



Potential for Applying Artificial Intelligence (AI) in Shipyards Processes

NSRP Sustainment Panel Meeting
Danville, VA
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Presenters:

Alaysha Shearn; HII-Newport News Shipbuilding
Mark Debbink; HII – Newport News Shipbuilding
Thomas Irwin; ODU – Center for Mission Engineering

Project Overview

- Prime/Lead:
 - Newport News Shipbuilding (HII-NNS)
 - Leads: Alaysha Shearn & Mark Debbink
- Team Members:
 - HII-Ingalls Shipbuilding: Ken Kenjale
 - HII-Mission Technologies – Unmanned Systems: Amanda Costa
 - Old Dominion University: Thomas Irwin & Mia Joe
- Duration
 - POP extension to 9/4/2026



Problem Statement

- AI is being increasingly integrated into defense industry processes and has proven to drive efficiency at lower costs.
- The Shipbuilding industry lags in the assessment of opportunities for AI integration to reduce costs, streamline processes, and provide competitive advantages.

Project Objectives

- Business Objectives:
 - To facilitate the planning and implementation of projects that drive the integration of artificial intelligence and machine learning in applicable use cases
 - To promote collaboration across the business at all levels
 - To identify and leverage defense AI projects and apply to shipbuilding processes
- Technology Objectives:
 - To increase the efficiency of technical processes
 - To increase knowledge of available artificial intelligence software and application
 - To leverage on premise systems and databases for data analytics



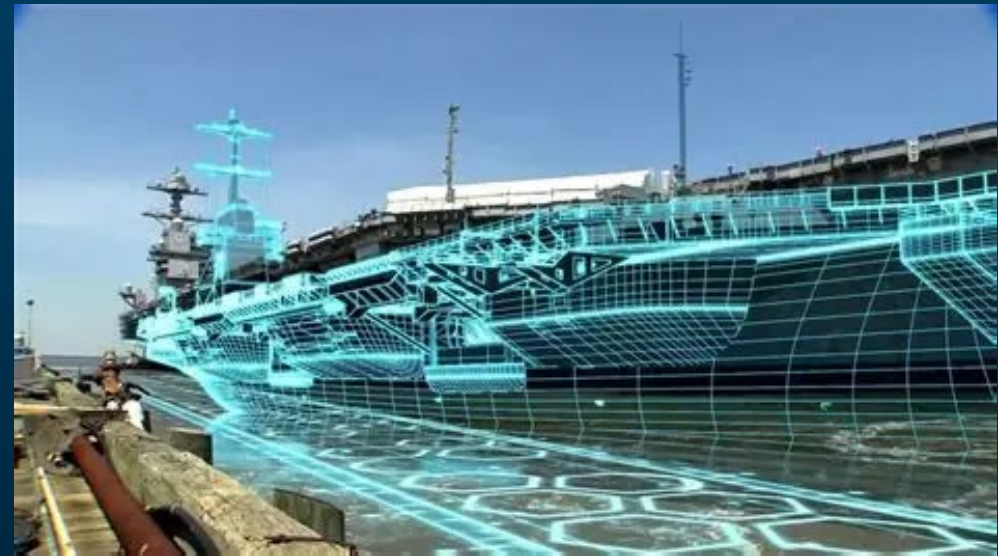
Expected Outcomes:

- Awareness of the opportunities AI can provide Shipbuilders.
- Results from AI pilot projects that can be extended to production use.
- Identified opportunities to drive efficiency throughout:
 - The engineering and design organization in the areas of communications, calculations, research gathering, evaluations, documentation, presentation, and digital twin applicability
 - Digital products for manufacturing data
 - Management of in-service data and sustainment products
 - Mission Readiness for the Navy
- Results that can have common use across Navy programs with minimal impact on software/hardware configurations.

Project Deliverables:

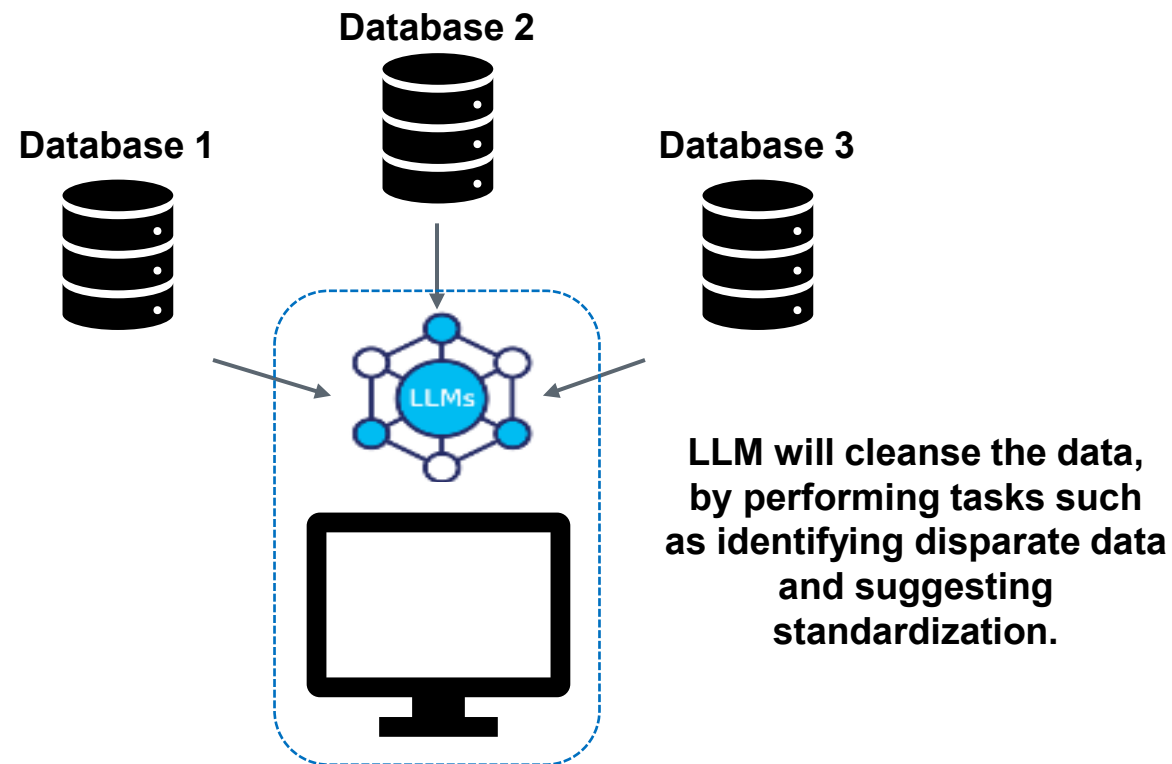
The tangible output of this project will be in the form of white papers describing:

- Categorization of AI use-cases applicability to shipbuilding
- Evaluation results of specific AI pilots/testing, implementation plans
- Follow-on Large-scale AI RA project options



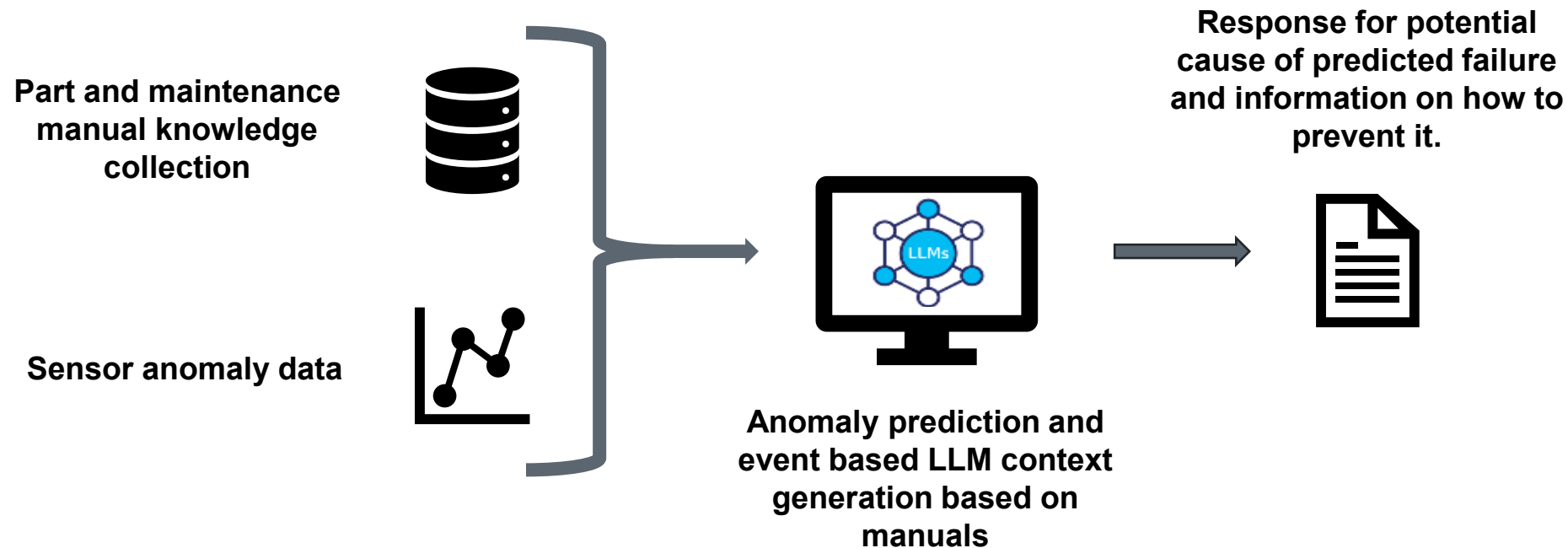
HII-Ingalls: LLMs for Data Harmonization

- Leverages a large language model (LLM) to identify and harmonize disparate data.
- Aims to detect semantically similar labels across datasets – such as bill of material – which often represent the same underlying variable but are inconsistently named.
- Benefit: Streamlines data integration and analysis



Unmanned Systems: Predictive Maintenance

- Unmanned Systems is in the process of developing a tool used for predictive maintenance on surface vessels
- Pilot will leverage AI/ML capabilities to identify maintenance events and predict when new events will occur. Event driven context will be provided by an LLM.
- Benefit: Increases longevity and optimizes sustainment activities



NNS Artificial Intelligence (AI) Industry Review – Manufacturing/Shipbuilding Application

Comprehensive Research/ Literature Review

Leverages online information, industry partner publications and use cases, academic publications, and more to provide an overview of AI application in shipbuilding.

AI Manufacturing and SCADA Technology (AIMST) Conference and Exhibition

(August 25-27, 2025 – Pittsburgh, PA)

- Three Tech Tracks

- AI Manufacturing
- Industrial AI 101 for SMEs
- SCADA Technology

- Discussion Topics of Interest

- Industrial AI Strategy & Implementation
- Manufacturing & Processing Technology
- Legacy System Integration
- Data Quality & Availability
- Digital Transformation



Artificial Intelligence (AI) Industry Review - Categorization

The below categories are AI application areas within Manufacturing. The industry review will determine how these applications are leveraged in shipbuilding.

Smart Design & Engineering



- Generative Design & Optimization AI
- Expert Systems / Rule-Based AI

Intelligent Shipyard Automation



- Computer Vision
- Machine Learning for Process Optimization
- Reinforcement Learning & Robotics
- Sensor Fusion AI

Connected Ship Lifecycle & Digital Operations



- Predictive Analytics / Machine Learning
- Anomaly Detection Algorithms
- Natural Language Processing (NLP)
- AI in the Metaverse/ AR/VR

ODU: Shipyard Mission Readiness Level Pilot

Discovery, Identification, and Review of:

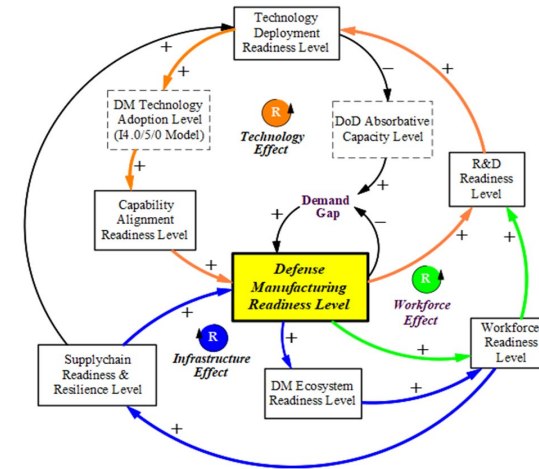
- Existing Data and AI Strategies to Understand Current and Potential Data Sources.
- Internal and External Data and Information Sources Relevant to Shipyard Readiness.
- Current Use Cases of AI Within Shipyard Processes.

Assessment Of:

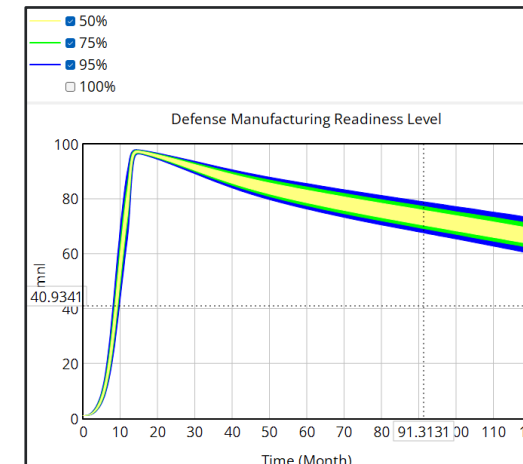
- How Existing Data Sources Map to Readiness Model Variables.
- Mission Readiness Dashboard Design & Functionality.

Development Of:

- An Inventory of Variables, Systems, and Feedback Loops Necessary to Model Shipyard Activities, Organizations, and Processes.
- A Report on the Strategy for Developing an Operational Shipyard Readiness Decision-Support Tool with User-centered Dashboards, Displays, and Information.

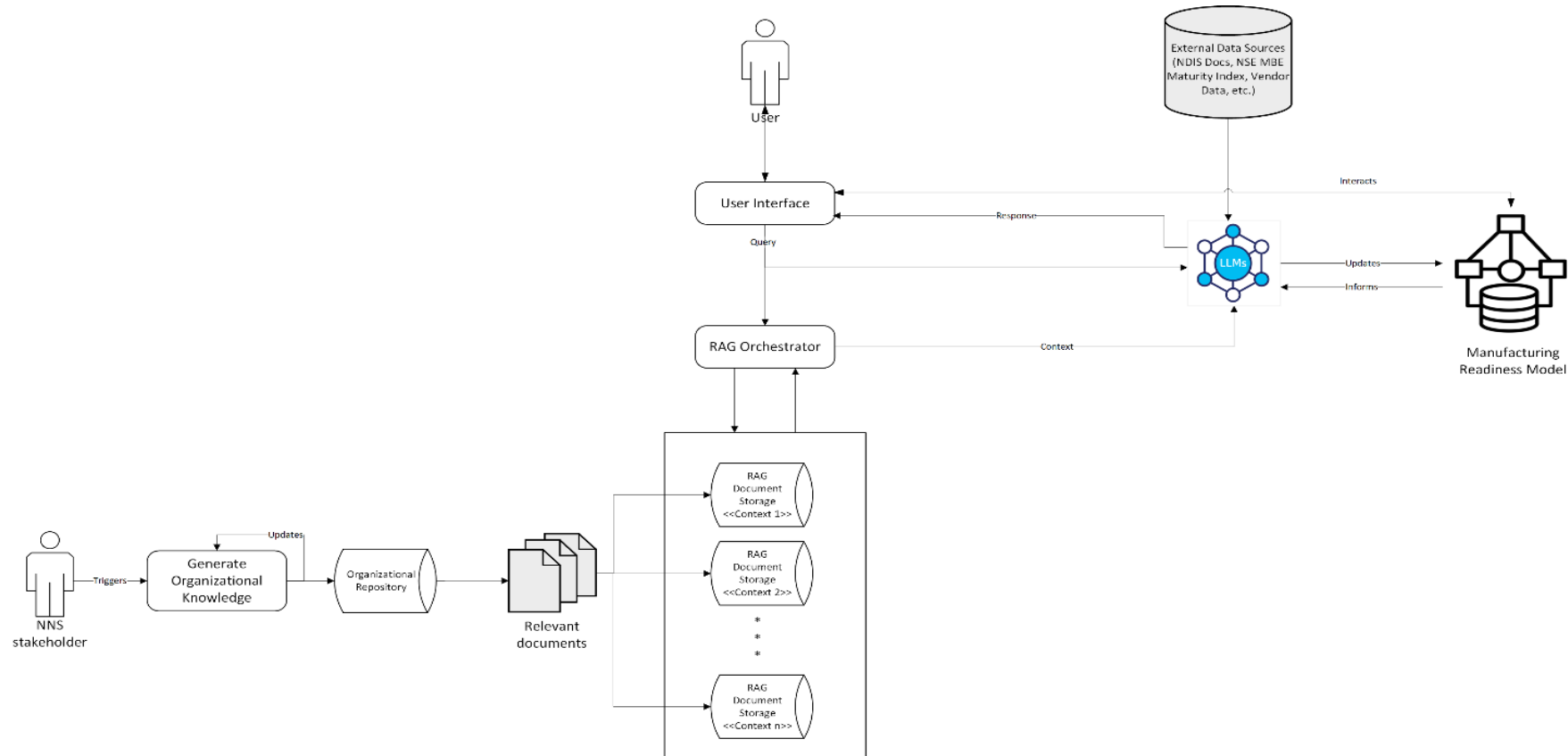


Readiness framework driving the decision-support tool.



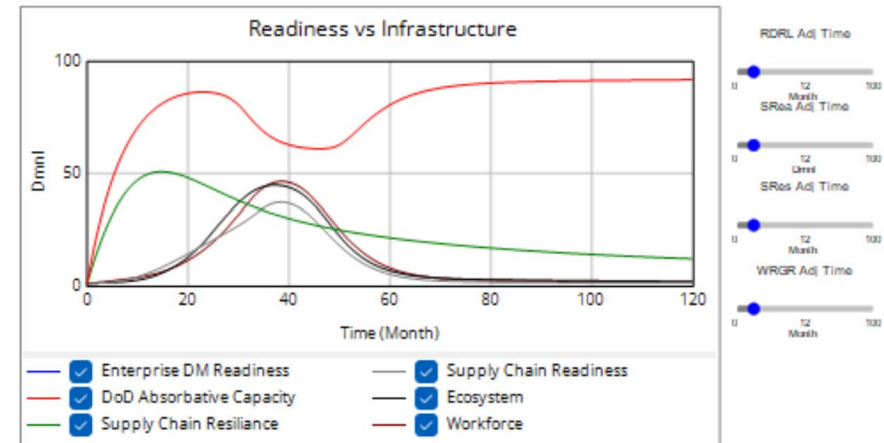
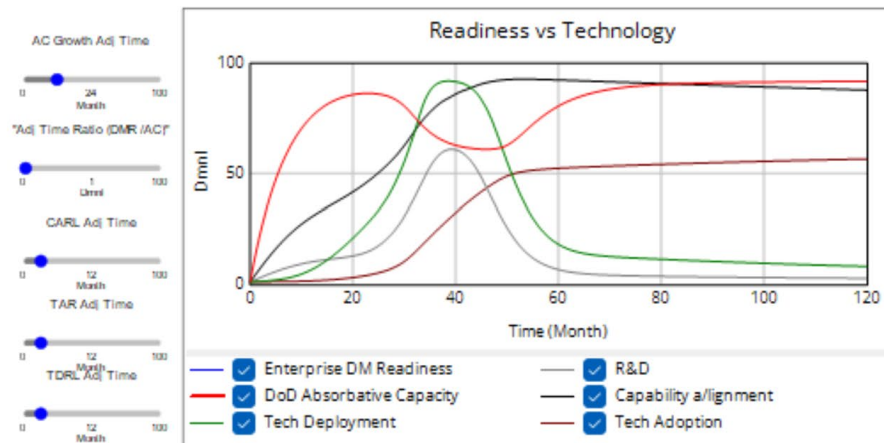
Architecture Overview

The high-level architecture of information and process flow in the RAG+LLM system, database connections and the resulting manufacturing readiness model.



Mission Readiness Key Systems of SoS

- Research & Development (R&D)
- Technology Deployment
- Technology Adoption
- Capability Alignment
- Supply Chain
- Workforce
- Ecosystem



Readiness is the Perishable Ability to Develop, Produce, Deploy, And Sustain.



Mission Readiness Systems Adapted to Component Completion

R & D

Ability to experiment, learn, and try improved methods or tools.

TECHNOLOGY DEPLOYMENT

Ability to turn tools and concepts into into repeatable day-to-day practice.

CAPABILITY ALIGNMENT

Degree to which work and outputs meet meet CVN program needs.

SUPPLY CHAIN

Reliability and resilience of materials, kits, materials, kits, parts, and supporting logistics.

ECOSYSTEM

External conditions that support work, work, such as training pipelines or regional support.

WORKFORCE

Availability, skill, and readiness of people people needed to complete the work. work.



Workshop 1: Current-State Readiness Assessment

Workshop Inputs:

- Mission statement and scope for CVN compartment completion.
- Current-state journey map for a representative compartment.
- Six-capability readiness snapshot.
- Three to four priority readiness challenge statements.
- Decision hot spots and initial opportunity themes for Workshop 2.



Workshop 1 Structure

1 - Empathize

People, roles,
good day / bad
day, mission
framing.

2 - Map

Map one
representative
CVN
compartment
end to end.

3 - Readiness

Readiness
Rate six
capabilities.

4 - Define

Convert issues
into 3–4
problem
statements.

5 - Ideate

Identify decision
hot spots and
opportunity
themes.

6 - Close

Validate outputs
against the
Workshop 1
deliverable.



Mission Statement

Activity

Round-robin

Name

Role

Primary Department

What a good day looks like for you on CVN compartments.

What a bad day looks like.

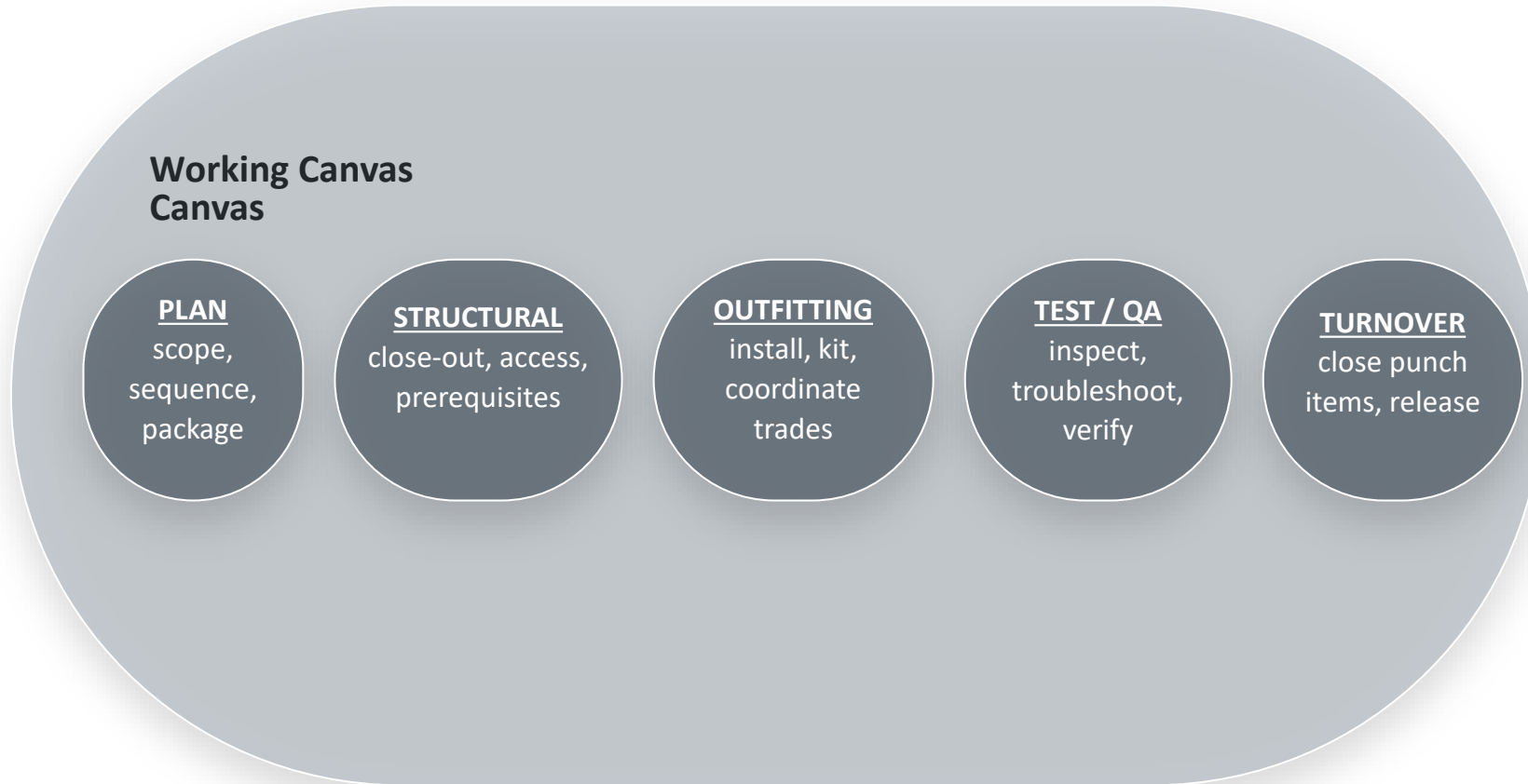
Mission

Ensure compartments are planned, executed, and tested on-time in support of the compartment completion schedule to deliver the capabilities to the Navy.

(Note: material, communication and accountability are implied in execution).



Journey Map One Compartment



Decision Hotspots and Opportunities

DECISION CARD

Decision to be made, owner role, current inputs, pain points, what better support would change.

PROMPT

“What is one decision that is consistently hard to make well because the information is late, incomplete, or fragmented?”

EXPECTED THEME

Forecasting & scheduling, cross-department visibility, material readiness, workforce planning.

1
Predict whether a compartment will turn over on plan.

2
Prioritize constrained craft or craft or materials across compartments.

3
Assess effect of late changes on downstream trades and test.

4
See whether punch-list growth signals a larger readiness issue.

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Heatmap Example



Workshop 2: Compartment Transition Readiness

Workshop 1 Problem Statement for Construction Supervisor: As a Construction Supervisor I need a live update of material and construction process to better gauge where we need to go. So that if I have a live tracker we can coordinate better with less down time and ping the next process without down time

Mission Context: The Construction Supervisor is responsible for ensuring that a compartment progresses through Planning, Structural, Outfitting, Testing, and Turnover activities according to schedule while minimizing delays, rework, and readiness risk.

Mission-Level User Story: As a Construction Supervisor I want to understand the real-time readiness status of a compartment before authorizing its transition to the next phase of work, so that I can make informed go/no-go decisions, prevent schedule disruption, reduce rework, and ensure compartment capabilities are delivered to the Navy on time.

**Integrated Decision Maturity Pathway (IDMP):
A Human-Centered Readiness and Decision-Support Framework**



Workshop 2: IDMP Visualizing Core Elements and Operational Factors



Core Elements

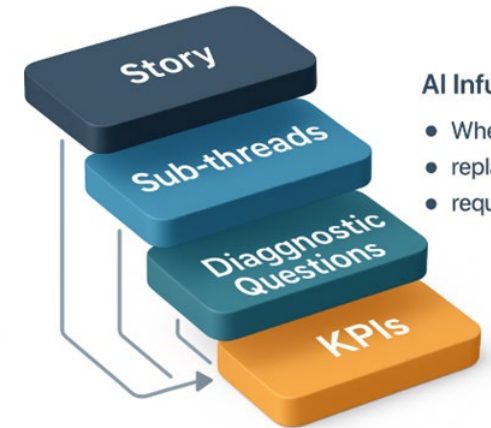
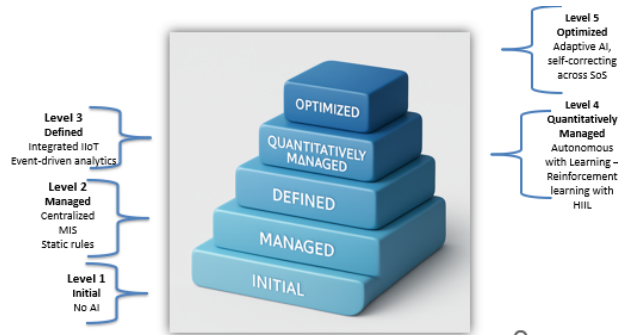
'Voice of the Operator' in mission readiness evaluations



Operationalizing Factors

-Defines AI input/Output conditions

-Highlights trust boundaries and fallback procedures



AI Infusion Points

- Where AI augments
- replaces
- requires oversight



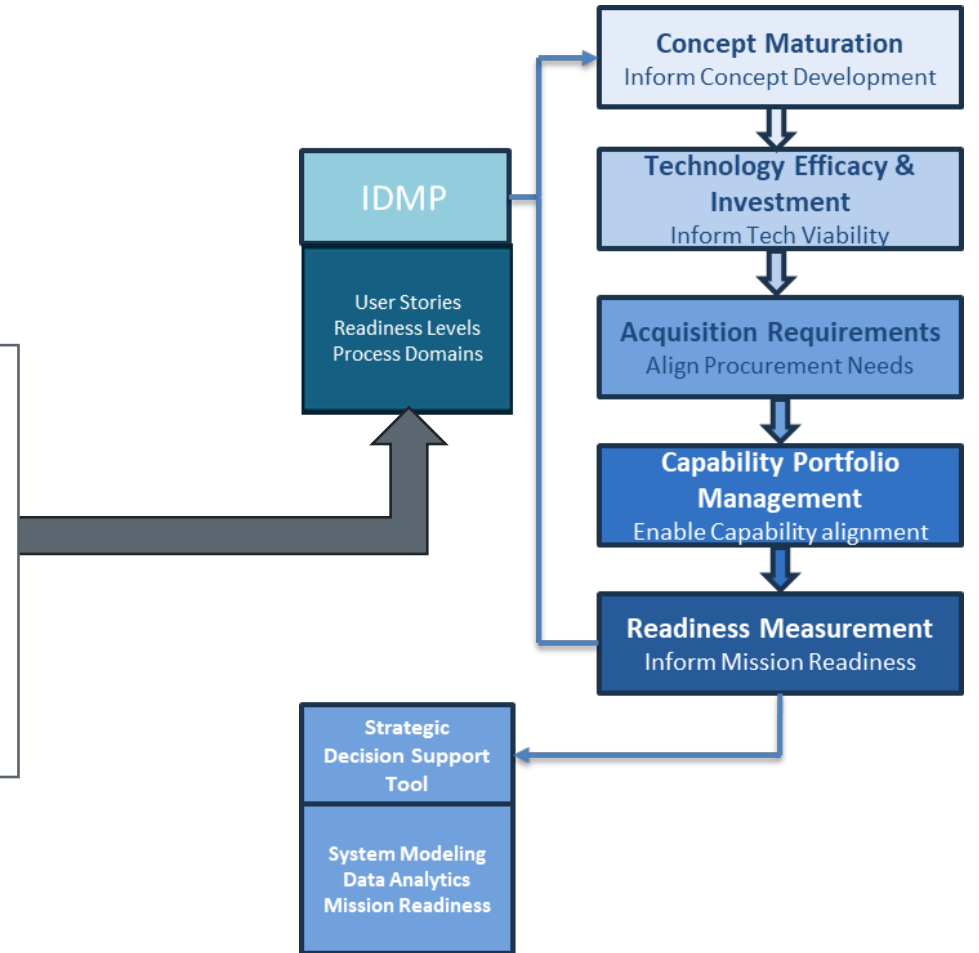
Compartment Completion IDMP Application

IDMP User Stories

As a construction Supervisor:

I want to understand the real-time readiness status of a compartment before authorizing its transition to the next phase of work, so that I can make informed go/no-go decisions, prevent schedule disruption, reduce rework, and ensure compartment capabilities are delivered to the Navy on time.

User Story development by production personnel facilitates discussion of digital analytic (AI, etc.) use in core job categories.

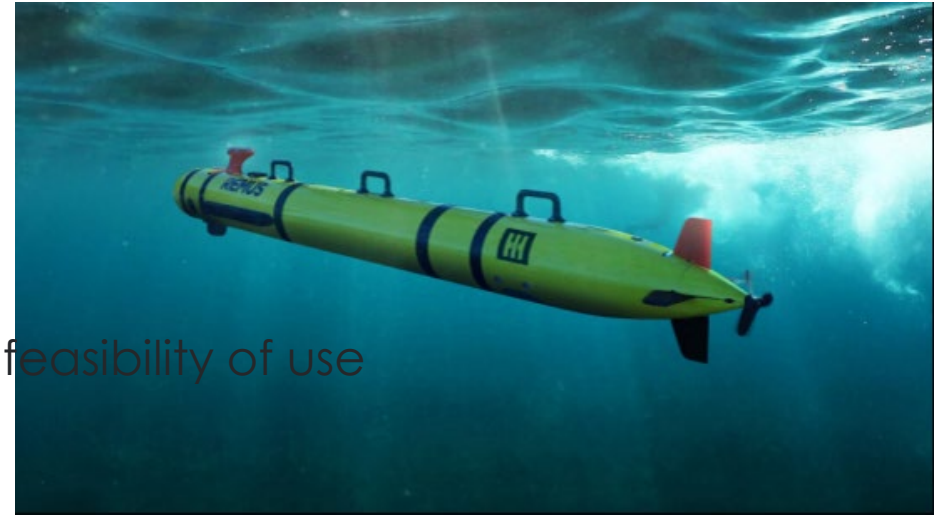


Mission Success depends on *Data-defined Mission/Mission Engineering Threads* for accurate Readiness Assessments



Upcoming Activities

- NNS-ODU Implementation Plan
- Ingalls Pilot Results & Demo
- Mission Technologies Pilot Results & Demo
- Final Report evaluates and scores value and feasibility of use case



Mission-Based AI-Driven Compartment Completion Readiness Assessment

Mission Statement: Ensure compartments are planned, executed, and tested on-time in support of the Compartment Completion schedule to deliver the capabilities to the Navy.



Phase #1

Partial NSRP Panel Project

Team: HII-NNS & ODU-CME

Compartment Completion:

- Use-Cases
- Interviews
- Pain-Points
- Initial ROI

Status: COMPLETE

Phase #2

Full NSRP Panel Project

Team: HII-NNS, HII-Ingalls , ODU-CME, PSNS

Data & Architecture:

- Data Source & Formats
- Data Normalization
- HW/SW Architecture
- AI Model Structure
- Add: System Completion
 - AI Model Extension

Status: NSRP Panel Project Proposal

Phase #3

Navy ManTech Project

Team: HII-NNS, HII-Ingalls , ODU-CME, PSNS, others

AI Model Development & Pilots:

- AI Model Completion
- AI Environment Stand-Up
- Pilot selected Use-Cases
- Output Report Format
- Test & Optimize
- Implementation Plans

Status: ManTech Proposal Under Development

Goals: Apply AI capabilities to improve Ship Compartment Completion processes by addressing:

- 1) Common Causes of Delay for delayed compartment turnover: Material availability, Incomplete work, packages, Workforce skill gaps, Documentation and approvals, Access constraints, Test issues
- 2) Workforce Readiness Findings (Skills)
- 3) Supply Chain Readiness (Material)
- 4) Process & Technology Pain Points (Approvals & Real Time Information)
- 5) Data & Analytics Usage; Not timely, Not trusted, Incomplete, Hard to find, Conflicting
- 6) Communication & Coordination (what works best –What fails)

Business Objectives:

- Resolve Identified Issues associated with the Compartment Completion Workshops
- Facilitate the planning and implementation of projects that drive the integration of artificial intelligence (AI) and machine learning in applicable use cases
- To promote collaboration across the business at all levels

Technology Objectives:

- To increase the efficiency of technical processes
- To increase Application of artificial intelligence (AI) software and application
- To leverage on premise systems and databases for data analytics



Thank you for your participation.

Potential for Applying AI in Shipyards Processes

