

# Building “Failure Data & Prediction Models” for Ship Construction & Sustainment Support

Exploiting Digital Data

NSRP Joint Panel Meeting at ODU M&S Center

RA Project Presentation

May 1, 2024 Suffolk, VA

Presenters:

Mark Debbink; HII-Newport News Shipbuilding

David Walker; ABS



# WHY Go Digital?



## Customer

- Tighter budgets
- Need for a bigger Navy
- Need accelerated acquisition
- Need more capable platforms
- Increased mission availability ( $A_o$ )



## Workforce

- “The Great Workforce culture shift”
- Large workforce retirement
- Increased resource demand
- Decrease time to talent
- Greater competition for talent

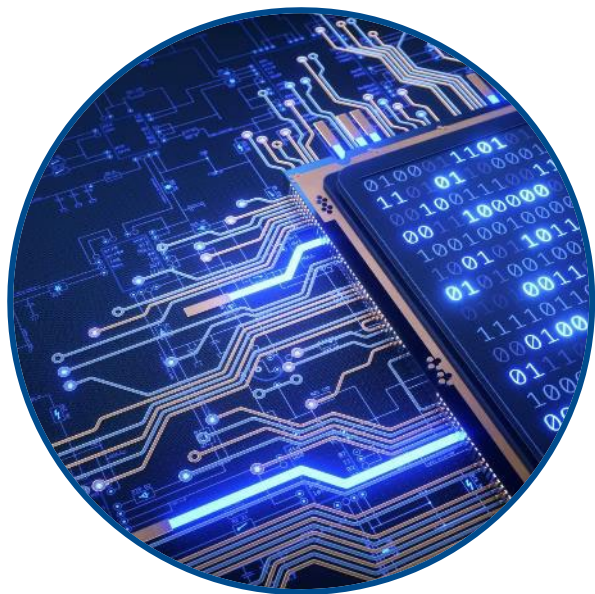


## Technology

- Model Based Engineering
- Digital Twin
- AR/VR/MR
- Additive Manufacturing
- Artificial Intelligence

**“We are not in a status quo time!” – Jennifer Boykin (NNS President)**

# Value in Digitally Transforming



## Engineer & Design

- Reduce Time to Customer / Market
- Reduce Cycle Time
- Increase Efficiency
- Reduce R&D Costs



## Build & Deploy

- Increase Production / Throughput
- Increase Quality
- Reduce Operational Costs

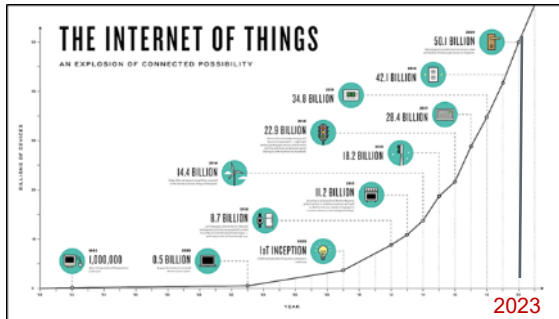


## Sustain & Operate

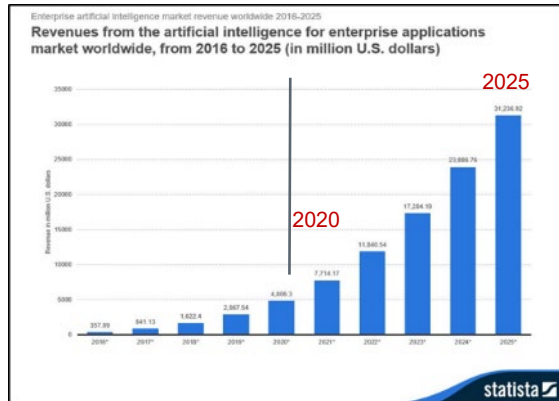
- Increase Op-Availability
- Reduce Operating Costs
- Reduce Sustainment Costs
- Improve the predictability of scheduling for yard availability

# Industry Digital Technology Trends – Consistent Projections for Rapid Advancement

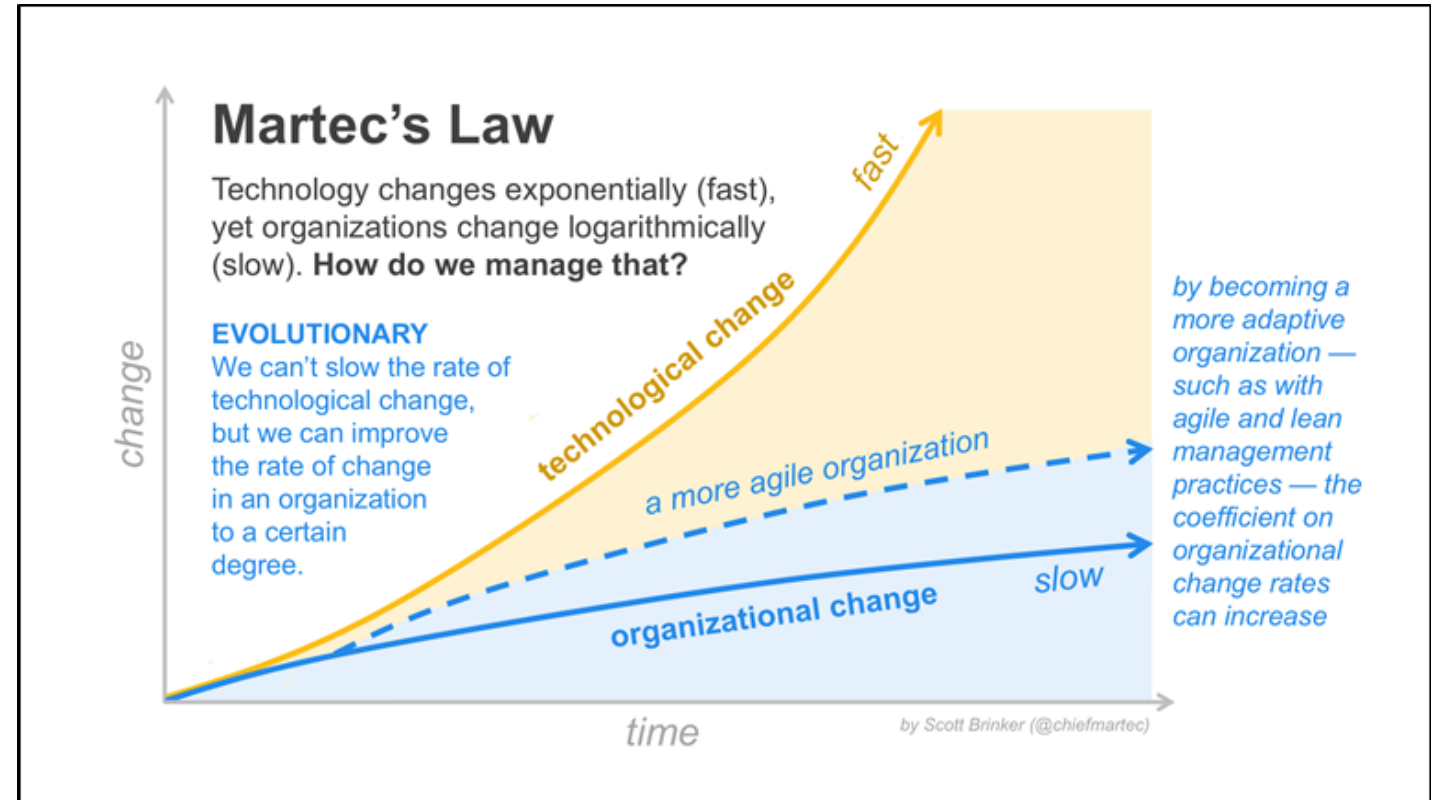
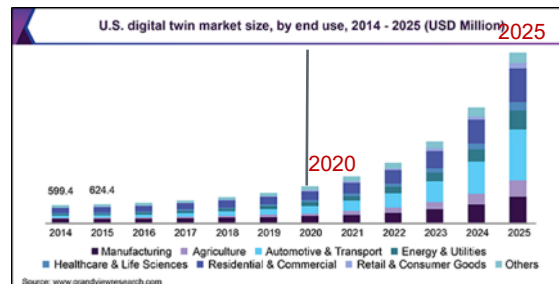
## IOT Internet of Things



## AI Artificial Intelligence



## DT Digital Twins



To take advantage of Technology Growth Trends we need  
Utilize data to Improve Ship Construction & Sustainment Support.



# Building “Failure Data & Prediction Models” for Ship Construction & Sustainment Support

NSRP RA Project 2024-01

## Prime/Lead:

American Bureau of Shipping (ABS)

## Team Members:

Newport News Shipbuilding (HII-NNS)

Ingalls Shipbuilding (HII-Ingalls)



## Government Participants:

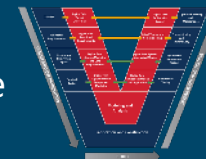
NAVSEA 05Z with NSWC Philadelphia & USCG Surface Forces Logistics Center

NOAA (MSC, MARAD?)

Supporting Organizations: TBD

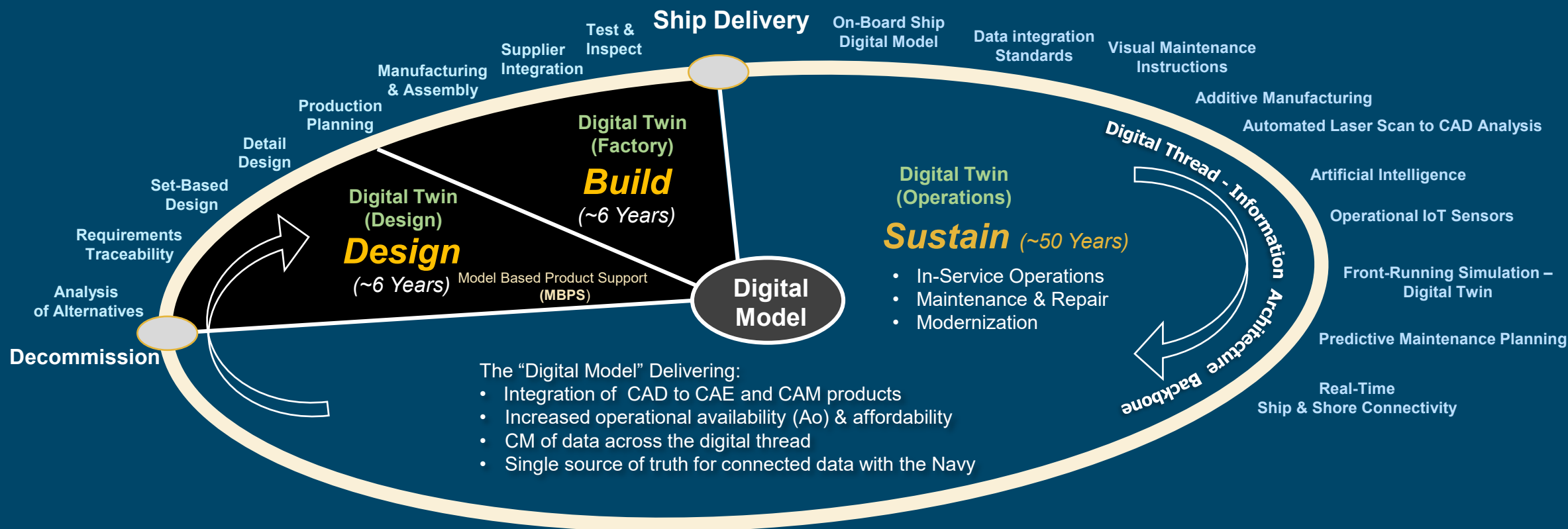
**Duration:** 18 Months , 2 phases with go-no/go review

Note: This project leverages RA project 2023-07 Digital Twin TRUST V&V Guide





# The Shipbuilding Digital Thread will require Advanced Digital Twin Capabilities



*Advancing Digital Data Management through the Ship's Lifecycle*



# Building “Failure Data & Prediction Models” for Ship Construction & Sustainment Support

**ISSUE to ADDRESS:** Sustainment costs for ships continue to be a large and difficult to manage cost for the Navy and other services. Considerable effort is being spent on sensing and measurement of parameters that may help identify and predict failures. However, there remain substantial opportunities to extract much more value from the amount of data already being collected.

Historical challenges that the Navy and other government fleet owner/operators have had in tackling ship sustainment costs.

Sustainment Cost	Ticonderoga Class cruiser (CG-47)	Nimitz Class aircraft carrier (CVN-68)	Arleigh Burke Class destroyer (DDG-51)	Freedom Class littoral combat ship (LCS-1)	Independence Class littoral combat ship (LCS-2)	America Class amphibious assault ship (LHD-6)	Wasp Class amphibious assault ship (LHD-1)	San Antonio Class amphibious assault ship (LPD-17)	Whidbey Island Class dock landing ship (LSD-41)	Harpers Ferry Class dock landing ship (LSD-49)
Service life longer than expected	●	●							●	●
Unexpected replacement of parts and repairs		●	●	●	●		●	●		●
Access to technical data		●								
Delays in depot maintenance	●	●	●	●	●	●	●	●	●	●
Delays in intermediate maintenance	●		●		●		●			
Shortage of trained maintenance personnel	●		●	●	●	●	●	●	●	●
Unscheduled maintenance	●	●	●	●	●	●	●	●		
Diminishing manufacturing resources	●	●	●		●		●			
Parts obsolescence	●	●	●	●	●		●	●		●
Parts shortage and delays	●	●	●	●	●		●	●	●	●

● Applicable maintenance issues

Source: GAO Analysis of Navy Information | GAO-23-106673

Note: Diminishing manufacturing sources refers to loss, or impending loss, of manufactures or suppliers of items, raw materials, or software.



# Building “Failure Data & Prediction Models” for Ship Construction & Sustainment Support

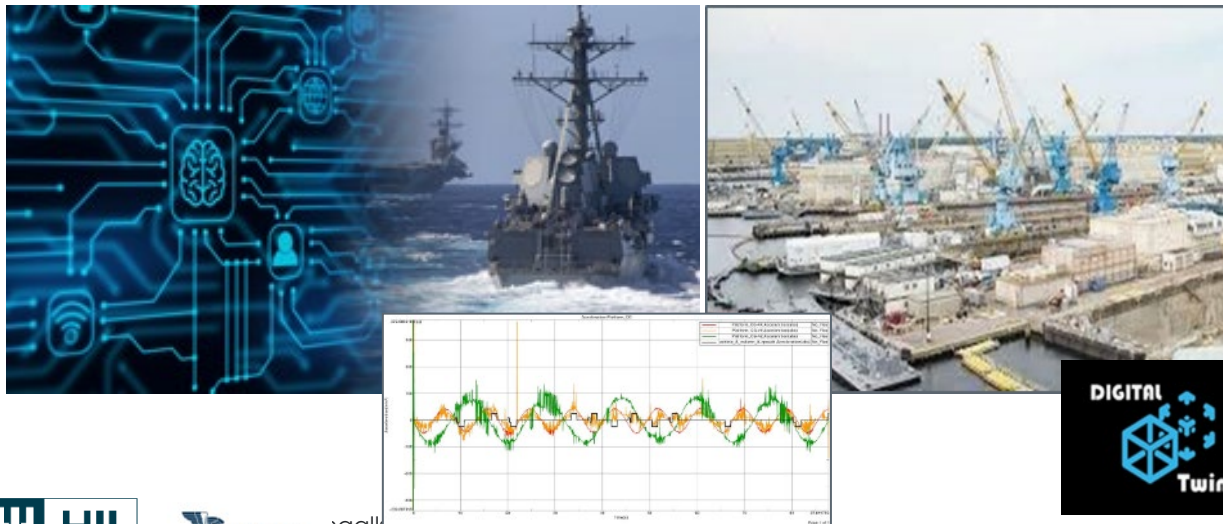
## OBJECTIVES:

❖ **Provide a failure data readiness/quality assessment and develop a roadmap for government fleet owner/operators and shipyards to:**

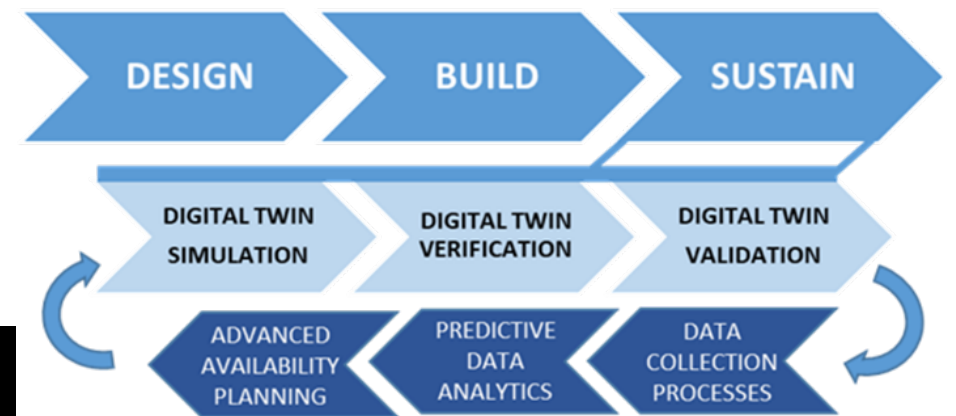
- (1) Optimization yard availabilities and
- (2) Provide feedback to follow-on vessels using advanced data analytics of available ship condition.

❖ **Lay the foundation for increased use of advanced data analytics that reduce:**

- (1) The cost and improve the predictability of scheduling for yard availability periods for ships and
- (2) The total cost of ownership of ships produced and sustained by yards, especially due to unrecognized vulnerabilities and material conditions that lead to failures.



## “Failure Data & Prediction Models” for Optimizing Yard Availabilities





# Building “Failure Data & Prediction Models” for Ship Construction & Sustainment Support

## Deliverables:

**Phase 1: D1** - Report on Failure Data Sources, Availability, Quality, & Potential Uses

**Phase 1: D2** - Recommendations on Necessary Data Improvements

**Phase 1: D3** – Representative Data Sets for Data Analytics Demonstration Cases

**Go-No/Go review**

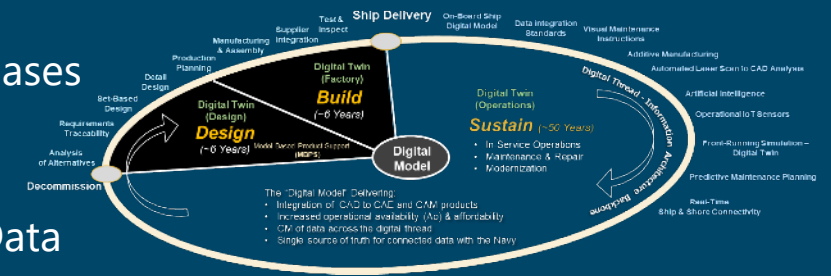
**Phase 2: D4** - Roadmap for Advanced Data Analytics of Failure/Condition Data

**Phase 2: D5** - Example Application Demonstration Cases

**Phase 2: D6** - ABS Industry Guidance Publication on Leveraging Data Analytics to Optimize Yard Availabilities and Improve New Ship Construction

**Phase 2: D7** - Webinar(s) for Government & Industry on best practices

**Phase 2: D8** - Final Report Documenting Research Process & Demonstration Results



ABS will summarize the research work in a new ABS guidance publication on ***Leveraging Data Analytics to Optimize Yard Availabilities and Improve New Ship Construction*** to help disseminate lessons learned through the project across government agencies and industry. Additionally, ABS will provide one or more webinars for government and industry on best practices identified. Finally, ABS will document the research project in an NSRP final report.

# Building “Failure Data & Prediction Models” for Ship Construction & Sustainment Support

## Significant Benefits:

Reduce the cost and improve the predictability of scheduling for yard availability periods for ships, and eliminate recurring failures within a vessel class by addressing critical system issues during new construction of subsequent ships, providing major savings for government owner/operators and shipyards while also improving mission availability.

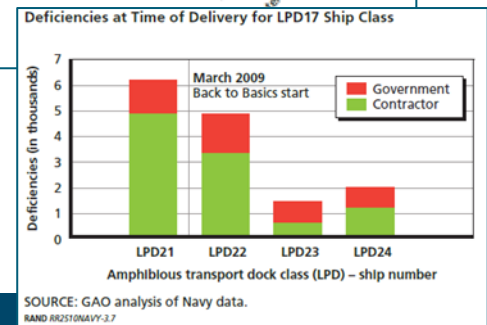
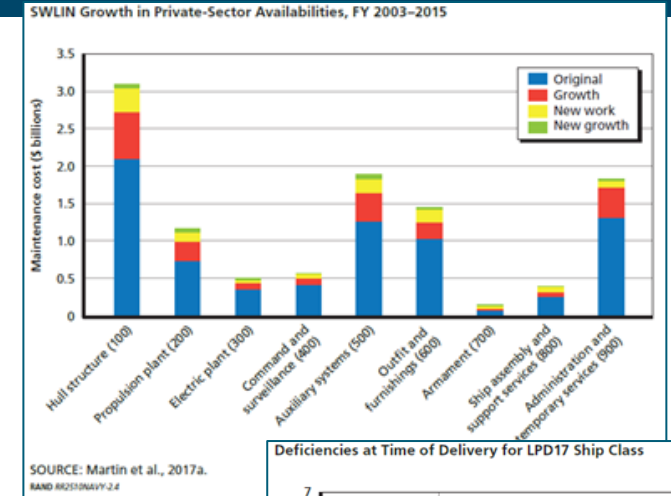
**Benefit 1:** Reduced Costs for Government Owner/Operators Tied to Unrecognized System/Equipment Conditions.

- Reduce Growth Work During Availabilities, and/or
- Reduce Subsequent Damage/Defect-initiated Availabilities.

**Benefit 2:** Value of Operational Days That Would Have Been Lost to Extended Availabilities Because of Unrecognized Conditions.

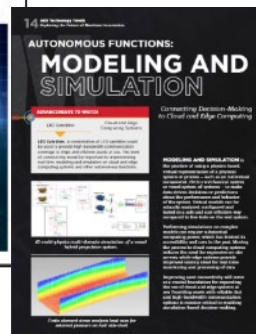
**Benefit 3:** Value to Shipyards from Improved Predictability of Yard Availabilities.

**Benefit 4:** Value to the Government Owner/Operators and/or Shipyards Generated by Mitigating Equipment/System Issues in Subsequent Ship Construction.

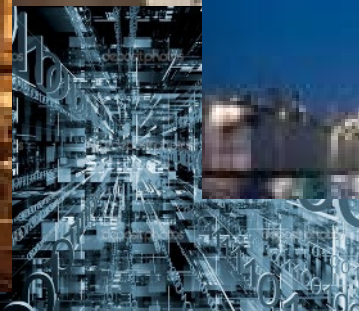


## ROI:

Foundational steps for unlocking value of data analytics to improve ship construction and sustainment (> 100x the cost of this project)



Thank You for your participation.  
Discussion...



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