



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Ramona, California	Accident Number:	ANC18LA043
Date & Time:	June 1, 2018, 11:18 Local	Registration:	N9410M
Aircraft:	Cessna 210	Aircraft Damage:	Substantial
Defining Event:	Landing gear collapse	Injuries:	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot was conducting a personal, cross-country flight. He reported that he attempted to lower the retractable landing gear during a visual approach; however, the right main landing gear (MLG) did not fully extend. He attempted to manually pump the landing gear down with the emergency hand pump, but it was very difficult to move, and after several pumps, it would not move at all. Upon landing, the right MLG collapsed and the airplane impacted the ground, which resulted in substantial damage to the right horizontal stabilizer and elevator. Postaccident examination and tests revealed that, when the MLG system was tested using the airplane's engine-driven hydraulic pump, fluid started leaking from a gap in the pump's diaphragm seal between the front plate assembly and the rear housing assembly, and the MLG would not extend. Subsequently, the MLG system was tested with an external hydraulic pump, and it functioned properly. The two front plate cap screws on the side of the leaking pump gap were loose, had only three or four threads engaged with the rear assembly, and had insufficient shank length. The corresponding rear housing internal threads were sheared.

Due to the installation of cap screws with insufficient shank length, fewer threads were engaged when the screws were tightened. The insufficient length of the shanks likely led to excessive force being applied on the engaged threads when the cap screws were installed, the threads being damaged, and a gap in the pump housing to develop, which allowed fluid to leak from the pump when it was pressurized. The hydraulic leak prevented the right MLG from fully extending and resulted in it collapsing upon landing.

Probable Cause and Findings

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

The failure of the engine-driven hydraulic pump due to the installation of improper cap screws, which resulted in a gap in the pump housing, a subsequent hydraulic leak, and the landing gear collapsing.

Findings

Aircraft	Pump, main - Incorrect service/maintenance
Aircraft	Hydraulic fluid - Related operating info
Aircraft	Main landing gear - Malfunction

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Approach	Sys/Comp malf/fail (non-power)
Landing-landing roll	Landing gear collapse (Defining event)

On June 1, 2018, about 1118 Pacific daylight time, a Cessna 210 airplane, N9410M, sustained substantial damage when it was involved in an accident at Ramona Airport (RNM), Ramona, California. The pilot and the passenger were uninjured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot stated that, while approaching RNM after a 4-hour flight, he selected the landing gear handle to the “down” position; however, the green gear down light did not illuminate and the main landing gear did not lock in the down position. He then selected the landing gear handle up but the landing gear did not retract. He then attempted to manually pump the landing gear down using the emergency hand pump, but the handle was very difficult to move, and then it would not move. He conducted a visual approach and landing to the runway.

During the landing, the right main landing gear (MLG) collapsed, followed by the right wing and horizontal stabilizer impacting the ground. The airplane then veered right, departed the runway, and came to rest on the parallel taxiway. The mechanic who recovered the airplane reported seeing a lot of hydraulic fluid on the airplane’s belly.

Examination of the airplane revealed that right horizontal stabilizer and elevator had sustained substantial damage. The landing gear system was operated with an external hydraulic pump, and the landing gear extended and retracted normally; however, during the manual operation of the system, the right MLG down-lock did not engage consistently.

The airplane’s engine-driven hydraulic pump was mounted on an external electric-driven system, and when the hydraulic system was pressurized, fluid started leaking from a gap in the diaphragm seal between the rear housing assembly and front plate assembly, and fractured pieces of the diaphragm seal were visible in the gap (see figure 1). The right MLG would not cycle when powered by the leaking pump. When an airworthy pump was used to test the MLG, it functioned properly.

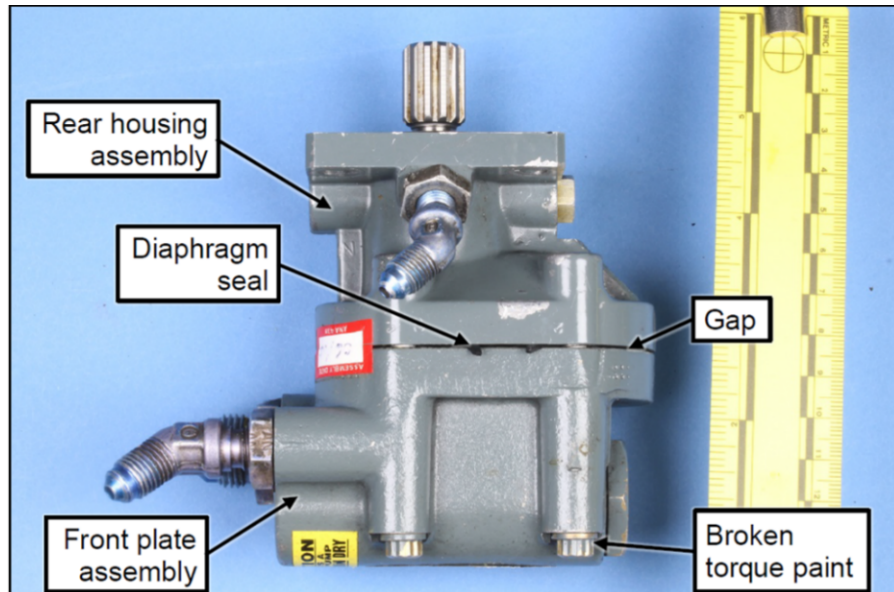


Figure 1. A photograph showing the engine-driven hydraulic pump before disassembly.

Four cap screws were installed and holding the assembly together; however, the two front plate cap screws on the side with the leaking seal gap were loose and could not be tightened. The screws only had three or four threads engaged with the rear assembly, and the one screw's shank length was .173 inch shorter than the manufacturer's specified minimum shank length, and the other was .158 inches shorter than the minimum shank length. The corresponding rear housing internal threads were sheared and displaced. All four of the screws had evidence of locking compound on the threads, which was inconsistent with the aircraft service manual instructions. Only two of the four cap screws had torque markings present.

Pilot Information

Certificate:	Private	Age:	68,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Unknown
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:	May 1, 2017
Occupational Pilot:	No	Last Flight Review or Equivalent:	October 28, 2016
Flight Time:	(Estimated) 1951 hours (Total, all aircraft), 1432 hours (Total, this make and model), 13 hours (Last 90 days, all aircraft), 12 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N9410M
Model/Series:	210 K	Aircraft Category:	Airplane
Year of Manufacture:	1970	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	21059310
Landing Gear Type:	Retractable - Tricycle	Seats:	6
Date/Type of Last Inspection:	July 20, 2017 Annual	Certified Max Gross Wt.:	3803 lbs
Time Since Last Inspection:	221 Hrs	Engines:	1 Reciprocating
Airframe Total Time:		Engine Manufacturer:	CONT MOTOR
ELT:		Engine Model/Series:	IO 520-L53B
Registered Owner:	On file	Rated Power:	285 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:	KRNM, 1393 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	10:53 Local	Direction from Accident Site:	262°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots / None	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	300°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.97 inches Hg	Temperature/Dew Point:	24°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	BELEN, NM (E80)	Type of Flight Plan Filed:	None
Destination:	RAMONA, CA (RNM)	Type of Clearance:	VFR
Departure Time:	08:30 Local	Type of Airspace:	Class D

Airport Information

Airport:	RAMONA RNM	Runway Surface Type:	Asphalt
Airport Elevation:	1394 ft msl	Runway Surface Condition:	Dry
Runway Used:	27	IFR Approach:	None
Runway Length/Width:	5001 ft / 150 ft	VFR Approach/Landing:	Full stop

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	1 None	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	2 None	Latitude, Longitude:	33.038612,-116.910552(est)

Administrative Information

Investigator In Charge (IIC):	Price, Noreen
Additional Participating Persons:	Oded Moore; FAA FSDO; San Diego, CA
Original Publish Date:	May 27, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=97405

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).