

Improving RVSM-critical area inspection.

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CREAFORM

AMETEK
ULTRA PRECISION TECHNOLOGIES

Evaluating the RVSM-critical area



CAUSES OF ASE

4.3.1 Causes of ASE

- 1) Aircraft skin waviness;
- 2) Aircraft skin flexing in critical areas near to the pitot heads and static vents;
- 3) Decals or company logos fixed to aircraft skin in aerodynamically critical areas which cause micro turbulence and disruption of airflow;
- 4) Paint not to specification;
- 5) Loose or damaged rivet heads;
- 6) Rigging of static vents out of tolerance;
- 7) Damage in the sterile area of the static vents;
- 8) Fuselage damage;
- 9) Incorrect pitot head alignment;
- 10) Corrosion or erosion in pitot heads and static vents;
- 11) Humidity or leaks in static lines;
- 12) Air data computers (ADCs) drifting out of value often due to transducer deterioration;
- 13) Changes to the SSEC algorithms contained in ADCs or wrong version (dash number) of units fitted;
- 14) Operation of the aircraft outside the defined RVSM flight envelope;
- 15) Altimeters out of tolerance;
- 16) Addition of external units to skin surface;
- 17) Other changes to airframe configuration (winglets, cargo doors);
- 18) Faults in other mechanical and electrical components;
- 19) Angle of attack vane alignment;
- 20) ATC transponders (in certain classes of airspace);



Guidance Material for the Certification
and Operation of State Aircraft
in European RVSM Airspace

Edition: 1.0
Edition Date: 19 September 2012
Status: Released issue
Class: General Public

CAUSES OF ASE

4.3.1 Causes of ASE

1) Aircraft skin waviness;

2) Aircraft skin flexing in critical areas near to the pitot heads and static vents;

3-SIGMA RANDOM ERROR

use micro

Quantify Effects of Random Error

Example: Mach 0.7, 35kft, Light Weight

Error Type	3- σ Error Level (ft)	Effect on RSS (ft)	Typical level of error (1- σ)
Skin Waviness	120	49	40
Steps&Gaps	90	26	30
Probe Repeatability	60	11	20
Probe Mounting	45	6	15
Pressure Transducer	30	3	10
RSS	170		

units fitted;

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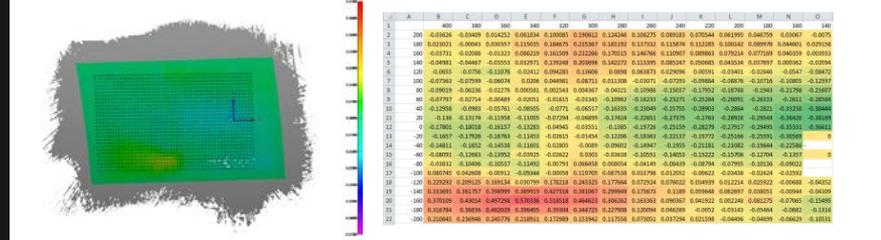
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TRADITIONAL METHOD OF MEASURING SKIN WAVINESS & PANEL STEPS

- Matrix of discrete points not whole surface
- Manual measuring equipment
- Requires team of 2 or 3 people
- Takes several hours
- Prone to human error
- Operator skill dependent
- No true auditable process



PROPOSED NEW METHOD: 3D SCANNING



- Already approved
- 0.03mm accuracy
- 480K measures/sec

Key benefits:

- > High accuracy
- > Repeatability
- > Traceability
- > Portability
- > Ease of use

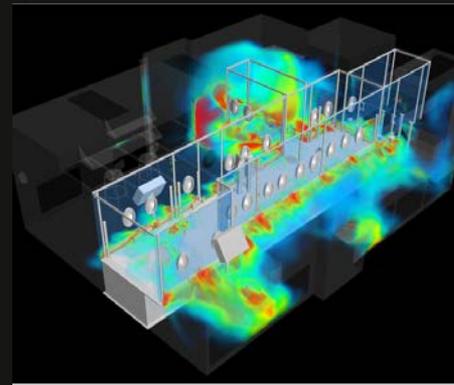


With the use of 3D scanning we can reduce inspection time to 30 minutes per square meter (-80%)!



OPENS THE DOOR TO:

- **Automated CFD analysis over the whole surface instead of simply measuring unidirectional skin height differences at discrete points**
- **Performing that CFD analysis for different flight levels, density altitudes and AOAs**
- **Checking alignment of the probe in relation to skin surface**
- **Automatic comparison of scans of probes or flush static ports with their manufacturer CAD files to check for deformation or wear**
- **Comparing same-type RVSMCAs to check for systemic problems (skin buckling)**



COMPUTATIONAL FLUID DYNAMICS (CFD)

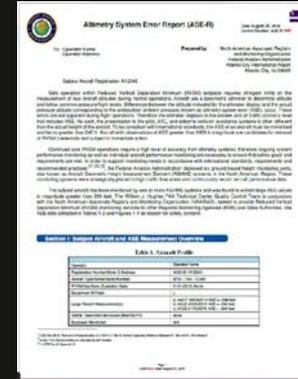
Creform's CFD engineer specialists have years of experience in providing CFD consulting services for discerning manufacturers looking for best practices in numerical simulations.

Throughout your entire product development, product design or QC process, Creform's CFD consulting team can help you achieve aggressive product performance and quality levels by identifying ways to optimize your product designs and manufacturing methods. We are proud members of the International Association for the Engineering Modeling Analysis and Simulation Community (NAFEMS).

[SUBMIT YOUR CFD PROJECT](#)

APPLICATIONS:

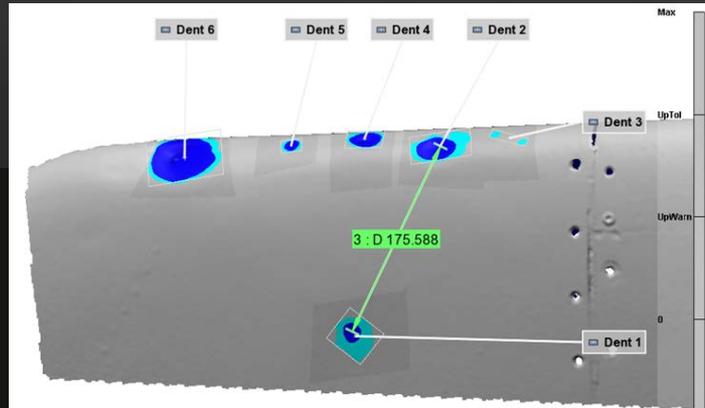
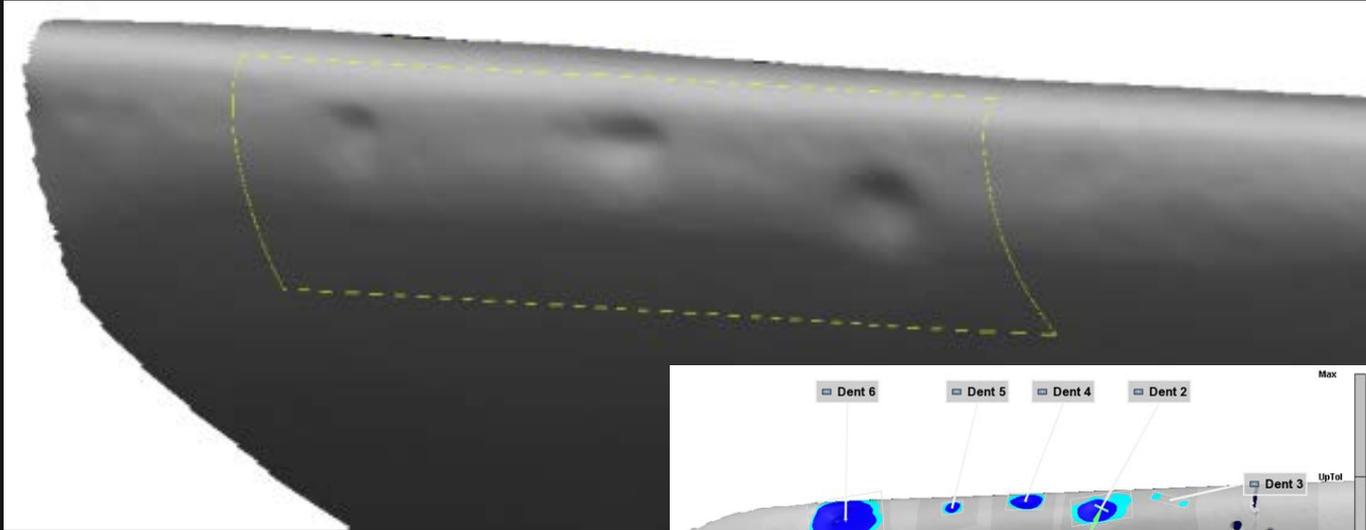
- Type RVSM compliance at point of manufacture
- Single A/C RVSM compliance
- Resolving ASERs from the AGHME system
- Deeper study of type-problems

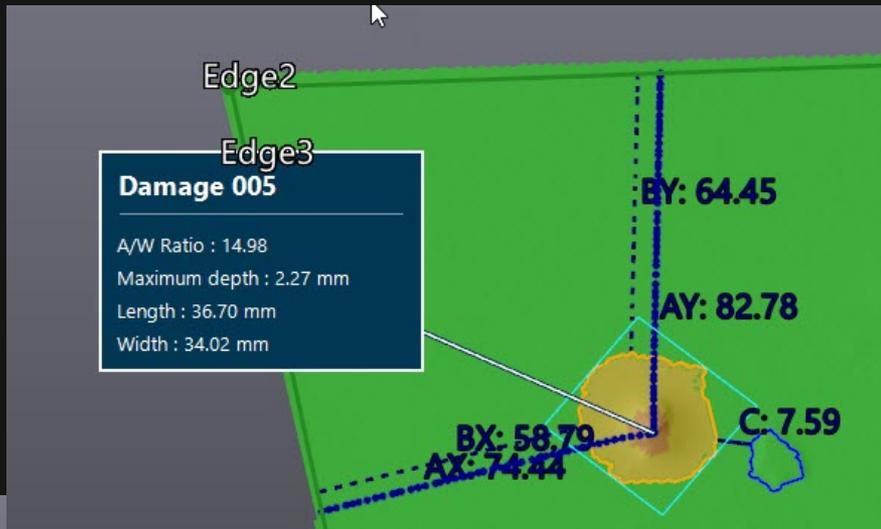


Creaform is not a DER, but we can bring improvements to the RVSMCA inspection process.

We want to collaborate with the FAA, A/C manufacturers and DERs with intimate knowledge of the RVSM process to implement a quicker, cheaper and easier way of inspecting RVSMCAs to reduce ASEs.

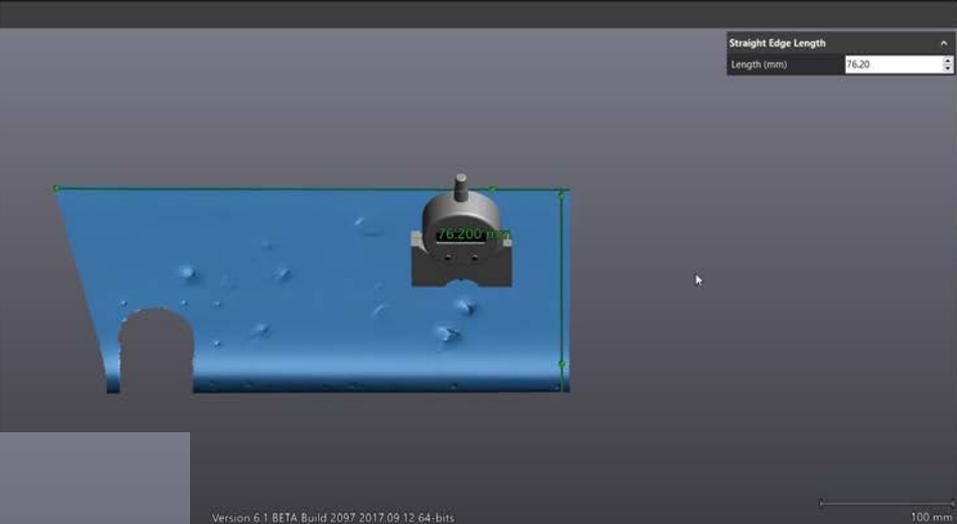
By-the-way we also do: Hail Damage





Damage 005

A/W Ratio : 14.98
 Maximum depth : 2.27 mm
 Length : 36.70 mm
 Width : 34.02 mm



Straight Edge Length

Length (mm) 76.20

Version 6.1 BETA Build 2097 2017.09.12 64-bits

100 mm



Damage 004

A/W Ratio : 47.35
 Maximum depth : 0.25 mm
 Length : 15.48 mm
 Width : 11.91 mm

Damage 006

A/W Ratio : 41.27
 Maximum depth : 0.88 mm
 Length : 46.08 mm
 Width : 36.37 mm

Damage 001

A/W Ratio : 7.04
 Maximum depth : 3.90 mm
 Length : 32.39 mm
 Width : 27.44 mm

Damage 005

A/W Ratio : 14.98
 Maximum depth : 2.27 mm
 Length : 36.70 mm
 Width : 34.02 mm

Add depth annotations



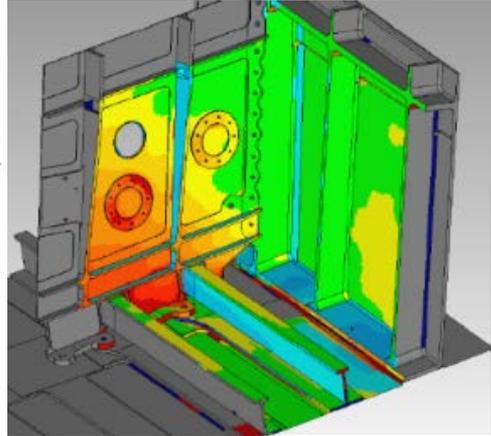
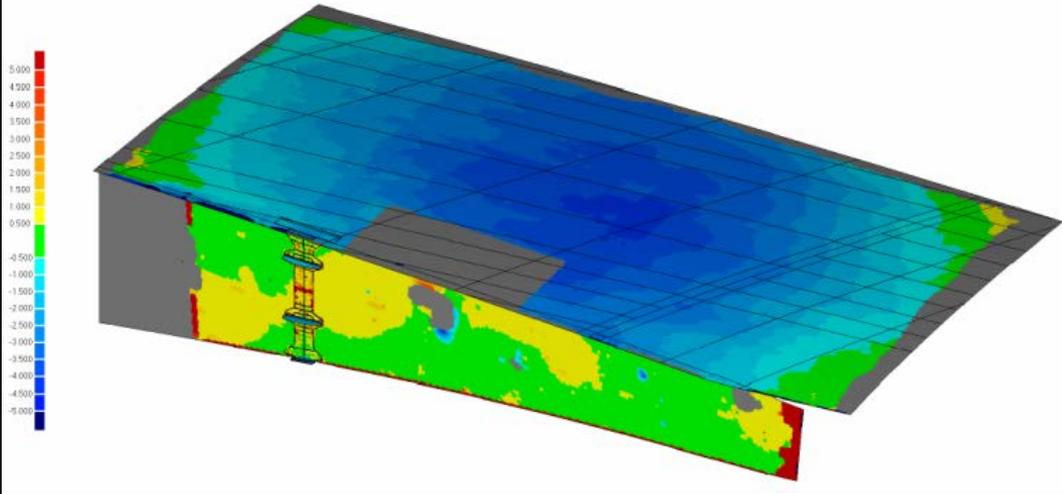


AIRBUS



BOEING





CONCLUSION

WHY DO CLIENTS OPT FOR A DIGITAL 3D SOLUTION?

1. REPEATABILITY & REPRODUCEABILITY OF RESULTS
2. OPERATOR SKILL INDEPENDANT
3. RAPIDITY AND SIMPLICITY OF DATA ACQUISITION
4. INFORMED DECISION-MAKING
5. TRACEABILITY AND ARCHIVING OF ALL MEASUREMENTS



We are:

CREAFORM


AMETEK[®]
ULTRA PRECISION TECHNOLOGIES

Thank you!

