



Advanced Metalworking Solutions for naval systems that go in harm's way

# Shipbuilding Technology Innovation

## How a New Technology goes from Problem Identification to Solution Implementation

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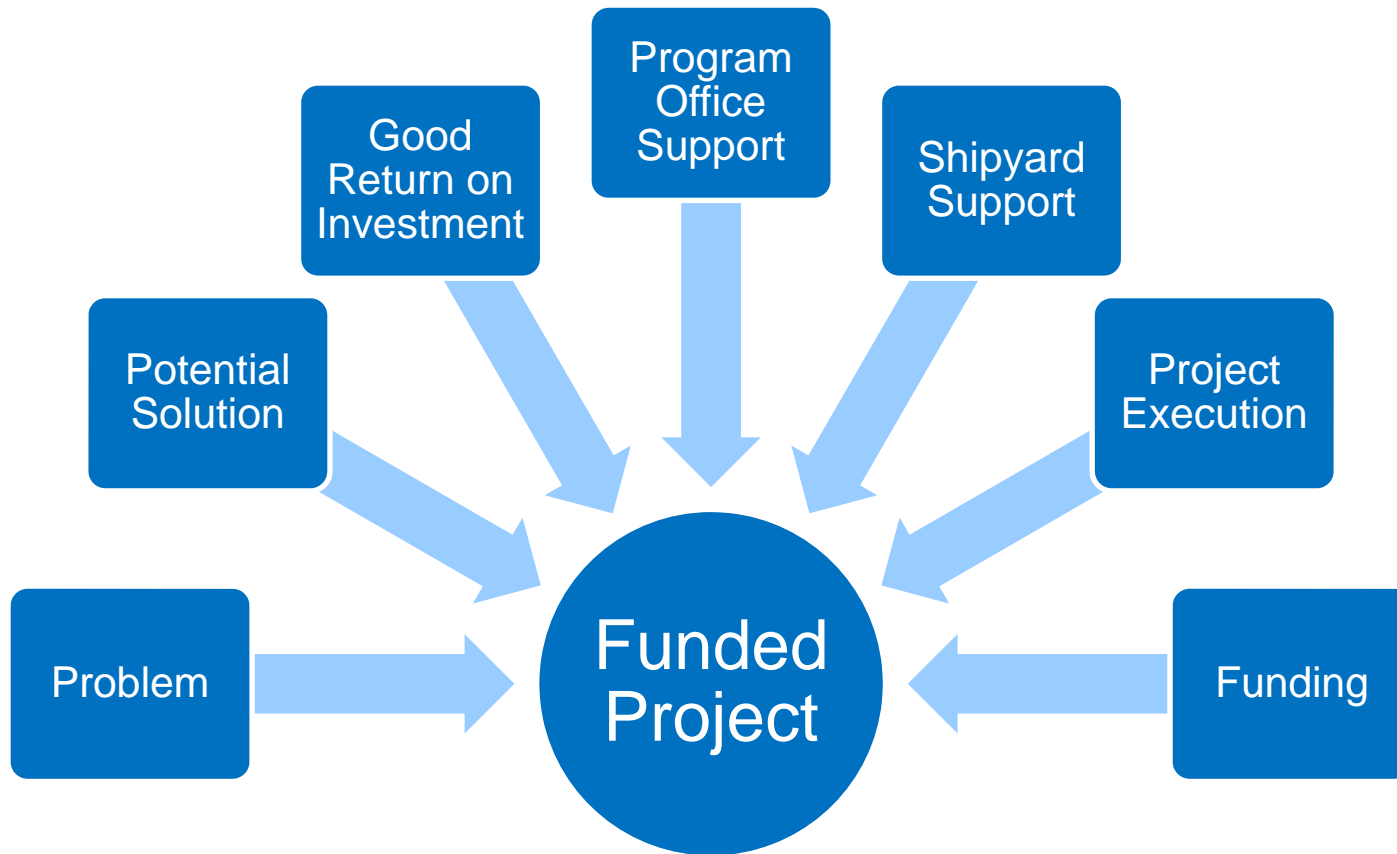


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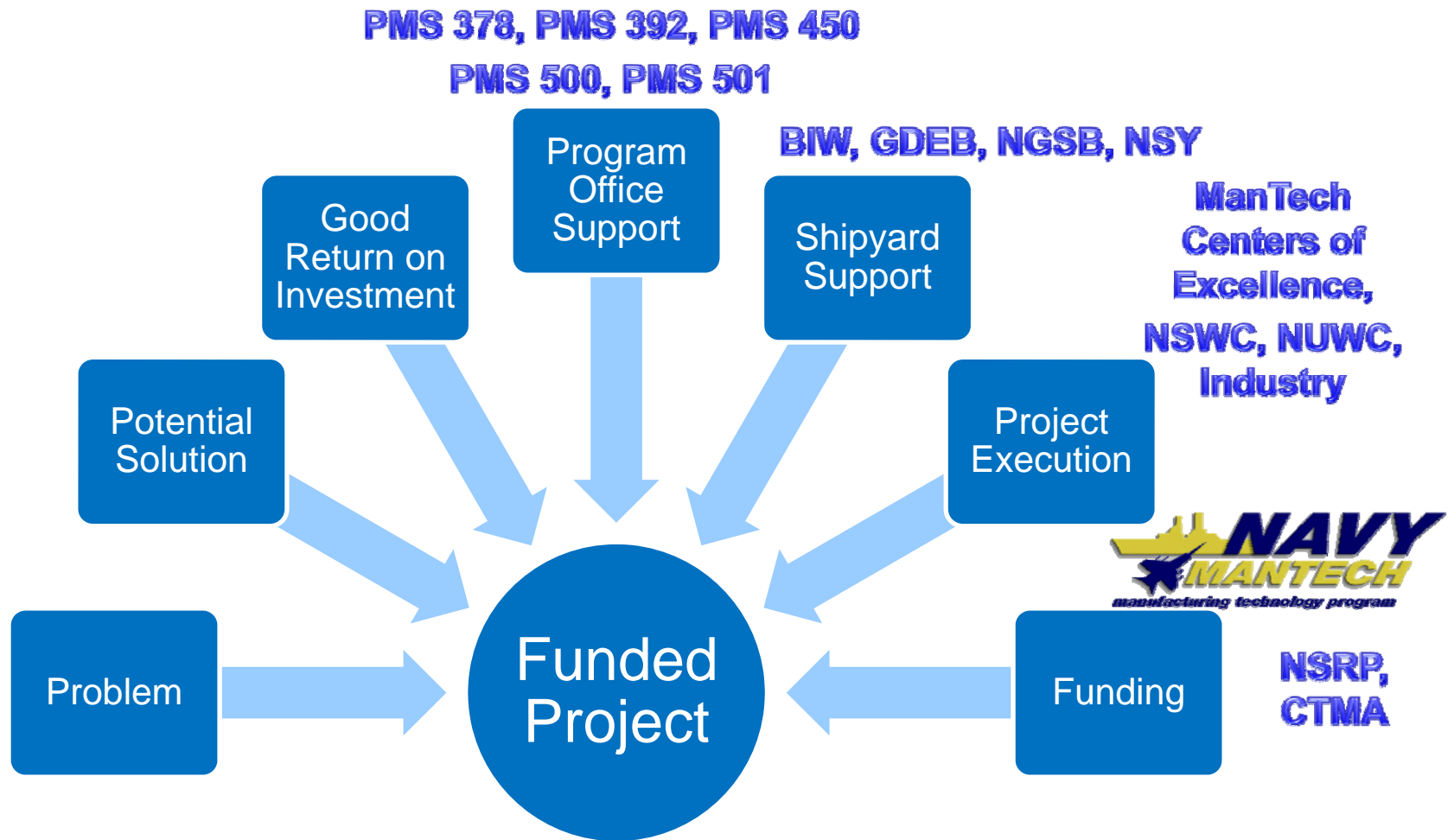
# Objectives

- **Explain how a new or improved technology goes from problem identification to solution implementation**
- **Introduce Concurrent Technologies Corporation and the Navy Metalworking Center**
- **Introduce some of the new technologies developed or being developed at the Navy Metalworking Center**

# Components of a Funded Project



# Components of a Funded Project



# ONR ManTech Program

- Navy ManTech Program provides for the development of enabling manufacturing technology and the transition of this technology for the production and sustainment of Navy weapon systems to support the Fleet.
- Current focus: Shipbuilding Affordability

**Primary Emphasis - Affordability**



PEO (Ships)  
DD(X) Family



PEO (Carriers)  
CVN 21



PEO (Ships)  
LCS



PEO (Subs)  
SSN



PEO (Ships)  
LPD 17  
DDG 51



PEO (T)  
F-18 Family  
EA-18G



PEO (IWS)  
Missiles  
Weapons  
Munitions



PEO (W)  
N-UCAS



# Navy ManTech Centers of Excellence

- **Focal points for the development and transition of new manufacturing processes and equipment in a cooperative environment with industry, academia, and the Naval Research Enterprise.**
- **Centers of Excellence**
  - **Execute projects; manage project teams**
  - **Serve as corporate expertise in technological areas**
  - **Collaborate with acquisition program offices / industry to identify and resolve manufacturing issues**
  - **Develop and demonstrate manufacturing technology solutions for identified Navy requirements**
  - **Provide consulting services to Naval industrial activities and industry**
  - **Facilitate transfer of developed technologies.**



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# Navy ManTech Centers of Excellence

- **Benchmarking and Best Practices Center of Excellence (B2PCOE)**
- **Center for Naval Shipbuilding Technology (CNST)**
- **Composites Manufacturing Technology Centers (CMTC)**
- **Electro-Optics Center (EOC)**
- **Electronics Manufacturing Productivity Facility (EMPF)**
- **Energetics Manufacturing Technology Center (EMTC)**
- **Institute for Manufacturing and Sustainment Technologies (iMAST)**
- **Navy Joining Center (NJC)**
- **Navy Metalworking Center (NMC)**

The ONR ManTech web page at [http://www.onr.navy.mil/sci\\_tech/3t/mantech/default.asp](http://www.onr.navy.mil/sci_tech/3t/mantech/default.asp) provides links to each of these centers.





# A Typical Project Team

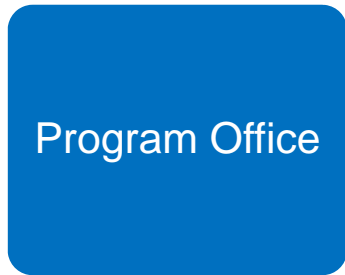
ManTech Centers of Excellence,  
NSWC, NUWC, Industry

BIW, GDEB, NGSB,  
NSY



NAVSEA, NSWC, NUWC

PMS 378  
PMS 392  
PMS 450  
PMS 500  
PMS 501



Concurrent Technologies Corporation



# Navy Metalworking Center

- **Funded by ONR to develop and transition advanced metalworking technologies to naval weapon systems**
- **Operated by Concurrent Technologies Corporation since 1987**
  - **CTC's roots link to Metalworking Technology Incorporated, which was established to operate the National Center for Excellence in Metalworking Technology**
- **Competitively awarded a five-year Indefinite Delivery Indefinite Quantity contract in October 2005**
  - **Changed name from National Center for Excellence in Metalworking Technology (NCEMT) to Navy Metalworking Center (NMC)**



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- **Metals and advanced metallic materials**
- **Metal-based composites**
- **Ceramics**
- **Metal/non-metal interface issues**
- **Shape-making processes**
- **Joining techniques**
- **Surface and heat treatment**
- **Primary metal materials manufacturing processes**
- **Materials characterization/testing**
- **Process design and control**
- **Product design and structural performance**
- **Environmental issues and recycling**
- **Information and data handling and transfer**





# Advanced Metallic Materials

- High-Strength Steels
- Titanium Alloys
- Aluminum Alloys
- Metal-Matrix Composites



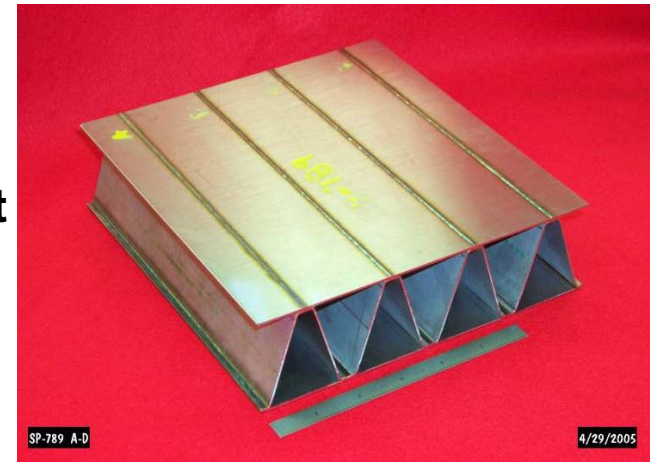
# High Strength and Toughness Naval Steels

- **OBJECTIVE:**
  - Investigate metallurgical and manufacturing aspects of high-strength steels for naval ship application, particularly CVN 21 and optimize the material
- **PAYOFF:**
  - Reduce topside weight
- **IMPLEMENTATION:**
  - HSLA-115 has been incorporated into the design of CVN 78

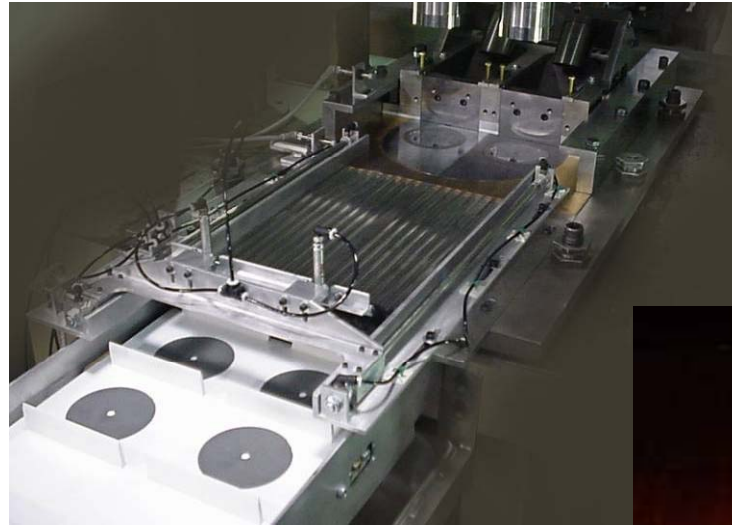


## Laser-Welded Metallic Sandwich Panel Technology

- **OBJECTIVE:**
  - Complete testing and implement the technology into shipyard applications while incorporating material, design and manufacturing improvements to reduce cost
- **PAYOFF:**
  - Established a steel lightweight, stiff and modular structural system to reduce weight and improve performance
- **IMPLEMENTATION:**
  - As principal subcontractor to Applied Thermal Sciences, Inc., **CTC** is developing, testing and producing six ship sets of Berms and Personnel Safety Barrier Panels for the DDG 1000 Program



- Casting
- Extrusion
- Forging
- Rolling
- Powder Metallurgy



# Steel Casting Optimization

- **OBJECTIVE:**
  - Develop a solution for defects occurring in steel during the casting process
- **PAYOFF:**
  - Reduced cost and delivery time
- **IMPLEMENTATION:**
  - Applicable to Virginia Class Submarine components and marine structures



# M777 Lightweight Howitzer

- **OBJECTIVE:**
  - Reduce manufacturing costs and improving reliability of M777 Lightweight 155mm Howitzer
- **PAYOFF:**
  - Cost savings of \$33 million plus cost avoidance
- **IMPLEMENTATION:**
  - Single-piece cast titanium spade, in production
  - Increased competition of flowformed cradle tube



- **Conventional Welding**
- **Friction Stir Welding**
- **Adhesive Bonding**
- **Heat Treatment**
- **Surface Engineering**



## Low-Cost Friction Stir Welding (FSW) Machine

- **OBJECTIVE:**
  - Leverage friction stir welding on Littoral Combat Ship, which uses significant aluminum
- **PAYOFF of FSW:**
  - Improved strength, ductility, fatigue and corrosion performance
  - Reduced residual stress and distortion
  - Improved weld quality and repeatability
  - Reduced operator skill and production cost
- **PAYOFF of Low-Cost FSW Machine:**
  - Transportable – within shipyard or among shipyards
  - In-yard operation – no lead time, custom panels poss.
  - Single axis – very simple controls
  - Minimal instrumentation
  - Lower cost for FSW machine
  - Addresses most shipyard welding needs
- **IMPLEMENTATION:**
  - Prototype FSW machine that limits functionality to specific shipyard needs is in development





## Product Design and Structural Capabilities – Representative Project

### Interface Ramp Technologies

- **OBJECTIVE:**
  - The Navy is seeking a new capability to enable vehicle transfer, via an advanced ramp or transfer system, to a landing platform through the high end of Sea State 4.
- **ATTRIBUTES:**
  - Torsion-tolerant, high-strength, lightweight structures made of advanced materials (composite, cellular, metal matrix)
  - Integrated advanced connections
  - Active motion compensation (electric actuators, motion sensors, algorithms)



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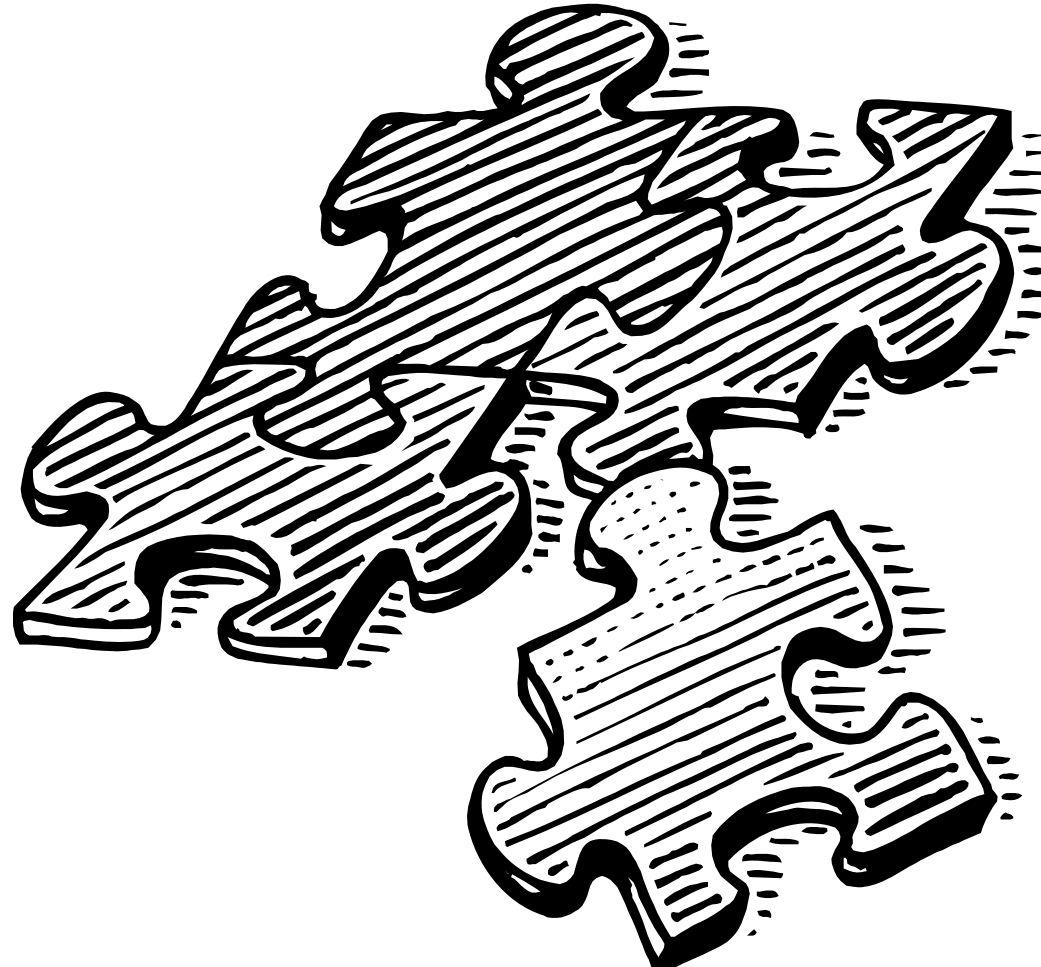


## Product Design and Structural Capabilities – Representative Project



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# Final Thoughts





For More Information

[www.nmc.ctc.com](http://www.nmc.ctc.com)



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