National Transportation Safety Board
Aviation Accident Final Report

Location:	Elyria, Ohio	**Accident Number:**	CEN10FA097
Date & Time:	January 18, 2010, 14:05 Local	**Registration:**	N80HH
Aircraft:	Mitsubishi MU-2B-60	**Aircraft Damage:**	Destroyed
Defining Event:	Aerodynamic stall/spin	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

On his first Instrument Landing System (ILS) approach, the pilot initially flew through the localizer course. The pilot then reestablished the airplane on the final approach course, but the airplane's altitude at the decision height was about 500 feet too high. He executed a missed approach and received radar vectors for another approach. The airplane was flying inbound on the second ILS approach when a witness reported that he saw the airplane about 150 feet above the ground in about a 60-degree nose-low attitude with about an 80-degree right bank angle. The initial ground impact point was about 2,150 feet west of the runway threshold and about 720 feet north (left) of the extended centerline. The cloud tops were about 3,000 feet with light rime or mixed icing.

The flap jack screws and flap indicator were found in the 5-degree flap position. The inspection of the airplane revealed no preimpact anomalies to the airframe, engines, or propellers. A radar study performed on the flight indicated that the calibrated airspeed was about 130 knots on the final approach, but subsequently decreased to about 95–100 knots during the 20-second period prior to loss of radar contact. According to the airplane's flight manual, the wings-level power-off stall speed at the accident aircraft's weight is about 91 knots. The ILS approach flight profile indicates that 20 degrees of flaps should be used at the glide slope intercept while maintaining 120 knots minimum airspeed. At least 20 degrees of flaps should be maintained until touchdown. The "No Flap" or "5 Degrees Flap Landing" flight profile indicates that the NO FLAP Vref airspeed is 115 knots calibrated airspeed minimum.

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 adequate airspeed during the instrument approach, which

resulted in an aerodynamic stall and impact with terrain.

Findings

Aircraft	Airspeed - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Aircraft	Trailing edge flaps - Incorrect use/operation
Personnel issues	Incorrect action performance - Pilot
Environmental issues	Tailwind - Effect on operation

Factual Information

HISTORY OF FLIGHT

On January 18, 2010, at 1405 eastern standard time, a Mitsubishi MU-2B-60, N80HH, was destroyed when it impacted terrain during an instrument approach to runway 07 (5,002 feet by 100 feet, asphalt) at the Lorain County Regional Airport (LPR), Elyria, Ohio. The pilot, the pilot-rated passenger in the right seat, and two passengers seated in the cabin received fatal injuries. The 14 Code of Federal Regulations Part 91 flight departed the Gainesville Regional Airport (GNV), Gainesville, Florida, about 1100, and was en route to LPR. Instrument meteorological conditions prevailed at the time of the accident, and an instrument flight rules (IFR) flight plan was filed.

Air Traffic Control (ATC) transcripts indicated that the airplane was approaching LPR on a heading of 325 degrees. At 1335:51, ATC informed the pilot that he could expect radar vectors for the instrument landing system (ILS) Runway 07 approach to LPR.

At 1345:53, ATC informed the pilot that he was 4 ½ miles from RAWLS, the final approach fix for the localizer (LOC) Rwy 07 approach, and instructed him to turn right to a heading of 050 degrees, maintain 2,600 feet mean sea level (msl) until established on the localizer. The flight was cleared for the ILS Runway 07 approach. The pilot acknowledged the clearance.

Radar track data indicated that the airplane flew through the inbound course of 070 degrees and continued on a 055 degree heading. At 1347:03, ATC instructed the pilot to turn to 090 degrees to intercept the inbound course. The ATC controller also stated, “I didn’t adjust for the wind there.” At 1347:19, ATC instructed the pilot to turn to 100 degrees and asked the pilot if he wanted to continue the approach, or take radar vectors to get reestablished on the inbound course, since he would be intercepting the inbound course near or at RAWLS. The pilot elected to continue the approach.

At 1348:27, ATC instructed the pilot to change radio frequency to LPR’s advisory frequency. The pilot acknowledged the frequency change.

At 1349:33, the pilot advised ATC that he was executing a missed approach. The radar track data indicated that the airplane’s altitude during the approach was never lower that 1,500 feet msl. The decision height for the ILS Runway 07 approach was 994 feet msl.

At 1350:29, ATC instructed the pilot to climb to 2,500 feet msl and turn left to a heading of 280 degrees for radar vectors for the ILS Runway 07 final approach course. The pilot requested that the controller extend the outbound leg to provide more time to get established on the inbound course. The radar track data indicated that the airplane was about 11 miles from the airport before it turned inbound to intercept the inbound localizer course.

At 1358:18, ATC instructed that pilot to turn left to 100 degrees, maintain 2,600 feet msl until established on the localizer, and he was cleared for the ILS Runway 7 approach. The pilot acknowledged the clearance.

At 1901:12, ATC instructed the pilot to change to the advisory frequency. The pilot acknowledged the frequency change.

Radar track data indicated that the airplane's altitude increased to about 3,000 feet msl when it turned inbound and intercepted the localizer. The altitude was about 2,200 feet msl when it crossed RAWLS (The altitude at RAWLS is depicted as 2,263 feet msl). The airplane continued inbound and the altitude continued to decrease. The radar track data indicated that the airplane was about 1 mile from runway 07 when the altitude was about 1,300 feet msl (about 506 feet above ground level (agl)). The last radar return indicated that the airplane's altitude was about 1,000 feet msl. The radar track data indicated that the airplane's heading started to go left of the centerline when it was about 1,400 feet msl, and it continued to "drift" left until the last radar return. The last radar return was about 0.19 miles (about 1,000 feet) left of centerline. The linear distance from the last recorded radar return to the initial impact point was about 750 feet.

A witness, who was waiting at the airport for the airplane to arrive, reported that he heard the radio transmission on the Unicom frequency and was looking to the west to observe the airplane as it landed. He reported that he saw the airplane as it descended out of the clouds. He stated that it was in a nose low attitude, rolling to the right into a steep right turn (initially he thought it might have been a left turn) with the wings at almost a 90 degree position relative to the ground. He stated that the airplane was "definitely out of control" when he saw it. A "huge cloud of snow" was created by the subsequent impact and when it cleared, he observed the airplane wreckage at the west end of the airport property. He stated that it happened very fast - "in the blink of an eye." He reported that the airplane's landing light was not turned on.

Another witness reported that he heard the airplane as it was approaching his house near the airport. He stated that he looked out a window and saw the airplane about 150 feet above the ground. Using an airplane model to describe the airplane's flight profile, he indicated that he observed the airplane in about a 60 degree nose low attitude with about an 80 degree angle of bank to the right.

PERSONNEL INFORMATION

The 30-year-old pilot held an airline transport pilot (ATP) certificate for single-engine land airplanes, multi-engine land airplanes, and helicopters. He was also a certified flight instructor with single-engine airplane, multi-engine airplane, and helicopter ratings; and he was an instrument instructor in airplanes and helicopters. The pilot's latest first class medical certificate was issued on November 29, 2007.

The pilot's flight logbook was not obtained during the course of the investigation. On April 15, 2009, the pilot had reported on an aircraft insurance form that as of 4/15/2009 he had a total of 2,010 flight hours. He had 1,285 multi-engine flight hours with 1,250 hours flown in the MU-2 make and model. He had 231 flight hours in helicopters. He recorded 290 hours of flight in actual instrument conditions. He flew 180 hours in the MU-2 within the preceding 12 months, and had flown 30 hours of instrument flying within the preceding 12 months.

The pilot's training records were obtained from the SimCom Training Center located in Orlando, Florida. The training records indicated that the pilot obtained his initial MU-2 simulator training in October of 2002. Records indicated that the pilot returned to SimCom for recurrent MU-2 simulator training on a yearly basis. On January 28, 2009, the pilot attended the SimCom Training Center and received a certificate signifying that he had satisfactorily completed a Special Federal Aviation Regulation (SFAR) 108 compliant MU-2 Recurrent course for the MU-2B-60 model. The pilot was scheduled to return to SimCom for recurrent MU-2 simulator training on January 25 – 27, 2010.

The owner of the airplane reported that the pilot was a competent pilot and was qualified to fly the MU-2 single pilot. The owner and the accident pilot routinely flew together, and they would switch pilot and copilot responsibilities. He stated that they routinely flew in instrument conditions and had often flown IFR approaches in actual instrument conditions. He stated that the accident pilot was a good instrument pilot and that there were no issues with his flying or his technique. The pilot had worked for the owner of the airplane for about 13 years.

The pilot rated passenger held a private pilot certificate with a single-engine land rating. His flight logbook was not obtained during the course of the investigation. During his third class medical examination on October 10, 2008, the pilot reported that his total flight time was 190 hours. The airplane owner reported that the pilot rated passenger was not performing the duties of copilot during the flight. The pilot rated passenger had flown with the pilot on numerous other flights, including flights from GNV to LPR. He also held an Airframe and Powerplant mechanic rating. He was employed by the airplane owner to maintain the accident airplane and a helicopter operated by the owner.

AIRCRAFT INFORMATION

The airplane was a twin-engine Mitsubishi MU-2B-60, serial number 732, and was certified for single-pilot operations. Its maximum gross weight was 11,575 pounds and it seated 10. The Honeywell TPE-331-10 engines were flat rated to 715 shaft horsepower. The last annual maintenance inspection was conducted on April 3, 2009. The airplane had flown approximately 90 hours since the last annual inspection and had a total time of 6,799 hours. At the last annual inspection, both the left and right engines had 2,910.4 hours time since overhaul (TSO).

A review of the airplane's maintenance records indicated that Airworthiness Directive (AD) 2000-09-15 was complied with. The AD required that a de-ice monitoring system, an automatic autopilot disconnect system, and a trim-in-motion alert system be installed on the airplane. The AD was intended to assist in preventing departure from controlled flight while operating in icing conditions.

The maintenance records indicated that the airplane's autopilot roll servo had been replaced on September 23, 2009, with an overhauled unit. The National Transportation Safety Board (NTSB) had all the autopilot primary servo's and trim servo's removed for inspection.

A Bendix KLN-94 GPS was installed in the airplane. The KLN-94 automatically switches to NAV when a localizer frequency is selected by the pilot. Therefore, the NAV sensing is

automatic and the course deviation indicator (CDI) correctly displays the localizer.

METEOROLOGICAL INFORMATION

At 1353, the surface weather observation at LPR indicated the following conditions: Winds 240 degrees at 9 knots, 2 miles visibility, mist, overcast 500 feet, temperature -1 degree Celsius (C), dew point -3 degrees C, altimeter 29.93 inches of mercury (Hg).

The National Weather Service (NWS) Weather Depiction Charts for 1100 and 1400 depicted an extensive area of IFR conditions over the region. The closest VFR conditions were over 200 miles south of the accident site.

The NWS Pittsburg 0700 sounding depicted a moist low-level environment with the lifted condensation level at 407 feet agl. The sounding had a relative humidity of 80 percent or more from the surface to approximately 8,000 feet. The freezing level was at the surface and the entire sounding was below freezing even with several temperature inversions noted between 7,500 and 10, 900 feet.

The NWS Current Icing Product indicated an approximately 70 to 80 percent probability of icing conditions below 3,000 feet in the vicinity of the accident site at 1400.

Numerous pilot reports indicated that there was an extensive overcast layer of clouds extending over Ohio with bases from 100 to 1,200 feet and tops at 2,200 to 3,800 feet. There were 12 reports of light rime to mixed type icing, and 4 reports of light to moderate intensity icing conditions in clouds below 3,000 feet.

A Cessna Citation XL landed at LPR about 10 to 15 minutes prior to the time of the accident. The Citation pilot reported that they flew the ILS Runway 07 approach and did a circle to land maneuver to runway 25. The pilot reported that they entered the clouds at 3,000 feet above msl and received radar vectors for the approach. He stated that the visibility was good above the clouds and there was no turbulence in the clouds. They leveled off at the Minimum Descent Altitude and flew the right hand circling pattern at 1,300 to 1,350 feet msl (about 500 to 550 feet agl). He said they had 3 miles visibility and he remained clear of clouds during the circle to land maneuver. The airplane's anti-icing and deicing equipment were on during the approach. He observed about 1/8 inch of ice on the nose of the airplane when they pulled the airplane into the hangar. He reported that the airplane was in the clouds for about 2 to 2 1/2 minutes.

The ATC transcripts of the Cleveland Approach Controller, who was handling the accident airplane during the instrument approach, indicated that the controller had stated that the tops of the clouds were about 3,000 – 3,100 feet msl with light rime or mixed icing. He stated that the wind was 210 degrees at 30 knots at 8,000 feet msl and that there was "similar wind down low."

AIRPORT INFORMATION

The approach plate for the ILS or LOC RWY 7 approach indicated the following information: 1) The localizer frequency was 111.7.

2) The runway length was 5,002 feet and the airport elevation was 794 feet.
3) The approach course was 070 degrees.
4) The glide slope/glide path intercept altitude was 2,400 feet msl.
5) The straight-in landing minimums were 994 feet msl decision height with a 1/2 mile visibility.
6) The circling approach landing minimums were 1,240 feet msl minimum descent altitude with 1 mile visibility.
7) Missed approach: Climb to 1,400 feet, then climbing left turn to 3,000 feet via heading 270 degrees, then left turn direct to DJB VOR/DME and hold.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted a field within the airport's boundary. The initial impact point was about 2,150 feet west of runway 07 threshold and about 720 feet north of the extended centerline of runway 07. The wreckage path was about 194 feet long and was oriented on a heading of about 100 degrees magnetic. The wings and landing gear separated from the fuselage. The cockpit cabin had partially separated from the rest of the fuselage during the impact sequence, but the flight control cables were not severed. The empennage remained attached to the fuselage. There was no post impact fire.

A piece of the green navigational lens and the strake from the right wing tip tank were found near the initial impact point. A crater about 6 feet wide by 7 feet long and 18 – 24 inches deep was located about 21 feet east of the initial impact point. The four-bladed right propeller and the right wing flap were located near the crater. The right wing tip tank was located about 61 feet along the wreckage path. The outboard section of the right wing was located about 79 feet along the wreckage path. The left engine was located about 123 feet along the wreckage path with the propeller still attached, but with two blades missing from the hub. The two other blades were located in the debris field. The cockpit and fuselage were located about 143 - 170 feet from the initial impact point. The left wing was separated from the fuselage, but was located next to the main wreckage. The left wing tip tank and the right engine were located about 170 feet and 179 feet along the wreckage path, respectively. One of the left propeller blades was located 194 feet from the initial impact point.

The on-site inspection of the wreckage revealed the deformation of the right wing tip tank was about 60 degrees to the left. The inspection revealed that the landing gear was extended and the flaps were set to 5 degrees. The pitch trim indicator was about 15 degrees nose up, the rudder trim indicator was about 1 – 2 degrees right, and the aileron trim was neutral. The trim surfaces corresponded to the indicated trim settings. The power levers were forward and above the flight idle position. The left condition lever was found forward of the stop and the handle was broken. The right condition lever was found on the forward stop at the Take-off/Land position. The generator switches and the battery master switches were found in the OFF position. The left engine auto-ignition switch was found in the Continuous position, and the right engine auto-ignition switch was found in the Auto-ignition position.

The inspection of the overhead switch panel revealed that it had impact damage that cracked the panel through the middle of the switches. The switches in the overhead switch panel were

in the OFF position. The four top lights on the Anti-Ice panel were intact. When 24-volts was applied to each light bulb, the light went on. The four bottom lights on the Anti-Ice panel could not be tested due to impact damage.

The airplane was equipped with an M-4D Automatic Flight Control System. The flight controller and mode selector are provided in separately mounted units, which are operationally equivalent to a single-unit controller. The M-4D autopilot mode selector controller has 6 modes of operation. Each mode had 4 light bulbs behind the mode faceplate. All the light bulb filaments of each mode were inspected. All the filaments were intact and there were no indications of filament stretch. The light bulbs on the flight controller AP/ON switch were inspected. All the filaments were intact and there were no indications of filament stretch.

The flight control cables were examined for continuity. The elevator and rudder push-pull rods and cables exhibited continuity from the flight controls to the control surfaces. The wing spoiler cables had continuity from the control yoke to the mixer box located in the wing center section. The push-pull tubes from the mixer box to the spoilers were broken and exhibited impact damage. The attach points of the push-pull tubes to the spoiler bell cranks exhibited continuity. The right outboard spoiler was found in the down position. The right inboard spoiler was attached but it was broken and moved freely. The left inboard and outboard spoilers were in the up position.

MEDICAL AND PATHOLOGICAL INFORMATION

The autopsies of the pilot and pilot-rated passenger were conducted on January 20, 2010, at the Cuyahoga County Coroner's Office, Cleveland, Ohio. The "Cause of Death" for both was noted as "Blunt force trauma to the head, neck, trunk and extremities with cutaneous, skeletal, soft tissue, vascular and visceral injuries." Forensic Toxicology Fatal Accident Reports were prepared by the FAA Civil Aeromedical Institute. The results for both were negative for all substances tested.

TESTS AND RESEARCH

Autopilot Servos

The autopilot servos and associated parts from the airplane were examined at Autopilots Central in Tulsa, Oklahoma, on March 17, 2010, under NTSB oversight. The following parts were bench tested: 1) Pitch Primary Servo 2) Pitch Servo Capstan Assembly 3) Roll Primary Servo 4) Roll Servo Capstan Assembly 5) Yaw Primary Servo 6) Yaw Servo Capstan Assembly 7) Yaw Trim Servo and 8) Pitch Trim Servo.

Bench tests revealed that the Primary Pitch Servo servo functioned correctly; however, the output torque was slightly under the minimum limit during counter-clockwise rotation. The servo passed all other tests. The Pitch Servo Capstan Assembly passed the clutch torque test. The Roll Primary Servo functioned correctly; however, the Velocity Generator Output test was slightly under limit, measuring 1.77 volts (min limit = 1.8 volts). The servo passed all other tests. The Roll Servo Capstan Assembly passed the clutch torque test. The Yaw Primary Servo functioned correctly; however, the Residual Drag test was slightly over the maximum limit of

30 inch-ounces, measuring 32 inch-ounces. Residual Drag is the torque required to rotate the pinion gear on the servo when the servo is NOT powered (no clutch current). The Yaw Servo Capstan Assembly passed the clutch torque test. The Yaw Trim Servo functioned correctly and passed the specified tests. The Pitch Trim Servo would not function in the clockwise direction. All other testing was satisfactory. Observing an exemplar servo in an MU-2 aircraft revealed that counter-clockwise rotation of the trim servo drive pulley provides nose-up trim and clockwise rotation provides nose-down trim. The pitch trim servo was analyzed by Autopilots Central's technician to determine loss of clockwise rotation. Findings determined that relay K1 was faulty (relay contact #2 bad). A jumper was connected between relay K1, pins 1 and 2 to provide confirmation. The servo operated in the CW direction with the jumper installed, confirming that relay K1 was faulty. It could not be determined if relay K1 was faulty prior to impact or was faulty as a result of the impact.

Powerplants

A teardown and examination were conducted on the two Honeywell Model TPE331-10-511M turboprop engines, serial numbers P-36169C and P-36070C that were installed on the airplane. The inspection took place at the Honeywell Investigation Laboratory in Phoenix, Arizona, on March 29 - April 1, 2010, under NTSB oversight.

The examination revealed that both engines exhibited similar impact damage. Both exhibited rotational scoring of the first-stage compressor impeller shroud, the leading edges of the first-stage impeller blades were bent opposite the direction of rotation, rotational scoring through 360 degrees on the second-stage compressor housing impeller shroud, and rotational scoring on the shroud line of all second-stage compressor impeller blades. Both engines exhibited rotational scoring on the second-stage turbine blade tip shroud, rotational scoring on the honeycomb seal on the second-stage turbine rotor blade tips, rotational scoring on the shroud line edge of all third-stage turbine rotor blade tips, and rotational scoring on the knife seals on the third-stage rotor. The engines also exhibited metal spray deposits adhering to the suction side of the second-stage turbine stator vanes, and to the suction side of the second-stage turbine blades. Both had rotational scoring damage to the sun gear and propeller shaft.

Propellers

An inspection of the Hartzell propellers, model HC-B4TN-5-JL, was conducted at Ottesen Propeller Service, Phoenix, Arizona on March 31, 2010, under NTSB oversight. The inspection of the left propeller revealed that all four blade clamps/counterweights were at a low or reverse pitch position. The piston/cylinder/spring assembly had separated from the hub but was still connected to the propeller by link arms. The number (No.) 2 and No. 3 blades had separated from their blades clamps. The No. 1 blade had not rotated in its clamp, and the No. 4 blade had turned in its clamp approximately 40 degrees toward lower pitch. The reverse pitch stop was intact and unremarkable. The feather stop was unremarkable and did not have significant impact marks. The start locks were intact. The start lock plates (on the blade clamps) were undamaged with no impact marks. The cylinder had separated from the hub and the attachment threads were damaged. The cylinder was partially covered with mud that provided an indication of the (external) piston position. The piston was approximately 1-21/32 inch from the feather position, which equates to 34.8 degree blade angle. The pitch change rod had an

impact mark at the point where the rod exits the front spring retainer. The mark was 2-21/32 inches from the aft side of the flange on the pitch change rod. This is a low/reverse pitch position, in proximity to the start lock position (2.5 degree blade angle). The No. 1 blade was bent forward approximately 100 degrees at mid-blade. It was not twisted. It had gouges in the leading edge. The No. 2 blade was bent aft approximately 10 degrees at mid-blade. It was twisted toward low pitch. The blade shank was sheared and the blade had separated from the propeller. The outer 4 inches of the tip was partially torn off. It had gouges in the leading edge. It was twisted toward low pitch.

The inspection of the right propeller revealed that the propeller had separated from the engine due to a fractured engine shaft. All four blades were in a reverse pitch position, but could be manually turned (No. 3 could not be manually turned until mud was removed). Blade clamp link screws had separated and were missing from blades No. 1, No. 2, and No. 4. The piston guide collar and one blade counterweight were missing. The piston/cylinder/spring assembly had separated from the propeller. The beta tube was bent and fractured on the aft side of the spring assembly. The No. 1 and No. 2 blades had not rotated in their clamps. The No. 3 blade had rotated in its clamp approximately 20 degrees toward lower pitch. The No. 4 blade had rotated in its clamp approximately 20 degrees toward lower pitch. The reverse pitch stop was intact and unremarkable. The feather stop was unremarkable and did not have significant impact marks. The start locks were intact. The start lock plates (on the blade clamps) were undamaged except for a small gouge in No. 1 start lock plate. The cylinder had separated from the hub and the attachment threads were damaged. The cylinder was partially covered with mud that provided an indication of the (external) piston position. The piston was approximately 29/32 inch from the feather position, which equates to 48.8 degree blade angle. The pitch change rod was intact and unremarkable. The No. 1 blade was bent aft approximately 20 degrees at 1/4 radius. It was twisted toward low pitch. The No. 2 blade was bent slightly aft at the tip. It was twisted toward low pitch. The No. 3 blade was bent aft approximately 70 degrees at 1/4 radius. It was twisted toward low pitch. The blade had leading edge damage. The No. 4 blade was bent aft approximately 70 degrees at 1/4 radius. It was twisted toward low pitch. The blade had leading edge damage.

Aircraft Radar Study

A NTSB Vehicle Performance Specialist conducted an aircraft radar study. Available ASR (radar), ARSR (radar), and ATC transcript data were processed and plotted to define the aircraft flight path, ground track, ground speed, rate of climb, and ATC communication event time history. No aircraft-based acceleration, airspeed, attitude, engine, flight control input, flight control surface position, or external atmosphere parameters were recorded. However, radar, meteorological, and estimated aircraft configuration data (i.e., flaps, gear, weight, and center of gravity) were used with a simplified Mitsubishi MU-2B-60 aerodynamic model to estimate the aircraft airspeed, attitudes, load factors, and engine power required as a function of time to match the accident flight trajectory. No attempt was made to model aerodynamic degradation due to potential in-flight wing, tail, engine, or propeller ice accretion.

The calculated results indicated that the calibrated airspeed was about 130 ±10 knots on the

final approach, but subsequently decreased to about 95–100 knots during the 20-second period prior to loss of radar contact. During the final approach and descent but prior to the airspeed decay, the calculated flight path angle was about -3 ±1 degrees, the calculated bank angle was about 0 ±10 degrees, and the estimated angle of attack (AOA) ranged from about 4 – 6 degrees. During the airspeed decay period, the estimated AOA increased by about 6 – 8 degrees (to about 10 – 14 degrees), depending on the assumed engine power setting. According to the Mitsubishi MU-2B-60 AFM, the flaps 5 minimum control speed is 99 knots and the wings-level power-off stall speed at the accident aircraft weight is about 91 knots.

Airplane Flight Manual Checklists

The MU-2B-60 Airplane Flight Manual's Approach Checklist indicated that the flaps are lowered to 5 degrees when the airspeed is below 175 knots calibrated airspeed (KCAS). The landing gear is lowered when the airspeed is below 175 KCAS. The NOTE states: "It is recommended to set the flap switch to the 5 degree position and confirm the 5 degree indication light illuminates before going to the 20 degree position." Airspeed is 140 KCAS minimum.

The Before Landing Checklist states the following WARNING:

"Use of 40 degree flaps for landing considerably restricts the go around capability should an engine failure occur in the approach or landing phase.

During landing, do not select 40 degree flaps when operating in icing conditions. The FAA has determined that ice accumulations on the tail plane of many aircraft may result in a reduced down force on the horizontal stabilizer when full flaps are used. This reduced down force may result in the aircraft pitching nose down."

The Before Landing Checklist states that the Flaps are set to 20 degrees (Below 155 KCAS) or 40 degrees (Below 120 KCAS). The airspeed is per the Section 6 Performance Charts for the appropriate weight and flap setting.

The MU-2B-60 Airplane Flight Manual contains Section 6 Performance Charts for "Landing Approach Speed – Flaps 20 Degrees" and "Landing Approach Speed – Flaps 40 Degrees," but it does not have a chart for a landing approach speed using 5 degrees of flaps.

SFAR-108 Approach and Landing Profiles

The SFAR-108 ILS and Missed Approach profile indicates that 5 degrees of flaps are used on the outbound leg of the procedure turn and when flying inbound on the localizer. The minimum airspeed when using 5 degrees of flaps is 140 knots (25 – 30 percent torque). Check gear down, flaps 20 degrees when approaching glide slope (G/S) intercept (One dot below G/S). The minimum airspeed with 20 degrees of flaps is 120 knots. Perform landing check (Approximately 25 percent torque). When landing is assured, check flaps 20 degrees (or 40 degrees of flaps below 120 knots). At the threshold, fly Vref airspeed (20 percent torque). At touchdown, retard the power levers to flight idle stop.

The SFAR-108 No Flap or 5 Degrees Flap Landing indicates that 150 KCAS minimum (25 – 30 percent torque) is flown on the downwind leg. Lower the landing gear when abeam the landing zone using 140 KCAS minimum. Complete the landing checklist. Turn onto base leg 1.5 miles past landing zone. Set 0 degrees or 5 degrees of flaps. Airspeed is 140 KCAS minimum. Sink rate is 500 – 600 foot per minute (fpm) (Approximately 26 percent torque). Check sink rate on base leg. Turn final with airspeed slowing to NO FLAP Vref (115 KCAS minimum). At the threshold torque is 20 percent. Airspeed is NO FLAP Vref (115 KCAS minimum). At touchdown, slowly retard power levers to flight idle stop.

ADDITIONAL INFORMATION

The owner reported that neither he nor the accident pilot used the autopilot while flying instrument approaches for landing. He stated that during the approach, the flaps were set to 5 degrees at 175 knots and 20 degrees of flaps at 155 knots. He stated that the approach is normally flown at 150 knots with 20 degrees of flaps. At the bottom of the approach at 115 knots, then bring in the flaps to 40 degrees.

The owner reported that he had never seen the accident pilot use 5 degrees of flaps below 500 feet in visual flight conditions. He stated that the accident pilot always used 20 degrees of flaps from the initial approach point (IAP) to the missed approach point (MAP). The owner stated that it was a "mystery" to him why the flaps were set at 5 degrees of flaps.

History of Flight

Approach-IFR final approach	Aerodynamic stall/spin (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline transport	**Age:**	30,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	November 29, 2007
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 2010 hours (Total, all aircraft), 1250 hours (Total, this make and model)		

Co-pilot Information

Certificate:	Private	**Age:**	46,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	October 3, 2008
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 190 hours (Total, all aircraft)		

Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Mitsubishi	**Registration:**	N80HH
Model/Series:	MU-2B-60	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	732
Landing Gear Type:	Retractable - Tricycle	**Seats:**	
Date/Type of Last Inspection:	April 3, 2009 Annual	**Certified Max Gross Wt.:**	11575 lbs
Time Since Last Inspection:	90 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	6799 Hrs at time of accident	**Engine Manufacturer:**	Honeywell
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	TPS-331-10
Registered Owner:		**Rated Power:**	715 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LPR,793 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:		**Visibility**	2 miles
Lowest Ceiling:	Overcast / 500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	-1°C / -3°C
Precipitation and Obscuration:			
Departure Point:	Gainesville, FL (GNV)	**Type of Flight Plan Filed:**	IFR
Destination:	Elyria, OH (LPR)	**Type of Clearance:**	IFR
Departure Time:	11:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Lorain County Regional Airport LPR	**Runway Surface Type:**	Asphalt
Airport Elevation:	793 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	07	**IFR Approach:**	ILS
Runway Length/Width:	5002 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	2 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	41.34,-82.193611

Administrative Information

Investigator In Charge (IIC):	Silliman, James
Additional Participating Persons:	Dave Pesarchick; FAA-Cleveland FSDO; Cleveland, OH Ralph Sorrells; Mitsubishi; Addison, TX Dave Studtmann; Honeywell; Phoenix, AZ Tom McCreary; Hartzell; Piqua, OH
Original Publish Date:	April 12, 2011
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=75275