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

October 1, 2002

MAINTENANCE RECORDS GROUP CHAIRMAN'S FACTUAL REPORT

DCA02MA001

A. ACCIDENT

Location: Belle Harbor, New York

Date: November 12, 2001

Time: 0916 Eastern Standard Time (EST)

Aircraft: Airbus Industrie A300B4-605R, N14053, American Airlines, Flight 587

B. MAINTENANCE RECORDS GROUP

Chairman: Frank McGill
National Transportation Safety Board
Washington, DC

Member: Stephen Carbone
National Transportation Safety Board
Washington, DC

Member: Donald Back
Federal Aviation Administration
Dallas/Fort Worth, Texas

Member: Danny Hodge
American Airlines
Tulsa, Oklahoma

Member: Patrick Marty
Airbus Industrie Technical Services
Toulouse, France

Member: Gérald Gaubert
Bureau Enquêtes Accidents
Paris/Le Bourget, France

C. SUMMARY

On November 12, 2001, at about 0916 eastern standard time (EST),[1] American Airlines (AAL)[2] flight 587, an Airbus A300B4-605R airplane, N14053, 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 (VMC) 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 operating under 14 Code of Federal Regulations (CFR) Part 121.

On November 14, 2001, the Maintenance Records Group met at the American Airlines Maintenance and Engineering facility in Tulsa, Oklahoma, to examine American's A300 maintenance program and the airplane records of N14053. This facility performs base maintenance and modification for A300, DC-10, MD-11, MD-80, F-100, B757, B727, and B737 airplanes, and the records for these airplanes are located here. The Maintenance Records Group completed the field review and examination on November 20, 2001.

D. DETAILS OF THE INVESTIGATION

1. Air Carrier Certificates

(a) American Airlines, Inc. has Air Carrier Certificate (AALA025A), Fort Worth, Texas, which authorizes it to conduct operations as a flag/domestic/supplemental passenger and cargo operator. The certificate date of issue was January 1, 1954.

(b) American Airlines, Inc. has Air Agency Certificate (AALR025A), Tulsa, Oklahoma, which authorizes it to operate as an approved "Repair Station" with airframe, powerplant, instrument, accessory, radio, and limited specialized service that includes nondestructive inspection, acrylic window repair, and composite (bonding metallic and

[1] Unless otherwise indicated, all times are Eastern Standard Time (EST), based on a 24-hour clock.
[2] Three-letter International Airline Decoding Designator assigned on a worldwide basis by the International Civil Aviation Organization (ICAO). The two-letter International Airline Decoding Designator is "AA." The FAA's four-letter designation is "AALA."

nonmetallic components per American's "Bonded Component Structural Repair Process/Procedure Manual"). The certificate was issued on January 14, 1961.

Note:

America Airlines performs contracted maintenance for Federal Express Corporation (FedEx) A300 airplanes, however, the maintenance is conducted under the Air Carrier Certificate (AALA025A). Currently, maintenance is not performed on airplanes under the Air Agency Certificate (AALR025A), and only a few items, such as DC-10 reversers, are shop overhauled under the conditions of this certificate.

(c) American Airlines, Inc. has Air Agency Certificate (DAS1SW), Tulsa, Oklahoma, which authorizes it to operate as an approved "Designated Alteration Station (DAS)."[3] The certificate was issued on July 10, 1970. The DAS procedures manual (revision 43, dated August 1, 2001) was reviewed, including product applicability and base capability.

(d) Under the authority of the FAA, and in accordance with the provisions of Special Federal Aviation Regulation (SFAR) No. 36,[4] America Airlines, Inc., Maintenance and Engineering Center, Tulsa, Oklahoma, holder of Repair Station Certification (AALR025A) and FAR 121 Domestic Operating Certificate (AALA025A) are authorized to develop technical data for use in accomplishing major repairs (excluding emergency equipment), provided the technical data for such repairs complies with the requirements of the special regulation and American Airlines SFAR No. 36 Procedure Manual. The authorization was approved on December 21, 2000, and is effective until January 23, 2004, which is the date that the FAA is scheduled to terminate the regulation. The SFAR procedures manual (revision 12, dated January 26, 2001) was reviewed, including authorization for class 4 airframe repairs for A300B4-605R airplanes and the procedure of SFAR approved repair data from the Aircraft Engineering Division, which includes advanced composite structure.

Note:

Since the accident, American Airlines has surrendered to the FAA its SFAR 36 authority.

2. Operations Specifications

American Airlines' Air Carrier Certificate (AALA025A), which included the standards, terms, conditions, and limitations contained in the Federal Aviation Administration (FAA) approved Operations Specifications (Parts A, B, C, D, and E) were reviewed. The following areas were noted:

[3] Designated Alteration Station has the authority to approve major alterations of type-certificated products when these alterations are initiated, designed, manufactured, and installed by AAL. However, AAL may contract for the installation portion of the major alteration. DAS functions may be performed under its Air Carrier Certificate and/or its Air Agency (Repair Station) Certificate.

[4] Special Federal Aviation Regulation (SFAR) No. 36 allows selected certificate holders to perform major repairs using technical data that has not been approved by the FAA.

(a) D072 Aircraft Maintenance- Continuous Airworthiness Maintenance Program (CAMP) Authorization was dated on August 15, 1997. An Engineering Specification Manual (ESM) defines the maintenance program for each type of airplane operated by American Airlines. The A300-B4605R CAMP document (ESM A300) was last revised on October 11, 2001.

(b) D074 Reliability Program Authorization (all airplanes) was dated on May 27, 1999. The document that describes American's airplane Reliability and Change Control Program is "RECON," ROO-592, and was last revised on November 1, 2000. The document that describes American's engine Condition Monitored Maintenance Program is "CMM," ROO-750, and was last revised on September 11, 2000. These two documents cover the reliability requirements for all of American airplanes and engines.

(c) D085 Aircraft Listing was dated on September 18, 2001, and listed a fleet of 739 airplanes, 35 being A300-B4605R airplanes (N14053 was included in the list).

(d) D086 Maintenance Program Authorization for two-engine airplanes used in extended-range operation was dated on August 15, 1997, and listed ten A300 B4605R airplanes (ROO-592) to a maximum diversion time of 180 minutes (N14053 was not one of these airplanes). The engine listed for the A300-B4605R CMM (ROO-750) program was the General Electric (GE) CF6-80C2A5.

Note:

1. *FAA Advisory Circular AC 120-42A provides the policies of extended range operation for Extended Twin Operations (ETOPS).*

2. *Since the accident, American Airlines no longer operates the A300 as an ETOPS airplane.*

(e) D097 Repair Assessment Program for Pressurized Fuselages was dated on October 17, 2000, and excluded –600 series Airbus A300 airplanes from any flight cycle implementation time requiring further repair assessment guidelines.

3. Type Certificate Data Sheet

FAA "Type Certificate Data Sheet" number A35EU (approved March 28, 1988) for Airbus A300, Model B4-605R (revision 15, January 19, 2001) airplanes was reviewed for compliance conditions and limitations. No discrepancies were noted.

FAA "Type Certificate Data Sheet" number E13NE (approved August 1, 1991) for two General Electric DF6-80C2A5 (revision 16, April 4, 2000) engines was reviewed for compliance conditions and limitations. The Auxiliary Power Unit (APU) was approved as AiResearch GTCP 331-250 (specification 31-2891). No discrepancies were noted.

4. Certificate of True Copy for N14053

The Certificate of True Copy issued by the FAA's Aircraft Registration Branch on November 16, 2001, for N14053 was reviewed. The Standard Airworthiness Certificate[5] was issued for N14053 on July 13, 1988. Also on file with the with the Registration Branch was an FAA Form 337 for "Major Repair and Alteration" made on October 15, 1996 by Airworks (Repair Station Certificate (A13R230N), for the installation of a telephone system (Claircom Communications Group, Supplemental Type Certificate [STC] ST00443NY).

5. FAA Certificate Management and Surveillance

On October 1, 1998, American Airlines was one of ten initial cadre air carriers that began the new Air Transportation Oversight System (ATOS)[6] process.

FAA accident/incident data for American Airlines Airbus airplanes was reviewed from January 1, 1996 to November 29, 2001. 16 events were noted, but none involved N14053. One of the events was as follows:

1. May 11, 1999, N7082, Miami, Florida: Reported erratic rudder movements during manual approach caused by a double fault with the autopilot yaw actuator. After replacement of the yaw auto pilot actuator, the system operated normally. Refer to NTSB Report, DCA-99-1A-058, dated May 17, 1999.

6. Airbus A300-600 Aircraft

The A300-600 airplane is manufactured by Airbus Industrie, with the company's central office in Toulouse, France. The airplane is type-certificated for operation in the United States under the provisions of 14 CFR part 21.29 and the applicable bilateral airworthiness agreement. On January 1, 2001, Airbus became a single integrated corporation consolidating all of its resources that were located in France, Germany, Spain, and the United Kingdom (UK). The company was established as a French simplified joint stock company S.A.S. (Societe par Actions Simplifiee) and two shareholders, the European Aeronautic Defense and Space Company, (a consortium merger among Aerospatiale-Matra of France, DaimierChrysler Aerospace of Germany, and CASA of Spain), and BAE Systems (the result of a 1999 merger between British Aerospace and Marconi Electronic systems) of the UK.

The first flight of an A300 occurred in October 1972, while the A300-600 (a later development of the original A300B2/B4 airplane) entered into service in April 1984. The A300-600 is a twin-engine, widebody (fuselage), Electronic Flight Instrumentation System (EFIS) cockpit, with a range up to 4150 nautical miles. It typically carries about 266 passengers in a two-class twin-aisle cabin, and is operated by two pilots at Mach 0.79, with a maximum operating speed of Mach 0.82. Four variants exist, which include the A300-600, A300-600R,

[5] The certificate is an FAA Form 8100-2 that must be displayed in the airplane.
[6] ATOS is an airline oversight process developed by the FAA with the support of Sandia National Laboratories. It embodies a system approach to certification and surveillance oversight, using system safety principles and risk management built into air carrier operations.

A300C4-600, and the all cargo A300-600F. At the end of October 2001, 242 A300-600 airplanes were in service.

7. Maintenance Review Board Report

The A300-600 Maintenance Review Board Report (MRB), revision 4, dated March 2000, was reviewed. The report outlines the initial minimum maintenance and inspection requirements to be used in the development of an approved continuous airworthiness total maintenance program for the following airplanes: A300B4-600, A300B4-600R, A300F4-600R, A300B4-620, A300C4-620, A300B4-620R, A300F4-620R, and the A300C4-600R variant F.

Requirements in the report have been developed using the Maintenance Steering Group (MSG-3), revision 2, dated September 12, 1993, analysis logic, and lists the approvals from the civil aviation authorities of France, Germany, Canada, and the United States (FAA). According to MSG-3 procedure the overall program is task oriented, and the maintenance process of "hard time," "on condition," and "condition monitoring" are not used.

The MRB Report for the A300-600 is based on the following airplane utilization:

2,500 to 5,000 flight hours (FH) in 15 months
2,500 flight cycles (FC) in 15 months

The basic initial check intervals are:

"A" Check and multiples	400 FH and multiples
"C" Check and multiples	15 months and multiples

The maintenance tasks and frequencies are defined in: "Systems and Powerplant Program," "Structures Program," and "Zonal Inspection Program."

- "**Systems and Powerplant Program**" defines tasks at the level of each Maintenance Significant Item (MSI)[7] considering the failure effects and failure causes.

Note:

In applying MSG-3 logic to MSIs, if a functional failure has a direct adverse effect on operating capability, it is directed to one of five "Failure Effect Categories (FEC)": Evident

[7] Maintenance Significant Items (MSI) are identified by the manufacturer whose failure could affect the safety (ground/flight), and/or is undetectable during operations, and/or could have significant operational impact, and/or could have significant economic impact.

Safety (5), Evident Operational (6), Evident Economic (7), Hidden Safety[8] (8), and Hidden Non-Safety (9).

Maintenance intervals, task descriptions, and FECs were reviewed in ATA 27 (flight controls) areas, including mechanical control of the rudder, rudder trim, and artificial feel and rudder travel limitations. In the Systems Program, there are no references for intervals or FECs in ATA 55 (stabilizers) areas.

- "**Structures Program**" defines necessary inspections for each Structural Significant Item (SSI)[9] developed through evaluation with respect to environmental, accidental, and fatigue damage. Per MSG-3 guidance, each structural item is assessed in terms of its significance to continuing airworthiness, susceptibility to any form of damage, and the degree of difficulty involved in detecting such damage. Once this is established, a structural maintenance program can be developed to be effective in detecting and preventing structural degradation because of fatigue[10], environment deterioration[11], or accidental damage[12] throughout the operational life of the airplane.

Note:

A cross-reference between MRB and American Airlines' Engineering Specification Maintenance (ESM) for the rudder and vertical stabilizer is attached.[13] The cross-reference notes that MRB 55.30.16 is not mentioned in the ESM, however, American accomplished these inspections with four separate SSIs (55.30.04, 55.30.05, 55.30.06, and 55.30.07). The 1998 and subsequent MRB revisions consolidated these four SSIs into 55.30.16, since they were all located in the same area.

The fatigue requirements are stated in flight cycles (FC), and the environmental deterioration requirements are stated in calendar time (years). The Corrosion Prevention and Control Program (CPCP)[14] is contained in the Structures Program. For each SSI, various inspection levels have been considered, with the aim of selecting the lowest

[8] The Hidden Function Safety Effect requires a task(s) to assure the availability necessary to avoid the safety effect of multiple failures. All questions must be asked. If no tasks are found effective, then redesign is mandatory.
[9] Structural Significant Item (SSI) is any detail, element, or assembly, which contributes significantly to carrying flight, ground, pressure, or control loads, and whose failure could affect the structural integrity necessary for the safety of the airplane.
[10] Fatigue damage is the initiation of a crack or cracks because of cyclic loading and subsequent propagation.
[11] Environmental deterioration is the physical deterioration of an item's strength or resistance to failure as a result of chemical interaction with its climate or environment.
[12] Accidental damage is the physical deterioration of an item caused by contact or impact with an object or influence, which is not part of the airplane, or human error during manufacturing, operation of the airplane, or maintenance practices.
[13] See Attachment 11B, References between MRB and ESM.
[14] The purpose of CPCP is to maintain the continuous airworthiness of the airplane structure and to control corrosion to Level 1 or better. Level 1 is corrosion occurring between successive inspections that can be reworked/blended-out within allowable limits as defined by the manufacturer, or damage that exceeds allowable limits but can be attributed to an unusual event, or operator experience has demonstrated only light corrosion between each successive inspection, but the latest inspection and cumulative blend-out now exceeds the allowable limits.

inspection level compatible with the type of damage and the expected damage growth. These levels are:

General Visual Inspection (GVI)

A visual examination that will detect obvious unsatisfactory conditions/discrepancies. This type of inspection might require removal of fillets, fairings, access panel/doors, etc. Work stands, ladders, etc. may be required to gain proximity.

Detailed Inspection (DET)

An intensive visual examination of specified detail, assembly, or installation. It searches for evidence of irregularity suing adequate lighting and, where necessary, inspection aids such as mirrors, hand lens, etc. Surface cleaning and elaborate access procedures might be required.

Special Detailed Inspection (SDET)

An intensive examination of a specific location similar to the detailed inspection, except for the following differences. The examination requires some special technique such as nondestructive test techniques, dye penetrant, high powered magnification, etc., and might require disassembly procedures.

The Fatigue Rating (FR)[15] for ATA 55 (stabilizers) of the structures program concerning vertical stabilizer skin panels, vertical stabilizer to fuselage attach and side load fittings, vertical stabilizer center box and front/rear spars, rudder hinge arms and support fittings, and rudder front spar and internal structure were reviewed. Included in the structures program for SSIs are: threshold (the time when the maintenance task is first due), interval (the repeat interval, which starts at the time of the last maintenance task performed), and concept (maintenance concept applicable to the SSI).

Maintenance concept includes one of the following:

100%	Inspection to be performed on all airplanes.
S	Inspection to be performed in accordance with Sampling Program[16] rules.
Z	Inspection requirements are considered adequately covered by the inspection requirements of the Zonal Program.
C	Task to be considered as part of CPCP.

- "**Zonal Inspection**" defines General Visual Inspections (GVI) of systems installations and structure by aircraft zone, and as per MSG-3 guidance, requires a summary review of

[15] The Fatigue Rating (FR) quantifies the level of fatigue sensitivity to flight duration for each individual SSI.
[16] The Sampling Program is designed to detect systematic deterioration caused by the environment and/or fatigue on a group of airplanes selected from those that have the highest age within a considered fleet.

each zone on the airplane. The repeat inspection interval, which starts at the time of the last performed inspection, was reviewed.

8. A300-600 Maintenance Planning Document

The Airbus Industrie A300-600 Maintenance Planning Document (MPD) is a three-volume manual that provides the manufacturer's scheduled maintenance recommendations and information to assist operators in establishing their own maintenance program and the planning of such maintenance events. Revision 20, dated April 30, 2001 was reviewed.

Among other things, the MPD includes task numbers, task description/preparation data/access requirements, and maintenance intervals/thresholds. For the purpose of program development, Airbus assumed that the 2,500 FH "C Check" would be accomplished approximately every 12 to 15 months.

Volume I includes the following sections: section 6 zonal program (empennage and fuselage tail section and vertical stabilizer sections), section 7 structure program (vertical stabilizer center box/spar sections and rudder spar/side panels/hinge arms), and section 9 airworthiness limitations (life limits/monitored parts, airworthiness limitation items, certification maintenance requirements).

The task description, threshold, interval, 100% limit, and fatigue ratings were reviewed for the areas listed in sections 6 and 7.

Volume II includes the following sections: section 10 aircraft zoning, section 11 access panels and data, section 12 significant structural item (SSI) illustrations.

Volume III includes the following sections: section 14 component data, section 17 low utilization program (vertical attach fittings), section 18 maintenance significant items (MSI) without task.

9. American Airlines Maintenance Interval Program Summary

American Airlines master specification for the A300B4-605R is contained in the "Engineering Specification Maintenance (ESM)" document. The document is maintained in accordance with its Continuous Airworthiness Maintenance Program, Reliability Program, and the Powerplant Condition Monitored Maintenance Program (CMM).

The specification document also contains American's customized requirements that comply with Airbus' A300-600 MRB, and summarizes those tasks and their frequencies to adequately maintain the airplane. Details of the work specified are contained within the

Maintenance Check Manual (MCM)[17] job cards or applicable Engineering Specification Orders (ESO).[18]

The maintenance checks in the document were converted from the MRB report definitions to standard American check intervals, and the following codes are used:

PS	Periodic Service Check	
A	A Check	(MRB Weekly Check)
B	B Check	(MRB- A Check)
C	C Check	(MRB- C Check)
BOW	Bill of Work	CF6-80C2A5 Engine Program

The type and interval of scheduled American Airlines maintenance (ESM, page 2, revision BK, dated February 24, 2000) is as follows:

"PS" Accomplished maximum 2 flying days since last PS or higher check.
SIC (Special Items Card) 0912
ETOPS[19] 1 or 2 (to be used for designated airplanes)

"A" Check 65 flight hours

"B" Check 500 flight hours

"1C" Check	15 months
"2C" Check	30 months
"3C" Check	45 months
"4C" Check	60 months
"5C" Check	75 months
"6C" Check	90 months
"8C" Check	120 months

Main Base Visit (MBV) Initial "MBV" 30 months maximum, subsequent intervals shall not exceed 30 months from last "MBV."

Notes:

1. *Structure Inspection Program contains inspection requirements for SSIs, which must be accomplished on a recurring basis of 100% or a fractional portion of the fleet.*

[17] The Maintenance Check Manual provides maintenance personnel with work cards to be used when accomplishing scheduled or unscheduled maintenance tasks.
[18] Engineering Specification Order (ESO) is issued by the Engineering Department to establish procedures, repairs, and specifications for maintenance functions, and subsequent release to Maintenance for accomplishment.
[19] Extended Twin Operations (ETOPS) check 1 is accomplished immediately prior to each operation from an American city. ETOPS check 2 is accomplished prior to extended range from an international city to America.

2. Zonal Interval Inspection Cards accomplish the general visual inspection requirements for all SSIs as listed in the A300-600 MRB report.

3. At this time, the EMS does not contain document references for task requirements greater than the "8C" Check (24,000 flight hours).

10. Engineering Specification Maintenance

The Engineering Specification Maintenance (ESM) document was reviewed, including sections "Systems-27-Flight Controls," "Structural-55-Fuselage," "Structural-55-Stabilizers," and "Zonal-300-Aft Fuselage and Empennage."

Several selected items from the last "C" Check in December 1999 were:

ITEM	TASK	ZONE	INTERVAL (THRESHOLD)	CONTROL DOCUMENT
Rudder Control	Detailed Inspection Control Linkage	311 325	2C	3206-27
Rudder Control Cables	Check Tension	120	4C	3411-27
Rudder	Functional Check Artificial Feel Unit	210	6C	2843-27
Safety Check Valve Rudder (VAL5684)	Functional Check Safety Valve	310	4C	3414-27
Safety Check Valve Rudder (VALR039)	Functional Check Safety Valve	310	4C	3414-27
Fin to Fuselage	Internal Detailed Inspection Fittings	311 312	5,808 Cycles 5 Years	3254-53
Fuselage Skin External Surface	Internal Detailed Inspection	311 312	5,568 Cycles (16,704 Cycles)	3255-53
Vertical Stabilizer	Internal Detailed Inspection 55-30-03	323	5,568 Cycles 10 Years	3264-55
Rudder	Internal Detailed Inspection (Arms)	325	5 Years (60 Months)	3227-55
Vertical Stabilizer Leading Edge	General Inspection	325	4C (12,600 Cycles)	3213-55
Vertical Stabilizer	Internal Detailed Inspection 55-30-12	323	5 Years (60 Months)	3228-55
Rudder Side Panels	External Special Detailed Inspection	326	5 Years (60 Months)	3232-55

11. Airplane N14053 Information

Manufacturer	Model/Series	Registration	Serial No.	Delivery Date	Total Time	Total Cycles
Airbus Industrie	A300 B4-605R	N14053	420	July 12, 1988 New Airplane	37,550 Hours	14,934 Cycles

- At the time of the accident, American had 35 A300B4-605 airplanes in its fleet, including N14053.

- Passenger Configuration was 251 (16 first class and 235 tourist class).
- Galleys: five
- Lavatories: seven
- Attendant Seats: eleven
- Door Exits in Cabin: eight
- Overwater Equipped

On the new delivery of N14053 from Airbus to American Airlines, several discrepancies and requests were answered by Airbus in the final commitment letter[20] dated July 12, 1988, including concession (TS-9802C) that "Delamination and bonding failure have been found in the aircraft fin central fittings." Airbus' reply was, "Further to the several actions and repairs accomplished, there are no further aircraft limitations. For customer information only."

The Airbus Industrie "List of Constituent Assemblies," including manufacturer and location, for N14053, dated July 8, 1988, was reviewed. It was noted that Messerschmitt-Broelkow-Blohm (MBB) located in Stade, Germany, was the builder for the vertical stabilizer assembly and rudder. List of modifications to S/N 420 included:

MODIF (Modification Initial Fix)

03761	Vertical stabilizer- Modify design at ribs 12, 13, and 14.
05090	Stabilizers- Rudder hinge arms- Introduce new surface protection.
05168	Flight Controls- Modify rudder and elevator frame.
05185	Stabilizers- Rudder- Modify production process.
05218	Stabilizers- Carbon Fiber Reinforced Plastic (CFRP) rudder- add hand hole in rudder spar.
05681	Stabilizers- Vertical stabilizer- Provide wet installation of rivets.
05844	Stabilizers- Vertical stabilizer- Introduce CFRF parts.
06671	Flight Controls- Rudder control- Adapt rudder leading edge.
06923	Stabilizers- Vertical stabilizer- Provide wet installation of CFRP parts.

Concession number TS-9802C[21] (six work sheets, one written in German) from MBB was completed on July 6, 1988, for the repair of the vertical stabilizer spar box (component number HF-1420), including drawing number 32A553-71590-006. The design and remedy of the bonding and assembly were described in the work sheets, with design and remedy actions dated March 9, 1987, for customer information. Concession number TS-9802C included the following:

[20] See Attachments 11C, Delivery Papers of N14053.
[21] See Attachments 11D, Concession Documents.

Description of Divergence:

1. Delamination in central fitting, sheet 2.
2. Bonding failure in central fitting (see sheet 2) and in module 20, see sheet 3.

In this area, a certain bond still exists but it is to be expected that delamination will occur when the part is exposed to stress, since the defect presents itself over a large area of same depth.

Decision and Remedy:

FW Step 1 Bonding Workshop-	Reinforce defect area with 4 Carbon Fiber Reinforced Plastic (CFRP) fabric layers. Configuration and dimensions see sketch sheet 4.
FW Step 2 Assembly-	Riveting of defect area according to sketch sheet 5.

12. Engines: GE CF6-80C2A5

The engines were manufactured by the General Electric Company, and are dual rotor, axial flow, high bypass turbofans. A 2-stage high-pressure turbine drives the 14-stage high-pressure compressor, and a 5-stage low-pressure turbine drives the integrated front fan and low-pressure compressor. Maximum continuous static thrust at sea level is 56,210 pounds. The CF6-80C2B6 engine (used on American Airlines' 767-323ER airplanes) is a common engine with the CF6-80C2A5 at bare engine level (fuel nozzles different on high pressure turbine rotor).

The following engine data was recorded on November 12, 2001, prior to the last flight:

Airplane N14053	**Engine Position 1** (left side)	**Engine Position 2** (right side)
Serial Number	695211	690280
Installation Date	August 13, 2001	November 27, 2000
Total Time (hours)	28,942	31,112
Total Cycles	11,386	12,282
Time Since Visit (hours)	693	2,887
Cycles Since Visit	264	1,072
Time Since Overhaul of Major Module Components	693 hours 264 cycles	9,788 hours 3,735 cycles

13. Auxiliary Power Unit

The auxiliary power unit (APU) was an AiResearch engine model GTCP 331-250H. The engine data was recorded on November 12, 2001, prior to the last flight.

Serial Number	P-1077A
Manufacturer's Part Number	381388-1
Installation Date	September 19, 2001

Total Time (hours)	19,723
Total Cycles	12,104
Time Since Visit (hours)	426
Cycles Since Visit	215

14. Weight and Balance Summary

American Airlines operate on a fleet weight basis, with a specified number of airplanes weighed at 36-month intervals to reestablish weight and balance. The number of weighings depends on fleet size. The weights of airplanes not weighed are adjusted by the average difference between the anticipated weigh and the actual weigh of the weighed airplanes, as FAA approved using the "Fleet Averaging Program."

N14053 was last weighed on July 4, 1997 at station JFK. The results were:

Basic Empty Weight (BEW): 193,677 pounds
Standard Operating Items: 16,132 pounds
Basic Operating Weight (BOW): 209,809 pounds
Basic Empty C.G. 28.2% MAC (1189.6 inches aft of datum)

As the Engineering Change Order (ECO)[22] change the master weighing, new summaries are computed. The last weight and balance summary change for N14053 was listed on November 6, 2001:

Basic Empty Weight (BEW) 193,696 pounds
Standard Operating Items: 16,132 pounds
Basic Operating Weight (BOW): 209,828 pounds

After corrections were made from the requirements of the program N14053 operated as:

BEW 193,418 pounds at arm 1189.04 inches.
EOW 209,600 pounds at arm 1189.00 inches.

15. Service Difficulty Report Data

Airbus A300 "vibration" Service Difficulty Reports (SDRs)[23] for ATA chapters 27 (flight controls), 53 (fuselage), 55 (stabilizers), and 57 (wings) were reviewed from 1995 to November 2001. All of the discrepancies (19) were cleared by maintenance, with no trend setting problems noted. Rudder servos, hinge bushings, flap actuators, and missing seals/panels caused most of the discrepancies.

[22] Engineering Change Order (ECO) is an authorizing document created by AAL engineering to perform modifications, alterations, new installations, technical evaluations, and other support equipment requirements to an airplane.
[23] A Service Difficulty Reports (SDR) is an FAA summation of a "mechanical reliability" report, which is submitted by an aircraft operator or maintenance facility, as required by regulation and without FAA review. FAA form 8070-1 is usually used.

(a) There were 12 Airbus A300 "vibration" SDRs reviewed for ATA chapters 27, 53, 55, and 57, from 1974 through 1994. No trends noted.

(b) There was one Airbus A300 "flutter" SDR reviewed for ATA chapter 27, from 1995 to November 2001, which was caused by the yaw damper system.

(c) There were two Airbus A300 "flutter" SDRs reviewed for ATA chapters 53 and 57, from 1974 through 1994. One discrepancy was caused by a missing fairing seal, and the other by an aileron hinge panel.

(d) There were five Airbus A300 "vibration and flutter" SDRs reviewed from 1974 to November 2001. Three of the discrepancies were caused by engine problems. The other two were caused by a landing gear and fuel over-servicing problem.

(e) There were 29 Airbus A300 "GE CF-6-80 engine" SDRs listed for ATA chapters 71, 72, and 73, from 1995 to November 2001. No trends or unusual events were noted.

(f) There were 54 Airbus A300 "group flight control system" SDRs listed for chapter 27, from 1995 to November 2001, including the following narrative:

American Airlines flight 916, N7082A, A300-B4-605R, serial number 643, aborted an approach to Miami, Florida (MIA) on May 11, 1999. "During approach after gear extension, aircraft experienced uncommanded rudder inputs. Flightcrew decided to go-around to resolve problem. Yaw dampers were cycled with no help, and left off until approach. During go-around, rudder inputs became violent and aircraft yawed. Crew turned aircraft around and landed in MIA.

Pilot write-up reported rudder pedals stiff during approach, and nose wheel steering operated normal on ground. Hydraulic pressures and quantities were normal during entire incident. Engage solenoid in the number one autopilot half of the actuator failed to disengage, due to manufacturing debris in the solenoid. The flight control computer detected the failure, but could not remove hydraulic pressure to the actuator mechanism. The number one pressure shutoff solenoid did not operate because the number one solenoid connector was installed on the number two solenoid, and the number two connector was hooked to the number one solenoid."

(g) There were six Airbus "flight control system" SDRs listed from 1974 to November 2001, including the following narrative:

NWA flight 211, N310NW, A320, November 24, 1996, while on approach into Detroit, Michigan, the Captain reported, "after approach in light icing conditions (with wing and engine anti-ice on), rudder pedals stuck in neutral position. Autopilot was off, returned to normal during taxi. Rudder pedals would not move during flare and roll out, and seemed stiff or possibly locked up." Captain stated that he was at the controls conducting a manual ILS approach.

The autopilot was disengaged approximately 15 miles from the airport and prior to making the turn to intercept final. The airplane flew normally with no adverse yaw noticed during the turn. The rudder/yaw damper appeared to be working normally. Speed on final was reported to be 141 knots. There was a right quartering tail wind, which subside to a very light right cross wind over the runway threshold. Due to this light crosswind, a slight application of rudder/wing low compensation was required for the flair and landing.

When he attempted to apply rudder, it was found that the pedals were locked in the neutral position. Slight banking toward runway centerline allowed a normal touchdown. Differential braking and nose wheel steering were used to exit the runway.

While stopped, the Captain performed several autopilot disconnects to verify the autopilot was disconnected, and several attempts to move rudder the rudder pedals. After about15 seconds of this, the rudder became free and moved normally. He also stated that no great pressure was ever exerted in attempting to regain rudder. He did not try to "break controls free." There were no airplane warning and no system monitoring messages to suggest what may have occurred.

The First Officer (FO) also noted that the rudder pedals were stiff. On the next flight, the FO put his feet on the rudder pedals while the autopilot was on and noted the stiff feel of the rudders, similar to the feel from the previous flight.

Maintenance was not able to duplicate the stiff rudder pedal discrepancy. Cold soaking with dry ice was done to rudder attach points, as a precaution. The rudder artificial feel and trim solenoid was replaced. A flight test was done and the airplane was returned to service.

FAA review of Airbus service history disclosed the manufacturer has had experience with stiff rudder pedals. Airbus technical follow ups (TFU) 27.23.48.01, October 15, 1990, and TFU 27.23.00.01, April 11, 1999, inform of cases of stiff rudder pedals. The rudder pedals were difficult to move during final phase after autopilot disengagement.

Airbus examination has determined that the autopilot was disengaged. Airbus evaluation of two artificial feel and trim units removed from the airplane were tested in icing conditions. The tests confirmed the failure of the artificial feel and trim unit to disengage when autopilot was disconnected. The solenoid was not able to move the connect/disconnect lever due to jamming of the lever.

Airbus released Service Bulletin (SB) A320-27-1042, March 21, 1992, to correct this occurrence. NWA had not incorporated the SB on the airplane at the time of the incident.

(h) There were 807 Airbus A300 "group fuselage structure" SDRs listed for ATA chapter 53, from 1995 to November 2001. All were reviewed. Most of the discrepancies were caused by corrosion. No significant findings relative to the accident were noted.

(i) There were 12 Airbus A300 "group empennage structure" SDRs listed for ATA chapter 55, from 1995 to November 2001, including the following examples:

1. "C" Check, vertical stabilizer rib 1 attach angle to front spar has corrosion on surface.

2. "C" Check, slight damage to trailing edge of rudder between ribs 25 and 26.

3. Rudder trailing edge (T/E) has areas of corrosion over entire length (approximately 33 feet), both right (RH) and left (LT) sides. Total Ship Time (TST): 24,654.15 hours. Cycles: 9,965.

4. Corrosion around lower clevis bolt (hinge) hole. Replaced rudder fitting. TST: 21,241.57 hours. Cycles: 8,851

5. Found corrosion along entire length of rudder T/E RT and LT sides. Replaced apex strip RH and LT sides.

(j) There were 62 SDRs listed for N14053 from 1995 to time of accident. Most of the discrepancies were caused by corrosion to frames, stringers, beams, intercostals, seat tracks, floor support structures, or some other type of support mounting. No significant findings relative to the accident were noted.

16. Last Maintenance Checks Performed on N14053

Periodic Service "PS" Check, including Special Items Card 0912 (seven pages of interior and exterior checks and servicing).

Station	Date/Time	Flight Hours	Cycles	To Go	Trip Number
MIA	09Nov01/2219	37,532	14,926	56	0988
EWR	10Nov01/2225	37,541	14,930	56	0882
JFK	11Nov01/2223	37,550	14,934	56	0988

"A" Check

Station	Date/Time	Flight Hours	Cycles	To Go	Trip Number
MIA	31Oct01/2206	37,465	14,898	22	1367
JFK	04Nov01/1805	37,486	14,908	44	1272
JFK	09Nov01/2219	37,532	14,926	19	0988

"B/C" Check

Check	Station	Date/Time	Flight Hours	Cycles	To Go	Trip Number
106	JFK	18Jun01/1750	36,377	14,494	98	1272
107	JFK	08Aug01/1824	36,822	14,657	55	0610
108	JFK	03Oct01/1815	37,234	14,812	88	1272

Note:

"B" Checks 102 (December 03, 2000) through Check 108 (October 3, 2001) were reviewed. No discrepancies noted.

Main Base Visit (MBV)

Check	Station	Date/Time	Flight Hours	Cycles	To Go	Trip Number
4	TUL	28Jan96/0305	21,713	8,831	812	9142
5	TUL	29Nov97/0003	26,718	10,861	995	9540
6	TUL	09Dec99/0136	32,241	12,979	170	9562

Notes:

Inspection of Vertical Stabilizer Attachment

Detailed Visual Inspections accomplished per A300 MRB every five years:
- Five years is every other MBV (every other TUL visit).
- Area was last inspected at MBV in December 1999.
- Inspection is for all airplanes and is based on Airbus A300 MRB Document (MSG-3 analyzed maintenance program).

17. Review of MBV Checks 4, 5, and 6

A review of MBV Checks 4, 5 and 6, including non-routine discrepancies was completed. Special emphasis was extended to sections ATA 27 (flight controls), 53 (fuselage), and 55 (stabilizer). The Bill of Work Detail Report from MBV Check 5, including the Component Change Record was also reviewed.

(a) MBV Check 4 (January 28, 1996), included the following check inspection cards, non-routine generated cards, and corrective actions.

Inspection Card 3263: A detailed visual inspection of rudder hinge arms number 1, 5, 6, and 7 for SSI 55-30-04. As per the MPD, 55-30-04, 55-30-05, 55-30-06, and 55-30-07 were consolidated into 55-30-16, with an inspection interval of 5 years.

Non-Routine Card 1541924- Rudder #5 and #6 hinge bearing loose.

Corrective Action- Installed serviceable #5 and #6 "A" frame, and performed a functional check.

Non-Routine Card 1541925- Rudder #7 hinge bearings loose on rear spar (two each top).

Corrective Action- Installed serviceable "A" frame, and performed a functional check.

Inspection Card 3265: A general visual inspection of various areas (fin, leading edge, center box, spar, and tip) of the vertical stabilizer, and a detailed visual inspection of the support fittings for rudder hinge arms and hydraulic actuator between ribs 12 and 15 for SSI (55-30-07).

Non-Routine Card 8999- Left and right fuselage to vertical leading edge support has corrosion.

Corrective Action- Removed corrosion per SRM 51-74-10, which included replacing attach section and coupling per SRM 51-72-00, and treating, priming, and painting per SRM 51-22-00.

Inspection Card 3268: A detailed visual inspection of support fittings for the rudder arms at vertical stabilizer ribs 7, 18, 21, and 25.

SSI inspection (55-30-06) of the detailed visual inspection indicated no defects.

(b) MBV Check 5 (November 29, 1997), included the following check inspection cards, non-routine generated cards, and corrective actions.

Inspection Card 3204[24]: This is a seven-part inspection card of the empennage and fuselage and tail section (work zone 300).

Non-Routine Card 2462733[25]- One fastener broken off and AFT fuselage doubler is gouged under vertical stabilizer, RH LWR panel 323AR.

Corrective Action[26]- Replace fastener then blended gouge and treated and painted area per ESO 3095.

Inspection Card 3232: A general visual inspection of the rudder, an internal visual inspection of the vertical stabilizer trailing edge, and a tap check of rudder side panels around forward fasteners up to hinge #5 (SSI 55-40-04).

Discrepancy: Corrosion on LH side of rudder hinge support on front spar under LH LE panel 326FL at rib #17. Corrective Action: Removed corrosion (level 1) per SRM 51-74-10-2.

[24] See Attachments 11E, Inspection Card 3204.
[25] See Attachment 11F, Non-Routine Card 2462733.
[26] See Attachments 11G, Corrective Action of Non-Routine Card.

Discrepancy: Corrosion on rudder hinge support on front spar at rib #14 and under LH LE panel 326HL. Corrective Action: Removed corrosion (level 1) per SRM 51-74-10-2.

Discrepancy: Corrosion on top aft fuselage doubler in two places 18 inches FWD of vertical stabilizer RH FWD attach point under vertical stabilizer RH LWR panel 323AR. Corrective Action: Removed corrosion (level 2) and reworked IAW ESO 30595.

Other non-routine discrepancies from other inspection cards included:

Card 2461902- Upper/lower actuator failed free play check.

Card 2461903- Center actuator and #3 A frame failed free play check.

Card 2462375- FWD fairing RHS of tail has sheared fastener and drill-damaged marks in fitting.

Card 2462687- #1 rudder fitting has corrosion 2 places.

Card 2462722- Top aft corner of rudder is eroded.

Card 2462724- Two static wicks eroded on top of vertical stabilizer.

Card 2462727- Bearings rusty at fwd and aft end of upper triangle hinge support at rudder actuators, and one bolt and nut rusty in control linkage torque tube 10 inches below FWD end of item 1.

Card 2462728- Bearings rusty at FWD and AFT end of CTR triangle hinge support at rudder actuators.

Card 2462729- Bearings rusty at FWD and AFT end of LWR triangle hinge support at rudder actuators.

Card 2462735- Vertical Stabilizer LE panel 322CL stainless LE cap is dented in numerous spots and disbonded in several spots.

Card 2462736- Vertical Stabilizer LE panel 322BL stainless LE cap is dented in numerous spots and disbonded in several spots.

Card 2462737- Vertical stabilizer LE panel 322AL stainless LE cap is dented in numerous spots and disbonded at edge.

Card 2462743- Rudder position transmitter cannon plug eroded and cracked under rudder LH LWR panel 326BL.

Card 2462846- Repair for delamination af GFRP fitting connection 2 through 4 per SRM 55-41-12.

Card 2462687- #1 Rudder fitting has corrosion 2 places on LH leg.

Card 2462696- Paint blistered on metal strip and around static wick base panel 326AT.

Card 2462698- Rudder apex strip has areas of corrosion along length to top to bottom RH and LH sides.

(c) MBV Check 6 (December 9, 1999), including the following non-routine discrepancies:

Card 3114102- Leading edge of vertical fiberglass is eroded.

Card 3114105- LE of fairing top of vertical stabilizer station 800/rib 18 eroded (324AT).

Card 3114107- Intercostal bent between FR 84-86, STR 33 and FR 86-88, STR 30.

Card 3114156- Deep erosion on LE of panel 322AL.

Card 3114157- Deep erosion on panel 324AT.

Card 3114158- Paint blisters on panel 322CL.

Card 3114159- Spots of corrosion on rudder position transmitter lever.

(d) Bill of Work Detail Report for MBV Check 6, including Component Change Record:

ECOs from the report concerning the empennage included:

ECO E0618BX- On one A300 aircraft, it was found that one of the three rudder servo control spring rods was jammed. A300-600 are equipped with identical spring rods. Investigations have shown that internal mechanism parts were heavily corroded. To prevent corrosion, this ECO removed the spring rods, enlarged the drain holes, and installed a new style retainer.

ECO E0832BX- This modification inhibits the rudder trim control (to avoid inadvertent selection), when the autopilot is engaged and the slats are deployed, by incorporating Airbus SB A300-27-6031.

ECO E0869XX- This ECO inspects various control surfaces to ensure that previous repairs are in accordance with the December 1, 1998 revision of the Structural Repair Manual (SRM) and rework as necessary. The ECO also inspects certain critical areas for damage.

Note:

All discrepancies from all three checks were resolved with repairs or corrective actions by American Airlines, and no significant problems were noted.

18. American Airlines A300 Maintenance Check Manual

Inspection guidelines of the Maintenance Check Manual (MCM) provides maintenance work cards with information, which should be used when accomplishing particular scheduled or unscheduled maintenance tasks, or complicated component changes, and as a guide in accomplishing visual inspections. The inspection card specifies the zone to be inspected. American states that these guidelines will be followed when inspecting a zone per the inspection cards published in the MCM. In addition, any specific inspections or checks to be accomplished along with the zonal inspection will be detailed on the card.

"Zonal inspection" states that when a pattern card calls for an inspection, it means that all items within that zone will be inspected using any method necessary. The inspection will be accomplished without removing any components and in line with the open-up access called out on the card. One item to be inspected is structure, which includes corrosion, cracks, distortion, and loose or missing fasteners.

The technical aspects of inspection for A300-600 airplanes do not yet include the "aging aircraft" airworthiness directive (AD) requirements, which provides other guidelines for assessing the severity of corrosion finds and evaluation of maintenance program effectiveness. However, the general structural aspects of inspection include:

(a) General Visual Inspection of Exterior Surfaces

Inspect the exterior surfaces as follows:

1. Check for the presence of corrosion residue.

   Gray or black powder or streaks on aluminum/painted surfaces.
   Red or brown powder or streaks on steel.

2. Clean the area to be inspected, as required, with solvent or soap with water.

3. Check the condition of the protective finish (i.e. alodine[27] or cladding[28]) or paint coating.

   Eroded or abraded finish on leading edges.
   Cracked or scratched paint.
   Filliform tracks or blistered paint.

4. Check condition of sealant in seams and crevices.

5. Check around fastener heads, particularly steel and titanium fasteners in aluminum structure for:

   Cracks.
   Bulges and blisters.
   Loose or missing fasteners.

6. Check bonded honeycomb structure for bulges indicating areas to be inspected in more detail for disbonding.

7. Check skin seams and skin areas over frames, longerons, ribs, and stringers, for bulges and loose or missing fasteners indicating corrosion in the faying surfaces.

8. Check gaps and faying surfaces around access doors.

(b) Detailed Inspection of Internal Pressurized Zones

1. Check condition of corrosion inhibiting compound, if applicable. Inspect for obvious structural distress, and presence of corrosion residue and trapped fluids.

2. Clean the area to be inspected of dirt, oil, and fluid spills.

   Note:

   Removal of corrosion inhibiting compound is required only if indications of deterioration exists or visibility of surface for inspection is impaired.

[27] The registered trade name for a conversion coating chemical of aluminum oxide formed on a piece of aluminum alloy.
[28] A sheet of aluminum alloy, which has a coating of pure aluminum, rolled on one or both of its sides. Cladding is done in the rolling mill when the aluminum is formed into sheets, because aluminum alloys corrode easily, but pure aluminum does not. By rolling a thin coating of pure aluminum onto the surfaces of an alloy sheet, the high strength of the alloy and the corrosion resistance of pure aluminum may be combined.

The MCM also states that task description call outs for "Zonal Detail" are intended to provide guidance as to the depth of inspection required to a particular item within the zone, but not to be construed as the only inspection required. Several of the zones are as follows:

(a) Zone 311/312- Horizontal and Vertical Stabilizer Attachment Area

Perform internal inspection of the zones.

Visually inspect rudder mechanical control including cables and rear quadrant.

Visually inspect pneumatic duct installation. All clamps must maintain the Kevlar envelope form without tension and must have longitudinal separation not exceeding 140 mm (5.5 in.) (Ref. IPC 36-12-04)

(b) Zone 323 Vertical stabilizer Spar Box

Perform an internal detailed inspection of the vertical stabilizer forward/center/aft fuselage attachment and side load fittings (post mod 4886-CFRFIN).[29]

(c) Zone 325 Vertical Stabilizer Trailing Edge

Visually inspect vertical stabilizer trailing edge.

(d) Zone 326 Rudder

Visually inspect rudder.

Note:

From American's GPM Chapter 16 on maintenance programs:

1. *Inspectors, acting inspectors, or designees will perform all inspections and may perform checks.*

2. *Mechanics will perform checks, but not inspections.*

3. *Only inspectors, acting inspectors, or designees qualified per GPM Section 18-02 will perform the Required Inspection Item, identified as RII.*

4. *Only inspectors and acting inspectors will perform those Confirmation Checks[30] identified by Quality Assurance (QA)[31] within the signature block.*

[29] A modification made to the airplane after delivery (Carbon Fiber Reinforced Functional Item Number 4886).
[30] Based on operational criticality, or when there is reason to believe that the work could be incorrectly accomplished, a Confirmation Check is performed.

5. Inspectors, acting inspectors, designees, crew chiefs or mechanics may perform Confirmation Checks as designated above, an open inspection/crew chief block, or an open inspection/mechanic block on a work card. (Refer to GPM Section 18-06 for Confirmation Check requirements).

19. Digital Flight Data Recorder

The Digital Flight Data Recorder (DFDR) is a L-3 Com P/N 2100-4042-XX, solid-state cylindrical Crash-Survivable unit. The DFDR unit is not tracked by serial number. The Identification-Labeling Serialization of AA Material (RSPAM), which is AA's tracking system, is REC8000 for the recorder.

N14053 was upgraded to 34 parameters at Tulsa, Oklahoma on December 8, 1999, with ECO E0890AX, card 0008. Complete subframe and octal readings were accomplished. Functional Checks (task card 2332), including an acquisition check of mandatory parameters, are performed at "2C" intervals (30 months), and the requirement agrees with the A300-600MRB Report. An Audit was accomplished for the 34 parameters in Miami, Florida on September 3, 2001.

20. Cockpit Voice Recorder

The Cockpit Voice Recorder (CVR) is a L-3 Com P/N 93A100-XX, which is tape driven. RSPAM is REC9715 for the recorder.

21. A300 Service Bulletins

Service Bulletins (SBs) for the A300 airplane, including General Electric engine SBs were reviewed. The status listing included disposition and method of compliance. ATA 27 (flight controls, ATA 54 (nacelles/pylons), ATA 55 (stabilizers), and ATA 57 (wings) indicated that applicable SBs had approved disposition with designated ECOs, ESOs, or assigned work card numbers. The SBs reviewed included:

27-6021 Rudder controls- reduce rudder deflection from 5 degrees to 3.5 degrees in high speed flight.

27-6023 Flight controls (mandatory)- rudder servo control spring rod to improve corrosion protection.

27-6027 Flight controls- replace rudder trim control switch.

27-6031 Flight controls- inhibit rudder trim control with autopilot engaged and slats extended.

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[31] Quality Assurance, through its inspectors/designees, has the responsibility to verify product quality in accordance with the requirements of the applicable inspection program and the standards and procedures outlined in the maintenance manuals.

27-6036 Flight controls- rudder hydraulic actuation check for synchronization.

27-6037 Not applicable for N14053.

27-6042 Flight controls- rudder trim control switch installation for new gap.

54-6011 Not applicable for N14053.

54-6014 Nacelles/Pylons- inspect pylon lower spar between ribs 6 and 7.

54-6016 Nacelles/Pylons Rib 12-inspect pylon spigot ball joint hole and improve corrosion protection. This SB was rejected by AA.

54-6018 Not applicable for N14053.

54-6020 Nacelles/Pylons- modify lower spar between ribs 6 and 7.

54-6034 Nacelles/Pylons- inspect rib 5 in the pylon box. MCM cards 4202 and 4205.

55-6006 Vertical Stabilizer- inspect/replace attachment bolts of the transverse load fittings.

55-6015 Vertical Stabilizer- for MSN 417 and subsequent (N14053 was MSN 420) is for information only. These airplanes have CFRP rudders installed as standard, and because of differences in the hinge attachments of the pre and post modification fin boxes and rudders, there is no interchangeability among the components.

55-6016 Stabilizers- Elevator Water Ingress and Elevator Replacement- The reason for this SB, as stated on the bulletin, was during a visual inspection of the upper skin of an elevator, a debonded area was discovered. When the external skin was cut to do the repair, water was discovered in the delaminated area.

The elevator was sent to the manufacturer for investigation. A study of the manufacturing process documentation was made and it was confirmed that all control parameters and manufacturing/inspection specifications had been complied with. A laboratory investigation revealed extensive areas of cracked paint and a high porosity of the upper panel.

It was determined that the water ingress was cause by the high porosity of the external skin combined with secondary affects of cracked paint, lack of surface adhesive and brittleness of the filler surface coat. The debonding was produced by the presence of water inside the upper panel structure.

This ECO (E0482XX) replaces the existing elevators with elevators that have a modification preventing water ingress.

55-6019 Vertical Stabilizer- modify the rudder support strut.

55-6020 Vertical Stabilizer- inspect the rudder support strut (information only), card 3285.

55-6022 Stabilizer and Rudder- replace the rudder hinge-arm bearings to improve the removal/installation procedure (information only). ESO 30595.

55-6023 Vertical Stabilizer and Rudder- inspect the rudder servo actuator attachment-structure for damage due to servo de-synchronization (mandatory). MCM card 3918.

57-6079 Wings- pylon thrust and side-load fitting inspection. Work cards 4216 and 4226.

22. Airworthiness Directives

A review of American's electronic record of accomplishments for the Airworthiness Directive (AD) status list on airplane N14053 included the method of compliance, completion date, AD memorandum, engineering action, FAA reporting requirement, and any revision to the AD.

Per American Airlines' GPM, all files are retained as long as the type airplane exists in the operating fleet, or as long as necessary to fulfill FAR record keeping requirements. Accomplishment of non-repetitive ADs or FARs is issued by Engineering as an ECO or Fleet Campaign Directive (FCD)[32], and status was noted by being completed, open, or not applicable. Modification Program ADs, Corrosion ADs, and Supplemental Structural Inspection Program ADs for A300 airplanes were also reviewed.

AD 94-18-02, which references the document "A300 Corrosion Prevention and Control Program (CPCP),"[33] dated November 1992, is not applicable on N14053, because of the age of the airplane.

The American AD compliance list, including airframe, engines, and appliances was compared to the FAA A300-B4-605A status list. No discrepancies were noted.

Note:

On November 15, 2001, American Airlines issued Fleet Campaign Directive EF0351X. This FCD was to provide a detailed visual inspection of the vertical stabilizer to fuselage attach points and the rudder to vertical stabilizer attach points. The inspection was to look for evidence of unusual conditions or degradation to the attachment points and adjacent structure. The

[32] Fleet Campaign Directive (FCD) is authorized by the AAL engineering department to initiate and record the results of special inspections or actions on an airplane, engine, or component.

[33] A program of maintenance tasks implemented at a threshold designed to control an airplane structure a low corrosion level (level-1). The vertical stabilizer on A300-600 airplanes is manufactured of advanced composite materials, and is not affected by CPCP requirements.

vertical stabilizer is made of carbon fiber reinforced plastic (CFRP) material, and the rudder is made of glass fiber reinforced plastic (GFRP) material.

On November 16, 2001, after the accident, the FAA issued emergency AD 2001-23-51 to require a one-time detailed visual inspection to detect repairs and alterations to, and damage of the vertical stabilizer attachment fittings, including the main attachment lugs and the transverse (side) load fittings; and the rudder hinge fittings, hinge arms, and support fittings for all rudder hinges, and rudder actuator support fittings; and repair if necessary. Damage of the metallic areas includes pulled or loose fasteners, wear areas, distorted flanges, cracks, and corrosion. The French DGAC (civil aviation authority) and the FAA simultaneously issued the AD.

On November 17, 2001, American Airlines issued FCD EF0351B. This FCD was an upgraded revision to meet the inspection requirements as mandated by FAA AD 2001-23-51.

23. Modification History of N14053

An electronic modification history of N14053, which included all ECOs, FCDs, and SBs by AD or FAR number was reviewed. The list included job number, general description, and station and dated that performed the maintenance. Two major repairs were recorded as follows:

March 5, 1992 (forward cargo door lower sill beam contained corrosion damage to the upper flange beneath the outboard roller track at FR25/25A). Damage was repaired by DYNAIR Engineering EO A300-53-134.

September 23, 1998 (during Tulsa MBV, the RHS FR40 lower wing root pick up angle was found to have a 0.8 inch long crack). An interim repair was made, and a permanent modification repair was made to incorporate SB 53-6063, per ECO E0794AX on August 31, 1999.

No discrepancies were noted .

24. Supplemental Type Certificates performed on N14053

The vender Supplemental Type Certificate (STC)[34] list and American's Designated Alteration Station (DAS) authorization STC list were reviewed. There were eight vendor STCs and nine DAS STCs listed. There were no vertical stabilizer repairs performed. No discrepancies were noted.

25. Special Manual Revisions and Repairs Log

American Airlines' Fleet Operations Engineering's (FOE) Special Manual Revision and Repairs Log for N14053 was reviewed. When a condition exists that is not covered in the GPM or is out of tolerance per the maintenance manual, special procedures are used by maintenance. However, Engineering cannot authorize parts missing from an airplane or deviations from or revisions to the Minimum Equipment List (MEL) or Configuration Deviation List (CDL).

[34] A certificate issued by the FAA authorizing a major change or alteration to airplane, engine, or component that has been built under an approved type certificate.

There were 35 Special Manual Revisions and Repairs listed, between April 1992 and October 2001. There were no vertical stabilizer repairs performed. No discrepancies noted.

26. Aircraft Damage Log

The Aircraft Damage Log (ADL) for N14053 is a computerized program that is used to record external damage to the airplane structure that was not permanently repaired at the time the damage was noted. It provides a ready reference to determine that the damage had been previously inspected and either found to be within maintenance manual limits or had an interim repair accomplished.

The log recorded the event date, station, damage and location, field action taken, and date/location of permanent repair, between February 22, 1991 and August 17, 2001. No damage was recorded on tail surface or vertical stabilizer.

27. Vertical Stabilizer/Rudder Removal

American stated that a vertical stabilizer had never been removed from any of its airplanes. Based on Product Team information, American Airlines stated that two or three rudders have been removed to facilitate the removal of "A" frames for shop repair. However, when this event was performed, the rudders were installed back on the same airplane.

28. Shop Repaired Rudder "A" Frames

American's Tulsa Base Maintenance repairs the Airbus rudder "A" frames. (There are seven arm hinge frames that attach the rudder to the vertical stabilizer). The shop repairs consist of dimensioning the size these frames, including component parts, and replacing bushings, bearings, and hardware to the assembly.

American stated that one #3 "A" frame was purchased, but had not yet been used. An "A" frame shop order list from December 15, 1997 to November 12, 2001, noted that N14053 had one induction date (December 1, 1999). Examples from the Airbus Illustrated Parts Catalog (IPC) of the stabilizer to fuselage fittings and "A" frames are attached.[35]

29. Maintenance Reliability

The Maintenance Reliability Program[36] authorization (D74 of the Operations Specifications) allows American to establish and change the frequency and work content of all maintenance and overhaul activities. It also provides a method to relate actual operating

[35] See Attachments 11-H, Examples from the A300 Illustrated Parts Catalog.

[36] A Maintenance Reliability Program is an advanced set of factors that control inspections, checks, and overhaul times for the entire airplane, and is the sole control as far as operations specifications are concerned. The analytical nature of reliability control emphasizes the existence of components and systems to determine maintenance intervals and processes.

experience to established maintenance controls by various applications, data analysis, and evaluations.

This document describes Report ROO-592 American Airlines' Aircraft Reliability and Change Control Program (RECON), and is administrated by the Maintenance and Engineering (M&E) Division. American's engine Condition Monitored Maintenance Program (CMM) is ROO-750.

PIREPS and component premature removals are monitored as three month moving averages are used as data points and are calculated by averaging the current and two previous months of data into one point. Using 12 consecutive months of three month moving averages sets control limits.

Reliability data, beginning in July 1999 to present, (Fleet Maintenance Reliability (FMR) history, delay and cancellation rates and details, Pilot Reports (PIREP)[37] and component rates, significant failures and discrepancies, and RECON system charts, including data analysis) were reviewed for American's all-airplane fleet, including ATA 27 (flight controls), 29 (hydraulic power) 53 (fuselage), and 55 (stabilizers). None of these systems was noted to exceed the upper control limit standard[38] that created specific trend analysis.

This same type of reliability data was also reviewed for only A300 fleet airplanes. From December 1999 through May 2001 (at the time this was the latest summary date available from American), ATA 27 and 29 exceeded the system standard for "Delay" count and rate (per thousand departures) most of the periods, but "PIREP" count and rate stayed under the upper limits, as did premature component removal. No trends or irregularities were established concerning the flight controls, stabilizer, or common component systems.

A Field Maintenance Reliability (FMR)[39] on-request report for N14053 was reviewed from January 1, 2001 until time of accident. The report provides additional data not found on AA E6 logbook discrepancy forms. The data fields of the FMR include mechanical discrepancies, corrective maintenance actions, and MEL deferrals.

The most recent GE engine cruise performance monitoring report was reviewed from August 17, 2001 to November 11, 2001. No discrepancies were noted from any of the parameters.

30. Logbook

[37] Suspected or known malfunctions or unsatisfactory conditions entered by flightcrew into the aircraft log, which requires maintenance.

[38] A system performance number that indicates when investigative action is appropriate to determine whether some kind of corrective action may be necessary. Performance standard numbers consist of system PIREP upper limits and component premature removal upper limits.

[39] Field Maintenance Reliability Report is a real-time management computer system that maintains the maintenance status of each airplane in American's fleet. The report monitors and controls the various maintenance requirements such as: discrepancies reported by flightcrew members, parts required, and selected repairs requiring technical review.

The airplane maintenance logbook forms (AA E6) were reviewed from September 13, 2000, to November 12, 2001. The following are selected discrepancies:

December 3, 2000:	Log 4305372: Pitch Trim #2 will not arm. Minimum Program (LMP)[40] status downgraded. Log 4305375: Accomplished Automatic Flight System (AFS) land checks, no faults noted.
December 10, 2000:	Log 6098857/6098859: Pitch trim #2 tripped off on approach could not reset. LMP status downgraded. Log 6101350: Removed and replaced #2 Flight Augmentation Computer (FAC).
December 21, 2000:	Log 6104631: Overweight landing. Weight at 328,000 pounds. Descent rate 200 FPM. Normal touchdown, roll out, and braking. Accomplished overweight landing check. No evidence of damage found.
February 24, 2001:	Log 6371636: #2 pitch trim does not stay engaged for more than a few seconds. LMP status downgraded. Log 6371640: Performed AFS land test, all system checked normal.
April 24, 2001:	Log 4316261: Pitch trim #2 kicked off during taxi out. Flightcrew placard per MEL. LMP status downgraded. Log 4316262: Performed AFS land test, no faults found.
May 10, 2001:	Log 4316278: #2 pitch trim disengaged during climb-out; would not reengage. Log 6371222: Removed and replaced #2 FAC. Accomplished AFS land test.
May 12, 2001:	Log 6371224: #2 pitch trim tripped off, could not be reset- previous write-up. LMP status downgraded. Log 6371203: Removed and replaced #2 pitch trim actuator. Accomplished #2 pitch trim check. Checks normal.
May 24, 2001:	Log 6371208: #2 pitch trim faulted during climb out. Would not reset. Replaced FAC/ATC/Engine control panel. Accomplished LMP operations test. All checks normal.
June 5, 2001:	Log 6356347: #2 pitch trim tripped and will not set. Found F/O's trim control switch faulty. Deferred. LMP status downgraded. Log 6356354: Removed and replaced #2 toggle holding relay. #2 trim pitch trim operations checked normal.

[40] LMP is an approved program authorizing aircraft operations for lower than standard landing minimums. Maintenance repairs to a LMP system/component must be accomplished in accordance with defined procedures.

June 21, 2001:	Log 6513410/6513411: #2 pitch trim inoperative. Placarded by crew. LMP status downgraded. Log 6513417: T/S and confirmed that the #1 FCC and #1 TCC at fault. Replaced both units. All operations checked normal.
June 29, 2001:	Log 6513783: #2 pitch trim will not engage. LMP status downgraded. Log 6513786: Maintenance and Test Panel (MTP) faults pitch trim control switch. Replaced F/O control wheel. #2 pitch trim operations check normal.
August 12, 2001:	Log 6708400: Overweight landing. Weight at 333,600 pounds. Sink at 180 FPM. Airspeed at 140 knots. Smooth landing. No action required as per MCM card 05-92-14. Ok for service.
August 29, 2001:	Log 5997794: After takeoff, the rudder travel system 2 fault light came on and the pitch feel system light came on. Unable to reset either one. Replaced feel limiter computer #2. Operations check normal.
November 11, 2001:	Log 6641536: #1 FMS will not run in the panel mode. #1 FMS (pilots) went to independent mode at level off, then got stuck on the aircraft status page. Performed tests on #1 FMC per MM, all checks normal. No faults noted.
November 11, 2001:	Log 6641537: Center tank indication on refueling panel inoperative. Reset circuit breakers. Fueling panel checks normal.
November 11, 2001:	Log 6641538: No items
November 12, 2001:	Log 664139: Info to crew: First flight security check complete at JFK at 0130 L.

Note:

Log 664130 was the last maintenance log sheet from flight 587. The logbook was recovered by the NTSB after the crash. No discrepancies were recorded in it.

31. Incident of Cruise Turbulence

On November 28, 1994, Flight 1218, N14053, en route from Bridgetown, Barbados (BGI) to San Juan, Puerto Rico (SJU), experienced severe turbulence (13 pages consisting of the pilot debrief report, FAA incident report, and copies of computer maintenance actions).[41] The flight landed at SJU with injuries to cabin crew and passengers.

[41] See Attachments 11-I, 1994 Turbulence Event.

A special inspection (AE059213) after the flight was because of excessive turbulence or in excess of Vmo.[42] The completed inspection was not available, because of retention of records. A generic copy of the task cards, revision on February 3, 1993, (seven pages) was available.

Inspection item 13 for the vertical stabilizer stated:

Item 13 Inspect torque box externally for distortion, cracks, pulled or torn fasteners, and damaged paintwork. If damage is found, accomplish step 13a, 13b, and 13c.

(a) Open access doors 311AZ and 311BZ and inspect attachment fittings and their adjacent structure for distortion, cracks, pulled or torn fasteners and damaged paintwork.

(b) Inspect front and rear spar webs for distortion, cracks, pulled or torn fasteners, and damaged paintwork.

(c) On rear spar, inspect hydraulic lines, mechanical linkages, electrical looms and their mounts for distortion, cracks, rupture, and fluid leakage.

Note:

The next revision of AE059213 occurred on April 30, 1997. The last revision for the Inspection after Flight in Excessive Turbulence or in Excess of Vmo/Mmo was on June 1, 2001, and is listed in the Maintenance Manual as 05-51-17-0 9 (12 pages). All three inspections of the vertical stabilizer are nearly identical.

31. Other Discrepancies Pertaining to N14053

A computer search review for any hazardous materials incident concerning N14053 was conducted. Except for two minor occurrences (aerosol spill in luggage on January 1996 and ammonia spill on May 2000), no relevant history was disclosed.

Following the accident, a review of all open Minimum Equipment List (MEL),[43] Configuration Deviation List (CDL),[44] and Priority Deferral List (PDL)[45] items was accomplished. There were no items listed for N14053.

32. Interviews

[42] Maximum permitted operating speed.
[43] Minimum Equipment List is a list of items not essential to an airplane's airworthiness that may be deferred for a limited period of time, which is approved by the FAA.
[44] Configuration Deviation List was developed for each airplane type that allows an operator to fly in various nonstandard configurations by identifying specific minor pars that may be missing from the airplane.
[45] Priority Deferral List is a program that provides control and expeditious repair of those deferred items that may have an adverse impact on passenger comfort or convenience.

Interviews that were conducted by the Port Authority of New York and New Jersey on November 19, 2001 were reviewed.[46] The interviews were taken from American's mechanics because these persons were called to gate 22 (flight 587) for trouble-shooting a maintenance discrepancy that was reported by the Captain.

The reported discrepancy indicated that the #2 pitch trim and yaw damper system would not engage. An AFS check indicated a #2 FAC fault. By resetting the circuit breaker, the fault went away. An autoland system check was also performed. At this point, the problem was deemed to have been resolved. The mechanics filled out a non-routine repairs document (E58D-3)[47] form, and had it sent to Tulsa.

33. Parts Information

A list of specified parts information,[48] including repair agents and references was provided by American Airlines for verification. After the accident, there was concern about bogus parts uncovered in Europe. However, none of these parts was supplied to American Airlines. The requested list was reviewed, and no discrepancies were noted.

Frank McGill
Maintenance Records Group Chairman

[46] See Attachments 11-J, Mechanic Interviews
[47] An E58D-3 form is a repair document that reports a discrepancy and includes the repair or corrective action. Discrepancies and work performed are documented on Maintenance Check Cards and /or E58 forms. See Attachment 11-K, E58 Repair Form
[48] See Attachments 11-L, Parts List Documentation.

LIST OF ATTACHMENTS