



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME EXAMINATION

WPR20FA051

A. ACCIDENT

Location: Santa Monica, CA
Date: December 27, 2019.
Aircraft: Cirrus Design SF50, Registration N52CV, S/N 0010
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson
Senior Aviation Accident Investigator
National Transportation Safety Board
Western Pacific Regional Office
Los Angeles, CA

Brad Miller
Manager Air Safety
Cirrus Aircraft
Duluth, MN

Steve Sonneson
Principal Maintenance Inspector
Federal Aviation Administration
Los Angeles Flight Standards District Office

Al Ghordlo
Field Sustaining Engineering Manager Cirrus
Aircraft
Duluth, MN

C. SUMMARY

Examination of the airplane was conducted at Santa Monica Airport on December 29, 30, and 31, 2019. Mr. Sonneson was present for the examination on December 29, Al Ghordlo was present for the examination in December 29, and 30. A follow up examination was performed by Elliott Simpson on February 18, 2020, to recover the audio and microphone interface cards for further examination.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

The airplane sustained extensive thermal damage, with fire consuming the cabin roof and destroying the cabin contents from the aft wall of the parachute (CAPs) enclosure through to the engine inlet nacelle (figure 1, 2, 3). Only carbon fiber cloth remnants of the cabin wall and seat structures remained. The airplane remained on its main landing gear, and was able to support its own weight without significant structural deformation. The flaps were in the extended position. The cabin door (left side of the airframe) was open during the fire, and thermal damage was

present on the belly immediately adjacent to the door opening, with smoke patterns traversing from the left to right side of the airframe. The airplane was positioned on the ramp facing north at the time of the accident, with wind out of the west, passing from left to right across the airframe.

Fire damage was more extensive on the right side of the airframe, from the nose through to the wing trailing edge. Fire had consumed the lower right walls of the cabin down to the wing root, with only carbon fiber cloth remaining. The right wing was intact, but sustained thermal damage to the upper skin from the root outboard about 4 ft short of the tip. The left wing, and lower left exterior skins of the cabin were largely free of fire damage.

The tail assembly aft of the pressure bulkhead, along with the engine and engine compartment appeared undamaged, although the engine compressor blades were coated in soot, and the right side of the engine nacelle outer shell was burnt about halfway along its length.

The instrument panel remained in place, but sustained thermal damage rendering its status at the time of the accident unknown.

Remnants of the various electrical systems harnesses along the lower right side of the cabin structure were examined. The insulating sleeve material for all conductors had burnt away, leaving brittle copper wire remnants. Multiple areas of the harnesses exhibited molten and globule-like breaks to their copper conductors (figure 4). The molten damage was consistent with electrical arcing, and was located at the following stations (the tape measure zero in the images is at the forward pressure bulkhead, station 93).

Station 113 – Damage and separation of ground conductors at a curve in the wire harness at the forward right ground blocks (figures 5, 6, 7).

Station 120 – Damage and breaks to multiple conductors (figure 8).

Station 151 through 179 – Multiple conductor breaks, and globular copper material. (figure 9).

Station 151 – Separation of conductors to smaller bundle (figure 10, 11).

Fire damaged remnants of the USB power supplies were located. The forward dc-to-dc USB power supply sustained melting to its outer case, but was largely intact (figure 12). The aft power supply (seat 5/7, P5362) printed circuit board was exposed and sustained extensive thermal damage, with the separation of multiple components (figure 13).

The following circuit breakers were in the open circuit “tripped” condition (figure 14):

IFE USB
PAX LIGHTS LIGHT CTRL CAPS A
CONV LIGHTS
EMER BATT1
AC INLET DOOR

None of the aft MCU fuses had blown. A group of fuses in the forward MCU had blown (figure 14).

All mechanics who responded to the airplane during and shortly after the fire stated that they were not aware of any circuit breakers being pulled. A Cirrus representative who responded to the airplane a few hours after the accident stated that when he arrived, the forward battery was still connected. He disconnected it and heard the clicking sound of what he believed to be a relay de-energizing. He stated that the aft battery had already been disconnected by the fire department upon his arrival.

1.1 Audio Interface Card Removal and Examination

The airplane was equipped with a system that allowed the occupants to connect their personal non-aviation headsets to the airplanes intercom and entertainment system utilizing 3.5 mm jack sockets mounted in the armrests on the cabin panel walls. The system consisted of a series of seven headset audio cards, and five microphone interface cards mounted throughout the airplane to the back of the side panels and connected to each individual jack.

All twelve interface cards were located within the wreckage. All displayed varying degrees of thermal damage and were removed and examined. The cards were then sent to the NTSB materials laboratory for examination utilizing a GE Nanomex high-resolution microfocus X-ray system.

The cards for seat locations four, five, and seven, all of which were located in the right cabin side panel exhibited significant thermal damage.

The audio card for seat four sustained thermal damage that resulted in all of its components detaching from the circuit board, along with the debonding of most of its copper tracks (figure 16,17). The input pad for the current-limiting resistor remained (figure 17).

For seat five, the audio card exhibited thermal damage that resulted in the detachment of the input filter capacitors and Integrated Circuit 1 from the board (figure 18, 19). X-ray analysis revealed that the current-limiting resistor was the wire-wound type and remained attached to the board and the copper track of the input capacitors.

Although seat seven audio card sustained thermal damage, most components appeared intact. X-ray analysis revealed that the current-limiting resistor was the wire-wound type and had partially detached from the board. The copper tracks connecting the resistor to the TVS diode, along with the track connecting the ground line were missing, leaving only partial remnants behind (figure 20,21,22).

2.0 Airframe Examination Figures



Figure 1 – Airplane Viewed from Front



Figure 2 – Airplane Viewed from Right



Figure 3 – Airplane Viewed from Left

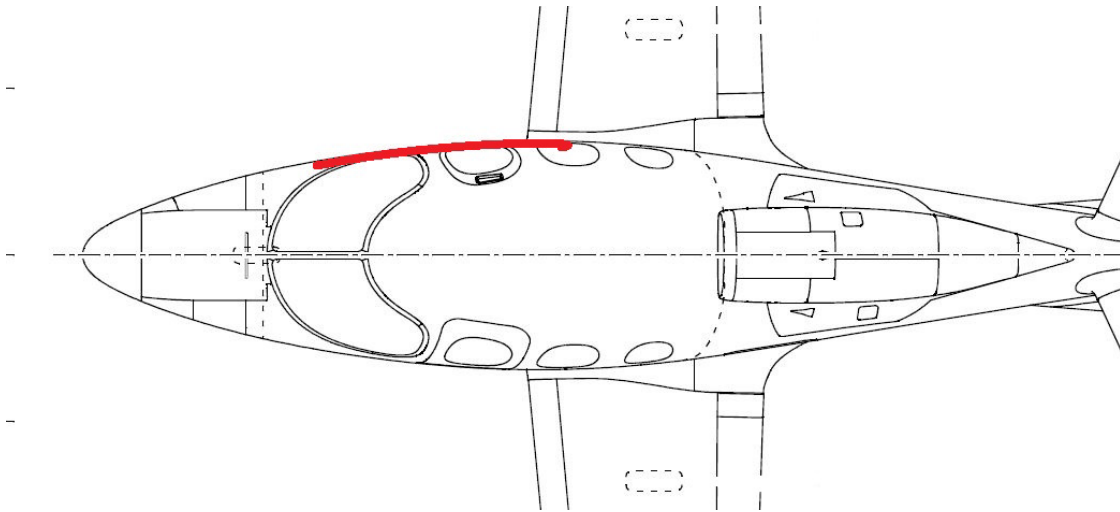


Figure 4 – Area of Arcing damage to Electrical Harnesses



Figure 5 – Arcing Damage at Forward Grounding Block at Station 113



Figure 6 – Arcing Damage at Forward Grounding Block at Station 113 (block indicated by red arrow)



Figure 7 – Arcing Damage at Forward Grounding Block at Station 113



Figure 8 – Arcing Damage at Station 120



Figure 9 – Close Image of Arcing Damage in General Area Between Station 151 through 179

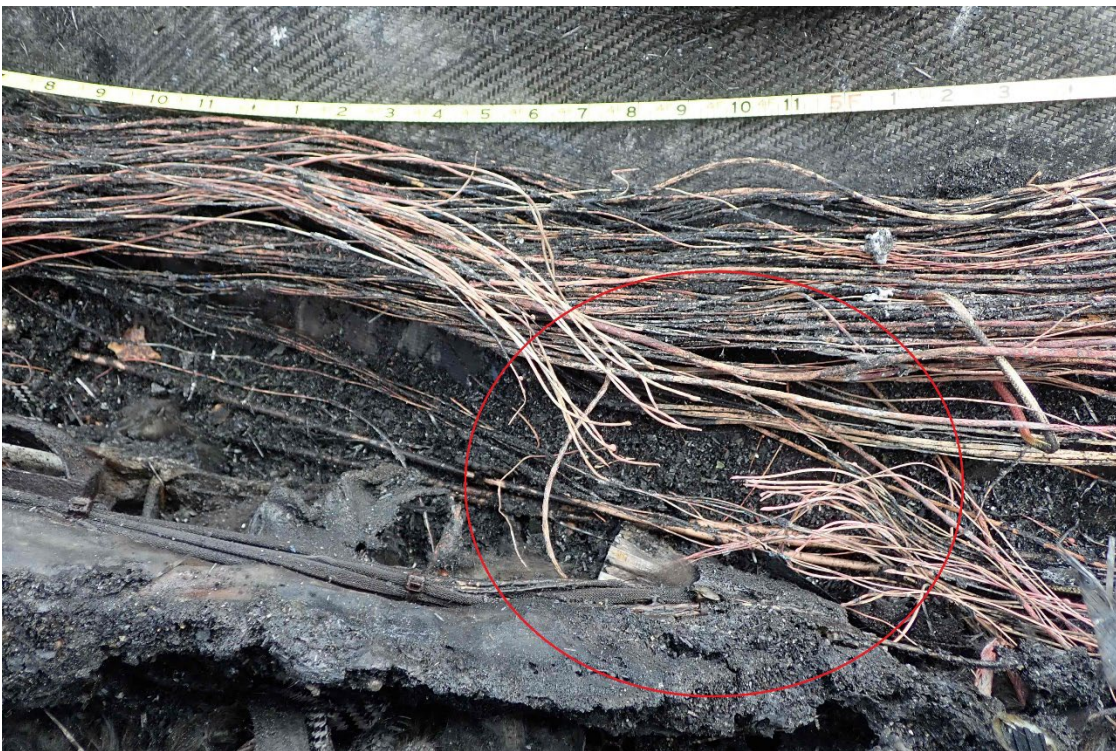


Figure 10 – Arcing Damage in General Area Between Station 151 through 179



Figure 11 – Arcing Damage in General Area Between Station 151 through 179



Figure 12 – Forward dc-to-dc USB Power Supply



Figure 13 – Aft dc-to-dc USB Power Supply

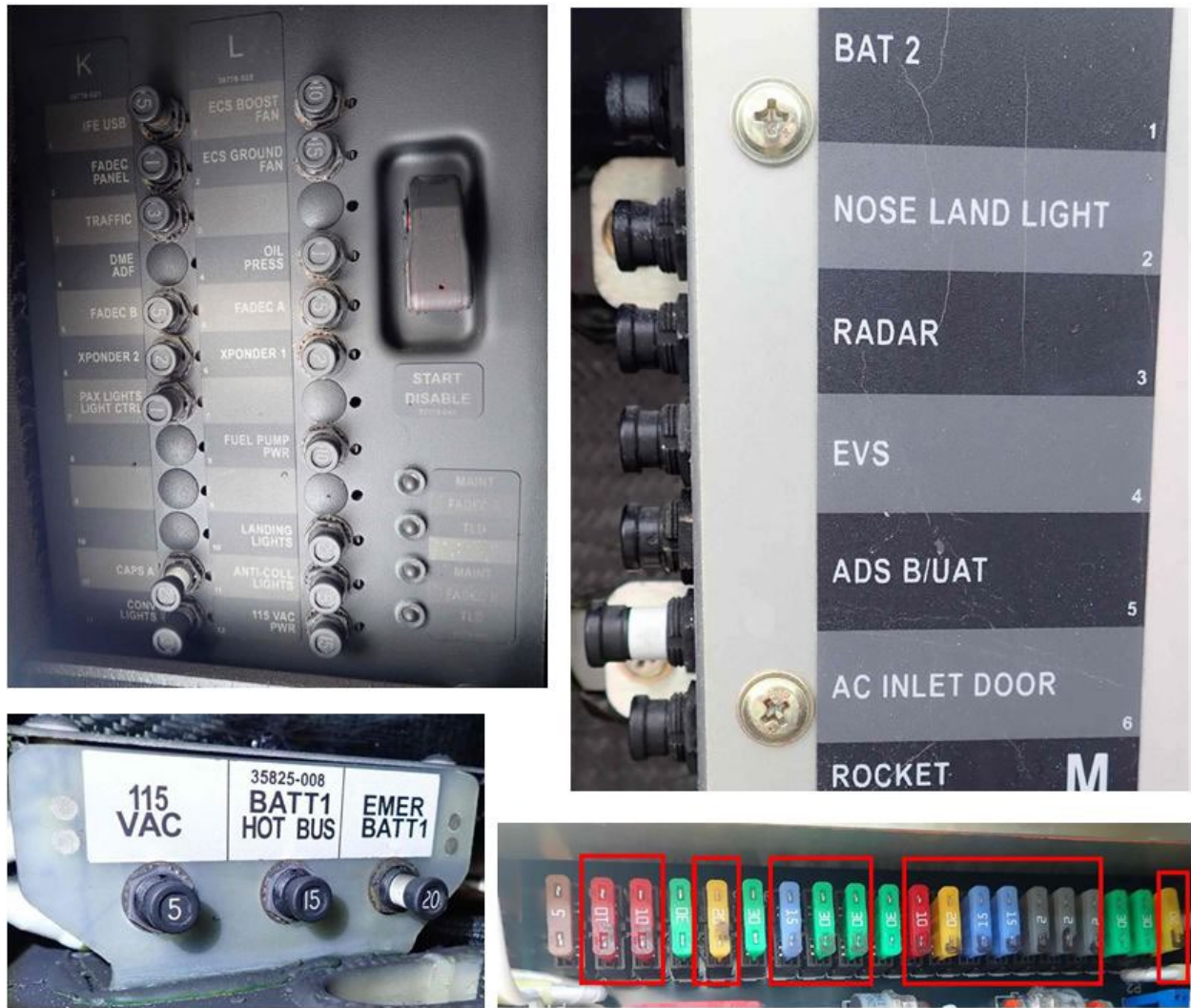


Figure 14 – Circuit Breaker Panels and Forward MCU Fuses (red boxes indicate blown fuses)

Figure 6-00-2: Airplane Principal Dimensions

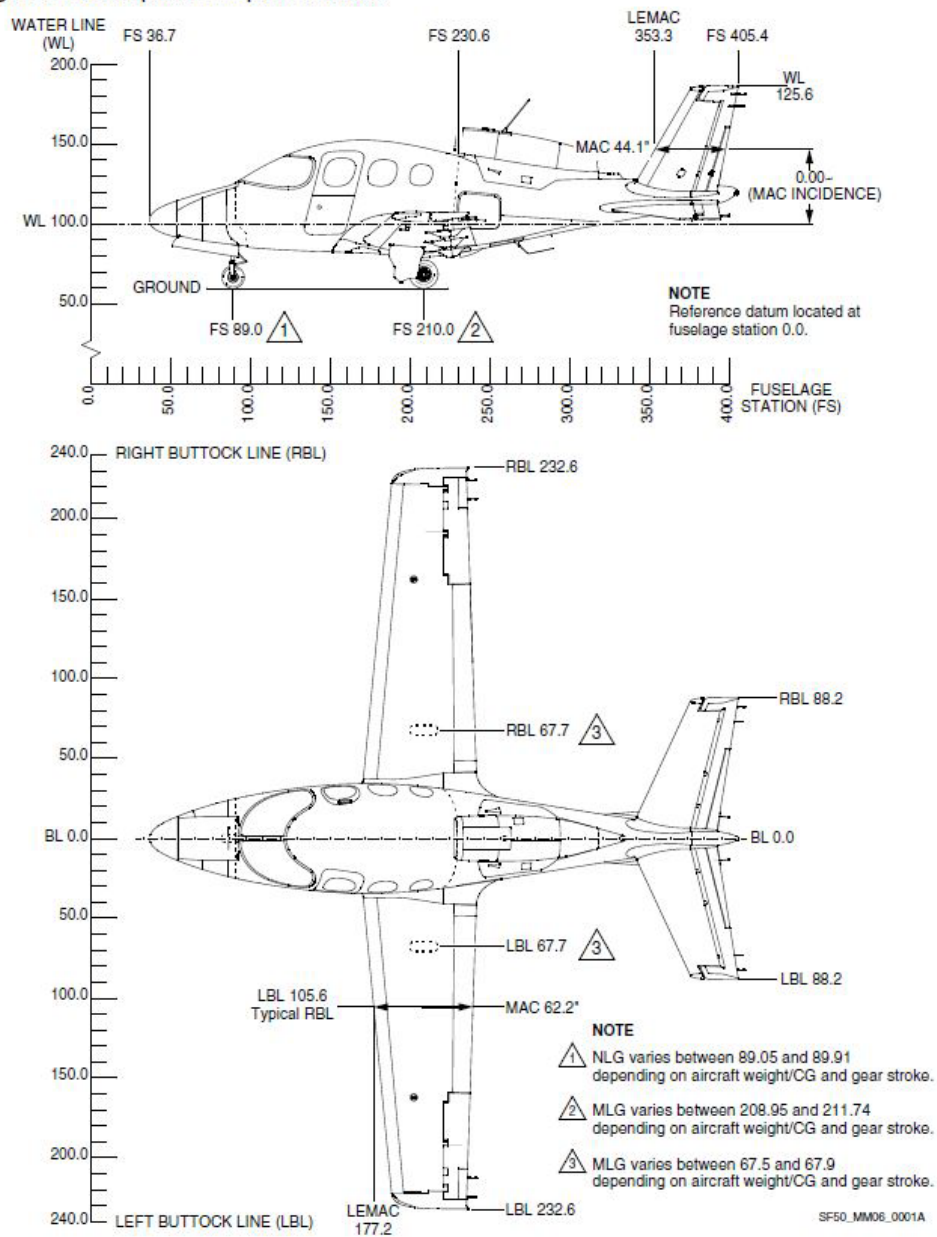


Figure 15 – Station Numbers

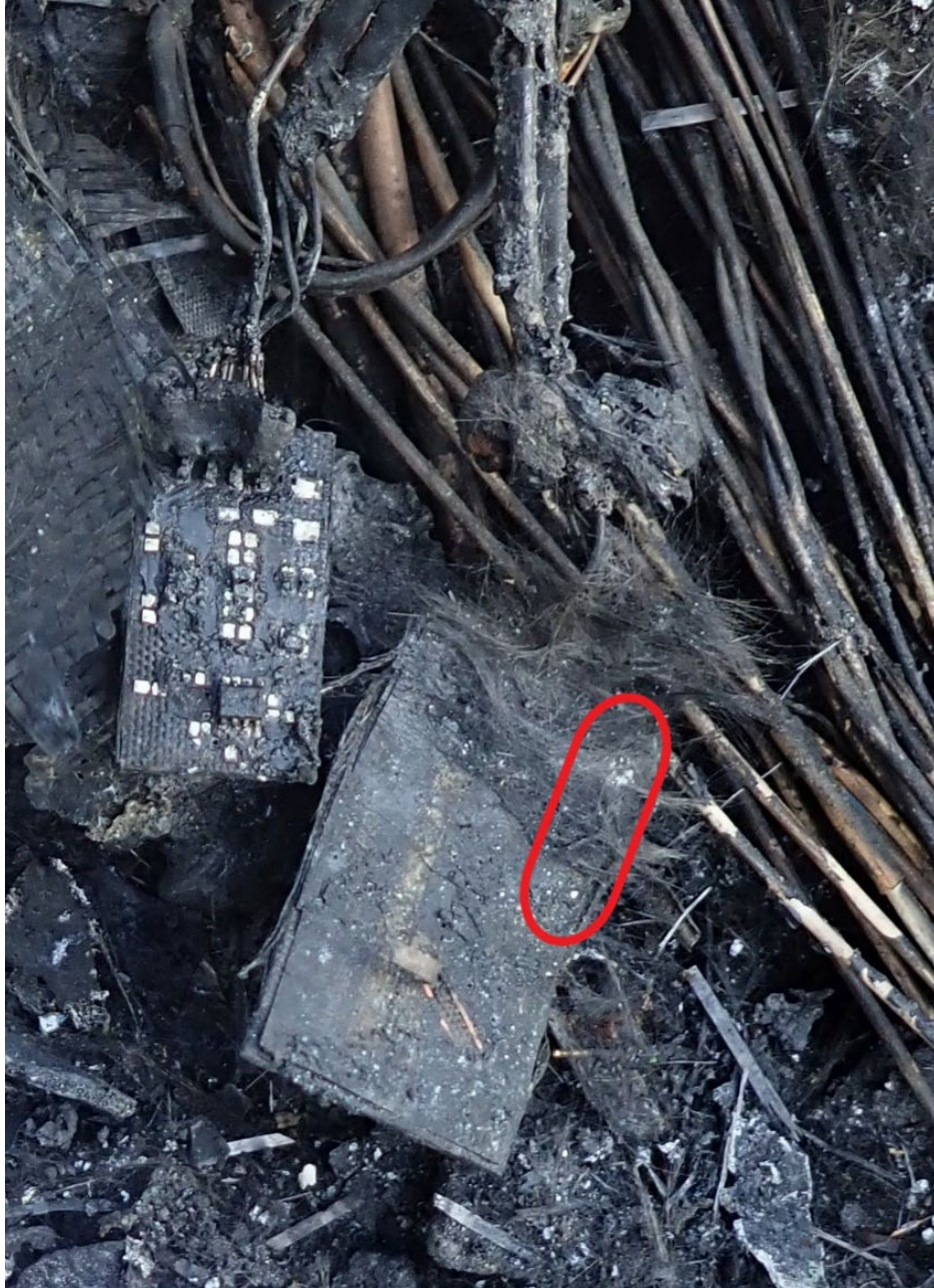


Figure 16 - Seat four audio card with location of current-limiting resistor circled

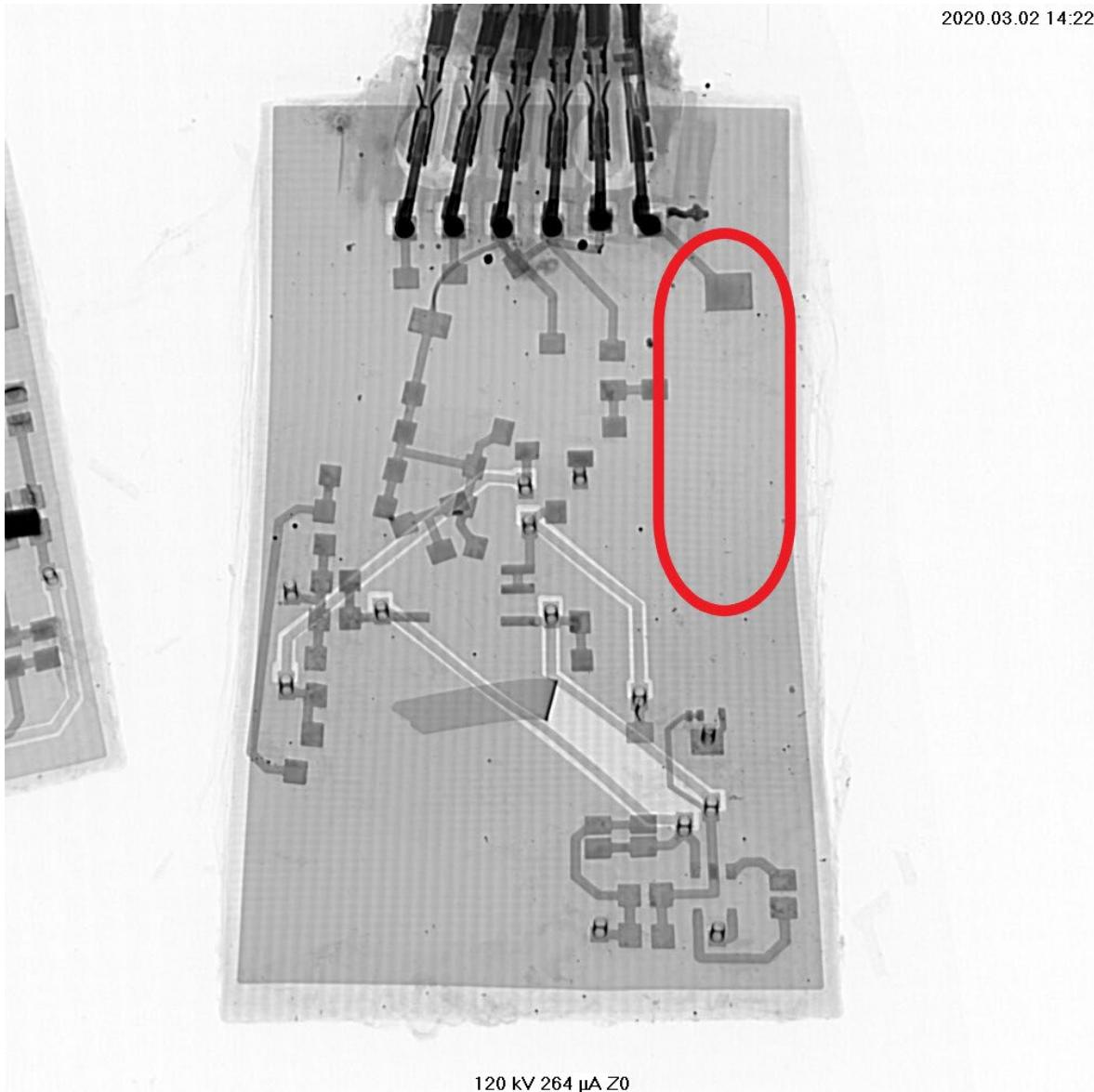


Figure 17 – X-ray image of seat four audio card with location of current-limiting resistor and input pad circled



Figure 18 - Seat five audio card with location of current-limiting resistor circled

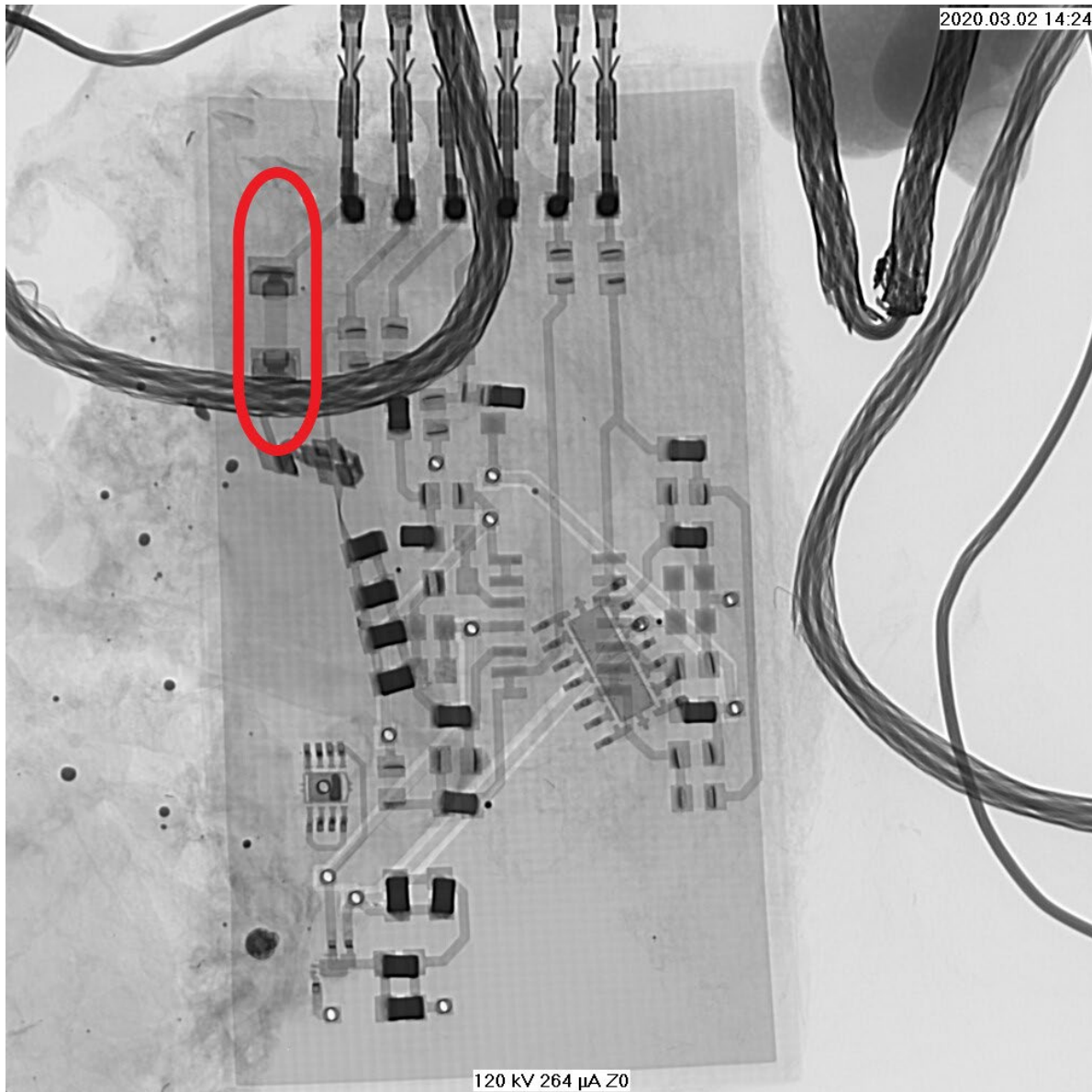
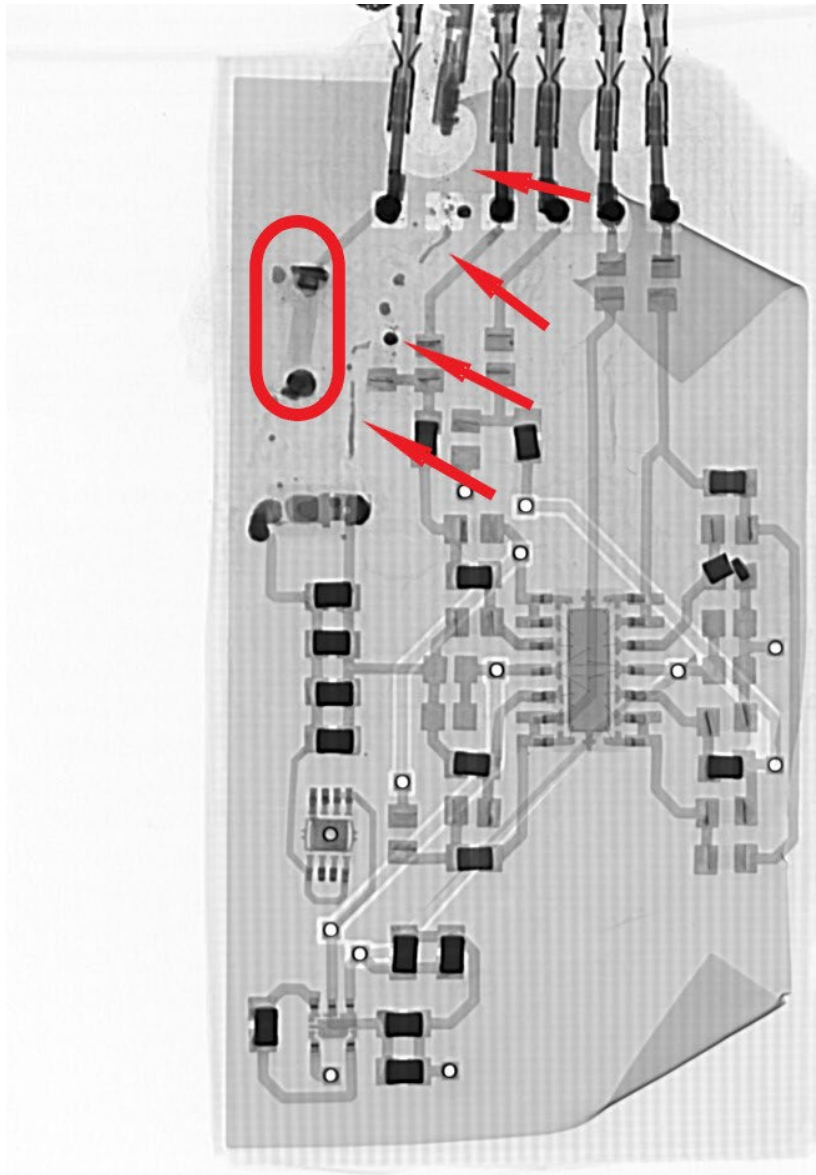


Figure 19 – X-ray image of seat five audio card with current-limiting resistor (circled) intact



Figure 20 - Seat seven audio card with location of current-limiting resistor circled



120 kV 264 μ A Z0

Figure 21 – X-ray image of seat seven audio card with current-limiting resistor (circled) and arrows indicated areas of missing track for ground line

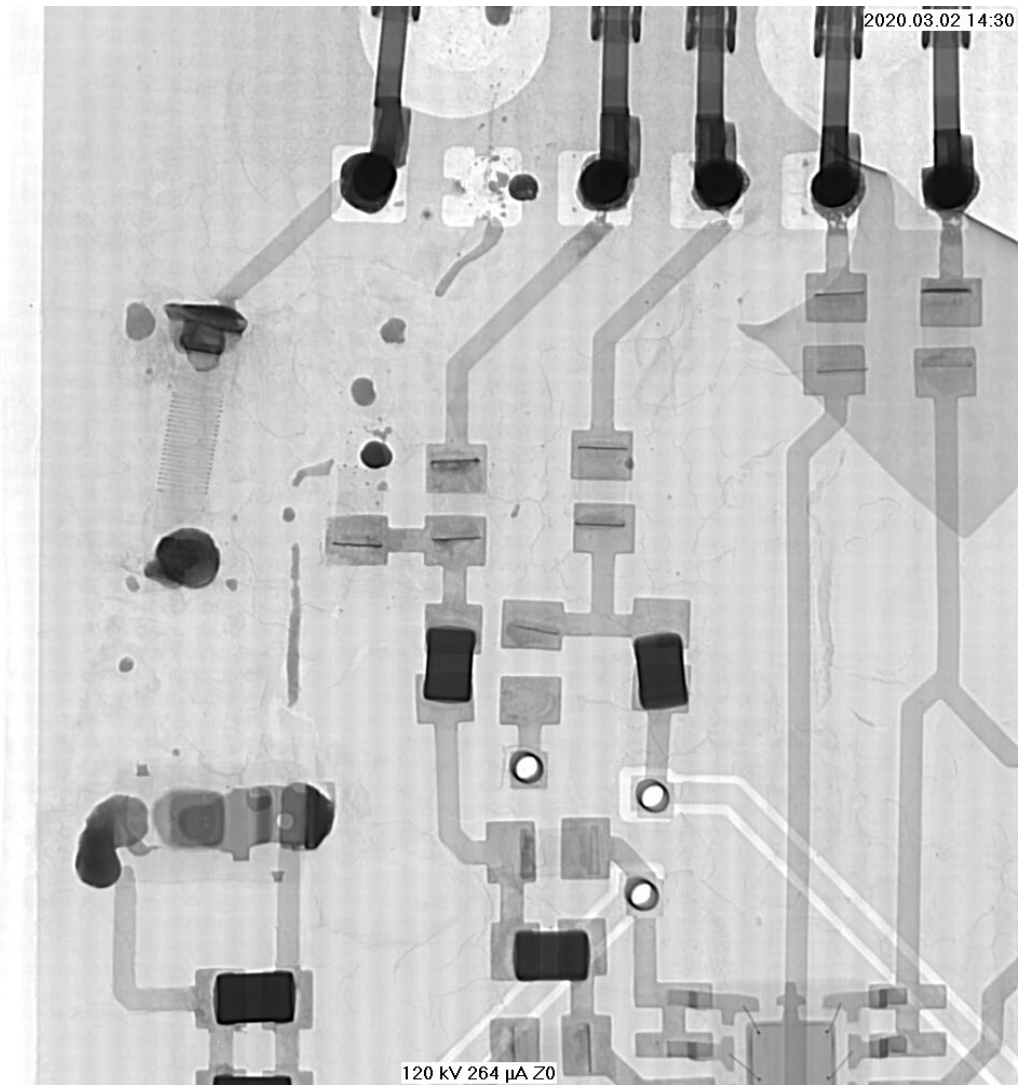


Figure 21 – Close-up X-ray image of seat seven audio card showing resistor area along with missing tracks

Submitted by: Elliott Simpson