Aviation Investigation Final Report

Location:	Medford, Oregon	**Accident Number:**	WPR12LA324
Date & Time:	July 20, 2012, 11:45 Local	**Registration:**	N7122T
Aircraft:	HAWKER BEECHCRAFT G58	**Aircraft Damage:**	Substantial
Defining Event:	Runway excursion	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The owner/pilot reported that all aspects of the personal cross-country flight were uneventful until touchdown when the airplane immediately experienced directional control issues. The airplane subsequently veered off the right side of the runway and struck a sign and a ditch before it came to rest. All three landing gear were fracture-separated from the airplane during the accident sequence.

The right and left main landing gear torque links exhibited different damage patterns. None of the attachment hardware for the left torque link knee joint was located. The lack of any landing gear operating anomalies during the accident flight's taxi, takeoff, gear retraction, and gear extension sequences, combined with the damage patterns to the left main landing gear torque links, were consistent with the knee joint attachment bolt being present through at least the beginning of the failure sequence on landing and with the bolt being at least partially installed during the landing. Further, the available evidence did not indicate that a pre-existing mechanical failure of the knee joint bolt had occurred.

For the bolt to partially back out of its proper position, the retaining nut would have to be missing either due to the cotter key being lost as a result of mechanical failure or absent because it was never installed. If the cotter key was damaged or the nut was improperly torqued, it is possible that multiple taxi, takeoff, and landing cycles could have damaged and eventually caused the cotter key, the nut, or the bolt to fail, but no evidence was found to support that scenario. The two mechanics who repaired the left main landing gear strut 7 months before the accident reported that the cotter key was installed during the repair. Although the pilot asserted that the cotter key was never installed, he and another pilot had completed 32 flights, not including the accident flight, in the airplane since that time, thus, providing 33 opportunities to detect its absence during their respective preflight inspections, yet neither did so. In addition, those flights were accomplished after renewed attention to the left main landing gear because of the strut repair; however, neither pilot noted any missing hardware. Based on the available evidence, which did not include the attachment hardware, the underlying reason for the loss of directional control could not be determined.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

A loss of directional control on landing for reasons that could not be determined based on the available evidence.

Findings

Aircraft	Main landing gear - Failure
Not determined	(general) - Unknown/Not determined
Aircraft	Directional control - Not attained/maintained

Factual Information

History of Flight

Landing	Loss of control on ground
Landing-landing roll	Runway excursion (Defining event)
Landing-landing roll	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On July 20, 2012, about 1145 Pacific daylight time, a Hawker Beechcraft G58, N7122T, was substantially damaged when it veered off the runway, and struck a sign and a ditch during landing at Rogue Valley International-Medford Airport (MRF), Medford, Oregon. Neither the pilot/owner nor his passenger was injured. The personal flight was conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions and light winds prevailed, and no Federal Aviation Administration (FAA) flight plan was filed for the flight.

According to the pilot, he based the airplane at Palm Springs International Airport (PSP), Palm Springs, California. He departed PSP about 0839, conducted the flight under visual flight rules, and reported that the flight and approach were unremarkable. He reported that he used 85 knots as his final approach speed, and full flaps for the landing. When the airplane touched down on runway 32, it seemed to roll straight for a "very short distance," but then "pulled left." The pilot was able to correct that with right rudder. Upon release of the right rudder, the airplane again pulled to the left, but "a little harder." That cycle repeated a few times in rapid succession, and when the pilot applied right brake, the airplane tracked rapidly, in a relatively straight line, towards the right edge of the runway. It exited the runway, struck a runway distance sign, and then a ditch. In his initial statement to first responders, the pilot reported that he believed that there was a malfunction of the rudder control system. The airplane was recovered by a maintenance facility on the airport. Based on the maintenance history of the airplane and certain physical evidence, components of the left main landing gear (LMLG) were retained for detailed examination.

PERSONNEL INFORMATION

FAA information indicated that the pilot held a private pilot certificate, with airplane single engine land, airplane multi engine land, and instrument airplane ratings. His most recent FAA third-class medical certificate was issued in March 2011. According to the pilot, he had a total flight experience of about 850 hours, including about 45 hours in the accident airplane make and model.

AIRCRAFT INFORMATION

The airplane was manufactured in 2011, and the pilot had purchased it new in December 2011. The pilot had made leaseback arrangements for a Hawker Beechcraft Company (HBC) representative to occasionally fly and use the airplane as an HBC marketing and sales demonstrator. At the time of the accident, the airplane had a total time in service (TT) of 54 hours.

METEOROLOGICAL INFORMATION

The MRF 1153 automated weather observation included variable winds at 4 knots, visibility 10 miles, clear skies, temperature 24 degrees C, dew point 12 degrees C, and an altimeter setting of 30.15 inches of mercury.

AIRPORT INFORMATION

MRF runway 32 was asphalt, dry, and reported to be in "excellent" condition per the FAA database. It measured 8,800 by 150 feet. MRF elevation was 1,335 feet above mean sea level. MRF was equipped with an air traffic control tower (ATCT), and the ATCT was staffed and operating at the time of the accident.

WRECKAGE AND IMPACT INFORMATION

MRF operations and rescue fire-fighting (RFF) personnel were the first responders to the accident. FAA personnel did not respond to MRF until several days after the accident, after the airplane had been recovered to a hangar. NTSB personnel did not respond to the accident site.

The airplane came to rest upright, approximately 4,000 feet down the runway, and about 500 feet right of the centerline. All three landing gear were fracture-separated from the airplane during the accident sequence; both the left and right main landing gear chromed struts had fracture-separated, which liberated the two main wheel and tire assemblies from the airplane. The final resting locations of the various separated components were not documented. According to responding personnel, the airplane left one or more partial or complete skidmarks that began near the runway centerline, and terminated at the edge of the runway. The skidmarks were not sufficiently documented to enable positive association with specific landing gear tires. The conditions of, and damage signatures to, the three landing gear tires were not documented in detail. According to the pilot, the LMLG was the portion of the airplane that struck the runway sign, but no evidence to either support or refute that recollection was obtained. Damage patterns to the propeller blades were approximately symmetric with regard to the left and right propeller blade sets, with the left engine blade set exhibiting slightly more damage. Both blade sets had gouges and scraping consistent with pavement contact, and both blade sets exhibited aft bending and curling of their outboard (tip) sections.

The two links of the right main landing gear torque link (sometimes referred to as "scissor link") assembly remained attached to one another. The lower link remained attached to the wheel assembly, and the upper link was fracture-separated from the upper landing gear structure.

The two links of the left torque link assembly were found separated from each other. The lower link remained attached to the wheel assembly, and the upper link had fracture-separated from the upper landing gear structure. Normally, the two lugs of the lower link mated with a tab on the upper link in a clevis-type arrangement, and the two links were attached with a bushing, a bolt, a washer, a castellated nut, and a cotter key. One of the lugs on the lower link was bent about 25 degrees laterally away from the link axis. Despite a dedicated search, neither the bolt nor any of the other attach hardware was found at the accident site. The pilot asserted that the bolt had backed out because the cotter key was never installed in the nut by the mechanics that repaired the LMLG 7 months prior to the accident.

The pilot provided the following explanation regarding the direction of the veeroff:
"Some would ask why the plane went off the runway to the right, with the left wheel dragging behind; and I would answer that in my effort to keep the plane rolling straight I was applying full right rudder intermittently back and forth and as the swerving got worse I believe I tried the right brake and the plane took off in that direction and I couldn't straighten it out."

Review of the airplane dimensions and geometry indicated that with a failed LMLG strut, it was possible but not likely for the left wing to support the airplane in such a manner that the LMLG strut (without a wheel/tire) would not contact the ground. Factors that affected whether the strut would contact the ground included, but were not limited to: nose and RMLG strut compression, wing flex and/or damage, LMLG strut fracture location, and airplane attitude (nose or tail low).

ADDITIONAL INFORMATION

Preflight Inspection Information

FAA regulations and standard operating practices dictate that a thorough preflight inspection of an aircraft be conducted prior to every flight. Preflight inspections are usually conducted by the pilot of a given flight. Typical preflight inspections address multiple aspects of the main components of all flight-critical systems, and include visual and functional checks as appropriate.

The "Preflight Inspection" subsection of Section 4 ("Normal Procedures") of the airplane manufacturer's Pilot Operating Handbook enumerated the components/systems and the relevant actions for a comprehensive preflight inspection of the airplane. Item 7p ("Left Main Gear") contained the guidance "Scissor Linkage.....SECURE." While not explicitly defined, the term "secure" normally denotes that the item be examined for presence and security of appropriate attach hardware, as well as for proper (if any) freeplay.

Maintenance Information

The pilot took delivery of the airplane at the HBC facility in Wichita Kansas, when the airplane had a total time (TT) in service of 2.9 hours. On December 10, 2011, he flew it to his home airport (PSP) in California. The next day, he flew the airplane out and back to a nearby airport, and a few days after his return he noticed that the LMLG strut of the hangared airplane was "flat." The pilot estimated that the airplane had a total about "7-10 cycles" (flights) on it since new.

On either December 21st or 22nd, the pilot contacted the HBC factory service representative in Arizona, who recommended that the pilot contact a repair facility at PSP "to take a look at it." The pilot contacted Palm Springs Aircraft Maintenance (PSAM), and the PSAM owner (who was also an aircraft mechanic) came to the hangar to examine the strut. The PSAM owner then retrieved strut servicing equipment from the PSAM facility, returned to the airplane, and replenished the nitrogen in the strut. The airplane remained in the hangar overnight, but when the pilot examined it the next day, the strut was again flat.

The pilot re-contacted the HBC service representative, who told the pilot that he was attempting to arrange for a dedicated HBC "service truck" to travel from Arizona to PSP to repair or replace the strut. Later that day, the HBC service representative told the pilot that he had arranged for PSAM to repair the strut, based in part on his understanding that a damaged strut O-ring was the cause of the leak, and also in part due to the lack of availability of a replacement strut. The HBC service representative's

understanding that the strut was leaking due to a defective O-ring was based on a re-examination and leak check of the strut conducted by the PSAM owner.

According to the PSAM owner, HBC was "in a hurry" to get the strut repaired, as evidenced by multiple telephone calls from HBC to PSAM. PSAM and HBC personnel coordinated with one another to ensure that PSAM had the appropriate parts and guidance to conduct the repair to the strut. The airplane was towed to the PSAM facility on PSP for the repair. Maintenance records, component invoices, and witness accounts indicated that two PSAM personnel participated in the repair; the PSAM owner, and a PSAM aircraft mechanic. According to the maintenance records and invoice, several internal strut components were replaced, the maintenance was completed on December 23, 2011, and the repair was signed off by the PSAM mechanic. According to the PSAM owner, the majority of the work was conducted by the PSAM mechanic, whereas according to the PSAM mechanic, the role of each was more "mutual." According to the pilot, the repairs were completed "on 12/28 or 12/29." The pilot was not present for the bulk of the maintenance activity, but he did arrive at the PSAM facility in time for the landing gear function check ("gear swing").

Also according to the pilot, once the repairs had been completed, the PSAM owner asked the pilot to conduct at least one takeoff and landing in the airplane to ensure that the maintenance actions resolved the strut problem. The pilot reported that he did so on December 29, and that "the strut held." In July 2012, the PSAM owner reported that "a few days or possibly weeks" after the repair, the HBC service representative telephoned PSAM to see whether PSAM could "re-service" the strut, but PSAM personnel were not available to conduct the work. The PSAM owner reported that he never determined whether or how that request was fulfilled. The PSAM mechanic had no knowledge of any such request by HBC.

In March 2012, the pilot observed that when the airplane was stationary, the left wingtip was approximately 1 1/4 inches lower than the right wingtip, and he was concerned that the repaired LMLG strut was leaking again. He re-contacted HBC, but spoke with a different representative than he did during the December activity. That HBC representative subsequently flew the airplane several times, for reasons unrelated to this issue, but did not notice anything unusual, or any problems with the landing gear. He also advised the pilot that some difference between the heights of the two struts was not unusual. The pilot and HBC decided that no servicing or maintenance was required at that time.

During the period between March 2012 and the accident in July 2012, the pilot continued to monitor and measure the strut and wing heights, and he did not note any abnormalities. The pilot reported that subsequent to the strut repair, he had not had any landing gear shimmy problems, unusual vibrations or behaviors, brake chatter, or any other possible indicators of an abnormal condition.

According to information provided by the pilot, between the time of the strut repair and the accident, the airplane completed 32 flight legs, not including the accident flight. Of those, 25 were by the pilot, and the other 7 were by the HBC representative. It was not determined whether each leg was terminated by a shutdown of the airplane, which generally would have dictated a preflight inspection prior to conducting the subsequent leg.

Despite the possibility of 33 preflight inspections by two different pilots, and the renewed attention to the condition of the LMLG, neither of the pilots observed a missing cotter key in the LMLG torque link ("knee") joint, or any other abnormalities with the LMLG.

LMLG Component Examination

The two torque links from the LMLG were sent to the NTSB Materials Laboratory in Washington, DC, for detailed examination. A portion of the attachment lug was fractured from the landing gear strut cylinder, and remained attached to the upper link segment. The fracture surface showed mostly rough matte gray fracture features consistent with overstress fracture. A thin region on the inboard edge of the fracture appeared shiny with a deformation lip at the edge, features consistent with the compression side of an overstress fracture under bending loads.

The torque link knee joint was a clevis arrangement, with the two lugs of the clevis located on the lower link, and the single lug located on the upper link. As assembled, a bushing is installed within the hole on the upper link, and a bolt is inserted through the holes in the lower link and through the bushing. The inboard lug on the lower link was bent inboard relative to the centerline of the link. The outboard lug of the lower link and the lug on the upper link appeared visually aligned with their respective link axes.

The bores of the attach bolt holes were generally free of impact marks, fretting, elongation, and wear. Dimensionally, all holes were in compliance with the manufacturer's design specifications. Damage consistent with sliding contact was observed at the edge of the hole at the inboard face of the outboard lug on the lower link, and corresponding sliding contact damage was also observed on the edge of the mating face on the upper link. In addition, damage consistent with sliding contact was observed at the edge of the inboard lug on the lower link, and corresponding sliding contact damage was observed on the mating face of the upper link.

A representative of the airplane manufacturer indicated that there were no known fatigue failures of the torque link knee joint attach bolt. He also reported that the manufacturer's technical personnel could not envision "a likely scenario in which a properly installed bolt/nut would fail due to excessive/improper landing loads." In addition, he reported that "If the bolt/nut had been installed correctly and [were] intact, we would expect to see more damage on the links than was observed in the photos" of the damaged components.

Pilot Information

Certificate:	Private	**Age:**	71
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	March 16, 2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 9, 2011
Flight Time:	864 hours (Total, all aircraft), 45 hours (Total, this make and model), 850 hours (Pilot In Command, all aircraft), 28 hours (Last 90 days, all aircraft), 7 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	HAWKER BEECHCRAFT	**Registration:**	N7122T
Model/Series:	G58	**Aircraft Category:**	Airplane
Year of Manufacture:	2011	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TH-2325
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	54 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	C126 installed, not activated	**Engine Model/Series:**	IO-550
Registered Owner:	W H Hampton III	**Rated Power:**	300 Horsepower
Operator:	W H Hampton III	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MFR,1335 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	11:53 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.14 inches Hg	**Temperature/Dew Point:**	24°C / 12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Palm Springs, CA (PSP)	**Type of Flight Plan Filed:**	IFR
Destination:	Medford, OR (MFR)	**Type of Clearance:**	IFR
Departure Time:	08:39 Local	**Type of Airspace:**	

Airport Information

Airport:	Rogue Valley Intl-Medford MFR	**Runway Surface Type:**	Asphalt
Airport Elevation:	1335 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	32	**IFR Approach:**	None
Runway Length/Width:	8800 ft / 150 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	42.374168,-122.873611(est)

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	Curt Cowley; FAA FSDO; Portland, OR
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Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=84442