



Aviation Investigation Final Report

Location:	Longmont, Colorado	Accident Number:	CEN12FA199
Date & Time:	March 23, 2012, 11:43 Local	Registration:	N10468
Aircraft:	Cessna 172S	Aircraft Damage:	Substantial
Defining Event:	Midair collision	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

Radar track data depicted the accident airplanes on gradually converging flight paths prior to the accident. Immediately before the collision, the Cessna 172 appeared to be on a northnortheast course in level flight at 7,200 feet mean sea level (msl), and the Cessna 180 was in a gradual climb from 6,800 feet msl to 7,000 feet msl on a north course. Day visual meteorological conditions prevailed at the time of the accident, with reported visibilities at 60 miles. Neither pilot was receiving air traffic control advisories at the time of the collision. The radar track associated with the Cessna 180 indicated that after the collision the airplane entered a 270-degree right turn before proceeding to the west. The Cessna 172 continued northbound, as it entered a descent and impacted the ground.

The pilot of the Cessna 180 airplane stated that she heard a loud bang during cruise flight and the airplane immediately pitched up and rolled into right bank. She subsequently determined that elevator control was limited. The pilot attempted to divert to a local airport, but was unable to land on a runway due to the impaired airplane control. She executed a forced landing to an open area adjacent to the airport. A witness reported that the right horizontal stabilizer of the Cessna 180 appeared to be bent down about 90 degrees at mid-span as the airplane approached for the forced landing. The outboard portion of the right horizontal stabilizer of the Cessna 180 airplane was structurally compromised, which resulted in a nearly complete loss of pitch control. The pilot of the Cessna 180 airplane retained marginal pitch control by varying engine power during the remainder of the flight.

A postaccident examination did not reveal any pre-collision failures or malfunctions associated with either airplane. The examination determined that the left aileron/wing of the

Cessna 172 likely contacted the right horizontal stabilizer of the Cessna 180 in flight. The outboard portion of the left wing on the Cessna 172 was structurally compromised, rendering the airplane uncontrollable. Regulations required that each person operating an aircraft maintain vigilance so as to "see and avoid other aircraft."

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The inadequate visual lookout by the pilots of both airplanes, which resulted in a mid-air collision.

5	
Personnel issues	Incomplete action - Instructor/check pilot
Personnel issues	Incomplete action - Pilot of other aircraft

Findings

Factual Information

History of Flight

Enroute-cruise Uncontrolled descent Midair collision (Defining event) Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On March 23, 2012, about 1143 mountain daylight time, a Cessna 172S, N10468, and a Cessna 180, N9325C, were substantially damaged during a mid-air collision near Longmont, Colorado. The Cessna 172 impacted an embankment adjacent to a two-lane roadway, about 5 miles east of the Vance Brand Airport (LMO). The Cessna 180 impacted power lines and a chain link fence during a forced landing adjacent to LMO. The flight instructor and private pilot receiving instruction on-board the Cessna 172 were fatally injured. The pilot of the Cessna 180 sustained minor injuries. The Cessna 172 was registered to MountainAir Aviation Services LLC and operated by McAir Aviation LLC under the provisions of 14 Code of Federal Regulations Part 91 as an instructional flight. The Cessna 180 was registered to and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flights, which were both operated without flight plans. The Cessna 172 departed Rocky Mountain Metropolitan Airport (BJC) about 1130. The Cessna 180 departed Erie Municipal Airport (EIK) about 1136.

At 1130, the Cessna 172 was issued a takeoff clearance by the BJC air traffic control tower. At 1132, an aircraft on a 1200 transponder beacon code [the standard code for visual flight rules (VFR) operations] was observed on Denver Terminal Radar Approach Control (TRACON) facility radar in the vicinity of BJC. Based on the subsequent course flown, this aircraft is presumed to be the Cessna 172 airplane. The radar track data indicated that the airplane initially proceeded on a northwest course from BJC, before turning to a north-northeast course. About 11 miles north of BJC, the airplane executed a left 360-degree turn and returned to a north-northeast course. The track data depicted the airplane converging with a second target about 0.5 miles south of the Cessna 172 accident site.

At 1136, an aircraft on a 1200 (VFR) transponder beacon code was observed on Denver TRACON facility radar in the vicinity of EIK. Based on the subsequent course flown, this aircraft is presumed to be the Cessna 180 airplane. The radar data indicated that the airplane departed to the south and executed a right 180-degree turn to a northwest course. The airplane subsequently turned right to a north-northeast course.

The radar track data depicted the flight paths slowly converging to a point about 0.5 miles south of the Cessna 172 accident site. The data indicated that the Cessna 172 was at 7,200 feet mean sea level (msl), while the Cessna 180 was in a slow climb from 6,800 feet to 7,000 feet msl. At 1142:28 (hhmm:ss), the airplanes were separated laterally by about 393 feet and

vertically by about 200 feet. A loss of potentially two radar data points corresponding to the Cessna 180 was observed between 1142:29 and 1142:41. The loss of the data points is consistent with the close proximity to the second airplane at the time of the collision.

At 1142:42, track data associated with the Cessna 180 indicated an altitude of 7,400 feet msl. The airplane subsequently descended to 7,000 feet msl and entered a right 270-degree turn to a west course. At 1143:37, the Cessna 180 was established on a west course at 6,200 feet msl. Track data associated with the Cessna 172 depicted the airplane continuing on a north course in the direction of the accident site. At 1142:37, the Cessna 172 was at 7,200 feet msl. The airplane subsequently entered a descent, passing 6,800 feet msl at 1142:42. The final radar data point was recorded at 1142:46, with an associated altitude of 6,300 feet msl. The accident site was located 0.14 miles north-northeast of the final radar data point.

The Cessna 180 pilot stated that she was northbound at approximately 7,000 feet mean sea level, when she heard a loud bang. The airplane immediately pitched up about 50 degrees and rolled into a 45-degree right bank. She adjusted engine power to control airplane pitch and was able to maintain flight; although, only with a 200 foot-per-minute descent. She subsequently determined that aileron (roll) control and engine operation were normal, but there was limited elevator (pitch) control. The pilot attempted to divert to LMO; however, she ultimately executed a forced landing to a small open area adjacent to the airport in order to avoid trees short of the runway. She did not initially believe that she had been involved in a mid-air collision because she had not seen or heard another airplane; only the loud bank, which she thought was an elevator system failure.

A witness located at the Longmont Airport reported that as the Cessna 180 approached it appeared that it couldn't turn to the left. As the airplane approached a line of trees, the engine increased power and the airplane nosed up. Engine power was then reduced and the airplane pitched down again. At this point, the airplane was not getting closer to the runway. The witness noted that the wings appeared to be intact and the engine seemed to be producing power. However, it appeared that the right horizontal stabilizer was bent down approximately 90 degrees at mid-span.

PERSONNEL INFORMATION

The Cessna 172 flight instructor held a commercial pilot certificate with single and multiengine land airplane, and instrument airplane ratings. He held a flight instructor certificate with single-engine airplane and instrument airplane ratings, which had been renewed on April 29, 2011. He was issued a second class airman medical certificate with a limitation for corrective lenses on July 30, 2008.

Records indicated that the flight instructor had accumulated about 796 hours total flight time, which included about 789 hours in single engine airplanes. Of the total flight time, about 743 hours were conducted as pilot-in-command and about 565 hours as flight instructor (dual given). The flight instructor's most recent flight review was completed on July 27, 2011.

The Cessna 172 pilot receiving instruction held a private pilot certificate with a single-engine land airplane rating. He was issued a third class airman medical certificate with a limitation for corrective lenses on October 6, 2011. On the application for the medical certificate, the pilot reported a total flight time of 312 hours, with 4 hours within the previous 6 months.

The Cessna 180 pilot held a commercial pilot certificate with single and multi-engine land airplane, and instrument airplane ratings. She held a flight instructor certificate with single and multi-engine airplane and instrument airplane ratings. She also had a current appointment as a Federal Aviation Administration (FAA) designated pilot examiner. She was issued a second class airman medical certificate with a limitation for corrective lenses on January 31, 2011.

Records indicated that she had accumulated about 6,315 hours total flight time, which included about 6,250 hours in single-engine airplanes and about 825 hours in Cessna 180 model airplanes. The total flight time included about 4,656 hours as flight instructor (dual given). Her most recent flight review was completed on November 12, 2010.

AIRCRAFT INFORMATION

The Cessna 172S, serial number 172S9817, was a high-wing, single-engine airplane, with a fixed tricycle landing gear configuration. It was powered by a 180-horsepower Lycoming IO-360-L2A engine, serial number L-31875-51A. The airplane was issued an FAA airworthiness certificate on May 16, 2005.

The most recent annual inspection was completed on February 2, 2012, at 1,955 hours total airframe time. The engine had also accumulated 1,955 hours total time in service. The most recent maintenance was conducted on March 22, 2012, at 2,017 hours airframe time, and consisted of replacement of the left strobe light bulb. There was no record of outstanding maintenance items related to the airplane.

The Cessna 180, serial number 31723, was a high-wing, single-engine airplane, with a conventional (tailwheel) landing gear configuration. It was powered by a 225-horspower Continental Motors O-470-J engine, serial number 46202. The airplane was originally issued an FAA airworthiness certificate on May 24, 1955.

The most recent annual inspection was completed on March 12, 2012, at 4,209 hours total airframe time. The engine had accumulated about 2,028 hours total time in service, with about 1,027 hours since overhaul. The accident flight was the first flight after the annual inspection.

METEOROLOGICAL INFORMATION

The Rocky Mountain Metropolitan Airport (BJC) Automated Weather Observing System (AWOS) located approximately 13 miles south of the accident site, recorded weather conditions at 1147 as: variable wind at 7 knots; 60 miles visibility; scattered clouds at 25,000 feet above ground level; temperature 19 degrees Celsius; dew point -12 degrees Celsius; altimeter 30.02 inches of mercury.

WRECKAGE AND IMPACT INFORMATION Cessna 172S – N10468

The Cessna 172 airplane impacted about midway up an embankment adjacent to the east side of Weld County Road 1, about 1/4 mile south of Great Western Drive. A ground impact scar was oriented on an approximate bearing of 135 degrees magnetic. The airplane came to rest nose down near the bottom of the embankment, adjacent to the pavement shoulder of the roadway. A narrow ground impact scar on the embankment appeared to conform to the wing contour. It was located immediately southeast of the engine. The impression extended about 20 feet south-southwest and 12 feet north-northeast of the engine. The engine was separated from the airframe and embedded into the embankment. Power/telephone lines paralleling the east side of the roadway and a set of lines crossing the roadway to a residence on the west side appeared intact.

The entire fuselage was crushed and fragmented. The cockpit/cabin area was completely compromised. The left and right wings were in position relative to the fuselage and engine. Both wings were crushed from the leading edge to the rear spar, along the entire span. The outboard 6 feet of the left wing was displaced upward and rotated about 180 degrees, with the displaced wing section lying on top of the inboard wing section. The ground impact scar on the embankment appeared to conform to the shortened span of the left wing. The impact scar appeared to correspond to the full length of the right wing. The ailerons and flaps remained attached to the wings. Control cable separations within the cockpit/cabin area appeared consistent with overload failures. A detailed examination of the control systems within the cockpit area was not possible due to the extent of the damage. The lower surface of the left aileron exhibited a black streak about 9 inches long and 1 inch wide. It was located near mid-span and oriented on an approximate 45-degree angle.

The empennage was oriented with the rudder and vertical stabilizer upward. The vertical stabilizer was crushed aft to the rear spar. The rudder remained attached to the vertical stabilizer. It was deformed. Both horizontal stabilizers were deformed with leading edge crushing damage. The elevators remained attached to the stabilizers. Control cable continuity was confirmed at the elevator and rudder attachment points. Control cable turnbuckles and bridle cable attachments were secure.

The engine had separated from the airframe and was buried approximately 2 feet into the ground. The two-bladed propeller assembly was separated from the engine aft of the propeller flange. Both propeller blades exhibited twisting and bending over the length of the blades, with leading and trailing edge gouges.

No anomalies consistent with a precollision failure or malfunction were observed.

Cessna 180 - N9325C

The airplane sustained damage to the left wing, aft fuselage, empennage, and firewall. The cockpit/cabin area was intact. The aft fuselage was partially separated immediately aft of the baggage area and immediately forward of the empennage. The aft fuselage was buckled and

twisted. The empennage remained attached to the aft fuselage. The vertical stabilizer exhibited denting and buckling; the rudder remained attached. The left horizontal stabilizer and elevator appeared intact. The right horizontal stabilizer came to rest against the chain link fence. It remained attached to the empennage; however, the right horizontal stabilizer and elevator were bent downward about 170 degrees near mid-span.

The leading edge abrasion strip on the right horizontal stabilizer exhibited several spanwiseoriented white streaks. The left horizontal stabilizer abrasion strip did not exhibit any visible white marks.

The left wing tip was separated and the outboard portion of the wing was damaged. The separated wingtip was located at the accident site. The wing appeared to have been displaced aft at the tip relative to the fuselage. The left aileron remained partially attached; however, the outboard one-half of the aileron was deformed upward.

The left wing leading edge exhibited damaged consistent with a wire strike. Two sections of missing paint, co-located with discolored holes in the skin, were located outboard of mid-span. The damage was oriented on a 45-degree to 55-degree angle relative to the leading edge. A fragment of airplane skin was located about 40 feet from the power lines. In addition to substantial deformation damage, the skin fragment exhibited a serrated pattern in the paint consistent with contact to a braided wire cable, such as a power line.

The right wing appeared intact with the exception of the aileron and flap. The right aileron remained attached to the wing; however, the outboard portion of the aileron was bent downward approximately 90 degrees beginning at the outboard hinge. The flap was deformed and torn over the outboard one-half of the span.

Aileron control continuity was confirmed from the cockpit control wheel to the control surfaces. Flap control continuity was also confirmed from the cockpit lever to the control surfaces. Elevator and rudder control continuity was confirmed from the cockpit control wheel and rudder pedals to the respective control surfaces.

The engine, with the propeller assembly and cowling attached, had separated from the airframe at the firewall. All three propeller blades remained securely attached to the hub. Each blade was bent aft near the tip. One blade was also bent forward slightly over the span of the blade. The blade tips exhibited chordwise scratches, with leading and trailing edge gouges.

No anomalies consistent with a precollision failure or malfunction were observed.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy of the Cessna 172 flight instructor was conducted on March 24, 2012, at the McKee Medical Center in Loveland, Colorado. The flight instructor's death was attributed to traumatic injuries sustained in the accident. Toxicology testing performed by the FAA Civil Aerospace Medical Institute was negative for all substances in the screening profile.

An autopsy of the Cessna 172 private pilot receiving instruction was conducted on March 24, 2012, at the McKee Medical Center in Loveland, Colorado. The pilot's death was attributed to traumatic injuries sustained in the accident. Toxicology testing performed by the FAA Civil Aerospace Medical Institute was negative for all substances in the screening profile.

ADDITIONAL INFORMATION

FAA regulations [14 CFR 91.113(b)] required that each person operating an aircraft maintain vigilance so as to "see and avoid other aircraft." When aircraft of the same certification category are converging, "the aircraft to the other's right has the right-of-way." However, the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25A) noted that even if entitled to the right-of-way, a pilot should yield if another aircraft seemed too close. The handbook also stated that high-wing and low-wing aircraft have their respective blind spots. In order to assistance with collision avoidance, pilots should execute clearing procedures periodically during sustained periods of straight-and-level flight. During climbs and descents, pilots should execute gentle banks left and right to permit visual scanning of the airspace. Vigilance should also be maintained during training operations and clearing turns should be made prior to a practice maneuver being performed.

The manufacturer provided information related to the field of view from both high-wing airplanes. For a Cessna 172 airplane, an individual seated next to a side window has a view from approximately 2 degrees up and 53 degrees down. When looking across the cabin out of the opposite side window, the field of view is restricted to 3 degrees up and 22 degrees down. For a Cessna 180 airplane, an individual seated next to a side window has a view from approximately 3 degrees up and 55 degrees down. When looking across the cabin out of the opposite side window, the field of view is restricted to 2 degrees up and 17 degrees down.

The Cessna 172 airplane was equipped with Garmin G1000 integrated cockpit display system, which is capable of providing traffic advisories to the flight crew via the Traffic Information Service - Broadcast (TIS-B) system. This traffic information is derived from air traffic surveillance radars. The FAA Aeronautical Information Manual (AIM) noted that TIS-B is intended to provide a more complete traffic picture and enhance a pilot's visual acquisition of other traffic. However, it is advisory in nature only. TIS-B is not intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft.

The Garmin G1000 system will record flight parameter information; however, only if a secondary data card is installed. No secondary data card was observed at the accident site. As a result, no flight parameter information was available. Additionally, no determination could be made related to the availability or the accuracy of any air traffic information provided to the Cessna 172 pilots prior to the collision. The Cessna 180 was not equipped with any air traffic alert system, nor was either airplane required to be equipped with such a system.

Flight instructor Information

Certificate:	Commercial; Flight instructor	Age:	30,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	Toxicology Performed:	Yes
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	July 30, 2008
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	July 27, 2011
Flight Time:	796 hours (Total, all aircraft), 743 hours (Pilot In Command, all aircraft), 49 hours (Last 90 days, all aircraft), 49 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Private	Age:	64,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	October 6, 2011
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	312 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N10468
Model/Series:	172S	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	172S9817
Landing Gear Type:	Tricycle	Seats:	4
Date/Type of Last Inspection:	February 2, 2012 Annual	Certified Max Gross Wt.:	
Time Since Last Inspection:	62 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	1955 Hrs as of last inspection	Engine Manufacturer:	LYCOMING
ELT:	Installed	Engine Model/Series:	IO-360-L2A
Registered Owner:	MountainAir Aviation Services LLC	Rated Power:	180 Horsepower
Operator:	McAir Aviation LLC	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	BJC,5673 ft msl	Distance from Accident Site:	13 Nautical Miles
Observation Time:	11:55 Local	Direction from Accident Site:	181°
Lowest Cloud Condition:	Scattered / 25000 ft AGL	Visibility	60 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.02 inches Hg	Temperature/Dew Point:	19°C / -12°C
Precipitation and Obscuration:	No Obscuration; No Precipitat	tion	
Departure Point:	Broomfield, CO (BJC)	Type of Flight Plan Filed:	None
Destination:	Broomfield, CO (BJC)	Type of Clearance:	None
Departure Time:	11:32 Local	Type of Airspace:	Class E

Airport Information

Airport:	Vance Brand LMO	Runway Surface Type:	
Airport Elevation:	5055 ft msl	Runway Surface Condition:	
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	40.15361,-105.055274

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	Phillip L Potter; FAA – Flight Standards; Denver, CO Steven Miller; Cessna Aircraft Company; Wichita, KS
Original Publish Date:	August 29, 2012
Last Revision Date:	
Investigation Class:	<u>Class</u>
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=83208

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

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 <u>here</u>.





Aviation Investigation Final Report

Location:	Longmont, Colorado	Accident Number:	CEN12FA199
Date & Time:	March 23, 2012, 11:43 Local	Registration:	N9325C
Aircraft:	Cessna 180	Aircraft Damage:	Substantial
Defining Event:	Midair collision	Injuries:	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Radar track data depicted the accident airplanes on gradually converging flight paths prior to the accident. Immediately before the collision, the Cessna 172 appeared to be on a northnortheast course in level flight at 7,200 feet mean sea level (msl), and the Cessna 180 was in a gradual climb from 6,800 feet msl to 7,000 feet msl on a north course. Day visual meteorological conditions prevailed at the time of the accident, with reported visibilities at 60 miles. Neither pilot was receiving air traffic control advisories at the time of the collision. The radar track associated with the Cessna 180 indicated that after the collision the airplane entered a 270-degree right turn before proceeding to the west. The Cessna 172 continued northbound, as it entered a descent and impacted the ground.

The pilot of the Cessna 180 airplane stated that she heard a loud bang during cruise flight and the airplane immediately pitched up and rolled into right bank. She subsequently determined that elevator control was limited. The pilot attempted to divert to a local airport, but was unable to land on a runway due to the impaired airplane control. She executed a forced landing to an open area adjacent to the airport. A witness reported that the right horizontal stabilizer of the Cessna 180 appeared to be bent down about 90 degrees at mid-span as the airplane approached for the forced landing. The outboard portion of the right horizontal stabilizer of the Cessna 180 airplane was structurally compromised, which resulted in a nearly complete loss of pitch control. The pilot of the Cessna 180 airplane retained marginal pitch control by varying engine power during the remainder of the flight.

A postaccident examination did not reveal any pre-collision failures or malfunctions associated with either airplane. The examination determined that the left aileron/wing of the

Cessna 172 likely contacted the right horizontal stabilizer of the Cessna 180 in flight. The outboard portion of the left wing on the Cessna 172 was structurally compromised, rendering the airplane uncontrollable. Regulations required that each person operating an aircraft maintain vigilance so as to "see and avoid other aircraft."

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The inadequate visual lookout by the pilots of both airplanes, which resulted in a mid-air collision.

Findings	
Personnel issues	Incomplete action - Pilot
Personnel issues	Incomplete action - Pilot of other aircraft

Factual Information

History of Flight	
Enroute-change of cruise level	Midair collision
Emergency descent	Off-field or emergency landing
Landing	Collision with terr/obj (non-CFIT)

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HISTORY OF FLIGHT

On March 23, 2012, about 1143 mountain daylight time, a Cessna 172S, N10468, and a Cessna 180, N9325C, were substantially damaged during a mid-air collision near Longmont, Colorado. The Cessna 172 impacted an embankment adjacent to a two-lane roadway, about 5 miles east of the Vance Brand Airport (LMO). The Cessna 180 impacted power lines and a chain link fence during a forced landing adjacent to LMO. The flight instructor and private pilot receiving instruction on-board the Cessna 172 were fatally injured. The pilot of the Cessna 180 sustained minor injuries. The Cessna 172 was registered to MountainAir Aviation Services LLC and operated by McAir Aviation LLC under the provisions of 14 Code of Federal Regulations Part 91 as an instructional flight. The Cessna 180 was registered to and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flights, which were both operated without flight plans. The Cessna 172 departed Rocky Mountain Metropolitan Airport (BJC) about 1130. The Cessna 180 departed Erie Municipal Airport (EIK) about 1136.

At 1130, the Cessna 172 was issued a takeoff clearance by the BJC air traffic control tower. At 1132, an aircraft on a 1200 transponder beacon code [the standard code for visual flight rules (VFR) operations] was observed on Denver Terminal Radar Approach Control (TRACON) facility radar in the vicinity of BJC. Based on the subsequent course flown, this aircraft is presumed to be the Cessna 172 airplane. The radar track data indicated that the airplane initially proceeded on a northwest course from BJC, before turning to a north-northeast course. About 11 miles north of BJC, the airplane executed a left 360-degree turn and returned to a north-northeast course. The track data depicted the airplane converging with a second target about 0.5 miles south of the Cessna 172 accident site.

At 1136, an aircraft on a 1200 (VFR) transponder beacon code was observed on Denver TRACON facility radar in the vicinity of EIK. Based on the subsequent course flown, this aircraft is presumed to be the Cessna 180 airplane. The radar data indicated that the airplane departed to the south and executed a right 180-degree turn to a northwest course. The airplane subsequently turned right to a north-northeast course.

The radar track data depicted the flight paths slowly converging to a point about 0.5 miles south of the Cessna 172 accident site. The data indicated that the Cessna 172 was at 7,200 feet mean sea level (msl), while the Cessna 180 was in a slow climb from 6,800 feet to 7,000 feet msl. At 1142:28 (hhmm:ss), the airplanes were separated laterally by about 393 feet and vertically by about 200 feet. A loss of potentially two radar data points corresponding to the Cessna 180 was observed between 1142:29 and 1142:41. The loss of the data points is consistent with the close proximity to the second airplane at the time of the collision.

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PERSONNEL INFORMATION

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Records indicated that the flight instructor had accumulated about 796 hours total flight time, which included about 789 hours in single engine airplanes. Of the total flight time, about 743 hours were conducted as pilot-in-command and about 565 hours as flight instructor (dual

given). The flight instructor's most recent flight review was completed on July 27, 2011.

The Cessna 172 pilot receiving instruction held a private pilot certificate with a single-engine land airplane rating. He was issued a third class airman medical certificate with a limitation for corrective lenses on October 6, 2011. On the application for the medical certificate, the pilot reported a total flight time of 312 hours, with 4 hours within the previous 6 months.

The Cessna 180 pilot held a commercial pilot certificate with single and multi-engine land airplane, and instrument airplane ratings. She held a flight instructor certificate with single and multi-engine airplane and instrument airplane ratings. She also had a current appointment as a Federal Aviation Administration (FAA) designated pilot examiner. She was issued a second class airman medical certificate with a limitation for corrective lenses on January 31, 2011.

Records indicated that she had accumulated about 6,315 hours total flight time, which included about 6,250 hours in single-engine airplanes and about 825 hours in Cessna 180 model airplanes. The total flight time included about 4,656 hours as flight instructor (dual given). Her most recent flight review was completed on November 12, 2010.

AIRCRAFT INFORMATION

The Cessna 172S, serial number 172S9817, was a high-wing, single-engine airplane, with a fixed tricycle landing gear configuration. It was powered by a 180-horsepower Lycoming IO-360-L2A engine, serial number L-31875-51A. The airplane was issued an FAA airworthiness certificate on May 16, 2005.

The most recent annual inspection was completed on February 2, 2012, at 1,955 hours total airframe time. The engine had also accumulated 1,955 hours total time in service. The most recent maintenance was conducted on March 22, 2012, at 2,017 hours airframe time, and consisted of replacement of the left strobe light bulb. There was no record of outstanding maintenance items related to the airplane.

The Cessna 180, serial number 31723, was a high-wing, single-engine airplane, with a conventional (tailwheel) landing gear configuration. It was powered by a 225-horspower Continental Motors O-470-J engine, serial number 46202. The airplane was originally issued an FAA airworthiness certificate on May 24, 1955.

The most recent annual inspection was completed on March 12, 2012, at 4,209 hours total airframe time. The engine had accumulated about 2,028 hours total time in service, with about 1,027 hours since overhaul. The accident flight was the first flight after the annual inspection.

METEOROLOGICAL INFORMATION

The Rocky Mountain Metropolitan Airport (BJC) Automated Weather Observing System (AWOS) located approximately 13 miles south of the accident site, recorded weather conditions at 1147 as: variable wind at 7 knots; 60 miles visibility; scattered clouds at 25,000 feet above ground level; temperature 19 degrees Celsius; dew point -12 degrees Celsius;

altimeter 30.02 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

Cessna 172S - N10468

The Cessna 172 airplane impacted about midway up an embankment adjacent to the east side of Weld County Road 1, about 1/4 mile south of Great Western Drive. A ground impact scar was oriented on an approximate bearing of 135 degrees magnetic. The airplane came to rest nose down near the bottom of the embankment, adjacent to the pavement shoulder of the roadway. A narrow ground impact scar on the embankment appeared to conform to the wing contour. It was located immediately southeast of the engine. The impression extended about 20 feet south-southwest and 12 feet north-northeast of the engine. The engine was separated from the airframe and embedded into the embankment. Power/telephone lines paralleling the east side of the roadway and a set of lines crossing the roadway to a residence on the west side appeared intact.

The entire fuselage was crushed and fragmented. The cockpit/cabin area was completely compromised. The left and right wings were in position relative to the fuselage and engine. Both wings were crushed from the leading edge to the rear spar, along the entire span. The outboard 6 feet of the left wing was displaced upward and rotated about 180 degrees, with the displaced wing section lying on top of the inboard wing section. The ground impact scar on the embankment appeared to conform to the shortened span of the left wing. The impact scar appeared to correspond to the full length of the right wing. The ailerons and flaps remained attached to the wings. Control cable separations within the cockpit/cabin area appeared consistent with overload failures. A detailed examination of the control systems within the cockpit area was not possible due to the extent of the damage. The lower surface of the left aileron exhibited a black streak about 9 inches long and 1 inch wide. It was located near mid-span and oriented on an approximate 45-degree angle.

The empennage was oriented with the rudder and vertical stabilizer upward. The vertical stabilizer was crushed aft to the rear spar. The rudder remained attached to the vertical stabilizer. It was deformed. Both horizontal stabilizers were deformed with leading edge crushing damage. The elevators remained attached to the stabilizers. Control cable continuity was confirmed at the elevator and rudder attachment points. Control cable turnbuckles and bridle cable attachments were secure.

The engine had separated from the airframe and was buried approximately 2 feet into the ground. The two-bladed propeller assembly was separated from the engine aft of the propeller flange. Both propeller blades exhibited twisting and bending over the length of the blades, with leading and trailing edge gouges.

No anomalies consistent with a precollision failure or malfunction were observed.

Cessna 180 – N9325C

The airplane sustained damage to the left wing, aft fuselage, empennage, and firewall. The

cockpit/cabin area was intact. The aft fuselage was partially separated immediately aft of the baggage area and immediately forward of the empennage. The aft fuselage was buckled and twisted. The empennage remained attached to the aft fuselage. The vertical stabilizer exhibited denting and buckling; the rudder remained attached. The left horizontal stabilizer and elevator appeared intact. The right horizontal stabilizer came to rest against the chain link fence. It remained attached to the empennage; however, the right horizontal stabilizer and elevator were bent downward about 170 degrees near mid-span.

The leading edge abrasion strip on the right horizontal stabilizer exhibited several spanwiseoriented white streaks. The left horizontal stabilizer abrasion strip did not exhibit any visible white marks.

The left wing tip was separated and the outboard portion of the wing was damaged. The separated wingtip was located at the accident site. The wing appeared to have been displaced aft at the tip relative to the fuselage. The left aileron remained partially attached; however, the outboard one-half of the aileron was deformed upward.

The left wing leading edge exhibited damaged consistent with a wire strike. Two sections of missing paint, co-located with discolored holes in the skin, were located outboard of mid-span. The damage was oriented on a 45-degree to 55-degree angle relative to the leading edge. A fragment of airplane skin was located about 40 feet from the power lines. In addition to substantial deformation damage, the skin fragment exhibited a serrated pattern in the paint consistent with contact to a braided wire cable, such as a power line.

The right wing appeared intact with the exception of the aileron and flap. The right aileron remained attached to the wing; however, the outboard portion of the aileron was bent downward approximately 90 degrees beginning at the outboard hinge. The flap was deformed and torn over the outboard one-half of the span.

Aileron control continuity was confirmed from the cockpit control wheel to the control surfaces. Flap control continuity was also confirmed from the cockpit lever to the control surfaces. Elevator and rudder control continuity was confirmed from the cockpit control wheel and rudder pedals to the respective control surfaces.

The engine, with the propeller assembly and cowling attached, had separated from the airframe at the firewall. All three propeller blades remained securely attached to the hub. Each blade was bent aft near the tip. One blade was also bent forward slightly over the span of the blade. The blade tips exhibited chordwise scratches, with leading and trailing edge gouges.

No anomalies consistent with a precollision failure or malfunction were observed.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy of the Cessna 172 flight instructor was conducted on March 24, 2012, at the McKee Medical Center in Loveland, Colorado. The flight instructor's death was attributed to

traumatic injuries sustained in the accident. Toxicology testing performed by the FAA Civil Aerospace Medical Institute was negative for all substances in the screening profile.

An autopsy of the Cessna 172 private pilot receiving instruction was conducted on March 24, 2012, at the McKee Medical Center in Loveland, Colorado. The pilot's death was attributed to traumatic injuries sustained in the accident. Toxicology testing performed by the FAA Civil Aerospace Medical Institute was negative for all substances in the screening profile.

ADDITIONAL INFORMATION

FAA regulations [14 CFR 91.113(b)] required that each person operating an aircraft maintain vigilance so as to "see and avoid other aircraft." When aircraft of the same certification category are converging, "the aircraft to the other's right has the right-of-way." However, the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25A) noted that even if entitled to the right-of-way, a pilot should yield if another aircraft seemed too close. The handbook also stated that high-wing and low-wing aircraft have their respective blind spots. In order to assist with collision avoidance, pilots should execute clearing procedures periodically during sustained periods of straight-and-level flight. During climbs and descents, pilots should execute gentle banks left and right to permit visual scanning of the airspace. Vigilance should also be maintained during training operations and clearing turns should be made prior to a practice maneuver being performed.

The manufacturer provided information related to the field of view from both high-wing airplanes. For a Cessna 172 airplane, an individual seated next to a side window has a view from approximately 2 degrees up and 53 degrees down. When looking across the cabin out of the opposite side window, the field of view is restricted to 3 degrees up and 22 degrees down. For a Cessna 180 airplane, an individual seated next to a side window has a view from approximately 3 degrees up and 55 degrees down. When looking across the cabin out of the opposite side window, the field of view is restricted to 2 degrees up and 17 degrees down.

The Cessna 172 airplane was equipped with Garmin G1000 integrated cockpit display system, which is capable of providing traffic advisories to the flight crew via the Traffic Information Service - Broadcast (TIS-B) system. This traffic information is derived from air traffic surveillance radars. The FAA Aeronautical Information Manual (AIM) noted that TIS-B is intended to provide a more complete traffic picture and enhance a pilot's visual acquisition of other traffic. However, it is advisory in nature only. TIS-B is not intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft.

The Garmin G1000 system will record flight parameter information; however, only if a secondary data card is installed. No secondary data card was observed at the accident site. As a result, no flight parameter information was available. Additionally, no determination could be made related to the availability or the accuracy of any air traffic information provided to the Cessna 172 pilots prior to the collision. The Cessna 180 was not equipped with any air traffic alert system, nor was either airplane required to be equipped with such a system.

Pilot Information

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Certificate:	Commercial; Flight engineer; Flight instructor	Age:	72,Female
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):	Airplane multi-engine; Airplane single-engine; Instrument airplane; Sport pilot	Toxicology Performed:	No
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	January 31, 2011
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	November 12, 2010
Flight Time:	6315 hours (Total, all aircraft), 825 hours (Total, this make and model), 6250 hours (Pilot In Command, all aircraft), 2 hours (Last 90 days, all aircraft), 1 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N9325C
Model/Series:	180	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	31723
Landing Gear Type:	Tailwheel	Seats:	4
Date/Type of Last Inspection:	March 12, 2012 Annual	Certified Max Gross Wt.:	
Time Since Last Inspection:	1 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	4209 Hrs as of last inspection	Engine Manufacturer:	CONT MOTOR
ELT:	Installed	Engine Model/Series:	0-470 SERIES
Registered Owner:	On file	Rated Power:	230 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:	BJC,5673 ft msl	Distance from Accident Site:	13 Nautical Miles
Observation Time:	11:55 Local	Direction from Accident Site:	181°
Lowest Cloud Condition:	Scattered / 25000 ft AGL	Visibility	60 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.02 inches Hg	Temperature/Dew Point:	19°C / -12°C
Precipitation and Obscuration:	No Obscuration; No Precipita	tion	
Departure Point:	Erie, CO (EIK)	Type of Flight Plan Filed:	None
Destination:	Erie, CO (EIK)	Type of Clearance:	None
Departure Time:	11:36 Local	Type of Airspace:	Class E

Airport Information

Airport:	Vance Brand LMO	Runway Surface Type:	
Airport Elevation:	5055 ft msl	Runway Surface Condition:	
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Minor	Latitude, Longitude:	40.15361,-105.055274

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	Phillip L Potter; FAA – Flight Standards; Denver, CO Steven Miller; Cessna Aircraft Company; Wichita, KS
Original Publish Date:	August 29, 2012
Last Revision Date:	
Investigation Class:	<u>Class</u>
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=83208

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

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 <u>here</u>.