

22 October 2018
66-ZB-H200-ASI-19067

Brian Murphy
Airworthiness Group Chairman
Office of Aviation Safety
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Washington, D.C. 20594-2000
[REDACTED]



Subject: Boeing EQA Report on T12 Sensor - Southwest Airlines 737-700 N772SW
Engine failure and decompression Philadelphia, 17 Apr 2018

Dear Mr. Murphy:

In support of the NTSB investigation into the subject event, Boeing's Equipment Quality Analysis (EQA) laboratory performed an examination of the left engine T12 sensor removed from the inlet cowl of the accident airplane. In addition, a fracture analysis was performed on the terminals of the T12 sensor. Please find both the Equipment Quality Analysis (EQA) and fracture analysis lab reports enclosed with this letter.

The information included with this correspondence is controlled under the US Export Administration Regulations (15 CFR Parts 300-799) and has been categorized as ECCN: 9E991.

Please feel free to contact us if you have any questions.

Best regards,

[REDACTED]
Robert J. McIntosh
Director, Product Safety

Enclosure: Boeing EQA Report AS12836

cc: Bill English, Investigator-In-Charge, NTSB



Equipment Quality Analysis Report

Boeing Commercial Airplanes



TO: Air Safety Investigations (ASI) **EQA NUMBER:** AS12836
DATE: October 15, 2018
MODEL NUMBER: 737-700
AIRPLANE NUMBER: YA070

SUBJECT: *Examination of T12 Sensor from Southwest Airlines (SWA) Aircraft YA070*

IDENTIFICATION: Part name: Probe, T12
Boeing part number: RP235-00
Supplier: CFM International

REFERENCES: (a) National Transportation Safety Board (NTSB) Accident No: DCA18MA142

BACKGROUND:

Per reference (a), on April 17, 2018, a SWA 737-700, N772SW (YA070), experienced a failure of the number one engine at approximately 32,000 feet en route from New York to Dallas. The majority of the engine cowl inlet, and outboard fan cowl as well as a portion of the inboard fan cowl departed from the left engine. Fragments of the cowlings are believed to have impacted the left wing, left horizontal stabilizer, fuselage, and a cabin window (row 14) resulting in cabin depressurization. The aircraft diverted and landed in Philadelphia.

Aircraft YA070 was delivered on July 7, 2000, and was reported to have accumulated 63,522 hours and 37,031 cycles as of April 18, 2018. Per reference (a), it was reported that the failed engine had accumulated more than 32,000 engine cycles since new, and the fan blades were last overhauled 10,712 cycles before the failure.

The T12 sensor from the left engine of aircraft YA070 was sent to the Boeing Equipment Quality Analysis (EQA) facility in Seattle, WA for examination of the fractured areas of the wire terminals. It was received by EQA on July 16, 2018, and remained unopened within the secure EQA facility.

SUMMARY:

The examination of the T12 sensor at the Boeing EQA facility, took place on July 18, 2018 with representatives from the NTSB and Boeing Air Safety Investigations in attendance.

Under the direction of the NTSB, the T12 sensor was sent to the Boeing Research and Technology (BR&T), Materials and Fracture Analysis Team, which determined that reduction of area (necking) was present on the fracture surfaces of all three terminal wires on the T12 sensor. The features are consistent with ductile separation, or an overload of the wire strands; see enclosure A for more details.

EXAMINATION:

An overview of the packaging that contained the T12 sensor as received is shown in Figure 1.



Figure 1: Overview of the T12 sensor packaging

The T12 sensor was removed from the packaging and was visually examined. An overview of the T12 sensor with the three wire termination points labeled, is shown in Figure 2.

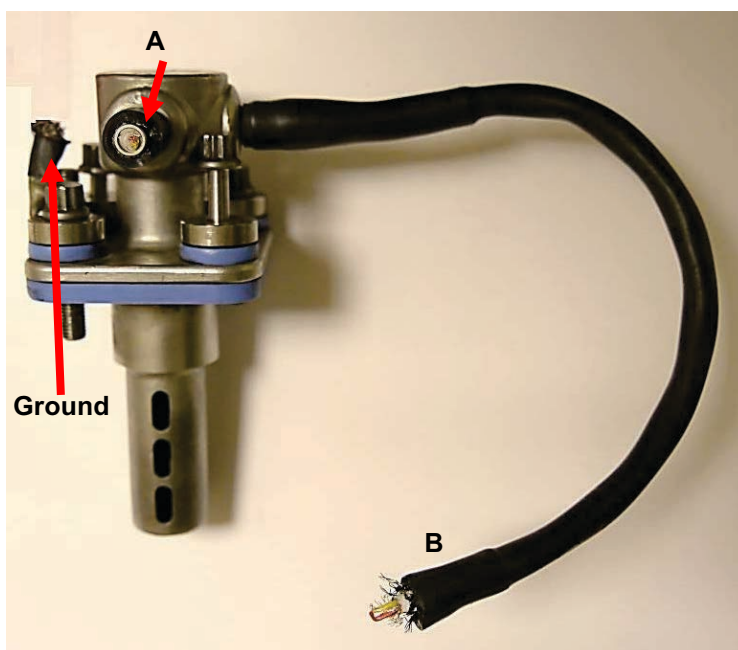


Figure 2: Overview of T12 sensor

An overview of the data markings of the T12 sensor is shown Figure 3.



Figure 3: Data markings on T12 sensor

The fractured termination point of wire A is shown in Figure 4.



Figure 4: Fractured termination point of wire A

A magnified view of several fractured, individual wire strands at the wire A termination point is shown in Figure 5.



Figure 5: Fractured, individual wire strands at the wire A termination point

The fractured termination point of wire B is shown in Figure 6.



Figure 6: Fracture termination point of wire B

A magnified view of several of the fractured, individual wire strands at the wire B termination point is shown in Figure 7.



Figure 7: Fractured, individual wire strands at the wire B termination point

The fractured ground wire termination point is shown in Figure 8.



Figure 8: Fractured ground wire termination point

A magnified view of several of the fractured, individual wire strands at the ground wire termination point is shown in Figure 9.



Figure 9: Fractured, individual wire strands at the ground wire termination point

ANALYSIS:

The NTSB directed that BR&T analyze the fracture surfaces of all three wire termination points, with the understanding that destructive analysis would be necessary. BR&T used scanning electron microscope (SEM) analysis to analyze the fracture surfaces, which concluded that reduction of area (necking) on all three wires is consistent with ductile separation or an overload of the wire strands; see enclosure A for more details.

DISPOSITION:

The T12 sensor was sent to a UTC Aerospace Systems (UTAS) facility in Chula Vista, CA, on August, 8 2018 per instructions from the NTSB.

The preceding information is being submitted for information purposes.

Signatures on file.

ENCLOSURE:

A. SWA1380 Fracture Analysis of T12 Sensor



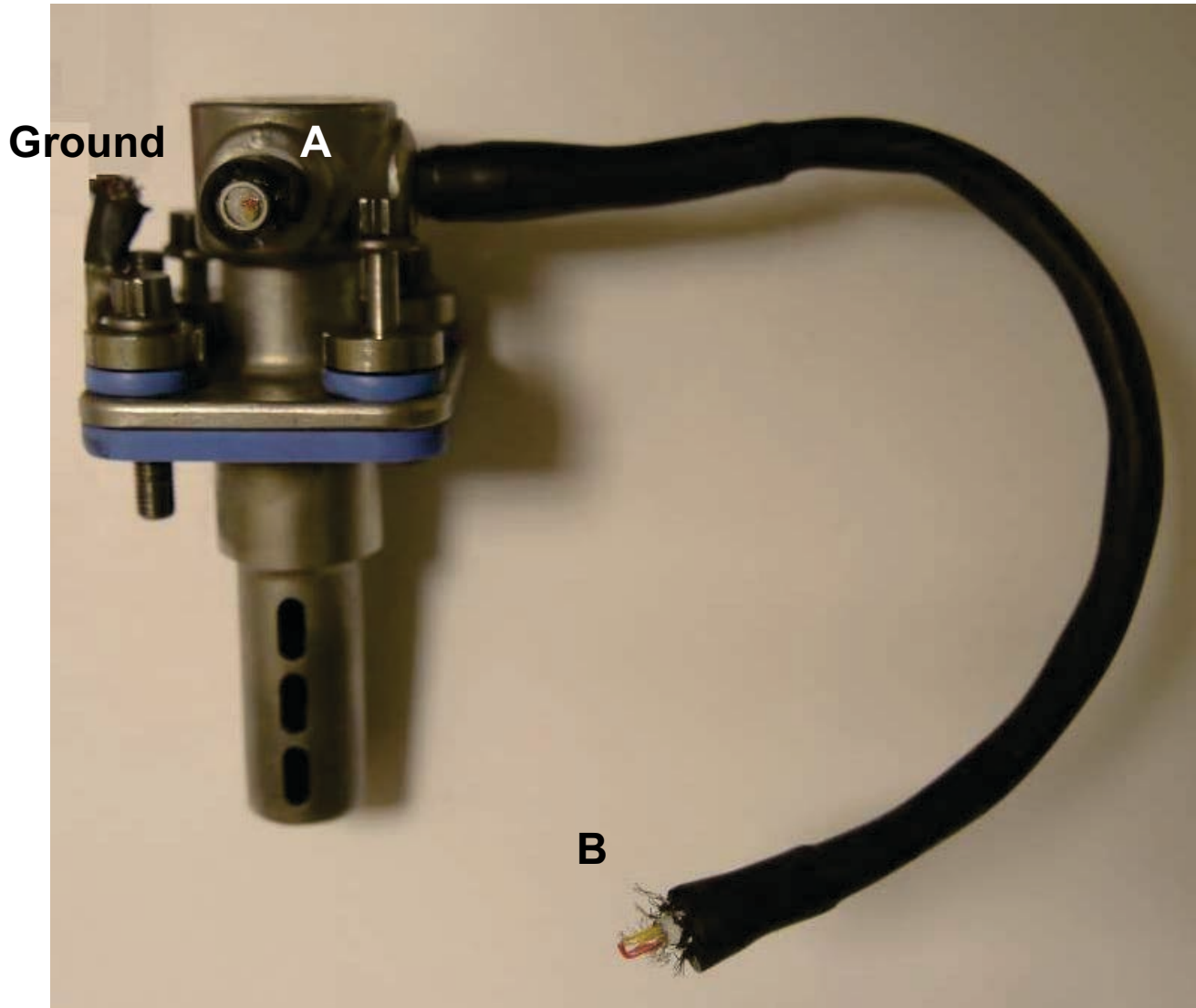
Engineering, Test & Technology
Boeing Research & Technology

Fracture Analysis Results for SWA YA070 T12 Sensor

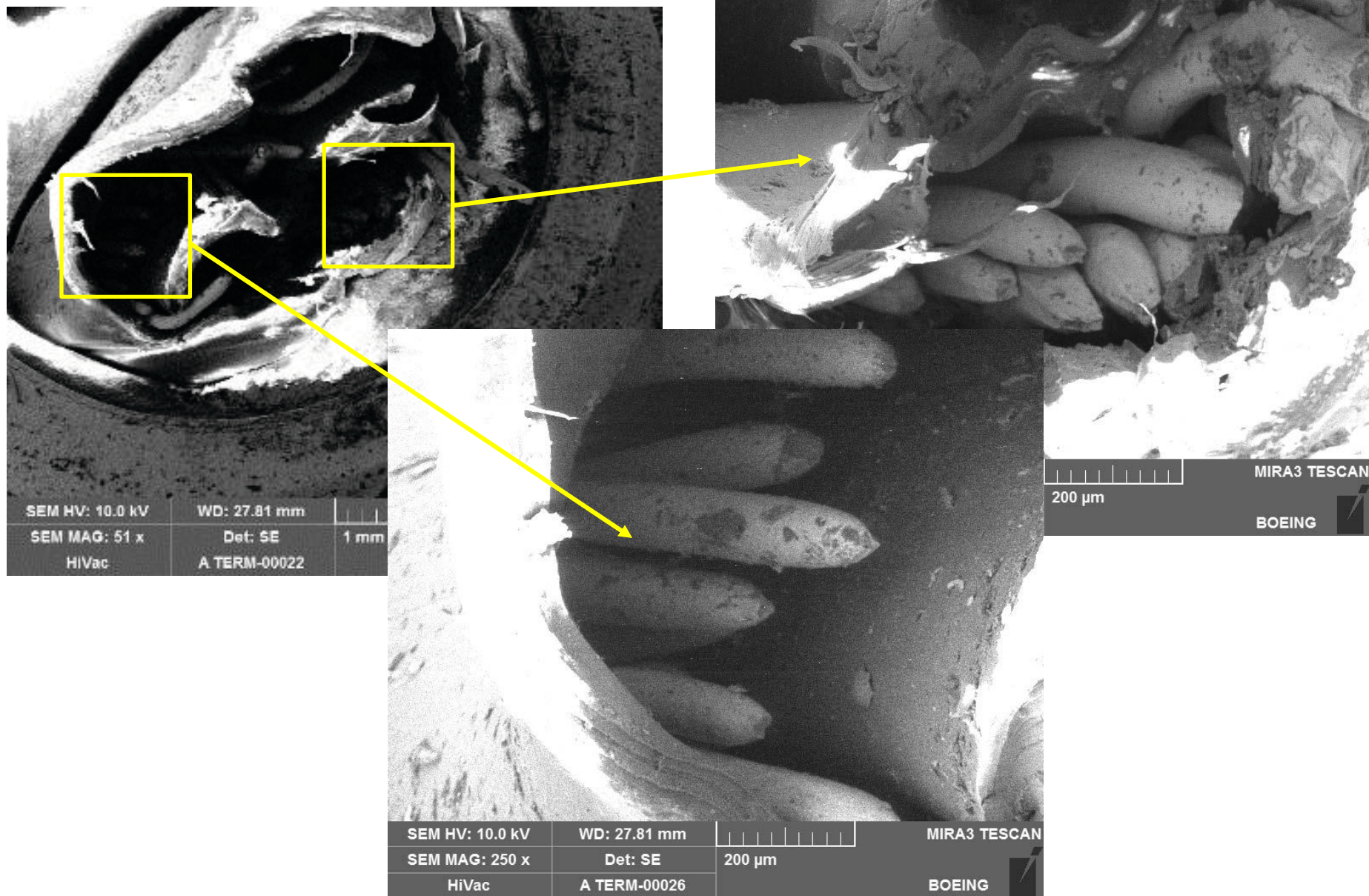
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Part Number: RP235-00

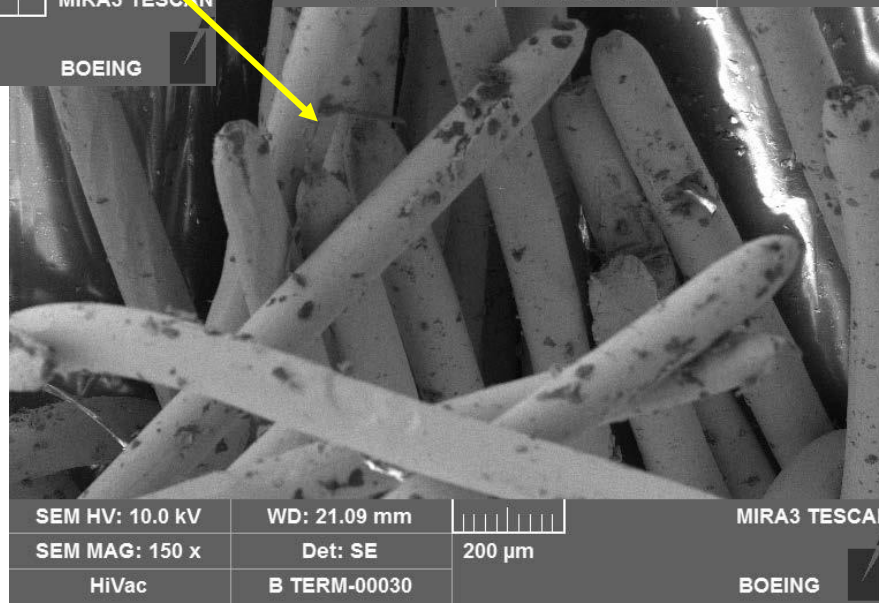
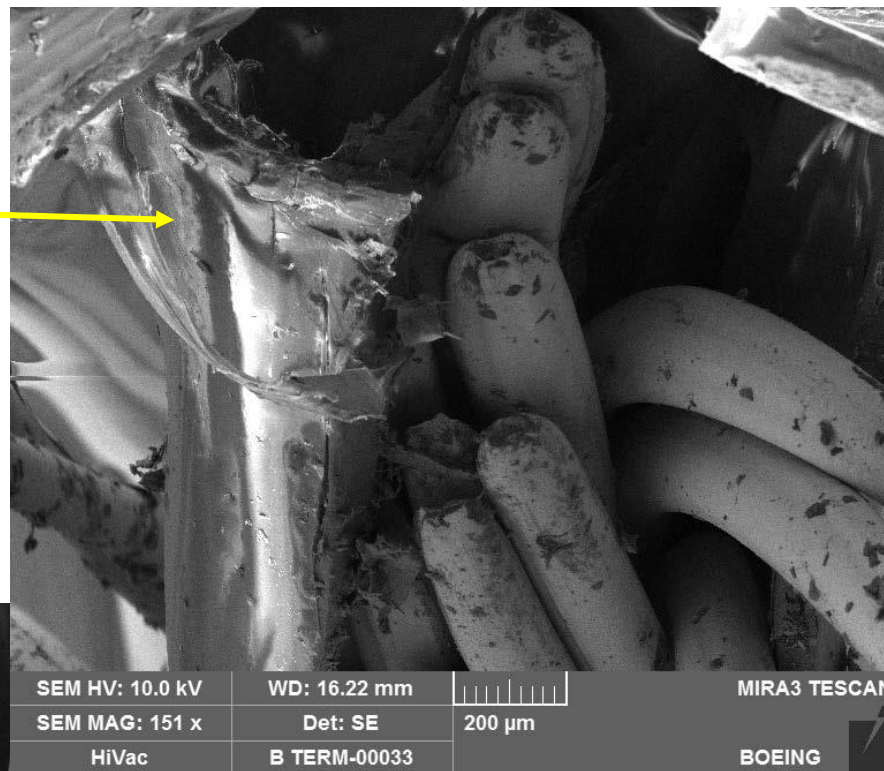
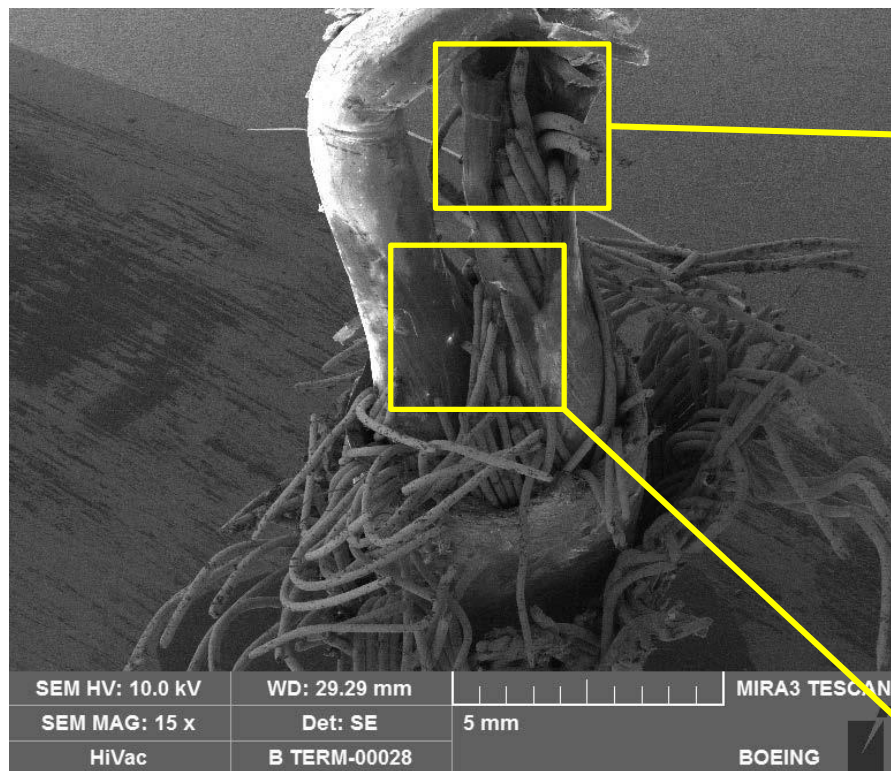
As-received part/Location IDs



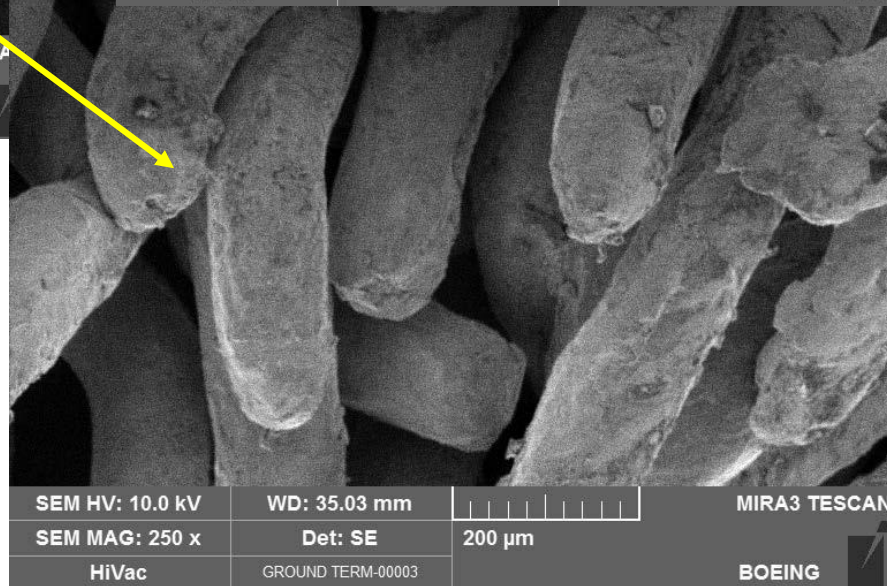
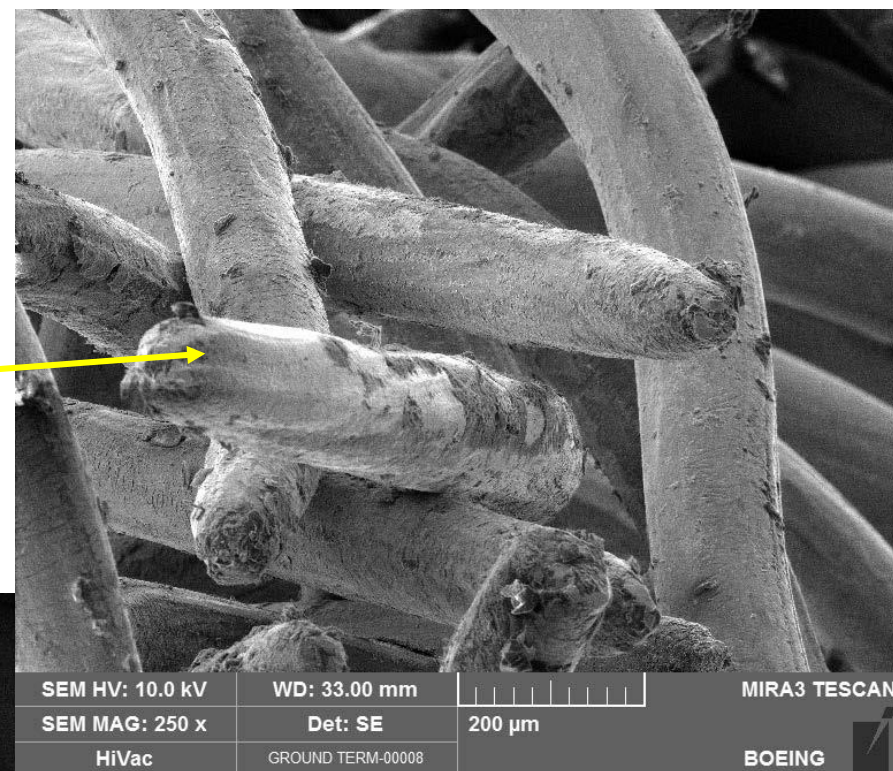
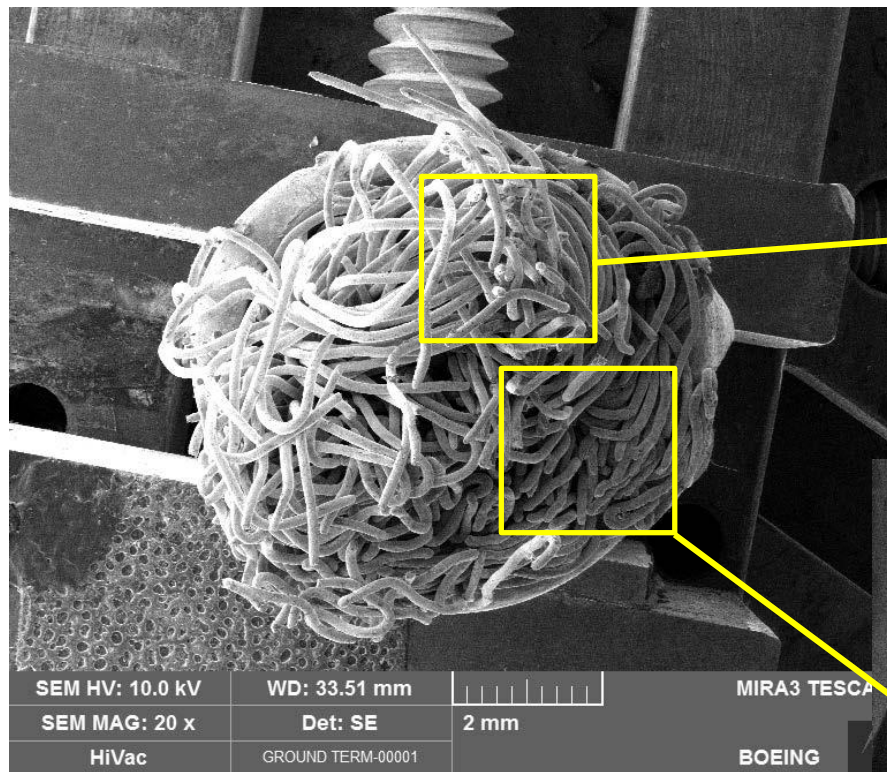
A Terminal



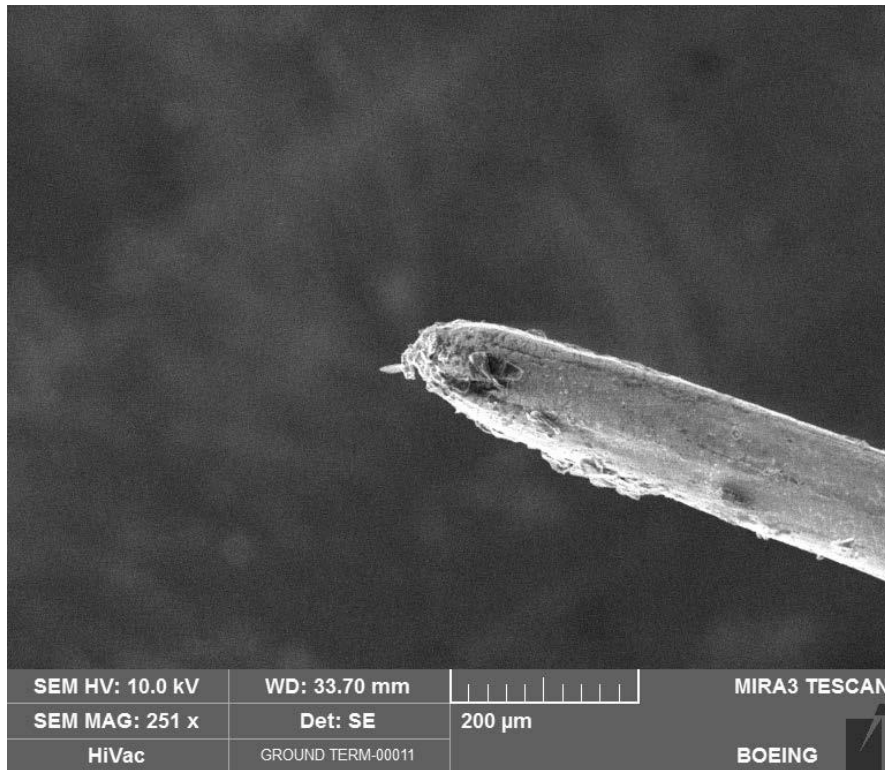
B Terminal



Ground Terminal



Ground Terminal



Conclusions

Reduction of area/necking was observed on the fracture surfaces of all three terminals, consistent with ductile separation/overload.