Aviation Investigation Final Report

Location:	Ludlow, South Dakota	**Accident Number:**	CEN13FA324
Date & Time:	June 6, 2013, 19:30 Local	**Registration:**	N350WR
Aircraft:	WEATHERLY AVIATION CO INC 620B	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 137: Agricultural		

Analysis

The pilot had been performing aerial applications; the airplane was found crashed in a field adjacent to the area where he was applying applicant. A map of the 891.72-acre application area showed that it was asymmetrical and that it included a series of diagonally adjoining rectangular fields bounded by fences and property and an irregularly shaped field bounded by a curved highway. The fields to be treated were located north, south, and east of the accident site. According to an aerial application pilot familiar with the work site, if the accident pilot were following a north-south application path, it would have been appropriate for the airplane to fly over the accident area in straight-and-level flight without spraying any materials in that area. However, given the irregular shape of the application area, it is possible that the pilot may have been maneuvering the airplane for a different application path to another part of the field.

An examination of the airplane, the engine, and related systems revealed no anomalies that would have precluded normal operation. The damage to the airplane and ground scars were consistent with the airplane being at a high angle-of-attack, consistent with a stalled condition, at the time of impact.

According to the pilot's colleagues, he got up at 0700 the morning of the accident after sleeping about 7 to 8 hours and started flying at 0930. He flew all morning and took a 10- to 15-minute break for lunch about 1300. The pilot then continued to fly until the time of the accident. He had flown at least 9 hours when the accident occurred. The low-level aerial application flight operations would have required considerable concentration to ensure proper application to the target crop, obstacle avoidance, and precise control of the airplane while dispensing multiple loads of chemical throughout the day. Such operations can induce fatigue, particularly when they are conducted during the course of a long work day like the pilot had. Therefore, it is likely that the pilot would have been affected by task- and/or work-related fatigue when the accident took place.

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 maneuvering, which resulted in an inadvertent stall. Contributing to the accident was task- and/or work-related fatigue.

Findings

Aircraft	(general) - Capability exceeded
Personnel issues	Aircraft control - Pilot
Personnel issues	Fatigue due to work schedule - Pilot

Factual Information

History of Flight

Maneuvering	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On June 6, 2013, about 1930 mountain daylight time, a Weatherly 620B airplane, N350WR, was substantially damaged when it impacted terrain near Ludlow, South Dakota. A postimpact fire ensued. The commercial pilot was fatally injured. The airplane was registered to and operated by Air Kraft Spraying Inc., under the provisions of 14 Code of Federal Regulations Part 137 as an aerial application flight. Visual meteorological conditions prevailed for the flight, which operated without a flight plan. The local flight originated from a private airstrip near Ludlow, South Dakota, about 1830.

According to colleagues of the pilot, he was applying pesticide and insecticide to a wheat-grass field adjacent to where the airplane crashed. A map of the field that the pilot was working, provided by the pilot's colleagues, illustrated 891.72 acres. The application area was not symmetrical – the southern boundary for application was delineated by Highway 858. A series of rectangles highlighted by fences and property boundaries defined the remainder of the application area. The wreckage was located between a north and south boundary of the application area. According to the pilot's colleagues, he should have been in straight and level flight in this area and should not have been maneuvering if he was following a north/south application path.

A local resident, located south of the accident site, reported seeing the airplane make multiple passes over the field. He lost site of the airplane, and a few minutes later observed smoke.

Pilot Information

Certificate:	Commercial	**Age:**	39
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	January 15, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 5, 2012
Flight Time:	752.2 hours (Total, all aircraft), 76 hours (Total, this make and model), 9 hours (Last 24 hours, all aircraft)		

The pilot, age 39, held a commercial pilot certificate with an airplane single-engine land rating issued on June 5, 2012. The certificate contained the limitation "not valid for carriage of persons for hire in

airplanes on cross-country flights of more than 50 nautical miles or at night." He was issued a second class airman medical certificate without limitations on January 15, 2013.

A review of the pilot's logbook indicated that he had logged no less than 752.3 hours flight time; 76 hours of which were logged in the make and model of the accident airplane. The pilot had logged 465 hours of agricultural experience during the 2012 season. There were no entries in his logbook to reflect the flight time he had accumulated since April 12, 2013. According to logbook records, the pilot successfully completed the requirements of a flight review on June 5, 2012. The pilot's logbook also had an endorsement illustrating that he had demonstrated his knowledge and skills of Part 137.19(c); however, this endorsement was not dated. The Federal Aviation Administration does not require an endorsement for aerial applications but does require that a pilot demonstrate their knowledge and skills prior to conducting operations.

According to Air Kraft Spraying, Inc., the pilot had flown his first season in 2012 and was starting his second season as an agricultural pilot when the accident happened. The pilot had not attended formal flight training for agricultural operations and had obtained all of his knowledge and experience through on-the-job training. The pilot had attended the Professional Aerial Applicators' Support System (PAASS) training provided by the National Agricultural Aviation Association in 2013. The pilot also held a chemical applicators license as required by the State of South Dakota.

Aircraft and Owner/Operator Information

Aircraft Make:	WEATHERLY AVIATION CO INC	**Registration:**	N350WR
Model/Series:	620B	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	1612
Landing Gear Type:	Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	May 20, 2013 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	3146 Hrs as of last inspection	**Engine Manufacturer:**	Pratt and Whitney
ELT:	Not installed	**Engine Model/Series:**	R-985-AN-14B
Registered Owner:	AIR KRAFT SPRAYING INC	**Rated Power:**	450 Horsepower
Operator:	AIR KRAFT SPRAYING INC	**Operating Certificate(s) Held:**	Agricultural aircraft (137)

The accident airplane, a Weatherly Aviation Company Incorporated 620B (serial number 1612), was manufactured in 1996. It was registered with the Federal Aviation Administration (FAA) on a restricted airworthiness certificate for agricultural and pest control operations. A Pratt and Whitney R-985-AN-14B engine rated at 450 horsepower powered the airplane. The engine was equipped with a Hartzell three-blade propeller.

The airplane was registered to and operated by Air Kraft Spraying, Inc., and was maintained under an annual inspection program. A review of the maintenance records indicated that an annual inspection had been completed on May 20, 2013, at an airframe total time of 3,146 hours.

The Weatherly 620B is not equipped with flaps.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KHEI,2706 ft msl	**Distance from Accident Site:**	45 Nautical Miles
Observation Time:	18:53 Local	**Direction from Accident Site:**	50°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.03 inches Hg	**Temperature/Dew Point:**	19°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Ludlow, SD	**Type of Flight Plan Filed:**	None
Destination:	Ludlow, SD	**Type of Clearance:**	None
Departure Time:	18:30 Local	**Type of Airspace:**	

The closest official weather observation station was Hettinger Municipal Airport (KHEI), Hettinger, North Dakota, located 45 nautical miles (nm) northeast of the accident site. The elevation of the weather observation station was 2,706 feet mean sea level (msl). The routine aviation weather report (METAR) for KHEI, issued at 1853, reported, wind calm, visibility 10 miles, sky clear, temperature 19 degrees Celsius (C), dew point temperature 06 degrees C, altimeter 30.03 inches.

Calculations of relevant meteorological data indicated that the density altitude was 4,094 feet.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	45.844722,-103.149444

The accident site was located in rolling terrain vegetated with short grass, at an elevation of 2,946 feet msl. The airplane impacted terrain on a magnetic heading of 180 degrees.

The initial impact point was defined by two deep scars in the ground, 12 inches apart and consistent with propeller strikes. The dirt within each scar was smooth and polished at an angle within each scar. The engine and propeller assembly was located immediately south of the second ground scar. The engine had separated from the main wreckage and the engine cowling was broken and torn.

The engine assembly included two of the three propeller blades. The spinner was crushed aft and exhibited rotational crushing and scoring along the face of the spinner. The engine was horizontal within the ground scar and was impact damaged. Dirt was imbedded in the front and the aft portion of the engine. The accessory housing exhibited impact damage.

The propeller blades were labeled "A", "B", and "C" for identification purposes only. Blade A remained attached to the propeller hub, exhibited leading edge scratches, and was relatively straight. Blade B remained attached to its respective hub, was bowed aft and twisted, and exhibited leading edge scratches and chordwise scratches on the outboard face of the blade. Blade C had separated from the hub and was located in the crater directly beneath the engine. The blade was bowed aft, twisted, and exhibited chordwise scratches on the outboard third of the blade face.

Two long and narrow ground scars, extending to the east and the west respectively of a center ground scar, were located immediately to the south of the engine and propeller assembly. Both scars were shallow, 12 inches at their widest point, and contained paint chips and plexiglass consistent with the leading edge of both wings. The center ground scar extended from the engine south to the main wreckage. Debris within the scar included bent and torn metal, fiberglass, engine accessories, and paint chips. The scar was 12 feet at its widest point and 26 feet long. A burn area extended 107 feet to the south and west of the main wreckage.

The main wreckage included both wings, the fuselage, and the empennage. The fuselage included the cabin and instrument panel; both were charred, melted, and partially consumed by fire, and damaged by impact forces. The aft portion of the fuselage, adjacent to the empennage was impact damaged.

The left wing included the left aileron and remained partially attached to the main wreckage. The leading edge of the wing exhibited accordion crushing, while the inboard portion of the wing adjacent to the main wreckage was damaged by fire. The left aileron remained partially attached and the aileron flight control was continuous from the aileron, inboard to the control pulley. Continuity past this point could not be established due to fire damage.

The right wing, including the right aileron, was adjacent to and south of the main wreckage and was charred, melted, and partially consumed by fire. The leading edge of the wing exhibited accordion crushing. Aileron flight control continuity could not be established due to fire damage.

The empennage included the horizontal and vertical stabilizer, the elevator, and the rudder. The rudder control cables were continuous from the rudder assembly, forward to the rudder pedals in the cabin. The elevator control tubes were continuous from the elevator forward to the aft portion of the fuselage. Elevator control continuity could not be established forward of the fuselage due to fire damage. The tail wheel had separated from the empennage and the empennage was otherwise unremarkable.

No preaccident mechanical malfunctions or failures were found that would have precluded normal operation.

Medical and Pathological Information

The autopsy was performed by the Clinical Laboratory of the Black Hills on June 10, 2013, as authorized by the Harding County Coroner's office. The autopsy concluded that the cause of death was due to blunt trauma injuries sustained in the accident, and the report listed the specific injuries.

The FAA's Civil Aerospace Medical Institute, Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the autopsy (CAMI Reference #201300111001). Testing of the urine revealed Salicylate. Tests for carbon monoxide and ethanol were negative. Tests for cyanide were not performed.

Tests and Research

The engine was examined under the auspices of the National Transportation Safety Board at a storage facility in Greeley, Colorado. During the examination, the forward bank of spark plugs was removed. Four of the plugs were covered in sediment as a result of the postimpact environment. The remaining plugs exhibited signatures consistent with worn out normal when compared to the Champion Spark Plug Chart. The engine cylinders, pushrods, and pushrod journals exhibited impact damage. All cylinders exhibited carbon deposits on the intake valves, corrosion on the exhaust valves, and were otherwise unremarkable.

The engine oil was clean and the oil filter and chip plug were unremarkable. The throttle and mixture linkage remained attached to the carburetor but were impact damaged. The carburetor fuel screen was free of contamination. The magnetos and the propeller governor were impact damaged and could not be functionally tested. No mechanical anomalies were noted that would have precluded normal operation.

Additional Information

According to the pilot's colleagues who had flown with him on the day of the accident, he had slept in, getting up around 0700 the morning of the accident. He had slept well in the bunk house for 7 to 8 hours. They were unable to start spraying until 0930, due to fog. The pilot flew all morning and took a 10 to 15 minute break for lunch around 1300. The pilot then continued to fly until the time of the accident. It was estimated that he had flown 9 hours on the day of the accident. His colleagues were

unaware of any other breaks that he may have taken prior to the accident, and they were unaware of exactly how many loads the pilot had flown that day.

Administrative Information

Investigator In Charge (IIC):	Rodi, Jennifer
Additional Participating Persons:	Bill Howell; FAA Flight Standards District Office; Rapid City, SD
Original Publish Date:	March 24, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=87118