National Transportation Safety Board
Aviation Accident Final Report

Location:	DULUTH, MN	**Accident Number:**	CHI99FA112
Date & Time:	03/23/1999, 1328 CST	**Registration:**	N115CD
Aircraft:	Cirrus Design Corp. SR20	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General Aviation -		

Analysis

The experimental airplane was on a test flight when it impacted terrain following an emergency landing attempt. The airplane was certified as an experimental airplane for crew training. The airplane's aileron spring cartridge and rudder-aileron interconnect had been removed for the test flight. The airplane was loaded with ballast to provide an aft center of gravity with stall tufts attached to both wings. During the test flight, the company test pilot declared an emergency and reported a flight control problem while maneuvering. Radar data indicates that 10 seconds prior to the declaration of an emergency by the test pilot, the aircraft was in a stall phase of flight. Postaccident inspection revealed that the right aileron exhibited evidence of jamming with its wing cove/skin. In postaccident testing of a similar SR20, a manual input pilot force was applied to the side yoke control by a Cirrus Design Corporation (CDC) test pilot. A maximum load of 85 pounds was achieved by the test pilot by leaning forward and applying both hands on the side yoke control. The control input could not be held indefinitely due to muscle fatigue. During the control input, the right aileron was deflected 11 degrees with the left aileron clamped at the inboard rib. CDC test pilots were not graduates of civilian or military flight test schools. The test pilot was not equipped with a personal parachute. A gusting crosswind of approximately 16 knots was present on the selected landing runway. The airplane's maximum demonstrated crosswind component was 19 knots. All runways were available at the time of the accident. CDC was not monitoring radio communications with the accident pilot during the test flight.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the lack of sufficient aileron-to-wing gap clearance design. Contributing factors were the inadequate oversight of the Federal Aviation Administration of the design and manufacturing and flight test process of Cirrus Design Corporation, the location of the control yoke, the inadequate surveillance of the test flight and the test flight procedures by the Cirrus Design Corporation. The destabilizing crosswind condition that existed on the landing runway was an additional factor.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: MANEUVERING

Findings
1. (C) FLIGHT CONTROL SYSTEM - CLEARANCE
2. (C) FACILITY,INADEQUATE DESIGN - MANUFACTURER
3. (F) INADEQUATE CERTIFICATION/APPROVAL,AIRCRAFT - FAA(ORGANIZATION)
4. (F) FLT CONTROL SYST,YOKE/CONTROL STICK - OTHER
5. (F) INADEQUATE SURVEILLANCE,INADEQUATE PROCEDURE - COMPANY/OPERATOR MGMT
6. MISC EQPT/FURNISHINGS,PARACHUTE/DRAG CHUTE - NOT INSTALLED

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: LANDING

Findings
7. (F) WEATHER CONDITION - CROSSWIND

Occurrence #3: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: GO-AROUND (VFR)

Findings
8. WEATHER CONDITION - CROSSWIND

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

HISTORY OF FLIGHT

On March 23, 1999, at 1328 central standard time, a Cirrus Design SR20, N115CD, operated by the Cirrus Design Corporation (CDC), was destroyed on impact with terrain following an emergency landing attempt on runway 27 (10,152 feet by 150 feet, dry concrete) at Duluth International Airport (DLH), Duluth, Minnesota. Prior to the landing attempt, the pilot had declared an emergency and reported a flight control problem while maneuvering. Visual meteorological conditions prevailed at the time of the accident. The 14 CFR Part 91 local test flight was not operating on a flight plan. A company test pilot, the sole occupant, was fatally injured. The flight originated from DLH at 1312.

At 1312:17, the Duluth Air Traffic Control Tower, Local Control (LC), transmitted, "cirrus one one five charlie delta duluth tower runway two seven you're cleared for take off right turn north bound approved the wind three two zero at one three".

The National Transportation Safety Board's (NTSB's) Recorded Radar and Aircraft Performance Study which is included in this report, indicates that N115CD climbed to an altitude of 6,500 feet msl at 1320:27, descended to an altitude of 6,300 feet msl at 1320:51, and returned to an altitude of 6,500 feet msl at 1321:15 which was then followed by a continued descent. At approximately 1322:10, the radar data shows a deceleration of airspeed to 52 knots which was then followed by a continued increase. According to CDC representatives, the typical scenario during stall testing would be to accomplish "aileron maneuvers" to determine hinge moments by first "tracing back and forth" prior to entering the stall series, which would be performed at a minimum altitude of 6,000-6,500 feet. Also, deep stall testing involves aggressively and repeatedly moving the control yoke left and right during the stall to characterize the SR20's deep stall roll stability.

At 1322:20, N115CD, transmitted, "---ah tower cirrus one one five charlie delta emergency aircraft about five miles north of the field." Radar data indicates that N115CD was at an approximate altitude of 5,000 feet msl, 167 knots airspeed, and 155 knot ground speed.

At 1323:46, N115CD, transmitted, "loud and clear emergency aircraft two miles north of the field flight control problems i'll be turning in bound trying to land on two seven."

At 1327:23, N115CD, transmitted, "--- --- cirrus one one five (keyed mike)." There were no additional transmissions by N115CD.

In a written statement, the executive vice president of CDC reported the following: "The morning of March 23, after what I believe was the first flight of the day, I had told both flight OPS [operations] and the flight maintenance crew that I wanted the squawks to be taken care of as quickly as possible between flight hops. The first concern that I wanted taken care of was the fact that our ailerons were heavy and that the autopilot could not overcome the friction and turn the airplane, I talked to [the accident pilot] and flight maintenance and had them remove the spring cartridge and the rudder aileron interconnect from the aileron control system. What we were looking for was isolating the problem from an aerodynamic problem or a rigging problem. After lunch I returned at about 12:30 PM and the airplane was outside with [maintenance] going over the logbook with [the accident pilot]. I felt, and believe [the accident pilot] also felt that this was a very routine flight. After [the accident pilot] had taxied away I got into the 182 to go for a short flight around the area. I was taxiing out to runway 27 when [the accident pilot] had flown by. The take off and climb out appeared normal. I took off and flew north over Fish and Island lakes. I was just north of Boulder Lake when I [heard the accident pilot] call and declare [an] emergency. He stated he was five miles north and had a control problem. I turned back to the airport. When [the accident pilot] made his second call I was just north of Rice and he called two miles north. I couldn't see [the accident pilot] but I called him to tell him I was just north of his position if he needed me to come in and take a look at the airplane. He did not answer. The tower did not answer. The tower stated that [the accident pilot] was turning final. I stayed just north of the pattern until the tower stated to the ground units that he had gone down in the prison. I then flew over the prison as the ground safety crew was approaching the sight. I did not see the plane as I flew over. I then circled to land..."

A witness reported seeing the airplane overshoot runway 27, track along taxiway A, and enter into a steep bank returning to runway 27. The airplane began tracking over runway 27 at an altitude of 5-15 feet above the runway with its nose yawed approximately 20 degrees to the right. The witness stated the aircraft performed a go-around at the midfield position and made a left 70 degree turn with a bank angle of about 90 degrees, when the airplane's nose sliced down about 20-40 degrees.

A second witness located at the U.S. Department of Justice Federal Prison camp, reported the following in a written statement: "On Tuesday, March 23, 1999, at 1:29 pm, I was standing outside the administrative building when I heard a planes engine throttle up to what appeared to be full power. I observed the white plane appear from behind the airport hangers at an approximately 60 degree angle upward. After the plane reached approximately 400-500 feet, the plane leveled his lift and appeared to wobble sideways. The wind appeared to have been a factor and the plane started to bank toward the left. The plane appeared to be maintaining his altitude still in a hard bank to the left, with the engine running at a lower speed. Once the plane appeared to have been over Dorm 211, the planes pitch changed to a steeper decline or nose dive toward the ground, still with the left wing tilting downward. The plane appeared that it would reach the point of impact behind the administrative building or possibly the adjacent parking lot. I immediately began running toward the rear of the building when I lost sight of the plane for approximately 5 seconds. I did not see the point of impact but heard the plane crash into the ground. When I turned the corner of the building, I observed the plane had struck the ground near the Special Housing Unit and slid striking the handicap railing on the walkway leading into the Health Service Unit, then came to rest against the far side of the building..."

PERSONNEL INFORMATION

The 33 year old pilot was hired by CDC, on June 6, 1996, as the Director of Flight Operations. During his employment at CDC, he served as a flight test pilot during initial and final test phase of the SR20's development and production. The pilot also held an airline transport pilot certificate with a multiengine land rating and a commercial pilot certificate with single engine land and sea ratings. He received a second class medical certificate on July 16, 1998 with no limitations. Federal Aviation Administration (FAA) records indicate that the pilot was involved in a general aviation accident on May 21, 1990 and a general aviation incident on May 20, 1998. He accumulated a total time of 1,311 hours as a United States Air Force Pilot (Air National Guard) and had last flown an F16 on March 19, 1999. CDC reported that the pilot accumulated a total flight time of 741.8 hours in the SR20. No records received indicated the pilot had any formal training as a test pilot.

AIRCRAFT INFORMATION

N115CD, a CDC SR20, serial number 1001, was a four-place single engine airplane powered by a six-cylinder, 200-horsepower, Teledyne Continental Motors model IO-360-ES(6), serial number 357110, with a three-bladed Hartzell constant speed propeller, serial number JC2A. N115CD was issued an experimental airworthiness certificate for crew training on March 22, 1999. The aircraft had been flown on three flights preceding the accident for a total flight time of 5.1 hours. The total airframe time at the time of the accident was 5.4 hours.

The SR20 utilizes conventional flight controls for aileron (roll axis), elevator (pitch axis), and rudder (yaw axis). The control surfaces are pilot-controlled through either of two single-handed side control yokes mounted beneath the instrument panel, and rudder pedals. The control system utilizes a combination of push rods, cables, bell cranks, and spring cartridges for control of the surfaces. Roll trim and pitch trim are available through an electric button on the tip of each "side stick" control yoke; however, the roll trim cartridge which is connected to the roll trim actuator had been disconnected on the accident airplane just prior to the accident flight. A bungee rudder-aileron interconnect is installed in SR20 aircraft to meet FAR (Federal Aviation Regulation) Part 23 certification requirements for lateral stability.

The rudder-aileron interconnect provides a minimum of five degrees down aileron with full rudder deflection. Right rudder input will cause right roll input and left rudder input will cause left roll input. With neutral aileron trim, aileron inputs will not cause rudder deflection. The interconnect is a bungee cord that transmits control loads from the aileron cables to the rudder cables after a certain amount of stretch is achieved.

The SR20's operating speeds are listed in section 2 of the Pilot's Operating Handbook (POH). The full flap operating range is 56-100 KIAS, the normal operating range is 65-165 KIAS, the caution range is 165-200 KIAS and the never exceed speed (Vne) is 200 KIAS.

Weight and balance information for the accident flight was reported by CDC as having a gross weight of 2,900 lbs and a center of gravity of 31.50 inches. The corresponding center of gravity range for a weight range of 2,871-3,045 lbs was 30.19-32.81 inches. The calculations were performed using a pilot weight of 210 lbs, 60 gallons of 100 low lead (100LL) aviation fuel for a fuel weight of 352.2 lbs, and 380 lbs of ballast, which consisted of lead shot.

POH Figure 5-8, Wind Components, depicts the wind components versus crosswind component and is included in this report. Using an "angle between wind direction and flight path" of 70 degrees and a wind gust velocity of 17 knots, the corresponding crosswind component is approximately 16 knots. The SR20 POH lists the maximum demonstrated crosswind component for the aircraft as 19 knots.

METEOROLOGICAL INFORMATION

The DLH automated surface observing system reported, at 1356:26, wind from 340 degrees at 11 knots, gusting 17 knots; 10 statue miles visibility; clear sky conditions; temperature of 2 degrees C and a dewpoint of -8 degrees C; an altimeter setting of 29.91 inches of mercury.

AIRPORT INFORMATION

DLH is served by runway 09-27 (10,152 feet by 150 feet, grooved concrete) and runway 03-21 (5,699 feet by 150 feet, grooved asphalt). The results of an airport inspection following the accident were reported as clean and dry.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted an asphalt street within the confines of the U.S. Department of Justice Federal Prison camp located on the southern perimeter of DLH. The coordinates of the main wreckage were: latitude 046 degrees, 50.091 minutes N; longitude 092 degrees, 11.973 minutes W (refer to attachment B of the Airworthiness Group Chairman's Factual Report for a wreckage distribution diagram). No evidence of fire or in-flight structural failure was noted.

A white paint scrape mark was found at the northern portion of the wreckage distribution path. The color of the scraping was similar to that of the left wing and belly of the airplane. The scrape mark was approximately 15 inches wide, 31 feet in length, and oriented along a magnetic bearing of 182 degrees. Striations of paint marks were found inside of the scrape mark and were oriented along a magnetic bearing of about 160 degrees.

These scrape marks terminated with two slash marks in the asphalt that were about 3/4-inch in depth. The first slash mark was 24 inches in length. The second slash mark was 15 inches in length and began about 15 inches forward, along the wreckage distribution path, from the beginning of the first slash mark. Pieces of propeller blade were found imbedded in a building wall located immediately to the east of the slash marks. The magnetic bearing perpendicular to the slash marks was found to be 170 degrees.

Forward of these slash marks was a larger ground scar on the grass that was oriented along a magnetic bearing of 154 degrees. Adjacent to the slash mark, and about 4 feet to the west of it, a gouge was found, followed by rubber marks and primer paint that was consistent with the right main landing gear. Grass scarring was found in this area and ran parallel to a wider area of grass scarring, both of which were oriented along a bearing 154 degrees magnetic.

A walkway with black steel railings was found about 75 feet downrange from the curb/grass boundary and was oriented nearly perpendicular to the wreckage distribution path. The steel railings on either side of the walkway were separated from the ground and deformed. The main ground scar ran the entire length of the curb-to-walkway distance. Laying amongst the deformed railing were damaged sections of the outboard right wing. The right aileron and right wing tip were also found in this area. The oil filter, a nose landing gear shock absorption puck, and exhaust tailpipe, and the exhaust attach springs were found near the eastern edge of the walkway (towards the adjacent building) and were embedded in a snowbank.

The main body of the airplane wreckage was located about 100 feet to the south of a white paint scraping at the northern edge of the wreckage distribution path. The main body of the airplane wreckage included the engine, cabin area, and empennage. The magnetic bearing of the longitudinal axis, from tail to nose, of the airplane was 163 degrees. The nose gear tire was found about 75 feet further down range where it lay next to a parked automobile that had a shattered windshield and damaged roof.

The aircraft engine remained attached to the airframe and was found folded aft and to the left side of the airframe. The linkages for the propeller governor and the mixture control were continuous from the engine to the cockpit. Liquid, consistent with 100LL aviation fuel, was found in the fuel lines leading to the engine-driven fuel pump and in the return lines.

A compression check revealed that all six cylinders exhibited compression when the propeller was rotated. The propeller was rotated by hand and engine continuity was established. Oil was found in the engine. Liquid, consistent with 100LL aviation fuel was found in the gascolator. The electrically-driven fuel boost pump was removed by investigators and functionally tested to be operable. Both magnetos were rotated by hand and electrical continuity through the ignition harness was established.

The propeller remained attached to the engine. Blade "A", serial number J1826-7, exhibited nicks on its leading edge beginning from the tip and continuing inboard for about 20 inches. Chordwise scratches were also found along the blade, and the outboard portion of the blade was curled forward beginning at a point located about 18 inches inboard of the tip. Blade "B", serial number J1826-6, also exhibited nicks on its leading edge beginning from the tip and continuing inboard about 12 inches. Chordwise scratches were found along the entire span of the blade, and the blade tip was curled forward beginning at a point located about 5 inches inboard of the tip. Blade "C", serial number unknown, separated at a point located approximately 5 inches from the hub and was found with the main wreckage. The separated blade exhibited leading edge gouging and curling.

The fuselage was found in one piece, and was severely damaged with disbonding in a majority of the bondlines. The cockpit roof and front windshield were cut away by rescue personnel in order to extract the pilot. The forward floor area was crushed.

The left wing was fragmented and the right wing remained attached to the fuselage. All major portions of the wing were found in the immediate vicinity of the wreckage. Inspections of the major bondlines exhibited evidence of either resin transfer from the structure's surface or cohesive fracturing of the adhesive. The left wing was separated from the main spar. The left wing rear spar was broken in numerous locations. The inboard section, from the wing root to the inboard rib of the fuel tank, remained attached to the left main landing gear structure. The upper left wing skin was found in one piece near the sidewalk handrail and exhibited deformation in the aft direction. The outboard and mid-span lower left wing skins were found at the east end of the railing. A portion of the lower wing skin, located inboard of the fuel tank, was found attached to the inboard portion of the left aft spar. Red yarn tufts were found attached to the wing's upper surface.

The right wing was found in two pieces. The wing was severed outboard of the trailing edge flap. The inboard portion of the wing remained attached to the fuselage. The right wing exhibited less damage than the left wing. The section of the wing just outboard of where the aileron begins was found near the western end of the walkway/handrail area. This section included the wing skins, aileron, wing tip, and leading edge cuff. The outboard flap hinge was separated from the flap and remained attached to the wing. The leading edges of the wing exhibited impact marks that had similar spacing as the distance between the handrailing structure. Red yarn tufts were found attached to the wing's upper surface.

Examination of the trailing edge of the right wing structure and the leading edge of the right aileron revealed scratch and rub marks on the upper surface of the right wing skin near the mating area of the right aileron. Corresponding marks were found on the leading edge of the right aileron. These pieces were sent to the NTSB's Materials Laboratory for additional examination.

The empennage remained mostly intact. The bottom of the fuselage, near the rear wing attach point, was separated with the entire tail bent in the downward direction. The lower bond line between the left and right fuselage halves was disbonded. All of the bulkheads in the empennage were intact but disbonded from the fuselage skins. The forward portion of the empennage exhibited evidence of a compressive fracturing on the upper surface just forward of the horizontal stabilizer. The horizontal and vertical stabilizers were intact. Scratch marks were found on the bottom of the tail, and the tail tie-down ring was broken off in the same direction.

Damage to the left elevator was more severe than the right elevator. The left elevator mass balance was found intact and bolted to the elevator horn structure. The left elevator hinges were found intact with all cotter pins in place. The elevator was found capable of rotation. The left elevator torque tube failed in shear at the inboard rib attachment. The outboard torque tube attachment was partially detached and was missing one rivet.

The right elevator mass balance was attached to the elevator horn structure. The right elevator hinges were intact with all of its respective cotter pins. The elevator was capable of rotation. No evidence of contact between the leading edge of the elevator skin and the trailing edge of the stabilizer was found. The right elevator torque tube was intact.

The elevator torque tubes were found attached to the elevator bellcrank. The bellcrank was capable of rotation. The empennage actuation pulley gang and pitch trim motor assembly were mounted to the bulkhead at fuselage station (FS) 306, located below the horizontal stabilizer. The pulley gang was intact and no deformation was noted. The elevator actuation pulley was intact and free to rotate. All required safety wires were in place. All push/pull rods and rod ends were properly bolted in place. All rod ends were free to rotate. All cable retainers were in place. Elevator cable continuity was established forward to the pulley gang located at Bulkhead FS186.

The bottom portion of the elevator actuation pulley exhibited a score mark. According to technical data provided by CDC, the mark was consistent with an elevator position of approximately neutral.

The pulley gang at Bulkhead FS186 consisted of four phenolic pulleys, two each for rudder and elevator control cables. The elevator pulleys could freely rotate. All cable retainers were properly attached with cables properly routed. The cable retainers and pulleys exhibited evidence of ground impact. The pulley gang was found directly above the fuselage seam, which was split. The turnbuckles had lock wire, and the Nico press swages on thimbles were intact. Cable continuity was established from the empennage to the spar tunnel.

Cable continuity from the forward console pulley gang aft through the spar tunnel was established. The cables were observed from the left side of the aircraft through the spar tunnel. Elevator pulleys on the forward console pulley gang could rotate. Cable continuity was established from the forward console pulley gang forward to the elevator pulley sectors. The cable was attached to the sector. Elevator control continuity was established from the elevator pulley sectors through the forward elevator torque tube to the push/pull rods attaching to the left and right control yokes. All rod ends were free to rotate. Both the left and right yoke tubes were found captured between the v-groove bearings as designed. The v-groove bearings were free to rotate. The yoke grips were attached to the yoke tubes. The aft adjustable elevator stop on the control yokes was not in place on either yoke assembly.

The pitch trim cartridge was attached to the elevator bellcrank, and the pitch trim motor was mounted on Bulkhead FS306 located under the horizontal stabilizer. The pitch trim cartridge was found intact and functional. The trim motor was found in the full aircraft nose-down trim position. CDC reported that if the conical trim switch located on the top of the control yoke is depressed and held in the forward position, the trim motor will run to the full nose-down position. Both the nose-down and nose-up limit switches were shattered; however, the trim motor limit switch arm was not contacting the physical stops. The trim motor limit switch arm was stopped at the limit switch.

The movement of the SR20 about the roll axis is controlled via the ailerons. The ailerons are of conventional design with skin, spar and ribs manufactured of aluminum. The leading edges of the ailerons are "open" or "slotted." Each aileron is attached to the wing shear web at two hinge points at the inboard and outboard ends of the aileron. Aileron control motion is generated through the pilot's control yokes by rotating the yokes in pivoting bearing carriages. Push rods link the pivoting carriages to a centrally located pulley sector. A single cable system runs from the sector to beneath the cabin floor and aft of the rear spar. From there, the cables are routed in each wing to a vertical sector/crank arm that rotates the aileron through a right angle conical drive arm.

An electric motor changes the neutral position of a spring cartridge attached to the left actuation pulley in the wing. A conical trim button located on top of each control yoke controls the motor. Moving the switch left will initiate left-wing-down trim. Moving the switch right will initiate right-wing-down trim. The aileron trim also provides a secondary means of aircraft roll control in the event of a failure in the primary roll control system not involving jammed ailerons. The roll trim cartridge, which connects to the roll trim actuator, was removed from the accident airplane prior to the accident flight.

The left aileron was found lying on the ground under the left elevator. The left forward leading edge corner exhibited impact damage. A puncture consistent in shape of the sidewalk railing was found on the lower left aileron surface about 12 inches from the outboard rib. The inboard aileron hinges were examined and met engineering geometric requirements.

The left aileron actuation arm pin was found separated at the thread, and the thread contained severe bending deformation and its fracture exhibited features consistent with overstress separation. The jamnut for the pin was still safetied and the actuation arm could be moved. (Tests performed by CDC and reviewed by the NTSB show that pilot input loads were not sufficient to shear the pin, and that the forces required to shear the pin were consistent with impact.) The bolt retaining the actuation arm was safetied. The inner race of both the inboard and outboard hinges were pulled out of the bearings and were still bolted to the surface. Safety wire was found with the hinge bolts. The hinges and aileron actuation pulley assemblies were found intact at the outboard flap hinge/inboard aileron hinge. The outboard flap hinge was bent inboard. No gouge marks, evidence of cable fouling, or damage to the attached pulleys were observed.

The left aileron actuation pulley was jammed in a left aileron trailing edge-up condition. The actuation pulley bracket was bent aft. The control stops, which are normally threaded into the pulley bracket, were also bent aft. The pulley was jammed under the lower control stop and to the point where the actuation arm pin entered a spherical bearing on the actuation pulley. Witness marks of the stops were observed on the spherical bearing mount in both up and down directions at positions that were beyond nominal rotation of the pulley.

The left aileron actuation pulley flange was bent aft over the cable ball swage. The left aileron cable was intact and safetied to the pulley. The left aileron cable was found wrapped around the left main landing gear.

Left aileron cable continuity was established from the actuation pulley in the wing to the "interconnect" area in the cabin. The cable was smooth from aileron actuation pulley through step closeout. No evidence of cable fouling was observed.

The right aileron hinge bolts were found in place. The inner races of the hinge bearings were present with the bolts, and the bolts had safety wire installed on them. The right aileron actuation arm pin was intact.

Right aileron cable continuity was established from the actuation pulley in the wing to the "interconnect" area in the cabin. The cable was smooth from aileron actuation pulley through the step closeout. No evidence of cable fouling was observed.

The cabin area of the aileron control system consists of kick-out and cross-over cables, pulleys, turnbuckles, and the aileron/rudder interconnect. All kick-out and cross-over pulleys were free to rotate and cables were routed properly. All brackets appeared intact with little to no deformation. Cable continuity was established from the aileron actuation pulley to the cabin and up to the spar tunnel (forward of the interconnect). The aileron turnbuckles were found intact and with lock wire properly installed. The Nico press thimbles were intact.

Aileron cable continuity from the forward console pulley gang aft through the spar tunnel was established. Aileron pulleys on the forward console pulley gang could be rotated. Cable continuity was established from the forward console pulley gang forward to the aileron actuation pulley on the console. The cable was on and safetied to the pulley.

The aileron cables were smooth from the forward pulley gang to the console actuation pulley. The console actuation pulley was free to rotate. Push/pull rods connecting the console actuation pulley and the control yokes were intact and properly bolted in place. All rod ends were free to rotate. Both the left and right yoke tubes were observed to be captured between the v-groove bearings as designed. The control yoke pivot points (rod ends) and their attachment to the outboard console ribs were found properly bolted and free to rotate. The yoke grips were found attached to the yoke tubes. A left roll witness mark was found on both sides of the bolster.

The roll trim cartridge was removed from the accident airplane prior to the final flight. All items removed from the aircraft were accounted for by investigators, including the trim cartridge and all attaching nuts, bolts, and washers. The roll trim motor was found properly attached to the left rear spar element located near the lower sidewalk.

The roll trim motor was found in the right roll position. (When the conical trim switch located on the top of the control yoke is depressed and held toward the right, the trim motor will run to the full right-roll position.)

The upper rudder hinge exhibited evidence of hinge clip yielding due to axial load. The rudder skin buckling near the hinge was consistent with impact loads on the mass balance in the rudder horn. The mid-span rudder hinge was intact and exhibited minor deformation. The lower rudder hinge was intact and exhibited evidence of hinge clip yielding due to axial loading. All bolts, rod ends, and cotter keys were intact. The aft tie-down, which is normally bolted at the bottom end of the vertical stabilizer aft shearweb, was folded 90 degrees aft.

The lower rudder hinge was also the attach point for the rudder actuation push/pull rod. The push/pull rod was attached. All bolts, rod ends, and cotter keys were intact. The rod ends were free to rotate.

The empennage actuation pulley gang was mounted to Bulkhead FS306, located below the horizontal stabilizer. The pulley gang was observed to be intact and no deformation was observed. The rudder actuation pulley was intact and free to rotate. All required safety wires were in place. All push/pull rods and rod ends were properly bolted in place. The rod ends were free to rotate. All cable retainers were found in place. Rudder cable continuity was established forward to the pulley gang located at Bulkhead FS186.

A witness mark on the rudder pulley from the push/pull rod jam nut was noted. The position of the witness mark correlated to a rudder deflection of approximately 13-15 degrees right rudder.

Rudder cable continuity was established.

The flap switch in the cockpit was found in the fully-extended flap position.

The throttle and mixture controls were found in the full forward position.

The pilot seat was found attached to the spar tunnel. The seat was locked into the most upright position. No other seats were installed in the aircraft. The seat belts were intact except for the right shoulder harness that was cut during the pilot extraction. The inertial reel lock was operational. The left side seat position pin was engaged and was bent in the forward direction. The front left side of the seat structure or pan was deformed downward. The majority of the energy absorbing material in the front left side of the seat pan was fully crushed. The rear right side was predominantly not crushed.

The pilot was not equipped with a personal parachute, and no parachutes were found in the wreckage.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was conducted by the Department of Pathology and Medical Services of St. Luke's Hospital and Regional Trauma Center, Duluth, Minnesota, on March 24, 1999.

FAA toxicological test results reported 3 (ug/ml, ug/g) Lidocaine.

TESTS AND RESEARCH

As the aircraft rolled off the assembly line, it was prepared for its first flight test, which occurred on March 22, 1999. According to the Chief Engineer of CDC (statement attached), who was involved in the first production test flights, the pilot reported that the rudder/aileron interconnect "seemed to be engaging too early causing heavy aileron feel" after the first flight, and that the pilot instructed the ground crew to "make the proper corrections before the next flight." The engineer also reported that the pilot was performing deep stalls, and that the airplane did not enter the deep stall condition in the same manner as the certification flight test. The chief engineer suggested that the stall tests be repeated with tufts on the wings to see if the airflow separation progression was the same as the certification flight test.

The second flight of the accident airplane was flown by the accident pilot on the evening on March 22, 2000, and the pilot reported ailerons are still "heavy", despite the "change to the rudder/aileron interconnect." The pilot also reported that the airplane "wanted to enter the stall condition around 1/4-1/2 a ball out of center." This was reported to the chief engineer on the morning of the accident, March 23, at which time the chief engineer suggested removing the spring cartridge to further quantify the aerodynamic hinge moment contribution to the "heavy" ailerons.

The third flight occurred on the morning of March 23, 2000, by another company test pilot. When the accident airplane returned from this flight, the chief engineer stated that he informally measured the wings using templates to see if they are symmetrical, and they were. He stated that as he did this, the ground crew indicated that the rudder was out of trim and had been corrected. He also observed the ground crew remove the aileron spring cartridge. The rudder-aileron interconnect was also disconnected at this time. He stated that he did not "actively follow their progress, but I did note that both wing tips had been removed."

The fourth flight of the accident airplane was the second flight of the day and departed at 1312. The purpose of the flight was to further evaluate the "heaviness" of the aileron and the deep stall characteristics after correcting the rudder trim rigging. It was during this flight that the accident occurred.

According to the manager of the Chicago Aircraft Certification Office (ACO), all flight operating limitations of the experimental certificate of the accident airplane were being complied with during the flights; however, the FAA was never informed nor was aware that the spring cartridge and rudder-aileron interconnect were removed from the aircraft.

According to CDC representatives, the prototype SR20 aircraft had been successfully flown "many times" during the type certification process without the aileron spring cartridge and aileron-rudder interconnect installed.

Postaccident Ground Testing

During the 60-day period following the accident, CDC conducted 12 ground tests related to the flight control system (excerpts of pertinent tests attached). Some of the tests that addressed the roll axis were witnessed by an FAA engineer. The results of these test were reviewed by the NTSB.

One of the ground tests involved aileron operation under induced positive wing bending loads. The test was performed on two SR20 airplanes that were assembled about the same time as the accident airplane. Prior to the tests, with no load applied, CDC verified that the aileron-to-cove gaps were within nominal specifications (0.050 inch to 0.130 inch). CDC recorded that the initial gap at the upper skin overhang ranged from 0.055 inch to 0.120 inch. While under 50 percent of ultimate wing deflection, the minimum upper skin overhang gap was reduced to 0.005 inch. While under 100 percent of ultimate wing deflection, with no load on the aileron and the aileron deflected leading edge full up, interference was encountered between the aileron leading edge and the upper skin overhang. When the aileron was deflected leading edge upward with hand forces in the ultimate load condition, the free leading edge skin of the aileron became latched over the upper skin overhang. The location of the latching was at the aileron inboard middle leading edge rib where the initial clearance was minimum at 0.055 inch, and the latching area was about one inch wide.

When this same test was applied to another SR20 airplane, the latch width was estimated to be about four inches, and the aileron surface did not free itself when the hand forces to the aileron were relieved. These tests revealed that it is possible for the slotted leading edge of the aileron to become jammed against the upper surface of the mating wing when the aileron is deflected leading edge upward with hand forces simulating surface loading and the wing is flexed upward to simulate wing deflection under ultimate load.

Another test revealed that limit pilot input load application to the ailerons during similar surface jams show about four to five degrees surface deflection on the opposite aileron due to cable stretch.

A third test was conducted to determine the maximum amount of opposite aileron authority available due to cable stretch with one surface jammed. A manual pilot input force was applied to the side stick controller. A maximum load of 85 pounds was achieved by a CDC test pilot, and could not be held indefinitely due to muscle fatigue reported by the test pilot. During the application of this load, the yoke was fully deflected to the right roll control carriage stops. Cable stretch in the system resulted in approximately 11 degrees of right aileron deflection with the left aileron clamped at the inboard rib. When the load was released, the yoke did not return to its original position due to permanent set. At a neutral aileron position, the side stick controls were oriented 45 degrees towards the inboard direction.

Metallurgical Examination of Wing and Aileron Components

Stereomicroscopic examination of the right wing (Materials Laboratory report attached) revealed the upper skin contained a narrow band mark at the trailing edge. This band measured approximately 0.13 inch chordwise and 3 inches spanwise.

Diagonal gouge marks that were oriented parallel to each other were found within the band mark. Each individual gouge mark was deeper at the trailing edge compared to the forward end. A paint chip had separated from the upper skin in the area. The forward edge of the narrow band mark intersected the forward portion of the chipped paint area. The small portion of the leading edge of the band mark that was located adjacent to the chipped paint area contained a spanwise impression.

Chips of paint had separated from the trailing edges in other areas of the upper skin from the right wing, exposing the glass/epoxy matrix composite structure. The paint chips had separated from the upper skin in seven areas. The spanwise width of the areas on the upper skin where paint chips had separated measured approximately 0.3, 0.5, 0.7, 0.1, 0.5, 0.3, and 0.8 inches, outboard to inboard, respectively. The trailing edge of the upper skin in areas that corresponded to the chipped paint regions exhibited a feathered texture compared to the undamaged manufactured edges. Feathered texture indicates that the individual glass fibers separated from the epoxy matrix and were randomly oriented.

Another area was found at the aft edge from the right wing where paint had separated from the upper skin. A black deposit was found on the trailing edge of the skin. A sample of this deposit was removed from the trailing edge with carbon backing tape. X-ray energy dispersive spectrographic (EDS) analysis of this deposit produced peaks of lead.

No feathered texture damage was found on the trailing edge of the lower skin of the right wing and the trailing edges of the left wing.

Examination of right aileron assembly also revealed chips of paint had peeled away from the leading edges of the upper skin in the areas that corresponded to chipped paint areas and gouge mark area on the trailing edge of the upper skin of the right wing.

The exterior surface of the cove for the wings was coated with white paint. Examination of the left wing revealed the inboard end of the cove contained abrasion damage in the area indicated. The abrasion damaged area measured approximately one inch square, and contained vertical gouge marks. No gouge marks or mechanical damage was noted on the corresponding leading edge of the aileron assembly.

Various pieces of the wing structure separated between the adhesive and the composite. Separated fragments of the composite plies were found adhered to the adhesive.

Evolution of the Aileron Design

A review of technical specifications (attached), certification test reports, and interviews with CDC and FAA personnel, revealed that the original SR20 design specified a minimum gap of 0.050 inches between the projected leading edge of the aileron and the mating wing structural assembly, or "cove". According to CDC, the relatively small gap provided lower drag and a reduction in roll forces. Additionally, CDC elected to design the aileron with an open leading edge, or slot, along its entire span to allow easier access for riveting.

Although the accident airplane and its predecessors were designed and manufactured with this minimum gap specification and open leading edge in existence, it was the first to incorporate additional changes to the ailerons and wings (detailed drawings attached). One of these changes was to eliminate an integral composite wing cove and replace with a separate cove piece that was adjustable and removable for better access to internal wing components. The change involved the use of a different wing mold, which slightly altered the profile of the upper wing cove area. The profile change created a decrease in the aileron-to-wing gap when the aileron leading edge was deflected upward. Additionally, CDC elected to incorporate an upper wing skin "overhang" that partially covered the wing cove gap and provided increased aileron effectiveness in stall. This overhang caused the trailing edge of the wing to be in close proximity to the open leading edge of the aileron when the aileron leading edge was deflected upward thus creating an additional decrease in the aileron-to-wing gap, and another critical gap to be controlled.

CDC stated that no jams were encountered during any of the certification static and flight tests that were performed on previous SR20 airplane, and the increased potential for interference, due to the extension of the wing trailing edge aft of the cove, between the aileron and adjacent wing structure was not considered during the design changes and production planning.

The specification that was effective at the time the accident airplane was designed and built was "Cirrus Specification 90027: Requirements for Aerodynamic Surfaces, revision A", dated April 4, 1998 (excerpts attached). The specification stated that "Aileron gap...shall be within .050 to .130 [inches] over full control surface travel." In the associated figure, dimension "A" was depicted from the cove to a closed leading edge of the aileron. This figure differed from the actual aileron, which had an open leading edge. No verbiage was found in the specification to describe how to accurately measure this distance.

A review of the drawings that were used by the production personnel to build the accident airplane revealed that the only mention of the specification was in the top-level detailed design drawing for the wing structure. No reference to the spec was found on any of the lower detail assembly drawings related to the installation of the aileron.

After the accident, CDC revised the specification (excerpts attached). This revision increased the minimum gap clearance from 0.050 to 0.110 inches. The revision also included more detailed figures and improved methods for measuring the gap.

Type Certificate Issuance

Five months prior to the accident, the FAA granted CDC a type certificate (TC) in the normal category for the SR20 after the airplane design had satisfied all applicable FAA certification requirements and guidelines. The SR20 became one of the first light single-engine airplanes constructed primarily of composite materials and certified by the FAA in the normal category.

At the time of the accident, however, CDC had not yet been granted a production certificate (PC) by the FAA, which would have permitted the company to establish compliance with its design and issue a Certificate of Airworthiness to completed SR20 airplanes. CDC recognized that their production processes were not yet adequate for FAA certification and the company requested that the airplane be classified as experimental.

Type and Production Certification Process

CDC submitted to the FAA an aircraft type design application for the SR20, on March 7, 1996. The FAA Chicago ACO was assigned to process the application because CDC fell within its geographical boundaries. During the following two and one-half years, the ACO convened a preliminary, preflight, and final Type Certification Boards. The ACO stated that they substantiated the design, and had the FAA's Aircraft Evaluation Group fly and evaluate the operational and maintenance aspects of the airplane. According to the manager of the ACO, the ACO "...conducted technical meetings on regular intervals to discuss and approve test plans, compliance findings, and review airworthiness limitations." On October 23, 1998, the FAA Administrator personally presented CDC with the approved type certificate.

In March 1999, the FAA's Minneapolis Manufacturing District Office (MIDO) conducted a standard Preliminary District Office Audit to evaluate CDC's quality control data for compliance with FAA regulations. According to the FAA, 37 observations and 36 issues were identified during the audit. The quality subsystem with observation or issues were: Organization and Responsibility; Design Data Control; Manufacturing Processes; Special Manufacturing Processes; Tool and Gauge; Supplier Control; Non-conforming material; Material handling and storage, and internal audit. The final Production Certification Board (PCB) convened subsequent to the MIDO's recommendation that CDC complied with all corrective action requirements identified during the district audit. The PCB Audit did not convene until March 21, 2000. CDC was issued a production certificate (PC) on June 12, 2000. Serial number 1043 was the first SR20 produced under the PC.

History of Accident Airplane Assembly and Certification

The accident airplane was the fifth SR20 airplane built by CDC. The first two airplanes were designated as "N1", serial number 001, and "N2", serial number 002, and were non-conforming developmental prototypes built prior to Type Certificate Application and used for concept evaluation and demonstration. The third and fourth airplanes were designated as "C1", serial number 003, and "C2", serial number 004, and were used for flight tests required for FAA certification. The accident airplane was designated as serial number 1001 and began its sub-assembly process in October 1998. At that time, Cirrus had intended on serial number 1001 to be the first customer-delivered airplane certified under the type certificate and used to verify that Cirrus was ready to receive its Production Certificate.

According to representatives at CDC, the FAA's Minneapolis MIDO assigned one FAA inspector to provide surveillance over CDC's' production of the accident airplane during the beginning of its sub-assembly process. CDC representatives stated that they requested that the inspector visit the Cirrus factory once per week so that specific production processes could be closed-out as the assembly progressed. CDC representatives further stated that the inspector could not visit more than about once per month. CDC representatives also indicated that the pace of production was increasing during this time, and that the frequency of the MIDO inspector's visits could not keep up with Cirrus's desired assembly rate, and that airplane serial number 1001 was moving through the production line faster than the planning and the paperwork could keep up. Cirrus had previously hired three FAA Designated Airworthiness Representatives (DARs), and in November 1998, the DARs were authorized by the MIDO to perform inspections for the MIDO inspector in order to continue the production process as per FAA requirements. The sub-assembly process of the accident airplane continued through the month of November and December.

According to CDC representatives, in mid-December 1998, CDC was experiencing "a steep learning curve" on the development of production paperwork required to establish type design conformity. This resulted in delays of the assembly of the accident airplane. They stated that the airplane seemed to be moving through the assembly process faster than the planning, inspection, and documentation required for the production certificate could be adequately completed. Moreover, problems with a batch of composite materials that did not meet specifications arose, as well as the inability to keep pace with the Cirrus' schedule for customer delivery. As a result, CDC elected to abandon its plan to submit the airplane serial number 1001 for a standard airworthiness certificate, and instead submit it for an experimental airworthiness certificate. CDC sent a letter to the FAA, which is attached to this report, requesting the change and furthermore noted that it would be beneficial to CDC in the long term to utilize serial number 1001 assembly to "pilot" the production process and documentation rather than present the aircraft for a standard airworthiness certificate.

At the time that this letter was sent, the accident airplane remained in the sub-assembly process at position 15. According to CDC production records (attached), the wing was not yet closed up or mated with the fuselage at that time. According to CDC, the "assembly line" technically began at position 14, which would occur after position 15 as per the "counting down" of positions designated for the assembly line process. Under this designation, the wing was to be mated at position 9, and the ailerons were to be installed and rigged at position 8. The first production flight test was to occur at position 2.

According to representatives at CDC, airplane serial number 1001 was no longer required to conform to process specifications or receive full oversight by the FAA because of its intended experimental status. However, they indicated that all attempts were made to have the airplane conform to current process specifications, including revision A of the aerodynamic surface gap requirement.

It was the FAA's understanding that aircraft serial number 1001 would be built to CDC process specifications, and CDC was using the aircraft to monitor their ability to build it to their work instructions and have it conform with the TC data. The FAA stated that the only difference would be that the FAA would not perform oversight conformity inspections as the aircraft would not be eligible for a Standard Airworthiness Certificate.

According to the FAA, since the airplane was being assembled after CDC had received its type certificate through the use of previously built SR20s, but was not being submitted for a standard airworthiness certificate and/or FAA production process verification, it did not receive an FAA project number and formal engineering and manufacturing oversight.

CDC records indicate that 13 days prior to the accident, on March 10, 1998, the ailerons were hung on the wings of the accident airplane. On March 11, 1998, the ailerons were "inspected," and no reference was made to process specification 90027-A. According to the director of production, the personnel inspecting the ailerons would have had to refer to the current engineering drawings. The director stated that the inspector would have measured the gaps of the ailerons for conformance to the drawings, but that there was no requirement to record the measurement. Although 90027-A applied to the aircraft, the planning for this particular station did not specify is applicability. The director stated that a "pin gauge" would have been used to measure the gap. If the gap was too tight, then it would have been "trimmed" until it met the drawing specification, with no requirement to document any of these actions or measurements. If the gap was too large, then a non conformance record (NCR) would have been documented. No record of a NCR was found.

Cirrus records indicate that from March 11 to March 19, 1998, the airplane progressed through assembly stations 7, 6, 5, 4, and 3.

According to CDC and the FAA, CDC initially desired to qualify aircraft serial number 1001 for the "Experimental - Market Survey" classification, and then ferry it to Europe for demonstration flights. Cirrus determined that the FAA would require that the airplane be flown for 50 hours before qualifying for market survey, so they discussed options with the FAA to circumvent this requirement. The option for "Experimental - Research and Development" was discussed, but the requirements for this classification could not be supported. The FAA and Cirrus finally agreed that the airplane would initially receive an "Experimental - Crew Training" classification so that 50 hours could be flown on it by one pilot and in sparsely populated areas.

Postaccident Design Modifications

Following the accident, CDC re-examined the SR20 design and made the following changes:

(1) Closed off the free edge of the aileron leading edge with an aluminum (or composite for existing assemblies) cover, thus eliminating free edge jam potential, and the jam potential due to rivets. (2) Updated and clarified specification requirements for aerodynamic surfaces, including an increase in the gap clearance between the aileron leading edge and the wing cove. (3) Modified aileron actuation pulley stops to eliminate the potential for overrun (larger striking surface, extension of pin, addition of blocks). (4) Increased clearance between aileron actuation arm and mass balance. (5) Improved retention of aileron actuation pulley cable. (6) Updated and clarified specification requirements for elevator surfaces, including an increase in the gap clearance between the elevator and the horizontal stabilizer. (7) Closed off the free edge of the leading edge of the elevator with aluminum (or composite for existing assemblies) cover. (8) Updated and clarified specification requirements for rudder surface. (9) Modified the access panel attach hardware to eliminate potential of elevator jams. (10) Modified the aileron-rudder interconnect to decrease interference potential. (11) Modified aileron crossover turnbuckles to decrease interference potential. (12) Modified yoke-console interface to increase clearances to fasteners. (13) Improved flight control rigging process.

FAA Regulations Regarding Flight Control Jams

Current regulations and guidance that address the certification of new airplanes in the normal category were conceived prior to the widespread use of composite materials and the associated methods of production. A review of the pertinent FAA certification requirements and guidelines for flight controls revealed that guidelines are found in two references: Federal Air

Regulation (FAR) Part 23, "Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes," which was originally released January 9, 1965 with amendments dated as recently as 1993; and Advisory Circular (AC) 23.683-1, "Control System Operation Tests", dated September 25, 1984. These references (pertinent excerpts attached) address structural deformation under load of individual surfaces, control surface travel and authority under load, and jamming of the flight control circuit while under maximum cockpit control forces.

There are no current FAA requirements or guidance for operational tests of flight controls while both the control surface and mating structure are operated under load to determine if any interference exists.

In January 2000, the FAA issued a proposed Notice of Policy Statement that is applicable to the type certification of normal, utility, acrobatic, and commuter-category airplane that advised the public of additional information related to the current compliance methods in AC 23.683-1. The FAA determined that additional information regarding AC 23.683-1 would be beneficial. The proposed general policy statement provides guidance on testing of airplane flight controls and associated systems to show that no binding or limitations to control movement exist when the airplane structure is deflected up to its load limit. The proposed general statement of policy was prompted, in part, by the Safety Board's investigation of the SR20 accident that this factual report addresses. According to the FAA, the proposed general statement of policy is only an interim action while the FAA prepares to issue a revision to AC 23.683-1 as soon as possible.

Parachute System

CDC SR20 airplanes that are to be type-certified by the FAA are required to be equipped with a CDC Airplane Parachute System (CAPS). The CAPS is designed to bring the aircraft and its occupants to the ground in the event of a life-threatening emergency. The system is intended to save the lives of the occupants, but, according to Cirrus "will most likely destroy the aircraft and may, under adverse circumstances, may result in serious injury or death to the occupants." The CAPS consists of a 2,400-square-foot parachute, a solid-propellant rocket to deploy the parachute, rocket activation handles, and a harness imbedded within the fuselage structure. According to CDC and the FAA, the CAPS is a requirement for the SR20 (certificated in the normal category) as part of the FAA Equivalent Level of Safety finding for a one turn spin recovery requirement.

The accident airplane was not equipped with the CAPS. According to the FAA and CDC, there was no requirement that the accident airplane be equipped with CAPS because it was certificated as experimental. None of the previous SR20 prototypes were equipped with the CAPS, except for one test article that was used to test and certify the CAPS. The majority of all FAA certification flight tests were conducted in experimental airplanes that did not have CAPS installed. Additionally, according to CDC, the manufacturer of the CAPS was scheduled to supply the first complete production parachute assembly to CDC by March 30, 1999 (one week after the accident flight).

The SR20 POH describes CAPS as, "The SR20 is equipped with a Cirrus Airplane Parachute System (CAPS) designed to bring the aircraft and its occupants to the ground in the event of a life-threatening emergency. The system is intended to saves the lives of the occupants but will most likely destroy the aircraft and may, in adverse circumstances, cause serious injury or death to the occupants. Because of this it is important to carefully read the CAPS descriptions in this section, section 3 Emergency Procedures and Section 10, Safety and consider when and how you would use the system".

Section 10 of the SR20 POH, General Deployment Information, Deployment Speed, states, "The maximum speed at which deployment has been demonstrated is 135 KIAS." Section 10 also states under Deployment Attitude, "...Most CAPS testing was accomplished from a level attitude. Deployment from a spin was also tested." The section continues with, "...However, it can be assumed that to minimize the chances of parachute entanglement and reduce aircraft oscillations under the parachute, the CAPS should be activated from a wings-level, upright attitude if at all possible."

ADDITIONAL INFORMATION

The wreckage and all components of N115CD were released to CDC on May 5, 1999.

The FAA and CDC were parties to the investigation.

Pilot Information

Certificate:	Airline Transport; Commercial	**Age:**	, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane Single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	06/16/1998
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	2053 hours (Total, all aircraft), 742 hours (Total, this make and model), 76 hours (Last 90 days, all aircraft), 30 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cirrus Design Corp.	**Registration:**	N115CD
Model/Series:	SR20 SR20	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Experimental	**Serial Number:**	1001
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	2900 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	6 Hours	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-360-ES
Registered Owner:	CIRRUS DESIGN CORPORATION	**Rated Power:**	200 hp
Operator:	CIRRUS DESIGN CORPORATION	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	DLH, 1427 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	1355 CST	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear / 0 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None / 0 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	11 knots / 17 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	340°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	36°C / 9°C
Precipitation and Obscuration:			
Departure Point:	, MN (DLH)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	VFR
Departure Time:	1312 CST	**Type of Airspace:**	Class E

Airport Information

Airport:	DULUTH INTERNATIONAL AIRP (DLH)	**Runway Surface Type:**	Concrete
Airport Elevation:	1428 ft	**Runway Surface Condition:**	Dry
Runway Used:	27	**IFR Approach:**	
Runway Length/Width:	10152 ft / 150 ft	**VFR Approach/Landing:**	Go Around; Straight-in

Wreckage and Impact Information

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

Administrative Information

Investigator In Charge (IIC):	MITCHELL F GALLO	**Report Date:**	04/09/2001
Additional Participating Persons:	VICTORIA ANDERSON; WASHINGTON, DC MIKE BUSCH; DULUTH, MN		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		