‘Go/No-Go’ 3D digital dent-mapping:
Achieving consistently accurate SRM compliant results that accelerate turn-around time

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September 21-24, 2015
“Don't bend to technology. 
Bend technology to your needs”

- Jason Pontin
MIT Technology Review
## The Dent-mapping Problem

<table>
<thead>
<tr>
<th>The Challenge</th>
<th>The Ideal Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve <strong>reliable</strong>, <strong>accurate</strong> and <strong>objective</strong></td>
<td>Real-time. Boosts inspection efficiency</td>
</tr>
<tr>
<td>- Dent-mapping &amp; assessment</td>
<td>Reliable &amp; Consistently Accurate</td>
</tr>
<tr>
<td>- Corrosion Blend-out</td>
<td>Comprehends SRM limits</td>
</tr>
<tr>
<td></td>
<td>Instant Answers...not just data</td>
</tr>
<tr>
<td></td>
<td>No Surface Preparation needed</td>
</tr>
</tbody>
</table>

- **Hail Damage**
- **Damage due to ground equipment**
- **Lightning strike**  
  *(Image Source: Boeing)*
**Customer Experience Today**

*3D Inspection Tools for dent mapping*

<table>
<thead>
<tr>
<th>What customers demand</th>
<th>What customers must tolerate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use</td>
<td>Difficult learning curve</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Complex tools &amp; menus</td>
</tr>
<tr>
<td>Consistency</td>
<td>Long interpretation time</td>
</tr>
<tr>
<td>Reliability</td>
<td>Subjectivity &amp; Human-error</td>
</tr>
</tbody>
</table>

*September 2015*
Empower the Operator

Delivering a Better Experience

Easy-to-use

- High-Accuracy & Consistency
- Flexible
- High-speed
- Portable & Self-contained
- Intuitive

Benchmark precision & performance
Configurable to different tolerance requirements
Lightweight
No cables or monitor
No external CPU

Efficiency boost >10x
Innovative User Interface
Real-time feedback
Principle of Operation

Structured Light Scanning

Sequence of encoded stripes projected on target surface

Stripes deform as per 3D features of object

3D data computed per triangulation methods

Further analysis performed on topology map
Measurement principle

- Analysis is performed without the need of a CAD model
- All information is calculated from the measured 3D data

![Diagram showing measurement principle](image)

- Measured coordinates used for Surface fitting
- Resulting surface fit

- Depth of dent
- Fitted Surface
- Object
Usability Engineering

Enabling Ease-of-Use

- Learnability: Ease of basic tasks
- Efficiency: Speed of performing tasks
- Memorability: Ease of regaining proficiency
- Errors: Frequency of user errors
- Satisfaction: Pleasant and intuitive design

Accuracy + Repeatability

Research Citation: Jacob Nielsen; “Usability Engineering”; 1993.
Simple One-button Operation

- No programming, no complex configuration menus...nada!
- Just One Button
- Quick Response (QR) barcodes = the right settings for the right job
Instant Answers

...not mountains of data

- Scan to Actionable Results™ < 2 seconds
- The Surface Becomes The Screen™ -- visual results projected onto the surface
- Simple color-coding = ‘go/no-go’ decisions
True Portability

- Designed for the shop floor
- Completely self-contained...no wires, no mess
- Fully networked design

(Image Courtesy: TAP M&E)
The Status Quo

- Manual gages, rulers and hand-drawn markings
- Hand-written results to quantify dents
- Time-consuming & Subjective
- Inconsistent and prone to Human-Error
# A Better Way

**Dent-mapping with dentCHECK®**

- **Zero-learning curve**
- **Point & Click**
  - Detailed dent analysis & classification
- **1-more Click**
  - SRM Compliant report saved

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**Image Courtesy: TAP M&E**

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### Measurement Report

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Part Name</th>
<th>Operator</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<td>3</td>
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<td>7</td>
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<td></td>
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<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Image Courtesy: TAP M&E**
End-to-End Digital Transcription

SRM Compliant 1-Click Analysis Report™

Answers @ your fingertips

<table>
<thead>
<tr>
<th>A / Y</th>
<th>Distance to frame &amp; stringer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deepest point x-section</td>
<td>Color-coded annotation</td>
</tr>
<tr>
<td>Audit-ready digital reporting</td>
<td>Detailed log (operator ID, time-stamp, job #)</td>
</tr>
<tr>
<td>Customizable reports</td>
<td>Fully networked</td>
</tr>
</tbody>
</table>

Note: Dimension 4A and 4Y should be measured from the edge of any underlying stringer or frame when internal access is possible. When measured from the outside, dimension 4A and 4Y should be measured to a distance 5mm from the nearest center line of underlying structure (deepest point to center of fastener line – 15mm).
Case Study

Hail-damaged 787 wing flap

Leading-edge wing-flap

Individual scans of flap sections
(scan duration → 1.8 seconds each)

Detailed Scan of 6-ft flap
(1-click scan stitching < 2 seconds)
Delivering a Better Experience

Innovative User Interface
Real-time feedback
Zero Learning Curve

Intuitive

High-Accuracy Consistency

Ease-of-use

Portable & Self-contained

Flexible

High-speed

Traceable to National Standards
Quick Analytical Reporting
Statistically Consistent & Repeatable

Lightweight
No cables or monitor
No external CPU

Actionable results <2 sec
Efficiency boost >10x

Configurable to different tolerance requirements

September 2015

www.8-tree.com
## Customer Benefits | The 8tree Advantage

*Boosting workflow efficiency*

<table>
<thead>
<tr>
<th>Task</th>
<th>Traditional 3D Inspection Tools</th>
<th>8tree® - The New Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpack, set-up &amp; power-on</td>
<td>Hours</td>
<td>Minutes</td>
</tr>
<tr>
<td>Understand how to operate</td>
<td>Hours</td>
<td>Seconds / minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Zero Learning Curve”</td>
</tr>
<tr>
<td>Program the tool to a task (one-time)</td>
<td>Days / weeks</td>
<td>Not required</td>
</tr>
<tr>
<td>Perform a measurement (scans)</td>
<td>Minutes</td>
<td>Seconds</td>
</tr>
<tr>
<td>Perform scan analysis</td>
<td>Hours+ *</td>
<td>Automatic (fractions of a second)</td>
</tr>
</tbody>
</table>

**Scan-to-Actionable Result (StAR index)™**

*Requires specialized analysis software (additional expense)*
Customer Benefits | The 8tree Advantage

What customers want  =  What customers get

Ease of Use

Accuracy

Consistency & Objectivity

Quick out-of-box experience

Simple to operate & understand

Instant Analysis = fast decisions!
Empower the Operator

- Real-time 3D dent-assessment
- 1-click SRM-compliant report
- Industry adoption

...what next?
End-to-End Solution

Digital Dent-Mapping → Aircraft Condition Tracking

...coming Jan 2016
Actionable Surface Inspection

Aerospace & Aviation

Automotive (OEMs & Insurance)

Pipelines & Civil Infrastructure
Thank you

Questions?

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