PERCEPTION®

Earned Value Management
For
Shipbuilding
Earned Value Management is a project management technique designed to:

✓ Ensure work is properly & adequately planned, budgeted & scheduled
✓ Isolate problems for corrective action
✓ Measure cost & schedule performance of work accomplished in accordance with ANSI 748
✓ Measure true cost condition
✓ Forecast completion date & final cost
PERCEPTION
Ties Together All Areas of Earned Value Management

- Cost Estimating
- Planning, Budgeting & Scheduling
- Labor Work Order & Manpower Management
- Purchasing & Inventory Control
- Change Order Management
- Earned Value Performance Measurement Reporting
- Cost & Schedule Forecasting
- Cost Analysis For Future Work Estimating
Cost Estimating

Planning, Budgeting & Scheduling

Labor & Manpower Cost Management

Purchasing & Material Cost Management

Earned Value Management Reporting

Cost/Schedule Analysis
Cost Estimating

• *PERCEPTION* was developed to permit cost estimating that can reflect modern ship design and production methods. Using product- and process-based information, cost estimates can be generated quickly and accurately at any level of detail:
  
  • **Parametric cost estimates** based upon modifiable ship design and mission characteristics
  • **Shipbuilding standard interim products**
  • **Detail cost estimates** based upon engineered bills of material and equipment specifications.
Cost Tracking & Forecasting

- *PERCEPTION* tracks cost and schedule performance.
- Forecasts are made by the system based upon earned value methods.
- Trends are developed by the system to provide management with improved visibility of changes to contract performance.
Tracking & Managing Costs and Schedules

- By SWBS (Ship System)
- By PWBS (Product & Process)
- By COA (Shipyard Organization Structure)
- By CLIN (Contract Line Item)
Option to select WBS for Project Roll-Up

A Work Order May Relate to Multiple WBS’s

A Work Order referencing more than one element of any WBS may be setup as a Distributed Work Order.
Planning Activity

Contract

Project

PWBS
- Ship Zones
- Outfit Zones
- Grand Blocks
- Units
- Blocks
- Assemblies
- Subassemblies
- Mfg Parts

SWBS
- SWBS Groups
- SWBS Accounts

COA
- Departments
- Stages
- Work Centers

CLINs
- Contract Line Items

• Stock issues
• Direct Purchase Materials
• Owner Furnished Materials
• Manufactured Parts

Production Material
Tracking & Managing Costs and Schedules:

- Original Estimated Costs & Schedules
- Baseline Costs & Schedules
- Current Plan Costs & Schedules
Tracking & Managing Costs and Schedules:

- Labor Hours
- Labor Dollars
- Overhead Dollars
- Material Dollars
- Purchased Services
- Total Dollars
- Weeks Ahead/Behind Schedule
- Forecast Finish Date
Multi-Ship Program Management
Cost & Schedule Consolidation

Contract

Project

PWBS
- Ship Zones
- Outfit Zones/Grand Blocks
- Units/Blocks
- Assemblies
- Subassemblies
- Mfg Parts

SWBS
- SWBS Groups
- SWBS Accounts

COA
- Departments
- Stages
- Work Centers

CLINs
- Contract Line Items

PWBS
- Planning Activity
- Work Order
- Time Charge

SWBS
- SWBS Groups
- SWBS Accounts

COA
- Departments
- Stages
- Work Centers

CLINs
- Contract Line Items

Planning Activity

Work Order

Time Charge
Managing Costs & Schedule by Interim

Products and Manufacturing Process

Product Structure
- Ship
- Zone
- Sub-Zone/Grand Block
- Block
- Assembly
- Sub-Assembly
- Part
- Component/Commodity

Stage
- Design
- Planning
- Procurement
- Mat'l Mgt.
- Fabrication
- Sub-Assembly
- Assembly
- On Unit
- On Board
- On Block
- Erection
- Grand Block
- Test
- Delivery
- Launch
- Post Delivery

Work Type
- Electrical
- Hull Outfit
- HVAC
- Joiner
- Machinery
- Paint
- Pipe
- Structure
- Operations Control
- Production Service
- Quality Assurance
- Testing/Trialing
- Administration
Multi-Shipyard Program Management
Cost & Schedule Consolidation

• **PERCEPTION** maps different shipyard WBS configurations to a selected WBS standard maintained on a central database.

• Large U.S. Shipyards already mapped include:
  – Avondale Shipyards
  – Ingalls Shipbuilding
  – Bath Iron Works
  – NASSCO
  – Newport News Shipbuilding
PERCEPTION Accommodates Different Shipyards & Work Breakdown Structures

- Avondale *
- Ingalls Shipbuilding *
- NASSCO *
- BIW *
- Newport News Shipbuilding *
- US Navy (SWBS & ESWBS)

- USCG (Modified SWBS) **
- MARAD (Weight System)
- Commercial Yards, US, Canada & Europe
- Ship Repair & Conversions
- Shipyard Plant Overhead Accounts

* Work performed under the U.S. Navy’s Product Oriented Design & Construction ("PODAC") Project

** Work performed under the USCG’s Deepwater Program.
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<thead>
<tr>
<th>Term</th>
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<td>BCWP</td>
<td>Budgeted Cost of Work Performed</td>
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<td>ACWP</td>
<td>Actual Cost of Work Performed</td>
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<td>Calendar Schedule Variance</td>
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<td>Calendar Variance Trend for 100% Progress</td>
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Compiling Cost & Schedule Performance Information

Measuring Schedule Performance

- ACWP (Actual Cost of Work Performed to date)
- BAC (Total Budget)
- BCWP (Budget Earned Value)
- BCWS (Planned Expenditure to date)
- Budget Variance (Over-Run)

Time

Labor Hours

Today

Weeks Ahead
Tracking & Managing Costs and Schedules

- Rework
- Change Orders
- Labor Hours per 1% Progress
- Production Process Rates by Stage of Construction
- Weeks Ahead/Behind Planned Schedules
- Trend Weeks Ahead/Behind for 100% Progress
- Forecast & Trend Over-Run/Under-Run
# Summary Progress Reports by Any WBS Level

## Chesapeake Marine

**SWBS Group Progress Report (PROG02)**

Contract: TSHIP CONTRACT - T-SHIP Series Contract - Produc

### Project: 2002 to 2002

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| Group Totals for Project - 2002 | 65.37 | 67.94 | 2.57 | 2.55 | 663,105 | 689,165 | 660,525 | 26,060 | 1,014,393 | 984,555 | 324,030 | 29,838 |

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[SPAR Associates, Inc.]
## Summary Progress Reports by Production Work Centers

### Work-PAC Center Progress Report (PROG14)

#### Labor Hours

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<th>% Diff</th>
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<th>BCWP</th>
<th>Actual Schedule</th>
<th>Schedule Ahead</th>
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**Report Totals**

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<th>Weeks Ahead</th>
<th>% Diff</th>
<th>BCWS</th>
<th>BCWP</th>
<th>Actual Schedule</th>
<th>Schedule Ahead</th>
<th>Budget</th>
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## Summary Progress Reports by Production Modules & Ship Zones

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<td>11,752</td>
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<td>Shelter Rales</td>
<td>94.92</td>
<td>91.04</td>
<td>3.88</td>
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<td>2,237</td>
<td>2,082</td>
<td>-95</td>
<td>2,237</td>
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<td>J</td>
<td>Hoppers</td>
<td>76.70</td>
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<td>22.30</td>
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<td>3,299</td>
<td>14,644</td>
<td>17,792</td>
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</table>

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**Notes:**
- PWBS Zone Progress Report (PROG04)
- Project: T-ship Contract - T-ship Series Contract - Production Demonstration
- Date: 08/15/2007 14:43:54
- Page 1 of 2

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**Company:** Chesapeake Marine

---

**Contact:** Spar Associates, Inc.
Summary Progress Reports by Shipyard Trade/Craft
Tracking Performance Costs

By Percent Progress

Re-Planning
Tracking Performance Costs

By Earned Value
Tracking EAC Confidence
Confidence in EAC is a composite of 3 factors:

- $F(\text{closed}) = \text{Degree of total work completed}$
- $F(\text{open}) = \text{Degree of work orders still open}$
- $F(\text{performance}) = \text{Consistency of budget performance of completed work orders (via normal distribution)}$. 
Tracking Progress
Tracking & Forecasting Schedule Variance

Re-Planning
Tracking & Forecasting Schedule Variance
Tracking & Forecasting Over-Budget/Savings Variance

Forecast Labor Hour Variance

- Current EAC Variance
- Trend EAC Variance
- Trend @ 100%
- Current EAC to Trend @ 100%

Percent "Real" Progress (ACWP/Current EAC)
Tracking & Forecasting
Earned Value Performance

Tracking Weekly Average Performance
(By Date)

Average Labor Hours/Week

Av. Earned Value Cumulative
Av. Earned Value To Complete
Forecast Av. Cost To Complete
Actual Av. Cost Cumulative

05/09/03 06/28/03 08/17/03 10/06/03 11/25/03 01/14/04 03/04/04 04/23/04 06/12/04 08/01/04 09/20/04
Tracking Cost per 1% Progress

Steady track of cost per 1% progress indicates consistent performance of work.
Tracking Performance Indexes

- **CPI**: Cost Performance Index \((BCWP/ACWP)\)
- **SPI**: Schedule Performance Index \((BCWP/BCWS)\)
- **FCPI**: Forecast Cost Performance Index \((BAC/EAC)\)
- **CSPI**: Current Schedule Performance Index \((ACWP/BCWS)\)
- **CCPI**: Combined Cost Performance Index 
  \[
  0.5 \times CPI \times [1 + SPI + SPI \times \frac{(BCWS-BCWP)}{BAC}]
  \]
- **TCPI**: To-Complete Performance Index 
  \[
  \frac{(BAC-BCWP)}{(EAC-ACWP)}
  \]
Total Contract Performance Summary

Performance Variances

-25%  -20%  -10%  0%  10%  20%  25%
Cost Schedule Cost x Schedule
Tracking Performance Indexes

Re-Planning
Tracking & Managing Dollar Costs and Schedules:

- Direct Labor Costs
- Overheads Costs
- Material & Subcontract Costs
- Management Reserves
Tracking & Managing Dollar Costs and Schedules

• Direct Labor Costs
• Overheads Costs
• Material & Subcontract Costs
• Management Reserves
Total Cash Budget Vs EAC

Total Cash Budget Versus EAC
(Labor, Material & Overhead)

- Total BAC + Reserves
- Total EAC
- Total Budget
- Total ACWP
- Total BCWP
- Extended Total BAC
- Extended EAC
- Extended Total ACWP-Cubic
- Total BCWS
Tracking Actual Costs
Tracking Earned Value Costs
Overall Performance Index
(Labor, Material & Overhead Dollars)

- Cost Perf. Index - CPI: 89.9%
- Schedule Perf. Index - SPI: 82.9%
- Combined CPI x SPI - SCI: 74.5%
Tracking & Managing **Material** Costs and Schedules

- Total Committed Costs:
  - Purchases + Stock Used + Stock Reserved
- Total Purchases
- Purchases Received
- Purchases Used
- Purchases Paid
- Stock Used
- Stock Reserved
Tracking Material Costs
On-Line Reporting of Cost/Schedule Status

<table>
<thead>
<tr>
<th>Details</th>
<th>Material Status</th>
<th>Totals</th>
<th>Indexes</th>
<th>Variances</th>
<th>Notes</th>
<th>Baseline</th>
<th>Options</th>
<th>Milestones</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Contract</td>
<td>TSHIP CONTRACT</td>
<td></td>
<td></td>
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<td>Project</td>
<td>2002</td>
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<tr>
<td>Budgeted Cost of Work Scheduled</td>
<td>693,209</td>
<td>689,077</td>
<td>660,525</td>
<td>1,014,393</td>
<td>984,555</td>
<td>100,000.00</td>
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<tr>
<td>Rate/Hours</td>
<td>17.30</td>
<td>16.27</td>
<td>16.16</td>
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<tr>
<td>Labor Cost</td>
<td>11,989,786</td>
<td>11,918,328</td>
<td>10,748,477</td>
<td>17,545,014</td>
<td>15,907,329</td>
<td>1,730,000</td>
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<td>Budget + Reserves</td>
<td>1,114,393</td>
<td>984,555</td>
<td>8,503</td>
<td>121,335</td>
<td>324,030</td>
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<tr>
<td>Less EAC</td>
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<td>Less Rework</td>
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<td>Labor Margin</td>
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<td>Estimated at Completion</td>
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<td>Reserves</td>
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<tr>
<td>Effective Date</td>
<td>01/14/1993</td>
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<table>
<thead>
<tr>
<th>Start</th>
<th>Finish</th>
<th>Total Progress</th>
<th>(Closed)</th>
<th>In-Process</th>
<th>Number of Work Packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/12/1991</td>
<td>09/17/1993</td>
<td>67.93 %</td>
<td>58.26 %</td>
<td>9.67 %</td>
<td>2529</td>
</tr>
<tr>
<td>Actual</td>
<td></td>
<td>05/13/1991</td>
<td>68.34 %</td>
<td>(Behind)</td>
<td>-0.41 %</td>
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<tr>
<td></td>
<td>09/09/0000</td>
<td>Total Planned</td>
<td>(Behind)</td>
<td>-0.21 weeks</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Total Manual</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>58.20 %</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Budgeted Hours: 1,014,393.00

NOTE: Rework included in ACWP or EAC

SPARK ASSOCIATES, INC.
# Material Cost/Schedule Status

## Project Details Information for the Production Environment

<table>
<thead>
<tr>
<th>Details</th>
<th>Material Status</th>
<th>Overall Status</th>
<th>Indexes</th>
<th>Variances</th>
<th>Notes</th>
<th>Baseline</th>
<th>Options</th>
<th>Milestones</th>
<th>Characteristics</th>
</tr>
</thead>
</table>

**Contract:** TSHIP CONTRACT

**Description:** Severn Bulk Carrier (work orders)

**Project:** 2002

**Effective Date:** 01/14/1993

<table>
<thead>
<tr>
<th>Mat'l Cost</th>
<th>Budgeted Cost of Work Scheduled</th>
<th>Budgeted Cost of Work Performed</th>
<th>Actual Cost of Work Performed</th>
<th>Budgeted Cost at Completion</th>
<th>Estimated at Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,044,883</td>
<td>19,863,117</td>
<td>18,697,496</td>
<td>29193294.00</td>
<td>29,193,294</td>
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</table>

**Mgmt Reserves:** 2,887,249

**Budget + Reserves:** 32,080,543

**Less Total Committed:** 28,840,055

**EAC Margin:** 2,887,249

## Total Committed Cost Status:

<table>
<thead>
<tr>
<th>Mat'l Purchased</th>
<th>Taxes And Duty</th>
<th>Freight</th>
<th>Stock Reserved</th>
<th>Stock Issued</th>
<th>Total RMA</th>
<th>Total Committed</th>
<th>Total Paid Invoices</th>
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<tbody>
<tr>
<td>25,982,032</td>
<td>+ 2,858,024</td>
<td>+ 274,833</td>
<td>+ 274,938</td>
<td>- 310,079</td>
<td>36,789</td>
<td>29,663,116</td>
<td>24,293,199</td>
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</table>

## Total Purchased Cost Status:

<table>
<thead>
<tr>
<th>Mat'l Cost</th>
<th>Delivered</th>
<th>Pending QA</th>
<th>Rejected QA</th>
<th>Accepted QA</th>
<th>RMA</th>
<th>Issued</th>
<th>Unused</th>
</tr>
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<tbody>
<tr>
<td>24,683,010</td>
<td></td>
<td>144,799</td>
<td>156,776</td>
<td>24,381,435</td>
<td>36,789</td>
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<td>6,295,593</td>
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</table>
### Combined Labor & Material Cost/Schedule Status

#### Project Details Information for the Production Environment

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<th>Material Status</th>
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<th>Indexes</th>
<th>Variances</th>
<th>Notes</th>
<th>Baseline</th>
<th>Options</th>
<th>Milestones</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract</td>
<td>TSHIP CONTRACT</td>
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<tr>
<td>Project</td>
<td>2002</td>
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- **Description**: Severn Bulk Carrier (work orders)
- **Effective Date**: 01/4/1993

<table>
<thead>
<tr>
<th>Man-Hours</th>
<th>Budgeted Cost of Work Scheduled</th>
<th>Budgeted Cost of Work Performed</th>
<th>Actual Cost of Work Performed</th>
<th>Estimated at Completion</th>
<th>Reserves</th>
<th>Rework</th>
</tr>
</thead>
<tbody>
<tr>
<td>629,864</td>
<td>698,984</td>
<td>692,695</td>
<td>660,706</td>
<td>984,817</td>
<td>88,522</td>
<td>8,503</td>
</tr>
<tr>
<td>18.00</td>
<td>17.35</td>
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<table>
<thead>
<tr>
<th>Labor Cost</th>
<th>Budgeted Cost of Work Scheduled</th>
<th>Budgeted Cost of Work Performed</th>
<th>Actual Cost of Work Performed</th>
<th>Estimated at Completion</th>
<th>Reserves</th>
<th>Rework</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,581,716</td>
<td>12,468,515</td>
<td>11,462,875</td>
<td>18,323,964</td>
<td>16,316,924</td>
<td>1,593,396</td>
<td>147,150</td>
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<tr>
<td>Overhead</td>
<td>10,065,372</td>
<td>9,974,811</td>
<td>9,170,300</td>
<td>13,053,539</td>
<td>127,4716,78</td>
<td>147,150</td>
</tr>
<tr>
<td>Mat'l Cost</td>
<td>20,044,883</td>
<td>19,863,117</td>
<td>18,897,496</td>
<td>29,193,294</td>
<td>2,887,249</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total Cost**: 42,691,971 + 42,304,842 = 39,330,671

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<th>Total Reserves</th>
<th>Estimated Remaining Hours</th>
</tr>
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<tbody>
<tr>
<td>5,755,362</td>
<td>324,111</td>
</tr>
</tbody>
</table>

**Total Budget + Reserves**: 67,931,791

Less **Total EAC**: 58,563,756

Less **Current Total Rework Cost**: 147,150

**Net Cost Margin**: 9,220,884

*NOTE: Rework included in AC/MP and EAC*
### Cost/Schedule Performance Indexes

#### Project Details Information for the Production Environment

<table>
<thead>
<tr>
<th>Details</th>
<th>Material Status</th>
<th>Overall Status</th>
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<th>Variances</th>
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<td>Contract</td>
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<tr>
<td>Project</td>
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#### Note: Rework Included

<table>
<thead>
<tr>
<th>Component</th>
<th>CPI Cost Performance Index</th>
<th>SPI Schedule Performance Index</th>
<th>CCPI Combined Cost Performance</th>
<th>TCPI To-Complete Performance Index</th>
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<tr>
<td>Man-Hours</td>
<td>1.05</td>
<td>0.99</td>
<td>1.05</td>
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<tr>
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<td>1.09</td>
<td>0.99</td>
<td>1.09</td>
<td>1.07</td>
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<td>Overhead</td>
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<td>1.00</td>
<td>0.66</td>
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<td>Mat'1 Cost</td>
<td>1.00</td>
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<tr>
<td>TotalCost</td>
<td>1.96</td>
<td>1.78</td>
<td>2.45</td>
<td>1.15</td>
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</table>

CPI measures how well expenditures are meeting planned budgets in accomplishing stated progress.

SPI measures how well expenditures are meeting planned schedules in accomplishing stated progress.

CCPI measures combined cost and schedule performance.

TCPI measures efficiency level required to complete the project at the latest estimate to complete. TCPI = 1.15 indicates 115% efficiency to complete as currently estimated.

An index equal to 1.00 indicates that performance is according to plan. An index less than 1.00 indicates a plan problem. An index greater than 1.00 indicates performance is better than planned.
Cost/Schedule Variance Analysis

### Project Details Information for the Production Environment

<table>
<thead>
<tr>
<th>Details</th>
<th>Material Status</th>
<th>Overall Status</th>
<th>Indexes</th>
<th>Variances</th>
<th>Notes</th>
<th>Baseline</th>
<th>Options</th>
<th>Milestones</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract</td>
<td>TSHIP CONTRACT</td>
<td>Description</td>
<td>Severn Bulk Carrier (work orders)</td>
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**Note: Rework included**

<table>
<thead>
<tr>
<th></th>
<th>Current Cost Variance (BCWP-ACWP)</th>
<th>Current Schedule Variance (BCWP-BCWS)</th>
<th>Current Forecast Final Cost Variance (BAC-EAC)</th>
<th>Trend Forecast Final Cost Variance</th>
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<tbody>
<tr>
<td>Man-Hours</td>
<td>31,940</td>
<td>-8,338</td>
<td>33,181</td>
<td>29,043</td>
</tr>
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<td>Labor Cost</td>
<td>1,004,750</td>
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<td>2,007,040</td>
<td>1,408,436</td>
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<td>803,800</td>
<td>-91,272</td>
<td>1,605,632</td>
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<td>Mat'l Cost</td>
<td>1,165,621</td>
<td>-181,766</td>
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<td>-3,555,153</td>
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<tr>
<td>Total Cost</td>
<td>2,974,171</td>
<td>11,533,881</td>
<td>3,612,673</td>
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**Effective Date:** 07/14/1993

<table>
<thead>
<tr>
<th></th>
<th>Planned Finish</th>
<th>Weeks Ahead</th>
<th>Trend</th>
<th>Projected Finish</th>
<th>Trend</th>
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<tr>
<td></td>
<td>09/17/1993</td>
<td>-0.33</td>
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<td>09/20/1993</td>
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**Trend Forecast Final Cost Variance:**

**Projected Finish:** 09/29/1993
## Cost/Schedule Baseline Plan Status

### Project Details Information for the Production Environment

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<td></td>
</tr>
</tbody>
</table>

**Budget Hours:**
- **Project Totals:** 1,017,998.00
- **Work Order Totals:** 1,018,212.00
- **Baseline Totals:** 0.00

**Actual Hours:**
- **Project Totals:** 660,706.00
- **Work Order Totals:** 660,706.00

**Budget Labor Cost:**
- **Project Totals:** 18,323,964.00
- **Work Order Totals:** 18,327,816.00

**Actual Labor Cost:**
- **Project Totals:** 11,462,875.00
- **Work Order Totals:** 11,462,875.00

**Planned Start:** 09/12/1991
**Baseline Start:** 00/00/0000
**Planned Finish:** 09/17/1993
**Baseline Finish:** 00/00/0000
**Actual Start:** 05/13/1993
**Actual Finish:** 00/00/0000

**Progress:** 68.04%

**Budget Mat'l Cost:** 29,193,294.00

**Number of Work Orders:** 2181
Tracking Manpower Requirements

- As Planned in Baseline
- As Currently Planned
- As Actually Expended To Date
- As Forecast to Complete

Manpower can be evaluated by WBS, by shipyard work center, for one project or across multiple projects.

The analysis can combine current back-log with proposed new work.
Tracking Manpower Requirements
(Planned Vs Actual Vs Forecast)
New Work Manpower Modeled On Top Of Active Work Manpower
Measuring Work Center Performance

Work Center Progress

Percent Progress

<table>
<thead>
<tr>
<th>Process</th>
<th>Planned Progress</th>
<th>Actual Progress</th>
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<tbody>
<tr>
<td>Fabrication</td>
<td>65.5%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Assembly - Fit</td>
<td>90.54%</td>
<td>85.0%</td>
</tr>
<tr>
<td>Assembly - Weld</td>
<td>86.56%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Machining - Fit</td>
<td>64.3%</td>
<td>70.0%</td>
</tr>
<tr>
<td>Cutting</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Plugging</td>
<td>55.0%</td>
<td>45.0%</td>
</tr>
<tr>
<td>Plunging</td>
<td>62.19%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Machining - Plun</td>
<td>77.23%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Machining - Mill</td>
<td>99.95%</td>
<td>90.0%</td>
</tr>
<tr>
<td>Machining - Lathe</td>
<td>11.0%</td>
<td>12.0%</td>
</tr>
</tbody>
</table>
Work Center Contribution to Current Total Project Savings/Losses
Current Work Center Schedule Variance

- Fabrication (001)
- Assembly Fit (002)
- Assembly Weld (003)
- Erection Fit (004)
- Erection Weld (005)
- Outfitting (006)
- Rigging (012)
- Piping (045)
- Erection, Misc. & Fixtures (0453)
- Engineering & Management (800)

Calendar Days Ahead of Schedule:

- .36
- .41
- .30
- .30
- .28
- .35
- .35
- .15

Legend:
- Projected end date
- Actual end date

Note: Figure represents the variance in calendar days ahead of schedule for various work centers.
Overall Work Center Performance
(Based on Available Work Orders)

<table>
<thead>
<tr>
<th></th>
<th>Percent Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total EAC</td>
<td>105.5%</td>
</tr>
<tr>
<td>Total ACWP</td>
<td>50.1%</td>
</tr>
<tr>
<td>Total BCWP</td>
<td>47.9%</td>
</tr>
<tr>
<td>Total BCWS</td>
<td>88.2%</td>
</tr>
</tbody>
</table>
Measuring Estimate At Completion (EAC)

*PERCEPTION* applies forecasting factor for EAC. As work orders close, system learns extent of cost variance for these work orders.

\[ EAC = BAC + \text{Factor} \times [\text{Variance}_{\text{closed w/ os}} + \text{Adjustments}_{\text{in-progress w/ os}}] \]

As progress advances, *PERCEPTION* places greater emphasis on recorded cost variance for the EAC.
Measuring Progress

From EAC and ACWP, PERCEPTION computes actual progress:

\[ \text{Progress} = 100 \times \left( \frac{\text{ACWP}}{\text{EAC}} \right) \]
Measuring Earned Value

From Progress and BAC, *PERCEPTION* computes earned value, BCWP:

\[ BCWP = \frac{\text{Progress} \times BAC}{100} \]
Measuring Trends

PERCEPTION tracks cost and schedule performance week by week or month by month.

Using regression formulas and weighting the more recent data more heavily than older data, the system computes trends at completion.

Trends provide management with an early indication of how effective management efforts are keeping performance to budget and planned schedules.
System’s Integration

CAD Systems

Financial & Accounting Systems

Desktop & Internet Products

- Volo View Express
- Acrobat Assistant
- Internet Explorer
- Outlook Express
- Microsoft Access
- Microsoft Excel
- Microsoft FrontPage
- Microsoft Outlook
- Microsoft PowerPoint
- Microsoft Word
**System’s Integration**

*PERCEPTION* has been linked to various Ship Design and Engineering systems:

- ARL’s *ShipConstructor*
- The Navy’s *ASSET* Ship Concept Model
- Proteus Engineering’s *Flagship* suite
- Intergraph’s *GSCAD*
- Autodesk’s *AutoCAD* general design system
- Rebis’ *AutoPLANT* piping system design and engineering system
- Bentley’s *MicroStation* general design system
CAD interfaces can be used to download detailed bills of material for:

- Cost Estimating
- Purchase Requisitions
- Work Order Bills of Materials
PERCEPTION
Integrated Shipyard Resource Management System
Data Import/Export Features

PERCEPTION can import/export data in various formats:

- SQL ODBC
- Databases: Excel, Access, Oracle, SQL Server, Sybase SQL Anywhere
- Text files (comma, tab delimited & strings)
- Windows cut, copy & paste
- U.S. EDI Standard X12 (XML)
- Microsoft Project
SPAR Associates, Inc.

• A Full Service Company

• Systems Development
• Systems Sales, Training & Support
• Independent Cost Estimating
• Planning & Scheduling Services
• Contract Cost/Schedule Tracking & Performance Analysis
SPAR has provided systems and services to the shipbuilding and ship repair industries around the world since 1972.

Our clients are both large and small, and they deal with commercial and/or government work.

SPAR understands the detail nature of this business, from the way shipyards organize and perform their work and manage their business.
SPAR has followed and has implemented features in its systems to support “world class” shipbuilding practices.

These practices enable shipyards to be much more efficient and improve the quality of their products and services.
Serving Government Agencies Too

- The U.S. Coast Guard
- The U.S. Navy
- The Federal Maritime Administration (MARAD)

These services include software developed by SPAR, training and system support, as well as independent cost estimating and cost realism evaluations.
Over 40 Years Serving the Shipbuilding & Repair Industry