

NATIONAL TRANSPORTATION SAFETY BOARD

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



March 9, 2018

MATERIALS LABORATORY FIRE FACTUAL REPORT

Report No. 18-023

A. ACCIDENT INFORMATION

Place : West Mifflin, Pennsylvania
Date : July 25, 2016
Vehicle : Yakovlev 11
NTSB No. : ERA16FA269
Investigator : Todd Gunther AS-ERA

B. COMPONENTS EXAMINED

Power wire with bus bar attached, Avionic wiring, Fuel sending wiring, C-4-A fuel strainer and fuel shutoff valve, and Electric fuel pump.

C. DETAILS OF THE EXAMINATION**1. Wreckage Examination**

During a left turn after landing, the pilot was advised that there was fire under the right wing. The airplane continued in the left turn until it traveled off the right side of the paved surface of the runway and rolled through the airport infield until it came to rest near a taxiway. Smoke and flames were then observed to increase in size from the right side of the airplane.

The metal and fabric fuselage skin in the areas of the cockpit, right wing, left wing root and forward portion of the empennage had been consumed by fire as shown in Figures 1 and 2. The cockpit was completely destroyed. The remaining metallic skin on the outboard section of the right wing and empennage exhibited extensive thermal damage—melting, oxidation of aluminum surfaces and brittleness. The wreckage was sooted with areas of vertically oriented resolidified globules of aluminum aircraft structure. The tail section, engine cowlings and the left wing were intact as shown in Figure 3.

There was extensive fire damage on the aft inboard trailing edge of the right wing and adjacent areas. The right side of the fuel system engine feeder tank was also located in this area. The feeder tank had multiple melt-through on the upper surface. The wing structure outboard from the feeder tank was intact. The inboard edges showed signs of melting, sooting and thermal discoloration of remaining paint.

A section of aircraft structure was found separated from the wreckage displayed evidence of broomstrawing on both ends of the section shown in Figures 4-6¹.

2. Component Examination

The following components were submitted to the Materials Laboratory for examination: C-4-A fuel strainer and fuel shutoff valve, avionic wiring, power wiring, fuel sending wiring, and electric fuel pump.

C-4-A fuel strainer and fuel shutoff valve

The fuel strainer fuel and shutoff valve unit is shown in Figure 7. There was no thermal damage to the main body of the unit. The outlet located near the top of the strainer section had a small section of aluminum fuel line still attached as shown in Figure 8. The section end exhibited high temperature deformation on the fracture surfaces as well as some areas indicative of overstress. The inlet located near the shutoff valve section also had a small section still attached as shown in Figure 9. The section end exhibited melting and thinning consistent with exposure to high temperatures.

Avionics wiring

A section of avionics wiring is shown in Figure 10. One end of the section still had the connector attached. The opposite end exhibited fractures consistent with mechanical breaks. The exterior of the braided conductor surface was bare and exhibited an oxidized layer, both consistent of exposure of high temperatures. There were no signs of electrical arcing, beading or melting on any of the conductors.

Power wiring

A section of power wiring is shown in Figure 11. The wiring was located on the right side of the cockpit during the wreckage examination. One end of the section was attached to a bus bar. The opposite end was fractured. The fracture end exhibited signs of arcing, beading, melting and welding of conductors as shown in Figure 12. The exterior of the braided conductor surface was bare and exhibited an oxidized layer, both consistent of exposure of high temperatures.

Fuel sending wiring

Three sections of fuel wiring are shown in Figure 13. All three sections exhibited end fractures consistent with mechanical breaking. Two of the wire sections had a twisted junction mid-length in the section. There were no signs of separations in the junctions and no sign of electrical arcing around the joined sections. There were no signs of electrical arcing, beading or melting on any of the conductors of the 3 sections.

¹ Broomstrawing is a fire signature where a near-molten aluminum component subjected to a shock loading (e.g., impact) can take on the physical appearance of broomstraw or feather-like appearance.

Electric fuel pump

The electric fuel pump is shown in Figure 14. The main body of the fuel pump was intact and appeared undamaged by heat. One inlet had a small section of thermally damaged polymeric hose. Two small outlets, shown in Figure 15 and 16, showed evidence of thermal deformation, thinning and melting. These signatures are indicative of exposure to high temperatures.

Nancy B. McAtee
Fire and Explosion Specialist



Figure 1. Photograph of cockpit (facing aft).

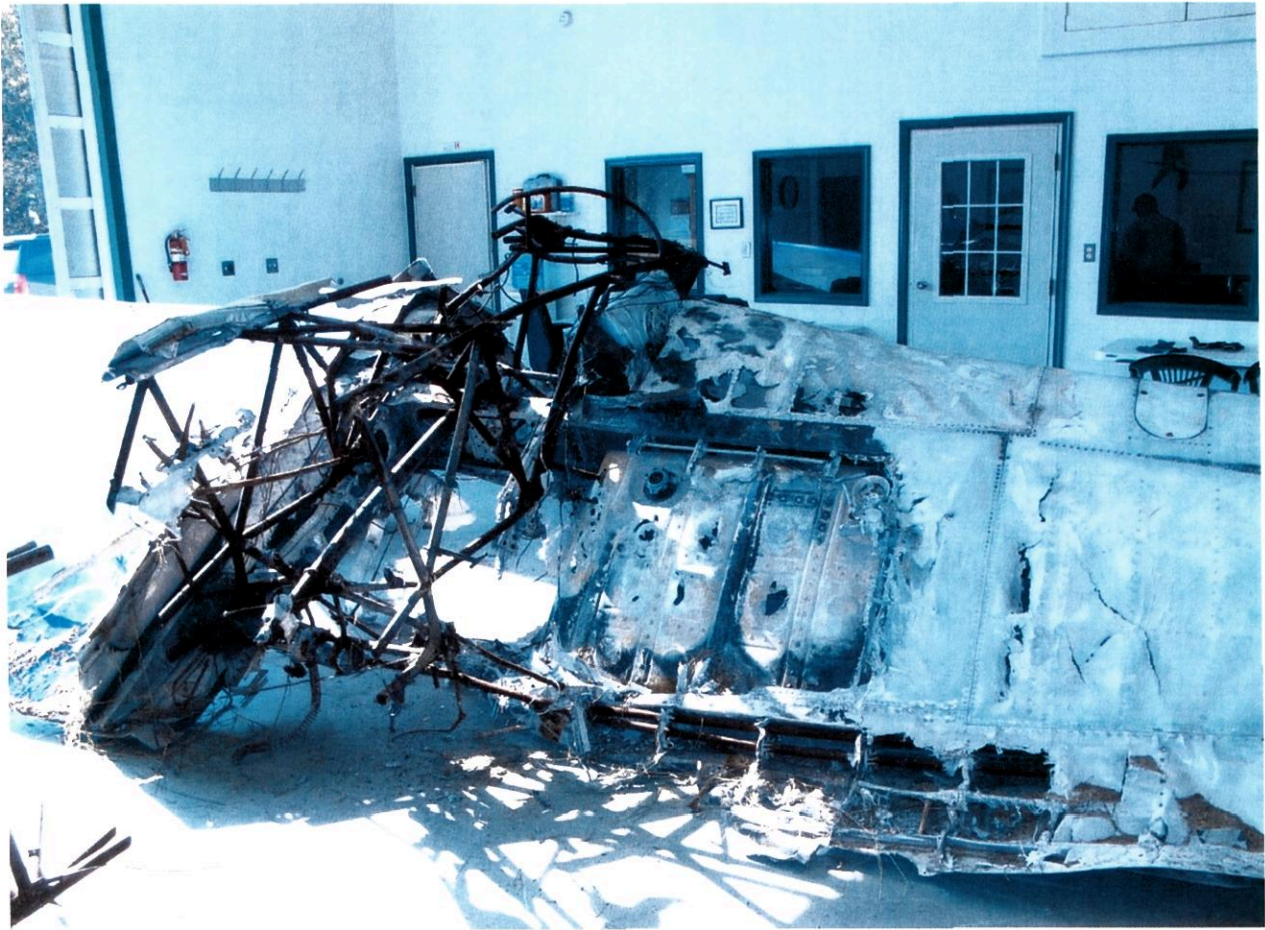


Figure 2. Photograph of cockpit and inboard section of right wing (facing forward).



Figure 3. Photograph of left side of aircraft.



Figure 4. Section of aircraft structure with broomstrawed ends.



Figure 5. Closeup photograph of one of broomstrawed end.



Figure 6. Closeup photograph of broomstrawed end.

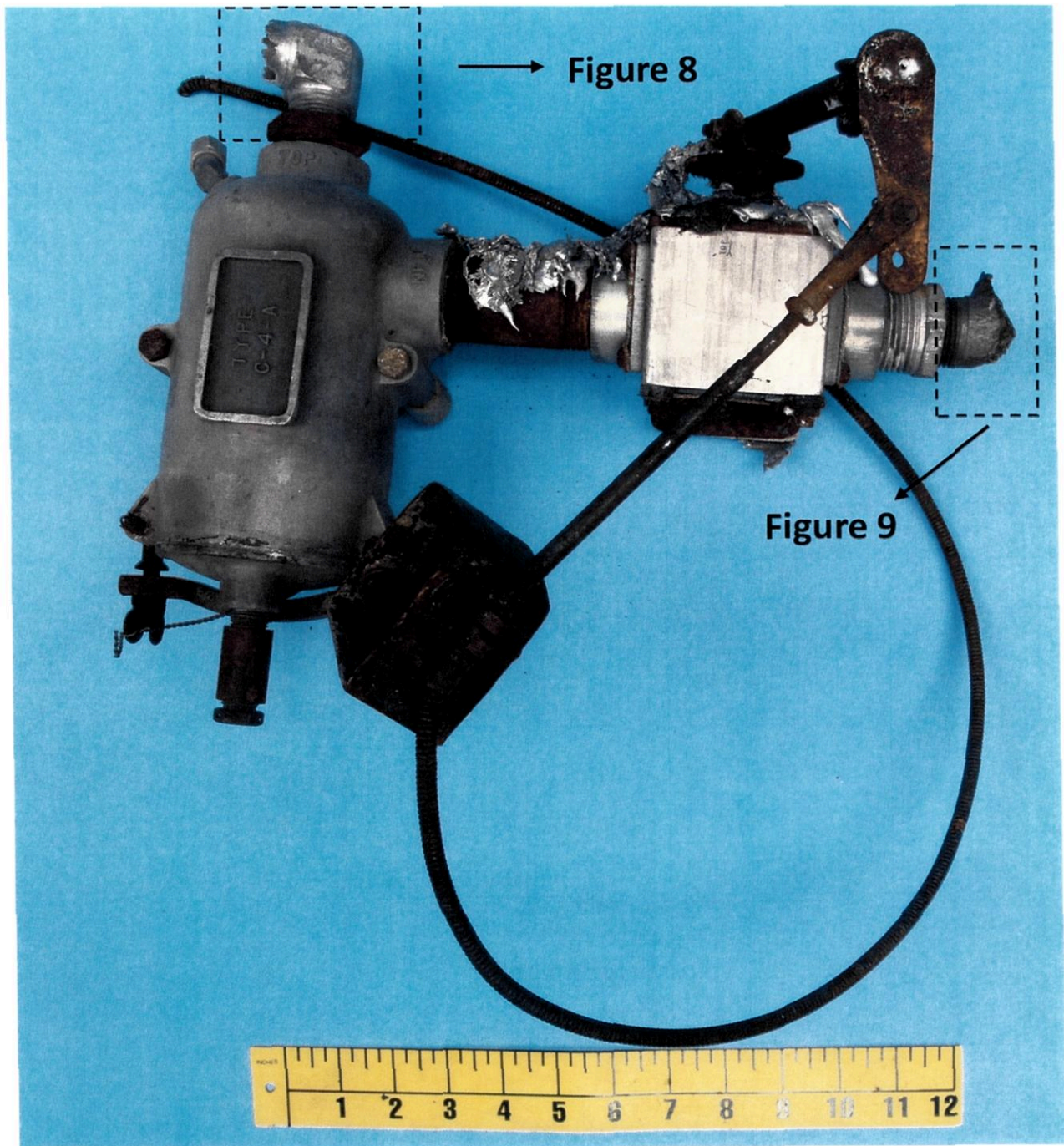


Figure 7. Photograph of C-4-A fuel strainer and fuel shutoff valve.



Figure 8. Photograph of outlet on top of fuel strainer.



Figure 9. Photograph of inlet on fuel shutoff valve.

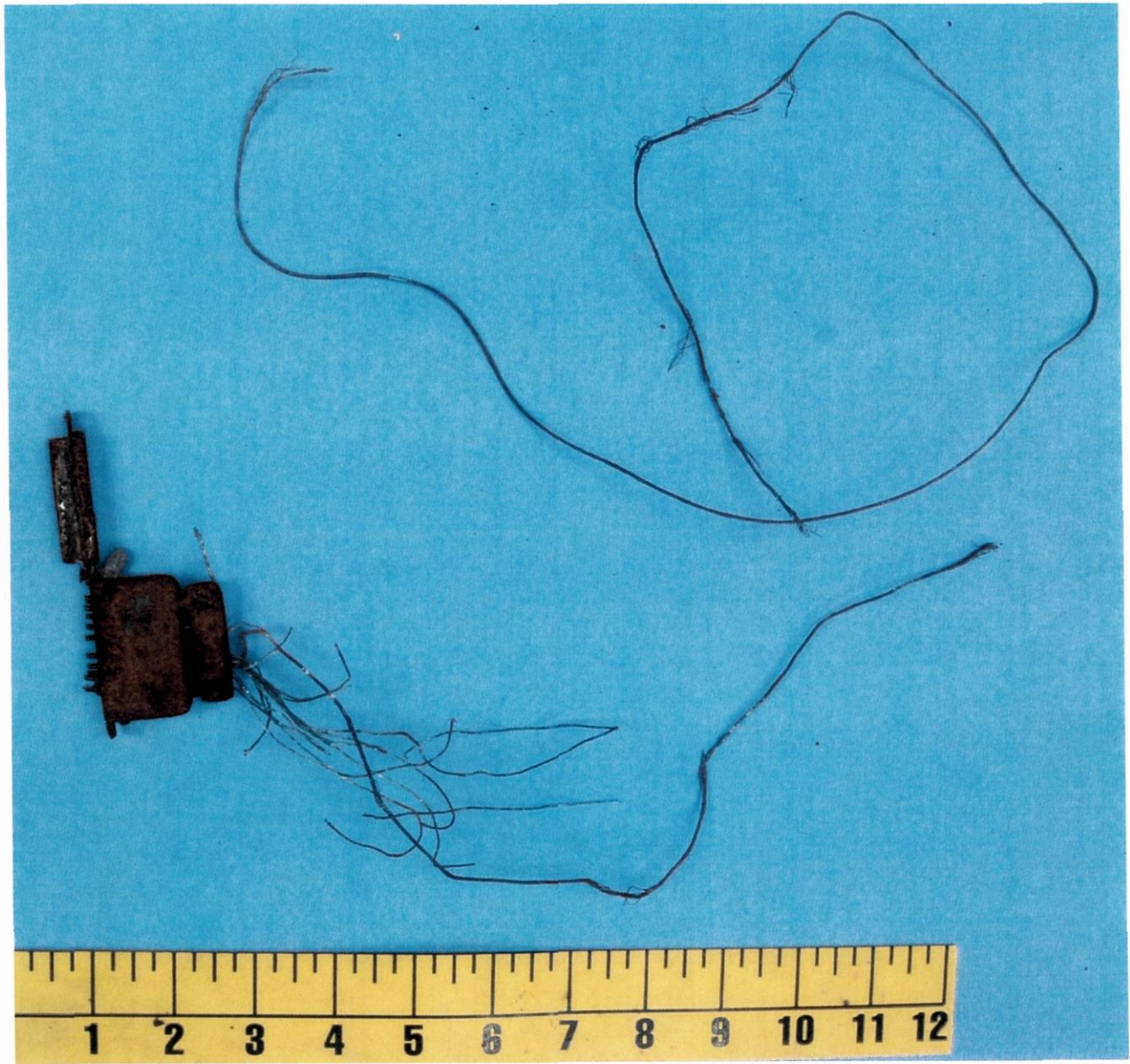


Figure 10. Photograph of avionics wiring.

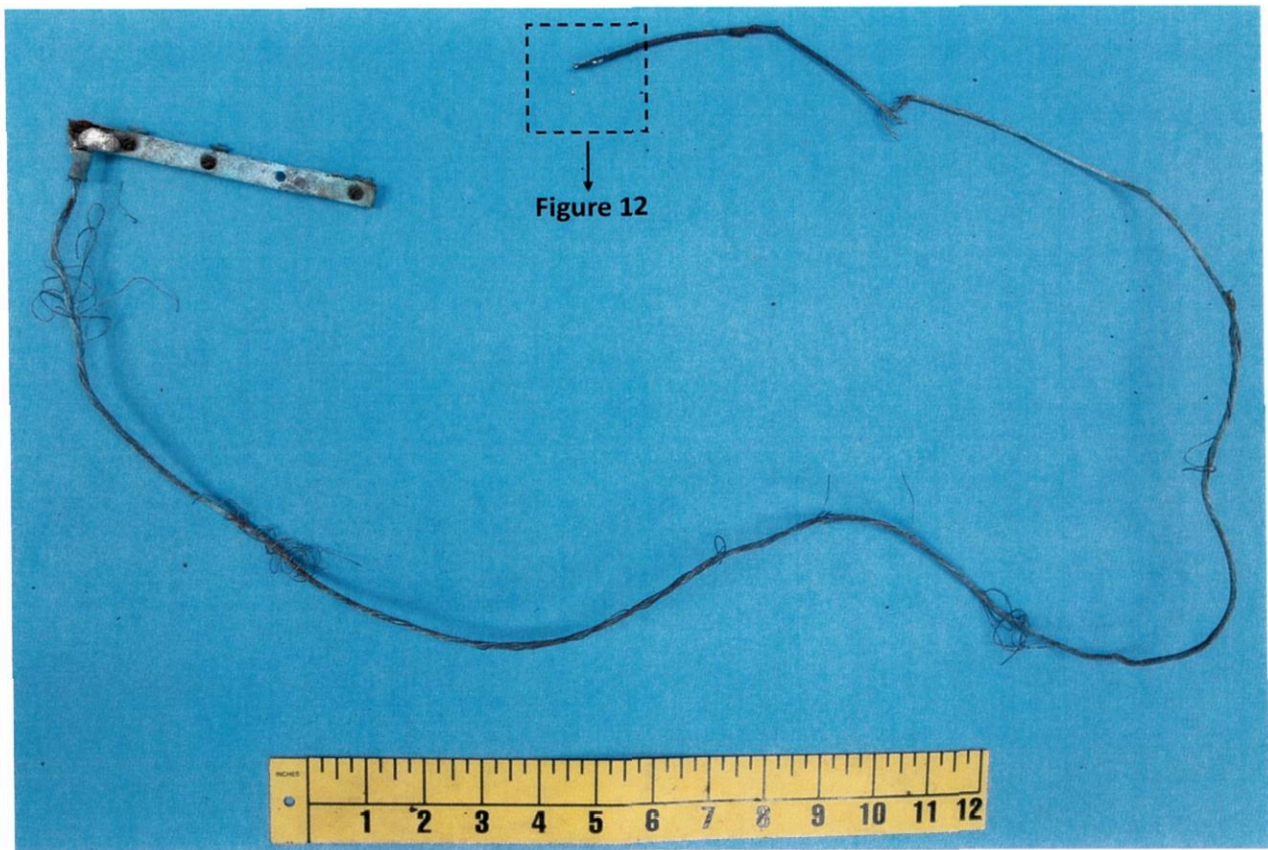


Figure 11. Photograph of power wiring.



Figure 12. Closeup photograph of arcing, beading and melting damage to end of power wiring section.

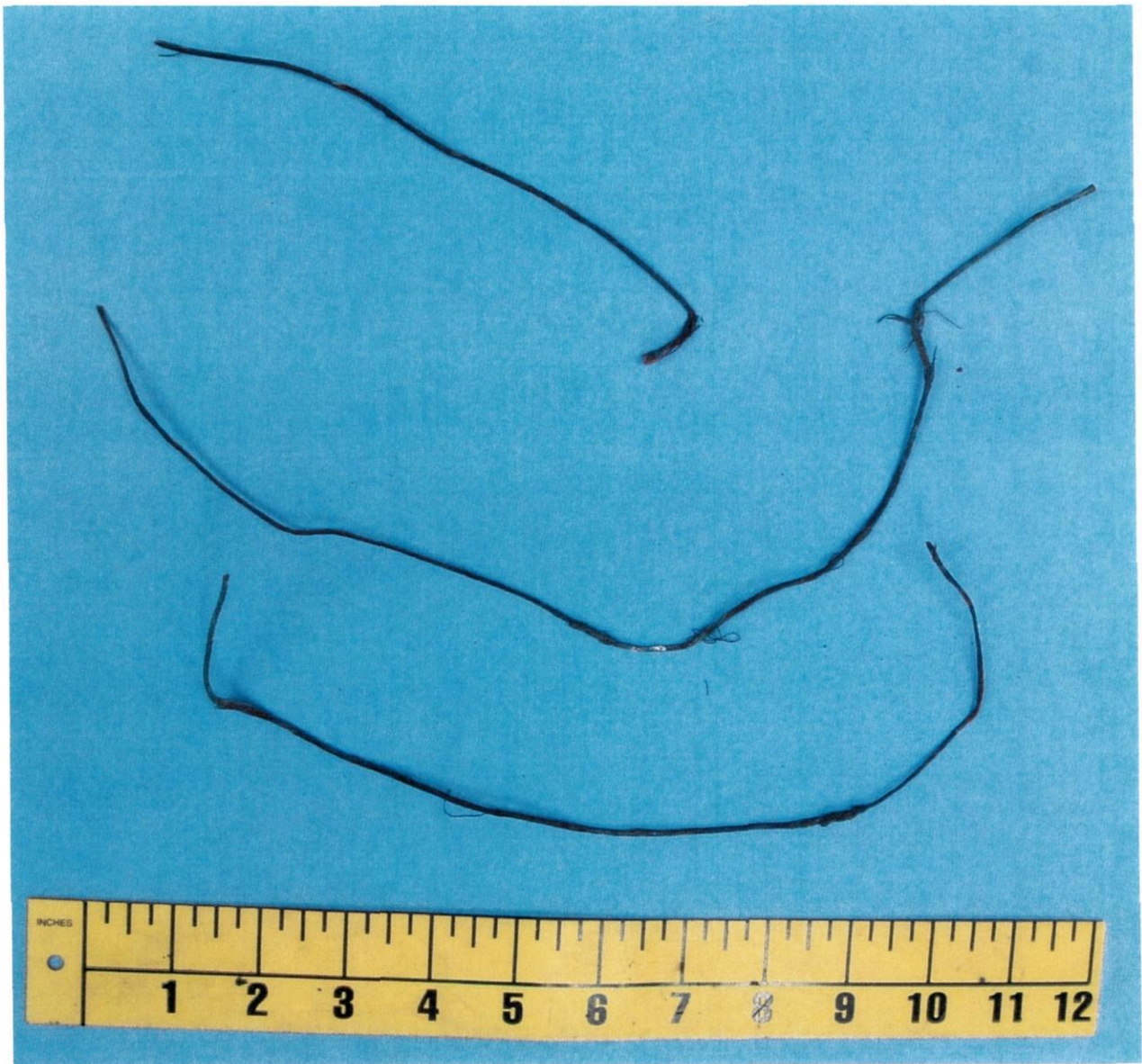


Figure 13. Photograph of fuel sending wiring sections.

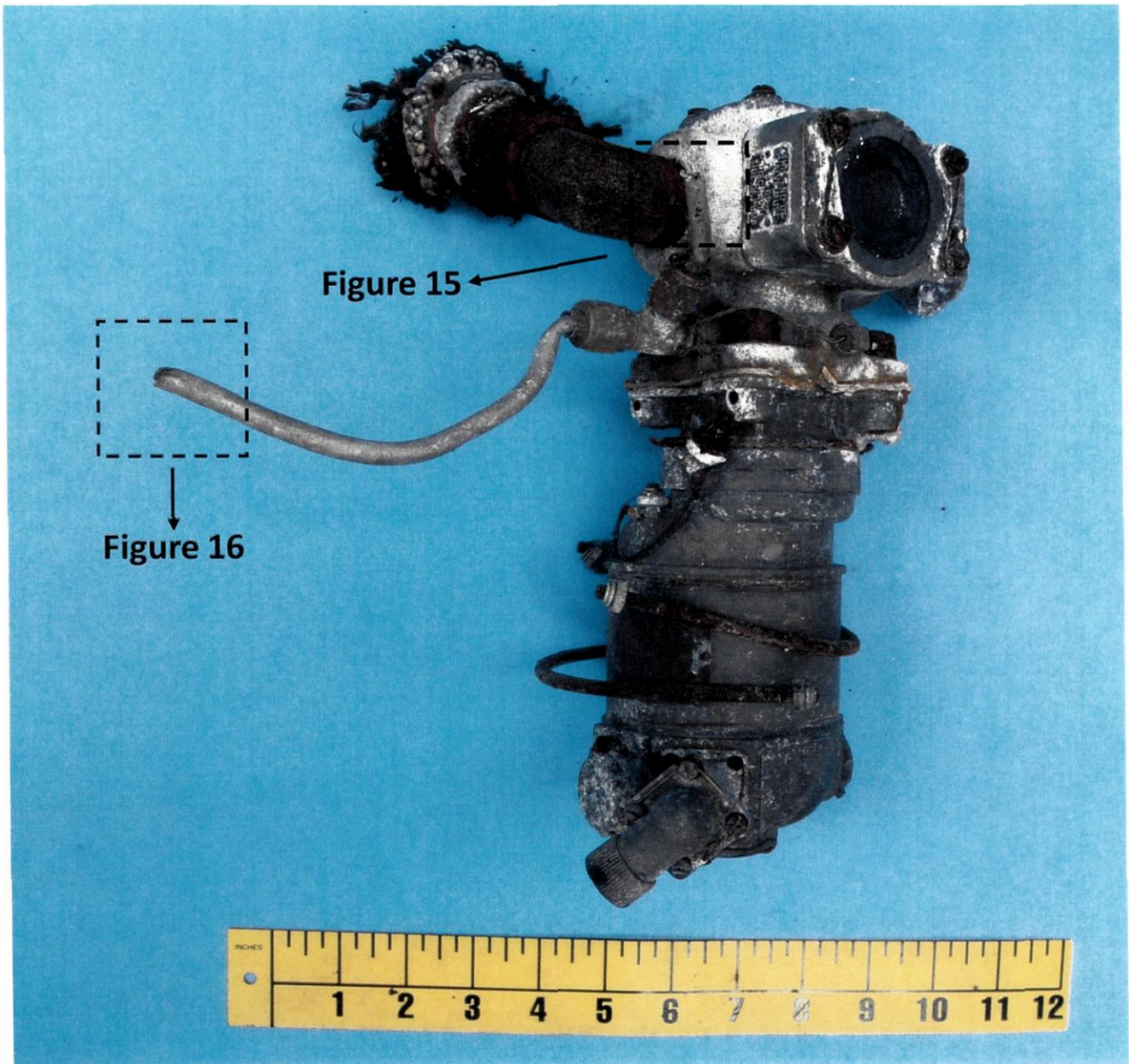


Figure 14. Photograph of electric fuel pump.



Figure 15. Closeup of one small outlet on fuel pump.



Figure 16. Closeup of second small outlet on fuel pump.