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

March 12, 2003

Aircraft Maintenance and Records Group Factual

DCA03MA022

A. ACCIDENT

Location:	Charlotte-Douglas Airport (CLT), North Carolina
Date:	January 8, 2003
Time:	0848 EST
Aircraft:	Air Midwest, Flight US5481, Beech 1900D Airliner, N233YV

B. AIRCRAFT MAINTENANCE AND RECORDS GROUP

Chairman:	Stephen Carbone National Transportation Safety Board Washington, DC
Member:	Evan Byrne, Human Performance Specialist National Transportation Safety Board Washington, DC
Member:	William Bramble, Human Performance Specialist * National Transportation Safety Board Washington, DC
Member:	Stephen Wright Federal Aviation Administration Wichita, Kansas

* - Not an original member. Mr. Bramble replaced Evan Byrne as Human Performance Specialist.

Member:	Stanley Patterson ** Raytheon Aerospace, LLC Madison, Mississippi
Member:	Thomas Peay Raytheon Aircraft Wichita, Kansas
Member:	Mark Hackett Airline Pilots Association Pittsburgh, Pennsylvania
Member:	Joseph Machalek Air Midwest Wichita, Kansas
Member:	Michael Madia International Association of Machinists Pittsburgh, Pennsylvania

** - Not an original member. Stanley Patterson became a group member after the retirement of Daniel Szumiesz.

C. SUMMARY

On January 8, 2003, about 0848 Eastern Standard Time, Air Midwest flight 5481 (d/b/a US Airways Express), a Beech 1900D, N233YV, crashed shortly after takeoff from Charlotte-Douglas International Airport (CLT) in Charlotte, North Carolina. The flight was a scheduled passenger flight to Greenville-Spartanburg, South Carolina. The two crewmembers and 19 passengers onboard received fatal injuries and one person on the ground received minor injuries. The airplane was destroyed due to impact forces and a post crash fire.

On January 9, 2003, the Aircraft Maintenance and Records Group convened at the Air Midwest Airlines maintenance base in Huntington, West Virginia, to interview maintenance personnel who worked the elevator control system of the accident airplane. On January 11, 2003, the Group met at the Air Midwest Airlines corporate offices in Wichita, Kansas, to examine Air Midwest's maintenance program and the airplane records of N233YV. This facility houses the Maintenance Control, Training, and company officers for Air Midwest, Inc. The Aircraft Maintenance and Records Group completed the field review and examination on January 13, 2003. The group reconvened in Huntington, West Virginia, to conduct follow-up interviews with maintenance base personnel.

The Aircraft Maintenance and Records Group Chairman performed a review of airworthiness directives, maintenance programs, weight and balance, supplemental type certificates, maintenance discrepancies, service difficulty reports, and contracts. Results of these reviews are summarized in this report.

All Interviews are attached to Appendix A of this report.

D. DETAILS OF THE INVESTIGATION

1.0 Aircraft History

Per Federal Aviation Administration (FAA), Civil Aviation Registration records, the Raytheon Aircraft Company sold the accident aircraft, serial number UE-233, to Mesa Airlines on August 30, 1996. It was registered on November 20, 1996 under tail number N233YV to Mesa Airlines of Farmington, New Mexico.

FAA Number	Serial Number	Delivery Date	Line Number	Total Hours	Total Cycles
N233YV	UE233	8/30/1996	233	15,003	21,332

2.0 Aircraft Maintenance

2.1 Maintenance Summary Program - Raytheon BE 1900D

The Air Midwest (AMI) Maintenance Program Manual (MPM) describes a Continuous Airworthiness Maintenance Program (CAMP) used by AMI. CAMP is broken down into a series of checks and inspections, which incorporates guidance from the Beech 1900D Airliner Maintenance Manual. It was revised by Air Midwest in accordance with the Air Midwest Maintenance Manual, Chapter One.

The checks and inspection times cannot be exceeded, except by use of a Short Term Escalation. A Special Flight Permit can be attained in case an inspection cannot be extended while at an airport that is not a maintenance-accessible station. The inspections and FAA tasks are tracked in the computerized task tracking system called the Reduced Instruction Set Computing (RISC).

Air Midwest has developed a Continuing Analysis Surveillance Program (CASP) in keeping with Federal Aviation Regulation (FAR) 121.373. This program allows Air Midwest to examine the maintenance and inspection program.

The Periodic Service Check is accomplished on layover. The check is performed as a walk-around, visually inspecting safety of flight items and servicing when necessary.

The Routine Inspection is performed every 100 flight-hours. A *Routine Inspection Procedures Checklist* is used to assure the check is completed. The Inspection consists of a visual inspection of the aircraft's major components. The Air Cycle Machine oil inspection panel, engine oil service door, and engine cowling panels are required to be opened to access the engines and propellers. Routine Inspections are performed in association with the Detail Inspections.

The Detail inspections are broken down into six different phases. Subsequent phases are accomplished every 200 flight-hours. The completion of Detail One through Six is one full cycle. An aircraft must complete at least one full cycle each year. Only a subset of the aircraft's components is inspected each phase, resulting in the complete aircraft being inspected within the 1200 flight-hour cycle. The following is a list of specific major component areas covered under each phase:

1. Wings
2. Powerplant
3. Flight Compartment/Cabin
4. Environmental Systems/Nose
5. Landing Gear
6. Aft Fuselage/Empennage

Breakdown of Air Midwest's Maintenance Program (attachment 1):

Periodic Service Check:	As Applicable.
Routine Check:	100 Flight Hours and with Detail Check
Detail Check:	200 Flight Hours
Structural Check:	12,000 Flight Hours, then every 3,000 Flight Hours
Engine Program:	Trend Group Analysis program.
Hot Section Inspection:	8,000 Flight Hours

Each inspection phase also includes General Service Items and Operational Inspection Procedures that require functions necessary to guarantee the aircraft's continued airworthiness.

Structural inspections are performed in accordance with guidelines set down by the manufacturer (attachment 2). The structural inspections begin at 12,000 flight-hours and follow every 3,000 flight-hours later.

The inspection schedule is:

A Check:	12,000 flight-hours
B Check:	15,000 flight-hours
C Check:	18,000 flight-hours
D Check:	17,500 flight-hours
E Check:	20,500 flight-hours
F Check:	24,000 flight-hours
G Check:	30,000 flight-hours

The previous checks for aircraft N233YV were accomplished as follows:

Periodic Service Check:	January 6, 2003
Routine Check:	January 6, 2003 & December 17, 2002
Detail Check 6:	January 6, 2003
Detail Check 5:	December 5, 2002
Detail Check 4:	November 7, 2002
Detail Check 3:	October 11, 2002
Detail Check 2:	September 16, 2002
Detail Check 1:	July 31, 2002
Structural Check:	August 27, 2002

2.2 Aircraft Summary

Total Hours at Time of Accident:	15,003 Flight Hours
Total Cycles at Time of Accident:	21,332 Flight Cycles

2.3 Weights and Balance Summary

An aircraft weigh is done every three years or when the aircraft is repainted. The aircraft was last weighed August 9, 2002 in Dubois, Pennsylvania (attachment 3).

Empty Weight	10280 lbs
Empty Weight Arm	282.4 in/lbs
Basic Operating Weight	10660 lbs
Basic Operating Weight Arm	276.9 in/lbs
Index	12.48

A Supplemental weighing was performed for installation of the Automatic Data Acquisition System on September 8, 2002, in Panama City, Florida.

New Weight added	12.6 lbs. at 57.5 in/lbs
New Basic Operating Weight	10672.6 lbs
New Basic Operating Weight Arm	276.7 in/lbs
New Index	11.95

2.4 Engines: PT6A-67D

Engine Position	Serial Number	Install Date
1	114328	10/24/1999
2	114091	1/9/1998

Section	Serial Number	Limit (Hours)	Limit (Cycles)	Hours Installed	Cycles Installed	Date Installed
#1 Gas Generator	114328	12,500	N/A	2,443.9	N/A	11/2/2001
#2 Gas Generator	114091	12,500	N/A	1,224.5	N/A	5/28/2002
#1 Hot Section	000X9Y2	N/A	8000	N/A	3,318	11/2/2001
#2 Hot Section	A0001YL6	N/A	8000	N/A	6,515	5/28/2002
#1 Power Section	114301	10,000	N/A	4,777.2	N/A	2/2/2000
#2 Power Section	114343	10,000	N/A	1,224.5	N/A	5/24/2002

2.5 Engine Monitoring System

Per the Air Midwest MPM, the engines are monitored as part of the Trend Group-Turner Trend Analysis program (attachment 4). Engines are maintained in accordance with the Air Midwest CAMP program and are based on the life cycle limits of the rotating components. Pratt and Whitney Canada Service Bulletins and engine teardown data determine these limits. Overhauls are performed at the Pratt and Whitney Canada Overhaul Service Center or at a Pratt and Whitney Canada PT6A-67D authorized Certified Repair Station.

The Trend Group in Clovis, California, provides a trend analysis of engine performance. The service reads crucial data from each engine and provides an analysis of its condition. This information is transferred to Air Midwest for tracking, reliability, and maintenance planning purposes.

2.6 Propellers: Hartzell HCE4A3I

Engine Position	Serial Number	Install Date	Cycles Since O/H	Hours Remaining	Time Since Installation	Last Shop Visit (HRS)	Total Hours	Total Cycles
1	HJ852	5/7/2002	5,167	667	3,991	3,991	12,869.8	18,879
2	HJ454	9/10/2001	3,703	1,949	2,709	2,709	11,263.6	16,505

Per the AMI MPM, the propellers are maintained under an approved Air Midwest CAMP program. The program provides guidelines for maintenance items and requirements to inspect, service, and replace life limited components. Overhauls are performed in accordance with the Hartzell 143 Overhaul Manual.

2.7 Aircraft Status

2.7.1 Minimum Equipment List (MEL)

Per AMI records, there was one open MEL item at the time of accident:
Vapor Cycle Machine inoperative. A "C" category item due to be repaired by January 17, 2003.

2.7.2 Aircraft Condition Report

Per AMI records, the Aircraft Condition Reports reviewed. One open item:
October 10, 2002 – Dent left wing leading edge. Repair due at next de-icing boot change.

2.7.3 Supplemental Type Certificates[1]

Supplemental Type Certificates supplied by AMI were reviewed.
One Supplemental Type Certificate was issued to upgrade the Flight Data Recorder with four extra parameters.

2.7.4 Airworthiness Directive (AD) Summary and Service Bulletins (SB)

The FAA provided AD and SB summaries, which were reviewed. All listed Airworthiness Directives and Service Bulletins have been complied with.

Four AD/SB items are of note:

AD 2002-23-11: Prevent Balance Weight Attachment Screws from Becoming Loose, Which Could Restrict Elevator Movement. This was accomplished on December 20, 2002. The item was previously complied with as a Service Bulletin #27-3187R1, under Work Order #1020827062 on August 3, 2002. No defects were noted (attachment 5).

AD 99-09-15: Flight Controls – Inspection for Control Column Interference with Wiring Behind the Instrument Panel. This was accomplished on October 11, 2002 as part of the Detail Three inspection as Service Bulletin #27-3232 (attachment 6).

Service Bulletin #27-3492: Flight Controls – Control Column Inspection/Modification. This was accomplished on August 27, 2002 on Work Order #05-10208270 (attachment 7).

[1] The FAA issues supplemental Type Certificates. They authorize a major change or alteration to an aircraft, engine, or component that has been built under an approved Type Certificate.

An Emergency AD was issued following the accident on January 27, 2003, AD #2003-03-18. The AD, distributed to all Beechcraft 1900 Series operators, required control column sweeps and stop bolt inspections to determine these items were in compliance (attachment 8).

2.7.5 Prior Discrepancies/Accidents Involving N233YV

Per AMI records, no previous accidents were reported for the accident aircraft.

2.7.6 Logbook Forms

The maintenance paperwork was reviewed from January 2001 through January 2003 for discrepancies, specifically discrepancies related to elevator or pitch control discrepancies. No trends or discrepancies noted.

2.7.7 Service Difficulty Reports[2]

The FAA Service Difficulty Reports were reviewed for the accident aircraft. No flight control maintenance trends or discrepancies were noted (attachment 9).

3.0 Maintenance Participants

Prior to the accident, the most recent scheduled maintenance performed on the accident aircraft was at the Huntington, West Virginia, facility (HTS) on January 6, 2003. Interviews, document review, and tests were conducted to obtain information about the maintenance performed at this station and organizations involved in this work[3].

3.1 Structural Modification and Repair Technicians, Incorporated

Structural Modification and Repair Technicians, Incorporated (SMART), supplies Raytheon Aerospace[4] Limited Liability Company (LLC), with personnel employed as maintenance mechanics and foremen (Lead Mechanics). SMART headquarters is located in Edgewater, Florida, and they recruit personnel from their site using the Internet. SMART recruits and provides to aviation industry clients a variety of support personnel, including: maintenance mechanics, inspectors, management, engineering, and technical writers.

[2] A Service Difficulty Report is a FAA summation of a “mechanical reliability” report. They are submitted by an air operator or maintenance facility. They are required by regulation.
[3] See Human Performance Specialists Factual Report for additional information about personnel, human factor issues, and the HTS base.
[4] Raytheon Aerospace Limited Liability Company is not to be confused with the manufacturer, Raytheon Aircraft Corporation.

SMART accepts resumes from interested aviation personnel through recruiters or the website, then qualifies the applicant by running the necessary 5-year history/security checks and conducting drug testing. According to interviews with SMART mechanics, there is no formal interview process to determine an applicant's experience level.

If the applicant passes the required drug testing and reference checks, they are allowed to bid open job postings and are placed at a client organization by SMART. While at the client organization, the employee continues to work for SMART, not the organization they are performing the work for. All pay and benefits are provided to the employee by SMART. SMART doesn't oversee, evaluate, or direct its employees at the contracted client's site(s). According to the SMART, Inc mechanics interviewed, the only routine communications they receive from SMART is their paycheck and when they have initiated a request to the company for reassignment, in which case they will be notified of availability.

3.2 Raytheon

The Raytheon Company is a parent company to several branches of aerospace divisions, including the Raytheon Aircraft Company. The Raytheon Company maintains a 26% holding in Raytheon Aerospace, while Veritas Capital, Inc owns 74%. The headquarters are located in Lexington, MA.

The various divisions of Raytheon include:

- Government and Defense contracting
- Computers
- Electronics
- Technologies
- Aircraft manufacture, resale, charter, and services

3.2.1 Raytheon Aircraft Company

The Raytheon Aircraft Company (RAC) is the manufacturer of the Beech BE 1900D Airliner. The headquarters for this division is in Wichita, Kansas and is a subsidiary under the Raytheon Aircraft group of companies. All the companies in the Raytheon Aircraft Group are subsidiaries of Raytheon Aircraft Holdings Inc.

RAC designs, manufactures, markets, and provides support for the jet, turboprop, and piston-powered aircraft. The aircraft RAC provide are used in the military, commercial, regional, and personal aviation markets.

RAC provides engineering support for Air Midwest Inc. RAC revises the manuals and parts catalogs Air Midwest uses to maintain the aircraft. Raytheon Aircraft Co provides engineering support for repairs and modifications in cooperation with Air Midwest's Maintenance Control staff.

3.2.2 Raytheon Aerospace, LLC

Raytheon Aerospace, LLC (RALLC) has their company headquarters located in Madison, Mississippi. Operating in 50 states, RALLC provides aircraft logistics and training support for military and government aircraft.

RALLC provides maintenance mechanics (contracted to RALLC by SMART), foremen, quality assurance inspectors, and maintenance managers as part of its contract service to Air Midwest Inc. The contract services RALLC provides to Air Midwest are located in Dubois, Pennsylvania; Huntington, West Virginia (HTS); Farmington, New Mexico; Little Rock, Arkansas; and Panama City, Florida.

The personnel employed to meet the contractual needs of Raytheon Aerospace, LLC in HTS are as follows:

Raytheon Aerospace

- One Maintenance Manager (MXMGR)
- Two Quality Assurance Inspectors/Foremen

SMART, Inc

- Seven Airframe and Powerplant (A&P) certified Maintenance Mechanics[5]

One Quality Assurance (QA) Inspector is designated as the primary QA Inspector. The second inspector's regular duty is as the Foreman. The second Inspector will assume the primary inspector's duties when the former is off work. In this event, a SMART mechanic will become Foreman. With the work schedule in effect at the time of the accident, this SMART mechanic acts as Foreman four nights out of seven.

The Inspectors/Foremen report directly to the RALLC MXMGR, who directs, disciplines, and evaluates the QA Inspectors. The MXMGR reports to his superior, who is located in Little Rock, Arkansas.

The RALLC Foreman assumes the QA Inspector's duties when the Inspector is off duty. The Foreman's responsibility is to assign work and follow the progress of the work assignments.

The MXMGR has limited managerial oversight over the seven A&P mechanics from SMART. The MXMGR works the day shift hours and does not personally oversee the work performed by the A&P mechanics. As per the interview, the MXMGR is dependent on the verbal input from the Foreman.

[5] The seven maintenance mechanics are SMART, Inc employees.

As per interviews, neither the Manager nor the Foreman discipline or evaluate the A&P mechanics. An A&P from SMART who doesn't meet work standards set by Raytheon Aerospace, LLC would be dismissed by SMART. It is determined by the MXMGR whether another A&P from SMART would replace him/her.

It is the responsibility of the MXMGR to assure the work is performed in accordance with Air Midwest Maintenance Manuals 210 and 260. The MXMGR and Foreman (attachments 10 and 11) provide the job assignments. The Foreman follows the progress of the work assigned while working the shift with the mechanics. The shift the MXMGR works does not align with the mechanics, foremen, or QA inspectors he manages.

The RALLC QA Inspectors and Foreman provide On-the-Job Training (OJT) to the mechanics and are responsible for signing off the trainee/mechanic on the training performed. The trainer follows the mechanic through the job and evaluates their understanding of the task(s). As on January 6, 2003, a single trainer is required to train two or more mechanics on separate tasks, while inspecting work on conflicting assignments.

Note: As per an interview, the primary Inspector stated that the QA inspector does not perform the function of teaching OJT. The interview specified that OJT is the Foreman's function.

3.3 Air Midwest, Incorporated

Air Midwest operates as a Part 121 Operator, a Domestic air carrier operator, operating under certificate number AMWA510A. The parent company, Mesa Air Group, is based out of Phoenix, Arizona. Air Midwest runs its own operation, separate from the parent company. Through a code share agreement with US Air Express, Mesa Air/Air Midwest operates its fleet of BE 1900D aircraft under the US Air Express livery.

Air Midwest has its main office in Wichita, Kansas. Beginning in 1999, Air Midwest assumed the Beech 1900D fleet from Mesa Airlines. Until September 30, 2002, Wichita was Air Midwest's maintenance base. Due to flight schedule changes, AMI no longer scheduled flights into Wichita and the maintenance operations in Wichita were eliminated. The maintenance work was moved to Little Rock, Arkansas, where RALLC performs maintenance on the AMI fleet. The stations at Dubois, Pennsylvania; Farmington, New Mexico; and Panama City, Florida were also opened as contract maintenance stations. The present contract with Raytheon Aerospace was re-negotiated in September 2002, following the original contract dated September 2001.

AMI-employed maintenance mechanics work for Air Midwest at its Line Maintenance facility in Kansas City, Kansas.

Huntington, West Virginia (HTS) was opened in July 2002 as a result of Air Midwest taking over routes previously operated by CC Air, another Mesa-owned airline.

AMI coordinates the maintenance program through its Part 121 certificate. There are three manuals that provide guidance related to the Aircraft Maintenance program:

- Manual 210 – Maintenance Procedures Manual
- Manual 240 – Maintenance Training Manual
- Manual 260 – Maintenance Program Manual

According to the organization chart (attachment 12), an AMI Maintenance Manager oversaw the Maintenance Foremen, a Materials Supervisor, and a Purchasing Agent. The Foremen oversaw the mechanics and aircraft cleaners. On September 30, 2002, the mechanics at AMI were furloughed due to routing changes. Discontinued service to Wichita, Kansas, made the Maintenance Manager position unnecessary. This Manager was promoted to the Director of Quality Assurance to fill a previously vacated position. The contracted RALLC maintenance managers and mechanics answer to their management (attachment 13), who report to the DOM for AMI.

Personnel working on the AMI aircraft at the various maintenance facilities must be familiar with the policies and procedures spelled out in the AMI Aircraft Maintenance manuals: 210, 240, and 260. The On-site AMI Quality Control (QC) Manager, or Regional Site Manager (RSM) puts the new employees through a four-hour Indoctrination program. The Indoctrination program explains Air Midwest's paperwork, tooling, equipment, safety policies, and training practices. It is accomplished before the mechanic begins work at the AMI facility. A written test is given afterwards to determine their understanding of the material and training. A grade of 70% is considered a passing score. Indoctrination training is overseen by the Maintenance Training Coordinator (MTC), but is delegated to on-site management.

Prior to the accident, AMI did not supply their own mechanics, foremen, or managers to work the aircraft at the HTS station. The RSM has been available at the HTS facility since July 2002. He does not supervise the RALLC or SMART personnel: MXMGR, Foreman, QA, or the mechanics. The MXMGR and the RSM do not share a common chain of command, but answer to separate companies. According to interviews, the interaction between the two is based on the relationships fostered between them, which though cordial, has no defined structure.

The Regional Site Manager's duties include quality control functions for AMI (attachment 14). Per the interview with the RSM, he works Day shift where his tasks include verbal turnovers of the day's assignments, taking part in the 9:00 AM, 9:30 AM, and 4:00 PM maintenance calls. He then reviews accomplished maintenance paperwork and OJT records. These forms are checked for both quality and accuracy. The OJT records are recorded, as accomplished.

The RSM is responsible for reviewing all maintenance and engineering paperwork accomplished in his jurisdiction. The paperwork must meet the standards set down by Air Midwest. The RSM is responsible for auditing the stations that fall into his/her region. Station and fuel provider audits are performed by the RSM to assure these contractors are following Air Midwest standards.

Note: In February 2003, the RSM was re-assigned from day shift to night shift, aligning with the RALLC/SMART work crews. This move allows the RSM to be present at the station when the work is performed. According to an interview with the RSM, this move prevents him from being an active participant in the morning and afternoon maintenance calls since they fall out of his shift times.

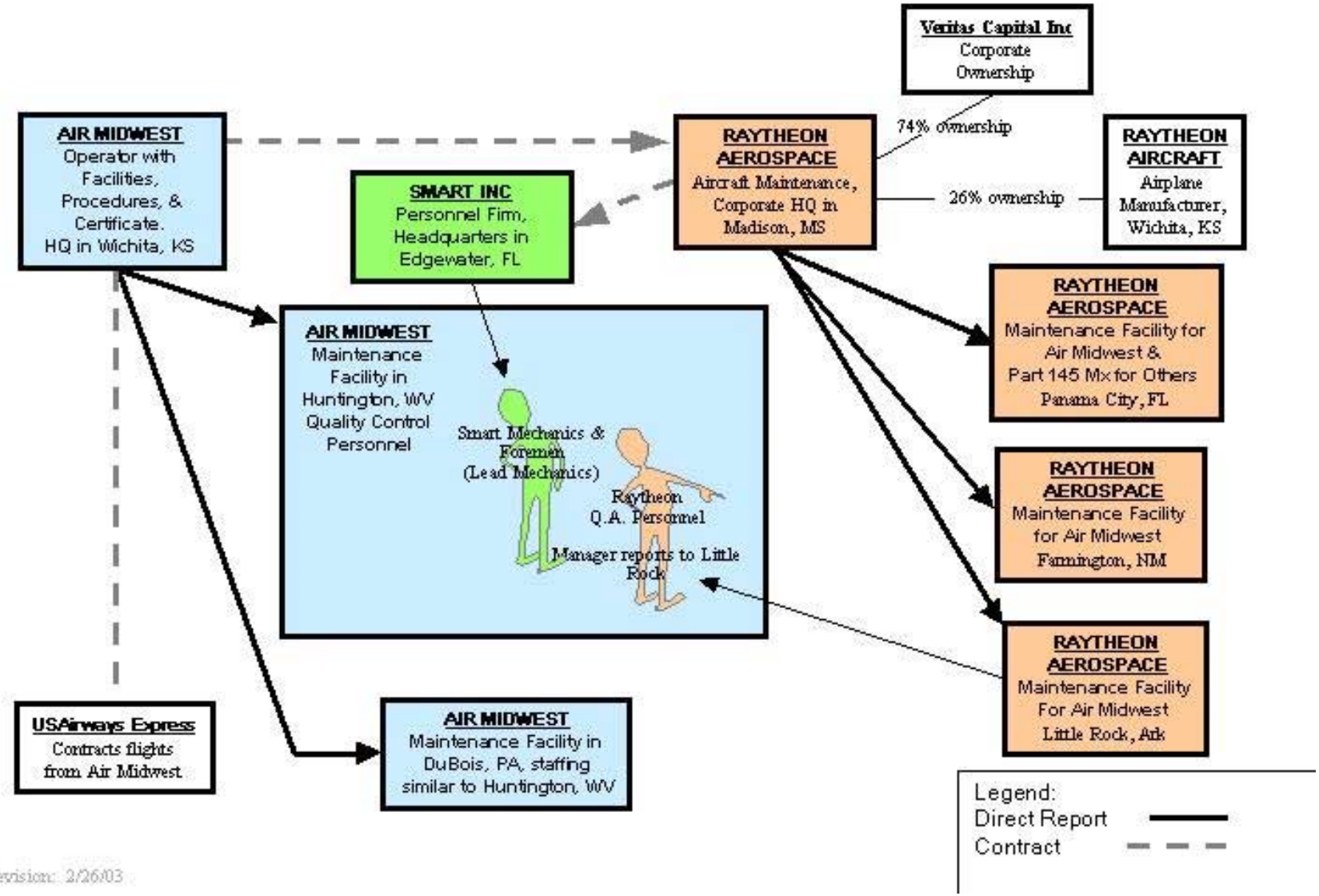
4.0 Training

Air Midwest maintains its training program in compliance with Federal Aviation Regulation (FAR) 121.375. The Director of Maintenance (DOM) and Director of Quality Assurance (DQA) have joint responsibility for assuring all required training is performed. The Maintenance Training Coordinator (MTC): assures that training records are properly recorded, develops training and testing programs, and assures OJT is recorded and completed in a timely manner.

Indoctrination training precedes an employee's start date. The employee is given a 4-hour introduction course that trains one on Air Midwest's paperwork, policies, safety, and procedures. The employee then demonstrates their knowledge with a written test, in which they must score 70% to pass. The record is then updated as being complied with. The MTC does not perform the Indoctrination training at the sites. The Regional Site Manager performs this function at each site and forwards the training record to the MTC.

The aircraft Systems training for the A&P mechanics, manager, foremen, and QA Inspectors at HTS is accomplished through either formal Systems training or On-the-Job Training (OJT). According to the training records and interviews, only one QA Inspector has received formal Systems training. All other training has been a result of OJT. Per an interview, the MTC has the authority to seek training class opportunities for the mechanics, but the training department doesn't pursue familiarization training.

Parties and Personnel Involved in Air Midwest Maintenance



Revision: 2/26/03

5.0 Contracts

5.1 SMART and Raytheon Aerospace, LLC

The contract between SMART and RALLC (attachment 15) was signed March 25, 2002. There are 22 agreement statements throughout the contract identifying conditions in which the two companies will work together.

Per the contract, aircraft maintenance personnel are chosen and supplied by SMART. SMART takes care of pay, worker's compensation insurance, vacations, working conditions, terminations, working hours, leave, and similar administrative duties for the maintenance personnel. SMART shall inform their employees to follow regulations and policies required by RALLC, provided these rules are communicated in a timely manner.

RALLC has no control over which mechanics they receive from SMART. SMART determines which mechanics to refer to RALLC for employment. RALLC does have the final decision on whether to put the SMART employee to work or not. There is no management control of the mechanic workforce by RALLC, except at the technical and administrative level in assigning work assignments. Per the interviews, SMART does not provide a means for evaluating the work capabilities of the employees they decide to contract out nor do they provide on-site supervision of their employees.

5.2 Raytheon Aerospace, LLC and Air Midwest, Inc

The contract between Air Midwest, Inc (AMI) and Raytheon Aerospace, LLC is a sixty-month agreement (attachment 16). It became effective on January 1, 2003. There are 29 statements of understanding and three Appendices that explain the conditions of the Agreement.

AMI provides the procedures for maintenance, training, and the program that RALLC will follow. These are provided under Air Midwest's Part 121 certificate. AMI sets the standards for documentation, use of aircraft parts, and how the maintenance actions are to be performed. AMI supplies the necessary consumables, routable parts, and equipment.

AMI has responsibility to provide:

- Technical Data Management.
- Quality Control/Quality Assurance Inspection (Subject to approval of the Flight Standards District Office).
- Technical Libraries.
- A means of tracking time-compliance items and hard-time items.

The responsibility of the hangar facilities belongs to AMI for Dubois, Pennsylvania and Huntington, West Virginia. AMI and RALLC share the costs of leasing the facility at Little Rock, Arkansas. AMI controls the Hazardous Materials and ensures the quality of the Environmental conditions at the three facilities.

RALLC provides maintenance crews to the sites determined by AMI. RALLC is responsible for pay and benefits for the employees and will work towards guaranteeing AMI a Reliability rate of 99%. Raytheon Aerospace, LLC provides manpower for Scheduled Maintenance, Unscheduled On-call Maintenance, and Line Maintenance.

Raytheon Aerospace, LLC is responsible for the Farmington, New Mexico facility.

5.3 Contract Issues

The SMART home office provides its new hires with security checks and drug testing, when the applicant submits a resume. An employee then qualifies to work for Raytheon Aerospace, LLC and other contractors. Per interviews performed on January 30, 2003, mechanics hired for SMART forego any formal interview process and are hired sight-unseen.

The RALLC/AMI contract requires that the mechanics working for Raytheon Aerospace, LLC follow procedures found in Air Midwest Maintenance Procedures Manual, pages 2.23 and 2.24 (attachment 17). These same procedures direct the RA contract employees on what their job assignments for AMI consist of. These manual procedures were written while the AMI employees occupied the maintenance positions, with a revision date that precedes the furlough date.

The SMART/RALLC contract specifies that SMART employees report to SMART for management issues, e.g., termination, work hours, etc. Per this contract, RALLC has the right to terminate the use of SMART employees. The RALLC MXMGR must depend on SMART to implement management tasks, e.g., the termination of employees.

Per an interview, the Huntington, West Virginia, RALLC MXMGR stated he doesn’t work the same shift as the SMART employees. He relies solely on the night shift foremen to provide information on the SMART employees and their performance. One of the foremen is a SMART employee and a coworker of the mechanics.

The RALLC MXMGR, RSM, and Foremen provide the supervision to assure the SMART employees follow the procedures spelled out in the Policy Manuals. The MXMGR and RSM do not enforce the rules by means of any standard managerial practice. Per the interviews, the RALLC MXMGR does not document or accomplish: performance reviews, hiring interviews, performance issues, or disciplinary actions.

The SMART contract provides a specific number of employees to RA to fulfill their contract with AMI. The employees are not dedicated to RALLC, but have the freedom to relocate with SMART outside the RALLC/AMI system. In the Huntington, West Virginia station, one employee has worked with SMART for one year. The other five have replaced previous SMART employees that had left since the station opened in July (attachment 18). Of these employees, four were hired in December 2002, and one in November 2002.

6.0 Maintenance Performed, January 6, 2003

6.1 Huntington, West Virginia Facility

The Huntington, West Virginia (HTS) facility is located at the Tri-State/Milton J. Ferguson Field in the town of Huntington, West Virginia, located on Airport Road. It is leased by Air Midwest Airlines and used by Raytheon Aerospace, LLC. The facility, which is located on the northwest side of the airfield, (attachment 19) is a fully enclosed hangar with a retractable aircraft entry door.

The facility has two large gas heaters on either side of the hangar bay. The aircraft parks diagonally in the bay, with the hangar door at a 45-degree angle to its port side. There is an assortment of equipment available to the mechanics, including: motorized high lifts, ladders, a forklift, and portable kerosene heaters.

Lighting units were added to the ceiling in the end of January 2003[6], to increase the illumination in the hangar bay. A tool crib is located inside the west wall for accessing aircraft tools and other calibrated tooling. Various tools, parts, and servicing units are located in the hangar bay area for use on the aircraft. Aircraft manuals, printers, and company documents can be accessed in the office area on the west side of the hangar.

6.2 Weather

The ambient temperature at the HTS airfield on the night of January 6, 2003 was (–3) degrees Centigrade (28 degrees Fahrenheit) (attachment 20).

[6] Lights were installed after the accident. However, their installation had been planned for before the accident and was the result of a recommendation made during an earlier audit of the facility.

6.3 Detail Six Check

On January 6, 2003, aircraft N233YV underwent a Detail Six (D6) phase check (attachment 21) as part of its approved phase maintenance program using guidance from the Beech 1900D Airliner Maintenance Manual. The D6 check was performed at the Huntington, West Virginia (HTS) station beginning at night on January 6 and ending January 7, 2003 in the morning.

The emphasis of the D6 check on the Raytheon BE 1900D is on the empennage and aft fuselage, which includes visual inspections, lubrications, free play checks, engine borescopes, engine mount torque checks, servicing, operational checks, and cable tension checks.

The aircraft schedule shows arrival at 9:20 PM EST. The passengers and cargo were offloaded and the aircraft was turned over to Maintenance. Prior to performing maintenance, the mechanics complied with an *Engine Ground Performance Worksheet* (attachment 22) to accomplish pre-dock operational checks. This worksheet checks the engine parameters and readings at different phases of operation. There are no other check forms for pre-dock available in the *Maintenance Performance Manual*. According to interviews, (please refer to Appendix A for all interviews) the aircraft arrived at the hangar for maintenance between 10:00 and 10:30 PM.

The night of January 6, the Quality Assurance (QA) Inspector was instructing two mechanics on specific tasks within the D6 check. He was training with the intention of signing off their OJT records as having complied with the task instruction. In addition to training, the Inspector was: overseeing a fuel control replacement on the #1 engine, performing a borescope inspection on the #1 engine, and covering the Inspector duties on the rest of the aircraft.

One trainee (M1) was assigned to inspect and check the elevator and rudder flight control cables. M1 performed these tasks with the intention of being checked out on his OJT form. A second trainee (M2) was assigned to check the elevator tab play[7] measurements on the man-lift at the tail. M2 worked with the Inspector to comply with these checks that were outlined in the D6 paperwork.

[7] Play refers to the amount of static movement a bearing allows when testing, e.g., a flight control surface. If the movement or play is excessive, the bearing may need to be replaced.

The aircraft was pushed into the hangar on pre-determined marks[8] and safetied[9]. The hangar door was shut. Per an interview, M2 stated that three kerosene heaters were placed around the aircraft: one off the aircraft's starboard side near the nose and two aft of the aircraft to the left and right of the tail. The airflows of the three heaters were directed towards the fuselage from a distance between ten and fifteen feet. The two hangar heaters were also radiating heat at the hangar bay from the east and west walls.

The Beechcraft Maintenance Manual, 27-30-02, refers to figure 203, *Elevator Cable Tension Graph*, in which a temperature reading is needed to determine what tension values the flight control cables should be set at. According to interviews with M1 this temperature was taken at the Outside Air Temperature (OAT) gauge located at the captain's window on the outside of the aircraft's cockpit and recorded as 55 degrees Fahrenheit (attachment 23) on the D6 paperwork.

Note: The Systems Group Chairman performed cable temperature tests at the HTS facility on February 24, 2003. During the process of recording temperatures, the Chairman was made aware of the method under which the cable temperatures were taken on January 6, 2003. According to a signed statement by the QA Inspector, " the OAT gage reading was taken while it was laying on the top shelf of the podium … approximately 6 ft away from the right avionics bay door." The QA Inspector signed a statement to this effect (attachment 24). This location was not near the captain's window of the accident aircraft or in a similar location to where the heaters were blowing.

The temperature is plotted on the *Elevator Cable Tension Graph* (attachment 25). The manual directs the mechanic to apply the temperature found to the chart, then follow directions to determine the correct cable tension.

On page 8 of 28 of the D6 work package, M1 was required to "Check cable tension per Beech Chapter 27" in the proper BE MM. The D6 paperwork (p/w) calls for elevator, tab, and rudder cable tensions to be taken following visual inspections of the cables themselves. M1 applied a cable tensiometer,[10] which was due calibration in June 2003, to the cables and plotted the readings.

[8] Pre-determined marks are marks placed on the hangar floor that mark where the nose gear and two main gears will be located when the aircraft comes to rest in its parked position. This assures proper distances from hangar structure and room for freedom of movement around the aircraft with maintenance equipment.

[9] Safetied refers to the proper ground handling of an aircraft in a hangar environment, i.e., chocking of the wheels, grounding, marking, etc.

[10] Tensiometer is a device used to check the tension present in a given cable. It measures several sizes of cable by substituting a series of replaceable blocks called 'risers'. Each riser is calibrated to measure a specific size cable.

While plotting the chart to the temperature referenced, M1 determined that the elevator-up cable and elevator-down cable tensions were too low. The D6 paperwork does not specify where in the MM to reference the corrective actions needed to bring the cables into proper tension. The mechanic referred to the MM 27-30-02 from the Beech 1900D Airliner Maintenance Manual, which is the *Elevator Control Rigging – Maintenance Practices* (attachment 26).

M1 worked under the supervision of the Inspector to adjust the cables back into determined tension. During the maintenance task of re-tensioning the elevator cables, M1 referred to the MM reference to determine cable tension and applying safeties to the system.

During the interview, M1 stated that he bypassed several steps of the complete rigging procedure referenced in attachment 25 while in the process of adjusting the tension on the elevator cables. The Inspector, during his interview, stated he knew about the bypassed steps and agreed to only doing the tensions.

The following steps between step a through step y were bypassed by M1 while performing the procedures for the Beech 1900D MM 27-30-02, ***ELEVATOR CONTROL RIGGING – MAINTENANCE PRACTICES***:
ELEVATOR CONTROL SYSTEM RIGGING during the course of tightening the tension on the cables.

1. Step a – Disconnect the autopilot servo cables. **This aircraft did not have autopilot.**

2. Step c – Locate and remove the flight compartment seats, …elevator bellcrank. **M1 determined that the flight compartment seat(s) did not require removal for complying with the MM procedure*.**

3. Step d – Locate and remove the passenger seats, carpet, and floorboards on the right side of the passenger compartment to gain access to the elevator cable turnbuckles. **This step applies to a different model, not the BE 1900D model. The turnbuckles for the 1900D are not located under these floorboards. This step had not been revised prior to the accident.**

4. Step f – Adjust the center-to-center length of the push-pull tube assembly between the control column and the forward elevator bellcrank to a dimension of 15.12 +/- 0.06 inches (in). **M1 determined that this step was not required*. The QA Inspector concurred**.**

5. Step g – Adjust the surface stop bolts on the elevator control horn support for up travel of 20° +1°/ -0° and down travel of 14° +1°/ -0°. **M1 determined that this step did not require taking a measurement. M1 had manually pushed the elevators up and down to determine if the elevator was hitting the stops, but never verified the movement at the control column*.**

6. Step h – Verify the bob weight stop bolt clearance is 0.5 +/- 0.06 in. **M1 determined that this step was not required*. The QA Inspector concurred**.**

7. Step i – Adjust the forward bellcrank stops for 0.37 +/- 0.06 in clearance from the stop bolts. **M1 determined that this step was not required*. The QA Inspector concurred**.**

8. Step j – Verify the forward bellcrank stop bolts make contact before the bob weight stop bolts make contact with the weight. **M1 determined that this step was not required*. The QA Inspector concurred**.**

9. Step n – Remove the safety clips from the turnbuckles and release cable tension. **As per the interview with M1, the cable tension adjustments were made by tightening the cables up to the desired tensions. The cable tensions were never released*.**

10. Step s – Perform the *Control Column Support Roller Inspection* procedure of this chapter. **M1 determined that these steps were not required*. The QA Inspector concurred**.**

Note - M1 and the QA inspector determined that the previous steps were not to be checked on the assumption that the rigging procedure they were following did not require the tasks be complied with. The response was that, although no troubleshooting was performed to determine the cause of the cable's losing tension, the checking of system measurements was not warranted for cable adjustment, only cable replacement. The Air Midwest Quality Control Manager, or RSM, stated in his interview that the paperwork should have been followed through all the steps of the procedure, except a requirement to drop cable tension to zero before re-tensioning.

11. Step u – On aircraft equipped with the F1000 Flight Data Recorder, calibrate the Pitch Position Potentiometer. Perform the *Flight Data Recorder (FDR) – Pitch Adjustment* procedure. **M1 felt that the adjustment of the cable tensions would have no effect on the FDR potentiometer*.**

12. Step w – Connect the autopilot servo cables to the primary control cables. **Again, this aircraft did not have an autopilot system – no cables.**

ELEVATOR CONTROL SYSTEM FRICTION TEST, steps a through k. **These steps were not accomplished. M1 determined that these steps were not required*. The QA Inspector concurred**.**

CONTROL COLUMN SUPPORT ROLLER INSPECTION, steps a though f. **These steps were not accomplished. M1 determined that these steps were not required*. The QA Inspector concurred**.**

*** Summarized from interview with M1**
** **Summarized from interview with QA Inspector**

The elevator cable adjustment was written up on the Maintenance Record for Work Order #05-1030106016, form #M001, page 3 of 5, item 18 (attachment 27). The item was written in the DISCREPANCY field, "Elevator cable tension low" with part number MS21256-2 in the PART SERIAL NUMBER block. A stamp "RII' (Required Inspection Item) stamp is in this block.

In the NATURE OF ACTION (work accomplished) block of item 18, the item is signed off as, "Adjusted elevator cable tension per BMM 27-30-02. Ops check normal". The item is dated 1/5/03 and the stamp for AM 704 is in the MECHANIC sign off block.

There is no other stamp or signature in the MECHANIC sign-off block, aside from the trainee. The INSPECTOR sign off block has the stamp DI 701. There is no other stamp or signature in the INSPECTOR sign-off block, aside from the instructor/inspector.

6.4 Raytheon Aircraft Maintenance Manual

As shown in Step d – *Locate and remove the passenger seats, carpet, and floorboards on the right side of the passenger compartment to gain access to the elevator cable turnbuckles*, the manual does not reflect the correct configuration of the Beech 1900D, which has the turnbuckles located in the empennage. Raytheon Aircraft uses a step from a different model in this manual reference.

The use of rig pins requires positive confirmation that the pin penetrates all the rig pin holes properly. During January 22, 2003 testing in the Raytheon Aircraft Services facility in Wichita, Kansas, and the aft bellcrank rig pin was put through the bellcrank from the left side of the vertical stabilizer and exited out the right side of the vertical stabilizer. Proper application of the rig pin is verified by immobilizing the aft bellcrank. This provides positive verification that the bellcrank was properly pinned through the rig pin holes.

The manual does not state the need for positive verification of the rig pin, which allows for inaccuracy of the cable rig. During the interview with M1, he stated that he did not put the pin completely through the stabilizer.

6.5 Aircraft Inspection

During the original interviews on January 9, 2003, another aircraft was located in the hangar facility at Huntington, West Virginia. M1 was able to walk through the aircraft and point out panels that were opened during the D6 Inspection. An inspection of the cargo area revealed the floorboards that were removed for the cable inspection/adjustment. M1 pointed out where he pinned the forward bellcrank for the rig. He referenced the bellcrank being on the captain's side, when it is located on the first officer's side. Other access was limited due to other maintenance being performed.

The cargo net was inspected and the hooks were checked for positive locking to the retention loops along the side of the cargo bay wall. The cargo net hooks along the port side of the aircraft were 'J' shaped hooks and would not provide a positive lock in the loops, unless there was pressure on the net aft-wards to hold the hooks against the loops.

Stephen Carbone
Aircraft Maintenance and Records Group Chairman