Presentation Overview

- Primary Hull Structure
  - Minehunters
  - Special Forces & Boats

- Superstructure

- Foils and Appendages
  - Surface Ships
  - Submarines

- Components
Primary Structure

OSPREY Class Minehunter

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>57.2 meters (187 feet, 10 inches)</td>
</tr>
<tr>
<td><strong>Beam</strong></td>
<td>11.0 meters (35 feet, 11 inches)</td>
</tr>
<tr>
<td><strong>Draft</strong></td>
<td>2.9 meters (9 feet, 4 inches)</td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>895 metric tons</td>
</tr>
<tr>
<td><strong>Propulsion</strong></td>
<td>two 800 hp amagnetic diesel engines with variable fluid drives turning two cycloidal propellers</td>
</tr>
<tr>
<td><strong>Accommodations</strong></td>
<td>5 officers; 4 CPO; 42 enlisted</td>
</tr>
</tbody>
</table>

Construction Particulars

All glass reinforcement for primary structure is E glass. Spun woven roving of 1400 grams per square meter is used for the hull, transverse bulkheads, and decks. The spun woven roving is a fabric with the weft direction reinforcement consisting of rovings that have been "tufted." This treatment, which gives the fabric a fuzzy appearance, improves the interlaminar shear strength over traditional woven rovings. The superstructure is constructed of a "Rovimat" material consisting of a chopped strand mat stitched to a woven roving. Stitching of the two fabrics was chosen to improve performance with the semi-automated resin impregnator (which is used during the lamination process). The total weight of the Rovimat is 1200 grams per square meter (400 g/m² mat + 800 g/m² woven roving).

The resin is a high grade toughened isophthalic marine polyester resin. It is specially formulated for toughness under shock loads and to meet the necessary fabrication requirements. The resin does not have brittle fracture characteristics of normal polyester resins, which gives it excellent performance under underwater explosive loads. Combined with spun woven roving, the laminate provides superior shock and impact resistance. The resin formulation has been optimized for improved producibility. Significant is the long gel time (up to four hours) with low exotherm and a long extended delay time to produce a primary bond. [1-32]
Primary Structure

Special Forces 11- Meter RIB

In-Service Photos of the U.S. Navy Special Warfare’s 11-Meter RIB
Built by U.S. Marine

Eric Greene
Primary Structure

Boats

Members of Inshore Boat Unit Seventeen (IBU 17) Patrol the Waters of Apra Harbor, Guam

At sea Aboard USS Blue Ridge (LCC 19) Sailors Practice Deployment of Ship’s Small Boats
Primary Structure

Swimmer Delivery Vehicles

Special Forces Divers Work with a Swimmer Delivery Vehicle

Schematic of Northrop Grumman’s 65-foot Advanced SEAL Delivery System
Superstructure

Helicopter Hanger for DDG 51 Flt IIA

Composite Helicopter Hanger for DDG 51 Flight IIA Destroyer Built at Northrop Grumman Ship Systems’ Gulfport Facility
Scheduled to be Installed on DDG 100
Superstructure

DDG 51 Forward Director Room

Forward Director Room
Built by Northrop Grumman’s El Segundo Facility as Technology Demonstrator for DDG 51 under ManTech Funding
Foils & Appendages

Surface Ships

Composite MCM Rudder Built by Structural Composites Shown During Shock Trials

A Composite Twisted Rudder under Development
Foils & Appendages

Submarines

Advanced Composite Sail Envisioned for Virginia Class Submarines (top left) and 1/4-Scale Prototype Built by Seemann Composites (bottom left).

Composite Submarine Bow Dome Produced by Goodrich Composites.
Components

Boat Davits

Priority
High

Opportunity
Potential to reduce maintenance and increase personnel safety

Technical Issues
Functional design, safety factors, interface with metal hardware

Previous Work
Advanced Lightweight Engineering in the Netherlands has developed a composite davit for Davit International in Germany

Return on Investment
Medium

Eric Greene
Components

Bulkheads, Nonstructural

**Priority**  Medium

**Opportunity**  Opportunity to reduce cost and weight while improving fire resistance

**Technical Issues**  Fire, cost, supportability

**Previous Work**  Currently use Nomex/phenolic sandwich

**Return on Investment**  Medium

---

Webcore Hybrid Fabric-Web/Strut-Web Core with Pre-Attached Fabric Proposed for Navy SBIR Door Project

Eric Greene
Components

Bulwarks

**Priority**  Low

**Opportunity**  Potential to reduce weight and maintenance

**Technical Issues**  Not suitable for retrofit

**Previous Work**  LPD 17 design calls for composite bulwarks

**Return on Investment**  Low
Components

Cable Passage Tubes

- **Priority**: Medium
- **Opportunity**: Reduced maintenance and ease of handling
- **Technical Issues**: Fire and watertight certification

**Previous Work**

- **Return on Investment**: Medium

Bulkhead Example of Nelson Firestop Multi-Plug Tested to US Navy Standards (DoD-Std-2003)
Cable Hangers

Components

Priority: Medium

Opportunity: Potential to reduce weight and maintenance

Technical Issues: Fire

Previous Work

Return on Investment: Medium

Single Cable Composite Pedestal Cable Hanger
[Dennis Conroy & Larry Murphy, NSWCCD Code 823]
Components

CHT Systems

Priority  High
Opportunity  Eliminate severe corrosion and make maintenance easier
Technical Issues  Fire; integrate with existing system elements
Previous Work  Navy has fielded prototype composite systems. The U.S. Navy is now specifying GRP (fiberglass) piping and ladders for use inside the CHT tank, as this material holds up extremely well in the sewage environment.
Return on Investment  Medium

U.S. Navy Type III Marine Sanitation Device [US Navy Shipboard Environmental Information Clearinghouse]
Components

Condensate Drains

**Priority** Medium

**Opportunity** Reduce corrosion and related maintenance

**Technical Issues** Fire

**Previous Work**

**Return on Investment** High

Intake Fan Room/Plenum Drain on **USS INCHON** (MCS12), Dec 2000. [Capital Investment for Labor Machinery Space Ventilation Program, Norm Clayton & John Miller, NSWCCD Codes 624 & 9213]
Components

Counter Measure Washdown Piping

Priority
High

Opportunity
Aluminum tubing subject to corrosion and fouling

Technical Issues
Demonstrate survivability of composite system

Previous Work
Fleet currently planning on replacing with CuNi system

Return on Investment
High

Images of Topside Counter Measure Washdown

[Photograph by Robert Benson (above) and Cathy A. Brenneman (below)]
Deck Grating

Priority: High

Opportunity: Eliminate corrosion and related maintenance and safety issues

Technical Issues: Fire and strength

Previous Work: ERM-7 has fielded composite grating on 4 ships; numerous unauthorized replacements in the fleet.

NAVSEA Drwg 803-6983499, GRP Deck Grating specifies MODAR resin – parts expected to be in supply system late FY 03

Return on Investment: High

Components

Composite Deck Grating on FFG-58 USS Samuel B. Roberts
Components

Door Hinges

Priority: High
Opportunity: Eliminate severe corrosion; make maintenance and operation easier
Technical Issues: Fire, operability and strength
Previous Work: Ken Brayton, NAVSEA 05P7 has led SBIR & other efforts to develop composite closures & mechanisms
Return on Investment: High

Watertight Door Showing Wear Due to Hinge Misalignment (above) and Corrosion (below)
### Doors

<table>
<thead>
<tr>
<th><strong>Components</strong></th>
<th><strong>Doors</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Priority</strong></td>
<td>High</td>
</tr>
<tr>
<td><strong>Opportunity</strong></td>
<td>Corrosion, weight, stealth &amp; ease of operation</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Fire &amp; strength</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Prototypes have been developed by Ingalls and Webcore</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

E-Glass/Vinyl Ester-Paneled Door Built by Ingalls used in ManTech Topside Project
Components

Electrical Enclosures

Priority  High

Opportunity  Reduce corrosion and related maintenance

Technical Issues  Fire and impact resistance

Previous Work  ERM-7 is in the process of certifying ULTEM 2300 electrical enclosures

Return on Investment  High

Typical Corrosion-Related Failure (above) and ULTEM 2300 Box Molded by Glenair (below)
Components

Fairings

Priority  High
Opportunity  Metal rope guards difficult to replace underwater
Technical Issues  Fastener interface
Previous Work  Composite propulsion shaft rope guards installed on Aircraft Carriers showing:
  • Less than ½ the cost and weight of original Cu-Ni
  • Bolt-on vs. weld-on
  • Easy waterborne removal/install gives full access to stave bearings & zinscs
Return on Investment  High
<table>
<thead>
<tr>
<th><strong>Components</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fans &amp; Blowers</strong></td>
</tr>
<tr>
<td><strong>Priority</strong></td>
</tr>
<tr>
<td><strong>Opportunity</strong></td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
</tr>
</tbody>
</table>

Typical Axial Fan
Foundations

**Priority**  High

**Opportunity**  Severe corrosion on saltwater pump foundations is major maintenance issue and contributes to machinery vibration; potential to make machinery "quieter"

**Technical Issues**  Fire and shock

**Previous Work**  Brunswick Defense built a filament-wound foundation that was tested at NSWCCD

**Return on Investment**  Medium
Components

Funnels & Deck Drains

- **Priority**: Medium
- **Opportunity**: Potential to reduce weight and maintenance
- **Technical Issues**: Interface to metal structure
- **Previous Work**: ERM-7 has awarded SPARTA a contract to build prototype Type D deck drains. Type A is scheduled for development in FY 04.
- **Return on Investment**: High

Typical Navy Funnels [Dolsey Ltd., Norfolk, VA]

Type “A” Deck Drain
Components

Gear Cases

**Priority**  Low

**Opportunity**  Reduce weight and make machinery quieter

**Technical Issues**  Strength, creep and high temperature performance

**Previous Work**  Some "high end" work done by DTRC, Annapolis

**Return on Investment**  Low

Example of Reduction Gear Arrangement for DDG 51 Class Where Each of the Ship's Two Propellers is Driven GE Multiple-Input Reduction Gear Powered by Two GE Gas Turbines
### Components

#### Handrails

<table>
<thead>
<tr>
<th>Priority</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity</td>
<td>Reduce maintenance and electronic interference</td>
</tr>
<tr>
<td>Technical Issues</td>
<td>Cost and UV resistance</td>
</tr>
<tr>
<td>Previous Work</td>
<td>Some isolated topside use</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>Medium</td>
</tr>
</tbody>
</table>

A Sailor uses a Pneumatic Sander to Prepare Metal Handrail for Painting Preservation
Hatches

Priority  High

Opportunity  Reduced weight improves ease of operation; reduce maintenance; and improve stealth

Technical Issues  Hardware operability and fire resistance

Previous Work  Ingalls’ door with composite panel; Webcore SBIR project: UCSD cargo door

Return on Investment  High

Scuttle Hatch Locking Device (above) and Lifting Assist Mechanism (below)
[Ken Brayton, 05P7]
Components

Heat Exchangers

Priority Medium
Opportunity Reduce corrosion and fouling

Technical Issues
Increase thermoconductivity at reasonable cost

Previous Work
NSWC, Annapolis developed carbon epoxy laminates with conductive additives that performed better than Cu-Ni

Return on Investment Medium

Example of Fouled Heat Exchanger Head Inlet (above) [ERM, Fred Tsao, 05L] and Relative Effectiveness of Composites (below) [Joseph Korczynski, NSWCCD]
Components

Helicopter Hanger Doors

Priority: High

Opportunity: Reduced corrosion maintenance and machinery maintenance from less weight

Technical Issues: Strength and fire resistance

Previous Work: Seemann Composites and BIW have developed a composite helicopter door for DDG 51 Flt IIA. A composite helicopter hanger is scheduled to be installed on DDG-100.

Return on Investment: Medium

Composite Helicopter Hanger First Article Door (above) and Operational Test Jig (below) [Seemann Composites]
Components

Helicopter Net Frames

- **Priority**: High
- **Opportunity**: Reduce corrosion and weight
- **Technical Issues**: Certification
- **Previous Work**: Frames changed from flame sprayed steel to CRES on DDG 79 and later; safety net component hardware modified to CRES material
- **Return on Investment**: High

Helicopter Net Frames on the **USS Thach** (FFG-43)

Eric Greene
Components

Insulation

**Priority** Medium

**Opportunity** Reduce weight and maintenance.

**Technical Issues** Cost

**Previous Work** Polyimide foam certified as fire-safe insulation. The replacement of fiberglass with polyimide foam hullboards on USN CG 47 Class cruisers produced a weight reduction of approximately 50 tons.

**Return on Investment** Medium

Inspec Foams’ Thermal Hullboard for MIL-I-742 Type Applications with Glass Cloth Laminated to SOLIMIDE® Thermal Insulation Foam Weighing 0.15 lbs/ft² at 1” Thickness [Inspec]
### Components

#### Ladders

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>Corrosion elimination and enhanced safety</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Cost and functionality</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Some isolated topside use of composites</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

Composite Ladder Located Topside on FFG-58, the *USS Samuel B. Roberts*
Components

Life Rails & Lines

**Priority**  High

**Opportunity**  Reduce maintenance and electronic interference

**Technical Issues**  Cost and UV resistance

**Previous Work**  Some isolated topside use

**Return on Investment**  Medium

Life Rails & Lines Located Topside on FFG-58, the *USS Samuel B. Roberts* and the *USS Gary* (FFG-51)

Eric Greene
Components

Louvers

**Priority**  High

**Opportunity**  Reduce maintenance and improve stealth

**Technical Issues**  Cost, certification and durability

**Previous Work**  Composite louvers developed for the DDG 51 class destroyers

**Return on Investment**  High

Radar Absorbing Composite Louver
Developed for the DDG 51 Class Destroyers
## Components

### Mast Stays & Lines

<table>
<thead>
<tr>
<th>Priority</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>Reduce weight, electronic interference and maintenance</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>End fittings and overall cost</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Used on recreational sailboats</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

Mast Arrangement on *[USS Elrod](https://en.wikipedia.org/wiki/USS_Elrod) (FFG 55)*
Showing Stays and Lines
Components

Masts

**Priority**  Medium

**Opportunity**  Improve equipment supportability

**Technical Issues**  Cost

**Previous Work**  AEM/S on *USS Radford* and LPD-17

**Return on Investment**  Low

Advanced Enclosed Mast System for LPD 17 Class Ships
Components

Motor Housings

**Priority**  Low

**Opportunity**  Improve equipment supportability

**Technical Issues**  Shock qualification

**Previous Work**

**Return on Investment**  Low

Examples of Typical Electric Motor Housings
## Components

### Pipe Hangers

**Priority**  High

**Opportunity**  Eliminate corrosion and reduce pipe vibration

**Technical Issues**  Cost and fire

**Previous Work**  All hangers in weather, passageways to weather, in the mast, uptakes and dirty side of CPS fan rooms have been changed to CRES 316L material on DDG 77 and later

**Return on Investment**  High

Navy Type 1 and Type 2 Hangers [Dolsey Ltd., Norfolk, VA]
Components

Piping

**Priority**  High

**Opportunity**  Eliminate corrosion related maintenance: reduce weight & vibration

**Technical Issues**  Cost and fire

**Previous Work**  Numerous offshore installations and Navy prototypes waiting congressional plus-up

**Return on Investment**  High

Ameron’s Bondstrand® 2000USN MIL-P-24608 Pipe Assembly Weighs 3.6 pounds Compared to 6.8 pounds for CuNi

FIBERBOND® Pipe Shown to Withstand 2000°F Fires [EDO Specialty Plastics]
Plenums

**Priority** High

**Opportunity** Eliminate severe corrosion and associated maintenance

**Technical Issues** Cost and fire

**Previous Work** Plastic turning vanes have been fielded on a limited basis

**Return on Investment** High

Proposed FFG Composite Plenum for 1180 CFM Nat Supply Aux Mchry Rm #3, Helo Hgr #2, 1-278-2-Q
Components

Propellers

**Priority** | Low
---|---
**Opportunity** | Potential to make propellers quieter

**Technical Issues** | Strength and cost

**Previous Work** | Existing systems for large yachts and R&D work on underwater propulsors

**Return on Investment** | Low

The Contur® Propeller with Exchangeable Composite Blades Offered by AIR Fertigung-Technologie GmbH, Germany
Components

Propulsion Shafting

**Priority**  Medium

**Opportunity**  Reduce vibration, weight and corrosion maintenance

**Technical Issues**  Interface to metal couplings and cost

**Previous Work**  Commercially available for high speed craft, NSWC Annapolis prototype work on AOE & subs

**Return on Investment**  Medium

33 inch Diameter Filament Wound Section of Propulsion Shafting
Developed by DTRC, Annapolis for Testing to Meet AOE-Class Performance Requirements
[George Wilhelmi]
Components

Pump Internals

**Priority**  High

**Opportunity**  Increase mean time between failure and reduce time to repair

**Technical Issues**  Standardization of U.S. Navy pump population

**Previous Work**  ERM-7 has fielded composite pump internals on 19 ships

**Return on Investment**  High

Navy Shock-Qualified Composite Pump Internals Built by Flowserve
Components

Pumps

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity</td>
<td>Reduce corrosion, much quicker to repair and quieter</td>
</tr>
<tr>
<td>Technical Issues</td>
<td>Cost and standardization of U.S. Navy pump population</td>
</tr>
<tr>
<td>Previous Work</td>
<td>ERM-7 has funded production of 1 size pump, ManTech effort pending</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>High</td>
</tr>
</tbody>
</table>

Navy Shock-Qualified Composite Pump Built by Flowserve and Installed as Part of the Navy’s SMARTSHIP Program
Components

Retractable Bitts & Chocks

Priority  Medium

Opportunity  Corrosion related maintenance and safety – corroded bitts difficult to retract

Technical Issues  Certification

Previous Work  The following modifications have been made to retractable bitts on DDG 79:
  • Modified surface preparation requirements
  • Improved Bar Rust coating system
  • Revised PMS MRC to require more frequent maintenance
  • Drain lines installed in bitt chambers Bar Rust coating on DDG 79 Bitts

Return on Investment  Medium

Typical Retractable Bitt Showing Corrosion from Mooring Line Wear and Standing Water
**Components**

## Saltwater Piping

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>Potential to reduce corrosion, fouling and vibration problems</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Fire &amp; certification</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Many offshore installations and proposed U.S. Navy use pending congressional plus-up</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

Composite Pipe Installed in Severe Saltwater Ship Environment (Ameron®)

Eric Greene
Seachest Strainers

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>Reduce corrosion and integrate antifouling agent</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Integrate effective, environmentally-friendly antifouling</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>PMS 400F funding pilot program</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

Fouled Seachest Strainer (top) Cutout (middle) and Prototype Composite Strainer (bottom)
Shafting Overwraps

**Priority**  High

**Opportunity**  Current manual method labor intensive and not durable. All shafting exposed to seawater must be coated to prevent corrosion, which can lead to fatigue failure. Glass Reinforced Plastic (GRP) (in accordance with MIL-STD-2199) consists of four alternately wrapped layers of fiberglass cloth and Phillyclad 1775/620 resin.

**Technical Issues**  Environmentally-compliant process; bond to steel; durability

**Previous Work**  NNS currently funded as ManTech project

**Return on Investment**  High
Components

Stacks

**Priority**  Low

**Opportunity**  Potential to reduce topside weight and integrate sensors

**Technical Issues**  Cost precludes retrofit

**Previous Work**  Ingalls completed Low Observable Stack project

**Return on Investment**  Low

Low Observable Multifunction Stack Concept [ONR]
Components

Stair Treads

Priority: Medium
Opportunity: Corrosion elimination and enhanced safety

Technical Issues: Fire

Previous Work: Some unauthorized installations

Return on Investment: Medium

Topside Example of Stair Treads on the USS Samuel B. Roberts Showing Wear of Painted Finish
Components

Stanchions

Priority  Medium

Opportunity  Reduce corrosion and weight

Technical Issues  Cost & functionality

Previous Work
Some topside applications utilized products with insufficient strength and UV protection.

Improved polyurethane/E-glass composite stanchions are currently installed on a carrier for evaluation. These stanchions can bend 90° and spring back to original shape.

Return on Investment  Medium

Topside Example of Stanchion on the **USS Samuel B. Roberts** Showing Surrounding Deck Grating
## Components

### Stowage Lockers

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity</td>
<td>Reduce corrosion, weight &amp; condensation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technical Issues</th>
<th>Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Work</td>
<td>Some commercially available products</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Damage Controlman Checks Fit of a Self Contained Breathing Apparatus (SCBA) from a Damage Repair Locker
Components

Tanks

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>Reduce corrosion especially with saltwater &amp; sewage systems - Tank and Void preservation has been reported by the Type Commanders as their single largest maintenance burden.</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Fire and certification</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Some prototype sewage treatment systems on carriers</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

Current Tank Coatings after 36 Months [ERM, Beau Brinckerhoff, 05M]
Components

Tank Vents

- **Priority**: High
- **Opportunity**: Reduce corrosion maintenance and weight
- **Technical Issues**: Fire and certification
- **Previous Work**
- **Return on Investment**: High

Eric Greene
## Components

**Topside Personnel Protection**

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>FFG role for homeland security may increase vulnerability of topside personnel</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Cost, stowability &amp; performance</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Kevlar®-reinforced systems have been fielded on a limited basis, including <em>USS Radford</em> (DD-968) under MAC ALT 384 for up to forty ships supporting Desert Storm</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

Machine Gun Installation on the *USS Elrod* (FFG 55) and Armor Frames [MAC ALT 384]
## Components

### Topside Superstructure

<table>
<thead>
<tr>
<th><strong>Priority</strong></th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity</strong></td>
<td>Potential for in-situ repair of chronic aluminum deckhouse corrosion areas</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>Fire and bond to aluminum</td>
</tr>
<tr>
<td><strong>Previous Work</strong></td>
<td>Numerous prototype systems developed including MARITECH, Helo Hanger and ManTech projects</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>Low</td>
</tr>
</tbody>
</table>

MARITECH Composite Superstructure Project Built by Structural Composites and Ingalls using Adhesive Technology
Components

Valves

**Priority**  High

**Opportunity**  Potential to extend service life, and significantly reduce maintenance and adverse mission impacts of corrosion-prone metal components by using composite materials. Potential to eliminate hydroblast cleaning of CHT system valves

**Technical Issues**  Shock qualification and fire

**Previous Work**  Composite valves have passed shock test (NAVSEA drwg 803-6983491) and installed on 6 ships. The Capital Investment for Labor program plans on a major carrier CHT system installation.

**Return on Investment**  High

Composite Ball-Valve Family Developed by NSWCCD
Components

Vent Screens

Priority: High

Opportunity: Eliminate corrosion related maintenance and improve operability

Technical Issues: Fire

Previous Work: ERM-7 has fielded composite vent screens on 13 ships. NAVSEA drwg 803-6983500, Vent Screen, GRP Installation and Details will lead to MODAR screens in the supply system by the end of FY 03.

Return on Investment: High

Example of Vent Screen Fielded by ERM-7
Components

Ventilation Ducting

**Priority**  High

**Opportunity**  Eliminate corrosion related maintenance; improve ship air quality and improve ship availability

**Technical Issues**  Cost

**Previous Work**  NSWCCD and ManTech have fielded prototype systems

**Return on Investment**  High
# Components

## Weapon System Enclosures

<table>
<thead>
<tr>
<th>Priority</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity</td>
<td>Eliminate corrosion related maintenance and improve operability</td>
</tr>
</tbody>
</table>

| Technical Issues     | Certification |

| Previous Work | ASROC housings were unsuccessfully built with aluminum-honeycomb core composite |

| Return on Investment | High |

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Example of Severely Corroded ASROC Housing That Utilized Aluminum Honeycomb