**NATIONAL TRANSPORTATION SAFETY BOARD**
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

October 30, 2014

MATERIALS LABORATORY FACTUAL REPORT Report No. 14-010

## A. ACCIDENT INFORMATION

| | | |
|---|---|---|
| Place | : | Birdseye, Utah |
| Date | : | June 27, 2013 |
| Vehicle | : | Cessna 172 |
| NTSB No. | : | WPR13FA294 |
| Investigator | : | Michael Huhn<br>AS-WPR |

## B. COMPONENTS EXAMINED

Supplemental power supply system for onboard radar system

## C. DETAILS OF THE EXAMINATION

Components from a supplemental power supply system for an onboard radar system that had been installed on the accident aircraft were submitted to the Materials Laboratory for examination. The system was designed to provide 12VDC, 28VDC, and 120VAC to company radar components and laptop computer equipment on the accident airplane. The submitted components included the power distribution box, battery box (no battery), inverter, isolator and associated terminals, switches, wiring, and relays. A diagram of the system layout is shown in Figure 1 although not all of the components shown in were submitted to the laboratory.

According to the manufacturer, the installation configuration for the power supply system consisted of the battery box serving as the base of the installation with the power distribution box sitting on top and all associated wiring running between bottom of the power distribution box and the top of the battery box. The wiring placement is in the area where the most significant thermal damage occurred. The battery box had extensive melting and missing material to the upper corner of the box and lid. This is shown in Figures 2-4.

The configuration of the top of the power distribution box is shown in Figure 5. The power distribution box sustained sooting, paint discoloration, paint blistering and warping of the lower corner (sidewall and bottom) of the case as shown in Figures 6 and 7. The damage to the battery box corresponded to the damage on the lower corner of the power distribution box as shown in Figure 8. The interior of the distribution box had minimal

sooting and thermal damage as shown in Figure 9. The wiring that ran in between exhibited significant thermal damage in the forms of brittle and welded wire conductors, missing material and melted or missing wire insulation. Examples of the wire damage are shown in Figures 10 and 11.

Additional testing by the airframe manufacturer was done to confirm the type of wire insulation present on the wire bundle. The wire insulation (both the red insulation and the black insulation) was found to be polyvinyl chloride. Thermal degradation (in air) of both wire insulation types was complete at approximately 1100°F with white smoke evolution between 455 and 660°F and again at 840-890°F. The wire insulation did not display a definite melting point (when tested between about 100 °F and 390 °F), but became soft at approximately 305°F. The complete report is attached at the end of this report.

The inverter was found to be intact and undamaged as shown in Figure 12 . The wiring attached to the inverter had some thermal damage at the interface. A functionality test was performed and the inverter operated as expected by the system manufacturer. The isolator was intact and had thermal damage to the exterior case as shown in Figure 13.

Nancy B. McAtee
Fire Investigator

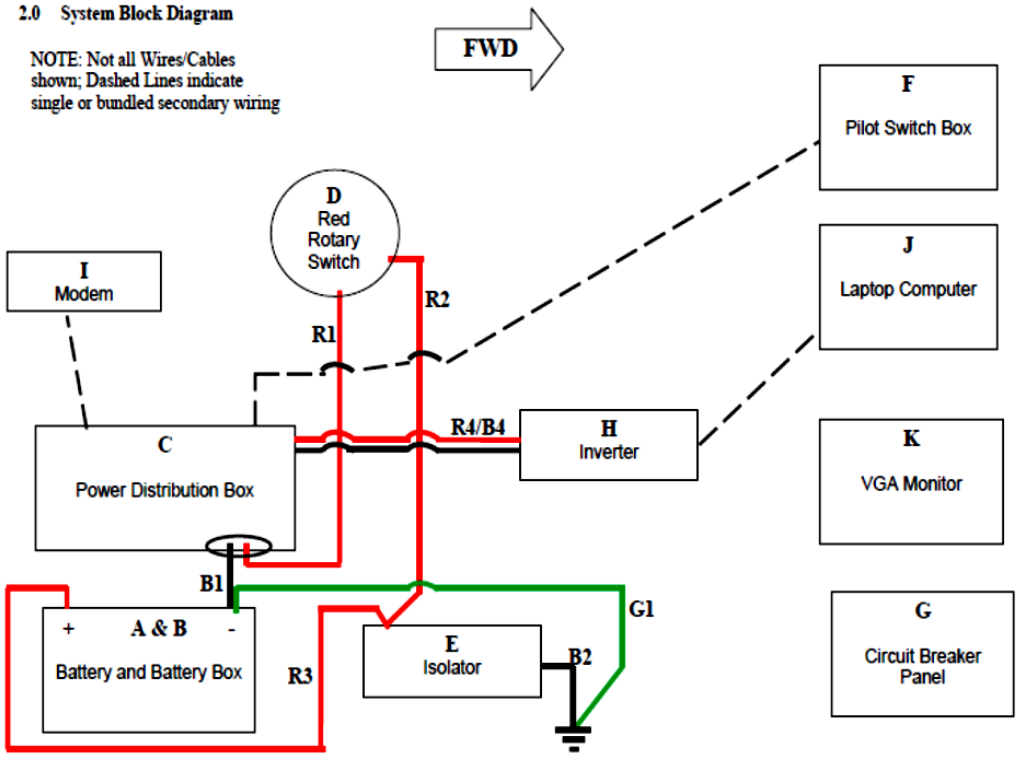


**Figure 1. Overall schematic drawing of power distribution system.**


**Figure 2. Top view photograph of battery box.**


**Figure 3. Close-up photograph of damaged battery box lid.**


**Figure 4. Photograph of battery box without lid.**

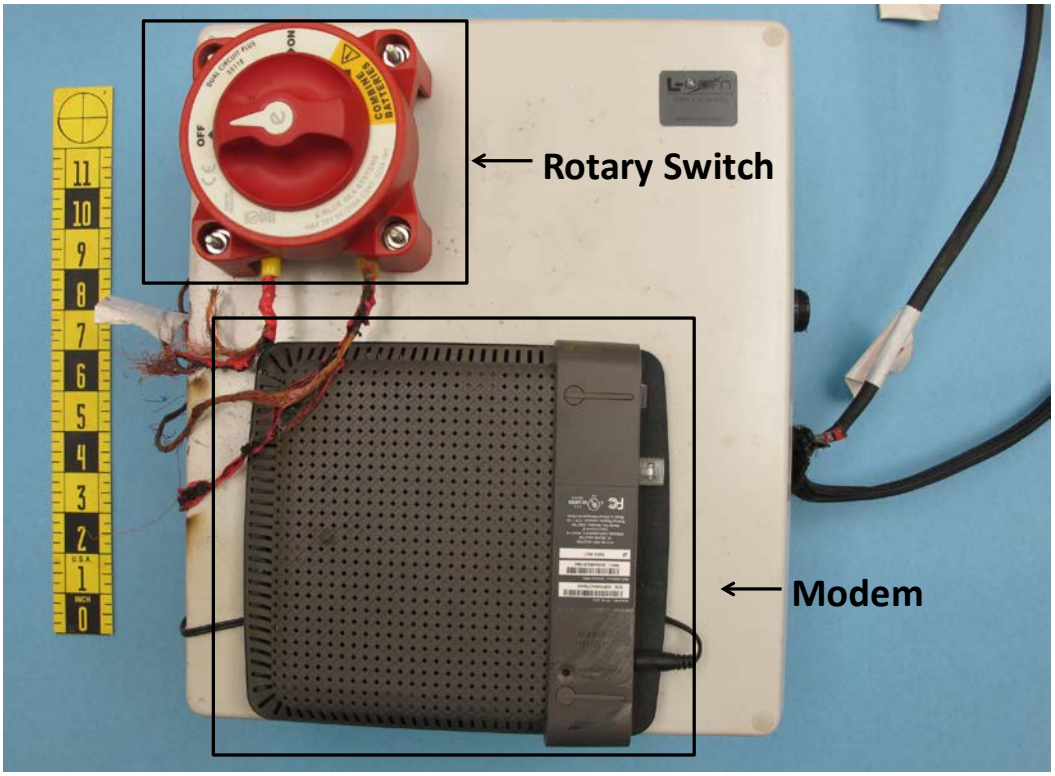


**Figure 5. Top view photograph of power distribution box.**

**Figure 6. Photograph of lower corner of power distribution box.**

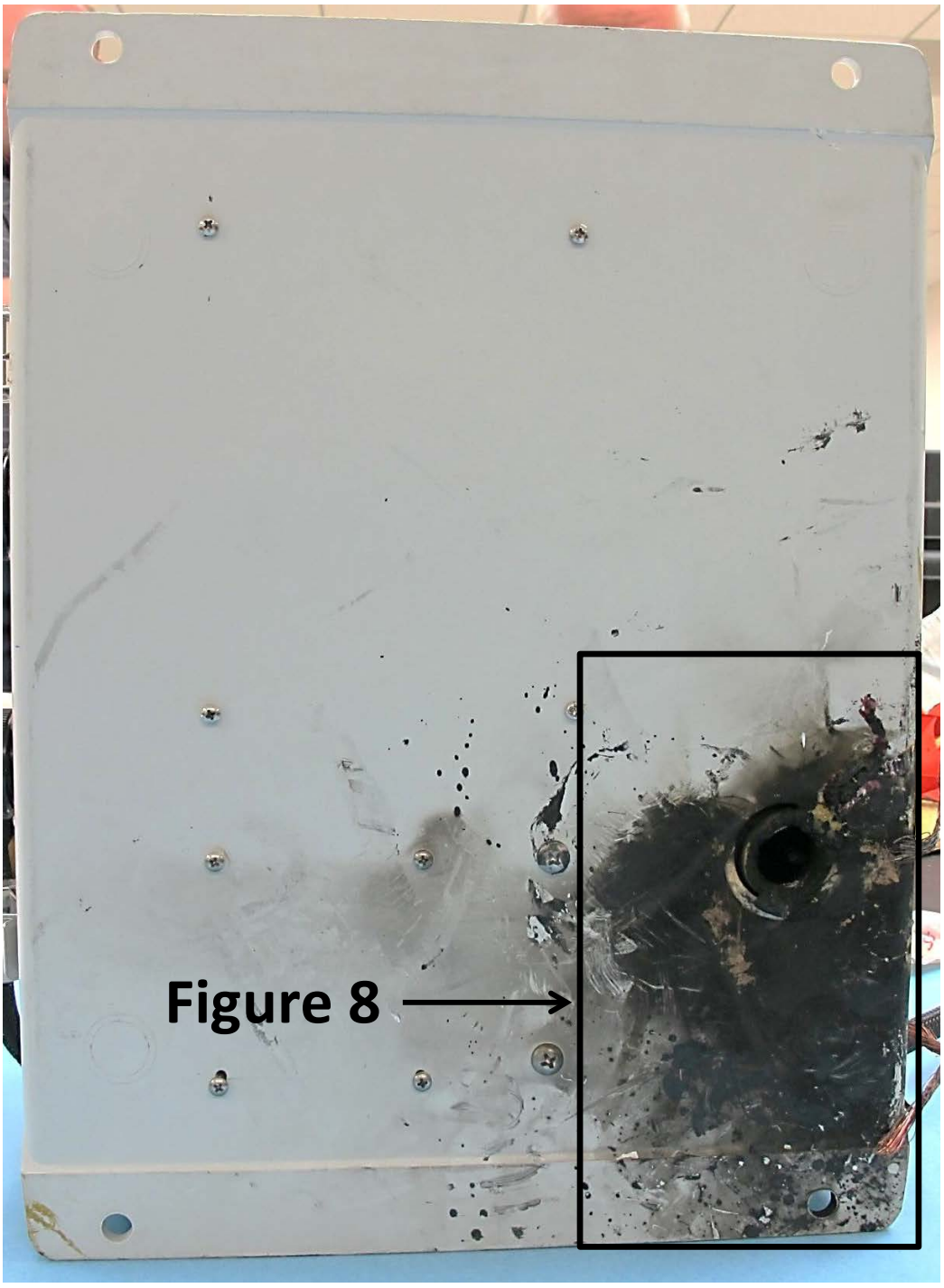


**Figure 7. Photograph of bottom of power distribution box.**

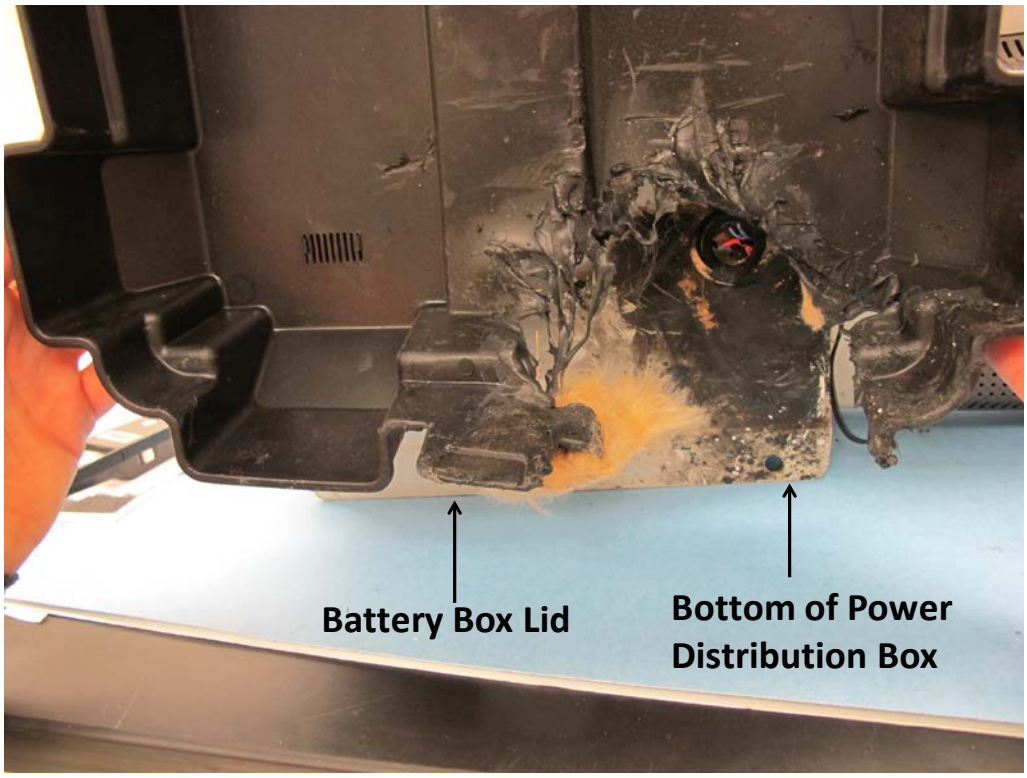


**Figure 8. Photograph of damage to battery box lid and the bottom of the power distribution box.**

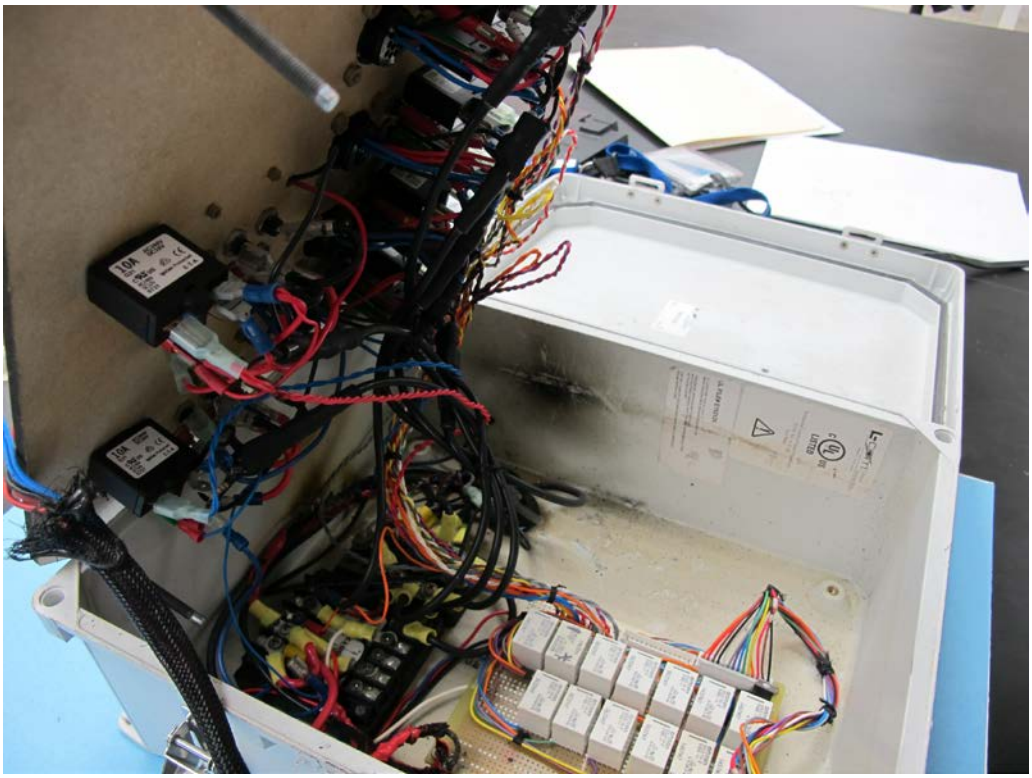

**Figure 9. Photograph of interior of power distribution box.**

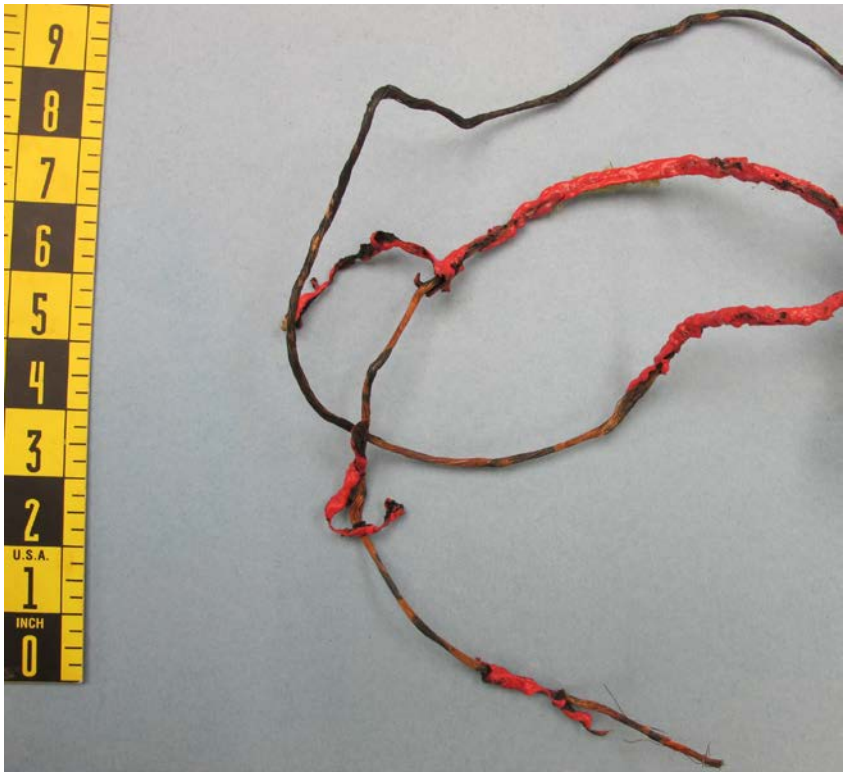


**Figure 10. Photograph of thermally damaged isolator wiring.**


**Figure 11. Close-up photograph of wiring damage.**


**Figure 12. Photograph of the power inverter**.

**Figure 13. Photograph of the isolator unit.**