

NATIONAL TRANSPORTATION SAFETY BOARD

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



June 10, 2020

MATERIALS LABORATORY FACTUAL REPORT

Report No. 20-029

A. ACCIDENT INFORMATION

Place : Deer Park, WA
Date : July 13, 2018
Vehicle : Cessna 172, N24442
NTSB No. : WPR18FA195
Investigator : Zoe Keliher (AS-WPR)

B. COMPONENTS EXAMINED

Control yoke and associated mounting hardware, various control cables.

C. DETAILS OF THE EXAMINATION

The control yoke and associated mounting hardware was submitted for evaluation (Figure 1). The parts were examined macroscopically and using a 5x to 50x stereomicroscope. The fracture surfaces on the separated portions of the yoke and hardware were consistent with overstress. The secondary damage to the hardware surfaces was consistent with impact damage. No obvious signs of long-term wear or contact marks were observed.

Several control cables were also submitted for evaluation (Figures 2-8). The control cables had areas where some of the strands had loosened, with strand wires that had separated and unraveled. The separated wires had necking at the ends and cup-cone fracture surface geometries, as indicated by the blue arrows in Figure 5. These features were consistent with overstress fracture.

Red colored debris was visible on several of the cables in areas where strands had unraveled (red arrows, Figures 2-4). The debris appeared to be entangled with the strands. Several cables were selected for further examination using a digital microscope, including those with the following labels: left wing aileron, left wing aileron 2, left wing aileron outboard, and left overhead aileron to wing. The debris was determined to be fibers entwined with the cables. Both red colored and gold colored fibers (red and orange arrows, respectively) were observed, as shown in Figure 9. The exact source of the fibers was not determined.

Adrienne V. Lamm
Materials Engineer



Figure 1: Overall photo of the submitted control yoke and associated mounting hardware, and various control cables.

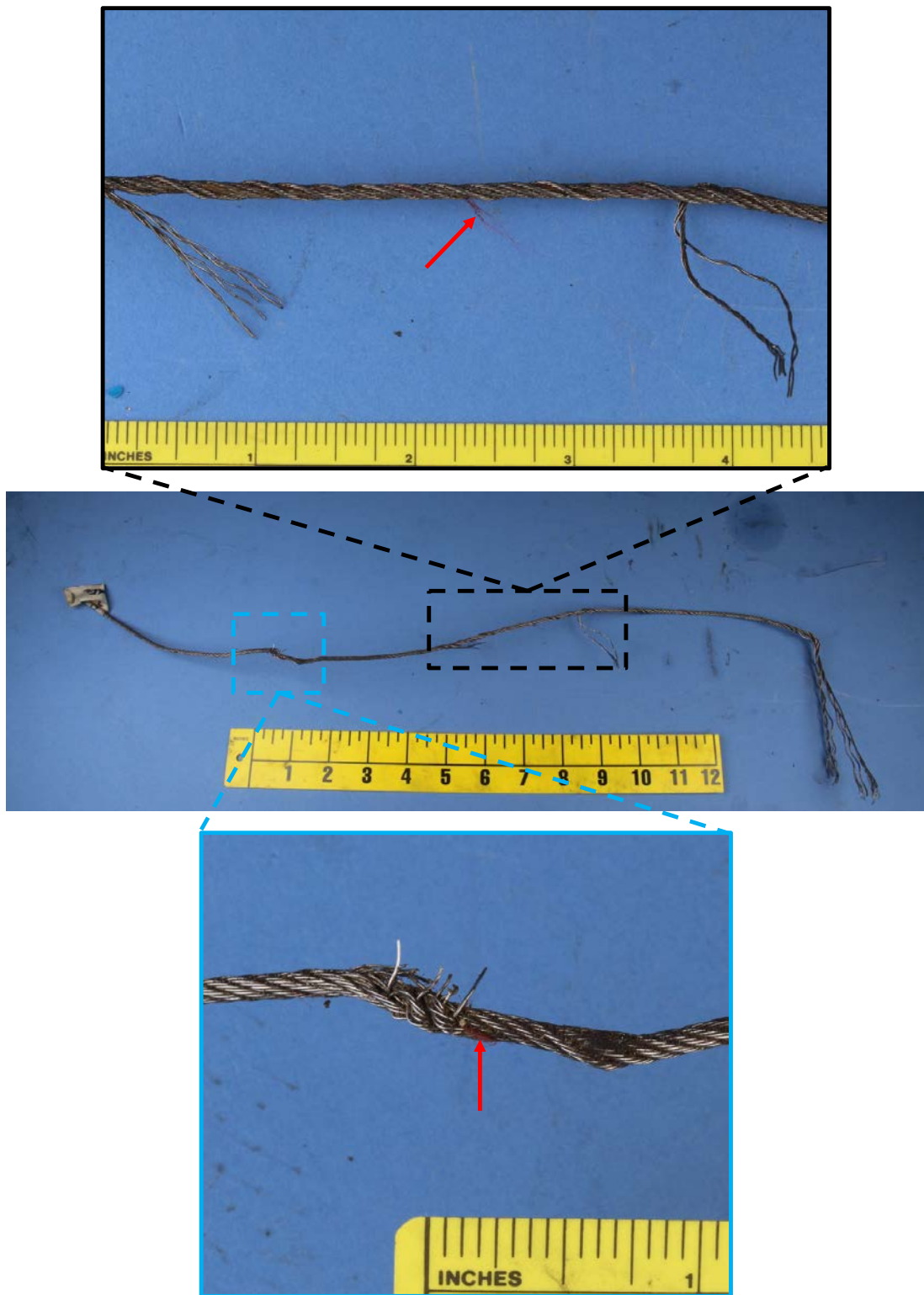


Figure 2: Photos of the left wing aileron cable. The red arrows points to red colored debris observed between loosened strands of the cable.

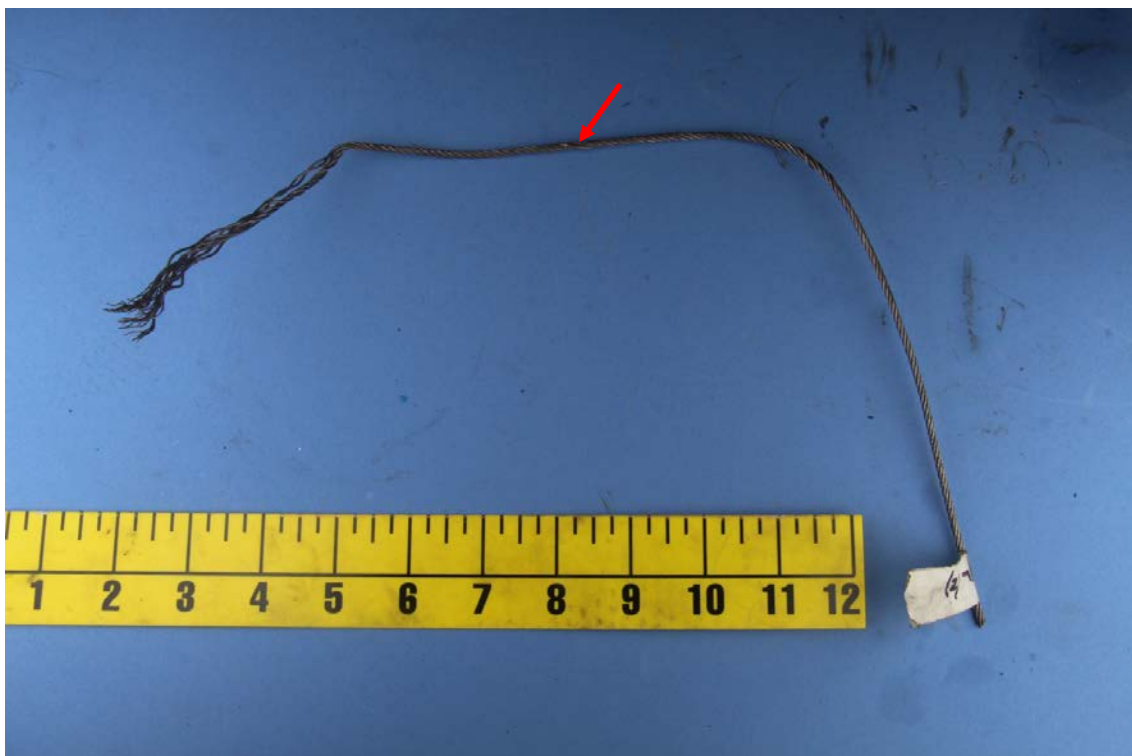


Figure 3: Photos of the left overhead aileron to wing cable (top) and left wing aileron 2 cable (bottom). The red arrows point to red colored debris observed between loosened strands of the cables.

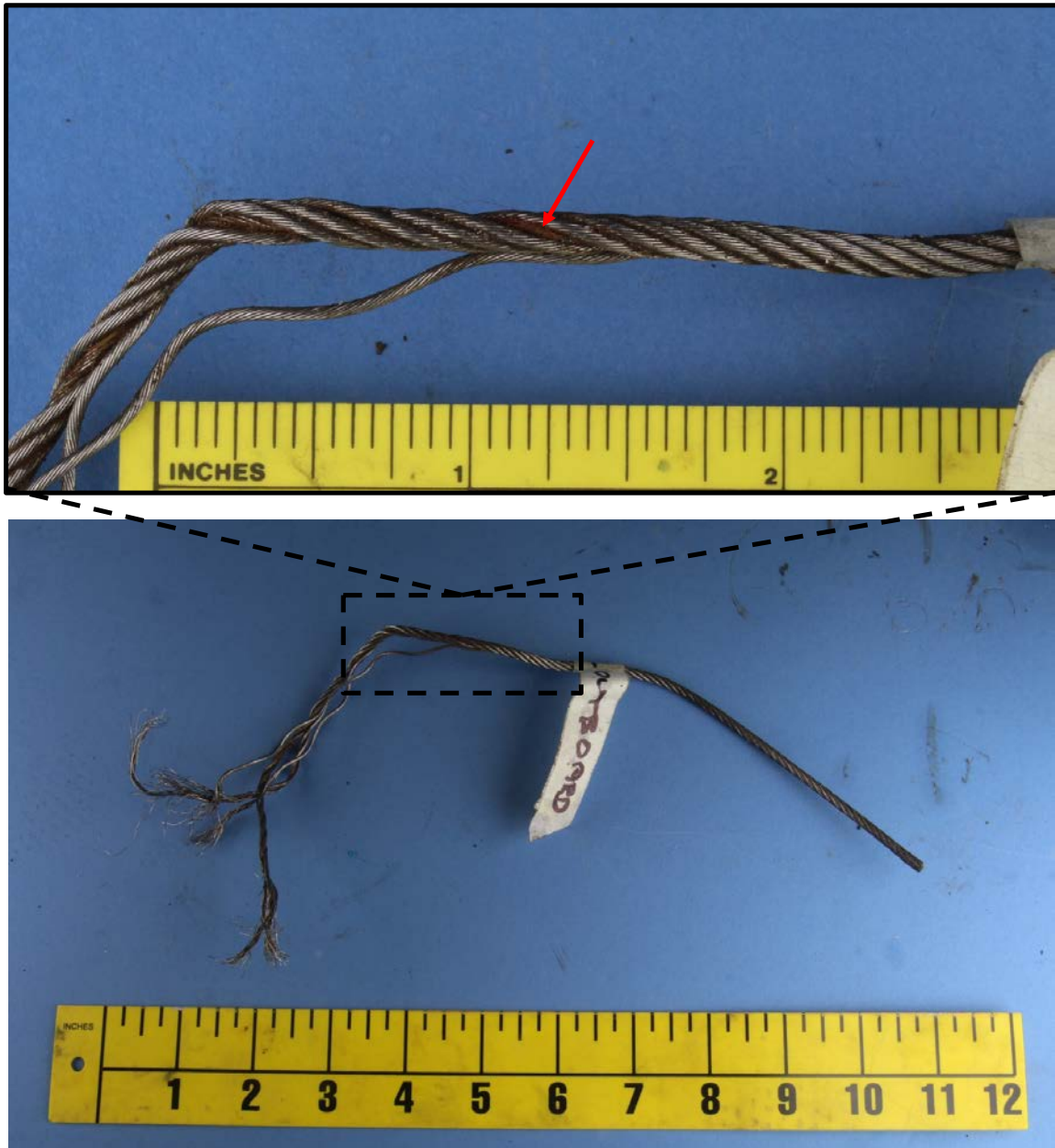


Figure 4: Photos of the left wing outboard cable. The red arrow points to red colored debris observed between loosened strands of the cable.

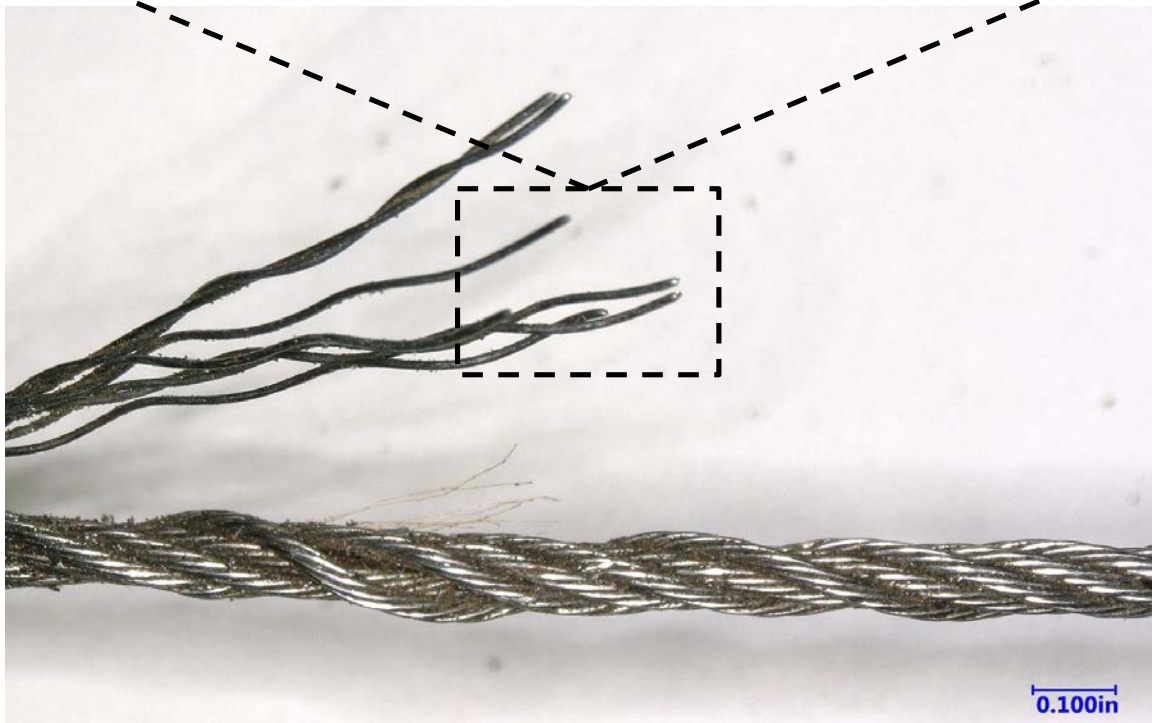
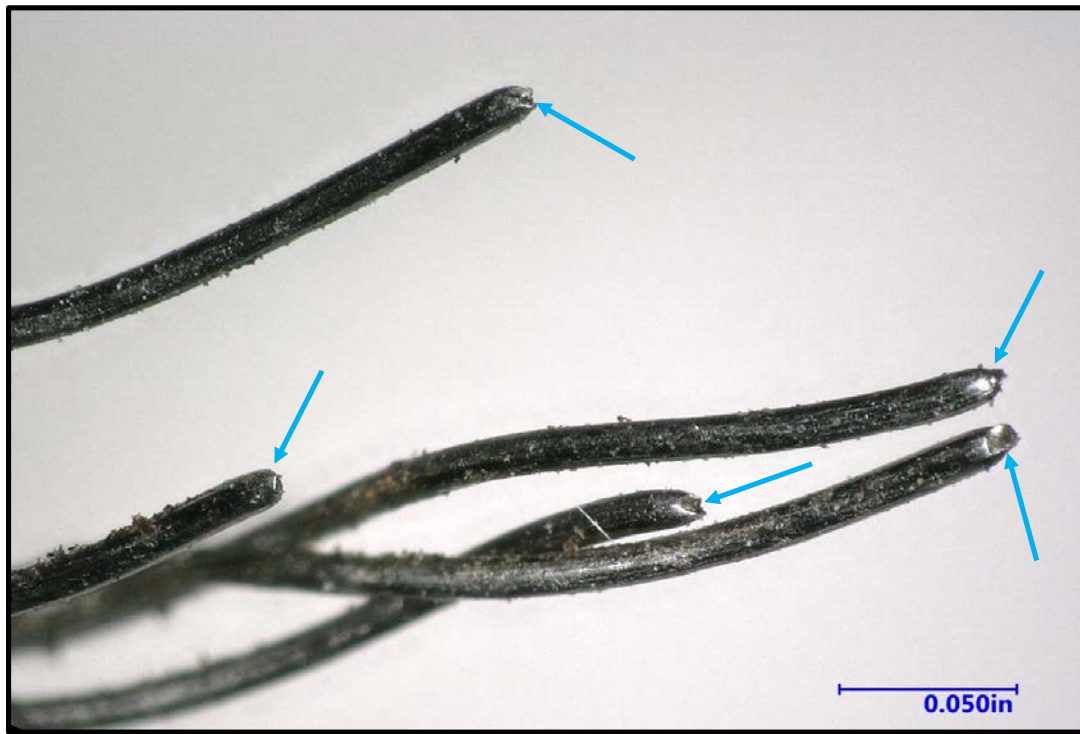


Figure 5: Digital microscope images of separated wires (blue arrows) from one the strands in the left wing aileron cable.

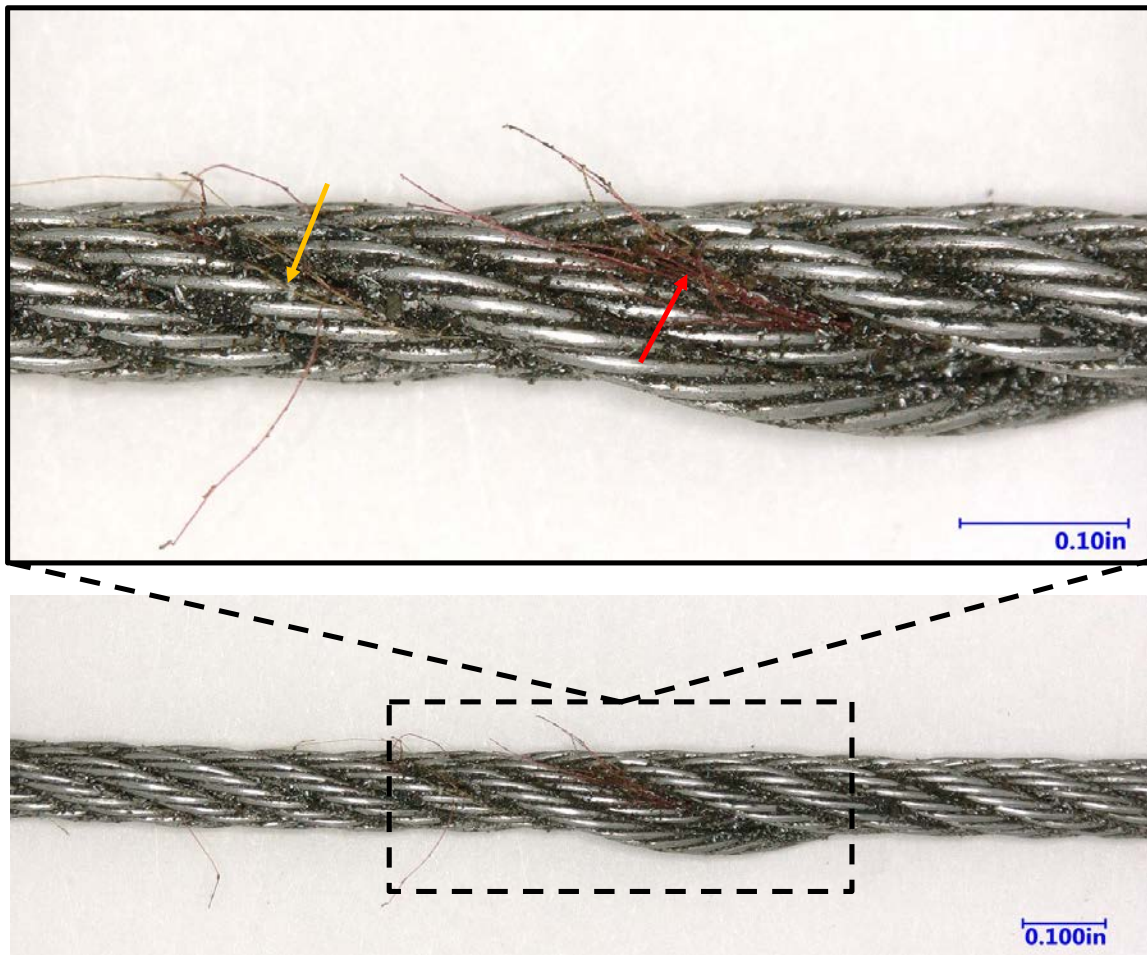


Figure 6: Digital microscope images of red colored and gold colored fibers (red and orange arrows, respectively) entwined it the left wing aileron 2 cable.

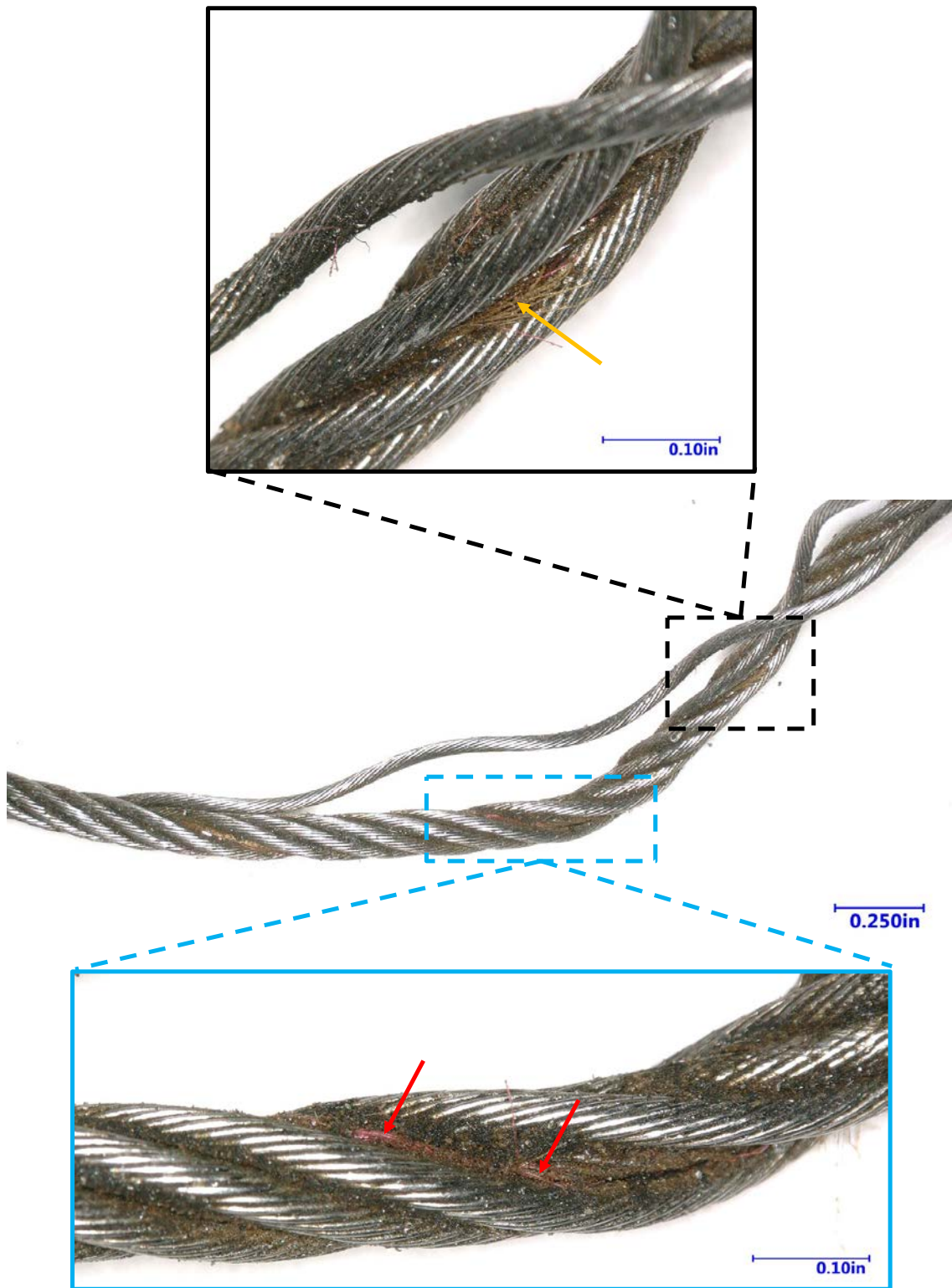


Figure 7: Digital microscope images of red colored and gold colored fibers (red and orange arrows, respectively) entwined in the left wing aileron outboard cable.

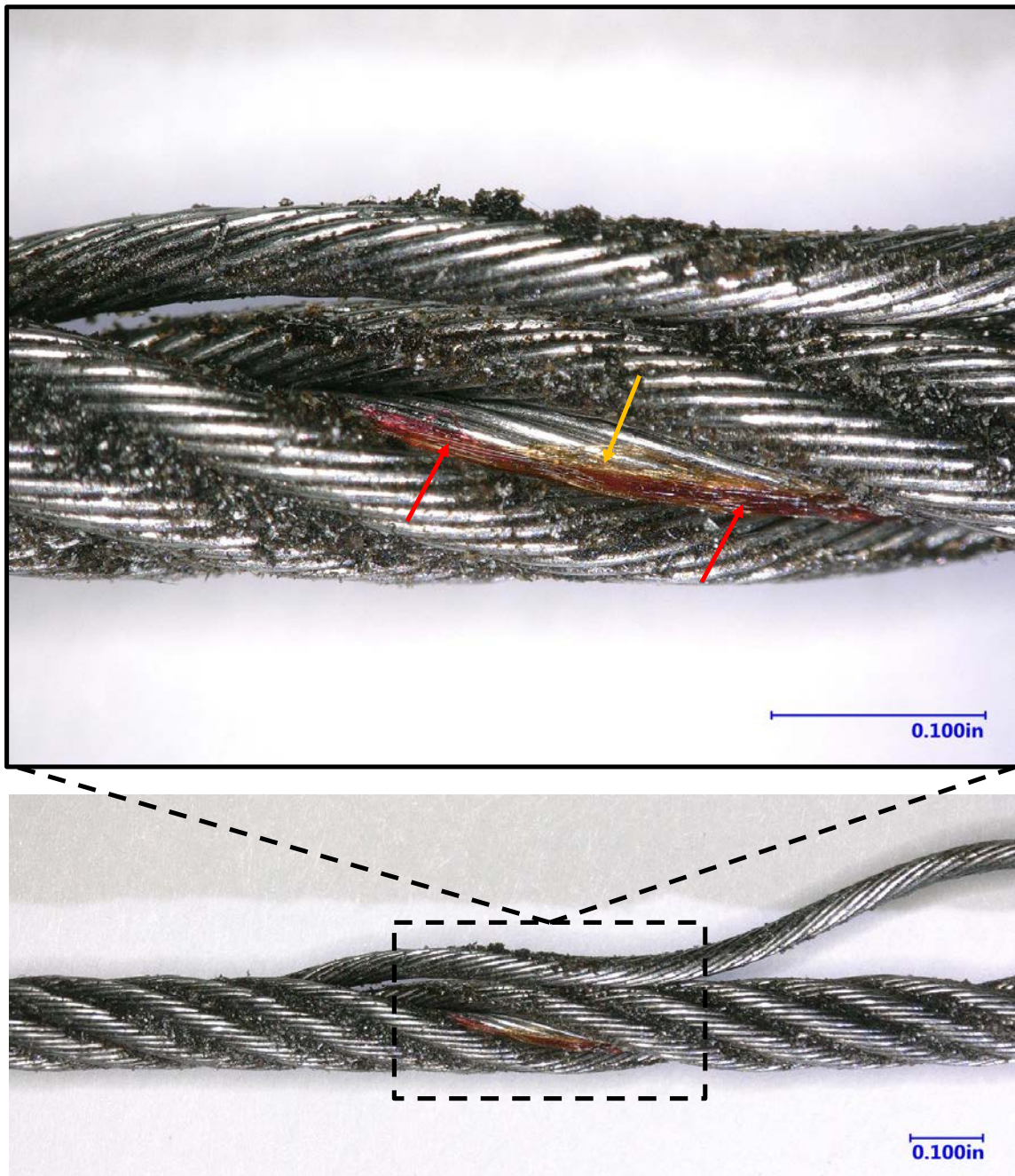


Figure 8: Digital microscope images of red colored and gold colored fibers (red and orange arrows, respectively) entwined in the left overhead aileron to wing cable.



Figure 9: Digital microscope image of red colored and gold colored fibers removed from the left overhead aileron to wing cable.