Aviation Investigation Final Report

Location:	PHOENIX, Arizona	**Accident Number:**	LAX99LA097
Date & Time:	February 15, 1999, 11:43 Local	**Registration:**	N1557T
Aircraft:	Cessna 414	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot landed on runway 26R with three green landing gear down indicator lights. He said that the airplane seemed to roll normally down the centerline for approximately 200 feet, then the left landing gear collapsed and the airplane subsequently veered off the runway and struck taxiway lights. Postaccident investigation of the airplane revealed that the attachment location of the left main landing gear for the downlock bellcrank was separated and the attachment bolt was sheared. Additionally, there was a significant difference in the downlock tension adjustment of the landing gear components of the left side versus the right side of the airplane. System rigging of the landing gear requires adjustments to the fork bolt and the push-pull tube, which must be made together and in the same amount in opposite directions. The failed components were tested for chemical composition and hardness and all met their material specifications. Metallurgical examination of the parts disclosed that all fractures and bends were a direct result of an overload event. Maintenance records established that a re-rigging was performed on the airplane following the maintenance work on the landing gear system 10 days and 11 flight hours prior to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The overload failure of the left main gear locking mechanism due to improper system rigging by maintenance personnel.

Findings

Occurrence #1: MAIN GEAR COLLAPSED
Phase of Operation: LANDING - ROLL

Findings
1. (C) LANDING GEAR,MAIN GEAR ATTACHMENT - OVERLOAD
2. (C) MAINTENANCE,ADJUSTMENT - IMPROPER - OTHER MAINTENANCE PERSONNEL

Occurrence #2: ON GROUND/WATER COLLISION WITH OBJECT
Phase of Operation: LANDING - ROLL

Findings
3. OBJECT - RUNWAY LIGHT

Factual Information

On February 15, 1999, at 1143 hours mountain standard time, a Cessna 414, N1557T, sustained substantial damage when the left main gear collapsed during touchdown on runway 26R at Phoenix Sky Harbor Airport, Phoenix, Arizona. The aircraft veered off the runway following the gear collapse and subsequently struck three sets of runway lights. The private pilot/owner of the aircraft was not injured. The airplane had departed Scottsdale airport at 1120 and was en route to Sky Harbor airport for routine maintenance. The aircraft was being operated under 14 CFR Part 91 when the accident occurred. Visual meteorological conditions prevailed and a flight plan was not filed for the flight.

The pilot reported that he was landing on runway 26R at the airport and he had three green lights for the landing gear and was using 45 degrees of flaps. He stated that he pulled the power completely off and touched down on the runway using first the main gear and then the nose gear. He said the airplane seemed to roll normally down the centerline for approximately 200-feet and then noticed it "lean" to the left. He said he looked out the window and saw the left wingtip on the ground and the propeller hit the ground and stop spinning. He then pulled the mixture control for the left engine and applied right rudder to try and keep the airplane in the center of the runway. He added that he never applied brakes during the landing. He stated that the airplane was sliding towards the left side of the runway, and it finally hit three taxi lights on the side of the runway.

The pilot told Safety Board investigators that the airplane had just had the landing gear bushings replaced approximately 8 hours before the date of the accident. The pilot reported to the City of Phoenix Airport personnel that he had taken his airplane to Sawyer Aviation near the end of December 1998 to have some work done on both the right and left main gear, and he had picked the airplane up after the work was completed on February 5, 1999. A review of the pilot's logbook pages revealed that he had flown the airplane for a total of 11.4 hours since having the maintenance performed on the airplane.

An entry in the airplane maintenance logs found that Sawyer Aviation performed some work on the landing gear (reference work order #52662) on January 29, 1999. The entry documented the replacement of the landing gear bushings, bearings, and hardware, as well as the repair of a broken left gear proximity switch wire. Additionally, the left main upper retract brace was replaced with a serviceable unit. The landing gear was reportedly re-rigged per the maintenance manual.

At the request of Safety Board investigators, a Cessna Aircraft Company air safety investigator traveled to Phoenix to examine the airplane under the supervision of Federal Aviation Administration (FAA) inspectors. During the inspection, which took place on February 22, 1999, the Cessna investigator noted that the attachment location on the left main landing gear

(MLG) for the downlock bellcrank was separated and the attachment bolt was sheared. Additionally, the adjustment screw at the bottom of the downlock switch actuator was sheared. A significant difference was found in the downlock tension adjustment of the left side versus the right side of the airplane. According to the Cessna representative, the adjustment of the downlock tension is made with the fork bolt and the push-pull tube, which attaches to the downlock bellcrank. If the push-pull tube is shortened then the fork bolt must be lengthened. He also added that the two adjustments must be made together and the same amount in the opposite directions.

The damaged parts were sent to the FAA Wichita Aircraft Certification Office (CMO), who supervised a metallurgical examination of the components at the Cessna Aircraft Company. A copy of the report is appended to this report. The link assembly-side brace lock, end fitting assembly, left-hand brace assembly, left-hand main gear trunnion, bolt and bushing, and adjusting screw were visually examined and photographed prior to being examined further. As noted in the Cessna report, the bolt and bushing used to connect the end fitting assembly to the link from the left-hand brace assembly were bent and deformed. The NAS bolt used to connect the bellcrank assembly to the MLG trunnion was bent forward of the fracture surface. The forward ear of the bellcrank attach lug from the MLG trunnion was bent in a forward direction immediately outboard of the fracture surface.

Sections of material from the adjusting screw, NAS bolt, and nose landing gear (NLG) trunnion were submitted for chemical analysis. The results of the tests showed that all three components were in conformance with the composition requirements of their respective material specifications.

Hardness testing was also performed on sections removed from the three components. The average hardness of the adjusting screw was determined to be 36.1 HRC, which corresponds to an equivalent tensile strength of approximately 162 ksi. According to the Cessna report, this exceeds the 125 ksi minimum tensile strength required by MIL-S-6758 for 4130 steel in the quenched and tempered condition. The average hardness of the NAS bolt was found to be 37.5 HRC, which is within the 36- to 40-HRC hardness requirements of the NAS 498 specification to which the bolt was manufactured. The average hardness of the MLG trunnion was determined to be 80.6 HRB. According to AMS 2658, 2014 aluminum in the T6 temper is required to have a minimum hardness of 78 HRB. Based on the measured hardness, the MLG trunnion conformed to AMS 2658.

The MLG trunnion, adjusting screw, and NAS bolt were examined using a scanning electron microscope (SEM). The examination revealed the presence of ductile dimples over the entirety of each of the three component fractures. According to the Cessna metallurgical report, the presence of ductile dimples on the fracture surfaces, coupled with deformation of the parts at and away from the fracture surfaces, indicated that separation fracture of each of the three components was the direct result of an overload event. The report concluded that there was no evidence of fatigue or material imperfections that was visually apparent on any of the fracture surfaces examined.

Pilot Information

Certificate:	Private	**Age:**	31,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	September 24, 1998
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	1320 hours (Total, all aircraft), 40 hours (Total, this make and model), 1320 hours (Pilot In Command, all aircraft), 55 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N1557T
Model/Series:	414 414	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	414-0272
Landing Gear Type:	Retractable - Tricycle	**Seats:**	7
Date/Type of Last Inspection:	September 26, 1998 Annual	**Certified Max Gross Wt.:**	6350 lbs
Time Since Last Inspection:	52 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	5363 Hrs	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	TSIO-520-J
Registered Owner:	THOMAS P. SMITH	**Rated Power:**	285 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PHX ,1135 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	11:56 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	290°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	17°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	SCOTTSDALE (SDL)	**Type of Flight Plan Filed:**	None
Destination:	(PHX)	**Type of Clearance:**	VFR
Departure Time:	11:20 Local	**Type of Airspace:**	Class B

Airport Information

Airport:	PHOENIX SKY HARBOR KPHX	**Runway Surface Type:**	Asphalt
Airport Elevation:	1135 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	26R	**IFR Approach:**	None
Runway Length/Width:	10000 ft / 150 ft	**VFR Approach/Landing:**	Full stop

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	33.430522,-112.009582(est)

Administrative Information

Investigator In Charge (IIC):	Childress, Deborah
Additional Participating Persons:	STEVE HANES; SCOTTSDALE , AZ ANDREW L HALL; WICHITA , KS
Original Publish Date:	November 30, 2000
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45777