



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Moss Beach, CA	<b>Accident Number:</b>	WPR17FA023
<b>Date &amp; Time:</b>	11/18/2016, 1117 PST	<b>Registration:</b>	N6610D
<b>Aircraft:</b>	CESSNA 172N	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Turbulence encounter	<b>Injuries:</b>	1 Fatal, 1 Serious
<b>Flight Conducted Under:</b>	Part 91: General Aviation - Personal		

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## Analysis

The private pilot and a passenger were approaching the airport to land with a 70° right crosswind at 10 knots (kts) with gusts to 14 kts. The pilot reported that, on final approach, the airplane was configured with full flaps (30°) at an airspeed of 60 kts, and an altitude of 500 ft mean sea level (msl) when it began to encounter turbulence. The pilot then elected to conduct the landing approach at a higher airspeed and subsequently retracted the flaps from 30° to less than 20°. Immediately after reconfiguring the flaps, the pilot reported that he experienced strong turbulence that violently rocked the airplane and simultaneously felt a "strong downdraft" as the airplane entered a right bank. The pilot was unable to correct the airplane's attitude, and the airplane subsequently descended into terrain, where it impacted a paved road, several vehicles, and two houses before coming to rest.

A weather study revealed that, at the time of the accident, a weak temperature inversion was present between 400 and 600 ft msl. The stable layer of air produced by the temperature inversion trapped any updrafts or downdrafts created by the wind flowing over nearby terrain. This created an environment favorable for the development of low level wind shear and turbulence below 600 ft msl. Although airplane performance data revealed that the pilot maintained an airspeed above the airplane's stall speed throughout the landing approach, his decision to retract the flaps likely resulted in a sudden loss of lift. This loss of lift, combined with the low level wind shear and turbulent conditions, most likely resulted in the pilot's loss of control during the approach for landing.

## Probable Cause and Findings

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

The pilot's loss of airplane control following an encounter with low level wind shear and turbulence during final approach for landing. Contributing to the loss of control was the pilot's decision to retract the wing flaps on final approach, which resulted in a sudden loss of lift.

## Findings

<b>Aircraft</b>	Lateral/bank control - Attain/maintain not possible (Cause) Descent rate - Attain/maintain not possible (Cause) TE flap control system - Incorrect use/operation (Factor)
<b>Personnel issues</b>	Aircraft control - Pilot (Cause) Use of equip/system - Pilot (Factor) Decision making/judgment - Pilot (Factor)
<b>Environmental issues</b>	Windshear - Effect on operation (Cause) Terrain induced turbulence - Effect on operation (Cause)

## Factual Information

### History of Flight

Approach-VFR pattern final	Turbulence encounter (Defining event)
Maneuvering-low-alt flying	Loss of control in flight
Approach	Collision with terr/obj (non-CFIT)

On November 18, 2016, about 1117 Pacific standard time, a Cessna 172N, N6610D, was substantially damaged when it impacted terrain while on final approach to Half Moon Bay Airport (HAF), Half Moon Bay, California. The private pilot sustained serious injuries, and the passenger was fatally injured. The personal flight was operated in accordance with 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed in the area, and no flight plan was filed for the flight, which originated from Sacramento Executive Airport (SAC), Sacramento, California, about 1015, and was destined for HAF.

The pilot reported that, before departing SAC, he checked the weather for HAF, which indicated winds were from the southwest. He subsequently departed and requested visual flight rules flight following to HAF. The pilot stated that while approaching HAF, he made position reports on the airport's common traffic advisory frequency (CTAF) and requested traffic information. Someone responded that the wind was from the southeast up to 15 knots (kts) and that runway 12 was in use.

The pilot stated that he entered the airport traffic pattern for runway 12, and that as the airplane entered the final leg of the traffic pattern, the visual approach slope indicator (VASI) lights indicated that the airplane was high. At that time, the airplane was at an altitude about 800 ft mean sea level (msl) and at an airspeed of 65 kts when he reduced power to intercept the VASI glideslope.

As the airplane continued on the final approach path with full flaps (30°) at 60 kts and about 500 ft msl, it began to encounter light turbulence. The pilot was concerned that if the turbulence continued during the approach, he would be vulnerable to strong buffeting at normal approach speed, which might lead to a rough landing; as a countermeasure, he elected to land at a higher airspeed. The pilot then retracted the flaps to less than 20° while applying additional power to stay on the glideslope. The pilot added that, immediately after making these adjustments, he felt strong turbulence violently rock the airplane, which caused the wings to "dip," first to the left, and then to the right. He "simultaneously" felt a strong downdraft, and the airplane entered a steep right bank. The pilot stated that he fought to level the wings and gain altitude by applying full power, slight back pressure on the yoke, and then left aileron and rudder, but nothing seemed to correct the descent and right bank attitude. The pilot stated that he observed runway 12 come into view about 90° to his right but could not reach the runway due to the airplane's low altitude. Shortly thereafter, the pilot noticed large trees coming into view. Wanting to avoid trees in his flight path, the pilot stated that he maneuvered and tried to drag the airplane's tail on the ground. He next recalled closing his eyes to protect them, followed by impact.

## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	64, Male
<b>Airplane Rating(s):</b>	Single-engine Land	<b>Seat Occupied:</b>	Left
<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>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 With Waivers/Limitations	<b>Last FAA Medical Exam:</b>	04/15/2015
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	07/21/2015
<b>Flight Time:</b>	1145 hours (Total, all aircraft), 884 hours (Total, this make and model), 1011 hours (Pilot In Command, all aircraft), 17 hours (Last 90 days, all aircraft), 10 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

The pilot held a private pilot certificate with ratings for airplane single-engine land and instrument airplane. He reported 1,145 total hours of flight experience, with 884 hours in the accident airplane make and model. Further, the pilot reported that he had flown 16.7 hours, 10.4 hours, and 1 hour in the preceding 90 days, 30 days, and 24 hours respectively. His most recent flight review was conducted on July 21, 2015, in the same make and model as the accident airplane.

The pilot was issued a third-class Federal Aviation Administration (FAA) medical certificate on April 15, 2015, with the limitation that he must have available glasses for near vision.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	CESSNA	<b>Registration:</b>	N6610D
<b>Model/Series:</b>	172N N	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1979	<b>Amateur Built:</b>	No
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	17272897
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	04/05/2016, Annual	<b>Certified Max Gross Wt.:</b>	2299 lbs
<b>Time Since Last Inspection:</b>	173 Hours	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	5768 Hours at time of accident	<b>Engine Manufacturer:</b>	LYCOMING
<b>ELT:</b>	C126 installed, not activated	<b>Engine Model/Series:</b>	O-360 SERIES
<b>Registered Owner:</b>	SAC AERO FLYING CLUB INC	<b>Rated Power:</b>	180 hp
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The airplane was a single-engine, high wing, fixed landing gear, four-seat Cessna 172N, manufactured in 1979. It was powered by a normally aspirated, 180-horsepower Lycoming O-360-A4M engine, serial number RL-12115-36E, that drove a Sensenich, metal, 2-bladed, fixed-pitch propeller. A review of maintenance records revealed that the last annual inspection was accomplished on April 5, 2016, at an engine total time of 1,068.9 hours, and an airframe total time of 5,768 hours. The airplane and engine had accumulated a total of 173.2 hours since its most recent inspection.

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	HAF, 66 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	1115 PST	Direction from Accident Site:	155°
Lowest Cloud Condition:	Clear	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	10 knots / 14 knots	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	190°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	30.03 inches Hg	Temperature/Dew Point:	17° C / 3° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Sacramento, CA (SAC)	Type of Flight Plan Filed:	None
Destination:	Half Moon Bay, CA (HAF)	Type of Clearance:	None
Departure Time:	1015 PST	Type of Airspace:	Class G

At 1115, the HAF weather reporting facility, located about 1/2 nm southeast of the accident site, reported wind from 190° at 10 kts, with gusts to 14 kts, visibility 10 statute miles, sky clear, temperature 17° C, dew point 3° C, and an altimeter setting of 30.03 inches of mercury.

A weather study revealed that a weak temperature inversion between 400 and 600 ft msl was present near the accident site at the time of the accident. Between 1100 and 1200 PST, the vertical environment changed from an unstable layer to a stable layer. The study found that the stable layer trapped any updrafts or downdrafts created by the wind flowing over the rise in terrain to the west and southwest of the airport. These changes created an environment favorable for low level wind shear and turbulence below 600 ft msl.

FAA Advisory Circular 00-6B (AC-00-06B), section 17.2.3.1, describes how areas near temperature inversions are favored for wind shear conditions. The AC notes that "Strong wind shears often occur across temperature inversion layers, which can generate turbulence."

## Airport Information

Airport:	Half Moon Bay (HAF)	Runway Surface Type:	Asphalt; Concrete
Airport Elevation:	66 ft	Runway Surface Condition:	Dry
Runway Used:	12	IFR Approach:	None
Runway Length/Width:	5000 ft / 150 ft	VFR Approach/Landing:	Precautionary Landing; Traffic Pattern

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Serious	<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>	1 Fatal, 1 Serious	<b>Latitude, Longitude:</b>	37.520000, -122.511389

The airplane descended into a residential area about 1,822 ft northwest of the HAF runway 12 threshold. The initial point of impact was identified by two parallel rubber tire marks on a street about 245 ft southwest of the main wreckage. The airplane continued in a northeast direction across an open field that was about 100 ft wide, and subsequently struck a wooden fence that separated the field from a home. The airplane then continued on a northeast heading as it impacted the southeast corner of the roof of the home, which was followed by impact with a utility truck. The airplane's right wing tip and a landing gear strut were found in the front yard of the home.

The wreckage path then continued about 60 ft in a northeasterly direction. The nose landing gear was located about 30 ft northeast of the utility truck, and the main wreckage came to rest on the southwest corner of a second home. The lower fuselage came to rest flush against the brick structure of the residence with the engine firewall resting upright on the ground. The empennage separated just behind the rear passenger seats and was folded over and on top of the cabin, with the vertical stabilizer and rudder resting on the ground. The horizontal stabilizer and elevator remained attached to the fuselage. The cabin and cockpit areas were both destroyed by impact forces.

The left wing remained attached to the fuselage; the wing strut remained attached. The left flap and the inboard half of the aileron remained attached to the left wing.

The right wing, which had separated from the fuselage, impacted a white cargo van that was parked in an adjacent driveway about 7 ft from the main wreckage site.

About 4 ft of the outboard right aileron was separated from the wing and located next to the fuselage. The inboard section of the right aileron remained attached to the wing. Additionally, the right flap remained attached to the wing and appeared to be in the fully retracted position. The leading edge of the wing sustained impact damage. About 5 ft of the leading edge skin was separated at the wing's mid-span section. The outboard leading edge exhibited a concave depression.

The engine, propeller, and one of the landing gear struts were located under the right wing. The left and right main landing gear wheels were separated from the wreckage and found about 42 ft north of the fuselage, next to the backyard fence of the second residence.

## Additional Information

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### Performance Study

An airplane performance study based on radar data revealed that the airplane approached HAF from the north and entered at 45° to the upwind leg for runway 12. The airplane's speed was about 86 knots indicated airspeed (KIAS) and its altitude about 1,000 ft mean sea level (msl) when the pilot completed the turn for a left downwind to runway 12.

The airplane slowed to about 80 KIAS and descended to about 700 ft msl on the downwind leg. The airplane then entered a continuous, 180° left turn from the downwind to final legs of the traffic pattern. Radar data indicated that, at 1116:20, the airspeed was about 57 KIAS, the altitude was 500 ft msl (about 440 ft above ground level), and the airplane was at the apex of a 10°-bank left turn to final. At this point, the airplane's pitch angle changed from about 5° nose up to about -3° nose down, and the airplane accelerated as it descended until impact, which occurred about 1117:10.

The airplane's Pilot Operating Handbook (POH) estimates that the airplane will stall between 31 kts calibrated airspeed (KCAS) and 40 KCAS, depending on the airplane's flap position and bank angle. Additionally, the POH recommends "a slightly higher approach speed under turbulent air conditions." This is to compensate for any sudden loss in the headwind component, which would result in a momentary loss of airspeed and could lead to an aerodynamic stall above the published stall speed. Although the POH does not define "slightly higher", the FAA Airplane Flying Handbook recommends adding one-half of the reported surface wind gust to the normal final approach airspeed when landing in turbulent conditions.

The handbook states that the degree to which flaps should be extended during a crosswind approach and landing vary with the airplane's handling characteristics, as well as the wind velocity. Additionally, the handbook advises that retraction of wing flaps during an approach for landing "suddenly decreases lift and causes the airplane to sink rapidly."

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Thomas Little	<b>Report Date:</b>	03/14/2018
<b>Additional Participating Persons:</b>	Michael Arraiz; Federal Aviation Administration; Oakland, CA Peter Basile; Textron Aviation; Wichita, KS Troy Helgeson; Lycoming Engines; Williamsport, PA		
<b>Publish Date:</b>	03/14/2018		
<b>Note:</b>	The NTSB traveled to the scene of this accident.		
<b>Investigation Docket:</b>	<a href="http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=94398">http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=94398</a>		

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