National Transportation Safety Board
Aviation Accident Final Report

Location: Grover Hill, OH
Date & Time: 11/06/2014, 1800 EST
Aircraft: CIRRUS DESIGN CORP SR22
Defining Event: Loss of control in flight
Flight Conducted Under: Part 91: General Aviation - Personal

Accident Number: CEN15FA040
Registration: N811CD
Aircraft Damage: Destroyed
Injuries: 3 Fatal

Analysis

Before departing on the instrument flight rules cross-country flight, the private pilot obtained a weather briefing that forecast moderate icing conditions along the intended route. The pilot, a commercial pilot-rated passenger, and a second passenger then departed on the flight in the high-performance, single engine airplane, which was not certified for flight into known icing conditions. Both the pilot and pilot-rated passenger were heard communicating with air traffic controllers during the flight and it could not be determined who was flying the airplane at the time of the accident. About 1 hour, 45 minutes into the flight, the pilot requested a higher altitude and stated to a controller that the airplane was "picking up a little ice." The pilot was granted a higher altitude, which was above the clouds, thus, reducing the potential for icing. About 20 minutes later, the flight began its descent toward the destination airport. Radar contact was lost about 8 minutes later when the airplane was at an altitude of 3,600 ft mean sea level.

Based on an analysis of the weather conditions near the accident site at the time of the accident, the atmosphere was conducive to the formation of supercooled large droplet (SLD) icing. It is likely that, during the descent, the airplane encountered SLD icing, which rapidly accumulated on the airframe to the extent that the airplane could no longer sustain flight. The airplane then entered a steep, uncontrolled descent to ground contact. Due to the night conditions, it is possible that the pilots were not able to visually observe the amount of ice on the airframe or did not realize how quickly the ice was accreting. The airplane was equipped with a parachute system (CAPS) that could be deployed by the pilot in flight. The CAPS rocket motor was found expended; however, the parachute remained in its pack. The investigation could not determine whether the rocket was deployed before impact or as a result of impact forces. There were no observed airplane preimpact anomalies.

Probable Cause and Findings
The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The airplane’s encounter with supercooled large droplet (SLD) icing, which resulted in a loss of lift and a subsequent uncontrolled descent into terrain. Also causal was the pilot's preflight and in-flight decision to fly in known icing conditions in an airplane that was not certified to do so.

**Findings**

<table>
<thead>
<tr>
<th>Personnel issues</th>
<th>Weather planning - Pilot (Cause)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Decision making/judgment - Pilot (Cause)</td>
</tr>
<tr>
<td>Environmental issues</td>
<td>Freezing rain/sleet - Effect on operation (Cause)</td>
</tr>
<tr>
<td></td>
<td>Freezing rain/sleet - Effect on equipment (Cause)</td>
</tr>
</tbody>
</table>
On November 6, 2014, about 1800 eastern standard time, a Cirrus Design Corporation SR22 airplane, N811CD, impacted a farm field near Grover Hill, Ohio, and a post impact fire occurred. The pilot, a pilot-rated passenger, and another passenger sustained fatal injuries. The airplane was destroyed by the impact and subsequent fire. The airplane was registered to and operated by Orthopedic Aviation Services LLC under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Night instrument flight rules (IFR) conditions prevailed in the area of the accident. The flight operated on an activated IFR flight plan. The flight originated about 1545 from the Washington Municipal Airport (AWG), near Washington, Iowa, and was destined for the Findlay Airport (FDY), near Findlay, Ohio.

A fueling receipt from AWG showed that N811CD was serviced with 26.67 gallons of 100 low lead aviation gasoline at 1519. The AWG airport manager indicated that he was at the airport at 1530 and he talked to three people who flew in N811CD. There were two men and a woman of the same age. He reported that they said they were flying east and would be back on Sunday as part of their return flight. Witnesses reported to the airport manager that they thought the woman was seated in the front right seat. The manager indicated that from 300 feet away, the airplane looked very clean. He was outside when they took off and the engine start-up sounded normal as did the engine run-up. The manager said that the takeoff appeared to be under full power and they climbed at a normal rate of climb.

According to records from the Federal Aviation Administration (FAA), the accident airplane communicated with the Terminal Radar Approach Control (TRACON) located near Ft. Wayne, Indiana. About 1729, the pilot requested a climb to 10 or 11 thousand feet above mean seal level (MSL) because he was "picking up a little ice". The air traffic controller cleared the flight to 10,000 feet MSL, and asked for more details. The pilot reported that the windshield was picking up a little ice, and the outside air temperature was minus six degrees. About 1746, the pilot reported that the cloud tops were ragged between 9,500 and 10,300 feet MSL. About 1749, the pilot requested a lower altitude and the controller cleared the flight to 5,000 feet MSL. About 1751, the controller handed the flight off to Toledo TRACON.

About 1752, the pilot checked on with Toledo TRACON and indicated that he was on descent to 5,000 feet. The controller asked if the pilot had the current FDY weather. About 1754, the pilot reported that he had the current FDY weather and requested the RNAV [Area Navigation] Runway 25 approach to FDY. The controller advised the pilot to expect that RNAV approach. The last radio transmission from the airplane restated that the RNAV Runway 25 approach was requested and that transmission was received about 1754. The last transponder reply was about 1757, which indicated the airplane was at 3,600 feet MSL. That transponder reply showed the
airplane was located to the south and east of the intersection of Route 60 and Town Road 137, near Grover Hill, Ohio.

A witness was driving in her car eastbound on Route 60 and was approaching Town Road 117. This intersection was about three miles west of the accident site. She indicated that she was driving about 45 to 50 mph. It was dark at the time and "spit" rain was coming down. She said that she could see through the car's windshield. She stated that above woods just south of Route 60, she saw a light coming down slowly. She described it as looking similar to a comet. The descent angle she physically gestured while being interviewed was about 35 to 45 degrees downward in the direction of the accident site. She said she saw the descending light for about two seconds. She subsequently saw an explosion, which was orange in color.

Another witness was in a house about a third of a mile northwest of the accident site. She indicated that a heavy wind or tornado sound is what got her attention. She also heard a sound she vocally described as "NEEEEEEER." She saw a reflection of light in a mirror. An explosion occurred when the NEEEEER sound stopped. She said that the conditions at that time were windy, dark, and rainy.

### Pilot Information

<table>
<thead>
<tr>
<th>Certificate:</th>
<th>Private</th>
<th>Age:</th>
<th>59</th>
</tr>
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<tbody>
<tr>
<td>Airplane Rating(s):</td>
<td>Single-engine Land</td>
<td>Seat Occupied:</td>
<td>Unknown</td>
</tr>
<tr>
<td>Other Aircraft Rating(s):</td>
<td>None</td>
<td>Restraint Used:</td>
<td>4-point</td>
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<tr>
<td>Instrument Rating(s):</td>
<td>Airplane</td>
<td>Second Pilot Present:</td>
<td>Yes</td>
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<tr>
<td>Instructor Rating(s):</td>
<td>None</td>
<td>Toxicology Performed:</td>
<td>Yes</td>
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<tr>
<td>Medical Certification:</td>
<td>Class 3 With Waivers/Limitations</td>
<td>Last FAA Medical Exam:</td>
<td>10/15/2014</td>
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<tr>
<td>Occupational Pilot:</td>
<td>No</td>
<td>Last Flight Review or Equivalent:</td>
<td>08/16/2014</td>
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<tr>
<td>Flight Time:</td>
<td>(Estimated) 1000.3 hours (Total, all aircraft), 127.8 hours (Total, this make and model)</td>
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### Pilot-Rated Passenger Information

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<tr>
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<td>Seat Occupied:</td>
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<td>Other Aircraft Rating(s):</td>
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<td>Restraint Used:</td>
<td>Unknown</td>
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<tr>
<td>Instrument Rating(s):</td>
<td>Airplane</td>
<td>Second Pilot Present:</td>
<td>Yes</td>
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<tr>
<td>Instructor Rating(s):</td>
<td>Airplane Single-engine; Instrument Airplane</td>
<td>Toxicology Performed:</td>
<td>Yes</td>
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<tr>
<td>Occupational Pilot:</td>
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<td>Last Flight Review or Equivalent:</td>
<td>12/12/2013</td>
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<tr>
<td>Flight Time:</td>
<td>5016 hours (Total, all aircraft)</td>
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</table>
The 59-year-old pilot held a FAA private pilot certificate with an airplane single-engine land and instrument ratings. He had been issued a FAA third-class medical certificate on October 15, 2014, with a limitation that he must have available glasses for near vision. The pilot reported on the application for that medical certificate that he had accumulated 987 hours of total flight time and 150 hours of flight time in the six months before that application.

The last entry in the pilot's logbook was dated November 5, 2014. The pilot recorded that he had accumulated 1,000.3 hours of total flight time, 151.5 hours of flight time during night conditions, 127.8 hours of flight time in SR22 airplanes, and 19.3 hours of flight time in actual instrument conditions. A certified flight instructor's endorsement in the pilot's logbook showed that the pilot received a flight review on August 16, 2014.

The 65-year-old pilot rated passenger held a FAA commercial pilot certificate with airplane single-engine land, airplane multiengine land, and instrument airplane ratings. He also held a FAA flight instructor certificate with airplane single-engine and instrument airplane ratings. He had been issued a FAA second-class medical certificate on April 21, 2014. This medical certificate was issued to the pilot rated passenger as a Time-limited Special Issuance Second Class Medical Certificate with the following limitation(s): "Not Valid for Any Class After 04/30/2015" and "Must wear corrective lenses for near and distant vision." He reported on the application for that special issuance medical certificate that he had accumulated 5,016 hours of total flight time and 160 hours of flight time in the six months prior to that application.

Aircraft and Owner/Operator Information

<table>
<thead>
<tr>
<th>Aircraft Make:</th>
<th>CIRRUS DESIGN CORP</th>
<th>Registration:</th>
<th>N811CD</th>
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<tbody>
<tr>
<td>Model/Series:</td>
<td>SR22 NO SERIES</td>
<td>Aircraft Category:</td>
<td>Airplane</td>
</tr>
<tr>
<td>Year of Manufacture:</td>
<td>2001</td>
<td>Amateur Built:</td>
<td>No</td>
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<tr>
<td>Airworthiness Certificate:</td>
<td>Normal</td>
<td>Serial Number:</td>
<td>0120</td>
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<tr>
<td>Landing Gear Type:</td>
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<td>Seats:</td>
<td>4</td>
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<tr>
<td>Date/Type of Last Inspection:</td>
<td>10/08/2014, Annual</td>
<td>Certified Max Gross Wt.:</td>
<td>3400 lbs</td>
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<tr>
<td>Time Since Last Inspection:</td>
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<td>Engines:</td>
<td>1 Reciprocating</td>
</tr>
<tr>
<td>Airframe Total Time:</td>
<td>1806.2 Hours as of last inspection</td>
<td>Engine Manufacturer:</td>
<td>CONT MOTOR</td>
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<tr>
<td>ELT:</td>
<td>Installed</td>
<td>Engine Model/Series:</td>
<td>IO-550-N7B</td>
</tr>
<tr>
<td>Registered Owner:</td>
<td>On file</td>
<td>Rated Power:</td>
<td>310 hp</td>
</tr>
<tr>
<td>Operator:</td>
<td>On file</td>
<td>Operating Certificate(s) Held:</td>
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</table>

N811CD, a 2001 model Cirrus Design Corporation SR22, serial number 0120, was a four-place single engine low-wing airplane powered by a six-cylinder, 310-horsepower, Continental
Motors model IO-550-N7B engine, with serial number 686224, that drove a three-bladed Hartzell constant speed propeller. According to airplane logbook entries, an annual inspection was completed on October 8, 2014. The airplane accumulated 1806.2 hours of total flight time at the time of that inspection.

A FAA Inspector reported that the airplane was modified with a LoPresti Aviation BoomBeam landing light system in November of 2013. The installed 60-watt BoomBeam bulb emitted a 2,990 lumen output.

The airplane was fitted with a Cirrus Airframe Parachute System (CAPS) designed to recover the airplane and its occupants to the ground in the event of an in-flight emergency. The CAPS contains a parachute (within a deployment bag) located within a fiberglass CAPS enclosure compartment, a solid-propellant rocket contained within a launch tube to deploy the parachute, a pick-up collar assembly and attached Teflon-coated steel cable lanyard and incremental bridle, a rocket activation system that consisted of an activation T-handle, an activation cable, and a rocket igniter, and a harness assembly which attached the parachute to the fuselage.

The accident airplane was not equipped nor certified for flight in icing conditions.

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**Meteorological Information and Flight Plan**

<table>
<thead>
<tr>
<th>Conditions at Accident Site:</th>
<th>Instrument Conditions</th>
<th>Condition of Light:</th>
<th>Night/Dark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation Facility, Elevation:</td>
<td>KFDY, 812 ft msl</td>
<td>Distance from Accident Site:</td>
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<tr>
<td>Observation Time:</td>
<td>1753 EST</td>
<td>Direction from Accident Site:</td>
<td>93°</td>
</tr>
<tr>
<td>Lowest Cloud Condition:</td>
<td>Visibility</td>
<td>Visibility (RVR):</td>
<td>3 Miles</td>
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<tr>
<td>Lowest Ceiling:</td>
<td>Overcast / 600 ft agl</td>
<td>Turbulence Type Forecast/Actual:</td>
<td>/</td>
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<tr>
<td>Wind Speed/Gusts:</td>
<td>10 knots /</td>
<td>Turbulence Severity Forecast/Actual:</td>
<td>/</td>
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<tr>
<td>Wind Direction:</td>
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<td>Wind Direction:</td>
<td>260°</td>
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<tr>
<td>Altimeter Setting:</td>
<td>29.81 inches Hg</td>
<td>Temperature/Dew Point:</td>
<td>7°C / 6°C</td>
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<tr>
<td>Precipitation and Obscuration:</td>
<td>Mist; No Precipitation</td>
<td>Type of Flight Plan Filed:</td>
<td>IFR</td>
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<tr>
<td>Departure Point:</td>
<td>WASHINGTON, IA (AWG)</td>
<td>Type of Clearance:</td>
<td>IFR</td>
</tr>
<tr>
<td>Destination:</td>
<td>FINDLAY, OH (FDY)</td>
<td>Departure Time:</td>
<td>1545 EST</td>
</tr>
<tr>
<td>Type of Airspace:</td>
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<td></td>
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</table>

A National Transportation Safety Board (NTSB) senior meteorologist collected factual weather data in reference to the accident flight and produced a group chairman’s factual weather report. The report showed that the accident pilot was provided weather information from Lockheed-Martin Flight Service through the ForeFlight.com website. He also filed an IFR flight
plan for a direct flight from AWG to FDY. The pilot also requested a standard text weather briefing format. Standard weather information for the accident flight, to include the airmen’s meteorological information (AIRMETs), area forecast (FA), meteorological terminal air reports (METARs), terminal aerodrome forecasts (TAFs), and pilot reports (PIREPs), was contained in the text weather briefing package. Meteorological Impact Statements (MIS) were not contained in the weather briefing information package. There is no record of any additional weather briefing information the accident pilot received.

A review of the 1900 surface analysis chart showed that it depicted a surface trough stretching from central New York westward across northern Pennsylvania, northern Ohio, and central Indiana. Constant pressure charts depicted a low-level trough over or just to the northwest of the accident site around the accident time with temperatures below freezing.

At 1753, the recorded weather about 38 miles and 93 degrees from the accident site at FDY was: Wind 260 degrees at 10 knots; visibility 3 statute miles; present weather mist; sky condition overcast clouds at 600 feet; temperature 7 degrees C; dew point 6 degrees C; altimeter 29.81 inches of mercury.

At 1753, the recorded weather about 18 miles and 10 degrees from the accident site at the Defiance Memorial Airport, near Defiance, Ohio, (DFI) was: Wind 280 degrees at 8 knots: visibility 6 statute miles; present weather light rain, mist; sky condition overcast ceiling at 1,000 feet; temperature 8 degrees C; dew point 6 degrees C; altimeter 29.81 inches of mercury.

At 1853, the recorded weather at DFI was: Wind 320 degrees at 15 knots with gusts to 20 knots; visibility 9 statute miles; present weather light rain; sky condition overcast ceiling at 1,100 feet; temperature 8 degrees C; dew point 6 degrees C; altimeter setting 29.87 inches of mercury.

The 1900 Wilmington, Ohio, (KILN) upper air sounding was plotted. The plotted sounding depicted the lifted condensation level at 1,502 feet, a convective condensation level of 2,554 feet, and a level of free convection at 1,675 feet. The freezing level was located at 3,829 feet. The precipitable water value was 0.54 inches.

The sounding indicated a relatively moist vertical environment from the surface through 12,000 feet MSL with several layers of conditional instability. This environment would have been conducive of cloud formation from the surface to 12,000 feet and icing (clear, rime, and mixed) between 4,000 and 12,000 feet MSL. Additionally, the sounding was close to saturation between 0 degrees C and -11 degrees C (between 4,000 and 12,000 feet MSL) which, according to articles in professional meteorology journals, is considered a temperature range supportive of the growth of supercooled liquid water droplets (SLD).

Visible and infrared data from the Geostationary Operational Environmental Satellite number 13 (GOES-13) was obtained and plotted. GOES-13 imagery at a wavelength of 0.65 microns (µm) and 10.7 µm depicted brightness temperatures for the scene and imagery surrounding the time of the accident, from 1400 through 2000 at approximately 15-minute intervals, were reviewed. The review revealed a general northwest to southeast movement of the clouds over the accident site about the accident time. Based on the brightness temperatures above the
accident site and the vertical temperature profile provided by the 1900 KILN sounding, the
approximate cloud-top heights over the accident site were 13,000 feet at 1800.

Fort Wayne, Indiana, (KIWX) Weather Surveillance Radar-1988, Doppler (WSR-88D), was
located about 57 miles west-northwest of the accident site. Archive radar data was plotted with
the airplane’s radar track. Plotted base reflectivity values are located over and along the route
of flight with the precipitation targets moving from north to south between 1755 and 1757.
These reflectivity values correspond to very light precipitation targets. There were no lightning
strikes near the accident site at the accident time.

KIWX WSR-88D dual-polarization (dual-pol) archived radar data was obtained and plotted.
About 1750, radar data showed the accident flight began a descent from 10,000 feet and dual-
pol depicted conditions near the aircraft location at the precipitation targets indicated small
hydrometeor sizes, and/or a small amount of hydrometeors in the beam, hydrometeors that
were much more horizontally shaped as they fell than spherical, and all the hydrometeors in
the scan had very similar characteristics. These shape characteristics are similar to the freezing
drizzle and supercooled liquid water characteristics described in articles in professional
meteorology journals.

PIREPs, two hours before and after the accident and within 300 miles of the accident site, were
reviewed. A portion of the PIREPS reported light or moderate icing conditions to include one
report of severe clear icing at 4,000 feet MSL at 1900 about 180 degrees and 175 miles south of
the accident site.

There was no issued significant meteorological information valid for the area of the accident
site at the accident time.

There was no issued Center Weather Service Unit (CWSU) advisory valid for the area of the
accident site at the accident time.

There was a MIS issued at 1344 by the CWSU near Cleveland, Ohio, valid for the accident site
at the accident time. The MIS discussed patchy light to moderate icing conditions with bases at
4,500 feet in the northern half of Cleveland’s airspace, with the icing base at 7,500 feet across
the southern half of Cleveland’s airspace. The top of the icing was forecast to be at 16,000 feet
with patchy instrument conditions in the precipitation.

AIRMET Zulu was issued at 1545 and was valid at the accident time. It was the only AIRMET
valid for the accident site, at the accident time, and the accident flight level. AIRMET Zulu
forecasted moderate icing conditions between the freezing level and flight level (FL180 with
the forecasted freezing level between 2,000 and 7,000 feet within the AIRMET airspace.

A corrected FA issued at 1540, valid at the accident time, forecasted an overcast ceiling from
1,500 to 2,500 feet MSL with tops to FL240, visibility between 3 and 5 miles, scattered light
rain showers, and mist.

The Ft Wayne, Indiana, TAF, valid at the time of the accident, was issued at 1235 and was valid
for a 24-hour period beginning at 1300. The TAF forecast for the time period surrounding the
accident was for wind from 300 degrees at 16 knots with gusts to 26 knots, 6 miles visibility, light rain shower, and an overcast ceiling at 2,000 feet.

The current icing potential (CIP) supplements other icing advisories. The CIP icing probabilities, icing severity, and SLD potential, valid at 1700 and 1800 EST at 10,000, 9,000, 8,000, 7,000, and 6,000 feet MSL were reviewed. The CIP icing probabilities depicted 50 to above 85 percent probability of icing at every flight level between 10,000 and 6,000 feet around the accident site around the time of the accident. The highest probabilities for icing were located between 8,000 and 6,000 feet with the tongue of greater than 85 percent probability of icing stretching westward from the accident time into northern Indiana. In addition to the CIP indicating greater than 85 percent probability of icing, the CIP indicated that the icing severity around the accident site was between light and moderate. Below 8,000 feet, the icing severity around the accident site was depicted as mostly moderate icing at both 1700 and 1800. SLD potential was also calculated by CIP. Around the accident site at the accident time, where the SLD potential was calculated as "unknown", the SLD potential was between 40 and 70 percent with the highest probability of SLD between 9,000 and 6,000 feet.

### Airport Information

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<th>Airport:</th>
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<tr>
<td>Runway Surface Type:</td>
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<td>Airport Elevation:</td>
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<tr>
<td>Runway Used:</td>
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<td>Runway Length/Width:</td>
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### Wreckage and Impact Information

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<tr>
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<tr>
<td>Ground Injuries:</td>
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<tr>
<td>Total Injuries:</td>
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<tr>
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<tr>
<td>Aircraft Fire:</td>
<td>On-Ground</td>
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<tr>
<td>Aircraft Explosion:</td>
<td>On-Ground</td>
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<tr>
<td>Latitude, Longitude:</td>
<td>41.045833, -84.496944</td>
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</table>

The main sections of the airplane fuselage and empennage were found impacted and buried in soft terrain about 199 degrees and 907 feet from the intersection of Route 60 and Town Road 137. The airplane's resting heading was about 77 degrees. The airplane's airframe was found fragmented with its heavier components north of the main wreckage and its lighter components east of the main wreckage. The observed debris field of components extended about 124 feet north and about 187 feet east of the main wreckage.
Flight control cable and engine cable continuity was not established due to fragmentation and thermal damage. Airframe components in the debris field exhibited localized discoloration and charring consistent with a post-impact ground fire. Both navigation light covers were found and green glass fragments were found under the navigation light cover on the south side of the main wreckage. The engine cowling was fragmented and it exhibited a crush line consistent with a right wing low impact. Both left and right ailerons and flaps were found resting on the ground in the debris field to the north of the main wreckage. The empennage, to include the lower section of the rudder, was found discolored and deformed consistent with thermal damage. A portion of the vertical stabilizer and the lower section of the rudder were found on top of and adjacent to charred sections of wing skin and wing spar at the southwest side of the main wreckage. The upper section of the rudder was found resting on the ground about 100 feet east of the main wreckage in a debris field mostly north of the wreckage. Separation surfaces on the upper and lower sections exhibited consistent sized and shaped tears and separations. The upper rudder section did not exhibit the same dark discoloration as the lower section did.

The rocket motor and parachute were found within subsurface empennage and fuselage fragments in the main wreckage area. The rocket motor along with its pick-up collar and attached lanyards were found situated together near the parachute. The rocket motor's propellant was found to be expended and the motor exhibited discoloration consistent with thermal damage. The parachute was found in a packed state. The snubbed rear harness and 3-point links remained in place consistent with an as-installed configuration. The parachute exhibited deformation and discoloration consistent with thermal damage. The CAPS activation handle along with a retained section of its activation cable were found about 100 feet to east/northeast in the debris field. The handle exhibited witness marks consistent with impact damage and its cable exhibited separation signatures consistent with overload. The CAPS activation handle holder/bracket was found about 100 feet east of the main wreckage in the debris field. The holder/bracket exhibited witness marks consistent with impact damage and the bracket was found bent about 180 degrees. The CAPS cover was not identified in the wreckage or recovered during the investigation.

The propeller and propeller flange separated from its engine crankshaft and was found buried about four feet below the field. The propeller blades exhibited S-shaped bending and leading edge gouges. The engine was found deformed and buried about eight feet below the field. The No. 5 and No. 6 cylinders separated from their crankcase. Disassembly of the fuel pump showed its shear shaft separated in overload and it shaft was bent. The pump's vanes were intact and the pump rotated by hand about a quarter turn. The pump's mixture arm also rotated when moved by hand. Both magnetos sustained impact damage. One magneto produced spark when its impulse coupling was rotated by hand. Removed sparkplugs exhibited normal combustion discoloring and a "worn out, normal condition" when compared to a Champion Check-A-Plug chart. Accessible cylinders were inspected using a lighted borescope and no preimpact anomalies were detected during the borescope inspection. Disassembly of the oil pump revealed no debris or preimpact anomalies. Disassembly of the fuel manifold revealed that its seal surface facing its screen and valve exhibited deterioration and its seal surface facing its spring did not exhibit deterioration.

Disassembly of the attitude indicator revealed rotational scoring on its rotor and cage.
Medical And Pathological Information

An autopsy was performed on the pilot and pilot-rated passenger by the Paulding County Coroner’s Office. Both their causes of death were listed as blunt force trauma. Toxicological samples were not able to be taken on neither the pilot nor the pilot-rated passenger.

Fire

The main wreckage exhibited charring, deformation, and discoloration consistent with a ground fire. Separated airframe components in the debris field exhibited localized discoloration and charring consistent with a post-impact ground fire. A witness reported the sound of an explosion consistent with a ground impact explosion.

Tests And Research

An NTSB senior air traffic specialist obtained radar data from the FAA. He produced a table of the data and graphical images of the airplane’s radar returns. The data was given to the weather group chairman and vehicle performance group chairman for use in their reports. The radar data and graphics are appended to the docket material associated with this case.

An NTSB senior aerospace engineer, who was the vehicle performance group chairman, used the radar data to produce a three dimensional graphic. The graphic does not depict the airplane’s airspeed or descent rates. However, the graphic visually shows the slope of the accident airplane’s descent near the accident site. The vehicle performance graphic is appended to the docket material associated with this case.

The vehicle performance group chairman produced a performance study that, in part, found that the accident flight encountered clouds and ice while in cruise at 9,000 feet just south of Tippecanoe, Indiana. A climb to 10,000 feet took the flight out of the clouds. However, when the airplane began its descent to the destination airport about 20 minutes later over Woodburn, Indiana, it again encountered clouds. During the descent, at an altitude of about 6,000 feet, the airplane pitched down over 70 degrees and entered a steep right turn. During the final 20 seconds of radar data, the airplane’s bank angle exceeded 60 degrees as it descended at a rate of about 9,000 feet per minute. Impact occurred about seven and a half minutes after the start of the descent.

The published aerodynamic stall speed for the Cirrus SR22 is 70 knots, and estimates from radar data indicated that the airspeed was around 150 knots before the airplane pitched down abruptly. However, both bank angle and ice accretion would increase the stall speed. The vehicle performance study is appended to the docket material associated with this case.
The accident airplane's CAPS activation handle, activation handle holder, activation handle safety pin, and the rudder's upper and lower sections were shipped to the NTSB Materials Laboratory. An NTSB chemist indicated that the submitted rudder from this accident was sent to the NTSB Materials Laboratory to determine if rocket fuel residue from the parachute system was present on the exterior surface of the rudder skin. The entire surface was swabbed and the individual swabs were analyzed using a Fourier transform infrared spectrometer with a diamond attenuated total reflectance accessory in accordance to ASTM E1252-98 (American Society for Testing Materials E1252-98: Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis). The spectra from all the samples were compared to a known spectra for the rocket fuel components. No spectral signatures matching the rocket fuel components were found in any of the swab samples.

An NTSB senior materials engineer also examined the airplane components and produced Materials Laboratory Factual Report No. 16-026. The report, in part, indicated that the plunger portion of the handle exhibited marks along the outer edge of the plunger end face and along the edge of an inner pass-through hole for its cable. The edge exhibited an arc-shaped segment where the red anodization layer had been removed and circumferential wear marks were observed, consistent with a sliding contact. On either end of the sliding contact region and at a few locations within, the edge exhibited linear impression marks consistent with the width of wires that makes up the cable. A deformed flat was observed on the side of the plunger next to the edge and additional linear impression marks were observed further up the plunger. The marks along the edge of the inner hole also exhibited linear features and the hole was deformed. The marks along the edge of the inner hole subtended a similar arc angle as the marks along the outer edge.

Visual examination of the cable revealed one of its wires was bent at a right angle at a location consistent with it having been bent over the outer edge of the plunger end face. A second wire was found fractured at the same location as the bend. Examination of the cable at the pass-through hole revealed three broken wires, wear, and material transfer on the outside of the cable.

The handle holder exhibited linear impression marks, similar to those observed on the plunger. The marks were concentrated along the edges of the chamfer where the barrel meets the end face of the holder. The width of one of the deeper impression marks was consistent with the width of wires that comprise the cable.

The handle holder mounting bracket was bent forming a U-shape. Relative to its as-installed orientation, the bend was consistent with the bracket bending down, aft, and to the right side of the airplane.

The safety pin was visually examined and no notable features were observed.

Examination of the rudder revealed it was fractured through the middle third separating it into a lower piece and an upper piece. The lower piece exhibited features consistent with exposure to elevated temperatures including soot on the skin, organic constituents volatilized from the paint, and incipient melting of the skin at the upper end. The upper piece was crushed and bent and it exhibited features consistent with scraping of the paint off of the right side.
At the forward end and bottom edge of the upper piece there was a riveted L-shaped bracket with a horizontal arm that was deformed downward and the rivets had pulled out of the bracket. The rudder skin fractures along the right and left sides of the rudder respectively, exhibited features consistent with tensile overstress fractures. At the aft end of the rudder, the skin exhibited a bend and tear in the skin. Together, the features were consistent with a tensile/bending overstress fracture starting at the forward end of the rudder and terminating at the aft end of the rudder.

The skin at the upper end of the lower piece exhibited sagging, surface oxide cracking, and waviness of the skin, consistent with incipient melting. The region of incipient melting was confined to the upper portion of the skin and the transition occurred along an approximately linear boundary. Toward the forward end on the left side, there was a split in the skin that had opened into two approximately parabolic shapes. The skin on the left hand side of the rudder was resting on the skin on the right hand side of the rudder at either end of the parabolic region and the left side skin was sagging in between. The materials laboratory report is appended to the docket material associated with this case.

Additional Information

Both the pilot and pilot-rated passenger were heard communicating on the air traffic control frequency during the flight. Additionally, the investigation could not determine which pilot-rated occupant was flying the airplane or where each pilot-rated occupant was seated due to the fragmentation of the airplane.

According to NTSB accident report CEN13FA096, on December 10, 2012, about 2016 central standard time, a Messerschmitt Bolkow-Blohm model BK 117-A3 helicopter, N911BK, impacted the ground near Compton, Illinois. The pilot, flight nurse, and flight paramedic were fatally injured, and the helicopter sustained substantial damage from impact forces. The emergency medical services (EMS) equipped helicopter was registered to Rockford Memorial Hospital, and operated by Air Methods Corporation under the provisions of 14 Code of Federal Regulations Part 135 as an on-demand air-taxi flight. Night visual meteorological conditions prevailed for the flight, which operated on a company visual flight rules flight plan. The flight originated from the Rockford Memorial Hospital Heliport (LL83), Rockford, Illinois, about 1958 and was en route to the Mendota Community Hospital Heliport (14IL), Mendota, Illinois, where it was to pick up a patient for transport back to the Rockford Memorial Hospital.

Within the report, weather data and reports from first responders indicated that the flight likely encountered areas of snow, freezing drizzle, and supercooled liquid water.

The National Transportation Safety Board determined the probable cause in reference CEN13FA096 as follows: The inadvertent encounter with inclement weather, including snow, freezing rain, and reduced visibility conditions, which led to the pilot’s spatial disorientation and loss of aircraft control.

According to preliminary information supplied to the NTSB, on October 18, 2013, about 1017 central daylight time, N610ED, a Cessna 500, Citation, multi-engine turbofan airplane, was
destroyed during impact with terrain near Derby, Kansas. The pilot and passenger were fatally injured. The airplane was registered to and operated by Dufresne, Inc.; Murrieta, California. Day visual meteorological conditions (VMC) prevailed at the time of the accident and an instrument flight rules flight plan had been filed for the 14 Code of Federal Regulations Part 91 business flight. The airplane departed Wichita Mid-Continent Airport (ICT), Wichita, Kansas, about 1007 and was destined for New Braunfels Regional Airport (BAZ), New Braunfels, Texas.

Preliminary data from Federal Aviation Administration (FAA) air traffic control showed normal operations during climb before the pilot contacted the FAA Kansas City Air Route Traffic Control Center at 1014 and reported leveling at 15,000 feet. The controller cleared the pilot to proceed direct to Millsap, Texas and climb to 23,000 feet. Over the next minute, the aircraft made an abrupt right turn followed by an abrupt left turn. Radar data showed the airplane descended to 14,600 feet before resuming climb and reaching 15,200 feet at 1016:20. The aircraft then made an abrupt descending left turn and radar and radio contact was lost.

Several witnesses reported seeing the airplane below the clouds in a nose down vertical dive. One witness reported that after impact he saw a fireball about 500 feet high followed by a column of smoke. Evidence at the accident scene showed evidence of a postimpact fire with most of the wreckage located in or near a single impact crater. The outboard portion of the left wing and the left aileron was located about 3,000 feet west of the main wreckage.

At 1038, the closest official surface weather observation site at McConnell Air Force Base (IAB), Wichita, Kansas, reported a northeast wind at 12 knots, light rain, and a broken ceiling at 1,700 feet above ground level. Satellite imagery indicated abundant cloud cover with the cloud cover top near 21,000 feet mean sea level (msl). Pilot reports in the area indicated light to moderate icing conditions above 6,000 feet msl at the accident time. This accident investigation's report number is CEN14FA009

FAA Advisory Circular (AC) 91-74B, "Pilot Guide: Flight In Icing Conditions," defined supercooled large droplets (SLD) as, "Water drops with a diameter greater than 50 micrometers that exist in a liquid form at air temperatures below 0 degrees C. SLD conditions include freezing drizzle drops and freezing raindrops." The AC stated that, "a significant reduction in CLmax (maximum coefficient of lift) and a reduction in the AOA (angle of attack) where stall occurs can result from a relatively small ice accretion. A reduction of CLmax by 30 percent is not unusual, and a large-horn ice accretion can result in reductions of 40 percent to 50 percent. Drag tends to increase steadily as ice accretes. An airfoil drag increase of 100 percent is not unusual, and, for large-horn ice accretions, the increase can be 200 percent or even higher."

The AC stated that a pilot may detect airframe icing as a loss of airspeed or an increase in the power required to maintain the same airspeed. "The longer the icing encounter, the greater the drag increase; even with increased power, it may not be possible to maintain airspeed. If the aircraft has relatively limited power (as is the case with many aircraft with no ice protection), it may soon approach stall speed and a dangerous situation."

According to the Australian Transport Safety Bureau (ATSB) Aviation Occurrence Investigation AO-2007-018, on February 5, 2007, a Cirrus SR22 aircraft, registered VH-HYY, with a pilot and one passenger on board, was being operated on a private flight from Canberra,
ACT to Bankstown, NSW. As the aircraft approached the Cecil Park area, NSW, the pilot reported to air traffic control that the engine had lost power and he was attempting a forced landing. Soon after, the aircraft impacted terrain close to the M7 motorway and both occupants sustained serious injuries.

The ATSB report, in part, indicated that before impact, the pilot activated the Cirrus Airframe Parachute System (CAPS), but the system malfunctioned and the parachute did not deploy correctly. According to the report, subsequent testing by the aircraft and CAPS manufacturers found that the pick-up collar could move prematurely from the top of the rocket launch tube during activation. Such movement was considered to have the potential to adversely affect the rocket’s trajectory. However, the trajectory of the rocket that was evident in this accident, was not able to be replicated.

Subsequent to this ATSB report, the FAA issued airworthiness directive (AD) 2007-14-03 for Cirrus Design Corporation Models SR20 and SR22 Airplanes. The AD, in part, stated:

SUMMARY: We are adopting a new airworthiness directive (AD) for certain Cirrus Design Corporation (CDC) Models SR20 and SR22 airplanes. This AD requires you to replace the pick-up collar support and nylon screws, of the Cirrus Airplane Parachute System (CAPS), with a new design pick-up collar support and custom tension screws. This AD results from a CDC report of an in-flight CAPS activation where the parachute failed to successfully deploy. We are issuing this AD to correct pick-up collar support fasteners of the CAPS, which could result in the premature separation of the collar. This condition, if not corrected, could result in the parachute failing to successfully deploy (CAPS failure).

Logbook entries revealed that AD 2007-14-03 had been complied with on N811CD before the accident.

According to NTSB incident report CEN13IA285, on May 16, 2013, about 1120 central daylight time, a Cirrus Design Corp (CDC) SR22, N715CD, airplane ballistic parachute was activated by the pilot during flight near Dallas, Texas, following a loss of control in cruise flight. The parachute pack remained in its compartment, its rocket was deployed, and the rocket propellant was expended. The airplane received no damage. The private pilot was uninjured. The airplane was registered to Jeramiah 2911 Inc and operated by the pilot under the provisions of 14 Code of Federal Regulations (CFR) Part 91. Marginal visual flight rules conditions prevailed and the flight was operating on instrument flight rules (IFR) plan for the flight that originated from Addison Airport (ADS), Dallas, Texas, about 1055 and was destined for Independence Municipal Airport (IDP), Independence, Kansas. The flight returned to ADS and landed without further incident.

The report, in part, found that the CAPS rocket was on the ground behind the airplane and the D-Bag was in the enclosure compartment. The incremental bridal was found completely unzipped, which with D-Bag strap length, would allow the rocket motor to be positioned about 10 feet behind the rudder. The D-Bag was found extracted about half way out of the enclosure compartment. The 3-point links were found displaced from their as-installed configuration. The report further stated that the postincident examination of the parachute system did not
reveal any system component failure. Postincident testing showed that off-axis deployment of
the parachute could exceed the forces required for a successful deployment of the parachute. If
the airplane has a large pitch or bank angle or angular rates (or a combination of these) as the
parachute rocket leaves the airplane, the airplane will rotate and cause the rocket tether to pull
at an angle other than that intended, and the parachute will fail to deploy. Radar data showed
that the airplane was in a very dynamic flight pattern with extreme pitch and bank angles when
the parachute system was activated. Thus, the parachute likely failed to deploy when activated
due to the dynamic maneuvering of the airplane at the time of the activation, which exceeded
the parachute system’s certification requirements.

The National Transportation Safety Board determined the probable cause in reference to
CEN13IA285 as follows: The failure of the airplane’s parachute to deploy when activated
during a loss of control in cruise flight due to the dynamic maneuvering of the airplane at the
time of the activation, which exceeded the parachute system's certification requirements.

The Cirrus Owners and Pilots Association (COPA) safety representative was asked for
operational safety comments that would assist future pilots when flight conditions are like the
accident conditions. He, in part, indicated:

COPA recognizes that flights into significant weather conditions pose great
risks, especially for icing and supercooled liquid droplet (SLD) conditions.
COPA emphasizes that all non-FIKI aircraft are prohibited from flight into
known icing conditions.

Consequently, COPA offers several weather knowledge courses designed to
inform Cirrus pilots about the sources of information about weather
conditions, ways to manage on-board weather sources, and planning
options for dealing with inadvertent encounters with significant weather
conditions. These courses attempt to provide practical guidance for pilots
rather than meteorological analyses of weather.

For icing conditions, especially forecasted SLD conditions, COPA guidance
focuses on understanding the tools now available and practical responses
to those conditions. These informational tools include those published by
the Aviation Weather Center of NOAA with forecast icing models
highlighting SLD threats and probabilities of icing potential at various
altitudes. Guidance for pre-flight planning in areas with forecast icing
conditions seeks to a) avoid routes or altitudes above the freezing level(s)
that would penetrate such conditions, b) escape actions to deal with
inadvertent encounters, such as 180-turn, descend or climb, with emphasis
on knowledge of the extent of the conditions, c) operation of no-hazard
weeping wing (TKS) system to facilitate escape, and d) practical advice for
pilots flying FIKI equipped Cirrus aircraft in such conditions, especially the
potential to be overwhelmed by SLD conditions.

COPA also refers Cirrus pilots to the guidance on icing conditions provided
by Cirrus Aircraft in their Flight Operations Manuals (FOM). The Cirrus FOM
includes procedures for preflight and periodic checks of the TKS system that
help ensure it will operate effectively when needed, as well as guidance to deal with inadvertent icing encounters.

In 2006, both COPA and Cirrus Aircraft issued safety letters concerning winter flying, partly in response to a cluster of icing-related accidents. Since then, with consistent emphasis on weather planning and avoidance procedures, no fatal icing-related accident in a Cirrus aircraft occurred until this event.

The published maximum demonstrated deployment speed of the CAPS is 133 knots. However, COPA advised of other events where the parachute deployed following an airplane's three turn spin, an inverted attitude with an airspeed near 40 knots, a bank angle of 86 degrees, and an airspeed of 187 knots.

The witness's observation of the descending light that illuminated for about two seconds, which was described as a comet, is similar to the visible time of a 1.2 second CAPS rocket burn. The airplane was modified with the BoomBeam landing light. Given the radar data, the airplane's landing light would have been visible below the clouds consistent with the witness's statement.

The rudder deformation near its separation was consistent with the size of the CAPS rocket motor. The approximate location of the separation/deformation was above the rudder trim tab, which is about the same height as the opening of the enclosure compartment. This height would place the separation in the red zone indicated in the extraction report in CEN13IA285. Although the rudder's deformation was consistent with the shape of the CAPS rocket motor, the investigation did not detect any propellant signatures or transfer marks that would be consistent with rocket contact with the rudder.

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**Administrative Information**

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<thead>
<tr>
<th>Investigator In Charge (IIC):</th>
<th>Edward F Malinowski</th>
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<th>Additional Participating Persons:</th>
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<tr>
<td>John Welsh; Federal Aviation Administration; Columbus, OH</td>
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<td>Brannon Mayer; Cirrus Design; Duluth, MN</td>
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<tr>
<td>Nicole Charnon; Continental Motors; Mobile, AL</td>
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<tr>
<td>Rick Beach; COPA; San Diego, CA</td>
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<td>Gregg Ellsworth; Ballistic Recovery Systems, Inc.; South St Paul, MN</td>
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<td>Borris Popov; Ballistic Recovery Systems, Inc.; South St Paul, MN</td>
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| Publish Date: | 05/11/2017 |

| Note: | The NTSB traveled to the scene of this accident. |

| Investigation Docket: | [http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=90368](http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=90368) |
The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.