



# Aviation Investigation Final Report

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<b>Location:</b>	Willoughby Hills, Ohio	<b>Accident Number:</b>	CEN14FA453
<b>Date &amp; Time:</b>	August 25, 2014, 21:58 Local	<b>Registration:</b>	N4207P
<b>Aircraft:</b>	Cessna 172R	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Loss of control in flight	<b>Injuries:</b>	4 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

The pilot and three passengers boarded the airplane for a local flight at night. The controller cleared the flight for takeoff and observed the airplane lift off about 2,000 feet down the runway. Shortly after liftoff, the pilot contacted the controller and reported that the airplane was not "climbing fast" and that he wanted to make a left turn to return to the airport. The controller approved the left turn and observed the airplane begin a left turn and descend to impact with the terrain. A postimpact fire ensued. Examination of the accident site indicated that the airplane impacted in a steep descent. The witness observations and the impact geometry are consistent with the pilot failing to maintain adequate airspeed while turning to return to the airport, resulting in the airplane exceeding its critical angle of attack and experiencing an aerodynamic stall. A postaccident examination of the airplane and engine did not reveal any anomalies that would have prevented normal operation of the aircraft. Weight and balance calculations showed that the airplane was between 93.6 and 165.6 pounds over maximum gross weight at the time of the accident. The decreased takeoff climb performance reported by the pilot was likely due to the airplane's over gross weight condition.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain control of the airplane while returning to the airport immediately

after takeoff, which resulted in the airplane exceeding its critical angle of attack and entering an aerodynamic stall during the turn. Contributing to the accident was the pilot's inadequate preflight planning, which resulted in the airplane being over maximum gross weight and its subsequent decrease in takeoff climb performance.

## Findings

<b>Personnel issues</b>	Aircraft control - Pilot
<b>Aircraft</b>	Angle of attack - Capability exceeded
<b>Personnel issues</b>	Weight/balance calculations - Pilot
<b>Aircraft</b>	Climb rate - Not specified

## Factual Information

### History of Flight

<b>Prior to flight</b>	Aircraft loading event
<b>Maneuvering</b>	Loss of control in flight (Defining event)
<b>Maneuvering</b>	Aerodynamic stall/spin
<b>Uncontrolled descent</b>	Collision with terr/obj (non-CFIT)

On August 25, 2014, at 2158 eastern daylight time, a Cessna 172R airplane, N4207P, collided with terrain in Willoughby Hills, Ohio, following a loss of control shortly after takeoff from the Cuyahoga County Airport (CGF). The private pilot and three passengers were fatally injured. The airplane was destroyed by impact and a post impact fire. The airplane was registered to a private individual and operated by T&G Flying Club, Inc. The pilot rented the airplane and was flying it on a personal flight under 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed for the flight which was not operating on a flight plan. The flight was originating at the time of the accident.

At 2022, the pilot reserved the airplane from T&G Flying Club using an online reservation system. He reserved the airplane for 4 hours, beginning at 2030. The employees of the flying club had left for the evening by time the pilot and passengers arrived at their facility.

Two witnesses, stated that shortly after 2100, they saw 4 males walk across the ramp toward the tie-down area near hangar 7. One of the males had a carry-on type suitcase. It was later determined that the "suitcase" was most likely the roller-type flight bag that the pilot used. The pilot and passengers then boarded the accident airplane. One of the witnesses stated the airplane stayed on the ramp for about 30 minutes with the engine running. They did not see the airplane after this time. A security camera mounted on one of the buildings near the ramp captured four individuals walking on the ramp at 2107.

At 2146, the pilot called ground control for a takeoff taxi clearance stating he was on the ramp south of the T&G Flight Club. The controller issued the pilot a clearance to taxi to runway 6 via the Alpha 7 taxiway to the Alpha taxiway. The controller issued the wind condition as 140 degrees at 8 knots along with the altimeter setting. The pilot stated his radio was a little "fuzzy" and he asked the controller to repeat the clearance. The controller repeated the taxi clearance, which the pilot subsequently repeated correctly. About four minutes later, the controller informed the pilot that he is taxiing to the wrong runway. After asking the controller to repeat what he said, the pilot stated "Thank you I'm sorry." The controller then issued taxi instructions to the approach end of runway 6.

At 2156, the pilot radioed that he was ready to takeoff on runway 6. The controller asked the pilot what his direction of flight was going to be. The pilot responded that they were going to fly east to sightsee and that they would be back in a little while. The controller issued the takeoff clearance with a right turn after takeoff. At 2158, the pilot radioed that they were not "...climbing fast..." and they wanted to immediately make a left turn to turn around. The controller approved the left turn. The controller stated it appeared the airplane began a left turn when it descended to the ground. The controller reported that

during the takeoff, the airplane became airborne about 100 feet past taxiway Alpha 6, which was approximately 2,000 down the runway.

### Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	19
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Unknown
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 3 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	November 10, 2011
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	August 8, 2013
<b>Flight Time:</b>	(Estimated) 116.3 hours (Total, all aircraft), 86 hours (Total, this make and model), 7.6 hours (Last 90 days, all aircraft), 2.7 hours (Last 30 days, all aircraft)		

The pilot held a private pilot certificate with an airplane single-engine land rating which was issued on August 8, 2013. The pilot also held a third-class medical certificate issued on November 10, 2011. The medical certificate did not contain any limitations.

The pilot's logbook records were not located during this investigation. The pilot completed a membership application for the T&G Flying Club on October 1, 2013. On that form, the pilot reported having 104.3 hours of flight time in Cessna fixed gear airplane models 150-177. A reconstruction of flight times that the pilot flew at both T&G Flying Club and at the Jack Barstow Airport, Midland, Michigan, indicate the pilot had flown 12 hours since his private pilot flight test, resulting in a total flight time of about 116.3 hours. Most if not all of the pilot's flight time was in Cessna 172 airplanes.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N4207P
<b>Model/Series:</b>	172R	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1999	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	17280798
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	August 1, 2014 100 hour	<b>Certified Max Gross Wt.:</b>	2299 lbs
<b>Time Since Last Inspection:</b>	19 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	596 Hrs at time of accident	<b>Engine Manufacturer:</b>	LYCOMING
<b>ELT:</b>	Installed	<b>Engine Model/Series:</b>	IO-360-L2A
<b>Registered Owner:</b>	ROHL LAURENCE E	<b>Rated Power:</b>	200 Horsepower
<b>Operator:</b>	T & G Flying Club	<b>Operating Certificate(s) Held:</b>	None

The accident airplane was a Cessna 172R, serial number 17280798. It was a four-place, high-wing, single-engine airplane with fixed landing gear. The owner of T&G Flying Club purchased the airplane on November 29, 2005.

Maintenance records indicate the last annual inspection on the airframe was completed on August 1, 2014, at a total aircraft time of 5,957.6 hours. The last logbook entry was dated August 19, 2014, which noted the vacuum pump was replaced at a total aircraft time of 5,969 hours. According to the operator's rental records, the airplane had been flown 18.8 hours since the annual inspection which would have resulted in an aircraft total time of 5,976.4 hours at the beginning of the accident flight.

The airplane was equipped with a 180-horsepower, Lycoming IO-360-L2A engine, serial number L-25996-51A. The last annual inspection of the engine was completed on August 1, 2014. The engine total time at the last annual inspection was listed as 3,679.4 hours and the time since the factory overhaul was listed as 2,061.7 hours.

The airplane was equipped with a McCauley propeller model 1C235/LFA7570, serial number TG025. The last propeller annual inspection was completed on August 1, 2014.

The airplane's total useable fuel capacity was 53 gallons. The airplane was last fueled on August 21, 2014, with 25.1 gallons of 100LL which filled the tanks. The airplane was flown 1.9 hours between the last fueling and the accident flight. An average fuel burn for the airplane was approximately 9 gallons per hour which would have resulted in approximately 36 gallons of fuel on board at the accident takeoff. First responders reported that fuel was leaking from the airplane at the accident site and they were able to capture approximately 18 gallons of fuel from the fuel tanks.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Night
<b>Observation Facility, Elevation:</b>	CGF,879 ft msl	<b>Distance from Accident Site:</b>	0 Nautical Miles
<b>Observation Time:</b>	22:00 Local	<b>Direction from Accident Site:</b>	0°
<b>Lowest Cloud Condition:</b>	Scattered / 3500 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	Broken / 20000 ft AGL	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	10 knots /	<b>Turbulence Type Forecast/Actual:</b>	/ None
<b>Wind Direction:</b>	140°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	30.09 inches Hg	<b>Temperature/Dew Point:</b>	24°C / 20°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Willoughby Hills, OH (CGF )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Willoughby Hills, OH (CGF )	<b>Type of Clearance:</b>	VFR
<b>Departure Time:</b>	21:58 Local	<b>Type of Airspace:</b>	

The weather conditions reported at CGF at 2200 were wind from 140 at 10 knots; visibility 10 miles; clouds 3,500 ft. scattered; ceiling 20,000 ft. broken; temperature 24 degrees Celsius; dew point 20 degree Celsius, and altimeter 30.09 inches of mercury.

Records indicate that there were three computerized weather briefing requests from N4207P on the day of the accident. All three were for flights from CGF to 89D (Kelleys Island Land Field Airport, Kelleys Island, Ohio). The first two briefings were logged at 1609:04 and 1609:19. Those briefings had a proposed departure time of 2030. The third briefing was at 2024:06 with a proposed departure time of 2100.

## Airport Information

<b>Airport:</b>	Cuyahoga County Airport CGF	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	879 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	06	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	5102 ft / 100 ft	<b>VFR Approach/Landing:</b>	None

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>	3 Fatal	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	On-ground
<b>Total Injuries:</b>	4 Fatal	<b>Latitude, Longitude:</b>	41.572223,-81.478057

The airplane impacted the ground, a chain link fence, a guy wire, and a telephone pole before coming to rest about 1,000 feet from the departure end of runway 6 on a bearing of 20 degrees. This location is just north of the intersection of Bishop Road and Curtiss Wright Parkway.

The wreckage path was along a 210 degree heading. The left wing tip, including the position light, was embedded in the ground at the first impact mark east of the chain link fence. The airplane then traveled through the fence, with the left wing contacting one of the fence posts. The main impact ground scar was on the west side of the fence. Adjacent to the main impact mark were two slash marks in the soft ground. Both marks were about 12 inches long. One of the slash marks was about 7 inches deep and the other was about 4 inches deep. The airplane came to rest on a heading of about 160 degrees with the left wing against the telephone pole. A postimpact fire ensued.

The left wing tip was the first part of the airplane to impact the terrain. The wing tip light assembly was embedded in the ground. A concave impact mark along with paint and rust transfers on the left wing aileron indicate that it contacted a metal fence post. The inboard six feet of the aileron was accorded and crushed toward the outboard section of the aileron which remained attached to the wing. A three foot section long outboard section of the flap remained attached to the wing. The inboard section of the wing and flap were burned. The wing was separated from the fuselage. The wing strut remained attached to the wing. The leading edge of the wing was crushed aft.

The outboard section of the right wing was bent upward about 30 degrees starting near the strut attach point. The right wing was separated from the fuselage. The strut remained attached to the wing. The flap and aileron remained attached to the wing. The inboard section of the wing sustained fire damage. The outboard section of the wing was crushed aft.

The flap actuator showed the flaps were in the retracted position.

The empennage remained intact with the rudder and elevator attached to their respective stabilizers. The outboard section of the right horizontal stabilizer and elevator were crushed. The elevator trim was measured and the measurement equated to a 9 to 10 degree nose-up trim setting.

The cabin area and instrument panel were destroyed by the post impact fire. The fuel selector was on the "Both" position and the fuel shutoff valve was in the open position.

Flight control continuity was established from all of the flight controls to their respective cockpit controls.

## Engine

The engine was located with the main wreckage. The engine mounts were separated from the firewall due to thermal damage. The propeller remained attached to the engine. The exhaust system sustained impact damage. The rear accessory case and the accessories sustained thermal damage.

The accessories and cylinder valve covers were removed. Thumb compression and engine continuity from the propeller to the accessory section was established when the propeller was rotated by hand. The cylinders and pistons were examined using a lighted borescope and no anomalies were noted.

The left magneto could not be turned by hand. The magneto cap was removed and the internal components of the magneto were melted. The right magneto turned by hand, but no spark was visible on the ignition leads. The ignition cap was removed and the inside of the magneto was found melted.

The engine was equipped with two vacuum pumps. The pump with the longer shaft was mounted lower on the accessory case. The pump frangible shaft couplings were melted on both pumps and therefore they could not be turned by hand. Both pumps were opened. The vanes and rotor inside both pumps were intact.

All fuel lines from the flow divider to fuel nozzles were intact. The fuel nozzles were removed. Nozzle No. 1 was not obstructed, nozzle No 2. was inadvertently dropped in oil during removal, nozzle No 3. was separated in two pieces neither of which were obstructed, and nozzle No. 4 was 80% obstructed with the insert not obstructed. The fuel flow divider was opened and examined. The rubber diaphragm was intact.

The engine driven diaphragm fuel pump housing was burned; however, the pump plunger was intact.

The throttle arm on the fuel servo was connected and moved the throttle plate. The mixture control arm was separated from impact. The finger screen was clean.

The ignition leads sustained thermal damage, but they remained attached to all of the spark plugs. The spark plugs were slightly worn and showed normal operating signatures. The No. 1 bottom plug was wet with oil.

## Propeller

The propeller spinner was fractured and separated from the propeller. Both propeller blades were straight. One propeller blade contained a  $\frac{3}{4}$  to 1-inch deep gouge near the tip of the blade. Chordwise scratches and leading edge polishing were visible on this blade. The other blade contained light chordwise scratches.

There were no anomalies identified with the airframe, engine, or propeller which would have precluded normal operation of the airplane.

## Medical and Pathological Information



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An autopsy was performed on the pilot at the Cuyahoga County Medical Examiner's Office on August 28, 2014. The death of the pilot was attributed to blunt trauma and thermal injuries sustained in the accident.

The FAA's Civil Aerospace Medical Institute performed forensic toxicology testing on specimens from the pilot with negative results for drugs and alcohol.

## **Additional Information**

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### Weight and Balance

Two sets of weight and balance calculations, using different variables, were performed for the airplane. The airplane's weight and balance paperwork showed the maximum gross weight for the airplane was 2,457 pounds, the maximum useful load was 787.4 pounds, and the maximum aft moment was 116,000 pound-inches.

The occupant weights provided by the medical examiner were: pilot - 130 pounds; right front passenger - 200 pounds; left rear passenger - 172 pounds; and right rear passenger - 166 pounds.

The first calculation used the occupant weights that were provided by the medical examiner's office, 10 pounds of baggage, and 35 gallons of fuel. These calculations showed the airplane had a takeoff weight of 2,550.6 pounds with a moment of 112,957 pound-inches.

The second calculation increased the occupant's body weights by 10% to account for the weight lost by the thermal injuries and increased the baggage to 15 pounds. These calculations resulted in the airplane at a gross weight of 2,622.6 pounds, which is 165.6 pounds over gross weight and with a moment of 117,127 pound-inches.

Witnesses who were with the pilot and passengers before the flight stated the pilot asked two of the passengers how much they weighed. One witness recalled that the passenger who would become the right front seat passenger stated he weighed 200 pounds. The witness stated the pilot performed some calculations in his head and indicated that he believed they would be below the weight limit for the airplane.

### Personal Electronic Device

Two iPhones were located in the wreckage. One of the iPhones was able to be accessed and it was sent to the NTSB Vehicle Recorder Division for examination. The iPhone was owned by one of the passengers. At 20:33:01, a text message first referenced the flight. Text messages continued with the same recipient until 21:37. The messages discussed a destination of Kelley's Island; a half hour flight

each way for a total flight time of one hour; and the possibility of further communication about the flight using Snapchat.

At 21:49, a 10-second video was taken from the back right passenger seat while the aircraft was taxiing. The video panned from the right exterior of the airplane to the forward interior. Persons were in both the left and right front seats. The person in the right front seat was not touching the flight controls. The person in the left front seat had both hands on the yoke. The flap handle was visible in the full up position.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Sullivan, Pamela
<b>Additional Participating Persons:</b>	Michael Rutherford; FAA; Cleveland, OH Paul Yoos; Textron Aviation; Wichita, KS Judson Rupert; Lycoming; Williamsport, PA
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<b>Note:</b>	
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