Aviation Investigation Final Report

Location:	Durango, Colorado	**Accident Number:**	CEN14FA339
Date & Time:	July 4, 2014, 09:27 Local	**Registration:**	N1451D
Aircraft:	NORTH AMERICAN/AERO CLASSICS P 51D	**Aircraft Damage:**	Substantial
Defining Event:	Abrupt maneuver	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The pilot was seated in the front seat and the flight instructor in the rear seat during an instructional flight. The pilot had not received an endorsement to fly solo in the airplane. Witnesses reported that, shortly after departure, the airplane entered a hard left bank to about 90 degrees, pitched up slightly, and then banked past 90 degrees to an inverted position. The airplane's nose then pitched down to about a 45-degree angle and then impacted terrain. The witness's description of the flight is consistent with a torque roll, which can occur after takeoff in airplanes that have a high-performance engine such as that installed in the accident airplane, and subsequent loss of control. Witnesses also indicated that the pilot typically dipped the left wing during takeoff to wave, and it is possible that the pilot did this during the accident flight and that this contributed to the torque roll. Due to the low altitude at the time of the torque roll, the flight instructor would not have had sufficient time to enter control inputs to regain control of the airplane before it impacted terrain.

Toxicology testing for the pilot detected tetrahydrocannabinol (THC), the active compound in marijuana, and its inactive metabolite in his cavity blood and lung tissue. It was determined there was enough THC in the pilot's system to have been impairing, and it is likely that this led to his failure to appropriately compensate for the risk of a torque roll in the high-performance airplane.

Probable Cause and Findings

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

The pilot's failure to compensate for the high-performance airplane's tendency to enter a torque roll during the initial climb, which resulted in the airplane entering a torque roll and the subsequent loss of control at too low of an altitude to recover. Contributing to the pilot's failure to compensate for the airplane's tendency to enter a torque roll was his impairment from tetrahydrocannabinol.

Findings

Personnel issues	Incorrect action performance - Student/instructed pilot
Personnel issues	Illicit drug - Student/instructed pilot
Aircraft	Altitude - Not specified

Factual Information

History of Flight

Initial climb	Loss of control in flight
Initial climb	Abrupt maneuver (Defining event)

On July 4, 2014 at 0927 mountain daylight time, a North American P-51 Mustang airplane, N1451D, impacted terrain near the Durango-La Plata County Airport (DRO), Durango, Colorado, shortly after takeoff. The airplane was owned and operated by Bridgewood Holdings, LLC, Durango, Colorado. The airplane was substantially damaged. The flight instructor, who occupied the rear seat, and the pilot, who occupied the front seat, were fatally injured. Visual meteorological conditions prevailed for the instructional flight, which was being operated in accordance with 14 Code of Federal Regulations Part 91.

In statements provided to the National Transportation Safety Board (NTSB) Investigator-in-Charge (IIC) by local law enforcement, and written statements provided to the IIC, witnesses reported the airplane departed runway 3 and entered a hard left bank to approximately 90 degrees. The nose pitched up slightly and continued to bank past 90 degrees to an inverted position, and then the nose pitched down to approximately a 45 degree angle. The witnesses stated they lost sight of the airplane when their view was blocked by a hangar, unable to see the ground impact. Additionally, witnesses reported that the pilot usually "dipped the left wing" of the airplane to wave as he flew over.

Student pilot Information

Certificate:	Private	**Age:**	51,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Front
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:**	March 29, 2013
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	263 hours (Total, all aircraft), 53 hours (Total, this make and model)		

Flight instructor Information

Certificate:	Airline transport; Flight instructor	**Age:**	Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Glider; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	April 10, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	12414 hours (Total, all aircraft), 26 hours (Total, this make and model)		

Flight Instructor

The flight instructor, age 53, held an airline transport pilot certificate with an airplane single and multi-engine, and glider airplane ratings. He also held a flight instructor certificate for airplane single and multi-engine land, glider and instrument airplane. Additionally, he held an airframe and powerplant mechanic certificate.

His most recent Federal Aviation Administration (FAA) first-class airman medical certificate was issued on April 10, 2014, with the limitation: must have available glasses for near vision.

The flight instructor reported on his medical certificate application that he had accumulated 12,400 total flight hours, with 130 hours in the previous 6 months. The flight instructor's pilot logbook indicated he had 12,414 total flight hours as of July 1, 2014, with 3,609 in single-engine land airplanes and 26 flight hours in the accident airplane, all flown with the pilot.

The flight instructor began instructing the accident pilot in June 2013, providing training for completion of his private pilot certificate in September 2013 and high performance airplane check out in October 2013. He last flew in the accident airplane with the accident pilot receiving instruction on June 24, 2014 during a 4-hour flight.

A review of the instructor's log book noted an entry dated February 1, 2014 which annotated he was 'competent to act as pilot-in-command of a North American P-51D.'

Pilot

The pilot, age 51, held a private pilot certificate with an airplane single-engine land rating. His FAA third-class airman medical certificate was issued on March 29, 2013, with the limitation: must wear corrective lenses. The pilot did not report total flight hours accumulated on his medical certificate application. The pilot's logbook indicated he had 263 total flight hours as of June 31, 2014, with 53 of those flight hours being in the accident airplane make and model. His last flight in the accident airplane was on June 24, 2014 during a 4-hour flight with the accident instructor pilot. A review of the pilot's log

book noted the pilot recorded 71 flight hours in a Beechcraft T-6 Texan.

The flight instructor flew with the pilot for his private certificate flight training in the Husky and completed his checkout in the BE33 Bonanza and the T-6.

A review of the P51's operating limitations revealed that, in order to act as pilot-in-command; a log book endorsement was required. The review of the pilot's log book did not reveal an endorsement for the P51.

Aircraft and Owner/Operator Information

Aircraft Make:	NORTH AMERICAN/AERO CLASSICS	**Registration:**	N1451D
Model/Series:	P 51D	**Aircraft Category:**	Airplane
Year of Manufacture:	1944	**Amateur Built:**	
Airworthiness Certificate:	Limited (Special)	**Serial Number:**	44-74446A
Landing Gear Type:	Retractable - Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	September 12, 2013 Condition	**Certified Max Gross Wt.:**	11610 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	2381.3 Hrs as of last inspection	**Engine Manufacturer:**	PKRD-ROLL
ELT:		**Engine Model/Series:**	V1650 SERIES
Registered Owner:		**Rated Power:**	1490 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The accident airplane was a P-51D Mustang, serial number 44-74446A N1451D. The airplane's Special Airworthiness Certificate was issued on October 9, 1975. The airplane was manufactured in 1944, and was a two-seat, low-wing, retractable-gear airplane, and was powered by Packard Merlin V-1650-7 engine, rated at 1,490 horsepower. This super-charged reciprocating engine had 12 cylinders and was liquid cooled. The engine drove a metal, 4-blade Hamilton Standard 24D50-105 variable pitch propeller.

According to the airplane's logbooks, the most recent annual [condition] inspection of the airframe and engine was accomplished on September 12, 2013, at a Hobbs time of 630.0 hours and airframe total time of 2,381.3 hours. The airplane tachometer was not located in the wreckage; therefore, the airframe's total time at the time of the accident could not be determined.

The aircraft was modified with a dual flight control system to enable the rear seat passenger to manipulate the primary flight controls. The dual flight control system consisted of a rear control stick, elevator controls, rudder controls and throttle quadrant. In August of 2011, a mechanic (inspector authorization (IA)) approved this major repair and alteration of the aircraft.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KDRO,6685 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	08:53 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	100°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.38 inches Hg	**Temperature/Dew Point:**	19°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Durango, CO (DRO)	**Type of Flight Plan Filed:**	None
Destination:	Durango, CO (DRO)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class E

At 0853, the DRO automated weather reporting facility reported wind from 100 degrees at 3 knots, visibility 10 miles, temperature 19 degrees Celsius (C), dew point 07 degrees C, and an altimeter reading of 30.39 inches of mercury.

Airport Information

Airport:	DURANGO-LA PLATA COUNTY DRO	**Runway Surface Type:**	Asphalt
Airport Elevation:	6685 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	03	**IFR Approach:**	None
Runway Length/Width:	9201 ft / 150 ft	**VFR Approach/Landing:**	None

Durango-La Plata County Airport is a non-towered airport operating under Class-E airspace. The airport is equipped with one runway. Runway 3/21 is 9,201 feet in length and 150-feet wide. The reported field elevation of the airport is 6,689 feet mean sea level.

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:**	37.165554,-107.745277(est)

The airplane impacted a public road on the northwest side of the airport at a nose-down angle. The wreckage path continued into a field at an approximate 290 degree orientation from the initial impact and was approximately 120 feet long. The entire airplane was fragmented. The wreckage was examined at the accident site on July 5, 2014, all of the major airframe components were contained within the wreckage distribution path. The entire fuselage was crushed and almost unrecognizable.

The airplane was recovered and taken to a storage facility where a detailed examination of the airframe and engine was completed on August 21, 2014. Examination of the airframe and engine revealed no preimpact mechanical anomalies. A layout of the main airframe pieces confirmed all of the major airframe parts and flight controls were present. Although the engine was impact damaged, the gearing system for the magnetos and cam shaft were intact and able to be rotated. The propeller blades exhibited curling at the blade tips with chordwise scraping consistent with power at the time of impact.

Additional Information

Excerpt from the Pilot's Handbook of Aeronautical Information, FAA- H-8083-25A, Chapter 4:

Torque Reaction

Torque reaction involves Newton's Third Law of Physics—for every action, there is an equal and opposite reaction. As applied to the aircraft, this means that as the internal engine parts and propeller are revolving in one direction, an equal force is trying to rotate the aircraft in the opposite direction.

When the aircraft is airborne, this force is acting around the longitudinal axis, tending to make the aircraft roll. To compensate for roll tendency, some of the older aircraft are rigged in a manner to create more lift on the wing that is being forced downward. The more modern aircraft are designed with the engine offset to counteract this effect of torque.

NOTE: Most United States built aircraft engines rotate the propeller clockwise, as viewed from the pilot's seat. The discussion here is with reference to those engines.

Generally, the compensating factors are permanently set so that they compensate for this force at cruising speed, since most of the aircraft's operating lift is at that speed. However, aileron trim tabs permit further adjustment for other speeds.

When the aircraft's wheels are on the ground during the takeoff roll, an additional turning moment around the vertical axis is induced by torque reaction. As the left side of the aircraft is being forced down by torque reaction, more weight is being placed on the left main landing gear. This results in more ground friction, or drag, on the left tire than on the right, causing a further turning moment to the left. The magnitude of this moment is dependent on many variables. Some of these variables are:

1. Size and horsepower of engine,

2. Size of propeller and the rpm,

3. Size of the aircraft, and

4. Condition of the ground surface.

This yawing moment on the takeoff roll is corrected by the pilot's proper use of the rudder or rudder trim.

Medical and Pathological Information

The FAA Bioaeronautical Research Laboratory, Oklahoma City, Oklahoma, performed toxicology testing for the flight instructor and the pilot.

The flight instructor's toxicology results were negative for carbon monoxide, alcohol and drugs.

The pilot's toxicology results were negative for carbon monoxide and alcohol. His toxicology tested positive for 0.0063 ug/ml of tetrahydrocannabinol (THC, the active compound in marijuana) and 0.0308 ug/ml of tetrahydrocannabinol carboxylic acid (THC-COOH, an inactive metabolite of marijuana) in cavity blood. In addition, 0.0743 ug/g of THC and 0.0133 ug/g of THC-COOH were identified in lung tissue. No other tested-for substances were identified.

Although now available for medicinal use in some states and decriminalized in limited amounts in Washington and Colorado, marijuana continues to be labeled as a Schedule 1 Controlled Substance by the Drug Enforcement Administration. Marijuana's primary psychoactive compound, THC, has mood altering effects including inducing euphoria and relaxation. In addition, marijuana causes alterations in motor behavior, perception, cognition, memory, and learning. Specific performance effects include decreased ability to concentrate and maintain attention, impairment of hand-eye coordination is dose-related over a wide range of dosages. For additional details, refer to the NTSB Medical Officer's Factual Report in the public docket for this accident.

Post mortem examinations of the flight instructor and pilot were conducted under the authority of Rocky Mountain Forensic Services, PLLC, Loma, Colorado on July 7, 2014. The cause of death for both pilots was attributed to "multiple injuries consistent with an airplane accident."

Tests and Research

After the aircraft accident a fuel quality inspection was completed by the local fixed-based operator on the airport that regularly refueled the accident airplane.

Separate samples of aviation gasoline were tested from the above-ground fuel storage tank and two fuel trucks containing aviation gas (avgas). The above-ground storage tank was tested from the filter sump and the tank drain. The first fuel truck was tested at both sump drains, the filter sump, and both fuel delivery nozzles. The second fuel truck was tested at the single sump drain, the filter sump, and the fuel

delivery nozzle.

The most recent bulk delivery of avgas was approximately 8,500 gallons of fuel received on 7/2/2014. Additionally, the fuel filters indicated the most recent filter change for the fuel storage tank was 10/17/2013, and the two fuel trucks 10/10/2013 and 10/15/2012, respectively.

There was no evidence of debris or other contamination. The color of the fuel was absent indication of contamination from jet fuel or diesel fuel.

Administrative Information

Investigator In Charge (IIC):	Liedler, Courtney
Additional Participating Persons:	Kent Gibbons; FAA; Salt Lake, UT
Original Publish Date:	August 31, 2016
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89606