Analysis

The private pilot was intending to conduct a cross-country flight when the light sport airplane collided with a power line and terrain. Several witnesses reported seeing the airplane flying at low altitude near the accident site. There were no eyewitnesses to the final portion of the flight; however, an individual near the accident site heard the airplane's engine from inside his residence. After the crash, he saw the airplane in the field outside his residence and flames from the power lines along the road. A postaccident airframe examination and operational engine test revealed no evidence of a mechanical malfunction or failure that would have precluded normal operation.

The intended destination was 65 miles north-northwest of the departure airport. The accident site was located about 12 miles northwest of the departure airport, and according to engine data, the airplane crashed about 35 minutes after takeoff. The wreckage debris path was consistent with the airplane colliding with a 35-ft-tall power line while on a southerly heading. The pilot's partner reported that the pilot was familiar with the route of flight and that he had made the flight numerous times. She further noted that he typically flew at 3,500 ft mean sea level (msl) during cruise flight. A review of available air traffic control (ATC) radar data revealed no transponder or primary radar data associated with the flight. The lower limit of ATC radar coverage in the general area of the accident site was about 2,000 ft above ground level (2,750 ft msl). Based on the crash location, witness accounts, and the lack of ATC radar data for any portion of the flight, the pilot did not follow a direct route toward his intended destination or climb to his normal cruise altitude.

According to toxicological test results, the pilot was using two impairing medications, diphenhydramine and gabapentin, which likely impaired him during the flight. However, he had likely used these drugs during previous flights where he did not demonstrate unusual behavior; thus, these medications alone do not explain the pilot's performance during the accident flight. The pilot remained at low altitude and in the general vicinity of the departure airport; he did not fly toward his intended destination, which suggests that he may have become confused about where he was, what he was doing, and where he was going.
The pilot had several medical conditions that could have affected him during the flight; coronary artery disease, multiple previous ischemic and hemorrhagic strokes, and recent pneumonia. Another stroke or transient ischemic attack (TIA) during the flight could have made him confused or made it difficult to operate the airplane due to weakness in his arm and/or leg. The pilot’s coronary artery disease and valvular heart disease could have also caused weakness and confusion due to low blood pressure as a result of an arrhythmia, or an ischemia could have worsened his shortness of breath and caused him to become hypoxic (have low oxygen), which could also result in confusion. Any such physiologic event would have further worsened the psychoactive effects from the two sedating medications the pilot was using. Although the pilot was likely impaired by his use of two impairing medications, by themselves they do not explain the airplane’s flight path and his behavior. Therefore, it is more likely that some physiologic event occurred that caused his inability to safely carry out the flight.

### Probable Cause and Findings

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

The pilot's low altitude flight into a power line due to his impairment from an acute physiologic event during the flight. Contributing to the pilot's impairment was his use of two sedating medications.

### Findings

<table>
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<tr>
<th>Personnel issues</th>
<th>Impairment/incapacitation - Pilot (Cause)</th>
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<tr>
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<td>Prescription medication - Pilot (Factor)</td>
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<td>OTC medication - Pilot (Factor)</td>
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<tr>
<td>Environmental issues</td>
<td>Wire - Ability to respond/compensate (Cause)</td>
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<td>Wire - Contributed to outcome (Cause)</td>
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On December 23, 2017, about 1420 central standard time, a light sport X-Air LLC XA85 airplane, N20XA, collided with power lines while maneuvering at low altitude near Oskaloosa, Iowa. The private pilot was fatally injured, and the airplane sustained substantial damage. The airplane was registered to the pilot who was operating it as a Title 14 Code of Federal Regulations (CFR) Part 91 personal flight. Day visual meteorological conditions prevailed for the flight, departed Oskaloosa Municipal Airport (OOA), about 1345 with the intended destination of Marshalltown Municipal Airport (MIW), Marshalltown, Iowa.

The pilot's partner reported that they had driven to OOA to retrieve the airplane after the left main tire was replaced because it had deflated during a landing at OOA on December 16. The plan was for the pilot to fly the airplane back to MIW by himself. After arriving at OOA, the airplane was pulled out of the hangar for a preflight inspection. The partner noted that it was extremely cold and that the pilot taxied the airplane between 5 and 10 minutes to warm up the engine before the flight while she configured the onboard GPS to navigate to Grinnell Regional Airport, Grinnell, Iowa, an intermediate airport along the direct route to MIW. After the engine had warmed up, the pilot taxied back to the fixed base operator (FBO), where he stopped the engine and the pilot's partner exited the airplane. The pilot's partner stated that she and the airport manager watched the pilot start the airplane, taxi to the runway, and take off about 1345. She noted that the pilot had flown between OOA and MIW numerous times and that his use of the GPS to navigate would not have been necessary for the flight. She further noted that the pilot typically flew the airplane at 3,500 ft mean sea level (msl) during cruise flight.

A review of available Federal Aviation Administration (FAA) air traffic control (ATC) radar data revealed no transponder or primary track data that could be correlated to the accident flight. The lower limit of ATC radar coverage in the general area of the accident site was about 2,000 ft above ground level (agl).

Several witnesses reported seeing an airplane flying at low altitude in the general area of Oskaloosa, Iowa. One witness, who was driving south on Highway 63 about 1/2 mile east of the accident site, reported seeing an airplane flying west at low altitude near 210th Street. There were no eyewitnesses to the final portion of the flight; however, an individual heard the airplane's engine from inside his residence located near the accident site. After the crash, he saw the airplane in the field outside his residence and flames from the power lines along the road.
### Pilot Information

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According to FAA records, the 70-year-old pilot held a private pilot certificate with airplane single-engine land and instrument airplane ratings. His most recent aviation medical examination was on July 6, 2012, when he was issued a third-class medical certificate with the limitation that he must wear corrective lenses. On the application for that medical certificate, the pilot reported 1,610 hours of total flight experience, of which 26 hours were flown within the previous 6 months. The medical certificate expired on July 31, 2014; however, federal regulations only required the pilot to possess a valid driver's license to operate the light sport airplane. According to local law enforcement, the pilot held a valid Iowa driver's license. A search of FAA records showed no previous accidents, incidents, or enforcement proceedings.

The pilot's logbook was not located during the investigation. On June 6, 2016, the pilot reported a total flight experience of 1,806 hours on an insurance application for the accident airplane. An airplane use log recovered from the wreckage was used to calculate the pilot's recent flight experience. According to the airplane use log, he had flown 16.9, 11.7, 2.9, and 2.2 hours during the 1 year, 6 months, 90 days, and 30 days before the accident, respectively. The accident flight was about 35 minutes and was the only flight conducted within 24 hours of the accident.
The two-seat, light sport airplane, serial number XA850006, was manufactured in 2009 and was a high-wing monoplane constructed of aluminum tubes covered with fabric. The airplane was powered by an 85-horsepower, 4-cylinder, Jabiru 2200J reciprocating engine, serial number 22J795. The engine provided thrust through a ground-adjustable, two-blade, DUC Hélices Swirl propeller, serial number 5339. The airplane was equipped with fixed tricycle landing gear and wing flaps and had a maximum gross weight of 1,234 pounds. The FAA issued the light sport airplane a special airworthiness certificate and associated operating limitations on March 18, 2009.

The airplane's hour meter indicated 308.5 hours at the accident site. The most recent condition inspection of the airplane was completed on June 27, 2017, at 288.6 total airframe hours.

According to the airplane's pilot operating handbook, the expected cruise speed was about 90 mph with the engine operating at 2,900 rpm.
A postaccident review of available meteorological data established that day visual meteorological conditions prevailed at the accident site. The nearest aviation weather reporting station was located at OOA, about 12 miles southeast of the accident site. At 1415, about 5 minutes before the accident, the automated surface observing system reported wind from 350° at 9 knots, 10 miles surface visibility, a clear sky, temperature -6°C, dew point -11°C, and an altimeter setting of 30.24 inches of mercury.

The accident site was located in an open agricultural field about 12 miles north-northwest of the departure airport. The initial point of impact was a power line about 35 ft above the ground. The damage to the airplane was consistent with it impacting the ground in a nose-down pitch attitude on a southerly heading. The airplane subsequently came to rest inverted in the field about 230 ft from the power line. An 80-ft section of steel-braided power line was found wrapped around the main landing gear. The nose gear had separated from the airframe. All major structural components and flight controls were identified at the accident site, and flight control continuity was confirmed. The wing flaps were found fully retracted. First
responders reported that they turned the electric master switch from ON to OFF. The electric fuel pump switch was in the ON position. Both electronic ignition switches were in the ON position. The starting fuel control was in the OFF position. The carburetor heat control was in the OFF position. The cabin heat control was in the ON position. The altimeter’s Kollsman window was centered on 30.24 inches of mercury. The communication radio was turned on, and the active frequency was set to the common traffic advisory frequency for the departure airport. First responders reported that they observed fuel leaking from the estimated half-full fuselage tank. The fuel tank was subsequently removed from the fuselage. The fuel selector was found in the ON position. The engine remained attached to the fuselage through its engine mounts. An external examination of the engine did not reveal any damage. The carbon-composite propeller was fragmented. The damaged propeller was removed from the engine to facilitate an operational engine test. The engine started and ran at various engine speeds without any hesitation or anomalies. The postaccident airframe examination and operational engine test revealed no evidence of a mechanical malfunction or failure that would have precluded normal operation.

Medical And Pathological Information

The Iowa Office of State Medical Examiner, Ankeny, Iowa, performed an autopsy on the pilot. The cause of death was attributed to multiple blunt force injuries. The medical examiner also identified atherosclerotic and thrombotic cardiovascular disease, and the probable component of positional asphyxia. Toxicological test results from the autopsy identified warfarin and diphenhydramine (0.062 ug/ml) in femoral blood. Clinical testing for electrolytes in vitreous were normal for postmortem results.

The autopsy identified several areas of significant natural disease. At some point previously, the pilot had had his left lung completely removed. There was a scar in his larynx. The heart was enlarged, weighing 560 grams with right ventricular dilation and a floppy mitral valve. Average heart weight for a 215-pound man is 387 grams with a range of 293 to 511 grams. There was severe coronary artery disease with 50% stenosis of the left anterior descending vessel, 75% stenosis of the anterolateral distribution of the right coronary artery, and greater than 75% stenosis of the posterior descending branch. The right and posterior descending branches had areas of brown discoloration of the wall consistent with previous hemorrhage into the plaques. In addition, these vessels had partial occlusion of the lumen by intraluminal thrombus (clot). The remainder of the cardiac exam was unremarkable.

A neuropathologist examined the brain as part of the postmortem examination. The cerebral vessels revealed moderate to severe atherosclerosis and the intracerebral vessels demonstrated vasculopathy that could not be specifically typed. There were lacunar infarcts (previous small strokes) scattered throughout the right and left frontal lobes and the right occipital lobe. There was an area of scar in the left frontal lobe consistent with a previous brain contusion.
Toxicology testing performed at the FAA Forensic Sciences Laboratory identified atorvastatin, diphenhydramine (0.072 µg/ml), gabapentin (12.79 µg/ml), loratadine, losartan, metoprolol, sotalol, and warfarin in femoral blood. Except for loratadine and metoprolol, the above substances were also detected in urine. Metoprolol was detected in liver. The toxicology results were negative for carboxyhemoglobin in femoral blood and ethanol in vitreous.

Diphenhydramine is a sedating antihistamine used to treat allergy symptoms and as a sleep aid. It is available over-the-counter under various names, including Benadryl and Unisom. Diphenhydramine carries the following warning: "May impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)." Compared to other antihistamines, diphenhydramine causes marked sedation; it is also classed as a CNS depressant and this is the rationale for its use as a sleep aid. Altered mood and impaired cognitive and psychomotor performance may also be observed. In fact, in a driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol concentration of 0.100%. The range of blood levels thought to coincide with therapeutic and psychoactive effects from diphenhydramine is 0.0250 to 0.1120 µg/ml.

Gabapentin, commonly marketed with the name Neurontin, is an antiseizure medication often used to treat nerve pain. The associated drug information warns that gabapentin may cause dizziness, somnolence, and other symptoms and signs of CNS (central nervous system) depression. The range of blood levels thought to coincide with therapeutic and psychoactive effects from gabapentin is 2.00 to 10.00 µg/ml.

Metoprolol is a beta-blocker used to treat hypertension and to prevent recurrent heart attacks, commonly marketed with the names Lopressor and Toprol. Sotalol is another beta blocker with more prominent pro- and anti-arrhythmic effects. It is indicated for the treatment of life-threatening ventricular arrhythmias and atrial fibrillation with significant symptoms. Sotalol is associated with an increased risk of a life-threatening ventricular arrhythmia, Torsade de Pointe.

Warfarin is a blood thinning medication used to prevent the formation of clots in patients with atrial fibrillation or other thrombotic disorders. Commonly marketed with the name Coumadin, treatment requires regular blood testing to ensure the degree of blood thinning remains in the desired range. It is associated with an increased risk of bleeding.

Loratadine, commonly marketed with the name Claritin, is a non-sedating antihistamine available over-the-counter. Losartan is a prescription blood pressure medication commonly marketed with the name Cozaar. Atorvastatin is a cholesterol-lowering medication commonly marketed with the name Lipitor. These three medications as well as metoprolol, sotalol, and warfarin are not generally considered to be impairing.

The pilot’s personal medical records, obtained from the pilot’s primary care provider for the period from January 1, 2015, through December 23, 2017, were reviewed by a National Transportation Safety Board Medical Officer. The first office visit during this period was on February 9, 2015, at which time the pilot’s medical conditions included type 2 diabetes, hypothyroidism, hypertension, high cholesterol, sarcoidosis, a history of squamous cell cancer of the neck during 1999, a snoring disorder other than sleep apnea treated with continuous positive airway pressure (CPAP) (initial diagnosis July 2011), a transient ischemic attack
(January 4, 2013) and a spontaneous intracranial hemorrhage (March 2013). The pilot had a previous hernia surgery as a child and bilateral carotid stents placed in January 2013 (left) and February 2013 (right).

Over the subsequent years, the pilot remained off diabetes medication with a hemoglobin A1C that ranged from 6.1 to 6.9%. In July 2015, the pilot developed atrial fibrillation as a complication of sepsis from a urinary tract infection. In August 2015, the pilot was diagnosed with non-occlusive coronary artery disease by cardiac catheterization and underwent cardioversion that returned him to a normal sinus rhythm. Detailed catheterization results were not available in the primary care records. In June 2016, the pilot fell a couple of times at home and had lower-than-usual blood pressures. He had also developed a cough. The chest X-ray findings were initially thought to represent a pneumonia, but the symptoms failed to clear and additional evaluation demonstrated squamous cell lung cancer. In August 2016, the pilot underwent a left pneumonectomy, and in September 2016 had a central venous port placed in order to receive chemotherapy. He also received external beam radiation. During November 2016, the pilot developed peripheral neuropathy as a result of the chemotherapy with numbness and tingling in his fingertips and the bottoms of his feet and difficulty with balance. His strength and mobility improved with physical therapy and his subjective symptoms were treated with gabapentin.

Records from November 26, 2017, indicate that the pilot had developed a cough, dizziness, and shortness of breath. He was admitted to the hospital with pneumonia in his remaining lung. He was discharged but returned to the emergency department with persistent symptoms and weakness and was readmitted. At his last outpatient visit, dated December 18, 2017, the pilot's daily medications included warfarin, losartan, metoprolol, gabapentin, magnesium, cholecalciferol (Vitamin D), cyanocobalamin (Vitamin B-12), pyridoxine (Vitamin B-6), atorvastatin, levothyroxine, diphenhydramine, sotalol, and loratadine.

The pilot's partner stated that the pilot's health had been a "little off" from pneumonia during the previous 2 months. She noted that, on occasion, the pilot would hold onto her arm for support when walking. She added that the pilot's mental condition was normal for a 70-year-old individual.

The airport manager at MIW reported that he recently saw the pilot walking with difficulty into the FBO building. The airport manager also stated that the pilot seemed to be talking slower than normal and was out of breath. The airport manager believed the pilot's general health had worsened during the previous 2 months.

Tests And Research

The airplane was equipped with a Dynon EMS-D10 electronic engine monitor. The undamaged device was removed from the instrument panel and its non-volatile memory was downloaded. A review of the recovered engine parameter data revealed consistent readings throughout the flight and no anomalies with engine operation. According to the recovered data, 35 minutes 40 seconds into the flight, the engine speed abruptly decreased from a typical cruise power setting (2,850 rpm) to 0 rpm and the oil pressure dropped from 67 psi to 0 psi. The end of the accident
flight was identified by the abrupt decrease of the engine speed and a momentary power interruption to device. The abrupt engine stoppage, loss of oil pressure, and momentary power interruption were consistent with the airplane’s impact with the power line and terrain.

The airplane was equipped with a Garmin GPSmap 396. The GPS device was normally installed in a cradle located on the right side of the instrument panel. The GPS device was recovered outside of the airplane with no apparent damage. The device had separated from its antenna coaxial cable and external power supply during impact. The device was powered-on using its battery, and its non-volatile track data was downloaded. A review of the downloaded data established that the last recorded flight was on December 16, 2017, from MIW to OOA. There was no track data recorded on the day of the accident. Further examination of the last recorded map position, alerts, and calendar/clock established that the device was not powered on during the accident flight. A review of the device settings revealed that it was configured to automatically power on when an external power source was detected and to automatically record the airplane’s flight path. The device normally received power through the airplane’s electrical system and was protected by a 3-ampere, fast-acting fuse installed on the primary bus. A postaccident examination of the fuse associated with the GPS external power supply revealed that it had blown; however, the GPS battery remained installed and was capable of powering on the device if the power button was depressed.

Additional Information

The intended destination (MIW) was 65 miles north-northwest of the departure airport (OOA), and the estimated time en route was about 43 minutes based on the typical cruise airspeed (90 mph) for the airplane with no wind.

Administrative Information

<table>
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<th>Investigator In Charge (IIC):</th>
<th>Andrew T Fox</th>
<th>Report Date:</th>
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<tr>
<td>Additional Participating Persons:</td>
<td>Christina Grabill; Federal Aviation Administration, Des Moines FSDO; Ankeny, IA</td>
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<td></td>
<td>Craig Decker; Federal Aviation Administration, Des Moines FSDO; Ankeny, IA</td>
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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.