National Transportation Safety Board
Aviation Accident Final Report

Location:	Lake Wales, FL	**Accident Number:**	ERA12FA385
Date & Time:	06/07/2012, 1235 EDT	**Registration:**	N950KA
Aircraft:	PILATUS AIRCRAFT LTD PC-12/47	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	6 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The instrument-rated pilot activated the autopilot shortly after takeoff and proceeded in a west-northwesterly direction while climbing to the assigned altitude of flight level (FL) 260. Light-to-moderate icing conditions were forecast for the area; the forecast conditions were well within the airplane's capability, and the pilot of a nearby airplane reported only encountering light rime ice at the top of FL260. About 26 minutes 35 seconds after takeoff, the airplane's central advisory and warning system (CAWS) recorded activation of Pusher Ice Mode at FL247, consistent with pilot's activation of the propeller de-ice and inertial separator; the de-ice boots were not selected. Less than a minute after the activation of Pusher Ice Mode, an air traffic controller cleared the flight to deviate right of course due to adverse weather well ahead of the airplane. The airplane then turned right while on autopilot in instrument meteorological conditions (IMC) at FL251; about 4 seconds into the turn, with the airplane indicating about 109 knots indicated airspeed and in a right bank of less than 25 degrees, the autopilot disconnected for undetermined reasons. The pilot allowed the bank angle to increase, and about 13 seconds after the autopilot disconnected, and with the airplane descending in a right bank of about 50 degrees, the pilot began a test of the autopilot system, which subsequently passed. Recovered data and subsequent analysis indicate that the pilot allowed the bank angle to increase to a minimum of 75 degrees while descending; the maximum airspeed reached 338 knots. During the right descending turn, while about 15,511 feet and 338 knots (about 175 knots above maximum operating maneuvering speed), the pilot likely applied either abrupt or full aft elevator control input, resulting in overstress fracture of both wings in a positive direction. The separated section of right wing impacted and breached the fuselage, causing one passenger to be ejected from the airplane. Following the in-flight break-up, the airplane descended uncontrolled into an open field.

Examination of the separated structural components revealed no evidence of pre-existing cracks on any of the fracture surfaces. Postaccident examination of the primary flight controls and engine revealed no evidence of preimpact failure or malfunction. The flaps were found in the retracted position, and the landing gear was extended; it is likely that the pilot extended the landing gear during the descent. The horizontal stabilizer trim actuator was positioned in the green arc takeoff range, the impact-damaged aileron trim actuator was in the left-wing-nearly-

full-down position, and the rudder trim actuator was full nose right. The as-found positions of the aileron, rudder trim, and landing gear were not the expected positions for cruise climb. Examination of the relays, trim switch, and rudder trim circuit revealed no evidence of preimpact failure or malfunction, and examination of the aileron trim relays and aileron trim circuit revealed no evidence of preimpact failure or malfunction; therefore, the reason for the as-found positions of the rudder and aileron trim could not be determined. Impact-related discrepancies with the autopilot flight computer precluded functional testing. The trim adapter passed all acceptance tests with the exception of the aural alert output, which would not have affected its proper operation. The CAWS log entries indicated no airframe or engine systems warnings or cautions before the airplane departed from controlled flight. A radar performance study indicated that the airplane did not enter an aerodynamic stall, and according to the CAWS log entries, there was no record that the stick pusher activated before the departure from controlled flight.

Before purchasing the airplane about 5 weeks earlier, the pilot had not logged any time as pilot-in-command in a turbopropeller-equipped airplane and had not logged any actual instrument flight time in the previous 7 years 4 months. Additionally, his last logged simulated instrument before he purchased the airplane occurred 4 years 7 months earlier. Subsequent to the airplane purchase, he attended ground and simulator-based training that included extra flight sessions in the accident airplane, likely due to his inexperience. The training culminated with the pilot receiving his instrument proficiency check, flight review, and high-altitude endorsements; after the training, he subsequently logged about 14 hours as pilot-in-command of the accident airplane. Although the pilot likely met the minimum qualification standards to act as pilot-in-command by federal aviation regulations, his lack of experience in the make and model airplane was evidenced by the fact that he did not maintain control of the airplane after the autopilot disengaged. The airplane was operating in instrument conditions, but there was only light rime ice reported and no convective activity nearby; the pilot should have been able to control the airplane after the autopilot disengaged in such conditions. Further, his lack of experience was evident in his test of the autopilot system immediately following the airplane's departure from controlled flight rather than rolling the airplane to a wings-level position, regaining altitude; only after establishing coordinated flight should he have attempted to test the autopilot system.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the pilot to maintain control of the airplane while climbing to cruise altitude in instrument meteorological conditions (IMC) following disconnect of the autopilot. The reason for the autopilot disconnect could not be determined during postaccident testing. Contributing to the accident was the pilot's lack of experience in high-performance, turbo-propeller airplanes and in IMC.

Findings

Aircraft	Autopilot system - Not specified
	Lateral/bank control - Not attained/maintained (Cause)
	Pitch control - Not attained/maintained (Cause)
	Flight surfaces (wing) - Capability exceeded (Cause)
Personnel issues	Delayed action - Pilot (Cause)
	Total experience - Pilot (Factor)
	Total instrument experience - Pilot (Factor)

Factual Information

HISTORY OF FLIGHT

On June 7, 2012, about 1235 eastern daylight time, a Pilatus PC-12/47, N950KA, registered to and operated by Roadside Ventures, LLC, departed controlled flight followed by subsequent in-flight breakup near Lake Wales, Florida. Instrument meteorological conditions prevailed at the altitude and location of the departure from controlled flight and an instrument flight rules (IFR) flight plan was filed for the 14 Code of Federal Regulations (CFR) Part 91 personal flight from St Lucie County International Airport (FPR), Fort Pierce, Florida, to Freeman Field Airport (3JC), Junction City, Kansas. The airplane was substantially damaged and the private pilot and five passengers were fatally injured. The flight originated from FPR about 1205.

After departure while proceeding in a west-northwesterly direction and climbing, air traffic control communications were transferred to Miami Air Route Traffic Control Center (Miami ARTCC). The pilot remained in contact with various sectors of that facility from 1206:41, to the last communication at 1233:16.

About 6 minutes after takeoff the pilot was advised by the Miami ARTCC Stoop Sector radar controller of an area of moderate to heavy precipitation twelve to two o'clock 15 miles ahead of the airplane's position; the returns were reported to be 30 miles in diameter. The pilot asked the controller if he needed to circumnavigate the weather, to which the controller replied that deviations north of course were approved and when able to proceed direct LAL, which he acknowledged. A trainee controller and a controller providing oversight discussed off frequency that deviation to the south would be better. The controller then questioned the pilot about his route, to which he replied, and the controller then advised the pilot that deviations south of course were approved, which he acknowledged. The flight continued in generally a west-northwesterly direction, or about 290 degrees, and at 1230:11, while at flight level (FL) 235, the controller cleared the flight to FL260, which the pilot acknowledged. At 1232:26, the aircraft's central advisory and warning system (CAWS) recorded that the pusher system went into "ice mode" indicating the pilot had selected the propeller heat on and inertial separator open. At that time the aircraft's engine information system (EIS) recorded the airplane at 24,668 feet pressure altitude, 110 knots indicated airspeed (KIAS), and an outside air temperature of minus 11 degrees Celsius.

At 1232:36, the Miami ARTCC Avon Sector radar controller advised the pilot of a large area of precipitation northwest of Lakeland, with moderate, heavy and extreme echoes in the northwest, and asked him to look at it and to advise what direction he needed to deviate, then suggested deviation right of course until north of the adverse weather. The pilot responded that he agreed, and the controller asked the pilot what heading from his position would keep the airplane clear, to which he responded at 1233:04 with, 320 degrees. At 1233:08, the Miami ARTCC Avon Sector radar controller cleared the pilot to fly heading 320 degrees or to deviate right of course when necessary, and when able proceed direct to Seminole, which he acknowledged at 1233:16. There was no further recorded communication from the pilot with the Miami ARTCC.

Radar data showed that between 1233:08, and 1233:26, the airplane flew on a heading of approximately 290 degrees, and climbed from FL250 to FL251, while the EIS recorded for the same time the airplane was at either 109 or 110 KIAS and the outside air temperature was minus 12 degrees Celsius. The radar data indicated that between 1233:26 and 1233:31, the

airplane climbed to FL252 (highest recorded altitude from secondary radar returns). At 1233:30, while at slightly less than 25 degrees of right bank based on the NTSB Radar Performance Study based on the radar returns, 109 KIAS, 25,188 feet and total air temperature of minus 12 degrees Celsius based on the data downloaded from the CAWS, autopilot disengagement occurred. This was recorded on the CAWS 3 seconds later. The NTSB Performance Study also indicates that based on radar returns between 1233:30, and 1233:40, the bank angle increased from less than approximately 25 degrees to 50 degrees, while the radar data for the approximate same time period indicates the airplane descended to FL249.

The NTSB Performance Study indicates that based on radar returns between 1233:40 and 1234:00, the bank angle increased from 50 degrees to approximately 100 degrees, while the radar data indicates that for the approximate same time frames, the airplane descended from FL249 to FL226. The right descending turn continued and between 1233:59, and 1234:12, the airplane descended from 22,600 to 16,700, and a change to a southerly heading was noted. The NTSB Performance Study indicates that the maximum positive load factor of 4.6 occurred at 1234:08, while the NTSB Electronic Device Factual Report indicates that the maximum recorded airspeed value of 338 knots recorded by the EIS occurred at 1234:14. The next recoded airspeed value 1 second later was noted to be zero. Simultaneous to the zero airspeed a near level altitude of 15,292 feet was noted.

Between 1234:22, and 1234:40, the radar data indicated a change in direction to a northeast occurred and the airplane descended from 13,300 to 9,900 feet. The airplane continued generally in a northeasterly direction and between 1234:40 and 1235:40 (last secondary radar return), the airplane descended from 9,900 to 800 feet. The last secondary radar return was located at 27 degrees 49.35 minutes North latitude and 081 degrees 28.6332 minutes West longitude. Plots of the radar targets of the accident site including the final radar targets are depicted in the NTSB Radar Study which is contained in the NTSB public docket.

At 1235:27, the controller asked the pilot to report his altitude but there was no reply. The controller enlisted the aid of the flight crew of another airplane to attempt to establish contact with the pilot on the current frequency and also 121.5 MHz. The flight crew attempted on both frequencies but there was no reply.

At 1236:30, the pilot of a nearby airplane advised the controller that he was picking up an emergency locator transmitter (ELT) signal. The pilot of that airplane advised the controller at 1237:19, that, "right before we heard that ELT we heard a mayday mayday." The controller inquired whether the pilot had heard the mayday on the current frequency or 121.5MHz, to which he replied that he was not sure because he was monitoring both frequencies. The controller inquired with the flight crews of other airplanes if they heard the mayday call on the frequency and the response was negative, though they did report hearing the ELT on 121.5 MHz. The controller verified with the flight crew's that were monitoring 121.5 MHz whether they heard the mayday call on that frequency and they advised they did not.

A witness who was located about 1.5 nautical miles south-southwest from the crash site reported that on the date and time of the accident, he was inside his house and first heard a sound he attributed to a propeller feathering or later described as flutter of a flight control surface. The sound lasted 3 to 4 cycles of a whooshing high to low sound, followed by a sound he described as an energy release. He was clear the sound he heard was not an explosion, but more like mechanical fracture of parts. He ran outside, and first saw the airplane below the clouds (ceiling was estimated to be 10,000 feet). He noted by silhouette that parts of the

airplane were missing, but he did not see any parts separate from the airplane during the time he saw it. At that time it was not raining at his location. He went inside his house, and got a digital camera, then ran back outside to his pool deck, and videotaped the descent. He reported the airplane was in a spin but could not recall the direction. The engine sound was consistent the whole time; there was no revving; he reported there was no forward movement. He called 911 and reported the accident.

Another witness who was located about .4 nautical mile east-southeast of from the crash site reported hearing a boom sound that he attributed to a lawn mower which he thought odd because it had just been raining, though it was not raining at the time of the accident. He saw black smoke trailing the airplane which was spinning in what he described as a clockwise direction and flat. He ran to the side of their house, and noted the airplane was still spinning; the smoke he observed continued until he lost sight. His brother came by their back door, heard a thud, and both ran direct to the location of where they thought the airplane had crashed. When they arrived at the wreckage, they saw fire in front of the airplane which one individual attempted to extinguish by throwing sand on it, but he was unable. The other individual reported the left forward door was hard to open, but he pushed it up and then was able to open it. Both attempted to render assistance, and one individual called 911 to report the accident. One individual then guided local first responders to the accident site.

The airplane crashed in an open field during daylight conditions. The location of the main wreckage was determined to be within approximately 100 feet from the last secondary radar return.

Law Enforcement personnel responded to the site and accounted for five occupants. A search for the sixth occupant was immediately initiated by numerous personnel from several state agencies; he was located the following day about 1420. During that search, parts from the airplane located away from the main wreckage were documented and secured in-situ.

PERSONNEL INFORMATION

The pilot, age 45, held a private pilot certificate with airplane single engine land, and instrument airplane. He held a third class medical certificate with no limitations issued April 6, 2012. On the application for his last medical certificate he listed 800 hours as his total flight time. There were no records of enforcement action or previous accidents or incidents in the FAA database. Further, the FAA records indicate he failed the cross country flight planning portion during his first private pilot checkride, though he subsequently passed. There was no other record of failure for any additional rating.

The pilot's first logged flight was February 3, 1994, and his last logged flight was May 29, 2012. Between these dates, he logged flights in aircraft consisting of Grumman AA1, Cessna 150, Cessna 182, Mooney M20J, Beech B36TC, Piper PA-46-500TP, and the accident airplane. His first logged flight in a turbine engine equipped airplane was dated "2009"; the entry indicates 7.5 hours were flown as dual received in a Piper PA-46-500TP, though there was no endorsement by certified flight instructor. There were no logged flights between this flight and his first flight in the accident airplane which occurred on May 6, 2012. The first flight duration in the accident airplane was recorded to be 4.1 hours, with 0.4 hours as actual instrument time, and was signed off as "dual received." A detailed review of his logbook between May 5, 2002, and the last entry revealed a record keeping error of approximately 30 hours overstatement of total time. Additionally, numerous lines did not depict whether the flight was as pilot-in-

command (PIC) or as dual received or both; therefore, for the purpose of calculations, the times were calculated to be as PIC.

He obtained his instrument rating in November 1997; prior to which he logged 3 hours actual instrument flight time. Between obtaining his instrument rating and December 31, 2004, he logged approximately 28 hours actual instrument flight time. He did not log any actual instrument flight time between December 31, 2004 and May 6, 2012, though between these dates he did log ½ hour simulated instrument flight time which occurred on September 3, 2007. Between May 6, 2012, and the last entry dated May 29, 2012, he logged approximately 4 hours actual instrument flight, and 11 instrument approaches.

The pilot who provided dual flight instruction to the accident pilot for the May 6, 2012 flight from Junction City, Kansas, to Scottsdale, Arizona, reported that was the first and only flight with him. He also reported that the purpose of the flight was to fly the owner/accident pilot and his airplane to SIMCOM where the owner/accident pilot planned to attend ground and flight training for the Pilatus PC-12. The pilot reported that during the flight which lasted 4.1 hours, he explained the systems to the accident pilot, who also asked questions. There were no issues with any of the systems during the flight, and that all avionics were operating, including the autopilot which worked satisfactory. During the flight, the accident pilot told him about his experience flying a Beech Bonanza, which he sold 2 years earlier.

He attended SIMCOM for initial Pilatus PC-12 training from May 7 through May 16, 2012. While at SIMCOM he also received 4 extra flight lessons in the accident airplane, accruing a total of approximately 19 hours, of which a total of 3.2 hours were recorded to be in actual instrument conditions. The training sessions in the accident airplane were on 4 successive days beginning on May 13th. The procedures portion of the training was performed in a fixed training device (FTD), and also included flight time in the accident airplane with a SIMCOM flight instructor. He received a total of approximately 20 hours ground instruction covering the airplane and its systems, and also received 12 hours of instruction in the FTD as the pilot flying covering 6 lessons from May 7 through May 12, 2012. Although not recorded in the training records, he also sat in the right seat of the FTD and observed while his training partner was in the left seat. The pilot received his certificate for initial training in the Pilatus PC-12 on May 12, 2012.

The training records reflect that for all sessions in the FTD or accident airplane, he demonstrated satisfactory skill with no areas identified as unsatisfactory. Standard rate turns were performed in all lessons in the FTD or actual airplane, and unusual attitude recovery and unscheduled trim activation (stabilizer, aileron, and rudder) were satisfactory performed in the FTD on the 2nd day of training. Unusual attitude recovery in the instrument procedures section was also discussed/demonstrated on the 3rd extra lesson which was performed in the accident airplane. Auto-Pilot test was discussed/demonstrated during the first 2 days and then he demonstrated satisfactory skill during all of the remaining sections. He also demonstrated satisfactory skill with auto-pilot malfunction/failure during the training sessions on May 11th and 12th, and again during a flight in the accident airplane on May 16, 2012. On May 16, 2012, he was signed off for his instrument proficiency check in accordance with 14 CFR Part 61.57, his high altitude performance IAW 14 CFR Part 61.31 (2)g, and his flight review in accordance with 14 CFR Part 61.56(e). The SIMCOM training records are contained in the NTSB public docket.

Following the training, between May 17 and May 29, 2012, he logged a total of 8.5 hours in the

accident airplane, of which .2 hour were recorded to be in actual instrument conditions. He also logged 5 instrument landing system approaches during that same period of time.

Although he did not log any flights after May 29, 2012, the CAWS recorded a flight on May 31, 2012, lasting approximately 5.0 hours. Additionally, the CAWS recorded an approximate 49 minute flight on the accident date. No determination was made as to the weather conditions for either of those flights.

Including the logged flights (corrected for the error) and recent unlogged flights in the accident airplane totaling approximately 6 hours, but excluding the accident flight, he accrued a total time of approximately 755 hours. Of the 755 hours, approximately 38 hours were in the accident airplane, of which approximately 14 hours were after the date he was signed off for his flight review (May 16, 2012). His total time as PIC was approximately 657 hours. Excerpts from his pilot logbook are contained in the NTSB public docket.

NTSB interview of a pilot who had attended training at SIMCOM between May 7, 2012, through May 12, 2012, and who was paired with the accident pilot was performed. The individual, a retired captain from a major U.S. airline, requested and was issued a subpoena for the interview. At various times during the interview in response to question(s), he stated that he did not think it was appropriate to give his opinion as to what he observed because he was there for training, although he did respond to the questions. He stated that during the training, the ground school was every day until 1200; he added that the instructor did an excellent job with the ground training. The afternoon was spent in the fixed training device (FTD) simulator; both seat stations were identical with respect to the instruments, displays, etc. During the simulator sessions each pilot would take a turn in the left seat for the session, followed by a break and then an exchange of seats. With respect to the training in the FTD, the individual reported that the accident pilot was able to grasp new concepts to him consisting of hot and hung starts, and seemed to know the systems. The individual also reported that he observed some improvement, but he also thought he needed additional training, which in fact he did get.

The individual who attended the training with the accident pilot was also asked to explain operational aspects about the accident pilot observed during the training and he recalled that during one takeoff, he failed to retract the landing gear, flew through the clearance of 1,500 feet, and noticed the airspeed bleed off or was decreasing. The individual also reported that with respect to approaches, he did not detect any improvement during the course of the training. He was also asked if he sensed any frustration of the accident pilot during the training in the FTD, and he reported he did feel there was some frustration, and when asked if he thought based on his experience that the accident pilot was behind the airplane, he said he would have to say yes. The individual also commented that if he were to return to SIMCOM for future training, he would request the same instructor as he felt he did a great job and he received very good training on this airplane. The individual also stated that the accident pilot told him about the upcoming trip to the Bahamas, and the individual told the accident pilot that although he had 21,000 flight hours, he planned to get more dual instruction before flying the airplane solo. He also suggested he get a pilot to fly with him to the Bahamas, and that he may want to get more comfortable in the airplane before making the trip.

Before departure the pilot spoke in person with an individual at the departure airport who flies a Pilatus PC-12/45, and informed him that that it takes him a long time for him to accomplish a task in the Pilatus because he does the checklist twice. The accident pilot relayed to him the individual that he had 35 hours in the airplane, and asked him about the inertial separator, to

which he informed the accident pilot of his usage of it. He also relayed to the accident pilot that he had encountered moderate to severe icing while inbound to FPR; however, they did not discuss any other weather conditions associated with what would be the accident flight.

AIRCRAFT INFORMATION

The Pilatus PC-12/47, is a low-wing, T-tail, single-engine airplane designed to transport passengers, cargo, or both. The FAA approved the type design in December 2005; it was certificated in the normal category and the certification basis included the requirements of 14 CFR Part 23, "Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes." The airplane is certificated for flight into known icing conditions, and the flight load factor limits with flaps up are plus 3.3 to minus 1.32 g's. The maneuver limits incidental to normal flying include turns in which the bank angle does not exceed 60 degrees. The design maximum takeoff weight is 10,450 pounds; therefore, a type rating is not required. The maximum operating maneuvering speed is 163 knots indicated airspeed (KIAS), maximum operating speed is 236 KIAS, or .48 Mach, and the airplane type certificate data sheet indicates the maximum diving speed (Vd) is 290 knots.

The accident airplane (serial number 730) was manufactured in 2006, powered by a Pratt & Whitney PT6A-67B turbine engine and equipped with a Hartzell four-bladed, constant-speed, feathering and reverse pitch propeller. It was also equipped with a Honeywell (formerly Bendix/King) KFC 325 digital automatic flight control system, which provides 3-axis control for roll, pitch, and yaw.

The autopilot system consists in part of an autopilot computer, a mode controller, an altitude preselector, a pitch trim adapter, pitch, roll, and yaw servo-actuators, a control wheel steering (CWS) switch, a go-around switch, and an autopilot disconnect switch. By design, a lockout device prevents autopilot engagement until the system has successfully passed preflight testing. Also by design, the autopilot computer continuously does a check for failure of the autopilot system, and if a failure occurs, the computer sends signals to the mode control panel, the CAWS for "A/P TRIM" warning, and to the audio integrating system providing an audible tone to the pilot. The autopilot computer will disengage the autopilot when the computer detects a failure.

The autopilot system incorporates an automatic electric pitch trim system which provides pitch autotrim during autopilot operation via the stabilizer pitch trim actuator, and automatic rudder trim relief function to provide directional trim during yaw damper and autopilot operation. No aileron autotrim function is available on the installed autopilot system. Annunciation of pitch and rudder autotrim occurs on the triple trim indicator by illumination of each respective pitch or rudder trim light, and annunciation to the CAWS to make the Autopilot Trim advisory caption illuminate.

The airplane's primary flight control system for pitch, roll, and yaw is controlled by push-pull rods and/or cables, while the secondary flight control system for roll and yaw consists of electrically actuated trim tabs installed on the primary flight control surfaces, while the horizontal stabilizer is also trimmed electrically. Trim position for roll, pitch, and yaw is visually depicted on a triple trim indicator on the center console. The rudder trim actuator is an electrically operated linear actuator which moves the rudder trim tab automatically by the autopilot yaw servo actuator, or when the rudder trim switch on the Power Control Lever is manually pressed. Activation of rudder trim by the switch on the Power Control Lever with the

autopilot engaged does not disconnect the autopilot or yaw damper if engaged. The aileron trim actuator is also an electrically operated linear actuator which moves the aileron trim tab when a trigger-type switch and a 4-way trim switch (china hat) installed on either the pilot's or co-pilot's control wheel are manually manipulated. During manual trimming of the aileron, pressing the trim trigger switch disconnects the autopilot, irrespective of an actual pitch or roll trim action by the 4-way switch (china hat). The horizontal stabilizer, rudder, and aileron trim systems share a "Trim Interrupt Switch" which if pressed due to a trim runaway of any of the respective systems, disconnects power from the pitch trim adapter, and the aileron, rudder and horizontal stabilizer trim actuators. The switch is a rocker type installed on the center pedestal protected by a safety cover. The two-position switch has "INTR" for interrupt and "NORM" for normal positions.

According to personnel of the airplane manufacturer, certification reports provide rudder trim data up to 10,000 feet, and at that altitude, 110 KIAS, and maximum climb power (torque) of 36 psi, nearly full rudder trim is required.

The airplane was last inspected in accordance with an annual inspection on January 12, 2012. The airplane total time and the total cycles/landings at that time were recorded to be 1,227.1 and 832, respectively. Since the annual inspection was signed off as being completed on January 12, 2012, the only maintenance items documented in the airframe maintenance records include replacement of a hydraulic pump shaft o-ring, replacement of the EIS display, repair of a Garmin GNS430, and installation of new bulbs in the co-pilot map light and in the instrument panel annunciator.

The pilot purchased the airplane on April 30, 2012; the airplane total time at the time of the accident was 1,263.2 hours.

Review of the airframe maintenance records revealed no record that the autopilot flight computer was removed, replaced, or repaired. Excerpts of the maintenance records are contained in the NTSB public docket.

The International Standard Atmosphere (ISA) Temperature Conversion Chart found in Section 5 of the Pilot's Operating Handbook and FOCA Approved Airplane Flight Manual indicates that the outside air temperature of minus 12 degrees Celsius recorded by the EIS at 25,000 feet pressure altitude corresponded to ISA plus 23 degrees. Correlation of the ISA plus 23 degrees with the Cruise Climb Airspeed Schedule also listed in Section 5 of the Pilot's Operating Handbook and FOCA Approved Airplane Flight Manual indicates that at ISA plus 20 and ISA plus 30 degrees at 25,000 feet, the climb airspeed is 110 KIAS.

Flight Manual Supplement No. 33, indicates that the recommended climb speed with the flaps retracted and pusher ice mode selected is 135 KIAS.

METEOROLOGICAL INFORMATION

There was no record of a preflight weather briefing with Lockheed Martin Flight Services, or with DTC or CSC direct user access terminal (DUAT) vendor; however, the pilot did file the instrument flight rules (IFR) flight plan with CSC DUATS.

Earlier that day after landing at FPR following a flight from the Bahamas, the pilot informed the fueler about the need for a quick turnaround. The pilot and fueler also discussed the local weather conditions.

The fixed base operator (FBO) where the pilot had been seen before departure contains a

computer with access to weather information products; however, the software provider indicated there was no record of the pilot utilizing their system. No determination could be made whether the pilot obtained weather information from the computer at the FBO before the flight departed.

The southeast section of the surface analysis chart issued at 1100 EDT, or approximately 1 hour 5 minutes before the flight departed indicates a stationary front extended across northern Florida. The area forecast encompassing the area of southern and central portions of Florida issued on the day of the accident at 0445 EDT, and valid through 1700 EDT, indicated scattered clouds at 2,000 feet, broken clouds between 4,000 and 6,000 feet, with layered tops to 25,000 feet. Widely scattered light rain showers and isolated thunderstorms with light rain were forecast, with cumulonimbus cloud tops to 40,000 feet. Between 1100 and 1400 EDT, the forecast was for clouds scattered at 2,500 feet, broken at 5,000 feet, and broken at 12,000 feet, with widely scattered light rain showers and thunderstorms with tops to 42,000 feet. Convective Sigmet 35E existed over the planned route of flight, but it did not extend over the accident site area. Further, there was no organized area of turbulence or icing identified outside of the convective activity area.

The Geostationary Operational Environmental Satellite No. 13 (GOES 13) infrared image at 1232, at 2X magnification indicates the accident site location was on the eastern side of an area of enhanced cloud cover associated with high cirrus clouds potentially from anvil from cumulonimbus clouds located to the west depicted by the enhanced areas in blue to yellow. Also depicted were multiple layers of clouds producing a broken to overcast layer of clouds over the accident site. No defined cumulonimbus clouds were observed within 20 miles of the accident site; however, cumulonimbus clouds were observed to the west through northwest between Plant City and Ocala, Florida.

The closest Weather Surveillance Radar (WSR-88D), was located about 48 miles east of the accident site. The 4.3 degree elevation scan, which encompassed altitudes between 21,080 and 25,920 feet, at 1233, depicted reflectivity of 0 to 15 dBZ, which equates to light intensity echoes. Additionally, the 4.3 degree elevation scan for 1233 with the flight path overlaid depicts clear areas east and southeast of the accident site area before the flight encountered the light intensity echo.

The current icing product (CIP) which provides a forecast of icing conditions indicates that for 25,000 feet at 1200 and 1300 EDT, the chance for light to moderate icing existed. The NTSB Weather Factual report is contained in the NTSB public docket.

The pilot of a Beechcraft Corporation 400A that was determined to be located about 13 nautical miles southeast of the accident airplane and at Flight Level (FL) 290 about the time the accident airplane began a right descending turn, reported his on-board weather radar was not depicting any returns. He also reported encountering light rime ice at the top of FL260 while in a cloud layer climbing to his assigned altitude; the airplane was clear of icing conditions within seconds. He further reported the temperature at FL 260 was ISA plus 10 to ISA plus 15.

FLIGHT RECORDERS

The airplane was not equipped, nor was it required to be equipped with a cockpit voice recorder or flight data recorder; however, it was equipped with an engine condition monitoring system (ECMS) that records and retains certain engine parameters to a SD card installed in the engine information system (EIS). The SD card from the EIS was removed and sent to the NTSB

Vehicle Recorder Division for readout.

It was also equipped with a CAWS system which consists of a Central Advisory Computer Unit (CACU), and a Central Advisory Display Unit (CADU), which is located on the bottom center instrument panel. The CAWS system is a microprocessor-based system that acquires information regarding the state of the aircraft systems while the airplane is in the air and logs all warnings, cautions, and advisory conditions. The CAWS provides visual and aural annunciation essential for safe operation, but warnings, cautions, and advisories that are active prior to the air/ground monitor switching to air are not recorded as activated. The CAWS log function has a resolution of 1 second, and an "Activated" log entry is created when all applicable delays for this caption have expired, while a "Cleared" log entry is created as soon as the condition is no longer met and may be present without a preceding "Activated" entry. The CAWS computer was removed and also sent to the NTSB Vehicle Recorder Division for readout.

The data from the SD card installed in the EIS was downloaded which revealed in part that leading into the right descending turn, the recorded values for oil temperature, oil pressure, propeller rpm, engine rpm, and ITT were within normal limits, and continue in the normal limits range for a period of time into the right descending turn.

The flash memory devices labeled U4 and U5 from the CACU were removed by NTSB personnel and downloaded. With the assistance of the German BFU, the downloaded data was decoded.

According to the NTSB Electronic Devices Factual Report, correlation of the data downloaded from the CAWS, the data downloaded from the EIS, radar data, and the ATC transcription of communications was also performed in an attempt to determine a timeline sequence. Messages downloaded from the CAWS continue for about 28 minutes 42 seconds from the point of takeoff which is derived from the weight on wheels switches installed on both main landing gears. The autopilot trim which is a green visual indication only indicates when the autopilot trim is operating, was first noted about 40 seconds after takeoff. The autopilot trim is noted to cycle in either 1 or 2 second increments from that time until 27 minutes 42 seconds after takeoff, or at 1233:33, at which time the autopilot disengage amber visual annunciation occurred. This indicates that the autopilot pitch and aileron servos disengaged, and has an annunciation delay of about 3 seconds. The autopilot trim annunciation occurred about 13 seconds later, or at

1233:46, and 1 second later the autopilot trim fail occurred, which cleared 4 seconds later. Correlation of the timing of the autopilot trim annunciation at 1233:46, with the NTSB Radar Performance Study indicates about that time, the airplane was in a descent of about 6,200 feet per minute. The EIS recorded the maximum airspeed value of 338 knots, which occurred at 1234:14. The pusher ice mode activated twice; the first activation occurred about 17 minutes 53 seconds after takeoff and remained activated for 4 minutes 18 seconds, while the second activation occurred 26 minutes 35 seconds after takeoff and stayed on for the remainder of the recorded data.

Further review of the decoded data revealed there was no record indicating the de-icing boots were selected on. The "PASS DOOR" annunciation occurred at 1234:08. Further messages decoded from the CAWS are contained in the NTSB Electronic Devices Factual Report which is contained in the NTSB public docket.

WRECKAGE AND IMPACT INFORMATION

The accident site containing the main wreckage consisting of the fuselage with sections of both wings, vertical stabilizer with attached rudder and rudder trim tab, and engine with attached propeller assembly was located in an open field containing few trees in the Tiger Creek Preserve, Lake Wales, Florida. Separated structural components consisting of the right hand wing center section, right aileron, right aileron trim tab, left wingtip, right elevator balance weight, right wingtip, and horizontal stabilizer were scattered over an approximately 2 mile area along a northeasterly heading. The separated components were recovered and secured; the locations of the main wreckage and separated components are documented in Attachment 1 to the NTSB Structure Group Chairman Factual Report which is contained in the NTSB public docket.

Examination of the accident site revealed no evidence of ground scarring to indicate motion of the airplane relative to the ground prior to impact. Fire damage was isolated to the engine, engine accessories, firewall, and to some structure adjacent to the firewall; however, no soot was noted aft of the pilot's windscreen.

Inspection of the fuselage, remaining portions of both wings, and the separated structural components was performed by the NTSB Structures Group Chairman with assistance by representatives of the airframe manufacturer. The left wing consisted of 2 pieces; between wing rib (WR) 1 and WR 16 it remained attached, while the wing was fractured in an upward direction at WR 17, or about 6 feet from the wingtip. The right wing was fractured in 2 locations creating 3 sections of the wing; the separated sections measured approximately 14 feet. The wing between WR 1 and WR 10 remained attached with multiple tears in the skin panel noted. The second section of wing consisted of WR 10 to about WR 16 and 17, while the third section consisted from about WR 16 or 17 to WR 20. The fracture between WR 10 and 11 was in an upward direction, while the fracture exhibited a down direction at WR 16 that transitioned to an upward direction at WR 17. Further examination of the section of the right wing between WR 16 or 17 to WR 20 revealed the upper and lower wing skins beginning at about WR 17 were compressed together into the shape of the letter C. The upper wing surface formed the concave portion of the C while the lower surface maintained the convex portion of the C. In the area of the leading edge de-ice boots of the outboard wing section the upper and lower wing skins were compressed together and measured about 8 inches in width when measured from leading edge to trailing edge. Displacement of the vertical stabilizer was noted, and inspection of the completely separated horizontal stabilizer revealed that a portion of the leading edge of the right hand side was deformed up and aft. Examination of all fracture surfaces of the wings, and horizontal stabilizer were consistent with overstress failure; no evidence of pre-existing fatigue cracks were noted on any of the fracture surfaces.

Examination of the fuselage revealed the right hand side fuselage (RHS) above and below passenger windows 2 and 3 between frames 24 and 29 was torn open in an aft and downward direction along with the upper fuselage crown skin from the upper edge of the baggage door to the upper edge of the RHS passenger windows between frames 25 and 29. Black material transfer marks are present along the forward edge of passenger window 2 and continue up and aft diagonally in the direction of forward upper corner of the baggage door located on the LHS of the fuselage. The scuff marks continued across a tear in the fuselage skin and measured about 36 inches in length and 8 inches in width. For further information pertaining to the structures see the Structures Group Chairman Report and attachments contained in the NTSB

public docket.

Examination of the cabin revealed that the R3 window was separated from its frame; the window was found in the cabin near the aft side of the aft cargo door. Inspection of the R3 window revealed black transfer on the exterior surface.

The inspection of the cockpit revealed the landing gear selector was in the down position, which agreed with the as-found positions of the nose and main landing gears. The center pedestal which contained the trim and flap trim interrupt switches was impact damaged and was displaced from its normal position. The guarded cover of the trim interrupt switch was not in place, and damage to the panel adjacent to the trim interrupt switch was noted. An impact mark on the left side of the trim interrupt switch was noted and was consistent with contact by adjacent structure. The orientation of the impact mark on the switch was consistent with it being in the trim interrupt position at impact, which was confirmed during postaccident testing. No discrepancies were noted of the trim interrupt circuit from the power side of the battery bus to the K003 relay, which was found in the normal/relaxed position. For safety concerns power could not be applied to the trim interrupt circuit; therefore, the K003 and K004 relays were removed for further testing. The rudder trim switch tested satisfactory mechanically with a positive return to the neutral position, and tested satisfactory during electrical continuity testing for the left and right positions to the K011 and K012 relays, which were found in the normal/relaxed positions. For safety concerns power could not be applied to the rudder trim circuit; therefore, the K011 and K012 relays were removed for further testing. Additionally, the rudder trim circuit tested satisfactory during electrical continuity testing from the cockpit to the J011 connection adjacent to the rudder trim actuator. Inspection of the aileron trim circuit revealed the K001 and K002 relays were in the normal/relaxed positions. For safety concerns power could not be applied to the aileron trim circuit; therefore, the K001 and K002 relays were removed for further testing. The aileron trim circuit tested satisfactory during electrical continuity testing from the K001 and K002 relays to where the wiring was broken in the wing as a result of the accident sequence. Excerpts of the on-scene field notes documenting the cockpit and cabin are contained in the NTSB public docket.

Examination of the flight controls for roll, pitch, and yaw revealed no evidence of preimpact failure or malfunction; all flap actuators were fully retracted. The aileron trim tab actuator installed on the left wing was examined and the housing remained attached to the aft spar while the jackscrew and actuator rod remained connected to the trim mechanism. Disassembly inspection of the aileron trim actuator revealed it was extended nearly full length; therefore, the aileron trim was full left wing down. The rudder trim tab actuator was inspected and found to be extended 1.125 inches which equates to full tab trailing edge tab left (tail left). The horizontal stabilizer pitch trim actuator was inspected and found to be extended 52 mm which equates to 1.8 degrees airplane nose up, which was within the green arc takeoff range.

Initial examination of the engine revealed it was upright and remained attached to the airframe by the engine mount; the engine exhibited impact deformation and some fire damage. Inspection of the reduction gearbox revealed the airframe beta feedback linkage and torque transmitter was intact. The propeller shaft was rotated by hand; slight resistance was noted and there was no continuity with the power turbine. No pockmarks or dimples were noted on the interior surface of the exhaust duct. Inspection of the fire damaged accessory gearbox revealed the condition lever was in the running position, and the airframe connection was intact. The fuel control input lever was in the maximum power position and was continuous

with the controls cam box. The manual override input lever was near the stowed position, and its airframe linkage was impact fractured approximately 2 inches from the clevis fitting jam nut. Inspection of the power control and reversing linkage revealed it was continuous with impact deformation from the forward linkage to the controls cam box and fuel control unit input lever. The airframe input linkage was intact to the firewall connection. The cam box was locked in the maximum power position. The Teleflex cable rod end was disconnected at the beta lever and power turbine governor reset linkage to verify continuity; no movement or play was detected. Inspection of the compressor discharge air (P3) and power turbine control (Py) pneumatic lines revealed impact deformation and fire damage; however, all connections were intact. The engine with attached propeller was removed from the airframe, and the propeller was then removed from the engine, which was sent to the manufacturer's facility for further examination.

Inspection of the engine was performed at the manufacturer's facility with Transportation Safety Board (TSB) of Canada oversight. Disassembly inspection of the engine revealed circumferential contact signatures of adjacent rotational and stationary components of the compressor and turbine components consistent with engine operation at impact. Functional testing of the propeller governor revealed the unit was above the calibration requirement at one of the test points; however, that was attributed to the desire to not perform a reset adjustment and/or permissible field adjustments and normal in-service deterioration. Functional testing of the torque limiter also revealed deviation from calibration limits; however, after 2 repeated tests with the same results, the field adjustable torque limit screw was turned which brought the unit in line with the test requirements. Heat damage precluded functional testing of the high pressure fuel pump, fuel control unit, compressor bleed valve, flow divider valve. These components were disassembled and no evidence of preimpact failure or malfunction was noted. The overspeed governor was removed and sent to the manufactures facility for operational testing with NTSB oversight. A copy of the engine examination report is contained in the NTSB public docket.

Inspection and operational testing of the overspeed governor at the manufacturer's facility revealed no evidence of preimpact failure or malfunction. The field notes documenting the inspection and bench testing are contained in the NTSB public docket.

Examination of the four bladed, single acting, hydraulically operated constant speed propeller with feathering and reverse pitch capability revealed all blades remained secured in the propeller hub and were at a high blade angle position; however, one propeller blade could be turned manually. The feather stop nut was located 13/32 inch from the feather stop, which equates to approximately 62 degrees propeller blade angle. Impact marks on the propeller blade preload plates between approximately 32 and 51.0 degrees were noted. Disassembly inspection of the propeller revealed no evidence of preimpact failure or malfunction. A copy of the propeller examination report is contained in the NTSB public docket.

The pneumatic de-icer timer was inspected in-situ, and was noted to be electrically connected; no obvious bridging was noted to the pins. The component was removed from the airplane for inspection at the manufacturer's facility in an effort to determine the position and functionality of the timer. With FAA oversight, electrical continuity testing revealed that the unit was in the "Home/off" position, consistent with the system being off at the time of the accident. Functional testing was then performed; the unit was determined to function properly with no evidence of preimpact failure or malfunction. A copy of the de-icer timer report is contained in

the NTSB public docket.

Components consisting of both symbol generators, roll servo actuator and mount, pitch servo actuator and mount, yaw servo actuator and mount, mode controller, trim adapter, and autopilot flight computer were examined before removal. A copy of the NTSB Field Notes describing each component condition before removal is contained in the NTSB public docket. The components were sent to the FAA Kansas City, Missouri FAA Flight Standards District Office for examination at the manufacturer's facility with FAA oversight. Inspection of the symbol generators revealed both exhibited separated AIRINC 429 cards unseated from the input/output board; the separated cards were either reinstalled or exemplar cards were installed to replace impact damaged cards. Both units were powered electrically and both displayed discrepancies with the HSI and ADI displays. Further disassembly of both revealed impact damage to the either the HSI and/or ADI boards; no burn or heat signatures were noted on any of the boards. Acceptance testing of the roll servo actuator and roll servo mount revealed the roll servo passed all tests with the exception of one, while the roll servo mount passed all tests. Impact damage to the pitch servo actuator precluded performing an acceptance test; however, the clutch engagement and disengagement was satisfactory with the servo motor drives in both directions. The pitch servo mount and the yaw servo actuator passed the tests, while the yaw servo mount was slightly out of tolerance; the manufacturer representative reported the out of tolerance condition would not adversely affect the autopilot operation.

The mode controller exhibited impact damage which included bent and broken pins of the display board. The bent pins were straightened in an attempt to functionally test the unit. The unit was powered electrically and in part the heading, altitude, and test annunciators did not illuminate but all mode select buttons functioned satisfactory. The lack of lighting was attributed to be the result of impact damage to the display board. An exemplar face was installed and all mode and backlighting annunciators illuminated. The trim adapter was inspected internally in advance of functional testing and leads of several transistors were broken and a transorb was partially lifted off the board. The broken transistor wires were soldered together and the unit was subjected to functional testing with no defects noted. The trim adapter was then subjected to acceptance testing, and was found to pass all tests with the exception of the aural alert output test; the manufacturer representative reported the out of tolerance condition (7 volts measured versus a specified maximum limit of 6.5 volts) would have no affect on the proper operation of the trim adapter.

Finally, the KCP 220 autopilot flight computer was inspected and impact damage and separated components were noted. Specifically, one ribbon cable was not properly seated, one ribbon cable was separated, and the ribbon cable on the roll circuit board was off by one row of pins. Power was applied to the unit, but it did not power-up. This was attributed to impact damage to the unit on-board power supply. Testing of an exemplar KCP 220 was performed with the ribbon cable at the roll board installed as-found (off by one row of pins), and the exemplar unit would not enter or pass the preflight test; therefore, in that state autopilot engagement and use would not be possible. A copy of the Honeywell examination report with FAA concurring statement is contained in the NTSB public docket.

MEDICAL AND PATHOLOGICAL INFORMATION

Postmortem examinations of the pilot and passengers were performed by the District 10 Medical Examiner's Office, located in Winter Haven, Florida. The cause of death for all was

listed as blunt force trauma.

Forensic toxicology was performed on specimens of the pilot and right front seat passenger by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, and also by Wuesthoff Reference Laboratory, Melbourne, Florida. The toxicology report by FAA for testing of pilot specimens stated the results were negative for carbon monoxide, cyanide, volatiles, and drugs of abuse. The toxicology report by Wuesthoff Reference Laboratory for testing of pilot specimens stated that the volatile panel was negative for ethanol, acetone, methanol, and isopropanol. The same report also indicated the blood drug screen was positive for caffeine and caffeine metabolite, but all tests of the blood immunoassay screen were negative.

The toxicology report by FAA for testing of specimens of the right front seat passenger stated the results were negative for carbon monoxide and cyanide. The same report indicated testing for volatiles and drugs of abuse was not performed. The Wuesthoff toxicology report indicated the results were negative for volatiles, and the blood immunoassay screen, while caffeine and caffeine metabolite were detected in the blood drug screen.

Toxicological testing of specimens of the remaining passengers was performed; the results are contained in the NTSB public docket.

TEST AND RESEARCH

A video capturing the airplane while descending below clouds was submitted to the NTSB Vehicle Recorder Division for analysis which revealed the total recorded video time was 39 seconds. According to the factual report, while descending the airplane was in a relatively level pitch; however, at times during the descent the pitch attitude changed to a nose down attitude. No parts or debris were observed separating from the airplane during the recorded video, while the audio portion of the recording captured propeller noise. An acoustic analysis of the audio portion of the video recording was not performed. A copy of the report is contained in the NTSB public docket.

Cellular phones and I-pads were removed from the wreckage and sent to the NTSB Vehicle Recorder Division for examination; however, no accident related data was recovered from any device. A copy of the report is contained in the NTSB public docket.

The airplane was fueled before departure with 242 gallons of Jet A with Prist. According to the individual who fueled the airplane, the fuel tanks were topped off. Records from the facility that fueled the airplane indicate they received a load of approximately 8,000 gallons of Jet Fuel (Domestic) on June 4, 2012. The load contained 10 gallons of fuel system icing inhibitor (FSII) meeting military specification (MIL-DTL-85470), with the volume percent of FSII between 0.10 and 0.15. Also on the accident date, excluding the accident airplane, two other aircraft were fueled from the same truck; there were no reported problems related to the fuel quality or FSII additive.

Postaccident testing of samples of fuel drained from the airplane's fuel tanks and also fuel filter, and also a sample of fuel taken from the facility that fueled the airplane last was performed. Because of the small amount of fuel recovered from the airplane's fuel tanks and fuel filter, the samples were combined. The testing of the combined sample revealed the specimens met the American Society for Testing and Materials (ASTM) D1655 specification limits; however, the existent gum weight of 22 milligrams per 100 milliliters of fuel exceeded the ASTM limit of 7 milligrams per 100 milliliters of fuel. Additionally, the sample contained 0.10 volume percent FSII. The testing of the sample of fuel taken from the facility that fueled

the airplane last revealed the specimen met the ASTM D1655 specification requirements; the sample contained 0.13 volume percent FSII. A copy of the test report is contained in the NTSB public docket.

Both attitude heading reference units (AHRS) were sent to the manufacturer's (NG Litef) facility for inspection and operational testing with German Bundesstelle fur Flugunfalluntersuchung (BFU) oversight. Because both units exhibited impact damage, both were opened and both CPU boards were removed for inspection. Additionally, the internal components of both AHRS were inspected; no loose components were noted inside the housings and there was no noticeable damage to either CPU board. The units were reassembled, and supplied power. The BITE history of both units was downloaded successfully. Both units were put onto a rate table for an incoming inspection test (IIT), which is similar to the acceptance test procedure (ATP); however, no extensive performance tests are performed during the IIT. Both units failed the IIT due to sensor axis misalignment, existing BITE-history entries, and missing calibration data because no incoming inspection calibration was performed before the IIT. Both units passed all other tests; there was no evidence of preimpact failure or malfunction of either AHRS. A report of the AHRS examinations is contained in the NTSB public docket.

A NTSB Radar Performance Study was performed in an effort to determine airspeed, rate of climb, pitch, bank angle, heading, load factor, and body angle of attack (AOA) which is the angle between the (true airspeed) velocity vector and the body or fuselage reference plane (FRP). Pilatus Engineering defines the FRP, which typically/closely runs through the wing chord (or very close to it). The performance study was also performed in an effort to determine what approximate control input(s) would have been needed in order to correlate with the recorded radar data. The radar performance study indicates that flying the Pilatus PC-12 aerodynamic and flight control models through the ground track defined by the FAA radar data revealed the peak load factors obtained in the simulation were between plus 3.3 and plus 4.6g which occurred at 1233:55, and 1234:08, respectively. The simulation was stopped at 1234:08, when 4.6g were obtained, which when correlated with the NTSB Electronic Devices Factual Report, was the same time that the "PASS Door" annunciation occurred. The maximum airspeed calculated from the radar data was approximately 300 knots, and the maximum airspeed during the simulation was over 318 knots.

The NTSB Radar Performance Study further indicates that in order to approximately match the recorded radar targets by simulation, the bank angle was required to increase from standard rate at approximately 1233:25, to 50 degrees, and remained at that bank angle for less than 10 seconds before increasing to over 50 degrees at 1233:40. The simulation indicates that between 1233:40, and 1233:45, a roll to near wings level occurred, and between 1233:45 and 1233:50, an increase to about 75 degrees of right bank occurred. Between 1233:50 and 1234:00, the bank angle decreased slightly, then beginning at 1234:00 until 1234:08, the bank angle increased, and at 1234:08, the maximum load factor of 4.6g occurred during the simulation. The simulation did not consider the affect that the autopilot was engaged until 1233:30. The NTSB Radar Performance Study is contained in the NTSB public docket.

Testing of a PC-12/45, that contains the same Central Advisory and Warning System (CAWS) as the accident airplane was performed at the manufacturer's facility with oversight from the Swiss Accident Investigation Board (SAIB). The testing was performed in an effort to understand entries recorded by the CAWS during the accident flight. The testing did not take

into account automatic disengagement of the autopilot due to exceedances of pitch rates in excess of 5 degrees per second and roll rates in excess of 10 degrees per second unless the control wheel steering (CWS) switch is depressed. The testing also did not take into account automatic disengagement of the autopilot due to accelerations outside of plus 1.6 g to plus 0.3 g envelope.

Testing of the yaw damper trim command and autopilot pitch trim command revealed "A/P Trim" activated and cleared entries consistent with those recorded during the accident flight between corrected times 1206:31 and 1230:46, which was the last "A/P Trim Cleared" entry. No determination could be made as to what trim function (yaw or pitch) caused the "A/P Trim" indication during the accident flight.

The testing revealed that based on the 5 entries between corrected times of 1233:33 and 1233:58, no determination could be made whether the autopilot disconnect that occurred at 1233:30 was because of a pilot action or autopilot command disconnect. Testing also revealed that activation of stickshaker disconnects the autopilot with the associated CAWS entry of "A/P DISENG." The pattern of 4 entries for sequence and corrected times of 1233:46 and 1233:58, were consistent with a test of the autopilot initiated by the pilot at 1233:46, which passed successfully at 1233:58. No determination could be made whether the autopilot or yaw damper were reengaged after the autopilot test. The testing also revealed that the pattern of entries recorded by CAWS of the accident airplane were not consistent with those in which the Trim Interrupt switch was placed to the "INTR" or interrupt position with the autopilot engaged. A copy of the report is contained in the NTSB public docket.

During certification flight testing of a PC-12 pertaining to trim runaway (specifically related to rudder and aileron trim), it was demonstrated that up to 10,000 feet, 4,500 kg (9,921 pounds), which equates to the maximum landing weight of the accident airplane, the yaw trim can runaway for greater than the time delay of 3 seconds for cruise and Vmo speed demonstrations prior to reaching the temporary control force limit of 14 CFR Part 23.143. With respect to aileron trim, aerodynamic improvements and maximum takeoff weight increase to 4,740 kg (10,450 pounds), which equates to the maximum takeoff weight of the accident airplane, required flight testing for lateral trim runaway. The testing was performed at 10,000 feet and Vmo speed which indicated that allowing for 6 second delay following the start of trim runaway (3 second recognition delay plus 3 second response), the resulting control forces and attitude excursion following an aileron trim runaway were lower than the requirements set forth in Advisory Circular (AC) 23-8B for 14 CFR Part 23.677(d).

While the CAWS did not record any system warnings or cautions before autopilot disconnect occurred during the accident flight, a review of the entire file downloaded from the CAWS was performed. The CAWS which recorded data associated with 344 "flights" from April 18, 2011, to the accident flight, was correlated with the results of postaccident ground based testing of an exemplar airplane. The CAWS data was also correlated with known maintenance actions, and only CAWS data associated with an actual flight were reviewed. For clarification, a takeoff event is logged by CAWS approximately 5 seconds after the conditions set for takeoff are met (engine running and weight off wheels), and events that become active or clear during this 5 seconds will be recorded under the previous flight number.

The results revealed that excluding the accident flight, there were only 2 flights in which an "A/P Trim Fail" entry was logged and was not attributed to normal system logic and/or testing of the autopilot only after takeoff. The first "flight" occurred on July 17, 2011; excerpts of

entries recorded for this "flight" are listed below. Because of system logic, entries 66859 thru 66861 belong to flight 1018, and correlation of entry 66861 indicates the trim adapter in a failed status, although there was not a corresponding disengagement of the autopilot entry 3 seconds later. The entry cleared before time 0754:11. Entries 66867 thru 66871 are consistent with an autopilot test that passed successfully.

Ety: 66859 FlNo: 1017 Date: 17.07 2011 Time: 07:54:01 WNo 52 : BAT Current/Vol :Cleared

Ety: 66860 FlNo: 1017 Date: 17.07 2011 Time: 07:54:02 WNo 20 : BUS TIE :Activated

Ety: 66861 FlNo: 1017 Date: 17.07 2011 Time: 07:54:02 WNo 11 : AP TRIM FAIL :Activated

Ety: 66862 FlNo: 1017 Date: 17.07 2011 Time: 07:54:02 WNo 52 : BAT Current/Vol :Cleared

Ety: 66863 FlNo: 1018 Date: 17.07 2011 Time: 07:54:04 WNo 47 : TAKE OFF :Activated

Ety: 66864 FlNo: 1018 Date: 17.07 2011 Time: 07:54:05 WNo 27 : N ESNTL BUS :Activated

Ety: 66865 FlNo: 1018 Date: 17.07 2011 Time: 07:54:07 WNo 20 : BUS TIE :Cleared

Ety: 66866 FlNo: 1018 Date: 17.07 2011 Time: 07:54:07 WNo 27 : N ESNTL BUS :Cleared

Ety: 66867 FlNo: 1018 Date: 17.07 2011 Time: 07:54:11 WNo 11 : AP TRIM FAIL :Cleared

Ety: 66868 FlNo: 1018 Date: 17.07 2011 Time: 07:54:11 WNo 43 : A/P TRIM :Activated

Ety: 66869 FlNo: 1018 Date: 17.07 2011 Time: 07:54:12 WNo 11 : AP TRIM FAIL :Activated

Ety: 66870 FlNo: 1018 Date: 17.07 2011 Time: 07:54:16 WNo 11 : AP TRIM FAIL :Cleared

Ety: 66871 FlNo: 1018 Date: 17.07 2011 Time: 07:54:16 WNo 43 : A/P TRIM :Cleared

The 2nd "flight" also occurred on July 17, 2011; excerpts of entries recorded for this "flight" are listed below. Correlation of entry 67225 is consistent with an autopilot trim command, which caused a momentary trim adapter issue that actually disengaged the autopilot, but was logged 3 seconds later at 67227. At the same time the failed state cleared when the condition was no longer met. Autopilot trim entries 67231 to 67272 (not listed) indicate normal autopilot operation. The entry 67273, indicates the autopilot disconnected, while entries 67274 and 67275 are consistent with yaw damper was still active, while entry 67276 is a normal entry 26 seconds after an autopilot disconnect entry occurs.

Ety: 67176 FlNo: 1021 Date: 17.07 2011 Time: 17:13:58 WNo 47 : TAKE OFF :Activated

Ety: 67225 FlNo: 1021 Date: 17.07 2011 Time: 18:09:01 WNo 43 : A/P TRIM :Activated

Ety: 67226 FlNo: 1021 Date: 17.07 2011 Time: 18:09:02 WNo 11 : AP TRIM FAIL :Activated

Ety: 67227 FlNo: 1021 Date: 17.07 2011 Time: 18:09:05 WNo 17 : A/P DISENG :Activated

Ety: 67228 FlNo: 1021 Date: 17.07 2011 Time: 18:09:05 WNo 43 : A/P TRIM :Cleared

Ety: 67229 FlNo: 1021 Date: 17.07 2011 Time: 18:09:05 WNo 11 : AP TRIM FAIL :Cleared

Ety: 67230 FlNo: 1021 Date: 17.07 2011 Time: 18:09:30 WNo 17 : A/P DISENG :Cleared

Ety: 67273 FlNo: 1021 Date: 17.07 2011 Time: 19:44:10 WNo 17 : A/P DISENG :Activated

Ety: 67274 FlNo: 1021 Date: 17.07 2011 Time: 19:44:13 WNo 43 : A/P TRIM :Activated

Ety: 67275 FlNo: 1021 Date: 17.07 2011 Time: 19:44:15 WNo 43 : A/P TRIM :Cleared

Ety: 67276 FlNo: 1021 Date: 17.07 2011 Time: 19:44:36 WNo 17 : A/P DISENG :Cleared

Review of the maintenance records covering the period from June 14, 2011, to the last entry dated May 3, 2012, correlated to the CAWS entries time frame cited above revealed that on July 1, 2011, the pitch trim actuator was removed and replaced and a 5 year/2000 hour inspection of the flight control cables including the autopilot and stick pusher servo cables was performed. The entry indicates the autopilot was operationally tested. On January 12, 2012, a 1000 hour/1 year check of the servo mount clutches was performed and all were satisfactory. There were no other entries pertaining to autopilot system components.

Inspection of the K001, K002, K003, K004, K011, and K012 relays was performed at the NTSB Materials Laboratory located in Washington, DC. Radiographs were performed of all relays, and the K004 relay in an unpowered state was found to be in the same position as the unpowered position as the K003 relay, which was the normal/relaxed position. The radiographs showed no anomalies in any of the relays. In addition, the relays were tested to determine actuating time/voltage. The findings for that examination indicate that

the K001, K003, K011, and K012 relays required 12 volts application to initiate instantaneous actuation, while the K002 relay required 10 volts application to initiate instantaneous actuation. The K004 relay required 11 volts application to initiate instantaneous actuation. Upon removal of power, all relay contacts relaxed (returned to the appropriate unpowered position) with no apparent sticking of contacts.

According to Pilatus Report EAA-12-AER-076 titled, "Stick shaker, pusher and fast-slow pointer settings", dated January 5, 1996, with pusher ice mode selected (propeller de-icing system and the engine inlet inertial separator are selected to on and open, respectively), the wing vane angle of attack (AOA) is automatically reduced by eight degrees, or to 26 degrees for stick shaker. Correlation of the indicated airspeed at the point of departure from controlled flight recorded by the EIS (109 knots), with the flaps retracted position and a weight of 9,921 pounds (which was only 196 pounds and approximately 2 percent greater than the accident airplane weight of 9,725 pounds), indicates the average vane AOA would be approximately 25 degrees. While the actual vane AOA at the time of autopilot disconnect was not determined, Pilatus personnel indicated it would have been close to 25 degrees.

ADDITIONAL INFORMATION

14 Code of Federal Regulations (CFR) Part 61.31

On August 4, 1987, the Federal Aviation Administration (FAA) amended 14 CFR Part 61.31, which prohibited a person from serving as pilot-in-command of a pressurized aircraft unless that person has received and logged ground training from an authorized instructor and obtained an endorsement in his/her pilot logbook or training record certifying that he/she has satisfactorily accomplished the ground training.

NTSB Database Of Accidents And Incidents Involving Turbo Propeller Operated Airplanes

A search of the NTSB database concerning accidents and incidents occurring in turbo-propeller airplanes involving pilots with 1,000 hours or less, and which occurred on or after August 4, 1987, was performed. That date was selected because it was the date that 14 CFR Part 61.31 changed requiring type specific training. The search excluded turbopropeller equipped airplanes operated in aerial application, and only included airplanes consistent with or similar to the accident airplane make and model. Of the 66 accidents and incidents, only 20 cases met

the criteria. Review of the 20 accidents revealed only 4 stipulated that factor(s) in the accident was related to the pilot's experience in make and model or in instrument conditions. Closer review of the 4 cases revealed 2 specified that a factor was the pilot's lack of total experience in make and model, the third case specified that a factor was the left seat occupants limited total experience and experience in high performance aircraft types, while the 4th case specified that a factor was the pilot's lack of instrument experience.

FAA Service Difficulty Reports

A review of malfunction or defect reports submitted to FAA of the Pilatus PC12 series airplane was performed for the period of January 1, 2009, through April 30, 2014. The review yielded a total of 275 records, none of which were attributed to the accident airplane. Of the 275 records, only 2 discuss either the rudder trim or yaw damper. The first record that occurred in February 2010, was related to a Pilatus PC-12/47E and was not applicable, while the second record that occurred in April 2012, describes an event in which while on approach, the rudder trim went to full deflection; however, the entry does not indicate to what direction the rudder trim travelled to. The pilot declared an emergency and landed without incident. The malfunction or defect report attributed the issue to be associated with the rudder trim actuator; however, personnel from Pilatus indicate that the rudder trim actuator is passive; therefore, the rudder actuator being causal to the trim runaway is not a valid conclusion.

Weight And Balance

Postaccident weight and balance calculations were performed using the empty weight of the airplane (6542.30 pounds based on weighing July 29, 2011), the weights of the occupants provided by the medical examiner's office, the actual or estimated locations of the occupants and the luggage, the weight of the luggage, and full fuel load at departure. The calculations indicate that at takeoff, the weight and center of gravity (CG) were within limits. About the time of departure from controlled flight based on the estimated fuel burn, the weight and mean aerodynamic chord (MAC) were calculated to be 9,725 pounds and 31 percent MAC, which were also within limits.

History of Flight

Enroute-climb to cruise	Miscellaneous/other Loss of control in flight (Defining event)
Uncontrolled descent	Aircraft structural failure Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Private	**Age:**	45
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without Waivers/Limitations	**Last FAA Medical Exam:**	04/06/2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	05/16/2012
Flight Time:	755 hours (Total, all aircraft), 38 hours (Total, this make and model), 657 hours (Pilot In Command, all aircraft), 38 hours (Last 90 days, all aircraft), 38 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	PILATUS AIRCRAFT LTD	**Registration:**	N950KA
Model/Series:	PC-12/47	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	730
Landing Gear Type:	Retractable - Tricycle	**Seats:**	8
Date/Type of Last Inspection:	01/12/2012, Annual	**Certified Max Gross Wt.:**	9039 lbs
Time Since Last Inspection:	36 Hours	**Engines:**	1 Turbo Prop
Airframe Total Time:	1263 Hours at time of accident	**Engine Manufacturer:**	P&W CANADA
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	PT6A-67B
Registered Owner:	Roadside Ventures, L.L.C.	**Rated Power:**	1200 hp
Operator:	Roadside Ventures, L.L.C.	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	BOW, 125 ft msl	**Distance from Accident Site:**	21 Nautical Miles
Observation Time:	1150 EDT	**Direction from Accident Site:**	315°
Lowest Cloud Condition:	Few / 1200 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	Broken / 6000 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	24°C / 23°C
Precipitation and Obscuration:	Light - Showers - Rain; No Obscuration		
Departure Point:	Fort Pierce, FL (FPR)	**Type of Flight Plan Filed:**	IFR
Destination:	Junction City, KS (3JC)	**Type of Clearance:**	IFR
Departure Time:	1205 EDT	**Type of Airspace:**	Class A

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	5 Fatal	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	6 Fatal	**Latitude, Longitude:**	27.823056, -81.477222

Administrative Information

Investigator In Charge (IIC):	Timothy W Monville	**Report Date:**	11/24/2014
Additional Participating Persons:	David Keenan; FAA/AVP-100; Washington, DC Robert H Potts; FAA/FSDO; Orlando, FL Daniel Boggs; Hartzell Propeller, Inc.; Piqua, OH Robert Renshaw; Pilatus Business Aircraft; Broomfield, CO Thomas Berthe; Pratt & Whitney; South Burlington, VT Bill Gill; Honeywell; Olathe, KS Steve Krugler; Woodward, Inc.; Rockford, IL Carl Aeschliman; UTC Aerospace Systems; Uniontown, OH		
Publish Date:	11/24/2014		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=83886		

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. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.