



# PDMT Panel R and D Investment Portfolio

Bill Palko

NSWCCD Code 6101/NAVSEA 05DM

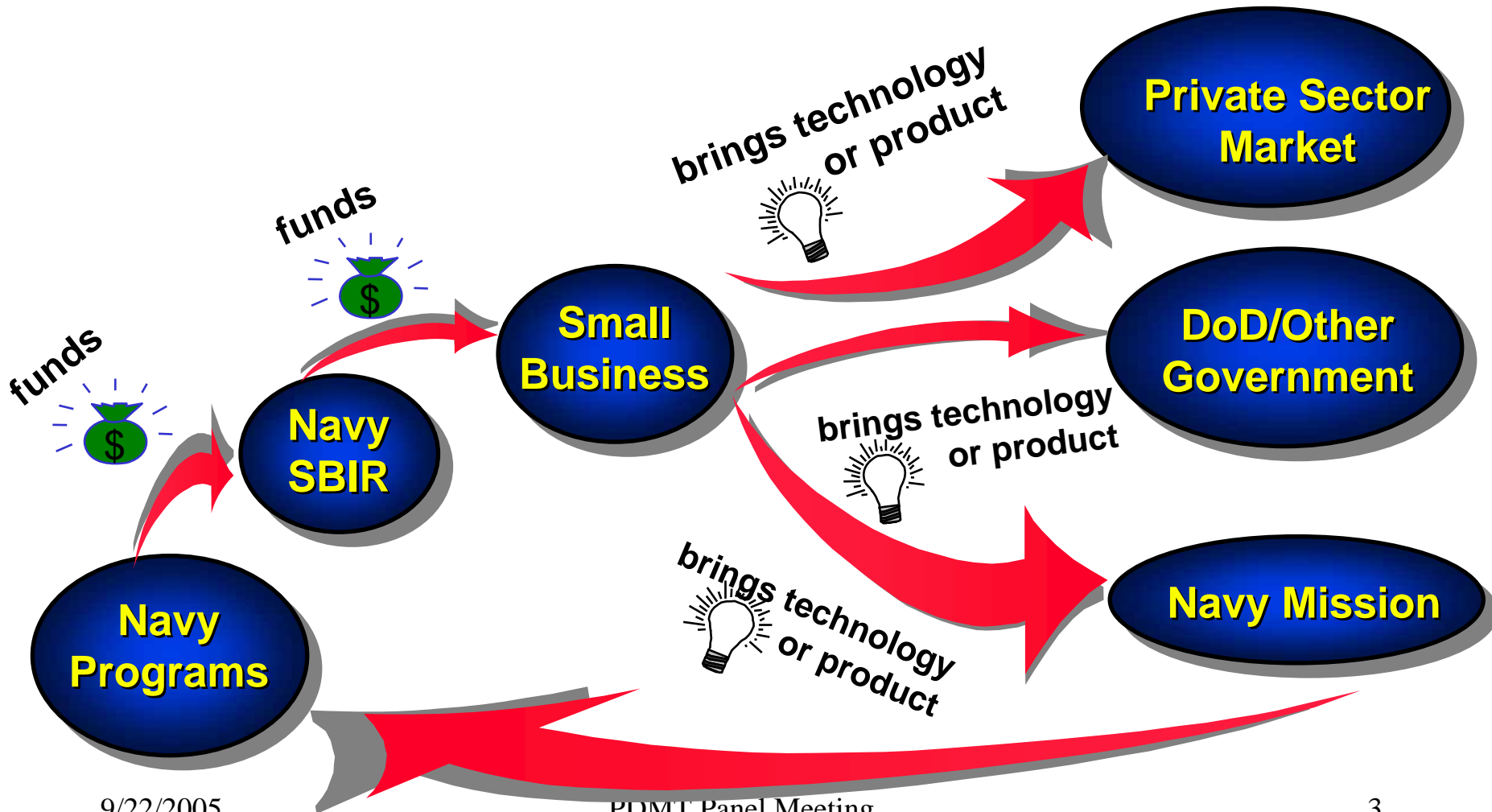
PDMT Panel Meeting

22 Sept 2005

# NSRP-Associated R and D Initiatives

- NSRP Research Announcements
  - \$0.4M to \$4.0M
  - Multi-year
- NSRP Panel Projects
  - <\$100K
  - <12 months duration
- **Small Business *Innovative* Research Program**
  - **Phase I - Feasibility (\$100K)**
  - **Phase II –Demonstration/Prototyping (\$750K)**
- **Navy Manufacturing Technology (MANTECH)**
  - **Funded at or Through a Center of Excellence**
  - **Funding Range of \$100K - \$6M**

# SBIR - Leveraging Investment in Small Business





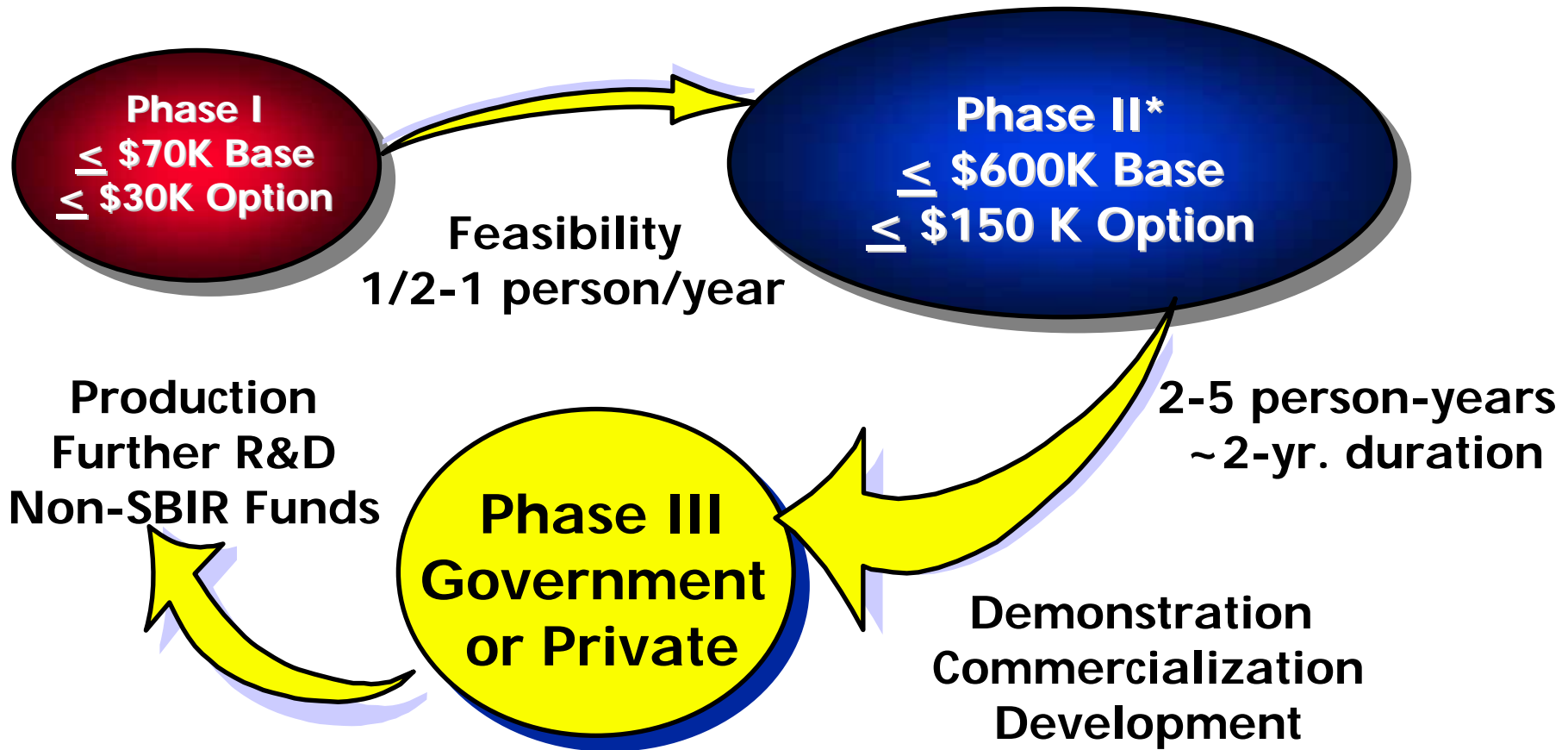
# SBIR Ground Rules



- To Qualify for SBIR Funding the Organization:
- Is Independently Owned and Operated
- Is Owned 51% by US Citizens
- Is Less than 500 Employees
- Is Based Principally in the US
- Is Not Dominant in its Field
- Is Organized for Profit
- Spends Minimum 2/3 of Funding Internally in Phase I
- Spends Minimum of 1/2 of Funds Internally in Phase II
- Employs PI a Minimum of 1/2 Time with SB Firm



# Program Phases





# Current SBIR NSRP- Related Projects

- Design
  - Development of Shipboard Electrical Analysis and Production Software
  - Digital Video Photogrammetry
  - Enhancement of Common Parts Catalog with Engineering Data
  - Virtual Pipe Shop Module for ShipConstructor CAD System
  - Strategic Application of Design and Planning Software to Key Shipbuilding Areas
- Advance Materials
  - Joining Very Large, Low Cost Pultruded Advanced Composites Structures in Shipbuilding
  - Pultrusion-Based Phenolic Foam Replacement for Balsa in Navy Ship Structures



# Current PDMT-Focused SBIR Projects

- *Development of Shipboard Electrical Analysis and Production Software*
  - **Firm:** Art Anderson Associates
  - **Objective :** Develop Software that can assist in designing a ship's electrical system, analyzing of the system design versus current specification and detailing of the pre-production planning information to facilitate the assembly and installation of the system
  - **Status:** In Phase II Contracting Cycle
  - **Period of Performance:** 24 months (Estimated Start Nov 2005)
  - **Principal Investigator:** Ron Selvidge, Joe Payne

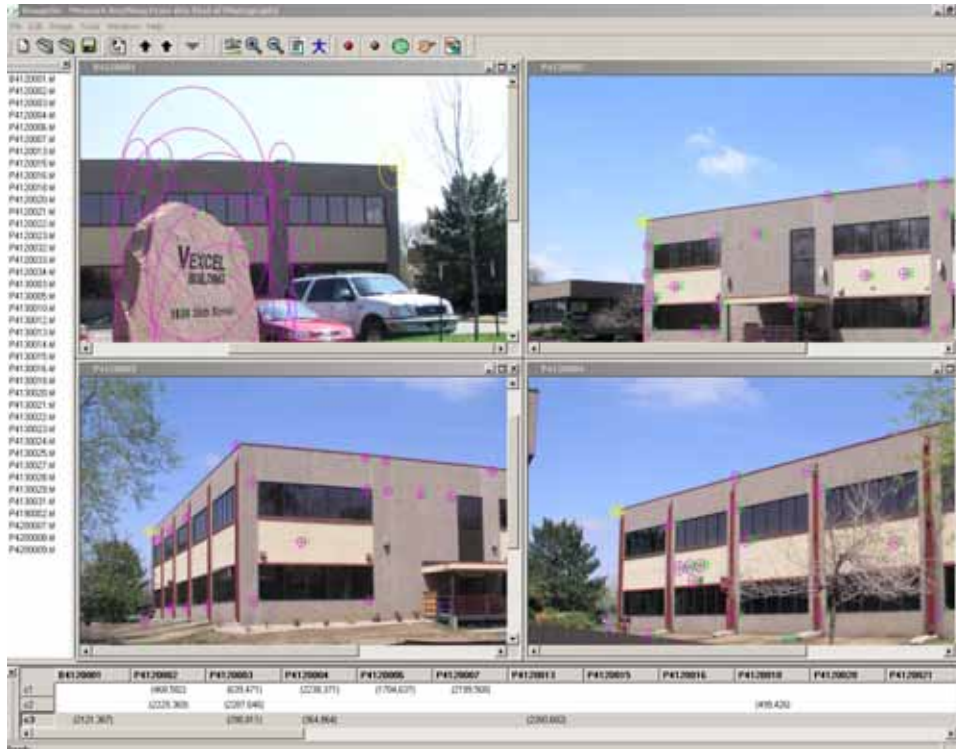


# Current PDMT-Focused SBIR Projects

• **Project:** Digital Video Photogrammetry

• **Firm:** Vexcel Corporation

- Automated photogrammetric analytics
- Multiplatform software licensing
- Simple GUI – interlinked image and tabular info c/w error ellipsoids



Video to 3D Model  
➔



- **Status:** Completing Phase II base contract – Demo is preparation at Todd
- **Period of Performance:** Sept 2003 – Sept 2005
- **Contact:** Dr. Jason Szabo

9/22/2005



# Current PDMT- Focused SBIR Projects

- **Project:** Enhancement of Common Parts Catalog with Engineering Data
- **Firm:** Atlantec ES
- **Objective:** To enhance the common parts catalog with engineering information that could be directly downloaded into the shipbuilder's CAD system for direct insertion into ship system model
- **Status:** Phase I in Progress
- **Period of Performance:** 6 months (Estimated Completion Nov 2005)
- **Principal Investigator:** Pat Cahill



# Current PDMT-Focused SBIR Projects

- **Project:** Virtual Pipe Shop Module for ShipConstructor CAD System
- **Firm:** Industrial Planning Technology Inc.
- **Objective:** Develop a software module compatible with ShipConstructor CAD system to design ship piping systems, develop shop instruction and machine programming to facilitate rapid shaping and assembly of the piping system design.
- **Status:** Phase I in Progress
- **Period of Performance:** 6 months (Ends Nov 2005)
- **Principal Investigator:** Pat O'Rourke



# Current PDMT-Focused SBIR Projects

- **Project:** Strategic Application of Design and Planning Software to Key Shipbuilding Areas
- **Firm:** Industrial Planning Technology
- **Objective:** Develop a software module compatible with ShipConstructor CAD system to estimate paint and insulation requirements for ship spaces. Determine the sequencing of application of these items based upon the overall ship construction schedule to minimize rework and production down-time.
- **Status:** Currently in Phase II base contract
- **Period of Performance:** 24 Months (Ends July 2007)
- **Principal Investigator:** Patrick Rourke



# Current PDMT-Focused SBIR Projects

- **Project: Joining Very Large, Low Cost Pultruded Advanced Composites Structures in Shipbuilding**
- **Firm:** Kazak Composites Inc.
- **Objective:** To produce low-cost composite sandwich panels for shipboard structural application with edge details design for full-load carrying capacity
- **Approach:** Use the pultrusion process to produce lower-cost composite sandwich panels in widths up to 10 feet. Include edge details in edge mold to facilitate assembly.
- **Status:** Phase II basic task is in progress
- **Period of Performance:** 24 months
- **Principal Investigator:** Dr. Jerry Fanucci





# Current PDMT-Focused SBIR Projects

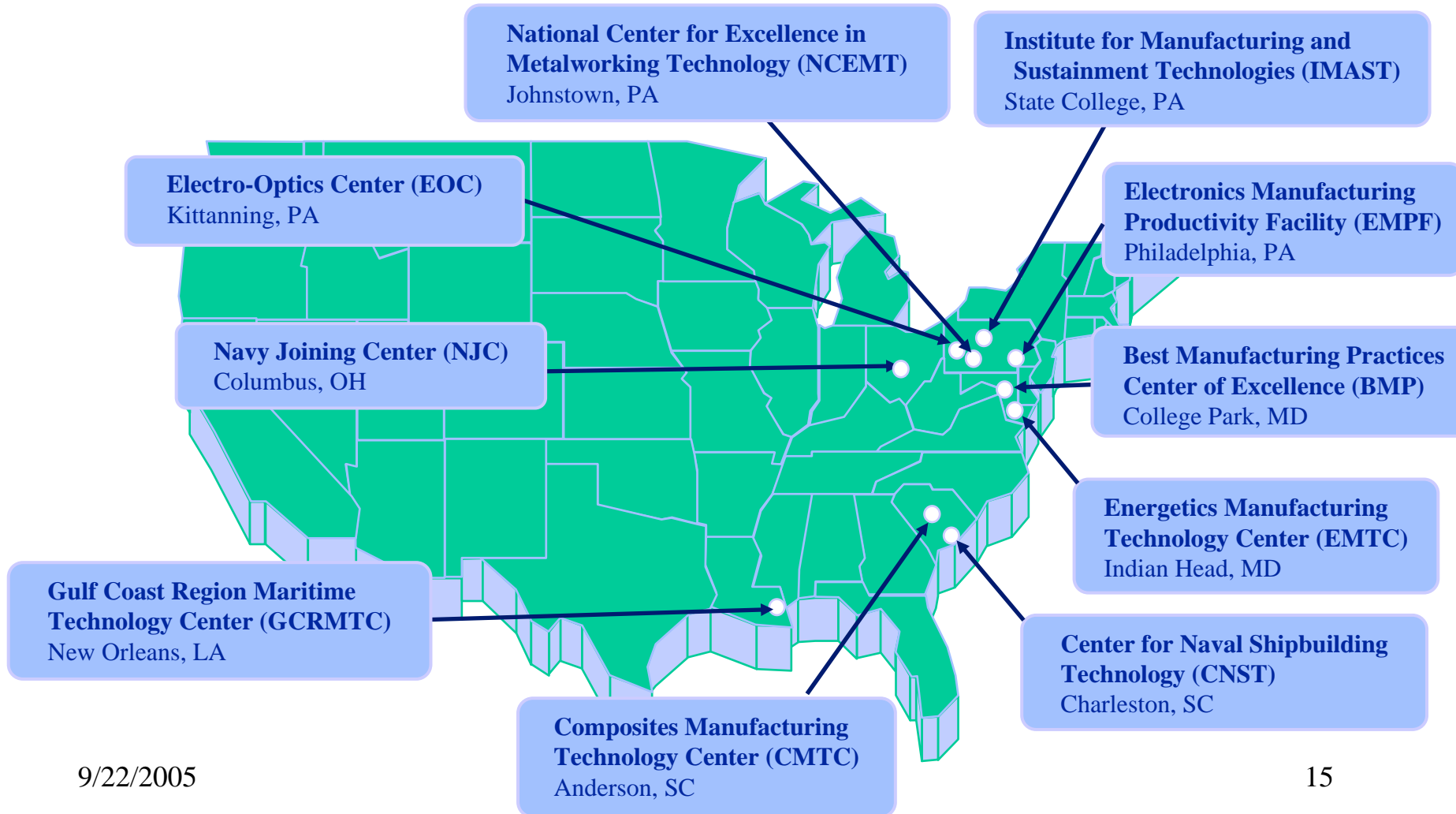
- **Pultrusion-Based Phenolic Foam Replacement for Balsa in Navy Ship Structures**
  - **Firm:** KaZaK Composites INC – Woburn MA
  - **Objective:** Develop an Improved Fire-Resistant Core Material for Top-Side Composite Sandwich Panels
  - **Approach:**
    - Modify Phenolic-Based Core Material to Exceed the Fire, Smoke, Toxicity Performance of Balsa while Maintaining Structural Properties.
    - Investigate Concurrent Pultrusion of Sandwich Panel to Reduce Cost
  - **Status:** In Phase II Contracting Cycle
  - **Period of Performance :** 24 Months After Contract Award
  - **Principal Investigator:** Dr. Jerry Fanucci,

# Navy ManTech: Mission and Functions

- A mechanism for the development of enabling manufacturing technology, in the form of new equipment and processes, and its implementation on DoD weapon system production lines:
- **DoD 4200.15 states investments should:**
  1. Transition emerging S&T results to acquisition programs
  2. Improve industrial capabilities in production, maintenance, repair and industrial base responsiveness
  3. Advance manufacturing technology to reduce cost, improve performance, and responsiveness

**Navy ManTech executed through Centers of Excellence**

# Navy MANTECH Centers of Excellence

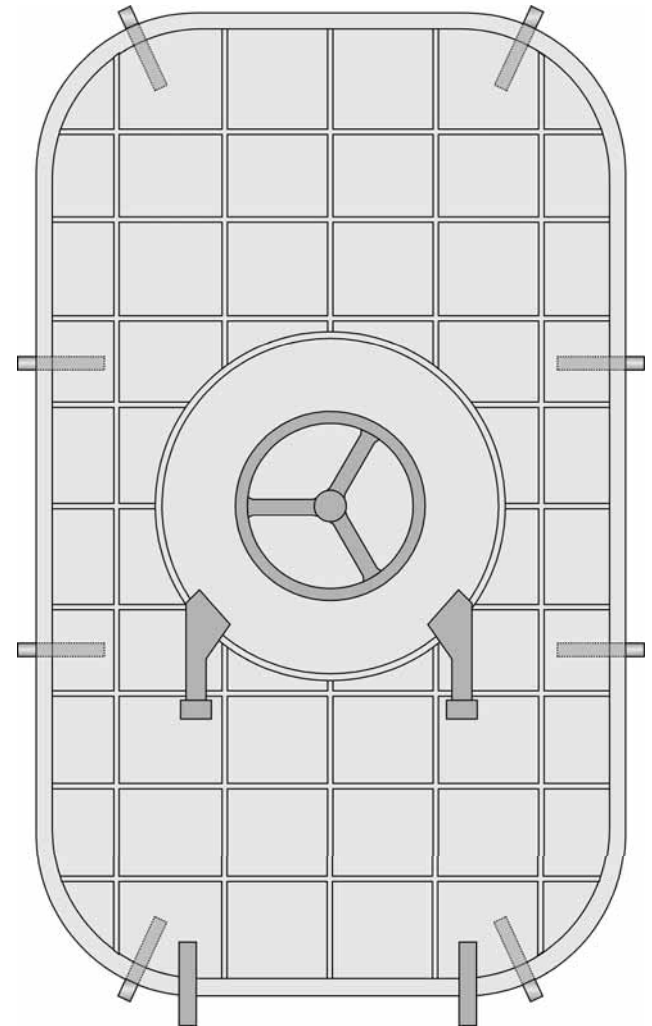


## PDMT-Focused MANTECH Projects

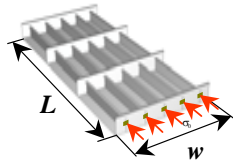
- **Advanced Surface Ship Watertight Enclosures (S2031)**
- **Collarless Construction (S1019)**
- **CVN 21 Composites Applications for Weight Reduction (S1069)**
- **Issues Associated with the Fabrication of Titanium Components (S1062)**
- **Fabrication of Titanium Components for CVN 78 (S2021)**
- **Large Marine Composite/Steel Adhesive Joints (S1002)**

# PDMT-Focused MANTECH Projects

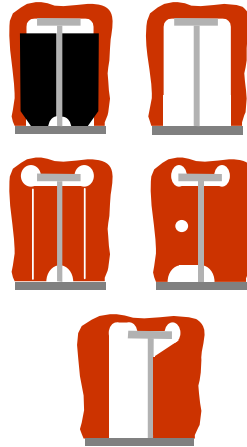
- **Advanced Surface Ship Watertight Enclosures (S2031)**
  - **Performing CoE:** NCEMT
  - Stakeholder: PEO Carriers
  - **Background:** Weight reduction is a critical component of achieve design requirements for CVN 21.
  - **Objective:** To reduce weight ship systems will be examined to determine the benefit of substituting a titanium alloy to achieve substantial weight savings.
  - **Deliverables:** Processing and manufacturing detail along with mechanical testing will be performed candidate titanium components and provided to the stakeholder for consideration of substituting titanium for selected applications



## Longitudinal Compression Test



## Collarless Designs



- **Project Number:** S-0998
- **Performing Activity:** iMAST
- **Start/End Dates:** FY01 – FY05
- **Primary Benefits:** Reduced Fabrication Costs and Reduced Weight
- **Objective:** Develop and Implement Collarless Construction Techniques for DDX
- **MANTECH Cost:** \$4,433K
- **Implementation Cost:** TBD after Phase II
- **Systems Impacted:** DDX, LPD17, LPH, DDG
- **Implementation:** Northrup Grumman Ship Systems and Bath Iron Works

## Technical Achievements:

### Phase II, Part 1 – Develop Test Plan to Evaluate Penetration Design Options

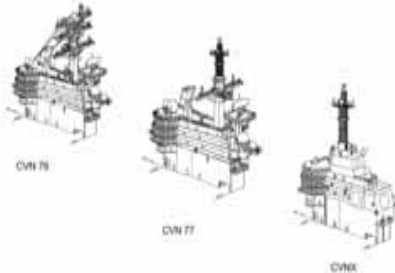
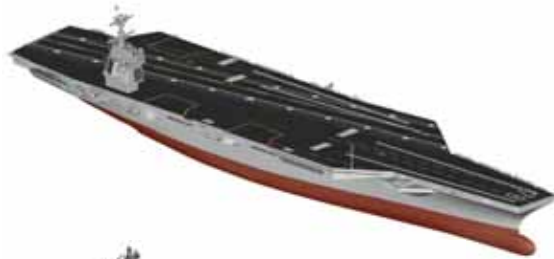
- Identified hydrostatic, linear compression, fatigue testing, and dynamic testing necessary to confirm collarless construction techniques
- Roadmap detailing testing and qualification plan for collarless construction techniques prepared for the LIPT and NAVSEA
- NGSS subcontracted to perform hydrostatic test panel fabrication, testing, data collection, and producibility study
- Team began briefing other organizations for application to other platforms

## Payoff/ROI:

- Estimated total direct cost savings per ship is \$500k
- Estimated total cost savings over first 5 years is \$25M\*
- Estimated ROI on total Navy investment is 0.7:1\*\* for first 5 years
- Estimated weight savings per ship is 70,000 lbs
- Cost to develop "location specific rules" per section 6.3.3 of the Phase I final report and the cost for inspection to verify design rule compliance should be included in final ROI calculations.

\* assuming build schedule of 1 ship per year per shipyard for 5 years

# CVN-21 Composite Applications for Weight Reduction: Phase I Concept Exploration



- **Project Number:** S1069
- **Performing Activity:** Composites Manufacturing Technology Center, Northrop Grumman Newport News, Northrop Grumman Ship Systems, General Dynamics Land Systems, and ARL Penn State
- **Start/End Dates:** June 2004 – May 2005
- **Primary Benefit:** Develop affordable, lightweight, multi-functional composite ship structures that will meet weight Key Performance Parameters (KPP) and critical performance requirements for CVN-21.
- **Objective (Phase I):** Determine candidate manufacturing processes and materials for lightweight, affordable composite ship structure panels that meet the following five (5) CVN-21 requirements: a) Fragmentation Protection; b) Fire, Smoke, & Toxicity (FST); c) Nuclear Overpressure (NOP); d) Seaway; e) Underwater Shock (UNDEX)
- **ManTech Cost:** \$ 928K **Cost Share:** \$ 0K
- **Implementation Cost:** TBD
- **Systems Impacted:** CVN-21
- **Implementation:** Fabrication processes and materials for candidate solutions identified in Phase I will be optimized for large-scale ship structure implementation in Phase II of this ManTech program. Phase III of this project will transition these fabrication processes to the shipyard.

### Problem:

Existing Navy designed lightweight composite ship structures are not considered viable options for CVN-21 because (1) they do not meet CVN-21 fragmentation protection requirements with weight reduction and (2) they only meet fire protection requirements with the addition of fibrous blanket insulation, which is expensive to install, and adds additional weight penalty.

### Solution:

Provide the CVN-21 Lead Design Yard with an alternative, affordable, lightweight, multi-functional composite ship structure capable of meeting weight Key Performance Parameters (KPP) and critical performance requirements for CVN-21.

### Project Tasks:

- Task 1: Requirements Definition
- Task 2: Concept Exploration
  - Task 2.1: Component Evaluation
  - Task 2.2 System Manufacturing Option(s) Evaluation
  - Task 2.3 Final Performance Evaluation
- Task 3: Acceptance Criteria Development
- Task 4: Project Management

# PDMT-Focused MANTECH Projects



## Issues Associated with the Fabrication of Titanium Components



### Performing Activities

- PMS 378 – design & specification overview; Stakeholder; Technical Assistant
- NAVSEA – technical contribution
- NSWCCD – technical contribution
- NJC – evaluate joining and repair processes
- NGNN – system integrator, technical contribution
- CTC – project management, technical contribution
- Titanium Suppliers – manufacture components

### Objective

- Identify, develop, evaluate and demonstrate suitable manufacturing techniques for titanium naval components for weight reduction

### Expected Benefits

- Reduced weight
- Increased loading capacity
- Reduced magnetic signature
- Reduced maintenance and life cycle costs

### Key Deliverables

- One or two titanium demonstration component(s) for field testing and implementation onto CVN-21 ship class
- Standard operating procedure for joining and repair of titanium bi-metallic components
- Fabrication Issues Report
- Redesigned Component(s)
- Phases Two and Three Project Plan

## Issues Associated with the Fabrication of Titanium Components (S1062)

### Performing Activities

- PMS 378 – design & specification overview; Stakeholder; Technical Assistant
- NAVSEA – technical contribution
- NSWCCD – technical contribution
- NJC – evaluate joining and repair processes
- NGNN – system integrator, technical contribution
- CTC – project management, technical contribution
- Titanium Suppliers – manufacture components

### Objective

- Identify, develop, evaluate and demonstrate suitable manufacturing techniques for titanium naval components for weight reduction

### Expected Benefits

- Reduced weight
- Increased loading capacity
- Reduced magnetic signature
- Reduced maintenance and life cycle costs

### Key Deliverables

- One or two titanium demonstration component(s) for field testing and implementation onto CVN-21 ship class
- Standard operating procedure for joining and repair of titanium bi-metallic components
- Fabrication Issues Report
- Redesigned Component(s)
- Phases Two and Three Project Plan

## Fabrication of Titanium Components for CVN-78 (Phase I)



- **Project No.:** S2021
- **Performing Activity:** Navy Joining Center
- **Start/End Dates:** FY04 – FY05
- **Objective:** Develop optimized welding procedures and Supporting technologies to permit the cost effective fabrication of high quality titanium components for CVN-78
- **Stakeholder:** PEO Aircraft Carriers PMS 378
- **MANTECH Cost:** \$243K
- **Systems Impacted:** CVN-78
- **Implementation:** Northrop Grumman Newport News

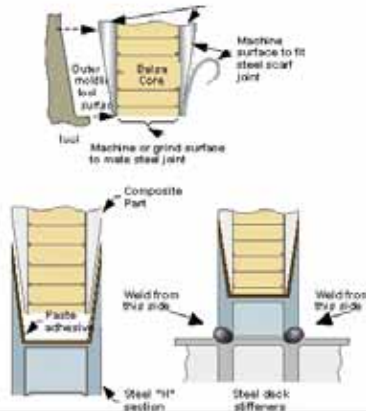
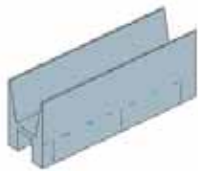
**Problem:** The Program Executive Office Aircraft Carriers and Northrop Grumman Newport News have requirement to significantly reduce the weight of the CVN-78 in order to meet operational objectives.

### Technical Approach

- Task 1: State of the art review
- Task 2: Select candidate applications
- Task 3: Dissimilar metal joining
- Task 4: Titanium arc welding development
- Task 5: Phase II plan

### Benefits/Payoff:

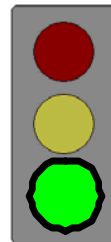
- Weight reduction
- Lower center of gravity
- Reduce titanium fabrication cost



- **Project Number:** S1002
- **Title:** Large Marine Composite to Steel Adhesive Joints
- **Objective:** Develop & implement producible & cost effective steel-to-composite adhesive joining technology meeting requirements applicable to DD(X) Class/Family of ships & other surface combatants & aircraft carriers. PEO-SHIPS / PMS 500
- **Stake holder:** DD(X) Class/Family of ships, DDG 51, LPD 17, LHD, LCS
- **Systems Application:** Navy Joining Center/ Composites Manufacturing Technology Center
- **Performing Activity:** Navy Joining Center/ Composites Manufacturing Technology Center
- **Start/End Dates:** FY01 – FY05
- **MANTECH Cost:** \$5.3M
- **Implementation:** Bath Iron Works, Northrop Grumman Ship Systems

### TECHNICAL APPROACH/ACHIEVEMENTS

- Phase I – Completed
- Phase II – 90% Complete
- Phase III
  - Subscale article fabrication and testing in progress
  - New joint design & analysis performed – change in DD(X) reqm'ts
  - Fabricated full scale manufacturing producibility article
  - NDI demonstration performed for composite panel (E-Glass)
  - Advanced signal processing software and equipment obtained for NDI using COTS UT hardware
  - Test plan integrated with DD(X) program of office



### STATUS & BENEFITS/ROI

- Joining technology that facilitates reliable integration of composites into surface combatant designs
- Manufacturing cost avoidance by eliminating
  - Mechanical fasteners
  - Intensive Labor
- Long term maintenance /Life cycle cost reduction
- Increased weapons system performance
  - Improved RCS
- Qualitative Benefits
  - “Rules and Tools” for technology implementation on all Navy ships
  - Exploit the many performance benefits of composite materials
  - Leverage adhesive technology for general ship adhesive bonding applications

# SBIR/MANTECH R&D Investment

- **Summary**

- The Navy SBIR and MANTECH programs offer considerable resources outside of NSRP to address near-term and longer-term shipbuilding issue
- Current PDMT-Related Projects' Total Funding
  - MANTECH - \$13.3M
  - SBIR - \$4.3M
- Continued support through these programs requires interaction with Navy sponsors and superior record for technology transition with demonstrated shipbuilding cost and schedule savings