Navy ManTech and Sustainment

Penn State Applied Research Laboratory
Institute for Manufacturing and Sustainment Technologies

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**Mission:** Industrial Preparedness
Development of enabling manufacturing technology --new processes and equipment-- for implementation on DoD weapon system production lines

DoD 4841 states investments should:
- Transition emerging S&T results to acquisition programs
- Improve industrial capabilities in production, maintenance, repair and industrial base responsiveness
- Advance manufacturing technology to reduce cost, improve performance, and responsiveness

**Execution:** ManTech Centers of Excellence (COEs)

**POCs:**
- ONR Program Officers / COEs

**ManTech** –
- Provides a bridge from R&D to production
- Introduces innovation into factory floor processes
ManTech Requirements (DoD4200.15, E2.1.3)

- Well-defined DoD requirement for the technology
- Technology demo’d in lab environment
- Can be delivered in time to meet the requirement
- Results applicable to more than one weapon system, component, or end item
- Specific plan to transition, implement, and insert results
- Potential for multiple Component-sponsored investments identified
- Investment not duplicative of other activities, both within and outside ManTech
ManTech Cannot Be Used For:

- Technology push, advancing general science
- Routine application of existing technology
- Implementation of manufacturing technology beyond the first-case application
- Product design (design for production analysis ok)
- Material development or optimization
- Purchase of off-the-shelf equipment (unless a minor portion of the investment and required to establish the first-case application of the ManTech deliverable)
- Purchase of capital equipment/facilities
- Component/system certification or qualification testing
- Technology proprietary to one company
Two Focus Areas:

1. **Major Acquisition Platform Affordability** (est. 80%)
   - A. Virginia Class
   - B. Columbia Class
   - C. DDG 51 Class
   - D. CVN 78 Class
   - E. FFG 62 Class
   - F. F-35

2. **Capability Acceleration** (est 20%)
   - A. Supports CNO direction to get capabilities to the fleet faster
     1) Unmanned/Autonomous Vehicle Production
     2) High Energy Laser Weapons Systems
     3) Advanced Submarine Fabrication Technology
     4) Fleet Sustainment Technology
     5) Energetics Production
     6) Hypersonics Fabrication
     7) Manufacturing Acceleration of other ONR Activities
Centers of Excellence - Core Competencies

Composites (CMTC) – Neil Graf – Prog Officer
• Automated Fiber Placement
• Out of Autoclave Composites
• Thick-Walled Composites
• Vacuum Assisted Resin Transfer Molding
• Controlled Volume Molding for High Temp Composites
• Manufacturing Automation for Polymer Composites
• Composites for Very Large Format Radomes

Metalworking (CNM) – Dr. Jeff Farren – Prog Officer
• Joining Technologies
• Metals Manufacturing Processes
• Robotics and Automation
• Inspection Technologies
• Mfg Technology / Industrial Base Infrastructure

Institute of Mfg & Sustainment Tech (iMAST/ REPTECH) – Paul Huang – Prog Officer
• Laser Processing
• Materials and Composites Processing
• Manufacturing Systems
• Systems and Operations Automation
• Sustainment / Repair Technologies

Shipbuilding / Advanced Mfg (NSAM) – Paul Huang – Prog Officer
• Shipbuilding Technology
• Process / Fabrication Optimization
• Digital Work Instructions
• Modeling
• Spatial Scheduling
• Inspection Technology
• Sustainment

Electronics (EMPF) – Mike Hackert – Prog Officer
• Automated Packaging
• RF Technology
• Wide Band Gap Technology
• Environmental

Electro-Optics (EOC) – Mike Hackert – Prog Officer
• Focal Plane Array & Sensor Technology
• Fiber Optics & Photonics
• Image Processing and Inspection Systems
• Optics and Coatings
• Lasers and Laser Weapon Systems
• Laser Micromachining

Energetics (EMTC) – Chuck Painter – NSWC Indian Head
• Propellants
• Munitions
iMAST Overview

Institute for Manufacturing and Sustainment Technology (iMAST) established February 1995 as one of the Navy ManTech program’s Centers of Excellence

Located at Penn State’s Applied Research Laboratory, iMAST partners with industry, DoD, and OEMs to solve advanced weapon and systems issues.

iMAST provides a focal point for the development and transition of cost saving Manufacturing Technology innovations, processes, hardware and software.

iMAST supports the Navy with life cycle cost reduction projects within the Repair Technology (RepTech) program in support of shipyards and DON depots.

iMAST supports Capability Acceleration projects aimed at maintaining the Navy’s technical superiority.
- Repair Technology (RepTech) Projects: Addresses repair, overhaul and sustainment functions that emphasize manufacturing processes and advancing technology as a component of Navy ManTech.

- RepTech projects target fielded weapon systems and provide the process and equipment technology needed to repair and maintain fleet assets. Implementation of RepTech projects target naval depots, shipyards, Marine Corps logistics bases, intermediate maintenance activities and contractor facilities responsible for the overhaul and maintenance of fleet hardware.
# Sustainment

## False Deck Panel
Identification of a new false decking material based on COTS or modified COTS products to improve performance and installation process through modern metrology tools

**Team:** iMAST, CMTC, BIW, HII-NNS & Ingalls  
**Achievements:** Milperf updates complete, testing alternate materials, evaluating metrology tools. Composite and aluminum panels tested and approved.  
**Implementation focus:** DDG and CVN  
**Status:** Implemented  
**Goals:** reduce fabrication & installation labor, less susceptible to installation damage, reduced acquisition cost

## UHP Dual-Track Crawler System for Coating Removal
Develop, test, demonstrate, transition and implement a dual-track UHP water jet system for removal of underwater materials from submarines and shafts

**Team:** iMAST, PSNSY, PNSY, NAVSEA 04  
**Achievements:** Prototype complete and in use. All 4 shipyards funded one system with technical data, drawings, maintenance requirements and training  
**Implementation focus:** Submarines  
**Status:** Implemented  
**Goals:** Significantly improved removal rates, decreased hazard and strain of UHP, better surgical precision

## SPS-48E Radar Waveguide Refurbishment
Development of new refurbishment techniques to reduce costs and improve system and component reliability

**Team:** iMAST, PEO IWS-2.0, NSWC Crane  
**Achievements:** Improved radome removal process proven and implemented at vendor site, material changes approved to reduce susceptibility to corrosion  
**Implementation focus:** Surface Ships  
**Status:** Implemented  
**Goals:** reduce condemnation rate for slats undergoing overhaul/Modification, improved quality and consistency in radome performance, reduce cost

## Radar Parts Laser Ablation & Passivation
Investigate Laser Ablation and passivation on aluminum radar components to replace media blasting and conversion coating application

**Team:** iMAST, PEO IWS-2.0, NSWC Crane  
**Achievements:** Testing of ablation completed and successful. Passivation testing on various Al alloys successful, to include adhesion showing hyper-passivation superior performance compared to conversion  
**Implementation focus:** Surface Ships  
**Status:** Implemented  
**Goals:** Improved corrosion resistance, eliminate hazardous conversion coat.
Facility Sustainment

**Diagnostic Monitoring of Equipment & Capacity Planning**
Incorporation of advanced machinery health monitoring technologies for critical facilities equipment with integration of CBM data into OEM planning systems

*Team:* iMAST, GD-EB, PEO Subs  
*Achievements:* Identification and sensoring of candidate capital equipment for implementation of a Reliability Centered Maintenance solution. Enabled CBM on 28 systems, ID’ed and prevented 28 catastrophic failures before complete.  
*Implementation focus:* Submarines  
*Status:* Implemented  
*Goals:* Early detection of critical systems or infrastructure breakdown with input into the yard planning system to allow early accommodation

**Rapid Automated Technology Evaluation**
Optimization of key automated manufacturing assets through the incorporation of machine performance parameters and quality output data into prescriptive maintenance models.

*Team:* ONR, NSAM, iMAST, JPO/NAVAIR, NGAS  
*Achievements:* Develop predictive & prescriptive maintenance models from real-time industrial automation digital data leveraging Industrial Internet of Things (IIoT) solutions.  
*Implementation focus:* F-35  
*Status:* Implementation in-work  
*Goals:* Reduction in maintenance time/cost and optimized master scheduling enabled by prescriptive corrective actions.

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**Predictive Maintenance II – Industrial Internet of Things**
Incorporation of web enabled, advanced machinery health monitoring technologies for difficult to reach or hazardous facilities equipment with integration OEM planning systems

*Team:* iMAST, GD-EB, PMS 450/397  
*Achievements:* Project kickoff April 2022, conducted FMEA, Identified some candidates for sensoring.  
*Implementation focus:* Submarines  
*Status:* Active  
*Goals:* Early detection of critical systems Breakdown through automated data collection and analytics. Final step will be to integrate Into yard planning system.

**Motor Generator Rewind Optimization**
Rapid response project to explore for potential acceleration and quality improvement in a labor intensive motor overhaul.

*Team:* iMAST, PNSY, NNSY, NAVSEA 05  
*Achievements:* Project kickoff April 2022, conducted FMEA, Identified some candidates for sensoring.

*Implementation focus:* Submarines  
*Status:* Transitioning to FY23 new start  
*Goals:* Improve first time test success, decrease time to repair and stress-related injuries

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### Materials & Manufacturing

#### Large Diameter Ball Valve Repair
Identification of a coating system or surface modification process to improve ball valve performance

**Team:** iMAST, PNSY, GD-EB, PMS 450, PMS 397  
**Achievements:** Successfully tested and qualified two solutions, based on combination of ceramic bond coat and Teflon.  
**Implementation focus:** Submarines  
**Status:** Active  
**Goals:** Improve system reliability and extend mean time between repair for numerous ball valves with ship’s seawater systems and significantly reduce emergent repair events.

#### Improved Low Loss Launch Valve
Improve valve sustainment by depositing 0.050 inch ceramic wear coating to increase overhaul potential of existing valves through life of Nimitz Class

**Team:** iMAST, NAVAIR ALRE (PMA 251), Lakehurst NAS  
**Achievements:** Evaluated and implemented an increased thickness of plasma spray wear coat to extend life of valve from ~2 overhauls to life of ship class.  
**Implementation focus:** Nimitz Class Carriers  
**Status:** Active  
**Goals:** Evaluate new bond and ceramic coating materials, improve application processes, prove positive wear and spalling characteristics.

#### Laser Ablation of Coatings/Debris
Identification of COTS tools and extensive proof of concept testing to qualify process and affect to substrate metals. Implementation initially on NNS panel line to remove preconstruction primer from stock metal.

**Team:** iMAST, HII-NNS  
**Achievements:** Evaluating metallurgical affect and panel line efficiency.  
**Implementation focus:** CVN  
**Status:** Active  
**Goals:** Qualify LA to the satisfaction of NAVSEA 05 TWH including metal impacts and fatigue level of compromise.

#### Retractable Bow Plane System Improvements
Develop, test, demonstrate, transition and implement an improved process to apply highly adhering ceramic coating via plasma spray to correct hydraulic seal failures

**Team:** iMAST, NSAM, GD-EB, PMS 450  
**Achievements:** Developed new bond coat and improved application process, developed new QA spray process, tested system to equivalent of 70 years of wear successfully  
**Implementation focus:** Submarines  
**Status:** Implemented  
**Goals:** System reliability improved beyond original design requirements, helped return favored vendor as a quality performer.
Portable Hatchable Cold Spray Repair
ManTech partnership with SBIR and Tactical Innovation and Implementation programs to develop Cold Spray systems and components capable of shipboard use

Team: iMAST, PSNSY, NAVSEA 04, SBIR, TII

Achievements: Development of an enclosure with flexible design to facilitate transport to and use within tight ship and sub spaces. Final testing complete, UIPI in update to authorize.

Implementation focus: Ships and Subs

Goals: Develop and integrate a system to conduct Cold Spray repair of ship’s components that are difficult to remove for in-ship repair.

Additive Manufacturing Repair
Evaluation and development of an Additive Manufacturing repair process for geometry critical and obsolete aircraft and engine components

Team: iMAST, NAVAIR

Achievements: Successfully developed and tested AM as a method to add material to otherwise unrepairable parts

Implementation focus: AV-8C

Goals: Successfully demonstrated repair of geometry critical components. Previous attempts using conventional weld/clad processes failed for distortion. First approved AM repair for NAVAIR

Cold Spray Technology for Ship Components
Evaluation of Cold Spray as a method to repair ship’s components of various metals and with no previously acceptable repair authorized.

Team: iMAST, PSNSY, NNS, NAVSEA 04/05

Achievements: Developed, tested, demonstrated and implemented an improved process to restore geometric form of otherwise unrepairable ship’s components for reuse

Implementation focus: Surface Ships

Goals: Prove viability of Cold Spray as an economical means to repair parts. Test and characterize repair to satisfy TWH requirements and build standard

Corrosion Repair of Missile Decoys
Evaluation of Cold Spray as a method to repair Aluminum decoy launcher systems requiring replacement every four years due to environment exposure/corrosion.

Team: iMAST, IWS, Crane IN

Achievements: Developed, tested, demonstrated and implemented an improved process to repair launcher components previously shipped off shore.

Implementation focus: Surface Ships

Goals: Prove viability of Cold Spray as an economical means to repair launcher parts. Establish a new source of onshore repair for USN assets.
**Advanced Manufacturing Enterprise**

**Submarine Factory Simulation and Capacity Planning**
Submarine IRR processes are extensive and include many unique planning challenges. Active (higher priority) ship overhaul requirements = frequent replanning for IRR.

**Team:** iMAST, PSNSY
**Achievements:** Successfully developed and implemented a schedule replanning capability to rapidly adjust to changing shipyard priorities and availability of critical skills/tools

**Implementation focus:** Subs
**Status:** Complete
**Goals:** Build project replanning system to rapidly adjust to current and near future work plans with integration into yard planning systems

**Marine Corps Depot Shop Floor Control**
Development of an automated and enterprise integrated planning tool to facilitate workload planning for overhaul of USMC armored vehicles

**Team:** iMAST, Marine Depot Maintenance Command, PP Albany
**Achievements:** Identified critical data, (both existing and needed) and identified critical nodes in the depot overhaul process to facilitate programming for simulation and planning.

**Implementation focus:** Ground Combat Vehicles
**Status:** Active
**Goals:** Improved planning tool integrated into LOGCOM and PP Albany enterprise planning system.

**Critical Resource Planning**
Developed user-friendly software tool that provides accurate information regarding the use and availability of critical resources for production planning

**Team:** ONR, NSAM, iMAST, PMS-450, PMS-397, GDEB
**Achievements:** Developed custom software application that has an interface to Artemis 9000/EX back-end data to meet the schedule post-processing analysis and user interface functions.

**Implementation focus:** VCS, CLB
**Status:** Implemented
**Goals:** Transition from a current manpower-intensive resource accounting method to unified solution to reduce planning labor hours and material costs

**Production Bill of Materials using AI for QA**
Develop an Artificial Intelligence (AI) process to automatically detect patterns and anomalies within PBOM data and a user-friendly front-end software for planners to efficiently

**Team:** iMAST, BIW
**Achievements:** Prototype system in place at BIW and actively working.
Developed data pre-processing software and AI methods for PBOM anomaly detection.

**Implementation focus:** DDG
**Status:** Active Dec 17-Mar 21
**Goals:** Reduce error rate and duplication of effort and repeat planning waste.
Questions?