



National Transportation Safety Board Aviation Accident Factual Report

Location:	California City, CA	Accident Number:	WPR16LA108
Date & Time:	05/13/2016, 1315 PDT	Registration:	N9370C
Aircraft:	CESSNA 180	Aircraft Damage:	Substantial
Defining Event:	Loss of control on ground	Injuries:	2 Minor
Flight Conducted Under:	Part 91: General Aviation - Personal		

On May 13, 2016, about 1315 Pacific daylight time, a Cessna 180, N9370C, was substantially damaged when it nosed over onto its back following a landing at California City airport (L71), California City, California. The private pilot and his passenger received minor injuries. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed.

According to the pilot/owner, the airplane had just been approved for a return to service via an annual inspection the day prior to the accident. Subsequent to that, the pilot conducted one uneventful flight in the airplane. The following day, the pilot and his passenger flew from Shafter Minter field (MIT), Shafter California, to L71, in order to have another maintenance facility provide a cost estimate for some sheet metal work. The flight was uneventful until the landing on runway 24. The airplane touched down in the three-point attitude, bounced once, and then touched down again. Immediately after touchdown, the airplane began veering to the left, but the pilot was unable to correct the veer, despite control inputs and right brake application. When the airplane had slowed to a speed between 15 and 10 mph, it exited the south edge of the paved runway surface, and nosed over onto its back.

Personnel from two separate airport maintenance facilities were summoned to right the airplane, and clear it from the runway environment. The individual who was to conduct the sheet metal work was an aircraft mechanic with an Inspection Authorization, and he assisted in the recovery. He reported that prior to righting the airplane, he manually rotated both main wheels in both directions; they rotated freely, and offered only normal resistance. The airplane was then righted, and towed backwards on its main gear to his facility. On-scene documentation indicated the presence of a skid mark that terminated at the edge of the pavement, and aligned with the right main gear. The skid mark was estimated to be about 300 feet long. The airplane was retained undisturbed for subsequent examination by Federal Aviation Administration (FAA) and NTSB personnel.

Pilot Information

Certificate:	Private	Age:	62, Male
Airplane Rating(s):	Single-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:	04/02/2015
Occupational Pilot:	No	Last Flight Review or Equivalent:	04/10/2015
Flight Time:	1433 hours (Total, all aircraft), 105 hours (Total, this make and model), 1307 hours (Pilot In Command, all aircraft), 31 hours (Last 90 days, all aircraft), 7 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

The pilot held a private pilot certificate with an instrument rating. He reported that he had about 1,430 total hours of flight experience, including over 1,000 hours in taildragger airplanes, and 105 hours in the accident airplane make and model. His most recent flight review was completed in April 2015, and his most recent FAA third-class medical certificate was also issued in April 2015.

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	Registration:	N9370C
Model/Series:	180 UNDESIGNAT	Aircraft Category:	Airplane
Year of Manufacture:	1955	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	31768
Landing Gear Type:	Tailwheel	Seats:	4
Date/Type of Last Inspection:	05/12/2016, Annual	Certified Max Gross Wt.:	2550 lbs
Time Since Last Inspection:	1 Hours	Engines:	1 Reciprocating
Airframe Total Time:	2271 Hours at time of accident	Engine Manufacturer:	CONT MOTOR
ELT:	C126 installed, not activated	Engine Model/Series:	O-470 SERIES
Registered Owner:	On file	Rated Power:	230 hp
Operator:	On file	Operating Certificate(s) Held:	None

FAA information indicated that the airplane was manufactured in 1955, and was equipped with a Continental O-470 series engine. The airplane was involved in a landing accident in 1974 but was repaired and returned to service.

The pilot purchased the airplane in May 2015. According to the pilot, the airplane and engine had a total time in service of about 2,271 hours.

The most recent annual inspection included some brake maintenance. Both brake discs, and the left brake pads, had been replaced with new components; the previous/used brake pads were retained on the right brake caliper. Comparison of the maintenance entry writeup and the airplane manufacturer's maintenance guidance indicated that the components that were replaced were the correct part numbers. No other potentially relevant activity was noted in that annual entry.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	MHV, 2801 ft msl	Distance from Accident Site:	9 Nautical Miles
Observation Time:	1320 PDT	Direction from Accident Site:	225°
Lowest Cloud Condition:	Clear	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	15 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	200°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	32° C / -4° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Shafter, CA (MIT)	Type of Flight Plan Filed:	None
Destination:	California City, CA (L71)	Type of Clearance:	None
Departure Time:	1230 PDT	Type of Airspace:	Class E

The 1320 automated weather observation at Mohave Air and Space Port (MHV), Mohave, California, located about 9 miles southwest of L71, included winds from 200 degrees at 15 knots, visibility 10 miles, clear skies, temperature 32 degrees C, dew point minus 4 degrees C, and an altimeter setting of 30.00 inches of mercury.

Airport Information

Airport:	California City (L71)	Runway Surface Type:	Asphalt
Airport Elevation:	2453 ft	Runway Surface Condition:	Dry
Runway Used:	24	IFR Approach:	None
Runway Length/Width:	6027 ft / 60 ft	VFR Approach/Landing:	Full Stop; Traffic Pattern

L71 is located in the Mojave Desert, near California City California. The airport is situated at an elevation of 2,454 feet above mean sea level (msl). The single paved asphalt runway, designated 6/24, measures 60 by 6,027 feet. The airport was not equipped with an air traffic control tower or any automated weather detection or reporting equipment. Three windsocks, one midfield, and one near each threshold, were located north of the runway.

Wreckage and Impact Information

Crew Injuries:	1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:	1 Minor	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Minor	Latitude, Longitude:	35.151111, -118.016667 (est)

The airplane came to rest inverted, on a magnetic heading of approximately 025 degrees, in the desert soil just off the south edge of the runway. The outboard end of the left wing extended onto the paved surface. The stopping point was located about 1,800 feet from the 24 threshold. A tire skid mark began near the runway centerline, approximately 150 feet prior to the airplane stopping point. The first 15 to 20 feet of the skid mark was light and was oriented approximately parallel to the runway. The mark then began to turn to the left, and became darker. About halfway (laterally) between the initiation point and the runway edge, the skid mark became very pronounced, and then sequentially exhibited a cusp to the right, an interruption, and an 'S' bend. It then continued nearly straight, oriented about 45 degrees to the runway edge, before curving right, and terminated about 2 feet prior to the runway edge. The soil was disturbed between the skid mark and the airplane just beyond it. The alignment of the skid mark and airplane was consistent with it having been made by the right main tire.

The airplane sustained damage to both wings, vertical stabilizer and rudder, cowl, firewall, engine mounts, and propeller. There was no fire, and there was negligible leakage of fuel or other fluids.

Additional Information

Airplane Examination

A few days after the accident, an FAA airworthiness inspector examined the recovered airplane. His examination did not reveal any apparent anomalies or pre-impact deficiencies. About one month later, the FAA inspector and the NTSB investigator examined the airplane in detail, in a hangar of the L71 facility that the pilot was planning to visit for his pre-accident sheet metal repair cost estimate.

Some interior and exterior components and panels were removed to enable access to the entire rudder/tailwheel control system. A 'Leatherman' type multi-tool (in its case) was found on the right cockpit floor, forward of the copilot's right rudder pedal. When found, it was not in a position/location that impeded rudder pedal travel, but its original (pre-accident) position/location was not able to be determined. The pilot/owner identified the tool as his. He noted that many cockpit/cabin items were displaced during the accident, and that at least one item had not been located. That item was not recovered by the investigators during their examination.

All control cables were found to be properly routed, and no components (pulleys, bellcranks, etc) displayed any unusual wear, corrosion, damage, or other anomalies that could be associated with previous or potential control interference.

Because the rudder & vertical stabilizer damage precluded full and free travel of the rudder, the deformed sections were cut away just below the upper rudder hinge, in order to free the rudder for normal travel for the examination. The aft fuselage was hoisted to lift the tailwheel off the ground. The bottom end of the rudder and the tailwheel appeared centered/neutral when the rudder pedals were set to the 'neutral' (left and right pedals 'even' with one another) position; this was confirmed for both the pilot's & copilot's pedal sets.

Both sets of cockpit rudder pedals were then exercised to their travel limits, and the system operation, and rudder and tailwheel deflections, were noted. The rudder and tailwheel responded similarly, irrespective of which pedal set (pilot vs copilot) was exercised. The rudder travel was bounded in both directions by the rudder stops, which were properly safetied. No binding, unusual noises, or other anomalies were noted when the pedals were exercised. Cable tensions were measured, and found to be within the proper range.

Rudder deflections (from neutral/0°) in the plane parallel to the airplane longitudinal and lateral axes were measured to be as follows:

- Left: 13°
- Right: 16°

The tailwheel was a Scott fully castering model, capable of swiveling 360° in either direction, with a centering detent. All cables, springs, and other components were properly routed, connected, and safetied. Manual manipulation of the tailwheel indicated that it operated normally.

Refer to the NTSB public docket for this accident for additional examination details.

Cessna Rudder Travel Limit Values

Per the Cessna Maintenance Manual (MM), the proper rudder travel limits, measured in the plane parallel to the airplane "waterline" and lateral axes, were 24° either side of the neutral/0° position. Those same values were published in the FAA Type Certificate Data Sheet (TCDS) for the airplane.

Previous Airplane Condition and Maintenance

The pilot arrived at the examination hangar towards the end of the examination. After the examination was completed, as the investigators were preparing to depart, the pilot mentioned that the reason that he had flown the airplane to L71 was to get a cost estimate to have his rudder "re-skinned." He explained that the re-skinning was intended to correct an improper top-to-bottom curvature (bowing) of the rudder, which was apparently the result of a previous accident.

The pilot did not know whether the rudder was deformed during that accident, or as a result of improper repair. He discovered the bowing problem shortly before the subject accident, when he attempted to have the airplane re-rigged, because it flew "left wing-heavy." At that time, he was advised by his mechanic that any effort to re-rig the airplane without first repairing/straightening the rudder would be unsuccessful and futile.

The pilot reported, and provided substantiating photographic evidence, that the curvature was such that when the top of the rudder was aligned with the fin, the bottom was deflected about 1.5 inches to the airplane right. Thus, with the bottom of the rudder centered (and the rudder pedals aligned with one another), the rudder curvature would result in the trailing edge of the upper portion of the rudder to be deflected to the airplane left. Because the rudder had been damaged in the subject accident, the curvature profile could not be measured and quantified.

Review of the NTSB database indicated that the airplane struck a horse during landing in 1974.

The airplane maintenance records contained entries or documentation for six separate maintenance activities/events regarding the rudder or rudder control or tailwheel steering systems, as follows:

- October 1973 Rudder and vertical stabilizer "replaced due to hangar damage"
- September 1979 Replaced right rudder cable
- May 1992 Airplane stripped and repainted; control surfaces removed and reinstalled
- September 1994 "Rudder reskinned"
- August 1999 Tailwheel "spring mount bracket" replaced, and new (accident) tailwheel installed
- April 2014 Annual inspection; "Check & adjust cable tensions"

Annual Inspection Guidance and Requirements

Aircraft operated in the United States under FAR Part 91 rules are required to be inspected on an annual basis; that inspection is formally designated the "Annual Inspection." The FAA

delineates guidance regarding the scope and detail of such inspections; the guidance specifies that the person conducting the inspection must use a checklist while performing the inspection. The guidance states that the checklist "may be of the inspector's own design, one provided by the manufacturer of the equipment being inspected or one obtained from another source," and elaborates that the checklist must include the scope and detail of the items contained Appendix D of FAR Part 43.

The manufacturer's published inspection guidance for the accident airplane make and model contained a comprehensive enumeration of items to be checked. Under the subheading "Rudder control system" the final line item was "Rudder system for correct rigging and proper travel."

The Annual Inspection affirms that the aircraft meets all applicable airworthiness requirements, which in part signifies that the airplane is in compliance with its type design, much of which is specifically cited in the TCDS. The TCDS for the accident make and model airplane specified the rudder travel ranges. Therefore, satisfactory completion of an Annual Inspection requires that the flight control surface travel ranges are in accordance with the type design and TCDS-specified ranges.

May 2016 Annual Inspection Information

The airframe maintenance record entry stated that the inspection was completed "per 43 Appendix D," and was followed by "checked cables and tension Inspected Pulleys; Rod Ends, Bellcranks; P/P tubes, Bearings, Hinges checked Flight control travels." NTSB communications with the mechanic who conducted the annual inspection revealed that he was the one who advised the pilot about the rudder bow. The mechanic reported that contrary to the pilot's statements, he (the mechanic) did not conduct any re-rigging or travel adjustments of any flight controls, including the rudder.

In a subsequent conversation between the FAA inspector and the mechanic, the mechanic reported that:

- He used the Cessna "100-180 Series" checklist as his guidance for the subject annual inspection
- He did not retain a copy of the checklist and findings from that inspection, but agreed to send the inspector an exemplar copy
- He checked the travel/deflection of the rudder with a protractor, while manually manipulating the rudder (by hand, not via the rudder pedals) to its respective left and right stops
- He also checked the cable tensions and "rigging"
- He determined that "no adjustments were necessary"

Attempted Follow-up Activity

As a result of the discrepancies between the inspection mechanic's rudder travel findings and those of the FAA/NTSB subsequent to the accident, the NTSB attempted to arrange for a third-party mechanic to conduct yet another measurement of the rudder travel. Although the third-party mechanic agreed to conduct the re-measurement, he instead purchased and

disassembled the wreckage without conducting the agreed-upon re-measurements. Therefore, the discrepancy between the two existing sets of measurements could not be reconciled.

Desert Wind Characteristics

L71 was situated in the Mojave Desert. According to multiple articles, including *Journal of Climate* (Influence of Albedo Variability in Complex Terrain on Mesoscale Systems) and *Journal of Applied Meteorology* (General Characteristics of Dust Devils), low level desert atmospheric conditions have several unique characteristics.

During all times of the year, daily solar insolation can be intense, with the spring and summer months the most likely times of year for greatest solar insolation. Solar insolation results in significant ground heating, especially in desert terrain, which in turn results in low-level atmospheric heating and thermally-induced, localized, small-scale turbulence. Excluding mesoscale or frontal activity, the typical daily cycle begins with calm, stable air at sunrise. The air remains relatively calm for a few hours, until the surface temperature rises, and heating rates reach the point where the air below approximately 150 feet becomes destabilized. With the air below 150 feet destabilized, strong, localized, short-duration, thermally induced wind disturbances are generated. These thermally induced wind disturbances manifest themselves as disorganized, random gusts, and as better organized, but still unpredictable and sometimes undetectable 'dust devils'. Powered by insolation, their occurrence, strength, location, and direction are influenced by multiple factors, including local surface topography, albedo, and structures, as well as small- and larger-scale air disturbances, all of which result in significant unpredictability. Durations of the thermally induced wind disturbances typically range between less than 1 minute to about 3 minutes. These thermally-induced wind disturbances increase in frequency as the day progresses, tending to peak an hour or two after local noon, and then diminish as the sun elevation decreases in the afternoon.

The repair facility owner, who had significant experience flying at L71 and MHV, stated that the winds could be very transient and unpredictable, particularly from late morning to early afternoon, during the hotter months. He also noted that in his experience, although L71 and MHV were only 9 miles apart, the concurrent wind conditions, speeds, and directions at the two airports could differ significantly from one another.

The pilot stated that the initial swerve to the left did not seem to him to be wind-induced, but that he could not completely discount wind as the cause for the initial swerve.

Administrative Information

Investigator In Charge (IIC):	Michael C Huhn
Additional Participating Persons:	Ray Martin; FAA; Van Nuys, CA
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=93160