

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



February 1, 2017

MATERIALS LABORATORY FACTUAL REPORT

Report No. 17-013

A. ACCIDENT INFORMATION

Place : Austin, Pennsylvania
Date : October 16, 2016
Vehicle : Piper PA-28-161, C-GYSN
NTSB No. : ERA17FA017
Investigator : Tim Monville, ASI-ERA

B. COMPONENTS EXAMINED

Pitot Heater Wires.

C. DETAILS OF THE EXAMINATION

The as-received pitot and wires are displayed in the upper view of figure 1. The wiring consisted of two power wires, one going to each pitot heating element, forward and rear and two ground wires, one from each heater element. The heater ground wires were received separated from the individual elements. All pitot heater wires were stranded copper wire approximately 18 gauge in size. The two heater ground wires were combined into one insulated crimp connector that joined to a second insulated crimp connector. These connectors were marked "AMP 14-16" indicating they were suitable for 14 to 16 gauge wire. This joint was separable. One ground wire continued from the second connector to a spar mounted crimp connector. The ground wire was also stranded copper but about 16 gauge in size.

The ground wire connector joint is displayed in the lower view of figure 1. The wire labeled as going to the spar was separated at the crimp connection, labeled "1" and shown in figure 2. One of two pitot heater ground wires on the other side of the joint was also separated from its connector, as shown and labeled "2". The other ends of the ground wires had been pulled out of the heaters.

The separated spar ground wire is displayed in the upper view of figure 2. Microscopic examination found that the ends of all wires in the strand were fractured. The fracture features and deformation patterns indicated that they were tensile overstress fractured. Inspection of the terminal found the remnants of the wires trapped in the terminal crimp area as shown in the lower view of figure 2. No indications of electrical arcing were noted on the wires or connector.

The wires for the separated heater side ground wire are displayed at the top of figure 3 after being manually spread out. One wire was tension overstress fractured while the other conductor wires were intact. The intact wires showed deformation consistent with the crimping action on the connector and additional sliding marks consistent with being pulled from the crimped connector. The lower view shows the wire side of the connector with the other wire in place. No indications of electrical arcing were noted on the wires or connector.

The crimp deformation for both ground wire connectors is visible in the lower view of figure 1. The heater side crimp appeared uniformly deformed into an oval consistent with properly sized tool dies. In contrast, the spar side crimp was very localized and the insulation highly deformed and nearly penetrated by the crimp tool. The crimp and insulation deformation were indicative of an undersized die set for the crimping tool.

The two power wires for the heater elements were also separated from their connectors, denoted "3" in the upper view of figure 1. The connectors were not received. The separated conductor ends are displayed in figure 4 with the individual wires splayed out for viewing. The individual wires in both conductors showed deformation patterns consistent with crimping forces. The wires also showed sliding marks and deformation indicative of tension separation from crimped connectors similar that noted for separation "2". No indications of arcing were noted on the exposed wire ends.

The insulation on the forward power wire was damaged and the conductor wires were exposed as shown in figure 5. Magnified examination found that the insulation had been scraped for approximately 3 inches with conductor wires were exposed for about 1 inch. In the area shown in the lower view of figure 5 the wires themselves were scraped. No indications of arcing were noted on the exposed wires.

Joe Epperson
Senior Metallurgist

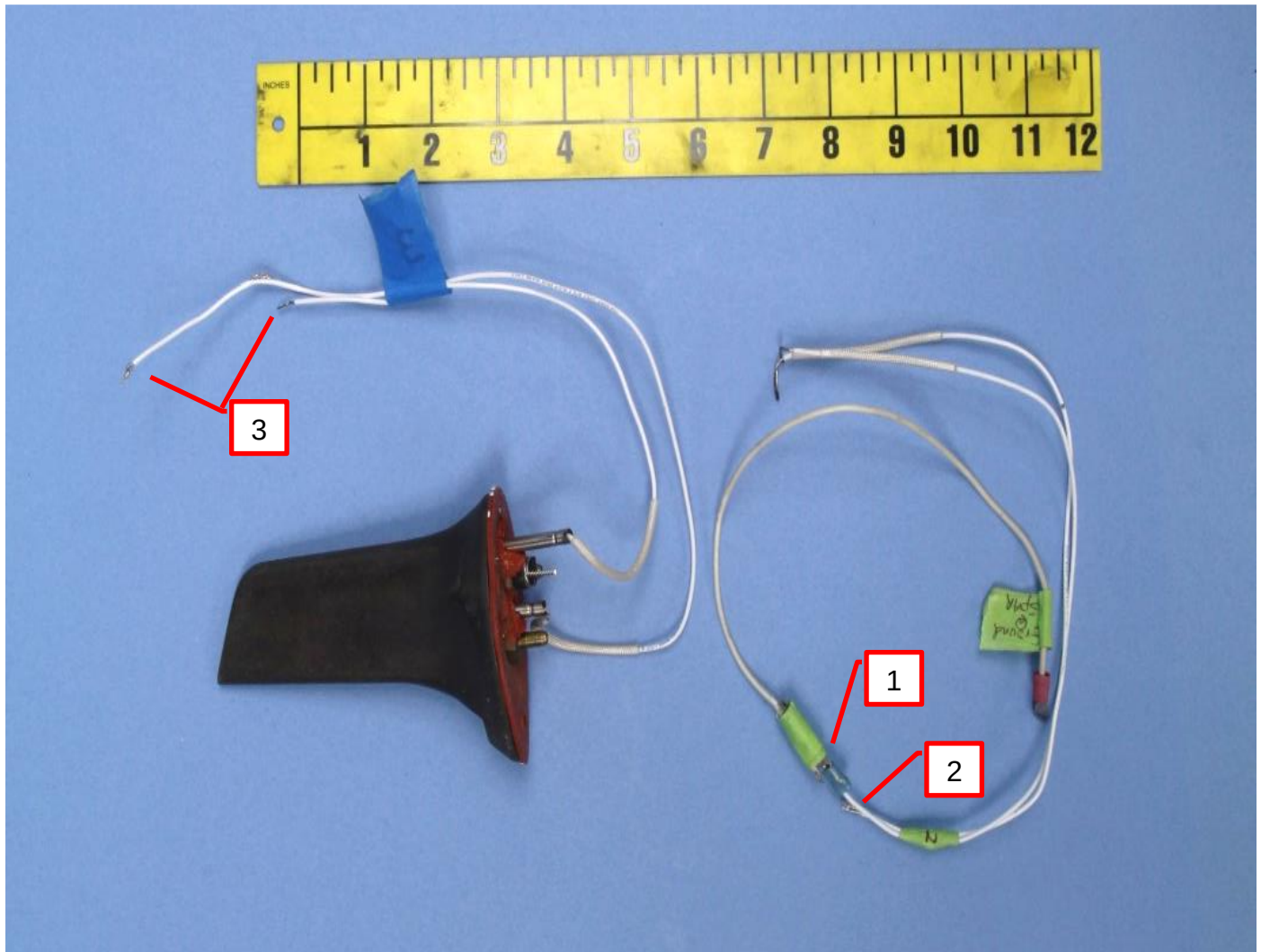
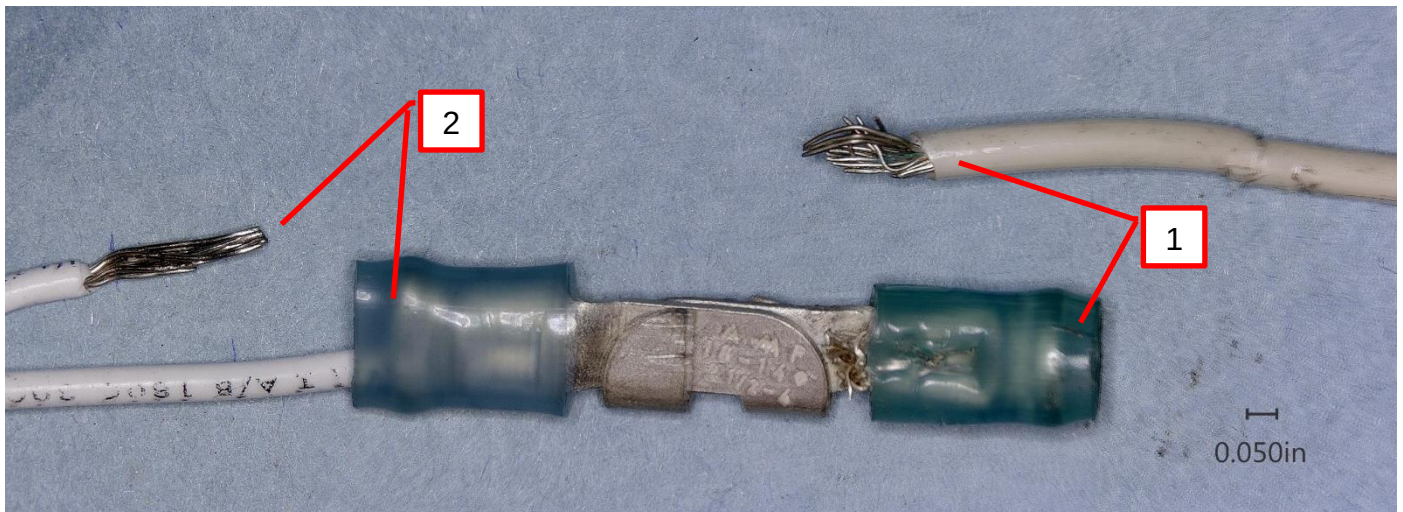


Figure 1. At top, the as-received pitot and wiring with separations numbered. Ground wires at right. Assumed pitot forward is at the top of the view. The lower view shows the ground wires and connectors with the spar wire at right. Separations 1 and 2.



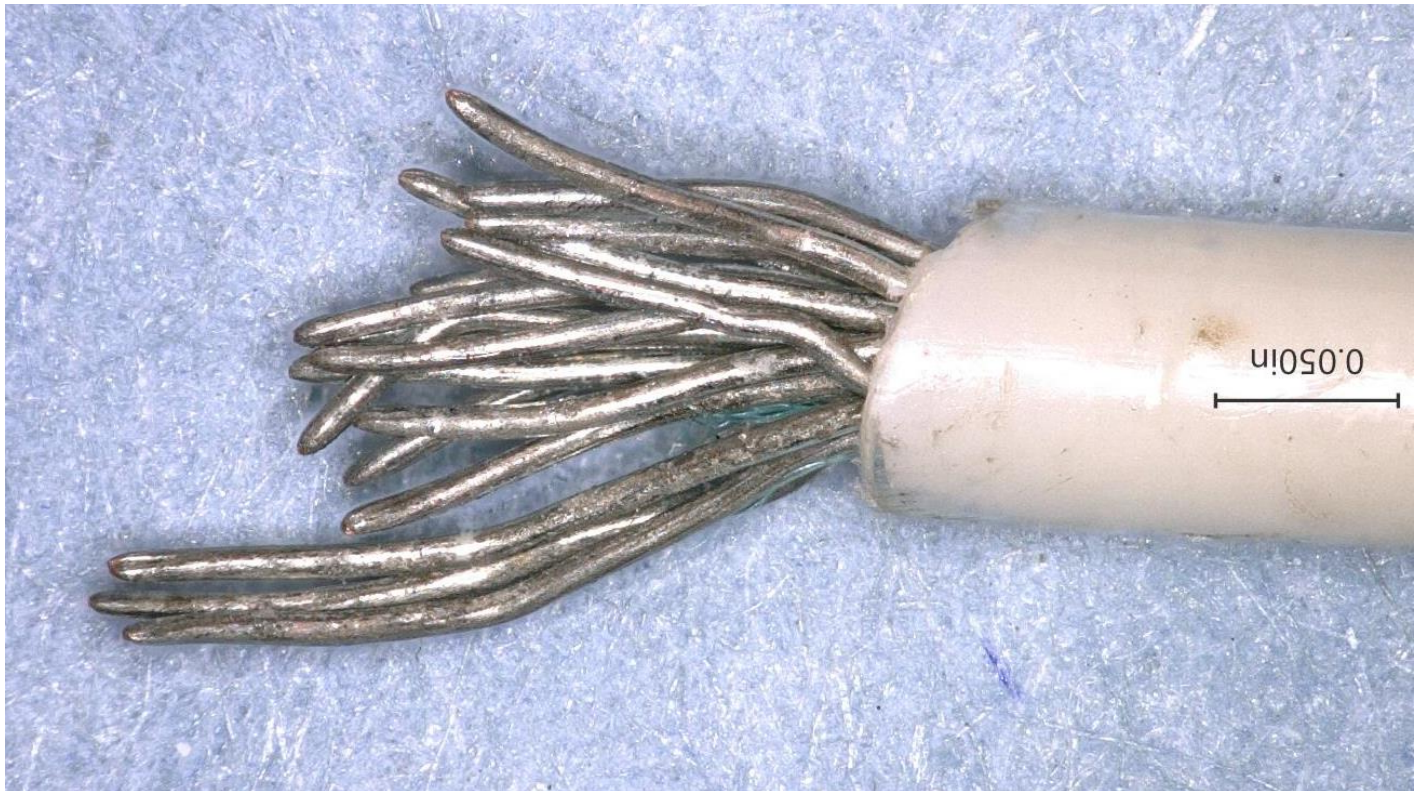


Figure 2. Wire separation 1 with tension overstress fractured wires at top and crimp at left.

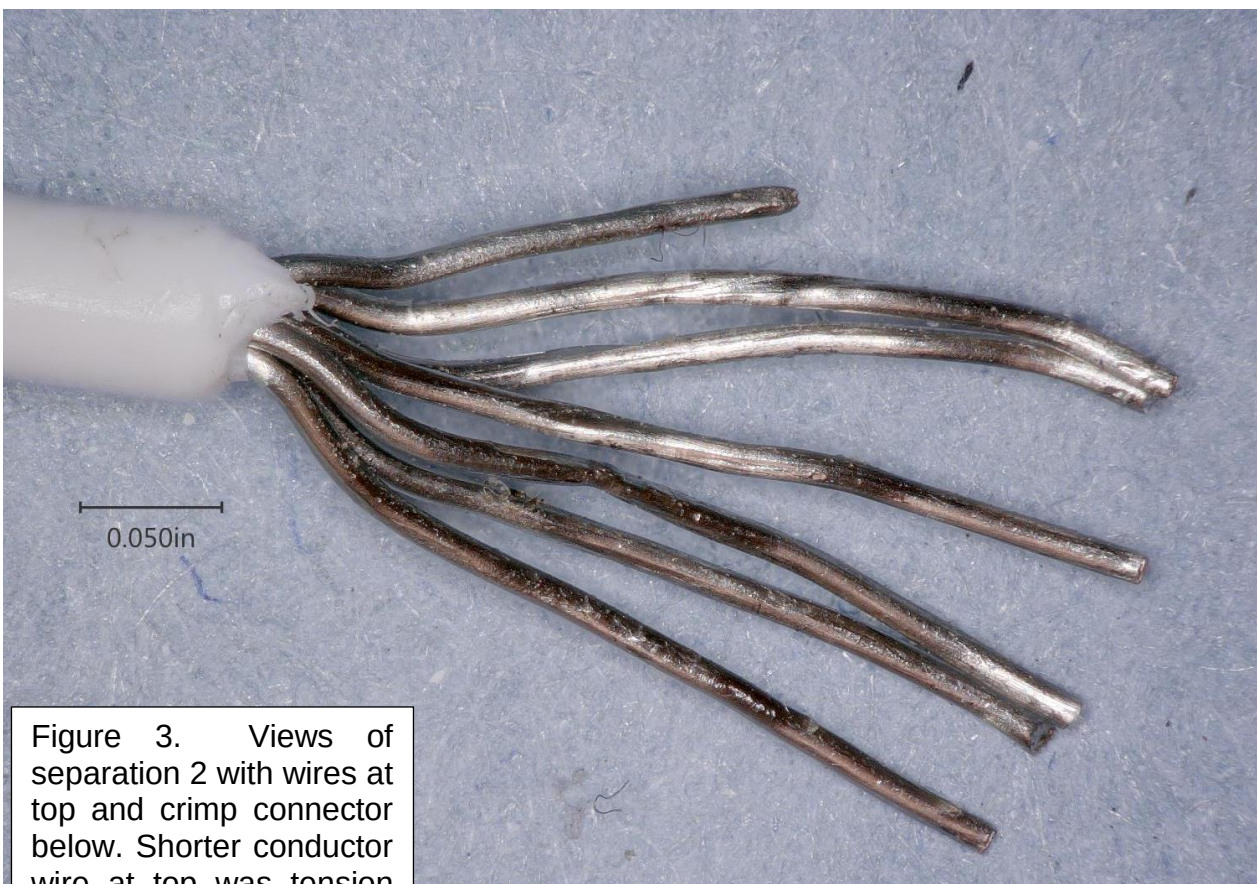


Figure 3. Views of separation 2 with wires at top and crimp connector below. Shorter conductor wire at top was tension fractured.

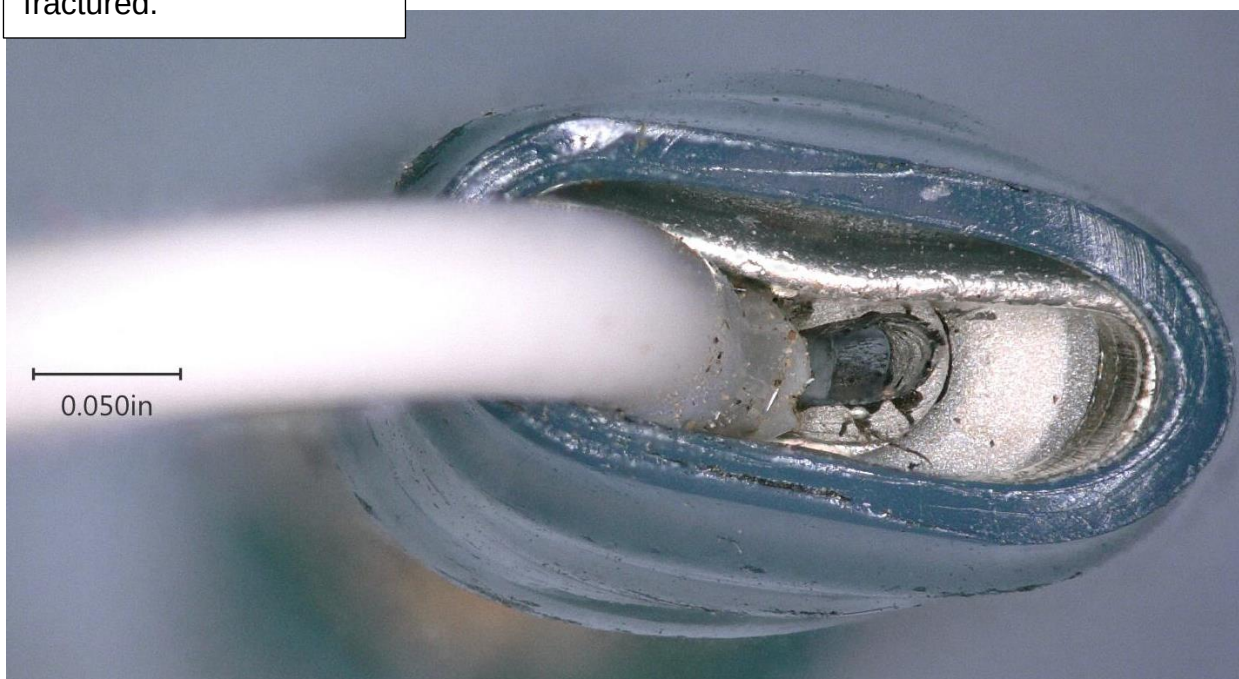




Figure 4. Power wires from separation 3, Forward wire at left, rear wire below.

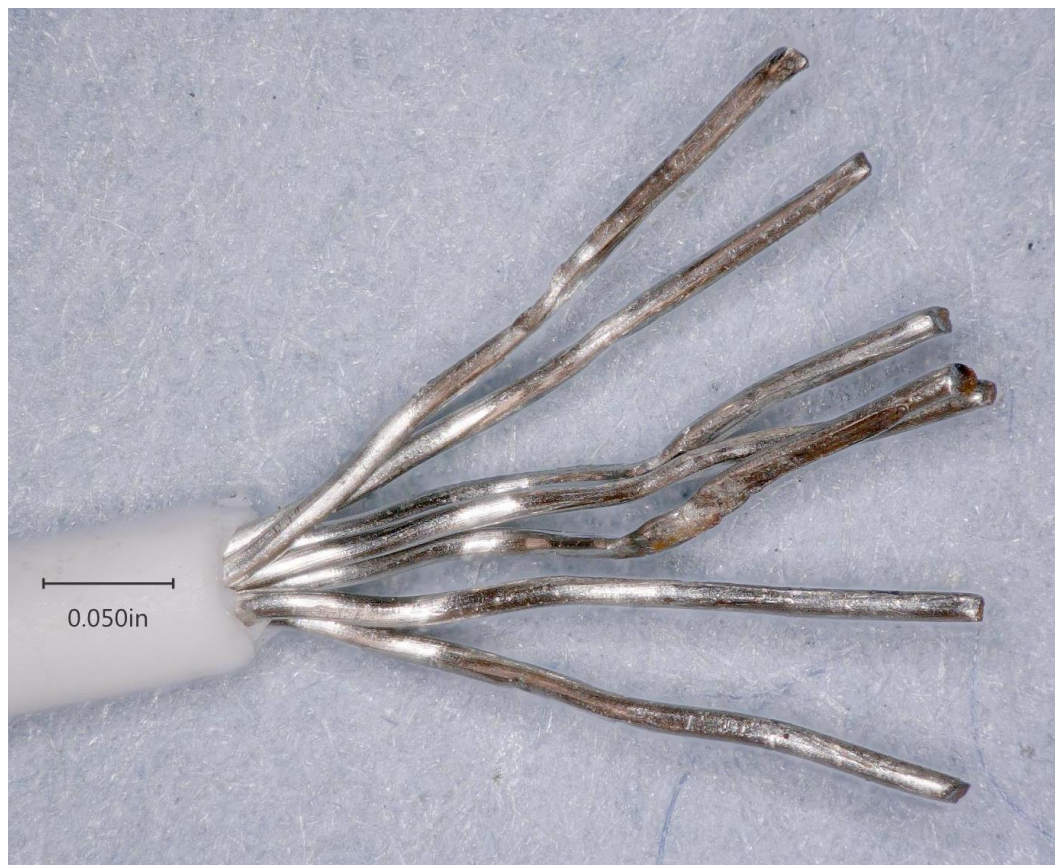




Figure 5. Two views of the exposed conductors in the forward pitot heater power wire. Lower view shows scraping damage on conductors.