# Aviation Investigation Final Report

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| **Location:** | Mesa, Arizona | **Accident Number:** | WPR17FA155 |
| **Date & Time:** | July 17, 2017, 16:52 Local | **Registration:** | N571JM |
| **Aircraft:** | Evolution 19 Lancair Evolution | **Aircraft Damage:** | Substantial |
| **Defining Event:** | Loss of control in flight | **Injuries:** | 2 Fatal |
| **Flight Conducted Under:** | Part 91: General aviation | | |

## Analysis

The private pilot departed on a cross-country flight in his recently purchased high-performance experimental amateur-built airplane. About 25 minutes after takeoff, the pilot informed an air traffic controller that he was experiencing electrical problems and requested to divert to the airport where his maintenance facility was located. The pilot further stated that his electrical system was not charging and that he expected he may lose radio communications due to the loss of electrical power. The pilot continued about 30 minutes to the diversion airport. Radar data revealed that, about 1 minute after being cleared for landing, the airplane's transponder stopped sending altitude information, consistent with electrical power decreasing below the 18 volts required to power the radio system. The pilot performed a low pass over the runway, presumably for the tower controller to confirm that the landing gear were extended; although the pilot was not in communication with the controller, the controller transmitted that the gear appeared to be down. The airplane continued on a close-in downwind leg and turned onto the base leg of the traffic pattern; witnesses saw it enter a steep left turn followed by a near-vertical descent consistent with an aerodynamic stall. Examination of the wreckage revealed no evidence of preimpact mechanical malfunction or failure that would have precluded normal operation; however, the electrical system was consumed by fire, precluding functional testing or examination of its components. The starter-generator drive shaft was fractured in overload, consistent with it turning at the time of impact.

The pilot had owned the airplane about 3 months, during which time he logged about 40 hours of flight experience in it, including transition training with a provider who specialized in the accident airplane make and model; however, the pilot's most recent experience was flying about 35 hours in his other airplane, which operated at much lower airspeeds. The transition between the airplanes may have contributed to the pilot's failure to identify that he had let the airspeed drop below stall speed during the landing approach.

The accident airplane had experienced electrical problems several days before the accident; however, the pilot's handling of that situation suggested a lack of familiarity with the airplane and its emergency

procedures. During that event, he allowed the airplane to become slow at low altitude while troubleshooting, and he attempted to activate the emergency landing gear extension system, but instead pulled the parking brake handle. Despite the fact that the airplane's published generator failure checklist included recycling the generator switch, the pilot was only able to remedy the electrical problem after an individual at the maintenance facility instructed him via cell phone to recycle the generator switch, which he did. After restoring electrical power and landing without incident, the pilot admitted that he had forgotten to turn the generator switch on in the first place, an item that was included in the airplane's after-start procedures.

During the accident flight, the pilot displayed similar evidence of failure to follow the airplane's published emergency procedures, which, for a generator failure, included reducing the electrical load by turning off nonessential equipment and landing at the nearest suitable airport. Onboard photos of the instrument panel during the flight indicated that the air conditioner, a nonessential item, remained on after the pilot initially reported electrical problems to the air traffic controller. Additionally, the pilot chose to continue the flight for 30 minutes to his maintenance facility, overflying other airports at which he could have landed. (The emergency procedures noted that battery power would last about 30 minutes with all nonessential equipment off.) Finally, the pilot was likely distracted from his primary task of flying the airplane as he was text messaging the maintenance facility about 8 minutes before the accident and placing a phone call within the 3 minutes before the accident, which may have been an attempt to reach the tower controller to confirm the status of the landing gear.

Due to the postcrash fire, the origin of the electrical system failure could not be determined. Based on the available evidence, the accident is consistent with the pilot's failure to maintain airspeed while maneuvering for landing, which resulted in an exceedance of the airplane's critical angle of attack and an aerodynamic stall/spin.

## Probable Cause and Findings

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

The pilot's failure to maintain adequate airspeed while maneuvering for landing, which resulted in an exceedance of the airplane's critical angle of attack and a subsequent stall/spin. Contributing to the accident was the pilot's distraction due to a failure with the airplane's electrical system, failure to follow emergency procedures and to continue with a known electrical problem.

## Findings

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| **Aircraft** | Airspeed - Not attained/maintained |
| **Personnel issues** | Aircraft control - Pilot |
| **Aircraft** | (general) - Not specified |
| **Personnel issues** | Monitoring equip/instruments - Pilot |
| **Personnel issues** | Task monitoring/vigilance - Pilot |
| **Personnel issues** | Decision making/judgment - Pilot |

# Factual Information

## History of Flight

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| **Enroute-cruise** | Electrical system malf/failure |
| **Approach-VFR pattern final** | Loss of control in flight (Defining event) |
| **Uncontrolled descent** | Collision with terr/obj (non-CFIT) |

On July 17, 2017, at 1652 mountain standard time, an experimental amateur-built Lancair Evolution, N571JM, was substantially damaged when it impacted a golf course while on approach for landing to Falcon Field Airport, Mesa, Arizona. The private pilot and passenger were fatally injured. The airplane was privately owned and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 business flight. Visual meteorological conditions prevailed and an instrument flight rules (IFR) flight plan was filed and activated for the flight, which departed from Phoenix Deer Valley Airport, Phoenix, Arizona, about 1555, with a planned destination of John Wayne-Orange County Airport, Santa Ana, California.

The Federal Aviation Administration (FAA) provided radar data and audio transcripts of the pilot's communications with air traffic control. After departing Deer Valley, the pilot was cleared to climb to 21,000 ft mean sea level (msl). About 1615, the pilot advised an Albuquerque Center controller that he was having "an electrical charging issue" and requested to go to Falcon Field, explaining that was where the airplane's maintenance facility was located. The airplane subsequently made a right turn and began an east-southeasterly track directly toward Falcon Field as the airplane climbed to 22,000 ft msl (see figure 1). At 1617:20, no altitude was associated with the radar return, consistent with a temporary lack of power to the airplane's transponder. The pilot overflew numerous airports on the way to Falcon Field and did not declare an emergency.

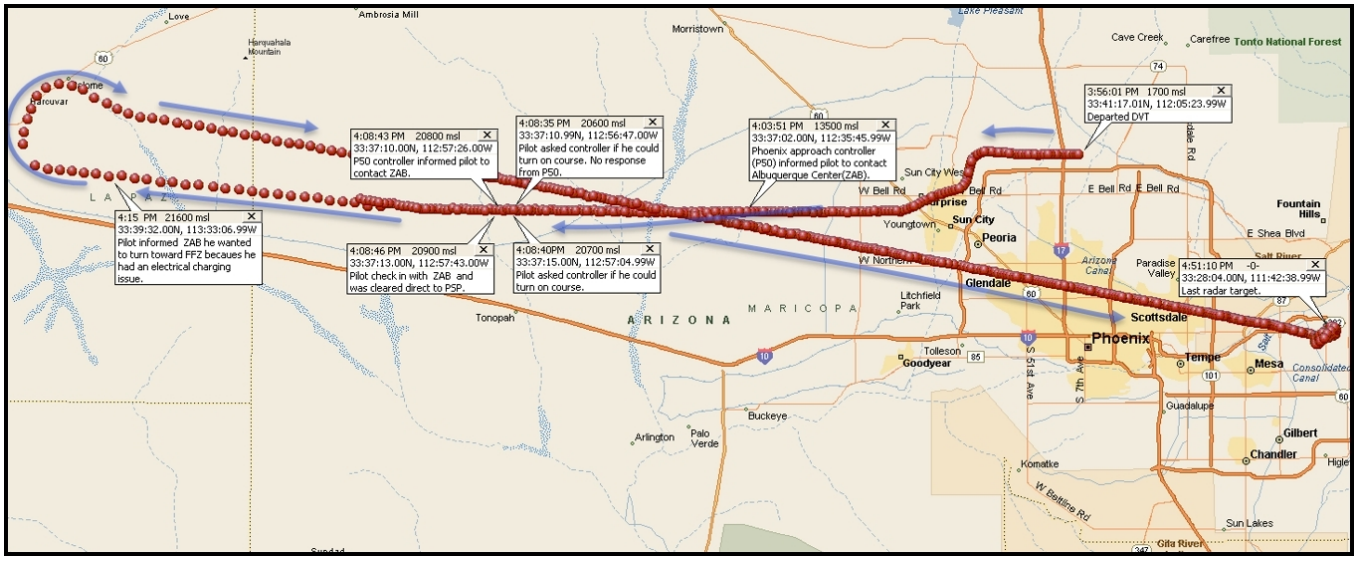

Figure 1: Flight Path

The Phoenix Approach and Falcon Field Air Traffic Controller (ATC) were in contact with the pilot. At 1633, the pilot stated to the controller, "just in case, my system is not charging," explaining that he had an incident "the other day" where the airplane's primary and multifunction flight displays (PFD and MFD, respectively) "just died on me and I don't think its going to happen before we get to Falcon, but if you could keep me on a direct heading to Falcon that would be great." At 1644, the pilot was cleared to land on runway 22L at Falcon Field and requested to cross midfield to enter the downwind leg of the traffic pattern. He then explained that he was "still having an electrical issue," and that his electrical system was "about to go dead." From 1645:56 through the remainder of the accident flight, the airplane's radar returns showed no associated altitude. The radar track indicated that the airplane crossed over the runway around 1647:27 and joined the left downwind leg of the traffic pattern for runway 22L. At 1649, the controller transmitted, "if you can hear me [your] gear appears down." Radar data indicated that the airplane flew the base and final legs of the traffic pattern and then continued over the runway, consistent with a low-level pass. The airplane then continued in a left turn and began a close downwind leg at 1650, about 1,500 ft from the runway centerline. The airplane proceeded from the downwind to the base leg; the final radar target was about 1,400 ft south of the accident site (see figure 2).

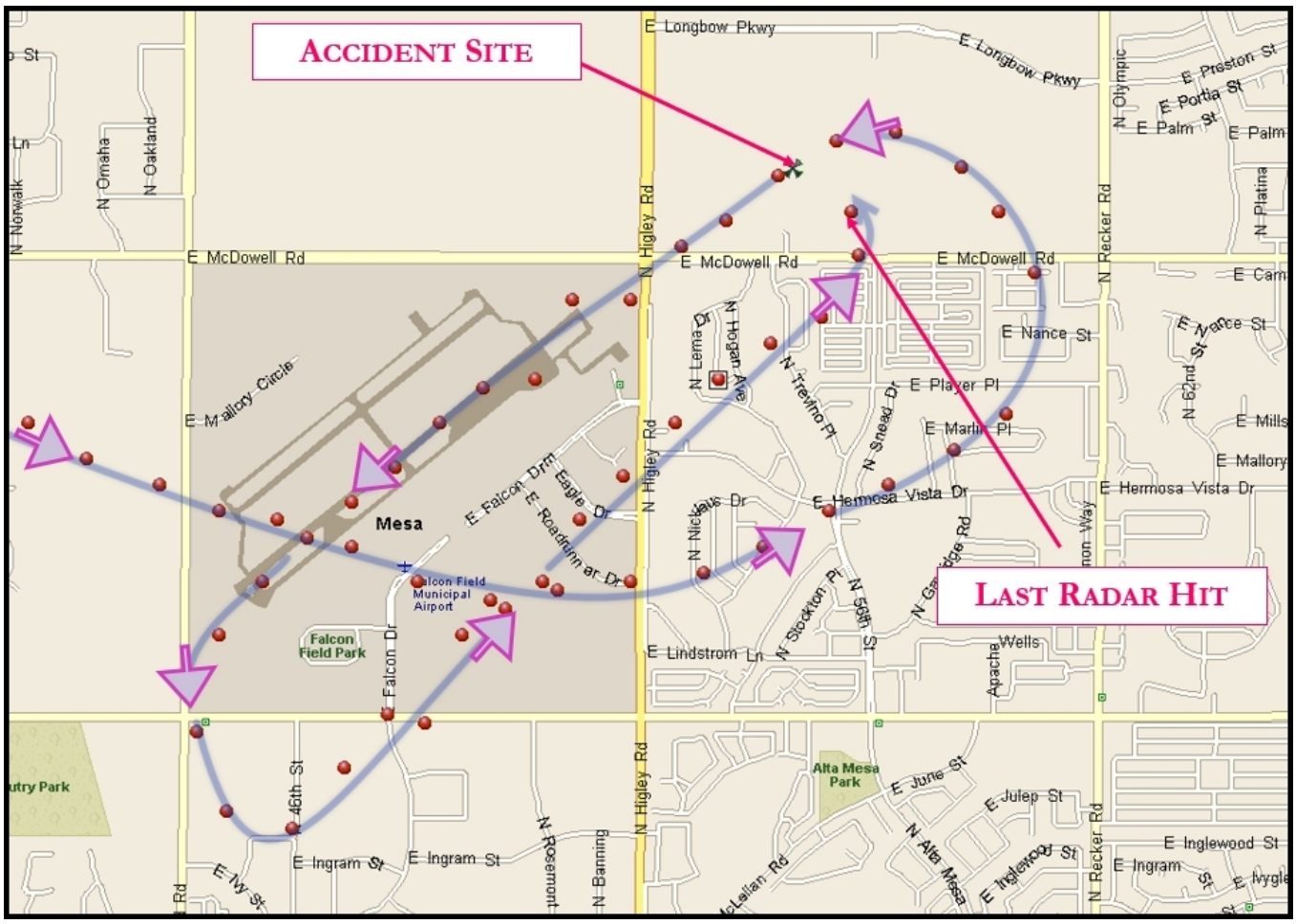


Figure 2: Last Portion of Flight

Numerous witnesses in the vicinity of the accident site reported seeing the airplane maneuvering very low and making a steep left turn. They stated that the airplane then entered a nose-low, near-vertical descent. Video footage of the accident captured by a camera mounted in a moving car showed the airplane at an altitude about 325 ft above ground level (agl) before it momentarily climbed 100 ft while making a left turn onto the base leg of the traffic pattern. The airplane remained in a left-wing low attitude at an estimated ground speed of about 83 kts and descended below the tree line. A complete video study is contained in the public docket for this accident.

## Pilot Information

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| **Certificate:** | Private | **Age:** | 53,Male |
| **Airplane Rating(s):** | Single-engine land | **Seat Occupied:** | Left |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | Unknown |
| **Instrument Rating(s):** | Airplane | **Second Pilot Present:** | No |
| **Instructor Rating(s):** | None | **Toxicology Performed:** | Yes |
| **Medical Certification:** | Class 3 Without waivers/limitations | **Last FAA Medical Exam:** | January 24, 2017 |
| **Occupational Pilot:** | No | **Last Flight Review or Equivalent:** | |
| **Flight Time:** | (Estimated) 1700 hours (Total, all aircraft), 41 hours (Total, this make and model), 80 hours (Last 90 days, all aircraft) | | |

A review of FAA airman and medical certification records revealed that the pilot, age 53, held a private pilot certificate with ratings for airplane single-engine land and instrument airplane. The pilot's most recent third-class medical certificate was issued January 2017 with no limitations.

The pilot's personal flight records indicated that he had about 1,630 total hours of flight experience. In the 90 days preceding the accident, the pilot had accumulated about 80 hours of which 41.3 hours were in the accident airplane. These hours were accumulated during 14 flights of familiarization training at a training provider. The last flight in the accident airplane was logged on June 17, 2017.

The pilot also owned an Aviat Husky A1-200 (purchased in November 2016) and a Columbia 400. According to the pilot's logbooks, he completed a mountain flying course in the Husky and flew that airplane from June 27 through July 12, 2017, totaling 37.7 hours. According to paperwork the pilot completed as part of that class, he noted that the Husky's stall speed with the flaps retracted was 55 kts and about 48 kts with the flaps extended.

## Aircraft and Owner/Operator Information

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| **Aircraft Make:** | Evolution 19 | **Registration:** | N571JM |
| **Model/Series:** | Lancair Evolution | **Aircraft Category:** | Airplane |
| **Year of Manufacture:** | 2011 | **Amateur Built:** | Yes |
| **Airworthiness Certificate:** | Experimental (Special) | **Serial Number:** | EVO-019 |
| **Landing Gear Type:** | Retractable - Tricycle | **Seats:** | 4 |
| **Date/Type of Last Inspection:** | May 8, 2017 Condition | **Certified Max Gross Wt.:** | 4550 lbs |
| **Time Since Last Inspection:** | 55 Hrs | **Engines:** | 1 Turbo prop |
| **Airframe Total Time:** | 376.2 Hrs as of last inspection | **Engine Manufacturer:** | P&W CANADA |
| **ELT:** | Installed, activated, did not aid in locating accident | **Engine Model/Series:** | PT6A-135A |
| **Registered Owner:** | On file | **Rated Power:** | 750 Horsepower |
| **Operator:** | On file | **Operating Certificate(s) Held:** | None |

The pilot purchased the accident airplane in late May 2017. The Lancair Evolution is an experimental amateur-built airplane constructed mainly of composite materials. The high-performance, pressurized airplane was equipped with four seats, retractable tricycle landing gear, and traditional flight control surfaces. The airplane received a special airworthiness certificate in the experimental category in August 2011. The last condition inspection was completed on May 8, 2017, at a total time of 376.2 hours.

The airplane was equipped with a Pratt and Whitney PT6-135A engine, serial number PCE-PZ1066, rated at 750 shaft horsepower.

The Lancair Airplane Flight Manual stated that the airplane's stall speed was 76 knots indicated airspeed (KIAS) and that stall speed in the landing configuration (flaps extended) was 61 KIAS. Both speeds noted that the speeds should be verified with flight testing. According to the airworthiness documentation provided to the FAA, the accident airplane was flight-tested at a gross weight of 4,246 lbs and a center-of-gravity location of 130 inches. Under these conditions, the airplane's stall speed in the landing configuration was 64 kts; cruise speed was 285 kts.

The manual's after-start procedures required that the generator switch be turned "ON" and that the pilot confirm a minimum of 28 volts. The before-landing checklist stated that the landing gear should be extended below 150 KIAS and the landing flaps extended below 140 KIAS. The minimum speeds listed for operation in the traffic pattern were 100, 90, and 85 KIAS on the downwind, base, and final legs, respectively.

Maintenance History

About 1 week before the accident, the pilot contacted the maintenance facility to repair some cosmetic cracks and to service the oxygen system, which he believed was leaking. On July 14, the pilot went to the maintenance facility to retrieve the airplane. A mechanic noticed that the left main landing gear

microswitch had been damaged, presumably while they were washing the airplane, and spent about 30 minutes replacing the switch. During that time, the pilot had the radios on and was checking the weather in the area.

The pilot told the personnel at the maintenance facility that he needed to fly to Deer Valley and stated that, following his departure, he would perform one circuit in the traffic pattern to make sure that the airplane's systems were working normally. The maintenance facility stated that, before departure, the voltage had dropped to about 22.5-22.7 volts from the pilot operating the radios for a prolonged period on the ground.

The pilot departed and stayed in the traffic pattern, performing a low pass over the runway with the landing gear and flaps in the retracted position. The airplane then climbed to about 1,000 ft agl, and the pilot transmitted over the radio that something was wrong with the airplane's landing gear. He sent a text message to the president of the maintenance facility relaying the same information. According to the president, he witnessed the airplane's airspeed become slow and it appeared to be approaching a stall. The president called the pilot on his cell phone and told him to increase the power and climb to an altitude where he could troubleshoot the problem safely. The president instructed him to use the emergency landing gear dump valve, which the pilot responded was not working. The pilot stated that the PFD and MFD had gone blank and the president asked if he had turned on the generator switch. The pilot replied that he "just cycled it." The pilot then said the system came back on, and he subsequently landed the airplane without incident.

After landing, the pilot and the maintenance facility president discussed what had happened. The pilot showed the president the actions he had taken to try to use the emergency landing gear system; the president stated that he had pulled the parking brake and not the emergency landing gear system handle. Additionally, the pilot admitted that he had forgotten to turn on the generator switch, and when he did turn it on, all electrical power was restored.

The maintenance records indicated that, on the day of the accident, the pilot requested that the facility perform an "operational check of the engines and systems and verify door operations." The July 17 logbook entry noted an airframe total time of 429.9 hours. The action taken listed that the mechanic had performed a landing gear operational check and found no anomalies. The entry also stated: *Performed charging system fault isolation inspections and checks. No faults found. Top charged main batteries. Operational ground checks performed with no malfunctions or defects noted.*

The postinspection checklist accompanying the entry showed that the primary charging system was 27.7 volts. A partially-burned logbook entry was found in the wreckage that was not provided by the maintenance facility. It had the same airframe total time of 429.9 hours, but the date could not be determined. The entry stated that a generator switch was changed, but the maintenance facility stated that they did not do that maintenance and only provided that entry to the pilot to make his passengers feel that the airplane was safe after his electrical problems on July 14.

Electrical System

The airplane's 28-volt electrical system comprised a 300-amp starter/generator, a voltage regulator, and two 24-volt batteries. The generator provided power to the main electrical bus and the batteries. The

electrical panel was located immediately in front of the pilot on the left panel and comprised battery, fuel pump, starter, ignitor, generator, and alternator switches. The generator control unit (GCU), a Hitek Inc. model 5-11-0003F, was mounted on the engine side of the firewall. The circuit breaker panel was located between the seats under the armrest. The GCU required a minimum of 18 volts to operate.

The emergency procedures checklist for a generator failure listed the following items:

*1. Ammeter: Check*

*2. Generator Switch: OFF*

*3. Electrical Load: Reduce*

*4. Generator Circuit Breaker: Check and Reset*

*5. Generator: ON*

*If generator operation is not restored*

*6. Generator Switch: OFF*

*Land at nearest suitable airport*

The following caution was listed under the checklist:

*with generator inoperative, battery power should last approximately 30 minutes with all non-essential equipment off. When possible, turn battery switches OFF to conserve power and then ON for landing. If total electrical failure is experienced, it will be necessary to perform an Emergency Gear Extension and landing without flaps.*

The airplane was equipped with an L3 Trilogy Electronic Standby Instrument (ESI), ESI-2000, which provided backup attitude, altitude, and airspeed information on a colored display on the panel. The instrument contained an internal battery that provided backup power for at least 1 hour.

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | KFFZ,1380 ft msl | **Distance from Accident Site:** | 1 Nautical Miles |
| **Observation Time:** | 16:57 Local | **Direction from Accident Site:** | 263° |
| **Lowest Cloud Condition:** | Scattered / 15000 ft AGL | **Visibility** | 40 miles |
| **Lowest Ceiling:** | None | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 5 knots / | **Turbulence Type Forecast/Actual:** | / None |
| **Wind Direction:** | 210° | **Turbulence Severity Forecast/Actual:** | / N/A |
| **Altimeter Setting:** | 29.8 inches Hg | **Temperature/Dew Point:** | 36°C / 19°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | PHOENIX, AZ (DVT ) | **Type of Flight Plan Filed:** | IFR |
| **Destination:** | Mesa, AZ (FFZ ) | **Type of Clearance:** | VFR |
| **Departure Time:** | 15:56 Local | **Type of Airspace:** | |

The automated weather observation recorded at Falcon Field about 5 minutes after the accident included scattered clouds at 15,000 ft agl; 40 statute miles visibility; wind from 210° at 5 knots; temperature 97°F; dew point 66°F; and altimeter 29.81 inches of mercury.

## Airport Information

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| **Airport:** | FALCON FLD FFZ | **Runway Surface Type:** | Asphalt |
| **Airport Elevation:** | 1394 ft msl | **Runway Surface Condition:** | Dry |
| **Runway Used:** | 22L | **IFR Approach:** | None |
| **Runway Length/Width:** | 5100 ft / 100 ft | **VFR Approach/Landing:** | Full stop;Precautionary landing;Traffic pattern |

## Wreckage and Impact Information

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| **Crew Injuries:** | 1 Fatal | **Aircraft Damage:** | Substantial |
| **Passenger Injuries:** | 1 Fatal | **Aircraft Fire:** | On-ground |
| **Ground Injuries:** | N/A | **Aircraft Explosion:** | None |
| **Total Injuries:** | 2 Fatal | **Latitude, Longitude:** | 33.469165,-111.713058 |

The wreckage was located about 0.5 nm northeast of the end of runway 22L, in a green area of a golf course (see figure 3).

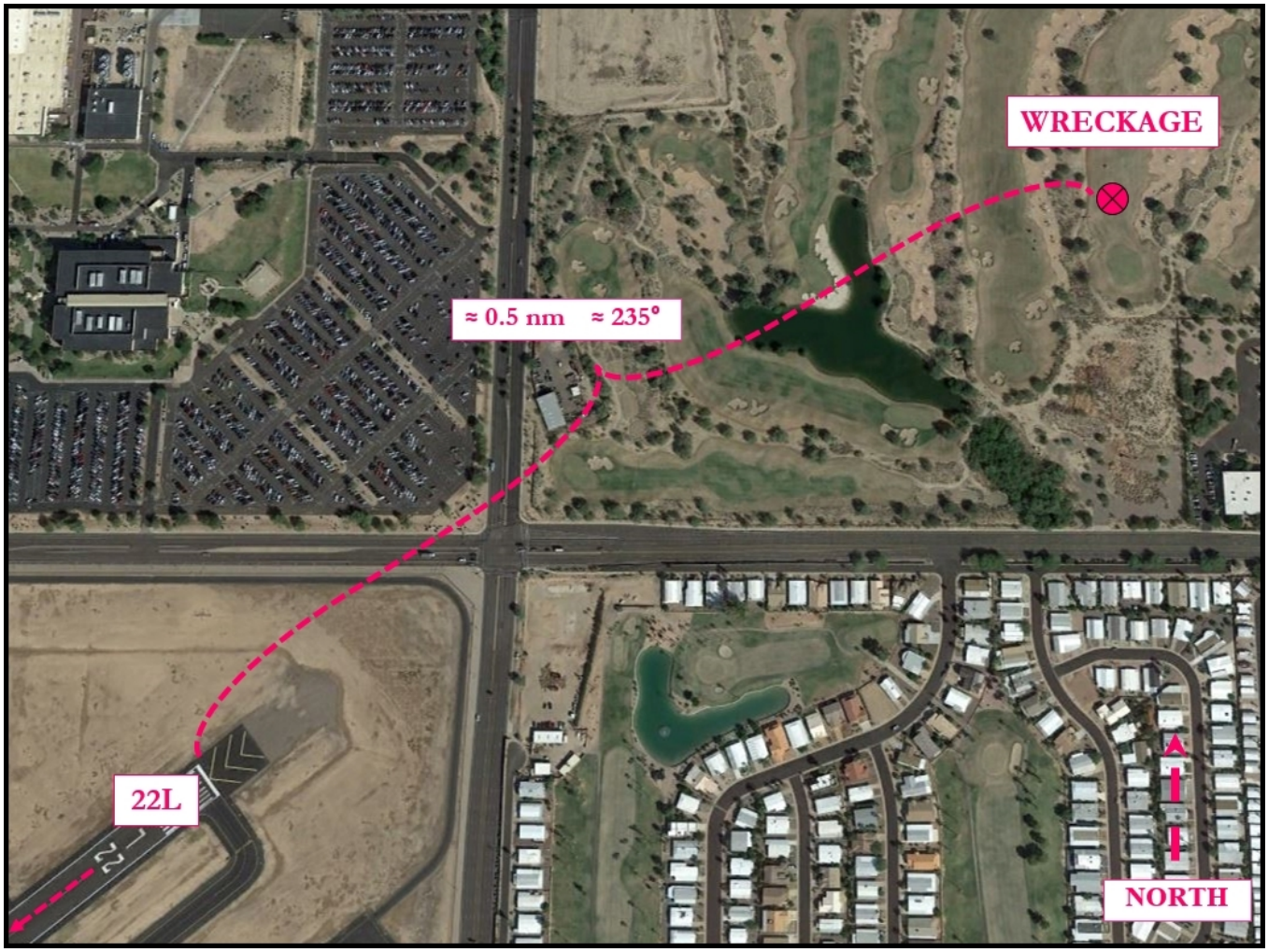


Figure 3: Wreckage in Relation to Runway

The first identified point of impact was a crater in the soft terrain in which the propeller blades were embedded. The engine and numerous portions of the airframe were located in the debris field leading from the initial impact point to the main wreckage. The main wreckage was located in an upright position about 25 ft from the initial impact point on a magnetic heading of 115°. The main wreckage sustained thermal damage and consisted of a majority of the airframe's ashen remains (see picture 4).

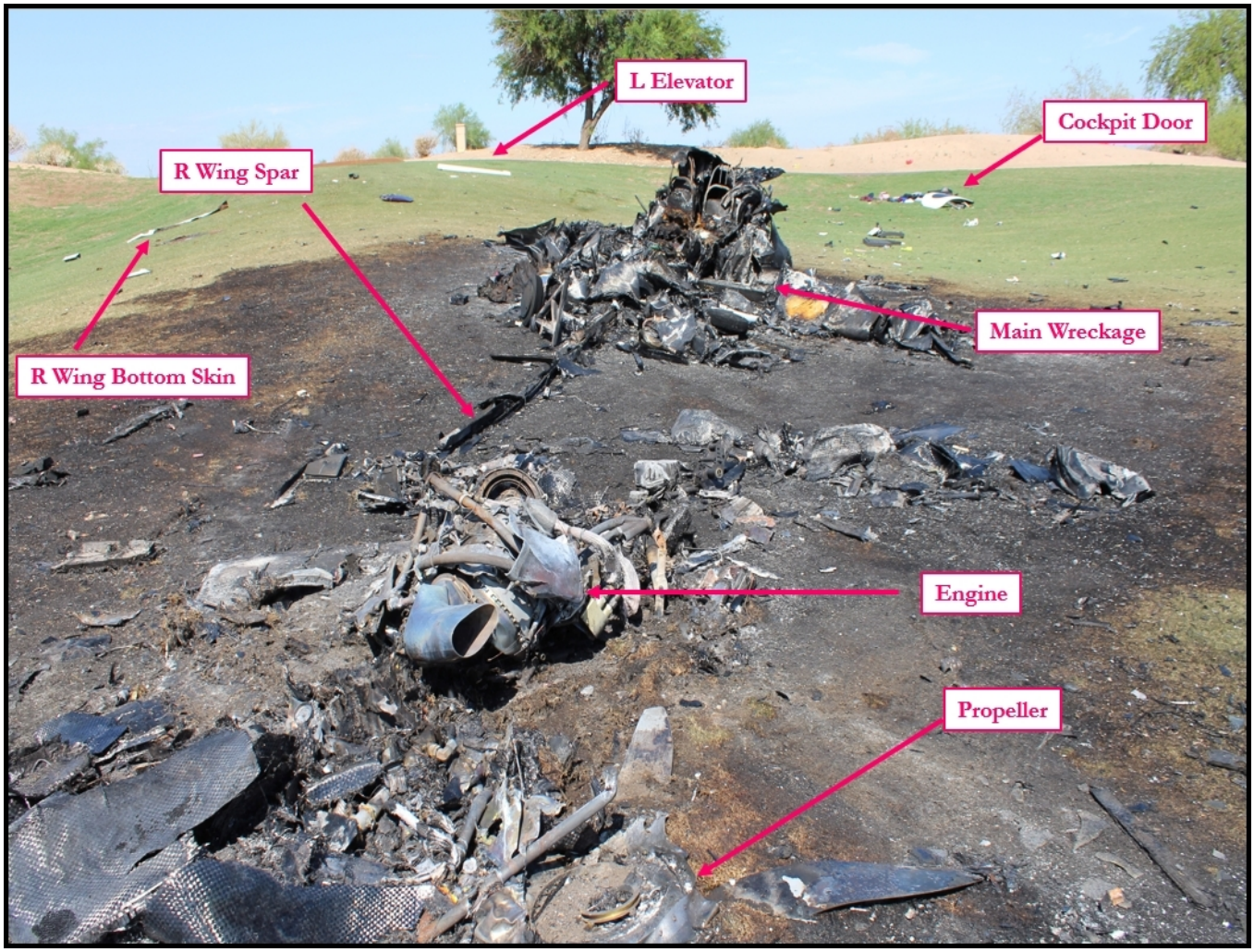


Figure 4: Main Wreckage

The cockpit area sustained severe thermal damage. The avionics were charred with wire bundles exposed and partially melted. The wings were consumed by fire. The wing flaps were consistent with a retracted position at the time of impact. The physical landing gear position and landing gear selector position was consistent with the gear being retracted at the time of impact.

The engine sustained major impact damage, resulting in the engine separating into three sections. The gas generator and exhaust case exhibited extensive structural deformation, and the front reduction gearbox housing was shattered.

The compressor section displayed tip rubs and bent stator vanes caused by contact with adjacent components. There was no evidence of pre-impact anomalies found on the accessed section of the compressor. The compressor turbine exhibited circular contact damage on the disk consistent with rotation at impact. The power turbine blades were fractured at various locations within the airfoils. Visual examination of the fracture surfaces showed features consistent with overload. Fragments of blades were recovered from the exhaust section of the engine, and the shroud tip portions exhibited rubbing damage from contact with the turbine shroud. These signatures were consistent with the fracture of the power turbine blades due to rotational contact at impact. The remaining components did not show any evidence of pre-impact anomalies.

The accessory gearbox housing was intact. The external surfaces were covered in dirt, debris, and soot. The external oil pump had separated from the gearbox. The starter-generator was in place. The starter-generator was removed and the drive shaft was found fractured. Visual examination of the fracture surface was consistent with overload.

The electrical system could not be examined due to extensive thermal damage of its components.

The examination of the airframe and engine revealed no evidence of preimpact mechanical malfunction or failure that would have precluded normal operation. The complete examination reports are contained in the public docket for this accident.

## Medical and Pathological Information

The Maricopa County Coroner's Office, Phoenix, Arizona, completed an autopsy on the pilot. The cause of death was due to multiple blunt impact injuries.

The FAA Forensic Sciences Laboratory performed toxicological testing of specimens collected during the autopsy. The results of the testing were negative for ethanol and tested-for drugs.

## Additional Information

The pilot's cell phone was recovered from the wreckage and investigators were additionally provided the cell phone of the president of the maintenance facility to review the text threads.

The following excerpts of text messages occurred between the maintenance facility and the pilot just before the accident:

1542: [maintenance facility]: hi there, how did the flight go?

1622: [pilot]: headed back. The system isn't charging. My voltage keeps dropping

1625: [pilot]: At 22.9v and dropping

1626: [pilot]: be there in 20

1632: [pilot]: System not charging

…

1644: [pilot]: This is [the pilot's first and last name]. Coming back to you. The system isn't charging. My voltage keeps dropping.

1645: [maintenance facility]: okay [the president] wants you to turn off ac to save battery life and call home if you can

Additionally, the pilot's cell phone displayed a call made to the FAA WXBrief phone number, which lasted 2 minutes 37 seconds and ended at 1650:35.

Photos were recovered from the pilot's cell phone; the associated metadata indicated the date/time of image capture, 3D GPS location (including mean sea level altitude), true heading of the device, and speed-over-ground of the device at time of capture.

At 1603, with the airplane about 13,800 ft msl, a photo showed that the PFD indicated a low voltage warning for buses 1 and 2, and the MFD showed the voltage on both buses at 23.6 volts; the air conditioning was on. At 1627, with the airplane at an altitude about 10,000 ft msl the voltage was at 22.7 volts; the air conditioner was still on. The last picture recovered was taken at 1641:12 about 14 nm west-northwest of the accident site at an altitude of about 5,300 ft msl; the MFD showed a voltage of 19.6 volts.

## Administrative Information

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| **Investigator In Charge (IIC):** | Keliher, Zoe |
| **Additional Participating Persons:** | Mark Pritchett; Federal Aviation Administration; Scottsdale, AZ |
| **Original Publish Date:** | April 20, 2020 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | The NTSB traveled to the scene of this accident. |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=95594 |