

NATIONAL TRANSPORTATION SAFETY BOARD

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



September 18, 2015

MATERIALS LABORATORY FACTUAL REPORT

Report No. 15-098

A. ACCIDENT INFORMATION

Place : Lakeland, Florida
Date : January 22, 2015
Vehicle : Piper PA-23, N465JA
NTSB No. : ERA15FA109
Investigator : Timothy W. Monville, AS-ERA

B. COMPONENTS EXAMINED

Pieces of tubular frame and portion of the left rudder control cable with attached fittings.

C. DETAILS OF THE EXAMINATION

Overall views of the submitted tubular frame pieces are shown in figure 1. Two fracture locations with mating sides of the fracture are labeled A and B. The frame pieces were located from the left side of the airplane and include welded clusters at fuselage stations (FS) 153 $\frac{7}{8}$ and 168 $\frac{1}{2}$.

Overall, the components showed black scale and orange oxidation consistent with exposure to high heat. In some areas, black bubbled remnants of paint were observed. In areas shown circled in figure 1, metal loss through the thickness of the tube walls was observed.

Views of the inboard side of the cluster at FS 153 $\frac{7}{8}$ are shown in figures 2 and 3 where mating sides of fracture A are indicated. Fracture surfaces of fracture A were covered with orange oxides. Metal loss through the wall was observed in the tube piece above and inboard of the fracture. Areas adjacent to the fracture showed deformation of the wall where the wall was folded toward the forward direction, features consistent with contact with another object moving forward relative to the cluster. In figure 3, the mating sides of fracture A are shown in close proximity, and unlabeled arrows indicate the deformed tube walls adjacent to the fracture.

Views of fracture B from several perspectives are shown in figure 4. The surfaces of fracture B were covered with orange oxides. Metal loss through the thickness of the tube wall was observed on the aft side of the tube up to approximately 2 inches above the fracture and 3.5 inches below the fracture as shown in the left and middle images in figure 4. The tube wall was deformed inward at the left edge of the

metal loss approximately 2.25 inches below fracture B, and the wall was deformed outward at the opposite edge of the area of metal loss approximately 2.5 inches below fracture B (see figure 4). A crack extended from the edge of the metal loss at a location adjacent to and just below the outward deformation as indicated in the right image in figure 4. The crack extended at an angle relative to the circumferential plane. The crack fracture surfaces were covered with orange oxide.

Closer views of the tube piece inboard of fracture A are shown in figure 5. As shown in the upper image, the tube was bent near the middle of the segment, and a closer view of the bend is shown in the lower image. Within the bend itself, metal loss through the wall was located only at the edge of the crease viewed in figure 5. However, other areas within several inches of the bend showed much larger areas of through-thickness metal loss, including sides of the tube longitudinally in line with the inside and outside surfaces of the bend.

An overall view of the left rudder control cable is shown in figure 6. The cable was fractured at one end, and at the other end, the cable connection was fractured through an attachment lug. The total length of the cable from the fractured lug to the fractured cable end was 8 feet 9 inches. Most of the length of the cable showed exposed wires generally covered with orange oxide. Near the fractured end of the cable, a black material was observed covering segments of the cable. In several locations, the cable was bent and partially fractured through many of the wires comprising the cable. The cable fracture was covered in black material and orange oxides. The wires at the fractured end were together and did not show any splaying or broomstraw fracture appearance. However, fracture features were mostly covered by the black material, and where visible, fracture features were obliterated by oxidation. At the other end of the cable piece, the fracture through the attachment lug showed rough fracture features consistent with overstress fracture.

Matthew R. Fox
Senior Materials Engineer

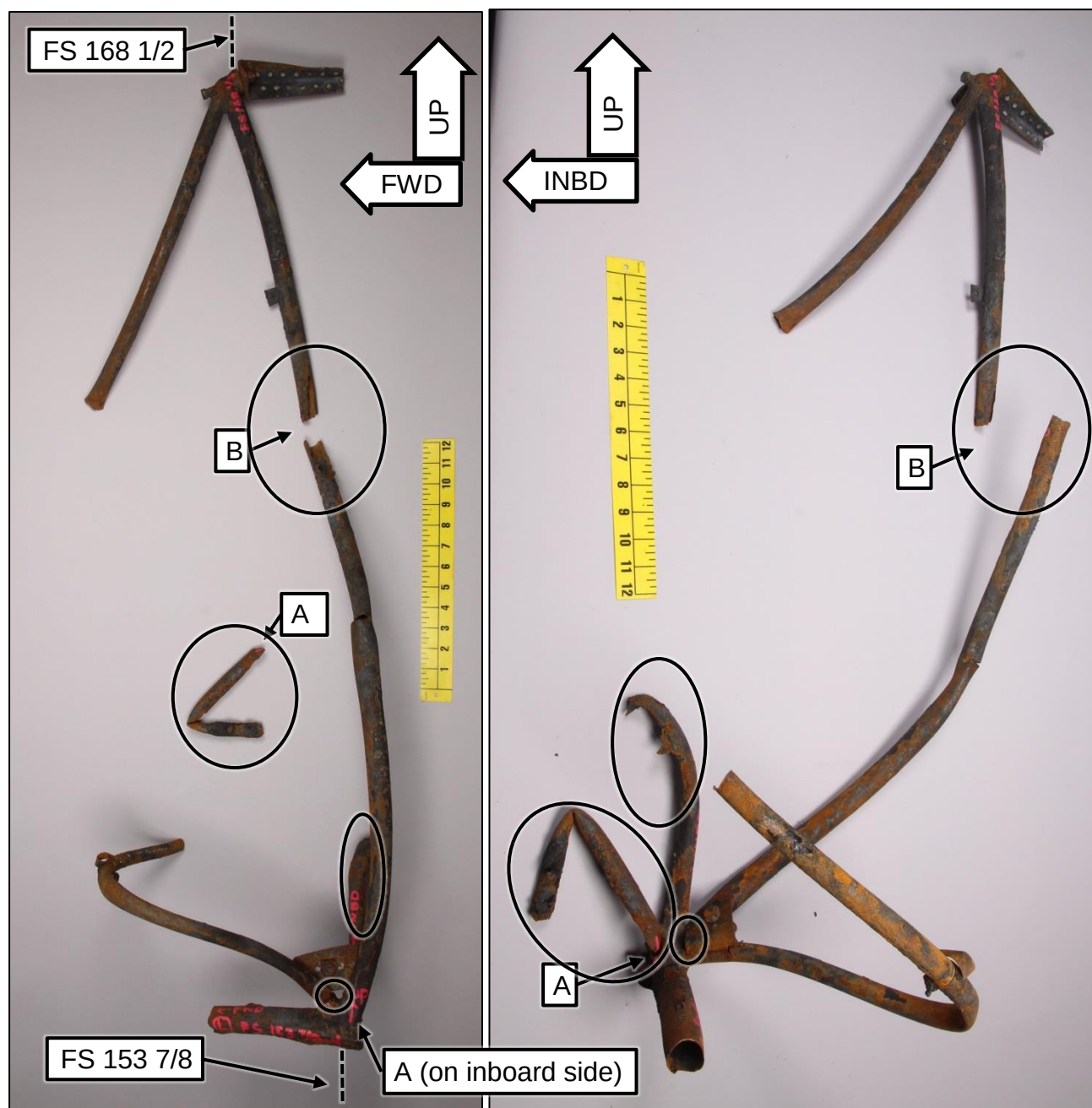


Figure 1. Overall views of the submitted frame pieces looking inboard (left image) and to the aft (right image). Fractures labeled A and B are indicated. In the aft view, mating fracture faces for fracture A are shown in close proximity. In the lateral view looking inboard, the outboard face of fracture A is not visible since it faced away from the camera. Circled areas in each image indicate areas on the structure where through-wall metal loss was observed.

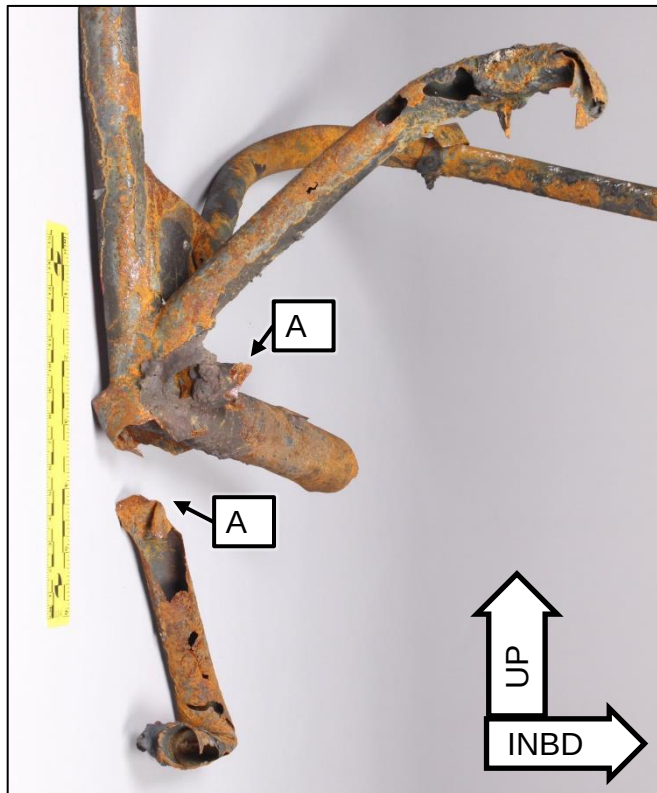


Figure 2. View of the cluster at FS 153 7/8 looking forward showing fracture A.

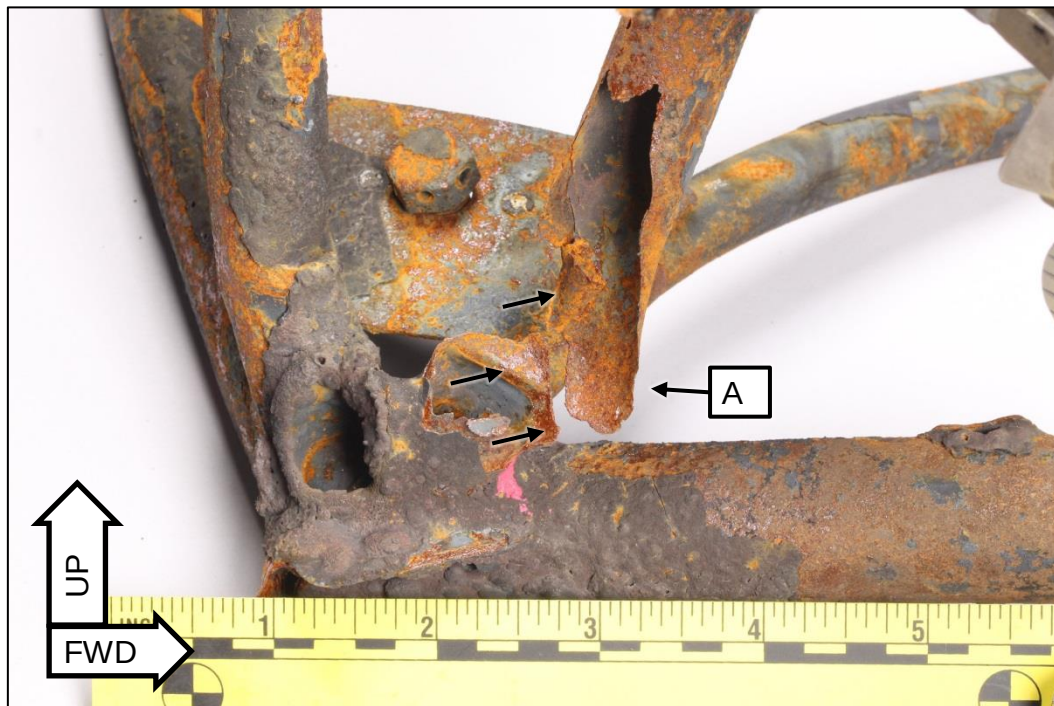


Figure 3. Closer view of fracture A. Arrows indicate deformation of the tube wall adjacent to the fracture consistent with contact with another object moving forward relative to the frame.

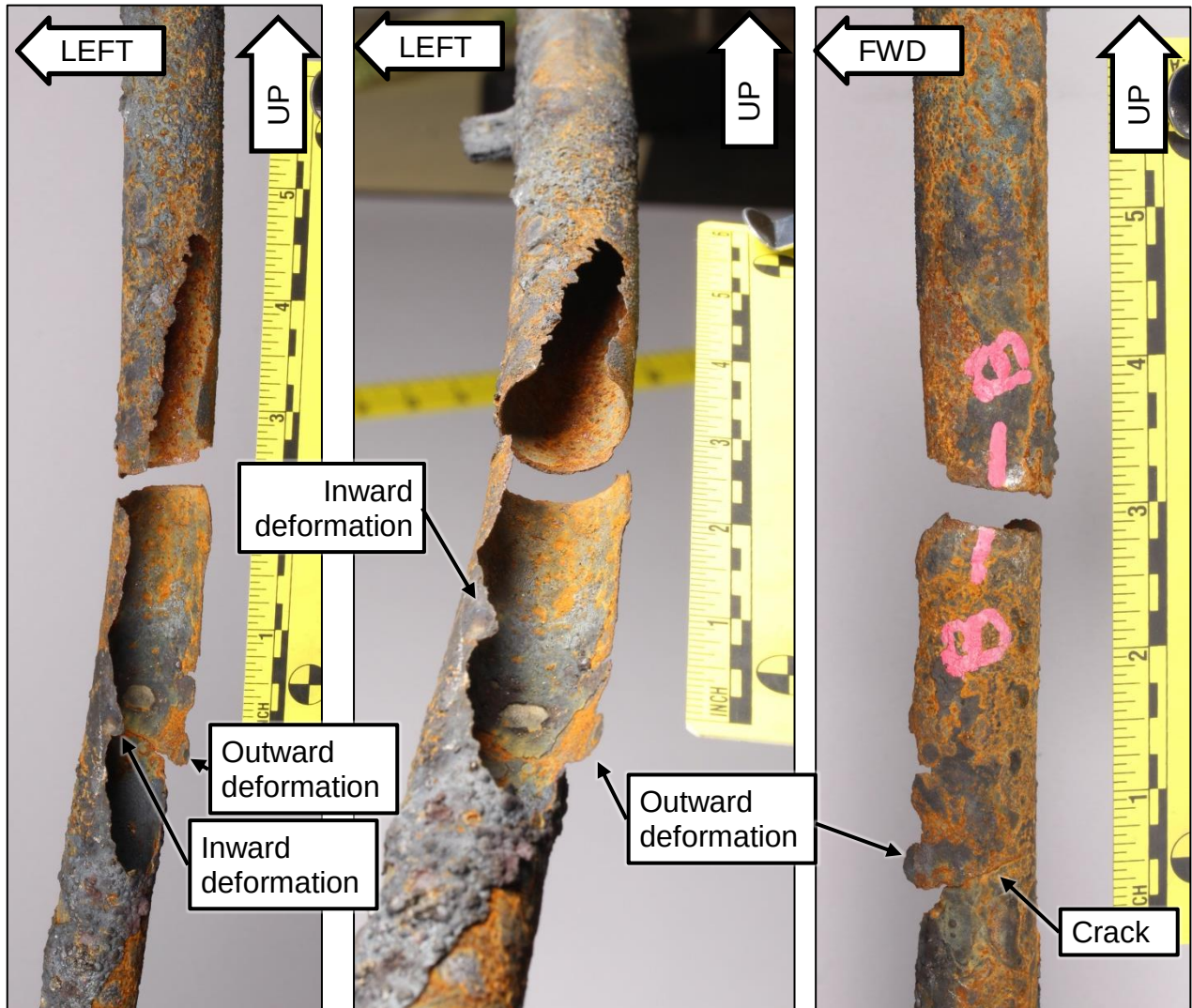


Figure 4. Views of fracture B looking forward (left image), upward and forward (middle image), and right (right image).

Figure 5. Tube piece inboard of fracture A with a close view of the location of the bend.





Figure 6. Overall image of the rudder cable as-received.