



# Aviation Investigation Final Report

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<b>Location:</b>	Deer Park, Washington	<b>Accident Number:</b>	WPR18FA195
<b>Date &amp; Time:</b>	July 13, 2018, 10:21 Local	<b>Registration:</b>	N24442
<b>Aircraft:</b>	Cessna 172	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Birdstrike	<b>Injuries:</b>	3 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Instructional		

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## Analysis

The purpose of the flight was for the student pilot to make his first flight in his training program, with the flight instructor and an observer also onboard the airplane. There were no aggressive maneuvers planned during the flight. Radar data indicated that, following departure, the airplane flew about 25 minutes making a series of benign turns. With the airplane maneuvering in a level attitude, configured at 77 kts (ground speed), it suddenly made a sharp 90° right turn and rapidly descended; the last speed recorded was 117 kts. The airplane was in a steep dive as it approached the accident site and just before impact, the outboard wings broke off the airplane about the same time.

Postaccident examinations revealed no anomalies with the airplane. Flight control system continuity could not be definitively confirmed due to the fragmentation of the wreckage, but the fractured control cables all showed signatures consistent with overload.

Numerous pieces of the windscreen and swabs of the airframe were sent to the Smithsonian Institution's Feather Identification Lab. Found within the samples were a partial feather and the microscopic downy feather characters, which were consistent with an American white pelican, which has an average weight of 7.7 kg. There were many observations of American white pelicans reported near the area around the date of the accident.

The airplane manufacturer's recommended maneuvering speed was about 97 kts and abrupt control movements above that speed could impose excessive loads beyond the structural strength of the airplane. The airplane likely collided with an American white pelican resulting in a rapid descent that the flight instructor was unable to recover from before the airplane exceeded the manufacturer's recommended maneuvering speed, which led to the exceedance of the airplane's structural strength capability and breaking up in-flight.

## Probable Cause and Findings

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

An in-flight breakup as a result of the airplane exceeding the structural strength of the airplane during a rapid descent that the flight instructor was unable to recover from following a collision with a large bird.

### Findings

<b>Environmental issues</b>	Animal(s)/bird(s) - Contributed to outcome
<b>Personnel issues</b>	Aircraft control - Instructor/check pilot
<b>Aircraft</b>	Flight surfaces (wing) - Capability exceeded
<b>Aircraft</b>	Descent rate - Capability exceeded

## Factual Information

### History of Flight

<b>Maneuvering</b>	Birdstrike (Defining event)
<b>Maneuvering</b>	Loss of control in flight
<b>Maneuvering</b>	Part(s) separation from AC

On July 13, 2018, at 1021 Pacific daylight time, a Cessna 172R airplane, N24442, was substantially damaged when it was involved in an accident near Deer Park, Washington. The flight instructor and two student pilots were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 141 instructional flight.

The purpose of the flight was for the student pilot to undergo flight instruction. This was the first flight in his training program and the student pilot who was seated in the rear seat was an observer. The flight departed from Felts Field Airport (SFF), Spokane, Washington about 0955, and the pilots intended to remain in the local area.

Following departure, the flight proceeded to the Clayton practice area located about 15 miles northwest of the airport.

A review of the radar track data indicated that, after entering the practice area at 1010, (Figure 1) the airplane began a gradual 90° left turn and continued in a southwesterly direction, temporarily leaving the Clayton boundary. The airplane continued in a gradual climb to about 7,000 ft mean sea level (msl) and then made a 180° right turn. The flight track remained on a northeasterly heading until about 1018, at which point the airplane made another 180° left turn to a heading of 208°. The airplane proceeded about 2.5 miles at altitudes varying between about 7,000 to 7,450 ft msl. At 1020:53, the data indicated the airplane was at an altitude of 7,000 ft msl and an estimated ground speed of 77 knots. The airplane then made a sharp 90° right turn (Figure 2) and continued on a 305° heading for about 14 seconds. The airplane then made another sharp 90° right turn, and the last recorded track data, at 1021:18, indicated an estimated ground speed of 117 knots.

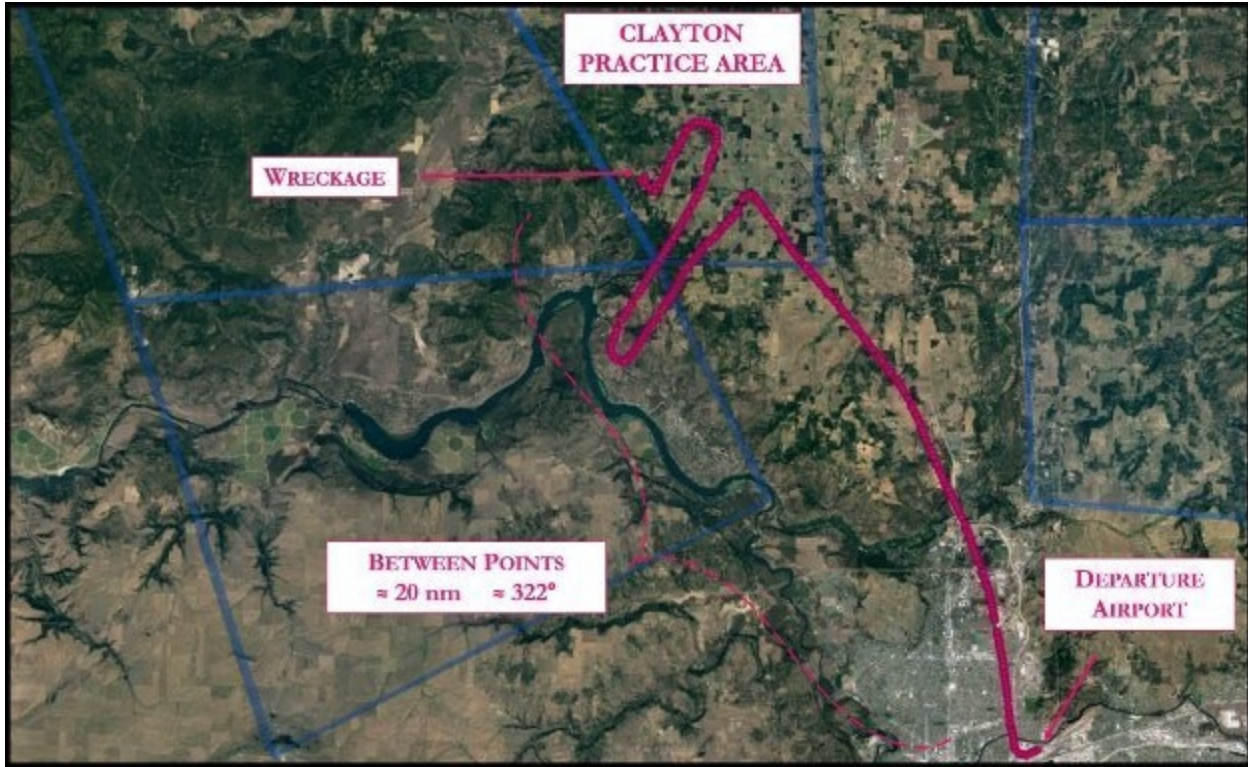


Figure 1: Radar Data from Departure Airport to Accident Site.

The accident site was located about 740 ft southwest of the last recorded track data (Figure 2). Witnesses reported that the airplane banked hard, then descended in a steep dive toward terrain. During the descent, the wings departed the airplane before ground impact.



Figure 2: Radar Data Prior to Accident (showing altitude profile)

About 1110, the operator's dispatcher noted that the airplane was overdue, and he attempted to reach the flight instructor on the radio and on his cell phone. Thereafter, the dispatcher contacted air traffic control, and eventually they confirmed that the airplane's last radar return was received at 1021.

## PERSONNEL INFORMATION

### Flight Instructor

According to the operator, the flight instructor was hired in 2017; he received his flight instructor certificate in October 2016. The flight instructor had last flown in the Clayton practice area 9 days earlier, for a flight time of 1.8 hours. The operator's records indicated that the flight instructor had accrued 613 hours as an instructor. The instructor received stall and spin recovery training in October 2016.

The instructor's schedule for the day consisted of two flights: the first flight blocked from 0800 to 0920 and the second flight from 0930-1050 (the accident flight).

## AIRCRAFT INFORMATION

Weight and balance computations at the time of the accident, based on the airplane's empty weight and center of gravity obtained from the maintenance records, revealed that the gross weight was about 2,400 lbs, and the airplane was within the flight envelope.

The Cessna 172R Airplane Owner's Manual reported the airplane's never-exceed speed ( $V_{ne}$ ) was 160 kts calibrated airspeed and its maximum structural cruising speed ( $V_{no}$ ) was 126 kts. The manual stated, "Do not exceed this speed [ $V_{no}$ ] except in smooth air and then only with caution." The manual also listed the design maneuvering speed ( $V_a$ ) of 97 kts calibrated for a gross weight of 2,400 lbs. The manual stated that full or abrupt control movements should not be made above  $V_a$ . The manual noted that the airplane was certified for both normal and utility category and prohibited abrupt use of the controls above 99 kts and 92 kts [indicated], respectively. The manual added that:

*The important thing to bear in mind in flight maneuvers is that the airplane is clean in aerodynamic design and will build up speed quickly with the nose down. Proper speed control is an essential requirement for execution of any maneuver, and care should always be exercised to avoid excessive speed which in turn can impose excessive loads. In the execution of all maneuvers, avoid abrupt use of controls.*

The manual further stated that "if a bird strike or other incident should damage the windshield in flight to the point of creating an opening, a significant loss in performance may be expected."

## WRECKAGE AND IMPACT INFORMATION

The accident site was located in a grass field in rural farmland, about 20 nautical miles northwest of Felts Field Airport. The elevation of the main wreckage site was 2,260 ft msl.

The wreckage was distributed over a 400 ft distance on a median magnetic bearing of about 030°. The outboard sections of both the right and left wings were located at the beginning of the debris field about 330 and 190 ft from the main wreckage, respectively (Figure 3). The debris between the outboard wing

sections and the main wreckage consisted of left-wing pieces. All control surfaces and their associated mass balance weights were accounted for in the debris field.



Figure 3: Accident Site

The 78-inch inboard portion of the left wing was found embedded with the main wreckage and had sustained the most damage of all the wing sections. An outboard section of the left flap and attached wing skin was adjacent to the outboard wing. A small piece of the aileron skin, upper wing skin, landing light lens, and the remainder of the inboard aileron were located in the debris field. The forward and aft upper spar caps were bent in a downward direction. The leading edge and bottom skin of the inboard portion of the wing had folded back from the ribs. The trailing edge rivets had sheared consistent with a downward torsional force. The upper portion of the strut was still attached; the lower position was located immediately nearby. The left aileron was separated into numerous pieces with only the outboard portion remaining attached. The area of the most fragmentation was near where the aileron and flap meet. The flap remained attached to the inboard attach fitting and was bent back on itself.

The 94-inch inboard section of the right wing and its flap were 50 ft from the main wreckage. The outboard right wing had numerous creases on the lower skin oriented from the outboard aft trailing edge to the inboard leading-edge area. Examination of the forward and aft spars disclosed evidence of compressive and tensile overstress on the upper and lower spar caps, respectively.

A 10-inch tear in the fuselage skin created a saw mark from the outboard aft area inboard; the saw mark was consistent with the shape of the aileron control cable.

The vertical stabilizer was intact, and the rudder remained attached at its receptive fittings and had folded to a stationary position against the vertical stabilizer. The right elevator remained attached to the mid connection hinge. The horizontal stabilizer was crushed forward. Both surfaces sustained the most deformation at the center hinge. The upper spar caps contained a torsional load and the lower spar caps

appeared to have been bent as a result of impact damage; the fracture surfaces were indicative of that of compression. The forward spar was too deformed to determine any fracture directions. At the elevator control tubes most of the rivets were sheered out of the coupling. The right elevator was bowed upward; the actuator on the trim tab was ripped past a meaningful point to be able to measure. The spar on the fuselage connecting the horizontal stabilizer was bent upward on the lower spar cap and downward on the upper spar cap.

The left horizontal stabilizer was crushed and sustained torsional twisting with the outboard section folded almost fully over on itself to the bottom of the elevator. The left elevator control tube had sheared almost completely out of the coupling on the fuselage and had sheared from the ribs in the elevator body.

The engine came to rest partially buried in dirt. During the postaccident examination, investigators removed the cylinders. The combustion chambers were mechanically undamaged, and there was no evidence of foreign object ingestion or detonation. The valves were intact and undamaged. There was no evidence of valve-to-piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers and exhaust system components displayed coloration consistent with normal-to-lean operation.

There was no oil residue observed in the exhaust system gas path. The oil sump and exhaust were broken off the engine. Ductile bending and crushing of the exhaust system components were observed. The oil screen was clean. Removal of the fuel manifold (spider) revealed it contained slight traces of liquid consistent in odor with that of Avgas. The diaphragm was pliable, and the spring was intact. The fuel servo was broken free and throttle linkage and cable remained attached at the arm. The fuel pump was broken at the flange.

The magnetos were broken from their respective flanges as a result of impact and could not be functionally tested. Spark was obtained at each post during rotation.

Numerous cable control ends were sent to the NTSB Materials Laboratory for examination of their fracture surfaces. All cables showed signatures consistent with overstress fractures.

## MEDICAL AND PATHOLOGICAL INFORMATION

The Spokane County Office of the Medical Examiner, Spokane, Washington, completed an autopsy on the student pilot and flight instructor. The cause of their deaths was blunt force injuries.

Toxicology testing performed at the Federal Aviation Administration's Forensic Sciences Laboratory was negative for carbon monoxide.

The flight instructor's specimens had 29 mg/dL (mg/hg) ethanol detected in muscle tissue and 25 mg/dL (mg/hg) ethanol in the liver. The student's specimens had 34 mg/dL (mg/hg) of ethanol detected in muscle tissue as well as 11 mg/dL(mg/hg) in the liver. No drugs were detected in the muscle of the flight instructor or the student. The tested specimens had evidence of putrefaction; thus, it is likely that the ethanol was consistent with postmortem production.

## TEST AND RESEARCH

Numerous pieces of windscreen and swabs of the airframe were sent to the Smithsonian Institution's Feather Identification Lab for examination. DNA analysis was conducted on 21 samples of various windscreen pieces. None of the samples contained avian DNA. A microscopic examination was conducted on all of the pieces, and a total of 40 microslides were prepared from the material. Nine microslides from 2 bags of windscreen shard samples contained bird feather fragments. The feather material consisted of 1 white partial feather tip, 2 microscopic pennaceous feather parts, and 7 separate microscopic downy feather barbules. No feather fragments were found in the swipes, but very little material was available in these samples.

The white partial feather and the microscopic downy feather were consistent with American white pelican, which has an average weight of 4.6 – 7.7 kg, but weights have been reported up to 13.6 kg. American white pelicans were observed near the area of Deer Park, Washington, during July 2018 (<https://ebird.org/map>): 46 sightings were at a lake 26 miles away and 90 sightings were at another lake 26 miles away.

#### ADDITIONAL INFORMATION

The accident flight was scheduled to leave at 0940 and was due back at 1046. The lesson plan for the flight, Visual Attitude Flying and Procedures Introduction, was the first flight in the private pilot curriculum. The inflight training elements were as follows (in sequential order):

- Normal/crosswind takeoff—power check
- Climbs—straight and turning. Emphasis on pitch control,  $V_y$  climb, Cruise climb at 1000' AGL
- Level off and straight cruise—use of checklist
- Practice area orientation
- Demo—coordinated turns and uncoordinated turns
- Trimming exercise
- Level turns—coordination and roll out on headings
- Slow flight introduction
- Traffic pattern at altitude
- Descents—straight and turning (Cruise, Approach,  $V_g$ )
- Normal/crosswind landing



## Flight instructor Information

<b>Certificate:</b>	Commercial; Flight instructor	<b>Age:</b>	30, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	3-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	Airplane single-engine	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	February 11, 2014
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	1054 hours (Total, all aircraft), 502 hours (Total, this make and model), 815 hours (Pilot In Command, all aircraft), 105 hours (Last 90 days, all aircraft), 16 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

## Student pilot Information

<b>Certificate:</b>	Student	<b>Age:</b>	24, Male
<b>Airplane Rating(s):</b>	None	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	3-point
<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 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	May 15, 2018
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 0 hours (Total, all aircraft), 0 hours (Total, this make and model)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N24442
<b>Model/Series:</b>	172 R	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	2000	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	17280862
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	May 1, 2018 AAIP	<b>Certified Max Gross Wt.:</b>	2450 lbs
<b>Time Since Last Inspection:</b>	29 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	4755 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Lycoming
<b>ELT:</b>	C126 installed, not activated	<b>Engine Model/Series:</b>	IO-360-L2A
<b>Registered Owner:</b>	Moody Bible Institute Of Chicago	<b>Rated Power:</b>	160 Horsepower
<b>Operator:</b>	Moody Bible Institute Of Chicago	<b>Operating Certificate(s) Held:</b>	Pilot school (141)

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KSFF, 1953 ft msl	<b>Distance from Accident Site:</b>	20 Nautical Miles
<b>Observation Time:</b>	16:53 Local	<b>Direction from Accident Site:</b>	141°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	4 knots / None	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	110°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	30.03 inches Hg	<b>Temperature/Dew Point:</b>	28°C / 10°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Spokane, WA (SFF )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Spokane, WA (SFF )	<b>Type of Clearance:</b>	VFR flight following
<b>Departure Time:</b>	09:55 Local	<b>Type of Airspace:</b>	Class G

## Wreckage and Impact Information

<b>Crew Injuries:</b>	2 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	1 Fatal	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	3 Fatal	<b>Latitude, Longitude:</b>	47.941112,-117.626388

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Keliher, Zoe
<b>Additional Participating Persons:</b>	Douglas Belcher; Federal Aviation Administration; Spokane, WA Ian Kerrigan; Moody Bible College of Chicago; Spokane, WA Ricardo Asensio; Textron Aviation (Cessna); Wichita, KS Troy Helgeson; Lycoming Engines; Williamsport, PA
<b>Original Publish Date:</b>	December 3, 2020
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class 3</a>
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=97758">https://data.nts.gov/Docket?ProjectID=97758</a>

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 [here](#).