NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

January 28, 2020

MATERIALS LABORATORY FACTUAL REPORT Report No. 20-006

1. ACCIDENT INFORMATION

Place	:	Los Angeles, CA
Date	:	December 4, 2019
Vehicle	:	Eurocopter AS350 B2, N71HD
NTSB No.	:	DCA20NA034AB
Investigator	:	Bill English, AS-10

2. COMPONENTS EXAMINED

Section of horizontal stabilizer
Pieces of tail rotor assembly

3. DETAILS OF THE EXAMINATION

On December 4, 2019, a Eurocopter AS350 B2 helicopter reported an inflight collision with a small object near Los Angeles, CA. After landing, damage consistent with impacts was noted on several areas of the aircraft. These components were sent to the NTSB Materials Laboratory for additional examination.

The Materials Laboratory received portions of the tail rotor assembly and the horizontal stabilizer from the aircraft. Figure 1 shows the portion of the tail rotor blade assembly, as received. Of note on the tail rotor blades was an impact mark, denoted in Figure 1c and highlighted in Figure 2.

Figure 2 shows the elongated witness mark on the tail rotor blade. The mark was elongated and measured approximately 1.2 inches long and 0.25 inches wide. The mark was located approximately 1.25 inches from the tip of the leading edge of the tail rotor blade. The shape of the mark was comet-tailed, consistent with an impact with another object moving across the blade.

This impact mark and the tail rotor blade assembly fragments were inspected using an ultraviolet (UV) light. Figure 3 shows the tail rotor blade impact mark exposed to UV light. In this figure, most of the surface did not fluoresce under UV light exposure. Some dust particles and the material internal to the tail rotor fluoresced a violet color. There were no indications of material that fluoresced green, which could indicate remnants of biological fluids.

Figure 4 shows a closer view of the tail rotor blade impact. This showed an underlying ribbed structure, with a cyan colored filler material. No indication of biological material was found embedded in this area.

Figure 5 shows a typical area of the leading edge of the tail rotor blades. This leading edge exhibited a wrinkled surface layer, consistent with a polymeric adhesive or tape. This area and the leading edges of both blades were examined using a UV light, as typified in Figure 6. No indications of fluorescing material were found using UV exposure. These features were inconsistent with the tail rotor impacting organic or biological materials, such as from a bird. There was also a lack of small fluorescing features, such as consistent with impacts of insects of small biological species.

Figure 7 shows the top surface of the right horizontal stabilizer, as received in its crate. The outboard region, shown in Figure 7c, exhibited an impact area. Figure 8 through Figure 10 show a closer view of this impact area. The area consisted of a dent, located approximately 9 inches inboard from the stabilizer tip, and a dented and torn area located 5 inches further inboard.

This area was examined using a UV light, as typified in Figure 9. The dented and torn area revealed bare metal, with an underlying green-colored primer beneath the blue topcoat of paint. The underlying primer did fluoresce under UV exposure. However, no other areas examined exhibited any fluorescing indications. Likewise, the underside of the impacted area of the horizontal stabilizer, shown in Figure 10, was inspected using a UV light. No indications of fluorescing matter were found with exposure to UV light (Figure 11). These features were inconsistent with the tail rotor impacting organic or biological material, such as from a bird.

The impacted region of the stabilizer leading edge was sectioned out, forward of the internal spar. This sectioned portion of the stabilizer leading edge is shown in Figure 13. No foreign material was found inside the stabilizer structure after sectioning and removing this portion of the leading edge. A closer inspection of the dented region found multiple witness marks, consistent with a second object sliding across the outer surface of the stabilizer (Figure 14). These marks were dull white and gray and were consistent with material transfer from the impacting object (Figure 15).

This dented region exhibiting material transfer was examined using Fourier-transform infrared spectroscopy (FTIR). The white and gray areas were probed, and the data were contrasted with an area of the painted stabilizer skin surface away from the impact zone. In subtracting out the spectrum peaks from the control area away from the impact zone, several peaks consistent with a different or foreign material were noted. These peaks were consistent with a polycarbonate polymer.

Figure 16 shows a closer area of the impacted and torn portion of the leading edge. In this area, the skin of the stabilizer leading edge was deformed inward, with tears in the skin radiating outward from the hole. This area also exhibited paint spalling, exposure of

the underlying primer, and exposure of the underlying bare metal skin surfaces. The paint and primer were able to be readily moved with handling.

Of note within this impact mark was a small circular depression, highlighted in Figure 17. This impression was approximately 0.125 inches in diameter, and it exhibited tears and cracking around its circumference. These features were consistent with impact with a hard, cylindrical object.

Erik M Mueller
Materials Research Engineer

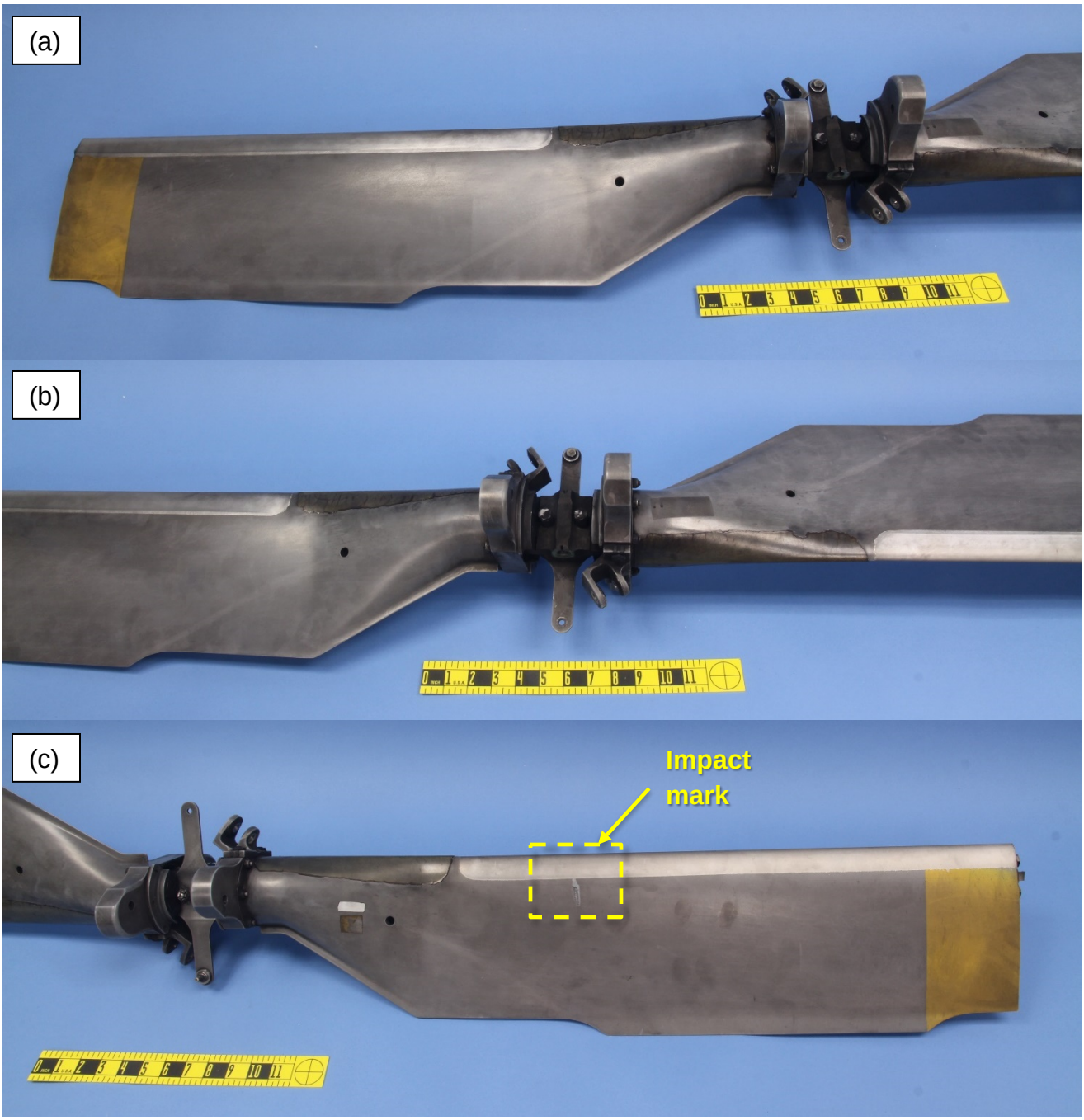

Figure 1 – The tail rotor blade assembly, shown from left to right in (a), (b), and (c). The boxed area in (c) is highlighted in Figure 2.

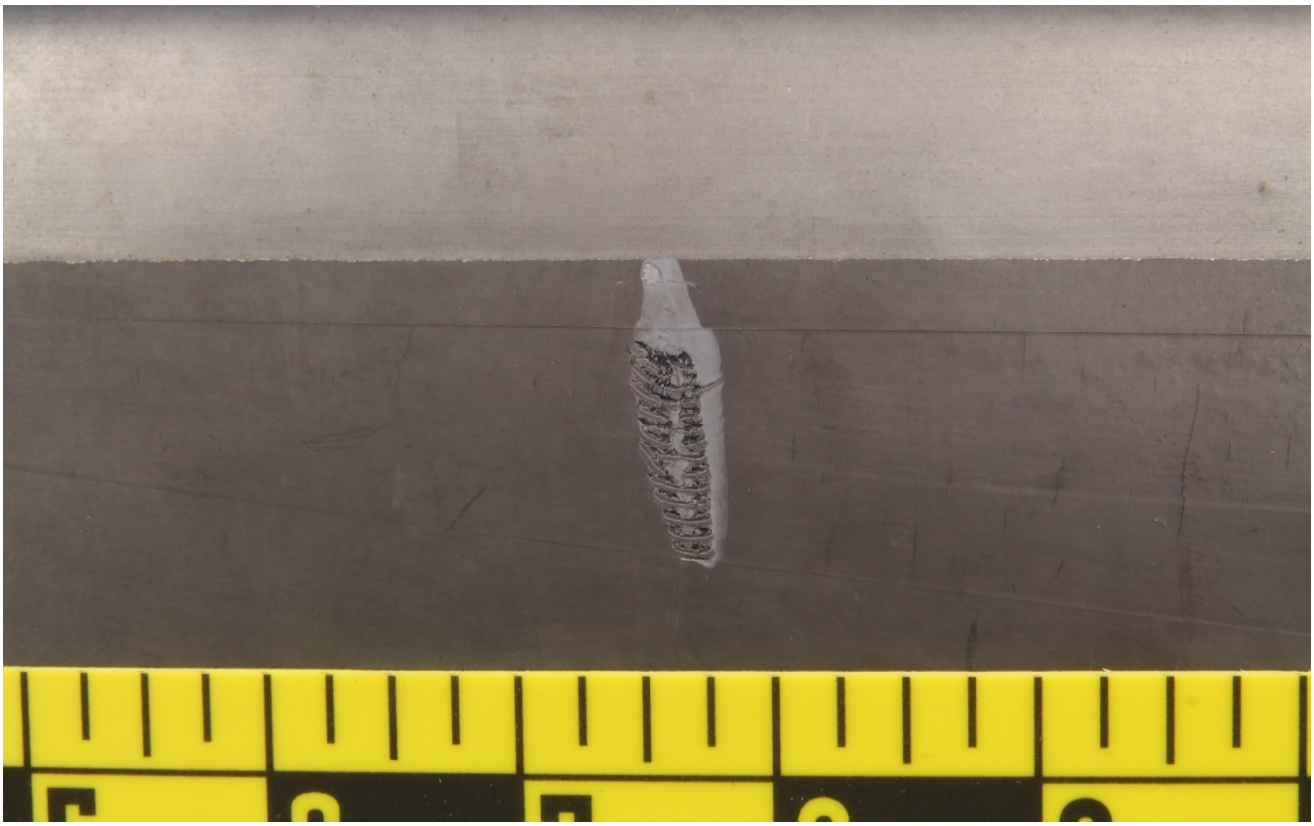

Figure 2 – The tail rotor impact mark near the leading edge from Figure 1c.

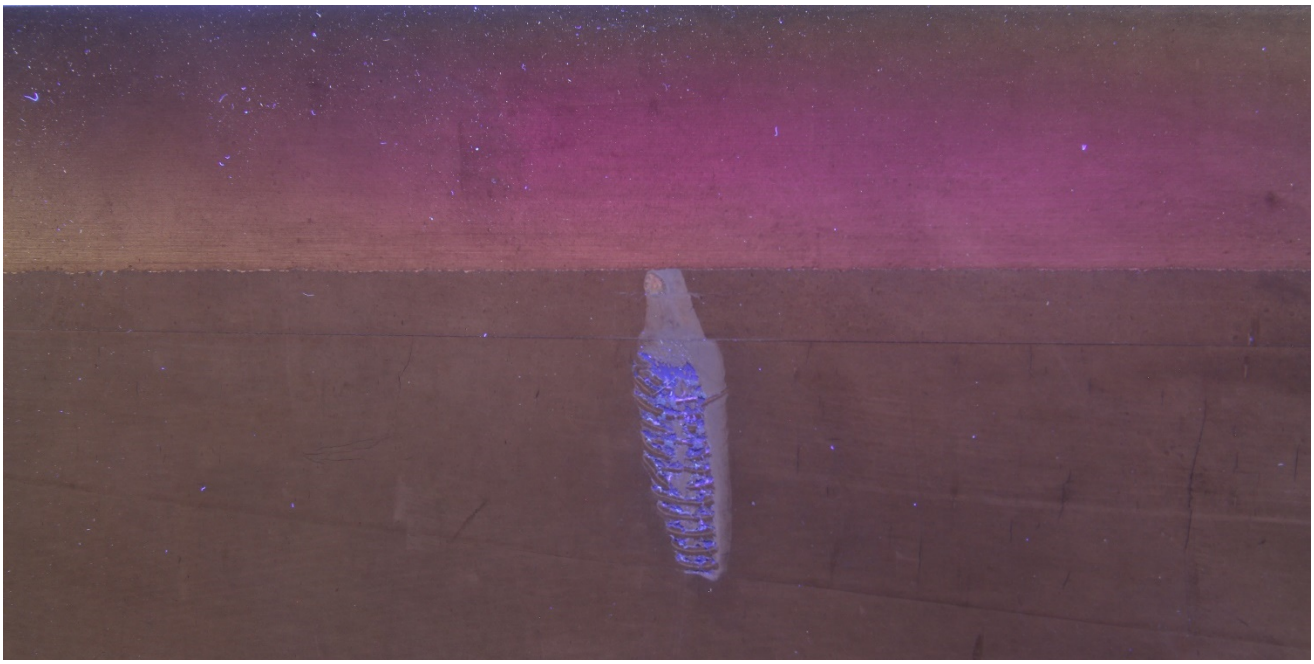

Figure 3 – The tail rotor impact mark in Figure 2, exposed to ultraviolet light.

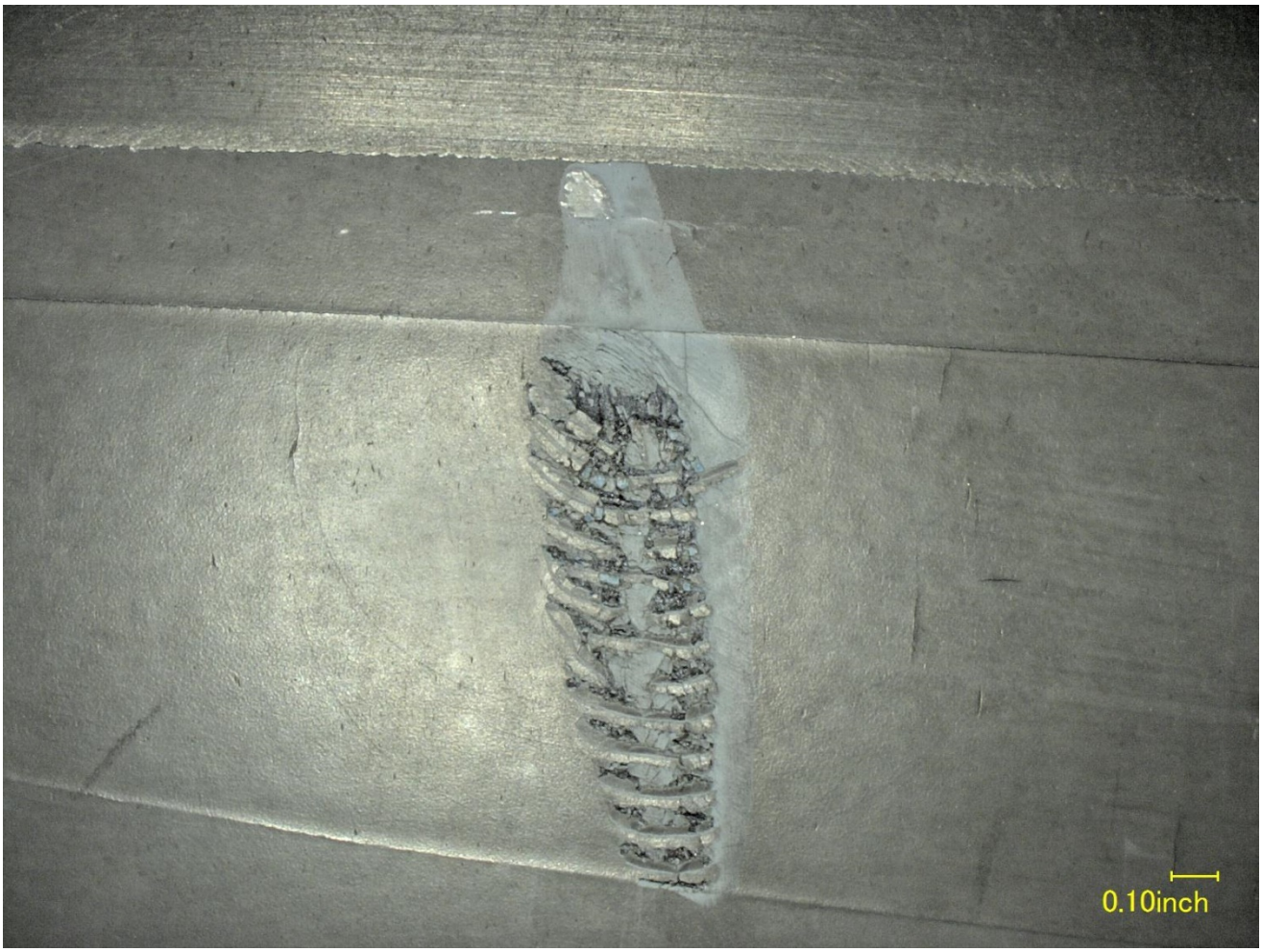

Figure 4 – Closer view of the tail rotor impact mark, showing the underlying material.

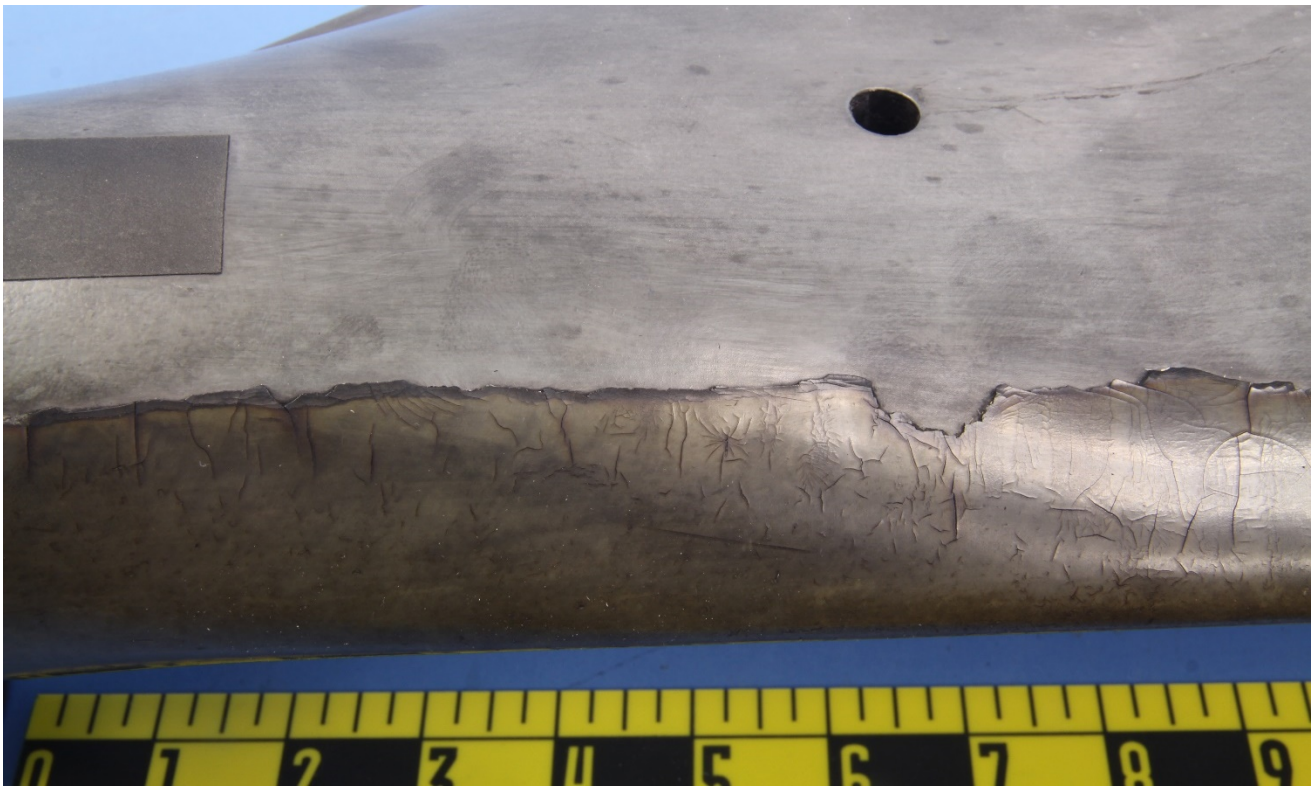

Figure 5 – View of an area of the leading edge from the tail rotor.

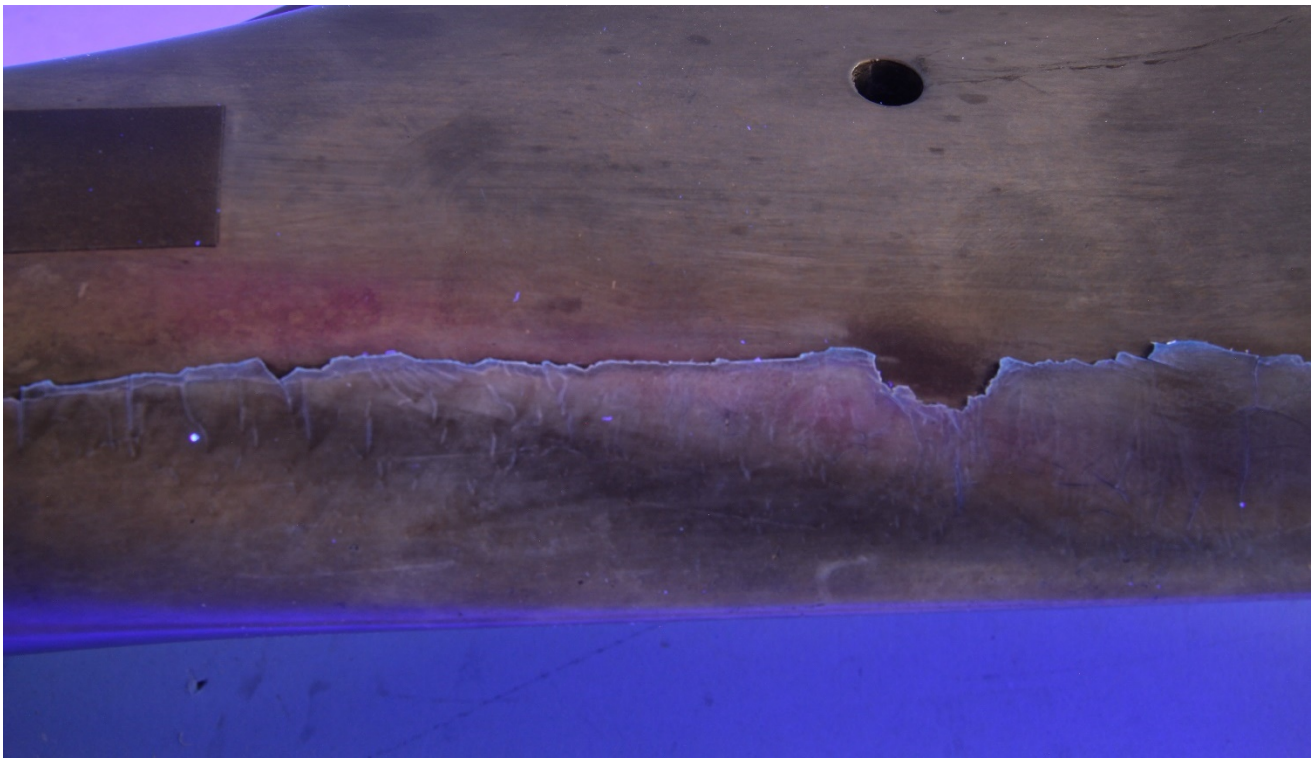
Figure 6 – The tail rotor leading edge in Figure 5, shown exposed to UV light.

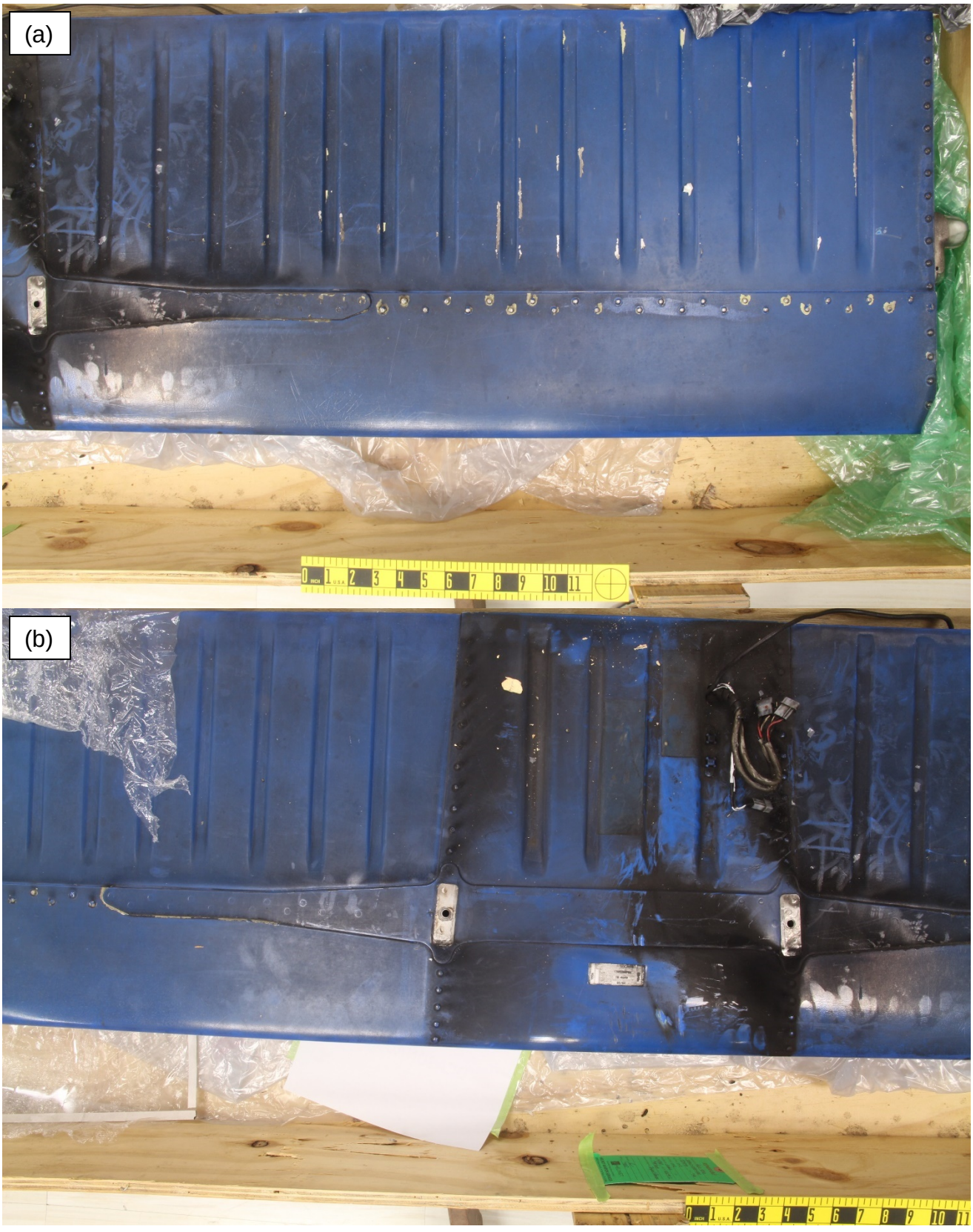
(a)
(b)

Figure 7 – The topside of the right horizontal stabilizer assembly, shown from inboard to outboard in (a), (b), and (c). The boxed area in (c) is highlighted in Figures 8 – 10

Figure 8 – View of the leading edge of the impact area of the horizontal stabilizer.

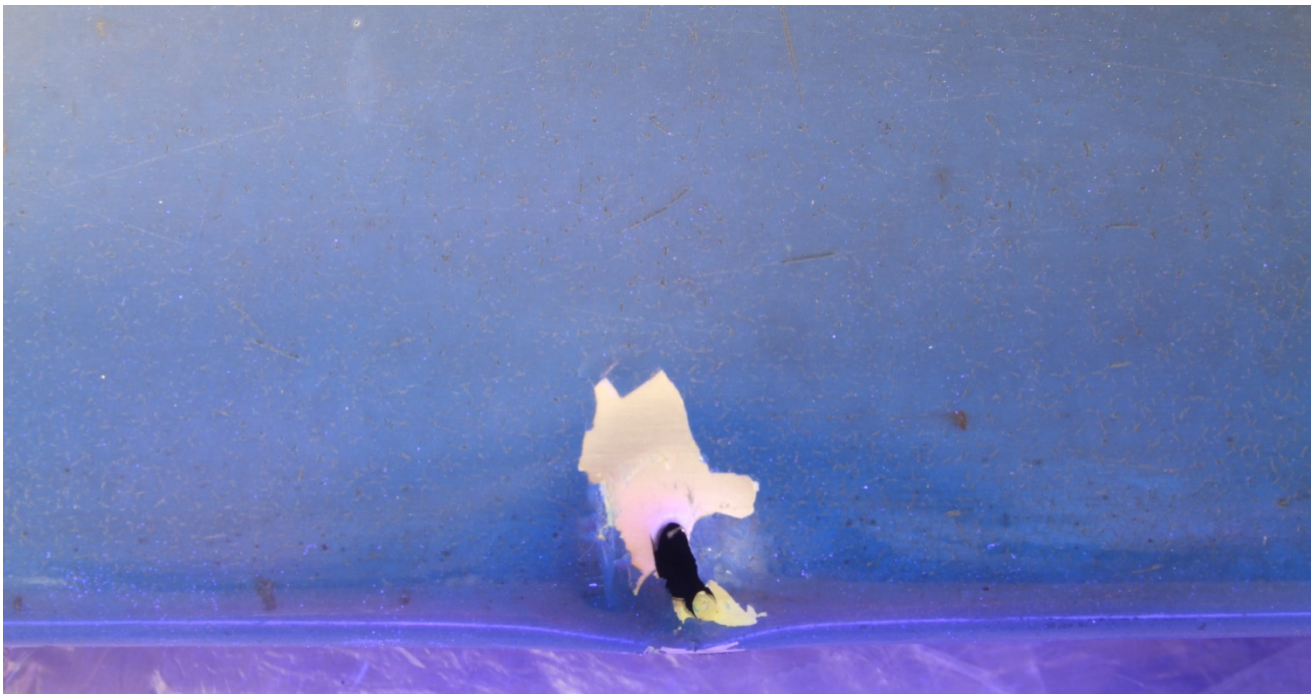

Figure 9 – View of the impact area in Figure 7, shown exposed to UV light.

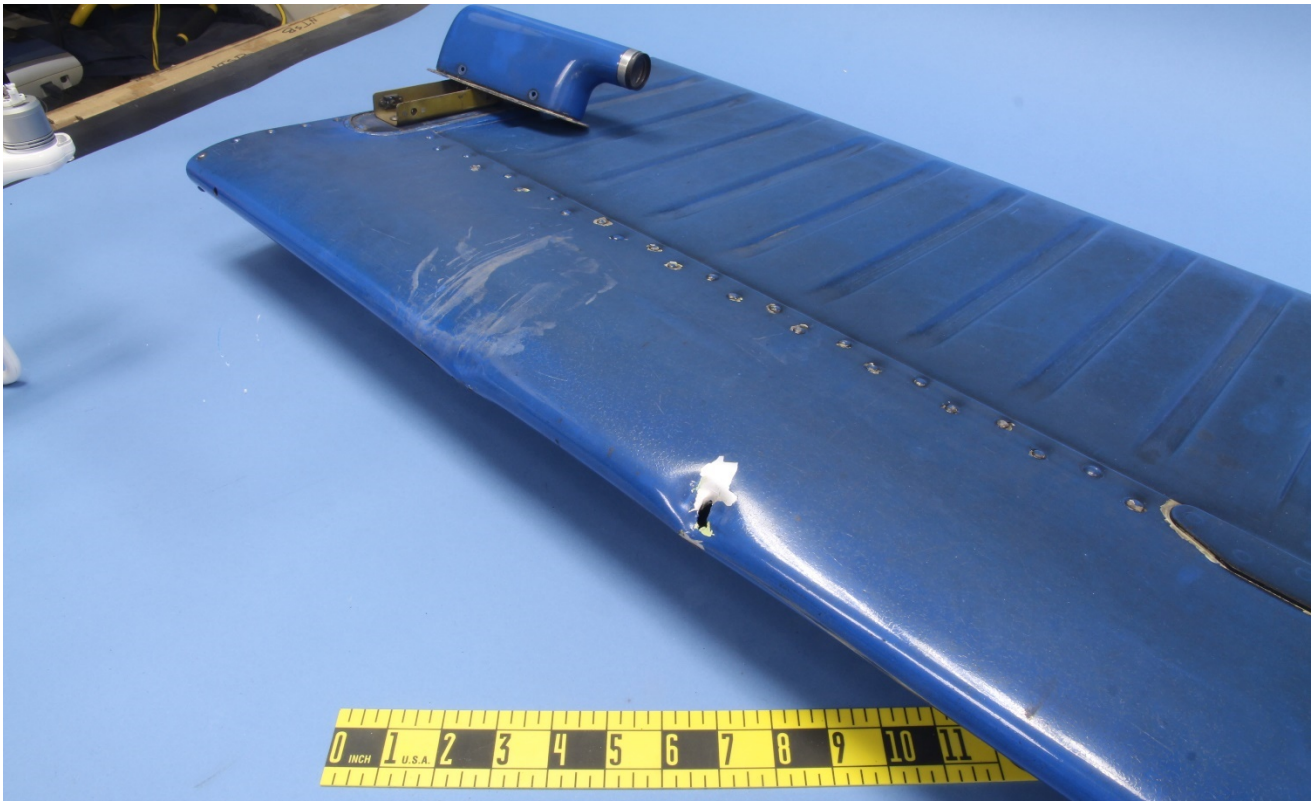

Figure 10 – Angled view of the leading edge of the impact area of the horizontal stabilizer.

Figure 11 – View of the underside of the horizontal stabilizer at the impact area.

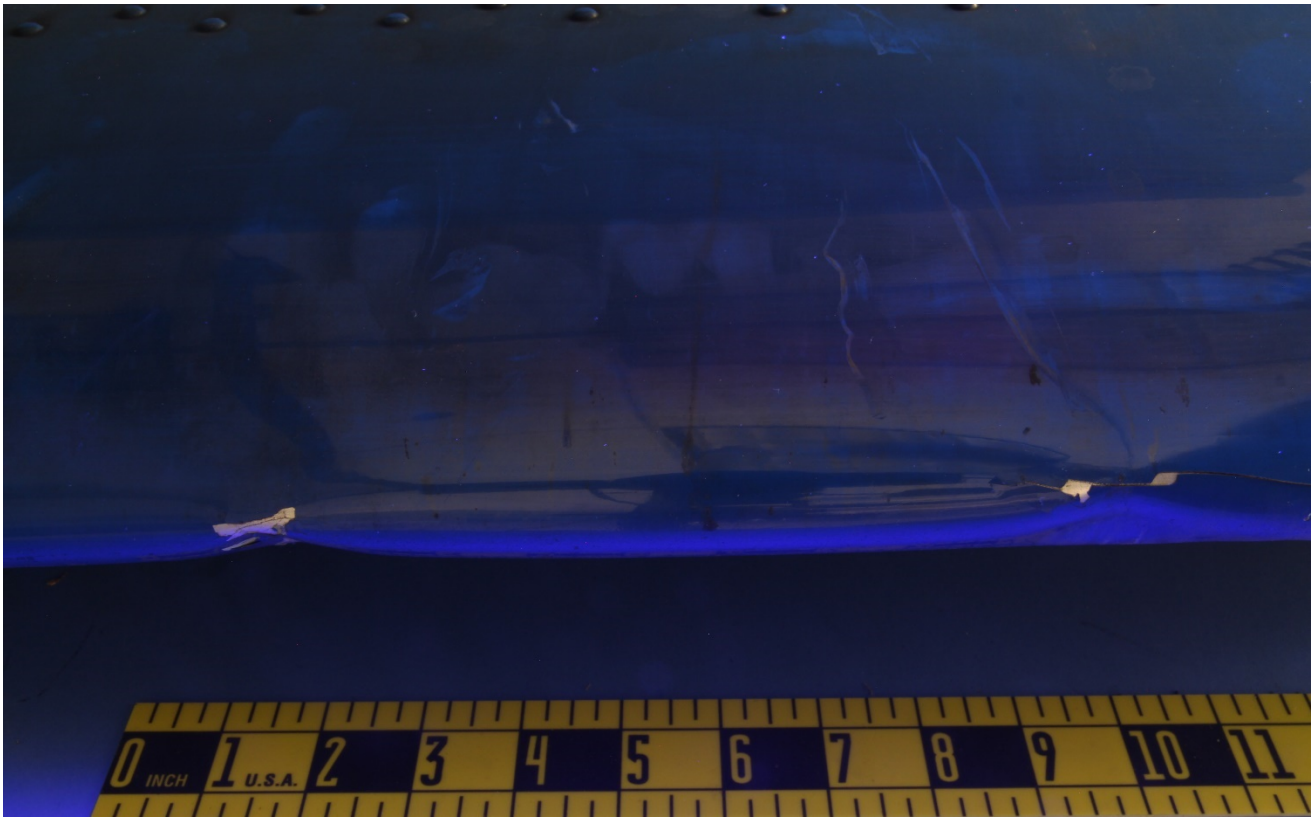

Figure 12 – The area in Figure 11, shown exposed to UV light.

Figure 13 – The sectioned portion of the horizontal stabilizer impact area, viewed from the topside.

Figure 14 – The dented portion of the impact area in Figure 13, showing gray material transfer marks.

Figure 15 – Closer view of the material transfer and impact marks in Figure 14.

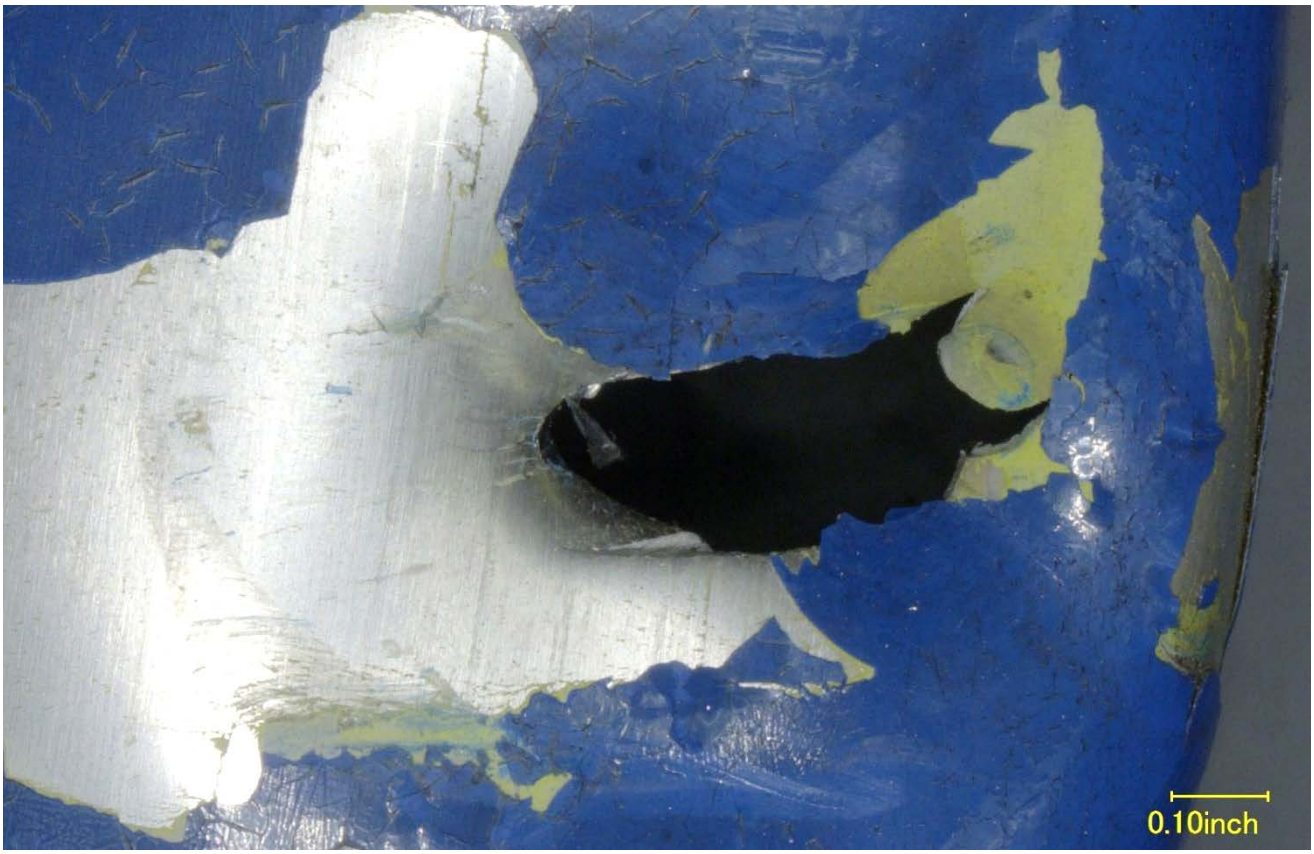

Figure 16 – Closer view of the impact tear on the horizontal stabilizer.

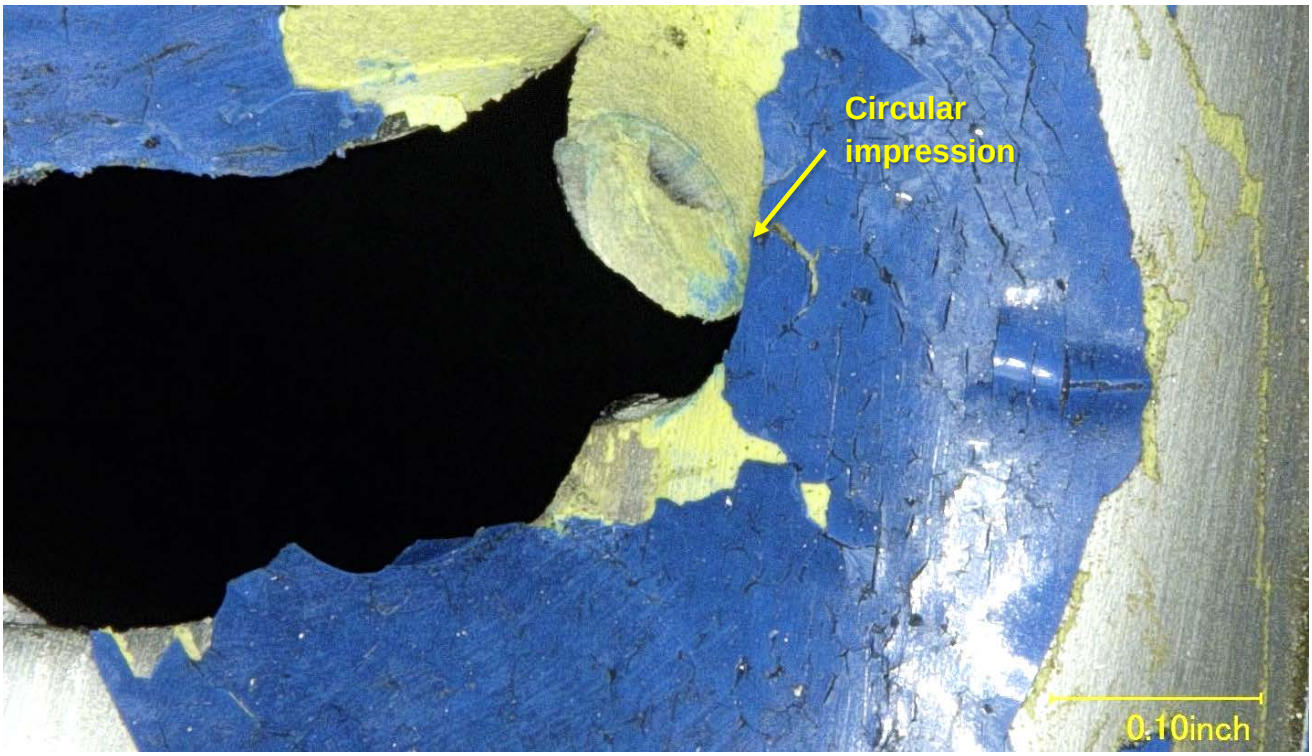

Figure 17 – The circular impression at the torn portion of the impact in Figure 16.