Crash During Landing
Executive Airlines (doing business as American Eagle) Flight 5401
Avions de Transport Regional 72-212, N438AT
San Juan, Puerto Rico
May 9, 2004

Aircraft Accident Report

NTSB/AAR-05/02

PB2005-910402
Notation 7650A

National Transportation Safety Board
Washington, D.C.

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Adopted September 7, 2005

National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2005. ***Executive Airlines (doing business as American Eagle) Flight 5401, Avions de Transport Regional 72-212, N438AT, San Juan, Puerto Rico, May 9, 2004.*** **Aircraft Accident Report NTSB/AAR-05/02. Washington, DC.**

Abstract: This report explains the accident involving Executive Airlines (doing business as American Eagle) flight 5401, an Avions de Transport Regional 72-212, which skipped once, bounced hard twice, and then crashed at Luis Muñoz Marin International Airport, San Juan, Puerto Rico. Safety issues discussed in this report focus on flight crew performance, the lack of company bounced landing recovery guidance and training, and malfunctioning flight data recorder potentiometer sensors. Safety recommendations concerning these issues are addressed to the Federal Aviation Administration.

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Abbreviations

AFFF	aqueous film forming foam
ALAR	approach and landing accident reduction
AOM	Airplane Operating Manual
ARFF	aircraft rescue and firefighting
ASOS	Automated Surface Observing System
ATC	air traffic control
ATIS	automatic terminal information service
ATR	Avions de Transport Regional
BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile
c.g.	center of gravity
CAM	cockpit area microphone
CF	center field
CFR	*Code of Federal Regulations*
CLB	climb
CRM	crew resource management
CRZ	cruise
CVR	cockpit voice recorder
DFDAU	digital flight data acquisition unit
DFW	Dallas/Fort Worth International Airport
FAA	Federal Aviation Administration
FARs	*Federal Aviation Regulations*
FDR	flight data recorder
fps	feet per second
GPWS	ground proximity warning system
HBAW	flight standards handbook bulletin for airworthiness
IOE	initial operating experience
KIAS	knots indicated airspeed
LOFT	line-oriented flight training
MAZ	Eugenio Mariá de Hostos Airport
MDCRS	Meteorological Data Collection and Reporting System

mg	milligram
MLG	main landing gear
msl	mean sea level
NLG	nose landing gear
PA	public address
PIC	pilot-in-command
SB	service bulletin
SJU	Luis Muñoz Marin International Airport
SNPRM	supplemental notice of proposed rulemaking
STC	supplemental type certificate
STT	Cyril E. King International Airport
TO	takeoff
VASI	visual approach slope indicator

Executive Summary

On May 9, 2004, about 1450 Atlantic standard time, Executive Airlines (doing business as American Eagle) flight 5401, an Avions de Transport Regional 72-212, N438AT, skipped once, bounced hard twice, and then crashed at Luis Muñoz Marin International Airport, San Juan, Puerto Rico. The airplane came to a complete stop on a grassy area about 217 feet left of the runway 8 centerline and about 4,317 feet beyond the runway threshold. The captain was seriously injured; the first officer, 2 flight attendants, and 16 of the 22 passengers received minor injuries; and the remaining 6 passengers received no injuries. The airplane was substantially damaged. The airplane was operating under the provisions of 14 *Code of Federal Regulations* Part 121 as a scheduled passenger flight. Visual meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan.

The National Transportation Safety Board determines that the probable cause of this accident was the captain's failure to execute proper techniques to recover from the bounced landings and his subsequent failure to execute a go-around.

The safety issues in this report include flight crew performance, the lack of company bounced landing recovery guidance and training, and malfunctioning flight data recorder potentiometer sensors. Safety recommendations concerning bounced landing recovery guidance and training and flight control surface position sensors are addressed to the Federal Aviation Administration.

1. Factual Information

1.1 History of Flight

On May 9, 2004, about 1450 Atlantic standard time,[1] Executive Airlines (doing business as American Eagle) flight 5401, an Avions de Transport Regional (ATR) 72-212, N438AT, skipped once, bounced hard twice,[2] and then crashed at Luis Muñoz Marin International Airport (SJU), San Juan, Puerto Rico. The airplane came to a complete stop on a grassy area about 217 feet left of the runway 8 centerline and about 4,317 feet beyond the runway threshold. The captain was seriously injured; the first officer, 2 flight attendants, and 16 of the 22 passengers received minor injuries; and the remaining 6 passengers received no injuries. The airplane was substantially damaged. The airplane was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 as a scheduled passenger flight. Visual meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan.

Flight 5401 departed Eugenio Mariá de Hostos Airport (MAZ), Mayagüez, Puerto Rico, for SJU about 1415. The captain was the nonflying pilot for the flight, and the first officer was the flying pilot. The flight crew stated that the takeoff, climb, and en route portions of the flight were uneventful.

At 1437:05, as the flight approached the SJU traffic area, the cockpit voice recorder (CVR) recorded the first officer confirming with the captain that automatic terminal information service (ATIS) Juliet, which reported that winds were 060° magnetic at 17 knots and gusting at 23 knots, was current.[3] Shortly thereafter, the captain briefed a V_{ref} (the minimum approach airspeed in the landing configuration before the airplane reaches the runway threshold) of 95 knots and told the first officer to "stand by for winds."[4] The first officer asked the captain if he should set his airspeed bug[5] to 95 knots, and the captain replied, "yeah."

At 1443:03, a controller from the SJU Terminal Radar Approach Control cautioned the pilots of possible wake turbulence from a preceding Boeing 727.[6] The

[1] Unless otherwise indicated, all times in this report are Atlantic standard time.

[2] For the purposes of this report, the term "skip" refers to a landing airplane that momentarily becomes airborne after contact with the runway. A bounce is similar to a skip; however, the airplane reaches a higher altitude after contact with the runway. A skip or a bounce is typically caused by excessive airspeed or excessive back pressure being applied to the flight controls by the pilot.

[3] ATIS information Juliet was based on a 1356 meteorological aerodrome report. For more information about the meteorological conditions that existed before and after the time of the accident, see section 1.7.

[4] For information about Executive Airlines' wind additive to approach airspeed procedures, see section 1.17.2.1.

[5] An airspeed bug is an orange reference marker on the inside of the airspeed indicator that is set to V_{ref} by the pilot before the approach.

captain then told the first officer to "get your speed back. You do not want to take wake turbulence from a seven five." At 1443:44, the approach controller told the flight crew to reduce the airspeed to 160 knots. After this instruction, the captain again told the first officer to slow down because of the preceding airplane. The first officer replied, "[approach control] said one sixty though I thought." The captain stated, "yeah, slow it down even more though…just go about one forty."

At 1446:17, the captain stated, "San Juan tower Eagle four zero one ILS [instrument landing system] runway one zero, with eight in sight." The SJU air traffic control (ATC) tower local controller stated, "one departure prior to your arrival…seven twenty seven, mile final just reported loss of ten knots." At 1446:33, the local controller cleared the airplane to land on runway 8. The captain acknowledged the clearance. At this time, the first officer turned the airplane left toward runway 8 and transitioned to the visual approach slope indicator (VASI), which is located near the approach end of the runway for glideslope guidance.

At 1449:07, during the approach to landing, the captain stated, "you better keep that nose down or get some power up because you're gonna balloon."[7] The captain then told the first officer to "bring the power back." About 2 seconds later, the ground proximity warning system (GPWS) alerted "minimums," and the captain instructed the first officer to get the airplane's nose up. Four seconds later, the GPWS alerted "glideslope," and the captain stated, "below the glideslope." The first officer responded, "correcting."

[6] The 727 landed on runway 10. The accident airplane was initially on approach to runway 10 but was later vectored to runway 8. For information about the Safety Board's air traffic control (ATC) radar data study, see section 1.16.2.

[7] The term "balloon" refers to a landing airplane that rises slightly before touching down. Ballooning is typically caused by excessive airspeed or excessive back pressure being applied to the flight controls by the pilot during the landing flare.

At 1449:28, the captain told the first officer to "power in a little bit." Flight data recorder (FDR) data indicated that the airplane was about 45 feet above ground level[8] and traveling at 110 knots indicated airspeed (KIAS) when it crossed the runway 8 threshold 2 seconds later. After the airplane crossed the runway threshold, the captain stated, "power in a little bit, don't pull the nose up, don't pull the nose up." At 1449:39, the captain stated, "you're ballooning," and the first officer replied, "all right."

CVR and FDR information indicated that the airplane touched down for the first time about 1449:41 and about 1,600 feet beyond the runway 8 threshold. At this time, the FDR recorded vertical and lateral loads of about 1.3 Gs and -0.10 G, respectively.[9] At 1449:41, the captain stated, "get the power," and, 1 second later, "my aircraft." The first officer responded, "your airplane." FDR data indicated that, by 1449:43, the airplane had skipped to an altitude of about 4 feet.

CVR and FDR information indicated that the airplane touched down a second time about 1449:45 and about 2,200 feet beyond the runway 8 threshold. FDR data indicated that the airplane then pitched up to an angle of 9° while climbing to an altitude of 37 feet and that the engine torque increased from 10 to 43 percent. About 1449:49, the pitch angle decreased to -3°, and the engine torque started to decrease to 20 percent. The pitch angle continued to decrease to -10°.

CVR and FDR information indicated that the airplane touched down a third time about 1449:51 at a bank angle of 7° left wing down and about 3,300 feet beyond the runway 8 threshold. Concurrently, the FDR recorded vertical and lateral loads of about 5 Gs and 0.85 G, respectively. By 1449:54, the pitch angle was 11°, and the airplane had bounced to an altitude of about 24 feet.

CVR and FDR information indicated that the airplane touched down a fourth time about 1449:56 (about 15 seconds after the initial touchdown) and about 4,000 feet beyond the runway 8 threshold. FDR data indicated that the airplane pitched down to -7° and that it was banked 29° left wing down. The airplane came to a complete stop about 4,317 feet from the runway threshold. Figure 1 shows the ground track of the accident flight, and figure 1a shows the altitude profile of the accident flight.

[8] Unless otherwise indicated, altitudes referenced in this report are reported as height above ground level.

[9] One G is equivalent to the acceleration caused by the earth's gravity (32.174 feet/second^2). The Safety Board conducted an airplane performance study, which included airplane trajectory, load, and standard performance calculations. For more information about the Board's airplane performance study, see section 1.16.1.

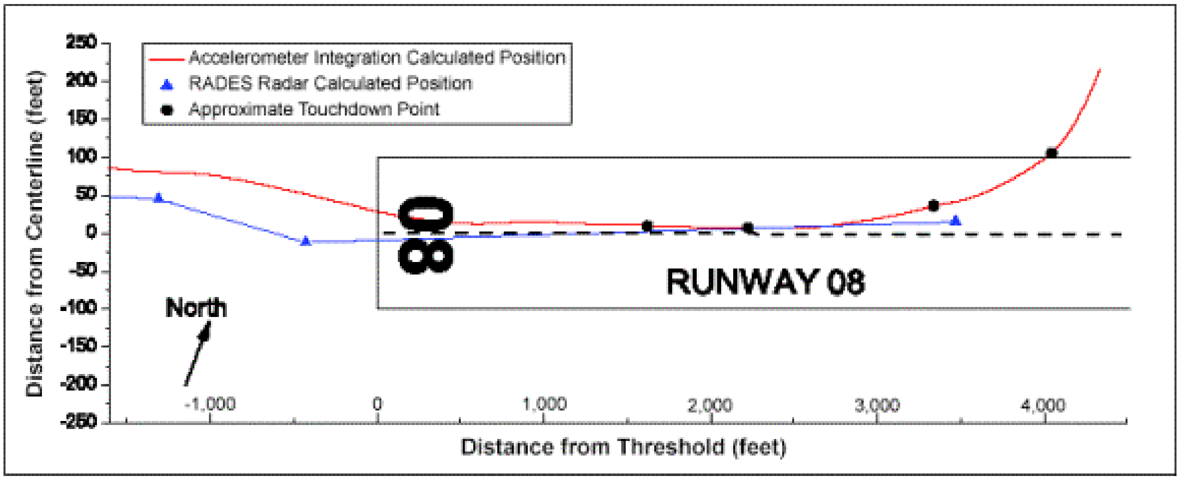

Figure 1. Ground track of the accident flight.

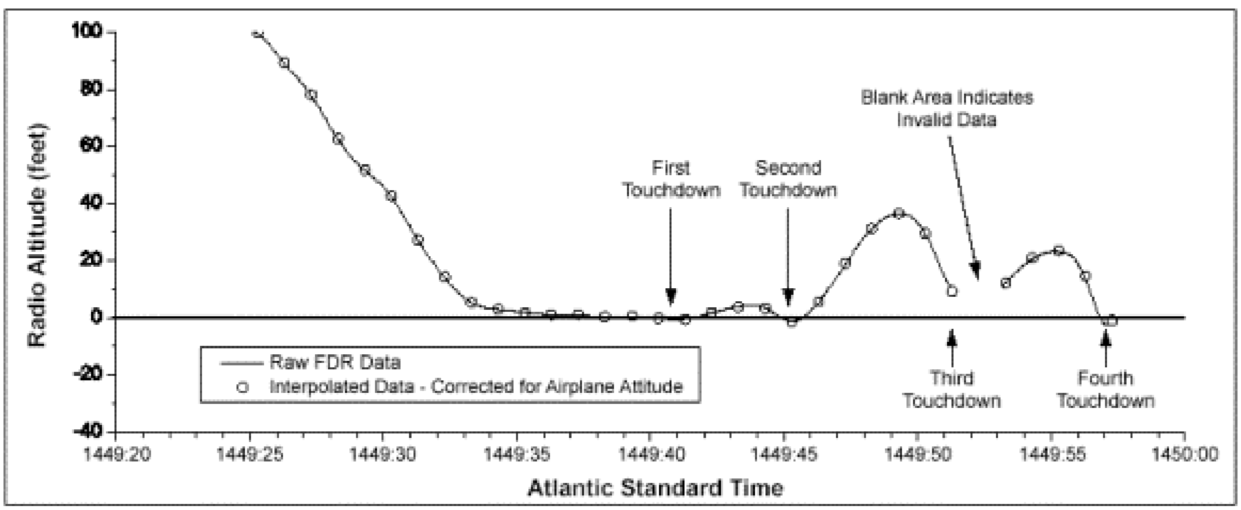

Figure 1a. Altitude profile of the accident flight.

1.2 Injuries to Persons

Table 1. Injury chart.

Injuries	Flight Crew	Cabin Crew	Passengers	Other	Total
Fatal	0	0	0	0	0
Serious	1	0	0	0	1
Minor	1	2	16	0	19
None	0	0	6	0	6
Total	2	2	22	0	26

Note: Title 14 CFR 830.2 defines a serious injury as any injury that (1) requires hospitalization for more than 48 hours, starting within 7 days from the date that the injury was received; (2) results in a fracture of any bone, except simple fractures of fingers, toes, or the nose; (3) causes severe hemorrhages or nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns or any burns affecting more than 5 percent of the body surface. A minor injury is any injury that does not qualify as a fatal or serious injury.

1.3 Damage to Airplane

The airplane was substantially damaged.

1.4 Other Damage

None.

1.5 Personnel Information

1.5.1 The Captain

The captain, age 33, was hired by Executive Airlines on January 11, 1999. He held a multiengine airline transport pilot certificate with an ATR-42/-72 type rating.[10] (The Federal Aviation Administration [FAA] denotes both airplane models on a pilot's airman certificate regardless of which simulator or airplane model the pilot used to qualify for the type rating.) The captain's most recent FAA first-class airman medical certificate was issued on February 10, 2004, and contained the limitation that he "must wear corrective lenses."

According to the captain's employment application for Executive Airlines, from October 1996 to November 1997, he worked as a pilot-in-command (PIC) at Westwind Aviation, Phoenix, Arizona. From December 1997 to February 1998, the captain held

[10] On August 17, 2001, the captain received a notice of disapproval from the Federal Aviation Administration (FAA) after a checkride for his ATR-42/-72 type rating. The notice of disapproval stated that the entire flight check would have to be repeated, except for the portions involving stalls and steep turns. On September 2, 2001, the captain was rechecked successfully, and he received his ATR-42/-72 type rating.

nonaviation-related jobs. From March 1998 to January 1999, he worked as a PIC at Sunrise Airlines in Phoenix.

Executive Airlines records indicated that the captain had accumulated a total flight time of about 6,071 hours, about 3,814 hours of which were with the company in its ATR-42 and -72 airplanes, including about 1,120 hours as PIC. The captain had flown about 177, 134, 72, and 3.5 hours in the last 90, 60, and 30 days, and 24 hours, respectively. The captain's last ground training occurred on October 10, 2003; his last PIC proficiency check occurred on October 15, 2003; and his last PIC line check occurred on October 20, 2003.

On May 7, 2004, the captain flew the first leg of a 2-day trip sequence, which was a roundtrip between SJU and Flamingo Airport, Antilles Islands, the Netherlands, where he remained overnight. On May 8th, the captain flew the return flight to SJU. He stated that he felt "well rested" for the flights to and from the Antilles Islands. On May 9, the captain reported for standby duty at SJU about 1000. The captain stated that he had slept well the night before. The captain stated that he did not smoke, drink alcohol, or take any medications.

1.5.2 The First Officer

The first officer, age 26, was hired by Executive Airlines on March 15, 2004. He held a commercial pilot certificate with single-engine and multiengine land and instrument airplane ratings. The first officer's most recent FAA airman first-class medical certificate was issued on February 10, 2004, and contained the limitation that he "must wear corrective lenses."

According to the first officer, his only previous aviation-related employment was as a flight instructor in Cessna 172 and Baron airplanes at Windy City Flyers, Wheeling, Illinois. Executive Airlines records indicated that the first officer had accumulated a total flight time of about 2,000 hours, about 20 hours of which were with the company as first officer in its ATR-42 and -72 airplanes. About 18.5 hours of the first officer's flight time, which included eight landings in the ATR-72, were accumulated during his initial operating experience (IOE).[11] Flight 5401 was the first officer's first scheduled flight since he completed IOE on May 4, 2004. The first officer had flown about 20 hours, all of which were flown in the last 30 days. The first officer's last recurrent ground training occurred on April 10, 2004, and his last first officer proficiency check occurred on April 26, 2004.

On May 8, 2004, the first officer was assigned standby duty at SJU from 0600 to 1400. He was not assigned any flights during this period. On May 9, the first officer reported for standby duty at SJU about 1100.

[11] IOE consists of revenue flights flown by pilots after they complete their initial simulator training. These flights are conducted in the presence of a company check airman. Federal regulations require that Part 121 pilots have 20 hours of IOE, which can be reduced by 1 hour (up to 10 hours) for each landing that they have completed.

1.5.2.1 The First Officer's Medical History and Prescription Drug Use

A review of the first officer's medical records from his personal psychiatrist revealed that, in July 2001, he began seeing the psychiatrist for treatment of various anxiety-related symptoms. The psychiatrist prescribed alprazolam to treat the first officer's condition.[12] Common side effects of alprazolam include drowsiness and light-headedness.

The first officer noted on his psychiatric patient information form that he was employed as a part-time flight instructor and that his ambition was to become a commercial airline pilot. In March 2004, the psychiatrist noted in the first officer's medical records that they discussed the following:

> heightened anxieties surrounding…his intensive 'wind-down' training for full commercial jet pilot licensure….we looked at creative as needed manipulation of alprazolam being mindful of…the need to stay alert.

The first officer's pharmacy refill records indicated that he filled prescriptions for 60 0.25-milligram (mg) alprazolam tablets on July 15, August 19, and November 3, 2001, and on March 28 and May 4, 2004. The first officer stated that he typically took one-half of a 0.25-mg tablet and that he took that dosage about once every 2 or 3 days. He stated that he did not take any alprazolam on the day of the accident and that he thought that the only time he took a whole 0.25-mg tablet in the 72 hours before the accident flight was on May 8 about 2000.

A review of the first officer's three most recent FAA airman medical certificates (dated August 13, 2001; August 7, 2003; and February 10, 2004) revealed that he did not indicate that he was taking alprazolam or being treated by a psychiatrist for anxiety.[13] Specifically, the first officer checked the "no" box in response to item No. 18 on the airman medical certificate application, which asks, "Have you ever in your life been diagnosed with, had, or do you presently have any of the following…Mental disorders of any sort, depression, anxiety, etc.?" Further, the first officer did not provide any information about his psychiatric visits in response to item No. 19 on the application, which asks the applicant to list any "visits to health professional within last 3 years."

The Executive Airlines Flight Manual, Chapter 3, "Crew Qualification and Responsibility," Section 12.5, "Use of Medication (FARs [*Federal Aviation Regulations*] 91.17)," states, in part, the following:

[12] The prescription was for 60 0.25-milligram (mg) tablets with instructions to take one to two tablets every 2 to 3 hours, as needed, and not to exceed 8 mg per day.

[13] The National Transportation Safety Board is aware that, after the accident, the FAA revoked the first officer's airman medical certificate because he allegedly falsified his application.

> FARs prohibit [a person from] acting or attempting 'to act as a crewmember of a civil aircraft while using any drug that affects the person's faculties in any way contrary to safety…' Crewmembers who are unsure of the side affects of a particular prescription or non-prescription drug are advised to consult their FAA Aeromedical Examiner, or [company] Corporate Medical Director.

Although 14 CFR 61.53, "Prohibition on Operations During Medical Deficiency," does not specifically note anxiety as a disqualifying condition, the FAA "Guide for Aviation Medical Examiners," dated September 2003, states, "the use of a psychotropic drug is disqualifying for Aeromedical certification purposes. This includes all…anxiolytics [that is, medications used for the treatment of anxiety.]"

The first officer stated that he was not taking alprazolam at the time of his last FAA medical examination in February 2004. The investigation determined that the first officer did not consult either an FAA aeromedical examiner or executive airlines' medical director regarding his use of alprazolam.

1.5.3 The Flight Attendants

The flight attendant assigned to the forward jumpseat[14] had worked for Executive Airlines as a flight attendant for 6 weeks. This flight attendant had been employed by the company for 6 years in another capacity. On May 8, 2004, she was assigned a 2-day trip sequence, which included flight 5401. On May 9, she began duty at Cyril E. King Airport (STT), St. Thomas, Virgin Islands, about 1130.

The flight attendant assigned to the aft jumpseat, who was the lead flight attendant on the accident flight, had worked for Executive Airlines for 4 months and had no previous airline experience. This flight attendant was off duty during the 2 days before the accident. On May 9, 2004, she began duty at STT about 1210.

1.6 Airplane Information

The ATR 72-212 is a high-wing, twin turbopropeller, pressurized airplane. The airplane has an overall length of 89 feet 1.5 inches and a wingspan of 88 feet 9 inches. The accident airplane, serial number 438, was delivered new to AMR Leasing Corporation,[15] Dallas, Texas, from ATR, Toulouse, France, on March 27, 1995. At the time of the accident, the airplane had 19,276 total flight hours and 18,086 total cycles.[16]

The airplane was equipped with two Pratt & Whitney 127 PW turbopropeller engines and two Hamilton Standard four-blade propellers. The time since new for the left

[14] For a description of the airplane's interior configuration, see section 1.15.1 and figure 4.

[15] AMR Leasing Corporation is owned by AMR Eagle Holding Corporation, which also owns Executive Airlines.

[16] An airplane cycle is one complete takeoff and landing sequence.

engine was 18,208 hours, and the time since overhaul was 11,709 hours. The time since new for the right engine was 15,637 hours, and the time since overhaul was 8,435 hours.

According to the load manifest for flight 5401, the airplane's takeoff weight was about 36,590 pounds, including 3,960 pounds of passenger weight and 770 pounds of baggage weight,[17] and its takeoff center of gravity (c.g.) was -11 inches.[18]

1.6.1 Pitch Control System

Two elevators (left and right) perform pitch control of the airplane. The elevators are movable control surfaces attached to the rear spar of the horizontal stabilizer, which is mounted on top of the vertical stabilizer in a T-tail configuration. Each elevator has a trim tab with an actuator. The elevators are controlled either by manual inputs from the captain or first officer control columns, which are not directly mechanically linked, or the autopilot system.

Each control column is connected through a dynamometric rod[19] to a cable tension regulator located under the cockpit floor. The cable tension regulator maintains constant cable tension and transmits column movement to two cables that run the length of the fuselage to the aft fuselage elevator cable quadrant, which converts cable movement to pushrod and elevator control bellcrank movement. Rotation of the elevator control bellcrank deflects one elevator, and the pitch uncoupling mechanism (located in the horizontal stabilizer between the left and right elevator bellcranks) moves the other elevator.

Pitch uncoupling occurs when opposing rotational forces exist between the left and right elevator control bellcrank shafts. When the pitch control system becomes uncoupled or experiences a malfunction (such as jamming) that restricts one side of the pitch control system, the independent operation of both elevators from either pilot's control column is allowed. Also, when the pitch control system becomes uncoupled, a microswitch located on the pitch uncoupling mechanism closes, which illuminates the master warning and pitch uncoupling warning lights located on each pilot's instrument panel and activates a repetitive aural chime.[20]

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[17] Average passenger weights were used to calculate the total passenger weight. According to the load manifest for flight 5401, 290 pounds of cargo were stowed in the forward cargo area, and 480 pounds of cargo were stowed in the aft cargo area. The airplane's maximum certificated gross takeoff weight was 48,501 pounds.

[18] The airplane's takeoff c.g. limits were from -14.4 inches to -0.2 inch.

[19] Each dynamometric rod has two microswitches, which change state when 22.48 pounds are applied to the control column. One microswitch indicates that the control column has been pushed downward, and the other microswitch indicates that the control column has been pushed upward. When the microswitches change state, the autopilot might disengage and trigger the "effort on pitch axis" FDR parameter.

[20] According to ATR, recent ATR model airplanes incorporate a device (a switch installed on the first officer's maintenance panel) that allows the pitch control system to be recoupled. Because recoupling the pitch control system is considered a maintenance action, recoupling can only be performed on the ground. The accident airplane was not equipped with a recoupling device.

1.6.2 Landing Gear System

The ATR-72 is equipped with a retractable, fuselage-mounted, tricycle-arranged landing gear system. The landing gear system consists of one forward-retracting, steerable, nose landing gear (NLG) assembly and two inboard-retracting main landing gear (MLG) assemblies, all of which are hydraulically controlled.[21] Each MLG assembly consists of a trunnion leg, a trailing arm, a shock absorber, an actuator, and a side brace. Figure 2 shows the MLG assembly.

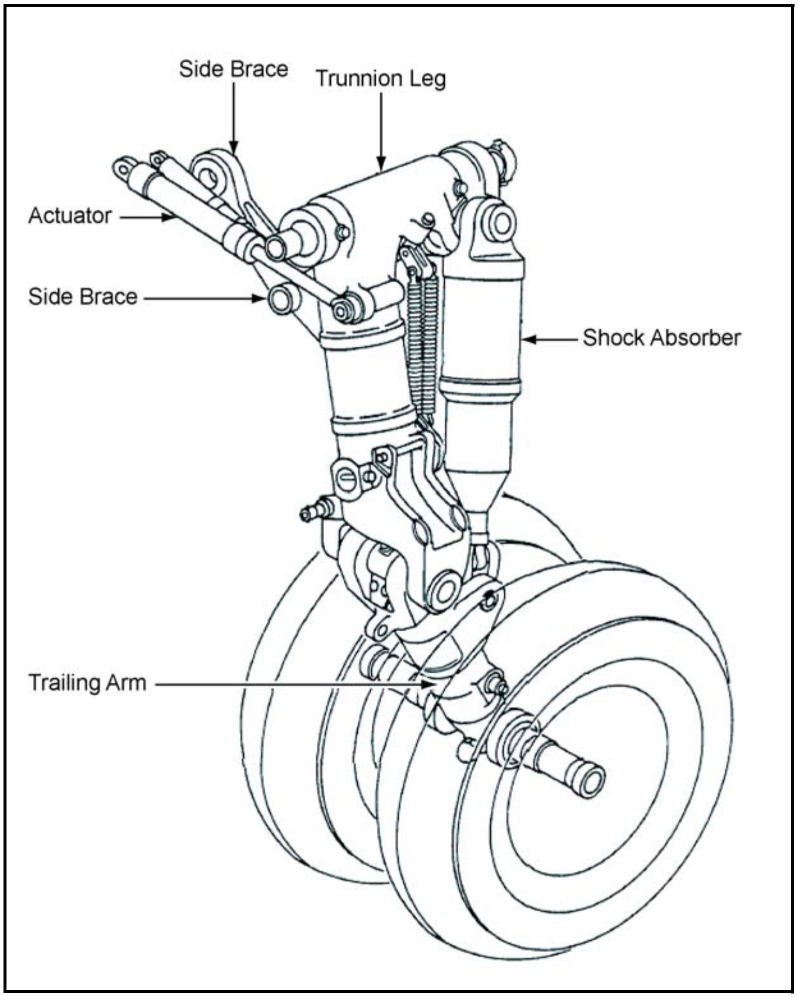

Figure 2. Main landing gear assembly.

The ATR-72 landing gear and associated structure were designed to absorb energy equivalent to a maximum airplane descent rate of 10 feet per second (fps) when landing at the airplane's maximum design landing weight (consistent with the landing design limits

[21] The NLG assembly retracts into the nose wheel well, and the MLG assemblies retract into the fuselage.

imposed by 14 CFR 25.473 to 25.487). In addition, in accordance with Section 25.723, the ATR-72 MLG is designed to absorb reserve energy equivalent to a maximum airplane descent rate of 12 fps when landing at the airplane's maximum design landing weight.

1.6.3 Cockpit Seats

The accident airplane's cockpit seats were designed by Ipeco Europe, Ltd. According to Ipeco, the accident cockpit seats were manufactured in 1986, and the sleeve assemblies installed on the seats were manufactured in 2000 and were 2 of 30 assemblies manufactured in a batch run. Ipeco Test Report No. 1057, issued March 25, 1983, indicated that the design of the accident airplane cockpit seats met the static load requirements contained in 14 CFR 25.561 and Technical Standard Order C-39a (9 Gs forward, 1.5 Gs side, 6 Gs down, and 2 Gs up).

1.7 Meteorological Information

1.7.1 Airport Weather Information

Weather observations at SJU are made every hour by an Automated Surface Observing System (ASOS),[22] which transmits an official meteorological aerodrome report every 56 minutes after the hour. The ASOS is located about 1,900 feet south of the approach end of runway 8, and its wind measuring equipment is installed 33 feet above the ground. About 1356 on the day of the accident, the ASOS reported that visibility was 10 statute miles, clouds were scattered at 3,000 and 4,300 feet and broken at 5,000 feet, and winds were 050° at 17 knots and gusting to 23 knots. At 1456, the ASOS reported that visibility was 10 statute miles; clouds were few at 2,300 feet, scattered at 3,400 feet, and broken at 5,500 feet; and winds were 060° at 15 knots and gusting to 22 knots.

The SJU ASOS also provides high-resolution observations that are measured and stored every 5 minutes. About 1445, the ASOS reported that visibility was 10 statute miles, clouds were scattered at 2,300 feet and broken at 3,400 feet, and winds were 050° at 15 knots and gusting to 23 knots. About 1450, the ASOS reported that visibility was 10 statute miles, clouds were scattered at 2,300 feet and broken at 3,400 feet, and winds were 060° at 18 knots and gusting to 22 knots.

1.7.2 Additional Wind Information

The 2000 upper air sounding (that is, a vertical profile of atmospheric conditions) from SJU showed northeasterly winds aloft from 15 to 24 knots below 4,000 feet mean sea level (msl).[23]

[22] ASOS is a system that continuously measures weather information, including windspeed and direction, visibility, precipitation, cloud cover, temperature, dew point, and altimeter setting.

Center field (CF) wind data,[24] which report 2-minute average winds, were obtained from the FAA for the period from 1445:02 to 1452:02. During this 7-minute period, the CF anemometer indicated wind directions of 060° and 070° magnetic, and the CF 2-minute average windspeed ranged from 12 to 16 knots. No wind gusts were reported for this period.[25]

A Safety Board meteorologist retrieved Meteorological Data Collection and Reporting System (MDCRS)[26] reports from the National Oceanic and Atmospheric Administration Forecast System Laboratory archive. Two ascent profiles from airplanes departing STT (about 58 nautical miles from SJU)[27] before and after the time of the accident showed 13-knot winds at 1,160 feet msl, 15-knot winds at 1,440 and 1,600 feet msl, and 13-knot winds at 1,670 feet msl.

1.8 Aids to Navigation

No problems with any navigational aids were reported.

1.9 Communications

No communications problems between the pilots and any of the air traffic controllers who handled the accident flight were reported.

1.10 Airport Information

SJU is located 3 miles southeast of San Juan at an elevation of 9 feet msl. The airport has an ATC tower, which provides approach and departure services. SJU has two precision instrument approach runways: runways 8/26 and 10/28. Runway 8/26 is about 10,000 feet long and 200 feet wide. Runway 10/28 is about 8,000 feet long and 150 feet wide. The runway surfaces are constructed of grooved asphalt and are accessible by parallel taxiways.

SJU was certificated under 14 CFR Part 139. A standard two-bar VASI is located near the approach end of runway 8. SJU maintains an index D aircraft rescue and firefighting (ARFF) facility, which has six ARFF vehicles.[28]

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[23] The National Weather Service typically launches radiosonde balloons about 0700 and 1900. The 2000 upper air sounding was taken shortly after 1900.

[24] According to the FAA, the CF anemometer is located midfield, about 1,500 feet south of runway 8, and the wind is measured at 48 feet.

[25] According to the FAA, wind gust values are not reported unless the wind gust exceeds the 2-minute average windspeed by 9 or more knots.

[26] The MDCRS collects, decodes, and disseminates automated weather reports.

[27] No MDCRS data were available for the SJU area.

1.11 Flight Recorders

1.11.1 Cockpit Voice Recorder

The accident airplane was equipped with a Fairchild model A-100A CVR, serial number 55031. The exterior of the CVR was not structurally damaged. The tape spool assembly and other components inside the case were not damaged and were generally in good condition.

The CVR was sent to the Safety Board's laboratory in Washington, D.C., for readout and evaluation. The tape was played back normally and without difficulty. The recording started at 1422:02 and continued uninterrupted until 1452:54. The recording consisted of four separate channels of audio information: the cockpit area microphone (CAM), the captain and first officer audio panels, and the public address (PA) system. Hot microphone transmissions were also captured on the flight crew's respective audio channels. The audio information from all four channels was generally of good quality.[29] A transcript of the 31-minute recording was prepared (see appendix B).

1.11.2 Flight Data Recorder

The accident airplane was equipped with an L3 Communications Fairchild model F-800 FDR, serial number 3151, which used magnetic tape as the recording medium. The FDR was found to be in good condition.

The FDR was sent to the Safety Board's laboratory for readout and evaluation. The magnetic tape was removed from the FDR, and the data were transcribed directly to a hard disk. About 25 hours of data were recorded on the FDR, including data from the accident flight, and 56 parameters that were pertinent to the circumstances of the accident were verified.

1.11.2.1 Validation of Flight Data Recorder Data

The Safety Board recovered data from the accident flight, the last landing before the accident flight,[30] the first recorded landing (made about 25 operational hours before the accident flight), and the first recorded flight control ground check and subsequent

[28] According to 14 CFR 139.317, an index D ARFF facility is required to have (1) either one firefighting vehicle with 500 pounds of sodium-based dry chemical or Halon 1211 or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of aqueous film forming foam (AFFF) to total 100 gallons and (2) two firefighting vehicles with water and a commensurate quantity of AFFF so that the total quantity of water for foam production carried by all vehicles is at least 4,000 gallons.

[29] The Safety Board uses the following categories to classify the levels of CVR recording quality: excellent, good, fair, poor, and unusable. A good quality recording is one in which most of the crew conversations could be accurately and easily understood. At times during the flight 5401 recording, the ambient noise level of the CAM channel made it somewhat difficult to discern sounds or conversations recorded on the other three channels. The transcript that was developed may indicate one to two words that were not intelligible. Any loss in the transcript can be attributed to simultaneous cockpit/radio transmissions that obscure each other.

takeoff. However, the Board could not recover three segments of the event data (8 seconds total). The Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA) had developed a program to decode the waveforms from F-800 magnetic tape FDRs. With the use of this program, the BEA was able to decode two of the three segments of waveforms; however, because of the very high variation in tape speed, only the last second of the 4-second third segment could be fully recovered.[31]

1.11.2.2 Aileron Surface Position Sensors

In accordance with 14 CFR 121.344, the accident FDR was required to record left and right aileron surface positions no later than August 20, 2001. According to Executive Airlines, the accident airplane was modified on August 7, 2001, in accordance with Supplemental Type Certificate (STC)[32] No. ST01310NY, which required adding two new sensors and associated hardware on each wing.[33] Although the airplane had been equipped with the required sensors and associated hardware, the left aileron surface position data were invalid; therefore, the airplane did not meet the requirements of 14 CFR 121.344.

The aileron sensors installed on the accident airplane were string potentiometers. The string is attached to the aileron linkage so that any aileron movement is registered by the potentiometer, which produces a voltage input to the digital flight data acquisition unit (DFDAU). The DFDAU then converts the voltage to a digital value that is recorded by the FDR and then calibrated by Executive Airlines to determine the aileron surface position.

Executive Airlines stated that it added aileron surface position sensors to its 41 ATR-72 airplanes (2 sensors per airplane, for a total of 82 sensors) in accordance with STC No. ST01310NY, and that, in the last 3.5 years, the company has replaced 47 of these sensors, which is a 57 percent failure rate. The company indicated that the sensors are not tracked and, therefore, that the times from installation to failure could not be determined. The company also indicated that the sensors do not incorporate a warning or an indication system. The company further indicated that aileron surface position sensor failures were typically caused by wear or weather-related damage.

At the time of the accident, Executive Airlines performed FDR functional checks every 3,000 flight cycles. Executive Airlines indicated that the accident airplane's last FDR functional check was conducted on January 3, 2003, about 1 year and 5 months after the STC modification and about 1 year and 4 months before the accident. After the accident, Executive Airlines started conducting FDR functional checks every 1,000 flight cycles.

[30] The accident flight crew made the airplane's last landing at MAZ about 1347 on the same day of the accident.

[31] Most of the 56 verified parameters recorded from 1449:58.8 to 1450:01.86 (the first 3 seconds of the third segment) were deemed invalid.

[32] An STC is issued for major design changes to type-certificated products when the change is not extensive enough to require a new type certificate.

[33] Executive Airlines stated that all of its ATR-72s were modified in accordance with STC No. ST01310NY.

1.12 Wreckage and Impact Information

1.12.1 General Wreckage Description

The first evidence of ground impact (from the airplane's third touchdown) was located on runway 8 about 44 feet left of the runway centerline and about 3,361 feet beyond the runway threshold. Various ground impact, gouge, scrape, and tire marks were found near the first ground impact mark. These marks were on a magnetic heading of about 075° and were consistent with the landing gear tires on the accident airplane. The tire marks extended about 40 feet from the first ground impact area in the direction of the main wreckage. No other tire marks that were consistent with the tires on the accident airplane were found beyond the first impact area. An oily spray pattern extended outward to the left of the gouge marks. The oily substance was consistent with the fluid contained in the MLG shock absorbers. Most of the pieces found at the first ground impact area were small sections of the NLG, including the NLG door, pieces of the left MLG, and the fuselage belly fairing.

Evidence of another ground impact (from the airplane's fourth touchdown) was found on the grassy area about 145 feet left of the runway 8 centerline and 4,053 feet beyond the runway threshold (about 692 feet from the initial ground impact area). This evidence included left wing tip scrape marks, left engine propeller strike marks, and a fuselage belly impact impression, which were all on a magnetic heading of about 070°. The marks on the grassy area continued from the second ground impact area to the main wreckage location. Sections of the outboard left wing and the left propeller blades were also found in this area.

The main wreckage was located about 217 feet left of the runway 8 centerline and about 4,317 beyond the runway threshold. The main wreckage consisted of most of the airplane structure, except for the lower section of the left MLG tire assembly, which was found about 302 feet left of the runway 8 centerline and 3,944 feet beyond the runway threshold (about 373 feet from the main wreckage). Figure 3 shows ground scrape marks and the main wreckage.

Figure 3. Ground scrape marks and the main wreckage.

The landing gear handle was found in the down position. The parking brake and gust lock levers were found positioned to off. The flap handle showed 030° of flaps. The captain and first officer internal V_mHB30 (minimum high bank at flaps 030°) airspeed bugs were found set at 96 KIAS. The power management selector was found set at CLB (climb). The CVR, left elevator, rudder, and first officer-side fuel pump circuit breakers were found tripped.[34]

1.12.2 Fuselage, Wings, and Engines

The airplane fuselage was found intact and orientated upright. The vertical and horizontal stabilizers remained attached to the tail structure and showed no evidence of impact damage. The left forward hatch exit was found open, and the hatch was found

[34] The Safety Board documented the positions of the circuit breakers, switches, and movable controls on the day after the accident. The documented positions of the circuit breakers, switches, and other movable controls may not represent their actual positions after the accident. Emergency medical technicians entered the cockpit during the emergency response to help the flight crew evacuate the airplane. Further, an Executive Airlines mechanic entered the cockpit after the emergency response and reportedly turned off all switches and disconnected the battery system.

inside the airplane. The aft main entry door was found open, and the handrail was found locked in the up position.

A section of about 13 feet of the forward, left side of the lower fuselage was severely crushed. The left forward cargo door and surrounding structure were severely deformed and buckled. A section of about 8 feet of the forward, right side of the lower fuselage was crushed. The damage on both the left and right sides of the lower fuselage extended from the belly to the floor line, and the left side exhibited some evidence of scrape marks just below the floor line.

Most of the left belly fairing forward and aft of the left MLG was found crushed and deformed, and a portion was missing. The aft, lower surface of both sides of the fuselage exhibited evidence of scraping, minor crushing damage, and skin wrinkling. The aft fuselage just forward of the tail cone was found wrinkled around its circumference.

All eight of the wing attachment fittings and the two shear web supports located on the fuselage were fractured; however, the wing assembly remained near its installed location in the fuselage. The left wing was found rotated counter-clockwise about 15° left (as viewed from aft), and the wing tip and engine propeller hub contacted the ground. The right wing section was found attached to the center wing box and exhibited minimal damage. All control surfaces were found intact and exhibited no damage. All of the fracture surfaces on the wing frames, struts, and shear web were consistent with overload failure.

The left and right engine assemblies were found attached to the airframe. All four propeller blades on the left engine were sheared off at the blade root section. A section of about 12 inches was missing from each of the right propeller blades, which remained attached to the engine. The fuselage near the right engine exhibited propeller strike marks.

1.12.3 Landing Gear System and Components

The right MLG was found down and locked and remained attached to the fuselage by the trunnion attach points. All of the right MLG components, including the trunnion leg, side brace, shock absorber, and actuator, were found intact and attached to the gear assembly. The right MLG outboard tire was found inflated, and the inboard tire was found deflated. The right MLG inboard tire exhibited some evidence of rubber scraping and minor tears along several circumferential tread lines. No evidence of preexisting damage was found on either tire. Both tires were free to rotate with slight resistance. Both brake assemblies were found intact. Both ground proximity sensors were found attached.

The left MLG was fractured circumferentially at its vertical trunnion leg just below the actuator attach point. The upper portion of the vertical trunnion leg, which remained attached to the horizontal trunnion leg, was 4 inches long. The horizontal trunnion leg remained attached to the fuselage by the trunnion attach points, and no evidence of any damage to these components was found. The lower portion of the vertical trunnion leg, which remained attached to the wheel assembly, was 24 inches long.

Sections of the vertical trunnion that contained the fractures were removed from the airplane and sent to the Safety Board's Materials Laboratory for further examination. The examination revealed that the fracture surfaces were consistent with overstress separation. No evidence of fatigue was found.

The upper portion of the left MLG side brace remained attached to the fuselage, and the lower portion had separated from the fractured vertical trunnion leg and showed no evidence of scraping or scoring. The secondary side brace remained attached to the left MLG and exhibited minimal damage. The left MLG shock absorber was found separated from the MLG assembly. The shock absorber was found along the wreckage path in the fully compressed condition, and no shock absorber fluid was present. The shock absorber base was fractured about 5 inches from the bottom. The upper portion of the shock absorber was intact.

Both left MLG tires were found inflated. The inboard tire exhibited evidence of scoring and rubber tearing over about 22 inches of the circumference of the tire. Both tires rotated freely with slight resistance. Both brake assemblies were found intact.

The NLG was found embedded in the belly of the forward fuselage, folded rearward (opposite of its normal position), and rotated counter-clockwise (the right tire was in contact with the ground). The NLG had separated from its fuselage attach points in the wheel well, which was severely crushed. The right attach point had sheared off. The NLG remained attached to the fuselage by the actuating cylinder.

Both NLG tires were found deflated and exhibited evidence of rubber scoring and tearing. No evidence of tire rupture or burst was found. Both inner hubs were fractured, and pieces of the hubs were found on runway 8 near the first ground impact area. The wheel well structure was severely crushed.

1.12.4 Elevator and Rudder Control Systems

The elevator pitch uncoupling mechanism was found uncoupled. All of the other tail section elevator components were found intact and attached to their respective attachment points. Both elevator control quadrants could be rotated by hand until their respective elevators contacted their up or down stops. No mechanical binding or resistance was felt. The elevator components beneath the cockpit floor, including the pulleys and brackets, were found damaged. All of the elevator cables were found intact and routed through and contained within their respective pulleys.

The tail section rudder components were found intact and attached to their respective attachment points. The aft rudder control quadrant showed limited travel in both directions when rotated forward and aft using hand pressure.

1.12.5 Cockpit Seats

The captain seat was found attached to the floor at all mounting points, and the floor beneath the mounting brackets was not deformed. The inertia reel was found in the locked position and worked normally. The forward and aft seat adjustment lever would not move. The seat height lever moved freely, but the seat would not lock into any position. The seat was found in the lowest height position and moved freely up and down. The first officer seat was found attached to the floor at all mounting points, and the floor beneath the mounting brackets was not deformed. The first officer seat operated normally. Both seats were removed from the airplane and sent to the Safety Board's Materials Laboratory for examination.[35]

1.13 Medical and Pathological Information

Required Federal drug and alcohol testing of the captain and first officer were negative for alcohol and drugs of abuse. Company drug and alcohol testing also tested negative for alcohol and a wider range of drugs, including alprazolam.

A review of the captain's postaccident medical records revealed that he sustained a compression fracture of the first lumbar vertebrae. The first officer reported that he sustained a contusion on his forehead. The forward flight attendant reported that she had arm, shoulder, and neck pain and bruises on her arms. The aft flight attendant reported that she had neck and back pain. According to medical records and personal injury reports, 16 of the 22 passengers sustained minor injuries. The remaining six passengers did not report any injuries.

1.14 Fire

No evidence of an in-flight or a postcrash fire was found.

1.15 Survival Aspects

1.15.1 General

The airplane was configured with 64 passenger seats in a single-aisle configuration. The cockpit contained two flight crew seats and one retractable observer seat. An aft-facing, single-occupancy, retractable flight attendant jumpseat was mounted on the forward bulkhead, and a forward-facing, single-occupancy, retractable flight attendant jumpseat was mounted on the aft bulkhead. Figure 4 shows the interior configuration of the airplane.

[35] For information about the metallurgical examinations of the cockpit seat assemblies, see section 1.16.3.

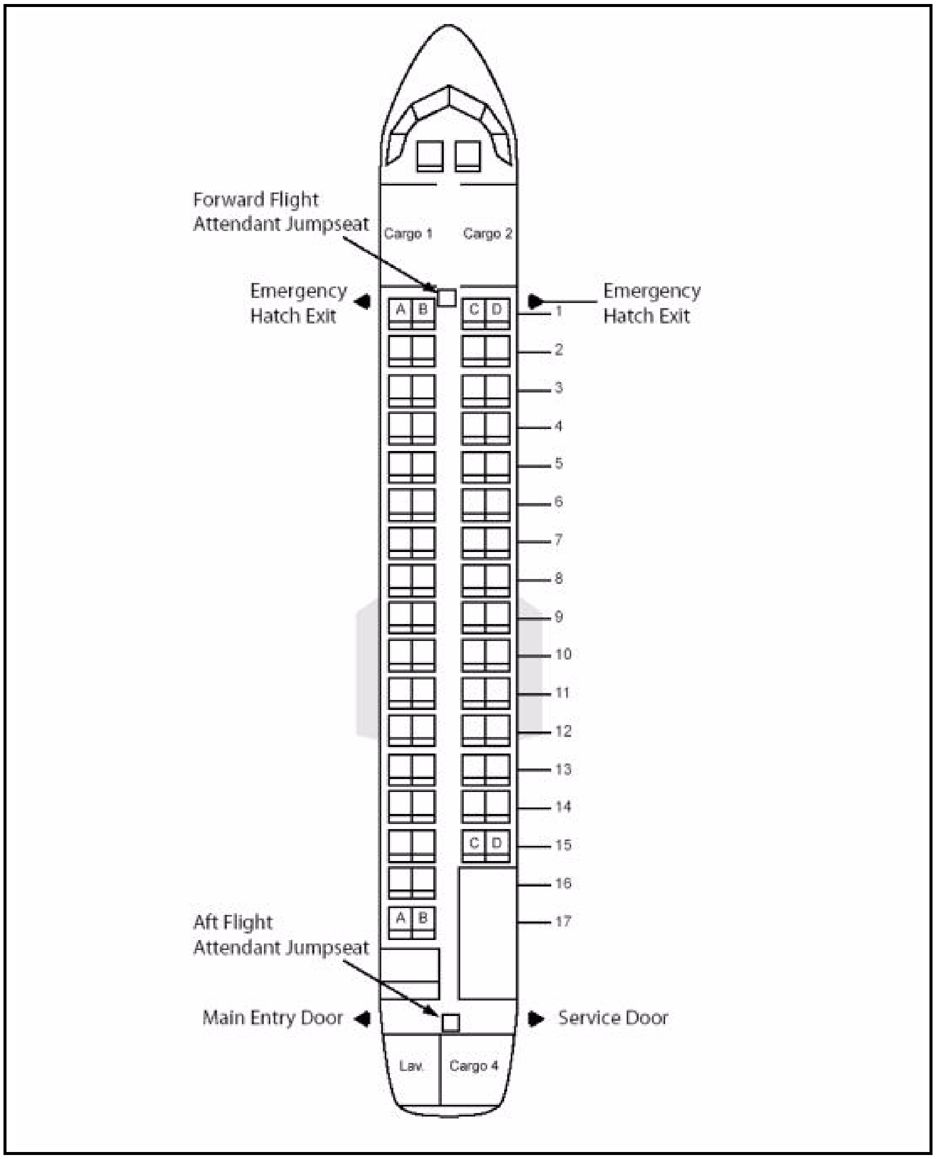

Figure 4. Interior configuration of the airplane.

As shown in figure 4, the airplane had a main entry door on the left side of the aft fuselage, emergency hatch exits on each side of the first row of passenger seats, and a service door on the right side of the aft fuselage. The airplane was equipped with all required cabin emergency equipment, as specified in Executive Airlines' In-Flight Manual.

1.15.2 Evacuation of Passengers and Crewmembers

The cabin crew initiated the evacuation of the passengers in accordance with standard company procedures. The forward flight attendant stated that she looked out the forward left emergency exit window and saw a lot of "crash debris" on the ground and that she then looked out the right emergency exit window and thought that the exit looked as if it were too far above the ground to use; therefore, she decided not to open either forward exit. This flight attendant stated that most of the passengers were seated near the rear of the airplane.[36]

The aft flight attendant stated that, after she assessed conditions, she asked a nonrevenue pilot who was sitting in the back of the airplane to open the service door. This flight attendant stated that, while he opened the service door, she opened the main entry door. She added that emergency response personnel were waiting outside the airplane and that they assisted the passengers as they exited the airplane through the main entry door.

1.15.3 Emergency Response

An ARFF specialist in a fire truck was positioned between the Executive Airlines operations area and the taxiway adjacent to runway 8 (about 1,500 feet from the approach end of the runway). The ARFF specialist stated that, about 1455, he watched the accident airplane make the approach to landing. The ARFF specialist stated that, after the second touchdown, the airplane pitched up "sharply" and that he called the ARFF station because he thought that something might be wrong. The ARFF specialist stated that he then turned on the vehicle beacon and siren and visually tracked the airplane until it came to a complete stop. The ARFF specialist stated that he drove to the location where the airplane had stopped and then approached it from the left aft side. He stated that, because he saw "black and white" smoke coming from near the left engine, he "hosed [it] down."

By 1500, four additional ARFF vehicles and five additional ARFF personnel and G.E.S. Ambulance Service ambulances had arrived. About 1515, the State Emergency Medical, San Juan Municipal, Carolina Municipal, and Guaynabo City Emergency Medical Service units arrived. Additionally, five fire trucks and crews from off-airport mutual aid services responded to the accident. According to the airport operations coordinator, he coordinated with the operations supervisor and ARFF and security personnel to escort these units to the main terminal building. The captain and the injured passengers were transported to area hospitals.

1.16 Tests and Research

1.16.1 Airplane Performance Study

The Safety Board conducted an airplane performance study, which used CVR transcript information and FDR and radar data[37] that were correlated to a common time reference. The study integrated FDR lateral, vertical, and longitudinal loads with pitch,

[36] According to passenger information provided by Executive Airlines, the passengers were assigned to seats 4A, 5B and 5C, 6B and 6C, 7A and 7D, 8A through 8D, 9A through 9D, 10A through 10D, 11A, 14D, and 16A.

roll, and yaw values and wreckage survey data and determined the accident airplane's ground track, the corresponding time history of the airplane's motions, and the estimated load factors on the left MLG and cockpit area. The airplane performance study also derived windspeed and direction to determine whether the winds had affected the airplane's performance.

Before and during the time that the CVR recorded the sound of the first thump (1449:41), the airplane encountered an 8-knot decrease followed by an 11-knot increase in windspeed. Immediately thereafter, the CVR recorded the captain's statement, "my aircraft." At this time, FDR data showed the engine torque decrease from about 30 to 10 percent, which is slightly above the flight idle position, and the elevators deflect from 5° to -2°. At 1449:45, the CVR recorded the sound of a second thump. FDR data showed that, immediately thereafter, the airplane pitch angle decreased to -4°, and the derived windspeed increased by 6 knots. The pitch angle then increased to about 9° while climbing to an altitude of 37 feet, and the engine torque started to increase from 10 to 43 percent. About 3 seconds later, the engine torque started to reduce to 20 percent, and the pitch angle decreased to -3°. While the pitch angle continued to decrease to -10°, the derived windspeed decreased by 8 knots, and the elevator deflection began to increase to 4°.

The airplane performance study showed that, about 1449:51, when the airplane was about 3,300 feet beyond the runway 8 threshold, the CVR recorded a very loud bang, and the FDR recorded vertical and lateral loads of about 5 Gs and 0.85 G, respectively. The average vertical load for the left side of the cockpit area was calculated to be about 12 Gs. It is possible that the vertical loads experienced in the cockpit during the third touchdown were more than 12 Gs; however, this value could not be calculated because of the low FDR sampling rate. The airplane's descent rate was determined to be about 19 to 32 fps.

During the last touchdown, when the most substantial damage to the airplane most likely occurred (especially to the left side of the cockpit), the left bank angle recorded by the FDR was 29° left wing down. The average vertical loads experienced in the cockpit during the last touchdown could not be determined because the FDR data became unreliable at this point and because of the airplane's orientation.

1.16.2 Air Traffic Control Radar Data Study

The Safety Board conducted an ATC radar data study to evaluate the separation of radar tracks associated with the accident airplane and the preceding 727 that landed on runway 10 about 3 minutes before the accident airplane landed on runway 8. The study began at 1444:26, when the 727 was about 5.7 miles west of SJU on final approach to runway 10 and the accident flight was about 4.3 miles behind the 727. The study ended at 1446:42, when the last radar return associated with the 727 was received. At their closest

[37] Radar data from the U.S. Air Force 84th Radar Evaluation Squadron, which were recorded by the SJU Airport Surveillance Radar-8 sensor, were used in the calculations.

point, the airplanes were separated about 4.3 miles laterally and 400 feet vertically, which is greater than the minimum lateral separation specified in Federal requirements.[38]

1.16.3 Cockpit Seat Assembly Metallurgical Examinations

1.16.3.1 Accident Airplane Cockpit Seat Assemblies

The accident airplane's cockpit seat assemblies were sent to the Safety Board's Materials Laboratory for metallurgical examination. Figure 5 shows a schematic of the cockpit seat assembly.

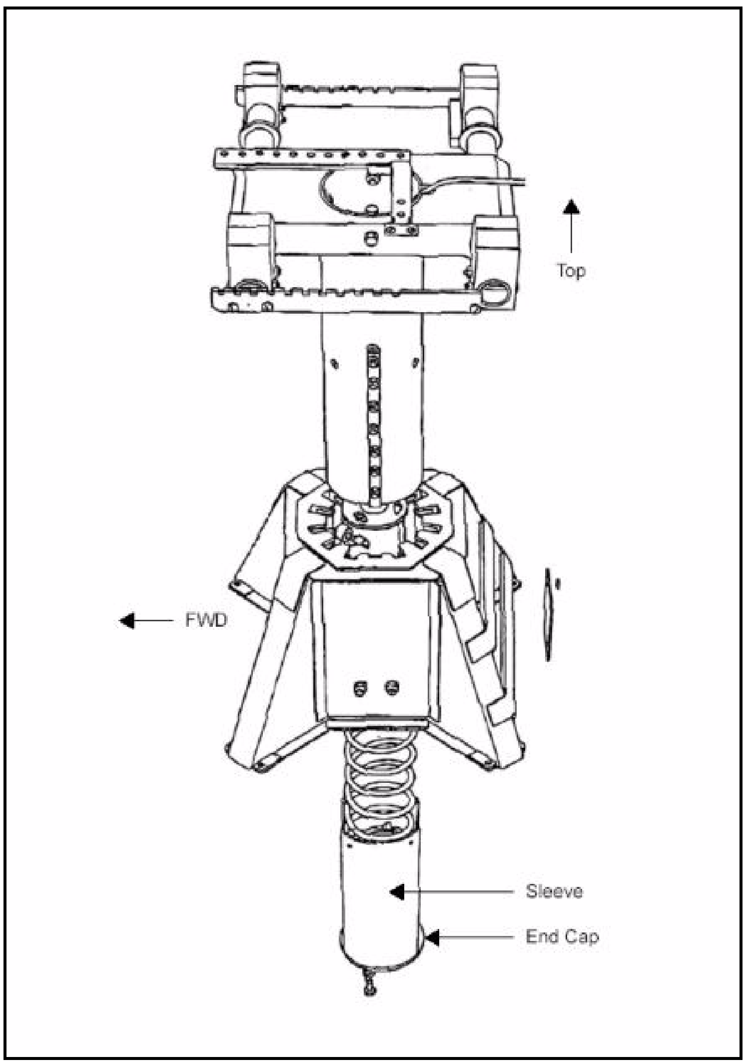

Figure 5. Schematic of the cockpit seat assembly.

[38] FAA Order 7110.65, "Air Traffic Control," paragraphs 4-5-1, 5-5-4, and 5-5-5, require that airplanes be separated at least 3 miles laterally and/or 1,000 feet vertically.

Visual examinations of the captain seat revealed that the weld that attached the end cap to the sleeve was fractured at both welded joints, releasing the end cap from the sleeve. Visual examinations of the fractured welded joints revealed the presence of dark, oxidized, preexisting regions that were consistent with weld discontinuities at the inner diameter side of both joints. On the forward sidewall fracture, intermittent weld discontinuities extended along most of the 4.2-inch circumferential length of the joint to a depth of about 0.03 to 0.06 inch.[39] On the aft sidewall fracture, the weld discontinuity was continuous and extended along the entire circumferential length of the joint to a depth of about 0.03 to 0.06 inch.

A Safety Board materials engineer estimated that the weld discontinuities extended through about 25 percent of the cross-sectional area on the forward side and about 40 percent of the cross-sectional area on the aft side. The discontinuities contained repeating columnar patterns with curved features at an angle to the surface, which was consistent with a lack of fusion that resulted from molten regions not bonding during the welding process. High-magnification optical and scanning electron microscope examinations of the aft sidewall fracture showed the presence of small fatigue cracks that had propagated from the weld discontinuity region toward the outer diameter, which slightly increased the total penetration of the preexisting defect region.

Visual examinations of the intact welded joints on the first officer seat revealed that gaps existed between the mating surfaces of both welded joints, which was consistent with incomplete weld penetration. The forward sidewall region had about a 2.9-inch-long gap (the total joint length was 4.2 inches). The aft sidewall region had two slightly overlapping gaps that extended about 3 inches. A section of the forward sidewall welded joint was excised and fractured open, revealing that the gaps at the inner diameter of the welded joint had features similar to the preexisting weld discontinuity (lack of fusion) regions on the inner diameter of the welded joints on the captain seat. The maximum penetration of the weld discontinuity was about 0.045 inch in the section that was fractured open for examination.

1.16.3.2 FAA Vertical Drop Test of ATR-42 Cockpit Seats

In May 2003, the FAA Technical Center in Atlantic City, New Jersey, conducted a vertical drop test of an ATR-42 airplane that had cockpit seats with the same design and part number as the cockpit seats on the accident airplane. According to the test report, vertical loads in the cockpit area were measured at 30 Gs for the left cockpit floor and 34 Gs for the right cockpit floor.[40] Neither of the cockpit seats broke during the test. Because of the similarities between the accident and test airplanes' cockpit seats and vertical loading, the cockpit seats from the FAA drop test were sent to the Safety Board's Materials Laboratory for comparison to the cockpit seats from the accident airplane.

[39] An Ipeco representative stated that the manufacturing specification for the sleeve assembly called for 100 percent weld penetration; therefore, the accident end cap and sleeve assemblies did not meet manufacturing specifications.

[40] Federal Aviation Administration, *The Vertical Drop Test of an ATR-42-300,* FAA Technical Center (Atlantic City, New Jersey: FAA, 2004).

Visual examination of the test airplane's captain seat parts revealed that gaps existed at the inner diameter between the end cap and sidewall portions of the sleeve on both the forward and aft welded joints. No evidence indicated that the inner diameter surface had become molten during the welding process. Both the forward and aft welded joints were fractured in the laboratory by bending the sidewall portion outward relative to the end cap, revealing that the gaps at the inner diameter of the welded joints corresponded to weld discontinuity regions. These weld discontinuity regions extended along the entire circumferential length of the joints and penetrated about 50 to 60 percent of the joints' depth. Visual examination of the test airplane's first officer seat parts revealed gaps at the inner diameter that extended along the circumferential length of the welded joint.

1.17 Organizational and Management Information

Executive Airlines began service as Executive Air Charter in 1982 and began scheduled passenger operations in 1985. American Eagle Holding Corporation bought Executive Air Charter in 1989. In October 2002, the company reorganized, and Executive Airlines began operations as a separate entity doing business as American Eagle and AMR Leasing Corporation.

Executive Airlines is a regional airline that provides Part 121 scheduled passenger service to 40 island locations in the Caribbean. The company operates 130 flights daily from its major hubs at SJU and Miami International Airport, Miami, Florida. At the time of the accident, Executive Airlines was the largest ATR-42 and -72 operator in the United States and had a fleet of 8 ATR-42 and 41 ATR-72 airplanes.

1.17.1 Flight Crew Training

Executive Airlines' pilots attend training at the American Eagle training center located at Dallas/Forth Worth International Airport (DFW), Dallas/Fort Worth, Texas. All first-time pilots at Executive Airlines attend a basic indoctrination course, where they are taught general information on company operations. Pilots then attend initial and/or transition ground school and simulator training. According to the Executive Airlines ATR-42/72 Ground Training Instructor Lesson Plan, the typical initial and transition training consists of 10 days of ground school and 20 hours of IOE. As stated previously, new and upgrade pilots perform their IOE in the presence of a check airman. In addition, all pilots are required to attend recurrent training (a 4-hour, line-oriented flight training [LOFT] session)[41] and perform a 1.5-hour proficiency checkride every year. Recurrent training and the proficiency checkrides are conducted by company check airmen.

1.17.1.1 Simulator Flight Training

According to the Executive Airlines ATR-42/72 Simulator Training Syllabus, all new pilots and pilots qualifying for upgrades receive nine 4-hour simulator lessons (for a

[41] LOFT facilitates the transition from simulator to line flying.

total of 36 hours of simulator training)[42] and one 2-hour simulator checkride. In addition, pilots receive 2 hours of ATR-42 training and a 1.5-hour airplane checkride. Further, pilots receive 5 hours of ATR-72 differences training.[43] Simulator training is conducted by a company check airman and a simulator instructor.

Executive Airlines uses an ATR-42 simulator located at DFW for most of its pilot training. The company also uses an ATR-42 simulator located at FlightSafety International, Houston, Texas, when not enough training time is available in the DFW simulator. The ATR-42 simulators used for Executive Airlines' training are Level C simulators.[44]

1.17.1.1.1 Observations of Simulator Sessions

On June 20, 2004, the Safety Board observed various flight profiles and procedures conducted by Executive Airlines pilots in the ATR-42 simulator at DFW, including the following:

- a visual approach to the runway with the first officer as the flying pilot, 090° winds at 10 knots, gusts at 15 knots, and ATC assigning various airspeeds during the approach;
- an initiation of a go-around after touchdown; and
- a visual approach to the runway with the first officer as the flying pilot, the captain taking control at 80 feet, and a pitch uncoupling during a go-around—making the trim system inoperative.[45]

Executive Airlines' procedures for operation of the ATR-72 allow the flying pilot to position the condition levers[46] to 100 percent for landing or to leave the levers positioned at 86 percent. During a go-around, if the condition levers are positioned at 86 percent, the propellers automatically position to 100 percent when the throttles are advanced and the power management selector[47] is in the TO position. This automatic

[42] The hours scheduled for the nine simulator training periods are based on the pairing of two students. A student who does not have a partner is scheduled for only 18 hours of simulator training.

[43] The Executive Airlines FAA-Approved Training Manual states that differences training is required for ATR-42 captains and first officers before they can serve as flight crewmembers on the ATR-72 during revenue operations. The manual states that the required crewmember emergency training and operating experience for either initial or recurrent training may be accomplished in either the ATR-42 or -72 and that the crewmember will be considered trained for both airplane models.

[44] Level C simulators may be used for specified light operational task training for Part 121 and 135 transition, upgrade, recurrent, and requalification training. These simulators may also be used for initial new hire and initial equipment training on specified events for individuals who have previously qualified as PIC or second-in-command with the training operator or who meet the FARs for advanced simulator training.

[45] An emergency was declared, and the appropriate checklist was completed.

[46] The condition levers, which are located next to the power management selector, control propeller rpm.

[47] The power management selector, which is located on the center instrument panel, provides maximum torque limit indications on each torque indicator for the selected mode of operation. The selector has four labeled operating modes: TO (takeoff), MCT (maximum continuous), CLB (climb), and CRZ (cruise).

feature is not available in the ATR-42. During the simulations, investigators observed that the flying pilot always positioned the condition levers to 100 percent before landing.

1.17.1.2 Crew Resource Management

The Executive Airlines FAA-Approved Training Manual, chapter 1, section 2, page 24, outlined the curriculum for the 2.5-hour, stand-alone crew resource management (CRM) training segment, which all new-hire pilots were required to attend. The manual states the following:

> Material presented in this subject area acquaints the crewmember with the principles and importance of effective crew resource management. Emphasis shall be placed on precise communication, crewmember interaction, crewmember assertiveness, and delegation of cockpit duties.

The CRM curriculum contains instruction on methods of fostering crew input, maintaining situational awareness, crew coordination during an emergency or abnormal situation, cockpit discipline, and proper cockpit procedures.

During day 5 of basic indoctrination training, all first officers attend a 4-hour First Officer Duties and Responsibilities Program, which is based on CRM techniques and R.E.A.C.T procedures[48] and includes instruction on flight crew communications, decision-making, and stress and fatigue management. When pilots transition from first officer to captain, they attend a 6.5-hour Captain Leadership Duties and Responsibilities Program, which emphasizes flight crew roles and responsibilities, leadership development, and conflict resolution.

1.17.1.3 Bounced Landing Recovery Training

Executive Airlines' manager of training and standards stated that the company did not provide formalized bounced landing recovery techniques to pilots before the accident and that none of the company manuals contained any information about bounced landing recovery.[49] The manager stated that he would not want to conduct bounced landing recovery techniques in the simulator because it is very difficult to demonstrate a bounce. The manager stated that bounced landing recovery techniques could be addressed during pilot briefings. The manager stated that, after the accident, Executive Airlines' president and vice president of operations asked him to look into the feasibility of conducting bounced landing recovery training and incorporating bounced landing recovery techniques in the company manuals.

One simulator instructor stated that, if the airplane landed hard enough to bounce, the pilot should execute a go-around. He added that, if an airplane bounced 15 to 20 feet

[48] According to company documentation, a first officer can use R.E.A.C.T. (review and reconfirm, evaluate, advise, challenge, and take) procedures to challenge the captain if the first officer believes that the captain's actions might jeopardize the safety of the operation.

[49] A Safety Board review of Executive Airlines' operations and training manuals verified that the company had no documentation regarding bounced landing recovery techniques.

into the air after touchdown, the pilot should power up and get back to the flare position. Another simulator instructor stated that a pilot should add power to recover from a bounce. A third simulator instructor stated that, if sufficient runway existed, the pilot should add power and land, and, if sufficient runway did not exist, the pilot should execute a go-around.

A company line check airman stated that, if a first officer were to bounce the airplane on landing, he would take control of the airplane, apply power, and go around. Another company line check airman stated that, if a bounced landing could be corrected safely, the pilot should proceed with the landing, and, if a bounced landing could not be corrected safely, the pilot should execute a go-around. This line check airman added that he would allow the first officer to execute the go-around after the bounce but that he would take control of the airplane if he felt the need to do so.

On September 25, 2004, Executive Airlines incorporated bounced landing recovery techniques in its Airplane Operating Manual (AOM). The bounced landing recovery guidance states the following:

> In the event the aircraft should bounce after landing, hold or re-establish a normal landing attitude and immediately add power as necessary to control the rate of descent. When using this recovery technique, exercise extreme caution not to increase the pitch attitude above normal as this will only increase the height of the bounce and may cause entry into stall warning. DO NOT push over, as this will only cause another bounce and damage the nose gear. If there is any doubt as to a safe recovery, the captain will call for and conduct an immediate go-around. Apply go-around power and fly the Missed Approach/Rejected Landing Profile. DO NOT retract the Landing Gear until a positive rate of climb is established because a second touchdown may occur during the recovery.

The Safety Board informally surveyed six airlines, an airplane manufacturer, and a pilot training facility to determine if bounced landing recovery techniques were typically contained in industry flight manuals. The survey revealed that only some of the companies included bounced landing recovery techniques in their flight manuals and discussed these techniques during training. Most of the companies indicated that bounces commonly occurred during IOE checkrides and that, when a bounce did occur, the check airman would provide verbal guidance to the pilot on how to recover the airplane.

1.17.2 Operational Guidance

1.17.2.1 Approach Airspeed Guidance

Executive Airlines' ATR-42/72 AOM, Volume 1, Performance, "Landing Speeds" (dated April 1, 2004), contains initial approach airspeed guidance. The manual states that V_{app}, which is the initial approach airspeed, is to be selected at the pilot's discretion and must be more than V_{ref} plus V_{m}GA15 (minimum go-around airspeed, 15° of flaps, low bank) and less than or equal to V_{m}LB0 (minimum low bank, 0° of flaps) or V_{m}HB0 (minimum high bank, 0° of flaps). The manual adds that V_{app} is to be maintained until

500 feet, at which point, power and attitude should be adjusted to ensure that the airplane crosses the runway threshold within +10/-0 knots of V_{ref}. According to the airspeed flip cards and the airspeed guidance contained in Executive Airlines' AOM, assuming an airplane weight of 37,000 pounds, the flight crew should have selected an initial approach airspeed more than 107 KIAS and less than or equal to 128 KIAS.

Executive Airlines' ATR-42/72 AOM also contains wind additive to approach airspeed guidance. The manual states that V_{ref} is determined by correcting V_mHB30 (minimum high bank, 30° of flaps) for wind. The manual states that the wind factor should be the greater of one-third of the headwind component or the full gust factor[50] and should not exceed 15 knots of correction. The manual also states that the pilot should set the calculated V_{ref} on the airspeed bug.

The manual states that the airspeeds are published in the AOM and in the flip cards[51] for various landing weights and that the airspeeds to be used for approach and go-around are based on actual airplane weight and are rounded to the next heaviest increment. The AOM and the flip cards showed that the V_{ref} for the accident flight, assuming a landing weight of 37,000 pounds, would have been 95 KIAS.[52] As noted previously, ATIS Juliet, which was current at the time of the accident, reported winds of 060° at 17 knots with gusts up to 23 knots. According to the wind data, one-third of the headwind component (1/3 x 17 knots) would have been 6 knots, and the full gust factor (23 - 17 knots) would also have been 6 knots; therefore, the correct V_{ref} for the accident flight would have been 101 KIAS.

During postaccident interviews, the captain stated that he could not recall what airspeeds were used throughout the approach. Further, he could not remember if he made a correction to the airspeed during the accident flight or if he used the airspeed that was specified on the airspeed flip card (95 KIAS). He stated that airspeed corrections were needed most of the time when he landed at SJU. The first officer stated that he set the bugs on his airspeed indicator according to the airspeeds read to him by the captain. He stated that the captain did not mention if he had made an airspeed correction. Neither pilot could recall the airspeed when the airplane crossed the approach end of runway 8.

1.17.2.2 Before Landing Checklist

Executive Airlines' ATR-42/72 AOM, Volume 1, Normals, "Before Landing Checklist," states that the power management selector should be set to the TO position by the nonflying pilot before landing. The power management selector was found in the CLB position. During postaccident interviews, the captain stated that he could not recall if the power management selector was in the CLB or TO position before landing. The captain thought all of the appropriate checklists were performed. The first officer stated that the

[50] The full gust factor is the gust speed minus the headwind speed.

[51] Flip cards are carried on board all company airplanes and list takeoff and approach airspeeds for various landing weight and flap configurations.

[52] During postaccident examinations, Safety Board investigators found the flip cards in the airplane opened to the page that specifies the airspeed for a landing weight of 37,000 pounds.

power management selector was in the TO position before departing MAZ. The first officer stated that he did not notice if the power management selector was positioned to CLB when he called for the climb checklist after departure from MAZ. He thought that the captain had moved the power management selector to the CRZ position when he called for the cruise checklist. Shortly after recording the captain stating that he had completed the before landing checklist, the CVR recorded him stating that he was going to position the power management selector to CLB. The CVR did not record the captain stating that he was repositioning the selector to TO.

Executive Airlines' ATR-42/72 AOM states that the condition levers should normally remain at 86 percent for landing and that the minimum setting for landing is 86 percent. The AOM adds that the maximum rpm could be set at the captain's discretion. The AOM notes that, if the power management selector is set to TO before retarding the power levers, the condition levers might automatically advance to 100 percent. During the cruise portion of the flight, the CVR recorded the captain discussing the use of the condition levers with the first officer. The captain stated that he always landed with the condition levers set at 86 percent. He added that some pilots landed with the condition levers set at 100 percent but that he did not see any reason to land with the levers set at 100 percent. During the before landing checklist, the CVR recorded the captain stating that he was setting the condition levers to 86 percent. On September 25, 2004, Executive Airlines standardized its procedures and required that the condition levers on all of its ATR airplanes be set to 100 percent before landing.

1.17.2.3 Evacuation Procedures

Executive Airlines' ATR-42/72 AOM, Volume 1, Emergency/Abnormals, states that the alternate evacuation signal if the PA system becomes inoperative is the following:

SEATBELT SIGN .... OFF
EMER EXIT LT [light] ....ON
ATTND [attendant] Calls pb [push button]................................Depress

Executive Airlines' ATR-42/72 AOM, Volume 1, Emergency/Abnormals, contains the following ground evacuation checklist:

AIRCRAFT PARKING BRAKE ....STOP/SET
ATC (TIME PERMITTING) (F/O)..NOTIFY
CL [Condition Levers] (BOTH) .... FEATHER then FUEL S/O
MIN [Minimum] CAB LIGHTS..ON
FLIGHT ATTENDANT (PA) .... NOTIFY
SEATBELTS SIGN .... OFF
EMERGENCY EXIT LIGHTS ....ON
ENGINE FIRE HANDLES (both) ....PULL
FIRE AGENTS .... AS RQD
ENG [Engine] START Selector .... OFF

FUEL PUMPS (both).. OFF
BAT [Battery] (before leaving A/C [aircraft]) .... OFF
VOICE RECORDER CB [Circuit Breaker] 42/Row D 72/Row...PULL

After the airplane came to a complete stop, the CVR recorded a discussion between the first officer and the captain about which checklist should be initiated. The CVR recorded the captain instructing the first officer to perform the emergency evacuation checklist, which was on placards on both the first officer and captain control wheels. The first officer stated that he did not know "where to start," and the captain then told him to perform the fire on ground checklist, which was located on the yellow emergency procedures checklist in the cockpit.

During postaccident interviews, the captain stated that he tried to perform the emergency evacuation checklist but that he could not recall specifically how many steps were accomplished or if the battery switch was turned off. He stated that he tried to shut down the right engine and feather[53] the right propeller. The captain added that, after shutting down the engines, his main concern was evacuating the passengers. The captain stated that he could not remember who pulled the engine fire handles or whether the fire bottles were activated.

The first officer stated that he performed the fire on ground checklist first and then the emergency evacuation checklist. The first officer stated that he recalled that the captain attempted to feather the propellers and that he was able to feather the left propeller but not the right propeller because the condition lever in the cockpit had jammed. He stated that battery power was available but that the radios and the PA system were inoperative.

1.18 Additional Information

1.18.1 Additional Information About Ipeco Cockpit Seats

1.18.1.1 General Information

An Ipeco representative stated that, since 1983, when the cockpit seat design found on the accident airplane went into service, the company had produced 1,420 seat assemblies and had never received a report that a seat had broken similarly to the accident seat. The representative stated that, since 1983, the company had manufactured 125 sleeve assemblies as spare parts, which were provided to FAA-authorized repair stations. He stated that he did not know how many of these assemblies had been used or were still in parts inventories. He also stated that Ipeco did not maintain records indicating why the parts were replaced.

[53] Feathering means to rotate the propeller blades so that the blades are parallel to the line of flight (streamlined to the airflow) to reduce drag in flight and prevent further damage to an engine that has been shut down.

An Ipeco representative from the company's subsidiary in Torrance, California, stated that sleeve assemblies are periodically replaced on seats sent to its facility for overhaul. The representative stated that, during overhaul, the entire cockpit seat is inspected and that sleeve assemblies are replaced when evidence of cracking in the metal adjacent to the weld at the base of the sleeve is found. He stated that he thought that the damage on these assemblies was caused when mechanics dropped or dragged them during the removal process. According to the representative, during the last 5 years, the company had overhauled 131 ATR seats and had replaced the sleeve assemblies on 45 of the overhauled seats.

1.18.1.2 Ipeco Cockpit Seat Tensile Strength Testing

As a result of the Safety Board's metallurgical findings and Ipeco's U.S. subsidiary's reports of damaged sleeve assemblies, Ipeco conducted tests in December 2004 to determine the effects of weld discontinuity and cracking on the tensile strength of the sleeve assemblies.[54] The Ipeco test report stated that, of the six sleeve assemblies that were used during the tests, five had been removed from in-service seats by Ipeco's U.S. subsidiary because the assemblies had cracks, which were found during overhaul, and exhibited a lack of weld penetration that was similar to that found on the accident sleeve assemblies. The sixth sleeve assembly was newly manufactured and had 100-percent weld penetration.

According to Ipeco's report, the tests were conducted on a tensile/compression machine. Fixtures were used to mount the sleeve assemblies as they would be when normally installed on a cockpit seat. Tensile loads were then applied to the assemblies until they failed or stopped reacting to the loads. The highest load value attained before the assemblies failed or stopped reacting was recorded and was considered the ultimate load for each assembly. All of the test assemblies exceeded the certification strength requirements, including the 6-G vertical load requirement, contained in 14 CFR 25.561.

1.18.1.3 Ipeco's Postaccident Actions

Since the accident, Ipeco has taken several actions to address the issues found during the investigation. According to an Ipeco representative, Ipeco changed the type of weld it used on the sleeve assemblies to allow easy visual inspection of the weld penetration. In May 2005, Ipeco performed tensile strength tests (identical to the December 2004 tensile strength tests) on a number of parts welded with the new weld material to ensure that the parts met the seat's strength requirements, and the weld was found to meet the requirements. The company started using the new weld in its new production seats beginning in July 2005.

Further, on June 5, 2005, Ipeco issued service bulletin (SB) No. 063-25-04 to direct all operators and approved repair facilities to visually inspect under magnification all in-service sleeves at the next aircraft "C" check (conducted every 4,000 flight hours) for signs of cracks and replace all cracked sleeves before returning the seat to service. The

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[54] A representative of the British Civil Aviation Authority attended the tests.

SB also stated that seat assemblies held as spares should be inspected within 90 days of receipt of the bulletin and, if cracks are found, the sleeve should be destroyed.

1.18.2 Previous Bounced Landing Recovery Guidance and Training-Related Safety Recommendation

On July 31, 1997, Federal Express flight 14, a McDonnell Douglas MD-11, N611FE, bounced once and then crashed while landing at Newark International Airport, Newark, New Jersey. In its final report on this accident, the Safety Board concluded that the captain's overcontrol of the elevator during the landing and his failure to execute a go-around from a destabilized flare were causal to the accident.[55] The report stated the following:

> The risk of a future catastrophic accident could be reduced if air carrier pilot training programs devote additional attention to safety issues related to landings. It is particularly important to instill in pilots the orientation to perform a go-around in the event of an unstabilized approach or destabilized landing flare.

On August 25, 2000, the Safety Board issued the following recommendation to the FAA:

> Convene a joint government-industry taskforce composed, at a minimum, of representatives of manufacturers, operators, pilot labor organizations, and the FAA, to develop, within 1 year, a pilot training tool to provide a syllabus for simulator training on the execution of stabilized approaches to the landing flare, the identification of unstabilized landing flares, and recovery from these situations, including proper sink rate recovery techniques during flare to landing, techniques for avoiding and recovering from overcontrol in pitch before touchdown, and techniques for avoiding overcontrol and premature derotation during a bounced landing. (A-00-93)

In a May 15, 2002, letter, the FAA stated that a joint taskforce had produced the following training materials to address Safety Recommendation A-00-93:

- Advisory Circular 120-71, "Standard Operating Procedures for Flight Deck Crewmembers," Appendix 2, "Stabilized Approach: Concepts and Terms," in August 2000.

[55] For more information about this accident, see National Transportation Safety Board, *Crash During Landing, Federal Express, Inc., McDonnell Douglas MD-11, N611FE, Newark International Airport, Newark, New Jersey, July 31, 1997,* Aircraft Accident Report NTSB/AAR-00/02 (Washington, DC: NTSB, 2000).

- Flight Standards Information Bulletin for Air Transportation 00-08, "Standard Operating Procedures for Flightdeck Crewmembers, Including Stabilized Approach," in August 2000.
- Approach and Landing Accident Reduction (ALAR) Training Guide, July 2001.

The FAA stated that the ALAR training guide specifically addressed guidance on maintaining a stabilized approach and identifying an unstable approach. The FAA further stated that the taskforce member organizations endorsed the use of the training guide in developing and evaluating ALAR training. On October 22, 2002, the Safety Board classified Safety Recommendation A-00-93 "Closed—Acceptable Action."

1.18.3 Previous Flight Data Recorder Potentiometer Sensor-Related Safety Recommendations

On August 21, 1995, Atlantic Southeast Airlines flight 529, an Embraer EMB-120RT, crashed on approach to West Georgia Regional Airport, Carrollton, Georgia. The flight crew was attempting to make an emergency landing after the in-flight failure of a propeller blade. Examination of the FDR data for this accident revealed that two flight control position sensors had malfunctioned, preventing the required data from being accurately recorded. The Safety Board determined that the absence of the data hindered its investigation.[56]

The EMB-120 was equipped with potentiometer sensors that were similar to those installed on the ATR-72; however, the potentiometers installed on the EMB-120 used an input shaft instead of a string. Examination of the EMB-120 revealed that the coupler connecting the input shaft of the potentiometer to the rudder pedals had become loose, causing incorrect data to be recorded. Further, the control wheel and column potentiometers were not calibrated correctly, rendering the recorded data inaccurate.

In a June 27, 1996, recommendation letter to the FAA regarding the flight 529 accident, the Safety Board noted that it had investigated seven other EMB-120 accidents and incidents. For six of these seven airplanes, malfunctions of the potentiometers prevented accurate data from being recorded. The letter noted, "these malfunctions are indicative of a design deficiency and/or inadequate FDR system maintenance practices." The letter also noted that tests, such as FDR parameter readouts and potentiometer calibrations, could be conducted to ensure timely identification and repair of potentiometer malfunctions. The letter further stated the following:

[56] For more information about this accident, see National Transportation Safety Board, *In-Flight Loss of Propeller Blade, Forced Landing, and Collision with Terrain, Atlantic Southeast Airlines, Inc., Flight 529, Embraer EMB-120RT, N256AS, Carrollton, Georgia, August 21, 1995,* Aircraft Accident Report NTSB/AAR-96/06 (Washington, DC: NTSB, 1996).

> The Maintenance Program Manual for the EMB-120 requires operators to perform a readout of the FDR each year. Potentiometer malfunctions are often identified and repaired during these checks, but malfunctions that occur between readouts are undetected….the Maintenance Manual contains the procedure to test the potentiometers for proper operation and calibration; however, operators are not required to perform this test at regular intervals.

As a result of its investigation, the Safety Board issued the following two recommendations to the FAA:

> Conduct a design review of the Embraer-120 flight data recorder system, with emphasis on potentiometer failures, and mandate design, installation, and/or maintenance changes, as necessary, to ensure that reliable flight control data are available for accident/incident investigation. (A-96-33)
>
> Require Embraer-120 operators to perform a flight data recorder (FDR) readout or a potentiometer calibration test per section 31-31-00 of the Embraer-120 Maintenance Manual every 6 months until FDR sensor design, installation, and/or maintenance improvements are incorporated. (A-96-34)

Because of high maintenance costs and the need for frequent inspections and replacement of the sensors, the primary operator of EMB-120s in the United States identified an alternative sensor design that would be more reliable. In December 2002, the FAA issued an STC for the EMB-120 FDR system that authorized the replacement of the potentiometer rudder and control column position sensors with the improved sensor. In an August 3, 2004, e-mail, the FAA stated that a survey of EMB-120 commercial operators indicated that 74 of the 88 EMB-120s in operation had or would have the upgraded sensors installed. On October 21, 2004, the Safety Board responded that upgraded sensors eliminated the need to revise the FDR system inspection procedures and, therefore, classified Safety Recommendation A-96-33 "Closed—Acceptable Action."[57]

On September 19, 1997, the FAA issued Flight Standards Handbook Bulletin for Airworthiness (HBAW) 97-14B, "Embraer EMB-120 Flight Data Recorder Test," which directed principal avionics inspectors to require affected EMB-120 operators to perform an initial and recurring potentiometer calibration test every 6 months until the FDR design and installation were enhanced. On May 5, 1998, the Safety Board classified Safety Recommendation A-96-34 "Closed—Acceptable Action."

In an August 11, 2003, letter, the Safety Board noted that the FAA had reversed its position on these inspections by issuing a supplemental notice of proposed rulemaking (SNPRM), which proposed to adopt an airworthiness directive to require the replacement of noisy potentiometers with sensors of the same make and model that are less than

[57] On November 30, 1998, the Safety Board issued Safety Recommendation A-98-104, which asked the FAA to revise its current EMB-120 FDR system inspection procedure to include an FDR readout and evaluation of parameter values from normal operations to ensure a more accurate assessment of the operating status of the flight control position sensors on board the airplane. As a result of the FAA's actions taken in response to Safety Recommendation A-96-33, the Safety Board classified Safety Recommendation A-98-104 "Closed—Acceptable Alternate Action."

12 months old and conduct annual inspections of the potentiometers. The Board stated that the FAA's proposed corrective action did not address the sensor reliability problem addressed in Safety Recommendation A-96-34. The Board reiterated its position on inspection intervals, stating that the only way to properly evaluate the effectiveness of the proposed corrective action was to require an FDR readout and evaluation every 6 months for 2 years and submission of the results to the FAA for evaluation.

2. Analysis

2.1 General

The captain was properly certificated and qualified under Federal regulations. No evidence indicated any preexisting medical or physical conditions that might have adversely affected his performance during the accident flight. The first officer held a current FAA airman medical certificate at the time of the accident; however, he failed to provide information about his medical condition (anxiety) or his use of the prescription drug alprazolam when he applied for the certificate. When the FAA was informed about the first officer's medical condition and prescription drug use, his medical certificate was revoked. For a discussion of this issue, see section 2.5.

The airplane was properly certificated, equipped, and maintained in accordance with Federal regulations and approved company procedures. The airplane was loaded in accordance with approved company weight and balance procedures. The weight and balance of the airplane were within limits during all phases of the flight.

Meteorological data indicated that, before and after the time of the accident, surface winds were about 17 to 22 knots and winds aloft were about 15 to 24 knots below 4,000 feet. Although the pilot in the 727 that preceded the accident airplane reported a 10-knot loss of airspeed during the approach to SJU about 3 minutes before the accident, he landed the airplane safely. Further, the Safety Board's airplane performance study and FDR data showed that, although the accident airplane was encountering windspeed shifts during the approach and landing phases of the flight, the airplane's pitch motion corresponded with the flight control inputs. Therefore, the Safety Board concludes that winds were within the airplane's performance capabilities and did not adversely affect the flight crew's ability to maneuver the airplane during the approach and landing as significant aircraft control authority remained.

The emergency response was timely and appropriate. The passengers and crewmembers were safely evacuated from the airplane.

Postaccident examination of the captain seat revealed that the weld that attached the end cap to the sleeve fractured at both welded joints during the accident sequence. Although examinations revealed that both the captain and first officer seats exhibited weld discontinuities, the Safety Board could not determine whether the captain seat would have failed if these defects had not existed. On the basis of the airplane performance study, the Safety Board concludes that, at some point during the accident sequence, the captain cockpit seat failed when it was subjected to vertical loads that exceeded those required for certification.

This analysis discusses the accident sequence, including the role of the flight crew's performance. The analysis also discusses the lack of company bounced landing recovery guidance and training, the failure of the airplane's left aileron surface position sensors, the first officer's medical condition and prescription drug use, the uncoupling of the pitch control uncoupling mechanism, and the failure of the left MLG.

2.2 Accident Sequence

Postaccident interviews with the flight crew and examination of CVR and FDR data indicated that the en route and cruise portions of the flight were uneventful. About 1437, the captain told the first officer that the V_{ref} was 95 KIAS and instructed him to "stand by for winds." The first officer then set 95 KIAS on his airspeed bug.

Using the guidance contained in Executive Airlines' airspeed flip cards and AOM, the Safety Board calculated that, at the airplane's calculated landing weight, the flight crew should have selected an initial approach airspeed more than 107 KIAS and less than or equal to 128 KIAS. Also, the flight crew should have maintained the selected initial approach airspeed until the airplane reached an altitude of 500 feet and then slowed, crossing the runway threshold within +10/-0 knots of V_{ref}. In addition, the AOM stated that, to compensate for strong wind gradients and/or gust effects during approach and landing, V_{ref} must be corrected for wind. According to the wind data reported about the time of the accident,[58] the correct V_{ref} for the accident flight would have been 101 KIAS.

Although the CVR recorded the captain telling the first officer to "stand by for winds" after confirming 95 KIAS as the V_{ref}, the CVR did not record him providing the first officer with a wind-corrected V_{ref}. Postaccident examinations of the cockpit revealed that the airspeed bugs on both pilots' airspeed indicators were set to 96 KIAS, and the airspeed flip cards were found opened to the page that showed the airspeed for a landing weight of 37,000 pounds (95 KIAS). Further, during postaccident interviews, neither the first officer nor the captain could remember making any airspeed changes to compensate for the winds. Therefore, the Safety Board concludes that the flight crewmembers did not account for winds when calculating the V_{ref}, and, as a result, they were not in compliance with Executive Airlines' approach airspeed procedures.

About 1443, an SJU approach controller contacted the flight crewmembers, cautioned them of possible wake turbulence from a preceding 727, and told them to reduce the airspeed to 160 KIAS. The captain told the first officer to reduce the airspeed even further.[59] The Safety Board's ATC radar study determined that the separation between the accident airplane and the 727, at their closest point, was greater than the minimum lateral separation required by Federal regulations (FAA Order 7110.65). Further, the 727 landed on runway 10, and the first officer was performing an approach to runway 8. In addition, the existing winds would have blown any wake turbulence from the 727 away from the accident airplane's approach path. Therefore, the Safety Board concludes that, given the

[58] Winds were reported to be 060° at 17 knots and gusting at 23 knots.

[59] The CVR recorded the captain state that they were behind a "seven five." Therefore, the captain most likely asked the first officer to reduce the airspeed further because the 757 is a bigger airplane than the 727 and would create greater wake turbulence.

relative positions of the accident airplane and the preceding 727, the runway configuration, and the existing winds, wake turbulence was not a factor in this accident.

At 1444:57, the captain stated that he was setting the condition levers to 86 percent.[60] At 1445:02, the first officer called for the before landing checklist. About 1 minute later, the captain stated that he was going to move the power management selector from TO to CLB "just for now" to prevent the condition levers from automatically advancing to 100 percent. However, the CVR did not record the captain repositioning the power management selector back to TO.[61] Postaccident documentation of the cockpit switch positions by the Safety Board's Operations Group confirmed that the power management selector was set to CLB. Therefore, the Safety Board concludes that the captain did not properly follow Executive Airlines' before landing procedures.

At 1446:39, the SJU local controller cleared flight 5401 to land, and the first officer turned the airplane left toward the runway and monitored the VASI for glideslope guidance for the rest of the approach. At 1449:07, the captain told the first officer to keep the airplane's nose down or to increase power (to maintain airspeed) because he was concerned that the airplane was going to balloon. About 2 seconds later, he instructed the first officer to get the airplane's nose up, and, at 1449:28, he told the first officer to "power in a little bit."[62] About 2 seconds later, the airplane crossed the runway threshold at an airspeed of about 110 KIAS, which was almost 15 knots more than the V_{ref} set on both pilots' airspeed indicators (96 KIAS) and 9 knots more than what should have been set.

After crossing the runway threshold, the captain again told the first officer to "power in a little bit" and not to pull the airplane's nose up. CVR and FDR data indicated that the airplane touched down on the runway the first time about 1449:41 and then skipped and became airborne, reaching an altitude of about 4 feet. Only minor flight control inputs and/or slight power adjustments would most likely have been necessary to regain the proper landing attitude and settle the airplane back on the runway. Therefore, the Safety Board concludes that the flight crew could have completed a successful landing after the initial touchdown.

After the initial touchdown, the captain took control of the airplane, most likely because of the first officer's inexperience. FDR data indicated that he then made several abrupt changes in pitch and power. Wreckage and impact information and CVR and FDR data indicated that the captain's actions after the initial touchdown resulted in the airplane bouncing on the runway twice. The captain's inputs made it less likely that he could

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[60] Executive Airlines' AOM states that the condition levers can remain at 86 percent for landing the ATR-72 and that maximum rpm could be set at the pilot's discretion. After the accident, the company standardized its procedures, requiring that the condition levers on all of its ATR airplanes be set to 100 percent before landing.

[61] Executive Airlines' AOM states that the nonflying pilot should set the power management selector to TO before landing.

[62] As noted previously, this flight was the first officer's first since he completed IOE; therefore, it was appropriate for the captain to instruct the first officer during the flight.

recover from the two bounces and safely land the airplane; as a result, he should have executed a go-around.

The Safety Board concludes that, after each bounce of the airplane on the runway, the captain did not make appropriate pitch and power corrections or execute a go-around, both of which were causal to the accident. On the basis of the evidence presented in this section, the Safety Board concludes that the captain demonstrated poor cockpit oversight and piloting techniques before and during the accident sequence.

2.3 Bounced Landing Recovery Guidance and Training

Postaccident interviews with the first officer, two company check airmen, and three company simulator instructors revealed that Executive Airlines did not have standardized guidance regarding bounced landing recovery. For example, one of the check airmen and one of the simulator instructors stated that, if the airplane bounced, they would execute a go-around. The other three company personnel indicated that, if possible, they would try to correct the bounce and land and that, if not possible, they would execute a go-around.

Further, Executive Airlines' manager of training and standards stated that, before the accident, the company did not teach its pilots bounced landing recovery techniques. The manager also stated that he would not want to conduct bounced landing recovery training in the simulator because it was very difficult to demonstrate. However, he stated that, after the accident, the president and the vice president of operations asked him to look into the feasibility of conducting bounced landing recovery flight training and incorporating bounced landing recovery techniques in company manuals. The Safety Board concludes that written company guidance on bounced landing recovery techniques would have increased the possibility that the captain could have recovered from the bounced landings or handled the airplane more appropriately by executing a go-around. As noted previously, on September 25, 2004, Executive Airlines incorporated bounced landing recovery techniques in its AOM.

In its final report on the July 31, 1997, Federal Express flight 14 landing accident,[63] the Safety Board concluded that the captain's overcontrol of the elevator during the landing and his failure to execute a go-around from a destabilized flare were causal to the accident. As a result, the Board issued Safety Recommendation A-00-93 to the FAA, which required, in part, that a syllabus for simulator training be developed that addressed how to recover from unstabilized landing flares, including techniques for avoiding and recovering from overcontrol in pitch before touchdown and techniques for avoiding overcontrol and premature derotation during a bounced landing. In a May 15, 2002, letter, the FAA stated that an industry taskforce had been convened and that the taskforce had produced several significant training materials, including an ALAR

[63] NTSB/AAR-00/02.

Training Guide, to address the safety recommendation. On October 22, 2002, the Board classified Safety Recommendation A-00-93 “Closed—Acceptable Action.”

The training materials produced in response to Safety Recommendation A-00-93 do not specifically address bounced landing recovery techniques. Further, an informal Safety Board survey of six airlines, an airplane manufacturer, and a pilot training facility revealed that only some of the companies included bounced landing recovery techniques in their flight manuals and discussed these techniques during training. The Board is concerned that the lack of guidance on bounced landing recovery techniques could contribute to similar landing accidents.

The Safety Board concludes that the performance of air carrier pilots would be improved if additional guidance and training in bounced landing recovery techniques were available. Therefore, the Safety Board believes that the FAA should require all 14 CFR Part 121 and 135 air carriers to incorporate bounced landing recovery techniques in their flight manuals and to teach these techniques during initial and recurrent training.

2.4 Quality of Data Provided by Flight Data Recorder Potentiometer Sensors

The Safety Board determined that the left aileron surface position data recorded by the accident airplane’s FDR were invalid even though the accident airplane had been modified on August 7, 2001, with the position sensors and associated hardware required by STC No. ST01310NY. Executive Airlines stated that the first and last FDR parameter readout since the installation of the sensors occurred on January 3, 2003, about 1 year and 5 months after the installation and 1 year and 4 months before the accident. Executive Airlines stated that it had replaced 47 aileron surface position sensors in the last 3.5 years. However, the company indicated that, because the sensors are not tracked, the times from installation to failure could not be determined.

During its investigation of the Atlantic Southeast Airlines flight 529 accident,[64] the Safety Board determined that the EMB-120’s two flight control position sensors had malfunctioned, preventing the required data from being accurately recorded, and that the lack of data hindered the investigation. The Board’s report on the accident noted that tests could be conducted to ensure timely identification and repair of potentiometer malfunctions, including FDR parameter readouts. The report also noted that malfunctions that occur between readouts are typically not detected.

As a result of the flight 529 investigation and six other investigations involving EMB-120s in which potentiometer malfunctions prevented accurate data from being recorded on the EMB-120, the Safety Board issued Safety Recommendations A-96-33 and -34. Safety Recommendation A-96-33 asked the FAA, in part, to conduct a design review of the EMB-120 FDR system, emphasizing potentiometer failures, and mandate design,

[64] NTSB/AAR-96/06.

installation, and/or maintenance changes, as necessary. In December 2002, the FAA issued an STC that authorized the replacement of the potentiometer sensors for the EMB-120 FDR system with more reliable sensors. The Safety Board classified Safety Recommendation A-96-33 "Closed—Acceptable Action" in October 2004.

Safety Recommendation A-96-34 asked the FAA, in part, to require EMB-120 operators to perform an FDR readout or a potentiometer calibration test every 6 months until FDR sensor design, installation, and/or maintenance improvements are incorporated. In September 1997, the FAA issued an HBAW, which directed operators to conduct FDR potentiometer calibration testing every 6 months. As a result, the Safety Board classified Safety Recommendation A-96-34 "Closed—Acceptable Action" in May 1998. However, in an August 2003 letter commenting on an SNPRM in which the FAA proposed a 12-month FDR potentiometer inspection interval, the Board reiterated its position on the inspection interval recommended in Safety Recommendation A-96-34.

The potentiometer sensors installed on Executive Airlines ATRs were similar to the potentiometer sensors used on the EMB-120; therefore, they were susceptible to the same problems that previously prevented accurate data from being recorded on the EMB-120. However, at the time of the accident, Executive Airlines only performed functional checks of the FDR system every 3,000 flight cycles. As evidenced by company maintenance data, it is possible that FDR functional checks performed every 3,000 flight cycles will only occur once every 1.5 years. As noted previously, after the accident, Executive Airlines began conducting FDR functional checks every 1,000 flight cycles.

The Safety Board concludes that the aileron flight control surface position sensors installed on airplanes in accordance with STC No. ST01310NY are unreliable and that FDR functional checks every 6 months could ensure the timely identification and correction of potentiometer malfunctions and ensure that accurate flight control data are available for accident and incident investigations. Therefore, the Safety Board believes that the FAA should require the replacement of aileron surface position sensors installed in accordance with STC No. ST01310NY with more reliable aileron surface position sensors within 1 year or at the next heavy maintenance check, whichever comes first, after the issuance of an approved STC. Until reliable aileron surface position sensors have been installed, require FDR functional checks every 6 months and replacement of faulty sensors, as necessary. Additionally, the Safety Board believes that the FAA should conduct a review of all FDR systems that have been modified by an STC to determine the reliability of all sensors used as flight control surface position sensors. If the review determines that a sensor does not provide reliable flight control surface position data, require that the sensor be replaced with a more reliable sensor.

2.5 The First Officer's Medical Condition and Prescription Drug Use

The first officer's medical records from his personal psychiatrist indicated that he had a history of treatment for various anxiety-related symptoms, which are generally considered incompatible with aviation duties, at least during the time that the disorders require treatment.[65] Further, the first officer was prescribed alprazolam, which can cause drowsiness and light-headedness and, in doses of 0.5 mg or higher, can impair the performance of cognitive and psychomotor tasks.[66] The first officer should not have omitted information regarding his medical condition on his three most recent FAA airman medical certificate applications (dated August 14, 2001; August 7, 2003; and February 10, 2004), especially given that item Nos. 18 and 19 on the application specifically and clearly asked for this information.[67] Therefore, the Safety Board concludes that, because the first officer started getting treatment for anxiety in July 2001, he should have reported this information on his last three FAA airman medical certificate applications. The Safety Board is aware that, after the accident, the FAA revoked the first officer's airman medical certificate because he allegedly falsified his application.

The first officer stated that he typically took only 1/2 of a 0.25-mg alprazolam tablet every 2 to 3 days; however, an examination of his recent pharmacy refill records suggested that he likely took more than one 0.25-mg tablet per day. Although it is possible for the drug to cause impairment if it is taken as frequently as was prescribed (one to two 0.25-mg tablets every 2 to 3 hours, as needed, not to exceed 8 mg per day), postaccident company drug testing of the first officer, which included screening for alprazolam, tested negative. Therefore, the Safety Board concludes that not enough evidence was available to determine whether or to what extent the first officer's medical condition and prescription drug use contributed to the accident.

2.6 Uncoupling of the Pitch Control Uncoupling Mechanism

Postaccident testing and examination revealed that the pitch control uncoupling mechanism had uncoupled, thereby mechanically disconnecting the left and right elevators from each other. As a result, either elevator could be independently deflected up and down by hand to its maximum control limits without the corresponding movement of the other elevator. During the testing, no binding or mechanical resistance was detected when either elevator was moved.

A review of FDR data indicated that, just before the airplane's third touchdown, the pitch uncoupling mechanism was configured in the normal coupled position. The data indicated that the left and right elevators deflected together throughout the entire flight and that the elevator deflections were consistent with both control column movements.

[65] D.R. Jones, "Aerospace Psychiatry," *Fundamentals of Aerospace Medicine* (Philadelphia, PA: Lippincott Williams & Wilkins, 2002).

[66] R.C. Baselt, *Drug Effects on Psychomotor Performance* (Foster City, CA: Biomedical Publications, 2001).

[67] The Safety Board has previously noted that pilots do not necessarily have sufficient information to determine which medications are contraindicated for flight. As a result, the Board issued Safety Recommendations A-00-04 through -06. For more information, see the Board's Web site at <www.ntsb.gov>.

After the airplane's third touchdown, the data showed three simultaneous events indicating that the pitch uncoupling mechanism had uncoupled. First, the control column positions deviated from their normally recorded deviations. Second, the left and right elevators began to move independently of each other. Last, the FDR pitch uncoupling parameter showed "warn." None of these events were present before the third touchdown. Therefore, the Safety Board concludes that the pitch control uncoupling mechanism uncoupled when the airplane touched down for the third time; as a result, the pitch uncoupling would not have prevented the flight crew from controlling or safely landing the airplane.

2.7 Failure of the Left Main Landing Gear

CVR, FDR, and wreckage and impact information indicated that the airplane's third touchdown severely damaged the left MLG, which caused it to fracture circumferentially at its vertical trunnion leg just below the actuator attach point. Examination of the fracture surfaces revealed evidence of overload failure. No evidence of preexisting defects was found.

The ATR-72 landing gear and associated structure were designed to absorb energy equivalent to a maximum airplane descent rate of 10 fps when landing at the airplane's maximum design landing weight (consistent with the landing design limits imposed by 14 CFR 25.473 to 25.487). However, the Safety Board's airplane performance study determined that, when the airplane touched down for the third time, the left MLG touched down at a descent rate of about 19 to 32 fps. Therefore, the Safety Board concludes that, when the airplane touched down for the third time, the vertical forces on the left MLG exceeded those that the gear was designed to withstand, and these excessive forces resulted in overload failure.

3. Conclusions

3.1 Findings

1. The captain was properly certificated and qualified under Federal regulations. No evidence indicated any preexisting medical or physical conditions that might have adversely affected his performance during the accident flight. The first officer held a current Federal Aviation Administration airman medical certificate at the time of the accident; however, he failed to provide information about his medical condition (anxiety) or his use of the prescription drug alprazolam when he applied for the certificate.

2. The airplane was properly certificated, equipped, and maintained in accordance with Federal regulations and approved company procedures. The airplane was loaded in accordance with approved company weight and balance procedures. The weight and balance of the airplane were within limits during all phases of the flight.

3. Winds were within the airplane's performance capabilities and did not adversely affect the flight crew's ability to maneuver the airplane during the approach and landing as significant aircraft control authority remained.

4. The emergency response was timely and appropriate. The passengers and crewmembers were safely evacuated from the airplane.

5. At some point during the accident sequence, the captain cockpit seat failed when it was subjected to vertical loads that exceeded those required for certification.

6. The flight crewmembers did not account for winds when calculating the minimum approach airspeed, and, as a result, they were not in compliance with Executive Airlines' approach airspeed procedures.

7. Given the relative positions of the accident airplane and the preceding Boeing 727, the runway configuration, and the existing winds, wake turbulence was not a factor in this accident.

8. The captain did not properly follow Executive Airlines' before landing procedures.

9. The flight crew could have completed a successful landing after the initial touchdown.

10. After each bounce of the airplane on the runway, the captain did not make appropriate pitch and power corrections or execute a go-around, both of which were causal to the accident.

11. The captain demonstrated poor cockpit oversight and piloting techniques before and during the accident sequence.

12. Written company guidance on bounced landing recovery techniques would have increased the possibility that the captain could have recovered from the bounced landings or handled the airplane more appropriately by executing a go-around.

13. The performance of air carrier pilots would be improved if additional guidance and training in bounced landing recovery techniques were available.

14. The aileron flight control surface position sensors installed on airplanes in accordance with Supplemental Type Certificate No. ST01310NY are unreliable, and flight data recorder functional checks every 6 months could ensure the timely identification and correction of potentiometer malfunctions and ensure that accurate flight control data are available for accident and incident investigations.

15. Because the first officer started getting treatment for anxiety in July 2001, he should have reported this information on his last three Federal Aviation Administration airman medical certificate applications.

16. Not enough evidence was available to determine whether or to what extent the first officer's medical condition and prescription drug use contributed to the accident.

17. The pitch control uncoupling mechanism uncoupled when the airplane touched down for the third time; as a result, the pitch uncoupling would not have prevented the flight crew from controlling or safely landing the airplane.

18. When the airplane touched down for the third time, the vertical forces on the left main landing gear exceeded those that the gear was designed to withstand, and these excessive forces resulted in overload failure.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the captain's failure to execute proper techniques to recover from the bounced landings and his subsequent failure to execute a go-around.

4. Recommendations

As a result of its investigation of the May 9, 2004, Executive Airlines (doing business as American Eagle) flight 5401 accident, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:

> Require all 14 *Code of Federal Regulations* Part 121 and 135 air carriers to incorporate bounced landing recovery techniques in their flight manuals and to teach these techniques during initial and recurrent training. (A-05-30)
>
> Require the replacement of aileron surface position sensors installed in accordance with Supplemental Type Certificate (STC) No. ST01310NY with more reliable aileron surface position sensors within 1 year or at the next heavy maintenance check, whichever comes first, after the issuance of an approved STC. Until reliable aileron surface position sensors have been installed, require flight data recorder functional checks every 6 months and replacement of faulty sensors, as necessary. (A-05-31)
>
> Conduct a review of all flight data recorder systems that have been modified by a supplemental type certificate to determine the reliability of all sensors used as flight control surface position sensors. If the review determines that a sensor does not provide reliable flight control surface position data, require that the sensor be replaced with a more reliable sensor. (A-05-32)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

MARK V. ROSENKER
Acting Chairman

ELLEN ENGLEMAN CONNERS
Member

DEBORAH A. P. HERSMAN
Member

Adopted: September 7, 2005

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5. Appendixes

Appendix A
Investigation and Public Hearing

Investigation

The National Transportation Safety Board was notified of the accident about 1400 eastern daylight time on May 9, 2004. A partial go-team was assembled, which departed that evening and arrived on scene about 0230 on May 10.

The following investigative groups were formed: Operations, Meteorology, Air Traffic Control, Aircraft Structures, Aircraft Systems, Survival Factors, Metallurgy, and Aircraft Performance. Specialists were also assigned to conduct the readout of the flight data recorder and transcribe the cockpit voice recorder in the Safety Board's laboratory in Washington, DC. A medical officer was assigned to review and analyze information on the first officer's medical condition and prescription drug use.

Parties to the investigation were the Federal Aviation Administration, Executive Airlines, the Air Line Pilots Association, and the Association of Flight Attendants. Accredited representatives from the Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile and the Transportation Safety Board of Canada and technical advisors from Avions de Transport Regional and Pratt & Whitney Canada also assisted in the investigation.

Public Hearing

No public hearing was held for this accident.

Appendix B
Cockpit Voice Recorder Transcript

The following is the transcript of the Fairchild model A-100A cockpit voice recorder, serial number 55031, installed on Executive Airlines flight 5401, an Avions de Transport Regional 72-212, which skipped once, bounced twice, and then crashed while landing in San Juan, Puerto Rico, on May 9, 2004.

LEGEND

RDO	Radio transmission from accident aircraft, American Eagle 5401
CAM	Cockpit area microphone voice or sound source
PA	Voice or sound heard on the public address system channel
HOT	Hot microphone voice or sound source[1]
INT	Voice or sound heard from the airplane's intercom system or "Audio Control Panel"

For RDO, CAM, HOT, INT and PA comments:

- **-1** Voice identified as the Captain
- **-2** Voice identified as the First Officer
- **-3** Voice identified as a flight attendant
- **-4** unidentified female voice
- **-?** Voice unidentified

OPS1	Radio transmission from American Eagle Operations at Mayaguez
OPS2	Radio transmission from American Eagle Operations at San Jaun
TWR	Radio transmission from the Air Traffic Control Tower at San Juan
CTR	Radio transmission from San Juan Air Route Traffic Control Center
APP	Radio transmission from the Approach Control at San Juan
EGPWS	Electronic-automated voice callout from the Enhanced Ground Proximity Warning System

[1] This recording contained audio from Hot microphones used by the flightcrew. The voices or sounds on these channels were also, at times, heard by the CVR group on the CAM channel and vice versa. In these cases, comments are generally annotated as coming from the source (either HOT or CAM) from which the comment was easiest to hear and discern.

CLI	Radio transmission from another airplane communicating with San Juan Air Traffic Control Tower
A863	Radio transmission from another airplane communicating with San Juan Air Traffic Control Tower
UNK	unknown source

*****	Unintelligible word
@	Non-Pertinent word (see note 4 below)
&	Third party personal name (see note 5 below)
#	Expletive
-, - - -	Break in continuity or interruption in comment
( )	Questionable insertion
[ ]	Editorial insertion
...	Pause
ch.1	heard on CVR channel 1 (First Officer's channel)
ch.4	heard on CVR channel 4 (Captain's channel)

Note 1: Times are expressed in Coordinated Universal Time (UTC).

Note 2: Generally, only radio transmissions to and from the accident aircraft were transcribed.

Note 3: Words shown with excess vowels, letters, or drawn out syllables are a phonetic representation of the words as spoken.

Note 4: A non-pertinent word, where noted, refers to a word not directly related to the operation, control or condition of the aircraft.

Note 5: Personal names of 3rd parties not involved in the conversation are generally not transcribed.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1822:02.6 CAM	[start of recording]		
1822:07 HOT-1	*.		
1822:10 HOT-1	seventy one Np.		
1822:12 HOT-2	there it goes.		
1822:12 HOT-1	goes off, (right)... AC wild.		
1822:14 HOT-2	takeoff data speeds are set and checked.		
1822:16 HOT-1	set check.		
1822:16 HOT-2	trims?		
		1822:17 CTR	eagle flight four zero one San Juan, go ahead.
		1822:18.4 RDO-1	eh yes sir we're five minutes.
		1822:23 CTR	* lookin for a release?

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1822:25.0 RDO-1	uh we already got the clearance, we're five minutes prior to departure.
		1822:28 CTR	Eagle zero one I know you have the clearance do you want your release?
		1822:30 RDO-1	yes sir.
		1822:35 CTR	Eagle flight four zero one's released for departure, clearance void if not off by one... eight three five, if not off by one eight three five advise center, center of intentions no later than one eight three seven, time now one eight two three.
		1822:50 RDO-1	clearance void three five, advise intentions no later than three seven, Eagle flight four zero one.
1822:59 HOT-2	takeoff (set) data speeds are set and checked.		
1823:01 HOT-1	set checked.		
1823:02 HOT-2	trims are checked, or set.		
1823:03 HOT-1	set.		
1823:04 HOT-2	radar's standby.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1823:05 HOT-1	standby.		
1823:06 HOT-2	condition lever... max R- sorry.		
1823:07 HOT-1	max RPM.		
1823:08 HOT-2	'n nosewheel steering?		
1823:11 HOT-1	its on.		
1823:11 HOT-2	'n tailstand.		
1823:12 HOT-1	removed.		
1823:13 HOT-2	after start checklist complete.		
1823:15 INT	[sound similar to frequency change alert tone]		
1823:16 HOT-1	just let 'em know you're taxiing fer- uh, runway nine.		
1823:18 HOT-2	(yup).		
		1823:19 RDO-2	Mayaguez traf-

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1823:21 RDO-2	Mayaguez traffic Eagle flight four oh one's taxiing for run-way nine, Mayaguez.
1823:31 HOT-1	try to get in the habit - that's kinda bad habit you don't need it- it may help you now but just try to do a visual scan.		
1823:37 HOT-2	ok.		
1823:38 HOT-1	you don't need to touch anything, just... it may-it kind-the way it perceived is if someone's looking you doin this to you, it looks like you don't know what you're doin.		
1823:47 HOT-2	ok.		
1823:47 HOT-1	which is probably true.		
1823:48 HOT-2	yeah its eh I'm not gonna lie yuh its true I mean-		
1823:49 HOT-1	well, well I'm just telling ya that-		
1823:51 HOT-2	no, ok.		
1823:52 HOT-1	-but try to look like ya kn- ya know try to blend in, peop- most people that know what they're doin, just look up at in a glance an just just get uh * you'll get a flow, it just takes time but * you see what I'm sayin there?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1824:02 HOT-2	no, yeah (totally totally).		
1824:03 HOT-1	it just makes you look more professional if you're not like-		
1824:06 HOT-2	duhh.		
1824:06 HOT-1	-touch duhhh... yeah exactly.		
1824:10 HOT-1	taxi check.		
1824:11 HOT-2	taxi check, brakes?		
1824:15 HOT-2	checked.		
1824:16 HOT-1	check.		
1824:16 HOT-2	flight director and autopilots... set and off.		
1824:19 HOT-1	set, off.		
1824:20 HOT-2	flaps are fifteen?		
1824:21 HOT-1	fifteen degrees.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1824:22 HOT-2	takeoff config test is ok... takeoff briefing is complete... cabin PA?		
1824:28 HOT-1	complete.		
1824:29 HOT-2	she already called?		
1824:30 HOT-1	no.		
1824:31 HOT-2	oh, I see what you're sayin.		
1824:33 PA-2	flight attendants please prepare for takeoff.		
1824:52 HOT-1	put the uh use the FMS. [flight management system]		
1824:56 HOT-1	map... there you go.		
1824:59 CAM	[sound similar to flight attendant call tone]		
1825:01 HOT-2	go ahead.		
1825:02 INT-3	* we're ready for takeoff.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1825:03 HOT-2	ok thanks.		
1825:03 INT-3	bye.		
1825:05 HOT-2	taxi checklist complete.		
1825:07 HOT-2	* one? okay.		
1825:09 HOT-1	yeah.		
1825:09 HOT-2	* * * if we're flyin the departure procedure.		
1825:13 HOT-1	yeah you've just got an RMI right there, right?		
1825:14 HOT-2	oh... good call.		
1825:17 HOT-1	* put ten six-		
1825:18 HOT-2	yeah.		
1825:18 HOT-1	-just do that, intercept the zero eight four on the RMI.		
1825:23 HOT-1	twenty five hundred feet, join your course.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1825:26 HOT-1	before takeoff.		
1825:29 PA	[sound similar to chime that accompanies the "no smoking" sign]		
		1825:35 RDO-1	Mayaguez Eagle four zero one is departing on runway nine at Mayaguez.
1825:46 HOT-2	* flight attendant's chimed flight controls are checked.		
1825:48 HOT-1	check.		
1825:49 HOT-2	rudder cam?		
1825:49 HOT-1	centered.		
1825:50 HOT-2	transponder's A-L-T and start selector continuous re-light, de-ice anti-ice is level ones...and-		
1825:56 HOT-1	level ones.		
1825:57 HOT-2	ya want me to wait on the high-flow, or go?		
1825:58 HOT-1	eh go ahead and turn it off.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1825:59 HOT-2	ok.		
1826:00 HOT-2	hi-flow's....bleed is off.		
1826:02 HOT-2	lights?		
1826:03 HOT-1	on.		
1826:04 HOT-2	takeoff inhibit... is on.		
1826:06 CAM	[sound similar to increase in propeller/engine speed/noise]		
1826:07 HOT-1	before takeoff checklist complete.		
1826:07 HOT-2	before takeoff checklist complete.		
1826:08 HOT-1	there you go.		
1826:09 HOT-2	set power.		
1826:11 HOT-1	that's my call.		
1826:11 HOT-2	sorry.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1826:12 HOT-1	set power.		
1826:16 HOT-1	power's set, right?		
1826:17 HOT-2	power's set, yup.		
1826:17 HOT-1	your aircraft, seventy knots.		
1826:22 HOT-1	centerline, V1 rotate.		
1826:28 CAM	[sound of click]		
1826:28 HOT-2	positive rate, gear up.		
1826:29 HOT-1	in transit.		
1826:31 HOT-1	be careful of drifting like that's a bad habit.		
1826:32 HOT-2	yup.		
1826:37 INT	[sound similar to frequency change alert tone]		
1826:42 HOT-1	(yaw damps on).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1826:43 HOT-2	(yuh).		
1826:50 INT	[sound similar to frequency change alert tone]		
1826:51 HOT-1	acceleration altitude.		
1826:52 HOT-2	climb power, climb sequence.		
1826:55 HOT-2	flaps up, climb checks.		
1826:58 CAM	[sound similar to decrease in propeller/engine speed/noise]		
1827:04 HOT-2	and, high-bank.		
1827:05 HOT-1	you're goin to NAV, right?		
1827:07 HOT-2	yup.		
1827:07 HOT-1	let's do that.		
1827:19 HOT-?	*.		
1827:22 HOT-1	you know how to use the maneuver?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1827:25 HOT-2	ehhh. Its been a while.		
1827:26 CAM	[sound similar to pitch trim in motion whooler]		
1827:26 HOT-1	go ahead and turn the autopilot on.		
1827:28 HOT-2	autopilot on.		
1827:31 PA	[sound similar to chime that accompanies the "no smoking" sign - or "fasten seatbelt sign"]		
1827:32 HOT-1	climb checklist complete.		
1827:33 HOT-2	allright.		

INTRA-COCKPIT COMMUNICATION | **AIR-GROUND COMMUNICATION**

TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1827:35 PA-3	ladies and gentlemen all American Eagle flight are no smoking we appreciate your cooperation. it is now to safe to use portable electronic device, the passenger information section of the in-flight magazine, these devices may not be used on board the aircraft at anytime. as a reminder also cell phones and two-way pagers may only be used on the ground when the aircraft is park and must always be turned off in flight. for your safety please remain seated until the fasten seatbelt sign has been turned off. we strongly recommend unless you (may) have to leave your seat, to keep your seatbelt securely fastened at all times. * * fasten seatbelt sign is illuminated. please take care * you open overhead bins as items may have shifted during takeoff, and could possibly fall out. we extend a very special welcome to our One World Alliance and Advantage customers. in the seat pocket in front of you you will find complimentary copy like American Way or Latitudes. feel free to take this publication with you at the ends. as a reminder ladies and gentlemen this is a non-service flight, but if there is something that we can make your flight more comfortable, don't hesitate to ask us. once and again, thank you for choosing American Eagle.		
1827:37 HOT-1	ok check the uh... (press) heading.		
1827:39 HOT-1	I put you in NAV already, so.		
1827:41 HOT-2	oh, ok.		

INTRA-COCKPIT COMMUNICATION		**AIR-GROUND COMMUNICATION**	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1827:41 HOT-1	yeah, you should pass the course, now you gotta turn back right, to zero nine five.... put zero nine five... that's gonna intercept the course... enter... enter... and, there you go.		
1827:55 HOT-2	that's good.		
1827:55 HOT-1	no, that's not intercept... (for some reason). try a little more, about one zero zero.		
1828:04 HOT-1	there you go, enter... enter... what the #... should intercept on that heading... ummmmm. that's weird.... heading one, one zero five... enter.		
1828:26 HOT-1	two point seven to the right.... * its showin it to the left...allright, lets try the other way.....try heading uh... zero eight five.		
		1828:37 RDO-1	San Juan Center, Eagle flight...four zero one.
1828:41 HOT-1	enter.		
1828:47 HOT-1	there you go.		
		1828:48 CTR	Eagle flight four zero one, is radar contact about five east northeast of Mayaguez.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1828:53 PA-3	[announcement in Spanish - duration 87 seconds]		
		1828:54 RDO-1	that checks. Eagle four zero one out of four for seven.
1828:58 HOT-1	ok now, enter.		
		1828:59 CTR	Eagle flight four zero one confirm you were assigned seven thousand? I'm showing five.
		1829:02 RDO-1	ok five thousand, Eagle flight four zero one that's what we had in our flight plan.
		1829:06 CTR	you wanna go up to seven that's fine, climb and maintain seven thousand for Eagle four zero one.
		1829:09 RDO-1	yeah that works better for us.
		1829:12 CTR	four zero one say again?
		1829:13 RDO-1	that works better for us at seven.
		1829:16 CTR	allright climb and maintain seven thousand for Eagle flight four zero one.
		1829:18 RDO-1	ok seven thousand Eagle four zero one.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1829:20 HOT-1	ok.		
1829:20 HOT-2	I got seven thousand in there.		
1829:22 HOT-1	what the # this doesn't * ... oh # it just fly it manually... sometimes the computer, it showin you right of course, so... try a bigger intercept. lets try a heading zero seven zero.		
1829:35 HOT-1	I'm off one for a sec.		
		1829:37 RDO-1	Mayaguez, four oh one.
1829:41 HOT-1	allright, enter.		
		1829:42 OPS1	* * *.
		1829:43 RDO-1	yeah, times are one five two six.
		1829:47 OPS1	ok one five and two six. Have a nice flight * * happy connection.
		1829:50 RDO-1	ok seeya.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1829:53 HOT-1	I don't have a # clue what's what's doin (that), * that's weird. it should intercept on that heading.		
1830:00 HOT-1	we're (four) point eight miles to the right... four point nine... * the #.		
1830:08 HOT-1	see its showin you right on course.		
1830:10 CAM	[sound similar to altitude alerter]		
1830:13 HOT-1	beats the # outta me.		
1830:21 HOT-1	you know what, I think this thing is... do this... direct.... to Dorado... three, enter... now go NAV... there you go. I don't know, its some- something got messed up on the ground there for some reason.		
1830:42 HOT-1	you see what it was showin you, it was showing you to the right, and its like goin in the course.		
1830:43 HOT-2	yeah it is.		
1830:47 HOT-1	hundred feet.		
1830:47 HOT-2	hundred to go.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1830:48 PA	[sound similar to chime that accompanies the "no smoking" sign - or "fasten seatbelt sign" being cycled]		
1830:57 HOT-1	the seventy two, it stays in the notch.		
1830:58 HOT-2	oh that's right, sorry.		
1830:59 HOT-1	yeah.		
1830:59 HOT-1	you're familiar with the notch, right.		
1831:01 HOT-2	yeah, no yeah, I'm just-		
1831:02 HOT-1	yeah.		
1831:02 HOT-2	used to having- my last Captain....		
1831:06 HOT-1	what? he want you to have-		
1831:08 HOT-2	nuh. whu- he's like - I'm more used to it when we were hand flying it, I was having you know like kinda doin a lot of this with the * with the power, when I was when I was flying on final and approaches, so I just naturally just had my hand here, cause (when) we're comin back in and we're getting ready to s- slow down so I just had, I always just had it resting here... just so... to remind me. its its fine.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1831:28 HOT-1	ok... works for you.		
1831:37 HOT-1	that's what they're teaching you at the academy, I guess.		
1831:43 HOT-2	aand... prolly*... well... I guess we're still acceleratin.		
1831:52 HOT-1	this plane, the seventy two, if you're below about seven - you need trim by the way - * *... below seven, you probably go above... you may have to pull the power back a little bit.		
1832:03 HOT-2	ok.		
1832:04 HOT-1	cause it goes above uhhh.... not yet, till you get (some).		
		1832:07 CTR	Clipper one and Eagle flight four zero one San Juan altimeter three zero zero one.
		1832:11 RDO-1	uh zero zero one, Eagle three zero...
		1832:13 RDO-1	four zero one.
		1832:15 CTR	Eagle flight four zero one uh, turn twenty degrees to the left for sequencing, and should take you around some weather.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1832:21 RDO-1	ok twenty left, Eagle four zero one.
1832:30 HOT-1	zero five five.		
1832:41 HOT-2	now we can probably run the cruise checklist.		
1832:44 HOT-1	ok.		
1832:45 HOT-1	(altimeter's) three zero zero one, set cross check, cruise power.		
1832:49 HOT-2	seventy seven, err you want eighty... six?		
1832:51 HOT-1	whatever you want, you're pilot flying.		
1832:53 HOT-2	oh... kay.		
1832:55 HOT-1	check.		
1832:56 HOT-2	bring er back to seventy seven.		
1832:57 HOT-1	allright.		
1832:58 HOT-2	why you gotta make a connecting flight?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1833:00 HOT-1	uh. no I got plenty of time.		
1833:02 HOT-2	ok.		
1833:11 HOT-1	most people put it at seventy seven, we're not in icing conditions, so.		
1833:15 HOT-2	allright.		
1833:24 HOT-1	but I do always land at eighty six, though.		
1833:28 HOT-2	what?		
1833:28 HOT-1	the condition levers... eighty six... on the Np. for landing.		
1833:35 HOT-2	oh, right right right.		
1833:36 HOT-1	yeah. some people want it (one) hundred, I see no reason to do that.		
1833:40 HOT-2	oh yeah we were *-		
1833:40 HOT-1	its another change in the book they made.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1833:44 HOT-1	used to be pilot-pilot's flying discretion, now its Captains's discretion.		
		1833:51 CTR	Eagle flight four zero one, San Juan approach on one uh, correction right turn direct Dorado when you're around the weather and uh San Juan approach on one one niner point four.
		1833:58 RDO-1	right direct Dorado and nineteen four, Eagle four oh one.
1834:05 HOT-1	(its in there).		
1834:06 HOT-2	I was makin sure.		
1834:07 HOT-1	yeah that's it.		
1834:16 INT	[sound similar to frequency change alert tone]		
		1834:21 RDO-1	(San Juan) approach Eagle four zero one seven thousand direct Dorado.
		1834:24 APP	Eagle flight four zero one San Juan Approach expect the ILS runway one zero, descend and maintain six thousand.
		1834:29 RDO-1	seven for six, Eagle four zero one.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1834:31 APP	Eagle (flight) four zero one you said that you have Juliet?
		1834:33 RDO-1	affirm.
		1834:34 APP	four zero one *.
1834:36 HOT-2	so I normally... you're supposed to do this, but I started doing it.		
1834:41 HOT-1	six... well what they teach you in the academy and what people do on the line is-		
1834:44 CAM	[sound similar to altitude alerter]		
1834:46 HOT-2	often times different, I uh-		
1834:47 HOT-1	yeah.		
1834:48 HOT-2	-realize that .		
1834:49 HOT-1	yeah.		
1834:50 HOT-1	and one other thing you gotta do... is keep your heading bug.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1834:56 HOT-1	*.		
1834:59 PA	[sound similar to chime that accompanies the "no smoking" or "fasten Seatbelt" sign being cycled, followed by a single chime(same tone).]		
		1835:05 APP	Eagle flight four zero one descend and maintain five thousand.
1835:07 INT	[sound similar to Morse code navaid identifier]		
		1835:08 RDO-1	down to five thousand, four zero one.
1835:10 INT-3	yeah?		
1835:11 INT-1	hey, we're in range.		
1835:12 INT-3	uhhh, I don't need anything.		
1835:14 INT-1	ok.		
1835:14 INT-3	ok bye bye.		
1835:18 HOT-1	(five).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1835:19 HOT-2	(five).		
1835:20 HOT-1	I'm off of one.		
		1835:20 APP	Eagle flight four zero one turn left heading zero eight zero, vector for the sequence.
		1835:24.0 RDO-1	heading zero eight zero, four zero one.
		1835:28.5 RDO-1	operations, four zero one.
1835:36 CAM	[sound similar to altitude alerter]		
		1835:38.4 RDO-1	San Juan Eagle, four zero one.
1835:42 HOT-2	thousand to go.		
1835:50 HOT-1	lights on, cabin sign's on, CAP recall, pressurization's checked, seatbelt (shoulder harness) on.		
1835:55 HOT-1	descent checklist.		
1835:55 CAM	[sound similar to flight attendant call tone]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1835:55 HOT-1	hey what's up?		
1835:59 HOT-1	hello?		
		1836:04.2 RDO-1	San Juan Eagle four zero one, third call.
		1836:09 OPS2	(four zero one).
		1836:10.2 RDO-1	in range, alpha 1.
		1836:13 OPS2	copy, gate one.
		1836:13.7 RDO-1	roger.
1836:17 HOT-1	you know what I was gonna do, I brought my cell phone with my charger and I didn't bring it.		
1836:21 HOT-1	(think I) *.		
1836:28 HOT-1	yah you know you can charge your cell phone on this, right?... right behind you?		
1836:31 INT	[sound similar to Morse code navaid identifier]		

INTRA-COCKPIT COMMUNICATION		**AIR-GROUND COMMUNICATION**	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1836:32 HOT-2	I didn't know that.		
1836:33 HOT-1	plug in.		
1836:36 HOT-1	one of those things that's not in-		
1836:37 HOT-2	other way.		
1836:37 HOT-1	-the book... yeah.		
1836:38 HOT-2	there you go.		
1836:40 HOT-1	comes in handy in a pinch... those long flights.		
1836:49 HOT-1	or... what I've seen some people do, they bring uh... a DVD player with a movie.		
1836:55 HOT-2	ohh *.		
1836:56 HOT-1	* right in the middle.		
1836:59 HOT-1	you got your power outlet.		
1837:01 INT	[sound similar to Morse code from navaid identifier – ch.4]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1837:05 HOT-2	(allright so they're sayin we could prolly run err uh)... we got the ATIS, I believe, you said?		
1837:10 HOT-2	Juliet?		
1837:10 HOT-1	uhh yeah you wanna pull it up there?		
1837:16 HOT-1	preflight?... I can do that.		
1837:27 HOT-1	landing speeds.		
1837:30 HOT-1	thirty seven. ninety five, one oh seven, twenty one, twenty eight.		
1837:34 HOT-1	standby on the winds.		
1837:36 HOT-2	ninety five internal?		
1837:37 HOT-1	yeah.		
1837:42 HOT-1	AOA speeds reviewed and checked.		
1837:44 HOT-1	flight instrument (and radios) set checked.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1837:45 HOT-2	set checked.		
1837:45 HOT-1	approach briefing.		
1837:46 HOT-2	uhhh, we're doin the ILS ten.		
1837:48 HOT-1	yup.		
		1837:51 APP	Eagle flight four zero one descend and maintain four thousand.
		1837:53.1 RDO-1	four thousand, (Eagle) four zero one.
1837:55 HOT-1	(you'll) probably circle to eight.		
1837:56 HOT-2	ok.		
1837:57 HOT-1	probably be (a) lagoon.		
1838:01 HOT-1	complete, landing PA's comin up.		
1838:03 CAM	[sound similar to altitude alerter]		
1838:06 PA-1	flight attendants please prepare the cabin for landing.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1838:08 HOT-1	approach checklist complete.		
1838:09 HOT-2	allright.		
1838:15 PA-3	ladies and gentlemen as we prepare for landing return your seatback to the upright position... stow your tray tables and secure your seatbelt... please turn out all electronic devices and... carry on items should be placed under the seat in front of you... or in the overhead bins. we'll be landing soon. [followed by Spanish PA announcement, duration 22 seconds]		
1838:20 HOT-2	one oh nine seven's the inbound... one oh one's across CONDO.		
		1838:24 APP	Eagle flight four zero one, turn right heading one zero zero.
		1838:26.4 RDO-1	right turn one zero zero, Eagle four zero one.
1838:42 HOT-1	ahh this is nice, he's bringin us around all that crud... I came in this morning and just got hammered, * * (bam), all the way from Mayaguez, like-		
1838:52 HOT-2	oh really?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1839:31 HOT-1	briefing is complete.		
1839:35 HOT-1	check your trim... rudder trim.		
		1839:40 APP	Eagle flight four zero one turn * right heading one five zero
		1839:42.3 RDO-1	right turn one five zero, Eagle flight four zero one.
1839:48 HOT-1	you have to trim this plane all the time.		
1839:53 HOT-1	don't (go) crazy on it.		
1839:57 HOT-1	small (changes), see you went too far.		
1839:59 HOT-1	small changes.		
1840:00 HOT-2	yeah but * (its still) one thousand one, one thousand two in my head.		
1840:03 HOT-1	yeah just (go) like two (or) three knots...'n see what happens.		
1840:06 HOT-2	I'll wait till we're straight and level here.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1840:08 HOT-1	yeah, there you go.		
		1840:09 APP	Eagle flight four zero one descend and maintain three thousand.
		1840:10.9 RDO-1	three thousand Eagle flight four zero one.
1840:13 HOT-1	* * * .		
1840:15 HOT-1	before I land I always put it back in the center that way I don't have all this out of trim when I'm landing.		
1840:22 CAM	[sound similar to altitude alerter]		
1840:30 CAM	[sound of clicks]		
1840:45 HOT-2	allright (sorry/so I) * ... again we... brief whatever approach they gave us, and then expect the visual?... so... so you're sayin-		
1840:53 HOT-1	ninety nine percent of the time approaches you do in San Juan are visual approaches-		
1840:57 HOT-2	ok so you-		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1840:57 HOT-1	they give you an ILS-		
		1841:00 APP	Eagle flight four zero one, reduce speed to two one zero.
		1841:01.4 RDO-1	two one zero, Eagle four zero one.
1841:06 HOT-1	they givin you an ILS to get you inbound, an then they prolly gonna ask you, 'you got the airport runway eight in sight?', 'roger', 'clear lagoon visual eight', you're gonna circle to eight.		
1841:15 HOT-1	that's the most common approach they do here.		
1841:17 HOT-2	ok.		
1841:20 HOT-1	the only time you do approaches here, to minimums, is when its raining.		
		1841:24 APP	Eagle flight four zero one, traffic, ten o'clock and two miles, moving to the east. (Cessna) one seventy two at one thousand five hundred.
		1841:31.5 RDO-1	Eagle four zero one we have him on TCAS. [traffic collision avoidance system]
1841:52 HOT-1	the autopilot's on.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
		1841:53 APP	Eagle flight four zero one turn uh left one three zero intercept runway one zero localizer, reduce speed to one eight zero.
		1841:58.5 RDO-1	one eight zero and uh one three zero intercept the one zero localizer, Eagle flight four zero one.
1842:11 HOT-1	most people, what they do... if the autopilot's on.		
1842:13 HOT-2	uh huh.		
1842:14 HOT-1	set your power, take your hands, put 'em back on your lap.		
1842:17 HOT-2	ok.		
		1842:23 APP	Eagle flight four zero one, one one mile from CONDO present heading, maintain uh two thousand till established on the localizer, clear ILS runway one zero approach, one eight zero knots until CONDO.
		1842:32.7 RDO-1	two thousand one eight zero to CONDO Eagle flight four zero one, cleared ILS one zero approach.
1842:39 HOT-2	allright.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1842:40 HOT-2	cross check no flags, so heading bug runway heading.		
1842:43 HOT-1	well get the altitude in there first * *.		
1842:44 HOT-2	ok.		
1842:46 HOT-1	two thousand set.		
1842:46 HOT-2	two thousand.		
1842:48 CAM	[sound similar to altitude alerter]		
1842:50 HOT-1	the autopilot's on, right?		
1842:52 CAM	[sound similar to altitude alerter]		
1842:51 HOT-2	yup.		
1842:52 HOT-1	so you do that.		
1842:54 HOT-2	oh ok, they- they were having the non flying pilot do it then we set it.		
1842:58 HOT-1	allright.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1842:58 HOT-2	ok, that's fine.		
1843:00 HOT-1	the only thing the non flying pilot does, that I've always seen is-		
		1843:03 APP	Eagle flight four zero one, you're four miles behind a Boeing seven twenty seven, caution wake turbulence.
		1843:07.3 RDO-1	uh Eagle flight four zero one.
1843:09 HOT-1	slow your s-...		
1843:10 HOT-2	ok.		
1843:12 HOT-1	get your speed back.		
1843:14 HOT-1	you do not want to take wake turbulence from a seven five.		
1843:16 HOT-2	yeah.		
1843:19 HOT-1	you're going crazy with the power setting * jus-jus-		
1843:21 HOT-2	(sorry).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1843:23 HOT-1	-go flaps fifteen.		
1843:24 HOT-2	flaps fifteen.		
1843:25 HOT-1	now put it about thirty.		
1843:29 HOT-1	now leave it there.		
1843:30 CAM	[sound similar to pitch trim in motion whooler]		
1843:31 HOT-1	see what it does.		
1843:36 HOT-2	(runway) bug * .		
1843:37 HOT-1	(there you go).		
		1843:44 APP	Eagle flight four zero one reduce speed to one six zero, tower one three two point zero five. good day.
		1843:47.8 RDO-1	good day, four zero one.
1843:50 INT	[sound similar to frequency change alert tone]		
1843:51 INT	[sound similar to frequency change alert tone]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1843:53 HOT-1	gear down, right?		
1843:54 HOT-2	yeeaah.		
1843:55 CAM	[sound of click]		
1843:56 HOT-2	ok.		
1843:57 CAM	[sound similar to landing gear operation]		
1843:59 HOT-1	that was a little * *.		
1844:01 INT	[sound similar to frequency change alert tone]		
1844:08 CAM	[sound similar to pitch trim in motion whooler]		
1844:11 HOT-1	bulb's burned out.		
1844:13 HOT-2	three green.		
1844:14 HOT-1	allright.		
1844:15 HOT-2	*.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1844:18 CAM	[sound similar to altitude alerter]		
1844:24 HOT-1	get slowed down I don't wanna get too close (to this thing).		
1844:26 HOT-2	they said one sixty though I thought.		
1844:27 HOT-1	yeah, slow it down even more though, because you're already-		
1844:33 HOT-1	you ever been rolled by a seven five seven?		
1844:35 HOT-2	no, no I yeah no I agree I'm-		
1844:37 HOT-1	yeah.		
1844:37 CAM	[sound similar to pitch trim in motion whooler]		
1844:38 HOT-2	you're gonna do a flaps thirty then?		
1844:39 CAM	[sound of click similar to flap handle operation]		
1844:40 HOT-1	there you go.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1844:41 HOT-1	I've had the # thing roll it like fifty five degrees in an ATR.		
1844:45 HOT-?	*.		
1844:45 HOT-1	scares the # out of the passengers.		
1844:47 HOT-2	oh I'm sure it does.		
1844:48 HOT-1	yeah.		
1844:49 HOT-1	allright just go about one forty.		
1844:50 HOT-2	ok.		
1844:57 HOT-1	* (the) condition levers (going) eighty six.		
1845:00 HOT-2	and before landing checklist.		
1845:02 HOT-1	allrighengstsel kinyusrelay [Before landing checklist starts with 'Engine Start Selector, continuous re-light']* landing gear is-		
1845:04 HOT-2	three green.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1845:05 HOT-1	three green.		
1845:05 HOT-1	flaps set thirty degrees.		
1845:07 HOT-2	thirty.		
1845:08 HOT-1	there you go.		
1845:09 HOT-1	power management to... takeoff, condition levers are... * crazy cause now its gonna go a hundred percent. (keep your) there you go.		
1845:16 HOT-1	see that ARM light?		
1845:16 HOT-2	yeah.		
1845:17 HOT-1	you go, you know what happens when you come back too fast? * its gonna go to a hundred percent Np.		
1845:23 HOT-2	ok.		
1845:25 HOT-2	oh, I see EEC's [electronic engine control] kickin in.		
1845:28 HOT-1	yuh... see that seven five?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1845:31 HOT-2	uhhh... lookin.		
1845:34 HOT-1	you're ok now.		
1845:35 HOT-2	allright.		
1845:37 HOT-1	keep it up about one forty, now.		
1845:39 HOT-1	uhh... and before landing checklist complete.		
1845:42 HOT-2	allright.		
1845:44 HOT-1	I'm gonna put you in climb just for now so it doesn't do that.		
1846:04 HOT-2	aaay, set the altimeter or the altitude to uh missed approach altitude two thousand.		
1846:08 HOT-1	set.		
1846:08 HOT-2	thanks.		
		1846:12 CLI	San Juan Clipper one advise uh, out of seven hundred feet, loss of ten knots.

INTRA-COCKPIT COMMUNICATION TIME and SOURCE	CONTENT	AIR-GROUND COMMUNICATION TIME and SOURCE	CONTENT
		1846:16 TWR	Clipper one, thank you.
		1846:17.6 RDO-1	San Juan tower Eagle four zero one ILS runway one zero, with eight in sight.
		1846:24 TWR	Eagle flight four zero one San Juan tower, cleared to land runway one zero, one departure prior to your arrival, then uh seven twenty seven, mile final just reported loss of ten mu- uh ten knots on final.
		1846:32.4 RDO-1	kay, one zero and eight is not available?
		1846:35 TWR	Eagle flight four zero one uh, confirm you have eight in sight?
		1846:37.9 RDO-1	(affirm).
		1846:39 TWR	Eagle flight four zero one uh, change runways, cleared lagoon visual runway eight approach, runway eight cleared to land.
		1846:43.8 RDO-1	cleared to land runway eight, Eagle flight four zero one.
1846:45 CAM	[sound similar to altitude alerter]		
1846:47 HOT-1	you got cleared to land, eight.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1846:48 HOT-2	allright cleared to land eight... and runway in sight, good.		
1846:55 HOT-2	you still want me to keep it up * slow down to one twenty?		
1846:57 HOT-1	nah... just do whatever you need. just ya ya got traffic on a five mile final behind you anyway * you get too slow because it screws their sequence up.		
1847:03 HOT-2	ok.		
1847:04 HOT-1	cause I'se I slowed you up more than he wanted, so.		
1847:10 HOT-1	(cause) you were you were about four miles behind 'em and there's not very much wind.		
1847:14 HOT-2	ok.		
1847:14 HOT-1	and below his glideslope, which is a bad combination.		
1847:17 HOT-2	I am now.		
1847:18 HOT-1	you're ok now.		
1847:19 HOT-2	ok.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1847:19 HOT-1	yeah... no, cause you're on the glideslope now.		
1847:21 HOT-2	right.		
1847:22 HOT-1	but you were below the glideslope before.		
1847:23 HOT-2	I gotcha.		
1847:26 HOT-1	winds light, you're below the glideslope-		
1847:28 HOT-2	oh yeah.. (that's)		
1847:29 HOT-1	itsa itsa bad-		
1847:30 HOT-2	bad.		
1847:30 HOT-1	-combination.		
1847:35 HOT-1	just fly a normal approach now * eight.		
1847:52 HOT-1	so (I always) do before I land, I always center these, that help's me out when I'm in ground.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1847:57 HOT-2	ok.		
1847:57 HOT-1	you don't have all this control force.		
1848:01 HOT-1	that's just ah * somethin I do, its not somethin you have to do.		
1848:03 HOT-2	ok.		
1848:04 HOT-1	just makes it easier for me.		
1848:06 HOT-1	thousand feet.		
1848:06 HOT-2	allright.		
1848:08 HOT-2	I'll wait till five hundred and I'll bring the autopilot off and ADU [advisory display unit] standby.		
1848:17 HOT-2	little fast, correcting.		
1848:18 HOT-2	if I talk to-		
1848:19 HOT-1	allright, you're fine.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1848:19 HOT-2	-myself. If I talk to myself, its just so I... know what I'm doing.		
1848:24 HOT-1	ok (that) works for yuh.		
1848:27 CAM	[sound of brief interruption in recording]		
1848:33 HOT-1	actually its better you keep the speed up on this long runway, and you got traffic behind ya doin about a hundred and fifty knots.		
1848:40 HOT-2	ok.		
1848:43 HOT-2	allright autopilot's coming off.		
1848:44 CAM	[sound similar to autopilot disconnect alert]		
1848:45 HOT-2	ADU to standby.		
1848:49 HOT-2	and you probably turn yaw damp off.		
1848:52 HOT-1	you want it off, you said?		
1848:53 HOT-2	yeah... its (ok).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	CONTENT	TIME and SOURCE	CONTENT
1848:57 HOT-2	allright, red over white, lookin ok.		
1849:00 HOT-2	I'm just gonna kinda square it off here.		
1849:02 HOT-2	winds were... what?		
1849:04 HOT-1	out of the east.		
1849:04 HOT-2	ok.		
1849:07 HOT-2	*.		
1849:07 HOT-1	but you better keep that nose down or get some power up because you're gonna balloon like #.		
1849:14 HOT-2	yeah help me *.		
1849:15 HOT-2	*.		
1849:15 HOT-1	bring the power back to seventeen.		
1849:17 EGPWS	minimums minimums.		
1849:17 HOT-1	get your nose up.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1849:19 EGPWS	glideslope.		
1849:19 HOT-1	below the glideslope.		
1849:20 HOT-2	correcting.		
1849:21 HOT-1	right there.		
1849:21 HOT-?	*.		
1849:22 HOT-1	power.		
1849:22 HOT-1	your're gonna balloon.		
1849:28 HOT-1	* power in a little bit.		
1849:32 HOT-1	* your power in a little bit.		
1849:33 HOT-1	don't pull the nose up, don't pull the nose up.		
		1849:34 TWR	American eight sixty three traffic on final landing runway one zero, runway eight, position and hold.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1849:45 CAM	[sound of thump on ch.1, ch.4. and CAM]		
1849:46 HOT-?	God. [said in a whisper]		
1849:46.2 CAM	[sound of brief squeak or beep]		
1849:47.2 CAM	[sound of click]		
1849:49 HOT-1	# # *.		
1849:51 HOT-?	[sound similar to breath]		
1849:51 HOT-?	[sound similar to grunt]		
1849:51.4 CAM	[sound of very loud bang]		
1849:52.5 CAM	[sound of single chime similar to master caution / master warning]		
1849:53.6 CAM	[sound of continuous repetitive chime similar to master warning starts]		
1849:56 CAM-1	awe #.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1849:56 CAM	[sound of loud crunch]		
1849:58 PA	[sound similar to chime that accompanies the "no smoking" sign - or "fasten seatbelt sign"]		
1850:00.3 PA	[sound of unidentifed tone]		
1850:00 CAM-1	#.		
1850:20 CAM-?	#.		
1850:35 CAM-2	should I pull the fire (handles)?		
1850:36 CAM-?	*.		
1850:38 CAM	[sound similar to decrease in engine/propeller speed or noise]		
1850:40 CAM-?	*.		
1850:44 CAM-1	emergency checklist.		
1850:48 CAM-1	#.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1850:59 CAM-1	go ahead and run the uh, checklist *.		
1851:06 CAM-2	allright *.		
1851:09 CAM-2	I don't even know where to start.		
1851:11 CAM-1	evacuate.		
1851:12 CAM-1	awe #. * *.		
1851:16 CAM-1	go ahead and... run the fire checklist.		
1851:19 CAM-2	allright fire checklist, circuit breakers.		
1851:25 CAM-2	you allright?		
1851:26 CAM-1	yeah.		
1851:29 CAM-1	#.		
1851:32 CAM-1	emergency checklist for a fire please.		
1851:34 CAM-2	emergency checklist, fire.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1851:37 CAM-2	fire on the ground, power levers both. ground idle/reverse.		
1851:40 CAM-2	(aircraft stopped) feathered fuel shutoff.		
1851:44 CAM-2	engine fire * * discharge.		
1851:50 CAM-1	awe # #.		
1851:53 CAM-2	* cabin PA.		
1852:00 CAM-1	cancel the warning.		
1852:05 CAM	[sound of continious repetive chime similar to master warning ends]		
1852:09 CAM-1	awe #.		
1852:12 CAM-1	go ahead and continue with the checklist please.		
1852:15 CAM-2	ok.		
1852:16 CAM-1	the uh.		
1852:16 CAM-2	(min) cabin light.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1852:18 CAM-2	ATC.		
1852:18 CAM	[sound similar to flight attendant call tone]		
1852:21 CAM	[sound similar to flight attendant call tone]		
1852:22 CAM	[sound similar to cockpit door operating]		
1852:23 CAM-1	we're ok.		
1852:24 CAM-4	you guys ok?		
1852:25 CAM-1	we're ok.		
1852:25 CAM-2	yeah.		
1852:26 CAM-4	ok.		
1852:27 CAM-1	can you get the door open?		
1852:28 CAM-1	pull the circuit breaker for the CVR please.		
1852:30 CAM	[sound similar to interruption in recording]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1852:32 CAM-2	ATC F/O notify.		
1852:34 CAM-2	what should I tell em just we're here?		
1852:36 CAM-1	yeah, evacuate.		
1852:37 CAM-1	awe # my back.		
1852:39 CAM	[sound similar to knocking]		
1852:40 CAM-1	we're ok.		
1852:40 CAM-?	*.		
1852:41 CAM-1	yeah, we need to evacuate.		
1852:42 CAM-?	*.... Captain-		
1852:42 CAM-1	yeah we're-		
1852:43 CAM-?	-ok yeah yeah I got it no problem.... take it easy, ok?		
1852:44 CAM-1	ok.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME and SOURCE	**CONTENT**	**TIME and SOURCE**	**CONTENT**
1852:45 CAM-?	(give me a few) *.		
1852:46 CAM-1	ok.		
1852:48 CAM	[sound similar to emergency vehicle siren(s)]		
1852:49 CAM-2	that's all static I don't think they're comin in.		
1852:51 CAM-1	oh God... ok.		
1852:54 CAM-1	cvr's pull-		
1852:54.5 CAM	[end of recording]		

ERRATA

THE CORRECTIONS BELOW SHOULD BE MADE TO THE PREVIOUSLY PUBLISHED REPORT IDENTIFIED AS FOLLOWS:

AIRCRAFT ACCIDENT REPORT

LOSS OF PITCH CONTROL ON TAKEOFF
EMERY WORLDWIDE AIRLINES, FLIGHT 17
MCDONNELL DOUGLAS DC-8-71F, N8079U
RANCHO CORDOVA, CALIFORNIA
FEBRUARY 16, 2000

NTSB/AAR-03/02 (PB2003-910402)

- Page 5, third paragraph, first line has been updated with the correct time. The time originally printed, as 1940:50 should have been 1949:50. (15 August 2005)

CORRECTED PAGES ARE ATTACHED, AND ARE INCLUDED IN THE ONLINE VERSION OF THE PUBLICATION