



Aviation Investigation Final Report

Location:	Burns, Oregon	Accident Number:	WPR19LA020
Date & Time:	October 27, 2018, 07:50 Local	Registration:	N3267S
Aircraft:	Cessna 182	Aircraft Damage:	Substantial
Defining Event:	Landing gear collapse	Injuries:	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Upon approaching the intended landing area, the pilot performed a high reconnaissance to assess the wind conditions. The airplane touched down and, during the landing roll, the left wing dipped downward. The left wing made contact with the ground before coming to rest with the left main landing gear sheared off.

The attachment bolt that connected the left main landing gear leg bracket exhibited a fatigue crack that had progressed through about one third of the bolt cross-section. This fatigue crack initiated at multiple fatigue crack initiation sites along the thread root. This thread root exhibited corrosion pitting that had penetrated the outer cadmium plating, which had led to fatigue cracking. When the remainder of the bolt could no longer support the stress at landing, the remaining cross section fractured in overstress. As this crack had propagated through about one third of the cross section without a discernible transition or mixed fracture zone between the fatigue crack and subsequent stress, the final fracture occurred at a high load event, such as the accident landing.

The bolts had been plated with cadmium, a corrosion inhibitor. However, corrosion pitting was observed along the threads, which led to fatigue cracking in both bolts. Although the cadmium plating can provide protection to the underlying alloy steel, corrosion such as in the form of pitting can still occur. This may be due to the operational environment, including locations near saltwater, as well as from a crevice corrosion mechanism.

With the fatigued bolt having fractured, the bracket would be able to flex or slide out the side. With these components able to flex, the bottom of the support housing could not support the downward forces from the gear spring, which led to its fracture. This would allow a cantilever force on the inboard support, which would have been enough force to fracture the attachment bolt on that support and the upper support frame. Although a hard landing would have caused this bolt to fracture, the fatigue crack diminished the amount of stress it could withstand.

Probable Cause and Findings

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

The failure of the left main landing gear due to fatigue cracking of a bolt that initiated at a corrosion pit, which formed in the absence of a required protective cadmium coating.

Findings

Aircraft	Gear attach fittings (on fus) - Fatigue/wear/corrosion
Aircraft	Main landing gear attach sec - Failure

Factual Information

History of Flight

Landing-landing roll	Landing gear collapse (Defining event)
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On October 27, 2018, about 0750 Pacific daylight time, a Cessna 182G airplane, N3267S, was substantially damaged when it was involved in an accident near Burns, Oregon. The private pilot and two passengers were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot stated that, upon approaching the intended landing area in the Alvord Desert near Burns, the pilot performed a high reconnaissance to assess the wind conditions. He observed two other airplanes land before him and configured the airplane with the wing flaps in the full-down position. The airplane touched down, during the landing roll, the left-wing dipped downward. He applied left rudder and right aileron to correct the left wing's attitude. Despite his efforts, the left-wing made contact with the ground before coming to rest. The left main landing gear was sheared off and the nose gear collapsed.

A witness reported that she observed airplanes landing in the landing area and took photographs of part of the accident sequence. She stated that the accident airplane touched down and the airplane suddenly pitched up in the air, then the nose was pushed into the desert terrain (see figure 1).



Figure 1: The accident airplane impacting the ground.

The main landing gear consisted of two channels that attached to each leg. The inboard channel contained a bolt that was attached through a hole in the gear leg (see figure 2). The outboard channel was clamped around the gear leg, and a forward and aft bolt secured the clamp. The Textron Aviation Maintenance Manual contained a note stating that the bolts attaching the outboard channel must be torqued from 660 to 750 inch-pounds with at least 80% contact between the channel and strut.

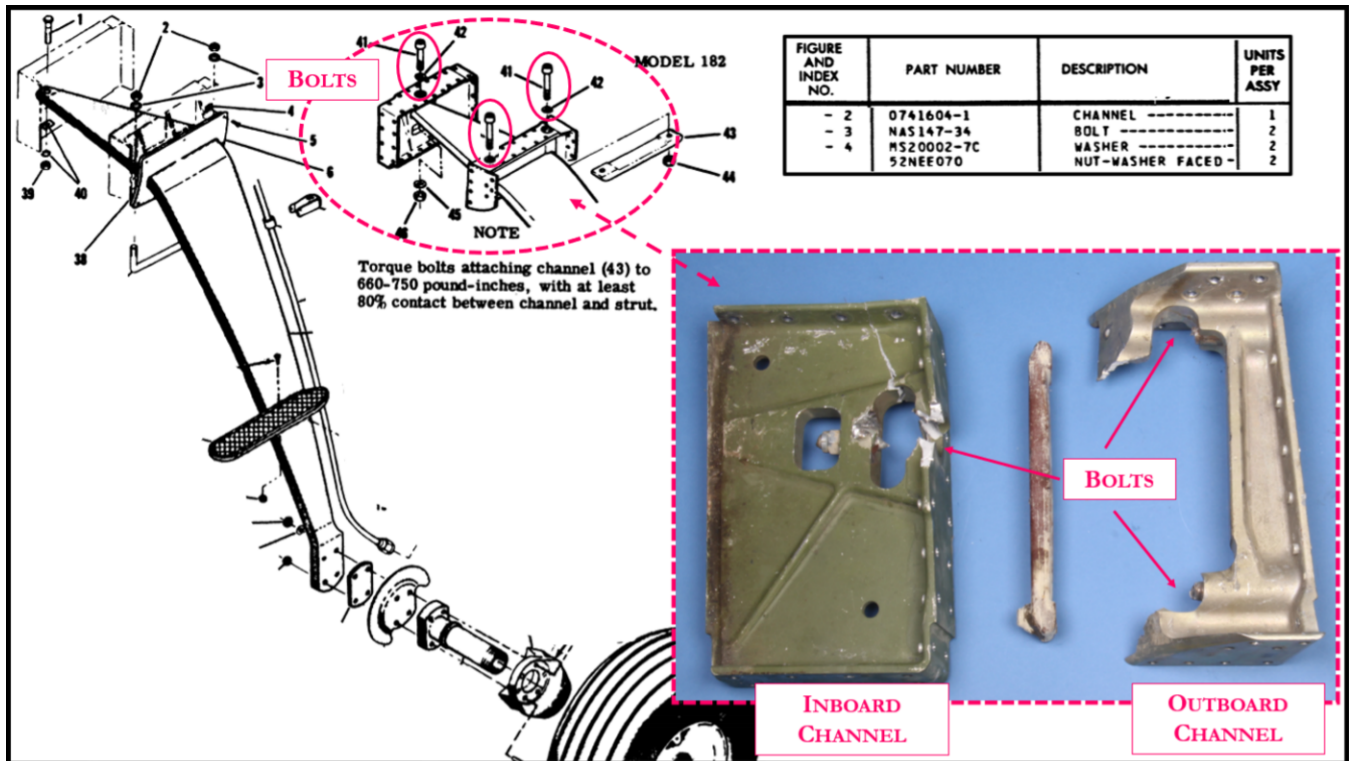


Figure 2: Main landing gear leg diagram and accident parts

The National Transportation Safety Board Materials Laboratory's examination of the left main landing gear's remaining channels and bolts revealed that the inboard support had two rounded rectangular cavities, which had contained an attachment bolt; the lower remnant of this bolt and the nut along the threaded portion of the shank were still affixed to the support. The upper portion of the bolt (the head) was missing, and the fracture surface displayed a 45° slanted orientation. Adjacent to the bolt on the support side was a V-shaped impact mark consistent with an adjacent component colliding with the support and moving downward (or outboard). A portion of the upper flange on the support had fractured and liberated, with cracks emanating from this position. The upper left portion of the support exhibited a crack emanating from the upper rectangular cavity, consistent with overstress fracture and another component impacting, fracturing, and deforming the support flange upward.

The bolts had been plated with cadmium, a corrosion inhibitor. However, corrosion pitting was observed along the threads, which is consistent with fatigue cracking in the thread roots of both bolts (the right bolt only exhibited small fatigue cracks, less than 100 μm in depth). While the cadmium plating can provide protection to the underlying alloy steel, corrosion pitting can still occur. This may be due to the operational environment, including locations near saltwater, as well as from a crevice corrosion mechanism.

The bolt exhibited a hardness of 31 Rockwell C Hardness Scale, which generally corresponds to a tensile strength of 141,000 pounds per square inch. With a crack depth of 0.13 inch, which is 32% of the bolt cross section, the fracture toughness of the bolt would be reduced by at least 45%.

Pilot Information

Certificate:	Private	Age:	58,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	August 17, 2018
Occupational Pilot:	No	Last Flight Review or Equivalent:	August 30, 2018
Flight Time:	(Estimated) 447 hours (Total, all aircraft), 191 hours (Total, this make and model), 447 hours (Pilot In Command, all aircraft), 15 hours (Last 90 days, all aircraft), 10 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N3267S
Model/Series:	182 G	Aircraft Category:	Airplane
Year of Manufacture:	1964	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	18255767
Landing Gear Type:	Tricycle	Seats:	
Date/Type of Last Inspection:	May 7, 2018 Annual	Certified Max Gross Wt.:	2348 lbs
Time Since Last Inspection:	25 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	3651 Hrs as of last inspection	Engine Manufacturer:	Continental
ELT:	C91A installed, activated, did not aid in locating accident	Engine Model/Series:	O-520-UTS
Registered Owner:		Rated Power:	280 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KREO,4050 ft msl	Distance from Accident Site:	25 Nautical Miles
Observation Time:	14:52 Local	Direction from Accident Site:	52°
Lowest Cloud Condition:	Clear	Visibility	
Lowest Ceiling:		Visibility (RVR):	
Wind Speed/Gusts:	3 knots /	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	70°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.13 inches Hg	Temperature/Dew Point:	10°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Caldwell, ID (EUL)	Type of Flight Plan Filed:	None
Destination:	Burns, OR	Type of Clearance:	None
Departure Time:	07:45 Local	Type of Airspace:	

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	2 None	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	3 None	Latitude, Longitude:	42.3325,-118.31583(est)

Administrative Information

Investigator In Charge (IIC):	Keliher, Zoe		
Additional Participating Persons:	Bryan Fisher; Federal Aviation Administration; Boise, ID		
Original Publish Date:	April 1, 2022	Investigation Class:	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=98612		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).