Presentation for:

"Pilot Results and Assessment"

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In-Service Ship Re-Documentation

NSRP Advanced Shipbuilding Enterprise Research Announcement
Submitted by: Huntington Ingalls Industries, Newport News Shipbuilding

A Collaborative Proposal on behalf of:

Huntington Ingalls Industries,
Newport News Shipbuilding

SIEMENS Product Lifecycle
Management Software

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Briefing Topics

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In Service Ship Re-Documentation Pilot Results and Assessment Agenda:

- ❑Ship Check Business Processes
- ❑ Requirements Addressed by Project
- ❑ User Acceptance Test Results
- ❑ ISSR Pilot Results
- ❑ ISSR Goals and Objectives
- ❑ ISSR Pilot Assessment
- ❑ Production Implementation Considerations

ISSR Project Goals and Objectives

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The goal of this project is to reduce ship total ownership cost (TOC) to the Navy by radically Re-Engineering the In-Service Ship Check process.

The Project Team will leverage and integrate with the ongoing Newport News Shipbuilding (NNS) PLM NeXt 3D product model development activities. This project will be devoted to the more efficient creation and management of in-service ship configuration by:

- Efficient creation and management of in-service ship configuration scanned & optical data.
- Match ship configuration scan geometry to 3D product model parts catalog using geometry recognition technology.
- Compare the Ship 3D Design Product model with the scanned in-service Product model.
- Provide a current configuration in-service 3D product model for use in downstream maintenance and modernization activities.
- TOC reduction through reduced man-hours, reduced schedule time, and improved quality.
- Output products will support downstream Digital Shipbuilding processes and data exchange.
- This technology and process may be extended to additional ship classes utilizing a 3D Product Model



This project builds and tests a digital process that will provide cost effective Product Life Cycle support for In-Service Ford Class Ships and can be extended to additional ship classes.

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Ship Check Business Process Flow

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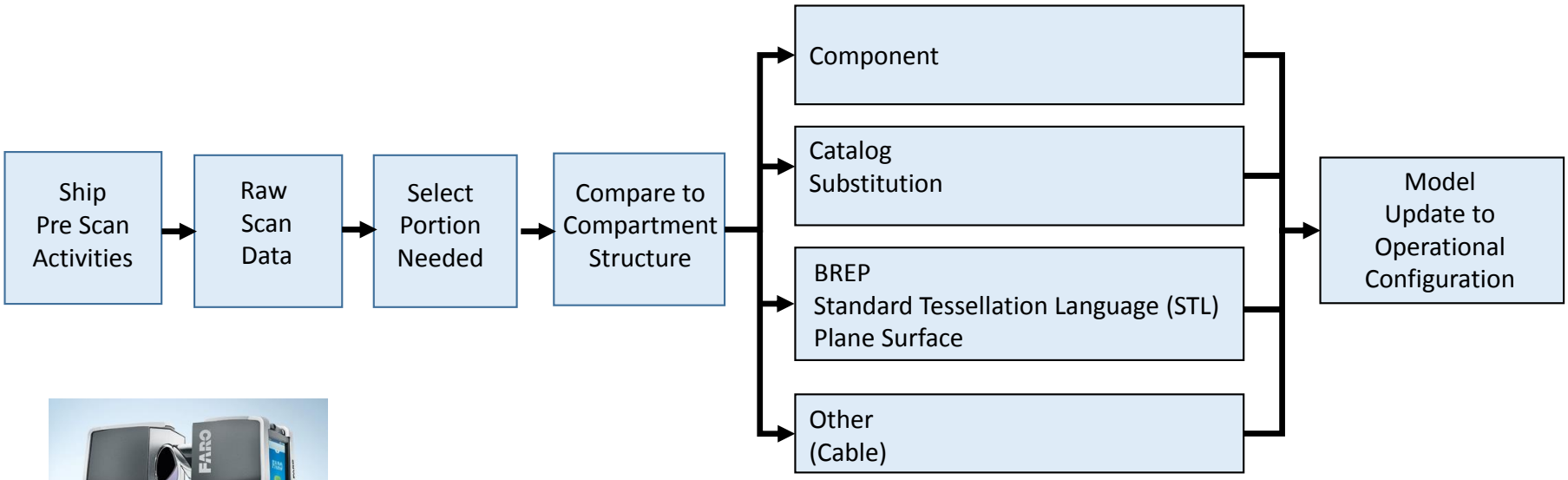

IN SERVICE SHIP RE-DOCUMENTATION

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Ship Check Business Requirements Addressed by this Project

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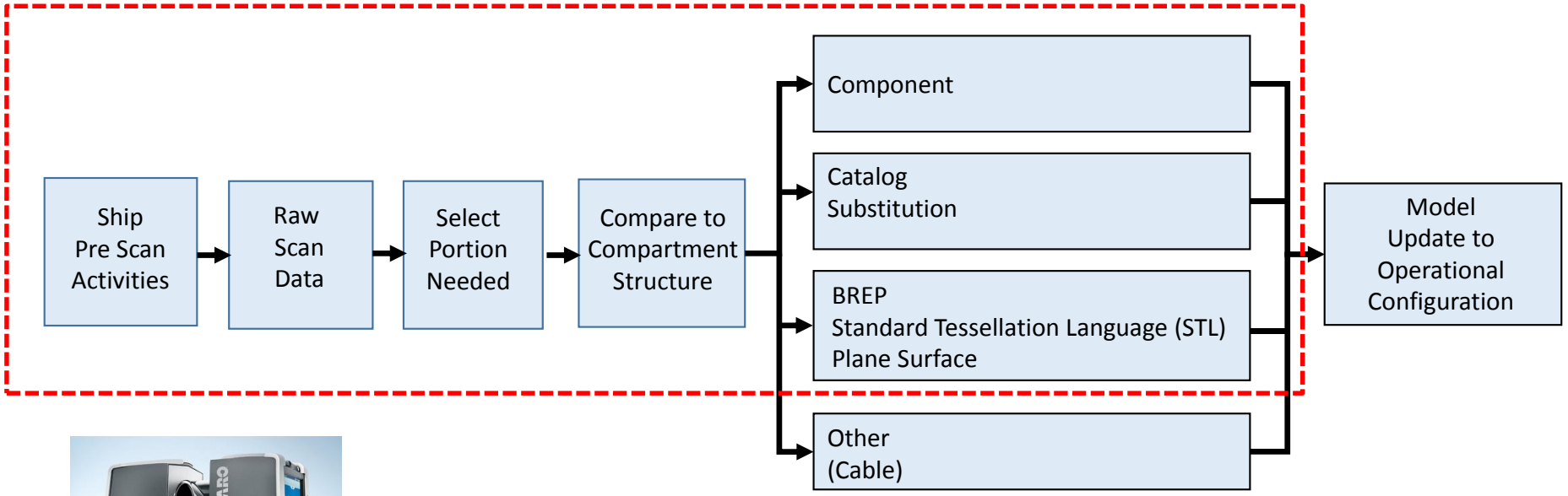
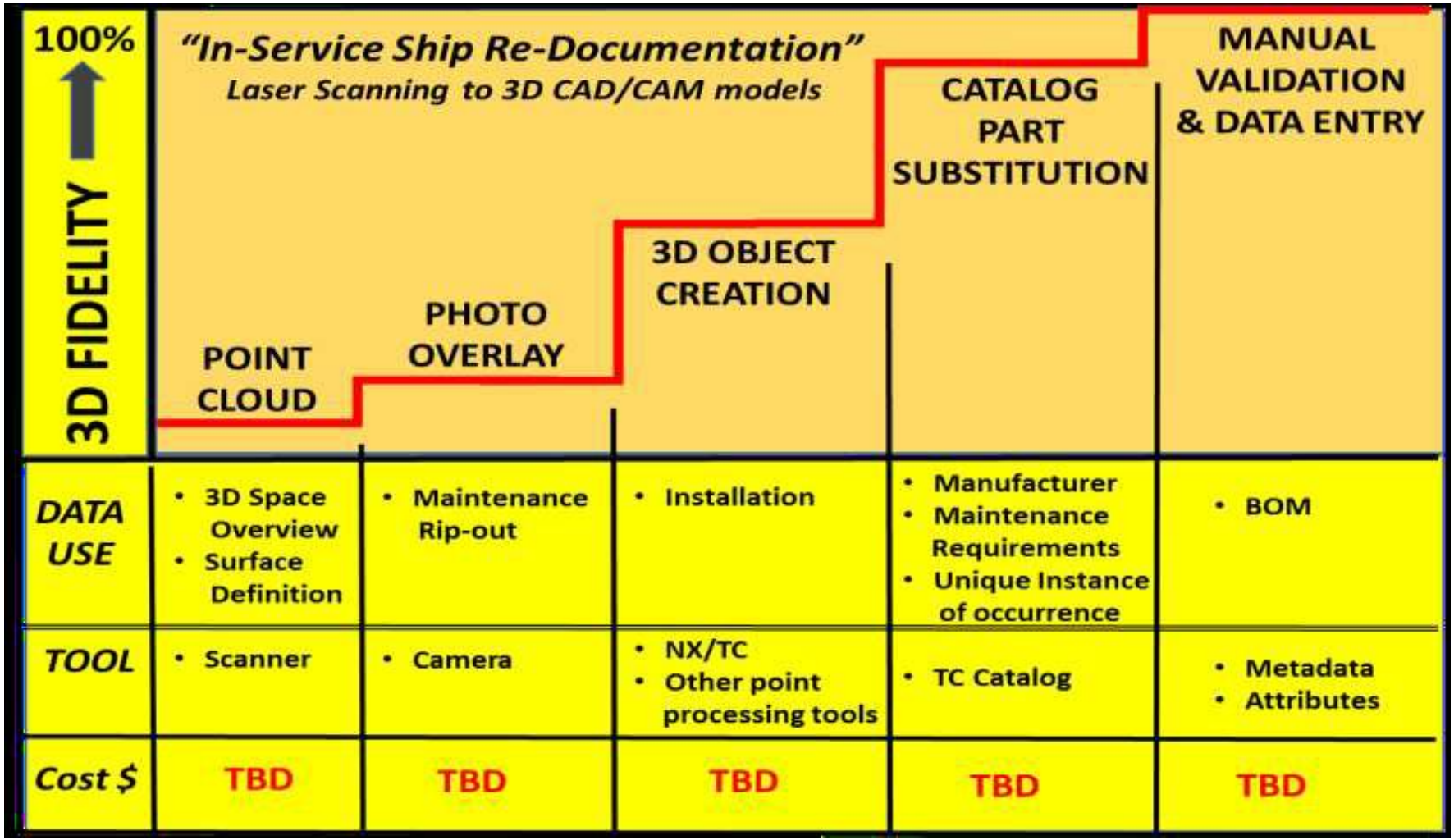
COMPLETED – In Scope Project Requirements



In Service Ship Re-Documentation Data "Fidelity" Increases as the Process is executed



ISSR Features List

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CLEAREDGE3D EdgeWise 5.0

ClearEdge3D's Building Information Modeling (BIM) software, EdgeWise, uses algorithms that can automatically identify and extract surfaces, structure, vent, piping, and other features from point clouds. The software's has an extensive library of steel members, and uses a proprietary pattern matching algorithm to make a precise mathematical best-fit to the point cloud without an operator having to clean, clip, or manipulate points.

Geomagic Design X

Geomagic Design X is a reverse engineering software that converts 3D scan data into high-quality CAD models. It utilizes a combination of automatic and guided solid model extraction, mesh editing, and point cloud processing capabilities.

ISSR Pilot Results

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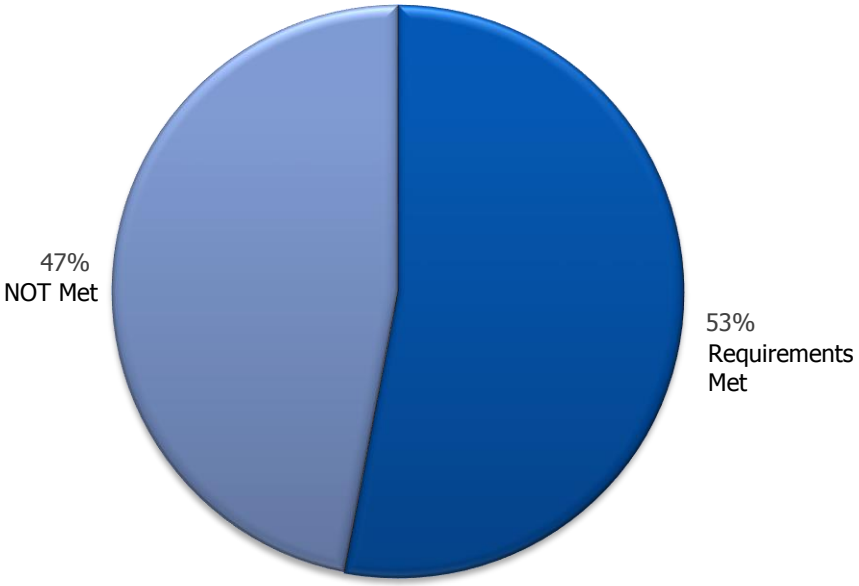
In Scope Project Requirements



Ship Class: CVN78

Product Model:
Forward Pump Room No 2

Success Rate: 53% of the in scope requirements were met.

ISSR Pilot Assessment Results

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ISSR Objectives - (CVN78 Pilot)

Efficient creation and management of in-service ship configuration from scanned and optical data	L (Largely Achieved)
Match ship configuration scan geometry to 3D product model parts catalog using geometry recognition technology	N (Not Achieved)
Compare the Ship 3D Design product model with the scanned in-service Product Model	P (Partially Achieved)
Provide a current configuration in service 3D product model for use in downstream maintenance and modernization activities	P (Partially Achieved)
TOC reduction through reduced man-hours, reduced schedule time, and improved quality	L (Largely Achieved)
Output products will support downstream Digital Shipbuilding processes and data exchange	P (Partially Achieved)
This technology and process may be extended to additional ship classes utilizing a 3D Shipbuilding Data Environment	P (Partially Achieved)
Increased Technology Readiness Level (TRL) - Pilot will increase TRL from 4 to 5	L (Largely Achieved)
Increased Manufacturing Readiness Level (MRL) - Pilot will create an MRL from 1 to 2	L (Largely Achieved)

ISSR Pilot Assessment Results

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ISSR NSRP Focus Areas - (CVN78 Pilot)

a.	Increased application of digital technolgies	• Innovative application of collected/stored data to shipyard business processes • Increased paperless workflow • Increased real-time digital communication and configuration management • *Increased application of modern communications and information technologies*	**L (Largely Achieved)**
b.	Reducing Total Ownership Costs	• Design for Maintenance and Repair • *Parts Commonality and re-use across platforms* • Other area in which ship total ownership costs can be reduced • Common Data Model to be used to support Maintenance and Production activities	**L (Largely Achieved)**
c.	Improving Processes	• Span Time Reduction from Shipboard to Engineering CAD models • Optimized Sequencing of Work (Reduction in Ship Check time and modeling efforts) • *Development and Implementation of Best Practices related to Process Technologies, and Build Strategy* • Configuration management of hull effectivity and part commonality in design and manufacturing execution systems	**L (Largely Achieved)**
d.	Improving Data Exchange	• *Leverage cloud data to compare scan geometry with Shipbuilding Data Environment parts catalog* • Integrate internal systems (scan data, product model data, ERP estimating, planning, scheduling, procurement, etc	**P (Partially Achieved)**

IN SERVICE SHIP RE-DOCUMENTATION

ISSR Pilot Assessment Results

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e.	Reducing Re-work	• Detailed scan data vs shipboard manual data collection of measurements, notes, and other ship check documentation. Multiple visits eliminated. • First Time Quality initiatives • *Design work packages with only required data*	**L (Largely Achieved)**
f.	Improving Specifications and Standards	• *Leverage cloud data to compare scan geometry with Shipbuilding Data Environment parts catalog*	**N (Not Achieved)**
g.	Improving Production Planning	• *Optimized Work packages* • *Work Package Development Tools* • *Capacity Planning Analysis* • Optimized Sequencing of Work	**P (Partially Achieved)**

ISSR Pilot Results

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Metric	"As is" Baseline	Project Goal	Pilot Assessment
Time to Create Ship-Check Engineering Drawings	Current Process	60% reduction	Achieved ✓
Time to create Shop Floor Docs	Current Process	50% reduction	Achieved ✓
Time to create distribute drawings	Current Process	90% reduction	Achieved ✓
Technology Readiness Level (TRL)	4 - Component validation in laboratory environment	5 - Component validation in relevant environment	5 - Component validation in relevant environment ✓
Manufacturing Readiness Level (MRL)	1 - Basic manufacturing implications identified	2 - Manufacturing concepts identified	2 - Manufacturing concepts identified ✓

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Production Implementation Considerations

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Point clouds are very large (sometimes made up of billions of points) data files. Hardware needs to be configured appropriately. The pilot machine was an HP Z800 Workstation with:

- two Intel Xeon X5560 2.8 GHz processors,
- 64 GB RAM,
- 8 GB Video Graphics Card, and
- a 2 TB hard drive

Learning how to scan can take awhile. Proficiency improves over time.

Pre Plan/Prep all scanning activities so needed scan details are not overlooked.

Scan teams need to move loose items when scanning a space.

Scan behind equipment to pick up cables and structure.

Scans should be reviewed daily to make sure all needed data has been captured.

Scanning shiny objects can be difficult (stainless steel or mirrors) because of laser reflection

Production Implementation Considerations

Laser scans are limited to line of sight, so complex spaces may require the scanner to be set up using several different stations. The pilot cloud test data (CVN 78 Forward Pump Room No 2) required the laser to scan from 19 different stations.

Physical obstructions that limit line of sight may require system details to be collected using hand held scanners.

Point clouds do not contain color information, only geometric information (X, Y, Z). If the team needs information about the color of the surface, it will be necessary to also use a a digital camera.

Many pipes, ventilation trunks, and surfaces are covered in insulation. Discrete parts, diameters, and other dimensions cannot be determined without removal of the insulation.

Laser scans cannot identify material