Aviation Investigation Final Report

Location:	PAGE, Arizona	**Accident Number:**	LAX04LA194
Date & Time:	April 17, 2004, 13:10 Local	**Registration:**	N1815Z
Aircraft:	Cessna 205	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane landed hard after the pilot's control wheel fractured and separated in the landing flare. The pilot said that as he was adding back pressure to flare the airplane his control wheel fractured and separated at the upper left corner. The airplane's nose dropped rapidly and impacted the runway surface first, resulting in the airplane bouncing back into the air. The pilot repositioned his hand behind the broken wheel to the control column and manipulated the broken control yoke forward in an effort to maneuver the airplane back down to the runway surface; the nose landing gear bent and the propeller impacted the runway. The airplane was manufactured in 1962 and equipped with a polymeric control wheel. A metallurgical examination of the fracture surface on the control wheel revealed smooth crack arrest markings along with bands of slightly different colors, indicative of fatigue cracking. The location of the fracture indicated that the fatigue crack propagated as a result of tensile stress from the continual force of the pilot manipulating the control wheel forward and aft. The discoloration and crazing gave evidence of aging effects. The fatigue cracks likely initiated from age related crazed cracks in an area of maximum tensile stresses. The dirt and discoloration of the fracture (and the adjacent cracks and/or crazes), along with the depth of the fatigue crack would suggest that the crack has been in existence for a relatively long time (years, perhaps). Although the fatigue crack would not have been visible from the pilot's viewpoint, it occurred in an area where cracking would be most likely to occur based on the geometry of the yoke. The airplane underwent its last annual inspection 17.76 hours prior to the accident. The airplane manufacturer issued a Service Letter in1964 requiring a one time inspection and proof testing of applicable control wheels. The Service Letter further stated that once control wheels were checked, no further control wheel inspection was required. To show compliance with the Service Letter, a red dot was to be placed on the forward rivet butt on the bottom of the yoke. Both control wheels installed on the accident airplane showed evidence of a red material within the forward rivet butt, indicating that the inspections dictated by the Service Letter were previously preformed. The Federal Aviation Administration issued a Special Airworthiness Information Bulletin (SAIB) in 2001 recommending that during periodic

(100-hour or annual) inspections "special emphasis" should be placed on the original plastic control wheels installed in applicable airplanes. If crack indications were "unclear," it recommended that a test be performed in accordance with the manufacturer's Service Letter. The SAIB does not provide a specific location or guidance as to the visual indicators where the cracks are likely to propagate. A review of the Service Difficulty Report (SDR) database revealed a history of 18 control wheel failures in the applicable airplanes, of which a majority reported failures that occurred during a critical phase of flight, including: takeoff, initial climb, spin recovery, and landing flare. Five of the reported failures occurred after the issuance of the SAIB.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the fatigue fracture and separation of the pilot's control wheel, which resulted in a momentary loss of control and a hard landing.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
1. (C) FLT CONTROL SYST,YOKE/CONTROL STICK - FATIGUE
2. (C) FLT CONTROL SYST,YOKE/CONTROL STICK - SEPARATION

Occurrence #2: HARD LANDING
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
3. TERRAIN CONDITION - RUNWAY
4. AIRCRAFT CONTROL - NOT POSSIBLE - PILOT IN COMMAND
5. FLARE - NOT POSSIBLE - PILOT IN COMMAND

Factual Information

HISTORY OF FLIGHT

On April 17, 2004, about 1310 mountain standard time, a Cessna 205, N1815Z, experienced a hard landing at Page Municipal Airport, Page, Arizona. The pilot/owner was operating the airplane under the provisions of 14 CFR Part 91. The private pilot and one passenger were not injured; the airplane sustained substantial damage. The personal cross-country flight departed Fort Collins Downtown Airport, Fort Collins, Colorado, about 0830, with the planned destination of Page. Visual meteorological conditions prevailed and a flight plan had not been filed.

In a written statement, the pilot reported that upon entering the vicinity of the Page Municipal Airport, he maneuvered the airplane on the downwind leg of the traffic pattern for runway 15. He completed a standard traffic pattern with the airplane configured with 15 degrees of wing flaps on final approach and maintained an airspeed of about 90 miles per hour (mph). He maneuvered the airplane into a flare and just prior to touchdown the control wheel, or yoke, fractured and separated at the upper left corner.

The pilot further stated that the airplane's nose dropped rapidly and the nose wheel impacted the runway surface first, resulting in the airplane bouncing back into the air. He manipulated the remaining control yoke to maneuver the airplane back down to the runway surface. The airplane touched down hard and the nose landing gear bent resulting in the propeller impacting the runway. He taxied the airplane off the runway where he shut the engine down and egressed the airplane. He noted that during the landing sequence the wind was blowing from about 210 degrees at 20 mph. The pilot was positioned in the pilot's seat, which is oriented on the left side of the aircraft.

The accident was reported to the Federal Aviation Administration (FAA) Scottsdale, Arizona, Flight Standards District Office on April 23, 2004. In addition to the nose landing gear and propeller damage, the airplane incurred damage to the firewall and wing strut.

In written statements provided to a National Transportation Safety Board investigator, witnesses reported observing the airplane touchdown hard on the nose wheel and bounce down the runway numerous times. After egressing the airplane the pilot reported to the witnesses that the control yoke had broken off in his hand while in the landing flare.

AIRCRAFT INFORMATION

The airplane was a 1962 Cessna 205, serial number 205-0015. A review of the airplane's logbooks revealed that the airframe had undergone an annual inspection on July 22, 2003, at a total time of 3,948.24 hours. The pilot noted that after the accident the tachometer displayed

3,966 hours, which equates to the airplane having accumulated 17.76 hours since the last annual inspection. In the mechanic's entry for the annual inspection there was no specific reference to a control wheel inspection, nor is one required by the FAA.

METEOROLOGICAL INFORMATION

At 1256, the Page Automated Surface Observing System (ASOS) reported the wind from 200 degrees at 17 knots, gusting to 27 knots; variable wind from 170 to 230 degrees.

TESTS AND RESEARCH

Materials Laboratory Examination

The pilot's control wheel was sent to the Safety Board Material Laboratory for analysis. The upper cross bar of the pilot's polymeric control wheel was fractured near the upper left corner, where the handle adjoins the crossbar. At the center section of the upper crossbar the control wheel is riveted to an aluminum shaft, which connects the wheel to control linkages. The examination of the fracture surface revealed smooth crack arrest markings along with bands of slightly different colors, indicative of fatigue cracking. Discontinuities of the fracture surface reveal that the fatigue cracking originated at several locations, with a propagation through about 95 percent of the cross section. In addition, the control wheel surface contained numerous cracks and crazes that were dark in appearance.

An examination was also performed on the copilot's intact control wheel (right side of airplane); it showed no evidence of cracks or crazing.

The complete copy of the Safety Board Materials Laboratory factual report is included in the public docket for this accident.

ADDITION INFORMATION

Cessna Service Letter 64-8

Cessna Service Letter 64-8, originally issued on February 14, 1964, required a one time inspection and proof testing of applicable control wheels. The service letter was issued as a result of temperature controlling problems in the molding process during manufacture. After completing the inspection stated in the service letter, a red dot was to be placed on the forward rivet butt on the bottom of the yoke to indicate compliance. Evidence of a red material was found within the forward rivet butt of both control wheels installed on the accident airplane. The service letter further states that once control wheels have been checked, no further control wheel inspection is required.

A supplement to the Service Letter was issued February 28, 1964, 14 days after the issuance of the Service Letter. It gives further clarification of the inspection required concerning cracks

that are found in the control wheels. It states that "control wheels having crazed marks or slight checks need not be replaced," and that "these are not to be confused with real cracks which will open when force is applied."

Special Airworthiness Information Bulletin

Following a series of control wheel failures reported in the Service Difficulty Report (SDR) database, the FAA issued a Special Airworthiness Information Bulletin (SAIB) on September 10, 2001, CE-01-41. The bulletin indicated that the FAA had previously initiated three safety recommendations for Airworthiness Directive (AD) action to mandate inspections, tests, and/or replacements of the applicable Cessna control wheels. The last of such recommendations prompted the issuance of a Notice of Proposed Rulemaking (NPRM) circular. As a result of the NPRM, several objections were made against an AD citing "minimal risk" and the "small" number of reported cracks in recent years.

Additionally, the SAIB stated that the accident risk was negligible due to the redundancy provided by the installation of two control wheels (the availability of the copilot's control). It further added that a visual inspection should already be performed in accordance with Cessna Maintenance/Service Manuals and in 14 CFR 43, Appendix D.

The SAIB recommended that during periodic (100-hour or annual) inspections "special emphasis" should be placed on the original plastic control wheels installed in applicable Cessna airplanes. If crack indications are "unclear," it recommends that a test proof be performed in accordance with Cessna Service Letter 64-8 (with the exception of a reduction in pull force from 30 pounds, rather than the stated 50 pounds). The SAIB does not provide a specific location or guidance as to the visual indicators where the cracks are likely to propagate.

Inspections required

According to 14 CFR Part 43 Appendix D - Scope and Detail of Items (as Applicable to the Particular Aircraft) To Be Included in Annual and 100-Hour Inspections, each person performing an annual or 100-hour inspection shall inspect (where applicable) the cabin and cockpit group. This includes "all systems - for improper installation, poor general condition, apparent and obvious defects, and insecurity of attachment." There are no specific references to the control wheel.

A review of the Cessna Service Manual for the 200 series aircraft reveals that an examination of the "control lock, control wheel, and control column mechanism" should be conducted every 100-hour inspection (page 2-36, number 7).

SDR Database

A review of the SDR database revealed a history of 18 control wheel failures in the applicable

Cessna airplanes. The entries were dated from 1984 to the accident day. A majority of the reported failures occurred during a critical phase of flight, including: takeoff, initial climb, spin recovery, and landing flare. Six of the failures specifically stated that the control wheel broke in the same location as the accident yoke (upper left corner). In addition, five of the reported failures occurred after the issuance of the SAIB.

Additional Control Wheel

Several months after the accident occurred a Safety Board investigator located a fractured control wheel that was installed on a Cessna 205. It was sent to the Safety Board Materials Laboratory for examination. The pilot's control wheel had fractured in the leftmost portion of the upper horizontal crossbar, adjacent to the transition from the horizontal crossbar vertical handle. There were multiple crack origins in the inside bend of the corner of the control wheel.

Pilot Information

Certificate:	Private	**Age:**	60,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	April 1, 2004
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 1, 2003
Flight Time:	800 hours (Total, all aircraft), 200 hours (Total, this make and model), 800 hours (Pilot In Command, all aircraft), 10 hours (Last 90 days, all aircraft), 10 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N1815Z
Model/Series:	205	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	205-0015
Landing Gear Type:	Tricycle	**Seats:**	6
Date/Type of Last Inspection:	July 1, 2003 Annual	**Certified Max Gross Wt.:**	3300 lbs
Time Since Last Inspection:	17.76 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3966 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	IO-470
Registered Owner:	William Malm	**Rated Power:**	260 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PGA,4313 ft msl	**Distance from Accident Site:**	
Observation Time:	12:56 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	17 knots / 27 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.79 inches Hg	**Temperature/Dew Point:**	23°C / -8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fort Collins, CO (3V5)	**Type of Flight Plan Filed:**	None
Destination:	PAGE, AZ (PGA)	**Type of Clearance:**	None
Departure Time:	08:30 Local	**Type of Airspace:**	

Airport Information

Airport:	Page Municipal Airport PGA	**Runway Surface Type:**	Asphalt
Airport Elevation:	4313 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	15	**IFR Approach:**	None
Runway Length/Width:	5157 ft / 150 ft	**VFR Approach/Landing:**	Full stop;Traffic pattern

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:**	36.932498,-111.833335

Administrative Information

Investigator In Charge (IIC):	Keliher, Zoe
Additional Participating Persons:	John Eller; Federal Aviation Administration ; Scottsdale , AZ Thomas Tepnik; Cessna Aircraft Company; Wichita, KS
Original Publish Date:	May 30, 2006
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=59144