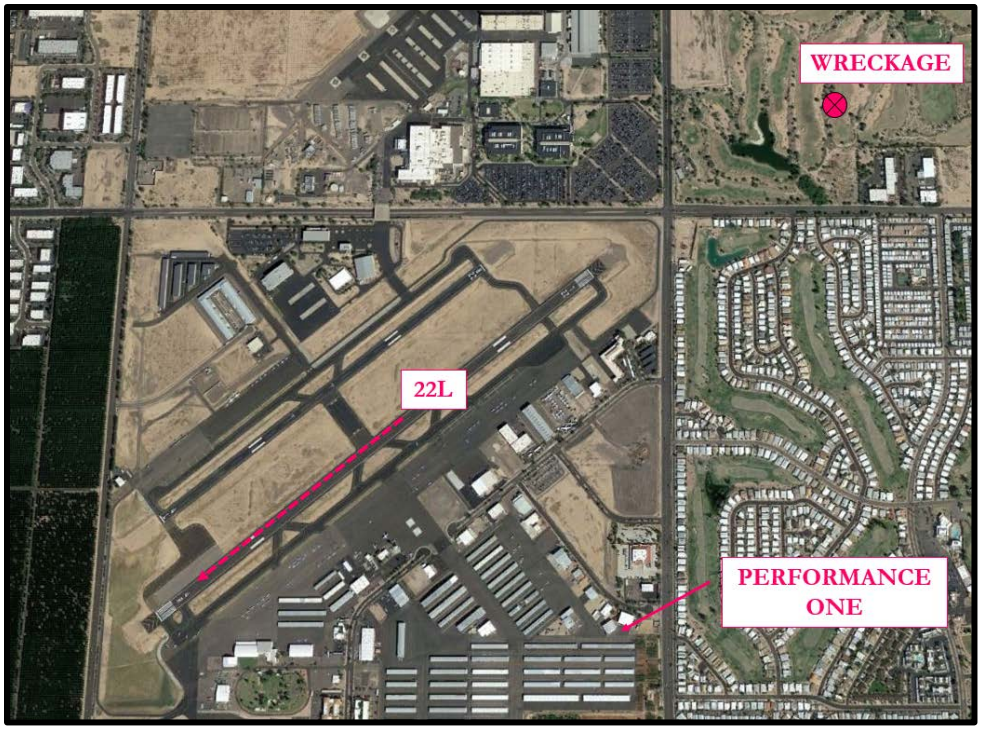
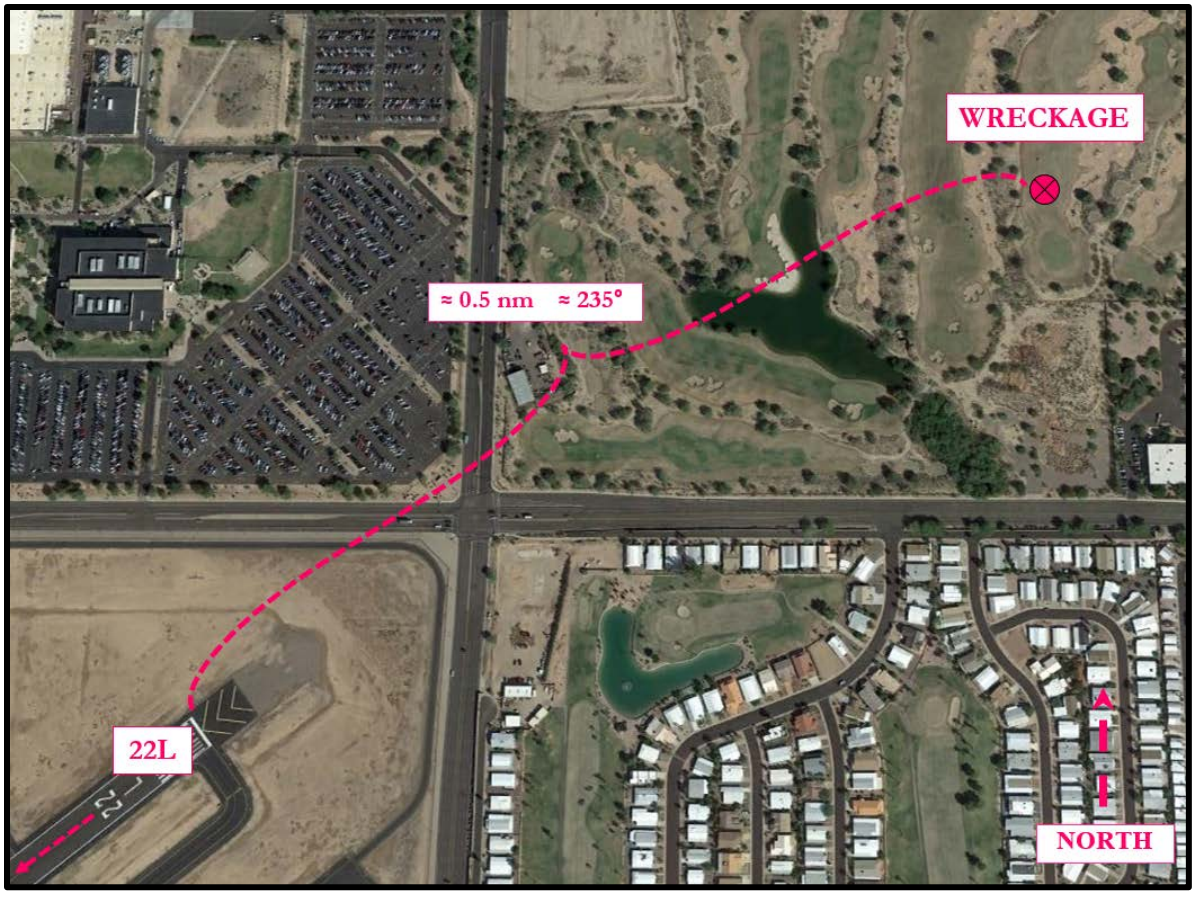
TESTS AND RESEARCH

The wreckage was located about 0.5 nm northeast from the end of runway 22L situated in a green area of a golf course at 1,410 feet msl.

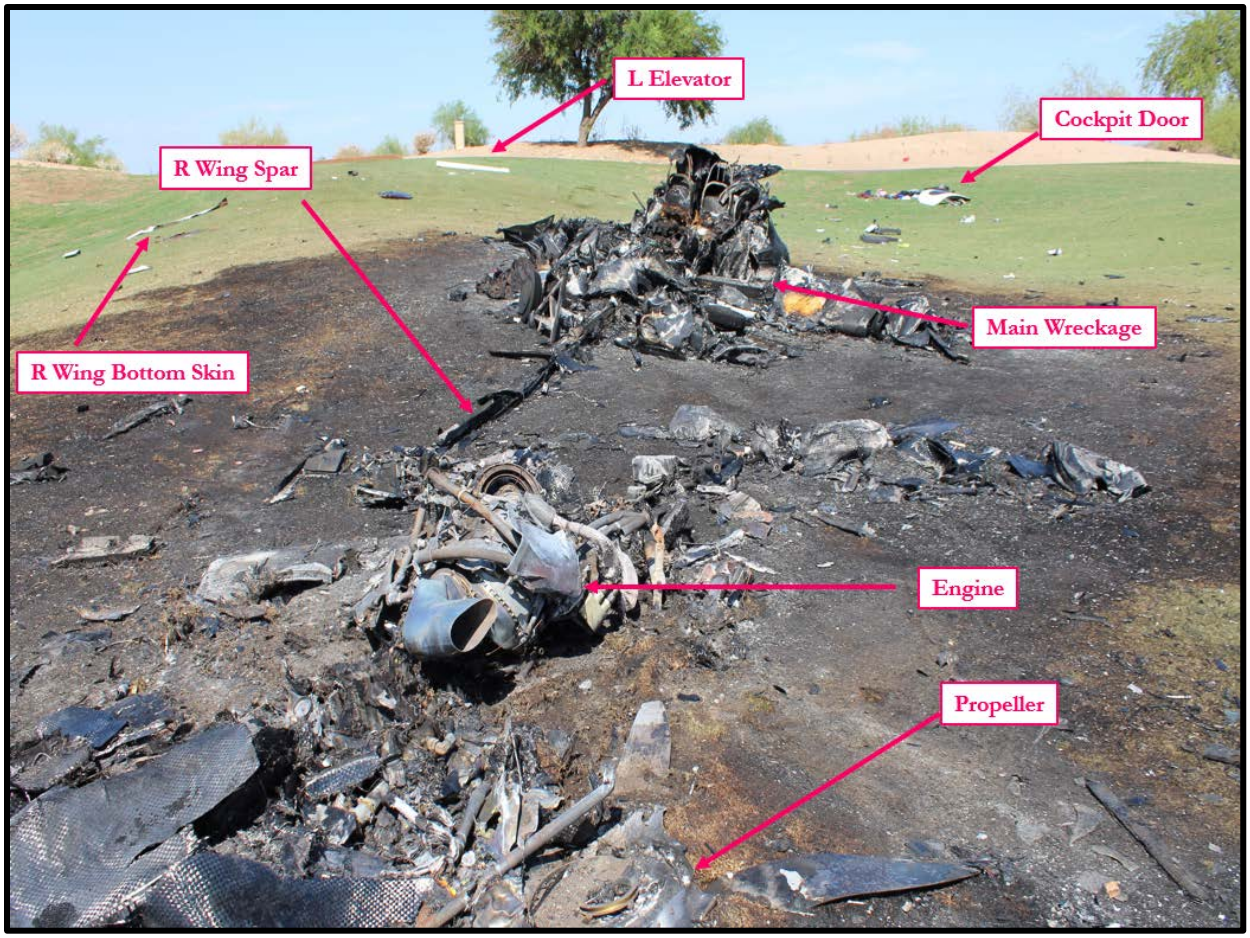


Picture 1: Wreckage Overview



Picture 2: Wreckage in Relation to Runway

The first identified point of impact consisted of a crater in the soft terrain where the propeller blades were embedded. The engine and numerous portions of the airframe were located in the debris field leading from the initial impact to the main wreckage. The main wreckage was located in an upright position about 25 feet from the initial impact point on a magnetic heading of 115 degrees. The main wreckage had sustained thermal damage and consisted of a majority of the airframe's ashen remains. The farthest piece of wreckage were the fuel caps, consistent with them ejecting from the wings at impact.



Picture 3: Main Wreckage

From the embedded propeller were craters in the grass consistent with the leading edge of the wings. The passenger seats remained attached to the frame. The luggage and door and part of the door frame were adjacent to the wreckage in the debris field. Part of the right upper wing skin and the elevator were unburned and adjacent to the debris field.

AIRFRAME EXAMINATION

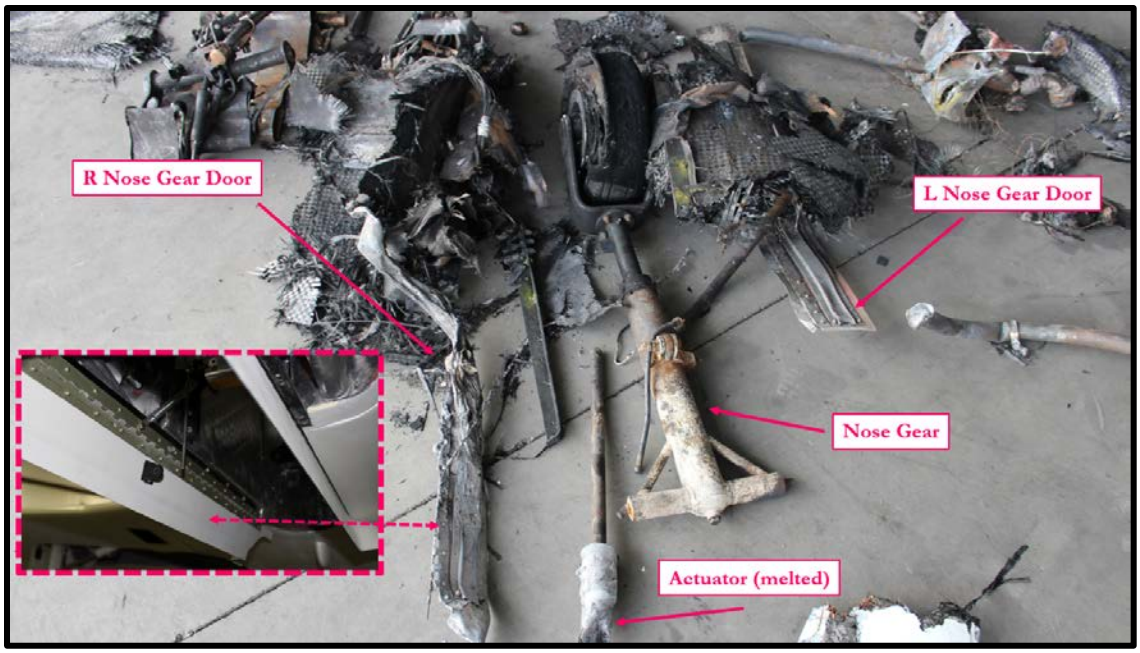
Examination of the recovered airframe was conducted on July 19, 2017 at the facilities of Air Transport in Phoenix, AZ.

The firewall and engine mounting brackets had sustained crush damage and were thermally deformed. Several pieces of the cowling were distinguishable from the latches; there was no oil or smoke signatures on those pieces. The cockpit area had sustained severe thermal damage. The avionics were charred with wire bundles exposed and partially melted. The front seat frames were not attached and the floor section at the forward spar was mostly consumed by fire.

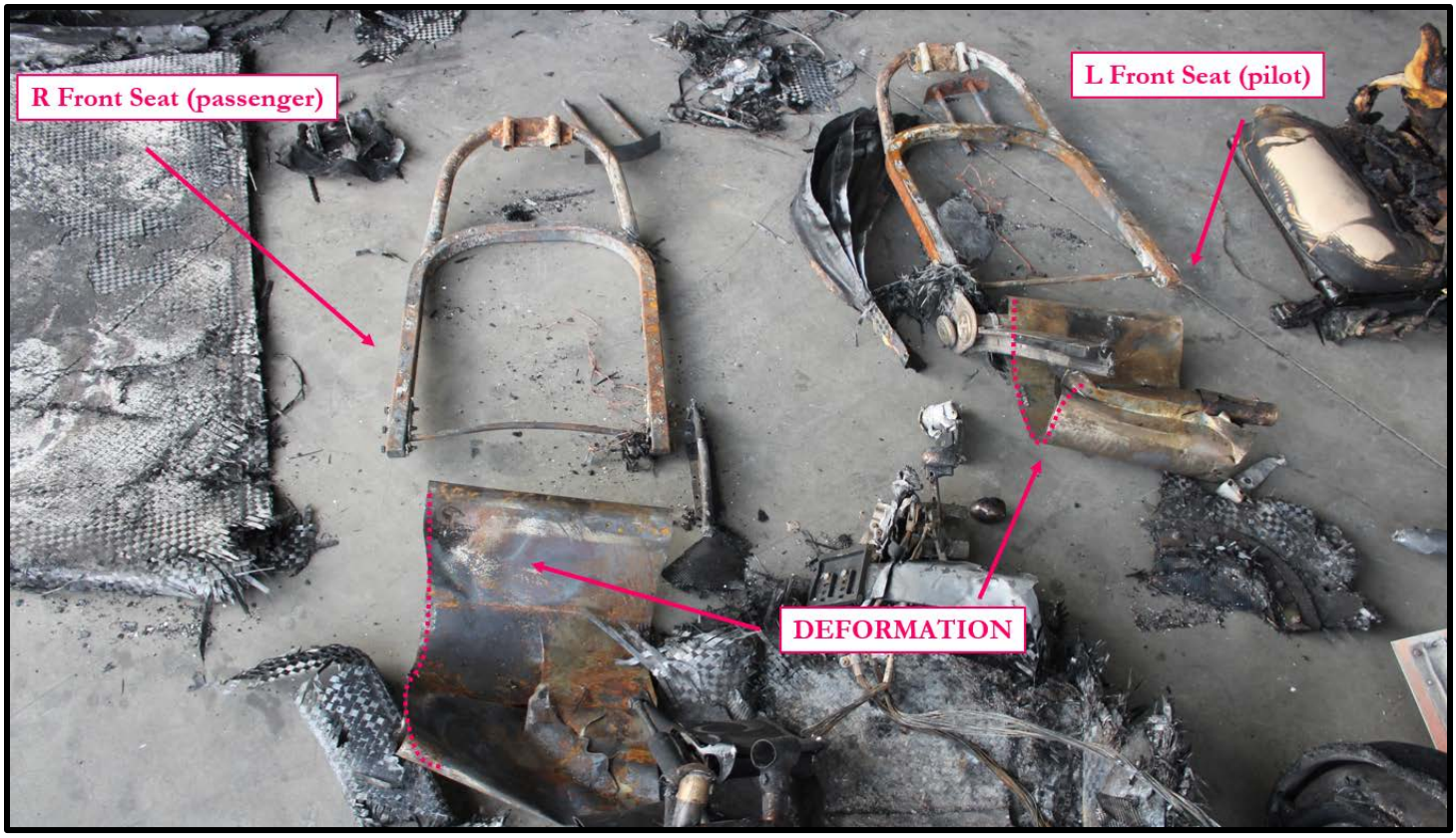
Picture 4: Main Wreckage Layout

The wings were consumed by fire. The flap position was consistent with the flaps being retracted at the time of impact. The bar assembly that the rudder pedals were attach to was burned though and the mounting brackets (from assembly to fuselage) were absent. The pedals for the right-front seat were found within the wreckage; the cables were consumed by fire.

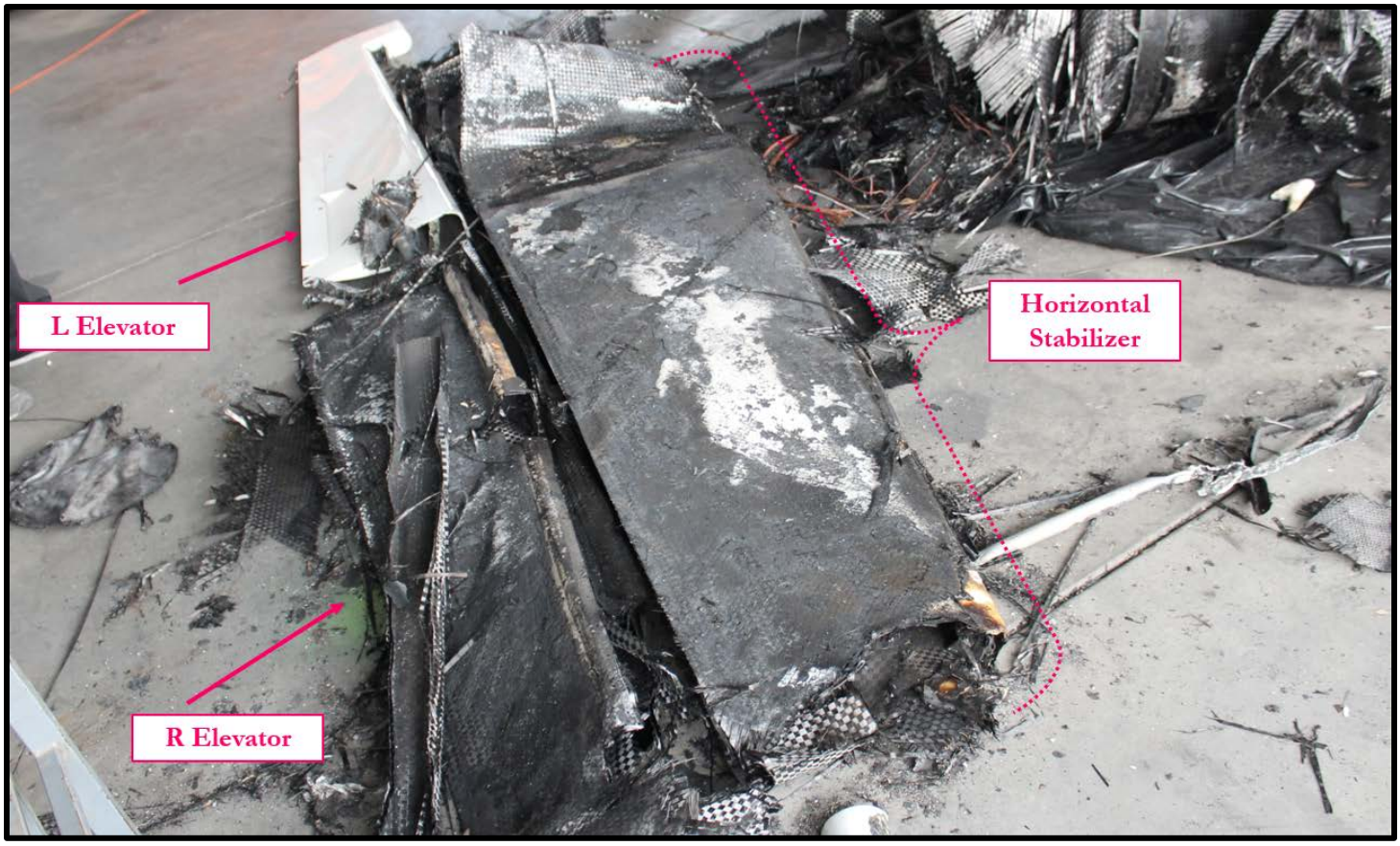
The landing gear indicator was up and locked. The batteries were consumed by fire.



Picture 5: Nose Landing Gear



Picture 6: Seats



Picture 7: Tail Section

According to the airworthiness documentation provided to the FAA for the phase one inspection, the airplane was tested at a gross weight of 4,246 pounds and a CG location of 130 inches to have the following flight characteristics: Vso 64; Vx 85; Vy 105; cruise speed 328 mph.

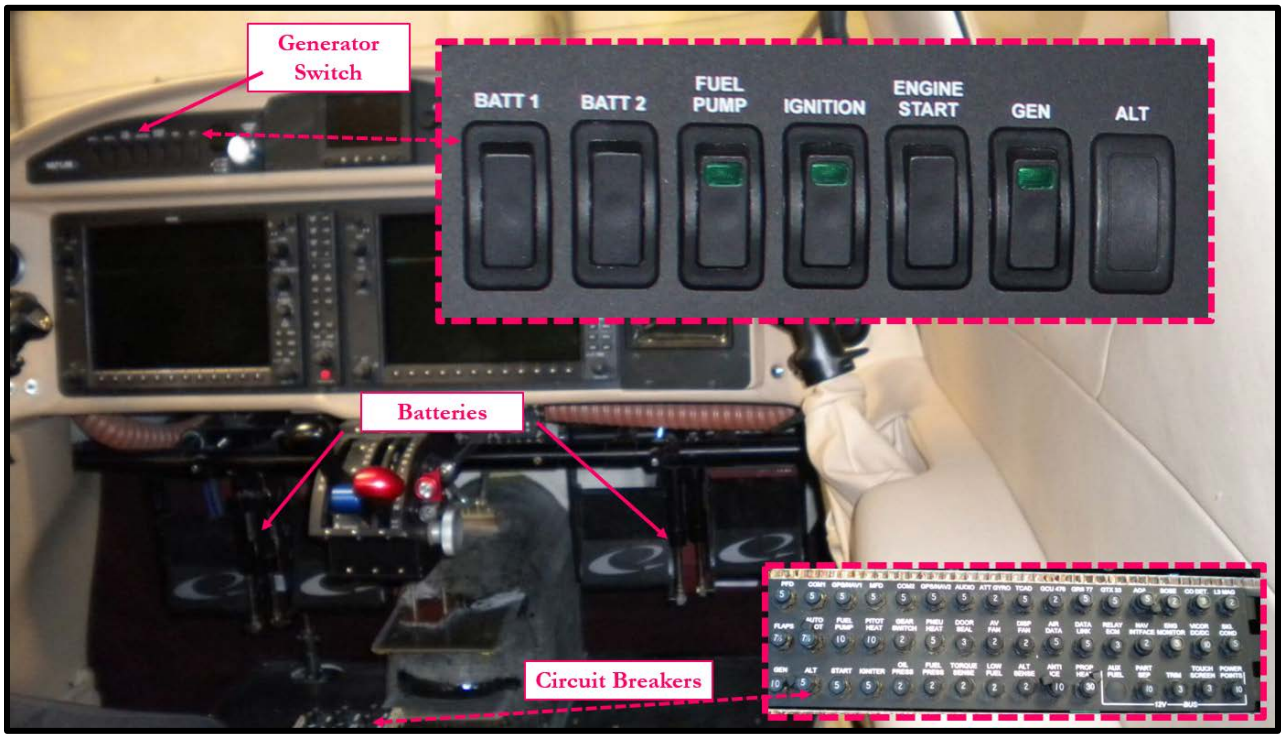
> **features, and is safe for operation. The following aircraft operating data has been demonstrated during the flight testing: speeds Vso 64, Vx 85, and Vy 105, and the weight 4246, and CG location 130.0 at which they were obtained."**

ELECTRIC SYSTEM DESIGN

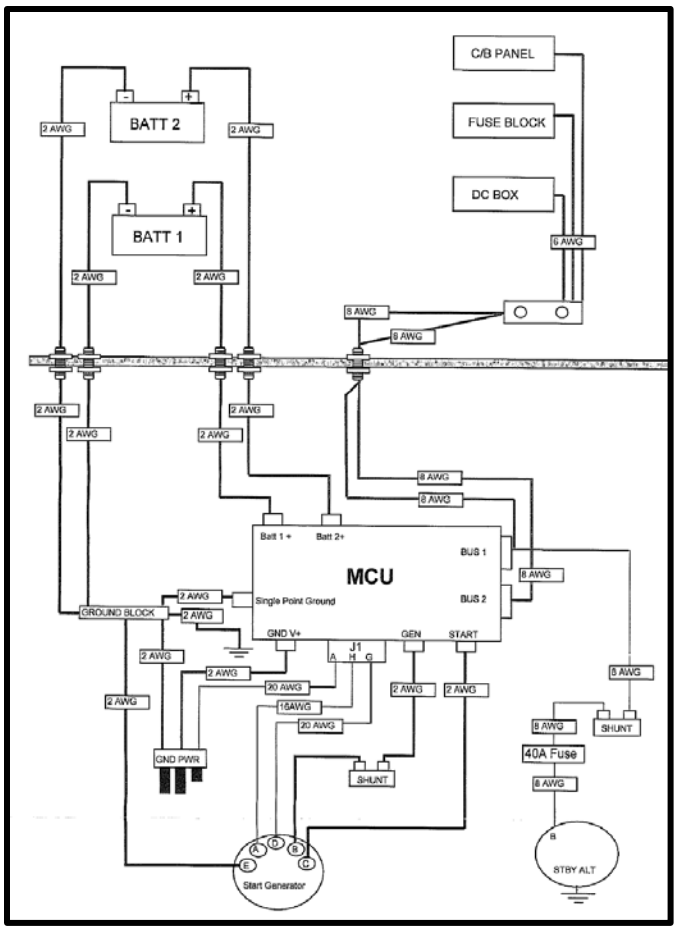
The airplane's 28-volt electrical system consisted of a 300 amp starter/generator, a voltage regulator and two 24-volt batteries. The generator provided power to the main electrical bus and the batteries. The electrical panel was located immediately in front of the pilot on the left panel and consisted of the following switches: Battery, Fuel Pump, Starter, Ignitor, Generator, Alternator. The generator control unit (GCU), a Hitek Inc., generator control panel model 5-11-0003F, was mounted on the engine-side of the firewall (shown as Master Control Unit (MCU) on the drawing below). The circuit breaker panel was in between the seats under the armrest.

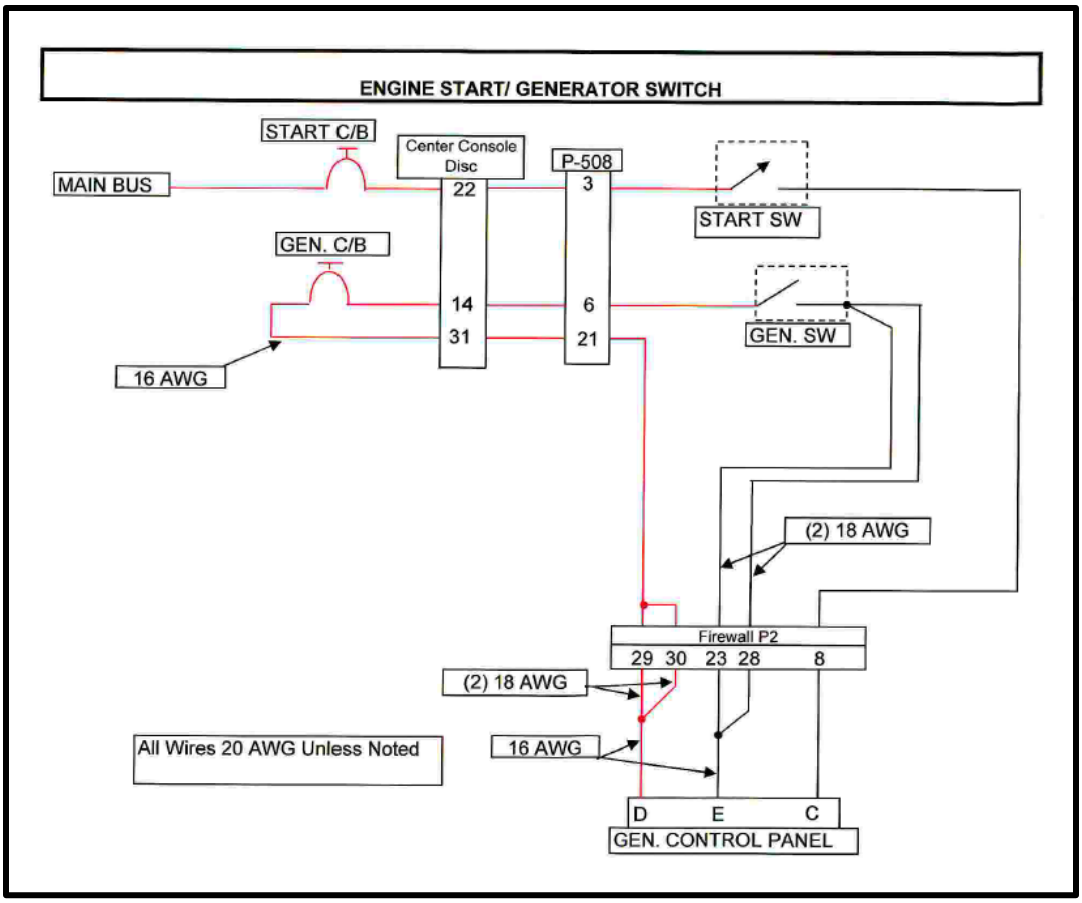
Because the airplane was a composite design, all circuits were required to have the use of a return wire leading to "ground". The use of a ground bus was recommended with it being located near the firewall requiring only one relatively large ground wire to the battery and one "hot" wire to the starter. The power to the starter was controlled by a relay.

The airplane was equipped with two Concord 24-volt batteries, p/n RG24-20, s/n 40809042 and 40811962. The records indicate they were installed in June 2016 at a hobbs time of 354.8 hours.



Picture 8: Electrical System in Cockpit


C/B PANEL
FUSE BLOCK
DC BOX
BATT 2
BATT 1
2 AWG
6 AWG
8 AWG
MCU
Batt 1 +
Batt 2+
BUS 1
BUS 2
Single Point Ground
GND V+
GEN
START
J1
A H G
GROUND BLOCK
GND PWR
20 AWG
18AWG
SHUNT
40A Fuse
STBY ALT
Start Generator


ENGINE START/ GENERATOR SWITCH
START C/B
Center Console Disc
P-508
MAIN BUS
22
3
START SW
GEN. C/B
14
31
6
21
GEN. SW
16 AWG
(2) 18 AWG
Firewall P2
29 30 23 28 8
(2) 18 AWG
16 AWG
All Wires 20 AWG Unless Noted
D E C
GEN. CONTROL PANEL

ENGINE EXAMINATION

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 compressor turbine blades were all fractured in the airfoil section, just above the blade platform. Examination of the fracture surfaces exhibited a coarse granular surface, consistent with overload.

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, on which the shroud tip portions exhibiting rubbing damage from contact with the turbine shroud. This evidence is consistent with the fracture of the power turbine blades occurring from rotational contact at impact, resulting from the deformation of the main engine casings, leading to axial displacement of the turbine. The remaining components did not show any evidence of pre-impact anomalies.

The propeller shaft, No. 5 and 6 bearings, the 2nd stage reduction gear train, and a section of the front reduction gearbox housing had separated from the engine. The propeller shaft was fractured between bolt holes. The 2nd stage planet gears were capable of rotation. The No. 5 and 6 bearings, propeller seal cover and propeller shaft were heat affected by the post impact fire. The 1st stage reduction gear train was in place in the rear reduction gearbox. The rear reduction gearbox assembly was not removed due to the severity of the compressive damage to the exhaust case.

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.

No mechanical anomalies were noted with the recovered engine or airframe that would have precluded normal operation.

TEXT CONVERSATIONS

The pilot's cellular phone was recovered from the wreckage and investigators were additionally provided the cellular phone of the maintenance facility to review the text threads. Mi! &

MAINTENANCE FACILITIES' TEXT MESSAGES JULY 14, 2017

1626: [pilot]: Problem
1627: [pilot]: Gear
1627: [pilot]: Coming back
1628: [maintenance facility]: What is it doing?
1637: [maintenance facility]: Make sure your emergency valve is in the correct position
1637: [pilot]: It is
1638: [maintenance facility]: If it is even slightly cocked open it won't build up pressure
1638: [maintenance facility]: I'll be there in 10 minutes
1732: [pilot]: Coming back
1732: [pilot]: Please guide me to the hanger
1739: [maintenance facility]: Meet you on the taxiway
1742: [pilot]: Where hyd pump relaat
1743: [maintenance facility]: Top right panel

1743: [pilot]: Is my gear down
1744: [maintenance facility]: Pull breaker, gear selector down, turn release valve. Can't see from here
1744: [maintenance facility]: I'm at the runway
1744: [maintenance facility]: Gear are up
1745: [pilot]: b
1745: [pilot]: Relay is Puullrdf
1746: [pilot]: Hydraulic pump is Paul
1746: [pilot]: Pulled
1746: [maintenance facility]: Gear selector down, then turn emergency valve
1747: [pilot]: Only to the right
1747: [maintenance facility]: Is your generator switch on?
1750: [maintenance facility]: Follow me to overnight hangar
1826: [pilot]: **[Expletive]**. Thanks again
1844: [maintenance facility]: Anytime my friend. You did good, I was just there for support! Glad you're safe!!!
2033: [pilot]: Saved my ass. Drive safe.

MAINTENANCE FACILITIES' TEXT MESSAGES JULY 17, 2017

The following excerpts of texts occurred between the maintenance facility and the pilot:
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
1627: [maintenance facility]: Can u call [the president]? He wants to talk to you
1632: [pilot]: System not charging
1639: [maintenance facility]: Did u talk to [the president] he wanted you to turn the ac [air conditioning] off to save the battery

The pilot continued to text from another telephone number:
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