



National Transportation Safety Board Aviation Accident Final Report

Location:	Kwethluk, AK	Accident Number:	ANC14FA022
Date & Time:	04/08/2014, 1557 AKD	Registration:	N126AR
Aircraft:	CESSNA 208B	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General Aviation - Instructional		

Analysis

The check airman was conducting the first company training flight for the newly hired second-in-command (SIC). Automatic Dependent Surveillance-Broadcast (ADS-B) data showed that, after departure, the airplane began a series of training maneuvers, consistent with normal operations. About 21 minutes into the flight, when the airplane was about 3,400 ft mean sea level, it began a steep descent and subsequently impacted terrain. An airplane performance study showed that the airplane reached a nose-down pitch of about -40 degrees and that the descent rate reached about 16,000 ft per minute. Numerous previous training flights conducted by the check airman were reviewed using archived ADS-B data and interviews with other pilots. The review revealed that the initial upset occurred during a point in the training when the check airman typically simulated an in-flight emergency and descent.

Postaccident examination for the airframe and control surfaces showed that the airplane was configured for cruise flight at the time of the initial upset. Examination of the primary and secondary flight control cables indicated that the cables were all intact at the time of impact. Trim actuator measurements showed an abnormal trailing-edge-up, nose-down configuration on both trim tabs. The two elevator trim actuator measurements were inconsistent with each other, indicating that one of the actuators was likely moved during the wreckage recovery. Based on the supporting data, it is likely that one of the actuators indicated the correct trim tab position at the time of impact.

Simulated airplane performance calculations showed that, during a pitch trim excursion, the control forces required to counter an anomaly increases to unmanageable levels unless the appropriate remedial procedures are quickly applied. Given the simulated airplane performance calculations, the trim actuator measurements, and the check airman's known training routine, it is likely that the check airman simulated a pitch trim excursion and that the SIC, who lacked experience in the airplane type, did not appropriately respond to the excursion. The check airman did not take remedial action and initiate the recovery procedure in time to prevent the control forces from becoming unmanageable and to ensure that recovery from the associated dive was possible.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
The check airman's delayed remedial action and initiation of a recovery procedure after a simulated pitch trim excursion, which resulted in a loss of airplane control.

Findings

Aircraft	Performance/control parameters - Not attained/maintained (Cause) Trailing edge flaps - Not specified
Personnel issues	Identification/recognition - Instructor/check pilot (Cause) Aircraft control - Instructor/check pilot (Cause) Delayed action - Instructor/check pilot (Cause)

Factual Information

On April 8, 2014, about 1557 Alaska daylight time, a Cessna 208B Caravan airplane, N126AR, was destroyed after impacting terrain about 22 miles southeast of Kwethluk, Alaska. The airplane was being operated by Hageland Aviation Services, Inc., dba Ravn Connect, Anchorage, Alaska, as a visual flight rules training flight under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The two crewmembers on board were fatally injured. Day, visual meteorological conditions prevailed at the time of the accident, and company flight-following procedures were in effect. The local training flight departed from Bethel Airport, Bethel, Alaska at 1535.

The flight was intended to be the first training flight of the newly hired second-in-command (SIC) pilot. The SIC was operating from the airplane's right seat during the training.

About 1745, personnel from Hageland Aviation in Bethel notified the Hageland Operational Control Center (OCC) in Palmer, Alaska, that the airplane was overdue. At 1754, the OCC called the Kenai Flight Service Station to initiate search and rescue operations. A company airplane was dispatched from Bethel to assist in the search, and, at 1839, the pilot of that airplane visually confirmed that the accident airplane had crashed. The Alaska State Troopers in Bethel, assisted by the Alaska Army National Guard, arrived at the accident scene at 2105 and confirmed that both pilots had died.

The National Transportation Safety Board (NTSB) investigator-in-charge, an inspector from the Federal Aviation Administration (FAA) Anchorage Flight Standards District Office, an investigator from Textron Aviation, and a representative of the operator traveled to the accident scene on the morning of April 10, 2014.

PERSONNEL INFORMATION

The check airman, age 42, held an airline transport pilot certificate with a multiengine land rating and commercial privileges for airplane single-engine land. His most recent FAA first-class airman medical certificate was issued on February 25, 2014, without limitations. His most recent FAA 14 CFR 135.293 and 135.297 proficiency checks were dated March 15, 2014, with approvals for single pilot, instrument flight rules, and lower-than-standard takeoff minimums. His last reported flight time to the company indicated that he had a total flight time of 14,417 hours, with 5,895 hours in the accident airplane type. The check airman's personal logbooks were not located.

The SIC, age 46, held a commercial pilot certificate, with single-engine land, multiengine land, and instrument ratings. He also held a single-engine airplane flight instructor certificate and an advanced ground instructor certificate. His most recent FAA second-class medical certificate was dated May 30, 2013, with a limitation that the pilot must wear corrective lenses for near and distant vision. He reported on his pilot qualification form that he had a total flight time of 593 hours, with no flight time in the accident airplane type. The SIC's personal logbooks were not located.

AIRCRAFT INFORMATION

The accident airplane was a Cessna 208B Caravan, registration number N126AR, serial number 208B1004, manufactured in 2002. At the time of the accident, the airplane had accumulated 11,206 total flight hours and was maintained under an approved aircraft

inspection program. The most recent inspection of the airframe and engine was completed on March 13, 2014.

The airplane was equipped with a Pratt & Whitney PT6A-114A turbine engine that was rated at 675-shaft horsepower. The engine was overhauled 4,286 hours before the accident.

Electric Trim System

The airplane was equipped with a Bendix/King KFC-150 Autopilot System that incorporated a three-axis autopilot and an electric pitch trim system, which provided autotrim during autopilot operation and electric trim to the pilot. According to the Bendix/King supplement to the Cessna 208 Operating Handbook, the trim system is designed to withstand any single in-flight malfunction. Trim faults are visually and aurally annunciated.

In Section 3 of the flight manual supplement, the emergency procedures for an electric trim malfunction (either manual electric or autotrim) were as follows:

1. A/P DISC/TRIM INTER Switch – PRESS and HOLD throughout recovery.
2. ELEV TRIM Circuit Breaker – PULL OFF.
3. Aircraft – RETRIM manually.

WARNING – When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly; up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level.

The supplement also provided the following information:

MAXIMUM ALTITUDE LOSS DUE TO AUTOPILOT MALFUNCTION

- Cruise, Climb, and Descent - 500 ft
- Maneuvering - 100 ft
- Approach - 100 ft

METEOROLOGICAL INFORMATION

The nearest official reporting station was Bethel Airport, located about 27 miles northeast of the accident site. At 1553, about 3 minutes before the accident, a meteorological aerodrome report was reporting wind from 020 degrees (true) at 8 knots, visibility 10 statute miles, sky condition clear, temperature 19 degrees F, dew point 3 degrees F, and altimeter 28.87 inches of Mercury.

COMMUNICATIONS

There were no communications with the accident airplane at the time of the accident.

FLIGHT RECORDERS

The accident airplane was not equipped, nor was it required to be equipped, with a cockpit voice recorder or a flight data recorder.

Automatic Dependent Surveillance-Broadcast (ADS-B) Tracking and Recording

The airplane was equipped with ADS-B technology. In typical applications, an airplane equipped with ADS-B uses an ordinary GPS receiver to derive its precise position from the Global Navigation Satellite System constellation and then combines that position with any

number of aircraft parameters, such as speed, heading, altitude, and flight number. This information is then simultaneously broadcast to other aircraft equipped with ADS-B and to ADS-B ground or satellite communications transceivers, which then relay the aircraft's position and additional information to air route traffic control centers (ARTCC) in real time.

A review of ADS-B data received by the Anchorage ARTCC showed that, after departure, the airplane flew northeast and began a series of maneuvers with track, altitude, and speed variations consistent with a training flight. About 21 minutes into the flight, when the airplane was about 3,400 ft mean sea level (msl), a slight fluctuation in altitude, followed by an initial upset, occurred. The airplane continued a rapid and steep descent until ground impact.

WRECKAGE AND IMPACT INFORMATION

The accident site was situated on a land thumb in a bend of the Kwethluk River at an elevation of about 75 ft msl. Ground scars extended from an area of frozen tundra and through an area of heavy willows, among which the airplane was found resting upright supported by a number of toppled willow trees. An extensive postcrash fire consumed the majority of the airplane's fuselage; the worst fire damage was situated near the forward fuselage and cockpit area.

The initial impact crater and wreckage path were oriented on a heading of about 128 degrees magnetic. Fragments of the belly pod structure and belly pod contents were sprayed forward from the initial impact point and scattered along the wreckage path. One of the main landing gear tires was the farthest piece of wreckage, located about 330 ft ahead of the main wreckage. Initial ground impact scars were about 200 ft west of the main wreckage. The fuselage was oriented on a heading of about 250 degrees magnetic.

An area of topped willow trees just behind and adjacent to the initial ground impact was determined to be the initial point of impact with an object. Initial strikes suggest an approximate 33-degree nose-down attitude at impact. A mark in the tundra that was about the same distance from the airplane centerline as the left main landing gear was also noted at the main impact area. A slight discoloration that resembled the shape and size of the left wing was also present at the initial impact area.

The propeller was separated from the airplane and located between the airplane and initial impact crater. Two of the three blades were loose in the hub, and one blade was fractured inside the hub and separated. Two blades exhibited torsional and aft bending. The separated blade was missing about 12 inches of its outboard section and had several large gouges in its leading edge.

Numerous sections of the severely fragmented airplane were located throughout the wreckage path. (See the wreckage plot and GPS coordinates for documented major portions of the wreckage in the public docket for this accident).

The main wreckage area consisted of the empennage, main fuselage, and cabin. The empennage was severely damaged during the impact but was relatively free of fire damage. The main fuselage, cabin, and cockpit area were mostly consumed by the postcrash fire. No identifiable instruments, gauges, or other equipment were recovered in the main fire-damaged area. Several pieces of instruments and the instrument panel were located throughout the wreckage path, but their condition at the time of impact could not be determined.

Both wings were separated from the fuselage and were located just west of the main wreckage area. Both wings had severe impact and thermal damage. The landing gear and wheel

assemblies were separated from the fuselage and were fragmented.

The engine was separated from the fuselage and was located about 67 ft east of the main wreckage. The engine case was crushed, and several portions of the case and accessories were fragmented or separated.

MEDICAL AND PATHOLOGICAL INFORMATION

Check Airman

A postmortem examination was conducted on the check airman under the authority of the Alaska State Medical Examiner, Anchorage, Alaska, on April 11, 2014. The cause of death for the pilot was attributed to multiple blunt force injuries.

The FAA Civil Aerospace Medical Institute (CAMI) performed toxicological testing of the check airman on May 12, 2014, which was negative for carbon monoxide, drugs, and ethanol.

SIC

A postmortem examination was conducted on the SIC under the authority of the Alaska State Medical Examiner on April 10, 2014. The cause of death for the pilot was attributed to multiple blunt force injuries.

The FAA CAMI performed toxicological testing of the SIC on April 20, 2014, which was negative for carbon monoxide and drugs. The testing detected 14 mg/dL, mg/hg ethanol in the SIC's muscle and 10 mg/dL, mg/hg ethanol in his liver. CAMI's review of the toxicology results was unable to determine if the ethanol was from ingestion or from postmortem sources.

SURVIVAL ASPECTS

The accident was not survivable.

TEST AND RESEARCH

Postaccident Airframe Examination

The NTSB Airworthiness Group convened to examine the airplane wreckage at the facilities of Alaska Claims Services on April 22 and 23, 2014. The wreckage was highly fragmented, and a substantial portion of the fuselage was consumed by the postcrash fire. The remaining major portions of the airplane were laid out in a hangar to facilitate examination.

The flap jackscrew was recovered in two pieces, and the screw was fractured at the ball nut. The jackscrew extension measured 6.5 inches, which indicated the flaps were in the "up" position at the time of impact.

The empennage was recovered in two major pieces that were significantly damaged. The largest piece consisted of the empennage structure from the canted bulkhead at fuselage station (FS) 436.68 aft to the end of the airplane at FS 509.50, the vertical stabilizer and rudder, the right horizontal stabilizer and elevator, and the left horizontal stabilizer to stabilizer station (SS) 80. The smaller piece consisted of the left horizontal stabilizer from SS 80 to SS 123 and the entire left elevator.

The right elevator and trim tab remained attached to the right horizontal stabilizer and had significant crushing damage. The right elevator torque tube separated from the center fitting along the rivet line. The right elevator trim tab actuator extension measured 2.2 inches, which equates to about 8 degrees tab up. The left elevator remained attached to the outboard section

of left horizontal stabilizer. The left elevator torque tube separated from the center fitting along the rivet line. The left elevator trim tab actuator extension measured 2.4 inches, which equates to about 14.5 degrees tab up. The right and left elevator trim cables were cut about 4 ft forward of the canted bulkhead during recovery. The right elevator trim cable was continuous from the cut to the right pulley in the horizontal stabilizer and to the chain at the right trim tab actuator. The balance trim cable was attached to the chain at the right trim tab actuator and ran through the center section of the horizontal stabilizer to about left SS 80, where it was cut during recovery. The left trim tab actuator chain remained on the actuator. The left elevator trim tab cable was cut at the chain and forward of the canted bulkhead and was pulled free of the empennage.

The rudder cables remained attached to the bell crank at the lower end of the rudder, and the rudder autopilot cables remained fastened to the rudder cables aft of the canted bulkhead. The rudder and rudder autopilot cables were cut about 4 ft forward of the canted bulkhead during recovery, but all had individual broken strands and were kinked in several places. The elevator cables and one of the elevator autopilot cables remained attached to the control horn. The upper elevator autopilot cable was broken at the aft cable end, and the cable end remained attached to the control horn. The lower elevator autopilot cable was broken about 6 ft forward of the canted bulkhead and had a splayed appearance consistent with overload failure. The two elevator cables were cut about 5 ft forward of the canted bulkhead during recovery, but all had individual broken strands and were kinked in several places. The elevator push-pull tube was fractured at the forward end and forced forward into the control horn. The aft end of the push-pull tube remained attached to the bell crank at the center elevator torque tube fitting. There was no evidence of binding or damage on the elevator push-pull tube.

All of the examined fractures had a dull, grainy appearance consistent with overload failure. No evidence of preexisting corrosion or cracking was found on any of the examined parts. No evidence of preimpact fire or bird impact was observed on any of the examined wreckage. (See the Airworthiness Group Factual report and appendixes in the public docket for additional information.)

Aircraft Performance ADS-B and Simulation Study

The NTSB's Office of Research and Engineering conducted an aircraft performance ADS-B and simulation study using data from the archived ADS-B data transmitted from the airplane, crash site information, and a simulator model of the Cessna 208B. The simulation provided a physics-based estimate of the position and orientation of the airplane throughout the accident flight. The performance observations noted below are based on the results of this simulation.

The simulation indicated normal flight conditions from the beginning of the transmitted ADS-B data until 1556:30. At this point, the airplane began a steep descent, which continued until impact. The simulation descent rate from 1556:30 to the time of impact steadily increased to a maximum of about 16,000 ft per minute. The elapsed time from the initial upset to the point of impact was about 22 seconds.

At the last recorded ADS-B plot, the simulation indicated a calibrated airspeed of about 256 knots and a bank angle of about 2 degrees right; just before impact, the pitch angle changed to -34 degrees from the maximum calculated pitch during the descent of -40 degrees. The simulation indicated that, during the initial upset, the left bank angle momentarily exceeded 60 degrees.

Simulated calculations of required engine power settings throughout the flight were consistent with normal engine operation. The calculations were also consistent with the airplane remaining upright throughout the upset sequence, with maximum simulation roll angles of about 45 degrees left and 47 degrees right.

Calculations of elevator position, elevator trim tab position, and control column force were also made using normal and runaway pitch trim scenarios. Elevator position calculations were consistent in both the normal and runaway pitch trim scenarios. Elevator trim tab position remained constant at near 0 degrees in the normal scenario and steadily increased from near 0 to about 19 degrees trailing-edge-up near the end of the simulation in the runaway pitch trim scenario. Control column force required to change elevator position under normal trim conditions steadily increased from 0 pounds of push force to about 130 pounds of push force at the time of impact. In the runaway pitch trim scenario, the control column force required to change the elevator position quickly increased from near 0 pounds of pull force to about 800 pounds of pull force at the time of impact. (See the NTSB ADS-B simulation study in the public docket for this accident for detailed graphs.)

ORGANIZATIONAL AND MANAGEMENT INFORMATION

Hageland Aviation Services is a Part 135 air carrier that holds on-demand and commuter operations specifications and is authorized to conduct business exclusively under the business names "Hageland Aviation Services, Inc." or "Ravn Connect." The company headquarters are located at the Ted Stevens Anchorage International Airport, Anchorage, Alaska. The president and chief pilot in place at the time of the accident resided in Anchorage. The director of operations and director of maintenance resided in Palmer, Alaska.

ADDITIONAL INFORMATION

Check Airman's Training Routine

Numerous previous training flights performed by the check airman were reviewed using archived ADS-B data and interviews with other pilots. The review of these flights showed that the construct of the flights were all similar in sequence and nature. After departure, the check airman would fly a set of standard maneuvers, including steep turns, slow flight, and aerodynamic stalls. At some point after the maneuvers portion of the flight was completed, a simulated emergency would be initiated, followed by a descent to an altitude that averaged between 100 and 200 ft above ground level. This descent would normally occur over a river bed, after which the pilot-in-training would be instructed to "fly the river." Company personnel were aware that this maneuver was being performed and stated that the maneuver was used to "teach coordination." After this low-level maneuver was completed, the check airman would then direct the airplane to an airport where numerous takeoff and landings would be accomplished before returning to the home base.

The accident flight followed a typical routine and flight pattern from previous training flights. The accident sequence initiated during the time when a simulated emergency and descent was typically initiated.

History of Flight

Maneuvering	Inflight upset Loss of control in flight (Defining event)
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Check Pilot Information

Certificate:	Airline Transport	Age:	42, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Without Waivers/Limitations	Last Medical Exam:	02/25/2014
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	03/15/2014
Flight Time:	(Estimated) 14417 hours (Total, all aircraft), 5895 hours (Total, this make and model), 376 hours (Last 90 days, all aircraft), 159 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Flight Instructor; Commercial	Age:	46, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Single-engine	Toxicology Performed:	Yes
Medical Certification:	Class 2 With Waivers/Limitations	Last Medical Exam:	05/30/2013
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	593 hours (Total, all aircraft), 1 hours (Total, this make and model), 482 hours (Pilot In Command, all aircraft), 1 hours (Last 90 days, all aircraft), 1 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	CESSNA	Registration:	N126AR
Model/Series:	208B	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	208B1004
Landing Gear Type:	Tricycle	Seats:	9
Date/Type of Last Inspection:	03/13/2014, AAIP	Certified Max Gross Wt.:	7449 lbs
Time Since Last Inspection:	85 Hours	Engines:	1 Turbo Prop
Airframe Total Time:	11206 Hours	Engine Manufacturer:	P&W
ELT:	C126 installed, not activated	Engine Model/Series:	PT6A 114A
Registered Owner:	ICECAP LLC TRUSTEE	Rated Power:	675 hp
Operator:	Hageland Aviation	Air Carrier Operating Certificate:	Commuter Air Carrier (135)
Operator Does Business As:	RAVN Connect	Operator Designator Code:	EPUA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	PABE, 150 ft msl	Observation Time:	2353 UTC
Distance from Accident Site:	27 Nautical Miles	Direction from Accident Site:	306°
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	-7° C / -16° C
Lowest Ceiling:	None	Visibility	10 Miles
Wind Speed/Gusts, Direction:	8 knots, 20°	Visibility (RVR):	
Altimeter Setting:	29.87 inches Hg	Visibility (RVV):	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	BETHEL, AK (BET)	Type of Flight Plan Filed:	Company VFR
Destination:	BETHEL, AK (BET)	Type of Clearance:	None
Departure Time:	1522 AKD	Type of Airspace:	Class G

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	60.524722, -161.087222

Administrative Information

Investigator In Charge (IIC):	Christopher R Shaver	Adopted Date:	02/26/2016
Additional Participating Persons:	James Holden; FAA Anchorage FSDO; Anchorage, AK Ryan Stanley; Hageland Aviation; Anchorage, AK Erin Talbot; Hageland Aviation; Anchorage, AK Ricardo Ascencio; Textron Aviation; Wichita, KS Jason Wilson; Hageland Aviation; Anchorage, AK Luke Hickerson; Hageland Aviation; Anchorage, AK		
Publish Date:	02/26/2016		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=89029		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.