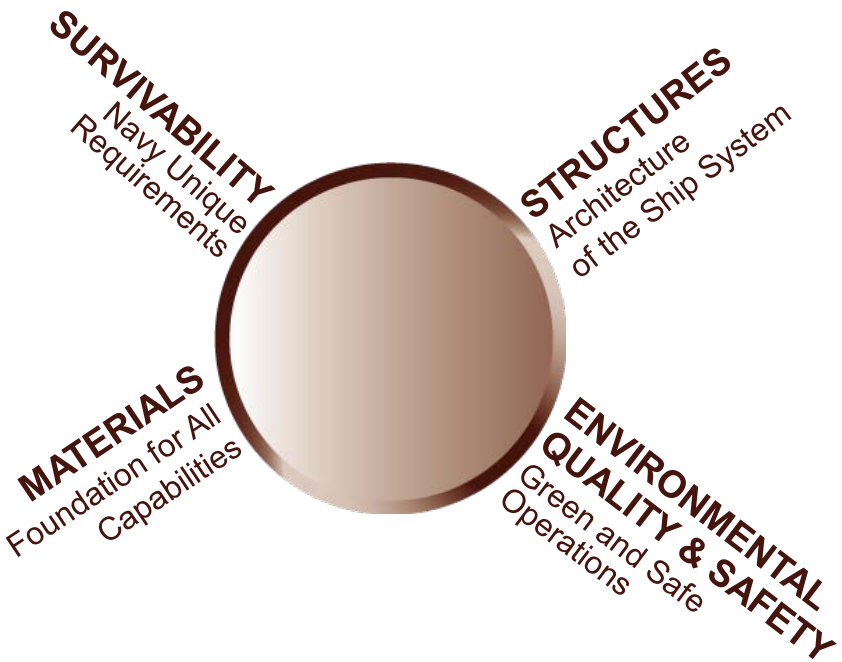
We Support Today's Fleet Tomorrow's Fleet and the Future Fleet

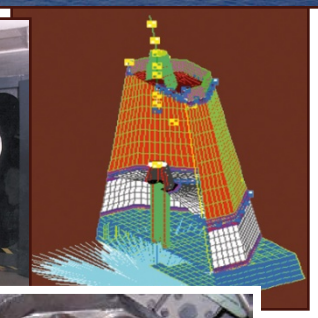
NAVSEA WARFARE CENTERS

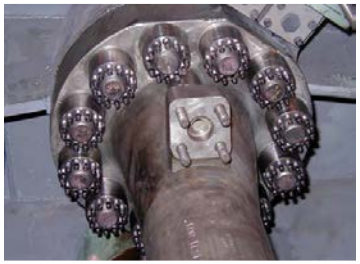
Mike Brown
Head, Department 60
Naval Surface Warfare Center – Carderock Division

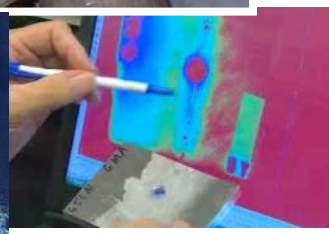
Mission

Provide fundamental enabling technologies for enhanced ship integrity and performance. Conduct full spectrum research, development, testing, life- cycle management, and in-service engineering in the areas of:









Vision

We will be the Navy's premier provider in survivability, structures, materials and environmental knowledge enabling the fleet and it's warfighters to perform all missions safely and effectively.

Technical Capabilities

TC 14: Surface, Undersea and Weapon Vehicle Materials

TC 15: Surface & Undersea Vehicle Structures

TC 16: Alternative Energy and Power Sources R&D

TC 17: Liquid Waste Management, Science and Systems

TC 18: Solid Waste, Hazardous Material & Radiation Technology Management, Science and Systems

CD 20: Surface, Undersea and USMC Vehicle Vulnerability Reduction and Protection

CD 21: Ship Recoverability and Damage Control

TC 25: Radiation Detection Technology Research and Management

Survivability, Structures, Materials & Environmental Department (60)

Materials Division (61)

- Propulsor Manufacturing
- Welding, Processing & NDE
- Corrosion & Coatings Engineering
- Naval Fluids
- Systems& Materials for Power & Protection
- Non-metallic Materials Research & Engineering

Environmental Quality (63)

- Radiation Detection & Safety
- Wastewater Management & In-service Engineering
- Solid Waste, Pollution Prevention, & Hazardous Material Management

Structures & Composites (65)

- Structures In-service Inspection
- Structural Systems
- Structural Mechanics
- Performance Evaluation
- Structural Criteria & Assessment
- Advanced Materials & Structures

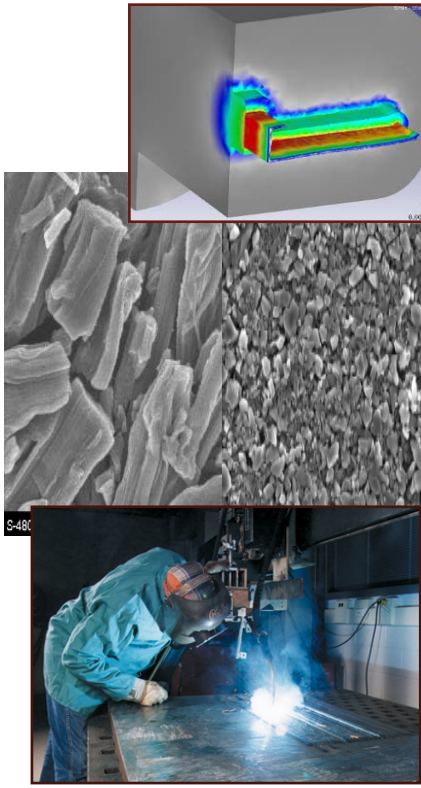
Survivability and Weapons Effects (66)

- Underwater Explosions R&D
- Dynamic Measurements & Testing
- Hull Response & Protection
- Vulnerability Assessment
- Ship Systems Hardening
- Damage Control, Recoverability & Chem Bio Defense

CD14 SURFACE & UNDERSEA & WEAPON VEHICLE MATERIALS	CD15 SURFACE & UNDERSEA VEHICLE STRUCTURES	CD16 ALTERNATIVE ENERGY & POWER SOURCES R&D	CD17 LIQUID WASTE MANAGEMENT, SCIENCE AND SYSTEMS
CD18 SOLID WASTE, HAZARDOUS MATERIAL MANAGEMENT, SCIENCE & SYSTEMS, AND SYSTEMS SAFETY	CD20 SURFACE, UNDERSEA & USMC VEHICLE VULNERABILITY REDUCTION & PROTECTION	CD21 SHIP RECOVERABILITY & DAMAGE CONTROL	TC 25 Radiation Detection Technology Research and Management

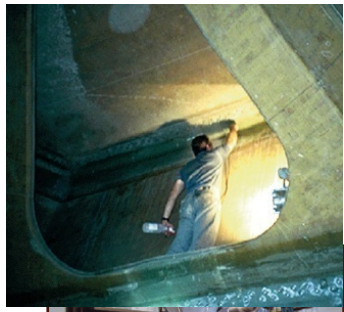
Materials Division (Code 61)

- **Material Science**
  - Naval alloys (ferrous, non-ferrous and welding consumables)
  - Polymer and metal matrix composites and processing
  - Fuels, lubricants, and hydraulic fluids
  - Magnetic materials, ceramics and high temperature materials
- **Material Performance and Readiness for Naval Applications**
  - Non-destructive test and evaluation
  - Fire Safety and protection
  - Fatigue and fracture assessment, failure analysis
- **Additive Manufacturing Technology**
  - Establishing an Additive Manufacturing Innovation Center
  - AM R&D Lab – Advancing the science of AM
  - AM Innovation Lab – AM Workforce development through open access and training in collaborative space
  - AM Fabrication Facilities – Fabrication of models, prototypes, and end items
  - Collaborating with Industry and Academia
- **Coatings and Hull Husbandry**
  - R&D of biofouling - surface interface, organism attachment mechanisms and properties of coatings
  - Developing anti-fouling paints and foul release coatings
  - ROV Hull inspection technologies for signatures, and force protection



Materials Division (Code 61)

- **Marine Corrosion Coatings and Corrosion Control**
  - Corrosion of metals and alloys in marine environments
  - Developing Marine Coatings for antifouling and corrosion protection
  - Quantifying corrosion rates and morphologies and develop protection strategies
- **Material Failure Investigation**
  - Metallurgical analysis, material characterization, and failure analyses
  - Understanding composition, microstructure, and property relationships that affect material performance
- **Power Materials and Systems**
  - Novel high performance electrochemical power sources
  - High Power and High Energy Li-ion Batteries application and safety
  - Solar Power and Fuel Cell development and testing
- **Propulsor Manufacturing**
  - Manufacturing technology, structures fabrication, and dimensional inspections
  - Navy lead for Virginia Class Propulsor construction
- **Welding and Advanced Joining Technologies**
  - NAVSEA lead for welding process and material specifications for non-ballistic applications
  - Advancing Friction Stir and Arc welding
  - Fastener Technologies



Environmental & Safety Division (Code 63)

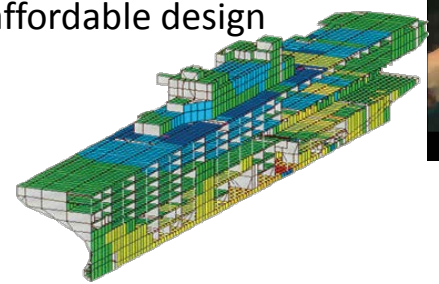
- **RDT&E of Naval Environmental Control Systems**
  - Designing, developing, and testing state-of-the-art systems (concept to full-scale prototype)
  - Assessing available and emerging systems for Navy suitability and use in the constraints shipboard operating environment
  - Developing solutions for compliance with at-sea international discharge standards
- **In-service support Shipboard Environment Control Systems**
  - Pier-side and shipboard data collection and testing of waste technologies
  - Providing reliable sensor and control systems to automate shipboard waste treatment
  - Supporting all In-Service Systems including: Pulpers, Shredders, Plasma Arc Waste Disposal System, Oil Pollution Abatement, Ballast Water Exchange and Treatment Systems, and HAZMAT management and disposal systems.
- **Future Fleet Environmental Quality Systems and Processes**
  - Advising Acquisition Program Offices on selection of environmental control systems
  - Analyzing operating envelope and providing guidance on international pollution control requirements
  - Supporting integration of Environmental, Safety and Occupational Health protection into ship acquisition strategies.

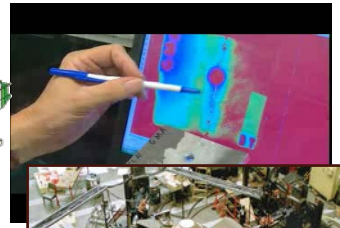
Environmental & Safety Division (Code 63)

- **NAVSEA lead for RADIAC Program**
  - Radiation detection, identification and measurement, dosimeter standards and calibration for Navy and DoD
  - R&D of radiation physics, with emphasis on dosimetry, shielding, and instrument development
  - Testing and evaluation of RADIAC instruments
  - Navy lead for Systems/Equipment Acquisition
- **Provide Support to US Navy Ship and Submarine Acquisition Programs as the Principal for Safety**
  - Develop Systems Safety Program Plans for all aspects of Life Cycle
  - Conduct Safety Analyses to assess hazards, develop mitigation strategies a define risk:
    - Human/system interfaces
    - Toxic/Hazardous Material
    - Production/Manufacturing
    - Testing
    - Facilities

Structures & Composites Division (Code 65)

- **Structural Design**
  - Providing structural assessments of marine structures based on an understanding of the loading, structural response component, and material characteristics
  - Providing structural design, analysis, and assessment support to the Fleet and Acquisition Program Offices including foreign Navies and the U.S. Coast Guard
  - Design procedure and criteria development
- **Computational structural mechanics, design and analysis, and physical structural modeling**
  - Maintaining and supporting Design Data Sheets (DDSs), design manuals, and assessment tools
  - Performing major naval architecture studies and whole ship finite element analysis of metallic and composite ships and submarines
  - Advanced Modeling and Simulation
- **Assessing in-service ship Structural Reliability**
  - Advanced structural health monitoring and assessment technologies
  - Non-Destructive Evaluation methods for inspections and evaluations of ship structures
  - Data analysis for ship machinery, foundations, and hull and topside structures
  - Maintain databases and structural integrity risk analysis for affordable design



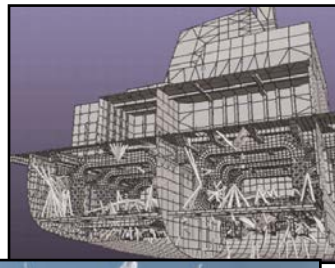


Structures & Composites Division (Code 65)

- **Composite Ship Structures**
  - R&D of new composite materials and systems
  - Novel applications of composite structures and parts
  - Design, processing, fabrication and structural integration of composite material
  - Aluminum ship repair patches
- **Structural Testing and Analysis**
  - Experience in structural loads and response (seaway, ice, air, and UNDEX)
  - Hull and component strength (including propulsors)
  - Large-scale structural laboratory testing and at-sea evaluations
- **On-site large scale testing capability**

Survivability & Weapons Effects Division (Code 66)

- **RDT&E to reduce vulnerability and improving recoverability of surface ship, submarine, aircraft carrier, and Marine Corps vehicle protection**
  - Developing advanced protection concepts, technologies, and systems to improve the damage tolerance of naval platforms
  - Analyzing and Assessing vulnerability and recoverability
  - Developing Ship/Submarine protection concepts against dynamic loading
- **Advanced modeling and simulation and analytical techniques**
  - Predicting the damaging effects of UNDEX on surface ship and submarine systems, equipment and personnel
  - Understanding weapons effects phenomenology and damage mechanisms in developing advanced vulnerability and recoverability modeling
- **Design guidance for damage tolerant structures and system recoverability**
  - Hardening of hulls and equipment to UNDEX/AIREX threats
  - Weapon's loading and effectiveness assessments
- **Shock Testing and Trails**
  - Shock trials, total ship survivability trials, surrogate ship tests, and full and scaled system/component tests
  - Underwater and Air Explosion (UNDEX/AIREX) testing, trials and analysis
  - Developing alternative testing methods and procedures to simulate underwater explosions



Survivability & Weapons Effects Division (Code 66)

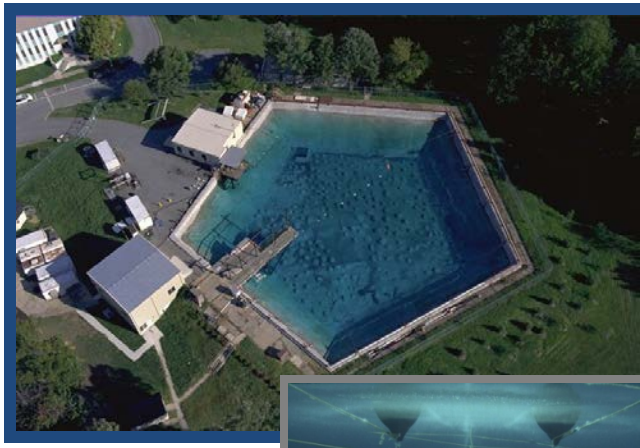
- **Shock Hardening and Qualification**
  - Provide engineering and technical support to Navy/DoD and authorized contractors on ship systems and equipment shock hardening and
  - Provide support for shock qualification
- **Damage Control, Firefighting and Chem-Bio Defense equipment and IPE**

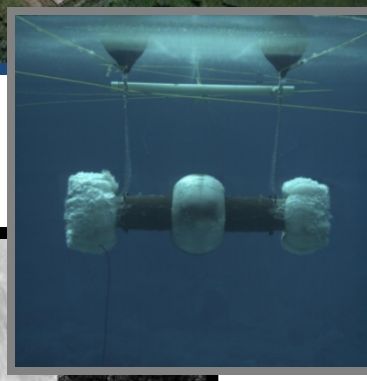
Structures & Composites Deep Submergence Pressure Test Facility

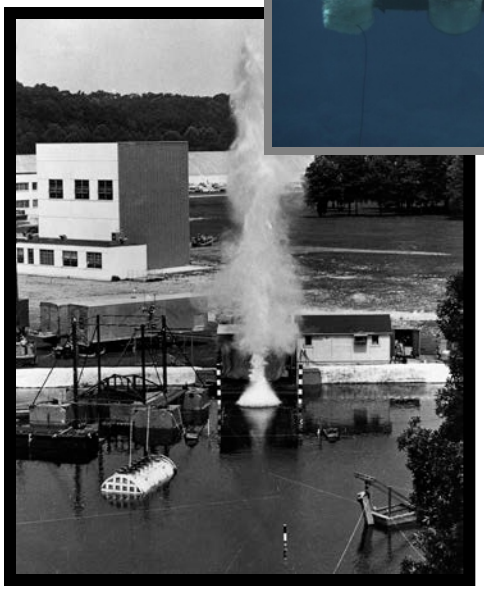
Deep Submergence Pressure Tank Facility (A-Bay)

- 4 Ft Tank: 20 ft long 15,000 psi
- 6 Ft Tank: 20 ft long 6,000 psi
- 10 Ft Tank: Spherical 10,000 psi (UNDEX)
- 13 Ft Tank: 40 ft long 3,000 psi
- Pressure Media: fresh water, salt water, oil

Explosion Test Pond Facility







- Provides near-laboratory conditions for evaluating effects of shock on structures and materials
  - 3 lb Net Explosive Weight capable
  - 125 ft long on each side, 25 ft deep, 3.5M gallons
- Event visualization using High Speed Digital camera recording systems
  - High speed digital camera systems 2k to 10k frames per second on average, higher with special circumstances.
  - Water Filtration systems to 1 micron
- Provides visual validation for code development and analysis; advanced warhead development & proof of concept
  - Complete sensor suite capable of measuring pressure, strain, velocity and acceleration

Radiation Detection Systems

- NSWCCD Code 6301 is assigned by SEA 04RN, RADIAC Program Office, as their Science & Technology Agent
- Principle areas include:
  - Radiation Detection
  - Personnel Protection
  - Standards
  - Shielding
- Responsible for:
  - Testing and Evaluation of RADIAC instruments
  - Calibration, Standardization and Quality Assurance
  - RADIAC Instrument System Integration
  - Radiation Safety Procedures
  - Representing the U.S. Navy on Standards Committees
  - Conducting Equipment/Systems Acceptance Testing
  - Systems/Equipment Acquisition
  - Technology Development for Expanded Maritime Operations (EMIO)

Inte

Major Prime Contractors

Technical and Programmatic Services

- Leidos
- McKean Defense Group
- Spectrum Technology Group
- ICI Services
- Hughes Associates
- Vision Point Systems
- Gibbs & Cox
- Concurrent Technology Corporation

Equipment, Supplies, and Materials

- Canberra
- Seemann Composites
- Thermo Fisher Scientific
- Material Sciences Corporation

FY15 Competitive Requirements

Brief Description	Anticipated Announcement Date (QTR/FY)	Incumbent Contractor
Materials Division Technical and Programmatic Services Seaport Task Order	3rd Qtr. – FY15	Spectrum Technology Group
Corrosion Prevention and Control Engineering Services Seaport Task Order	3rd Qtr. - FY15	Vision Point Systems
Shock Engineering Services Seaport Task Order	3rd Qtr. - FY15	Gibbs & Cox

FY15 Competitive Requirements

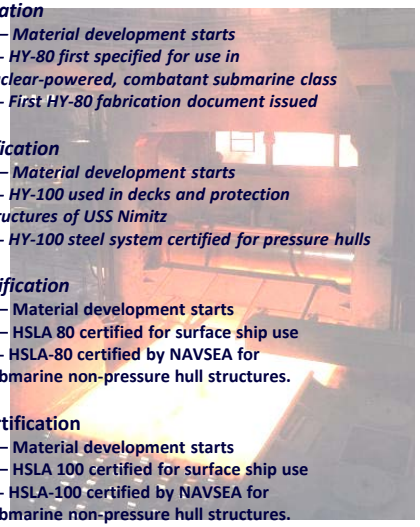
Brief Description	Anticipated Announcement Date (QTR/FY)	Incumbent Contractor
Corrosion Control Assistance Team Technical Services Seaport Task Order	3rd/4th Qtr. – FY15	Leidos
Naval Shipboard Fire Protection Systems Support Seaport Task Order	3rd/4th Qtr. - FY15	ICI Services
Metallurgical Testing Services IDIQ Contract	4th Qtr. - FY15	N/A

Back Up

Dept 60's Major Facilities

- Materials Technologies Complex
- Environmental Quality & Safety Complex
- Structural Mechanical Facility
- Survivability & Weapons Effects Complex
- RADIAC Range and Positive Ion Accelerator Facility (PIAF)
- Philadelphia Facility Complex
  - Materials Engineering & Fluid Processes
  - Metallics/Non-Metallics Materials/Tribology
  - Marine Coatings & Corrosion
  - Cathodic Protection Facility
  - Non-Destructive Test Laboratory
  - Environmental Quality ISE Test Site
  - Damage Control Sensors Engineering Site

Unique Capabilities
Development & Certification of Naval Materials



HY80 Certification

- ***1946 – Material development starts***
- ***1956 - HY-80 first specified for use in nuclear-powered, combatant submarine class***
- ***1960 - First HY-80 fabrication document issued***

HY 100 Certification

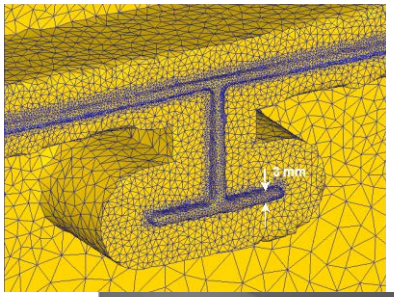
- ***1958 – Material development starts***
- ***1966 - HY-100 used in decks and protection structures of USS Nimitz***
- ***1980 - HY-100 steel system certified for pressure hulls***

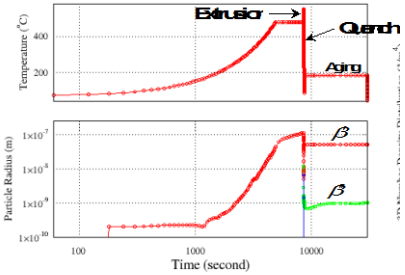
HSLA 80 Certification

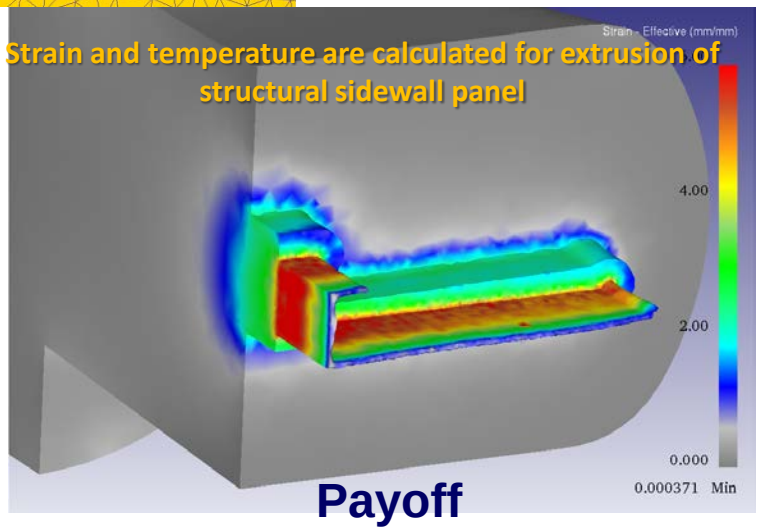
- **1980 – Material development starts**
- **1984 – HSLA 80 certified for surface ship use**
- **1995 - HSLA-80 certified by NAVSEA for submarine non-pressure hull structures.**

HSLA 100 Certification

- **1985 – Material development starts**
- **1990 – HSLA 100 certified for surface ship use**
- **1995 - HSLA-100 certified by NAVSEA for submarine non-pressure hull structures.**







Computational Materials Engineering

- Cutting-edge development of computational materials science tools to calculate
  - Effect of composition
  - Effect of process variables on properties and microstructure
- State of the art M&S system to reduce qualification testing, reduce risk, and accelerate time to insertion of new materials into the fleet
- High-end computational packages provide improved insight and advanced knowledge of Naval materials

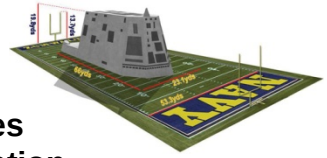
Payoff

- Reduced time needed to qualify new Naval materials, and changes to existing materials
- Reduced number of qualification tests (and costs), by screening with virtual experiments
- Calculation of property distribution can be integrated into computer-aided design process for optimized performance/weight

Unique Capabilities
Composites Ship Structures

DDG1000 IDHA Design

- Integrated Deckhouse and Apertures (IDHA)1 of 10 critical Engineering Development Models
- NSWCCD Code 60 involved to reduce technical risk prior to Ship System CDR
- Numerous test events ranging from coupon test to full-scale test articles complimented with modeling and simulation



>3000 Material Coupons

>100 Structural Elements

Material and Structural Testing and Analysis

Fabrication Support - DDG1000 Helo Hanger at HII Gulfport

Prototype Composite Patches to Temporarily Repair Aluminum Superstructure Cracks on CGs

- Installation procedure designed to adhere to non-flat aluminum surface
- Durability and effectiveness at retarding crack growth being assessed (>16 months success for first patches)

Acquisition and In-service Engineering Support for LPD-17 Composite Advanced Enclosed Mast/Sensor (AEMS)

- Addressing fleet maintenance issues related to coatings, bolted connections, composite bonded joints
- First hand knowledge from design and acquisition risk mitigation efforts invaluable

Distribution Statement E: Distribution authorized to DOD components only. Sensitive - For Official Use Only

Unique Capabilities
Radiation Detection

Radiation Detection Systems:

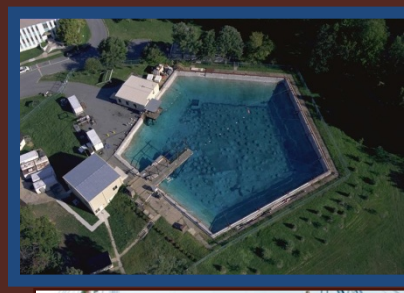
- NSWCCD Code 6301 is assigned by SEA 04RN, RADIAC Program Office, as the Science & Technology Agent
- Principal areas include:
  - Radiation Detection
  - Personnel Protection
  - Standards
  - Shielding
- Responsible for:
  - Testing and Evaluation of RADIAC instruments
  - Calibration, Standardization and Quality Assurance
  - RADIAC Instrument System Integration
  - Radiation Safety Procedures
  - Representing the U.S. Navy on Standards Committees
  - Conducting Equipment/Systems Acceptance Testing
  - Systems/Equipment Acquisition
  - Technology Development for Expanded Maritime Interception Operations (EMIO)

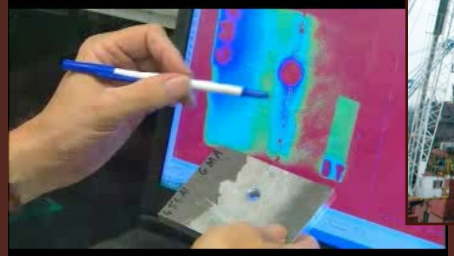
Department 60 Major Facilities

- Materials Technology Complex
  - Materials Characterization Facility
  - Fatigue and Fracture
  - Surface Analysis Lab
  - Nondestructive Evaluation Lab
  - Ceramics Processing lab
  - Polymers Processing Lab
  - Joining Processes Lab
  - Coatings Applications and Analysis Site
  - Fire Protection Materials Facility
- Environmental Quality & Safety Facility
  - Radiation Lab
  - Liquid Waste Lab
  - Solid Waste and Medical Waste and Pollution Prevention Lab
  - Positive Ion Accellerator Facility

Department 60 Major Facilities

- Structural Mechanics Facility
  - Deep Submergence Pressure Test Facility
  - Large Scale Structural Evaluation Facility
  - Fatigue and grillage Test Facility





- Vulnerability & Protection Complex
  - Explosives Test Pond & Dynamics Measurements Complex
  - Large Scale Underwater Explosions Test Complex (APG)
  - Protection Analysis Center
  - Damage Control Sensor System Engineering Facility