Aviation Investigation Final Report

Location:	Rockford, Illinois	**Accident Number:**	CEN20LA352
Date & Time:	August 20, 2020, 15:42 Local	**Registration:**	N198DM
Aircraft:	Beech 200	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The pilot departed on a positioning flight in the twin-engine airplane. Videos recorded by multiple airport-based cameras showed the airplane take off from runway 19. Shortly after liftoff, the airplane started turning left, and the airplane developed a large left bank angle as it was turning. The airplane departed the runway to the left and impacted the ground. During the impact sequence, an explosion occurred, and there was a postimpact fire.

An airplane performance study showed that during the takeoff, a nose-left sideslip, a left side force, and a left roll occurred, consistent with the loss or reduction in thrust of the left engine. The sideslip was reduced, likely due to inputting rudder to balance the side force, and the airplane briefly rolled right possibly due to an overcorrection in rudder. The airplane pitched up and was able to begin climbing again; however, it continued to lose speed. The sideslip then reversed, and the airplane rolled left again before impacting the ground. The study indicated that before rotating and lifting off, the airplane accelerated to a groundspeed of 98 knots (kts) and an airspeed of 105 kts, which was about 19 kts above the published minimum control speed for the airplane. Therefore, the airplane had achieved sufficient airspeed for the pilot to maintain control despite a loss or reduction in left engine thrust provided he made the appropriate control inputs. The sideslip force calculations indicated that there was a partially successful attempt to maneuver the airplane back to level flight when the airplane rolled back right, but it was not maintained. The right rudder input would need to be held until the thrust asymmetry was corrected.

Teardown examinations of the engines and propellers found no evidence of preimpact failure. Both engines exhibited evidence of operation at impact. Damage to the propeller blades and hubs indicated that neither propeller was feathered at impact. The predominant left propeller

blade bending and twisting was aft and toward low pitch. The predominant right propeller blade bending and twisting was forward in the thrust direction and toward high pitch. Analysis of the propeller internal witness marks and the blade damage found that the right engine was producing more power than the left engine at initial impact. Based on the available evidence, it could not be determined why the left propeller was not feathered at impact, even though the autofeather system was armed.

The rudder trim knob was found 4 units to the left; the aileron trim knob was found 6 units to the right; and the rudder boost switch was found in the OFF position. The before engine starting checklist in the pilot's operating handbook for the airplane specified that the rudder and aileron trim be set and that the rudder boost switch be on. Therefore, the postaccident positions of the rudder trim knob, aileron trim knob, and rudder boost switch likely indicate the pilot did not follow the before engine starting checklist. With the rudder boost switch not being on, it could not be determined based on the available evidence, what role that system may have had with the pilot attempting to maintain control of the airplane during the asymmetric thrust sequence.

Although the pilot's previous history of significant coronary artery disease and the scar in his left ventricle placed him at increased risk of an acute cardiac event, whether such an event occurred at the time of the accident could not be determined from the available information.

Absent evidence of an engine malfunction, the investigation considered whether the left engine's thrust reduction was the result of a malfunction in the throttle control system or an uncommanded throttle movement due to an insufficient friction setting of the airplane's power lever friction locks. However, heavy fire and impact damage to the throttle control system components, including the power quadrant and cockpit control lever friction components, precluded determining the position of the throttle levers at the time of the loss of thrust or the friction setting during the accident flight. Thus, the reason for the reduction in left engine thrust could not be determined.

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 airplane control following a reduction of thrust in the left engine during takeoff. The reason for the reduction in thrust could not be determined based on the available evidence.

Findings

Not determined	(general) - Unknown/Not determined
Personnel issues	Aircraft control - Pilot
Aircraft	Altitude - Not attained/maintained
Aircraft	Lateral/bank control - Not attained/maintained

Factual Information

History of Flight

Takeoff	Unknown or undetermined
Takeoff	Loss of control in flight (Defining event)
Takeoff	Runway excursion
Takeoff	Collision during takeoff/land
Post-impact	Explosion (post-impact)
Post-impact	Fire/smoke (post-impact)

On August 20, 2020, about 1542 central daylight time, a Beech B200 airplane (marketed as a King Air 200), N198DM, was destroyed when it was involved in an accident near Rockford, Illinois. The private pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 positioning flight.

The purpose of the flight was to relocate the airplane to the pilot's home base at the DuPage Airport (DPA), West Chicago, Illinois. The airplane had been at Chronos Aviation, LLC (a 14 *CFR* Part 145 repair station), at the Rockford International Airport (RFD), Rockford, Illinois, for maintenance work.

Multiple airport-based cameras recorded the accident sequence. The videos showed the airplane taking off from runway 19. Shortly after liftoff, the airplane started turning left, and the airplane developed a large left bank angle as it was turning. The airplane departed the runway to the left and impacted the ground. During the impact sequence, an explosion occurred, and there was a postimpact fire. A video study estimated the airplane’s maximum groundspeed during the takeoff as 105.5 knots (kts).

Data recovered from an Appareo Stratus device onboard the airplane showed that about 1538, the airplane began taxing to runway 19. At 1540:34, the airplane crossed the hold short line for runway 19. At 1541:19, the airplane began a takeoff roll on runway 19. At 1541:42, the airplane began to depart the runway centerline to the left of the runway. Subsequent tracklog points showed the airplane gaining some altitude, and the tracklog terminated adjacent to a taxiway in a grassy area.

The Appareo Stratus data showed the airplane began to increase groundspeed on a true heading of roughly 185° about 1541. Airplane pitch began to increase at 1541:41 as the groundspeed reached about 104 kts. The groundspeed increased to 107 kts within the next

2 seconds, and the pitch angle reached around 4° nose-up at this time. In the next few seconds, pitch lowered to around 0° as the groundspeed decayed to around 98 kts. The pitch then became 15° nose-up as the groundspeed continued to decay to about 95 kts. A right roll occurred of about 13° and changed to a rapidly increasing left roll over the next 5 seconds. The left roll reached a maximum of about 86° left as the pitch angle increasingly became negative (the airplane nosed down). The pitch angle reached a maximum nose down condition of -73°. The data became invalid after 1541:53.4.

An airplane performance study based on the Appareo Stratus data showed that during the takeoff from runway 19, the airplane accelerated to a groundspeed of 98 kts and an airspeed of 105 kts before rotating and lifting off. The airplane pitched up, climbed, and gained height above the ground. Then, 4 seconds after rotation, the airplane began descending and slowing, consistent with a loss of power. A nose-left sideslip, a left side force, and a left roll were recorded, consistent with the loss or reduction in thrust of the left engine. The sideslip was reduced, likely due to opposite rudder input, and the airplane briefly rolled right. The airplane pitched up and was able to begin climbing again; however, it continued to lose speed. The sideslip then reversed, and the airplane rolled left again and impacted the ground.

One witness reported that he observed the accident sequence. He did not hear any abnormal engine noises, nor did he see any smoke or flames emit from the airplane before impact.

The airplane came to rest on a flat grass field to the east of runway 19 on airport property. The airplane sustained fire damage and was fragmented from impacting terrain.

Pilot Information

Certificate:	Private	**Age:**	67,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	October 14, 2019
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 15, 2019
Flight Time:	(Estimated) 3650 hours (Total, all aircraft)		

The pilot established the King Air Academy in Phoenix, Arizona. The King Air Academy is a flight training facility that provides initial, recurrent, type rating, and simulator training for the King Air series of airplanes.

According to Federal Aviation Administration (FAA) records, the pilot did not hold a type rating for the accident airplane, nor was he required to hold one.

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N198DM
Model/Series:	200 B200	**Aircraft Category:**	Airplane
Year of Manufacture:	1984	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	BB1198
Landing Gear Type:	Retractable - Tricycle	**Seats:**	8
Date/Type of Last Inspection:	August 20, 2020 Continuous airworthiness	**Certified Max Gross Wt.:**	12590 lbs
Time Since Last Inspection:	0 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	8018.9 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Installed	**Engine Model/Series:**	PT6A-42
Registered Owner:	Bomac Air Inc.	**Rated Power:**	850 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None
Operator Does Business As:	None	**Operator Designator Code:**	None

Maintenance Records

A review of the airplane's maintenance records revealed no evidence of uncorrected mechanical discrepancies with the airframe, engines, or propellers. The recent maintenance work performed at Chronos Aviation, LLC, consisted of the installation of three new switches for the flaps, the installation of two auxiliary outboard fuel level senders, the adjustment of an ice vane door switch, work on a radar control data bus, and a patch repair to the left propeller de-ice boot.

Airplane Servicing

A fuel receipt showed that 304 gallons of Jet A fuel was purchased for the airplane at RFD on the day of the accident.

Airplane Systems

The airplane was certified for single-pilot operation. It was equipped with an autofeather system that was intended for use during takeoff and landing if there was a loss of engine power. The airplane was equipped with a rudder boost system, which was designed to reduce the required rudder pedal force in the event of an engine failure. The published minimum control airspeed (VMCA) was 86 kts.

The engine and propeller control levers on the accident airplane were located between the two cockpit seats. The power quadrant included two power levers (which controlled engine power from idle through takeoff) and two propeller levers (which controlled propeller speed and feathering) to the right of the power levers. When the power levers were lifted over the idle gate during ground operation, they controlled engine power and propeller blade angle through the ground fine and reverse ranges. Two engine condition levers were to the right of the propeller levers and had three positions: fuel cutoff, low idle, and high idle. The left condition lever controlled the left engine, and the right condition lever controlled the right engine.

Friction lock control knobs were located on the power quadrant. Each power lever had its own friction lock control knob at the base of the quadrant to adjust the power lever's tension. One friction knob controlled the tension of both propeller levers. Turning the knobs counterclockwise increased tension and turning them clockwise reduced tension. The before engine starting checklist called for these friction locks to be set.

Weight and Balance

A review of the airplane's weight and balance data showed that the airplane was within limitations for the accident flight.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KRFD,725 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	14:54 Local	**Direction from Accident Site:**	269°
Lowest Cloud Condition:	Scattered / 25000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.97 inches Hg	**Temperature/Dew Point:**	28°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Rockford, IL (RFD)	**Type of Flight Plan Filed:**	None
Destination:	West Chicago, IL (DPA)	**Type of Clearance:**	None
Departure Time:	15:41 Local	**Type of Airspace:**	Class D

The estimated density altitude for the airport was 2,545 ft mean sea level.

Airport Information

Airport:	Chicago/Rockford Intl RFD	**Runway Surface Type:**	Asphalt;Concrete
Airport Elevation:	742 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	19	**IFR Approach:**	None
Runway Length/Width:	8200 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 Fatal	**Latitude, Longitude:**	42.193054,-89.088607(est)

All the major structural components of the airplane were located at the accident site. Flight control continuity was established for the airframe. The airplane's fuel system was destroyed by the postimpact fire. All landing gear were found in the retracted position. The postimpact fire consumed most of the instrument and switch panels in the cockpit. The flap handle was found in the full up position; the rudder trim knob was found 4 units to the left; and the aileron trim knob was found 6 units to the right. The autofeather switch was found in the ARM position. The rudder boost switch (a gated switch) was found in the OFF position. The before engine starting checklist called for the rudder and aileron trim controls to be set and for the rudder boost switch to be in the ON position.

The power quadrant was destroyed by the impact sequence and the postimpact fire. When compared to an exemplar power quadrant, the throttle levers appeared to be full forward, and the propeller levers appeared to be forward of the feather range. Damage sustained to the control lever friction components precluded determining the friction setting during the accident flight.

Teardown examination of the left engine found rotational scoring damage to compressor turbine and power turbine rotor disk faces and adjacent stator structures consistent with loss of operating clearances during engine operation due to impact loads experienced during an accident sequence. The engine propeller shaft was fractured consistent with sudden arrest of

rotation during operation (torsional failure). No evidence of preimpact failure was found. The left propeller blades displayed leading edge and chordwise rotational scoring; the blades were predominately bent aft and twisted toward low pitch. Disassembly found marks indicating that the left propeller was not feathered at the time of impact. All the damage was consistent with impact.

Teardown examination of the right engine found 360° rotational scoring of compressor turbine and power turbine rotor disk faces and adjacent stator structures consistent with engine operation during impact. The engine propeller shaft was fractured, and the fracture was consistent with torsional failure. No evidence of preimpact failure was found. The right propeller blades displayed leading edge and chordwise rotational scoring; the blades were predominately bent forward in the thrust direction and were twisted toward high pitch. Disassembly found marks indicating that the right propeller was not feathered at the time of impact. All the damage was consistent with impact.

Flight recorders

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

Medical and Pathological Information

According to the autopsy performed by the Winnebago County Coroner's Office, the pilot's cause of death was thermal injuries. In addition, left ventricular wall thickening, coronary artery disease with stent present in the circumflex artery, and a 3-centimeter scar in the left ventricular wall from a previous heart attack were identified. No other significant disease was identified.

Toxicology testing performed at the request of the coroner by NMS Labs identified caffeine (a mild stimulant found in coffee, tea, and sodas), cotinine (a product of tobacco use), and a carboxyhemoglobin level of 6% (which may be related to smoking). Toxicology testing performed by the FAA Forensic Sciences Laboratory identified carvedilol (a beta blocker used

to prevent recurrent heart attacks) and atorvastatin (a cholesterol lowering drug) in the pilot's blood and urine. These two medications are not considered impairing.

Tests and Research

Simulator Research

Textron Aviation used a Beechcraft 260 simulator (not as a formal test flight) to replicate a takeoff with the postaccident positions found for the rudder trim knob (4 units to the left) and the aileron trim knob (6 units to the right). The elevator was set for a normal takeoff. Two takeoffs were performed, one with the flaps down and one with the flaps up. The simulator pilot reported the two takeoffs were normal until rotation at which point, he noticed a slight tendency to roll to the right. He had to input a slight left bank to counteract it, but it was nothing substantial. The pilot had no issue following the checklist and getting the main landing gear retracted. Once the airplane reached 200 kts, the pilot reported the offset trims required more effort to overcome.

Additional Information

The Australian Transport Safety Bureau has published Safety Advisory Notice AO-2021-034-SAN-01 Power Lever Friction Lock Adjustment, for the Beechcraft King Air series airplanes, and states in part:

The Australian Transport Safety Bureau advises pilots and operators of the King Air series aircraft (90, 200, and 300) that the power lever friction locks require careful adjustment to prevent power lever migration towards the idle position, particularly during take-off. Inadvertent migration of one power lever towards idle can result in power reduction and yaw that, when occurring at low height, can result in catastrophic outcomes. Operators should ensure pre-flight checks provide opportunities to confirm friction lock settings before the take-off run, and ensure pilots have adequate knowledge of friction lock sensitivity to help prevent and recover from inadvertent power lever migration.

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	William Borah; FAA Greater Chicago FSDO; Des Plaines, IL Henry Soderlund; Textron Aviation; Wichita, KS Les Doud; Hartzell Propeller; Piqua, OH Beverley Harvey (Accredited Representative); Transportation Safety Board of Canada; Gatineau, OF Jeffery Davis (Technical Advisor); Pratt & Whitney Canada; Bridgeport, WV
Original Publish Date:	January 19, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101836