

NATIONAL TRANSPORTATION SAFETY BOARD

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



September 5, 2017

MATERIALS LABORATORY FACTUAL REPORT

Report No. 17-059

A. ACCIDENT INFORMATION

Place : Fresno, California
Date : December 26, 2016
Vehicle : Petrus Express S90, N176PA
NTSB No. : WPR17FA041
Investigator : Michael Huhn, AS-ERA

B. COMPONENTS EXAMINED

Portions of the left and right wings that contained portions of their respective aileron assemblies.

C. DETAILS OF THE EXAMINATION

Figures 1 through 5 show photographs of the as-received portions of the left and right wings with portions of their respective aileron assemblies. The wing portions were saw cut from the airplane to facilitate shipping and handling. Each wing contained an aileron assembly and, in turn, each aileron assembly contained two counterweight assemblies. An arm extended forward of an aileron assembly. A lead counterweight is attached to each side of the arm (referred as inboard and outboard counterweight). For each wing, two through-rods (referred as the forward and aft through-rods) extend through an arm and the counterweight assemblies. The ends of the through-rods were threaded. Arrows in figures 4 and 5 indicate the ends of the through-rods. The outboard end of each threaded through-rod was attached to an attachment nut. The inboard end of each threaded through-rod was attached to a nut plate.

Visual examination of the counterweight assemblies for the left wing revealed the aft through-rod fractured at the outboard end of the inboard counterweight, in the area indicated by arrow "X" in figures 1, 2, and 5. The attachment nut was disassembled from the outboard end of each through rod. Figures 6 and 7 show a photographs of the disassembled through-rods. The bore for each threaded through-rod contained a sleeve (see figure 8). The entire length of each through-rod was threaded.

A 0.2 inch length portion of the through rod that incorporated the outboard fracture face was saw cut. The outer diameter of the threaded through rods measured approximately 0.18 inch, and the inside diameter of the sleeve measured approximately 0.2 inch, as measured with a caliper. All the through-rods were ultrasonic cleaned with Alconox, a commercial detergent. Scanning electron microscope examination of the

through-rod fracture face revealed micro-void coalescence features typical of ductile overstress separation in steel alloys with no evidence of fatigue cracking.

A magnet was used to determine whether the through-rods and sleeves were made from a ferrous alloy. The magnet was attracted to the disassembled through-rods indicating they were made from a ferrous alloy. The magnet was placed next to the edges of the counterweights in the areas of the sleeve, after the through-rod were removed from the sleeves. The magnet was not attracted to the sleeves or the counterweight assemblies, indicating that the sleeves were non-ferrous. The arm for the aileron assembly was attracted to a magnet, indicating the arm was made from a ferrous alloy. Examination of the exposed end of the arm revealed the arm was made from square steel bar stock. The distance between the outer walls of the square bar stock measured approximately 0.5 inch, and the wall thickness measured approximately 0.7 inch.

Frank Zakar
Senior Metallurgist

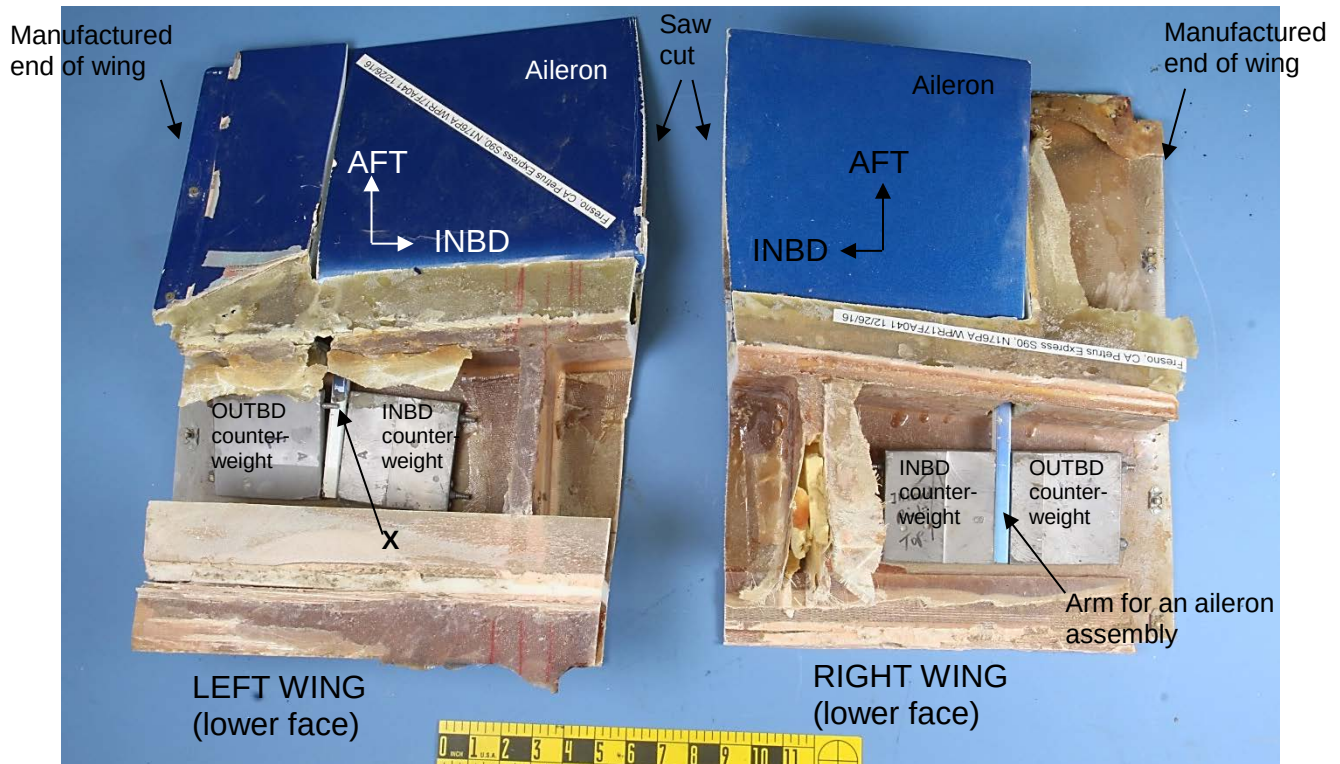


Figure 1. Overall view of the as-received portions of the left and right wings showing the lower faces of the ailerons and exposed counterweights assemblies. The aft through-bolt for the counterweight assembly on the left wing fractured in the area indicated by arrow "X". The lower face of the inboard counterweight assembly for the right wing was incorrectly labeled as "Top".

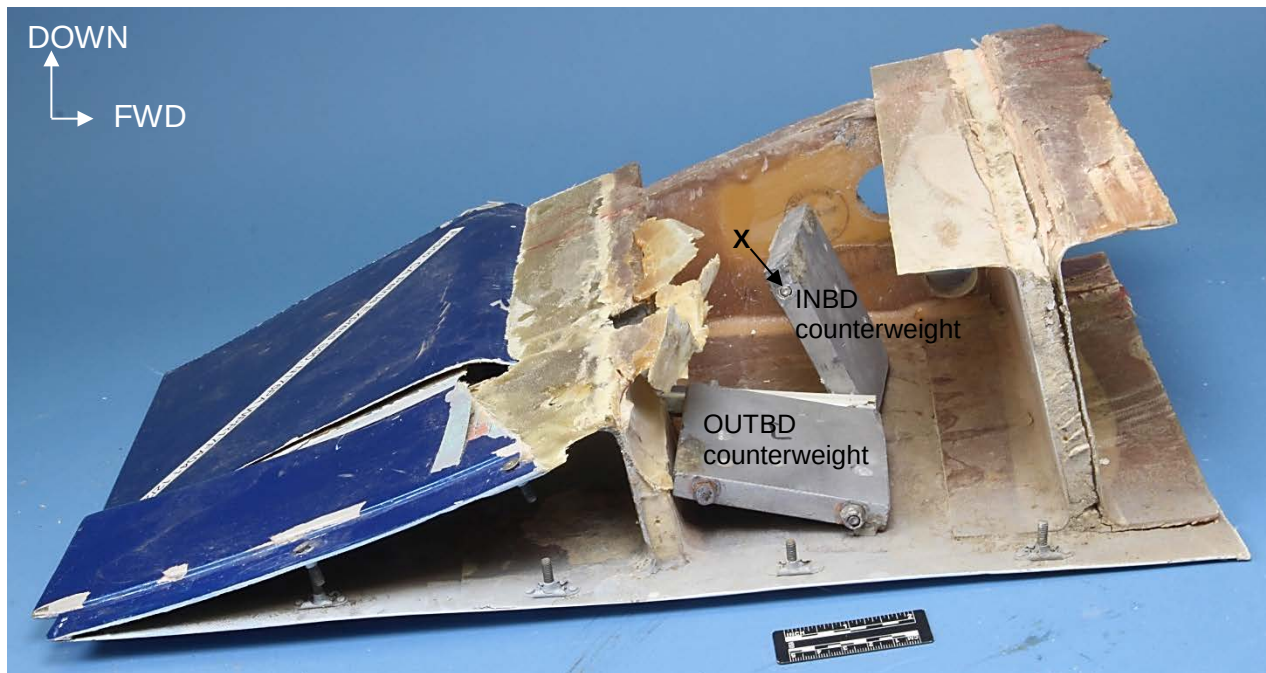


Figure 2. View of the outboard end of the left wing portion showing the exposed counterweight assemblies. The aft through-bolt for the counterweight assembly on the left wing fractured in the area indicated by arrow "X".

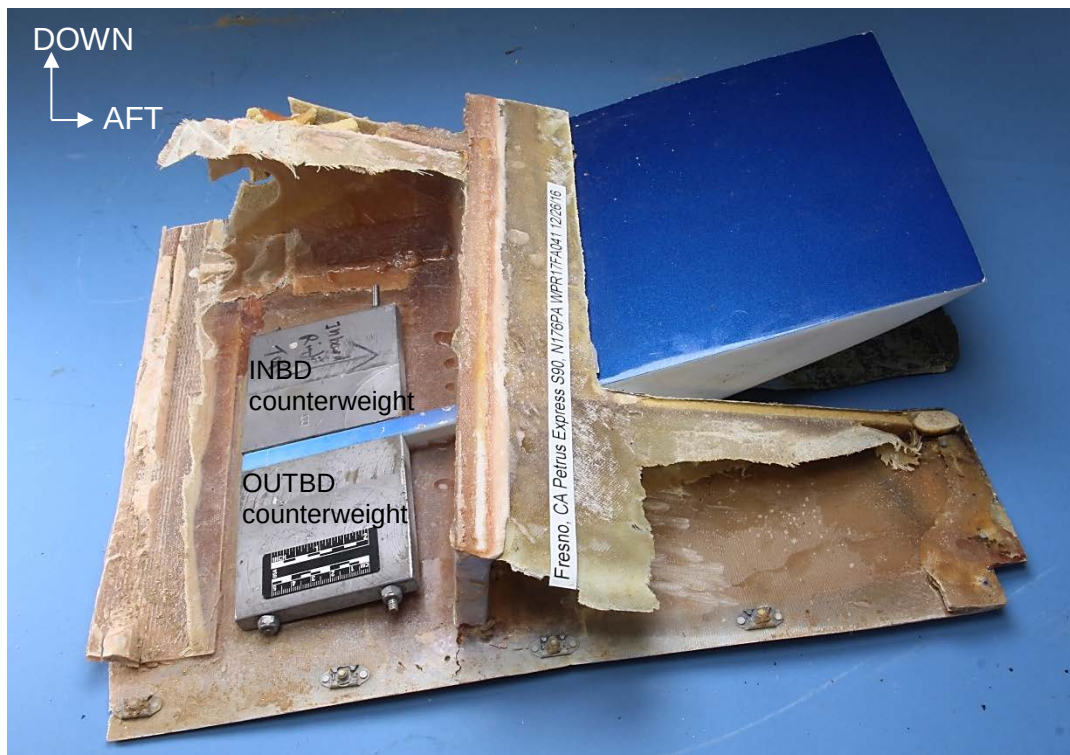


Figure 3. View of the outboard end of the right wing portion showing the exposed counterweight assemblies.

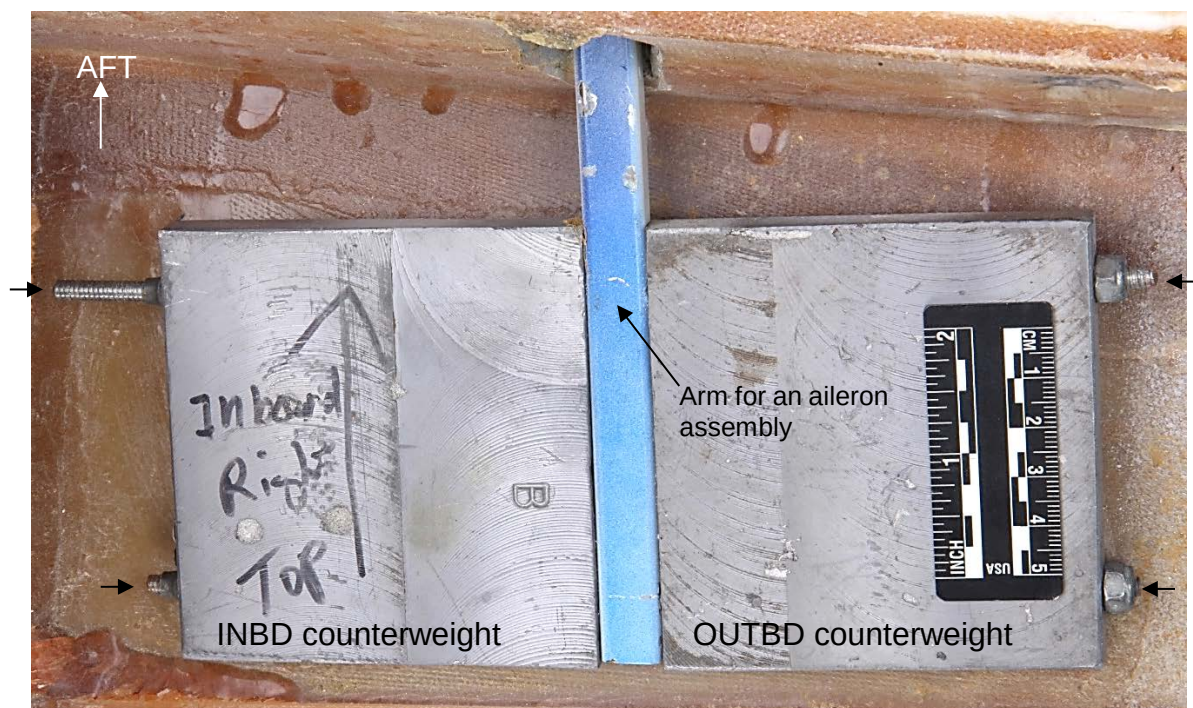


Figure 4. Close-up view of the counterweights from the right wing showing the lower faces. The ends of the two through-bolts are indicated by arrows. The lower face of the inboard counterweight assembly was incorrectly ink marked as “Top”.

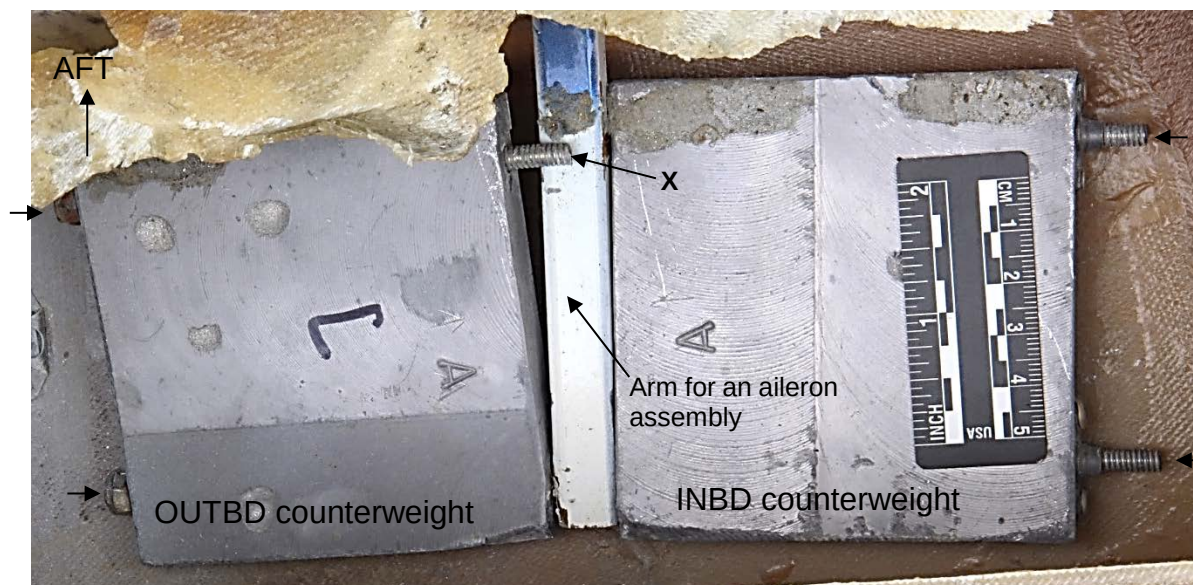


Figure 5. Close-up view of the counterweights from the left wing showing the lower faces. The ends of the two through-bolts are indicated by arrows. The aft through-bolt fractured at the outboard end of the inboard counterweight.

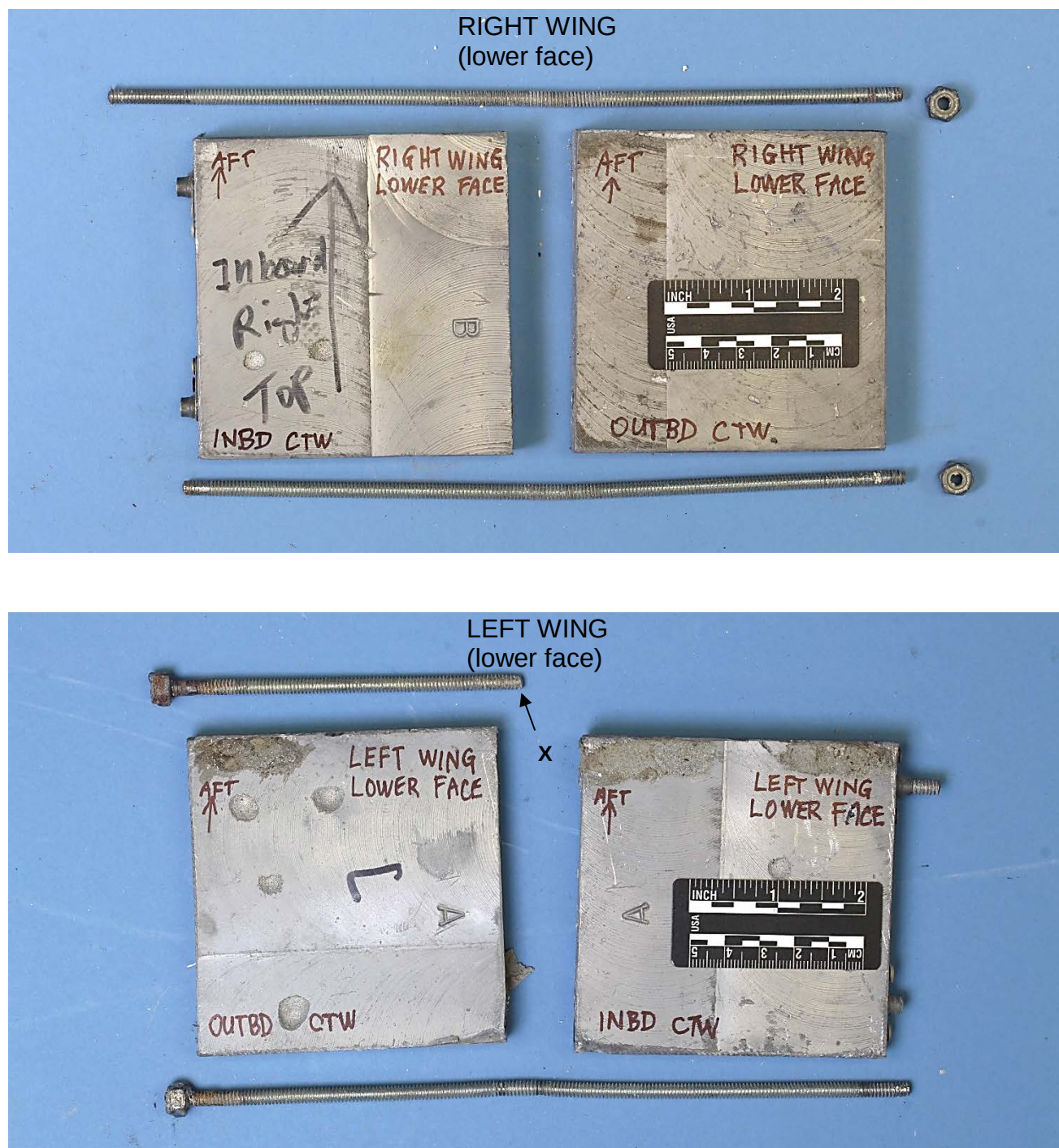


Figure 6. Photographs of the disassembled counterweights from the right and left wings showing the lower faces. The aft through-bolt for the right wing fractured at the outboard end of the inboard counterweight, indicated by arrow "X".

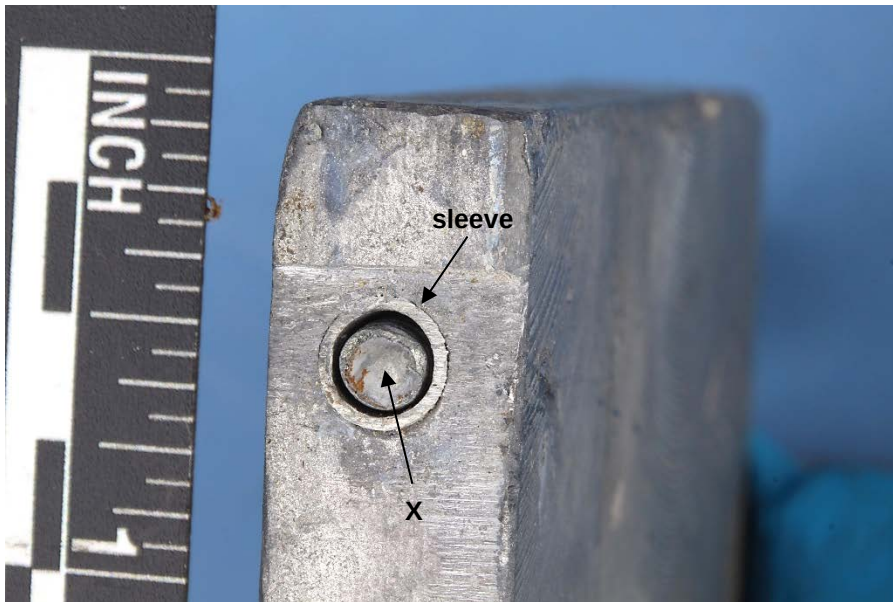


Figure 7. View of a portion of a counterweight showing one of the through-holes and the exposed end of the fractured through-bolt, indicated by arrow "X". The through-hole contained a sleeve.