National Transportation Safety Board
Aviation Accident Final Report

Location:	LAS VEGAS, NV	**Accident Number:**	LAX99FA272
Date & Time:	08/17/1999, 1817 PDT	**Registration:**	N454DP
Aircraft:	Beech BH 125-600A	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	8 None
Flight Conducted Under:	Part 91: General Aviation - Executive/Corporate		

Analysis

The pilot landed with the landing gear in the retracted position, when both the main and auxiliary hydraulic systems failed to extend the gear. The airplane caught fire as it skidded down the runway. The left inboard main tire had blown on takeoff and a 30-inch section of tread was loose. Black marks were along the length of the landing gear strut and up into the wheel well directly above the left inboard wheel. The normal and emergency hydraulic systems both connect to a common valve body on the landing gear actuator. This valve body also had black marks on it. A gap of 0.035 inch was measured between the valve body and actuator. When either the normal or auxiliary hydraulic system was pressurized, red fluid leaked from this gap. Examination revealed that one of two bolts holding the hydraulic control valve in place had fractured and separated. The fractured bolt experienced a shear load that was oriented along the longitudinal axis of the actuator in a plane consistent with impact forces from the flapping tire tread section.. Separation of only one bolt allowed the control valve to twist about the remaining bolt in response to the load along the actuator's longitudinal axis. This led to a loss of clamping force on that side of the actuator. Hydraulic line pressure lifted the control valve, which resulted in rupture of an o-ring that sealed the hydraulic fluid passage. 14 CFR 25.739 describes the requirement for protection of equipment in wheel wheels from the effects of tire debris. The revision of this regulation in effect at the time the airplane's type design was approved by the FAA requires that equipment and systems essential to safe operation of the airplane that is located in wheel wells must be protected by shields or other means from the damaging effects of a loose tire tread, unless it is shown that a loose tire tread cannot cause damage. Examination of the airplane and the FAA approved production drawings disclosed that no shields were installed to protect the hydraulic system components in the wheel well.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the complete failure of all hydraulic systems due to the effects of a main gear tire disintegration on takeoff. Also causal was the manufacturer's inadequate design of the wheel wells, which did not comply with applicable certification regulations, and the FAA's failure to ensure that the

airplane's design complied with standards mandated in certification regulations.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: TAKEOFF

Findings
1. (C) LANDING GEAR,TIRE - BURST
2. (C) MISCELLANEOUS,BOLT/NUT/FASTENER/CLAMP/SPRING - FRACTURED
3. (C) HYDRAULIC SYSTEM,SEAL - BURST
4. (C) LANDING GEAR,NORMAL RETRACTION/EXTENSION ASSEMBLY - DISABLED
5. (C) LANDING GEAR,EMERGENCY EXTENSION ASSEMBLY - DISABLED
6. EMERGENCY PROCEDURE - INITIATED - PILOT IN COMMAND
7. (F) ACFT/EQUIP,INADEQUATE COMPLIANCE DETERMINATION - FAA(OTHER/ORGANIZATION)
8. (F) INADEQUATE CERTIFICATION/APPROVAL,AIRCRAFT - FAA(ORGANIZATION)

Occurrence #2: WHEELS UP LANDING
Phase of Operation: LANDING

Findings
9. GEAR EXTENSION - NOT POSSIBLE

Factual Information

HISTORY OF FLIGHT

On August 17, 1999, at 1817 Pacific daylight time, a Beech Hawker BH 125-600A, N454DP, was forced to land with the landing gear retracted at McCarran Field, Las Vegas, Nevada. DP Air LLC was operating the corporate executive transportation flight under the provisions of 14 CFR Part 91. The airline transport pilot, copilot, and six passengers were not injured; the airplane sustained substantial damage. The airplane departed Salina, Kansas, about 1600 on an instrument flight rules (IFR) flight plan en route to Las Vegas. Day visual meteorological conditions prevailed at Las Vegas.

The pilots stated that the airplane had a history of unresolved shuddering for the first minute or two after takeoff. The nose tires had recently been inspected and found out of round; they were replaced as corrective action. The shudder persisted but to a lesser extent. During the departure from Salina, the pilots felt a vibration at rotation that was more violent than they were used to. They thought the nose wheel was in the air with the main landing gear still on the ground and they believed they might have blown a tire. Once the airplane lifted off, the normal vibration replaced the violent one, and gear retraction was normal. Usually, the airplane's owner did not feel the vibration, but this time he told the pilots he felt it in the cabin.

Ten minutes after departure the right hydraulic low flow light illuminated with the pressure gauge reading 2,300 psi. The crew reviewed the airplane's flight manual, which stated no immediate crew action was required, but emergency braking would probably have to be used. Approximately 10 minutes later, the left hydraulic low flow light illuminated, and the pressure gauge continued to indicate 2,300 psi. The pilots said the airplane flight manual indicated no immediate crew action was required, but now the emergency landing gear extension system (the auxiliary hydraulic system) and emergency braking would need to be used. Since they needed to burn fuel to lower their landing weight, they decided to continue to Las Vegas. If they had any complications, they thought they would have more support equipment available there.

The crew advised air traffic control of their problem as they arrived in the Las Vegas area. The hydraulic pressure gauge was still reading 2,300 psi and they tried to deploy the gear normally. The pilot stated he usually felt a slight pressure as the gear handle moved and actuated a valve, but this time he felt nothing and the gear did not deploy. The UC (undercarriage control) handle was pulled but with some difficulty. The crew stated they attempted to pump the gear down manually, but after a few strokes the auxiliary hydraulic low-pressure warning light illuminated. The gear doors did not open and they felt no pressure as they pumped the auxiliary system. The crew repeated the emergency procedures several times as they attempted to lower the landing gear. When all attempts failed, the pilots individually went to the cabin and briefed the passengers on emergency egress in case of crew incapacitation.

The crew discussed the landing and notified the tower of their intentions. They circled to burn off fuel and decided to attempt the landing with approximately 500 pounds of fuel remaining in each wing tank. The crew instructed the passengers to assume a brace position 30 seconds prior to touchdown. The pilot estimated the speed on short final approach for runway 19L was 130 knots, touchdown was at 110 knots, and the flaps were up. As the airplane flew into ground effect, the crew secured the engines and electrical system. On touchdown, they secured the fuel control and the pilot saw flames over his shoulder. The airplane skidded on the ground about

twice as far as the crew expected. It came to rest at the intersection of runway 19L and runway 25R. Flames were on the right side of the airplane; however, the entry door on the left side opened normally and everyone exited the airplane through it.

PERSONNEL INFORMATION

The pilot held an airline transport pilot certificate with airplane multiengine land rating. He also held a commercial certificate with airplane single engine land and sea ratings, and a private pilot certificate with a glider rating. He held a type rating in the HS-125. A first-class medical was issued on July 30, 1999, with the limitation pilot must have glasses available for near vision.

The second pilot held an airline transport pilot certificate with a multiengine land rating and commercial certificate with an airplane single engine land. A first-class medical was issued on June 19, 1998, with the limitation glasses must be available for near vision.

AIRCRAFT INFORMATION

The airplane was a Beech Hawker BH 125-600A, serial number 256044. The hour meter was observed at 5,753.7 after the accident. A 6-month airframe inspection was completed on April 9, 1999, at a total airframe time of 5,696.3 hours.

The left main landing gear assembly was removed and inspected on February 5, 1999, and a new tire was installed on the assembly. Total airframe time was 5,664 hours.

The left engine was a Rolls Royce Viper Mark 601, serial number VL601019. Time since overhaul was 1,477 hours; time since last inspection was 15 hours. The right engine was a Rolls Royce Viper 601, serial number VL601104. Time since overhaul was 2,322 hours; time since last inspection was 18 hours.

AIRPORT INFORMATION

The Airport/Facility Directory, Southwest U. S., indicated runway 19L was 9,777 feet long by 150 feet wide, and constructed of asphalt.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest on runway 19L. The airplane was hoisted by a crane and moved by trailer to Signature Aviation's hangar for inspection by the Safety Board Investigator-in-Charge (IIC), the Federal Aviation Administration (FAA), Raytheon Beech, and Rolls-Royce.

FIRE

The IIC reviewed videotape of the landing. Flames trailed behind the airplane as it slid down the runway. Fire continued under the airplane after it came to a stop. The belly and lower aft sections of the empennage were scorched. Hydraulic fluid was observed on the belly of the airplane and in pools near airframe cross members. Metal was worn away and the integrity of the fuel tanks was compromised. One of the occupants stated a backpack on the floor in the aft part of the cabin contained a toothbrush that melted.

TESTS AND RESEARCH

The left main landing gear inboard tire was blown with approximately 30 inches of tread disconnected from the sidewalls. Black marks, in line with the inboard tire, were evident the length of the left main landing gear strut and up into the wheel well. The landing gear actuator,

which had the hydraulic control valve body attached to it, was located in this area of the wheel well, and both units also had black marks. Hydraulic lines from the normal and emergency systems attach to this valve body. The valve body was observed to leak red fluid whenever hydraulic pressure was applied by either the normal hydraulic system or the emergency system.

Beech technicians and a Beech material's laboratory representative disassembled the left actuator and valve body at the Raytheon Beech factory, Wichita, Kansas, on September 21, 1999, under the supervision of the FAA. The Beech Air Safety Investigator prepared a written report.

The report outlined the procedures followed during the examination. The report indicated that one of the two bolts that clamped the hydraulic control valve to the actuator fractured and separated. One bolt was on either side of the extend side of the hydraulic fluid passage. The report indicated that the fractured bolt experienced a shear load oriented along the longitudinal axis of the actuator. The separation of only one bolt allowed the control valve to twist around the remaining bolt. This resulted in a loss of clamping pressure on the control valve on the side of the fractured bolt. Hydraulic line pressure lifted the control valve. An o-ring, which sealed the hydraulic fluid passage, ruptured when it was no longer restrained in its housing.

The airplane was certified under Type Certificate A3EU, which was amended on August 17, 1992, to include the BH-125 Series-600A. Type Certificate A3EU states that the certification was equivalent to CAR.4b dated December 1953, Amendment 4b-1 through 4b-11, exclusive of CAR.4b.350(e), and includes Special Regulation SR.422.B. The initial requirement of Federal Aviation Regulation (FAR) 25.721 regarding fuel spillage was added by Amendment 25-15. The introduction of requirements regarding landing gear well equipment protection in CAR.4b.334(g) was added by Amendment 4b-12.

14 CFR 25.739 describes the requirement for protection of equipment in wheel wheels from the effects of tire debris. The revision of this regulation in effect at the time the airplane's type design was approved by the FAA requires that equipment and systems essential to safe operation of the airplane that is located in wheel wells must be protected by shields or other means from the damaging effects of a loose tire tread, unless it is shown that a loose tire tread cannot cause damage. Examination of the airplane and the FAA approved production drawings disclosed that no shields were installed to protect the hydraulic system components in the wheel well.

The tires were Goodyear Flight Eagles, 23X7.00X12, part number 237K 23-2. Goodyear Tire and Rubber Company inspected the left main tires and wheel assemblies under the supervision of the FAA, Atlanta, Georgia. The examination indicated that the tires appeared to have been maintained properly; there were no signs of chronic under inflation. The ruptured tire appeared to be cut or it possibly sustained foreign object damage (FOD) at the junction of the tread and sidewall. The wheels' fuse plugs were satisfactory.

Post accident investigation revealed the skid plates on the belly and approximately 0.75-inch of wing spar material were ground off; one segment of a flange separated from the spar. Several belly skins were ground through and fuel tanks that were integral to the wing were compromised. Portions of the flap hinges wore off. The right-hand fuel pump was hanging below the wing skin; it's mounting was worn away.

Another Beech representative examined the airplane's skid configuration on scene under the supervision of the IIC and prepared a report. Pertinent parts of the report are reflected in the following paragraphs.

The skid installation extended on the belly approximately the length of the wing root chord. The skid material was in two sections. The forward section, about 48 inches long by 1.8 inches wide by 1.0 inch deep, was aluminum alloy material. The aft portion, 4.5 inches long by 2.8 inches wide by 0.6 inch deep, was a copper beryllium material. The skids were attached to a keel channel filled with aluminum honeycomb.

FAR 25.721 specifies general requirements that must be met in the event of a landing gear malfunction. Paragraph (a)(1) specifies requirements for airplanes that have a passenger seating configuration, excluding pilots' seats, of nine seats or less. It states that the main landing gear system must be designed so that if the gear system failed due to overloads during takeoff and landing (assuming the overloads to act in the upward and aft directions), the failure mode is not likely to cause the spillage of enough fuel from any fuel system in the fuselage to constitute a fire hazard.

The Beech report indicated that the touchdown was at a relatively high energy level. The ambient temperature was over 100 degrees Fahrenheit, the field elevation was 2,179 feet msl, and the wind was calm. Based on the crew's statements, the report estimated that the airplane landed at a touchdown speed of 119 knots true airspeed (TAS), weighed 16,500 pounds, and the flaps were up. The airplane's certification basis for an emergency wheels landing condition specified that the airplane experience no loss of services other than the landing gear being retracted; rate of descent not to exceed 2.5 feet per second (150 feet per minute); up to 10 degrees of yaw; and not less than half capacity of fuel in the wing (approximate landing weight 21,016 pounds).

The airport in Salina maintained a self-inspection checklist, and airport personnel physically checked the runway in the morning at 0630, and in the evening at 2030. The inspection checklists for August 17 and 18, 1999, denoted that the runway was satisfactory when inspected for foreign objects (such as gravel and debris), holes, and cracks. The personnel noted that the temperature was approximately 100 degrees Fahrenheit on the afternoon of August 17.

ADDITIONAL INFORMATION

The wreckage was released to the owner's representative.

Pilot Information

Certificate:	Airline Transport	**Age:**	49, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Glider	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	**Last FAA Medical Exam:**	07/30/1999
Occupational Pilot:		**Last Flight Review or Equivalent:**	07/31/1999
Flight Time:	10000 hours (Total, all aircraft), 275 hours (Total, this make and model), 9625 hours (Pilot In Command, all aircraft), 59 hours (Last 90 days, all aircraft), 22 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Co-Pilot Information

Certificate:	Airline Transport	**Age:**	52, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	**Last FAA Medical Exam:**	08/27/1999
Occupational Pilot:		**Last Flight Review or Equivalent:**	01/19/1999
Flight Time:	5300 hours (Total, all aircraft), 700 hours (Total, this make and model), 3800 hours (Pilot In Command, all aircraft), 59 hours (Last 90 days, all aircraft), 22 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N454DP
Model/Series:	BH 125-600A BH 125-600	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	256044
Landing Gear Type:	Retractable - Tricycle	**Seats:**	10
Date/Type of Last Inspection:	04/09/1999, AAIP	**Certified Max Gross Wt.:**	25500 lbs
Time Since Last Inspection:	58 Hours	**Engines:**	2 Turbo Jet
Airframe Total Time:	5748 Hours as of last inspection	**Engine Manufacturer:**	Rolls-Royce
ELT:	Installed, not activated	**Engine Model/Series:**	Viper MK601
Registered Owner:	DP AIR LLC	**Rated Power:**	3750 lbs
Operator:	DP AIR LLC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	LAS, 2181 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	1756 PDT	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Scattered / 12000 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	37°C / 10°C
Precipitation and Obscuration:			
Departure Point:	SALINA, KS (SLN)	**Type of Flight Plan Filed:**	IFR
Destination:	(LAS)	**Type of Clearance:**	IFR
Departure Time:	1600 CDT	**Type of Airspace:**	Class B

Airport Information

Airport:	McCarran International (LAS)	**Runway Surface Type:**	Asphalt
Airport Elevation:	2181 ft	**Runway Surface Condition:**	Dry
Runway Used:	19L	**IFR Approach:**	None
Runway Length/Width:	9777 ft / 150 ft	**VFR Approach/Landing:**	Full Stop

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	6 None	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	8 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	HOWARD D PLAGENS	**Report Date:**	11/25/2003
Additional Participating Persons:	JACK HOLBROOK; Federal Aviation Administration; LAS VEGAS, NV PAUL YOOS; RAYTHEON BEECH; WICHITA, KS HAROLD AUGUSTINE; ROLLS-ROYCE; HOUSTON, TX		
Publish Date:			
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