NSRP | National Shipbuilding Research Program

Strategic Investment Plan

MISSION

- Manage and focus national shipbuilding and ship repair research and development funding on technologies that will reduce the cost of ships to the U.S. Navy and other national security customers by leveraging best commercial practices and improving the efficiency of the U.S. shipbuilding and ship repair Industry.
- Provide a collaborative framework to improve shipbuilding-related technical and business processes.

March 2013
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### 1. RECORD OF CHANGES

NOTE: Previous changes to the Strategic Investment Plan are identified in the NSRP Organization and Operations Manual

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Sections</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change 5</td>
<td>November 30, 2010</td>
<td>All</td>
<td>- The original plan was divided into two documents:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Concise and focused Strategic Investment Plan</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>- Program Organization and Operations Manual</td>
</tr>
<tr>
<td>Change 6</td>
<td>March 14, 2013</td>
<td>2, 3, 6, 6.1, 7, 7.1-7.4</td>
<td>- Inclusion of new program sponsors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Inclusion of new Ship Warfare Systems Integration Panel</td>
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<tr>
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<td></td>
<td>- Updated R&amp;D interest areas</td>
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<td></td>
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<td>- Administrative updates, including</td>
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<td></td>
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<td>- Expanded Executive Summary</td>
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<td></td>
<td></td>
<td></td>
<td>- Updated graphics</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>- Updates to date references</td>
</tr>
</tbody>
</table>
2. FOREWORD

The National Shipbuilding Research Program Advanced Shipbuilding Enterprise (NSRP ASE) is a collaboration of U.S. shipyards working together to reduce the cost of building, operating and repairing Navy ships. The shipbuilding industry will achieve this by improving productivity and quality through advanced technology and processes. NSRP ASE leverages public/private cooperation to manage cost-shared R&D based on a consensus Strategic Investment Plan.

At its core, the program is built upon the following elements, all of which are critical to the continued success of the NSRP ASE.

- **Breakthrough technologies and processes** -- the catalyst for innovation and cost reduction
- **Collaboration** – creating a neutral climate for R&D teams to share ideas with their peers and support emerging technologies
- **Implementation Solutions** -- creating a sound plan that allows technologies to be easily transferred and implemented across the industry
- **Human and capital investment** -- the more capital and human investment that is allocated for R&D at the outset, proportionally greater are the long-term results.

The Strategic Investment Plan serves as the foundation for the National Shipbuilding Research Program and provides the direction for moving forward by all stakeholders involved.

The plan aims to meet the nation’s sea power needs at the lowest attainable ownership cost while maintaining a cost effective, responsive industrial base. To achieve this, the plan targets industry-wide technology and process improvements that have the highest potential to achieve gains in Navy ship affordability.

These focus areas have been developed by industry and Navy leaders from the input of seasoned industry experts and the results of numerous benchmarking studies. This document should be used to guide collaborative research and development among all segments of the U.S. ship construction and repair industry, including educational research and government institutions. The collaboration’s organizational structure promotes teaming and collaboration within and across all sectors and calls for investment by both government and industry over several years.
1. ENDORSEMENTS

The U.S. shipbuilding industry is committed to improving productivity and quality to reduce the total ownership costs of the nation’s defense. All stakeholders recognize that continuous improvement is the key to maintaining the industrial capacity and the shipbuilding skills necessary in support of the United States’ security. The collaborative framework of the National Shipbuilding Research Program will allow the industry to achieve this commitment. We are encouraged by and applaud Navy leadership and active engagement with the National Shipbuilding Research Program.

The National Shipbuilding Research Program is an important strategic component for the U.S. shipbuilding and repair industry to remain effective as suppliers to the U.S. Navy and other national security customers. In 1998, the CEOs of NSRP member companies stated, “It is the consensus of the industry representatives endorsing this Plan that two vital ingredients are needed to make this happen. First, a cooperative team effort on the part of the government and industry, and second, a strong commitment to finance the development and implementation of needed improvements in processes, systems and technologies.” That statement is still true today, and the commitment is evidenced by the participation, matching of funds, assignment of top personnel and collaboration among competitors.

We support and endorse the goals of NSRP ASE and the Strategic Investment Plan:

AUSTAL USA
By: Craig Periciavalle
Title: President
Date: 20 March 2013

BAE SYSTEMS SOUTHEAST SHIPYARDS
By: Richard McCreary
Title: VP & GM
Date: 3/20/13

GENERAL DYNAMICS - BATH IRON WORKS
By: John McCarthy
Title: Vice President, Planning, E.I.
Date: 3/29/13

BOLLINGER SHIPYARDS
By: Dennis Fanguy
Title: VP of AMS
Date: 20 - MAR - 2013
3. ENDORSEMENTS (CONTINUED)

GENERAL DYNAMICS - ELECTRIC BOAT
By: ______________________________
Title: VP Engineering
Date: 3/9/13

MARINETTE MARINE CORPORATION
By: ______________________________
Title: Director, Quality & Facilities
Date: 19 March '13

GENERAL DYNAMICS – NASSCO
By: ______________________________
Title: Manager, Industrial Eng.
Date: 3/21/13

HII - INGALLS SHIPBUILDING (PASCAGOULA)
By: ______________________________
Title: VP, Engineering & Design
Date: 3/20/2013

HII-INGALLS SHIPBUILDING (AVONDALE)
By: ______________________________
Title: VP, Quality and Engineering
Date: 3-19-13

HII - NEWPORT NEWS SHIPBUILDING
By: ______________________________
Title: VP, Engineering & Design
Date: 3-20-13

VT HALTER MARINE
By: ______________________________
Title: Chief Operating Officer
Date: 19- MARCH - 2013

VIGOR SHIPYARDS
By: ______________________________
Title: CCO
Date: 3/17/13.
4. **EXECUTIVE SUMMARY**

4.1 **PROGRAM ORGANIZATION**

The National Shipbuilding Research Program (NSRP) is a collaboration of U.S. shipyards that focuses on common issues with a goal of reducing the cost of acquiring, operating and maintaining Navy ships.

The program organization is outlined below:

![Figure 1 – NSRP Structure](image-url)

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**Figure 1 – NSRP Structure**
4.2 LEADERSHIP, MANAGEMENT AND EXTENDED TEAM

Executive Control Board: NSRP is governed by an Executive Control Board (ECB) that consists of a senior management representative from each of the member shipyards.

Executive Director: The ECB has selected SCRA Applied R&D (formerly ATI) as Program Administrator, who, acting with guidance from the ECB, shall be responsible for the overall management of the Collaboration, including technical, programmatic, reporting, financial and administrative matters. The Program Administrator employs the Program’s Executive Director, who will provide a single point of contact to the Collaboration, the Government and the respective designees.

Major Initiative Team Leaders and Assistants: The technical leadership of the NSRP is provided by the Major Initiative Team Leaders (MITL) and Assistant MITLs. The MITLs and Asst MITLs are volunteers selected from member shipyards by the ECB. Each MITL/Asst MITL team oversees one of the four major initiatives, providing input and recommendations on key elements of the program, such as the Strategic Investment Plan, project solicitations, and project execution. The MITLs/Asst MITLs are also the primary pool from which project technical representatives are selected.

Panel Chairs: The eleven panels are the working groups of the Program. Each panel elects a chair and vice-chair who lead and coordinate the panel activities, which include open industry meetings and execution of smaller-scale projects. As with the Major Initiative Team Leaders, the Panel Chairs also provide input and recommendations on key elements of the Program. However, the core focus of the Panels is open interaction with the industry at large, as well as with government representatives and members of academia engaged in their respective functional areas. This interaction is accomplished primarily through three to four open meetings per panel per year.
4.3 SPONSORS

As a joint industry/government program, the U.S. Navy is actively engaged with NSRP. Naval Sea Systems Command, with the Program Executive Offices, and the U.S. Coast Guard are key stakeholders.

- **Naval Sea Systems Command (NAVSEA):**
- **Program Executive Offices**
  - Carriers
  - Integrated Warfare Systems (IWS)
  - Littoral Combat Ships (LCS)
  - Ships
  - Subs
- **Coast Guard**

4.4 CORE PROGRAM ACTIVITIES

**Projects:** The greatest portion of industry and government funding for this program is invested in R&D projects. Projects selected and executed fall into two categories: Panel Projects and Research Announcement (RA) projects. Panel projects are lower cost and shorter duration ($150K, 12 months or less). RA projects can run into the millions of dollars, last up to three years, and involve much more stringent cost share requirements for project participants.

**Technology Transfer and Industry Networking:** One of the goals of NSRP is the sharing of project results to the maximum extent practicable to the U.S. shipbuilding industry, both throughout the project lifecycle as well as after project completion. This is achieved through Panel meetings, which serve a crucial role within the Program by providing a neutral, public forum for industry-wide networking, technology transfer and discussion of current Navy and industry areas of interest. Panels typically meet three times a year across the U.S. held throughout the country. Other opportunities for transferring the technologies developed under NSRP are industry conference, project demonstrations and training.

**Ad Hoc Groups:** Periodically, at the request of Navy or industry, ad hoc groups are established to focus efforts on specific target areas in the shipbuilding and ship repair industry. These ad hoc groups are quickly instituted to include key stakeholders of the focus area, then they carry out their task and are disbanded when required actions are complete.
The Strategic Investment Plan captures the fundamental approach to meeting the above objectives of the Program to support the U.S. shipbuilding industry in its efforts to improve cost, schedule, and quality.

5. STRATEGIC INVESTMENT PLAN 2010 METHODOLOGY

The Strategic Investment Plan has undergone several revisions throughout the life of the current Program to address and incorporate changes within the industry.

Previous versions of the Plan were designed to be a comprehensive document that combined the Program’s strategic outlook, business plan, investment portfolio, and R&D roadmap.

After extensive discussions with key industry and Navy stakeholders, consensus was reached that, although all of these components are essential in providing Program guidance and direction, including them in one document created a Plan that was too cumbersome, making it difficult to use, update and disseminate.

As a result, the Strategic Investment Plan was segregated into two documents to allow flexibility and adaptability to future Navy/Industry focus areas:

- **Strategic Investment Plan**: high-level synopsis, including the mission of the Program, overarching Navy and industry areas of interest, specific focus areas and recommendations on possible paths for implementation

- **Organization and Operations Manual**: in-depth description of the history of the Program, its organization, structure and the project selection process.

6. CURRENT PRIORITIES

Strategic Investment Plan 2013 is focused on the following priorities established by the Navy and concurred in by the program’s industry board:

- Improved quality in ship construction and/or repair
- Reduction in Total Ownership Cost of ships
- Improved energy efficiency and/or environmental impact in shipyards and/or ships
- Reduced cost associated with systems integration during ship construction, modernization and maintenance
6.1 FOCUS AREAS

Based on a series of interviews with Navy and industry leadership, the following focus areas, coupled with potential implementation avenues, were developed to address these current priorities. These topics provide a roadmap for the Program and the industry teams proposing R&D solutions through the Program’s project solicitation processes:

<table>
<thead>
<tr>
<th>Major Focus Area</th>
<th>Areas of Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting Modular Construction</td>
<td>• Outfitting Modules / Standard Interim Products</td>
</tr>
<tr>
<td></td>
<td>• Cable Splicing / Connectorization / Cable Routing</td>
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<tr>
<td></td>
<td>• Testing of Modules</td>
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<td></td>
<td>• Equipment Protection</td>
</tr>
<tr>
<td></td>
<td>• Controlling Environment for Efficient Outfitting</td>
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<tr>
<td></td>
<td>• Standardization of Interfaces / Open Systems Architecture</td>
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<tr>
<td></td>
<td>• Network Consolidation: Planning &amp; Pre-Subscription (reducing total number of networks and cable runs on common data switches)</td>
</tr>
<tr>
<td></td>
<td>• Standardized bolt down mounts for data processing racks</td>
</tr>
<tr>
<td></td>
<td>• Standardized bolt on overhead and wall mounts for monitors</td>
</tr>
<tr>
<td></td>
<td>• Voice Over IP Telecom system integration with Network Consolidation</td>
</tr>
<tr>
<td></td>
<td>• Flexible Deck bolt down panels for data-center like flexibility</td>
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<tr>
<td></td>
<td>• Reconfigurable lighting, cooling, power, workspace structures to allow fast tear-out and update</td>
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<tr>
<td>Reducing Re-work</td>
<td>• Process Control via statistical analysis of accuracy</td>
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<td></td>
<td>• First Time Quality initiatives</td>
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<tr>
<td>Improving Production Engineering</td>
<td>• Span Time Reduction</td>
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<td></td>
<td>• Optimized Sequencing of Work</td>
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<tr>
<td></td>
<td>• Definition of Interim Products</td>
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<td></td>
<td>• Cellular Manufacturing / Process Lanes</td>
</tr>
<tr>
<td></td>
<td>• Development and Implementation of Best Practices related to Process Technologies, Build Strategy and Design for Affordability</td>
</tr>
<tr>
<td>Improving Specifications and Standards</td>
<td>• Eliminate unnecessary and/or redundant requirements</td>
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<tr>
<td>Improving Manufacturing Processes</td>
<td>• Welding Process Improvements</td>
</tr>
<tr>
<td></td>
<td>• Advanced Metalworking Technologies</td>
</tr>
<tr>
<td></td>
<td>• Surface Preparation and Coatings Process Improvements</td>
</tr>
<tr>
<td></td>
<td>• Electrical Process Improvements</td>
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<tr>
<td></td>
<td>• Outfit Installation Process Improvements</td>
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<tr>
<td>Improving Production Planning</td>
<td>• Optimized Work Packages</td>
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<tr>
<td></td>
<td>• Work Package Development Tools</td>
</tr>
<tr>
<td></td>
<td>• Capacity Planning Analysis</td>
</tr>
<tr>
<td></td>
<td>• Optimized Sequencing of Work</td>
</tr>
</tbody>
</table>

Table 1 - Major Focus Areas
### 6.1 FOCUS AREAS (CONTINUED)

<table>
<thead>
<tr>
<th>Major Focus Areas</th>
<th>Areas of Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improving Integration of Shipboard Warfare Systems</strong></td>
<td>• Reduction of warfare system integration costs across new construction and modernization (in-service) platforms&lt;br&gt;• Analysis of past cost drivers and best practices between ship classes and shipyard activities for warfare system installation, ship integration and test...identification of investment areas to improve affordability&lt;br&gt;• Resolution of alteration maturity, scheduling, installation, test, evaluation and certification issues associated with warfare system installation efforts during in-service fleet availabilities&lt;br&gt;• Accelerated use of automated manufacturing and installation techniques for warfare system installation and testing, in the shipyard industrial environment&lt;br&gt;• Standardization of combat system interfaces with shipboard hull, mechanical and electrical systems</td>
</tr>
<tr>
<td><strong>Improving Data Exchange</strong></td>
<td>• Integrating internal systems (ERP, estimating, planning, scheduling, procurement, etc.)&lt;br&gt;• External Exchange (Navy-Industry)</td>
</tr>
<tr>
<td><strong>Improving Safety &amp; Health / Reducing Environmental Impacts</strong></td>
<td>• Reducing Injuries&lt;br&gt;• Increasing tool ergonomic features&lt;br&gt;• Reducing shipbuilding and repair energy consumption&lt;br&gt;• Ensuring environmental compliance in the shipbuilding/repair industry</td>
</tr>
<tr>
<td><strong>Improving Education and Training</strong></td>
<td>• Improved Processes&lt;br&gt;• Standardization across Industry</td>
</tr>
<tr>
<td><strong>Total Ownership Cost</strong></td>
<td>• Increased Use of Composites and other Advanced Materials that Reduce Ship Operating and/or Maintenance Costs&lt;br&gt;• Design for Maintenance and Repair&lt;br&gt;• Parts Commonality and re-use across platforms&lt;br&gt;• Any other area in which ship total ownership costs can be reduced</td>
</tr>
</tbody>
</table>

Table 2- Major Focus Areas (cont.)
7. MAJOR INITIATIVES

A group of leaders and seasoned professionals reviewed the focus areas listed in Table 1, the existing benchmarking data, emerging trends and the projects completed in the past. This resulted in the identification of four overarching, integrally connected major initiatives that tie the strategic vision to proposed industry research through collaborative R&D and other mechanisms. These areas, discussed in further detail in Section 5, are derived from both the basic organizational structure of a shipyard, the NSRP Program and the incorporation of the focus areas. The term “Major Initiative,” as used in this document constitutes operationally aligned groups of functional topics. Each Major Initiative group has identified technology development and improvement areas (sub-initiatives) that are mapped to the focus areas in Section 6 of this document.
7.1 SHIP DESIGN AND MATERIAL TECHNOLOGIES

7.1.1 DEFINITION

Implement cost reduction initiatives across the complete spectrum of design processes (conceptual to detailed) and the use of advanced materials to support the rapid and efficient development, construction, sustainment, and disposal of the next generation of vessels.

7.1.2 SUB-INITIATIVES

Previous NSRP benchmarking studies have identified that U.S. shipbuilders lag behind top foreign shipbuilders in the areas of Ship Design and Material Technologies, particularly in the higher number of man-hours and cycle time required by U.S. shipbuilders. There is also evidence that the lack of design rules and design and material standards results in U.S. ship designs having significantly greater material and labor content, and therefore higher costs. Despite these issues, there are opportunities that will demonstrate improvement in these areas.
To address these issues, this major initiative centers on nine technology development areas (sub-initiatives). These sub-initiatives align with the specific NSRP focus areas identified in section 6 and support required future projects that lead to implemented cost savings for the shipbuilding enterprise and our customers.

- Design for Total Ownership Cost
- Design for Producibility
- Work sequencing
- Design for modular construction
- Modeling and Simulation
- Improved standards and specifications
- Advanced product design
- Commonality and standardization
- Advanced materials
7.2  SHIP PRODUCTION TECHNOLOGIES

7.2.1  DEFINITION

The Ship Production Technologies major initiative addresses the fabrication and assembly phases of ship production including the planning and organizational structure (facilities) that support those phases.

7.2.2  SUB INITIATIVES

The goal is to improve the efficiency (both in man hours and schedule) and quality of constructing a ship, including the advances in technologies and materials used during the production phase, the optimization of the build strategies and improvements to facilities. Ship Production Technologies also collaborates with the Ship Design and Material Technologies major initiative to implement changes needed to fully realize the benefits of the new technologies, materials and techniques developed by both groups. Sub-initiatives to accomplish these goals include:

- Steel and aluminum fabrication (steel, composites, and all outfit types)
- Sub-assembly
- Assembly and erection
- Outfit fabrication
- Installation and test
• Surface preparation and coatings
• Process control (accuracy control and process management)
• Industrial engineering
• Production control (in-yard material planning and coordination)
• Services (e.g., transportation and rigging, tool rooms, temporary ventilation/lighting, etc.)
• Electrical work (e.g., cable routing, circuit management, composite enclosures, and electrical connectors)
• Outfitting Processes
• Structural Processes
• Welding / Joining / Non-Destructive Testing
• Production Planning
• Production Engineering
• Design for Production
7.3 BUSINESS PROCESSES AND INFORMATION TECHNOLOGIES

7.3.1 DEFINITION

Addresses the collection, use, storage and exchange of data related to all aspects of the shipbuilding enterprise, including all business processes required to acquire and transform raw materials into a quality, optimal-cost product.

7.3.2 SUB-INITIATIVES

- Contracting
- Data exchange / Interoperability / Intra-operability
- Standards-based open architecture
- Shipyard integration & collaboration
- Shipyard-NAVSEA collaboration
- Data Delivery
- Electronic Work Packaging
7.4 INFRASTRUCTURE AND SUPPORT

7.4.1 DEFINITION

Addresses overhead functions that support shipbuilding and repair processes to achieve safe, high-quality, environmentally responsible and productive work.

7.4.2 SUB-INITIATIVES

- Improve/maintain compliance posture for environmental, safety and health
- Reduce workers compensation costs
- Address environmental, safety, health, risk avoidance issues
- Promote product and service quality and a culture of continuous improvement
- Reduce overhead costs through mature processes with continuous impact metrics
- Sustain and improve competent and motivated workforce of managers, supervisors, production and administrative staffs
- Achieve R&D project knowledge transfer and change implementation that adds delivery, quality, and cost value
8. TECHNOLOGY TRANSFER AND IMPLEMENTATION

The table below was developed by the four major initiative teams and maps the focus areas and possible areas of implementation for each initiative:

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Potential Implementation Avenues by Initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ship Design &amp; Material Technologies</td>
</tr>
</tbody>
</table>
| Promotion of Modular Construction | • Design for Producibility  
  o Work Sequencing  
  o Design for modular construction  
  • Improved standards and specifications  
  • Advanced product design  
  • Commonality and standardization | • Handle larger ship blocks  
  • Greater use of connectors  
  • Increase unit outfitting  
  • Increased Accuracy Control  
  • Improved Equipment protection  
  • Improved work environments | • Data exchange / Interoperability / Intra-operability  
  • Electronic Work Packaging  
  • Enterprise Resource Planning systems  
  • Parts Commonality  
  • Supply Chain Management | • N/A |
| Reduction of Rework               | • Design for Producibility  
  o Work sequencing  
  o Design for modular construction  
  • Improved standards and specification  
  • Commonality and standardization  
  • Advanced materials | • Improve Accuracy Control  
  • Handling change more efficiently  
  • Improved process control | • Data exchange / Interoperability / Intra-operability  
  • Electronic Work Packaging  
  • Enterprise Resource Planning systems  
  • Estimating  
  • Parts Commonality  
  • Supply Chain Management | • Through first-time quality and training |
### Improving Production Engineering
- Design for Producibility
  - Work sequencing
  - Design for modular construction
- Improved standards and specifications
- Commonality and standardization
- Advanced materials

### Improving Specifications and Standards
- Design for Producibility
  - Work Sequencing
  - Design for modular construction
- Improved standards and specifications
- Commonality and standardization
- Advanced materials

### Improving Manufacturing Processes
- Design for Producibility
  - Work Sequencing
  - Design for modular construction
- Improved standards and specifications
- Commonality and standardization
- Advanced materials

### Improving Production Planning
- Design for Producibility
  - Work sequencing
  - Design for modular construction
- Modeling and Simulation

### Strategic Investment Plan
- Definition of Interim Product Standards
- Process Lanes
- Cellular Manufacturing

### Data exchange / Interoperability / Intra-operability
- Electronic Work Packaging
- Enterprise Resource Planning systems
- Estimating
- Parts Commonality
- Supply Chain Management

### Human Systems Integration
- Environmentally compliant

### Skills standards per job

### N/A
- Human Systems Integration
- Management and Supervision

### N/A
- Parts Commonality
- Supply Chain mgt
| **Interoperability and Data Exchange** | • Design for Total Ownership Cost  
• Modeling and Simulation  
• Improved Standards and Specifications  
• Commonality and standardization | • Improved Internal Data Flow (Design to ERP) | • Standards-based open architecture  
• Shipyard integration & collaboration  
• Shipyard-NAVSEA collaboration  
• Data Delivery | • N/A |
|---|---|---|---|
| **Improving Safety & Health / Reducing Environmental Impacts** | • Design for Total Ownership Cost  
• Design for Producibility  
• Design for modular construction  
• Modeling and Simulation  
• Improved standards and specifications  
• Advanced product design  
• Advanced materials | • Ergonomic Awareness and Training  
• Improved Material Handling | • Supply Chain Management | • Through material selection, design and other human factors  
• Continue to provide industry interface w/ OSHA and EPA |
| **Education and Training** | | | | Integrated across all initiatives, panels and projects |
| **Reducing Total Ownership Cost** | | | | Integrated across all initiatives, panels and projects |
| **Integration of all shipbuilding tools** | | | | Integrated across all initiatives, panels and projects |