Aviation Investigation Final Report

Location:	Indianapolis, Indiana	**Accident Number:**	CHI06FA245
Date & Time:	August 28, 2006, 10:38 Local	**Registration:**	N91MB
Aircraft:	Cirrus SR22	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal, 3 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

"THIS CASE WAS MODIFIED ON MARCH 25, 2009."

The right seat passenger reported that the takeoff and initial climb were uneventful until the airplane reached about 4,000 feet of altitude. That was when he noticed that the sound of the engine had changed and saw that the pilot was struggling to control the airplane. The airplane went through a series of three quick rolls and the wing dipped down. The airplane entered a counterclockwise spin. The pilot told the right seat passenger to pull the emergency parachute handle, so he pulled the throttle back to idle, and then pulled the parachute handle. The airplane impacted a water retention pond about 4 seconds later. Witnesses observed the airplane descending through the clouds with a partially deployed parachute. The inspection of the engine and airframe revealed no pre-existing anomalies. The engine data obtained from the Multi-Function Display indicated the engine was operating at full power for the entire flight. Instrument meteorological conditions prevailed with variable cloud bases of 400 - 1,100 feet above the ground (agl) and with cloud tops reported at 3,200 feet above mean sea level. The baggage found in the baggage compartment weighed 262 pounds. The weight limit of the baggage compartment was 130 pounds maximum. The calculated takeoff condition weight of the accident airplane was 3,733 pounds. The Maximum Takeoff Weight was limited to 3,400 pounds. The center-of-gravity (CG) position was at fuselage station (FS) 148.7 inches, or 32.8 percent mean aerodynamic chord (MAC). The CG limits at maximum gross weight are from FS 143.8 inches to FS 148.1 inches. The airplane was overloaded and the CG position was aft of the CG limit. An aircraft performance study, which utilized data extracted from accident airplane, indicated that the airplane's airspeed decayed until the stall angle of attack of the wing was exceeded. The airplane was in a stalled condition for about 30 seconds and then

entered a spin.

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 sufficient airspeed, which resulted in a stall and subsequent spin. Contributing to the accident were the pilot's inadequate preflight planning, the overloaded condition of the airplane, and the CG aft of the CG limit.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CLIMB - TO CRUISE

Findings
1. (F) PREFLIGHT PLANNING/PREPARATION - INADEQUATE - PILOT IN COMMAND
2. (F) AIRCRAFT WEIGHT AND BALANCE - EXCEEDED - PILOT IN COMMAND
3. (C) AIRSPEED - LOW - PILOT IN COMMAND
4. STALL/SPIN - ENCOUNTERED - PILOT IN COMMAND
5. WEATHER CONDITION - LOW CEILING
6. (F) WEATHER CONDITION - LOW CEILING

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
7. TERRAIN CONDITION - WATER

Factual Information

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HISTORY OF FLIGHT

On August 28, 2006, at 1038 eastern daylight time, a Cirrus SR22, N91MB, was destroyed when it impacted a water retention pond located about 2.4 miles from the Eagle Creek Airpark (EYE), Indianapolis, Indiana, after a loss of control during cruise climb. The 14 Code of Federal Regulations Part 91 personal flight departed EYE at 1034 en route to Hilton Head Airport (HXD), Hilton Head Island, South Carolina. The pilot received fatal injuries, and the three passengers received serious injuries. Instrument meteorological conditions prevailed at the time of the accident. The flight was on an instrument flight plan.

On Saturday, August 26th, the co-owner of N91MB (the accident pilot was the other co-owner) took ownership of the new airplane, and along with a Cirrus Standardized Instructor Program (CSIP) pilot, flew it from Duluth, Minnesota, where it was manufactured, to EYE. The co-owner of the airplane reported the approximately 500 nautical mile flight took about 3.5 hours to complete. A fuel receipt indicated that 50.9 gallons of fuel were added to the airplane after the flight.

On Sunday, August 27th, the accident pilot and the CSIP pilot flew N91MB for 1.7 hours on an instrument proficiency check flight. Instrument meteorological conditions were encountered during the flight and the accident pilot practiced instrument procedures and flew 2 instrument approaches. The CSIP pilot reported that the accident pilot was on the "top of his game" and that he flew a very good check ride. After the flight, the CSIP pilot topped off the airplane with fuel. A fuel receipt indicated that 14.4 gallons of fuel were added to the airplane. Although the accident pilot had recently undergone surgery, the CSIP pilot reported that the accident pilot was feeling good and that he had told the CSIP pilot that he did not feel any side effects and was not taking any medications. The CSIP pilot reported that the engine, navigation, and communication systems on the airplane operated normally.

The accident pilot telephoned the Terre Haute Flight Service Station (FSS) at 2131 on Sunday night to get a weather brief for a flight from EYE to HXD. The briefer informed him to expect marginal visual meteorological conditions and temporary instrument meteorological conditions at the departure airport between 0800 - 1200 the next morning.

On Monday morning, August 28th, the pilot and the three passengers met at the pilot's hangar prior to the flight. The pilot's 29-year-old son, who was not a pilot, assisted loading the cargo on board the airplane. The pilot's son sat in the right front seat, the pilot's wife sat in the right rear seat, and a friend of the family sat in the left rear seat.

The pilot taxied the airplane to the EYE ramp prior to takeoff, but was unable to contact Indianapolis Clearance Delivery, which was located at the Indianapolis International Airport, on his airplane's radio. At 1018, while the airplane's engine was running, he telephoned the Terre Haute FSS with his cellular telephone and requested an IFR departure clearance. The pilot was informed that his IFR flight plan was not in the system and that he would need to re-file the flight plan. The pilot stated to the briefer that he had filed an IFR flight plan the night before using Direct User Access Terminal Service (DUATS), but he re-filed his flight plan over the telephone with FSS. At 1030, he received his takeoff clearance, which included the following information: N91MB was cleared from the Eagle Creek Airport to the Hilton Head Airport via radar vectors as filed. He was cleared to climb and maintain 3,000 feet and expect 9,000 feet 10 minutes after departure. Contact departure control on 119.05, squawk 4004, and when able, fly heading 270 degrees. Void time was 1040.

The transcript of radio communications between the pilot and Indianapolis Airport Traffic Control (ATC) indicated the following:

At 1034:38, the pilot stated, "Indianapolis Departure, Cirrus, uh, Nine One Mike Bravo is off Eagle Creek, uh, turning to heading two seven zero, passing through fifteen hundred."

At 1034:48, ATC responded, "Cirrus Niner One Mike Bravo, Indy Departure, ident. What is your on course heading?"

At 1034:53, the pilot responded, "Uh, on course is going to be, uh, standby."

At 1035:03, the pilot stated, "Uh, we're with you at one five one."

At 1035:07, ATC stated, "Cirrus One Mike Bravo, roger. Radar contact one mile southwest of Eagle Creek. Climb and maintain six thousand."

At 1035:11, the pilot responded, "Up to six thousand, Niner One Mike."

About 1035, track data, which was derived from Airport Surveillance Radar (ASR) and the airplane's Avidyne Entegra EXP5000 Primary Flight Display (PFD), indicated that the airplane was on about a 270 degree heading at about 1,670 feet mean sea altitude with an indicated airspeed of about 117 knots. For about the next 30 seconds, the airplane's heading remained about 270 degrees. About 1035:50, the airplane's heading turned about 30 degrees left to about 240 degrees. The airplane's altitude was about 2,500 feet msl and the indicated airspeed was about 97 knots.

At 1036:12, ATC stated, "Cirrus One Mike Bravo, turn left on course."

At 103614, the pilot responded, "Uh, thank you, Nine One Mike Bravo, on course."

At 1036:19, ATC stated, "And still one fifty?"

At 1036:21, the pilot responded, "Uh, that's correct, sir."

There were no further radio transmissions recorded from N91MB. At 1036:21, track data indicated that the airplane's altitude was about 3,000 feet msl and the indicated airspeed was about 87 knots. For about the next 20 - 25 seconds the airplane turned left to a heading of about 105 degrees and remained on that heading for about the next 60 seconds.

At 1037:52, ATC stated, "One Mike Bravo, you say your on course heading is one five zero." At 1037:52, the airplane's heading was about 105 degrees, the altitude was about 3,800 feet msl, and the indicated airspeed was about 75 knots.

Track data indicated that the airplane's heading turned to the northeast on about a 075-degree heading and the airplane lost altitude. The last radar return recorded at 1038:22 indicated that the airplane's altitude was about 1,600 feet msl.

The pilot's son reported that the takeoff and initial climb were uneventful until the airplane reached about 4,000 feet of altitude. That was when he noticed that the sound of the engine had changed and saw that the pilot was struggling to control the airplane. The airplane went through a series of three quick rolls and the wing dipped down. The pilot was still attempting to control the airplane when he made an emergency call over the radio but there was no response. The pilot's son reported that the airplane entered a counterclockwise spin. The pilot told him to pull the parachute so he pulled the throttle back to idle and then pulled the parachute handle.

An officer of the Indianapolis International Airport Police Department interviewed the pilot's son. The officer's report stated that the pilot's son observed the pilot "pulling backwards on the control yoke of the aircraft trying to keep the aircraft's nose up." The report stated that the pilot's son "grabbed the right sided yoke and attempted to help his father keep the aircraft nose elevated."

The family friend who was sitting in the left rear seat reported "everything seemed normal" until "just to the point where we could be leveling off, just to the top of the clouds." She stated, "I remember hearing a different sound. I would call it the engine sounded differently, but something sounding differently. Kind of feeling and hearing something underneath of me." She stated, "The only thing I have to compare it to is when the wheels on a commercial flight are put down or up. And feeling two dips to the side, to the right, and definitely hearing [the pilot] talking to the tower at this time." She later stated, "It was like a rumble to me, you know. That the only thing I had to compare it to was the wheels going up and down, or I don't know, flaps, sometimes, on the wings of bigger planes." She stated that she heard the different noise and felt the rumble maybe 30 seconds before the pilot's son raised his arm to pull the parachute. She did not remember seeing him pull the parachute handle since she lost consciousness or blacked out.

Numerous witnesses on the ground reported hearing and seeing the airplane prior to the impact. One witness reported that she "heard the plane's engine stop and start and stop again. Then an explosion and it fell out of the sky with the parachute falling behind but it did not deploy all the way. The airplane fell nose first into the water." Another witness heard a loud "pop" and saw the airplane "falling through the clouds" with the parachute deployed about "3/4 open by the time it hit the water."

The airplane impacted a water retention pond in a residential neighborhood. People from the neighborhood went into the pond and assisted the pilot and passengers. Emergency rescue personnel arrived and all four occupants were transported to local hospitals.

PERSONNEL INFORMATION

The pilot was a 66-year-old private pilot with single-engine and multi-engine land limited to center thrust, and instrument airplane ratings. He held a third-class medical certificate that was issued in June 2005, with the limitations, "must have available glasses for near vision" and "not valid for any class after." He had a total of about 2,570 hours of flight time.

Pilot logbook records indicated the pilot had logged about 365 hours of flight time in Cirrus SR22 airplanes. The pilot had owned N48RE, a Cirrus SR22 that was equipped with conventional pilot cockpit instrumentation, and he logged about 308 hours in it. He had flown about 50.2 hours in Cirrus SR22 airplanes equipped with "glass" cockpit instrumentation, which included the Avidyne Entegra EXP5000 PFD and the Avidyne EX5000 Multi-Function Display (MFD), prior to the accident flight in N91MB. Pilot logbook entries indicated that he flew 46.8 hours of actual IFR time and 21.3 hours of simulated IFR time in all Cirrus SR22 airplanes prior to the accident flight.

According to the University of North Dakota training records, the pilot attended the Cirrus Factory Training Course December 9 - 11, 2002, when he purchased N48RE. The records indicated that he received 6.8 hours of flight training, and he was awarded a course completion certificate and an instrument proficiency check.

The pilot's son reported that the pilot had owned a Cessna 210 from 1979 until the time he purchased his first Cirrus SR22, N48RE. The pilot's son had taken "pinch-hitters" courses in the Cessna 210, and had flown with the CSIP pilot for about 2 hours in N48RE. He reported that the pilot routinely instructed his passengers about the purpose of the airplane's parachute, and how to deploy the parachute in case of an emergency.

AIRCRAFT INFORMATION

The airplane was a single-engine Cirrus SR22, serial number 1973, with a Continental 310-horsepower IO-55N engine. It received its standard airworthiness certificate on May 25, 2006. According to sales records, Cirrus Design used it as a demonstrator airplane from May 31,

2006, to August 17, 2006. On August 25, 2006, the airplane Hobbs time was listed as 150.3 hours. At the time of the accident, the Hobbs meter indicated 156.0 hours.

According to the Delivered Weight and Data Equipment List, the airplane was equipped with: Air conditioning, S-TEC 55X autopilot, dual Garmin GNS 430's, Avidyne PFD and MFD, TKS, EMax Engine Monitoring, Sky Watch, Stormscope, E-TAWS, and XM Satellite Weather and Radio. The airplane was equipped with a Cirrus Airframe Parachute System (CAPS), which is a whole airplane emergency parachute system.

Federal Aviation Administration (FAA) inspectors checked the Weight and Balance of the accident airplane. The baggage found in the airplane was collected and weighed twice, but it was determined that the contents needed to be professionally dried to get an accurate weight since they were water soaked. After the baggage was dried, the contents were weighed a third time on calibrated scales. The baggage found in the baggage compartment weighed 262 pounds. The weight limit of the baggage compartment is 130 pounds maximum. The calculated takeoff condition weight of the accident airplane was 3,733 pounds. The Maximum Takeoff Weight is limited to 3,400 pounds. The center-of-gravity (CG) position was at fuselage station (FS) 148.7 inches, or 32.8 percent mean aerodynamic chord (MAC). The CG limits at the Maximum Gross Weight (3,400 pounds) are from FS 143.8 inches to FS 148.1 inches. The airplane was overloaded on the accident flight, and the CG position was aft of the limit described for the maximum gross weight.

METEOROLOGICAL INFORMATION

At 0953, the Automated Surface Observing System (ASOS) at EYE indicated the following: Wind 180 degrees at 4 knots, visibility 4 miles, mist, overcast 500 feet, temperature 23 degrees Celsius (C), dew point 22 degrees C, altimeter 29.89 inches of Mercury (Hg), ceiling variable between 400 and 800 feet.

At 1053, the ASOS at EYE indicated the following: Wind 160 degrees at 4 knots, visibility 9 miles, overcast 700 feet, temperature 23 degrees C, dew point 2 degrees C, altimeter 29.90 inches of Hg, ceiling variable between 400 and 1,100 feet.

Pilot reports in the Indianapolis area indicated low overcast stratiform clouds with bases 900 feet and tops to 3,200 feet.

COCKPIT DISPLAY - RECORDED FLIGHT DATA

System Information

The Avidyne Entegra EXP5000 PFD and the Avidyne EX5000C Multi-Function Display (MFD) units were sent to the NTSB's Vehicle Recorder Laboratory for readout. The compact flash memory was removed from the MFD, and the Avionics Computing Resource (ACR) circuit card was removed from the PFD. The MFD compact flash card functioned normally in a standard

card reader. A binary copy of the MFD compact flash card was successfully completed. However, the flight data could not be accessed with a standard PC operating system. The card was sent to the manufacturer for data extraction and decoding.

The PFD ACR circuit board was sent to the manufacturer for data recovery as well. The manufacturer decoded the downloaded files and the results were returned to the NTSB lab.

The PFD unit includes a solid state Air Data and Attitude Heading Reference System and displays aircraft parameter data including altitude, airspeed, attitude, vertical speed, and heading. The PFD unit has external pitot/static inputs for altitude, airspeed, and vertical speed information. Each PFD contains two flash memory devices mounted on a riser card. The flash memory stores information the PFD unit uses to generate the various primary flight data displays.

The PFD samples and stores several data streams in a sequential fashion; when the recording limit of the PFD is reached, the oldest record is dropped and a new record is added. Data from the attitude and heading reference system (AHRS) is recorded at a rate of 5Hz. Air data information such as pressure altitude, indicated airspeed, and vertical speed are recorded at 1Hz. GPS and navigation display and setting data are recorded at a rate of .25Hz, and information about pilot settings of heading, altitude, and vertical speed references are recorded when changes are made.

The MFD unit is able to display the pilot checklist, terrain/map information, approach chart information and other aircraft/operational information depending on the specific configuration and options that are installed. One of the options available is a display of comprehensive engine monitoring and performance data.

Each MFD contains a compact flash memory card located in a slot on the side of the unit. This memory card contains all of the software that the MFD needs to operate. Additionally, this card contains all of the checklist, approach charts, and map information that the unit uses to generate the various cockpit displays.

During operation, the MFD display receives information from several other units that are installed on the aircraft. Specifically, the MFD receives GPS position, time and track data from the aircraft's two Garmin 430 GPS receivers. The MFD also receives information from the aircraft concerning altitude, engine and electrical system parameters, and outside air temperature. This data is also stored on the unit's compact flash memory card.

The MFD generates new data files for each power-on cycle. Similar to the PFD, the oldest record is dropped and replaced by a new recording once the storage limit has been reached. MFD data are sampled every six seconds, and is recorded to memory once every minute. If an interruption of power occurs during the minute between MFD memory-write cycles, data sampled during that portion of a minute are not recorded.

Note: No cockpit control position or aerodynamic control surface position data is recorded by either the PFD or MFD.

Recorded PFD Data Log Information

The PFD data log files indicated that the following parameters were set on the ground before takeoff, except the altitude bug, which was changed in flight:

Altimeter: 29.94 inches of Hg.
Altitude bug: 3,000 feet.
Magnetic heading bug: 270 degrees.
Vertical speed indicator (VSI) Bug: 650 FPM.
Map format: "0" (Display a full 360 compass with PFD navigation map.
Map range: "3" (Map range = 20 nautical miles)

About 10:35:24, the altitude bug changed from 3,000 feet to 6,000 feet shortly after Indianapolis ATC instructed N91MB to "climb and maintain six thousand." All other settings remained the same for the duration of the recording.

The PFD data log indicated that the PFD was in the VOR/Localizer Receiver (VLOC) navigation mode during the accident flight. Prior to takeoff at 10:06:36, the primary navigation (NAV) source was set to VHF 1. The primary NAV frequency was set to 111.5 megahertz (MHz). The PFD data log indicated that on the previous flight the day before the accident, the Primary NAV source was set to VHF 1 and the selected NAV frequency was set to 115.5 MHz, which is the localizer frequency for Runway 21 at EYE.

The PFD data log indicated that there was no flight plan or waypoints activated in GPS 1 during the accident flight, and the desired track (DTK) bearing value indicated a heading of 360 degrees, after an initial startup value of zero. During a test flight conducted in June 2007, it was demonstrated that if no active GPS navaids were active in GPS 1, when VLOC was pressed, the course needle indicated a heading of 360 degrees.

The autopilot status was not recorded in the PFD data log files. The PFD data log did not record the information that was entered into or displayed by the number two Garmin GNS 430.

WRECKAGE AND IMPACT INFORMATION

The accident site was located at coordinates 39 degrees 47.774 minutes North latitude and 086 degrees 19.204 minutes West longitude. The elevation at the site was about 812 feet msl. The airplane was in about 5 - 10 feet of water and the parachute was found deployed. The parachute rocket canister and deployment bag were located about 100 feet behind the airplane.

The engine and propeller remained attached to the fuselage. The firewall was buckled across

its width 2 -3 inches up from the bottom edge where it angles aft at the bevel. The left lower portion of the firewall exhibited a larger amount of damage compared to the right side. The nose landing gear remained attached to the engine mount.

The fuselage floor structure of the airplane was damaged fore and aft of the wing spar. The aft section of the fuselage at approximately the rear seats remained attached to the forward section of the fuselage by floor structure. The air conditioner system switches were found in the "on" position.

The left and right wings exhibited similar damage. There was leading edge buckling from the wing root outboard to the cuffed portion of the wings. There was a 45-degree buckle starting near the outboard flap hinge that extended forward and inboard towards the gas caps. The left and right ailerons remained attached to the wings. Aileron control cable continuity was established. The right and left flaps remained attached to the wings. The flap actuator arm extended from its housing about 2 inches, which is consistent with a flap position of 50 percent. The flap selector switch was found in the 50 percent flap position when the airplane was first recovered from the water. The left and right landing gear remained attached to the wings.

The horizontal stabilizer was intact and remained attached to the empennage. The left and right elevators were attached to the horizontal stabilizer by their respective hinge points. Elevator control continuity was established.

The vertical stabilizer was intact and remained attached to the empennage. The rudder remained attached to the vertical stabilizer at all three-hinge points. The rudder horn was displaced to the left. Rudder control cable continuity was established.

The visual examination of the propeller blades revealed no visible damage to the blades marked A and B. Blade C had span wise scratches on the cambered side of the blade from the tip inboard approximately 5 inches. All three propeller blades remained attached to the hub.

The roll servo was found in a full right wing down position. The autopilot and attitude gyro circuit breakers were found tripped. A FAA avionics inspector conducted a continuity check of the roll trim system. The manual and autopilot trim wiring continuity check was performed and found satisfactory.

FAA inspectors checked the Pitot Static lines to the standby airspeed and standby altimeter instruments. The instruments responded when pressure and vacuum were applied.

National Transportation Safety Board (NTSB) investigators and a representative of Ballistic Recovery System, Inc. (BRS) inspected the CAPS parachute system. The inspection of the rear attachment harness revealed that the rear harness was intact and undamaged. The incremental bridle assembly was intact and unloaded. The line cutters had been fired but no aerodynamic load was present after the time of cut to break the harness stitches that normally

allow the tail of the aircraft to drop. This occurs about 8-9 seconds from system activation. The nose down angle is about 60 degrees prior to the tail dropping. Once the tail drops, the nose down angle is about 10 degrees. The PFD data indicated that the airplane impacted the water about 4 seconds after the system was activated. The altitude at system activation indicated by the PFD data was about 1340 feet msl (528 feet agl).

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy of the pilot was conducted on August 29, 2006, in Indianapolis, Indiana, at the Forensic Pathology Associates on Indiana, LLC. The "Cause of Death" was noted as "Multiple blunt force injuries." A Forensic Toxicology Fatal Accident Report was prepared by the FAA Civil Aeromedical Institute. The results were negative for carbon monoxide, cyanide, and ethanol. Lidocane was present in the blood and liver.

SURVIVAL ASPECTS

The survival factors documentation focused on damage to the aircraft fuselage, damage to the cockpit, condition of the seats, restraints and the airbags that may have affected the passenger's motion or their level of injury. Hospital records and autopsy reports were also reviewed to document the level and extent of occupant injury. Indications of severe vertical loading on the seat pan energy absorbing materials and the non-severe markings of the lap belt webbing indicated a primary impact vector in the vertically downward direction, with significant but minor components in the forward longitudinal and left direction. Injuries to the occupants supported this direction of impact force.

The aircraft was equipped with four seating positions: two in the first row and two in the second row. Four point belts were present for all seating locations. The front passenger seats were also equipped with airbags mounted in the outboard shoulder harnesses.

Seat belt loading marks were documented on all four restraint systems indicating that the restraints were in use at the time of the crash. In addition, loading was documented on all seat pans indicating direction of occupant travel and vertical loading. For the front seats, greater vertical loading of the forward, left quadrant of both seats was noted. The left seat position indicated a more distributed and complete crushing, while the deformation to the right seat position was more localized.

The airbags were located on the outboard shoulder harness for each front seat. Witness marks were not noted on the airbags but differences in loading were documented based on the squaring of the vent holes. (Squaring of the vent holes occurs from fraying of the threads in line with the weave pattern) Two vent holes were present on each airbag facing away from the occupant. The left airbag showed squaring in both the upper and lower vent holes. The right airbag showed squaring in the lower vent hole and slight fraying in the upper vent holes. The amount of squaring indicated that the left airbag achieved higher pressures than the right airbag.

TESTS AND RESEARCH

Aircraft Systems Examinations

The engine was shipped to Teledyne Continental Motors in Mobile, Alabama, and an engine run was conducted under the supervision of the NTSB on November 2, 2006. During the engine run the RPM was advanced in steps for warm-up in preparation for full power operation. The engine was run at 2,100 RPM for 5 minutes, 2,450 RPM for 5 minutes, and at full throttle (2,700 RPM) for 10 minutes. Then the engine was advanced to 2,700 RPM from idle (600 RPM) six times where it performed normally without hesitation or interruption in power. The engine produced rated horsepower during the engine run.

The evidence in the MFD data indicated that the engine was running at full power throughout the flight. The engine RPM and manifold pressure (MAP) recorded on the MFD indicated that the RPM stayed near 2700 RPM and the MAP decreased slowly from 26 inches of Mercury during the climb, suggesting that the throttle remained fully open during the entire flight.

On January 9, 2007, a FAA avionics inspector and a representative of Cirrus Design tested the stall horn and the stall horn pressure switch on the airplane. The stall warning horn tested at 97dbm and an exemplar horn tested at 94dbm. During the examination of the pressure switch, electrical continuity was confirmed and the switch functioned when tested.

During interviews with the NTSB, the passengers reported that they did not recall hearing the stall warning horn, or any other audible warning, during the accident flight. Demonstration flights were flown with NTSB investigators in a SR22 using the same type of BOSE headsets used in the accident airplane. During stall maneuvers, the stall warning horn sounded and could be heard while using the headsets.

The NTSB conducted a Systems investigation of the S-TEC 55X autopilot system. The system's 55X autopilot flight guidance programmer/computer, pitch trim servo, and the altitude transducer were shipped to the manufacturer in Mineral Wells, Texas, for an examination on February 6, 2007. The inspection revealed that the autopilot computer, after being disassembled and cleaned extensively to remove all observed corrosion on the circuit boards, passed all functional tests. The pitch trim motor and pressure transducer were examined and passed their respective functional tests.

On March 14, 2007, the Bendix/King KGP-560 General Aviation Enhanced Ground Proximity Warning System (GA-EGPWS) processor was examined at the Honeywell facility located in Redmond, Washington. The NTSB Systems investigator and a representative from Cirrus Design were participants in the investigation. The flight history data from the GA-EGPWS unit's non-volatile memory was downloaded, analyzed by Honeywell Engineering, and provided to the NTSB. Within the tabular data, the M1SK flag indicated that a "Sink Rate" audio warning had been triggered.

Aircraft Performance Study

The Aircraft Performance Study described the results of using weight and balance information, radar data, PFD and MFD data, Pilot Operating Handbook (POH) information, and flight-test data to define the position of N91MB relative to a reference point throughout the accident flight, and to compare the performance of the airplane during the flight with the nominal performance of the SR22.

The results of the Study showed that N91MB departed EYE weighing about 3,733 pounds, or 333 pounds over the maximum allowable gross weight of 3,400 pounds, and with the CG at FS 148.7 inches, or 0.6 inches aft of the aft limit (FS 148.1 inches). The acceleration and the rate of the climb of N91MB throughout the flight were consistent with the expected flaps-up performance of the SR22 at full power and a gross weight of 3,700 lb. During the final three minutes of the flight, the airplane decelerated from 118 KIAS to about 90 KIAS over about 30 seconds, and then slowly decelerated to about 74 KIAS over about 2 minutes. At about 74 KIAS, the angle of attack of the airplane exceeded the stall angle of attack of the wing, and the airplane banked to the left, and started to descend.

Over the next 25 seconds, the airplane continued to "wallow" in a stalled condition, with erratic oscillations in the pitch and roll angles, and with the descent rate rapidly increasing. Finally, about 15 seconds prior to impact, the airplane entered left spin and continued descending to the ground. About four seconds prior to impact, a large decrease in the longitudinal load factor was recorded, which could be consistent with the deployment of the CAPS parachute.

The performance analysis was focused on the period from about 10:33:55 (shortly after takeoff) to 10:37:45, the time of the abrupt left roll that indicates the airplane's stall. During this time, the Lift Coefficient (CL) and Drag Coefficient (CD) computed based on the recorded PFD and MFD data were consistent with the flaps-up CL and CD based on full-power, flaps-up stall data from a SR22 test airplane. Consequently, the performance of N91MB was as expected for a SR22 flying at flaps-up and at full power. Since the flaps were found at 50 percent in the wreckage, it is likely that the flaps were deployed after the first stall, during the "wallowing" that followed, or during the final spin itself.

Flight tests of a SR22 at the loading condition of N91MB that attempted to duplicate the deceleration and stall scenario of the accident flight indicate that it is always possible to stall the airplane manually, and that the autopilot has sufficient elevator authority to stall the airplane when the commanded rate of climb exceeds the rate of climb the airplane can achieve. The autopilot will not disconnect at the stall warning or stall. On the accident flight, the rate of climb was about 450 ft/min at the time of the stall, or 200 ft/min less than the 650 ft/min set on the autopilot with the VSI bug. However, it cannot be determined conclusively whether or not the accident airplane was under autopilot control at the time of the stall.

In this study, the angle of attack (AOA) for the stall warning to activate was estimated to be

about 13 degrees. The AOA calculation indicated that N91MB likely maintained an AOA in excess of 13 degrees from about 10:36:45 onward, through the stall at about 10:37:45 and the entry into the final spin at 10:38:10. Hence, it was likely that the stall warning horn was active for about a minute before the stall, and for an additional 25 seconds while the airplane was in the stalled condition but had not yet entered the spin.

The lateral load factor and roll angle recorded by the PFD indicated that as N91MB decelerated during the climb, the sideslip angle progressively increased, reaching about 14 degrees at the time of the stall. Flight tests of the SR22 indicate that this relatively large sideslip angle can increase the CD, resulting in a decrement in the rate-of-climb by about 190 ft/min at the best-rate-of-climb airspeeds. Additionally, the air conditioning system (which was found in the "on" condition in the wreckage) will consume 6 horsepower from the engine, reducing the rate-of-climb by another 50 ft/min. Thus, coordinating the airplane with the rudder and turning off the air conditioner would likely have increased the rate of climb by about 240 ft/min.

Furthermore, the study indicated that the extra 300 pounds over the certified maximum takeoff weight reduced the available rate-of-climb at 4,000 feet by about 260 ft/min. Consequently, the combination of the excess weight, uncoordinated flight, and use of the air conditioner reduced the available rate-of-climb by about 500 ft/min from the numbers published in the POH. Nonetheless, the airplane still had adequate climb performance, and even at the accident flight conditions should have been able to maintain a steady-state rate-of-climb of about 900 ft/min at 4,000 feet and 105 KIAS. Reducing the airspeed below the best rate-of-climb speed put the airplane "behind the power curve", decreasing the rate-of-climb further to about 500 ft/min, the rate-of-climb present when the airplane stalled.

The airplane remained in the stalled condition, "wallowing" at high AOA and with erratic pitch and roll rates but still relatively upright, until 10:38:10, when the pitch angle dropped to about -70 degrees and the airplane started spinning to the left. A large and abrupt decrease in longitudinal load factor at about 10:38:22 may be an indication of the CAPS deployment. The data ends at 10:38:26, about four seconds later.

Pilot Information

Certificate:	Private	**Age:**	66,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	June 1, 2005
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 1, 2006
Flight Time:	2570 hours (Total, all aircraft), 365 hours (Total, this make and model), 2566 hours (Pilot In Command, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cirrus	**Registration:**	N91MB
Model/Series:	SR22	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1973
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	June 1, 2006 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	11.6 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	121.3 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550-N
Registered Owner:	Bob Law Air LLC	**Rated Power:**	310 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:	EYE,823 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	10:40 Local	**Direction from Accident Site:**	30°
Lowest Cloud Condition:		**Visibility**	6 miles
Lowest Ceiling:	Overcast / 600 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.88 inches Hg	**Temperature/Dew Point:**	23°C / 22°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Indianapolis , IN (EYE)	**Type of Flight Plan Filed:**	IFR
Destination:	Hilton Head, SC (HDX)	**Type of Clearance:**	IFR
Departure Time:	10:34 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	3 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 3 Serious	**Latitude, Longitude:**	39.77,-86.319442

Administrative Information

Investigator In Charge (IIC):	Silliman, James
Additional Participating Persons:	Jose Berrios; FAA-Indianapolis FSDO; Indianapolis, IN Brad Miller; Cirrus Design Corporation; Duluth, MN Josh Cawthra; Teledyne Continental Motors; Mobile, AL Dave Spangler; BRS; St. Paul, MN Thomas Barth; AMSAFE; Mesa, AR Fred Barber; Avidyne; Lincoln, MA
Original Publish Date:	August 15, 2008
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=64419