Aviation Investigation Final Report

Location:	Boulder, Colorado	**Accident Number:**	CEN10FA115
Date & Time:	February 6, 2010, 13:27 Local	**Registration:**	N8718L
Aircraft:	Piper PA-25-235	**Aircraft Damage:**	Substantial
Defining Event:	Midair collision	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Glider tow		

Analysis

While conducting glider-tow operations, the right wing of a Piper PA-25 was struck at a 90 degree angle by a Cirrus SR20. Analysis of the radar information, the flight condition of both airplanes, and the pilots' visibility in their respective cockpit configurations, suggests that until just prior to the impact, the Piper would have been located below the horizon and against the background of the surrounding terrain and city, between the 10 and 11 o'clock position of the Cirrus pilot. The Piper remained in this same relative position in the windscreen of the Cirrus pilot for the entire duration of its 7 minute flight. The Cirrus would have been above the horizon, against the white overcast sky, in about the 1 to 2 o'clock position of the Piper pilot. The Cirrus would have only appeared in this position after the Piper pilot completed the last turn and was headed to the west, which would have been (at most) the last 3 minutes of the flight.

Visual meteorological conditions existed at the time of the accident with an overcast layer and visibility of 8 miles. The overcast sky conditions likely made it difficult for the Piper pilot to detect the primarily white-colored Cirrus. The lack of maneuvering, as observed by the glider pilot prior to the accident, suggests that neither the pilot of the Cirrus nor the pilot of the Piper observed the other airplane prior to the accident. If the Piper pilot had observed the Cirrus prior to the impact, his ability to maneuver to avoid an impact would have been severely limited due to the glider in tow.

A postaccident examination of the engine and flight control systems on both airplanes revealed no mechanical anomalies that would have prevented either pilot from maneuvering to avoid an impact. Medical and pathological examination of both pilots revealed no medical or

toxicological issues that would have precluded either pilot from operating their airplane in a safe manner prior to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of both pilots to see and avoid the other resulting in a midair collision. Contributing to the accident was the lack of perceived visual relative motion of the Piper and the Cirrus to the pilot of each airplane, the terrain background, and the overcast weather conditions making it difficult for either pilot to visually acquire the other aircraft.

Findings

Personnel issues	Monitoring other aircraft - Pilot
Environmental issues	(general) - Contributed to outcome

Factual Information

History of Flight

Enroute	Glider tow event
Enroute	Midair collision (Defining event)

HISTORY OF FLIGHT

On February 6, 2010, at 1327 mountain standard time, a Cirrus SR20 airplane, N825BC, collided with a Piper PA-25-235 airplane, N8718L, while the Piper was conducting glider tow operations with a Schweizer SGS 2-32 glider, N2472W, near Boulder, Colorado. Both the Cirrus and the Piper were substantially damaged. The Schweizer was not damaged. The Cirrus was owned and piloted by a private individual. Mile High Gliding, Inc., operated both the Piper and the Schweizer. Visual meteorological conditions prevailed at the time of the accident. All three flights were being conducted under the provisions of 14 Code of Federal Regulations Part 91 without flight plans. The commercial pilot aboard the Piper and the private pilot and passenger aboard the Cirrus were all fatally injured. The commercial pilot and two passengers aboard the Schweizer were not injured. The Cirrus departed Erie Municipal Airport (KEIK), Erie, Colorado, as a local flight approximately 1245. The Piper and Schweizer departed Boulder Municipal Airport (KBDU), Boulder, Colorado, as a glider tow flight approximately 1320.

According to a statement taken from the pilot of the Schweizer, the purpose of the flight was a scenic glider flight for a birthday party. The tow flight departed runway 8, performed a 360-degree turn for altitude on the east end of the airport, and then continued to a west/northwest heading. He stated that during this portion of the flight he was pointing out various landmarks in Boulder, and other aircraft in the vicinity, to the two passengers.

The pilot of the Schweizer remarked that at 8,000 feet the tow rope was tight, they were climbing at 70 miles per hour, and that the air was smooth. At this approximate time and altitude, he observed a Cirrus airplane off the right side of his glider, less than 500 feet away. He was immediately concerned that the Cirrus was going to fly between the tow plane and the glider, and impact the tow line. He reached for the towline release, at which time the Cirrus impacted the forward right side of the tow plane at nearly a 90 degree angle.

The Schweizer flew through a ball of fire and was able to return to KBDU shortly thereafter. The pilot of the Schweizer and one passenger on board the glider stated that they did not observe either the Piper or the Cirrus maneuver prior to the collision. The pilot of the Schweizer stated that prior to the impact there were no control movements or turbulence induced by control movements of the tow plane. He commented that the flight was extremely smooth and that normally he can feel control movements or inputs from the tow plane. He elaborated that he felt that the tow pilot would have tried to correct or make an evasive maneuver had he seen the

Cirrus airplane prior to the impact.

Multiple witnesses heard the collision between the two airplanes and observed the post collision state of both airplanes. The Cirrus was observed to descend under the canopy of the Cirrus Airframe Parachute System (CAPS) while on fire. Debris from both airplanes was spread over a 1.5-mile area with components of the Piper at the northern most end of the debris field, and the main wreckage of the Cirrus at the southern most end of the debris field.

Radar data, provided by Denver Air Route Traffic Control Center (ZDV) in National Track Analysis Program (NTAP) format, identified and depicted the Cirrus flight from the time of departure from KEIK to the time of the accident. The encoded altitude of the Cirrus ranged from 6,800 feet to 8,800 feet mean sea level (msl). The flight track proceeded north from KEIK, maneuvered, and then reversed course back toward the south. Just prior to the accident the Cirrus was tracking an approximate course of 180 degrees.

Radar data, provided by ZDV in NTAP format, identified and depicted the Piper flight from the time of departure from KBDU to the time of the accident. The altitude of the Piper was intermittent with only two altitudes recorded during the accident flight. The first was reported at 1320:58 at an encoded altitude of 5,500 feet. The second was recorded at 1322:57 at an encoded altitude of 6,500 feet. The Piper performed one turn in the vicinity of KBDU. Just prior to the accident the Piper was tracking an approximate course of 270 degrees.

The radar data for the Cirrus depicted the airplane at a consistent altitude of 8,400 and 8,300 feet within the last minute of flight. There was no continuous altitude information associated with the radar data for the Piper tow flight; however, according to a statement from the glider pilot, they were climbing from the time of departure until the collision. He estimated the altitude at the time of the accident to be 8,000 feet.

Neither the Cirrus pilot or the Piper pilot were receiving radar flight following services, nor were they in voice communications with air route traffic control. There was no requirement for them to be in voice communications with air route traffic control.

PERSONNEL INFORMATION

Cirrus Pilot

The pilot of the Cirrus, age 58, held a private pilot certificate with an airplane single engine land rating. He was issued a third class airman medical certificate on December 4, 2008. The certificate contained the limitation “must wear corrective lenses.”

The charred remains of the Cirrus pilot’s flight logbook was located with the wreckage of the Cirrus airplane. The pilot of the Cirrus had logged no less than 640 hours of total time; 359 hours of which were logged in the accident airplane make and model. He had completed the requirements for a flight review on May 15, 2009, and had received an endorsement to operate

high performance airplanes on October 10, 2003.

Piper Pilot

The pilot of the Piper, age 25, held a commercial pilot certificate with airplane single and multiengine land, and instrument ratings. In addition, he held a certified flight instructor certificate with airplane single and multiengine ratings. He was issued a first class airman medical certificate, with no limitations, on February 12, 2009.

Mile High Gliding submitted a completed Pilot/Operator Aircraft Accident/Incident Report form. On this form they reported that the pilot of the Piper had completed the requirements for a flight review on October 24, 2009. He had logged 1,110 hours total time; 260 hours of which were in the accident airplane make and model.

Schweizer Pilot

The pilot of the Schweizer, age 39, held a commercial pilot certificate with a glider rating, and an airplane single engine land, and instrument rating. In addition, he held a certified flight instructor certificate with airplane single engine, and instrument ratings. He was issued a third class airman medical certificate, with no limitations, on March 15, 2006.

The pilot of the Schweizer submitted a completed Pilot/Operator Aircraft Accident/Incident Report form. On this form he reported that he had completed the requirements for a flight review on June 7, 2009. The pilot had logged 2,044 hours total time; 3 hours of which were in the make and model of the glider.

AIRCRAFT INFORMATION

Cirrus

The Cirrus Design Corporation SR20 (serial number 20-1655) low wing airplane, predominately white in color with blue striping, was manufactured in May of 2006. It was registered with the Federal Aviation Administration (FAA) on a standard airworthiness certificate for normal operations. A Teledyne Continental Motors engine, IO-360-ES(6), rated at 210 horsepower at 2,700 rpm, powered the airplane. The engine was equipped with a three-blade, constant speed, Hartzell propeller.

The Cirrus was registered to and operated by the Cirrus pilot, and was maintained under an annual inspection program. A review of the maintenance records indicated that Vector Air – Aircraft Inspection & Repair, Erie, Colorado, had completed an annual inspection on April 8, 2009, at a Hobbs hour reading of 319.0 hours. The engine oil was drained and the oil filter was inspected on December 11, 2009, at a Hobbs hour reading of 388.1 hours. Front Range Transponder Services of Bailey, Colorado, tested and inspected the Cirrus's altimeter system and altitude reporting equipment on May 28, 2008. The system was tested to 20,000 feet with

no "leakage" noted.

A traffic collision avoidance system was not installed on the accident Cirrus.

The Cirrus was equipped with pilot controlled exterior navigation and anti-collision strobe lights. The navigation lights and strobe lights were co-located on the wing tips; the navigation lights were red on the left side and green on the right side, and the anti-collision strobe lights were white.

Piper

The Piper PA-25-235 (serial number 25-5173) low wing airplane was manufactured in 1969. It was registered with the FAA on a special airworthiness certificate, in the restricted category for glider towing operations. A Lycoming O-540-B2C5 engine rated at 235 horsepower at 2,575 rpm powered the Piper. The engine was equipped with a four-blade, wooden composite Hoffman propeller.

The Piper was registered to and operated by Mile High Gliding Inc., and was maintained under an annual inspection program. A review of the maintenance records indicated that an annual inspection had been completed on December 7, 2009, at an airframe total time of 9,883 hours, and a recorded tachometer time of 3,346 hours. The Piper had flown 53.6 hours between the last inspection and the accident, and had a total airframe time of 9,936 hours. Front Range Transponder Services of Bailey, Colorado, tested and inspected the Piper's altimeter system and altitude reporting equipment on June 18, 2008. The system was tested to 18,000 feet with no "leakage" noted.

The Piper was not equipped with position or anti-collision lights; nor was it required to be equipped.

Schweizer

The Schweizer SGS 2-32 (serial number 47) glider, metallic color with yellow and red stripes, was manufactured in 1967. It was registered with the FAA on a standard airworthiness certificate for glider operations.

The glider was registered to and operated by Mile High Gliding, Inc., and was maintained under a 100-hour inspection program. A review of the maintenance records indicated that a 100-hour inspection had been completed on February 1, 2010, at an airframe total time of 6,201 hours. The annual inspection had been completed on August 24, 2009, at an airframe total time of 6,104.3 hours. The glider was not equipped with a transponder.

The Schweizer was not equipped with position or anti-collision lights; nor was it required to be equipped.

METEOROLOGICAL INFORMATION

The closest official weather observation station was Rocky Mountain Metropolitan Airport (KBJC), Denver, Colorado, located 14 nautical miles (nm) southeast of the accident site. The elevation of the weather observation station was 5,673 feet msl. The routine aviation weather report (METAR) for KBJC, issued at 1247, reported winds calm, visibility 8 miles, sky condition scattered clouds at 8,000 feet, overcast at 12,000 feet, temperature 4 degrees Celsius (C), dew point minus 6 degrees C, altimeter 29.89 inches.

The METAR for KBJC issued at 1353 reported winds calm, visibility 10 miles, sky condition few clouds at 9,000 feet, overcast at 12,000 feet, temperature 5 degrees C, dew point minus 7 degrees C, altimeter 29.86 inches.

AERODROME INFORMATION

Boulder Municipal Airport (KBDU) was a public, uncontrolled airport (Class G) located 3 miles northeast of Boulder, Colorado, at 40 degrees, 2 minutes, 21 seconds north latitude, and 105 degrees, 13 minutes, 32 seconds west longitude, at an estimated elevation of 5,288 feet. Class E airspace was located just to the east and north of KBDU and Class D airspace for KBJC was located to the south of KBDU. KBDU is located within the Mode C, 30 nm veil, by 3/4 miles.

The Boulder Municipal Airport website provided a depiction of the glider and tow plane traffic pattern at the airport. The flight track included a traffic pattern to the north and to the south of the airport with departures from the traffic pattern to the northwest and to the south. This map which depicted the flight track was also available at the airport.

In addition to this information provided by the airport, the FAA Cheyenne and Denver Sectional Aeronautical Charts and the Denver VFR Terminal Area Chart depicted glider activity, with a symbol of a glider and the letter “G,” in the vicinity of KBDU.

The Airport Facility Directory (AFD) published and maintained by the FAA stated that runway 08-26 G at KBDU was for glider use only. Further it stated that powered aircraft on approach to runway 08-26 should initiate a go around or yield right of way to gliders on final. There was no discussion of glider tow operations at the airport or in the vicinity of the airport.

WRECKAGE AND IMPACT INFORMATION

Wreckage debris from the Piper and the Cirrus were scattered over a 1.5 mile area. Measured field elevation was approximately 5,500 feet msl. The terrain where both wreckages came to rest was best characterized as rolling hills and rocky terrain, vegetated with wild grass, sagebrush, and yucca.

Cirrus

The largest identifiable portion of the Cirrus was categorized as the main wreckage and consisted of the fuselage, empennage, and both wing assemblies. The engine separated and was located 25 feet to the north of the main wreckage. The main wreckage was oriented on an approximate heading of 250 degrees and was positioned on a slope of approximately 10 degrees. The CAPS remained attached to the main wreckage, and came to rest downhill from the forward portion of the fuselage. Portions of the engine cowling, forward right fuselage, and personal effects were fragmented and scattered.

The forward portion of the fuselage, to include the cabin seats and the instrument panel, extending aft to the empennage, was charred, melted, and partially consumed by fire. The ceiling of the airplane was destroyed. The multifunction display exhibited exposure to heat and fire. The damage precluded the recovery of any information. The primary flight display was not present with the main wreckage and the remains, including the memory card, were not recovered. The empennage, to include the horizontal stabilizer, elevator, vertical stabilizer, and rudder, remained attached to the fuselage and exhibited heat and fire damage. The upper portion of the vertical stabilizer was destroyed by fire. The surfaces were otherwise unremarkable. The flight control cables/tubes were continuous from the rudder and elevator control surfaces, forward, to the flight controls in the cabin. The CAPS remained attached to the main wreckage through the Kevlar straps at their respective mounted locations.

The right wing remained partially attached and came to rest under the main wreckage. The right aileron was located on the left side of the airplane, adjacent to the remains of the outboard portion of the right wing. The right wing flap was located on the right side of the airplane. The right wing, aileron, and flaps exhibited extensive heat and fire damage. The outboard portion of the left wing, including the left aileron, separated from the airplane and was found adjacent the airplane. The left wing exhibited exposure to heat and fire. The inboard portion of the left wing, including the left flap was destroyed by fire. The flight control cables were continuous from aileron control surfaces, inboard, to the flight controls in the cabin.

The engine assembly, to include the propeller, separated from the fuselage and came to rest approximately 25 feet north of the main wreckage. The engine cowling was fragmented and destroyed.

It could not be determined if the anti-collision lights were on or operating at the time of the accident.

Piper

The largest identifiable components of the Piper were the engine and propeller assembly, the left wing assembly, the empennage, and two large segments of the fuselage. The right wing, portions of the fuselage, the body fabric, instrument panel, and personal effects were fragmented and scattered. The engine and propeller assembly was located to the north of the main scatter of wreckage. The left wing was located to the east of the main scatter of wreckage.

MEDICAL AND PATHOLOGICAL INFORMATION

Cirrus Pilot

The Boulder County Coroner's Office performed the autopsy on the Cirrus pilot on February 7, 2010. The autopsy concluded that the cause of death was "multiple traumatic injuries sustain in a mid-air airplane collision and subsequent ground impact."

The FAA's Civil Aerospace Medical Institute (CAMI), Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the autopsy. Results were negative for all tests conducted.

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TESTS AND RESEARCH

Piper

The fuselage, to include the cabin, pilot's seat, and instrument panel, was crushed from the right toward the left and fragmented. The pilot's seat separated from the seat track and was crushed to the left. The four-point seatbelt and harness remained latched at the center latching mechanism but separated from the airframe and seat area. The fuselage between the engine and the cabin, including the hopper, was impact damaged. The hopper cover separated from the fuselage and was unremarkable. The instrument panel was fragmented. The throttle quadrant separated and the throttle control was full forward. The frame of the fuselage was fragmented and destroyed. The fabric surrounding the frame was torn, portions were missing, and the remaining portions exhibited exposure to heat and fire.

The right wing was fragmented. The leading edge of the right wing was crushed and fragmented. The fabric on the outboard portion of the wing was missing or torn and exhibited exposure to heat and fire. The paint on the fabric of the right wing was melted. The forward spar on the right wing was bowed aft slightly and separated into several pieces. The center portion of the right wing, between the forward and aft spar, was fragmented and destroyed. The outboard five feet of the right aileron separated from the wing. The inboard portion of the right aileron separated and was fragmented. The right flap separated from the wing and was bent and buckled. The aileron control cables could not be checked for continuity due to impact

damage.

The fabric on the inboard leading edge of the right wing exhibited paint transfer that was blue in color. The paint transfer area was 46 inches in length and 10 inches in width along the top of the leading edge of the right wing. Grey paint transfer was also noted along the forward leading edge portion of the right wing strut.

The left wing separated from the fuselage of the Piper. The left wing strut was bent up slightly, 70 inches inboard from the wing/strut intersection. The strut was bent a second time 27 inches inboard from the first bend. The leading edge of the left wing was unremarkable. The left aileron remained attached to the wing and the control cables were continuous from the aileron control surface inboard to the wing root.

The empennage separated from the fuselage and was broken into several large and small pieces. The right horizontal stabilizer and elevator separated from the empennage. The right elevator and stabilizer were crushed aft and the fabric was torn and melted. The left horizontal stabilizer and elevator were bent and twisted. The vertical stabilizer and rudder were bent and the fabric was torn and melted. The elevator flight control cables were continuous from the elevator forward to the control stick. The rudder control cable was continuous from the rudder horn forward to the center portion of the fuselage. Due to impact damage, complete rudder cable continuity was not established.

The engine separated from the fuselage. The cowling was bent, broken, and exhibited exposure to heat and fire. The bottom portion of the engine exhibited extensive heat and impact damage. The four-blade propeller assembly remained attached to the engine at the propeller flange. The blades were arbitrarily labeled “A,” “B,” “C,” and “D” for report purposes. Blade A was broken and splintered 20 inches inboard from the blade tip and exhibited heat damage. Blade B exhibited leading edge scoring and heat damage at the blade hub. Blade C exhibited leading edge scoring and both the leading and trailing edges exhibited exposure to heat and fire. The outboard eight inches of the Blade C was broken. Blade D exhibited exposure to heat and fire.

ADDITIONAL INFORMATION

Radar Data

Radar data provided by ZDV was used to establish position and track information for both the Cirrus and the Piper. Primary data was available for the Piper with intermittent secondary data in the form of Mode C or altitude information. Both primary and secondary data were available for the Cirrus. Both airplanes were flying according to visual flight rules and a continuous 1200-transponder beacon code was received from the Cirrus airplane.

According to the radar data provided by the FAA, the first coordinate associated with the Cirrus airplane was recorded at 1246:54 in the vicinity of KEIK. This track continued to the north

toward the Longmont, Colorado, area, performed several turns, and then proceeded on a southerly track towards Boulder.

The first coordinate associated with the Piper was recorded at 1320:58, just to the north of the departure end of runway 8 at KBDU. This position is 18.25 miles south of the Cirrus on a bearing of approximately 175 degrees. The Cirrus was on a bearing of 355 degrees from the Piper.

At 1321:58, the Piper was 15.6 miles south southeast of the Cirrus on a bearing of 168 degrees from the Cirrus. The Cirrus was on a bearing of 348 degrees from the Piper.

At 1322:57, the Piper was 14.6 miles south southeast of the Cirrus on a bearing of 168 degrees from the Cirrus. The Cirrus was on a bearing of 348 degrees from the Piper.

There was no radar data available for the Piper tow flight between 1323:39 and 1324:16.

At1324:57, the Piper was 7.9 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

At 1325:58, the Piper was 4.4 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

At 1326:58, the Piper was .76 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

Cirrus Cockpit Visibility

The Cirrus SR20 was built with side-by-side cockpit seating with a front windscreen and two side windows on the left and right cabin entry doors. Structure from the A pillar was positioned just to the front left of the forward left cockpit seat. The pilot's seat was adjustable and could be adjusted full forward, full aft, or at any of the 9 positions in between, adjustable at 0.72 inch increments.

A review of the forward and side visibility, from the left seat of the cockpit, was conducted using an exemplar Cirrus SR20. The seat was positioned in several track locations, including full forward, full aft, and an intermediate position in between full forward and full aft. Forward visibility in a position consistent with the aviation terminology of 12 o'clock was unrestricted in all seat positions. Side visibility in a position consistent with 9 o'clock was unrestricted in all seat positions.

The structure from the windscreen and door on the left side of the airplane restricted the seat occupant's view in a position consistent with the 10 or 11 o'clock positions. The extent of restriction was dependant on the position of the seat. The forward position restricted more of the center of the 10 o'clock position whereas the aft position restricted more of the center of

the 11 o'clock position. The middle position restricted the 10 or 11 o'clock position, dependant on the position of the pilot's head. Investigators were able to look around the A pillar by moving their head forward and aft.

Piper Cockpit Visibility

The Piper PA-25 was designed with a single seat, a front windscreen, and two side windows on the left and right side of the cockpit. Narrow structure, from the front and side windows, was positioned just to the front left and right side of the cockpit seat. In addition, the front windscreen had a metal structure that divided the windscreen into two parts. The pilot's seat was adjustable and could be adjusted full forward, full aft, or at any of the three positions in between, adjustable approximately 5 inches from full forward to full aft.

A review of the forward and side visibility, from the left seat of the cockpit, was conducted using an exemplar Piper PA-25 and drawings of the Piper PA-25. The seat was positioned in several track locations, including full forward, full aft, and an intermediate position in between full forward and full aft. Forward visibility in a position consistent with the aviation terminology of 12 o'clock was unrestricted in all seat positions. Side visibility in a position consistent with 3 o'clock was unrestricted in all seat positions. The window structure in the airplane did not create a significant restriction to visibility.

Accident Video

The rear left seat passenger of the Schweizer glider was creating a video to document the birthday flight. The video started during the takeoff roll, continued until the glider landed uneventfully back at KBDU, and was 15 minutes and 34 seconds in length. Shortly after the takeoff, the tow flight initiates a gradual turn to the left. The tow flight rolls out on a heading towards the mountains.

During the video, radio transmission can be heard in the back-ground. In addition, the glider pilot points out other airplanes, in the vicinity of their flight, to the two passengers.

Approximately 7 minutes and 30 seconds into the video, a fireball was recorded. The camera was recording to the west/southwest of the direction of flight at the time this fireball was captured.

The glider circles over the accident area several times before returning to KBDU for an uneventful landing.

The video records an area to the north of their direction of flight approximately one minute prior to the impact. A review of the video by the NTSB IIC did not identify the Cirrus.

Regulations

§ 91.113 Right-of-way rules: Except water operations.

“(b) General. When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear.

(d) Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way.

… an aircraft towing or refueling other aircraft has the right-of-way over all other engine-driven aircraft.”

Glider Tow Operations

Gliders can be launched for flight in one of several methods. One method involves a ground launch and the second method involves an aerial tow provided by a second airplane such as the Piper involved in this accident. During aerial tow operations, a tow line connects the tow airplane to the glider. Either the pilot of the tow airplane or the pilot of the glider can release this tow line. The maneuverability of both the tow airplane and the glider is greatly reduced during the tow operations.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	25,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	February 28, 2009
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	October 24, 2009
Flight Time:	1112 hours (Total, all aircraft), 260 hours (Total, this make and model), 1005 hours (Pilot In Command, all aircraft), 86 hours (Last 90 days, all aircraft), 14 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N8718L
Model/Series:	PA-25-235	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	17256378
Landing Gear Type:	Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	February 1, 2010 Continuous airworthiness	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1
Airframe Total Time:	9929 Hrs as of last inspection	**Engine Manufacturer:**	
ELT:	Not installed	**Engine Model/Series:**	
Registered Owner:	Mile High Gliding Inc	**Rated Power:**	
Operator:	Mile High Gliding Inc	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBJC,5673 ft msl	**Distance from Accident Site:**	
Observation Time:	12:47 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 8000 ft AGL	**Visibility**	8 miles
Lowest Ceiling:	Overcast / 12000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.88 inches Hg	**Temperature/Dew Point:**	4°C / -6°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Boulder, CO (KBDU)	**Type of Flight Plan Filed:**	None
Destination:	Boulder, CO (KBDU)	**Type of Clearance:**	None
Departure Time:	13:20 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	40.076667,-105.270553(est)

Administrative Information

Investigator In Charge (IIC):	Rodi, Jennifer
Additional Participating Persons:	Joseph T Walsh; FAA Flight Standards District Office; Denver, CO Brad Miller; Cirrus Design; Deluth, MN David Campell; Mile High Gliders; Boulder, CO Eric P Vanderpool; Avidyne; Longmont, CO Gregg Ellsworth; Ballistic Recovery Systems; Saint Paul, MN
Original Publish Date:	April 28, 2011
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=75336

Aviation Investigation Final Report

Location:	Boulder, Colorado	**Accident Number:**	CEN10FA115
Date & Time:	February 6, 2010, 13:27 Local	**Registration:**	N825BC
Aircraft:	CIRRUS DESIGN CORP SR20	**Aircraft Damage:**	Substantial
Defining Event:	Midair collision	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

While conducting glider-tow operations, the right wing of a Piper PA-25 was struck at a 90 degree angle by a Cirrus SR20. Analysis of the radar information, the flight condition of both airplanes, and the pilots' visibility in their respective cockpit configurations, suggests that until just prior to the impact, the Piper would have been located below the horizon and against the background of the surrounding terrain and city, between the 10 and 11 o'clock position of the Cirrus pilot. The Piper remained in this same relative position in the windscreen of the Cirrus pilot for the entire duration of its 7 minute flight. The Cirrus would have been above the horizon, against the white overcast sky, in about the 1 to 2 o'clock position of the Piper pilot. The Cirrus would have only appeared in this position after the Piper pilot completed the last turn and was headed to the west, which would have been (at most) the last 3 minutes of the flight.

Visual meteorological conditions existed at the time of the accident with an overcast layer and visibility of 8 miles. The overcast sky conditions likely made it difficult for the Piper pilot to detect the primarily white-colored Cirrus. The lack of maneuvering, as observed by the glider pilot prior to the accident, suggests that neither the pilot of the Cirrus nor the pilot of the Piper observed the other airplane prior to the accident. If the Piper pilot had observed the Cirrus prior to the impact, his ability to maneuver to avoid an impact would have been severely limited due to the glider in tow.

A postaccident examination of the engine and flight control systems on both airplanes revealed no mechanical anomalies that would have prevented either pilot from maneuvering to avoid an impact. Medical and pathological examination of both pilots revealed no medical or

toxicological issues that would have precluded either pilot from operating their airplane in a safe manner prior to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of both pilots to see and avoid the other resulting in a midair collision. Contributing to the accident was the lack of perceived visual relative motion of the Piper and the Cirrus to the pilot of each airplane, the terrain background, and the overcast weather conditions making it difficult for either pilot to visually acquire the other aircraft.

Findings

Personnel issues	Monitoring other aircraft - Pilot
Environmental issues	(general) - Contributed to outcome

Factual Information

History of Flight

Enroute	Midair collision

HISTORY OF FLIGHT

On February 6, 2010, at 1327 mountain standard time, a Cirrus SR20 airplane, N825BC, collided with a Piper PA-25-235 airplane, N8718L, while the Piper was conducting glider tow operations with a Schweizer SGS 2-32 glider, N2472W, near Boulder, Colorado. Both the Cirrus and the Piper were substantially damaged. The Schweizer was not damaged. The Cirrus was owned and piloted by a private individual. Mile High Gliding, Inc., operated both the Piper and the Schweizer. Visual meteorological conditions prevailed at the time of the accident. All three flights were being conducted under the provisions of 14 Code of Federal Regulations Part 91 without flight plans. The commercial pilot aboard the Piper and the private pilot and passenger aboard the Cirrus were all fatally injured. The commercial pilot and two passengers aboard the Schweizer were not injured. The Cirrus departed Erie Municipal Airport (KEIK), Erie, Colorado, as a local flight approximately 1245. The Piper and Schweizer departed Boulder Municipal Airport (KBDU), Boulder, Colorado, as a glider tow flight approximately 1320.

According to a statement taken from the pilot of the Schweizer, the purpose of the flight was a scenic glider flight for a birthday party. The tow flight departed runway 8, performed a 360-degree turn for altitude on the east end of the airport, and then continued to a west/northwest heading. He stated that during this portion of the flight he was pointing out various landmarks in Boulder, and other aircraft in the vicinity, to the two passengers.

The pilot of the Schweizer remarked that at 8,000 feet the tow rope was tight, they were climbing at 70 miles per hour, and that the air was smooth. At this approximate time and altitude, he observed a Cirrus airplane off the right side of his glider, less than 500 feet away. He was immediately concerned that the Cirrus was going to fly between the tow plane and the glider, and impact the tow line. He reached for the towline release, at which time the Cirrus impacted the forward right side of the tow plane at nearly a 90 degree angle.

The Schweizer flew through a ball of fire and was able to return to KBDU shortly thereafter. The pilot of the Schweizer and one passenger on board the glider stated that they did not observe either the Piper or the Cirrus maneuver prior to the collision. The pilot of the Schweizer stated that prior to the impact there were no control movements or turbulence induced by control movements of the tow plane. He commented that the flight was extremely smooth and that normally he can feel control movements or inputs from the tow plane. He elaborated that he felt that the tow pilot would have tried to correct or make an evasive maneuver had he seen the Cirrus airplane prior to the impact.

Multiple witnesses heard the collision between the two airplanes and observed the post collision state of both airplanes. The Cirrus was observed to descend under the canopy of the Cirrus Airframe Parachute System (CAPS) while on fire. Debris from both airplanes was spread over a 1.5-mile area with components of the Piper at the northern most end of the debris field, and the main wreckage of the Cirrus at the southern most end of the debris field.

Radar data, provided by Denver Air Route Traffic Control Center (ZDV) in National Track Analysis Program (NTAP) format, identified and depicted the Cirrus flight from the time of departure from KEIK to the time of the accident. The encoded altitude of the Cirrus ranged from 6,800 feet to 8,800 feet mean sea level (msl). The flight track proceeded north from KEIK, maneuvered, and then reversed course back toward the south. Just prior to the accident the Cirrus was tracking an approximate course of 180 degrees.

Radar data, provided by ZDV in NTAP format, identified and depicted the Piper flight from the time of departure from KBDU to the time of the accident. The altitude of the Piper was intermittent with only two altitudes recorded during the accident flight. The first was reported at 1320:58 at an encoded altitude of 5,500 feet. The second was recorded at 1322:57 at an encoded altitude of 6,500 feet. The Piper performed one turn in the vicinity of KBDU. Just prior to the accident the Piper was tracking an approximate course of 270 degrees.

The radar data for the Cirrus depicted the airplane at a consistent altitude of 8,400 and 8,300 feet within the last minute of flight. There was no continuous altitude information associated with the radar data for the Piper tow flight; however, according to a statement from the glider pilot, they were climbing from the time of departure until the collision. He estimated the altitude at the time of the accident to be 8,000 feet.

Neither the Cirrus pilot or the Piper pilot were receiving radar flight following services, nor were they in voice communications with air route traffic control. There was no requirement for them to be in voice communications with air route traffic control.

PERSONNEL INFORMATION

Cirrus Pilot

The pilot of the Cirrus, age 58, held a private pilot certificate with an airplane single engine land rating. He was issued a third class airman medical certificate on December 4, 2008. The certificate contained the limitation “must wear corrective lenses.”

The charred remains of the Cirrus pilot’s flight logbook was located with the wreckage of the Cirrus airplane. The pilot of the Cirrus had logged no less than 640 hours of total time; 359 hours of which were logged in the accident airplane make and model. He had completed the requirements for a flight review on May 15, 2009, and had received an endorsement to operate high performance airplanes on October 10, 2003.

Piper Pilot

The pilot of the Piper, age 25, held a commercial pilot certificate with airplane single and multiengine land, and instrument ratings. In addition, he held a certified flight instructor certificate with airplane single and multiengine ratings. He was issued a first class airman medical certificate, with no limitations, on February 12, 2009.

Mile High Gliding submitted a completed Pilot/Operator Aircraft Accident/Incident Report form. On this form they reported that the pilot of the Piper had completed the requirements for a flight review on October 24, 2009. He had logged 1,110 hours total time; 260 hours of which were in the accident airplane make and model.

Schweizer Pilot

The pilot of the Schweizer, age 39, held a commercial pilot certificate with a glider rating, and an airplane single engine land, and instrument rating. In addition, he held a certified flight instructor certificate with airplane single engine, and instrument ratings. He was issued a third class airman medical certificate, with no limitations, on March 15, 2006.

The pilot of the Schweizer submitted a completed Pilot/Operator Aircraft Accident/Incident Report form. On this form he reported that he had completed the requirements for a flight review on June 7, 2009. The pilot had logged 2,044 hours total time; 3 hours of which were in the make and model of the glider.

AIRCRAFT INFORMATION

Cirrus

The Cirrus Design Corporation SR20 (serial number 20-1655) low wing airplane, predominately white in color with blue striping, was manufactured in May of 2006. It was registered with the Federal Aviation Administration (FAA) on a standard airworthiness certificate for normal operations. A Teledyne Continental Motors engine, IO-360-ES(6), rated at 210 horsepower at 2,700 rpm, powered the airplane. The engine was equipped with a three-blade, constant speed, Hartzell propeller.

The Cirrus was registered to and operated by the Cirrus pilot, and was maintained under an annual inspection program. A review of the maintenance records indicated that Vector Air – Aircraft Inspection & Repair, Erie, Colorado, had completed an annual inspection on April 8, 2009, at a Hobbs hour reading of 319.0 hours. The engine oil was drained and the oil filter was inspected on December 11, 2009, at a Hobbs hour reading of 388.1 hours. Front Range Transponder Services of Bailey, Colorado, tested and inspected the Cirrus's altimeter system and altitude reporting equipment on May 28, 2008. The system was tested to 20,000 feet with no "leakage" noted.

A traffic collision avoidance system was not installed on the accident Cirrus.

The Cirrus was equipped with pilot controlled exterior navigation and anti-collision strobe lights. The navigation lights and strobe lights were co-located on the wing tips; the navigation lights were red on the left side and green on the right side, and the anti-collision strobe lights were white.

Piper

The Piper PA-25-235 (serial number 25-5173) low wing airplane was manufactured in 1969. It was registered with the FAA on a special airworthiness certificate, in the restricted category for glider towing operations. A Lycoming O-540-B2C5 engine rated at 235 horsepower at 2,575 rpm powered the Piper. The engine was equipped with a four-blade, wooden composite Hoffman propeller.

The Piper was registered to and operated by Mile High Gliding Inc., and was maintained under an annual inspection program. A review of the maintenance records indicated that an annual inspection had been completed on December 7, 2009, at an airframe total time of 9,883 hours, and a recorded tachometer time of 3,346 hours. The Piper had flown 53.6 hours between the last inspection and the accident, and had a total airframe time of 9,936 hours. Front Range Transponder Services of Bailey, Colorado, tested and inspected the Piper's altimeter system and altitude reporting equipment on June 18, 2008. The system was tested to 18,000 feet with no "leakage" noted.

The Piper was not equipped with position or anti-collision lights; nor was it required to be equipped.

Schweizer

The Schweizer SGS 2-32 (serial number 47) glider, metallic color with yellow and red stripes, was manufactured in 1967. It was registered with the FAA on a standard airworthiness certificate for glider operations.

The glider was registered to and operated by Mile High Gliding, Inc., and was maintained under a 100-hour inspection program. A review of the maintenance records indicated that a 100-hour inspection had been completed on February 1, 2010, at an airframe total time of 6,201 hours. The annual inspection had been completed on August 24, 2009, at an airframe total time of 6,104.3 hours. The glider was not equipped with a transponder.

The Schweizer was not equipped with position or anti-collision lights; nor was it required to be equipped.

METEOROLOGICAL INFORMATION

The closest official weather observation station was Rocky Mountain Metropolitan Airport (KBJC), Denver, Colorado, located 14 nautical miles (nm) southeast of the accident site. The elevation of the weather observation station was 5,673 feet msl. The routine aviation weather report (METAR) for KBJC, issued at 1247, reported winds calm, visibility 8 miles, sky condition scattered clouds at 8,000 feet, overcast at 12,000 feet, temperature 4 degrees Celsius (C), dew point minus 6 degrees C, altimeter 29.89 inches.

The METAR for KBJC issued at 1353 reported winds calm, visibility 10 miles, sky condition few clouds at 9,000 feet, overcast at 12,000 feet, temperature 5 degrees C, dew point minus 7 degrees C, altimeter 29.86 inches.

AERODROME INFORMATION

Boulder Municipal Airport (KBDU) was a public, uncontrolled airport (Class G) located 3 miles northeast of Boulder, Colorado, at 40 degrees, 2 minutes, 21 seconds north latitude, and 105 degrees, 13 minutes, 32 seconds west longitude, at an estimated elevation of 5,288 feet. Class E airspace was located just to the east and north of KBDU and Class D airspace for KBJC was located to the south of KBDU. KBDU is located within the Mode C, 30 nm veil, by 3/4 miles.

The Boulder Municipal Airport website provided a depiction of the glider and tow plane traffic pattern at the airport. The flight track included a traffic pattern to the north and to the south of the airport with departures from the traffic pattern to the northwest and to the south. This map which depicted the flight track was also available at the airport.

In addition to this information provided by the airport, the FAA Cheyenne and Denver Sectional Aeronautical Charts and the Denver VFR Terminal Area Chart depicted glider activity, with a symbol of a glider and the letter “G,” in the vicinity of KBDU.

The Airport Facility Directory (AFD) published and maintained by the FAA stated that runway 08-26 G at KBDU was for glider use only. Further it stated that powered aircraft on approach to runway 08-26 should initiate a go around or yield right of way to gliders on final. There was no discussion of glider tow operations at the airport or in the vicinity of the airport.

WRECKAGE AND IMPACT INFORMATION

Wreckage debris from the Piper and the Cirrus were scattered over a 1.5 mile area. Measured field elevation was approximately 5,500 feet msl. The terrain where both wreckages came to rest was best characterized as rolling hills and rocky terrain, vegetated with wild grass, sagebrush, and yucca.

Cirrus

The largest identifiable portion of the Cirrus was categorized as the main wreckage and

consisted of the fuselage, empennage, and both wing assemblies. The engine separated and was located 25 feet to the north of the main wreckage. The main wreckage was oriented on an approximate heading of 250 degrees and was positioned on a slope of approximately 10 degrees. The CAPS remained attached to the main wreckage, and came to rest downhill from the forward portion of the fuselage. Portions of the engine cowling, forward right fuselage, and personal effects were fragmented and scattered.

The forward portion of the fuselage, to include the cabin seats and the instrument panel, extending aft to the empennage, was charred, melted, and partially consumed by fire. The ceiling of the airplane was destroyed. The multifunction display exhibited exposure to heat and fire. The damage precluded the recovery of any information. The primary flight display was not present with the main wreckage and the remains, including the memory card, were not recovered. The empennage, to include the horizontal stabilizer, elevator, vertical stabilizer, and rudder, remained attached to the fuselage and exhibited heat and fire damage. The upper portion of the vertical stabilizer was destroyed by fire. The surfaces were otherwise unremarkable. The flight control cables/tubes were continuous from the rudder and elevator control surfaces, forward, to the flight controls in the cabin. The CAPS remained attached to the main wreckage through the Kevlar straps at their respective mounted locations.

The right wing remained partially attached and came to rest under the main wreckage. The right aileron was located on the left side of the airplane, adjacent to the remains of the outboard portion of the right wing. The right wing flap was located on the right side of the airplane. The right wing, aileron, and flaps exhibited extensive heat and fire damage. The outboard portion of the left wing, including the left aileron, separated from the airplane and was found adjacent the airplane. The left wing exhibited exposure to heat and fire. The inboard portion of the left wing, including the left flap was destroyed by fire. The flight control cables were continuous from aileron control surfaces, inboard, to the flight controls in the cabin.

The engine assembly, to include the propeller, separated from the fuselage and came to rest approximately 25 feet north of the main wreckage. The engine cowling was fragmented and destroyed.

It could not be determined if the anti-collision lights were on or operating at the time of the accident.

Piper

The largest identifiable components of the Piper were the engine and propeller assembly, the left wing assembly, the empennage, and two large segments of the fuselage. The right wing, portions of the fuselage, the body fabric, instrument panel, and personal effects were fragmented and scattered. The engine and propeller assembly was located to the north of the main scatter of wreckage. The left wing was located to the east of the main scatter of wreckage.

MEDICAL AND PATHOLOGICAL INFORMATION

Cirrus Pilot

The Boulder County Coroner's Office performed the autopsy on the Cirrus pilot on February 7, 2010. The autopsy concluded that the cause of death was "multiple traumatic injuries sustain in a mid-air airplane collision and subsequent ground impact."

The FAA's Civil Aerospace Medical Institute (CAMI), Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the autopsy. Results were negative for all tests conducted.

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The FAA's CAMI, Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the autopsy. Results were negative for all tests conducted.

TESTS AND RESEARCH

Piper

The fuselage, to include the cabin, pilot's seat, and instrument panel, was crushed from the right toward the left and fragmented. The pilot's seat separated from the seat track and was crushed to the left. The four-point seatbelt and harness remained latched at the center latching mechanism but separated from the airframe and seat area. The fuselage between the engine and the cabin, including the hopper, was impact damaged. The hopper cover separated from the fuselage and was unremarkable. The instrument panel was fragmented. The throttle quadrant separated and the throttle control was full forward. The frame of the fuselage was fragmented and destroyed. The fabric surrounding the frame was torn, portions were missing, and the remaining portions exhibited exposure to heat and fire.

The right wing was fragmented. The leading edge of the right wing was crushed and fragmented. The fabric on the outboard portion of the wing was missing or torn and exhibited exposure to heat and fire. The paint on the fabric of the right wing was melted. The forward spar on the right wing was bowed aft slightly and separated into several pieces. The center portion of the right wing, between the forward and aft spar, was fragmented and destroyed. The outboard five feet of the right aileron separated from the wing. The inboard portion of the right aileron separated and was fragmented. The right flap separated from the wing and was bent and buckled. The aileron control cables could not be checked for continuity due to impact damage.

The fabric on the inboard leading edge of the right wing exhibited paint transfer that was blue in color. The paint transfer area was 46 inches in length and 10 inches in width along the top of the leading edge of the right wing. Grey paint transfer was also noted along the forward leading edge portion of the right wing strut.

The left wing separated from the fuselage of the Piper. The left wing strut was bent up slightly, 70 inches inboard from the wing/strut intersection. The strut was bent a second time 27 inches inboard from the first bend. The leading edge of the left wing was unremarkable. The left aileron remained attached to the wing and the control cables were continuous from the aileron control surface inboard to the wing root.

The empennage separated from the fuselage and was broken into several large and small pieces. The right horizontal stabilizer and elevator separated from the empennage. The right elevator and stabilizer were crushed aft and the fabric was torn and melted. The left horizontal stabilizer and elevator were bent and twisted. The vertical stabilizer and rudder were bent and the fabric was torn and melted. The elevator flight control cables were continuous from the elevator forward to the control stick. The rudder control cable was continuous from the rudder horn forward to the center portion of the fuselage. Due to impact damage, complete rudder cable continuity was not established.

The engine separated from the fuselage. The cowling was bent, broken, and exhibited exposure to heat and fire. The bottom portion of the engine exhibited extensive heat and impact damage. The four-blade propeller assembly remained attached to the engine at the propeller flange. The blades were arbitrarily labeled “A,” “B,” “C,” and “D” for report purposes. Blade A was broken and splintered 20 inches inboard from the blade tip and exhibited heat damage. Blade B exhibited leading edge scoring and heat damage at the blade hub. Blade C exhibited leading edge scoring and both the leading and trailing edges exhibited exposure to heat and fire. The outboard eight inches of the Blade C was broken. Blade D exhibited exposure to heat and fire.

ADDITIONAL INFORMATION

Radar Data

Radar data provided by ZDV was used to establish position and track information for both the Cirrus and the Piper. Primary data was available for the Piper with intermittent secondary data in the form of Mode C or altitude information. Both primary and secondary data were available for the Cirrus. Both airplanes were flying according to visual flight rules and a continuous 1200-transponder beacon code was received from the Cirrus airplane.

According to the radar data provided by the FAA, the first coordinate associated with the Cirrus airplane was recorded at 1246:54 in the vicinity of KEIK. This track continued to the north toward the Longmont, Colorado, area, performed several turns, and then proceeded on a

southerly track towards Boulder.

The first coordinate associated with the Piper was recorded at 1320:58, just to the north of the departure end of runway 8 at KBDU. This position is 18.25 miles south of the Cirrus on a bearing of approximately 175 degrees. The Cirrus was on a bearing of 355 degrees from the Piper.

At 1321:58, the Piper was 15.6 miles south southeast of the Cirrus on a bearing of 168 degrees from the Cirrus. The Cirrus was on a bearing of 348 degrees from the Piper.

At 1322:57, the Piper was 14.6 miles south southeast of the Cirrus on a bearing of 168 degrees from the Cirrus. The Cirrus was on a bearing of 348 degrees from the Piper.

There was no radar data available for the Piper tow flight between 1323:39 and 1324:16.

At1324:57, the Piper was 7.9 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

At 1325:58, the Piper was 4.4 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

At 1326:58, the Piper was .76 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

Cirrus Cockpit Visibility

The Cirrus SR20 was built with side-by-side cockpit seating with a front windscreen and two side windows on the left and right cabin entry doors. Structure from the A pillar was positioned just to the front left of the forward left cockpit seat. The pilot's seat was adjustable and could be adjusted full forward, full aft, or at any of the 9 positions in between, adjustable at 0.72 inch increments.

A review of the forward and side visibility, from the left seat of the cockpit, was conducted using an exemplar Cirrus SR20. The seat was positioned in several track locations, including full forward, full aft, and an intermediate position in between full forward and full aft. Forward visibility in a position consistent with the aviation terminology of 12 o'clock was unrestricted in all seat positions. Side visibility in a position consistent with 9 o'clock was unrestricted in all seat positions.

The structure from the windscreen and door on the left side of the airplane restricted the seat occupant's view in a position consistent with the 10 or 11 o'clock positions. The extent of restriction was dependant on the position of the seat. The forward position restricted more of the center of the 10 o'clock position whereas the aft position restricted more of the center of the 11 o'clock position. The middle position restricted the 10 or 11 o'clock position, dependant

on the position of the pilot's head. Investigators were able to look around the A pillar by moving their head forward and aft.

Piper Cockpit Visibility

The Piper PA-25 was designed with a single seat, a front windscreen, and two side windows on the left and right side of the cockpit. Narrow structure, from the front and side windows, was positioned just to the front left and right side of the cockpit seat. In addition, the front windscreen had a metal structure that divided the windscreen into two parts. The pilot's seat was adjustable and could be adjusted full forward, full aft, or at any of the three positions in between, adjustable approximately 5 inches from full forward to full aft.

A review of the forward and side visibility, from the left seat of the cockpit, was conducted using an exemplar Piper PA-25 and drawings of the Piper PA-25. The seat was positioned in several track locations, including full forward, full aft, and an intermediate position in between full forward and full aft. Forward visibility in a position consistent with the aviation terminology of 12 o'clock was unrestricted in all seat positions. Side visibility in a position consistent with 3 o'clock was unrestricted in all seat positions. The window structure in the airplane did not create a significant restriction to visibility.

Accident Video

The rear left seat passenger of the Schweizer glider was creating a video to document the birthday flight. The video started during the takeoff roll, continued until the glider landed uneventfully back at KBDU, and was 15 minutes and 34 seconds in length. Shortly after the takeoff, the tow flight initiates a gradual turn to the left. The tow flight rolls out on a heading towards the mountains.

During the video, radio transmission can be heard in the back-ground. In addition, the glider pilot points out other airplanes, in the vicinity of their flight, to the two passengers.

Approximately 7 minutes and 30 seconds into the video, a fireball was recorded. The camera was recording to the west/southwest of the direction of flight at the time this fireball was captured.

The glider circles over the accident area several times before returning to KBDU for an uneventful landing.

The video records an area to the north of their direction of flight approximately one minute prior to the impact. A review of the video by the NTSB IIC did not identify the Cirrus.

Regulations

§ 91.113 Right-of-way rules: Except water operations.

“(b) General. When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear.

(d) Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way.

… an aircraft towing or refueling other aircraft has the right-of-way over all other engine-driven aircraft.”

Glider Tow Operations

Gliders can be launched for flight in one of several methods. One method involves a ground launch and the second method involves an aerial tow provided by a second airplane such as the Piper involved in this accident. During aerial tow operations, a tow line connects the tow airplane to the glider. Either the pilot of the tow airplane or the pilot of the glider can release this tow line. The maneuverability of both the tow airplane and the glider is greatly reduced during the tow operations.

Pilot Information

Certificate:	Private	**Age:**	58,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3	**Last FAA Medical Exam:**	December 20, 2008
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	May 15, 2009
Flight Time:	640 hours (Total, all aircraft), 359 hours (Total, this make and model), 8 hours (Last 90 days, all aircraft), 4 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N825BC
Model/Series:	SR20	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1655
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	April 8, 2009 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	319 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed	**Engine Model/Series:**	IO-360-ES
Registered Owner:	On file	**Rated Power:**	210 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBJC,5673 ft msl	**Distance from Accident Site:**	
Observation Time:	12:47 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 8000 ft AGL	**Visibility**	8 miles
Lowest Ceiling:	Overcast / 12000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.88 inches Hg	**Temperature/Dew Point:**	4°C / -6°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Erie, CO (KEIK)	**Type of Flight Plan Filed:**	None
Destination:	Erie, CO (KEIK)	**Type of Clearance:**	VFR
Departure Time:	13:00 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	Both in-flight and on-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	40.076667,-105.270553(est)

Administrative Information

Investigator In Charge (IIC):	Rodi, Jennifer
Additional Participating Persons:	Joseph T Walsh; FAA Flight Standards District Office; Denver, CO Brad Miller; Cirrus Design; Deluth, MN David Campell; Mile High Gliders; Boulder, CO Eric P Vanderpool; Avidyne; Longmont, CO Gregg Ellsworth; Ballistic Recovery Systems; Saint Paul, MN
Original Publish Date:	April 28, 2011
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=75336

Aviation Investigation Final Report

Location:	Boulder, Colorado	**Accident Number:**	CEN10FA115
Date & Time:	February 6, 2010, 13:27 Local	**Registration:**	N2472W
Aircraft:	Schweizer SGS 2-32	**Aircraft Damage:**	None
Defining Event:	Midair collision	**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Glider tow		

Analysis

While conducting glider-tow operations, the right wing of a Piper PA-25 was struck at a 90 degree angle by a Cirrus SR20. Analysis of the radar information, the flight condition of both airplanes, and the pilots' visibility in their respective cockpit configurations, suggests that until just prior to the impact, the Piper would have been located below the horizon and against the background of the surrounding terrain and city, between the 10 and 11 o'clock position of the Cirrus pilot. The Piper remained in this same relative position in the windscreen of the Cirrus pilot for the entire duration of its 7 minute flight. The Cirrus would have been above the horizon, against the white overcast sky, in about the 1 to 2 o'clock position of the Piper pilot. The Cirrus would have only appeared in this position after the Piper pilot completed the last turn and was headed to the west, which would have been (at most) the last 3 minutes of the flight.

Visual meteorological conditions existed at the time of the accident with an overcast layer and visibility of 8 miles. The overcast sky conditions likely made it difficult for the Piper pilot to detect the primarily white-colored Cirrus. The lack of maneuvering, as observed by the glider pilot prior to the accident, suggests that neither the pilot of the Cirrus nor the pilot of the Piper observed the other airplane prior to the accident. If the Piper pilot had observed the Cirrus prior to the impact, his ability to maneuver to avoid an impact would have been severely limited due to the glider in tow.

A postaccident examination of the engine and flight control systems on both airplanes revealed no mechanical anomalies that would have prevented either pilot from maneuvering to avoid an impact. Medical and pathological examination of both pilots revealed no medical or

toxicological issues that would have precluded either pilot from operating their airplane in a safe manner prior to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of both pilots to see and avoid the other resulting in a midair collision. Contributing to the accident was the lack of perceived visual relative motion of the Piper and the Cirrus to the pilot of each airplane, the terrain background, and the overcast weather conditions making it difficult for either pilot to visually acquire the other aircraft.

Findings

Personnel issues	Monitoring other aircraft - Pilot
Environmental issues	(general) - Contributed to outcome

Factual Information

History of Flight

Enroute	Glider tow event

HISTORY OF FLIGHT

On February 6, 2010, at 1327 mountain standard time, a Cirrus SR20 airplane, N825BC, collided with a Piper PA-25-235 airplane, N8718L, while the Piper was conducting glider tow operations with a Schweizer SGS 2-32 glider, N2472W, near Boulder, Colorado. Both the Cirrus and the Piper were substantially damaged. The Schweizer was not damaged. The Cirrus was owned and piloted by a private individual. Mile High Gliding, Inc., operated both the Piper and the Schweizer. Visual meteorological conditions prevailed at the time of the accident. All three flights were being conducted under the provisions of 14 Code of Federal Regulations Part 91 without flight plans. The commercial pilot aboard the Piper and the private pilot and passenger aboard the Cirrus were all fatally injured. The commercial pilot and two passengers aboard the Schweizer were not injured. The Cirrus departed Erie Municipal Airport (KEIK), Erie, Colorado, as a local flight approximately 1245. The Piper and Schweizer departed Boulder Municipal Airport (KBDU), Boulder, Colorado, as a glider tow flight approximately 1320.

According to a statement taken from the pilot of the Schweizer, the purpose of the flight was a scenic glider flight for a birthday party. The tow flight departed runway 8, performed a 360-degree turn for altitude on the east end of the airport, and then continued to a west/northwest heading. He stated that during this portion of the flight he was pointing out various landmarks in Boulder, and other aircraft in the vicinity, to the two passengers.

The pilot of the Schweizer remarked that at 8,000 feet the tow rope was tight, they were climbing at 70 miles per hour, and that the air was smooth. At this approximate time and altitude, he observed a Cirrus airplane off the right side of his glider, less than 500 feet away. He was immediately concerned that the Cirrus was going to fly between the tow plane and the glider, and impact the tow line. He reached for the towline release, at which time the Cirrus impacted the forward right side of the tow plane at nearly a 90 degree angle.

The Schweizer flew through a ball of fire and was able to return to KBDU shortly thereafter. The pilot of the Schweizer and one passenger on board the glider stated that they did not observe either the Piper or the Cirrus maneuver prior to the collision. The pilot of the Schweizer stated that prior to the impact there were no control movements or turbulence induced by control movements of the tow plane. He commented that the flight was extremely smooth and that normally he can feel control movements or inputs from the tow plane. He elaborated that he felt that the tow pilot would have tried to correct or make an evasive maneuver had he seen the Cirrus airplane prior to the impact.

Multiple witnesses heard the collision between the two airplanes and observed the post collision state of both airplanes. The Cirrus was observed to descend under the canopy of the Cirrus Airframe Parachute System (CAPS) while on fire. Debris from both airplanes was spread over a 1.5-mile area with components of the Piper at the northern most end of the debris field, and the main wreckage of the Cirrus at the southern most end of the debris field.

Radar data, provided by Denver Air Route Traffic Control Center (ZDV) in National Track Analysis Program (NTAP) format, identified and depicted the Cirrus flight from the time of departure from KEIK to the time of the accident. The encoded altitude of the Cirrus ranged from 6,800 feet to 8,800 feet mean sea level (msl). The flight track proceeded north from KEIK, maneuvered, and then reversed course back toward the south. Just prior to the accident the Cirrus was tracking an approximate course of 180 degrees.

Radar data, provided by ZDV in NTAP format, identified and depicted the Piper flight from the time of departure from KBDU to the time of the accident. The altitude of the Piper was intermittent with only two altitudes recorded during the accident flight. The first was reported at 1320:58 at an encoded altitude of 5,500 feet. The second was recorded at 1322:57 at an encoded altitude of 6,500 feet. The Piper performed one turn in the vicinity of KBDU. Just prior to the accident the Piper was tracking an approximate course of 270 degrees.

The radar data for the Cirrus depicted the airplane at a consistent altitude of 8,400 and 8,300 feet within the last minute of flight. There was no continuous altitude information associated with the radar data for the Piper tow flight; however, according to a statement from the glider pilot, they were climbing from the time of departure until the collision. He estimated the altitude at the time of the accident to be 8,000 feet.

Neither the Cirrus pilot or the Piper pilot were receiving radar flight following services, nor were they in voice communications with air route traffic control. There was no requirement for them to be in voice communications with air route traffic control.

PERSONNEL INFORMATION

Cirrus Pilot

The pilot of the Cirrus, age 58, held a private pilot certificate with an airplane single engine land rating. He was issued a third class airman medical certificate on December 4, 2008. The certificate contained the limitation “must wear corrective lenses.”

The charred remains of the Cirrus pilot’s flight logbook was located with the wreckage of the Cirrus airplane. The pilot of the Cirrus had logged no less than 640 hours of total time; 359 hours of which were logged in the accident airplane make and model. He had completed the requirements for a flight review on May 15, 2009, and had received an endorsement to operate high performance airplanes on October 10, 2003.

Piper Pilot

The pilot of the Piper, age 25, held a commercial pilot certificate with airplane single and multiengine land, and instrument ratings. In addition, he held a certified flight instructor certificate with airplane single and multiengine ratings. He was issued a first class airman medical certificate, with no limitations, on February 12, 2009.

Mile High Gliding submitted a completed Pilot/Operator Aircraft Accident/Incident Report form. On this form they reported that the pilot of the Piper had completed the requirements for a flight review on October 24, 2009. He had logged 1,110 hours total time; 260 hours of which were in the accident airplane make and model.

Schweizer Pilot

The pilot of the Schweizer, age 39, held a commercial pilot certificate with a glider rating, and an airplane single engine land, and instrument rating. In addition, he held a certified flight instructor certificate with airplane single engine, and instrument ratings. He was issued a third class airman medical certificate, with no limitations, on March 15, 2006.

The pilot of the Schweizer submitted a completed Pilot/Operator Aircraft Accident/Incident Report form. On this form he reported that he had completed the requirements for a flight review on June 7, 2009. The pilot had logged 2,044 hours total time; 3 hours of which were in the make and model of the glider.

AIRCRAFT INFORMATION

Cirrus

The Cirrus Design Corporation SR20 (serial number 20-1655) low wing airplane, predominately white in color with blue striping, was manufactured in May of 2006. It was registered with the Federal Aviation Administration (FAA) on a standard airworthiness certificate for normal operations. A Teledyne Continental Motors engine, IO-360-ES(6), rated at 210 horsepower at 2,700 rpm, powered the airplane. The engine was equipped with a three-blade, constant speed, Hartzell propeller.

The Cirrus was registered to and operated by the Cirrus pilot, and was maintained under an annual inspection program. A review of the maintenance records indicated that Vector Air – Aircraft Inspection & Repair, Erie, Colorado, had completed an annual inspection on April 8, 2009, at a Hobbs hour reading of 319.0 hours. The engine oil was drained and the oil filter was inspected on December 11, 2009, at a Hobbs hour reading of 388.1 hours. Front Range Transponder Services of Bailey, Colorado, tested and inspected the Cirrus's altimeter system and altitude reporting equipment on May 28, 2008. The system was tested to 20,000 feet with no "leakage" noted.

A traffic collision avoidance system was not installed on the accident Cirrus.

The Cirrus was equipped with pilot controlled exterior navigation and anti-collision strobe lights. The navigation lights and strobe lights were co-located on the wing tips; the navigation lights were red on the left side and green on the right side, and the anti-collision strobe lights were white.

Piper

The Piper PA-25-235 (serial number 25-5173) low wing airplane was manufactured in 1969. It was registered with the FAA on a special airworthiness certificate, in the restricted category for glider towing operations. A Lycoming O-540-B2C5 engine rated at 235 horsepower at 2,575 rpm powered the Piper. The engine was equipped with a four-blade, wooden composite Hoffman propeller.

The Piper was registered to and operated by Mile High Gliding Inc., and was maintained under an annual inspection program. A review of the maintenance records indicated that an annual inspection had been completed on December 7, 2009, at an airframe total time of 9,883 hours, and a recorded tachometer time of 3,346 hours. The Piper had flown 53.6 hours between the last inspection and the accident, and had a total airframe time of 9,936 hours. Front Range Transponder Services of Bailey, Colorado, tested and inspected the Piper's altimeter system and altitude reporting equipment on June 18, 2008. The system was tested to 18,000 feet with no "leakage" noted.

The Piper was not equipped with position or anti-collision lights; nor was it required to be equipped.

Schweizer

The Schweizer SGS 2-32 (serial number 47) glider, metallic color with yellow and red stripes, was manufactured in 1967. It was registered with the FAA on a standard airworthiness certificate for glider operations.

The glider was registered to and operated by Mile High Gliding, Inc., and was maintained under a 100-hour inspection program. A review of the maintenance records indicated that a 100-hour inspection had been completed on February 1, 2010, at an airframe total time of 6,201 hours. The annual inspection had been completed on August 24, 2009, at an airframe total time of 6,104.3 hours. The glider was not equipped with a transponder.

The Schweizer was not equipped with position or anti-collision lights; nor was it required to be equipped.

METEOROLOGICAL INFORMATION

The closest official weather observation station was Rocky Mountain Metropolitan Airport (KBJC), Denver, Colorado, located 14 nautical miles (nm) southeast of the accident site. The elevation of the weather observation station was 5,673 feet msl. The routine aviation weather report (METAR) for KBJC, issued at 1247, reported winds calm, visibility 8 miles, sky condition scattered clouds at 8,000 feet, overcast at 12,000 feet, temperature 4 degrees Celsius (C), dew point minus 6 degrees C, altimeter 29.89 inches.

The METAR for KBJC issued at 1353 reported winds calm, visibility 10 miles, sky condition few clouds at 9,000 feet, overcast at 12,000 feet, temperature 5 degrees C, dew point minus 7 degrees C, altimeter 29.86 inches.

AERODROME INFORMATION

Boulder Municipal Airport (KBDU) was a public, uncontrolled airport (Class G) located 3 miles northeast of Boulder, Colorado, at 40 degrees, 2 minutes, 21 seconds north latitude, and 105 degrees, 13 minutes, 32 seconds west longitude, at an estimated elevation of 5,288 feet. Class E airspace was located just to the east and north of KBDU and Class D airspace for KBJC was located to the south of KBDU. KBDU is located within the Mode C, 30 nm veil, by 3/4 miles.

The Boulder Municipal Airport website provided a depiction of the glider and tow plane traffic pattern at the airport. The flight track included a traffic pattern to the north and to the south of the airport with departures from the traffic pattern to the northwest and to the south. This map which depicted the flight track was also available at the airport.

In addition to this information provided by the airport, the FAA Cheyenne and Denver Sectional Aeronautical Charts and the Denver VFR Terminal Area Chart depicted glider activity, with a symbol of a glider and the letter “G,” in the vicinity of KBDU.

The Airport Facility Directory (AFD) published and maintained by the FAA stated that runway 08-26 G at KBDU was for glider use only. Further it stated that powered aircraft on approach to runway 08-26 should initiate a go around or yield right of way to gliders on final. There was no discussion of glider tow operations at the airport or in the vicinity of the airport.

WRECKAGE AND IMPACT INFORMATION

Wreckage debris from the Piper and the Cirrus were scattered over a 1.5 mile area. Measured field elevation was approximately 5,500 feet msl. The terrain where both wreckages came to rest was best characterized as rolling hills and rocky terrain, vegetated with wild grass, sagebrush, and yucca.

Cirrus

The largest identifiable portion of the Cirrus was categorized as the main wreckage and

consisted of the fuselage, empennage, and both wing assemblies. The engine separated and was located 25 feet to the north of the main wreckage. The main wreckage was oriented on an approximate heading of 250 degrees and was positioned on a slope of approximately 10 degrees. The CAPS remained attached to the main wreckage, and came to rest downhill from the forward portion of the fuselage. Portions of the engine cowling, forward right fuselage, and personal effects were fragmented and scattered.

The forward portion of the fuselage, to include the cabin seats and the instrument panel, extending aft to the empennage, was charred, melted, and partially consumed by fire. The ceiling of the airplane was destroyed. The multifunction display exhibited exposure to heat and fire. The damage precluded the recovery of any information. The primary flight display was not present with the main wreckage and the remains, including the memory card, were not recovered. The empennage, to include the horizontal stabilizer, elevator, vertical stabilizer, and rudder, remained attached to the fuselage and exhibited heat and fire damage. The upper portion of the vertical stabilizer was destroyed by fire. The surfaces were otherwise unremarkable. The flight control cables/tubes were continuous from the rudder and elevator control surfaces, forward, to the flight controls in the cabin. The CAPS remained attached to the main wreckage through the Kevlar straps at their respective mounted locations.

The right wing remained partially attached and came to rest under the main wreckage. The right aileron was located on the left side of the airplane, adjacent to the remains of the outboard portion of the right wing. The right wing flap was located on the right side of the airplane. The right wing, aileron, and flaps exhibited extensive heat and fire damage. The outboard portion of the left wing, including the left aileron, separated from the airplane and was found adjacent the airplane. The left wing exhibited exposure to heat and fire. The inboard portion of the left wing, including the left flap was destroyed by fire. The flight control cables were continuous from aileron control surfaces, inboard, to the flight controls in the cabin.

The engine assembly, to include the propeller, separated from the fuselage and came to rest approximately 25 feet north of the main wreckage. The engine cowling was fragmented and destroyed.

It could not be determined if the anti-collision lights were on or operating at the time of the accident.

Piper

The largest identifiable components of the Piper were the engine and propeller assembly, the left wing assembly, the empennage, and two large segments of the fuselage. The right wing, portions of the fuselage, the body fabric, instrument panel, and personal effects were fragmented and scattered. The engine and propeller assembly was located to the north of the main scatter of wreckage. The left wing was located to the east of the main scatter of wreckage.

MEDICAL AND PATHOLOGICAL INFORMATION

Cirrus Pilot

The Boulder County Coroner's Office performed the autopsy on the Cirrus pilot on February 7, 2010. The autopsy concluded that the cause of death was "multiple traumatic injuries sustain in a mid-air airplane collision and subsequent ground impact."

The FAA's Civil Aerospace Medical Institute (CAMI), Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the autopsy. Results were negative for all tests conducted.

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The FAA's CAMI, Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the autopsy. Results were negative for all tests conducted.

TESTS AND RESEARCH

Piper

The fuselage, to include the cabin, pilot's seat, and instrument panel, was crushed from the right toward the left and fragmented. The pilot's seat separated from the seat track and was crushed to the left. The four-point seatbelt and harness remained latched at the center latching mechanism but separated from the airframe and seat area. The fuselage between the engine and the cabin, including the hopper, was impact damaged. The hopper cover separated from the fuselage and was unremarkable. The instrument panel was fragmented. The throttle quadrant separated and the throttle control was full forward. The frame of the fuselage was fragmented and destroyed. The fabric surrounding the frame was torn, portions were missing, and the remaining portions exhibited exposure to heat and fire.

The right wing was fragmented. The leading edge of the right wing was crushed and fragmented. The fabric on the outboard portion of the wing was missing or torn and exhibited exposure to heat and fire. The paint on the fabric of the right wing was melted. The forward spar on the right wing was bowed aft slightly and separated into several pieces. The center portion of the right wing, between the forward and aft spar, was fragmented and destroyed. The outboard five feet of the right aileron separated from the wing. The inboard portion of the right aileron separated and was fragmented. The right flap separated from the wing and was bent and buckled. The aileron control cables could not be checked for continuity due to impact damage.

The fabric on the inboard leading edge of the right wing exhibited paint transfer that was blue in color. The paint transfer area was 46 inches in length and 10 inches in width along the top of the leading edge of the right wing. Grey paint transfer was also noted along the forward leading edge portion of the right wing strut.

The left wing separated from the fuselage of the Piper. The left wing strut was bent up slightly, 70 inches inboard from the wing/strut intersection. The strut was bent a second time 27 inches inboard from the first bend. The leading edge of the left wing was unremarkable. The left aileron remained attached to the wing and the control cables were continuous from the aileron control surface inboard to the wing root.

The empennage separated from the fuselage and was broken into several large and small pieces. The right horizontal stabilizer and elevator separated from the empennage. The right elevator and stabilizer were crushed aft and the fabric was torn and melted. The left horizontal stabilizer and elevator were bent and twisted. The vertical stabilizer and rudder were bent and the fabric was torn and melted. The elevator flight control cables were continuous from the elevator forward to the control stick. The rudder control cable was continuous from the rudder horn forward to the center portion of the fuselage. Due to impact damage, complete rudder cable continuity was not established.

The engine separated from the fuselage. The cowling was bent, broken, and exhibited exposure to heat and fire. The bottom portion of the engine exhibited extensive heat and impact damage. The four-blade propeller assembly remained attached to the engine at the propeller flange. The blades were arbitrarily labeled “A,” “B,” “C,” and “D” for report purposes. Blade A was broken and splintered 20 inches inboard from the blade tip and exhibited heat damage. Blade B exhibited leading edge scoring and heat damage at the blade hub. Blade C exhibited leading edge scoring and both the leading and trailing edges exhibited exposure to heat and fire. The outboard eight inches of the Blade C was broken. Blade D exhibited exposure to heat and fire.

ADDITIONAL INFORMATION

Radar Data

Radar data provided by ZDV was used to establish position and track information for both the Cirrus and the Piper. Primary data was available for the Piper with intermittent secondary data in the form of Mode C or altitude information. Both primary and secondary data were available for the Cirrus. Both airplanes were flying according to visual flight rules and a continuous 1200-transponder beacon code was received from the Cirrus airplane.

According to the radar data provided by the FAA, the first coordinate associated with the Cirrus airplane was recorded at 1246:54 in the vicinity of KEIK. This track continued to the north toward the Longmont, Colorado, area, performed several turns, and then proceeded on a

southerly track towards Boulder.

The first coordinate associated with the Piper was recorded at 1320:58, just to the north of the departure end of runway 8 at KBDU. This position is 18.25 miles south of the Cirrus on a bearing of approximately 175 degrees. The Cirrus was on a bearing of 355 degrees from the Piper.

At 1321:58, the Piper was 15.6 miles south southeast of the Cirrus on a bearing of 168 degrees from the Cirrus. The Cirrus was on a bearing of 348 degrees from the Piper.

At 1322:57, the Piper was 14.6 miles south southeast of the Cirrus on a bearing of 168 degrees from the Cirrus. The Cirrus was on a bearing of 348 degrees from the Piper.

There was no radar data available for the Piper tow flight between 1323:39 and 1324:16.

At1324:57, the Piper was 7.9 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

At 1325:58, the Piper was 4.4 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

At 1326:58, the Piper was .76 miles south southeast of the Cirrus on a bearing of 160 degrees. The Cirrus was on a bearing of 340 degrees from the Piper.

Cirrus Cockpit Visibility

The Cirrus SR20 was built with side-by-side cockpit seating with a front windscreen and two side windows on the left and right cabin entry doors. Structure from the A pillar was positioned just to the front left of the forward left cockpit seat. The pilot's seat was adjustable and could be adjusted full forward, full aft, or at any of the 9 positions in between, adjustable at 0.72 inch increments.

A review of the forward and side visibility, from the left seat of the cockpit, was conducted using an exemplar Cirrus SR20. The seat was positioned in several track locations, including full forward, full aft, and an intermediate position in between full forward and full aft. Forward visibility in a position consistent with the aviation terminology of 12 o'clock was unrestricted in all seat positions. Side visibility in a position consistent with 9 o'clock was unrestricted in all seat positions.

The structure from the windscreen and door on the left side of the airplane restricted the seat occupant's view in a position consistent with the 10 or 11 o'clock positions. The extent of restriction was dependant on the position of the seat. The forward position restricted more of the center of the 10 o'clock position whereas the aft position restricted more of the center of the 11 o'clock position. The middle position restricted the 10 or 11 o'clock position, dependant

on the position of the pilot's head. Investigators were able to look around the A pillar by moving their head forward and aft.

Piper Cockpit Visibility

The Piper PA-25 was designed with a single seat, a front windscreen, and two side windows on the left and right side of the cockpit. Narrow structure, from the front and side windows, was positioned just to the front left and right side of the cockpit seat. In addition, the front windscreen had a metal structure that divided the windscreen into two parts. The pilot's seat was adjustable and could be adjusted full forward, full aft, or at any of the three positions in between, adjustable approximately 5 inches from full forward to full aft.

A review of the forward and side visibility, from the left seat of the cockpit, was conducted using an exemplar Piper PA-25 and drawings of the Piper PA-25. The seat was positioned in several track locations, including full forward, full aft, and an intermediate position in between full forward and full aft. Forward visibility in a position consistent with the aviation terminology of 12 o'clock was unrestricted in all seat positions. Side visibility in a position consistent with 3 o'clock was unrestricted in all seat positions. The window structure in the airplane did not create a significant restriction to visibility.

Accident Video

The rear left seat passenger of the Schweizer glider was creating a video to document the birthday flight. The video started during the takeoff roll, continued until the glider landed uneventfully back at KBDU, and was 15 minutes and 34 seconds in length. Shortly after the takeoff, the tow flight initiates a gradual turn to the left. The tow flight rolls out on a heading towards the mountains.

During the video, radio transmission can be heard in the back-ground. In addition, the glider pilot points out other airplanes, in the vicinity of their flight, to the two passengers.

Approximately 7 minutes and 30 seconds into the video, a fireball was recorded. The camera was recording to the west/southwest of the direction of flight at the time this fireball was captured.

The glider circles over the accident area several times before returning to KBDU for an uneventful landing.

The video records an area to the north of their direction of flight approximately one minute prior to the impact. A review of the video by the NTSB IIC did not identify the Cirrus.

Regulations

§ 91.113 Right-of-way rules: Except water operations.

“(b) General. When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear.

(d) Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way.

… an aircraft towing or refueling other aircraft has the right-of-way over all other engine-driven aircraft.”

Glider Tow Operations

Gliders can be launched for flight in one of several methods. One method involves a ground launch and the second method involves an aerial tow provided by a second airplane such as the Piper involved in this accident. During aerial tow operations, a tow line connects the tow airplane to the glider. Either the pilot of the tow airplane or the pilot of the glider can release this tow line. The maneuverability of both the tow airplane and the glider is greatly reduced during the tow operations.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	39,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	March 30, 2006
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 7, 2009
Flight Time:	2044 hours (Total, all aircraft), 3 hours (Total, this make and model), 1972 hours (Pilot In Command, all aircraft), 66 hours (Last 90 days, all aircraft), 13 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Schweizer	**Registration:**	N2472W
Model/Series:	SGS 2-32	**Aircraft Category:**	Glider
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	47
Landing Gear Type:	Tandem	**Seats:**	3
Date/Type of Last Inspection:	August 24, 2009 Annual	**Certified Max Gross Wt.:**	1340 lbs
Time Since Last Inspection:		**Engines:**	0
Airframe Total Time:	6107 Hrs as of last inspection	**Engine Manufacturer:**	
ELT:	Not installed	**Engine Model/Series:**	
Registered Owner:	MILE HIGH GLIDING INC	**Rated Power:**	
Operator:	MILE HIGH GLIDING INC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBJC,5673 ft msl	**Distance from Accident Site:**	
Observation Time:	12:47 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 8000 ft AGL	**Visibility**	8 miles
Lowest Ceiling:	Overcast / 12000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.88 inches Hg	**Temperature/Dew Point:**	4°C / -6°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Boulder, CO (KBDU)	**Type of Flight Plan Filed:**	None
Destination:	Boulder, CO (KBDU)	**Type of Clearance:**	VFR
Departure Time:	13:20 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	None
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	40.076667,-105.270553(est)

Administrative Information

Investigator In Charge (IIC):	Rodi, Jennifer
Additional Participating Persons:	Joseph T Walsh; FAA Flight Standards District Office; Denver, CO Brad Miller; Cirrus Design; Deluth, MN David Campell; Mile High Gliders; Boulder, CO Eric P Vanderpool; Avidyne; Longmont, CO Gregg Ellsworth; Ballistic Recovery Systems; Saint Paul, MN
Original Publish Date:	April 28, 2011
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=75336