Digital Problem Resolution (DPR)
Using 3D Scans to Support a Revised Growth IR Resolution Process

ManTech Project Number S2762
Process Change - Under Cognizance of Industry
DCN# 43-4994-19

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March 12, 2019

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Overview

● Digital Problem Resolution (DPR) Overview
● History of Technology at NNS
● Overview of Technology and Applications
● DPR Project Details
DPR Project Overview

Project Purpose:

“Develop a process for capturing and retaining *growth work* items using digital information capture technologies”

Project Goals

1. **Phase I: Establish a Knowledge Base** to store identified resolutions for each growth work item (Complete 12/2018)

2. **Phase II: Define a new problem resolution process** and evaluate both the process and Knowledge Base in active contracts. (On Track for 8/2019)
History

- In the midst of a digital transformation
- Our business is being disrupted
- There are a multitude of opportunities
- In recent years – Laser Scanning
  - MANTECH: Reality Capture (April 2015)
  - NSRP: 3 Views to 3D (September 2017)
  - NSRP: Capturing In-Service Ship Configuration (2019-2020)
About the Technology

- **LASER Scanning** is the controlled steering of LASER beams followed by a distance measurement at every pointing direction. This method is used to rapidly and accurately capture shapes of objects, buildings, and landscapes. A variety of sensors exist with accuracy’s of .002”–0.125”.

- A **Point Cloud** is digital display of all the point information captured by the laser scanner including each point’s location (x, y, and z relative to a given origin) and other relevant information (ex. color, temperature, etc.).

- A **3D model** can be developed by linking points together via lines and then creating surfaces where 3 or more lines. Surfaces can also be constructed by using the points as a guide to define new 3D solid shapes.
## About the Technology - Hardware

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Accuracy</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeoSLAM ZEB-REVO RT</td>
<td>1 – 3 cm</td>
<td>3D mobile mapping</td>
</tr>
<tr>
<td>FARO Scan Arm</td>
<td>≤ 1 mm</td>
<td>Dimensional analysis, inspection, reverse engineering</td>
</tr>
<tr>
<td>Basis Surphaser 100HSX</td>
<td>≤ 1 mm</td>
<td>Reverse engineering, dimensional control, BIM, historical preservation, architecture, forensics</td>
</tr>
<tr>
<td>FARO Freestyle X</td>
<td>≤ 1 mm</td>
<td>Complex measurements, reverse engineering, facility management, forensics, accident reconstruction</td>
</tr>
<tr>
<td>FARO Focus3D X 330</td>
<td>1 mm</td>
<td>Ship repair, as-built documentation, facility management, surveying, forensics, quality control, historical/archeological 3D documentation, BIM</td>
</tr>
<tr>
<td>Leica P-20</td>
<td>3 mm</td>
<td>Industrial as-built documentation, BIM, construction, forensics</td>
</tr>
<tr>
<td>DotProduct DPI-8X</td>
<td>≤ 1.7 mm</td>
<td>As-built MEP, BIM, renovation design, progress tracking, forensics, heritage documentation, shipboard conditions</td>
</tr>
</tbody>
</table>

GeoSLAM ZEB-REVO RT

FARO Focus3D X 330

DotProduct DPI-8X
# About the Technology - Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leica Cyclone</td>
<td>Process, model, and manage 3D point clouds</td>
</tr>
<tr>
<td>FARO Scene</td>
<td>Processing and managing FARO scan data</td>
</tr>
<tr>
<td>Autodesk ReCap</td>
<td>Create point clouds or meshes ready for CAD and BIM authoring tools</td>
</tr>
<tr>
<td>Geomagic Design X</td>
<td>Reverse engineering, combine history-based CAD with 3D scan data processing</td>
</tr>
<tr>
<td>Geomagic Wrap</td>
<td>Transform 3D scan data and imported files into 3D models for use downstream</td>
</tr>
<tr>
<td>Basis Software SurphExpress</td>
<td>Surphaser scanner control, data analysis, and exportation</td>
</tr>
<tr>
<td>Elysium InfiniPoints</td>
<td>Point cloud data processing, modeling, and analysis for engineering applications</td>
</tr>
<tr>
<td>Thinkbox Software Sequoia</td>
<td>Stand alone point cloud processing and meshing</td>
</tr>
<tr>
<td>Capturing Reality RealityCapture</td>
<td>Automatically extract 3D models from a set of ordinary images and/or laser scans</td>
</tr>
<tr>
<td>Bentley Systems ContextCapture</td>
<td>Hybrid process reality meshes using point clouds supplemented with high-res photography</td>
</tr>
</tbody>
</table>
Current Use Cases

- As-built condition assessment and ship check
- Clash detection and analysis
- Virtual product measurement
- Execution of damage investigation
- Critical alignment
- Reverse Engineering

- Improved quality review
- Collection of data in normally inaccessible areas
- Asset documentation
- Job briefings and animations
- Digital problem resolution (DPR)
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DPR Project Theory

- **Initiate** Growth Work
- **Resolve** Growth Work
- **Plan** Growth Work
- **Execute** Growth Work

Knowledge Base
DPR Project Theory

Initiate Growth Work

Knowledge Base
DPR Project Theory

Resolve
Growth Work

New Passageway

Knowledge Base
DPR Project Theory

**Plan**
Growth Work

<table>
<thead>
<tr>
<th>Part #</th>
<th>Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>57832</td>
<td>Door Assembly</td>
<td>1</td>
</tr>
<tr>
<td>T8735</td>
<td>Paint</td>
<td>3 gal</td>
</tr>
</tbody>
</table>

**Instructions**

1. Remove pipe
2. Cap ends
3. Remove sheeting between stiffeners
4. Install door
5. Coat all surfaces to match surrounding

**Knowledge Base**

New Passageway
DPR Project Theory

Execute
Growth Work

Knowledge Base
DPR Project Demo

Video cleared for 2018 Sea, Air, Space (not sure PCR)
Questions?