



NATIONAL SHIPBUILDING RESEARCH PROGRAM
ADVANCED SHIPBUILDING ENTERPRISE

Reducing Naval Ship Construction & Repair Costs



Newport News
Shipbuilding

3 Views to 3D

Joint Panel Meeting Update

Orlando, FL

Oct. 25-26, 2016

Brent Woodhouse

Frank Delar

The Opportunity

- New ship programs are being designed and built from the 3D model
 - Ohio Replacement Class and CVN 80 ENTERPRISE will be built from the model with little to no drawings
- Legacy programs, like the Nimitz, still have 40+ years of maintenance and modernization left
 - That means developing and maintaining drawings for workers that aren't born yet
- Laser scanning hardware and reverse engineering modeling software are becoming more affordable and efficient

Can the project show that creating a 3D model, in lieu of drawings, will support maintenance and modernization efforts?

Transitioning to model-based or maintaining drawing-based processes will require an investment


The Project Vision

Model-Based Enterprise (MBE) Capability





The Project Vision

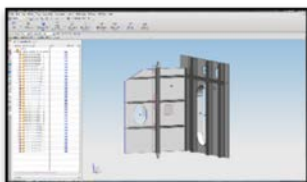
100%  3D FIDELITY	"In-Service Ship Re-Documentation" <i>Laser Scanning to 3D CAD/CAM models</i>					
	POINT CLOUD		PHOTO OVERLAY		CATALOG PART SUBSTITUTION	
	3D OBJECT CREATION			MANUAL VALIDATION & DATA ENTRY		
	DATA USE	<ul style="list-style-type: none"> • 3D Space Overview • Surface Definition 	<ul style="list-style-type: none"> • Maintenance Rip-out 	<ul style="list-style-type: none"> • Installation 	<ul style="list-style-type: none"> • Manufacturer • Maintenance Requirements • Unique Instance of occurrence 	<ul style="list-style-type: none"> • BOM
	TOOL	<ul style="list-style-type: none"> • Scanner 	<ul style="list-style-type: none"> • Camera 	<ul style="list-style-type: none"> • NX/TC • Other point processing tools 	<ul style="list-style-type: none"> • TC Catalog 	<ul style="list-style-type: none"> • Metadata • Attributes
Cost \$	TBD	TBD	TBD	TBD	TBD	

Depending on the use case, how efficiently can we increase model fidelity?



Capabilities Enabled by Going Model-Based

Siemens NX Product Model



Laser Scanning / Reality Capture



Mobile Shipbuilder



Shipyards Work Integrated Management System (SWIMS)



Visual Production Engineering & Planning

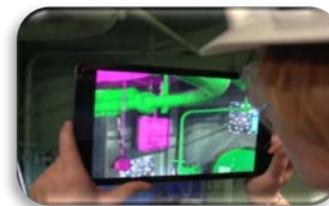
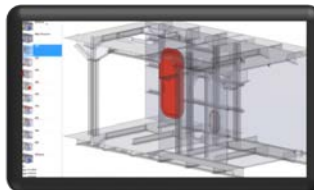


Model-based Manufacturing



Visual Work Instructions

Visual Build Sequence



Augmented Reality

Project Expectations

- This project is supportive of the long-term vision of an all-digital shipbuilding enterprise and Navy
 - Therefore, strive for the highest model fidelity level for each use case
- Be creative, innovative, and agile
- For the final report, need to show the cost/benefit of the current drawing-based processes vs our proposed model-based processes
 - Document current and proposed processes
 - Capture budgets and execution times for business cases later
- For the workshop, the team will give a LIVE demonstration of the processes
- At the end, the model will need to be available to NAVSEA, Norfolk Naval Shipyard, Puget Sound Shipyard for continued use

Project Goals

1. Create an environment to manage the data
2. Create a hull form for CVN 73
3. Load the laser scan data in ship's position
4. Based on the use cases, develop processes to model items needed for the RCOH
5. Consider collaborating members' use cases for later maintenance and modernization
6. Demonstrate process during a workshop

Team & Objectives

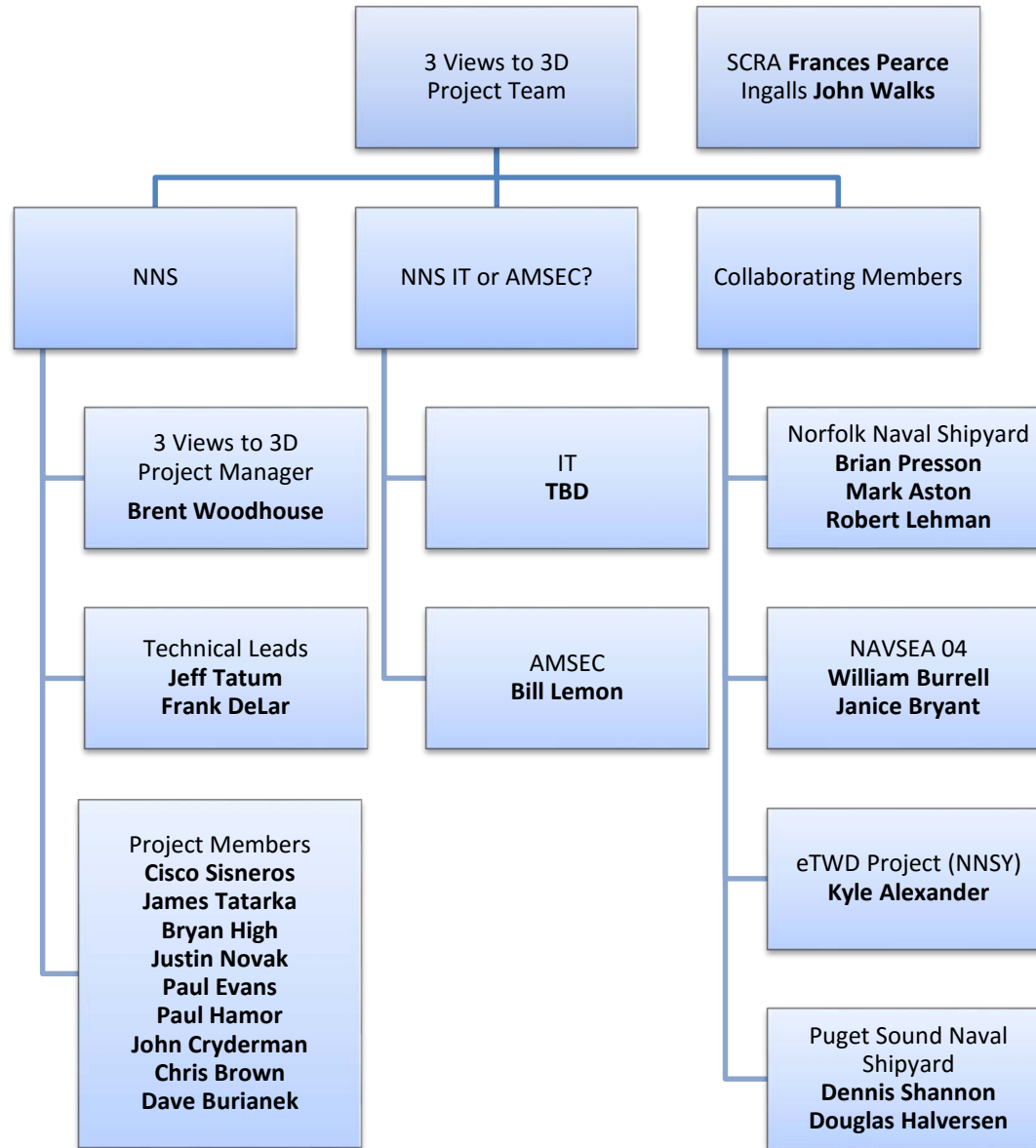
Project Team

- Lead: Newport News Shipbuilding
- Collaborating Members:
 - Norfolk Naval Shipyard (NNSY)
 - NAVSEA 04
 - Electronic Technical Work Document (eTWD) project
 - Puget Sound Naval Shipyard

Objectives

- Reverse engineer a 3D ship model for CVN 73
- Document best ‘2D to 3D’ practices
- Provide the 3D model to NNSY/NAVSEA for continued use during the remaining life-cycle

Project Organization



Project Plan

Original Start: April 1st
Actual Start: June 13th

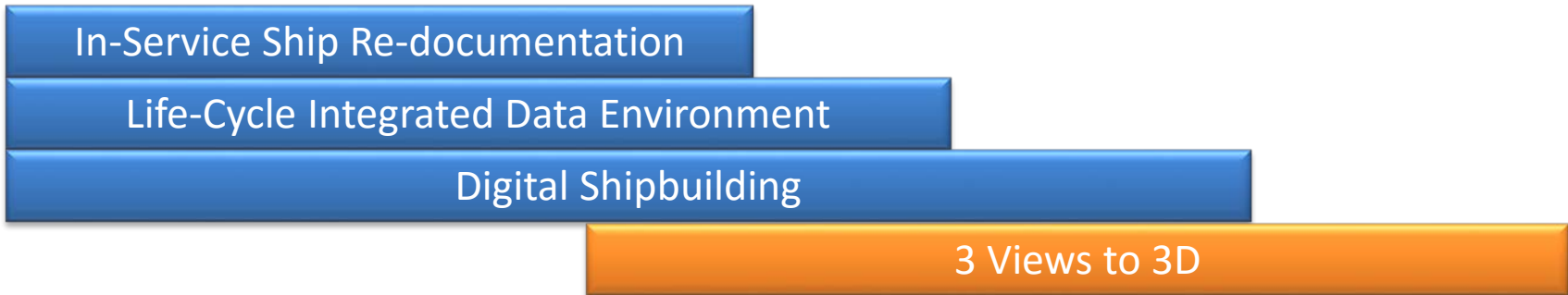
Project Duration 16 months

Phase I -3 months	Phase II - 7 months	Phase III - 6 months
Future State Requirements & Use Case Identification	Configure Environment & Develop '2D to 3D' Processes	Execute Pilots & Develop Workshop

Project Deliverables:

1. Use Case & Requirements Identification
2. Information Architecture Development
3. Pilot Plan and Environment Configuration
4. Pilot Execution Assessment Report
5. '2D to 3D' Conversion Processes
6. Final Report and Workshop

Supporting NSRP Projects:



Metrics/Benefit Realization Table

Once a digital environment is up and running, NNS President Matt Mulherin sees “certainly more than 15-percent savings”

Navy Fleet Savings:

Cost Reduction Forecast (Savings & Cost Avoidance, Immediate & Future)		
Cost Category	As-Is Baseline	Project Goal
Labor (6% total savings from the Navy's annual fleet maintenance budget)	\$9.4 billion	\$8.84 billion
TOTAL COST REDUCTION	\$540.0 million per year	

The following would be an example of this Business Case:
Drawing Process Today for Complex Overhaul and Refueling

Process Step	Ship Check	Drawing Development	Planning	Material Sourcing	Rip-out	Manf	Install	Inspect/Certify	Total
Est. Time	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs
Est. Cost	\$X	\$X	\$X	\$X	\$X	\$X	\$X	\$X	\$X

Project's Evaluated Model Processes

Process Step	Laser Scan	Model Development	Planning	Material Sourcing	Rip-out	Manf	Install	Inspect/Certify	Total
Est. Time	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs	X hrs
Est. Cost	\$X	\$X	\$X	\$X	\$X	\$X	\$X	\$X	\$X

Use Cases

1. Simple Ripout - Laser scan w/ annotation; video
 - i.e. gut space, upgrade equipment, electrical
2. Interferences - laser scan w/ annotation; video
 - i.e. direct and indirect impacts
3. Installation - Laser scan, hybrid 3D model
 - i.e. medical complex, island
4. Simple Repair & Maintenance - may need scan, use the 3D hull form with attached drawings
 - i.e. pump maintenance, motor overhaul
5. Complex Repair & Modernization - scan, model, removal paths
 - i.e. turbine casing, arresting gear removal
6. Address replacing CAPDAM with CVN 80 Piping processes

Go/No-Go Reviews

Decision for:	Required Deliverables	Criteria for “Go” Decision
<p>Phase 2 – Development (Newport News, VA, Sept 2016)</p>	<ol style="list-style-type: none"> 1. Project Management Plan 2. Use Case Identification 3. Requirements Definition 4. Information Architecture 	<ul style="list-style-type: none"> ✓ Requirements Definition and Use Cases completed and accepted by Stakeholders ✓ Information Architecture to support pilots ✓ Required resources available for next phase
<p>Phase 3 – Implementation (Newport News, VA, March 2017)</p>	<ol style="list-style-type: none"> 5. Pilot Plan 6. Pilot Environment Configuration 7. 2D to 3D Conversion Process 	<ul style="list-style-type: none"> ✓ Software/workflow unit testing successfully completed ✓ Pilot Project Plans completed and accepted by Stakeholders ✓ Mature Processes to Pilot accepted by Stakeholders ✓ Required resources available for next phase

Next Steps

- Complete pilot environment
 - Add decks, bulkheads to CVN 73 Hull Form
 - Test Process for loading point clouds in Ship's Position
- Develop 2D to 3D process
 - Refine Surfacing/Meshing process for each use case
 - Creating the 3D model parts
- Develop Pilot Plan
 - Ensure integration with Planning and Construction
 - Ensure can be visually planned for work packages
 - Manufacturing can create the model with PMI
 - Feed the VWI for Construction
 - Integrates with Visual Build Sequence and Progressing
- Develop metrics table for comparing current process to proposed process to capture cost savings



Thank You!

