would have left position 2, by the cargo door, empty, with position 1 (with locks up) by the forward (cockpit) bulkhead. Thus, based on loader statements about how the airplane was first loaded and subsequent changes to the cargo's configuration, the Safety Board concludes that the accident airplane (N27UA) was initially

[105] The Aeromar loading supervisor said the locks would not latch because cargo extended over the sides of the pallets. Because of conflicting testimony, it could not be determined who first identified the problem with the loading and who issued instructions to rearrange the load.

[106] These actions were initiated by the loading crew or its supervisors and did not adhere to any planned loading configuration for the cargo on this airplane, which was calculated in Fine Air operations by the Fine Air flight follower.

loaded according to Fine Air's load distribution for N30UA; further, the final load configuration did not match the planned load for either airplane.

Loaders gave contradictory statements about the number of pallet engaged locks from positions 6 through 18 when the rearrangement and loading were completed. The Aeromar loading supervisor, who was responsible for ensuring that pallet locks were in place, stated that he put up several locks near position 18, and that he relied on other loaders to put locks up forward of that position. However, the Safety Board found considerable evidence indicating that few of the pallet locks were engaged. For example, 57 of the 60 locks recovered from the wreckage (from a total of 85 installed) were found in the unlocked position, and postaccident testing found no evidence of cracking, shearing, or elongation associated with impact damage and failure. Although it was the Aeromar loading supervisor's responsibility (according to his job description) to ensure that the locks were in place, he did not verify that they had been latched, relying instead on the thoroughness of loaders working in what was described as a hot, cramped, and stifling environment.[107]

Moreover, the Fine Air supervisor, who was the forklift driver (and, according to all parties involved, was not acting in a supervisory capacity) for the loading of the accident airplane, stated that when he was in charge of loading operations he always checked to make certain that the locks were up around pallet position 1. He said that he did so because these locks were readily visible to the flight engineer, who otherwise might insist on a reload if locks were down or missing. This implies that he believed it was less important to engage the locks that were not visible to the flight engineer, and suggests a casual attitude about the importance of aircraft weight and balance.

Cargo loading requires the coordination of a team under the direction of a supervisor to accomplish a multistep process, including identifying the appropriate pallet, loading the pallet onto the airplane, positioning the pallet inside the airplane, and securing the pallet in position. These basic steps were not followed during the loading of the accident flight. When it became evident to the loading crew that the cargo would not secure properly, decisions were made about pallet positioning and load security that suggested a desire to complete the job quickly. Little or no attempt was made to determine whether these changes would adversely affect the airplane in flight. Therefore, the Safety Board concludes that the Aeromar cargo loading supervisor failed to ensure that the pallets were loaded according to an approved load plan (in this case neither load plan was followed) and failed to confirm that the cargo was properly restrained.

Because there were vacant spaces in the cargo distribution and the cargo was not properly secured, the Safety Board considered whether shifting cargo at rotation could have contributed to the accident. Unsecured cargo pallets could shift during acceleration, and more significantly during rotation, if there were empty pallet positions between unsecured pallets.

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[107] For example, loaders said the temperature inside of the airplane was "just like an oven." However, it could not be determined to what extent, if any, these conditions contributed to the misloading of the airplane.

However, when Aeromar loaders pushed all of the cargo pallets from position 5 rearward one position and turned pallet 4 sideways into position 5, this created a line of contiguous pallets from position 5 to position 18, the aft-most cargo pallet position in the airplane. This suggests that the misloaded, aft-heavy condition existed at the time of rotation and was not caused by cargo shifting as the airplane's deck angle increased. However, based on loader statements that cargo extended over the sides of some pallets (which prevented the locks from being engaged), some shifting of cargo and additional compression might have occurred as the airplane's deck angle increased. The Safety Board concludes that a significant shift of cargo rearward at or before rotation did not occur and was not the cause of the initial extreme pitch up at rotation; although, cargo compression or shifting might have exacerbated the pitch-up moment as the pitch increased.

Following the accident, the FAA's RASIP inspection team found numerous problems related to Fine Air's loading operations, including improperly secured and broken pallets, frayed and broken netting, and deficiencies in the areas of weight and balance control, cargo weighing, and security. These areas were also addressed in a consent agreement Fine Air signed with the FAA in September 1997, in which the operator agreed to revise its cargo handling system and procedures, including its "maintenance program for cargo pallets and cargo restraint devices, cargo pallet loading procedures, cargo weighing procedures...aircraft loading procedures [and] aircraft weight and balance procedures."

As part of its revised procedures, Fine Air developed a loading supervisor certification form that loading supervisors must sign to indicate that the load was placed on the airplane according to plan and restrained properly. In addition, the revised FOM breaks down the loading process into specific procedures and steps to be followed by the loading supervisor when loading the airplane,[108] which helps to standardize the loading process.

However, the load certification form only contains an overall statement attesting to the fact that loading was performed in accordance with Fine Air's loading requirements. Cargo loading supervisors and cargo handlers work under difficult conditions that can include physical strain, time pressure, extreme temperatures, and nighttime hours, all of which can affect job performance. Thus, the Safety Board concludes that the difficult work environment of cargo loaders has the potential to cause loading errors if the loading process is not adequately structured to compensate for the detrimental environmental effects on human performance. However, these conditions can be mitigated by developing independent controls to ensure that critical steps in the loading process are completed properly. Therefore, the Safety Board believes that the FAA should require carriers operating under 14 CFR Part 121 to develop and use loading

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[108] In addition to the loading supervisor certification form, Fine Air made significant revisions to its FOM, AOM, and other documents outlining new load planning procedures, loader and supervisor responsibilities, and flightcrew responsibilities after resuming operations in October 1997 under the consent agreement. The airline stated that it now has provisions in place to ensure that pallets are built properly, that weights are verified (e.g., pallets are now weighed by Fine Air before being loaded), and that loading operations are thoroughly supervised.

checklists to positively verify that all loading steps have been accomplished for each loaded position on the airplane and that the condition, weight, and sequencing of each pallet is correct.

2.3.3 Operational Control

Fine Air's wet lease agreement with Aeromar called for Aeromar to provide "fuel, loading and unloading at all stops," but stipulated that Fine Air retained operational control of all flights, and that all servicing was to be done under the supervision of Fine Air employees. Fine Air's operational control responsibilities were also defined in the company's FOM and spelled out in an addendum to Fine Air's lease agreement with Aeromar. Although 14 CFR Part 121.537 outlines supplemental air carrier operational control responsibilities, the POI assigned to Fine Air stated that operational control for loading was not specifically addressed in the regulations. Further, the Safety Board could identify no such requirement in these regulations. However, the FAA stated in an October 1997 letter to Fine Air that under provisions of Part 121, "no aspect of operational control can be negotiated away...[including] loading of cargo as it relates to weight and balance requirements, cargo restraint requirements and hazardous materials requirements."

Although the terms of the wet lease agreement (later determined by the FAA to be a "transportation" or "charter" agreement) stated that Fine Air retained operational control, Fine Air managers stated that before the accident, the company did not supervise loading operations carried out by Aeromar. In addition, Fine Air did not weigh palletized cargo delivered by Aeromar or have other procedures in place to verify cargo weights and the accuracy of the load form provided to the crew by Fine Air flight following (see appendix F). The Safety Board concludes that Fine Air failed to exercise adequate operational control of loading operations conducted by Aeromar on the accident flight as required by Part 121, the operational control terms of its lease agreement with Aeromar, and its own operating policy. Further, the Safety Board concludes that Fine Air's failure to exercise adequate operational control was causal to the accident by creating an operational environment in which cargo was loaded into Fine Air airplanes without verification of pallet weights and proper load distribution and by fostering a management philosophy that allowed airplanes to be dispatched without verification and control procedures in place to ensure that load-related, flight safety-critical tasks had been accomplished.

2.3.4 Loader Experience and Training

Four of the Aeromar cargo handlers had previous experience in air cargo operations in Miami. However, one cargo handler and the Aeromar loading supervisor had no experience in air cargo operations before employment with Aeromar. The Aeromar loading supervisor was hired about 3½ months before the accident and had been promoted to supervisor about 2 weeks before the accident on the basis of his performance. All cargo loading personnel interviewed by Safety Board investigators accurately described how to engage and disengage cargo locks and demonstrated a general knowledge of proper cargo loading procedures.

Air carriers are currently not required to provide initial classroom training or recurrent training for personnel involved in cargo handling. Training for loading personnel at Aeromar and Fine Air was described as on-the-job training. Aeromar cargo handlers stated that they did not receive any classroom training and that their supervisor had provided verbal instructions and information about the job of loading an airplane when they first were assigned to the cargo ramp. Aeromar cargo handlers who had previously worked at Fine Air indicated that while at Fine Air they received no classroom training. The Fine Air loading supervisor also stated that he had received no classroom training for cargo loading. Although it appears that on-the-job training was an effective method of instruction for the basic technical job requirements, the misloading of the accident airplane indicates that loaders did not recognize the importance of loading an airplane consistent with the calculated weight and balance plan, or the importance of properly restraining the cargo. Therefore, the Safety Board concludes the loaders who loaded the accident airplane were not aware of the potentially catastrophic consequences of misloading the airplane and the failing to properly secure cargo, and that this contributed to the accident.

It is the Safety Board's understanding that cargo handler positions are typically entry-level positions characterized by relatively high rates of turnover. The Safety Board is concerned that because of a high turnover rate it can be difficult to control the quality of instruction delivered through on-the-job training. Because it is critical to the safety of flight to ensure that cargo has been loaded according to plan and properly restrained, all individuals associated with the loading process must be provided with consistent and comprehensive training in airplane loading.

After the accident, the FAA issued air transportation bulletin HBAT 97-12 to FAA Order 8400.10 "Air Transportation Operations Inspector's Handbook."[109] In this bulletin the FAA states the following:

> Currently, part 121, section 121.400 prescribes the requirements applicable to each certificate holder for establishing and maintaining a training program for crewmembers, aircraft dispatchers, and other operations personnel. While the term "other operations personnel" is not currently defined in this subpart, it is evident that employees of a certificate holder who have the duty to supervise the loading of an aircraft or who qualify and authorize other persons to perform this function, must be trained on the certificate holder's procedures.

The bulletin encouraged principal inspectors to review any training program operators had for their cargo loading supervisors.

In the consent agreement issued after the accident, the FAA required Fine Air to "review and revise as necessary a training program for cargo handlers and other personnel responsible for cargo handling and aircraft loading." In response, Fine Air created a training program for cargo loader supervisors and cargo handlers[110] that included approximately 7 hours of training including curriculum areas covering the following:

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[109] The bulletin was issued on September 5, 1997, as a Joint Flight Standards Handbook Bulletin; therefore, it was also added to FAA Order 8300.10, "Airworthiness Inspector's Handbook" as HBAW 97-12.

[110] Fine Air's training manual states that "This category of training is for an employee whose job description includes the identification of, positioning, direct and indirect handling of cargo to be loaded on FINE

- basic aerodynamics
- weight and balance for ground handlers
- safe handling of aircraft cargo
- pallet building, loading, and unloading.

The Safety Board considers the steps taken by Fine Air to provide formal training to its cargo handling personnel to be a significant improvement in its training program because the curriculum is standardized and training modules go beyond the technical requirements of the job. However, the Safety Board recognizes that the consent agreement was directed only to Fine Air and is concerned that the training programs of other operators may suffer from similar deficiencies. Further, HBAT 97-12 only encouraged inspectors to examine operators' training for supervisory cargo loading personnel, and inspectors do not have the appropriate guidance material to evaluate training programs in cargo handling operations.[111] Thus, the Safety Board concludes that formal training is necessary to ensure that cargo handling personnel receive standardized instruction on safety-critical aspects of the loading process.[112] Therefore, the Safety Board believes that the FAA should require training for cargo handling personnel and develop advisory material for carriers operating under 14 CFR Part 121 and POIs that addresses curriculum content that includes but is not limited to, weight and balance, cargo handling, cargo restraint, and hazards of misloading and require all operators to provide initial and recurrent training for cargo handling personnel consistent with this guidance.

2.3.5 Flightcrew Load Verification Responsibilities

According to the Fine Air AOM used at the time of the accident, the flight engineer was required to verify that at least three cargo pallet locks were locked at each position loaded with a pallet during his preflight check in Miami. However, Fine Air representatives told Safety Board investigators that it would have been "unlikely" for a flight engineer to make this check of the entire airplane during routine operations in Miami.[113] Other company personnel indicated that in Miami airplanes were typically loaded before flightcrews arrived and some loads did not provide sufficient clearance for the flight engineer to verify the status of the locks in

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AIR aircraft to ensure the proper loading and handling of cargo aboard company aircraft." In addition to initial training there are provisions for recurrent training in this program.

[111] FAA Order 8400.10 does not provide guidance on evaluating training programs for cargo loading operations. In contrast, FAA Order 8400.10 and AC 120-60 provide guidance material for FAA inspectors reviewing the initial and recurrent training programs that air carriers establish as part of their ground deicing and anti-icing programs under 14 CFR 121.629.

[112] At least one industry trade union, the International Association of Machinists and Aerospace Workers, stated that it offers training to ramp workers and other aviation personnel on the impact on flight safety of routine duties such as cargo loading, hazardous materials handling, and deicing operations.

[113] According to Fine Air's FOM, it is the joint responsibility of the first officer and the flight engineer to ensure proper airplane loading at outstations.

positions aft of the cargo door.[114] The Safety Board recognizes that Fine Air changed the flight engineer's preflight checklist after the accident as part of a review and revision of its loading procedures and that new controls are now in place to ensure that the locks are engaged. However, at the time of the accident the flight engineer faced inconsistent guidance and expectations about this task. Thus, the Safety Board concludes that although the flight engineer was required to ensure that all cargo pallet locks were locked, company operating procedures and practices in MIA hindered him from accomplishing this task. Further, the Safety Board is concerned that such differences between flightcrew requirements for loading oversight and actual operational procedures may exist at other air carriers. Therefore, the Safety Board believes that the FAA should review the cargo loading procedures of carriers operating under 14 CFR Part 121 to ensure that flightcrew requirements for loading oversight are consistent with the loading procedures in use.

Although they possessed the airplane's load sheet (based on numbers provided by Fine Air flight followers) and the flight engineer was required to conduct a visual inspection, the accident flightcrew had no practical way to verify the airplane's weight and balance and gross weight before takeoff. However, the Safety Board notes that an electronic system has been in widespread use for years in both cargo and passenger operations that provides flightcrews with a digital readout in the cockpit of weight and balance and gross weight values. The STAN system uses pressure transducers to convert main gear and nose gear shock strut air pressure to an electronic signal. The cockpit readout, on the flight engineer's instrument panel, provides the flightcrew with an independent, direct measure of the airplane's gross weight and CG. Cockpit instrumentation showing these values would have added a critical last-minute safeguard for this flightcrew. Thus, the Safety Board concludes that if the flightcrew had had an independent method for verifying the accident airplane's actual weight and balance and gross weight in the cockpit, it might have alerted them to the loading anomalies, and might have prevented the accident. Therefore, the Safety Board believes that the FAA should evaluate the benefit of the STAN and similar systems and require, if warranted, the installation of a system that displays airplane weight and balance and gross weight in the cockpit of transport-category cargo airplanes.

2.4 FAA Surveillance and Oversight

The FAA's RASIP inspection of Fine Air following the accident found anomalies that the inspection team's report characterized as "an indication of a systemic problem at Fine Airlines." Echoing findings in previous preaccident FAA and DoD inspections, the RASIP report stated that inspectors had found problems in the areas of weight and balance control, cargo weighing, the accuracy of pallet weights, the condition of pallets and netting, and the condition of

[114] Pallets are typically configured so that there is access to the area around the cargo door, to verify that door has been secured. Therefore, it is likely that the flight engineer was able to verify locks were up on positions 1 and 3 in the accident airplane. Loaders told Safety Board investigators that if these locks were not locked and visible to the flightcrew they risked being asked to reload. The current Flight Engineer's Preflight expanded checklist (page 6-12-19, issued 9/26/97, revision 35) only requires a check that all pallet locks installed in the airplane be operable. It no longer requires the engineer to ensure that a minimum of three pallet locks per position be used and locked.

airplane cargo compartments and equipment. All of these findings, the report concluded, had "an impact on the safety of flight."

FAA inspectors assigned to Fine Air and Miami FSDO managers stated that before the Fine Air accident, there was "no guidance," or "minimal guidance," in FAA written directives for the surveillance of cargo operations, and that there were no guidelines on how to evaluate the condition of pallets, netting, and other cargo equipment. The PMI assigned to Fine Air described his attitude to cargo inspection before the accident as "to us, cargo is cargo." However, the team leader of the postaccident RASIP inspection at Fine Air, who is a PMI assigned to the United Parcel Service certificate, stated that specific guidance should not have been needed to discover the problems the RASIP inspection team found relating to the condition of pallets, nets, and cargo deck flooring, noting that these problems were "evident." Moreover, during an en route inspection to Santo Domingo conducted a week before the accident, the Fine Air PMI was able to identify numerous loading problems, including damaged pallet netting, improper cargo loading, and a scale that was not in a location to weigh pallets. Although the PMI wrote a letter to Fine Air after the accident (on August 11, 1997) that asked Fine Air to amend its work cards for "C" checks in the areas identified as deficient during the en route inspection, no enforcement case was opened based on these findings, and the PMI did not take any other direct action to correct the immediate problem.

The manager of the FAA's Miami FSDO stated that he believed that the FAA surveillance of Fine Air's operations was "adequate" before the accident, but acknowledged that inspectors were "concentrating their emphasis on other areas," not on cargo loading. The FAA regional director, based in Atlanta, whose jurisdiction included the Miami FSDO, stated that "it's hard to define quality of surveillance," but acknowledged that the problems found in the RASIP should have been found earlier by the principal inspectors assigned to Fine Air.

Although the regional director noted that local inspectors can become bogged down in "certificate maintenance" (manual revisions, training program oversight, and other paperwork duties) at the expense of surveillance, even when they are aware of the findings of special inspections conducted by other teams, the director conceded that operations involving older airplanes, less experienced crews, and a "smaller [cost/profit] margin...are a concern." Nevertheless, cargo loading and weight and balance problems were repeatedly identified at Fine Air before and after the accident, and inspectors assigned to Fine Air had discovered and documented at least some of these problems before the accident. Therefore, the Safety Board concludes that the FAA inspectors assigned to Fine Air failed to ensure that known deficiencies in Fine Air's cargo operations were corrected. Thus, these problems went beyond a lack of broader FAA inspector guidance on inspecting cargo operations, and the FSDO manager conceded that senior FAA management had expressed "concern that we're not proactive."

Although the problems with the Miami FSDO's surveillance program at Fine Air pertained mostly to a failure to act on findings, the Safety Board is also concerned that the surveillance of cargo loading operations is not specifically required in the annual work programs established for FAA flight standards inspectors. The Safety Board concludes that the entire sequence of cargo loading operations, from preparation of the pallets/containers through the information provided to flightcrews, has a direct effect on flight safety and should not be neglected by the FAA surveillance program, particularly for the cargo air carriers operating under 14 CFR Part 121. Therefore, the Safety Board believes that the FAA should require all principal inspectors assigned to 14 CFR Part 121 cargo air carriers to observe, as part of their annual work program requirements, the complete loading operation including cargo weighing, weight and balance compliance, flight following, and dispatch of an airplane.

During its investigation of this accident, the Safety Board found numerous preaccident indicators of problems not only at Fine Air, but at other cargo Part 121 operators under the jurisdiction of the Miami FSDO. In the case of Fine Air, these included the findings of previous NASIP, RASIP, and DoD inspections at Fine Air. In another situation similar to Fine Air, Miami-based cargo operator Millon Air voluntarily ceased operations on October 24, 1996, following an FAA inspection conducted after a Millon Air Boeing 707 freighter crashed in Manta, Ecuador, 2 days earlier on October 22, 1996. (In its investigation of several previous accident and incidents involving Millon Air, the Safety Board had found a series of FDR-related maintenance deficiencies). In 1995, the FAA suspended the operating certificate of another Miami-based Part 121 cargo and passenger carrier, Arrow Air, after an inspection found evidence of serious safety violations. Thus, the Safety Board concludes that the Miami FSDO lacked clear management policies to ensure that sufficient and appropriate surveillance was conducted and that surveillance results were acted upon; further, the FSDO was not aggressive in its inspection and management of the Fine Air certificate and this contributed to the accident.

Such cases were not limited to the Miami FSDO. In the case of the May 11, 1996, accident in the Florida Everglades involving a ValuJet DC-9-32, FAA postaccident inspections found numerous maintenance and operational deficiencies that resulted in the air carrier ceasing operations when it entered into a consent agreement with the FAA in June 1996. Deficiencies in ValuJet's operations had been thoroughly documented in an FAA report prepared before the accident and in RASIP and NASIP inspections conducted before the accident. The February 14, 1996, report noted "some weakness in the FAA surveillance" of the airline and inattention to "critical surveillance activities." The report, which recommended that consideration be given to the "immediate recertification" of the airline, was not provided to the Atlanta FSDO or to ValuJet until after the accident. These maintenance and operations-related problems, which were identified by FAA regional management as requiring greater scrutiny and concern, should have been sufficient to alert the FAA's senior managers to the need for more aggressive surveillance before the Fine Air accident. Since the accident, FAA officials have acknowledged that under current oversight programs what they described as system failures like Fine Air are difficult to detect, and that the existing system of surveillance was inadequate. Moreover, a recent GAO report on the effectiveness of FAA inspector surveillance concluded that many FAA inspections "are not thorough or structured enough to detect many violations," and that inspectors often do not initiate enforcement actions because "doing so entails too much paperwork." Based on these repeated problem indicators and the FAA's acknowledgement of the shortcomings of its current oversight system, the Safety Board concludes that the deficiencies found in the Miami FSDO's oversight of Fine Air and other carriers in its jurisdiction are indicative of a broader failure of the FAA to adequately monitor air carriers, especially supplemental cargo carriers, in which operational problems had been identified.

Based on its investigation of the ValuJet Everglades and the Fine Air accidents, the Safety Board is also concerned about the effectiveness of the NASIP and RASIP inspection processes. In the case of each airline, preaccident inspections identified operational and airworthiness deficiencies. Although the findings of these inspections resulted in short-term corrective actions for the specific items that were found to be deficient, the inspections failed to identify and address systemic problems that were found in postaccident inspections of both carriers and that resulted in their temporary shutdown. The FAA has developed considerable information on cargo-related problems from the results of two special emphasis ramp checks conducted after the Fine Air accident. However, the FAA Administrator noted in a March 3, 1998, memorandum that "much work remains to correct systemic problems with FAA's aviation safety inspection program." Further, FAA representatives told Safety Board investigators that "data collection, analysis and corrective actions are not well focused." The results of this investigation indicate that these deficiencies apply to both local FSDO surveillance and to NASIP and RASIP inspections. Thus, the Safety Board concludes that NASIP and RASIP inspections are not adequately identifying and addressing systemic safety problems that exist in air carrier operations at the time the inspections are conducted. Therefore, the Safety Board believes that the FAA should review its NASIP and RASIP inspection procedures to determine why inspections preceding these accidents failed to identify systemic safety problems at ValuJet and Fine Air and, based on the findings of this review, modify these inspection procedures to ensure that such systemic indicators are identified and corrected before they result in an accident.

The Safety Board notes current FAA initiatives to redesign and improve FAA oversight of air carriers, including the development and implementation of the ATOS program designed to target resources and inspections to identify systemic safety problems. The Safety Board is also encouraged by the FAA's recent enforcement actions against cargo carriers based on standards developed after the Fine Air accident (see section 1.18.3). Also encouraging are FAA proposals to better focus geographic inspector surveillance, planned changes in the new entrant carrier certification process and improved methods for the collection, analysis, and inspector access to FAA surveillance and safety trend data (the more effective use and dissemination of SPAS and PTRS data). Although these and other proposed changes are in response to Safety Recommendation A-96-163, issued following the 1995 Tower Air accident, are steps forward, the Safety Board is concerned that some operators that may benefit most from additional scrutiny have not been included in the initial implementation phases of the ATOS program. The program is being launched at 10 of the nation's largest carriers, for which FAA surveillance is already considerable, and operational incidents and accidents are relatively rare.

Although it is understandable why the FAA wants to "refine the new model" before expanding to other sectors of the industry, the Safety Board is nevertheless concerned about the potential for delays inherent in the implementation of such a comprehensive redesign of the FAA surveillance system. Initial implementation at the 10 designated carriers is not scheduled until October 1998. Although the proposed changes to the FAA oversight system address the intent of Safety Recommendation A-96-163, the Safety Board will continue to monitor the FAA's progress in implementing these changes. Pending further action, the Safety Board reiterates its February 23, 1998, classification of Safety Recommendation A-96-163 as "Open—Acceptable Response."

However, the Safety Board remains concerned about the FAA's ability to successfully enhance its surveillance capability at current budget and personnel resource levels, especially at a time when the aviation industry is growing rapidly and increasing demands are being placed on the agency's certificate management system. Indeed, principal inspectors assigned to Fine Air stated that they needed assistance in accomplishing their tasks and that the number of en route inspections they conducted were reduced because of scheduling, workload, and budget constraints. Following a February 16, 1995, accident involving an ATI DC-8-63, the Safety Board issued Safety Recommendation A-95-111, which asked the FAA to determine whether its budget and personnel resources were sufficient to maintain its surveillance programs adequately. Although the Safety Board in 1996 classified A-95-111 "Closed—Acceptable Action" following an FAA response stating that resources were "properly allocated to maintain oversight at an adequate level," the Safety Board concludes that, based on its investigation of the Fine Air accident, current FAA personnel and budget resources may not be sufficient to ensure that the quality of air carrier surveillance will improve. Therefore, the Safety Board believes that the FAA should evaluate the surveillance programs to ensure that budget and personnel resources are sufficient and used effectively to maintain adequate oversight of the operation and maintenance of both passenger and cargo carriers, irrespective of size.

2.5 Loss of FDR Data

The failure of the accident airplane's FDR to record 6 of the 11 required parameters of data hampered the Safety Board's investigation into the pitch-up and stall events that resulted in the airplane's departure from controlled flight. The FDR did not record information about engine data, airspeed, pitch and roll attitudes, vertical acceleration, and microphone keying, all of which would have been immensely useful in understanding the accident scenario.

The Safety Board has long been concerned about problems related to the absence of FDR data critical to accident investigations and has made a series of recommendations beginning in the early 1970s to improve FDR accuracy, expand the number of parameters, and require verification of parameter recordings (see section 1.18.11). Continued concerns about the airworthiness of FDRs resulted in the Safety Board's issuing two recommendations to the FAA in 1991 (Safety Recommendations A-91-23 and -24; see section 1.18.8 for details) aimed at developing a permanent policy for FDR maintenance and recordkeeping. Further, in 1997, following a series of accidents that involved problems with recordings on retrofitted FDRs, the Safety Board issued two additional safety recommendations (Safety Recommendations A-97-29 and -30) asking the FAA to require readouts of retrofitted 11-parameter FDRs to ensure that all required parameters were being recorded properly and to complete, by January 1998, an FAA-promised AC addressing the installation and maintenance of FDRs.

The problems with the Fine Air FDR in this accident once again underscore the need for prompt action in determining the functionality and airworthiness of retrofitted 11-parameter FDRs, the importance of FDR certification and maintenance requirements, and the importance of accurate FDR documentation. In the case of Fine Air, in addition to the six parameters that were missing, the heading data were recorded on three parameters and in reverse.

The Safety Board notes with concern that these deficiencies were found less than 4 months after a maintenance examination of the FDR that required the unit to be "downloaded into a computer capable of determining that all parameters are being recorded" and 3 months after it was overhauled and bench checked.

The Safety Board also notes with disappointment that the AC promised by the FAA to be issued by January 1998 has not yet been completed, even though the Safety Board provided a draft version of the AC upon request by FAA staff. The Safety Board has stated several times that inclusion of guidance relating to FDR maintenance documentation (which was addressed in FAA Notice N8110.65) into this AC would satisfy the intent of Safety Recommendations A-91-23 and -24. An AC addressing FDR maintenance and FDR certification would also satisfy the intent of Safety Recommendation A-97-30. However, the Safety Board is concerned that the AC, already delayed more than 7 years, still may not be produced in a timely manner. This AC is also essential to reduce retrofit problems that could occur on a much larger scale than those encountered during the less-sophisticated 11-parameter retrofit program. Accordingly, the Safety Board classifies Safety Recommendations A-91-23, A-91-24, and A-97-30 "Open—Unacceptable Response" pending the FAA's completion of the AC.

The Safety Board is also disappointed with the adequacy of the FAA's response to determine the airworthiness of retrofitted, 11-parameter FDRs, as requested in Safety Recommendation A-97-29 in May 1997. Although the FAA stated in a July 1997 response letter that it agreed with the intent of the recommendation and planned to require air carriers to perform readouts of all retrofitted 11-parameter FDRs within 180 days of the issuance of a new FDR flight standards bulletin (which became effective on December 15, 1997), the timetable intended for these readouts was not specified. For example, HBAW-97-13B, issued in response to Safety Recommendation A-97-29, made no mention of the 180-day timetable for readouts and only proposed scheduling FDR maintenance at "C" check intervals as part of the new FDR maintenance program guidelines it outlined.[115] Under the "C" check interval inspection plan described in the bulletin, Fine Air flight 101's FDR might not have been due for inspection until January 2001. This timeframe for completing a full readout of 11-parameter FDRs is not acceptable and does not address the intent of Safety Recommendation A-97-29.

Recent events suggest that the necessity for these readouts remains. Since the Fine Air accident, the Safety Board encountered yet another malfunction involving an 11-parameter retrofit, installed on an American Airlines Boeing 727 that landed short of runway 14R at O'Hare International Airport, in Chicago, Illinois, on February 9, 1998. Although the investigation is not complete, an initial readout of the accident airplane's FDR determined that data recorded on the elevator/pitch and longitudinal acceleration parameters were unuseable, resulting in the loss of information potentially critical to determining the cause of the accident. The Safety Board notes that this FDR malfunction occurred on an airplane maintained by a large international air carrier with extensive maintenance resources and substantial FAA oversight. FDR system documentation provided by the airline indicates that the elevator position sensor might have been installed incorrectly, and that this condition was not discovered during a

[115] At Fine Air, a C check interval occurs every 3,300 hours, or 36 months.

functional test conducted at a "C" check in November 1997. Examination of the elevator parameter data suggested that the person who performed the functional test either wrote the results in the wrong place or that the elevator values were reversed, with the value for "full column forward" in the correct value range for "full column aft" and vice-versa. Although the Safety Board has not yet drawn a conclusion regarding the ground test, the Safety Board is concerned that these malfunctions might have resulted in improper parameter installation and/or maintenance.[116]

The Fine Air accident also highlights the importance of proper documentation of FDR maintenance actions and readout results. Although Fine Air's maintenance manual required that the accident airplane's FDR data be downloaded into a computer to determine that the parameters were being recorded properly, the maintenance job card that tracked the work performed did not require this readout data to be printed or retained. Only a mechanic's signature was required to certify that the readout had been accomplished. Consequently, there was no way for another person to verify that the readout was correct. The Safety Board concludes that permanent documentation of FDR computer readouts is needed to later verify that such readouts have been properly accomplished.

Based on the continued discovery of malfunctioning 11-parameter FDRs and because the findings of this accident investigation indicate that it is advisable to require air carriers to maintain the records of FDR readouts, the Safety Board classifies Safety Recommendation A-97-29 "Closed—Unacceptable Action/Superseded" and believes that the FAA should require an immediate readout of all 11-parameter retrofitted FDRs to ensure that all mandatory parameters are being recorded properly; that the FDR system documentation is in compliance with the range, accuracy, resolution, and recording interval specified in 14 CFR Part 121, Appendix B; and require that the readout be retained with each airplane's records.[117]

The number of recent confirmed FDR malfunctions also suggests that the problem may go well beyond the scope of 11-parameter retrofits. Indeed, the number of problems encountered with 11-parameter FDRs suggests either inadequate installations or maintenance of FDR systems. The Safety Board is concerned that the problems encountered with 11-parameter FDR retrofits will not only continue, but worsen, without further corrective action as additional mandated parameters are added according to phase-in requirements under 14 CFR Part 121.343 and Appendix B.[118] Thus, the Safety Board concludes that current and proposed inspection

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[116] Examination of the data recorded on the longitudinal acceleration parameter indicated that the data were more representative of data for lateral acceleration, suggesting that the accelerometer might have been incorrectly installed on the airplane, resulting in lateral, rather than longitudinal, data being recorded.

[117] Appendix B outlines FDR specifications, including parameters, range, accuracy, sampling interval, and resolution.

[118] Under Part 121.343, all airplanes manufactured on or before October 11, 1991, with 30 or more seats will be required to have FDRs equipped with 22 channels (or 18 for those units that do not have FDAUs no later than August 18, 2001). Airplanes manufactured after October 11, 1991, up to August 18, 2000, will be required to have FDRs with 34 channels. Transport airplanes manufactured between 2000 and 2002 will be required

intervals for FDRs (at each "C" check) are not adequate because of fleet utilization variables at many carriers. Therefore, the Safety Board believes that the FAA should require maintenance checks for all FDRs of aircraft operated under 14 CFR Parts 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 AC 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 recorded 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.

Although an FDR's primary function is to provide detailed flight information following an accident or incident, this detailed flight information is useful even in the absence of an accident or incident. The Safety Board notes that the FDR phase-in requirement and the quick access capabilities of modern solid-state FDRs offer operators the opportunity to develop and implement a flight operations quality assurance (FOQA) program. Analysis of downloaded FOQA data enables operators to enhance crew and aircraft performance, to develop tailored training and safety programs, and to increase operating efficiency. FOQA programs can also be used to refine ATC procedures and airport configurations and to improve aircraft designs. Although FOQA programs based on the minimum 18 parameters called for in the FDR phase-in requirements would have some limitations, the potential safety and operational benefits of even a limited program are significant.

Because frequent FDR data downloads and data analysis are components of a viable FOQA program, the requirement for periodic readouts to validate the quality of the mandatory FDR parameters would likely be met if the operator corrected recording problems discovered in the readout. The need to download and analyze FDR would also require operators to maintain sufficient FDR system documentation to meet the Safety Board's needs in the event of an accident or incident.

In a May 1997 letter to the FAA, the Safety Board listed a series of accidents and incidents from 1991 through 1997 that involved problems extracting data from retrofitted FDRs (see section 1.18.11). Because many of the problems encountered with retrofitted FDRs have resulted from improper installation and poor system documentation, the Safety Board is concerned that deficiencies may exist in the supplemental type certificate (STC) process; and that retrofit errors and problems are not being identified and corrected by FAA inspectors.[119] An FDR's primary function is to provide detailed flight information following an accident or incident; it does not otherwise affect the airworthiness of an aircraft. As a result, air carrier maintenance technicians may not view the FDR system as critical to the operation of the airplane, and FAA avionics inspectors may have little or no exposure to the complex data collection and

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to have 57-parameter FDRs, and airplanes manufactured after August 18, 2002, will be required to have 88-parameter FDRs.

[119] An STC authorizes alteration of an aircraft engine or other component that is operated under an approved-type certificate.

recording features of FDR systems. Thus, the Safety Board concludes that FAA PAIs may lack the experience and training to provide adequate oversight of FDR installations and continued FDR airworthiness requirements. Therefore, the Safety Board believes that the FAA should provide FAA PAIs with training that addresses the unique and complex characteristics of FDR systems. Further, the Safety Board believes that the FAA should create a national certification team of FDR system specialists to approve all STC changes to FDR systems.

2.6 Deficiencies in Fine Air's CAS Maintenance Program

A Safety Board review of the accident airplane's maintenance logs for the 90-day period before the accident indicated a significant number of recurring problems involving the engines, belly cargo doors, and thrust reversers. Although none of these problems were factors in the accident, the Safety Board is concerned because the CAS program was designed to alert operators to repeat deficiencies and to facilitate prompt corrective maintenance action in problem areas. Fine Air's director of quality control stated that these repetitive repairs often involved "different parts" of "an old system." However, the number and similarity of the maintenance discrepancies on the accident airplane suggests that repeated problem indicators were either missed or ignored. Thus, the Safety Board concludes that Fine Air's CAS program was not as rigorous as its program description indicated and failed to result in the correction of systemic maintenance deficiencies. Therefore, the Safety Board believes that the FAA should direct the PMI assigned to Fine Air to reexamine the airline's CAS program and take action, if necessary, to ensure that repetitive maintenance discrepancies are being identified and corrected.

The Safety Board's review of the accident airplane's maintenance logs also found that all significant maintenance discrepancies were logged by flightcrews on return trips to Miami, where Fine Air's maintenance facilities are located. No significant entries were made at any outstation location. The FAA PMI assigned to Fine Air told Safety Board investigators that he had "raised concerns" with Fine Air management about flightcrews "having all their problems on final in Miami," adding that proving when the discrepancies actually occurred was impossible unless the inspector was accompanying the flightcrew on an en route inspection. In addition, an FAA PMI based in Milwaukee, Wisconsin, stated that such log entries "are common every day practice...if you're passenger or freight, that's standard." This inspector also described the difficulty inspectors encounter when trying to enforce proper logbook entry procedures, asking "how do you do something about it [prove the entries were intentionally deferred until the return leg]." In the case of Fine Air, the Safety Board found no evidence that corrective action was taken by the airline after the PMI raised his concerns to Fine Air management and no evidence of further FAA followup on the matter.

During its investigation of an uncontained engine failure on a Delta Air Lines MD-88,[120] the Safety Board determined that flightcrew members who found drops of oil on an engine bullet nose and two missing wing rivets did not have clear guidance on what constituted

[120] National Transportation Safety Board. 1998. *Uncontained Engine Failure, Delta Air Lines Flight 1288, McDonnell Douglas MD-88, N927DA, Pensacola, Florida, July 6, 1996.* Aircraft Accident Report NTSB/AAR-98/01. Washington, DC.

"maintenance 'discrepancies' and 'irregularities' and when to contact maintenance personnel and to log anomalies." Although the captain's decision to defer maintenance in Pensacola (the departure airport) until arrival in Atlanta, a Delta hub, appeared to have been contrary to Delta's FOM, Delta management later supported the flightcrew's failure to log the discrepancies or to contact maintenance.

The Safety Board is concerned that this return leg logging practice, which may be as widespread in the industry as it is difficult to verify, has become an unspoken, and largely tolerated, way of avoiding costly outstation repairs and flight delays. Safety Recommendation A-98-21, issued to the FAA as a result of the investigation of the Delta accident, was aimed at clarifying flightcrew responsibilities and when flightcrews "can, if at all, make independent determinations to depart when maintenance irregularities are noted." The recommendation called for POIs to review and clarify these policies at their respective operators. However, these policies may differ significantly among operators. Moreover, 14 CFR Part 121.363,[121] while outlining the airworthiness responsibilities of operators, contains no specific requirement to ensure that maintenance discrepancies are logged when they are discovered. According to 14 CFR Part 121.563, the pilot in command is required to "ensure that all mechanical irregularities occurring during flight time are entered in the maintenance log of the airplane at the end of that flight time" and to "ascertain the status of each irregularity entered in the log at the end of the preceding flight." The Safety Board is concerned that the term "flight time" is not specifically defined, and could be interpreted by flightcrews as meaning at the end of the last flight of a multiple-leg duty day, instead of at the end of the flight during which the irregularity was discovered. Part 121.563 also does not address irregularities and specific logging responsibilities for irregularities found during preflight inspections.

Faced with a maintenance irregularity at an outstation, flightcrews (under schedule pressures and perhaps a management preference for home-base repairs when possible) may be reluctant to risk the delay that a logbook entry could incur. Language addressing specific logging requirements in Part 121.563 (that defined specific logging requirements or stated that logging is mandatory, rather than referring only to the general airworthiness of the airplane) would reduce ambiguity. This would require flightcrews, especially at outstations, to contact maintenance for a deferral or a decision to seek contract maintenance repairs before departing. Although there may be circumstances in which independent flightcrew evaluation of maintenance discrepancies is warranted, maintenance personnel are the best qualified personnel to make such determinations. Thus, the Safety Board concludes that Fine Air's maintenance logs for the accident airplane suggest a practice of logging significant maintenance discrepancies on return flights to Miami, where repairs were completed, and that such practices may be widespread in the industry. Further, the Safety Board concludes that although the PMI noted a pattern of logging entries on return flights to Miami and expressed his concerns to Fine Air management, no further action was taken either by the PMI or Fine Air management to address this problem. Therefore, the Safety Board believes that the FAA should amend 14 CFR Part

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[121] Part 121.363, "Responsibility for Airworthiness," states that "each certificate holder is primarily responsible for...the airworthiness of its aircraft...[and] the performance of the maintenance, preventive maintenance...in accordance with its manual and the regulations of this chapter."

121.563 to specifically require that all discrepancies be logged when they occur and be resolved before departure through repair or deferral in consultation with (the certificate holder's or contracted) maintenance personnel.

3. CONCLUSIONS

3.1 Findings

1. The three-member flightcrew was properly certificated and qualified in accordance with applicable Federal regulations and company requirements.

2. There was no evidence that any medical, behavioral, or physiological factors affected the flightcrew on the day of the accident.

3. Weather was not a factor in the accident.

4. The airplane was properly certificated, equipped, and maintained in accordance with Federal regulations and approved procedures (with the exception of the flight data recorder (FDR) system, which was not functioning properly at the time of the accident).

5. There was no evidence that failures of the airplane's structures or flight control systems contributed to the accident.

6. The compressor surges, or stalls, were caused by the airplane's attitude before impact; no significant loss of engine thrust occurred; engine performance was not a factor in the accident.

7. The airplane pitched up quickly into a stall, recovered briefly from the stall, and stalled again; recovery before ground impact was unlikely once the stall series began.

8. The center of gravity (CG) of the accident airplane was near or even aft of the airplane's aft CG limit.

9. The center of gravity shift resulted in the airplane's trim being mis-set by at least 1.5 units airplane nose up (2.4 minus 0.9 units at 94,119 pounds).

10. The aft center of gravity (CG) location and mistrimmed stabilizer presented the flightcrew with a pitch control problem; however, because the actual CG location could not be determined, the severity of the control problem could not be determined.

11. The mistrim of the airplane (based on the incorrectly loaded cargo) presented the flightcrew with a situation that, without prior training or experience, required exceptional skills and reactions that cannot be expected of a typical line pilot.

12. Training for flightcrews in dealing with misloading, miscalculated center of gravity, and mistrimmed stabilizers would improve the chances for recovery from such situations.

13. Procedures used by Fine Air and Aeromar to prepare and distribute cargo weight pallet distribution forms and final weight and balance load sheets were inadequate to ensure that these documents correctly reflected the true loading of the accident airplane.

14. The security guard was not aware of the airplane change, and he instructed Aeromar loaders to load the airplane in accordance with the weight distribution form he possessed for N30UA.

15. The accident airplane (N27UA) was initially loaded according to Fine Air's load distribution for N30UA; further, the final load configuration did not match the planned load for either airplane.

16. The Aeromar cargo loading supervisor failed to ensure that the pallets were loaded according to an approved load plan (in this case neither load plan was followed) and failed to confirm that the cargo was properly restrained.

17. A significant shift of cargo rearward at or before rotation did not occur and was not the cause of the initial extreme pitch up at rotation; although, cargo compression or shifting might have exacerbated the pitch-up moment as the pitch increased.

18. The difficult work environment of cargo loaders has the potential to cause loading errors if the loading process is not adequately structured to compensate for the detrimental environmental effects on human performance.

19. Fine Air failed to exercise adequate operational control of loading operations conducted by Aeromar on the accident flight as required by Part 121, the operational control terms of its lease agreement with Aeromar, and its own operating policy.

20. Fine Air's failure to exercise adequate operational control was causal to the accident by creating an operational environment in which cargo was loaded into Fine Air airplanes without verification of pallet weights and proper load distribution and by fostering a management philosophy that allowed airplanes to be dispatched without verification and control procedures in place to ensure that load-related, flight safety-critical tasks had been accomplished.

21. The loaders who loaded the accident airplane were not aware of the potentially catastrophic consequences of misloading the airplane and failing to properly secure cargo, and this contributed to the accident.

22. Formal training is necessary to ensure that cargo handling personnel receive standardized instruction on safety-critical aspects of the loading process.

23. Although the flight engineer was required to ensure that all cargo pallet locks were locked, company operating procedures and practices in Miami International Airport hindered him from accomplishing this task.

24. If the flightcrew had had an independent method for verifying the accident airplane's actual weight and balance and gross weight in the cockpit, it might have alerted them to the loading anomalies, and might have prevented the accident.

25. The Federal Aviation Administration inspectors assigned to Fine Air failed to ensure that known deficiencies in Fine Air's cargo operations were corrected.

26. The entire sequence of cargo loading operations, from preparation of the pallets/containers through the information provided to flightcrews, has a direct effect on flight safety and should not be neglected by the FAA surveillance program, particularly for the cargo air carriers operating under 14 Code of Federal Regulations Part 121.

27. The Miami Flight Standards District Office (FSDO) lacked clear management policies to ensure that sufficient and appropriate surveillance was conducted and that surveillance results were acted upon; further, the FSDO was not aggressive in its inspection and management of the Fine Air certificate and this contributed to the accident.

28. The deficiencies found in the Miami Flight Standard District Office's oversight of Fine Air and other carriers in its jurisdiction are indicative of a broader failure of the Federal Aviation Administration to adequately monitor air carriers, especially supplemental cargo carriers, in which operational problems had been identified.

29. National aviation safety inspection program and regional aviation safety inspection program inspections are not adequately identifying and addressing systemic safety problems that exist in air carrier operations at the time the inspections are conducted.

30. Current Federal Aviation Administration personnel and budget resources may not be sufficient to ensure that the quality of air carrier surveillance will improve.

31. Permanent documentation of flight data recorder computer readouts is needed to later verify that such readouts have been properly accomplished.

32. Current and proposed inspection intervals for flight data recorders (at each "C" check) are not adequate because of fleet utilization variables at many carriers.

33. Federal Aviation Administration principal avionics inspectors may lack the experience and training to provide adequate oversight of flight data recorder (FDR) installations and continued FDR airworthiness requirements.

34. Fine Air's continuing analysis and surveillance program was not as rigorous as its program description indicated and failed to result in the correction of systemic maintenance deficiencies.

35. Fine Air's maintenance logs for the accident airplane suggest a practice of logging significant maintenance discrepancies on return flights to Miami, where repairs were completed, and that such practices may be widespread in the industry.

36. Although the principal maintenance inspector (PMI) noted a pattern of logging entries on return flights to Miami and expressed his concerns to Fine Air management, no further action was taken either by the PMI or Fine Air management to address this problem.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident, which resulted from the airplane being misloaded to produce a more aft center of gravity and a correspondingly incorrect stabilizer trim setting that precipitated an extreme pitch-up at rotation, was (1) the failure of Fine Air to exercise operational control over the cargo loading process; and (2) the failure of Aeromar to load the airplane as specified by Fine Air. Contributing to the accident was the failure of the FAA to adequately monitor Fine Air's operational control responsibilities for cargo loading and the failure of the FAA to ensure that known cargo-related deficiencies were corrected at Fine Air.

4. RECOMMENDATIONS

As a result of the investigation of this accident, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:

Require all 14 Code of Federal Regulations Part 121 air carriers to provide flightcrews with instruction on mistrim cues that might be available during taxi and initial rotation, and require air carriers using full flight simulators in their training programs to provide flightcrews with Special Purpose Operational Training that includes an unanticipated pitch mistrim condition encountered on takeoff. (A-98-44)

Conduct an audit of all Code of Federal Regulations Part 121 supplemental cargo operators to ensure that proper weight and balance documents are being used, that the forms are based on manufacturer's data or other approved data applicable to the airplane being operated, and that FAA principal inspectors confirm that the data are entered correctly on the forms. (A-98-45)

Require carriers operating under 14 Code of Federal Regulations Part 121 to develop and use loading checklists to positively verify that all loading steps have been accomplished for each loaded position on the airplane and that the condition, weight, and sequencing of each pallet is correct. (A-98-46)

Require training for cargo handling personnel and develop advisory material for carriers operating under 14 Code of Federal Regulations Part 121 and principal operations inspectors that addresses curriculum content that includes but is not limited to, weight and balance, cargo handling, cargo restraint, and hazards of misloading and require all operators to provide initial and recurrent training for cargo handling personnel consistent with this guidance. (A-98-47)

Review the cargo loading procedures of carriers operating under 14 Code of Federal Regulations Part 121 to ensure that flightcrew requirements for loading oversight are consistent with the loading procedures in use. (A-98-48)

Evaluate the benefit of the STAN (Sum Total Aft and Nose) and similar systems and require, if warranted, the installation of a system that displays airplane weight and balance and gross weight in the cockpit of transport-category cargo airplanes. (A-98-49)

Require all principal inspectors assigned to 14 Code of Federal Regulations Part 121 cargo air carriers to observe, as part of their annual work program requirements, the complete loading operation including cargo weighing, weight and balance compliance, flight following, and dispatch of an airplane. (A-98-50)

Review its national aviation safety inspection program and regional aviation safety inspection program inspection procedures to determine why inspections preceding these accidents failed to identify systemic safety problems at ValuJet and Fine Air and, based on the findings of this review, modify these inspection procedures to ensure that such systemic indicators are identified and corrected before they result in an accident. (A-98-51)

Evaluate the surveillance programs to ensure that budget and personnel resources are sufficient and used effectively to maintain adequate oversight of the operation and maintenance of both passenger and cargo carriers, irrespective of size. (A-98-52)

Require an immediate readout of all 11-parameter retrofitted flight data recorders (FDRs) to ensure that all mandatory parameters are being recorded properly; that the FDR system documentation is in compliance with the range, accuracy, resolution, and recording interval specified in 14 Code of Federal Regulations Part 121, Appendix B; and require that the readout be retained with each airplane's records. (A-98-53)

Require maintenance checks for all flight data recorders (FDRs) of aircraft operated under 14 Code of Federal Regulations Parts 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 recorded 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. (A-98-54)

Provide FAA principal avionics inspectors with training that addresses the unique and complex characteristics of flight data recorder systems. (A-98-55)

Create a national certification team of flight data recorder (FDR) system specialists to approve all supplemental type certificate changes to FDR systems. (A-98-56)

Direct the principal maintenance inspector assigned to Fine Air to reexamine the airline's continuing analysis and surveillance program and take action, if necessary, to ensure that repetitive maintenance discrepancies are being identified and corrected. (A-98-57)

Amend 14 Code of Federal Regulations Part 121.563 to specifically require that all discrepancies be logged when they occur and be resolved before departure through repair or deferral in consultation with (the certificate holder's or contracted) maintenance personnel. (A-98-58)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Member

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Member

June 16, 1998

5. APPENDIXES

APPENDIX A—INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was initially notified of this accident about 1300 eastern standard time on August 7, 1997. A go-team was dispatched at 1400 and arrived at the accident site at 1530. The go-team consisted of specialists from the following areas: operations, human factors, airworthiness (systems and structures), maintenance, aircraft performance, powerplants, airports and emergency response. Investigative groups for the cockpit voice recorder, flight data recorder, and airplane performance were also formed in Washington, D.C. Safety Board Chairman Jim Hall accompanied the investigative team.

Parties to the investigation were the FAA, Fine Air, Aeromar Inc., Metro Dade Police Department, Boeing Commercial Airplane Group, and United Technologies Pratt & Whitney.

2. Public Hearing

A public hearing was not held. Depositions were taken from 12 witnesses on November 19 and 20, 1997, in Miami, Florida. The witnesses included employees of FAA, Fine Air, and Aeromar.

APPENDIX B—COCKPIT VOICE RECORDER TRANSCRIPT

RDO	Radio transmission from accident aircraft
CAM	Cockpit Area Microphone sound or source
-1	Voice identified as Captain
-2	Voice identified as First Officer
-3	Voice identified as Second Officer
-4	Voice identified as male ground personnel
-?	Voice unidentified
TWR	Miami Local Controller (tower)
GND	Miami Ground Controller
CLR	Miami Clearance Controller
HOU	Houston HF radio
UNK	Unknown source
*	Unintelligible word
@	Nonpertinent word
#	Expletive deleted
%	Break in continuity
()	Questionable text
(())	Editorial insertion
-	Pause

Notes: All times are expressed in eastern daylight savings time. Only radio transmissions involving the accident aircraft were transcribed.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1205:30	Start of Recording.		
1205:34	Start of Transcript..		
1213:28 CAM-1	you don't have any scratch paper back here do ya?		
1213:30 CAM-3	sir.		
1213:31 CAM-1	A piece of scratch paper I can use.		
1213:36 CAM-3	scotch tape?		
1213:37 CAM-1	no ah never mind I'll I'll.		
1213:41 CAM-3	That's all that I got.		
1213:42 CAM-1	naw I didn't need ah no I got what I need thanks.		
1213:49 CAM-3	they had about a quarter inch missing on the skid.		
1213:52 CAM-1	oh really.		
1213:52 CAM-3	yeah I told the ah mechanic to ah.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1213:55 CAM-1	repaint it.		
1213:56 CAM-3	to repaint it.		
1213:56 CAM-1	okay good.		
1213:58 ATIS	— visibility one zero, four thousand scattered two five thousand scattered temperature three three dew point two four altimeter three zero zero four approaches are being conducted to parallel converging and intersecting runways arrivals expect ILS runway two seven right ILS runway two seven left localizer runway three zero bird activity in the vacinity of the airport advise on initial contact you have information fox-trot.		
1214:32 CAM-3	he said blame it on him he said okay.		
1214:37 CAM-1	you ah.		
1214:40 CAM-3	tail skid story I got to get that off.		
1214:44 CAM-1	who suppose to repaint the tail skid?		
1214:46 CAM-2	who's suppose to what?		
1214:47 CAM-3	repaint the tail skid.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1214:50 CAM-1	there is a little bit missing on the tail you got our flight plan? what are we one oh one?		
1215:04 CAM-2	one oh one that's correct.		
		1215:07 RDO-1	clearance Fine Air one oh one heavy information fox-trot Santa Domingo.
		1215:12 CLR	Fine Air one oh one on request.
		1215:14 RDO-1	rog.
1215:20 CAM-2	so what's it look like?		
1215:21 CAM-3	same old #.		
1215:33 CAM-3	*		
1215:49 CAM-1	* make any difference.		
		1216:14 CLR	Fine Air one oh one I'm showin' that you are proposin' at seventeen thirty are you departing earlier than that or what.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
		1216:20 RDO-1	nah they should have filed it for seventeen hundred okay ah naw we'll take it when ever you can give it to me.
		1216:25 CLR	okay I will get it·thirty minutes prior to ah so it'll take a couple minutes before I can change it.
		1216:29 RDO-1	yeah we should be ready to go actually in about fifteen minutes sir.
1216:36 CAM-2	want me to call radio ?		
1216:37 CAM	[sound similar to that of over-speed warning clacker]].		
		1216:39 RDO-1	and actually they should have filed it for sixteen hundred but I guess they messed up.
		1216:40 CLR	okay.
1216:42 CAM-1	that's all right he's gunna fix it.		
1216:48 CAM-3	hold up here for a second all right.		
1216:51 CAM-1	okay don't move it.		
1216:52 CAM-2	is it a mechanic.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1216:53 CAM-1	yeah don't don't move it.		
1216:54 CAM-1	what are we doin'? safety wirin' it, which one's disconnect?		
1217:01 CAM-1	number two is disconnected?		
1217:03 CAM-3	it's not disconnected it's ah it's ah safety wire missing.		
1217:07 CAM-1	ah okay.		
1217:08 CAM-2	I'll move forward if you want.		
1217:09 CAM-3	no it's all right.		
1217:10 CAM-1	okay, I mean the generator's okay it just the safety wire on the disconnect switch is ah okay.		
		1217:30 CLR	Fine Air one oh one cleared to Santa Domingo via the Miami eight departure swim transition then as filled maintain five thousand departure frequency will be one two five point five squawk one four zero seven where are you parked?
		1217:39 RDO-1	okay fourteen oh seven on the squawk and we're up in the northeast corner.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1217:43 CLR	ground point eight.
		1217:45 RDO-1	thanks.
1217:54 CAM-2	alrighty swim one oh eight.		
1217:56 CAM-1	correcto.		
1217:57 CAM-1	seventeen one one oh eight.		
1218:27 CAM-1	as soon as they're done with everything out there we can go.		
1218:56 CAM-4	all * out there.		
1218:57 CAM-1	thank you.		
		1219:01 RDO-2	Houston hello hello Houston Fine Air three ah Fine Air two seven on thirteen in Miami.
		1219:22 RDO-2	Houston Houston Fine Air two seven in Miami on thirteen.
		1219:41 RDO-2	Miami radio Miami radio Fine Air two seven on thirteen in Miami.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1220:10 RDO-2	Houston Houston radio Fine Air two seven on thirteen in Miami.
		1220:15 HOU	Fine Air two seven Houston.
		1220:17 RDO-2	roger Houston Fine Air two seven request a selcall check on lima mike charlie delta.
		1220:23 HOU	lima mike charlie delta standby ((sound of selcall tones)).
1220:34 CAM	((sound of selcall chime))		
		1220:35 RDO-2	selcall checks for Fine Air two seven Houston thank you.
		1220:39 HOU	good day sir.
1221:28 CAM-2	Franco said all of the freight's down there already.		
1221:30 CAM-1	I'm sure it is we're three and a half hours late so be just down and back.		
1221:33 CAM-2	this is the second trip though.		
1221:34 CAM-1	this is the second trip right but it was still scheduled to go out at nine but they got delayed in San Juan so.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1221:39 CAM-2	he called me this morning about it.		
1221:43 CAM-1	really.		
1221:44 CAM-2	yeah I don't know who was on it.		
1221:45 CAM-1	well I mean I've been on it since last night yesterday afternoon.		
1221:48 CAM-2	John called me about eight thirty this morning hay you son of a # get up you're flyin' at twelve o'clock.		
1221:56 CAM-1	((sound of laugh)) we're you on stand-by?		
1222:03 CAM-2	I don't think so I was goin' to Orlando the last two weeks I flew Saturday, Sunday, Monday night last night today Saturday Saturday I flew to you know that San Padro Guatemala five five and a half hours there no air-conditioning they got little kids fifteen years old loadin' the airplane.		
1222:21 CAM-1	what in San Perdo? I hate that # place.		
1222:24 CAM-2	so I went out and bought this and got a * attitude.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1222:29 CAM-2	then I went to Salvador the next day and I told them look if they don't have an air-conditioner down there I not gettin' on the airplane I'm gunna get off.		
1222:34 CAM-1	yeah.		
1222:35 CAM-3	they've taken care of that stuff.		
1222:36 CAM-1	they took care they took care of that okay, tail stand tail stand done.		
1222:38 CAM-3	yeah.		
1222:39 CAM-1	okay good are we ready basically?		
1222:41 CAM-3	ah no they they just pulled up with the spray so.		
1222:44 CAM-1	okay fine.		
1222:45 CAM-3	it'll be like a couple of minutes.		
1222:46 CAM-1	okay and they still got a belly open huh?		
1222:47 CAM-3	yeah I'm gunna go down and see what *		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1222:52 CAM-1	okay we **		
1222:54 CAM-2	* I'm gunna tell you the rest of my story.		
1222:59 CAM-1	yeah so what else happened.		
1223:00 CAM-2	so on Sunday in ah Salvador I told them that and man that's the first time I ever seen that they pulled up the air-conditioning cart and plugged it into the side of the Airplane where it goes cold air comin' in here, it was great.		
1223:11 CAM-1	that's the way it should be it should be that way everywhere.		
1223:13 CAM-2	first time.		
1223:14 CAM-1	cheap ##.		
1223:16 CAM-2	boy you got that right.		
1223:17 CAM-1	yeah (sound of laugh).		
1223:19 CAM-2	I'm serious.		
1223:19 CAM-1	really.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1223:20 CAM-2	voice recorder.		
1223:20 CAM-1	checked.		
1223:21 CAM-2	emergency exit lights.		
1223:22 CAM-1	armed.		
1223:22 CAM-2	navigation lights.		
1223:23 CAM-1	are on.		
1223:26 CAM-2	pitot heat.		
1223:26 CAM-1	is checked and off.		
1223:27 CAM-2	stall warning.		
1223:28 CAM-1	is checked.		
1223:28 CAM-2	reverser stowed switch.		
1223:29 CAM-1	normal.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1223:29 CAM-2	windshield heat.		
1223:30 CAM-1	warm up.		
1223:31 CAM-2	engine, scoops and PT2 switches.		
1223:32 CAM-1	they're off.		
1223:32 CAM-2	ignition switches.		
1223:33 CAM-1	they're off.		
1223:33 CAM-2	air brake handle and pressure.		
1223:34 CAM-1	safetied and checked.		
1223:35 CAM-2	static selectors.		
1223:36 CAM-1	they're normal.		
1223:37 CAM-2	normal airspeed mode selectors.		
1223:38 CAM-1	not installed.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1223:39 CAM-2	over-speed warnings.		
1223:40 CAM-1	checked.		
1223:40 CAM-2	standby horizon.		
1223:41 CAM-1	checked on.		
1223:42 CAM-2	ground proximity warning.		
1223:42 CAM-1	checked.		
1223:43 CAM-2	compasses.		
1223:43 CAM-1	three sixty heading excuse me mag sync and cross checked.		
1223:47 CAM-2	mag sync and cross checked, flight director system flight instruments.		
1223:49 CAM-1	set cross checked.		
1223:50 CAM-2	altimeter pressure and radio.		
1223:51 CAM-1	oh four is the altimeter.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1223:53 CAM-2	oh four is set.		
1223:54 CAM-1	and cross checked.		
1223:54 CAM-2	gear lever.		
1223:55 CAM-1	down and three green.		
1223:56 CAM-2	fuel flow indicators.		
1223:56 CAM-1	zeroed.		
1223:57 CAM-2	radios, radar and transponder.		
1223:58 CAM-1	checked stand-by.		
1223:58 CAM-2	windshear system.		
1223:59 CAM-1	tested.		
1223:59 CAM-2	long range nav.		
1224:00 CAM-1	checked set.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1224:00 CAM-2	PTC.		
1224:01 CAM-1	checked override.		
1224:02 CAM-2	ground spoilers.		
1224:02 CAM-1	checked light out.		
1224:03 CAM-2	power levers.		
1224:03 CAM-1	forward idle.		
1224:04 CAM-2	fuel shutoff levers.		
1224:04 CAM-1	off.		
1224:05 CAM-2	stabilizer-hydraulic electric.		
1224:06 CAM-1	is checked.		
1224:06 CAM-2	auto-pilot.		
1224:07 CAM-1	checked off.		

INTRA-COCKPIT COMMUNICATION | AIR-GROUND COMMUNICATION

TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1224:07 CAM-2	rudder and aileron trim.		
1224:08 CAM-1	free and zero.		
1224:08 CAM-2	navigation manuals.		
1224:09 CAM-1	got em.		
1224:10 CAM-2	down to the line.		
1224:11 CAM-2	yeah three hours ago huh.		
1224:26 CAM-2	yeah I did a Panama San Jose last night not last but the night before got back yesterday morning we were gone nine hours and had seven hours blocked.		
1224:35 CAM-1	that good.		
1224:35 CAM-2	that was freakin' sweet.		
1224:36 CAM-1	that's real nice, where the hell I did somethin' like that on some trip too where it turned out that way we got a it was unbelievable where you get-- I got back from Vera Copas not yester- well when was it not it wasn't yesterday it was the day before yesterday.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1224:58 CAM-2	how long were you down there?		
1224:59 CAM-1	it was a short trip actually it only took two days we left Monday we left Monday we went to ah Port of Spain Vera Copas had about fourteen hours on the ground there and went back Quito Guayecle Miami next day two day trip had twenty hours, nineteen hours and fifty nine minutes exactly.		
1225:13 CAM	((sound of ground start cart starts)) .		
1225:18 CAM-2	sweet.		
1225:20 CAM-1	yeah everything we could get out of it in forty eight less than forty eight hours.		
1225:24 CAM-2	preflight.		
1225:24 CAM-1	complete.		
1225:25 CAM-3	complete.		
1225:25 CAM-2	fuel dump system.		
1225:27 CAM-3	retract handle on board.		
1225:28 CAM-2	oxygen interphone.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1225:28 CAM-1	checked on set.		
1225:30 CAM-3	checked on 100%.		
1225:31 CAM-2	flight recorder.		
1225:32 CAM-3	checked and set.		
1225:33 CAM-2	radio rack blowers.		
1225:33 CAM-3	on.		
1225:34 CAM-2	smoke detector.		
1225:34 CAM-3	set.		
1225:35 CAM-2	electrical panel.		
1225:36 CAM-3	checked and set.		
1225:36 CAM-2	flight engineers quadrant.		
1225:37 CAM-3	checked and set.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1225:37 CAM-2	stand by rudder power.		
1225:38 CAM-3	checked and off.		
1225:39 CAM-2	alternate ground spoiler power.		
1225:40 CAM-3	normal.		
1225:40 CAM-2	all warning lights.		
1225:41 CAM-1	checked.		
1225:42 CAM-3	checked.		
1225:42 CAM-2	pneumatic switches and cross feeds.		
1225:43 CAM-3	off and normal.		
1225:44 CAM-2	T/C and freon.		
1225:45 CAM-3	off.		
1225:45 CAM-2	deice system.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1225:46 CAM-3	checked.		
1225:47 CAM-2	fuel oil and hydraulic quantity.		
1225:48 CAM-3	fifteen * flight plan load.		
1225:49 CAM-2	blow away jet.		
1225:50 CAM-3	light on.		
1225:50 CAM-2	fire warning system.		
1225:51 CAM-3	tested.		
1225:51 CAM-2	gear pins.		
1225:52 CAM-3	three onboard on in the nose.		
1225:53 CAM-2	windshield *anti-fog* circuit breakers.		
1225:54 CAM-3	pulled.		
1225:55 CAM-2	anti-skid's off lights checked preparatory checklist's complete.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1225:57 CAM-1	before start please.		
1225:59 CAM-3	log book forms cargo manifest on board- parking brake.		
1225:59 CAM-1	is set.		
1226:01 CAM-3	cargo door is visually checked closed and locked.		
1226:05 CAM-3	recirc fans and packs off starter arm switch.		
1226:05 CAM-1	armed.		
1226:07 CAM-3	rotating beacon.		
1226:07 CAM-1	on.		
1226:08 CAM-3	starting pressure's checked -- before start checklist's complete ready on three.		
1226:18 CAM-1	turning three.		
1226:20 CAM-3	okay valve's open.		
1226:21 CAM-1	rotation.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1226:25 CAM-3	oil pressure.		
1226:30 CAM-3	N-1.		
1226:31 CAM-1	fifteen fuel on, flow normal, light up.		
1226:44 CAM-1	thirty five release how about four.		
1226:46 CAM-3	valve closed.		
1226:50 CAM-1	ready four.		
1226:50 CAM-3	ready four.		
1226:51 CAM-1	turn four.		
1226:52 CAM-3	okay valve open.		
1226:54 CAM-2	nothing turning?		
1226:57 CAM-3	oil pressure.		
1226:59 CAM-2	three's stable.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1227:03 CAM-3	N-1.		
1227:05 CAM-1	fifteen, fuel on flow normal, light up.		
1227:19 CAM-1	thirty five released.		
1227:20 CAM-3	valve closed.		
1227:22 CAM-1	ship's power please.		
1227:23 CAM-3	stand-by.		
1227:29 CAM-3	internal.		
1227:29 CAM	((sound of power interruption to the CVR)).		
1227:35 CAM	((sound of ground engine cart noise decreases)).		
1227:58 CAM	((sound of altitude alert warning)).		
1228:01 CAM-2	yes,.		
1228:03 CAM-1	# things.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1229:08 CAM-1	*		
1229:38 CAM-2	what time do you want to push back?		
1229:40 CAM-1	about twenty ah ah seven.		
1230:19 CAM-3	you only get one eighty three on the EPR.		
1230:20 CAM-2	yeah *		
1230:21 CAM-1	listen it's a short taxi why don't you go ahead and fly this one.		
1230:32 CAM-3	green light on.		
1230:33 CAM-1	you might want to de-brief now because you don't have much time.		
1230:34 CAM-2	max power let's do bleeds off ** after takeoff -.		
1230:37 CAM-1	okay that's cool.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1230:38 CAM-2	- standard Fine Air procedures a problem prior to Vee-one which is a hundred and thirty knots the pilot in command will abort the airplane we'll treat anything after Vee one as an in-flight emergency no action will be taken below a thousand feet except to silence the master fire bell at a thousand feet we will accelerate the airplane clean it up then work on the problem if Pat assumes control I'll work the problem with you and plan for a right down wind for two seven right two seven left visual .		
1231:03 CAM-1	yeah sounds good.		
1231:05 CAM-2	any questions one oh eight outbound Virginia Key swim transition.		
1231:06 CAM-1	sounds good Sheez what is this guy doin' down here.		
1231:07 CAM-2	they're gettin' worse.		
1231:10 CAM-3	yeah they are.		
1231:11 CAM-1	I'm tellin' you.		
1231:12 CAM-3	haven't improved since yesterday.		
1231:22 CAM-1	okay you got brake pressure.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1231:24 CAM-2	ready on two.		
1231:25 CAM-3	ready on two?		
1231:25 CAM-2	turnin' two.		
1231:27 CAM-3	okay valve open, oil pressure, N-1.		
1231:37 CAM-2	two's fifteen percent, fuel's on light up, thirty five's, release.		
1231:50 CAM-3	okay valves closed ready one.		
1231:51 CAM-2	turning one.		
1231:53 CAM-3	valve open, oil pressure, N-1.		
1232:00 CAM-2	N-2's fifteen percent and fuel's on, flow normal, light up.		
1232:12 CAM-2	thirty five release.		
1232:13 CAM-3	okay valve closed.		
1232:16 CAM	((two sounds, similar to rain removal testing)).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1232:20 CAM-1	after start when ever you're ready.		
1232:22 CAM-3	okay.		
1232:27 CAM-3	okay after start - rain removal.		
1232:28 CAM-1	checked off.		
1232:29 CAM-2	checked off.		
1232:30 CAM-3	gust lock.		
1232:30 CAM-2	off.		
1232:32 CAM-3	electrical panel checked no lights.		
1232:33 CAM-3	aileron and rudder power.		
1232:34 CAM-1	clear.		
1232:35 CAM-2	clear right.		
1232:41 CAM-3	lights out hydraulics' checked, door lights checked out engine pneumatic bleeds off ground equipment.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1232:50 CAM-1	clear left.		
1232:50 CAM-2	clear right.		
1232:51 CAM-3	nose gear pin.		
1232:52 CAM-1	I saw it.		
1232:53 CAM-3	okay cockpit door is closed, starter arm switch.		
1232:54 CAM-1	it's off.		
1232:56 CAM-3	pitot heat.		
1232:57 CAM-1	it's on lights out.		
1232:58 CAM-3	after start checklist complete.		
		1232:59 RDO-2	Miami ground Fine Air one oh one heavy Jurassic park ready taxi.
		1233:02 GND	Fine Air one oh one heavy Miami ground taxi runway two seven right.
		1233:05 RDO-2	taxi two seven right Fine Air one oh one heavy.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1233:08 CAM-1	and ah we can block this baby at thirty one and let's go flaps one five and taxi and take off checklist.		
1233:15 CAM	((sound of clicks)).		
1233:17 CAM-2	cleared to taxi two seven *		
1233:19 CAM-1	okay		
1233:26 CAM-3	okay taxi takeoff check.		
1233:27 CAM-3	brakes.		
1233:28 CAM-1	they're checked.		
1233:28 CAM-3	flaps and slots.		
1233:29 CAM-2	fifteen fifteen slots lights out.		
1233:31 CAM-3	anti-ice, anti-ice, de-ice and PT2.		
1233:33 CAM-2	they're off.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1233:34 CAM-3	yaw damper.		
1233:34 CAM-1	checked and on.		
1233:36 CAM-3	okay flight recorder is on T/C's and bleeds are off spoiler pump is normal pressure's checked, fuel system is set and flight controls.		
1233:45 CAM-1	ready.		
1233:45 CAM-3	ready.		
1233:46 CAM-2	ailerons left.		
1233:47 CAM-3	double drop rise.		
1233:47 CAM-2	neutral.		
1233:48 CAM-3	double drop rise.		
1233:49 CAM-2	ailerons right.		
1233:50 CAM-3	double drop rise.		
1233:50 CAM-2	neutral.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1233:51 CAM-3	double drop rise.		
1233:53 CAM-2	EPI down, EPI aft indication.		
1233:56 CAM-1	rudder left.		
1233:56 CAM-3	drop rise.		
1233:57 CAM-1	neutral.		
1233:58 CAM-3	drop rise.		
1233:58 CAM-1	rudder right.		
1233:59 CAM-3	drop rise.		
1234:00 CAM-1	neutral.		
1234:00 CAM-3	drop rise.		
1234:01 CAM-1	checked.		
1234:04 CAM	((sound of trim-in-motion tone)).		

INTRA-COCKPIT COMMUNICATION TIME and SOURCE	INTRA-COCKPIT COMMUNICATION CONTENT	AIR-GROUND COMMUNICATION TIME and SOURCE	AIR-GROUND COMMUNICATION CONTENT
		1234:02 GND	Fine Air one oh one heavy monitor tower one one eight point three we'll see ya.
		1234:05 RDO-2	eighteen three see,ya later.
1234:07 CAM-1	data please.		
1234:08 CAM-3	okay takeoff data.		
1234:11 CAM-1	completed left center.		
1234:12 CAM-2	set right.		
		1234:14 TWR	Fine Air one oh one are you ready to go.
1234:15 CAM-1	I need thirty seconds.		
		1234:16 RDO-2	about thirty seconds.
1234:15 CAM-3	stabilizer and trim tabs.		
1234:19 CAM-2	two point four indicated zero zero.		
1234:22 CAM-3	takeoff and departure briefing completed radios and flight director.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1234:24 CAM-2	set for departure and cross checked.		
1234:26 CAM-3	seat-belts and shoulder harness.		
1234:26 CAM-1	on.		
1234:27 CAM-2	on.		
1234:27 CAM-3	okay at the line.		
		1234:28 RDO-2	Fine Air one oh one is ready for takeoff two seven right.
1234:30 CAM-1	I got this guy.		
		1234:31 TWR	Fine Air one oh one's traffic's five mile final seven four seven two seven right fly heading two seven zero cleared for takeoff.
		1234:35.9 RDO-2	cleared for take off two seven right Fine Air one oh one heavy.
1234:36.6 CAM-1	below the line please.		
1234:39.7 CAM-3	anti skid.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1234:40.0 CAM-1	on light's checked.		
1234:42.2 CAM-3	stand-by rudder pump's on continuous ignition.		
1234:42.8 CAM-2	all engines.		
1234:43.9 CAM-3	transponder DME.		
1234:44.4 CAM-2	on on.		
1234:45.2 CAM-3	okay landing lights.		
1234:46.1 CAM-1	they're on.		
1234:47.0 CAM-3	okay checklist complete.		
1234:50.0 CAM-1	this guy's pretty pretty close to I think we'll need to take it rollin' he looks like he is closer than four miles to me I don't want him to go around, we're not that heavy anyway *.		
1235:01.4 CAM-1	I'll just stand them up here, take it on the roll , okay you're spooled.		
1235:02.1 CAM	((sound of increasing engine sounds)).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1235:07.6 CAM-3	okay four spooled and ah stable.		
1235:10.6 CAM-2	max power.		
1235:13.2 CAM-1	just like auto throttles.		
1235:15.2 CAM-2	yeah.		
1235:17.3 CAM-2	airspeed on the right.		
1235:19.5 CAM-1	okay comin' up on sixty knots power's set.		
1235:26.2 CAM-1	eighty, you got the steer on the rudders.		
1235:36.7 CAM-3	okay number four's is (heatin' up a little).		
1235:39.6 CAM	((Sound of thump).		
1235:43.1 CAM-1	vee one.		
1235:47.3 CAM	((sound of thump)).		
1235:49.9 CAM-1	rotate.		

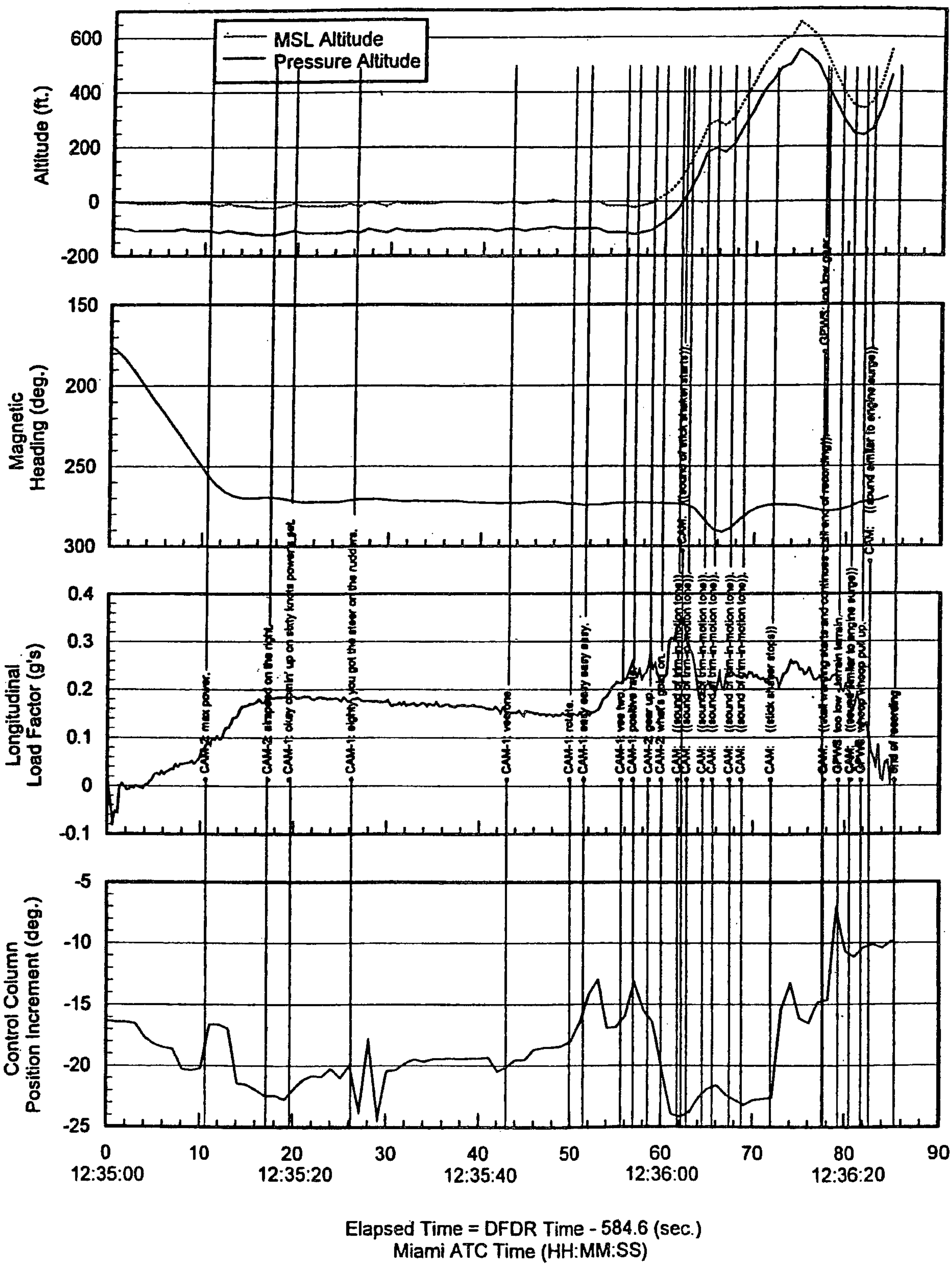
INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1235:51.5 CAM-1	easy easy easy easy.		
1235:55.6 CAM-1	vee two.		
1235:56.9 CAM-1	positive rate.		
1235:58.7 CAM-2	gear up.		
1235:00.0 CAM-2	what's goin' on.		
1236:01.3 CAM-1	whoa #.		
1236:01.7 CAM-1	##.		
1236:01.8 CAM	((sound of trim-in-motion tone)).		
1236:02.2 CAM	((sound of stick shaker starts)).		
1236:02.8 CAM	((sound of trim-in-motion tone)).		
1236:04.5 CAM	((sound of trim-in-motion tone)).		
1236:05.6 CAM	((sound of trim-in-motion tone)).		

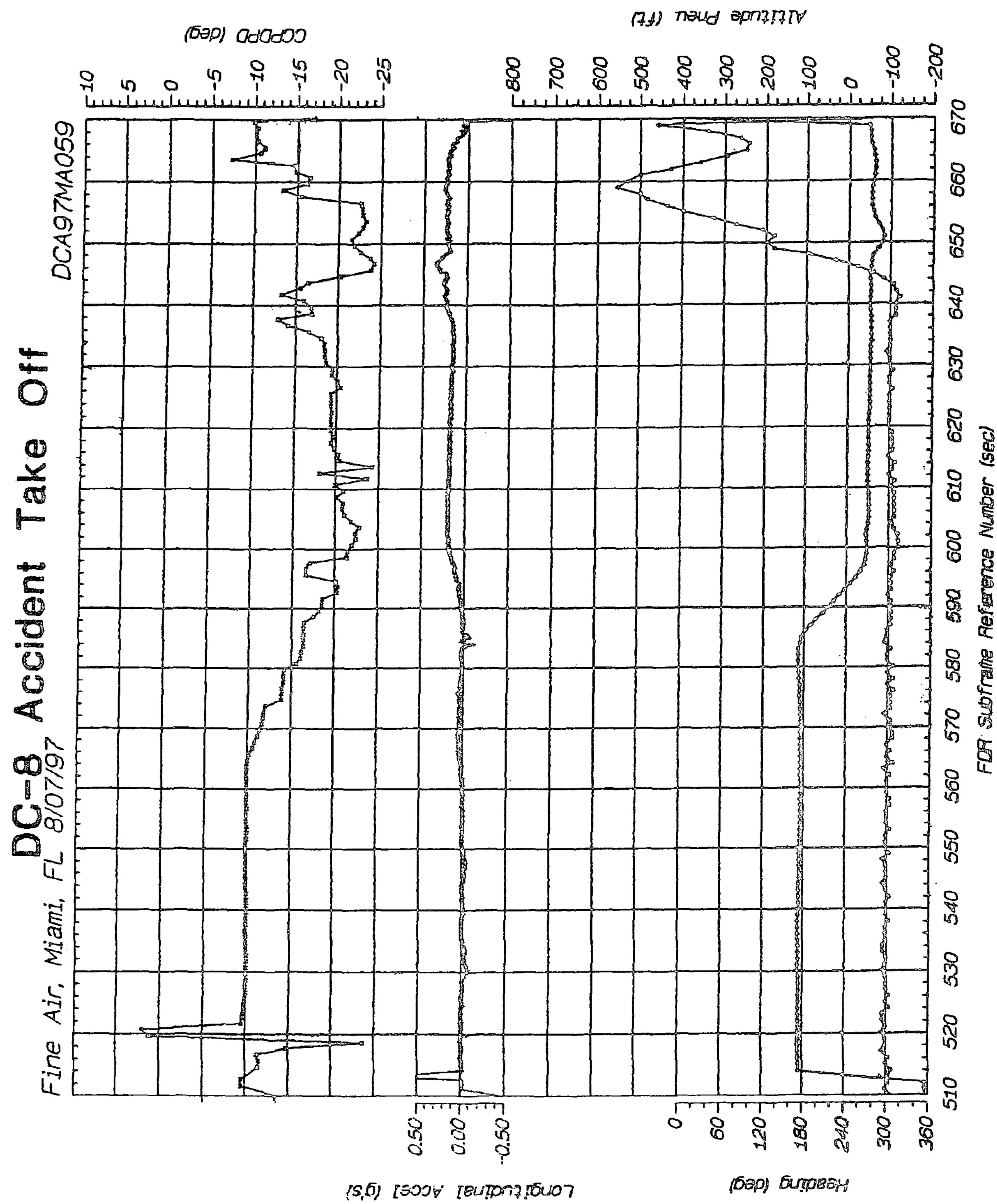
INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1236:07.4 CAM-1	oh no # no.		
1236:07.5 CAM	((sound of trim-in-motion tone)).		
1236:08.8 CAM	((sound of trim-in-motion tone)).		
1236:09.3 CAM-1	oh no # No.		
1236:12.0 CAM	((stick shaker stops)).		
1236:13.3 CAM-1	# # #.		
1236:15.1 CAM-1	hold on hold on keep it light easy #.		
1236:17.8 CAM	((stall warning starts and continues until end of recording)).		
1236:17.6 GPWS	too low gear.		
1236:19.2 CAM-1	oh #.		
1236:19.4 GPWS	too low - terrain terrain.		
1236:20.73 CAM	((sound similar to engine surge)).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1236:20.8 CAM-1	oh # #.		
1236:20.81 CAM	((sound similar to engine surge)).		
1236:20.88 CAM	((sound similar to engine surge)).		
1236:21.9 GPWS	woop woop pull up.		
1236:21.96 CAM	((sound similar to engine surge)).		
1236:22.73 CAM	((sound similar to engine surge)).		
1236:22.85 CAM	((sound similar to engine surge)).		
1236:22.9 CAM-2	something - what's happening.		
1236:24.5 CAM-2	oh no.		
1236:25.4	*end of recording.*		

APPENDIX C—EXCERPTS FROM THE FLIGHT DATA RECORDER

Fine Air Flight 101 - DFDR Data with Cockpit Voice Recorder Events




DC-8 Accident Take Off
Fine Air, Miami, FL 8/07/97
DCA97MA059
Altitude Pneu (ft)
Longitudinal Accel (g's)
Heading (deg)
FDR Subframe Reference Number (sec)

APPENDIX D—LEASE AGREEMENT BETWEEN FINE AIR AND AEROMAR

FineAir

FINE AIRLINES, INC.
P.O. BOX 523726
MIAMI, FLORIDA 33152
4600 NW 36TH STREET
BUILDING 22

AIRCRAFT WET LEASE AGREEMENT

This AIRCRAFT WET LEASE AGREEMENT ("Agreement") is made and entered into as of 1 May 1997 between Fine Airlines, Inc., a Florida Corporation, 1701 N.W. 66th Avenue, Miami, Florida, 33122 ("FINE"), and Aeromar C por A, a Dominican Republic Corporation ("AEROMAR"), 6245 N.W. 18th Street, Building 2144, Miami, Florida, 33122.

Now, therefore, in consideration of the mutual covenants, agreements, terms and conditions herein contained, the parties hereby agree as follows:

1. AIR CARRIER

FINE holds a valid certificate of public convenience and necessity to engage in interstate, overseas and foreign charter air transportation of property and mail issued by the Department of Transportation ("DOT") to operate as an air carrier under part 121 of the Federal Aviation Act of 1958, as amended ("ACT").

2. PROVISION OF SERVICES

FINE shall furnish AEROMAR with air charter services as set out in Section 4 in this Agreement ("Services"), using an aircraft having the specifications set out in this Agreement and AEROMAR shall utilize and pay FINE for the Services upon the terms and conditions set forth in this Agreement.

3. TERM OF SERVICE

The Services shall commence on or about May 1, 1997 and will terminate on May 1, 1999 unless terminated earlier by either party in writing.

4. NATURE OF THE SERVICES; OBLIGATIONS; EXCEPTIONS

A. Services. The aircraft will fly routes agreed upon by FINE and AEROMAR. FINE shall provide round trip service with a DC-8 aircraft, at the rate of $1,700.00 per block hour as per the aircraft logbook for 50 series aircraft and at the rate of $1,950.00 per block hour as per the aircraft logbook for 61 series aircraft. This includes aircraft, crew, maintenance, and aircraft liability insurance. AEROMAR to provide fuel, loading and unloading at all stops, landing fees, duties, permits, over flights, taxes, parking fees, civil aeronautic charges, airport charges, navigational and communication charges, ground handling and all other flight related expenses. AEROMAR to pay per diems and transportation charges, including hotel expenses, for the flight crew and maintenance representatives for all overnight situations away from Miami. Actual flight expenses and fuel adjustment charges will be calculated and invoiced the day after each flight. All flights covered under this Agreement shall be under the operational control of FINE.

FineAir

B. Fuel Economy. In rendering the Services, FINE's crew shall configure the fuel requirements of said Aircraft so as to provide the maximum cargo payload at all times, taking into consideration all relevant flight planning and scheduling factors. FINE shall at all times use its best efforts to conduct its flight operations in a manner consistent with fuel economy and safe airline practices.

C. Obligations of FINE. Except for the items to be provided by AEROMAR set out in this Agreement, FINE, at FINE's sole cost and expense, shall provide all personnel, equipment, licenses, and any additional items required to provide the Services, including but not limited to:

(1) Fully qualified, licensed, and experienced cockpit crews as necessary to fly the Aircraft on the routes agreed upon by FINE and AEROMAR;

(2) Salaries, social security, payroll taxes, other fringe benefits and insurance for the flight crews, ground staff, and other FINE personnel provided pursuant to the Agreement;

(3) Insurance coverages; to include hull and liability insurance. FINE shall be the sole loss payee in the event of a hull loss and AEROMAR shall be named additional insured under FINE's aircraft liability policy. AEROMAR shall maintain its own cargo legal liability insurance.

(4) The Aircraft that FINE will operate pursuant to this wet lease will be a DC-8 aircraft:

Registration N54FA, Series 54
Registration N55FB, Series 55
Registration N56FA, Series 54
Registration N57FB, Series 54
Registration N426FB, Series 54
Registration N427FB, Series 54
Registration N44UA, Series 54
Registration N7046H, Series 54
Registration N507DC, Series 51
Registration N508DC, Series 51
Registration N27UA, Series 61
Registration N29UA, Series 61
Registration N30UA , Series 61

All are fully modified as required by law and on FINE Operations Specifications;

(5) Complete maintenance, including, but not limited to, routine or line maintenance, overhaul, and repair or other major overhaul level of the maintenance program under which the Aircraft is operated, as required by law. FINE shall maintain all applicable aircraft instruments, components, parts, accessories, and controls to the requisite FAA specifications, and shall ensure that all flight crews, maintenance personnel, flight dispatchers, and other personnel shall be qualified to maintain such equipment, supervise, and conduct flight and ground operations;

(6) Preparation of flight-related documents at all locations flown;

(7) All necessary flight planning and flight following activities required to perform the required trips;

D. Obligations of AEROMAR. AEROMAR shall provide such services and supplies as set forth in this Agreement.

5. PAYMENTS

AEROMAR agrees to pay FINE on a weekly basis, in arrears, for flights flown during the week. Invoicing will be done on a per trip basis. FINE will charge AEROMAR at the rate of $1,700.00 per block hour as per the aircraft log book for 50 series aircraft and at the rate of $1,950.00 per block hour as per the aircraft logbook for 61 series aircraft. In addition, FINE shall bill AEROMAR per flight $322.00 for landing fees in Miami, $196.00 for parking fees in Miami, $150.00 for drug dog security in Miami, $61.00 APHIS user fees, $150.00 for ground handling in Miami.

6. CANCELLATION

Either party shall have the right to cancel this Agreement upon written notice to the other party giving five (5) days notice in advance of such date of cancellation.

7. ASSIGNMENT

Neither FINE nor AEROMAR may assign or subcontract its rights or obligations under this Agreement without the written consent of the other party.

8. REPRESENTATIONS, WARRANTIES, AND COVENANTS

FINE represents, warrants and covenants that:

A. Corporate Status. FINE is a corporation duly organized and validly existing, and in good standing under the laws of the State of Florida.

B. Authority. FINE has the full power, authority and legal right to execute, deliver and perform the terms of this Agreement. This Agreement has been duly authorized by all necessary corporate action of FINE and it constitutes a valid and binding obligation of FINE enforceable in accordance with its terms. This Agreement does not contravene any law, governmental rule, regulation, or order known to and binding on FINE or contravene the certificate of incorporation or by-laws of FINE or contravene the provisions of or constitute any default under, or result in the creation of any lien upon any of the property of FINE under any indenture, mortgage, contract, or other agreement to which FINE is a party or by which it is bound.

C. Indemnification. FINE shall assume all risks and/or liability for and shall hold AEROMAR, its employees, servants and agents free and harmless from any and all claims (including legal fees and court costs and expenses) in respect of death of or injury to FINE's employees when in the course of their employment or loss or damage to their property including, but not limited to, any liability for consequential damages arising directly or indirectly from or connected with this Agreement.

D. FINE shall be responsible for its crew and maintenance personnel with regard to any of their actions involving the carriage aboard the chartered aircraft of contraband or any materials, products or other substances that importation, possession, transportation or distribution of which would

Fine Air

constitute a violation of any law of the Dominican Republic, the United States of America, or any state (or division of such state) thereof. FINE agrees to indemnify and hold harmless AEROMAR from all costs, expenses (including legal fees), losses, liabilities, and damages incurred by AEROMAR as a result of any foregoing activities by FINE's crew or maintenance personnel.

AEROMAR represents, warrants and covenants that:

A. Corporate Status. AEROMAR is a corporation duly organized and validly existing, and in good standing under the laws of the Dominican Republic.

B. Authority. AEROMAR has the full power, authority and legal right to execute, deliver and perform the terms of this Agreement. This Agreement has been duly authorized by all necessary corporate action of AEROMAR and it constitutes a valid and binding obligation of AEROMAR enforceable in accordance with its terms. This Agreement dies not contravene any law, governmental rule, regulation, or order known to and binding on AEROMAR or contravene the certificate of incorporation or by-laws of AEROMAR or contravene the provisions of or constitute any default under, or result in the creation of any lien upon any of the property of AEROMAR under any indenture, mortgage, contract, or other agreement to which AEROMAR is a party or by which it is bound.

C. Indemnification. AEROMAR shall assume all risks and/or liability for and shall hold FINE, its employees, servants and agents free and harmless from any and all claims (including legal fees and court costs and expenses) in respect of death of or injury to AEROMAR's employees when in the course of their employment or loss or damage to their property including, but not limited to, any liability for consequential damages arising directly or indirectly from or connected with this Agreement.

D. AEROMAR hereby warrants and guarantees that the cargo to be transported by FINE pursuant to this Agreement shall not contain any contraband or any materials, products, or other substances that importation, possession, transportation, or distribution of which would constitute a violation of any law of the Dominican Republic, the United States of America, or any state (or division of such state) thereof, or any other destination that AEROMAR shall request FINE to fly. AEROMAR agrees to indemnify and hold harmless FINE from all costs, expenses (including attorneys fees), losses, liabilities, and damages incurred by FINE as a result of any breach of the foregoing commitment. AEROMAR agrees to pay and discharge any liens, claims or penalties imposed as a result of violations by it or its agents or its employees of any such laws, rules, regulations or requirements. AEROMAR agrees to pay lessor as liquidated damages for loss of use of the aircraft up to 8 hours of block time per day while the aircraft is out of use as a result of a violation described in this paragraph.

E. Obligations. AEROMAR shall provide FINE with

FineAir

accurate cargo weights so FINE can properly determine the weight and balance of the aircraft to insure lawful operating conditions. Actual payload shall be limited to either weight or volume and the weight or volume is not guaranteed. Operating conditions may result in increase or decrease in weight limit.

9. NOTICES

All notices, requests, demands and other communications under this Agreement, shall be in writing and shall be deemed to have been duly given on the date of service if served personally, by telegram, by telefax or overnight delivery, on the party to whom notice is to be given, and addressed properly as follows:

To FINE:
1640 N.W. 62 Avenue
Miami, Florida 33122

To AEROMAR:
2460 N.W. 66 Avenue
Miami, Florida 33122

10. GOVERNING LAW

The parties hereto agree that the law of the State of Florida shall govern the terms of this Agreement, and any litigation must exclusively be brought in the Federal District Court of the Southern District of Florida or the courts of the State of Florida located in Miami, Florida. This Agreement shall be construed and governed in agreement with the laws of the State of Florida and the United States of America.

11. CUSTOMS FEES

Any additional fees incurred due to U.S. Customs or Foreign Customs inspections of the cargo or aircraft shall be the responsibility of AEROMAR.

IN WITNESS WHEREOF: The parties hereto have affixed their hand and seals the day and year first written above.

AEROMAR C por A
"AEROMAR"

By: ______________________

Title: Vice-president

FINE AIRLINES, INC.
"FINE"

By: ______________________

Title: Vice President

FineAir

FINE AIRLINES, INC.
P.O. BOX 523726
MIAMI, FLORIDA 33152
4600 NW 36TH STREET
BUILDING 22

ADDENDUM TO AIRCRAFT WET LEASE AGREEMENT

This ADDENDUM TO AIRCRAFT WET LEASE AGREEMENT ("Agreement") is made and entered into as of June 19, 1997 and supplements the existing AIRCRAFT WET LEASE AGREEMENT between Fine Airlines, Inc., hereinafter FINE, and Aeromar C. por A., hereinafter AEROMAR, dated May 1, 1997 for the purpose of complying with United States Federal Aviation Regulation 119.53, "Wet leasing of aircraft and other arrangements for transportation by air."

Now, therefore, in order to comply with Federal Aviation Regulation 119.53, the parties hereby offer the following additional information as follows:

A. AUTHORIZED TO ENGAGE IN COMMON CARRIAGE

FINE holds a valid certificate of public convenience and necessity to engage in interstate, overseas and foreign charter air transportation of property and mail issued by the Department of Transportation ("DOT") to operate as an air carrier under part 121 of the Federal Aviation Act of 1958, as amended ("ACT").

AEROMAR holds a valid exemption under 49 U.S.C. section 40109, issued by the Department of Transportation ("DOT") to engage in non-scheduled foreign air transportation of property and mail between a point or points in the Dominican Republic on the one hand and points in the United States on the other hand.

B. AIRCRAFT

The registration markings of the aircraft involved in the AIRCRAFT WET LEASE are as follows:

N55FB, DC-8F-55	N44UA, DC-8F-54	N507DC, DC-8F-51
N54FA, DC-8F-54	N56FA, DC-8F-54	N508DC, DC-8F-51
N426FB, DC-8F-54	N7046H, DC-8F-54	N27UA, DC-8F-61
N427FB, DC-8F-54		N29UA, DC-8F-61
N57FB, DC-8F-54		N30UA , DC-8F-61

C. KIND OF OPERATION

FINE shall operate flights under this AIRCRAFT WET LEASE using the conditions and authorizations provided in the Federal Aviation Regulations Part 121 Supplemental Operations Specifications issued to FINE by the United States Federal Aviation Administration.

D. AREAS OF OPERATION

Flights shall be conducted between points in the United States and points in the Dominican Republic.

E. OPERATIONAL CONTROL

FINE shall maintain operational control of the aircraft at all times during operations conducted under this AIRCRAFT WET LEASE. In exercising operational control, FINE shall utilize FINE's flight crew members trained under FINE's FAA Approved training program; FINE's dispatch center; maintenance shall be performed under FINE's FAA Approved Maintenance Program; and servicing of the aircraft shall be done under the supervision of FINE's employees.

APPENDIX E—CONSENT AGREEMENT BETWEEN FAA AND FINE AIR

UNITED STATES DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ATLANTA, GEORGIA

In the Matter of:

Fine Airlines, Inc.

CONSENT AGREEMENT

Considering the Enforcement Investigative Report enumerated above, and the results of an inspection conducted in August and September of 1997, the Federal Aviation Administration (FAA) has concluded that Fine Airlines, Inc., (hereafter Fine Air) under its authority to operate as an air carrier under Part 121 of the Federal Aviation Regulations (FAR) (14 C.F.R. 121), conducted flight and ground operations, including but not limited to cargo operations, contrary to and in violation of the FAR and the Department of Transportation Hazardous Material Regulations (HMR) (49 CFR Part 171 et. seq.)

The FAA acknowledges Fine Air's cooperative attitude and its commitment to return to air carrier operations at the highest level of safety. In consideration of the foregoing, the FAA and Fine Air have reached a settlement of this matter under which both are willing to accept the issuance of this Consent Agreement, to avoid potential litigation and expedite the resumption of Fine Air's operations.

The FAA acknowledges and agrees that Fine Air's execution of, and payment in accordance with, this Consent Agreement, do not constitute or imply an admission by Fine Air of any facts, circumstances, and regulatory violations alleged by the FAA.

This Consent Agreement is issued under the authority contained in 49 U.S.C. Sections 46105 and 44709, and 14 C.F.R. 13.13.

In consideration of the above, Fine Air agrees to pay the FAA one million five hundred thousand dollars ($1,500,000), as provided in Paragraph 7 below, as a remedial payment, representing and reflecting the costs incurred or to be incurred by the FAA to investigate, review, and re-inspect Fine Air and establish and ultimately enforce this Consent Agreement. The FAA acknowledges that this payment is not a fine, penalty, or punitive sanction of any other nature, but compensatory and remedial in nature. Fine Air waives any right it may have to further itemization, accounting, or billing of these costs.

ACCORDINGLY, it is hereby ordered as follow:

1. Fine Air agrees to cease all Part 121 operations until the FAA determines that Fine Air has complied with all the terms of paragraph 10 (a) through (h).

2 Fine Air agrees to remove from its operations specifications any aircraft which it dry leases to an air carrier certificated under Part 129 of the FARs unless the Miami FSDO approves Fine Air's request to have the aircraft remain on its operations specifications during the period the dry lease is in effect.

3 The FAA further agrees that it shall not unreasonably withhold its consent for Fine Air to resume Part 121 operations. Fine Air specifically waives any and all rights to appeal or otherwise seek judicial review of this Consent Agreement.

4 These terms shall constitute a full and conclusive settlement of any FAA legal enforcement actions that may be brought by the Federal Aviation Administration against Fine Air based upon alleged violations of the FAR and HMR occurring on or before the date of execution of this Consent Agreement (including the outstanding order previously resolved between the parties concerning pilot training issues), with the exception of civil penalty actions resulting from the alleged violations of the HMR committed by persons not employed by Fine Air, but who were either providing ground services to Fine Air or otherwise offered hazardous material to Fine Air, through Fine Air, or on behalf of Fine Air; accepted hazardous material for Fine Air, through Fine Air, or on behalf of Fine Air or transported hazardous material for Fine Air, through Fine Air, or on behalf of Fine Air

5. The FAA will withdraw each of the enforcement actions pending against the Fine Air flight crewmembers relating to the conduct of operations into Bogota, Columbia or Quito Ecuador and that it will not institute any new actions relating to any such operations conducted prior to the date of execution of this Consent Agreement.

6. Fine Air agrees that it shall not raise any defense of double jeopardy, excessive fines, collateral estoppel, equitable estoppel or other defenses based upon the Consent Agreement, in any future criminal or civil action, if any, brought by any government agency other than the Federal Aviation Administration. Fine Air does not, by agreeing to the entry of the Consent Agreement, waive its right to contest any and all allegations of criminal violations or conduct.

7. In view of the fact that Fine Air's operations have temporarily ceased as of September 4, 1997, the FAA agrees that it will treat the re-inspection of Fine Air as a priority matter. As a condition of being permitted by FAA to recommence operations, Fine Air agrees to pay a remedial payment in the amount of one million five hundred thousand dollars to defray costs incurred or to be incurred by the FAA to investigate, review, and re-inspect Fine Air's procedures and operations, and establish and enforce this Consent Agreement. Fine Airlines, Inc., promises to pay the amount of one million five hundred thousand dollars ($1,500,000) to the order of the FAA in installments as follows ($500,000 of the total amount of $1,500,000 may be forgiven as described below):

$310,000 on or before the 12th day of October, 1997, or within 5 days of Fine Airlines, Inc., resuming operations under Part 121 of the Federal Aviation Regulation, whichever occurs first;

$115,000 on or before the 15th day of January, 1998

$115,000 on or before the 15th day of April, 1998

$115,000 on or before the 15th day of July, 1998

$115,000 on or before the 15th day of October, 1998

$115,000 on or before the 15th day of January, 1999

$115,000 on or before the 15th day of April, 1999

In addition, if Fine Airlines, Inc., does not comply with the terms in paragraph 10 items (i) through (t) of the Consent Agreement on or prior to December 31, 1997, Fine Airlines, Inc., will also pay the balance due under this note of $500,000 on or before the 15th day of April, 1999. If Fine Airlines, Inc., complies with paragraph 10 items (i) through (t) of the Consent Agreement on or before to December 31, 1997, and also complies with the other terms of the Consent Agreement and of this Promissory Note, $500,000 will be forgiven and will not be due and owing. Such payments shall be made to the Federal Aviation Administration by check or money order and addressed and delivered to FAA Southern Region, Accounting Operations Branch, ASO-22, P.O. Box 45719, Atlanta, Georgia 30320. Said payment shall be delivered to ASO-22 within five days of the date Fine Air's Part 121 operations are resumed or within 30 days of the execution of this Consent Agreement, which ever occurs first.

8. Within three working days after receiving Fine Air's plan referred to in paragraph 10 below, the Miami Flight Standards District Office (FSDO) and the Miami Civil Aviation Security Field Office (CASFO) will advise the company of the plan's acceptability or the need for changes. The FAA will specify any changes required, after which Fine Air shall submit a revised plan to the FSDO and CASFO.

9 The FAA acknowledges Fine Air's desire to resume Part 121 operations as quickly as possible consistent with the terms of this Consent Agreement. Accordingly, the FAA agrees that it will devote the necessary inspector resources to evaluate Fine Air's submissions and assess the company's compliance with the terms of this Consent Agreement.

10. Fine Air agrees to present a plan to the Miami Flight Standards District Office (FSDO) specifying the methods and schedule to accomplish the following. Only those items marked by an asterisk (*) must be accomplished before resuming flight operations under Part 121.

*a) Present all manuals as requested by the Miami FSDO and make changes where required to ensure compliance with the FARs.

*b) Successfully demonstrate all phases of flight operations.

*c) Review and revise, as necessary, cargo handling system and procedures that will ensure accuracy of cargo weights, restraint and loading for all flights under the operational control of Fine Air. This system will include but not be limited to; maintenance program for cargo pallets and cargo restraint devices, cargo pallet loading procedures, cargo weighing procedures, system for control of scales and maintaining calibration records for scales used for weighing cargo, aircraft loading procedures, aircraft weight and balance procedures.

*d) Review and revise as necessary a training program for cargo handlers and other personnel responsible for cargo handling and aircraft loading.

*e) Review and revise, as necessary, crewmember and flight follower training to include cargo handling, aircraft loading procedures, and aircraft weight and balance and performance computations.

*f) Review and revise as necessary a system to determine aircraft performance during takeoff, climb, cruise, and landing that is accurate for each aircraft operated and that is based on FAA approved data.

*g) Review and revise as necessary the system for controlling Condition and Correction (C&C) forms.

*h) Provide the Miami FSDO with a new and current Letter of Compliance.

i) Review and revise as necessary a system to ensure all "wet leases" and interchange agreements are properly authorized in operations specifications prior to conducting any operations under the agreement.

j) Revise maintenance program for engines on and off wing.

k) Review and revise as necessary a maintenance and inspection program for aircraft cargo floors.

l) Review and revise as necessary the maintenance program for flight data recorders.

m) Revise company organization and duties and responsibilities that allows Quality Control to directly make decisions that can affect the airworthiness of the aircraft.

n) Review and revise as necessary maintenance program procedures that ensure all deferrable fuel leaks are repaired no later than at a "B" check interval.

o) Review and revise as necessary the CASS program so as to determine what aircraft inspection intervals must be changed from "On Condition" (OC) to "Hard Time" (HT).

p) Revise GMM to include instructions for adding substantial maintenance facilities and vendors into the system.

q) Revise GMM to demonstrate how aircraft are scheduled for wash between "C" check intervals.

r) Revise engine monitoring program that clearly identifies procedures and personnel responsible for the program.

s) Clarify the separation between Fine Air and Fine Air Repair Center, Inc.

t) Review and revise the manual control system for tracking distribution of manuals.

11. Prior to commencing Part 121 operations as a "will not carry" dangerous goods air carrier (see 49 CFR and/or ICAO), Fine Air must comply with the provisions in this paragraph and paragraph 12(g).

When it resumes Part 121 operations, Fine Air will not carry, nor accept for transportation, hazardous materials, or dangerous goods ("DG") cargo as defined in appropriate DG transport regulations of ICAO and 49 CFR, in its US and foreign locations. Fine Air will review and revise as necessary, present to FAA Miami CASFO, and implement the following procedures acceptable to the FAA Administrator for ensuring Fine Air will not carry DG cargo:

a) Engage certified DG trainers to provide classroom "DG Recognition Training" for 100% of Fine Air "hazmat" employees as defined by 49 CFR 171.8.

b) Obtain upon receipt of cargo, statements from wet lease customers for each flight, certifying that no DG cargo is contained within offered shipment.

c) Obtain statements from wet lease customers certifying that all of their hazmat employees have received appropriate training.

d) Notify all customers of status change to "will not carry" operator, stating that Fine Air will not transport DG cargo, nor accept DG cargo for transportation, until future notice.

12. Prior to commencing Part 121 operations as a "will carry" dangerous goods air carrier (see 49 CFR and/or ICAO), Fine Air must comply with the provisions in this paragraph.

When it resumes Part 121 operations under this paragraph, Fine Air agrees to comply with appropriate dangerous goods transport regulations of ICAO and 49 CFR in its US and foreign locations, and agrees to develop, present to FAA Miami CASFO, and implement enhanced procedures as necessary which are acceptable to the FAA Administrator, for ensuring such compliance, including specifying the methods and schedule for accomplishing the following:

a) Present for evaluation upon request a job description of each of Fine Air's hazardous materials employees in US and foreign locations as required by Title 49, Code of Federal Regulations subpart H of part 172. [See also parts 106, 171,175 and 14 CFR 121.135, 121.401, 121.433(a), 135.323, 135.327 and 135.333.]

b) Present for evaluation upon request a list of initial and recurrent dangerous goods training received by each hazardous materials employee in US and foreign locations, by job description, including a time table for recurrent dangerous goods training, by job description.

c) Present for evaluation upon request all dangerous goods training manuals, including testing materials for each type of hazardous materials employee in US and foreign locations.

d) Present for evaluation upon request dangerous goods training manuals and testing material used in competency testing for each type of hazardous materials employee in US and foreign locations, including post-training, on-the-job testing to ensure competency of each hazardous materials employee in US and foreign locations.

e) Review and revise as necessary a method of internal audit of Fine Air's in-house hazmat class room training.

f) Review and revise as necessary a method of internal audit of Fine Air's dangerous goods program, to ensure compliance with 49 CFR and ICAO.

g) Recognizing the importance of effective oversight of wet lease operators and other cargo contractors, especially those offering or causing dangerous goods to be loaded aboard Fine Air aircraft. Fine Air agrees to review and revise procedures as necessary, and to present procedures acceptable to the FAA Administrator, for compliance by Fine Air, Fine Air's wet lease customers, and Fine Air's cargo contractors, with all applicable dangerous goods transport regulations in 49 CFR and/or ICAO.

13. Fine Airlines, Inc. agrees to correct the access investigation files, determined to be deficient by the Miami Civil Aviation Security Field Unit (MIA-CASFU), in the following outlined manner:

a) The records of those employees requiring unescorted air operations area (AOA)/security identification display area (SIDA) access, in the performance of their assigned duties, hired after February 1, 1996, but prior to December 3, 1996, will be amended and documented to show compliance with all applicable 14 Code of Federal Regulations (CFR) Part 107.31 provisions.

b) The records of personnel requiring unescorted AOA/SIDA access, in the performance of their assigned duties, hired on or after December 3, 1996, will be amended and documented to show compliance with all applicable 14 CFR Part 107.31 provisions; and

Upon correction, the 44 records identified by the MIA-CASFU as containing substantial errors, will be presented to the airport authority for review, prior to the individual's re-application for unescorted access and subsequent approval.

c) Fine Air agrees to process all future access investigations of employees/prospective personnel, requiring unescorted AOA/SIDA access, in performance of their assigned duties, in strict adherence to the applicable requirements of 14 CFR Part 107.31. Fine Air will provide a certification to the airport authority that said compliance has occurred.

14. Fine Air hereby waives any and all rights to appeal or otherwise seek judicial review of this Consent Agreement. However, both parties retain the right to judicially enforce the provisions hereof in the appropriate federal court.

FOR FAA:

Office of Assistant Chief Counsel

9/12/97
Date

FOR FINE AIRLINES, INC.

Marshall S. Filler
Counsel for Fine Airlines, Inc.

9/12/97
Date

APPENDIX F—FLIGHT 101 LOADING AND FLIGHT DISPATCH DOCUMENTS

AIRLINES

AIRCRAFT N-30UA

BQ-103

08-07-97

PALLET	PALLET-WEIGHT	GENERAL-CARGO
A"	5.027 # POSICION (1B)	
B"	5.880 #	
C"	5.854 #	
D"	6.096 #	
E"	5.674 #	
F"	6.097 #	
G"	6.950 #	
H"	5.444 #	
I"	5.970 #	
J"	5.611 #	
K"	5.976 #	
L"	5.960 #	
[illegible]"	5.108 #	
[illegible]"	4.129 # POSICION (1) PRIORITY.	
[illegible]"	4.390 #	
[illegible]"	4.757 #	
[illegible]"	Ø	
[illegible]"	Ø	
[illegible]Y (1)	Ø	
[illegible] (2)	Ø	
[illegible] (3)	Ø	
[illegible] (4)	Ø	

R/A "NO"

TOTAL WEIGHT = 88.923 #

Exhibit 1

AIRLINES

LOADING

AIRCRAFT: N27UA ~~N 50UA~~

BQ-103

08-07-97

PALLET	PALLET-WEIGHT	GENERAL-CARGO
A	5.027 + Position (1B)	
B	5.880 +	
[illegible]	5.854 +	
[illegible]	6.096 +	
[illegible]	5.674 +	
[illegible]	6.097 +	
[illegible]	5.950 +	
[illegible]	5.444 +	
[illegible]	5.970 +	
[illegible]	5.611 +	
[illegible]	5.976 +	
[illegible]	5.960 +	
[illegible]	5.108 +	
[illegible]	4.129 + Position (1) Priority.	
[illegible]	4.390 +	
[illegible]	4.757 +	
[illegible]	0	
[illegible]	0	
Y (1)	0	
(2)	0	
(3)	0	
(4)	0	

RECEIVED 97 AUG -7 AM 2:55 AEROHAR AIRLINES MIAMI AIRPORT

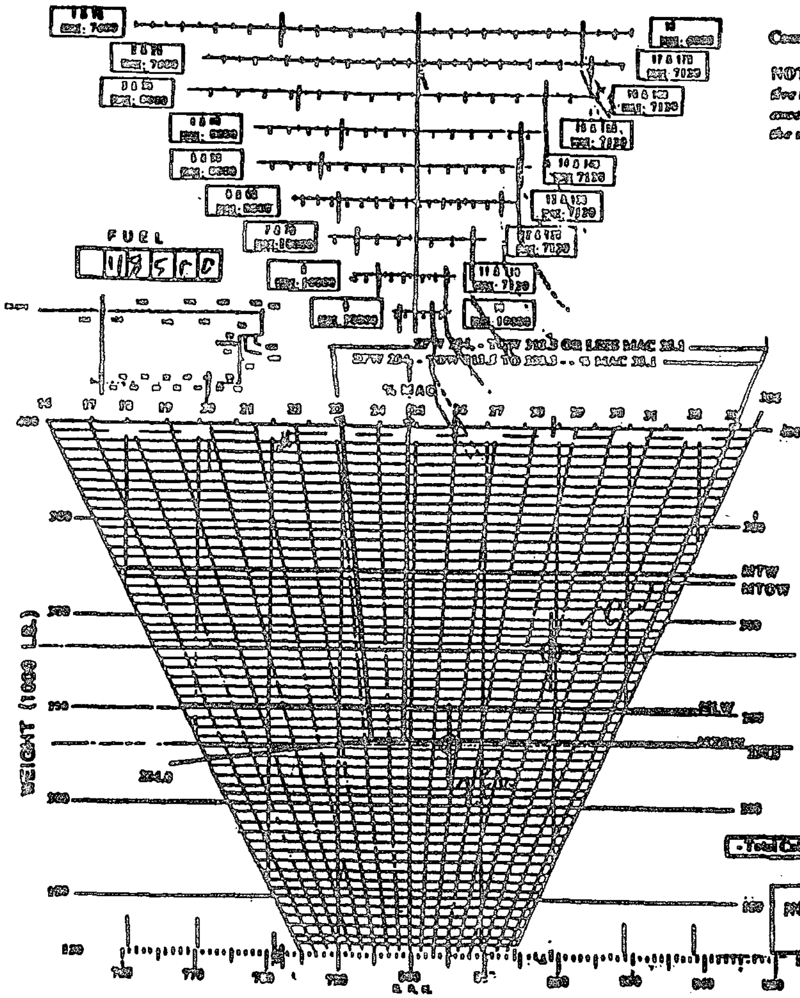
B/A NO   TOTAL WEIGHT = 87.923 +

FINE AIRLINES, INC
DC-8-61
WEIGHT DISTRIBUTION FORM

ACFT N27UA FLIGHT 101A DATE 8-7-97

POS	DEST	WT	REMARKS	POS	DEST	WT
1	SDQ	4129	REQ	1B		
2		0		2B		
3		4757		3B		
4		4390		4B		
5		5444		5B		
6		5674		6B		
7		5970		7B		
8		6076				
9		6097				
10		5950				
11		5880		11B		
12		5976		12B		
13		0		13B		
14		5554		14B		
15		5611		15B		
16		5138		16B		
17		5960		17B		
18	SDQ	5027	REQ			
PALLET WT		87923	TOTAL BELLY WEIGHT 0			
BELLY WT		0				
TOTAL WEIGHT (PALLET + BELLY) = 87923						

Exhibit 3



Compartment Max. Weight

NOTE: *Total load of upper and respective lower (belly) compartment must not exceed maximum allowable weight of the upper compartment.*

1	7680				
1 Belly	2551				
2	7680				
2 Belly	2910				
3	9800				
3 Belly	2910				
4	9800				
4 Belly	2910				
5	9800				
5 Belly	3270				
6	9800				
6 Belly	4040				
7	10000				
7 Belly	3001				
8	10000				
9	10000				
10	10000				
11	7120				
11 Belly	2800				
12	7120				
12 Belly	4040				
13	7120				
13 Belly	4040				
14	7120				
14 Belly	4040				
15	7120				
15 Belly	1979				
16	7120				
16 Belly	1307				
17	7120				
17 Belly	1311				
18	6800				
• Total Cabin Load		[illegible]			

NOTE: Bulk Loading on the A/C Floor is not permitted.

LOAD SHEET

DC-8-61

	ITEM	WEIGHT	B.R.N.
1	BASIC OPER. WT.	115919	7831
2	EXTRA FLT. CREW	+ 210	− 7
3			
4	ADJ. OPER. WT.	116159	7822
5	TOTAL LOAD	47821	% MAC
6	ZERO FUEL WT.	235941	26.4
7	FUEL LOAD	48500	
8	T.O. GROSS WT.	282482	30.0
9	FUEL BURN	31825	
10	LANDING WT.	250656	
11	CORR. ZERO FUEL WT.		
12	CORR. T.O. GROSS WT.		

PERFORMANCE LIMITATIONS

13	MAX T/O RWY MAX WT.	315400
14	CORR.	+
15	PENALTIES	−
16	WIND CORRECTION	+
17	CORR. RUNWAY LIMITED WEIGHT	315400
18	MAX SEC. SEG. LIMIT WEIGHT	325000
19	SEC. SEG. CORR.	+
20	CORR. SEC. SEG. LIMITED WEIGHT	325000
21	MAX T/O RWY MAX WT.	323500
22	TOTAL CORR.	+
23	T/O RWY LIMITED WT.	323500
24	MAX SEC. SEG. LAST WEIGHT	324900
25	SEC. SEG. CORR.	+
26	SEC. SEG. LAST WEIGHT	324900
27	DESTINATION MAX LANDING WEIGHT	252000
28	ALTERNATE MAX LANDING WEIGHT	252000

DATE	8-7-72
	Mi'10
FLIGHT	101
A/C REG.	N12 71|L1
	JWM
CAPTAIN	thompson
CAPTAIN	[illegible]
STAB TRIM	2.1
V_1	131
V_R	147
V_2	158
T/O FLAPS	15
REMARKS	

WEIGHT LIMITATIONS	
MAX TAXI	
MAX TAKEOFF	
MAX LANDING	252000
MAX ZERO FUEL	

FORM FA-01-02 REV: 09/11/54

Exhibit 4

SUMMARY
FINE DC-8-61F
NTSB SCENARIOS
WITH 88 X 125 PALLETS

CASE NO.	DESCRIPTION	ZFW	CG	% MAC	TOGW	CG	% MAC
Base	FINE AIR (as received)	233,982	861.5	26.0	282,482	862.8	26.5
Base (rev)	FINE AIR (as revised by Boeing, DPD)	234,082	861.8	26.1	282,582	863.0	26.6
1	Reverse position 13 & 17	234,082	852.7	22.9	282,582	855.5	23.9
2A	Case 1 with position 14-16 aft 1 position	234,082	862.6	26.4	282,582	862.6	26.4
2B	Case 2A with position 14-17 fwd i position	234,082	852.7	22.9	282,582	855.5	23.9
3A	Case 2A with pos. 4 @ 90 deg & in pos 5	234,082	880.5	32.9 *	282,582	878.6	32.2 *
4A	Case 1 with 6950 lb on pallet G	235,082	853.0	22.9	283,582	855.7	23.9
4B	Case 2A with 6950 lb on pallet G	235,082	861.5	26.0	233,582	862.8	26.5
4C	Case 2B with 6950 lb on pallet G	235,082	853.0	22.9	283,582	855.7	23.9
4D	Case 3A with 6950 lb on pallet G	235,082	881.0	33.1 *	283,582	879.0	32.4 *
5A	Case 1 with pos. 1 in pos 2	234,082	854.3	23.4	283,582	856.9	24.3
5B	Case 2A with pos. 1 in pos 2	234,082	862.9	26.5	282,582	863.9	26.9
5C	Case 2B with pos. 1 in pos 2	234,082	854.3	23.4	282,582	856.9	24.3
5D	Case 3A with pos. 1 in pos 2	234,082	882.1	33.5	282,582	879.9	32.7 *
5E	Case 4A with pos. 1 in pos 2	235,082	854.6	23.5	283,582	857.0	24.4
5F	Case 4B with pos. 1 in pos 2	235,082	863.1	26.6	283,582	864.1	27.0
5G	Case 4C with pos. 1 in pos 2	235,082	854.6	23.5	283,582	857.0	24.4
5H	Case 4D with pos. 1 in pos 2	235,082	882.6	33.7	283,582	880.3	32.8 *
6A	Case 1 with collapsed bear traps	234,082	856.0	24.0	282,582	858.3	24.8
6B	Case 2A with collapsed bear traps	234,082	864.5	27.1	282,582	865.3	27.4
6C	Case 2B with collapsed bear traps	234,082	856.0	24.0	282,582	858.3	24.8
6D	Case 3A with collapsed bear traps	234,082	883.5	34.0	282,582	881.0	33.1 *
6E	Case 4A with collapsed bear traps	235,082	856.3	24.1	283,582	858.5	24.9
6F	Case 4B with collapsed bear traps	235,082	864.7	27.2	283,582	865.5	27.5
6G	Case 4C with collapsed bear traps	235,082	856.3	24.1	283,582	858.5	24.9
6H	Case 4D with collapsed bear traps	235,082	884.0	34.2	283,582	881.5	33.3
6I	Case 5A with collapsed bear traps	234,082	857.6	24.6	282,582	859.5	25.3
6J	Case 5B with collapsed bear traps	234,082	866.1	27.7	282,582	866.6	27.9
6K	Case 5C with collapsed bear traps	234,082	857.6	24.6	282,582	859.5	25.3
6L	Case 5D with collapsed bear traps	234,082	885.1	34.6	282,582	882.3	33.6
6M	Case 5E with collapsed bear traps	235,082	857.8	24.7	283,582	859.7	25.4
6N	Case 5F with collapsed bear traps	235,082	866.3	27.8	283,582	866.7	27.9
6O	Case 5G with collapsed bear traps	235,082	857.8	24.7	283,582	859.7	25.4
6P	Case 5H with collapsed bear traps	235,082	885.6	34.7	283,582	882.7	33.7

Note: boxed values are outside the cg limits, * values are at or near the aft limit

FINE DC-8-61F
NTSB SCENARIOS
WITH 88 X 125
PALLETS

Case 4C:Case 2B/6950 on G	wt(lb)	cg	%MAC
OEW	146,159	834.3	16.2
pallet pos			
1	4,129	106.5	
2	0	196.5	
3	4,757	284.5	
4	4,390	373.5	
5	5,444	462.5	
6	5,674	551.5	
7	5,970	640.5	
8	6,096	729.5	
9	6,097	818.5	
10	6,950	907.5	
11	5,880	996.5	
12	5,976	1085.5	
13	5,960	1174.5	
14	5,854	1263.5	
15	5,611	1352.5	
16	5,108	1441.5	
17	0	1530.5	
18	5,027	1638.0	
Total Pallets	88,923	883.7	
ZFW	235,082	853.0	22.9
FUEL	48,500	869	
TOGW	283,582	855.7	23.9

Case 4D: Case 3A/6950 on G	wt(lb)	cg	%MAC
OEW	146,159	834.3	16.2
pallet pos			
1	4,129	106.5	
2	0	196.5	
3	4,757	284.5	
4	4,390	444.5	
6	5,444	551.5	
7	5,674	640.5	
8	5,970	729.5	
9	6,096	818.5	
10	6,097	907.5	
11	6,950	996.5	
12	5,880	1085.5	
13	5,976	1174.5	
14	5,960	1263.5	
15	5,854	1352.5	
16	5,611	1441.5	
17	5,108	1530.5	
18	5,027	1638.0	
Total Pallets	88,923	957.8	
ZFW	235,082	881.0	33.1
FUEL	48,500	869	
TOGW	283,582	879.0	32.4

Case 5A: Case 1/pos 1 in 2	wt(lb)	cg	%MAC
OEW	146,159	834.3	16.2
pallet pos			
1	0	106.5	
2	4,129	196.5	
3	4,757	284.5	
4	4,390	373.5	
5	5,444	462.5	
6	5,674	551.5	
7	5,970	640.5	
8	6,096	729.5	
9	6,097	818.5	
10	5,950	907.5	
11	5,880	996.5	
12	5,976	1085.5	
13	5960	1174.5	
14	5,854	1263.5	
15	5,611	1352.5	
16	5,108	1441.5	
17	0	1530.5	
18	5,027	1638.0	
Total Pallets	87,923	887.6	
ZFW	234,082	854.3	23.4
FUEL	48,500	869	
TOGW	282,582	856.9	24.3