NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

September 5, 2002

Group Chairman's Factual Report

OPERATIONS

DCA02MA001

A. ACCIDENT

Operator:	American Airlines, Inc. (AA) flight 587
Location:	Belle Harbor, New York
Date:	November 12, 2001
Time:	0916 Eastern Standard Time[1]
Airplane:	Airbus Industries A300-600, N14053

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[1] All times are Eastern Standard Time based on a 24-hour clock, unless otherwise noted. Actual time of accident is approximate, determined by the Flight Data Recorder (FDR) and Air Traffic Control (ATC) transcripts.

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C. SUMMARY

On November 12, 2001, about 0916 Eastern Standard Time, American Airlines flight 587, an Airbus A300-600, was destroyed when it crashed into a residential area of Belle Harbor, New York, shortly after takeoff from the John F. Kennedy International Airport (JFK), Jamaica, New York. Two pilots, 7 flight attendants, 251 passengers, and 5 persons on the ground were fatally injured. Visual meteorological conditions prevailed and an instrument flight rules (IFR) flight plan had been filed for the flight destined for Santo Domingo, Dominican Republic. The scheduled passenger flight was conducted under 14 Code of Federal Regulations (CFR) Part 121.

D. DETAILS OF THE INVESTIGATION

The operations group convened at 1800 on November 13, 2001 in Jamaica, New York. On November 14, 2001, the operations group visited the accident site. Interviews were conducted with pilots who witnessed the departure of AA 587, and flight and cabin crewmembers that had flown in the accident airplane on days prior to the crash. Pilots who had flown with the accident flight crewmembers were also interviewed.

Airplane weight and balance, center of gravity, and takeoff information was reviewed and calculated for the accident flight.

The operations group concluded the initial field phase of the investigation at 1500 on November 18, 2001.

On January 15, 2002 at 0730, the operations group reconvened at the American Airlines Training Center in Fort Worth, Texas. Mr. Loo and Mr. Payeur, members of the operations group, were not in attendance. Captain Arondel represented Mr. Loo from the Bureau Enquetes-Accidents (BEA) during this phase of the field investigation. The purpose of the meeting was to conduct interviews with company management, training pilots, and check airmen associated with A300 operations and training. Also interviewed

were representatives from Boeing, Airbus Industries Inc. (Airbus), and the Federal Aviation Administration (FAA). The principal operations inspector and aircrew program manager, who provided FAA oversight of American Airlines and the A300 fleet, were also interviewed. The operations group visited the A300 simulator to become familiar with the cockpit layout, flight characteristics, programmed unusual attitudes, and recovery procedures. Operation and effectiveness of the simulator flight controls in the pitch, roll, and yaw axis were observed. The operations group concluded the follow-up field investigation at 1500 on January 18, 2002.

1.0 HISTORY OF FLIGHT

Flight 587 was the first leg of a roundtrip 1-day sequence from JFK airport to Santo Domingo, Dominican Republic (SDQ). According to American Airlines company records, the captain checked in for the flight about 0614, and the first officer checked in about 0630. The accident airplane, N14053, arrived the prior evening at 2231 as flight 988 that operated from San Jose, Costa Rica to JFK, with a enroute stop in Miami, Florida. According to the airplane logbook, no maintenance items were entered upon arrival at JFK.

Flight 587 was scheduled to depart for SDQ at 0800. According to the gate agent working the flight, she arrived at the departure gate 22 about 0645. The flight attendants had boarded the airplane prior to her arrival. She said the pilots arrived about 0700 and both seemed very pleasant as she greeted them. She asked the captain to let her know when he had finished briefing the flight attendants, and then she would begin the boarding process for the passengers.

At about 0710, the airplane fueler stated he arrived at the airplane and began fueling. He pumped 8,513 gallons of fuel on the airplane and while fueling, he observed a pilot performing an exterior inspection of the airplane. He handed the fuel distribution slip to the pilot and said he had no conversation with him. He said he saw nothing unusual around the airplane and concluded the fueling about 0745.

According to statements taken by the Port Authority of New York and New Jersey[2], between 0730 and 0800, an American Airlines maintenance crew chief received a radio call from the cockpit of flight 587 reporting that the number two pitch trim and yaw damper would not engage. He reported the problem to the avionics crew chief. The avionics crew chief sent two avionics technicians to gate 22 to investigate the problem. The technicians confirmed that the number two pitch trim and yaw damper system could not be engaged. An Auto Flight System (AFS) check was performed on the airplane and indicated a number two flight augmentation computer (FAC) fault. The circuit breaker was cycled for the system and another AFS check was performed. No fault was indicated and after an LAN (autoland) system check was performed, there was no fault detected

[2] See Attachment C, Port Authority Police Reports.

during that test. The problem was corrected. According to the technicians, they were in the cockpit of the airplane at gate 22 for five to seven minutes.

According to company records, the flight 587 departed the gate at 0838. The gate agent stated the delay was due to additional security procedures that delayed boarding.

About 0901, the flight crew advised the Air Traffic Control Tower (ATCT) ground controller that they were coming out of the tango alpha taxiway[3]. The controller replied by issuing taxi instructions to the flight crew for a runway 31L departure and requested them to hold short of taxiway JULIETT on taxiway BRAVO.

About 0909, the controller told flight 587 to follow a Japan Air Boeing 747 and to monitor the tower radio frequency.

About 0912, the ATCT local controller [tower] cautioned the flight crew about wake turbulence and instructed them to taxi into position and hold on runway 31L. The flight crew acknowledged the transmission.

About 0914, the controller cleared flight 587 for takeoff. About one minute later, the controller transmitted to the flight crew to turn left, fly the bridge departure,[4] and contact the New York departure controller. The flight crew acknowledged the transmission.

After flight 587 departed, American flight 686 was cleared for take off and departed on runway 31L. The captain of that flight stated he saw flight 587 depart in front of him, and the last time he saw the accident airplane was about 200 feet climbing after departure. He stated the winds were less than 10 knots at the time of his departure.

Flight 587 contacted the Air Route Traffic Control Center (ARTCC) controller about 0915, and stated they were climbing out of 1,300 feet for 5,000 feet. The controller responded by clearing the flight to climb to 13,000 feet, turn left, and proceed direct to WAVEY.[5]

About 0916, the flight crew responded, "We'll turn direct WAVEY, American 587 Heavy." This was the last transmission received by the departure controller from flight 587.

There were several pilot eyewitnesses to the loss of control of flight 587. The pilots of Jet Blue flight 41 were holding short of runway 31L for departure, and noticed flight 587 entered an excessive left bank followed by a near vertical descent with the

[3] See Attachment E, Airport Diagrams.
[4] See Attachment F, Jeppesen Sanderson departure plate for the KENNEDY NINE DEPARTURE, Runways 31L/R Bridge Climb.
[5] WAVEY is a navigation intersection about 30 miles southeast of the JFK airport and depicted on the KENNEDY NINE DEPARTURE plate.

nose below the tail.[6] Some of the pilot eyewitnesses stated the airplane appeared to roll back and forth along the longitudinal axis while in the vertical descent. Several eyewitnesses stated seeing fire and trailing smoke near the fuselage coming from one of the wings. The pilots of Jet Blue flight 79 stated they saw some trailing debris falling from the airplane. The first officer of that flight stated that the falling debris appeared to be an aerodynamic surface. The captain stated the airplane was in a very nose down attitude just before impact. After impact, a large fireball and black smoke was observed.

2.0 PERSONNEL INFORMATION

Both flight crewmembers were certificated under American Airlines and Federal Aviation Administration certification requirements.

A review of FAA records disclosed there were no accident, incident, or enforcement records for either the captain or first officer airman certificate numbers.

A review of the National Driver Registry disclosed no suspensions or revocations of the driver's license of either pilot.

A review of American Airlines records indicated that Captain States and First Officer Molin had flown a total of 36 flight segments together before the accident.

2.1 Captain Edward Anthony States

Date of birth: August 22, 1959.
Date of hire with American Airlines: July 5, 1985

Airline Transport Pilot Certificate (issued 11-13-84)
Airplane Multiengine Land
Commercial Privileges; Airplane Single Engine Land
Type Ratings: B-727, A-310[7]

Flight Engineer Certificate (issued 08-20-85)
Turbojet Powered

Commercial Pilot (issued 12-09-80)
Multi-engine Airplane

[6] See Attachment C, Port Authority Police Reports and Attachment A, Interview Summaries of fight crewmembers from Jet Blue flights 41 and 79.
[7] Advisory Circular AC 61-89E *Pilot Certificates: Aircraft Type Ratings* provides pilot certificate designations adopted by the FAA for aircraft type ratings and standardizes aircraft designations placed on certificates to show type rating qualifications. The A-300-600R and A-310 are currently designated as A-310 on the pilot's certificate.

Certified Flight Instructor Certificate
Airplane Single Engine (issued 07-31-80)
Instrument Airplane (issued 03-16-81)

Commercial Pilot (issued 02-07-80)
Airplane Single Engine Land
Instrument

Private Pilot (issued 07-10-78)
Airplane Single Engine Land

Medical: First Class (issued 06-05-01)
Limitations: None

Flight Times[8]:	
Total flying time:	8,050.0 hours
Total Pilot-in-Command (PIC) A-300:	1,723.3 hours
Total American Airlines PIC time:	3,448.0 hours
Total flying time last 24 hours:	0.7 hours[9]
Total flying time last 30 days:	52.0 hours
Total flying time last 90 days:	146.11 hours
Total flying time last year:	584.21 hours

Initial type rating (A-310) issued:	September 5, 1988[10]
Additional type rating (B-727) issued:	December 30, 1991
Completed initial operating experience (A-300):	August 19, 1998
Last recurrent ground training:	June 22, 2001
Last recurrent checkride (Single visit training):	June 21, 2001
Last PIC line check (international):	July 31, 2001
Attended AAMP[11] Ground School:	May 23, 1997

A review of the American Airlines employment application of Captain States indicated he joined the United States Air Force (USAF) Reserve in June 1982. His flight experience included T-37, T-38, and C-141 airplanes while on active duty. He had

[8] Flight times include only American Airlines times as a captain and first officer. The company did not retain flight engineer times.
[9] Calculated time for the accident flight.
[10] The type rating was issued while Captain States was flying as a first officer. According to FAR 121.543, *Flight Crewmembers at Controls*, (b), (3), (i), states in part: "In the case of the assigned pilot in command during the enroute cruise portion of the flight, by a pilot who holds an airline transport pilot certificate and an appropriate type rating, is currently qualified as pilot in command or second in command, and is qualified as pilot in command of that aircraft during the enroute cruise portion of the flight. A second in command to act as a pilot in command enroute need not have completed the following requirements: The 6-month recurrent flight training…the operating experience…the takeoffs and landings required…the line check required…and the 6-month proficiency check or simulator training."
[11] Advanced Aircraft Maneuvering Program was taught by Captain Warren VanderBurgh.

accumulated 1,922 hours of total time in general aviation and the military, prior to being hired by American Airlines. According to the USAF records, Captain States received an honorable discharge from the USAF Reserve in 1992. The operations group was unable to locate any records pertaining to the captain's military flight time.

2.2 First Officer Sten Phel Molin

Date of birth: March 28, 1967
Date of hire with American Airlines: March 15, 1991

Airline Transport Pilot Certificate (issued 03-29-90)
Airplane Multiengine Land
Commercial Privileges; Airplane Single Engine Land
Type Rating: A-310
Limitations: A-310 CIRC. APCH. VMC ONLY[12]

Flight Engineer Certificate (issued 04-22-90)
Turbojet Powered

Certified Flight Instructor Certificate
Airplane Single Engine (issued 11-06-87)
Instrument Airplane (issued 11-19-87)
Airplane Multi-engine (issued 01-05-88)

Commercial Pilot (issued 11-12-87)
Airplane Single and Multi-engine Airplane
Instrument Airplane

Commercial Pilot (issued 10-25-87)
Airplane Single Engine Land
Instrument Airplane

Private Pilot (issued 09-19-87)
Airplane Single Engine Land
Instrument Airplane

Private Pilot (issued 06-11-87)
Airplane Single Engine Land

Medical: First Class (issued 10-18-01)

[12] Pilots employed by an air carrier certificate holder, operating under Part 121, whose manual prohibits a circling approach when the weather is below 1,000 feet and 3 miles' visibility are not required to be checked on the circling approach and landing from a circling approach. Airline transport pilot and aircraft type rating certificates issued without training and checking in the circling maneuver will be annotated "CIRC. APCH. VMC ONLY."

Limitations: Holder shall wear correcting lenses while exercising the privileges of his/her airman certificate.

Flight Times[13]:	
Total flying time:	4,403.0 hours
Total Second-in-Command (SIC) flying time:	4,403.0 hours
Total A-300 SIC time:	1835.48 hours
Total flying time last 24 hours:	0.7 hours
Total flying time last 30 days:	52.25 hours
Total flying time last 90 days:	134.54 hours
Total flying time last year:	582.64 hours
SIC qualification line check (A-300):	December 12, 1998
Initial type rating (A-310):	November 16, 1998
Last recurrent ground training:	January 5, 2001
Last recurrent checkride (Single visit training):	December 23, 2000
Attended AAMP[14] Ground School:	March 26, 1997

A review of the American Airlines employment application of First Officer Molin indicated he had flown Shorts SD-360, Beechcraft 99 and DeHavilland DHC-6 airplanes in commuter and regional operations under Parts 121 and 135. The total flight time listed prior to being hired was 3,220 hours including general aviation and commercial flying.

The Center Manager and Director of Flight Training for Flight Safety International (Flight Safety) at LaGuardia Airport in New York indicated that Business Express, the company where the first officer had flown Shorts 360 airplanes, had used Flight Safety for their training. They had started transitioning to simulators from airplanes to conduct training in the early 1990s. He stated that Flight Safety did not conduct upset maneuver training in the Shorts 360. They currently did not demonstrate roll upsets in the simulator due to the lack of useful and reliable simulator data. Further, he stated that the test standards do not require unusual attitude training for additional type ratings. There is no wake turbulence training conducted in the Shorts 360 simulator. According to the FAA, Business Express is no longer in business and could not be contacted regarding Shorts 360 training and operations.

3.0 WEIGHT AND BALANCE

[13] Flight times include only American Airlines times as a first officer. Flight engineer times were not retained.
[14] Advanced Aircraft Maneuvering Program was taught by Captain Warren VanderBurgh.

Weight and balance was calculated using American Airlines takeoff performance system (TPS) and the Airbus manual method. Both methods of computation indicated the airplane was in accordance with weight and balance limitations.

3.1 DETERMINATION OF TAKEOFF CENTER OF GRAVITY (CG)

STEP 1

Dry Operating Weight (DOW) (from Appendix 1 page 2 - extract of TPS)[15] = 208, 710 lbs (rounded value from 208,707)

Corresponding CG = 28 %

STEP 2

Define DOW Index

$$I = \frac{(H.Arm - 1181.1)W}{200{,}000} + 40$$

$$I = \frac{(1189 - 1181.1)208{,}710}{200{,}000} + 40 = 48.2$$

STEP 3

Weight deviation: - 890 lbs (from Appendix 1 page 1- EOWX in extract of TPS)

STEP 4

Basic index correction for Dry Operating Weight deviation for pantry.

Note: due to the TPS not reflecting the deviation zone, a worse case scenario was considered using the deviation from fwd zone D resulting in the CG to move further aft.

Index correction = + 3.1

Corrected index = 48.2 + 3.1 = 51.3

STEP 5

Enter index scale with corrected above index and apply corresponding index variation according to cargo and passenger loading through scales and draw from the final point a vertical line down to the Zero Fuel Weight determined on table:

CARGO (from Appendix 1 page 1 - extract of TPS)

F1 (cargo 1):	6,140 lbs
F2 (cargo 2):	9,100 lbs
A1 (cargo 3):	8,580 lbs
A2 (cargo 4):	4,520 lbs
AB (cargo 5):	240 lbs
TOTAL:	28,580 lbs

[15] See Attachment G, Airplane Weight and Balance Information.

PASSENGERS (from Appendix 1 page 1 for number and Appendix 2 page 1 for distribution)

CABIN OA (first class) = 15
CABIN OB (Coach) = 156
CABIN OC (Coach) = 75
TOTAL = 246 (note: this figure does not account for the 5 children under the age of 2 years)

STEP 6
Fuel in Trim tank = No fuel

STEP 7
Intersection between ZFW and ZFW CG is within ZFW limit.[16]
ZFW = 281,570 lbs
ZFW CG = 29.2 % MAC

STEP 8
With graph, determine Fuel Index correction = +3.1

Apply corresponding correction on scale to determine intersection of TAKEOFF weight line (349,370) and takeoff weight index. Read corresponding CG = 29.1% MAC

Intersection between TOW and TOW CG is within TOW limit.

STEP 9
On pitch trim scale enter with TOW CG and determine corresponding T/O TRIM SETTING = 0.6 Nose Down.

3.2 TAKEOFF SPEEDS

Check of TAKEOFF speeds used in TPS

In accordance with TPS of AA FLT 587, November 12th, takeoff speeds for Runway 31L were (Appendix 3 - extract of TPS):

OAT = +3°C
Pressure Altitude: - 400ft
SLATS/FLAPS 15/15
Bleeds ON
N1: 100.6

[16] See Attachment G, Airplane Weight and Balance Information, Load and Trim Sheet.

V1 = 149
VR = 153
V2 = 155

Assumed Temperature: 43°C

Max takeoff weight limitation was: 353,500 lbs.

This weight 353,500 lbs is below the Maximum allowable takeoff weight of 369,900 lbs defined using the American Airlines Performance Manual Takeoff Procedures (APPENDIX 4).

CROSS-CHECK of speeds using manual method:

Using the American Airlines Performance Manual V1/VR/V2 Speeds (APPENDIX 5) for takeoff weight of 353,500 lbs and Flaps 15 with pressure altitude - 400 ft and OAT + 3°C, speeds are:

V1 = 149
VR = 153
V2 = 156

These speeds are in line with Appendix 3 - TPS.

Referring to the Aircraft Manufacturer Airbus Flight Crew Operating Manual (APPENDIX 6) the V2 speed is within the approved V2/VS ratio range (1.24 Vs).

3.3 OPERATING SPEEDS

Referring to the extract of Aircraft Manufacturer Airbus Flight Crew Operating Manual (FCOM), the operating speeds for a gross weight of **349,400 lbs** are as follows[17]:

F speed (minimum speed at which flaps may be retracted to 0 degree) = 168 kts
S speeds (minimum speed at which slats may be retracted to 0 degree) = 215 kts
O speeds (maneuvering speed or green dot speed) = 243 kts

4.0 SIMULATOR VISITATION

[17] See Attachment G, Airplane Weight and Balance Information, FCOM 2.10.10 page 4 for takeoff speeds, and FCOM 2.02.01 page 1 for speed symbols and definitions.

The Operations Group visited the A300 simulator from 0730 to 1130 on January 16, 2002. The American Airline A-300 simulator is a training level C simulator. The following items were observed:

- Ground taxi flight control check.

- Yaw damper check during taxi.

- Reviewed rudder travel fault, including chime annunciation and electronic centralized aircraft monitoring (ECAM) alerting display.

- Evaluation of Rudder pedal travel and force on ground.

    - ECAM showed full range of travel.
    - Rudder pedal travel was approximately 4-5 inches (estimated).
    - Rudder force seemed uniform over the range of rudder pedal travel.

- Rudder travel and force airborne at 230 KTS, 3,000 feet.

    - ECAM showed between 1/3 and ½ of full rudder travel
    - Rudder pedal travel was estimated to be about two inches
        - About 1 second after sustained rudder pedal input to stop, feedback pressure developed and then increased.
    - Rudder pedal inputs resulted in a roll response in the direction of rudder application.

- Evaluated rudder travel and force at Vmo, at 4,500 feet

    - ECAM showed limited travel relative to full range of travel (less than 1/3 of full range)
    - Rudder pedal travel was estimated to be about 1 inch
    - Rudder pedal feedback with sustained rudder pedal application to stop was greater than that experienced at 230 KTS

- Examined airplane response to full reversals of rudder only, aileron only, and aileron and rudder in level flight and during standard rate turns, at 230-250 KTS

    - Observed that hydraulic pressure dropped with rapid control reversals to approximately 2,900 psi. (Thrust was set to maintain airspeed range and not set for climb thrust).
    - During rapid control reversals, pilots felt increased resistance in aileron and rudder controls as compared to slow sweeps of aileron and rudder inputs.

- Evaluated rudder doublet inputs at 230 KTS, 3,000 feet

    - Sideslip and roll characteristics were observed.
    - Dutch roll developed from doublet inputs.

- Demonstrated Dutch roll with yaw dampers off.

- Reviewed unusual attitude training scenarios including:

    - Roll associated with a wake turbulence encounter that resulted in a nose low unusual attitude with bank in excess of 90 degrees up to about 135 degrees

        - Supporting interview testimony indicated that the simulator software might inhibit aileron control effectiveness during development of the roll attitude.

        - Recoveries were attempted using aileron only, rudder only, and a combination of aileron and rudder.

    - Nose high unusual attitude:

        - The simulator commanded a runaway nose up pitch trim to establish a nose high attitude. Control column pitch control was either inhibited or reduced until a nose high attitude was achieved (i.e., in excess of 25 degrees nose high). Once a nose high attitude was established, trim and pitch control was returned to normal.

        - Recovery was initially attempted using pitch control. Subsequent recovery was attempted using aileron only, rudder only, and a combination of aileron and rudder in addition to pitch control.

- Demonstrated roll control with aileron only and rudder only at V (stick shaker**)** + 5 KTS, clean configuration.

- Demonstrated use of top rudder in a 90 degree bank

    - Rudder initially retarded development of pitch down for a few seconds, then nose began to drop
    - As pitch down increased and airspeed increased, rudder pedal travel became more limited.

The operations group recognized that the accuracy of the American simulator to replicate airplane-handling characteristics in unusual attitudes was unknown.

5.0 AIRPORT INFORMATION

JFK airport is located ½ mile southeast of the New York City limits and has an elevation of 13 feet. The airport has four runways. Runway 13R/31L is 14,572 feet long and 150 feet wide; runway 13L/31R IS 10,000 feet long and 150 feet wide; runway 4L/22R is 11,351 feet long and 150 feet wide; and runway 4R/22L is 8,400 feet in length and 150 feet wide. AA 587 departed from runway 31L[18].

According to a statement provided by the Port Authority Police of New York and New Jersey, after confirmation of the crash of flight 587, an employee of the Port Authority conducted a visual inspection of the full length of the runway and the taxi route of the accident airplane. The surface and shoulder areas were inspected from terminal 8 to taxiway TANGO BRAVO, taxiway BRAVO to taxiway JULIETT, and taxiway ZULU to runway 31L. The inspection was accomplished at 1000 and no debris was found.[19]

6.0 WEATHER

The flight crew of AA 587 called for taxi instructions and indicated they had the following Automatic Terminal Information Service (ATIS) DELTA.

ATIS DELTA that pertained to the accident flight and provided by FAA transcript was as follows:

> *"Kennedy Airport information DELTA. One two five one Zulu[20], wind three three zero at one one, visibility one zero, few clouds at three thousand four hundred, temperature four, dew point minus six, altimeter three zero four two. Approach in use, ILS runway three one right, departing runway three one left. Notice to airmen, runway four right two two left closed. Runway four left two two right closed. Numerous cranes operating in and around Kennedy Airport. Read back all runway hold short instructions. In the interest of noise abatement, please use the assigned runway. Advise on initial contact you have information DELTA."*

The ATIS information changed to information ECHO prior to the departure of flight 587. ATIS ECHO contained the following:

> *"Kennedy Airport information ECHO. One three five one Zulu[21], wind three two zero at one one, visibility one zero, few clouds at four thousand three hundred, temperature six, dew point minus six, altimeter three zero four four. Approach in use, ILS runway three one right, departing runway three one left. Notice to*

[18] See Attachments E and F, Airport diagrams and Kennedy International Airport Departure Information.
[19] See Attachment C, Port Authority Police Report.
[20] This time correlates to 0751 Eastern Standard Time.
[21] This time correlates to 0851 Eastern Standard Time.

airmen, runway four right two two left closed. Runway four left two two right closed. Numerous cranes operating in and around Kennedy Airport. Read back all runway hold short instructions. In the interest of noise abatement, please use the assigned runway. Advise on initial contact you have information ECHO."

7.0 ORGANIZATIONAL AND MANAGEMENT INFORMATION[22]

American Airways was incorporated in 1930, and later changed its name to American Airlines, Inc. in 1934. American was owned by the AMR Corporation and was headquartered in Dallas/Fort Worth, Texas. Passenger and cargo service was provided throughout North America, South America, the Caribbean, Latin America, Europe and the Pacific. AMR Corporation also owned and operated American Eagle, a regional airline that provided service from American's hubs and other destinations throughout the United States, Canada, and the Caribbean. American acquired the Airbus A300-600ER airplanes in order to serve the Caribbean markets from the mainland. Later, the A300 airplanes flights were expanded to serve European destinations. There had been several operators of the A300 series airplanes prior to the development of the A300-600ER. Eastern Airlines was the first US carrier to buy the Airbus operating the A300B2/B4 version. American Airlines was the first A300-600 customer in the US ordering 25 airplanes in 1988 followed later by an additional order or 10 airplanes.

In February 1999, American announced the acquisition of Reno Air and it was fully integrated into American Airlines on August 31, 1999. In April 2001, American completed the acquisition of Trans World Airlines assets.

At the time of the accident, American had 35 A300-600 airplanes operating in its fleet. Other airplanes in the American fleet included the Boeing 717, 727, 737, 757, 767, 777, Fokker F-100, and the Boeing Douglas MD-80 series. American's Web site indicated that, as of November 2001, the fleet consisted of 869 transport category airplanes. Of these, 107 were acquired through the acquisition of Trans World Airlines. As of March 2002, there were 12,746 pilots including 1,906 Trans World Airlines pilots.

According to the Flight Manual, Part 1, the Manager of Flight Operations Safety reports to the Director of Safety, who reported to the Vice President of Safety, Security, and Environmental. The Vice President of Safety, Security, and Environmental also holds the title of Director of Safety and reports directly to the Office of the Chairman. The Vice President Flight holds the title Director of Operations and reports directly to the Executive Vice President Operations[23].

8.0 FLIGHT CREW TRAINING

[22] Excerpts from American Airlines Website (http://www.amrcorp.com).
[23] FAR 119.65 required management positions for operations conducted under part 121 to include a full-time Director of Safety, Director of Operations, Chief Pilot, Director of Maintenance, and Chief Inspector.

American Airlines flight crew training academy is located in Fort Worth, Texas. The Managing Director of Flight Training and Standards reported to the Vice President Flight. The Managing Director of Flight Training had a staff that provided both the ground and flight training of pilots. According to the *AMERICAN AIRLINES-FLIGHT TRAINING General Flight Training Manual*, there was a wide variety of pilot training courses grouped into four broad categories of curricula: Indoctrination, Qualification, Continuing Qualification, and Special Training. Each course may be divided into four segments: distributed training, ground training, flight training, and qualification.

Distributed training includes material distributed electronically via computer system, computer disk, or the Internet. Paper products such as handouts and study guides, and various flight operations manuals and videotapes were provided. The ground training segment was primarily systems and procedures training conducted by professional ground school instructors. These instructors were non-line qualified personnel. The flight training segment was primarily maneuvers and line operational simulator (LOS) training conducted in traditional flight training devices and in simulator sessions. Except in a few instances where advanced simulators were not available, no training in an airplane was accomplished. The maneuver based training was conducted primarily by professional simulator instructors that were not line qualified pilots. This training was accomplished during the first half of the simulator flight training segment. Qualified line check airmen that flew with American Airlines, conducted the LOS training as line oriented simulator sessions during the last half of the flight training segment. Qualification training was to qualify and/or certify crew members in a specific airplane. Special training was any training that did not fit in one of the aforementioned curriculums defined above.

Both the captain and the first officer became qualified in their respective positions in the A-300 during the last half of 1998. As such, they were qualified in accordance with CFR Part 121 for ground training, and under appendix E and F of the same part, for flight training. Recurrent flight training was accomplished under the provisions of the Single Visit Training (SVT) exemption. SVT was one of the phases required by the FAA, preparatory to American Airlines becoming fully qualified under the Advanced Qualification Program (AQP). The single-visit concept was a combination of distributed training and on-site ground and flight training that must be accomplished every 12 months and not to exceed 13 months.[24] It should be noted that the major change in going from SVT to AQP was the modification of simulator training. Under SVT recurrent training, a pilot was given a proficiency check and a line oriented flight training (LOFT). Under AQP, a pilot received maneuvers validation and line operational evaluation (LOE) rather than the proficiency check and LOFT curriculum under SVT. In March 1999, the A-300 fleet met the provisions of AQP and became operational. On September 1, 2001 a new training program was implemented under AQP that revised the recurrent training cycle for all pilots, from twelve-month to nine-month intervals. Since both the accident

[24] Captains could request, on an individual basis, the option of voluntary additional training at the six-month point between annual cycles.

pilots received their recurrent training earlier than September 2001, they had not participated in the new nine-month training cycle.

8.0.1 ADVANCED AIRCRAFT MANEUVERING PROGRAM (AAMP)

In the spring of 1995, the American Airlines Vice President of Flight requested Captain Warren VanderBurgh to head the development of an AAMP[25]. American Airlines developed the AAMP in 1996 following a review of worldwide aviation industry accidents involving large multi-engine jet transports. Several causal factors were noted that included loss of airplane control, controlled flight into terrain, wind shear, and wake vortex encounters. It was believed that many of these accidents might have been prevented if pilots had been trained to recognize and respond properly to airplane upsets.

Prior to the development of AAMP, many airline pilots had not received any kind of training related to upsets in large transport category airplanes. Although many commercial airline pilots had received high performance jet training in the military or civilian aerobatic training, in most cases, these pilots had never performed any recovery procedures in airline operations.

During the development of AAMP, the FAA, other airlines, the U. S. Military, and airplane manufacturers were involved. In the formative stages, the chief test pilot from McDonnell Douglas took the course twice and offered his comments to American Airlines. The designer of AAMP stated that the chief test pilot was very helpful. He, "pretty much wrote the book on high altitude flight characteristics; flight handling characteristics segment of the program." During interviews with the chief test pilot, he stated that the rudder was "the main area for discussion…an area that should be very, very well understood." He also stated a concern for the use of simulation outside the boundaries for which there was valid data. Those were his major issues.

Both the AAMP developer and the Director of Training took the AAMP program to the Boeing Company in Seattle, Washington, and asked the test pilots and aeronautical engineers to observe and "help us make the program better and to ensure the accuracy of the program." Airbus was invited to participate in the formation of the program however, "no test pilot or representative from Airbus came and attended the course. They did later…."[26]

The first AAMP conference was held in 1997 and participants were invited from Boeing, McDonnell Douglas, and Airbus to attend. Several hundred attendees from the U. S. Military, FAA, and other airlines were also present. According to Senior Manager/Chief Test Pilot of the Boeing Douglas Products Division, the Vice President of Flight for American Airlines invited certain individuals from the FAA, Boeing, Boeing-

[25] See Attachment B, Volume III, Interview Summary, Captain Cecil Ewell.
[26] See Attachment B, Volume III, Interview Summary, Captain Warren VanderBurgh.

Douglas, and Airbus to attend the conference and to offer comments[27]. Airbus was in attendance for that first conference, according to the AAMP program developer. After attending the conference a letter was written to the Vice President Flight at American Airlines with recommendations for improving the program.[28] The letter was signed by representatives of the three airplane manufacturers[29] and the FAA. The Vice President Flight replied to the letter with an American Airlines response to the recommendations.

Other airlines about the same time were developing upset recovery programs as part of an industry effort to initiate this kind of training. The head of the AAMP worked with many airlines, both foreign and domestic, as well as the military to offer briefings and training. The AAMP training was a generic program that highlighted the differences between airplane designs. According to American Airlines, the AAMP maneuvers were consistent with FAA approved aircraft operating manuals. Several airlines developed their own programs and some were modeled after the AAMP presentation.

8.0.1.1 AAMP VIDEO

Due to the many demands from other carriers and American Airlines' own pilots, a series of videos were created for distribution. The first video produced was Unusual Attitude Recovery Procedures. The videos were sent to other carriers and all pilots at American Airlines for use in their home library. Further, during new hire indoctrination, the video was given to all new pilots. The video was distributed beginning in late 1997 upon completion of the line pilot ground training for AAMP. The unusual attitude video in use at the time of the accident was dated December 19, 1997. The videos distributed to all American Airlines pilots contained four of five subjects: (1) Unusual attitude recoveries, (2) automation dependency, (3) control flight into terrain and mountain wave, and (4) control malfunctions and flight instrument anomalies. The fifth segment was on microbursts and was never sent to the pilots, as it was being used in recurrent training.

A review of the video concerning unusual attitude recoveries contained language that emphasized smooth application of rudder with small applications for coordinated use. At high angles of attack, it was suggested to avoid large rudder inputs that would induce large sideslip angles. Information concerning lead and lag response times for the rudder was discussed and emphasized that a lack of understanding could lead to over controlling the airplane. The video demonstrated a high angle of attack control application in the simulator.

The video depicting control malfunctions and flight instrument anomalies also covered use of the rudder. The crossover angle of attack was demonstrated where the rudder became more powerful than the ailerons and spoilers at higher angles of attack. A Boeing flight test airplane demonstrated rudder versus aileron/spoiler control and how forward yoke pressure on the control column would regain aileron/spoiler control over

[27] See Attachment B, Volume I, Interview Summary, Captain Tom Melody.
[28] See Attachment H, Correspondence from Airplane Manufacturers to American Airlines and Response.
[29] McDonnell Douglas had merged with Boeing prior to the letter being generated.

rudder by reducing the angle of attack. Other anomalies were presented, including rudder hard over, slat abnormalities, and inboard flap failures. In the case of slat and flap problems, it was suggested to lead with ailerons and if roll continued, follow with rudder to arrest the roll rate.

Upon conclusion of the video presentation concerning unusual attitude recovery procedures, American Airlines added an additional segment to the video explaining proper use of coordinated rudder and emphasizing small, smooth inputs. The additional video segment explaining rudder use was a direct result of the concerns expressed by the manufacturers about the emphasis on the use of rudder, according to the AAMP program developer.

8.0.1.2 AAMP COURSE MATERIAL

As part of the AAMP, course material was developed to support the flight training. On October 1, 1996 the original AAMP Flight Training Booklet was provided to flight crews and contained information in part, related to aerodynamics of swept wing airplanes, unusual attitude recovery procedures, and phenomena that cause airplane upsets. A discussion of air mass anomalies was included in the booklet and addressed windshear, microbursts, wake turbulence and mountain wave activity. Since that date, the booklet has been revised several times and the current revision contained 94 pages at the time of the accident, and was dated May 1, 2000.[30]

Included within both the initial and current booklet was Pilot Response to Wake Turbulence. The current information regarding wake turbulence response contained the following:

- *Rolling moment on aircraft with shorter wingspans can be dramatic.*
- *Resulting attitude may be nose low with more than 90^0 of bank.*
- *Apply the appropriate unusual attitude recovery procedure.*
  -- Do not apply any back pressure on yoke at more than 90^0 of bank. ROLL FIRST – THEN PULL.
  -- High AOA [angle of attack] = Coordinated RUDDER.
  --Corner speed – high lift devices extended.

The only change from the original issue to the current issue of the booklet at the time of the accident pertaining to the pilot responses to wake turbulence was the addition of the word *"Coordinated."*

Additional information, in part, contained in the current booklet pertained to the AAMP Simulator Training:

[30] See Attachment I, Excerpts from the AAMP Flight Training Course Material.

- *High AOA Maneuvering Demonstration*
  --Apply maximum power
  --Maintain 15^0 to 30^0 deck angle
  --Fly in the PLI (pitch limit indication)
  --Respect the stick shaker
  --Now roll alternately left and right to 40^0 of bank-
  MAINTAIN HIGH AOA
  ** First, use only ailerons and spoilers*
  - Note: Sluggish roll response - Developing sink rate
  ** Second, use only rudder – (smoothly – note lead/lag)*
  - Note: Improved roll response – Developing climb rate
  ** Third, practice combination (both aileron & rudder)*
  - Note: Optimum roll response

8.0.1.3 SIMULATOR TRAINING

Both accident pilots received A300 simulator training under CFR Part 121, Appendix E and F, which was the approved program in place prior to American Airlines changing to AQP in March 1999. As part of the Selected Event Training, unusual attitude/recovery was incorporated into simulator training and required at least an "A" level simulator with a visual presentation or higher. The A300 simulator operating at the American Airlines Flight Training Academy was a level "C". According to the American Airlines Approved Training Manual, unusual attitude/recovery involved excessive roll attitudes (90 degrees plus) and high pitch attitudes (35 degrees plus) and were listed as training events to be used during initial, transition and upgrade training. Further, the manual indicated the same events were outlined during recurrent and proficiency check training. As part of the upgrade and transition training, period six in the simulator included unusual attitude and recovery training events.

The NTSB operations group chairman conducted a review of other US carriers that provide unusual attitude training and recovery. The information collected indicated that various scenarios and setups were used to obtain the desired results. Many carriers including the American Airlines A300 simulator had preprogrammed event buttons that would place the simulator in a nose high or a rolling condition. Nose low was not preprogrammed into American's simulator. Some carriers, including American Airlines A300 simulator, had roll control inhibited until the desired roll was established then the control was released back to the pilot. Others did not. Other carriers would ask the pilot to look away while the simulator was placed in an unusual attitude, then the pilot would be asked to recover. Although American Airlines used the preprogrammed selection in the simulator prior to the accident, they have since changed the procedure to manually place the simulator in an unusual attitude. Although this change has been made, it is currently under review by the American Airlines Flight Training Department.

Variations between carriers included the use of motion and non-motion in the simulators. American Airlines used motion in the A300 simulator during AAMP training. Recovery procedures included the use of trim during recovery in some carriers.

One carrier acknowledged modeling limits in the use of the simulator to 30 degrees of pitch and 60 degrees of roll. Emphasis in use of rudder varied between carriers.

8.0.1.4 SELECTED EVENT TRAINING

According to American Airlines records, the Managing Director of Flight Training/Standards petitioned the FAA Principal Operations Inspector (POI) providing oversight for the carrier to change the Approved Training Manual. The request was for the original version of Selected Event Training to include unusual attitude/recovery training. This request was a result of NTSB concerns and recommendations for operators to provide flightcrew members with flight training in hazardous in-flight situations. The request for change was made July 27, 1995 and was approved by the FAA on August 1, 1995.[31] Since that time, Selected Event Training had been conducted in the American Airlines simulators. At the time of the accident, during initial and transition training in the A300 simulator, unusual attitude training was conducted in simulator period 5 and AAMP was conducted in simulator period 6. Simulator period 5 was conducted with a simulator pilot that introduced and demonstrated to the student, nose high, nose low and rolling upset maneuvers. In simulator period 6, the student pilot is with an American Airlines check airman who repeats the upset maneuvers from period 5 and adds windshear/ microburst, and enhanced ground proximity warning system (EGPWS) maneuvers for training.

Recurrent training since September 1, 2001 required that pilots be scheduled for four hours of simulator training. Each pilot had to accomplish all first look and mandatory maneuvers and as many variable maneuvers as practical (minimum two). Unusual attitude recovery was a mandatory maneuver. Although the accident pilots received their recurrent training before that date, unusual attitude recovery training was also required under the AQP standards that were in place from November 1, 1999 to September 1, 2001 in which both pilots participated. Additionally, microburst/windshear and EGPWS training is required during the recurrent training. Since the implementation of the AAMP program, unusual attitude training had been required during recurrent training.

8.2 UPSET RECOVERY TRAINING AID

According to Airbus, a joint industry-working group was formed to produce an Airplane Upset Training Aid[32]. The group was formed in response to an Airline Transport Association (ATA) proposal in June 1996 and to increased interest by the NTSB in airplane loss of control accidents. The joint industry team was comprised of

[31] See Attachment J, FAA Correspondence.
[32] See Attachment K, Excerpt from Airbus Industrie presentation at 10th Performance and Operations Conference, held in San Francisco, CA on September 28-October 2, 1998.

manufacturers, airlines, governmental authorities, and pilot's unions. This also marked a "first" in showing that the "Big 3" aircraft manufacturers (Boeing, Airbus, and McDonnell Douglas) could and would work together on technical, non-commercial issues. It took two years to develop an upset recovery training aid and an accompanying CD-ROM package. At the time of the development of the training aid, Delta Airlines, United Airlines, and American Airlines had already been running training programs pertaining to upsets in their simulators.

Airbus stated that from the beginning, during the development of the training aid, there was a "conflict between the technical advice given by the manufacturers' training pilots and that expressed by those of the principal airlines already practicing upset training. They (airlines) naturally considered themselves to be the experts on this subject, based on the many hours of training that they had already conducted on a large number of pilots in their simulators."[33]

8.2.1 USE OF RUDDER

According to Airbus, one of the differences of opinion between the manufacturers and the operators was the use of rudder. Existing training courses emphasized using rudder for roll control at low speeds. After discussions with various airlines, including American Airlines, the training managers agreed to play down the use of rudder in their existing courses. Airbus advocated if necessary, to use aileron inputs that can be assisted by coordinated rudder in the direction of the desired roll. A caution was added "excessive rudder can cause excessive sideslip, which could lead to departure from controlled flight."

A review of the American Airlines *Flight Manual Part 1* regarding issues of rudder, provided only a discussion of its usage during hijackings. Section 19, page 17, 8. HIJACKING provided information related to airplane maneuvering during a known hijacking. In part:

> *As a "last ditch" maneuver in the event of a known hijacking judicious maneuvering can slow down or throw hijackers off balance so that passengers or other employees can gain control…. Maintain aircraft control and do not apply excessive control forces….*
>
> - *Excessive side loads can cause pylon mounted engines to break off the airplane.*
> - *Excessive rudder input can cause a departure or spin.*

[33] See Attachment L, Excerpt from Airbus Industrie presentation at 10th Performance and Operations Conference, held in San Francisco, CA on September 28-October 2, 1998, page 4.

According to the FAA, each of American Airlines fleet Operating Manual Volume 1, Maneuvers Section[34] contained information and procedures in part, for the following:

- Moderate to severe turbulence encounter
- Unusual attitude (both recognition and recovery)

The Operating Manual contained text of unusual attitude recoveries (both nose high and nose low) in the Operating Manual, similar to the text incorporated into the AAMP Course Material Booklet mentioned earlier.

American Airlines issued a *Flight Operations Technical Bulletin*[35], dated February 2002 in response to the NTSB Safety Recommendations addressing the issues of flight controls and in particular, rudder limiters, rudder reversals, sideslip angle and vertical stabilizer loading. The discussion of rudder limiters stated that the, "limiter is designed into the directional control system to reduce the available rudder throw as airspeed increases to avoid excessive structural loads on the vertical stabilizer. Pilots interviewed were familiar with that concept and the limiter function. The bulletin also addressed "rudder reversals" or "rudder doublets" which were defined by American Airlines as a large rudder deflection input in one direction followed immediately by a rudder deflection input in the opposite direction. All line pilots interviewed had not heard of the concept of "rudder doublet." Test pilots interviewed were aware of the term. Most pilots interviewed thought that the rudder limiter would prevent an overload of the vertical stabilizer and rudder through the use of the rudder load limiter system.

On February 8, 2002, the NTSB in cooperation with the BEA issued two safety recommendations that aircraft manufacturers re-emphasize the structural certification requirements for the rudder and vertical stabilizer, showing how some maneuvers can result in exceeding design limits and even lead to structural failure.[36] As a result of the safety recommendations, Airbus Issued an FCOM bulletin dated March 2002.[37] The bulletin emphasized proper operational use of the rudder, highlighted certification requirements and rudder control design characteristics. In part, the bulletin issued a "CAUTION":

> *Sudden commanded full, or nearly full, opposite rudder movement against a sideslip can generate loads that exceed the limit loads and possibly the ultimate loads and can result in structural failure.*
>
> *This is true even at speeds below the maximum design maneuvering speed, VA.*
>
> *Certification regulations do not consider the loads imposed on the structure when there is sudden full, or nearly full, rudder movement that is opposite the sideslip.*

[34] See Attachment L, Excerpts from American Airlines Operating Manual, Volume 1, 12 Maneuvers.
[35] See Attachment M, Flight Operations Technical Informational Bulletin.
[36] NTSB Safety Recommendation A-02-01 and A-02-02, issued February 8, 2002.
[37] See Attachment N, FCOM Bulletin dated March 2002, *Use of Rudder on Transport Category Airplanes.*

Since the accident, Boeing produced a *FLIGHT OPERATIONS TECHNICAL BULLETIN,* DATED May 13, 2002[38], concerning use of rudder on transport category airplanes. The bulletin applied to all models of Boeing airplanes from the earliest 707s to the current production 777s and latest MD-11s. The bulletin was also issued in response to the NTSB Safety Recommendations issued on February 8, 2002 concerning pilots being made aware that aggressive maneuvering using "sequential full opposite rudder inputs" can potentially lead to "structural loads that exceed those addressed by the requirements." The bulletin addressed the issues in the safety recommendation and in summary, discussed use of rudder and resultant roll, yaw, sideslip responses, and corresponding loads associated with large rudder input.

According to Boeing Flight Crew Training Manuals and Flight Crew Operating Manuals, material is contained therein on upset recovery guidance that includes guidance on the proper use of the rudder. The Quick Reference Handbook (QRH), in the Non-Normal Maneuvers section under Upset Recovery contains the **Warning**:

> *"Excess use of pitch trim or rudder may aggravate an upset situation or may result in loss of control and/or high structural loads."*

It should also be noted the United States Air Force (USAF) currently operates a KC-135 four-engine air refueling tankers. The military tanker airplane was derived from a basic design of a commercial Boeing 707 passenger airplane. The pilot's flight manual for the airplane [*T.O. 1C-135(K)-1*] contained a caution note pertaining to rudder application. This note was incorporated in the manual dated June 30, 2000.

> *The sudden reversal of rudder direction at high rudder deflections, due to improper rudder application or abrupt release, can result in overstressing the vertical fin. This condition could be brought about during recovery attempts from a flight condition induced by a lateral control malfunction.*[39]

9.0 LANDING GEAR UNSAFE INDICATION

On November 15, 2001, three days after the accident, a change to the *American Airlines, Volume 1 A300 Operating Manual* was issued. In part, the L/G UNSAFE INDICATION[40] stated:

> *If one gear remains unlocked, perform turns to increase load factor and perform alternating side slips in an attempt to lock the gear. Prior to performing any side slip maneuver, ensure all Flight Attendants and passengers are seated.*

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[38] See Attachment O, Boeing Commercial Airplane Group*, FLIGHT OPERATIONS TECHNICAL BULLETIN*.
[39] See Attachment P, Excerpt from T.O. 1C-135(K)-1, Flight Manual USAF Series KC-135E-R/T Aircraft, page 3-81.
[40] See Attachment L, Excerpts from American Airlines Operating Manual, Volume 1, Land 3.

A review of the *American Airlines A300-600 Volume 2 Flight Crew Operating Manual*, (FCOM) issued by Airbus Industries and containing Revision 25 contained, in part, the following information related to L/G UNSAFE INDICATION:

> *If one gear remains unlocked, accelerate to V_{MAX}, perform turns to increase the load factor and perform alternating side slips in an attempt to lock the gear.*[41]

A subsequent revision 26 was incorporated into the FCOM regarding the procedure for L/G UNSAFE INDICATION. In part:

> *Note: Side slip is used to generate aerodynamic loads on the landing gear structure to force the downlock into position. The sideslip should be initiated using the rudder on the same side of the aircraft as the unsafe gear indication, i.e. if the right main landing gear is unlocked, slowly apply right rudder up to full deflection if necessary while maintaining wings level to generate sideslip. If the gear still fails to lock, then slowly return the rudder to neutral, allow the airplane to stabilize, and then slowly apply opposite rudder. If necessary, repeat this cycle in an attempt to lock the gear.*

10.0 FEDERAL AVIATION ADMINISTRATION OVERSIGHT

The FAA Certificate Management Office (CMO) for the AMR Corporation is located in Dallas, Texas. According to the FAA, American Airlines is an extremely complex operator. There are ten fleets of airplanes with 742 airplanes flying to 176 destinations both domestic and international. With the completion of merging the TWA certificate into the American Airlines certificate, the airline may be composed of over 936 airplanes, 14,000 pilots, and 25,000 flight attendants.

At present, the principal operations inspector (POI) is a first level supervisor for over 25 personnel and is responsible for directing the work of up to nine remotely sited geographic inspectors. On August 17, 2001, a workgroup from the FAA's central and southwest regions recommended a new structure for the AMR CMO prior to the merger of TWA and American Airlines. The recommendation included adding an additional layer of supervisory personnel to the operations and maintenance units of the American Airlines certificate. These new supervisors would assume first level supervisory roles and the POI and maintenance inspectors would become second level supervisors.

At the time of the accident, the FAA CMO organizational structure staffing consisted of 84 persons. There were two temporary positions filled and 10 positions were vacant. Within the CMO are two certificate management units (CMU); one for

[41] See Attachment Q, Excerpts from the American Airlines A300-600 Volume 2 Flight Crew Operating Manual (FCOM).

American Eagle and the other for American Airlines. The American Airlines CMU consisted of 53 persons, including one temporary position and eight vacant positions.

The POI had a staff comprised of 23 inspectors, one clerk typist, and two inspector vacancies.

The geographic operations inspectors numbered five at the time of the accident with three additional positions unfilled.

According to the FAA, the oversight of the AAMP program is monitored in two basic ways. First, each inspector receives the same ground and simulator training as the pilots at American Airlines when the inspector undergoes initial and recurrent training. Second, the AAMP was monitored by the Aircrew Program Manager (APM) and the Assistant APMs during routine observation of ground instruction, initial and recurrent training observations of check airmen and designated pilot examiners from the company.

10.1 SIMULATOR CERTIFICATION

The National Simulator Program (NSP) performs the certification and qualification of a simulator for training.[42] The NSP is responsible to ensure that a simulator is properly programmed to replicate the respective airplane for use in training programs approved by POI. The NSP does not place limits on the aerodynamic parameters beyond which the simulator is not qualified to represent the real aircraft. Qualification is based on adequate presentation of results that meet the requirements of the applicable advisory circular (AC).

The simulator is qualified to the minimum requirements of that AC. Primarily; historic aircrew training needs have dictated the requirements of the applicable AC. Several AC's are used in simulator qualification. These include AC 121-14 as amended through Revision "C" and AC 120-40 as amended through draft Revision "C." Under a grandfather provision, a simulator remains subject to the requirements of the AC under which it was initially qualified regardless of publication of updates to the AC or publication of a new AC. The process that the FAA uses to evaluate and qualify the airplane flight simulators used in training programs or airman checking under 14 CFR is described in detail in the applicable AC.

The NSP does conduct annual recurrent evaluations of simulators in accordance with the requirements of the applicable AC. According to the FAA, the last simulator inspection performed on the American Airlines A300 simulator was on September 7, 2001.

[42] See Attachment J, FAA Correspondence, (Memorandum Response to NTSB's request for information regarding certification of simulators and their use in airline training programs).

AMR also performs secondary evaluations six months out of phase with the NSP evaluation cycle. The Certificate Management Office (CMO) Aircrew Program Managers (APM) regularly attend the evaluation sessions on the simulators utilized by their respective fleets, regardless of who is conducting the evaluation. The A300 simulator received a secondary evaluation from AMR, which was attended by the A300 APM, on January 9, 2002.

10.2 SELECTED EVENT TRAINING

According to the FAA, in direct response to the recommendations by the NTSB regarding flightcrew training, on August 16, 1995, they published Flight Standards Handbook Bulletin for Air Transportation (HBAT) 95-10[43], "Selected Event Training." The bulletin stressed, among other things, the importance of training regarding recovery from unusual attitudes. The FAA believed, however, that the most valuable training would not necessarily be limited to unusual attitude recovery but would also address recognition and containment of situations that could lead to unusual attitudes. The FAA further responded with programs that trained flightcrews on windshear, turbulence upsets, and wake turbulence encounters. The training was generally referred to as Selected Event Training (SET).

As a result, AMR initiated a SET module (upset training), identified as the American Airlines Advanced Maneuver Program (AAMP), as an integral part of initial, recurrent, transition, and upgrade training.

American Airlines on July 27, 1995, submitted a request to the POI requesting approval of "Selected Event Training."[44] The "selected events" included, in part, unusual attitude/recovery to include excessive roll attitudes beyond 90 degrees, and high pitch attitudes beyond 35 degrees. On August 17, 1995, the POI for American Airlines approved the curriculum request.

The FAA stated the maneuvers described as unusual flight attitudes (extreme pitch and roll angles) are not contained in the AC's for simulator qualification and the aircraft manufacturer provides no flight test data for these maneuvers. Without flight test data to validate a maneuver, the NSP is not able to assure that the simulator is properly programmed to replicate the respective airplane throughout these maneuvers. Further, SET training is not a requirement for pilot aircraft qualification and certification. It is additional training, long sought by the NTSB, with the objectives of pilot early recognition and proper control inputs for avoidance and for effective recovery. The emphasis is on recognition and procedures: Precise simulator response fidelity is not required to accomplish this training. A lower performance level flight training device would be equally adequate for SET training. According to the FAA, the use of any

[43] See Attachment J, FAA Correspondence (Flight Standards Handbook Handbook Bulletin for Air Transportation (HBAT) 95-10).
[44] See Attachment J, FAA Correspondence.

training device for procedural instruction is of significant value in preparing flightcrews for events they can never train for in actual aircraft.

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