National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: February 3, 2006

In reply refer to: A-06-4 and -5

Honorable Marion C. Blakey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On January 8, 2003, about 0847:28 eastern standard time, Air Midwest (doing business as US Airways Express) flight 5481, a Raytheon (Beechcraft) 1900D,[1] N233YV, crashed shortly after takeoff from runway 18R at Charlotte-Douglas International Airport (CLT), Charlotte, North Carolina. The 2 flight crewmembers and 19 passengers aboard the airplane were killed, and 1 person on the ground received minor injuries. The airplane was destroyed by impact forces and a postcrash fire. The airplane also struck and damaged a US Airways maintenance hangar on airport property. Flight 5481 was a regularly scheduled passenger flight to Greenville-Spartanburg International Airport, Greer, South Carolina, and was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 on an instrument flight rules flight plan. Visual meteorological conditions prevailed at the time of the accident.[2]

During its investigation of this accident, the Safety Board identified safety issues related to Emergency-One P-23 model aircraft rescue and firefighting (ARFF) vehicle wheel hub assemblies. Because efforts to address these issues (which involved an engineering analysis, redesign of the wheel hub assembly, and extensive laboratory testing) were in progress, the Board did not issue related safety recommendations in its February 26, 2004, report on this accident.[3] The Board monitored these efforts and notes that redesigned wheel hub assemblies should be available by early 2006. However, the Board has some concerns that are not addressed by the redesign and those concerns are addressed in this safety recommendation letter. (Figure 1 is a photograph of a P-23 ARFF vehicle.)

[1] Raytheon Aircraft Company acquired Beech Aircraft Corporation in February 1980.

[2] Details of this accident can be found in National Transportation Safety Board, *Loss of Pitch Control During Takeoff, Air Midwest Flight 5481, Raytheon (Beechcraft) 1900D, N233YV, Charlotte, North Carolina, January 8, 2003,* Aircraft Accident Report NTSB/AAR-04/01 (Washington, DC: NTSB, 2004).

[3] Recommendations addressing maintenance work practices, oversight, and quality assurance; maintenance training; aircraft weight and balance programs; Federal Aviation Administration (FAA) oversight; and cockpit voice recorders on Beech 1900D airplanes were issued to the FAA in the Board's report on this accident.

Figure 1. Photograph of a P-23 ARFF vehicle.

P-23 Wheel Hub Assembly Issues

Records indicate that 250 P-23 ARFF vehicles were manufactured between 1994 and 1996, 248 of which were sold to the United States Air Force (USAF).[4] A P-23 ARFF vehicle owned by the USAF and operated by the North Carolina Air National Guard (NCANG) and the City of Charlotte at CLT,[5] was the first ARFF vehicle to arrive at the accident site, and successfully engaged in firefighting activities. However, when the P-23 vehicle returned to the station after the emergency response, a firefighter observed grease stains on the station floor. Subsequent examination revealed that the stub axle on one of the wheel's hub assemblies was cracked, but had not completely fractured. (CLT ARFF personnel reported that, in 2001, another P-23 hub assembly cracked but did not completely fracture during daily operations/routine training. In both cases, the cracked hub assemblies were removed and replaced.) Figure 2 shows a cracked P-23 wheel hub assembly; figure 3 is a diagram of the 8-wheel assembly on the P-23, with a hub assembly location shown; and figure 4 is a diagram of the P-23 wheel hub assembly, with components identified.

[4] The remaining two P-23 vehicles were sold to the City of Tallahassee, Florida, for use at the Tallahassee Regional Airport (TLH).

[5] CLT is a joint-use airport, accommodating civilian and NCANG aircraft. The City of Charlotte and the NCANG maintain a 14 CFR Part 139.315, Index D ARFF facility on the airfield. At the time of the accident, NCANG owned the ARFF facility and equipment and provided fire protection for all on-airport firefighting efforts.

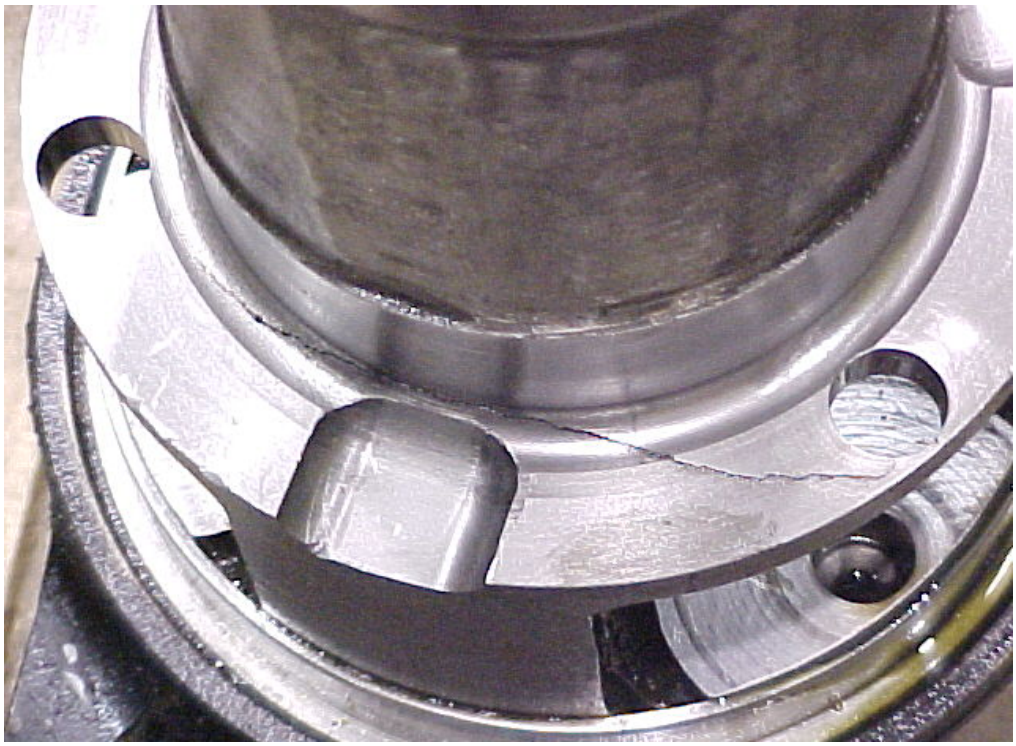

Figure 2. Cracked P-23 wheel hub assembly.

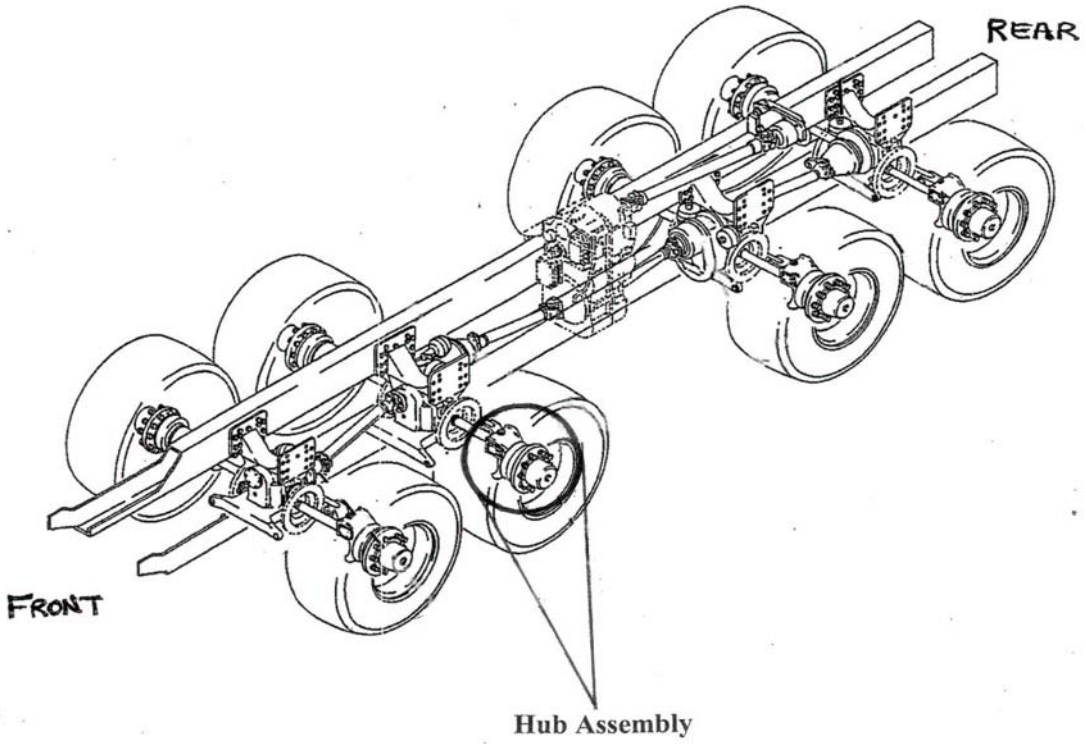

Figure 3. Diagram of the 8-wheel assembly on the P-23, with a hub assembly location shown.

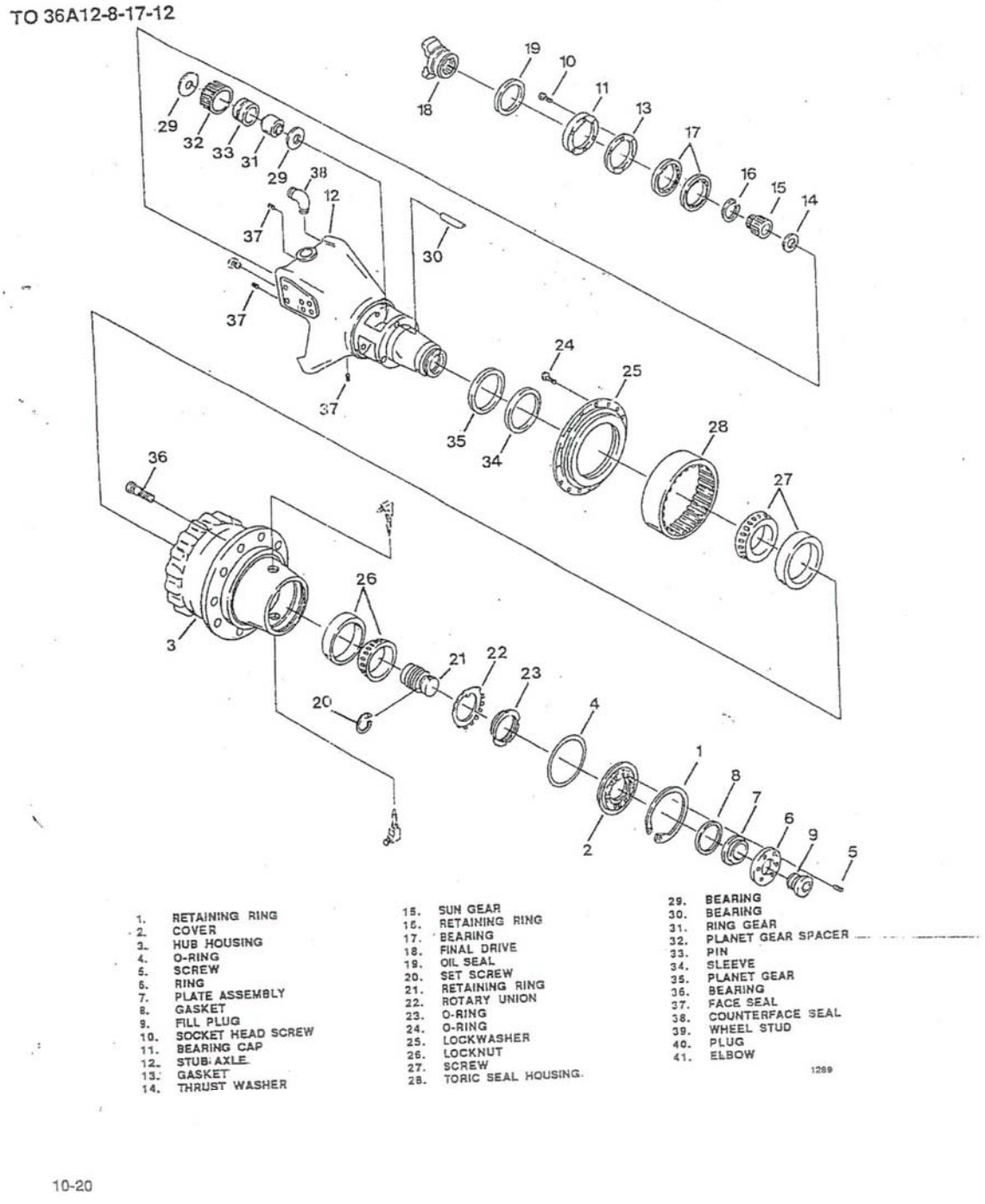

Figure 4. Diagram of the P-23 wheel hub assembly, with components identified.

The USAF became aware of numerous instances of cracked P-23 cast iron hub assemblies and began monitoring these cracks in late 1996/early 1997. They noted that the cracks

typically occurred in the wheel hub assembly's stub axle. Initially, the identified cracks did not result in complete failure or separation of components. However, in early 1998, the USAF became aware of an instance in which a cracked hub assembly actually resulted in separation of a P-23 hub assembly.

As a result of its concerns regarding 12 documented wheel hub assembly cracks that occurred between January 1997 and March 1998,[6] the USAF began an engineering analysis, including extensive laboratory testing, to determine the cause of the cracks and to identify criteria for a redesigned wheel hub assembly. Also in March 1998, the USAF issued a "restriction notice" for all P-23 vehicles. The notice stated that although the 8-wheel drive P-23 vehicle would likely remain stable in the event of a single wheel hub assembly separation, the USAF was concerned that the separated pieces would present a hazard to ARFF personnel, flight line crews, and other personnel or objects near the vehicle when a separation occurred. Therefore, the notice restricted P-23 vehicles to speeds no greater than 30 miles per hour (mph) during emergency operations, and no greater than 15 mph for all nonemergency operations. In addition, P-23 training operations were restricted to mission essential/currency training. Further, the notice required all operators to conduct visual inspections of each of the P-23's 8 hub assemblies after any use of the vehicles.

Despite these efforts, USAF personnel continued to observe stub axle failures, and their replacement wheel hub assembly stock was diminishing. The original manufacturer of the wheel hub assembly (Timoney Technology) provided the USAF with replacement stub axles made of stronger cast iron. However, these enhanced wheel hub assemblies also experienced failures. As a result, in February 2002, the USAF contracted with another developer/manufacturer (the Nevada Automotive Test Center [NATC]) to redesign and then manufacture the entire modified hub assembly. In June 2002, the USAF issued an updated P-23 restriction notice in which it cited continuing wheel hub assembly problems (with as many as 150 such failures documented) and required P-23 operators to continue to observe the speed and training restrictions and the visual inspection requirement cited in the March 1998 restriction notice. Because the failures continued to occur, the updated restriction notice informed P-23 operators that the enhanced wheel hub assemblies received from Timoney were considered only an interim solution. USAF personnel have indicated that the NATC-designed enhanced wheel hub assemblies may be available in early 2006.

The Safety Board's postaccident interviews with ARFF personnel revealed that the P-23 ARFF vehicle at CLT reached speeds of almost 50 mph during the response to the accident site. The Board recognizes that the ARFF vehicle reached the airplane and was able to begin firefighting efforts more promptly because the operator disregarded the speed restriction. However, the Board is concerned that if the cracked hub assembly had fractured completely during this emergency response, it would have resulted in airborne fragments and a destabilized P-23 operating at unsafe speeds, presenting serious hazards to the ARFF responders and other nearby personnel.[7] The Board also recognizes the pressure that emergency response personnel

[6] According to the restriction notice, 5 of the 12 documented hub assembly cracks involved cracked stub axles (#12 on figure 4), another 2 involved stub axles that cracked the castings in the lower suspension mounting ear (lower part of #12 on figure 4), and 5 involved stub axles that cracked inside the hub housing (#3 on figure 4).

[7] Numerous USAirways employees were standing near the damaged hangar during the emergency response.

are under to quickly respond to an emergency, and understands that operators may decide to disregard speed restrictions, even in light of potential risks.

During postaccident discussions, FAA personnel told Safety Board investigators that as long as CLT ARFF personnel could satisfy the 3- and 4-minute emergency response requirements under 14 CFR Part 139,[8] the airport could continue to use the P-23 ARFF vehicle in service as a primary emergency response vehicle.[9] FAA personnel further indicated that they believed that the P-23 hub assembly failures were a limited problem for civilian operations because currently only 4 of the 43 joint-use airports using Department of Defense ARFF vehicles to meet airport certification requirements are using P-23 vehicles.[10] Although it is likely that the P-23 at CLT could meet the 3- and 4-minute emergency response requirements while observing the speed restrictions because of the ARFF station location on the field,[11] the Safety Board notes that this might not be possible at the other affected airports. Depending on the location of the ARFF facilities at these airports and the criticality of the P-23 vehicles to the emergency responses, ARFF responders may not be able to satisfy the 3- and 4-minute response requirements if they abide by the P-23 speed restrictions.

The Safety Board also notes that other joint-use airports might acquire and operate P-23 ARFF vehicles as primary ARFF response vehicles and encounter similar difficulties. Additionally, although most P-23 ARFF vehicles are currently operated on military or joint-use airports, as the USAF acquires new ARFF vehicles and discontinues use of P-23 vehicles, some non-joint-use airports certificated under 14 CFR Part 139 may acquire and operate used P-23 vehicles. (Currently, TLH, a non-joint-use airport, operates two P-23 ARFF vehicles, one of which is required for the airport to meet FAA certification response time requirements.)

The Safety Board notes that, although the USAF restriction notice was broadly distributed among military operators, military personnel are not the only operators of the P-23 ARFF vehicles; many civilian airport operators and ARFF responders who operate the P-23 vehicles might not be aware or recognize the criticality of the USAF restriction notice. (For example, the civilian TLH ARFF personnel were unaware of the USAF restriction notice until Board personnel advised them of it in August 2005.) As a result, the Safety Board is concerned that civilian ARFF responders might be operating these vehicles at high speeds during emergency responses and training drills, which could result in an unsafe condition.

[8] According to 14 CFR Part 139.319(i), at least one ARFF vehicle on an airport shall be able to reach "the midpoint of the furthest runway serving air carrier aircraft from its assigned post, or reach any other specified point of comparable distance on the movement area which is available to air carriers," and begin application of agent within 3 minutes of the initial alarm. All other required ARFF vehicles shall be able to reach the same specified point, and begin agent application, within 4 minutes of the alarm.

[9] Although the FAA sets the emergency response standards for airports, unsafe conditions can result if emergency responders operate P-23 ARFF vehicles at speeds above those authorized in the USAF restriction notice.

[10] The four airports, which operated a total of seven P-23 ARFF vehicles, were CLT; Bangor International Airport in Bangor, Maine; Burlington International Airport in South Burlington, Vermont; and Portsmouth/Pease International Airport in Portsmouth, New Hampshire.

[11] The P-23 ARFF vehicle responded to the CLT accident site in just 1 minute 42 seconds, traveling at speeds of almost 50 mph.

As a result of these concerns, the Safety Board believes that the FAA should issue a CertAlert[12] to all Airport Certification and Safety Inspectors and operators of airports certificated under 14 CFR Part 139, describing the potential hazards with the existing P-23 hub assembly. The CertAlert should emphasize the need for inspection of the P-23 hub assemblies after any use of the vehicles, the retention of inspection results, and the timely replacement (upon availability of safe and reliable replacement assemblies) of all existing P-23 hub assemblies. In addition, the CertAlert should emphasize that FAA Airport Certification Inspectors must ensure that affected airports can still meet 14 CFR Part 139 response time requirements when ARFF personnel are restricted to operating P-23 vehicles at speeds less than 30 mph during emergency operations, and less than 15 mph for all nonemergency operations (as indicated in the USAF restriction notice).

The replacement of existing P-23 wheel hub assemblies with safe and reliable assemblies would eliminate the risks of fracture and possible injury during operation and allow the P-23 to travel at higher speeds during emergency operations to expedite response. Therefore, the Safety Board believes the FAA should require all airports that use P-23 ARFF vehicles to install a redesigned wheel hub assembly on all P-23 vehicles in the timeliest manner possible upon availability of suitable replacement assemblies.

Conclusion

The Safety Board's investigation of the emergency response to the January 8, 2003, accident in Charlotte, North Carolina revealed safety issues involving P-23 ARFF vehicle wheel hub assemblies. As a result, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue a CertAlert to all Airport Certification and Safety Inspectors and operators of airports certificated under 14 *Code of Federal Regulations* (CFR) Part 139, describing the potential hazards with the existing P-23 hub assembly. The CertAlert should emphasize the need for inspection of the P-23 hub assemblies after any use of the vehicles, the retention of inspection results, and the timely replacement (upon availability of safe and reliable replacement assemblies) of all existing P-23 hub assemblies. In addition, the CertAlert should emphasize the importance of Federal Aviation Administration Airport Certification and Safety Inspectors ensuring that affected airports can still meet 14 CFR Part 139 response time requirements when aircraft rescue and firefighting personnel are restricted to operating P-23 vehicles at speeds less than 30 mph during emergency operations, and less than 15 mph for all nonemergency operations (as indicated in the United States Air Force's restriction notice). (A-06-4)

[12] CertAlerts provide timely information on Part 139 airport certification-related subjects to airport operators and FAA Airport Certification and Safety Inspectors. CertAlerts are advisory in nature, nondirective, and have no regulatory authority. CertAlerts are issued, numbered, and logged on a calendar year basis, and are retained unless officially rescinded. Additional information can be found on the FAA's Web site at http://www.faa.gov/arp/certification/certalert.cfm.

Require all joint-use airports that use P-23 aircraft rescue and firefighting vehicles to meet 14 *Code of Federal Regulations* Part 139 certification requirements to install an enhanced wheel hub assembly on all P-23 vehicles in the timeliest manner possible upon availability of suitable replacement assemblies. (A-06-5)

Acting Chairman ROSENKER and Members ENGLEMAN CONNERS, HERSMAN, and HIGGINS concurred with these recommendations.

[Original Signed]

By: Mark V. Rosenker
Acting Chairman