Addressing Aerospace In-Service Damage Inspection with Creaform 3D Scanning Solutions

Mike Walsh – Creaform - Denver – USA, 18 – 21 September 2023

Bio Slide

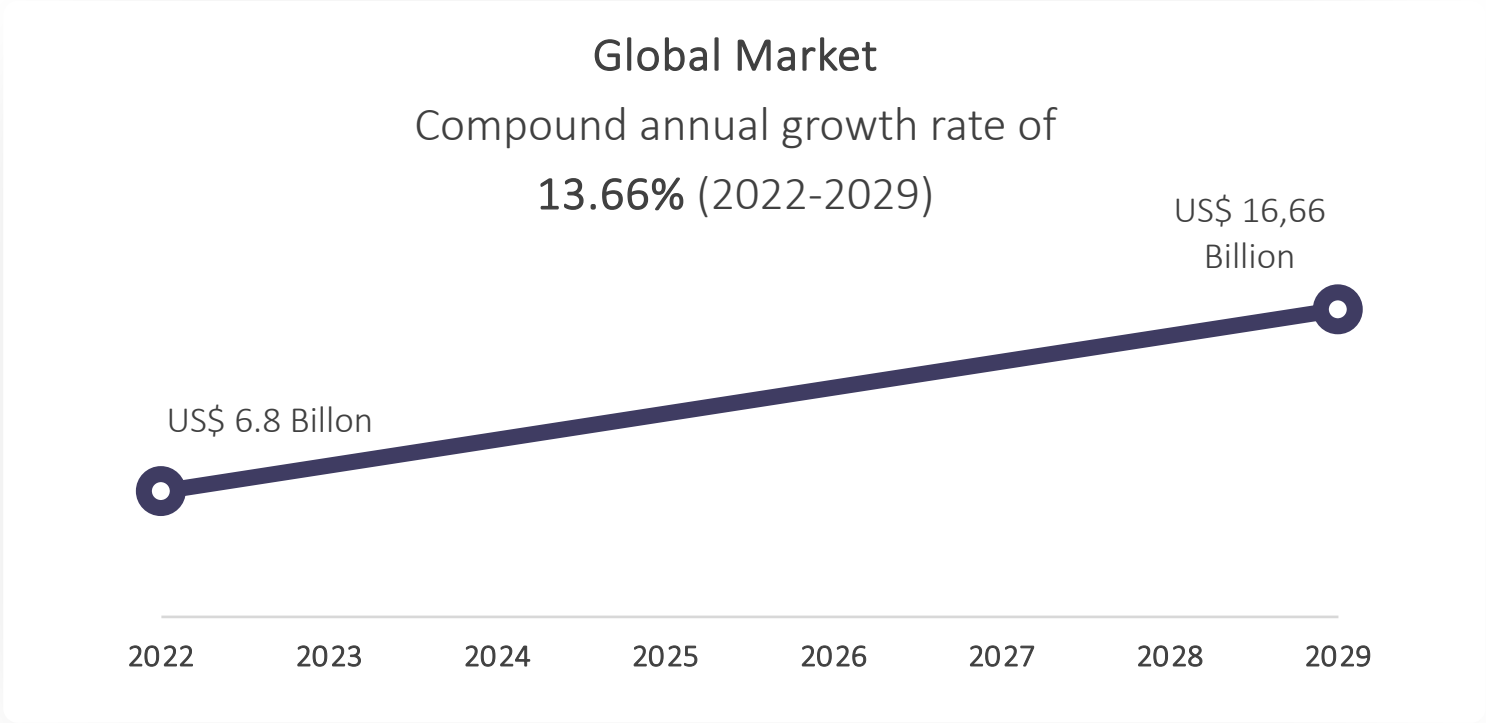
- Mike Walsh
- Account Manager with 10 years background in 3D scanning and NDT
- Specialize in using 3D scanners to resolve complex applications and perform damage assessments
- My passion for innovation drives me to deliver cutting-edge solutions that make a lasting impact in the NDT industry.

Agenda

- Non-destructive technique (NDT) industry challenges
- How 3D scanners can help you overcome these challenges
- 3D scanner benefits
- Eliminating Human Errors
- Surface damage analysis methods
- New applications
- Conclusion

NDT industry challenges

Non-destructive testing market **Trends and Forecast**



***Fortune Business Insights None-destructive-Testing (NDT) Market 2022*

NDT Demographic

01

The average NDT technician
is 45 years of age

02

Since 2018, the NDT technician
unemployment rate is bellow 3%

03

66% of the workforce is over 40
12% of the workforce is below 30

https://www.zippia.com/ndt-technician-jobs/demographics/

How can 3D scanners help you overcome these challenges?

3D scanning benefits

USER-INDEPENDENCE

Repeatable results regardless of the user's level of expertise

ACCURACY

Up to 0.025 mm (0.0009 in)

PORTABILITY

Easy to transport from one place to another and to reach constrained areas. Can be used indoors or outdoors.

SIMPLICITY

Short learning curve and easy to use

PRODUCTIVITY

80x faster than the pit gauge technique

Repeatability & Traceability

Main benefit compared to manual methods

Same part, same inspector, multiple scans

	Damage Measurement (mm)									
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Acquisition # 1	0.813	0.813	0.914	0.914	0.864	1.016	0.991	1.600	1.245	1.422
Acquisition # 2	0.813	0.813	0.940	0.889	0.889	1.016	0.991	1.372	1.219	1.422
Acquisition #3	0.813	0.838	0.889	0.889	0.838	0.991	0.965	1.397	1.245	1.397
Max Variation (mm)	0.000	0.025	0.051	0.025	0.051	0.025	0.025	0.051	0.025	0.025

Same part, different technician, multiple scans

	Damage Measurement (mm)									
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Technician # 1	0.813	0.813	0.914	0.914	0.864	1.016	0.991	1.346	1.245	1.422
Technician # 2	0.813	0.813	0.965	0.889	0.838	0.965	0.991	1.295	1.168	1.346
Technician #3	0.838	0.889	0.965	0.914	0.838	0.965	0.940	1.321	1.143	1.346
Max Variation (mm)	0.025	0.076	0.051	0.025	0.025	0.051	0.051	0.051	0.102	0.076

Eliminating Human Error

- Repeatable measurements regardless of operator or situation
- Traceable (and revisitable) data with 3D images/Scan Files
- Eliminates operator error
  - Pit Guage measurement placement, record of location, number of measurements taken, etc
- Allows for shorter inspection time, which allows for the ability to do more in-depth inspections or multiple passes
- Provides analysis using algorithms that remove operator error

https://www.hse.gov.uk/research/rrpdf/rr617.pdf

Key benefits of 3D scanners

3D scanner provides:

Conformity

Confidence in the result

Remove Doubt

Remove double inspection needs (audits)

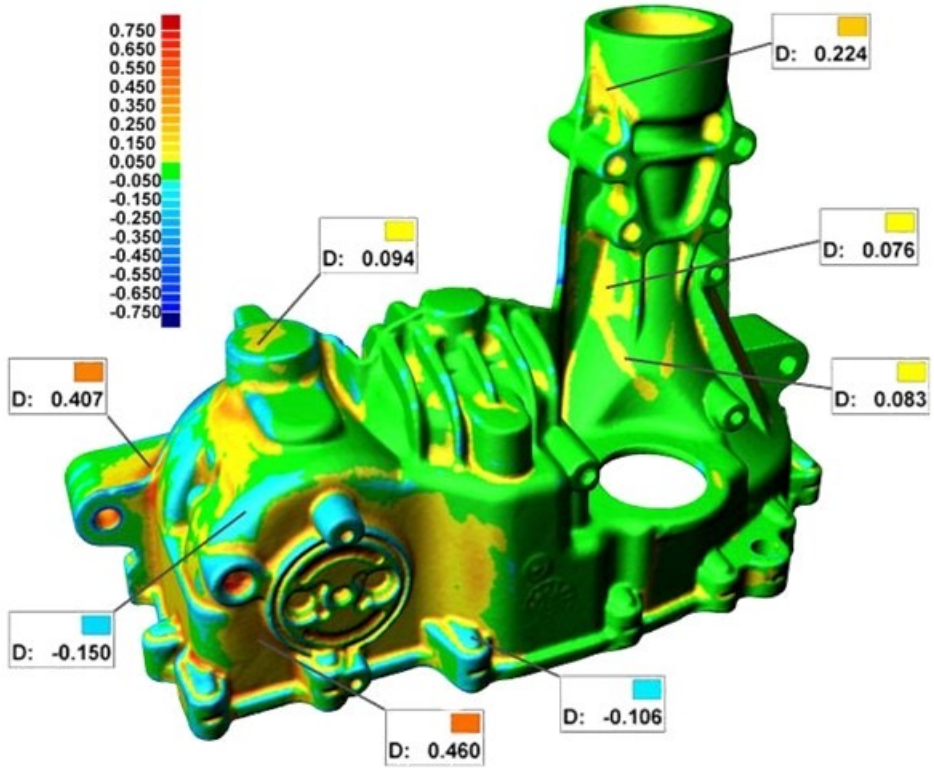
Analysis Method

How to see, measure and report digitalized surface damage

Color map & deviation map

Is the most common way to **visualize** the **deviation** of a scanned part to the design-intent model.

Generally does require a CAD file or an other reference of the part to control



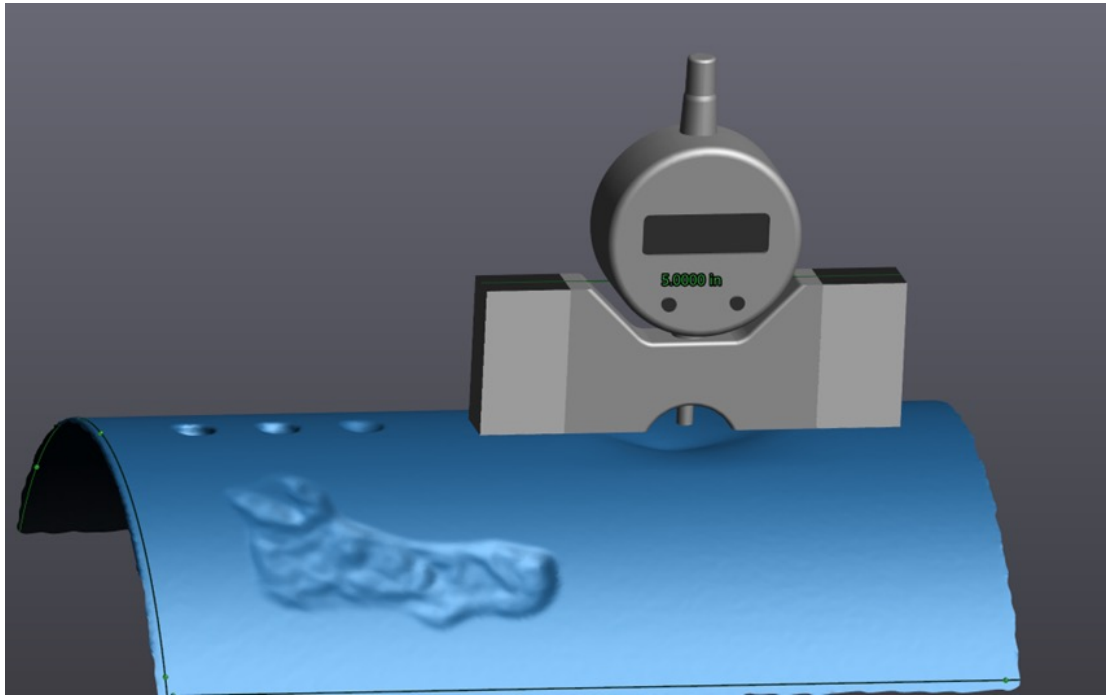
Virtual Measuring Methods / Virtual pit gauge

Advantages

- Mimics Manual Inspection with a pit gauge
- Relied upon in the pipeline industry for more than 10 years

Things to Consider

- Works only on cylinder
- Sensitive to surface quality



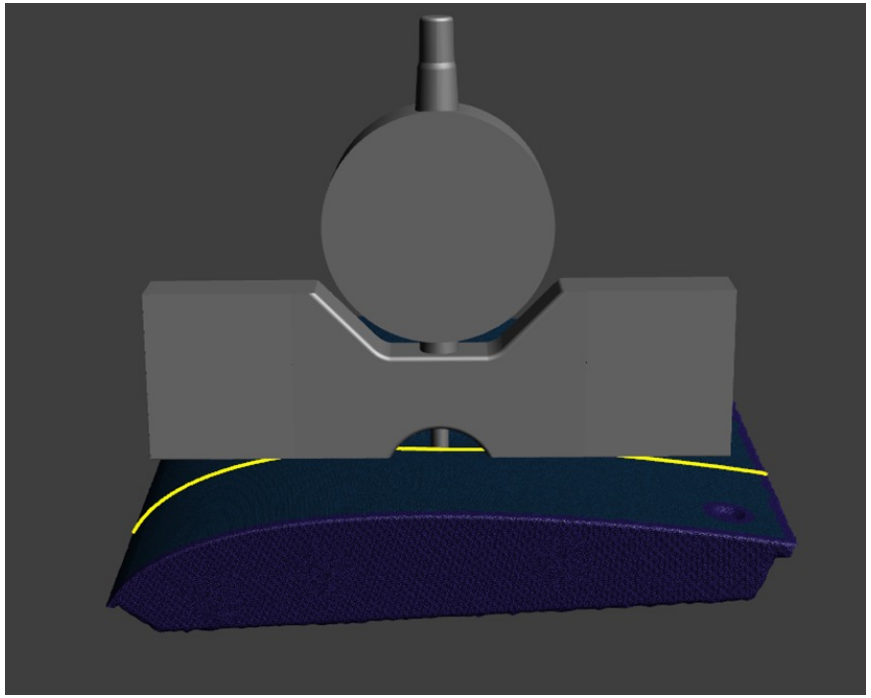
Virtual Measuring Methods / Virtual straight-edge

Advantages

- Optimise for the aerospace industry
- Works on 1 axis curve geometry
- Most sensitive algorithm for dents

Things to Consider

- Limitation on double curvature shapes
- Sensitive to surface quality



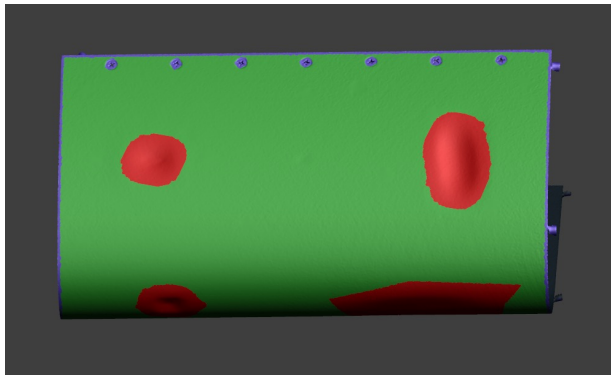
Virtual Measuring Methods / Virtual CAD

Advantages

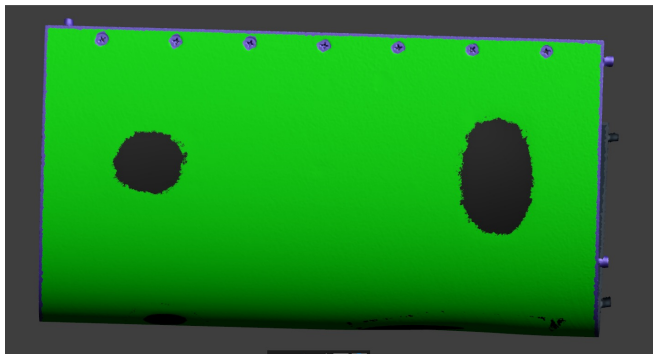
- Compatible on all geometries
- Accurate measurements to interpreted nominal surface

Things to Consider

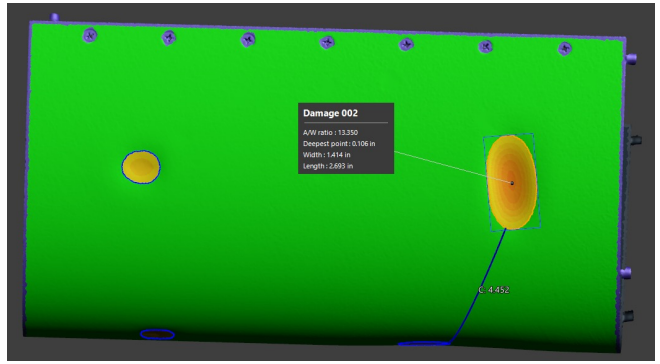
- Requires a somewhat clean surface
- Best fits surface based on surroundings – best for non-complex or uniform surfaces



Step #1
Damage Identification



Step #2
Reference reconstruction



Step #3
Color map Deviation

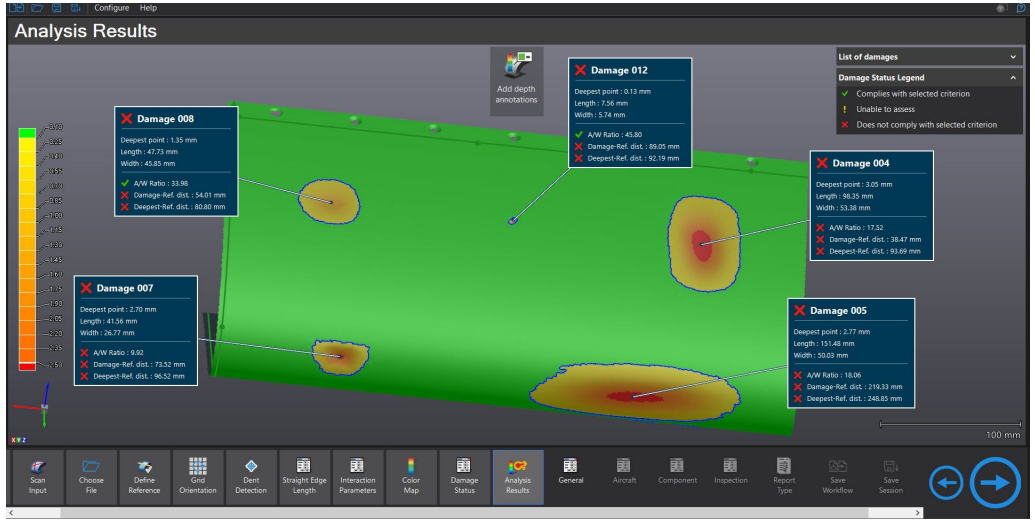
Virtual Measuring Methods

Advantages

- No human selection (human-independent)
- Traceable (data can be stored for a re-inspection)
- Easy collaboration and visualization
- Very productive and error-free (Automatic report)

Things to Consider

- Requires a somewhat of clean surface (Manual tools too)
- Each virtual method performs better in a specific industry



New Applications

3D scanners open the door to new applications and address unsolved industry challenges

Other applications

Fretting Between Tail Connection Assessment

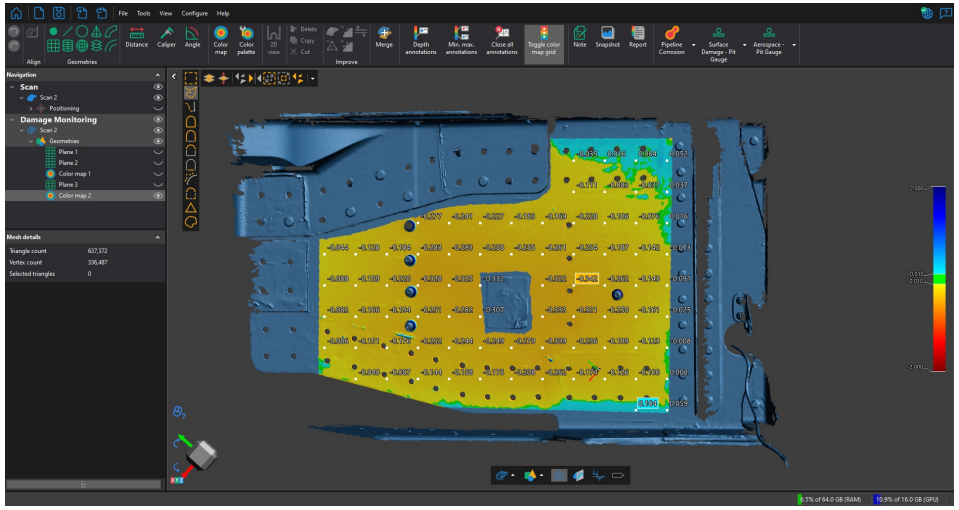


Figure 1-Connection tail **fretting** material loss assessment

Dent impact on the nose of a plane

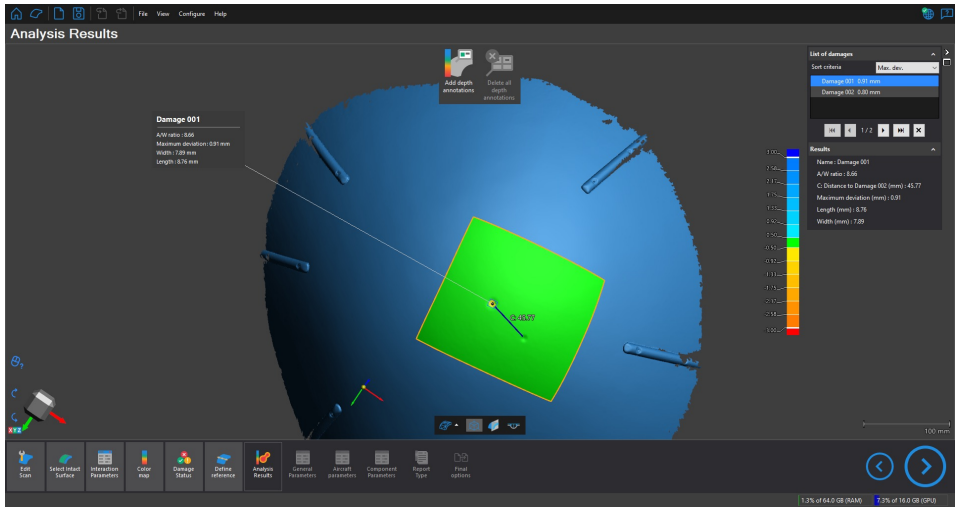


Figure 2-Small impact on the nose of a plane assessment

Other applications

Leading edge dent assessment

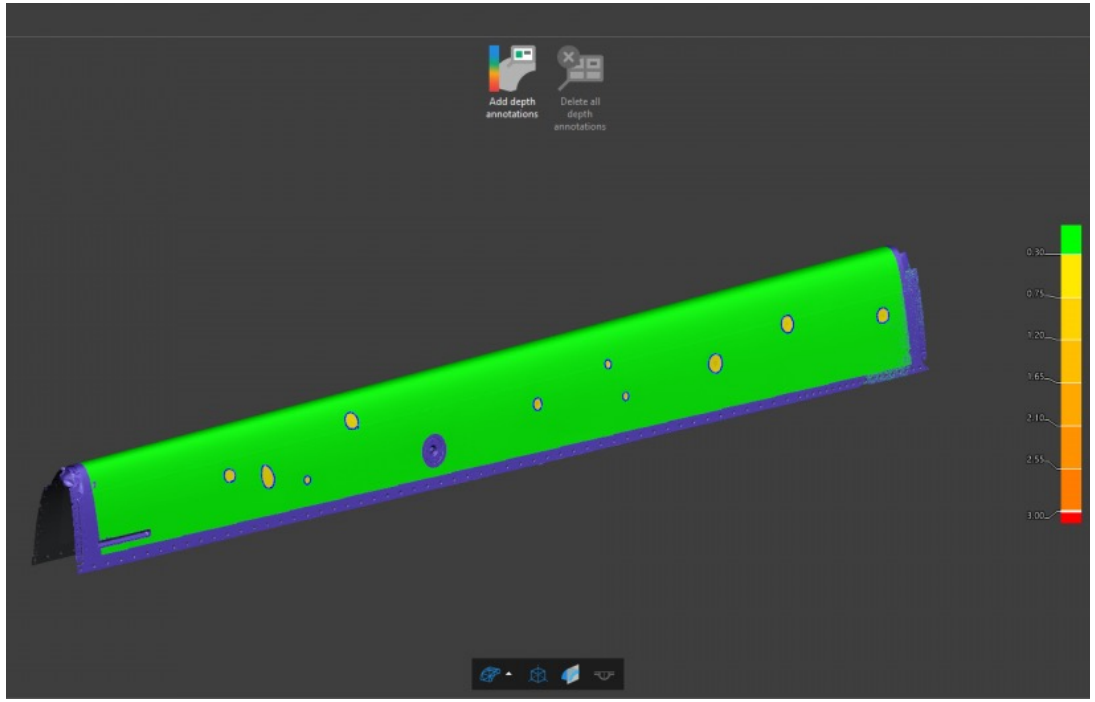


Figure 3 - Evaluation of small impacts on a whole leading edge

Material loss Assessment on complex part

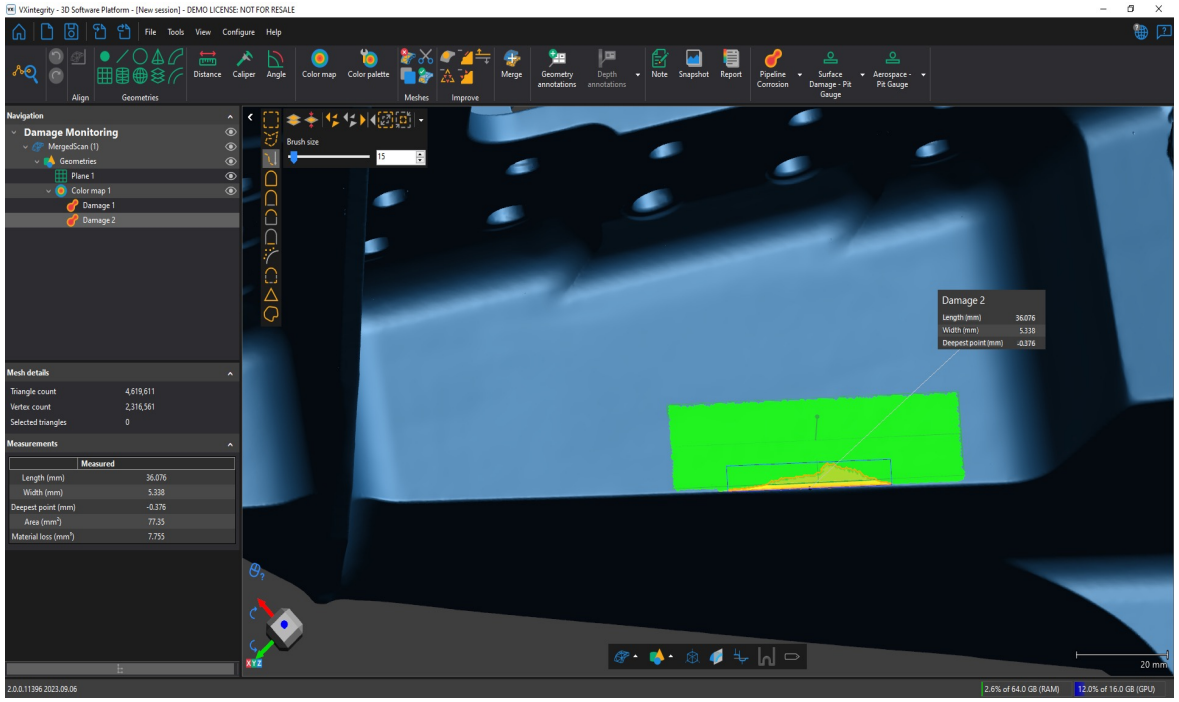


Figure 4 - Blend of corroded area material loss assessment

Other applications

Complete airplane assessment dent damage after a hailstorm

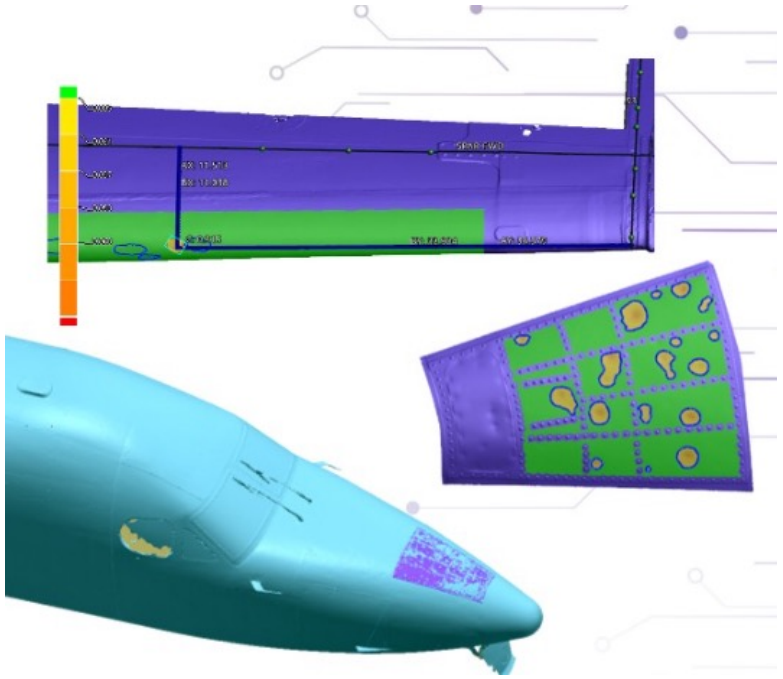


Figure 5 - Beechcraft 1900D that had flown through a hailstorm with dents everywhere on the aircraft

Questions ?