

NATIONAL TRANSPORTATION SAFETY BOARD

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



October 07, 2020

MATERIALS LABORATORY FACTUAL REPORT

Report No. 20-040

A. ACCIDENT INFORMATION

Place : Victorville, California
Date : 5/20/2020
Vehicle : Boeing 737-8Q8 N820TJ
NTSB No. : DCA20LA107
Investigator : Clinton Crookshanks, AS-40

B. COMPONENTS EXAMINED

1. Bolts, NAS6705-09, two submitted
2. Bolts, NAS6705-12, four submitted
3. Washers for NAS6705 bolts, eleven submitted
4. Various structure fragments, ten pieces submitted

C. DETAILS OF THE EXAMINATION

The as-received bolts, washers, and structural pieces are shown in Figures 1 and 2. In Figure 2, Boeing part numbers and names are indicated for the structural pieces. The bolts and structural pieces were documented. The washers were not examined.

NAS6750 Bolts

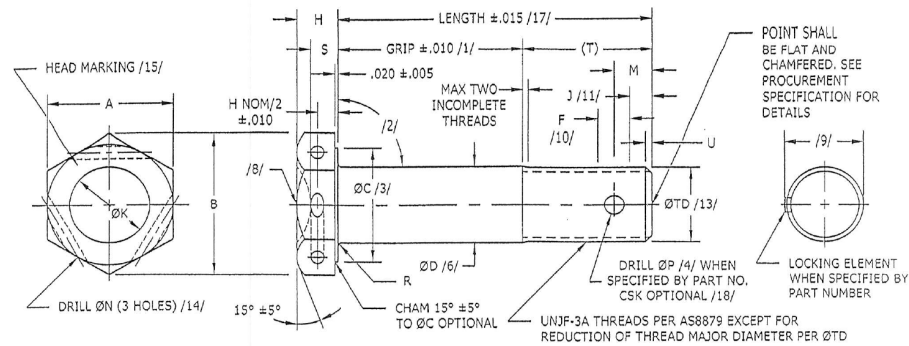
Closer views of the four NAS6705-12 bolts in the as-received and cleaned condition are shown in Figures 3-7. The bolts were arbitrarily numbered 1 through 4 for identification purposes. Bolts 1-3 were visibly bent to the unaided eye. Residual sealant was observed on the tops and hex flats of the bolt heads. The anti-seize compound in the as-received threads was dry and flakey. The bulk of the compound was removed using a wooden toothpick, the threads were subsequently cleaned using acetone and ultrasonic agitation. Higher magnification images of the threads are shown in Figures 5-7. In general, the threads were in serviceable condition, with a thread on bolt 3 exhibiting damage as indicated in Figure 7.

Closer views of the four NAS6705-9 bolts in the as-received and cleaned condition are shown in Figures 8-10. The bolts were arbitrarily numbered 1 and 2 for identification purposes. Residual sealant was observed on the tops and flats of the bolt heads. The anti-seize compound in the as-received threads was dry and flakey. The bulk of the compound was removed using a wooden toothpick, the threads were subsequently cleaned using acetone and ultrasonic agitation. Higher magnification images of the

threads are shown in Figure 10. In general, the threads were in serviceable condition, with no notable issues.

Using x-ray fluorescence, the coating on the bolts is aluminum and the bolt is fabricated from alloy type A286. Confirmation of key bolt dimensions is shown in Table 1.

Table 1 Key Bolt Dimensions



Bolt	Head ID	Coating/ bolt	H NAS*	H measured	Length NAS*	Length measured	Grip NAS*	Grip measured	ØD NAS*	ØD measured
1	NAS6705-12	Al/A286	0.156-0.171	0.164	1.204-1.234	1.228	0.740-0.760	0.743	0.311-0.312	0.310
2	NAS6705-12	Al/A286	0.156-0.171	0.164	1.204-1.234	1.227	0.740-0.760	0.751	0.311-0.312	0.310
3	NAS6705-12	Al/A286	0.156-0.171	0.163	1.204-1.234	1.227	0.740-0.760	0.746	0.311-0.312	0.310
4	NAS6705-12	Al/A286	0.156-0.171	0.163	1.204-1.234	1.224	0.740-0.760	0.748	0.311-0.312	0.310
1	NAS6705-9	Al/A286	0.156-0.171	0.171	1.016-1.046	1.030	0.552-0.572	0.552	0.311-0.312	0.311
2	NAS6705-9	Al/A286	0.156-0.171	0.170	1.016-1.046	1.019	0.552-0.572	0.558	0.311-0.312	0.311

*National Aerospace Standard. All dimensions are in inches, measurements are approximate.

Structure Fragments

Detailed images of the structural fragments are shown in figures 11 through 19. Descriptions of notable damage details will be identified through annotations in the images and the figure captions.

Michael Budinski
Chief, Materials Laboratory Division



Figure 1 Image of the as-received bolts and washers. The bolts were not marked or identified relative to their installation locations.



Figure 2 Image of the as-received structural pieces. Where known, Boeing part numbers are indicated.



Figure 3 The NAS6705-12 bolts, as-received. The bolts were arbitrarily numbered for identification purposes. View (a) shows the bolt heads with markings. The dark deposits in the center of the heads is residual sealant. View (b) shows the longitudinal view of the bolts. Bolts 1,2, and 3, exhibited pronounced bending deformation. The threads are filled with anti-seize compound.

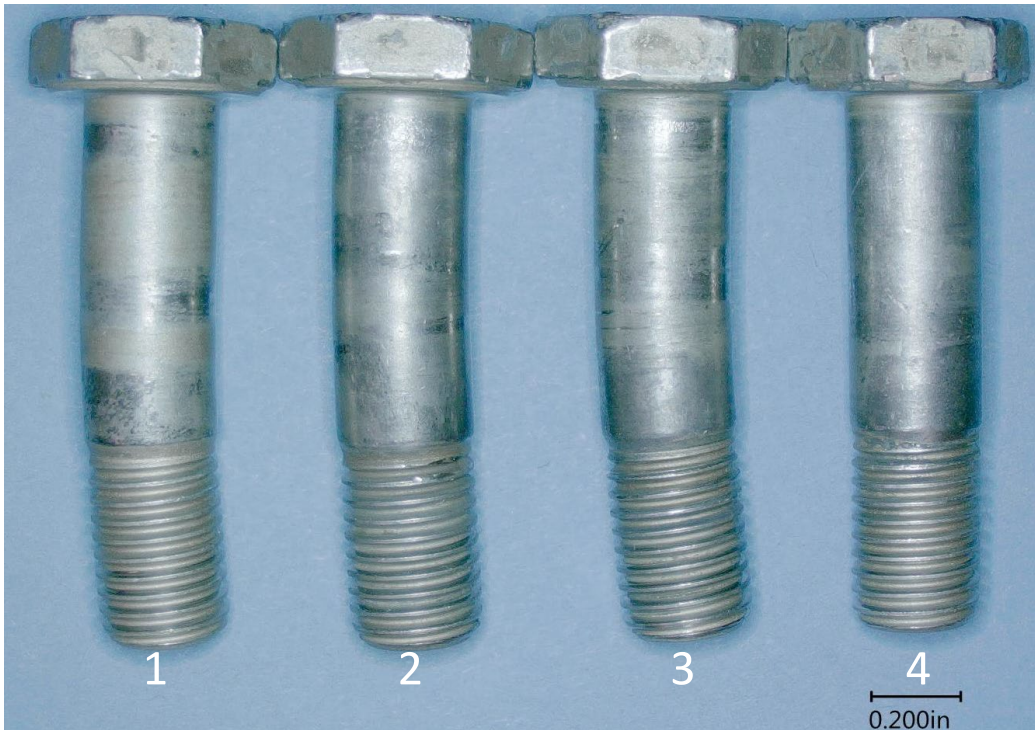


Figure 4 The NAS6705-12 bolts, after ultrasonic cleaning in acetone. Longitudinal view of the bolts. Bolts 1,2, and 3, exhibited pronounced bending deformation. The shanks exhibit isolated, semi-circumferential polishing wear scars.

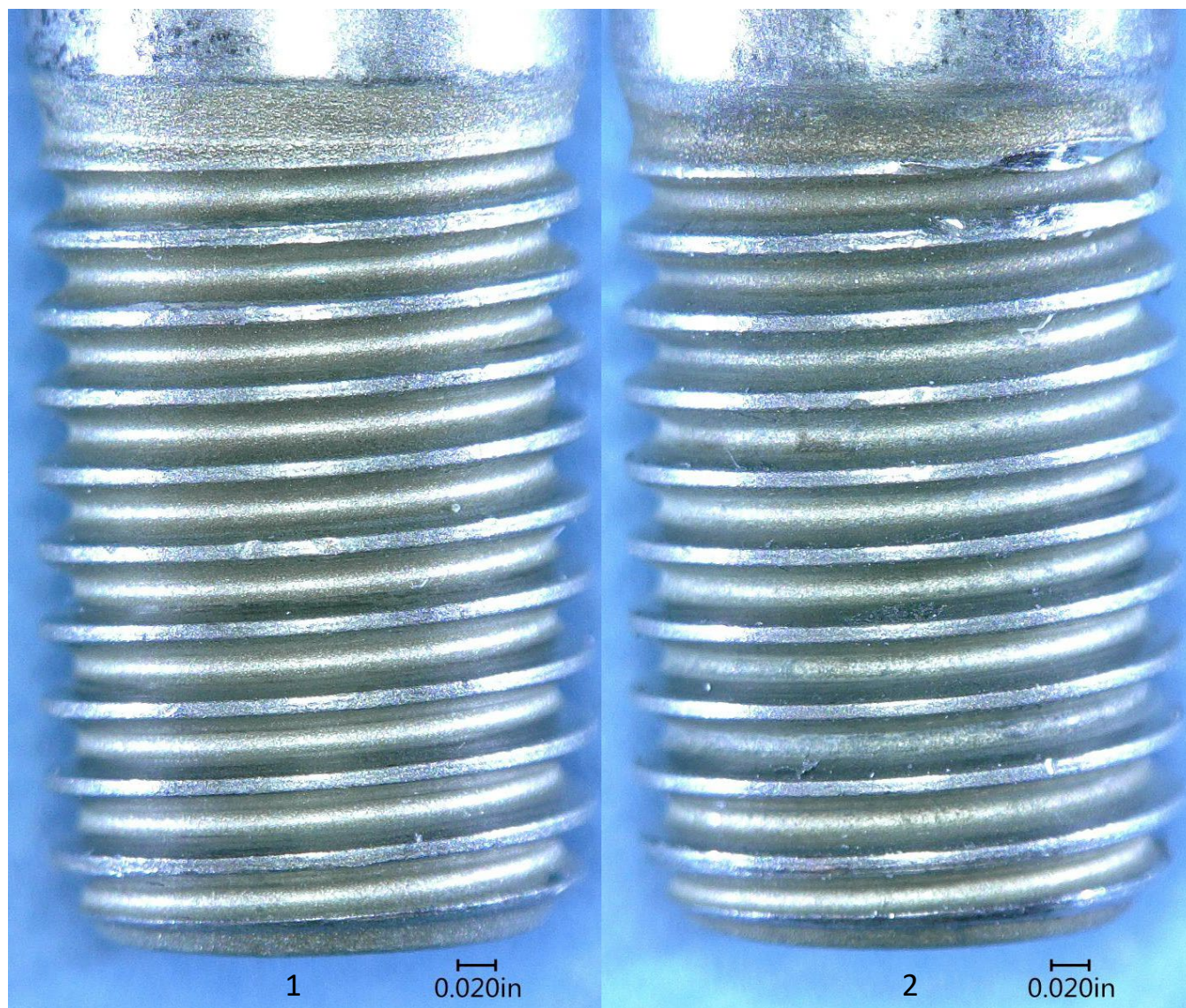


Figure 5 Close view of the threads from NAS6705-12 bolts 1 and 2 shown in Figure 4. Bolt 2 exhibited minor thread tip damage near the start of the grip.

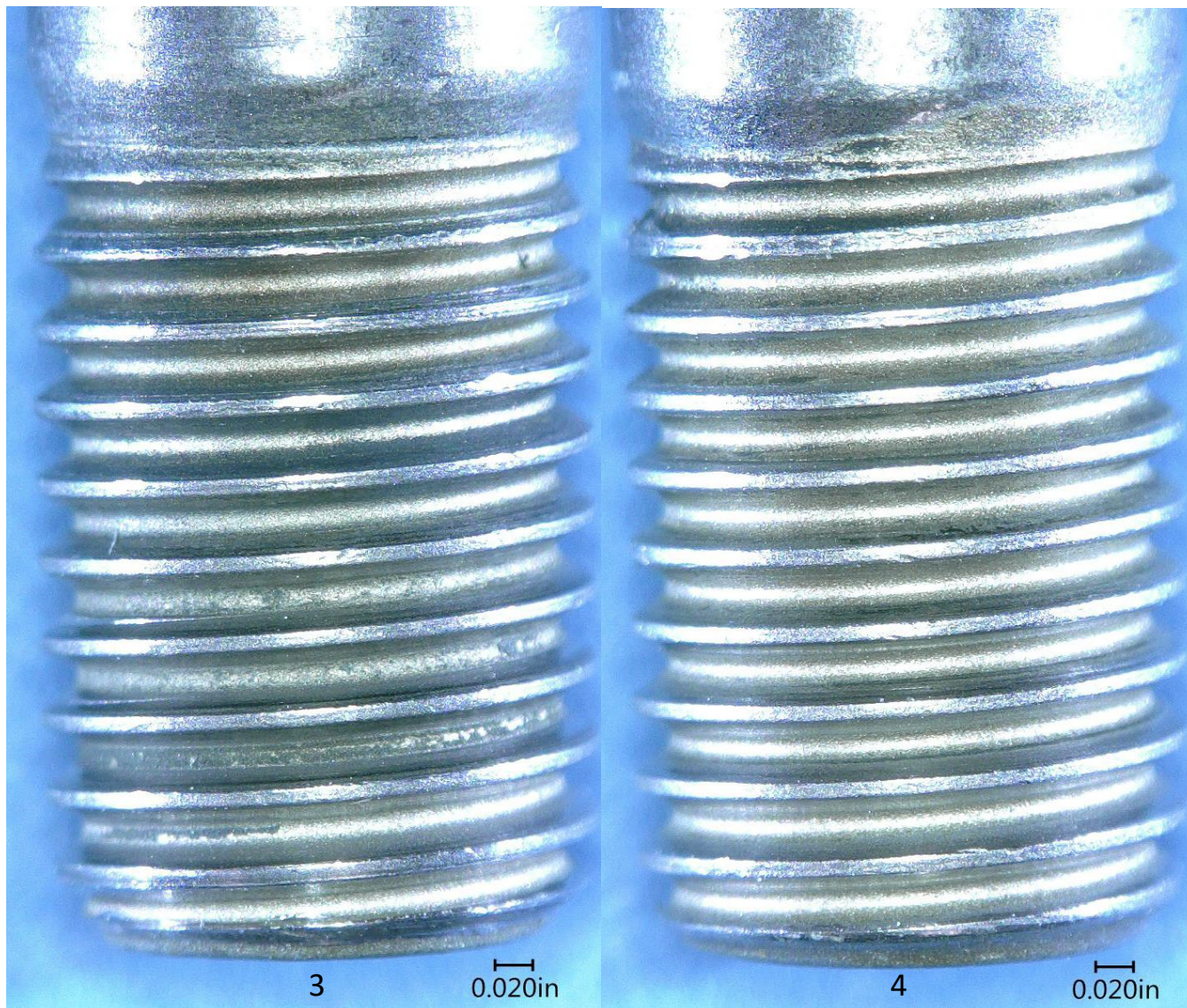


Figure 6 Close view of the threads from NAS6705-12 bolts 3 and 4 shown in Figure 4. Bolt 3 exhibited thread tip damage near the start of the grip as indicated in Figure 7.



Figure 7 Close view of the threads from NAS6705-12 bolt 3 shown in Figure 4. The thread exhibited thread tip damage near the start of the grip (see green arrow).

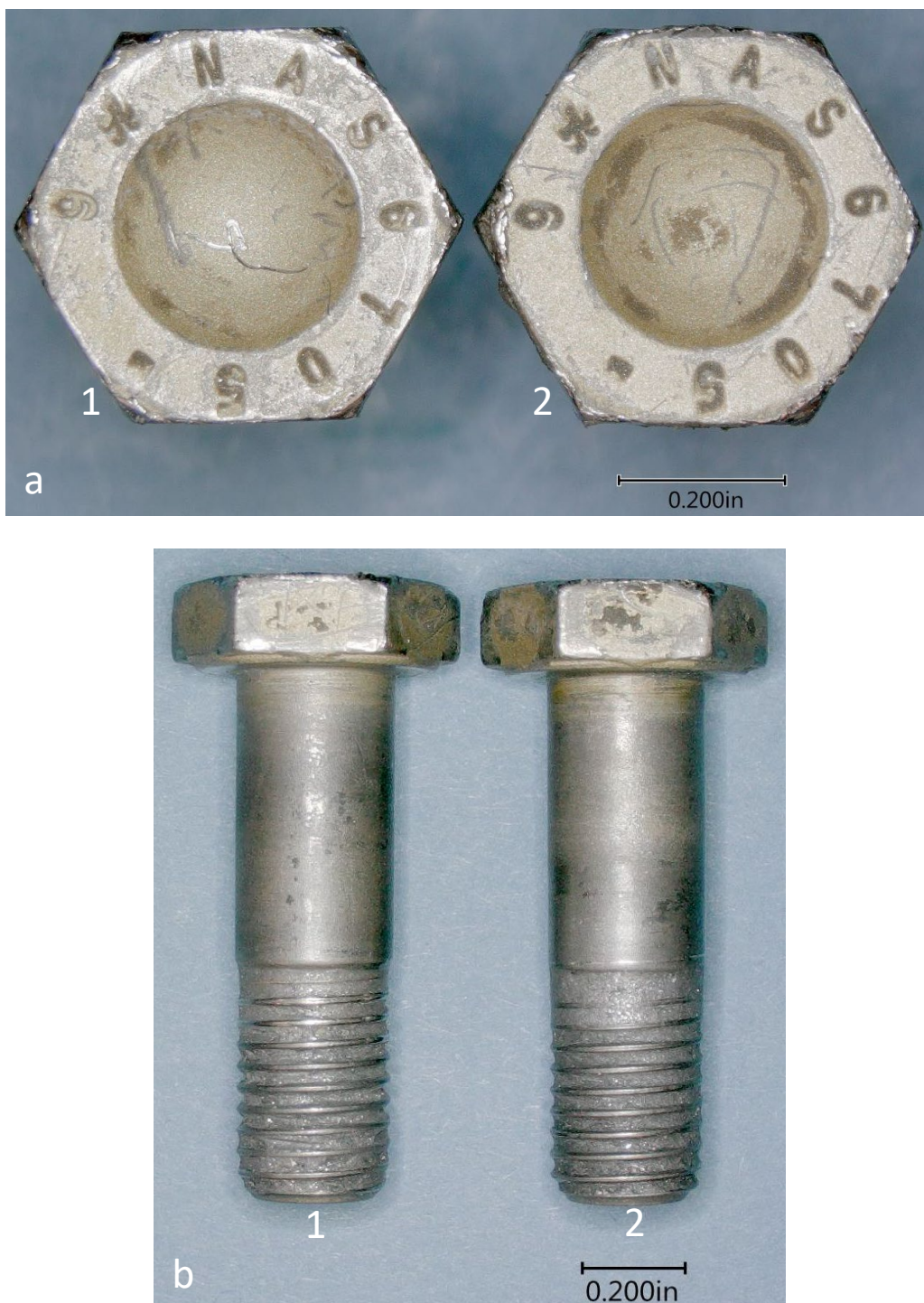


Figure 8 The NAS6705-09 bolts, as-received. The bolts were arbitrarily numbered for identification purposes. View (a) shows the bolt heads with markings. View (b) shows the longitudinal view of the bolts. The threads are filled with anti-seize compound.



Figure 9 The NAS6705-09 bolts, after ultrasonic cleaning in acetone. Longitudinal view of the bolts.

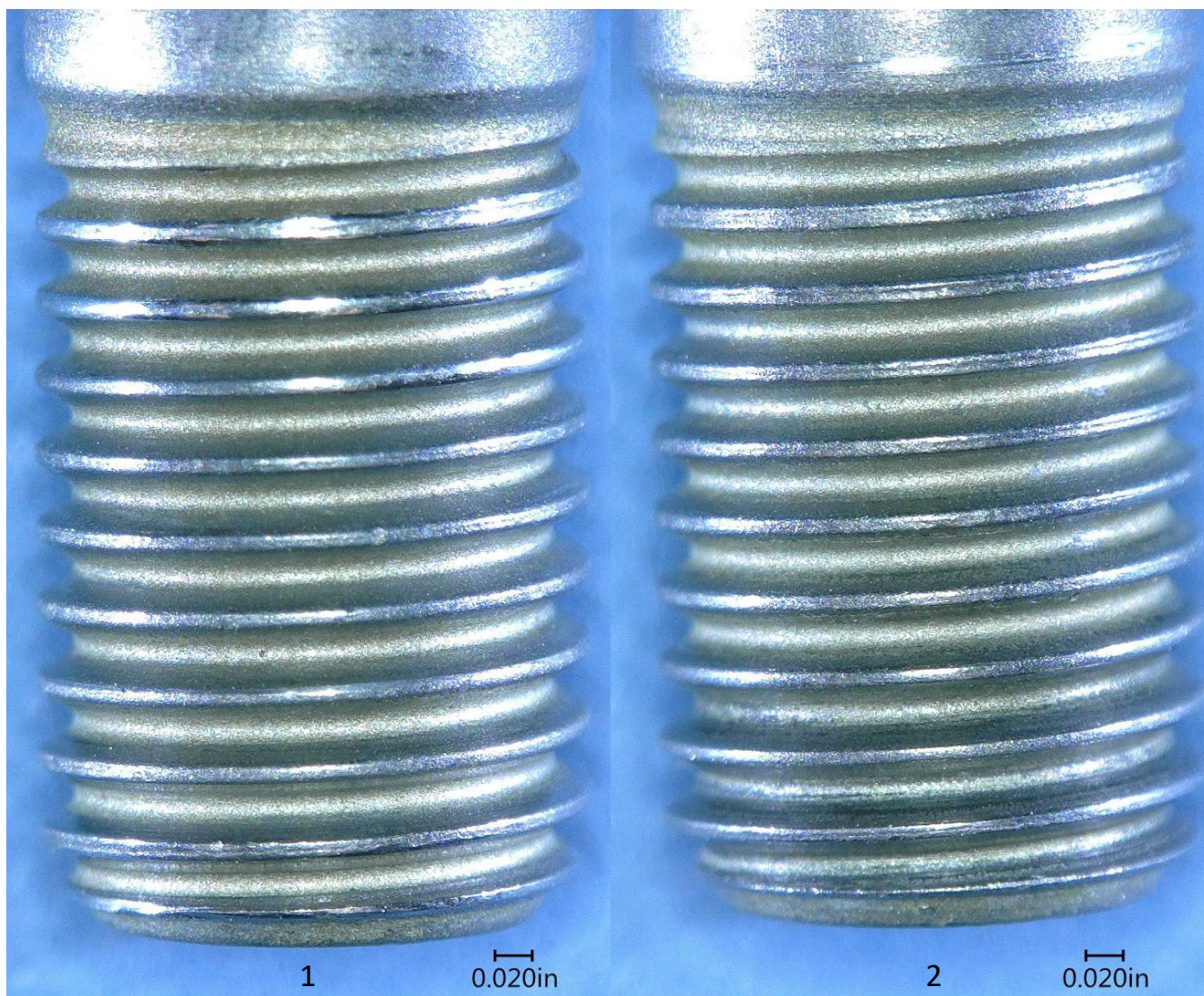


Figure 10 Close view of the threads from NAS6705-09 bolts 1 and 2 shown in Figure 9

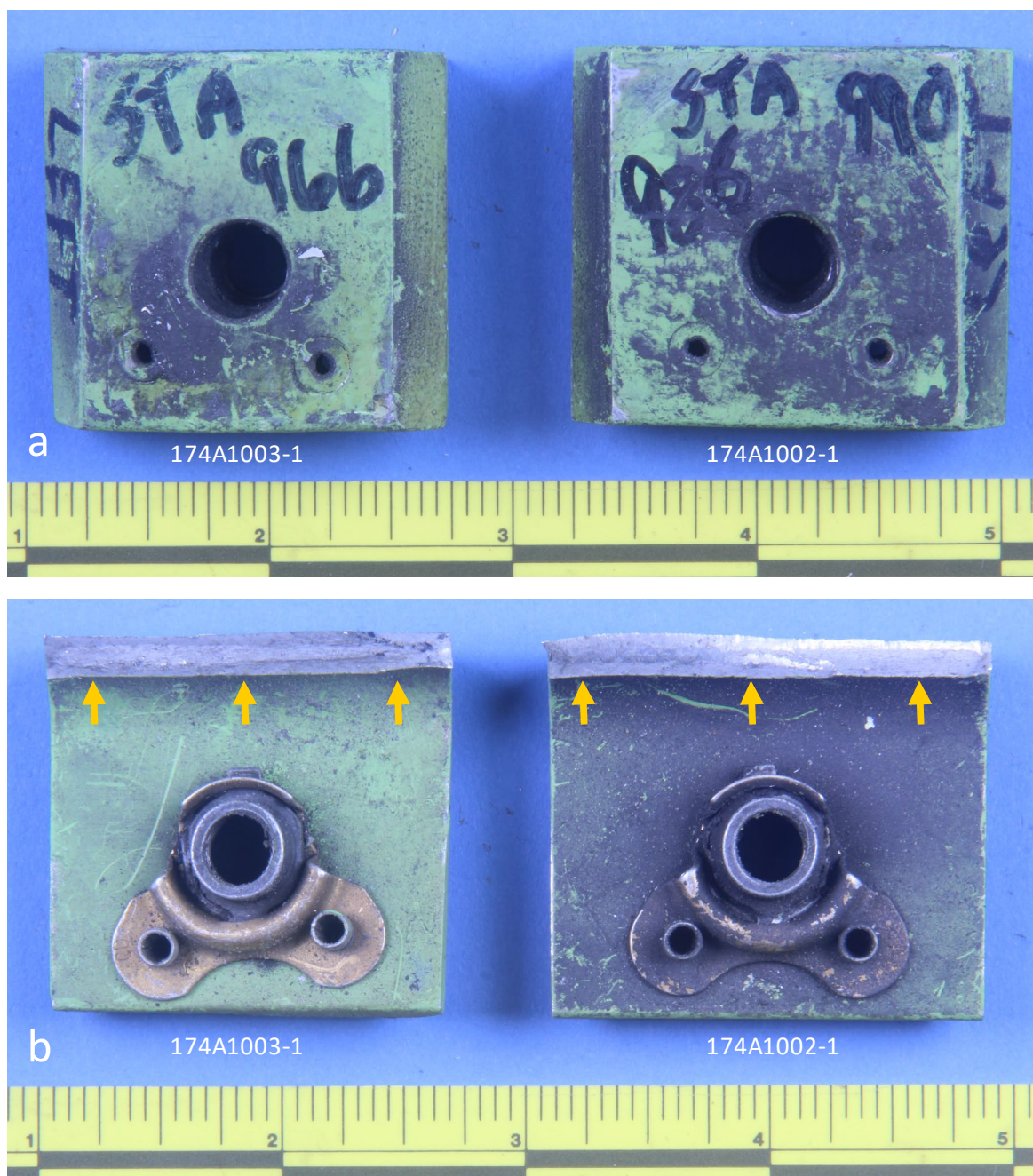


Figure 11 Dorsal fin rib assembly, fuselage attach fitting pieces (174A1003-1, 174A1002-1), station locations identified as marked on the pieces. View (a) is the lower face and view (b) is the upper face. The orange arrows in view (b) indicate general areas of monotonic overstress fracture. The fractures occurred due to combined twisting and bending forces. The nut threads are serviceable, with no indications of stripping.

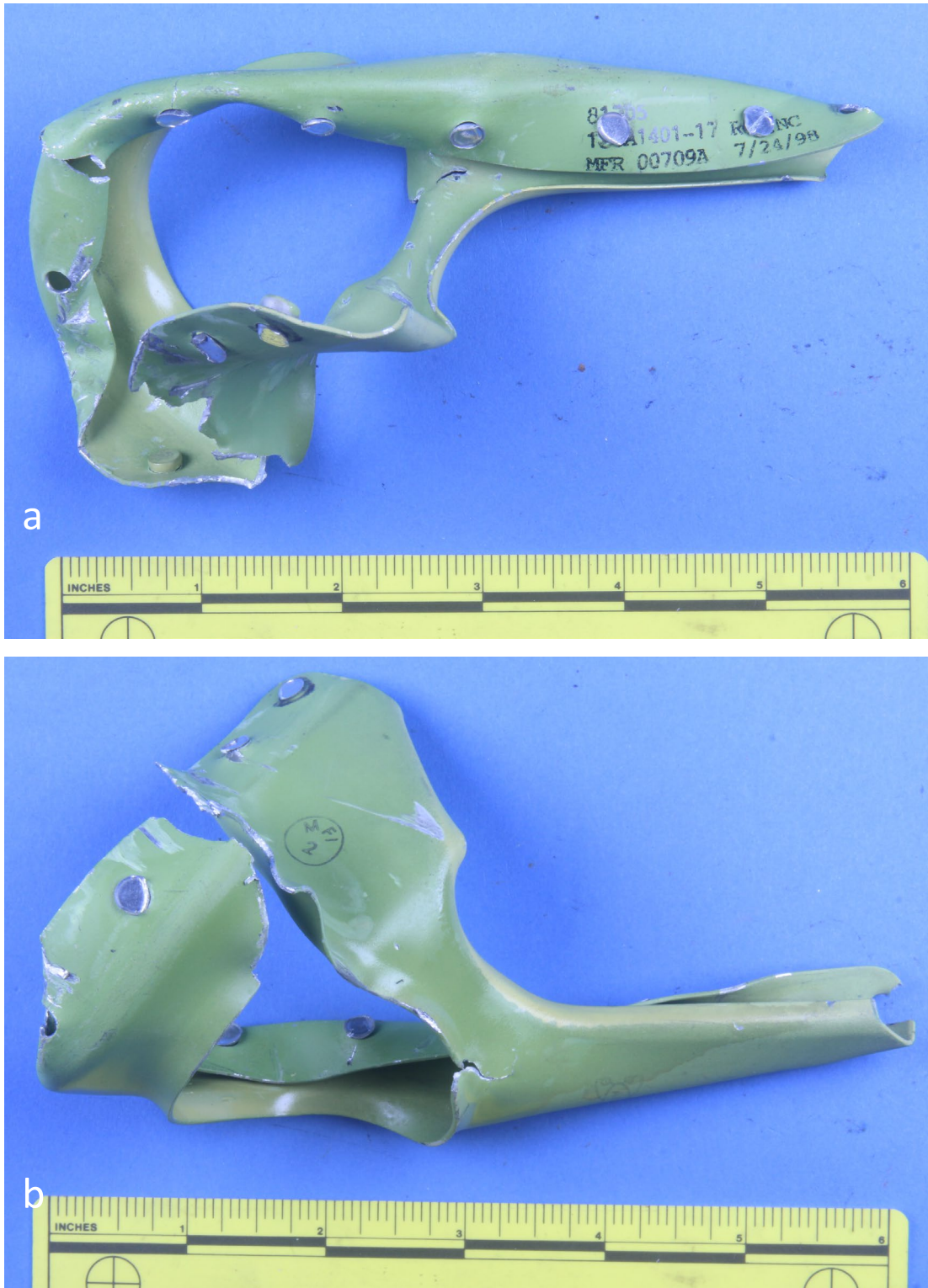


Figure 12 Horizontal stabilizer leading edge rib piece (186A1401-17) exhibiting bending distortion, overstress fractures, and rivet pullout.

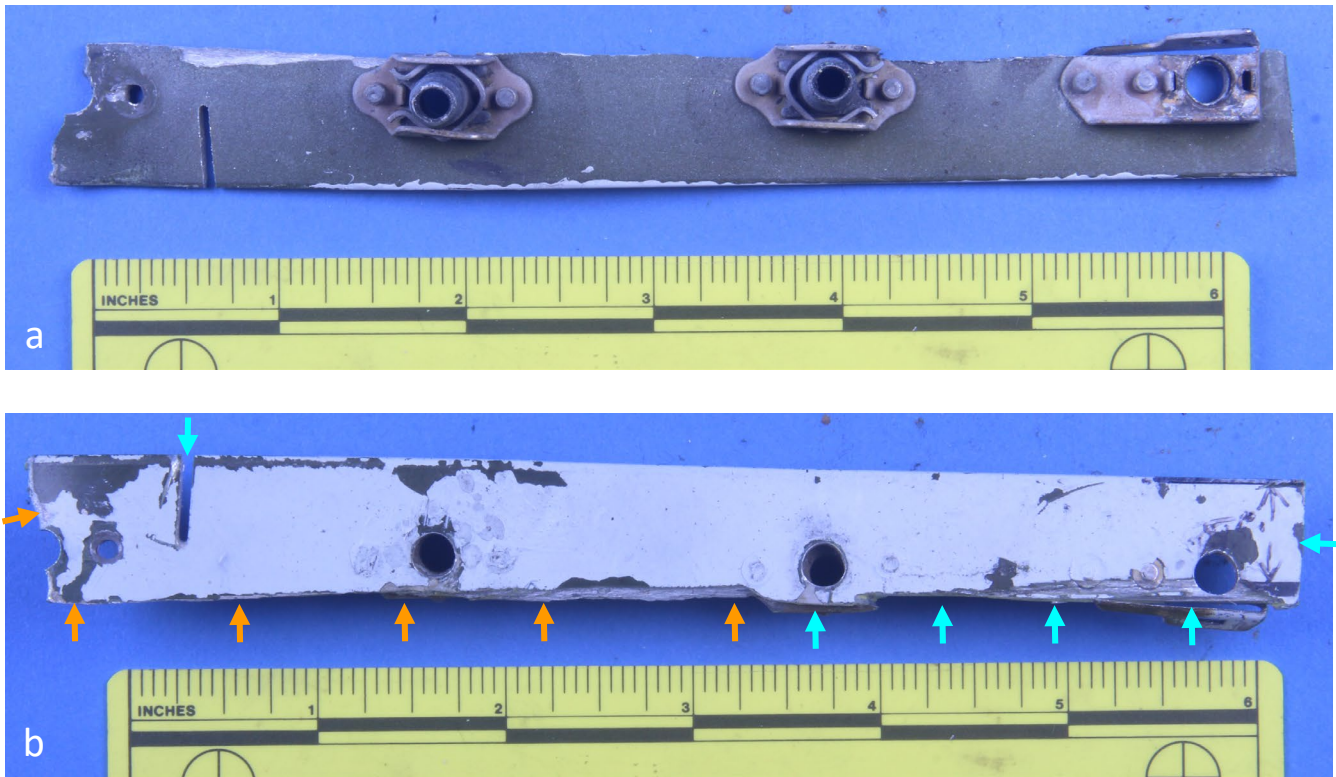


Figure 13 Horizontal stabilizer front spar upper chord flange piece (182A2408-1). The orange arrows in view (b) indicate general areas of monotonic overstress fracture and the blue arrows indicate areas that have been saw-cut. The nut threads are serviceable, with no indications of stripping.

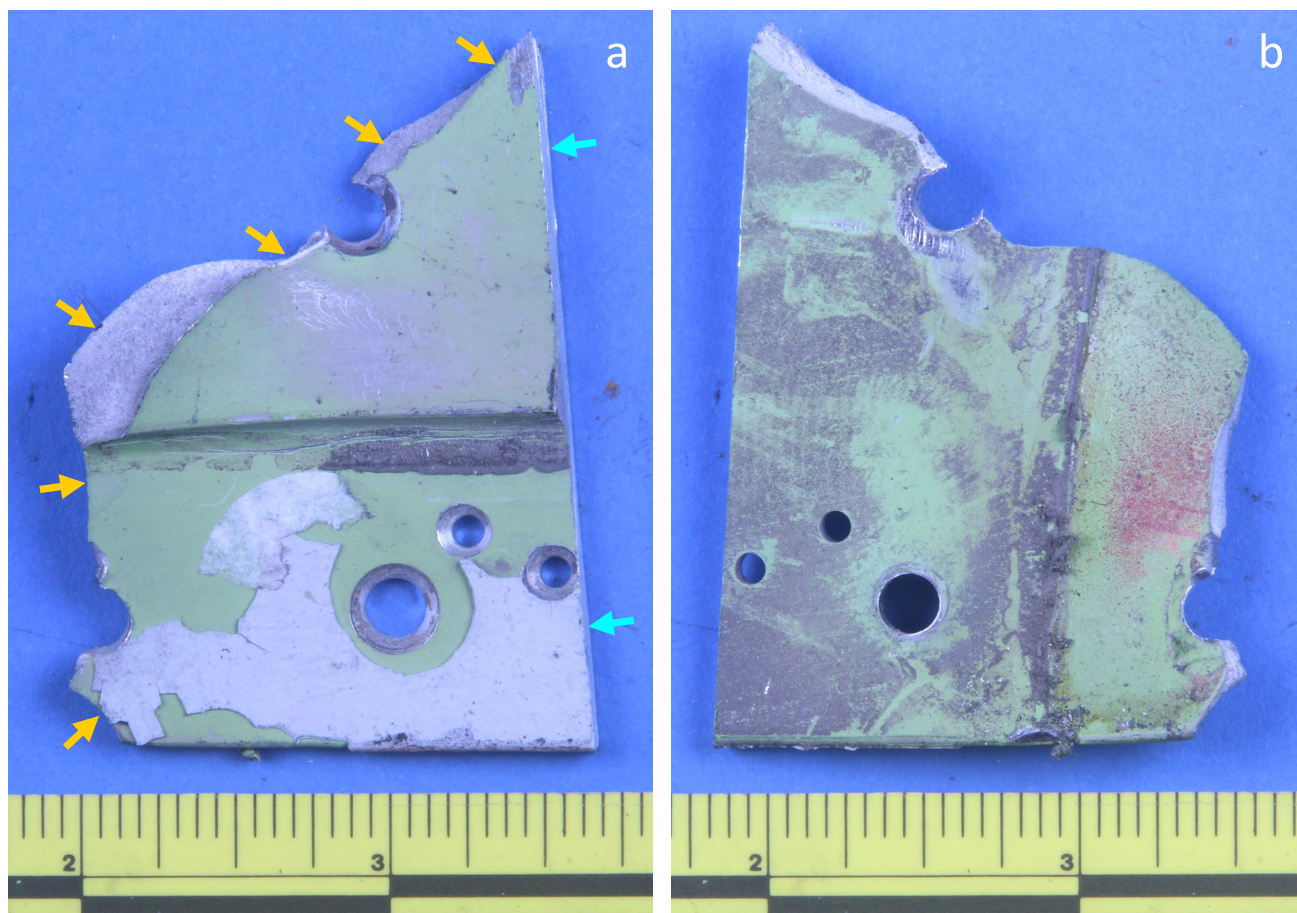


Figure 14 Panel support piece (175A1101-15). The orange arrows in view (a) indicate general areas of monotonic overstress fracture and the blue arrows indicate areas that have been saw-cut.

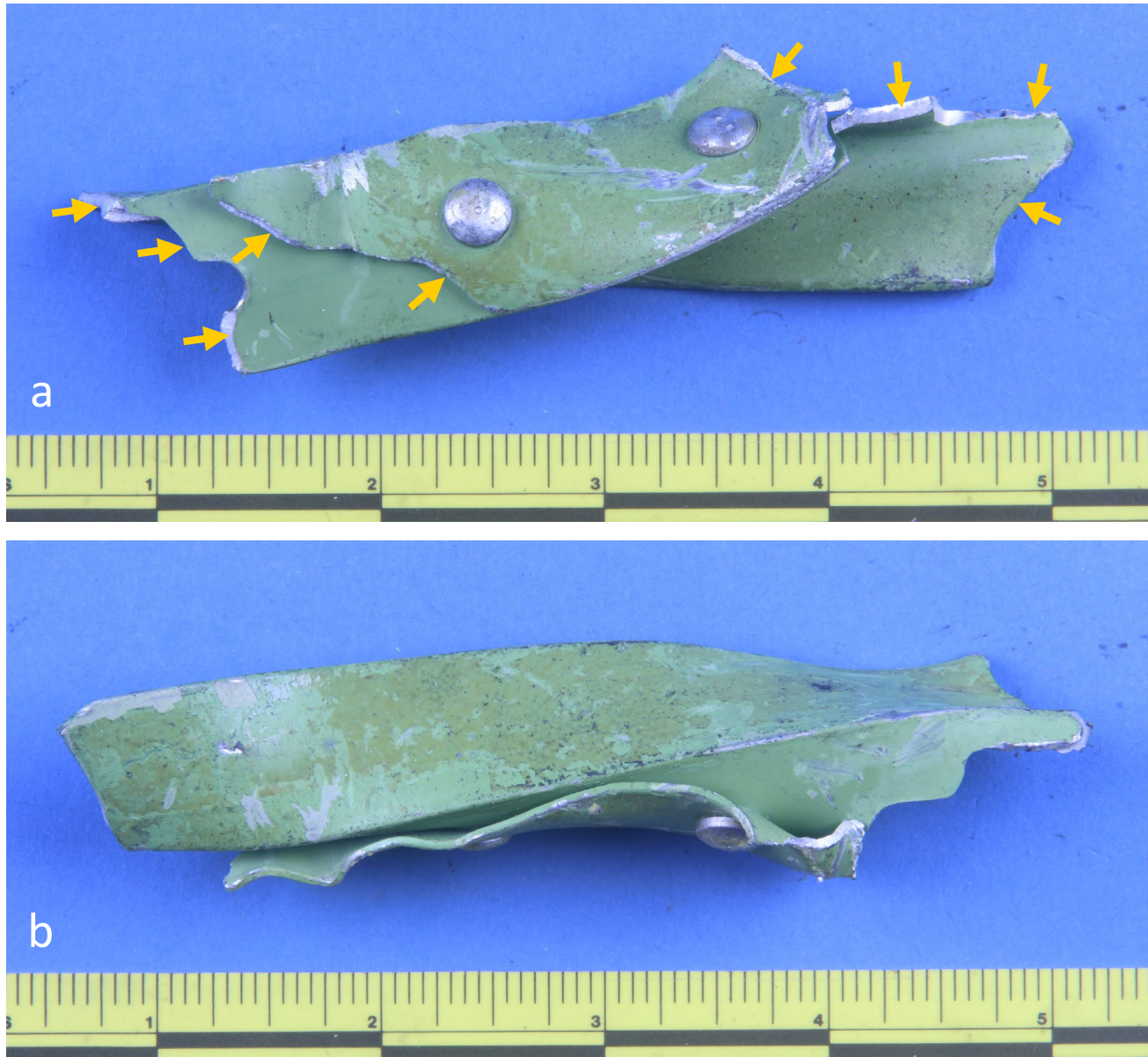


Figure 15 Unknown structural remnant. The orange arrows in view (a) indicate general areas of monotonic overstress fracture.

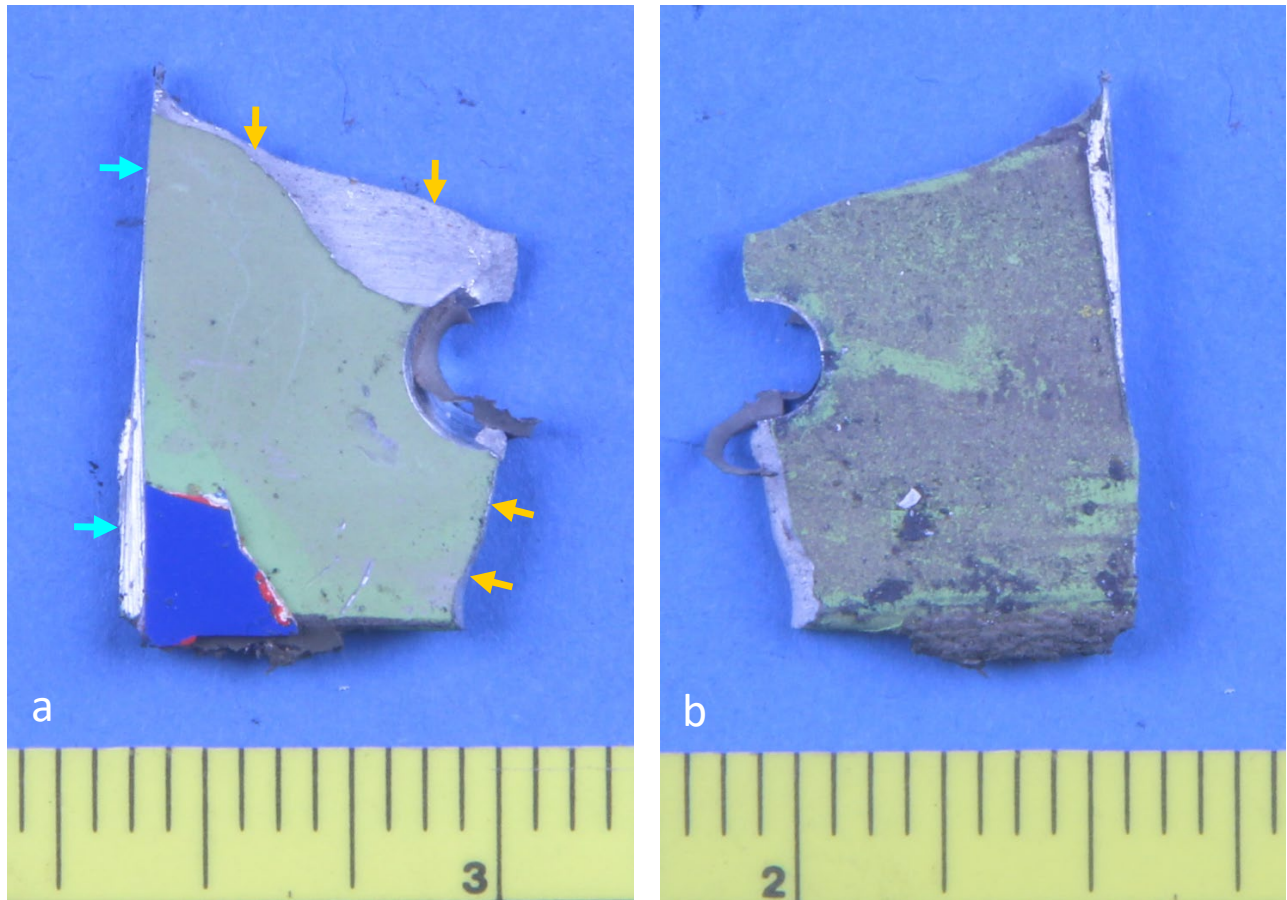


Figure 16 Unknown structural remnant. The orange arrows in view (a) indicate general areas of monotonic overstress fracture and the blue arrows indicate areas that have been saw-cut.

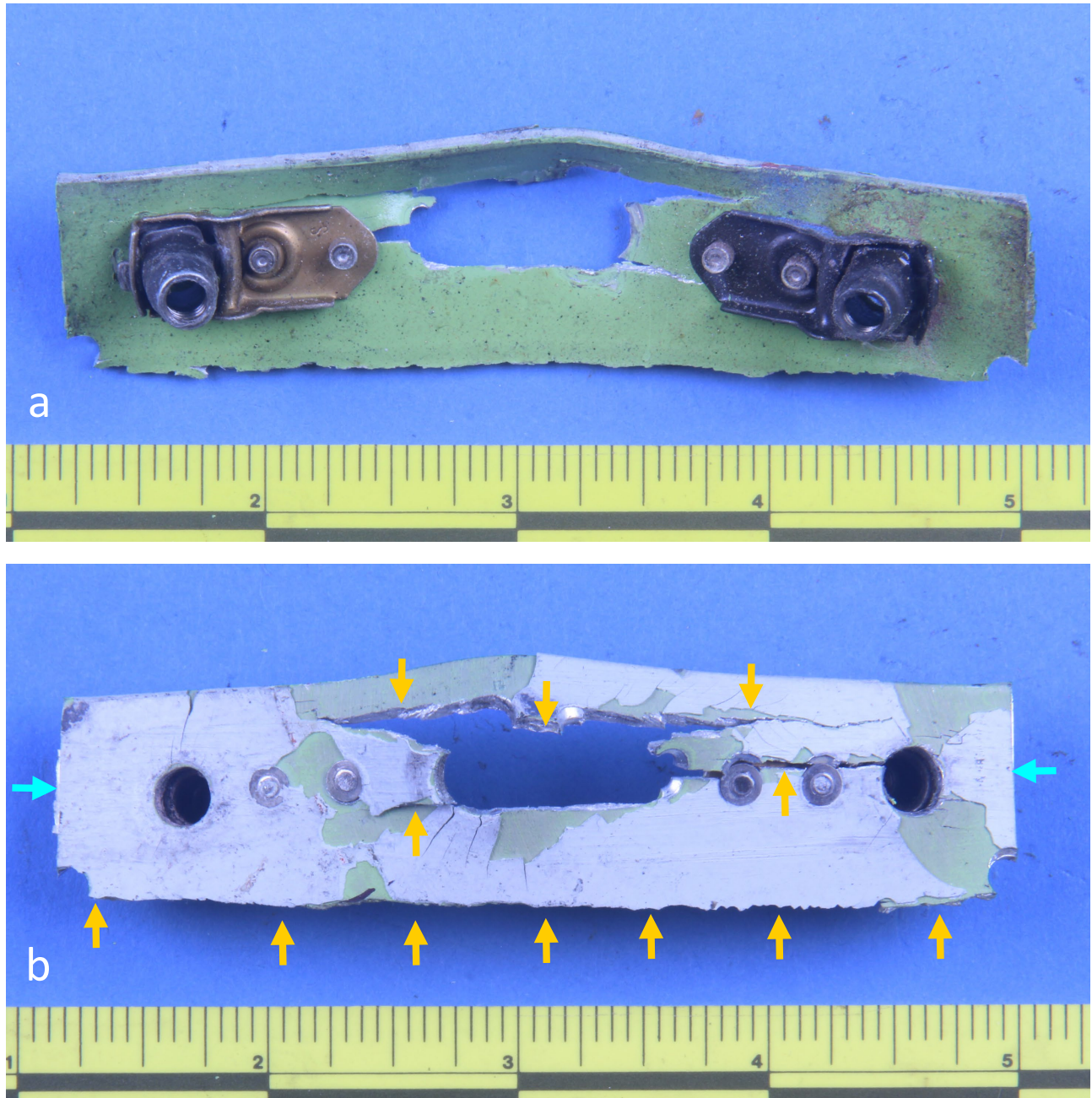


Figure 17 Rib assembly flange piece (175A1201-1). The orange arrows in view (b) indicate general areas of monotonic overstress fracture and the blue arrows indicate areas that have been saw-cut. The nut threads are serviceable, with no indications of stripping.

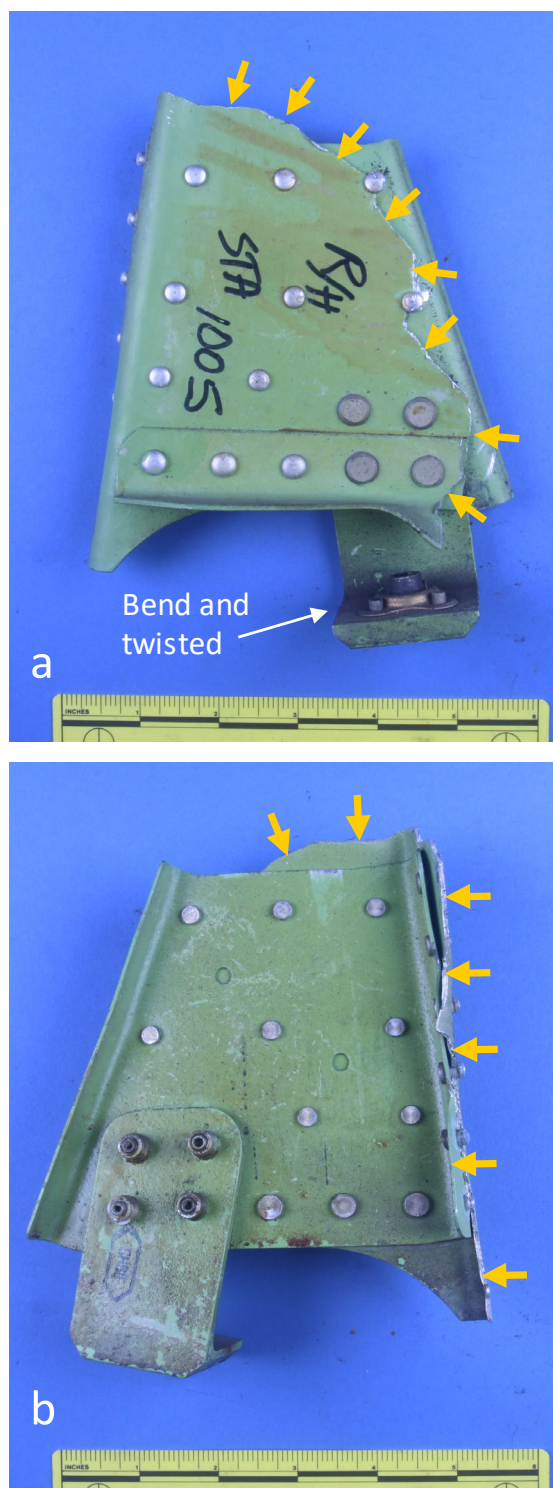


Figure 18 Dorsal fin rib assembly piece with fuselage attach fitting (174A1001-2). The orange arrows in views (a) and (b) indicate general areas of monotonic overstress fracture. The station location is marked on the piece. The nut threads are serviceable, with no indications of stripping.

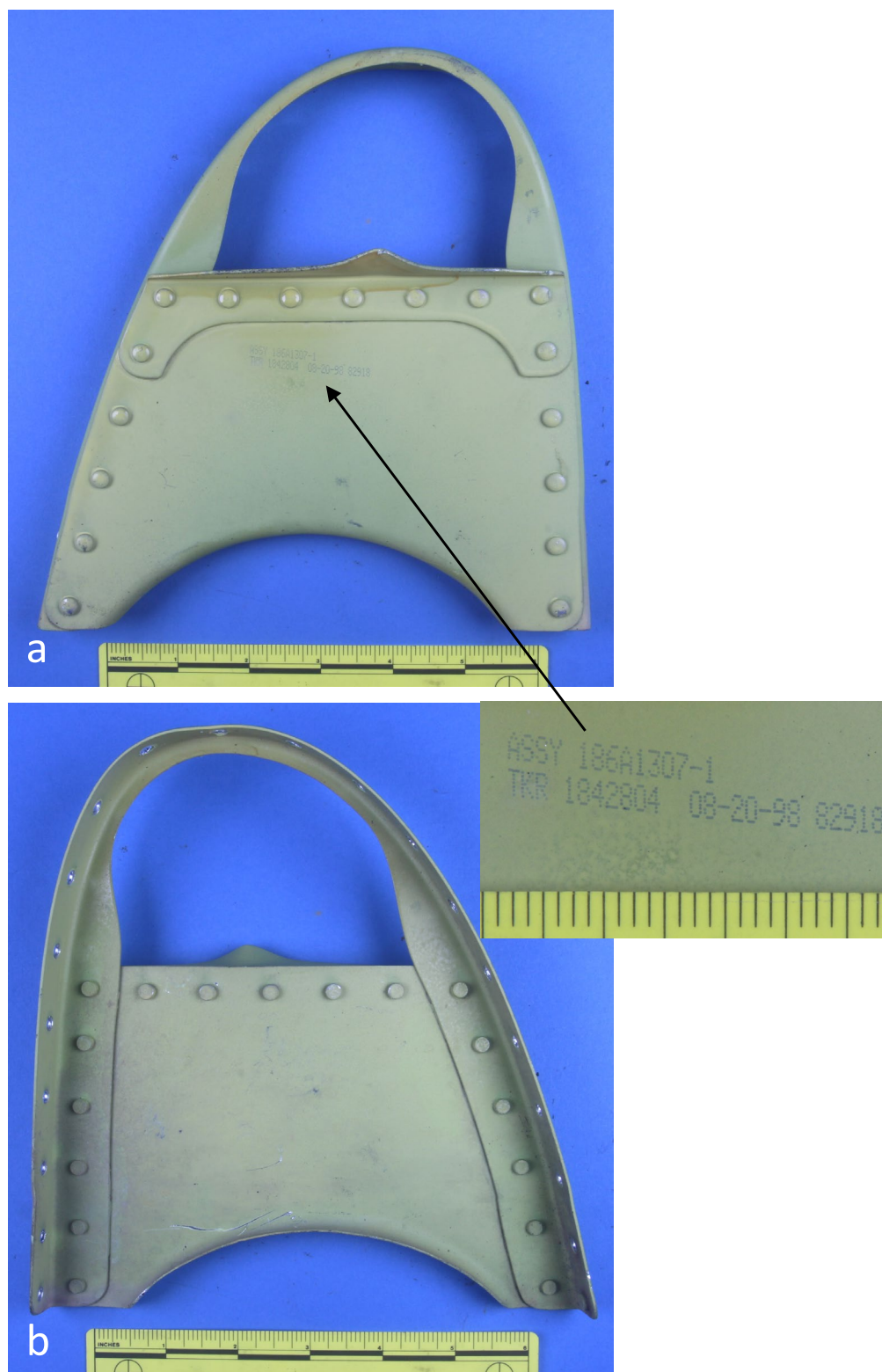


Figure 19 Horizontal stabilizer leading edge rib piece (186A1307-1). The piece exhibits bending distortion and evidence that the rivets have been drilled out.