NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

INITIAL and ON-SCENE INFORMATION

NTSB Accident: WPR13FA294
Accident Date: June 27, 2013

This document contains 47 embedded images

A. ACCIDENT

Location:	Birdseye, Utah
Date:	June 27, 2013
Aircraft:	Cessna 172M, N4459R, Serial # 17263201
NTSB IIC:	Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
National Transportation Safety Board
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C. ACCIDENT SUMMARY

On June 27, 2013, about 1020 Mountain daylight time, a Cessna 172M, N4459R, was substantially damaged when it struck powerlines and terrain during an attempted emergency landing, due to an onboard fire, on a road near Birdseye, Utah. The airplane was owned and operated by IMSAR Aviation, a wholly owned subsidiary of IMSAR, of Springville, Utah. The airplane was registered in the restricted category. The commercial pilot was seriously injured, and the required crewmember received fatal injuries. The radar equipment test flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight.

D. SUMMARY

The airplane was examined on-site by Federal Aviation Administration (FAA) personnel on the day of the accident, and then by FAA, NTSB, IMSAR, and Cessna Aircraft Company personnel the day after the accident, and was removed from the site that same day (June 28).

No evidence of any airplane or engine preimpact mechanical malfunction was noted during the examination; all evidence was consistent with an in-flight fire of the supplemental power system and a wire strike during the emergency landing attempt.

E. PRE-ACCIDENT AIRPLANE and FLIGHT INFORMATION

1.0 Airplane

Last Annual Inspection: 06-02-13 Hours: 2,098
Hours Since Inspection: 12.6
Total Aircraft Hours at Occurrence: 2,110.6

2.0 Engine

Manufacturer: Lycoming
Model: O-320-E2D
S/N: L-37603-27A
TTSN: 2,110.6
TSMO: 233.8

Engine was modified with a RAM conversion to 160 HP.

3.0 Propeller

Manufacturer: McCauley
Model: 1C160/DTM7557
Hub S/N: 723567
TTSN: 2,110.6

4.0 Airplane Modifications

According to representatives of IMSAR, the airplane was one of two Cessna 172 airplanes used as test platforms for the development of airborne radar equipment by IMSAR, and was therefore modified in multiple ways. Modifications included removal of the rear seats, installation of an external antenna mount on the baggage door, and hardpoint mounts under each wing.

IMSAR personnel had designed and fabricated a dedicated, re-configurable supplemental power supply to provide additional electrical power to the radar equipment that they were testing. The system was designed to provide 12VDC, 28VDC, and 120VAC to company radar components and laptop computer equipment on the subject airplane. The system was partially connected to the airframe electrical system. According to IMSAR personnel, the system had been used previously, and was being used on the accident flight. The system included a 12 volt wet-cell battery, an inverter, a distribution box, an isolator, and a battery switch. Most components were temporarily secured to the cabin floor aft of the two front seats.

5.0 Pilot and Flight Information

Both IMSAR airplanes were based at Spanish Fork-Springville airport (U77), Springville, Utah. IMSAR employed one full time pilot, and occasionally utilized the services of contract pilots. On the morning of the accident, the IMSAR pilot was operating the other company airplane, and a contract pilot was operating the accident airplane. The mission plan was to fly predetermined

tracks and/or orbits at a location about 16 miles south of U77, at an altitude of about 8,000 feet, for several hours. This location was frequently used for this testing.

About 2 hours after departure, smoke/fire event in the cabin was detected, and after an initial attempt to fly to the north (towards U77) to locate a suitable landing location, the pilot opted to land to the south on a north-south road near his current location. On short final, the pilot noticed a powerline that crossed the road was in his path, and pulled up in an attempt to overfly it. The airplane struck that wire, and then struck other powerlines and terrain.

F. SITE INFORMATION

1.0 Location

The pilot was attempting an emergency landing to the south on US Highway 89, a two-lane north-south asphalt road. The approximate street address was 18020 US89 in Birdseye, Utah. The road is situated in a north-south valley about 50 miles south of Salt Lake City. The approximate impact location was N 39º 54.433', W 111º 32.999', at an elevation of about 5,520 feet above mean sea level.

The airplane came to rest on terrain about 15 feet lower than, and about 25 feet west of, the roadway.

2.0 Impact Information

On-scene evidence was consistent with the airplane striking two separate sets of powerlines. The first set was oriented east-west, transversely across the road, and consisted of two lines. The second set was oriented north-south, parallel to the road, and consisted of four lines. The two powerline sets shared a common weathered-wood support pole located about 40 feet west of the roadway centerline. That pole was one in a series of poles that paralleled the road, and which supported the four-powerline group. The poles in that group were spaced about 350 feet apart. The eastern end of the transverse powerline set was supported by another weathered wood pole. That pole was situated in a field, and was located about 250 feet east of the roadway centerline.

The airplane first struck and broke the highest powerline in the transverse set. That fractured powerline was situated about 28 feet above the road, and was designated as a "#2 ACSR," which denoted that it was a bare (uninsulated) aluminum conductor, steel reinforced cable. The cable that consisted of 7 total strands; a central aluminum conductor wrapped with 6 steel reinforcing strands. The nominal overall cable diameter was 0.316 inches, and the diameters of the central aluminum conductor and each steel reinforcing strand diameter were 0.105 inches. The nominal rated strength of the cable was 2,850 pounds. A second line in the transverse set, which was situated 23 feet above the road, was not struck, and remained intact.

The airplane then struck at least two separate cables that were in the four-line set that paralleled the roadway on its west side. The uppermost cable was situated about 35 feet above the road, The cable was significantly damaged but not completely fractured; all but one strand of that cable were "bunched" at the south end of an approximately 18 foot section, consistent with them

being fractured and then compressed along the single intact strand by the airplane. This cable was designated as a "1/0 ACSR," which was a bare (uninsulated) cable with an aluminum core conductor, and 6 steel reinforcing wrapped strands. The nominal overall cable diameter was 0.398 inches, and the diameters of the central aluminum conductor and each steel reinforcing strand diameter were 0.1327 inches. The nominal rated strength of the cable was 4,380 pounds.

A second cable, situated about 4 feet closer to the road than, and 3 feet below, the top cable, was completely fractured. Two other cables in that group were not fractured but displayed electrical arcing burns in the vicinity of the bunching. All three of these cables were also 1/0 ACSR.

None of the powerlines were marked or highlighted with any devices (such as balls) to increase their visual conspicuity, nor were they required to be.

Cable and airplane witness marks were consistent with the nose landing gear first striking the transverse cable, and the rightwing and main landing gear subsequently striking the parallel cables.

The airplane came to rest about 270 feet south of the transverse cable strike location. The airplane came to rest inverted, with the fuselage oriented about 45 degrees from horizontal. The approximate at-rest heading was 220 degrees magnetic. A north-south ground scar that measured about 15 feet long, and that was consistent with being made by the left wingtip, was situated about 60 feet prior to the wreckage. Aside from multiple plastic and window fragments, no components had separated from the airplane.

Figure 1 - Airplane After Impact (view southwest)

Figure 2 - View North-Northwest (note downed wires)

Figure 3 - View North (note downed wires)

Figure 4 - View Northwest

Figure 5 - Nose Gear Tire with Wire Marks

Figure 6 - Right Main Gear with Wire Strike Damage

Figure 7 - Airplane, Road, and Parallel Wires (view west)

Figure 8 - Downed Parallel Wire and Road

Figure 9 - Bunched Wires on Parallel Powerline

Figure 10 – Pole Supporting Parallel and Transverse Powerlines

Figure 11 - Fractured Transverse Cable

Figure 12 - Fractured Transverse Cable (close up, strands bound post-accident)

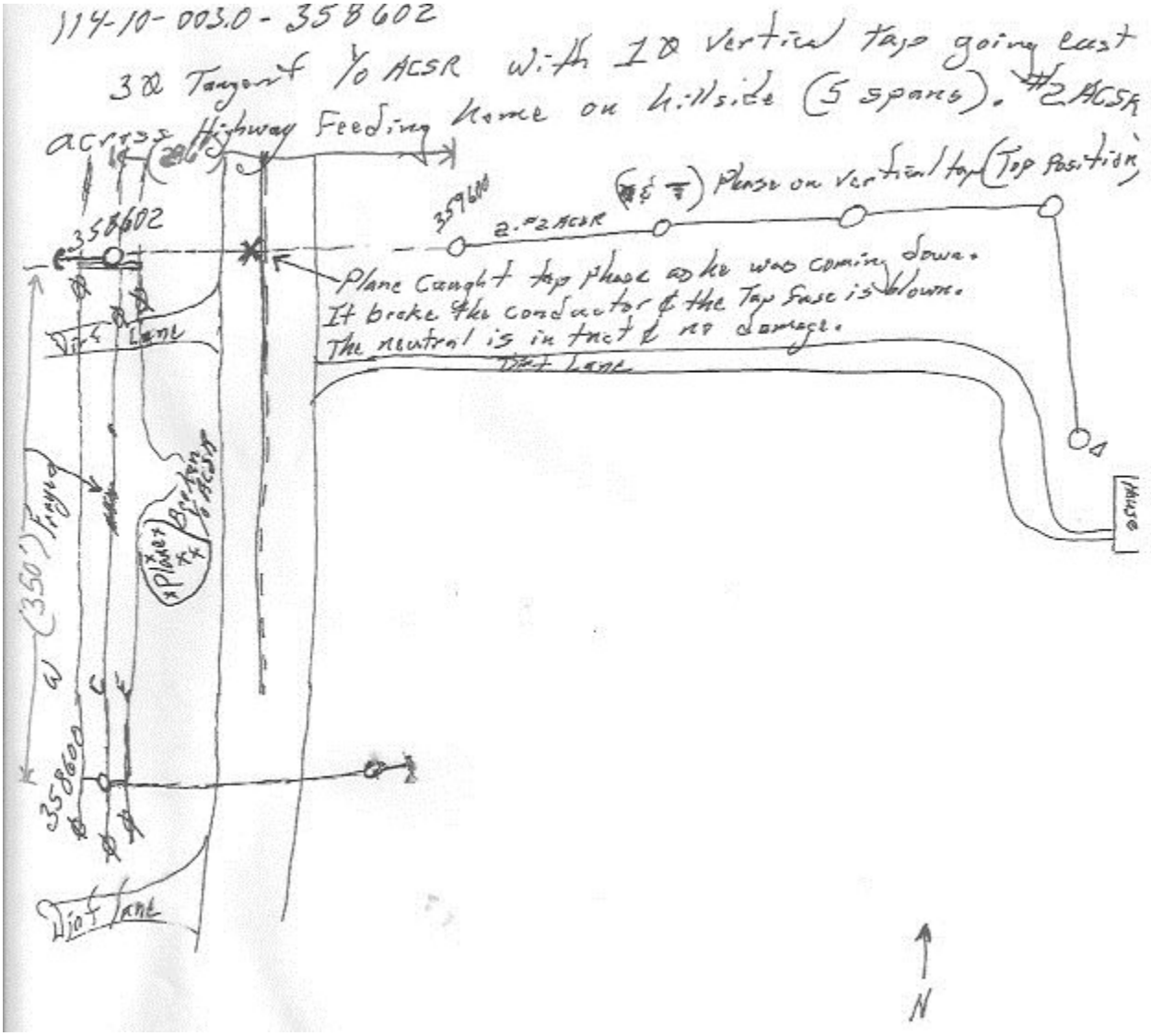

Figure 13 - Site Diagram (Courtesy Rocky Mtn Power)

Figure 14 - Left Wing Ground Scar

G. AIRPLANE EXAMINATION INFORMATION

1.0 General

The engine was displaced up, aft, and left in the airplane axis system. The two blade fixed pitch metal propeller remained attached to the engine. Cockpit occupiable volume was compromised forward of the front seats. The right wing displayed leading edge crush damage at the outboard-most foot of its span. The left wing exhibited tip crush and fragmentation damage. The outboard five feet of the left wing exhibited aft and up crush damage. The flaps were found extended to the full-down landing position of 40 degrees. Both wings and both flaps exhibited crush damage in the lateral direction in their aft inboard regions, and the upper aft fuselage exhibited similar damage in the region of the rear window. The fuselage exhibited slight buckling towards the aft end of the cabin. The aft fuselage, tailcone, and empennage were essentially undamaged.

All airplane components, including all flight controls were accounted for at the site. Control cable continuity was established throughout the airplane. The flap actuator was measured and found to be 5.9" which equates to flaps 40º. The elevator trim tab actuator was measured and found to be 1.25" which equates to neutral tab

Figure 15 - Left Wing Upper Surface

Figure 16 - Lower Fuselage with External Antenna Mount

Figure 17 - Instrument Panel

Figure 18 - Cockpit

2.0 Fuselage, Cockpit and Cabin

Although not explicitly documented by the first responders, the evidence was consistent with the test engineer's (right) seat possibly separating from its seat tracks during the impact sequence. The instrument panel and two control wheels sustained moderate crush damage, consistent with ground and occupant impact.

Selected Switch & Control Positions (as found June 28)
Battery Master: On.
Alternator Master: On
Navigation Lights: Off
Rotating Beacon: On
Strobe: Not Applicable
Landing Light: Off
Taxi Light: Off
Ignition Key/Switch Position: Left
Engine Throttle: Idle
Mixture: Full Rich
Primer: In & Locked
Carburetor Heat: Off
Fuel Selector Handle: Both
Fuel Selector Valve: Both

Selected Instrument Indications (as found June 28)

Hour Meter: 2,542.4
Tach RPM: 0
Tach Hours: 2,110.6
Engine Control Positions

Figure 19 - Tachometer

Figure 20 - Sub Panel with Ignition Key

Figure 21 - Sub Panel

Figure 22 - Radar Sub Panel

3.0 Seats

Restraint System Information						
Seat	Occupied	Restraint Type	Restraint Used	Condition	Manufacturer	2nd Seat Stop
1	Yes	3-Point	Yes	Lapbelt cut by first responder	Cessna	Yes
2	Yes	3-Point	Undt	Intact	Cessna	Yes

The left seat lap belt was observed with the buckles latched and the lap belt cut. The shoulder harness was not attached to the main buckle.

The right seat lap belt buckles were not latched, and the shoulder harness was not attached to the main buckle. The use of the seat restraint by the test engineer was not able to be determined.

Figure 23 - Right Seat Restraint System

Figure 24 - Left Seat Restraint System

Except for the right rear foot, the feet of the right seat displayed deformation consistent with loading the seat in the up direction (airplane axis system)

The Utah driver's license of the test engineer, who was fatally injured, was last issued on February 15, 2011, and indicated that his height was 6' 0 and his weight was 290 pounds.

Figure 25 - Right Seat Feet

Figure 26 - Right Seat Right Rear Foot

Figure 27 - Right Seat Right Front Foot

Figure 28 - Right Seat Left Rear Foot

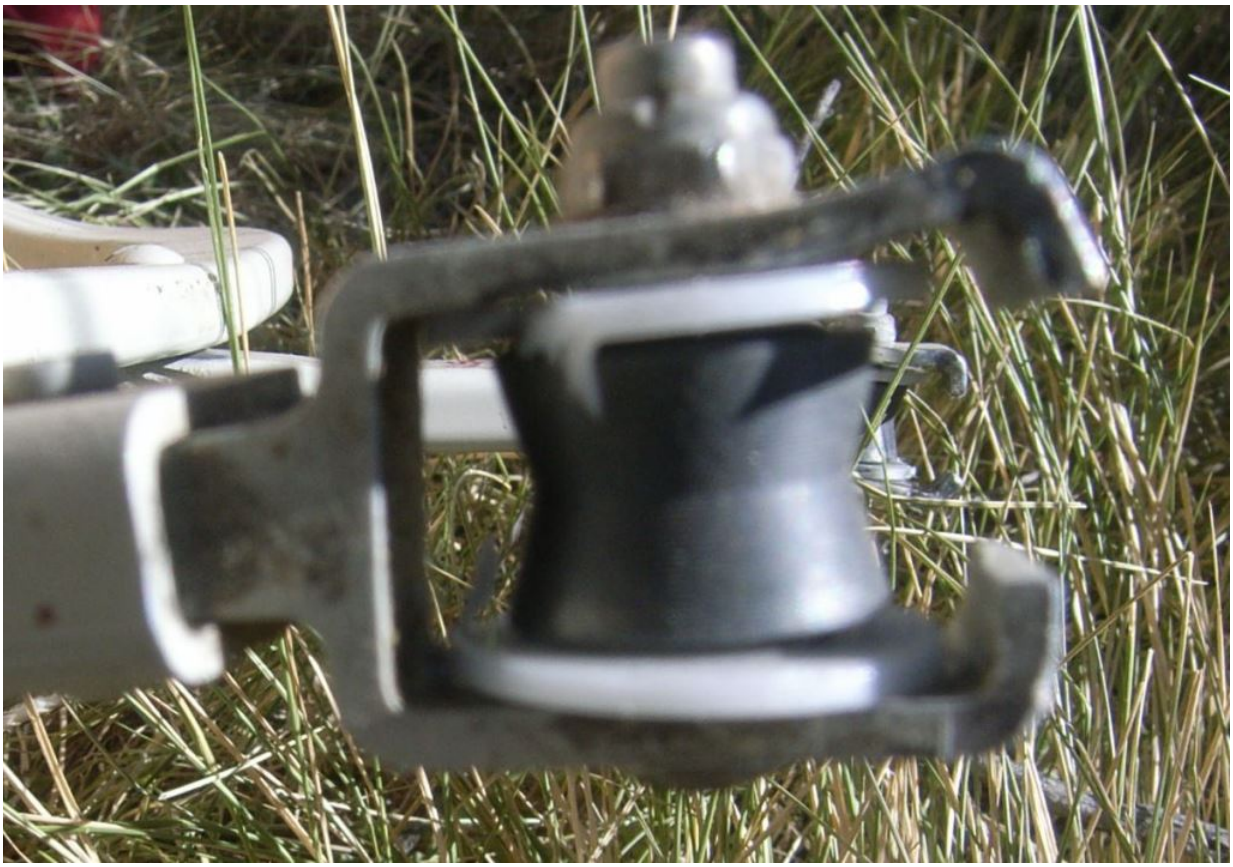

Figure 29 - Right Seat Left Rear Foot

Figure 30 - Right Seat Left Front Foot

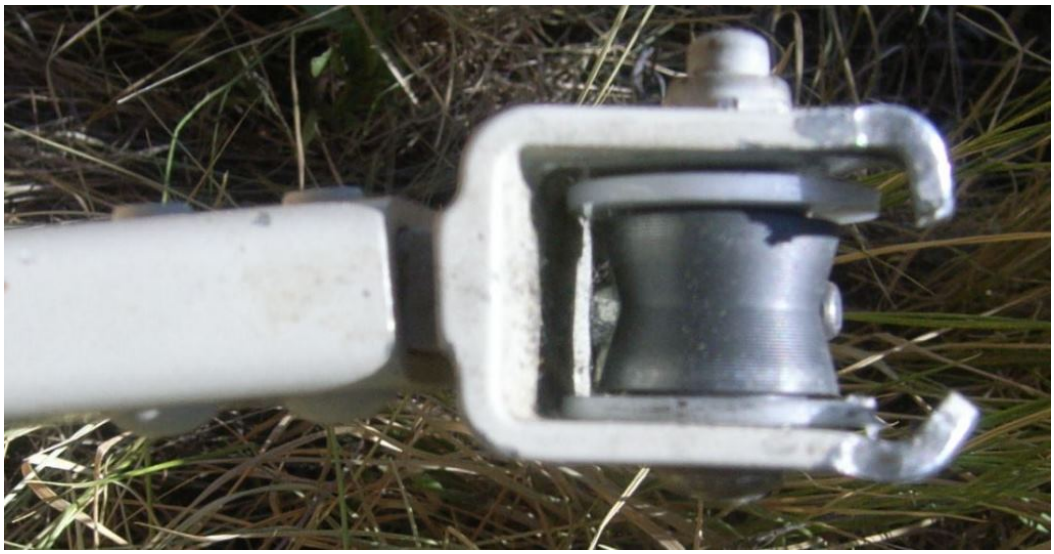

Figure 31 - Right Seat Left Front Foot

Some of the cabin sidewalls had significant evidence of burned or melted plastic remnants deposited on and/or fused to them. The cabin ceiling was covered with a layer of black sooty particulate matter that was consistent with uncontained, smoky combustion. The aft cabin carpet was partially burned; the burned areas and patterns were congruent with burned portions of the supplemental power (described below).

Figure 32 - Cabin Sidewall with Melted Deposits

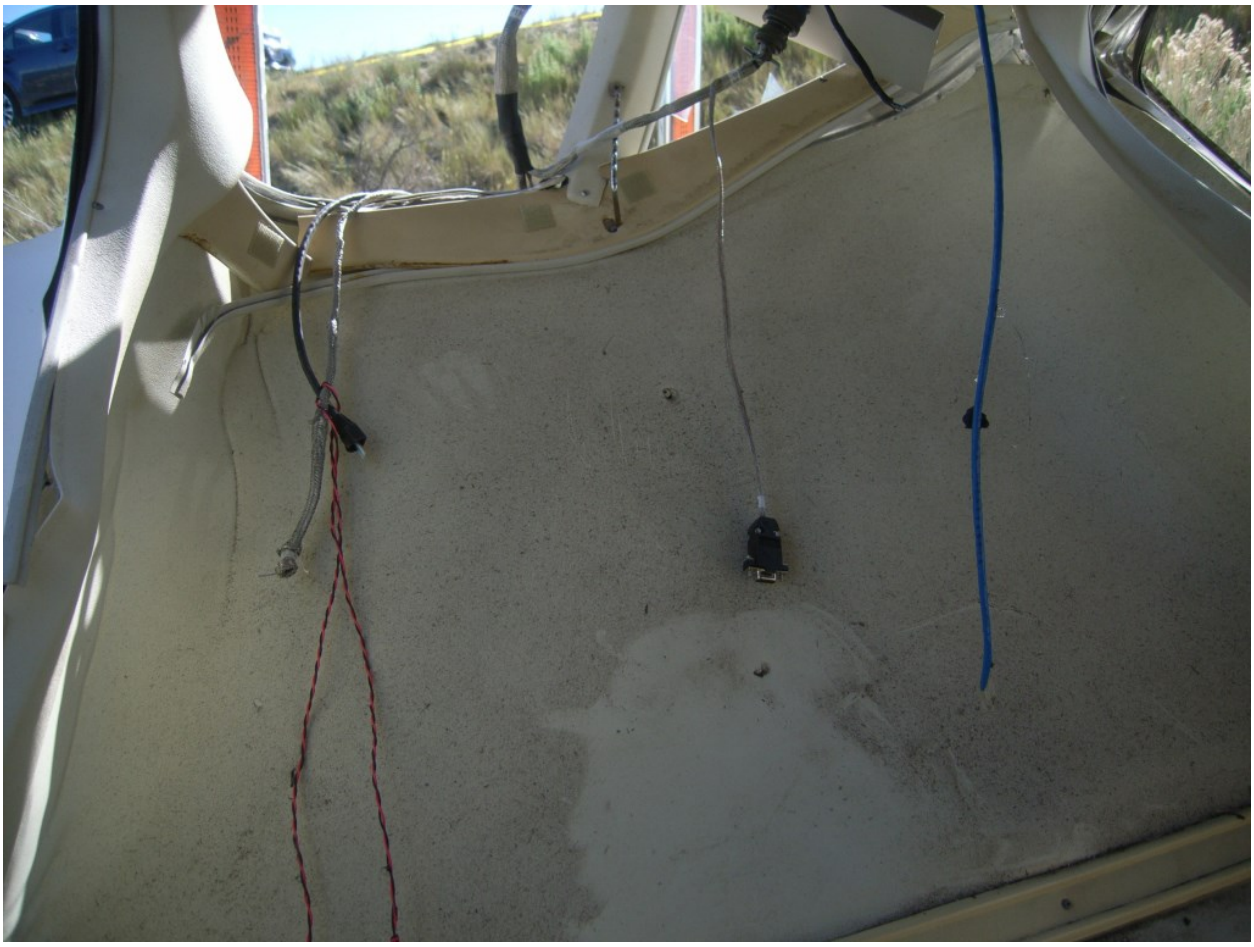

Figure 33 - Cabin Ceiling with Soot Layer

4.0 Engine and Propeller

The engine was displaced to the left of the fuselage, separated from its mounts, but still attached to the firewall by cables and hoses.

The propeller remained attached to the engine. Both blades showed S-bending, leading edge nicks, and chordwise scratches, consistent with power at impact.

Figure 34 - Spinner, Propeller, and Cowling

Figure 35 - Engine and Propeller

5.0 Other Equipment

A Lowrance AIRMAP 1000 GPS, serial number 12087064, was recovered from the wreckage and sent to the NTSB Recorders Laboratory in Washington DC for data download. Damage to the device, plus the unit's data storage protocols, prevented recovery of an airplane flight track time history. Additional details are provided in a separate report.

H. OPERATOR'S SUPPLEMENTAL POWER SUPPLY

1.0 Configuration and Components

Primary components included an automobile 12VDC battery, a plastic battery box, a "power distribution box" with multiple 12VDC and 28VDC ports, an "isolation unit/automatic charging

relay," a battery switch, a network modem, an inverter, a "remote switch box" and a cockpit-mounted circuit breaker panel.

The design intent was to provide multiple power outlets for 12VDC and 28VDC for the radar equipment. The system was powered by the 12VDC battery, which was charged by the airplane electrical system as needed. The inverter was used to provide 120VAC power to laptop computer(s) used by the onboard test engineer. The remote switchbox was to be used in flight to control power to the various 12VDC and 28VDC outlets, and the cockpit-mounted circuit breaker panel was to be used to control electrical power between the airplane and the supplemental power system. These were the only two components that were intended to, or could be, reached readily by the test engineer in flight.

2.0 POWER SUPPLY OBSERVATIONS

Most components had separated from the airplane or one another during the impact sequence. The components were removed from the airplane and laid out in their relative positions and documented. The plastic battery box, the distribution box, some of the wires from the battery, and the carpet sustained the bulk of the fire damage. The components were hand-carried to IMSAR the following day and examined in more detail with knowledgeable IMSAR personnel.

Most of the system components were then shipped to the NTSB materials laboratory in Washington DC. The examination found no evidence of failure of any electrical component. All components that were function-checked operated normally. Additional documentation is provided in a separate Materials Laboratory report.

Figure 36 - Layout of Power Supply Components

Figure 37 - Stackup of Battery, Distribution Box, and Modem & Switch (view from airplane right)

Figure 38 - Stackup of Battery, Distribution Box, and Modem & Switch (view forward)

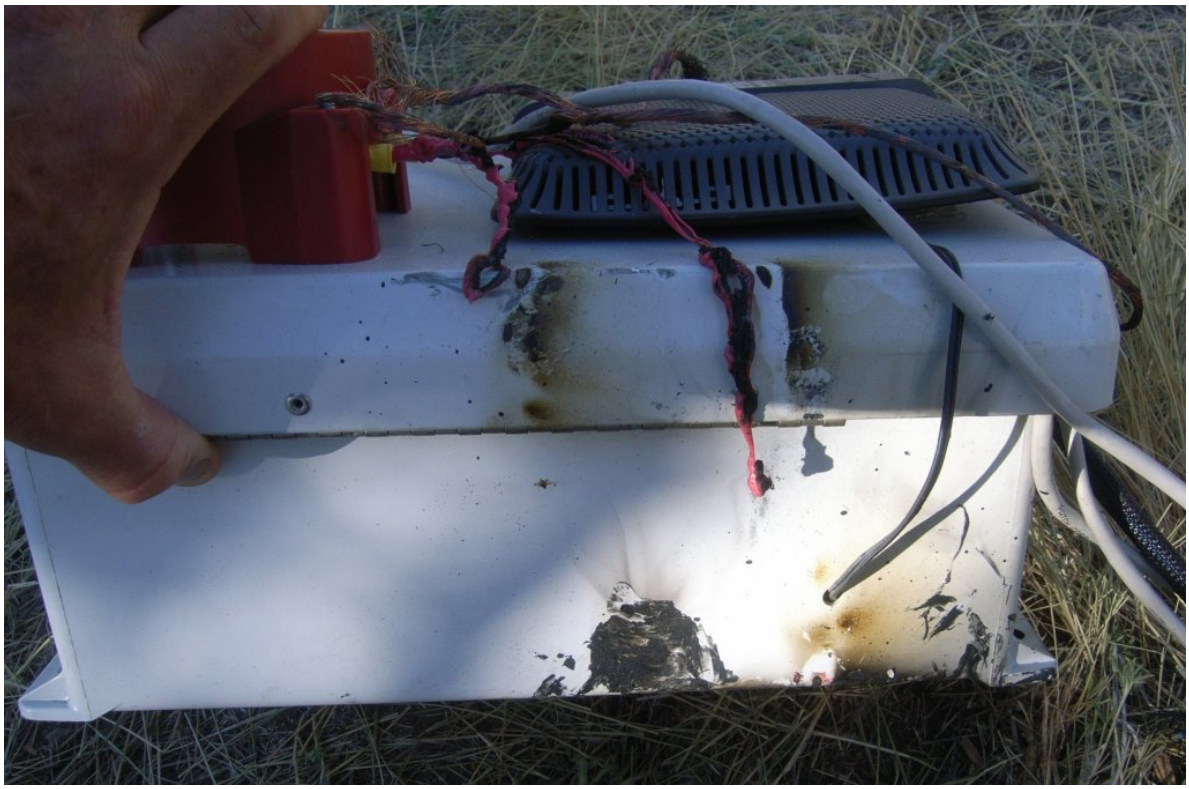

Figure 39 - Distribution Box, Modem, and Switch

Figure 40 - Underside of Distribution Box

Figure 41 - Battery in Battery Box

Figure 42 - Battery, Battery Box Cover, and Battery Box (Cessna photo)

Figure 43 - Isolator

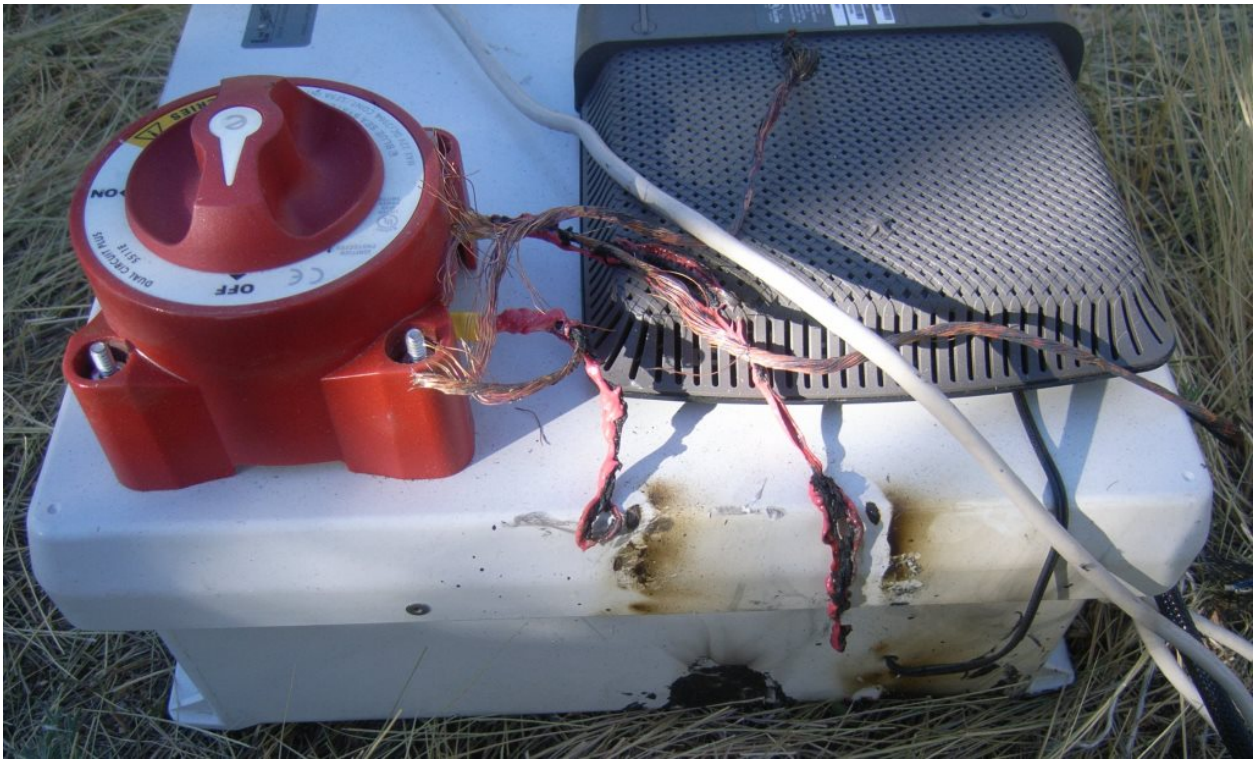

Figure 44 - Battery Switch & Modem on Distribution Box

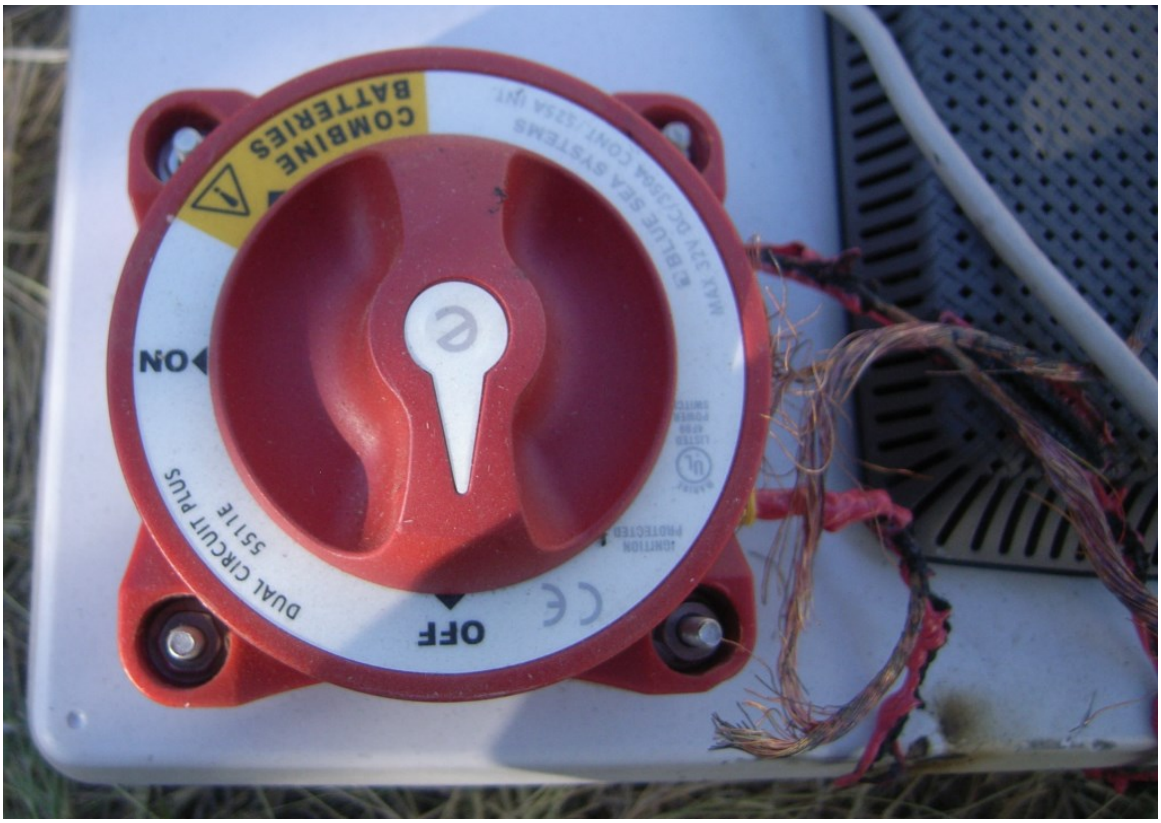

Figure 45 - Battery Switch

Figure 46 - Isolator on Airplane Carpet

Figure 47 - Burned Isolator, Wires, and Carpet

I. SISTER AIRPLANE

A second Cessna 172, N5285H was also modified with a supplemental power system and used by IMSAR as a test platform. According to IMSAR personnel, the supplemental power system in this airplane was similar, but not identical to, that in the accident airplane. This system was produced subsequent to the accident system, which enabled IMSAR to incorporate certain improvements based on their experience with the first system. One primary difference was that the power distribution box was attached directly to the N5285H airframe; the power distribution box was secured to the floor of N4459R by cargo tiedowns. In addition, the N5285H system was not equipped with an "isolator."

Figure 48 - Supplemental Power Supply (undergoing revision)