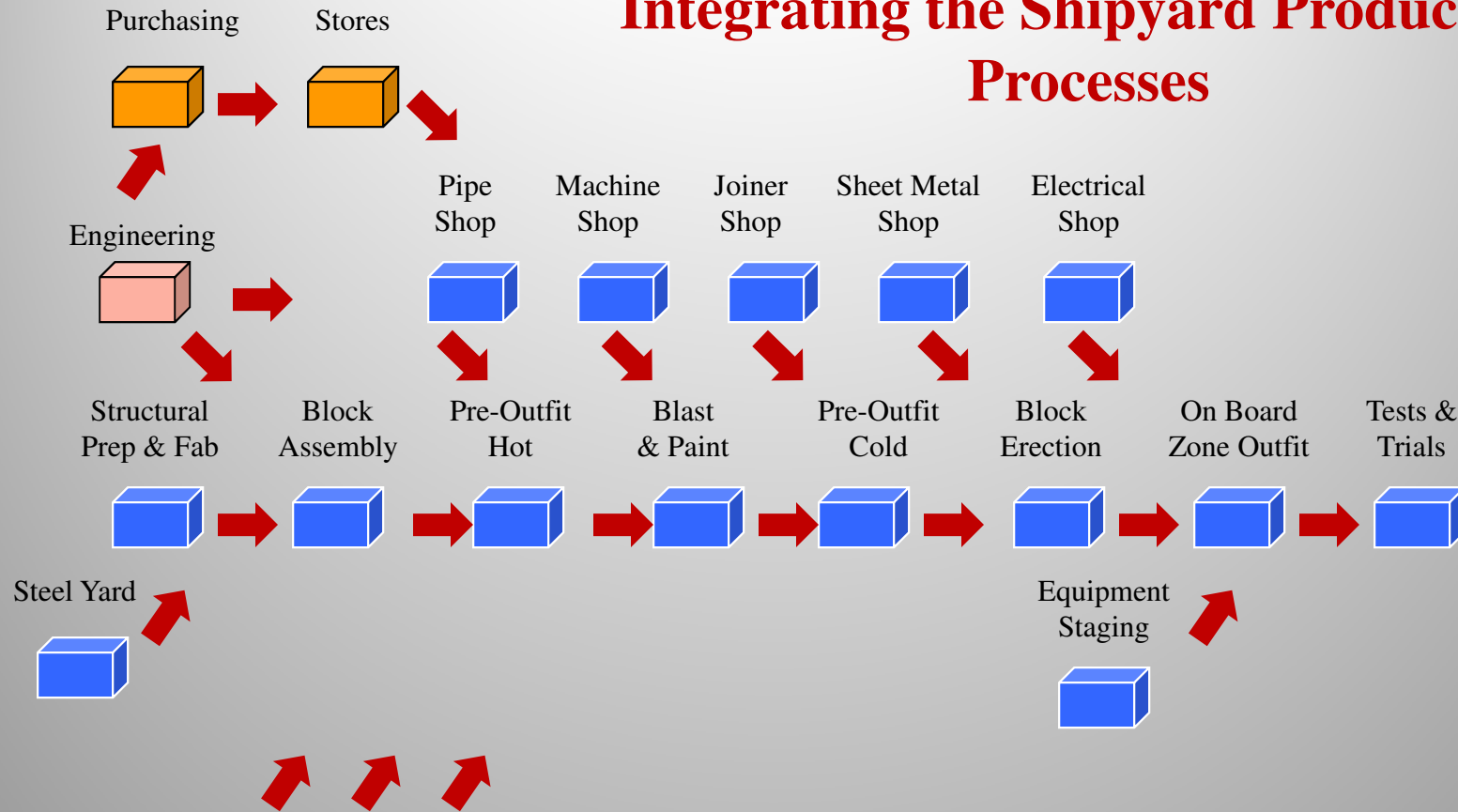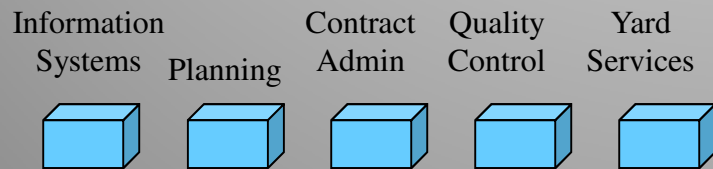# PERCEPTION ®

A Shipbuilder's Enterprise Resource Planning (ERP) & Earned Value Management (EVM) System
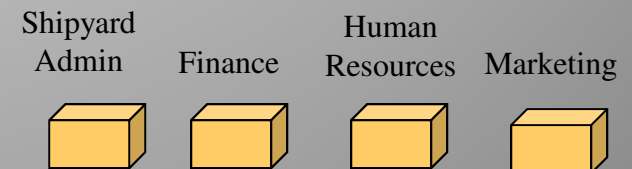
Integrating the Shipyard Production Processes

Purchasing → Stores

Engineering → Structural Prep & Fab → Block Assembly

Pipe Shop → Pre-Outfit Hot

Machine Shop → Blast & Paint

Joiner Shop → Pre-Outfit Cold

Sheet Metal Shop → Block Erection

Electrical Shop → On Board Zone Outfit → Tests & Trials

Steel Yard

Equipment Staging

Support Services

Information Systems · Planning · Contract Admin · Quality Control · Yard Services

Shipyard Administration

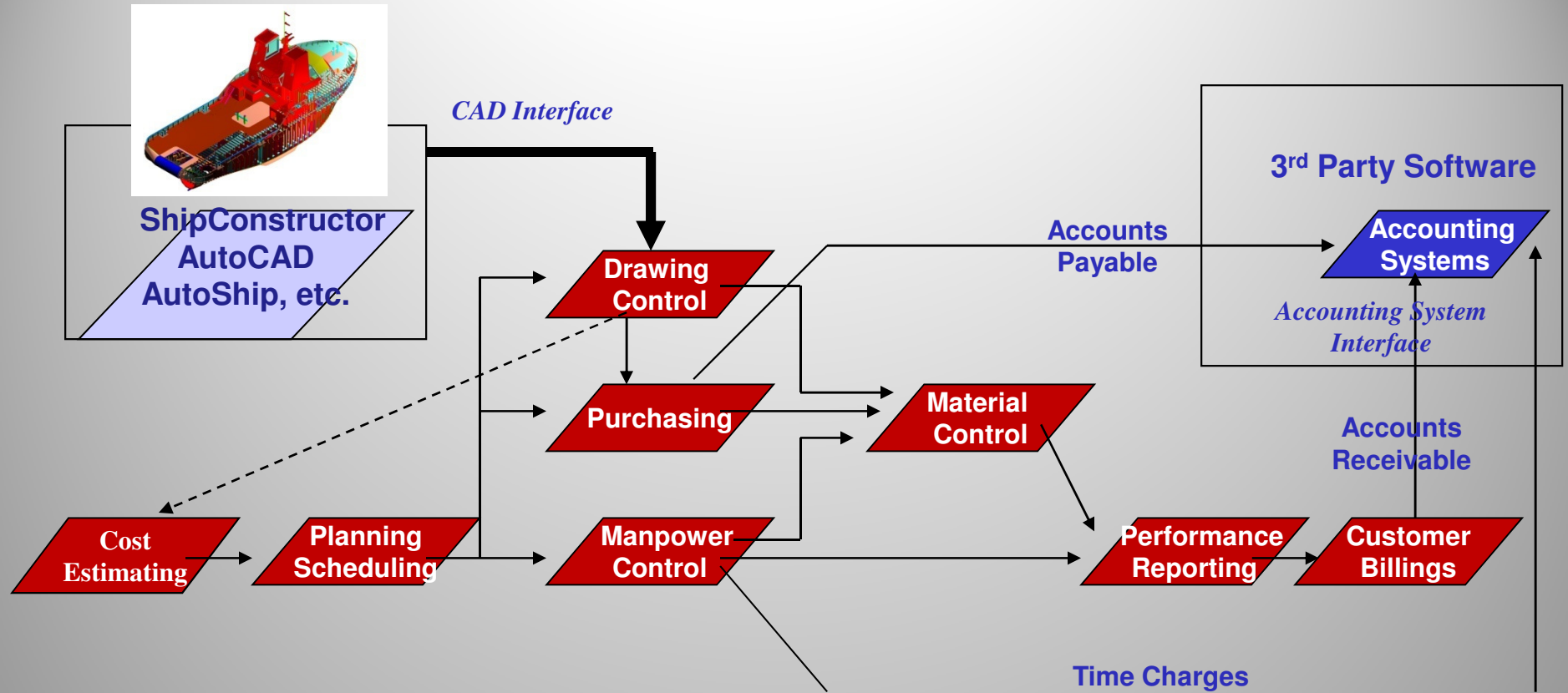Shipyard Admin · Finance · Human Resources · Marketing

SPAR ASSOCIATES, INC.

ERP

"An Enterprise Resource Planning (ERP) system is an integrated computer-based application used to manage internal and external resources, including tangible assets, financial resources, materials, and human resources.
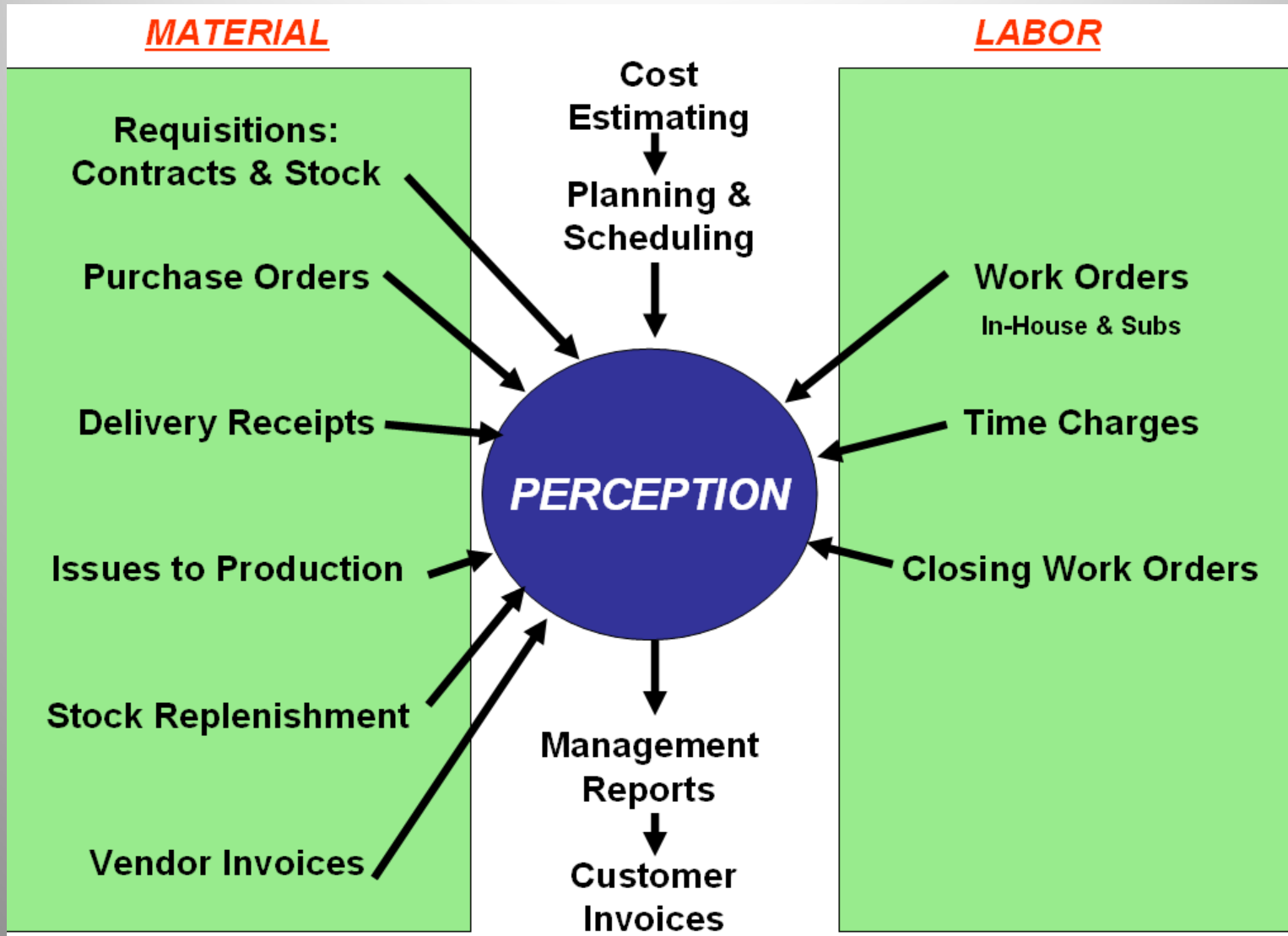
Its purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Built on a centralized database and normally utilizing a common computing platform, ERP systems consolidate all business operations into a uniform and enterprise-wide system environment."

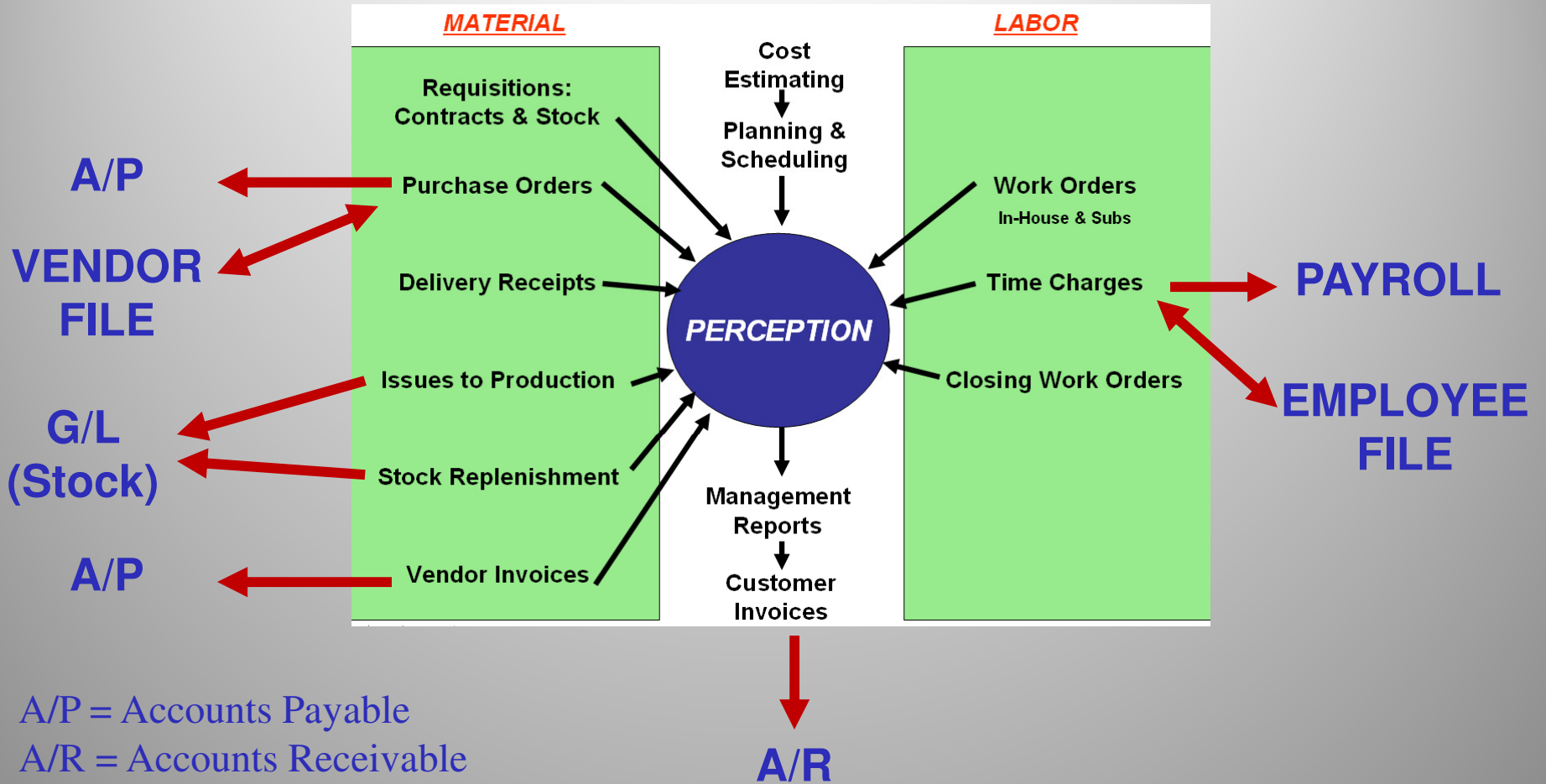From Wikipedia, the free encyclopedia

CAD Interface

ShipConstructor AutoCAD AutoShip, etc.

3rd Party Software

Drawing Control

Accounts Payable

Accounting Systems

Accounting System Interface

Purchasing

Material Control

Accounts Receivable

Cost Estimating

Planning Scheduling

Manpower Control

Performance Reporting

Customer Billings

Time Charges

PERCEPTION Integrated Shipyard Resource Management System

4

PRIMARY SYSTEM FUNCTIONS

MATERIAL

LABOR

Cost Estimating

Planning & Scheduling

PERCEPTION

Requisitions: Contracts & Stock

Purchase Orders

Delivery Receipts

Issues to Production

Stock Replenishment

Vendor Invoices

Work Orders
In-House & Subs

Time Charges

Closing Work Orders

Management Reports

Customer Invoices

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INTERFACES WITH ACCOUNTING SYSTEM

A/P = Accounts Payable
A/R = Accounts Receivable
G/L = General Ledger

INTERFACES WITH CAD SYSTEM
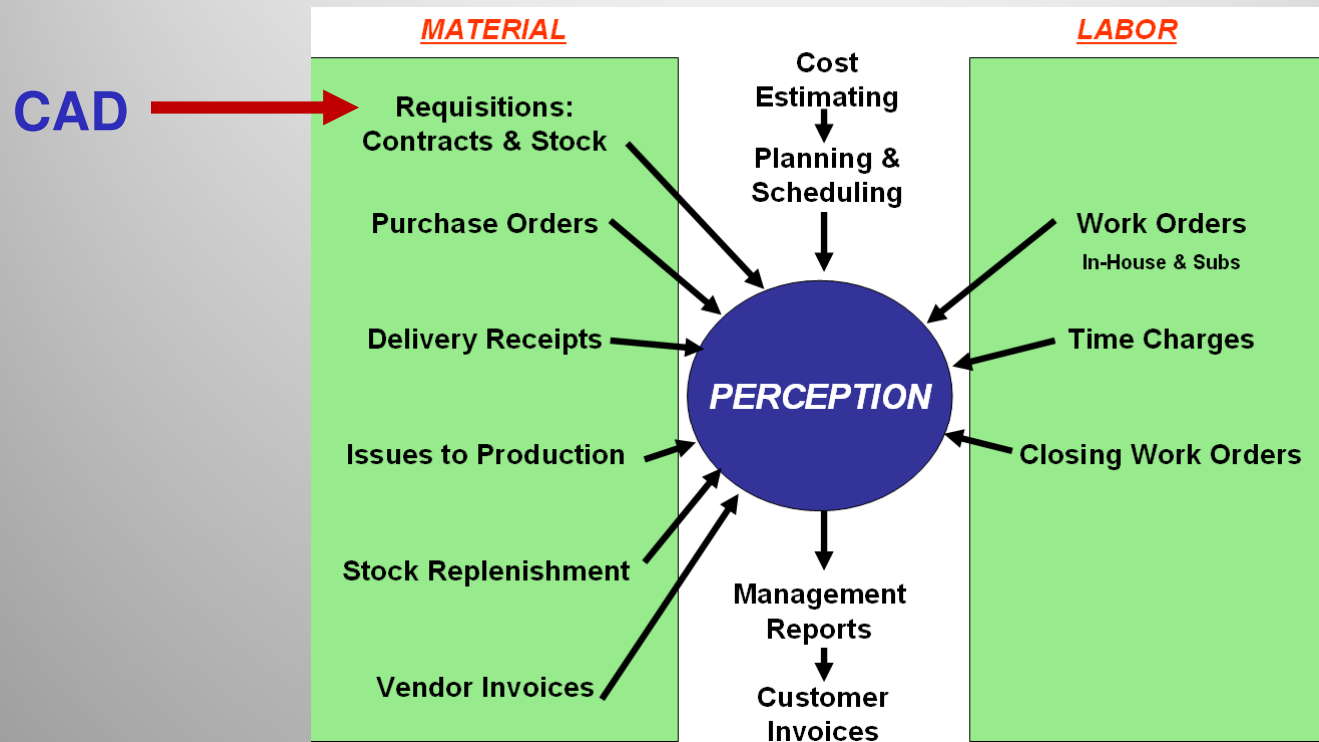
Most generic ERP systems do not provide a robust EVM capability.

None provide an EVM capability specifically designed for the shipbuilding and ship repair industry.

EVM

"Earned value management (EVM) is a project management technique for measuring project progress in an objective manner.

EVM has the ability to combine measurements of scope, schedule, and cost in a single integrated system. When properly applied, EVM provides an early warning of performance problems.

Additionally, EVM promises to improve the definition of project scope, prevent scope creep, communicate objective progress to stakeholders, and keep the project team focused on achieving progress."

From Wikipedia, the free encyclopedia

SPAR
ASSOCIATES, INC.

The following are typical production problems that EVM can recognize early:

• *Incomplete engineering drawings are preventing the manufacture of pipe spools in time to meet on-block assembly schedules leading this work to be done on-board with a 3:1 penalty in labor hours.*	**Engineering Problem**
• *Rented crane services arrives a week early with nothing to do.*	**Planning Problem**
• *Poor night shift welding causing excessive rework and impacting day shift progress*	**Quality Work Problem**
• *Panel line not able to maintain throughout that impacts platen schedules.*	**Scheduling Problem**
• *Late material deliveries creating cost and schedule problem with out-of-sequence work.*	**Material Expediting Problem**

EVM Terminology Used by PERCEPTION

BAC   = Total Budget At Completion

BCWS = Budgeted Cost of Work Scheduled (Sum of Budgets <u>Scheduled</u> To Date)

BCWP = Budgeted Cost of Work Performed (Actual Progress x BAC)

ACWP = Actual Cost of Work Performed

EAC   = Estimated Cost At Completion (Six Methods Provided & Tracked)
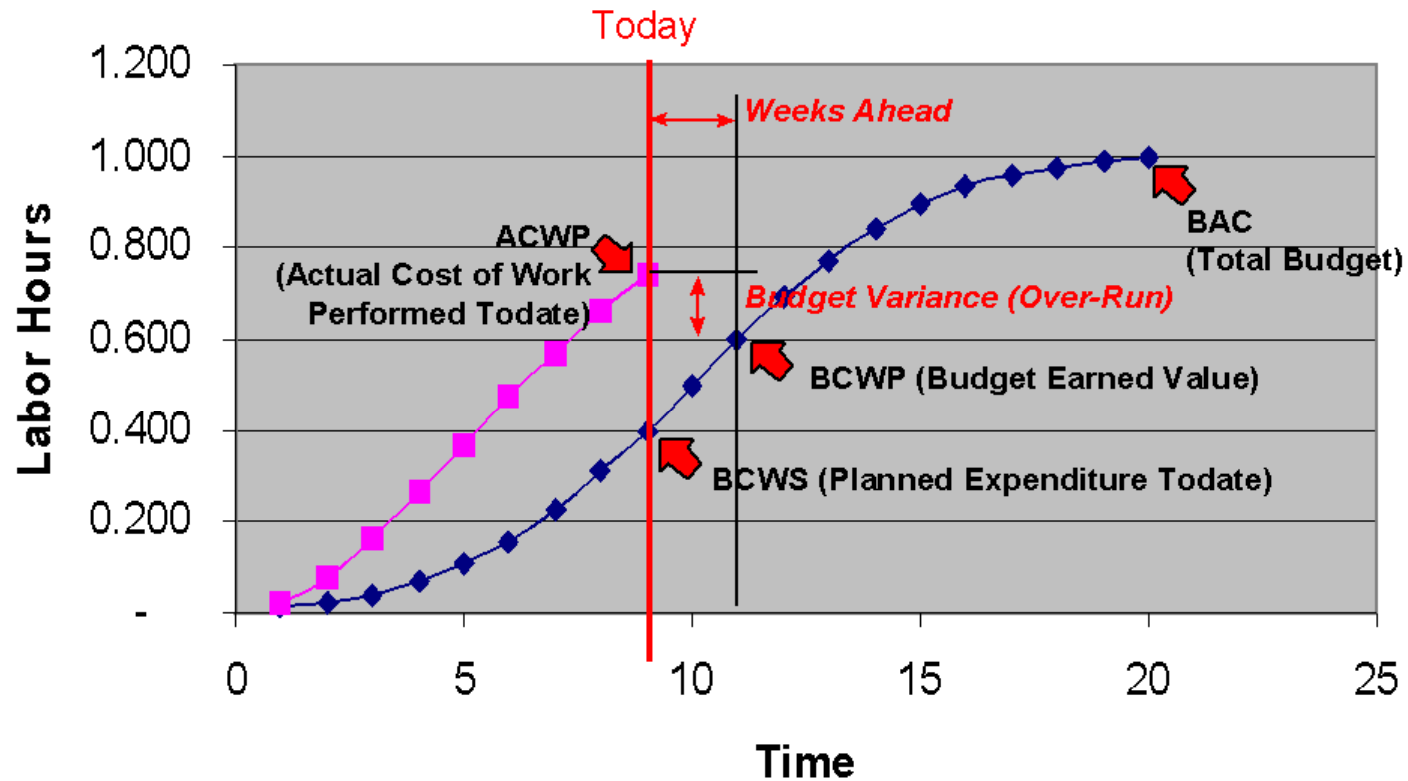
ETC   = Estimate To Complete (EAC – ACWP)

Planned Progress = % Budget Scheduled To Date (BCWS/BAC)

Actual Progress   = % Physical work progress regardless of cost expended

------------   (BCWP/BAC)

Performance Indexes = Measures of Cost and Schedule Performance (CPI, SPI, FCPI, TCPI, etc.)

Measuring Schedule Performance

Today

Weeks Ahead

ACWP
(Actual Cost of Work
Performed Todate)

Budget Variance (Over-Run)

BCWP (Budget Earned Value)

BCWS (Planned Expenditure Todate)

BAC
(Total Budget)

Labor Hours

1.200
1.000
0.800
0.600
0.400
0.200
-

Time

0   5   10   15   20   25

PERCEPTION determines WBS level performance from work performance.

- ✓ 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

- ✓ Performance Indexes (CPI, SPI, and others)

ERP → **EVM**

Coordinate Resources

Measure Progress & Performance

SPAR's PERCEPTION© System Combines ERP & EVM to better plan, coordinate and manage the shipyard.

Unlike other ERP and EVM systems, <u>PERCEPTION was designed specifically for shipyards.</u>

PERCEPTION ties together all areas of Earned Value Management:

1. Cost Estimating
2. Planning, Budgeting & Scheduling
3. Labor Work Order & Manpower Management
4. Purchasing & Inventory Control
5. Change Order Management
6. Earned Value Performance Measurement Reporting
7. Cost & Schedule Forecasting
8. Cost Analysis For Future Work Estimating

Cost Estimating

Planning Budgeting & Scheduling

Labor, Manpower Cost Management

Purchasing & Material Cost Management

Earned Value Performance Reporting

Cost Analysis

PERCEPTION: **An Integrated System of Shipyard Business Functions**

PERCEPTION ESTI-MATE

Cost Estimating

New Construction & Repair

ESTI-MATE™

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

- **Standard shipbuilding & ship repair interim products & services**

- **Detail cost estimates** based upon engineered bills of material and equipment specifications.

System Benefits

1. *PERCEPTION* has flexible features to address almost any estimating situation, whether for commercial or government requirements.

2. *PERCEPTION* offers a toolbox of easy-to-use functions to help the estimator expedite the process and ensure the estimate is both complete and accurate.

3. *PERCEPTION* allows cost data to be cataloged in convenient and easy-to-use database libraries.

4. *PERCEPTION* cost libraries ensure all estimators are using consistent information.

5. *PERCEPTION* libraries can be configured to accurately define standard shipyard production processes to ensure every estimate is complete, nothing is missing.

PERCEPTION can manage extensive cost estimating libraries

1. **Various libraries of <u>Cost Estimating Relationships</u> ("CERs")**

2. **Standard Parts Catalog for detail parts costs**

3. **Standard Interim Products & Services Packages that identify standard manufacturing, assembly and support operations plus material requirements**

# Putting together an estimate from manual cost entries and from cost libraries.

CER Libraries

Parts Catalog

Prior Estimates

Standard Package Library Cost Items

Project Estimate

Manual Cost Items
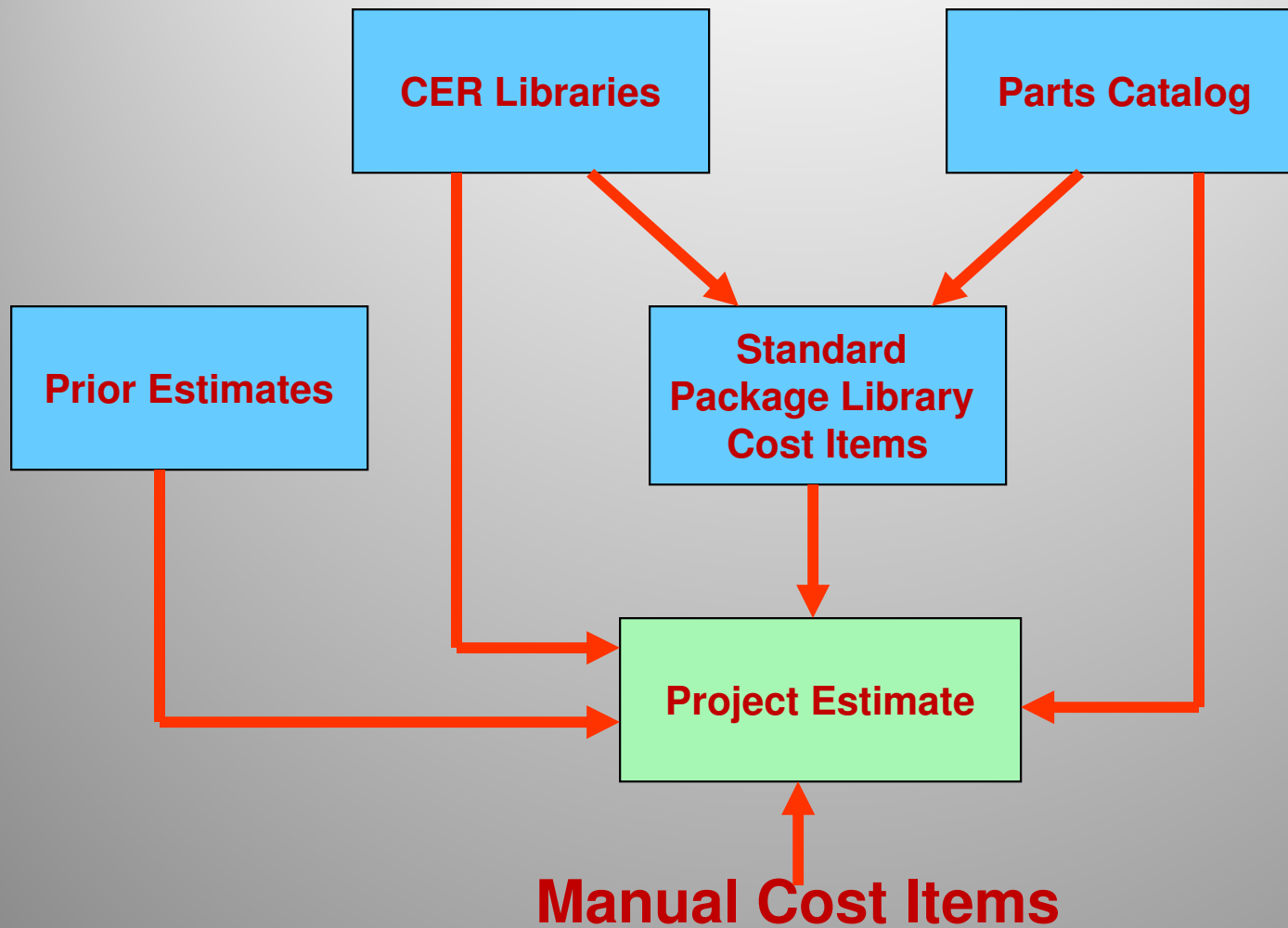
Cost Risk Analysis

Cost Probability
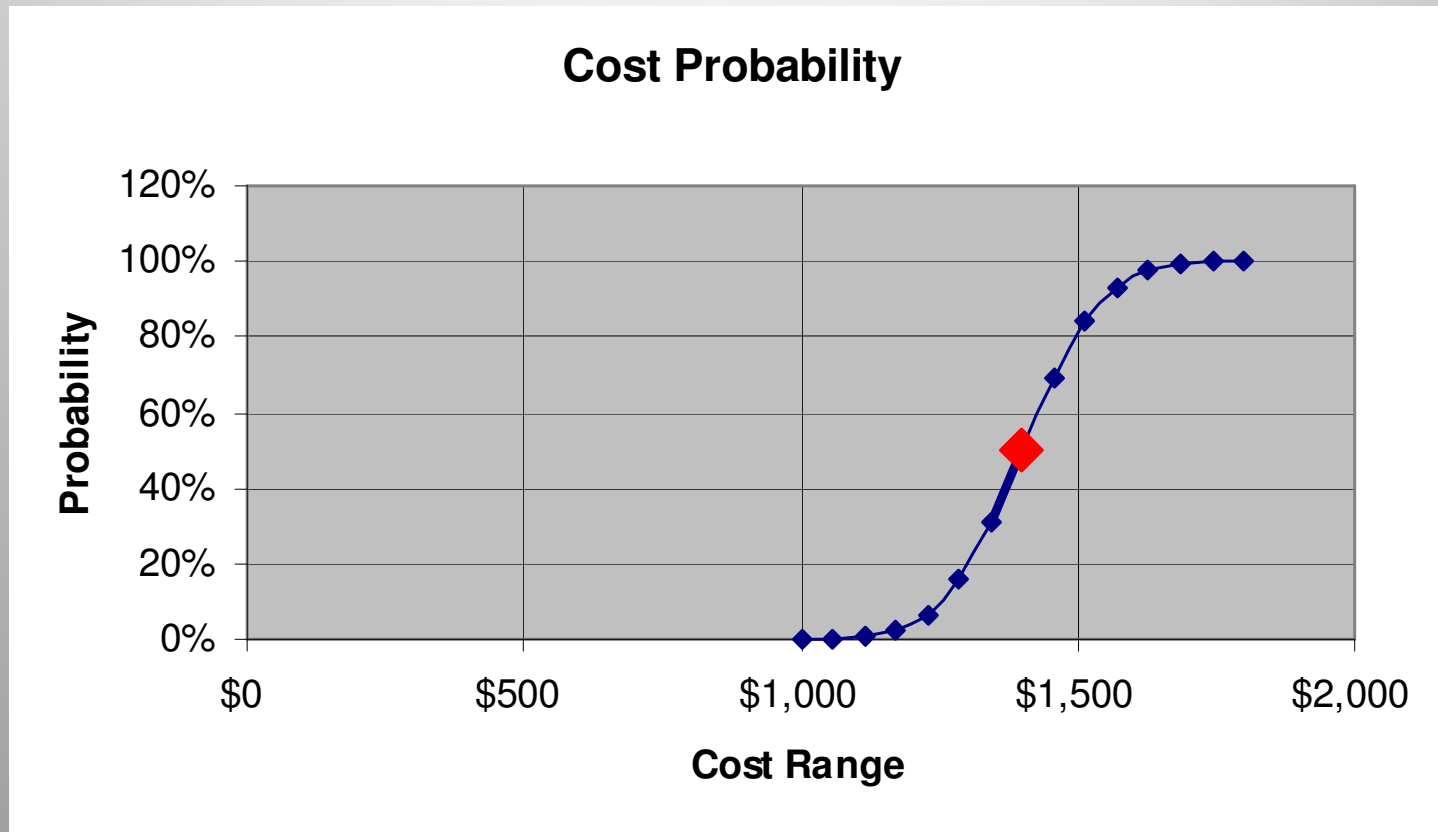
For large, complex bids, *PERCEPTION* provides more confidence in the cost estimates

PERCEPTION PERT-PAC
Production Scheduling

Scheduling Deliveries to Meet Master Product Schedules

Interim Product Bills of Material

On-Unit Schedules

Master Product Schedules

On-Block Schedules

Ship Zone Schedules
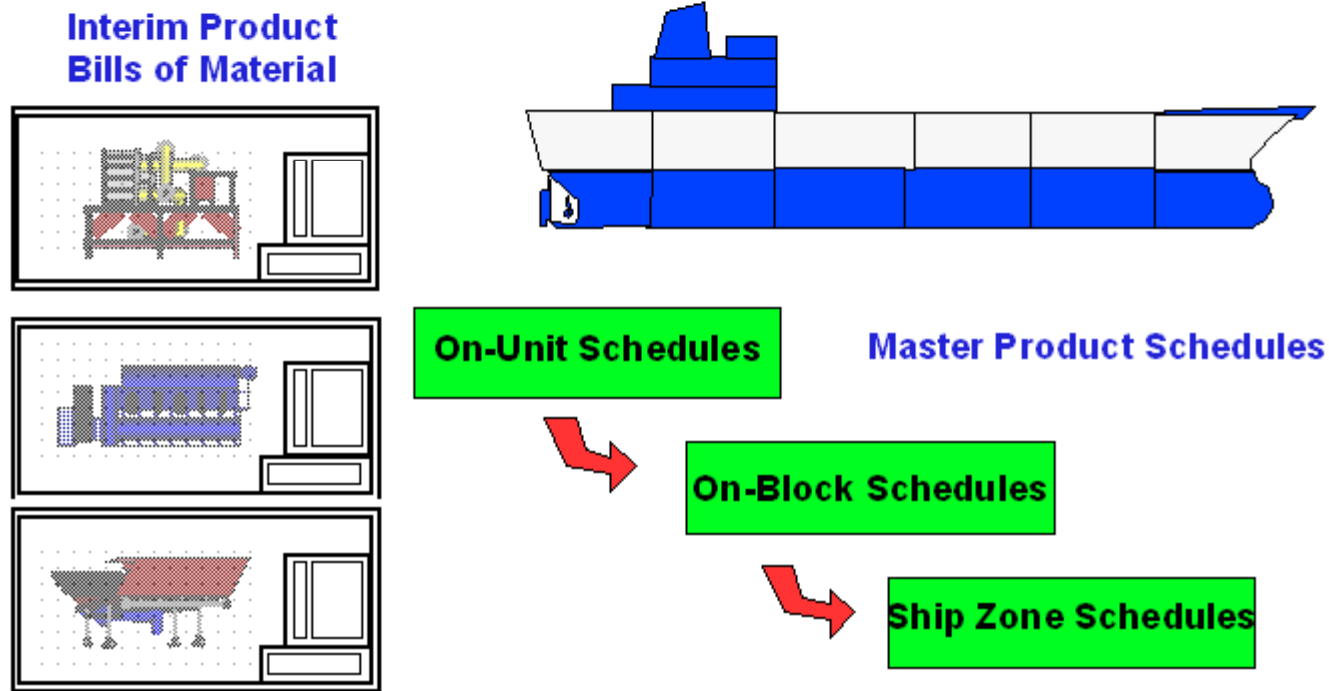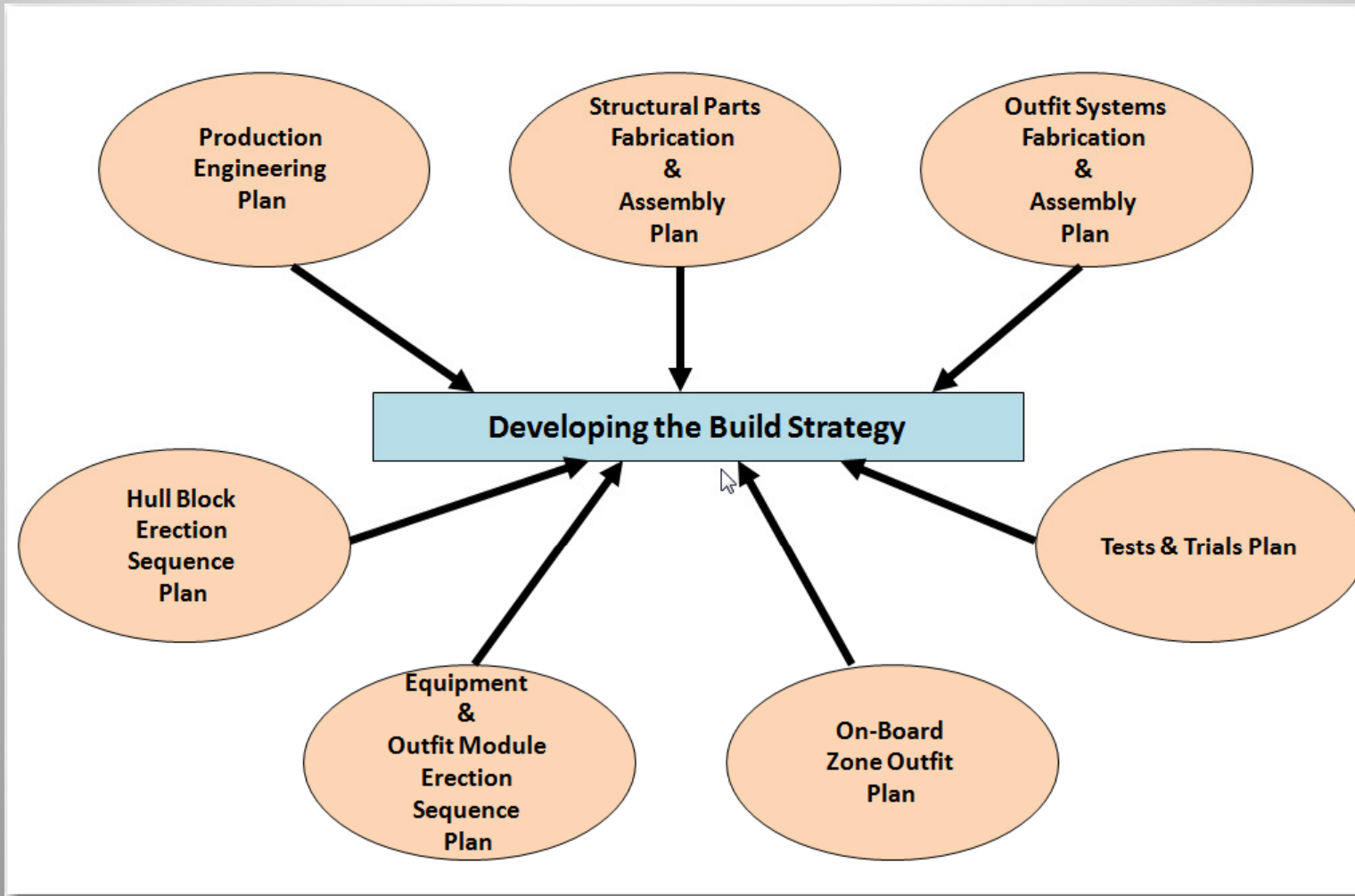
All successful shipyard contracts are based on a well-thought-out and executed build strategy

PERCEPTION **provides a system's integration feature for using Microsoft** *Project* **to automatically develop and schedule** **Planning Activities.**

PERCEPTION maintains schedule updates automatically.

Planning & Scheduling

Pre-Outfitted Hull Block Construction

On Board Outfitting

Tests & Trials
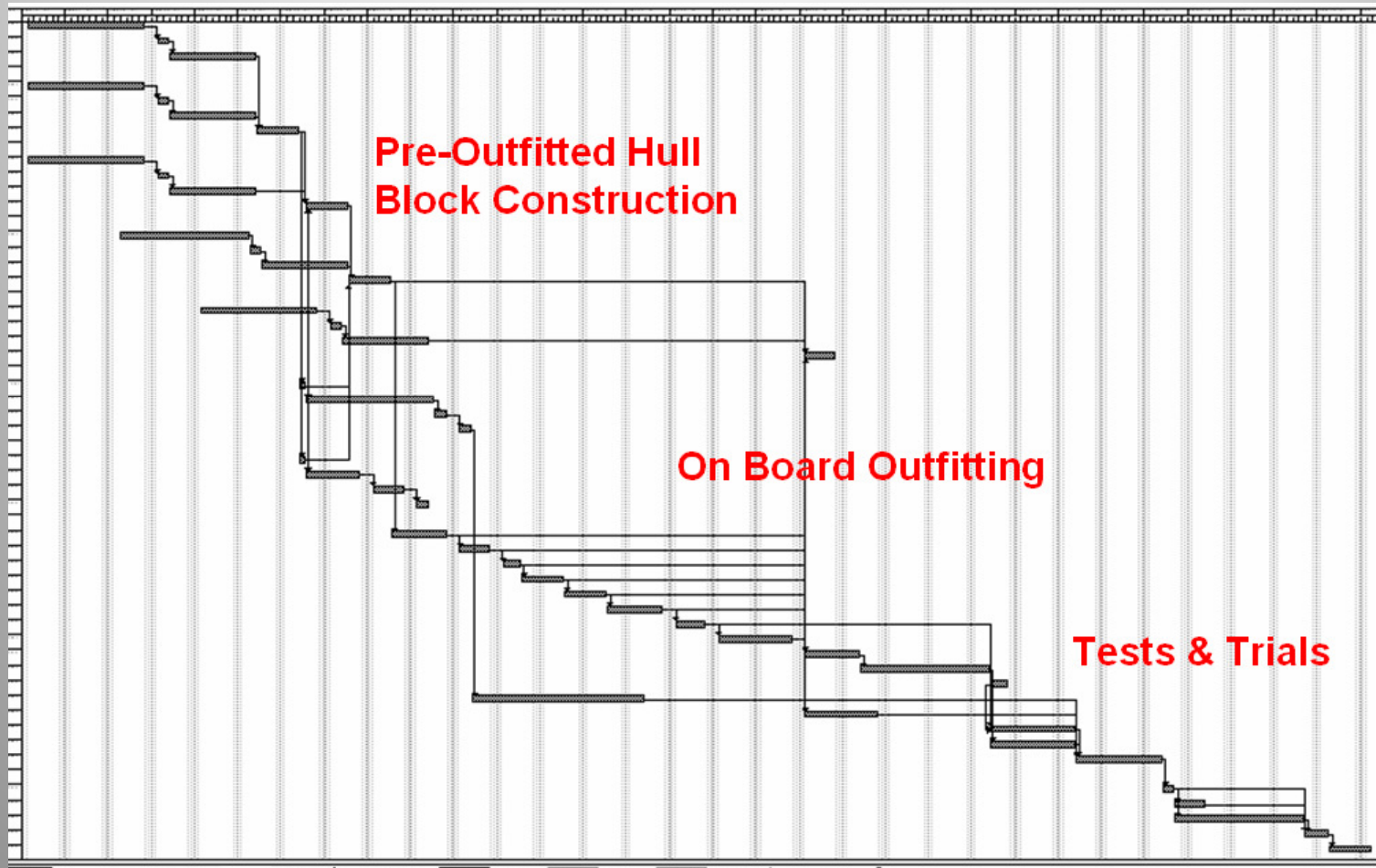
PERCEPTION **has features for planning and scheduling all project activities:**

- **Schedule Design & Engineering Activities**

- **Schedule Engineering Drawings**

- **Schedule Production Work Orders**

- **Schedule Work Order Material Pallets**

- **Schedule Purchased Material Deliveries**
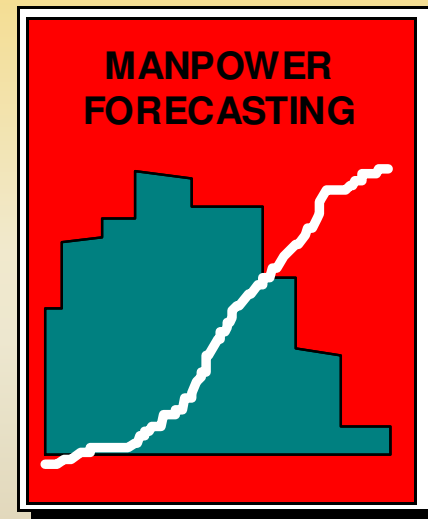
- **Schedule Subcontractors**
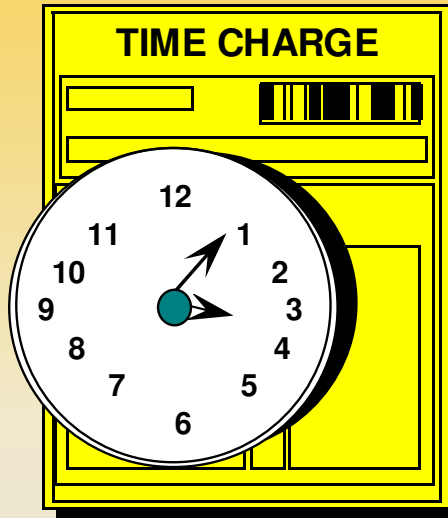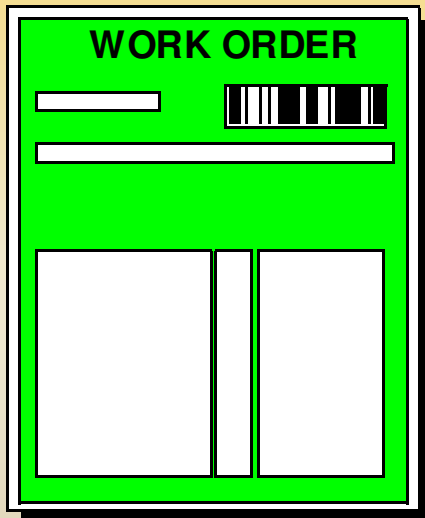
- **Schedule Tests & Trials**

Planning & Scheduling

Hull Block Construction

Loft · Plan · Prep · Fab · Assem. · Outfit Hot · Paint · Outfit Cold · Erect
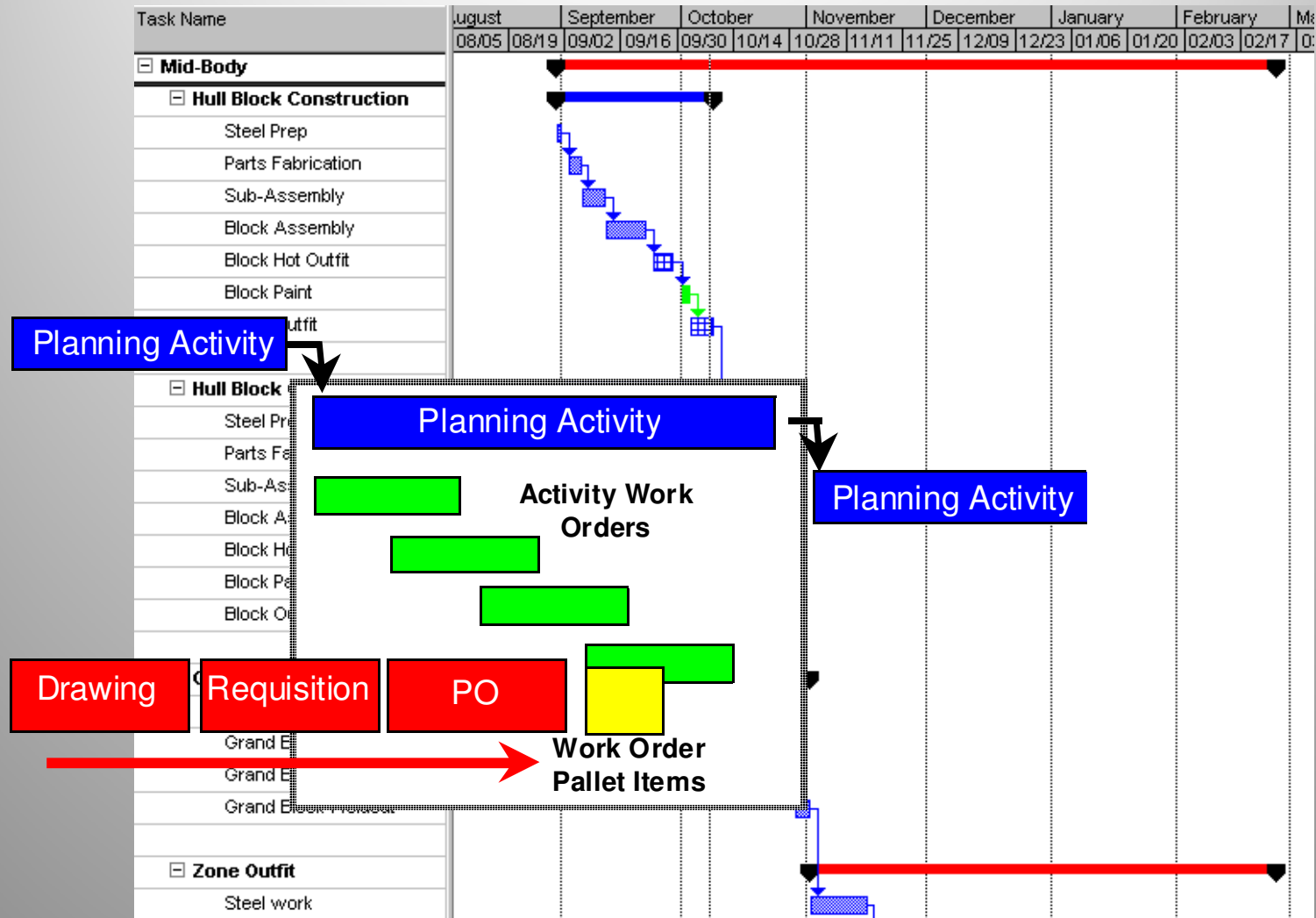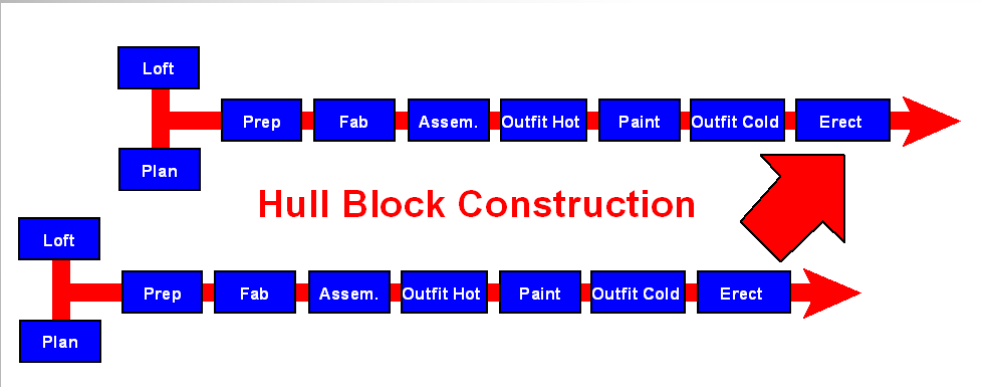
Scheduling requires the proper sequencing of work and related project activities.

Ship Zone Outfit Work Type Scheduling

Maintain Clear Access Alleys for Men & Materials

Steel Hot Work → Pipe Work → HVAC Work → Electrical Cables → Linings & Bulkheads → Paint & Deck Covering → Ceilings & Doors → Outfit & Furnishings → Fixtures & Breakables → Groom & Clean

Ship Repair

Plan · Rip Out · Fab · Assem. · Install · Test · Remove · Repair
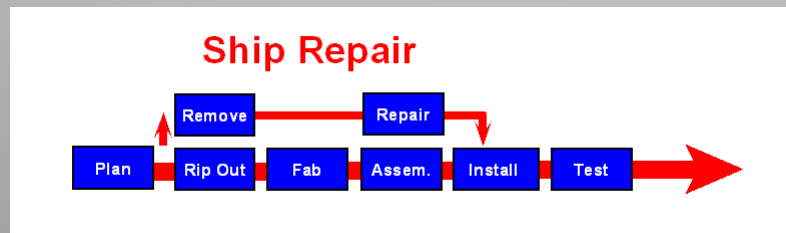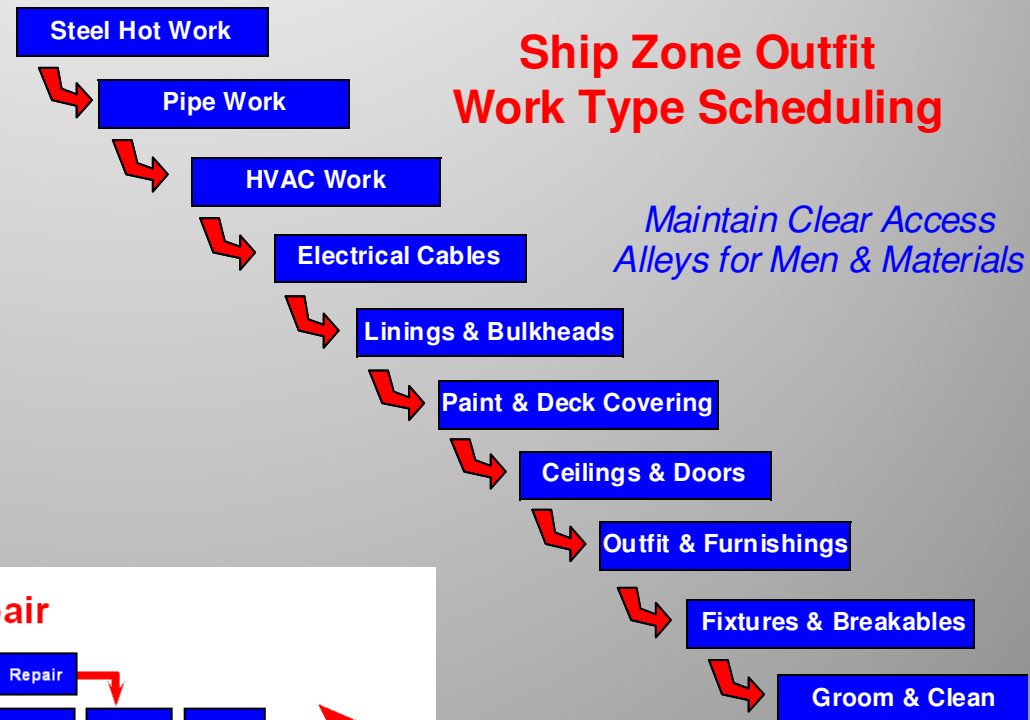
PERCEPTION WORK-PAC
Managing Labor Costs & Schedules

WORK ORDER

TIME CHARGE

MANPOWER FORECASTING

System Benefits

1. Better labor planning cost/schedule control.

2. Improved management control of job progress and labor expenditures.

3. Immediate job cost reporting and summarization.

4. Fast and accurate reporting of labor cost problems.

5. Labor costing by project (job) work breakdown structure and by organization structure.

6. Automated final labor cost forecasting based upon actual performance.

7. Automated job progressing - no manual assessments required.

8. Generous checks for erroneous data and bad timecard charges.

Three Types of Work Orders Provide Extra Flexibility

Discrete Work Orders

Time-Phased Work Orders

Distributed Work Orders

Contract Work Breakdown Structure

Production Processes (Work Centers)

Production Interim Products, Assemblies & Modules
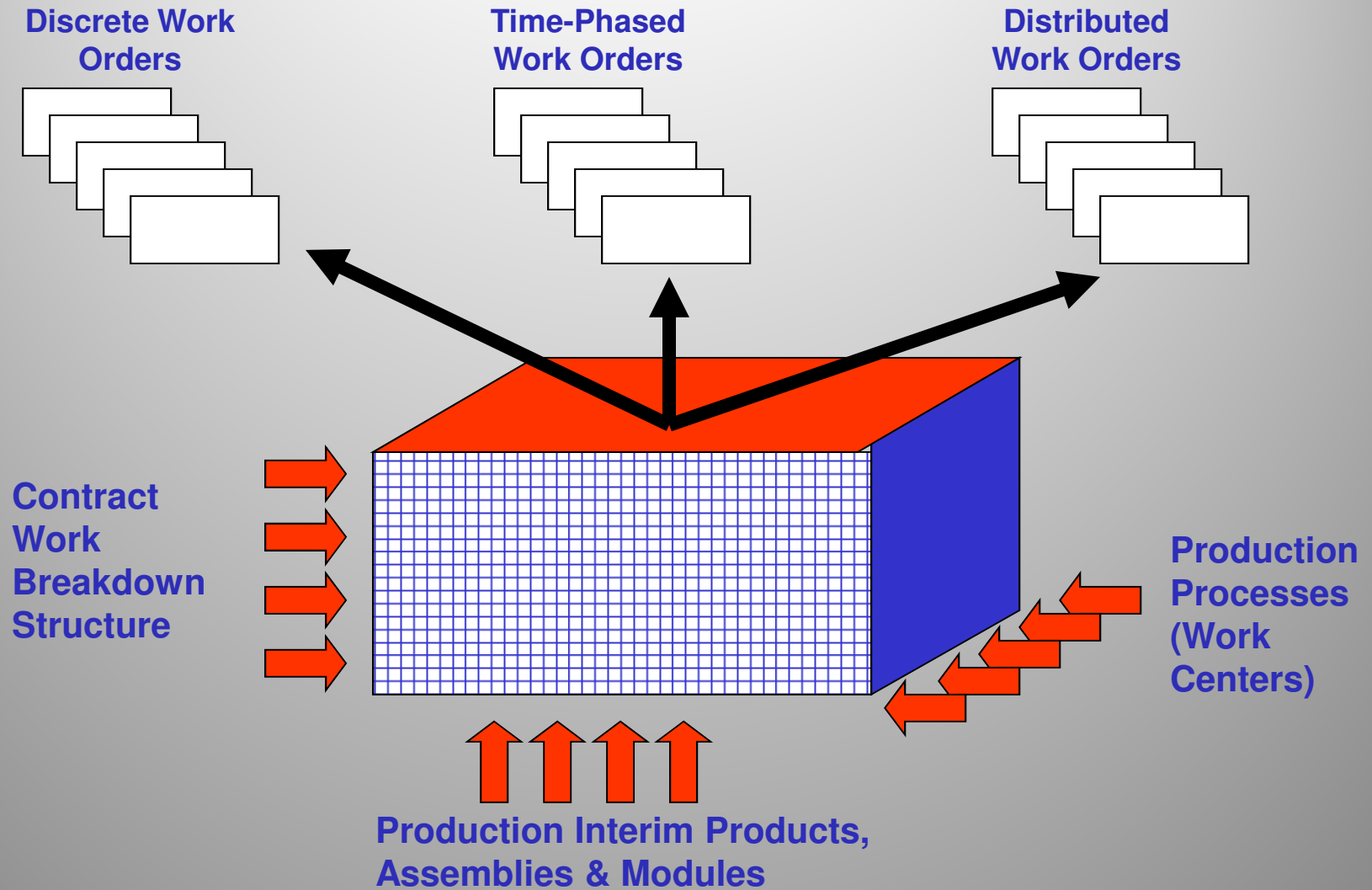
The system allows the user to develop three different types of work orders:

1. <u>Discrete work order</u> (default) that can clearly be assigned to any single element or level of the project WBS.

2. <u>Distributed work order</u> that cannot be assigned to any single project WBS element, but rather includes work that involves multiple elements.

3. <u>Time-phased level of effort work order</u> that has no clear-cut end product, but rather is a service to be provided over time within a fixed budget.

Sample Daily Time Card

For Manual Time Chare Entries

Sample Bar Coded Work Order List for Time Charging using Bar Code Scanners (Optional)

Data Flow for Labor Cost Management
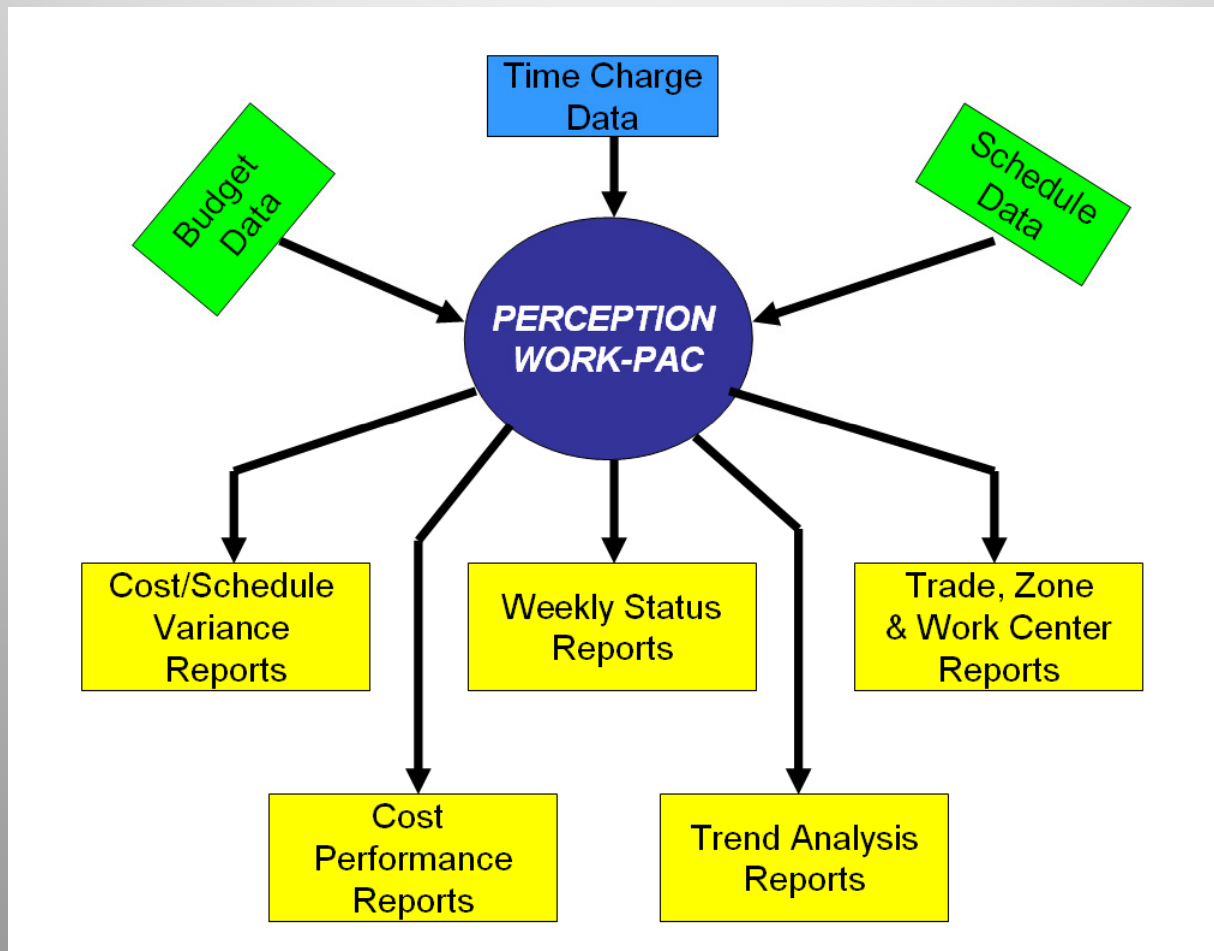
Tracking Manpower Requirements

- 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
Project Manpower Requirements
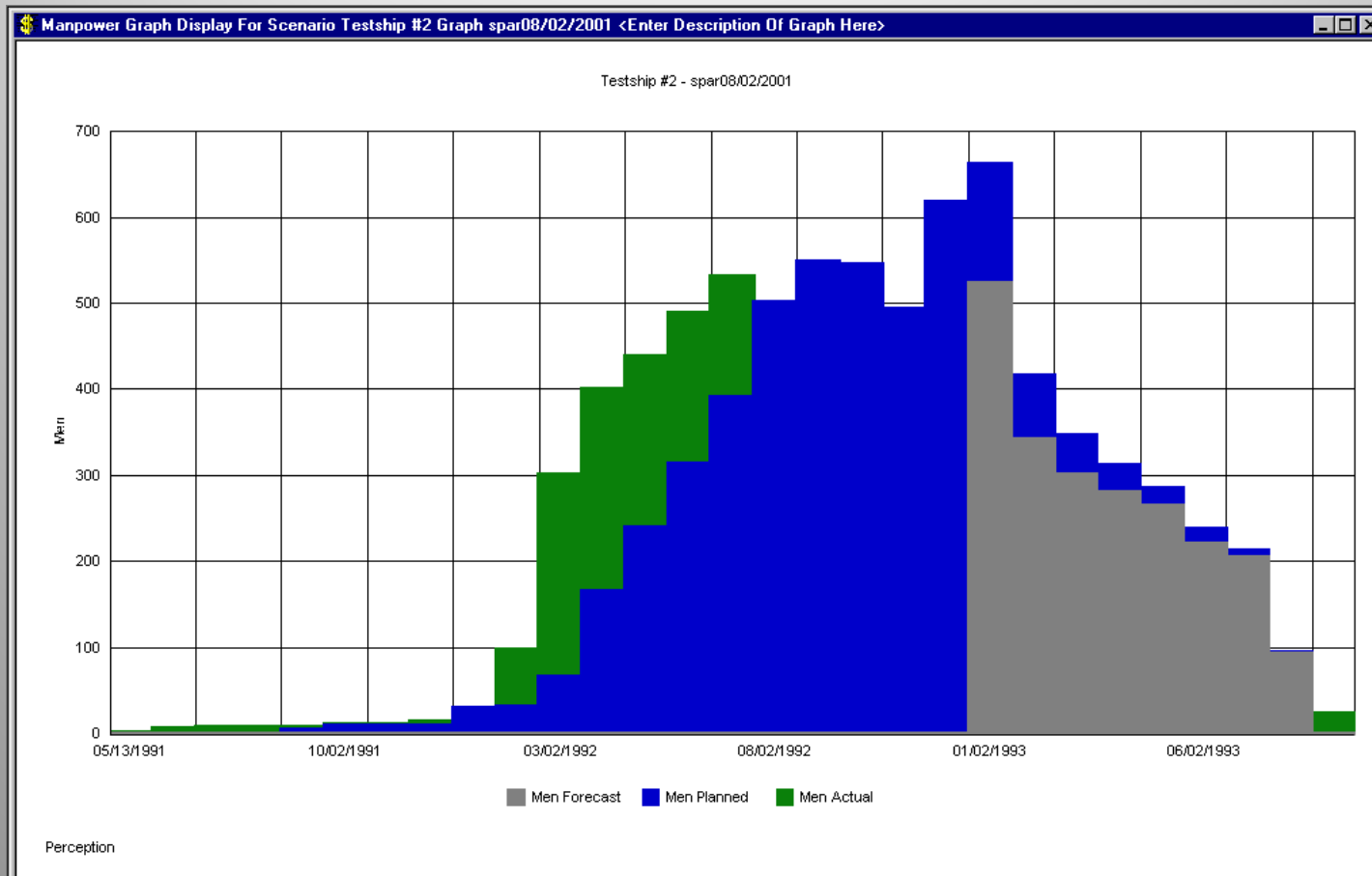
Total Shipyard Manpower Modeling
(New Work Modeled On Top Of Active Work)
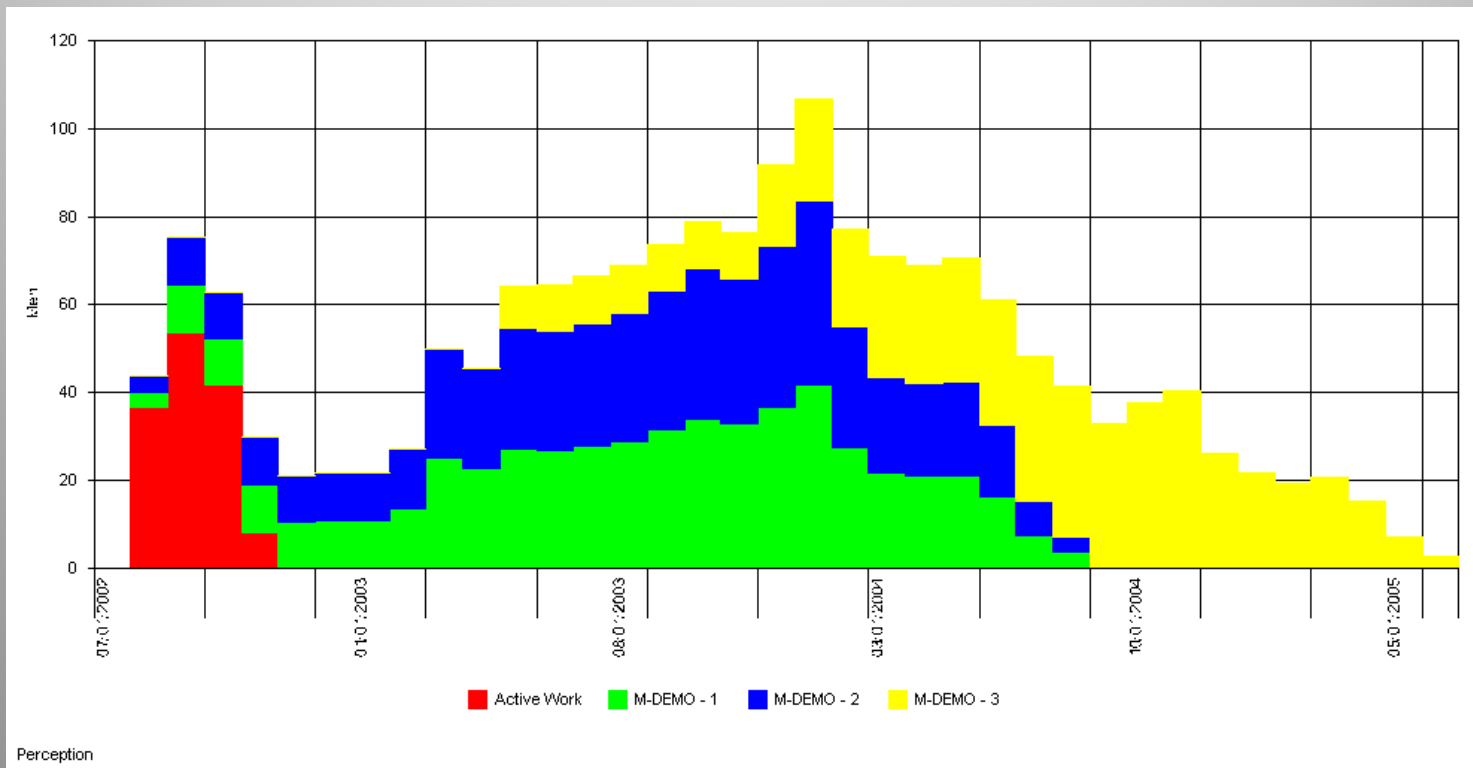
PERCEPTION MAT-PAC
Managing Purchasing & Material Control

Managing Material
From Engineering to Production

INSPECTING

RECEIVING

WAREHOUSING

PURCHASING

PERCEPTION

KITTING

MATERIAL REQUISITIONS

Life Cycle Material Control

ISSUES TO PRODUCTION

PLANNED REQUIREMENTS

ACTUAL USAGE

OPTIONAL CAD INTERFACE

VENDOR INVOICES CUSTOMER BILLINGS

HISTORICAL RECORDS

Interface With Accounting Systems

EXCESS STORES
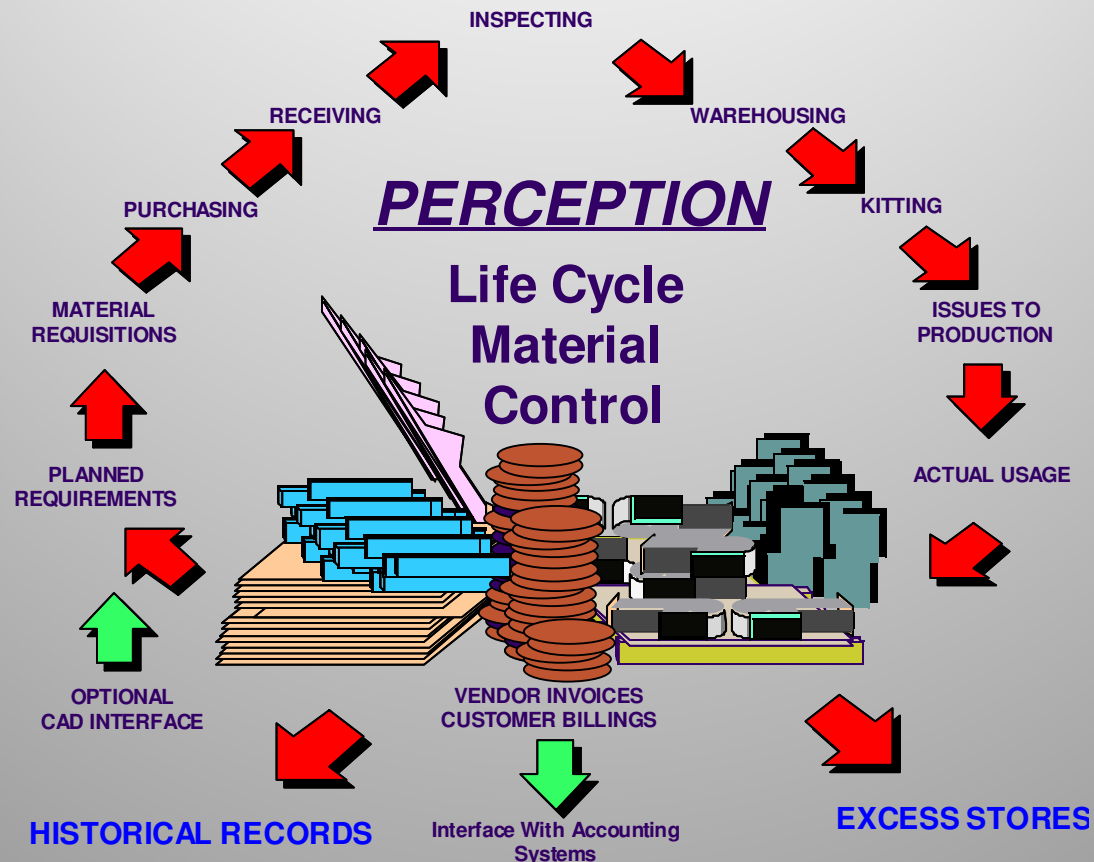
Sources of Ship Materials:

- **Direct purchased material (spec items & standard parts)**

- **Stock inventory**

- **Owner-furnished material**

- **Manufactured parts**

Tracking Material Throughout the Shipyard

- **Engineering Bills Of Material**
- **Stock, Direct Purchase & Manufactured Parts**
- **Material Requisitions**
- **Purchase Orders, RFQs And Amendments**
- **Delivery Expediting Information**
- **Delivery Receipts & Inspections**
- **Warehousing & Storage Locations**
- **Work Order Pallets**
- **Issues To Production**
- **Vendor Invoice Control**
- **Customer Invoice Control**
- **Tool Room Control**

SPAR
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PERCEPTION **tracks material and subcontractor costs via issued purchase orders or via open purchase orders & vendor invoices.**

Purchasing

PERCEPTION generates a variety of purchase orders:

➢ **Normal POs formulated directly from purchase requisitions**

➢ **QUICK PO for items not entered on a requisition.**

➢ **Blanket Purchase Agreement**

➢ **Bulk Purchase Order**

Purchasing schedules that are integrated with technical and production schedules ensure production can perform its work on schedule

PERCEPTION manages all purchasing and material control cost and schedule functions:

- **Purchase Requisitions**

- **Requests for Quotations (RFQs)**

- **Purchase Orders**

- **Expediting Functions & Reports**

- **Receiving Functions**

- **Vendor Invoice Control**

- **Transactions To Accounting System's Accounts Payable (A/P) & General Ledger (G/L)**

Tracking & Managing Material Costs and Schedules

❖ **Total Committed Costs:**

   Purchases + Stock Used + Stock Reserved

❖ **Total Purchases**

❖ **Purchases Received**

❖ **Purchases On Back Order**

❖ **Purchases Used**

❖ **Purchases Paid**

❖ **Stock Used**

❖ **Stock Reserved**

Costs & Schedules Reported by Project and Yard-Wide

Bar Code Options

- **Tool Room Control**
- **Production Issues**
- **Physical Inventory**

123 123 123 123

System's Integration With CAD (Optional)

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 System's** *MicroStation*

Options to Automate Transfer of BOMs from CAD systems.
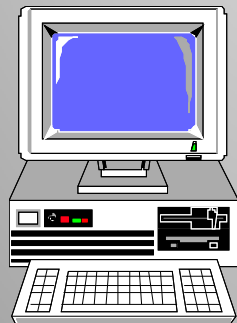
CAD System
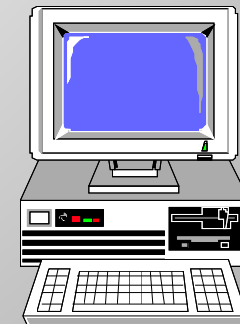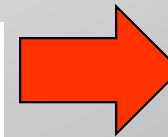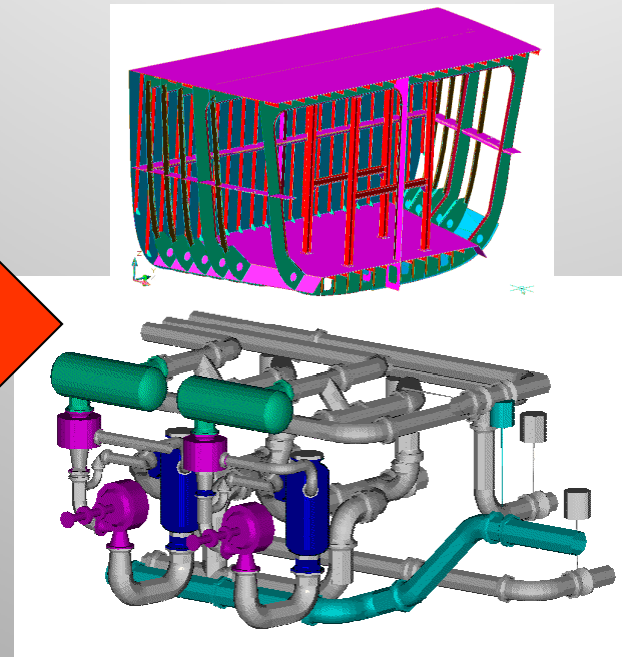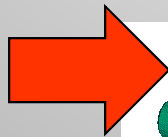
PERCEPTION
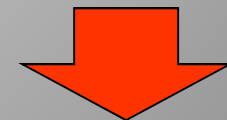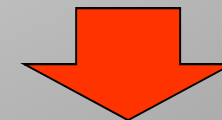
Purchase Requisitions

Production Control

Drawing Control (Disciplined drawing controls will prevent cost and schedule problems in production)

Material requirements for a project can begin with requisitions.

However, requisitions can be <u>preceded by engineering drawings and their bills of material (BOMs).</u>

Drawing BOMs can be entered manually or via down-loading this detail information from CAD systems.

Electronically accessing CAD design data can significantly expedite the purchasing and material control process.
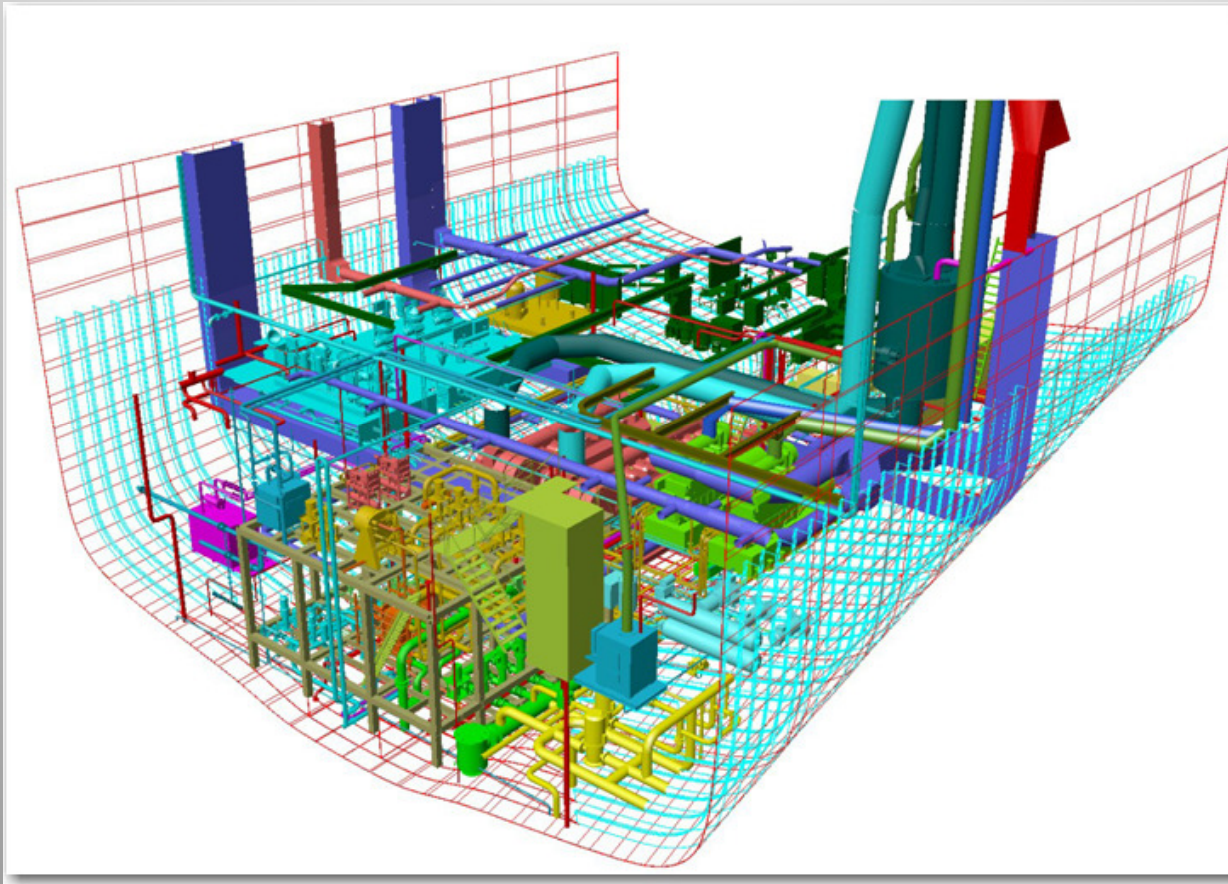
Linking Basic Material Documents
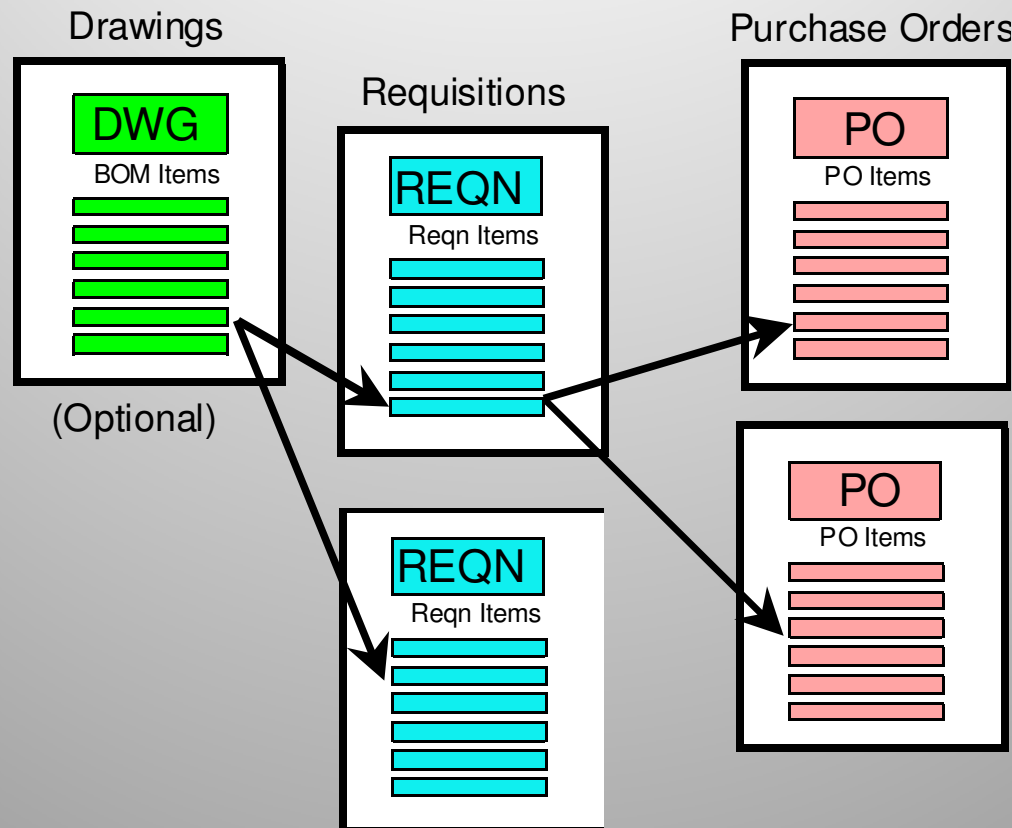
Flexibility for Linking Material Documents to Suit Special Needs

DWG
BOM Items

REQN
Reqn Items

PALLET
Pallet Items

Requisition can be created from Drawing BOM or manually.

Pallet can be created from a Drawing BOM

Pallet can be created from a Requisition

Requisition can be created from a Pallet

REQN
Reqn Items

PALLET
Pallet Items

PALLET
Pallet Items

REQN
Reqn Items
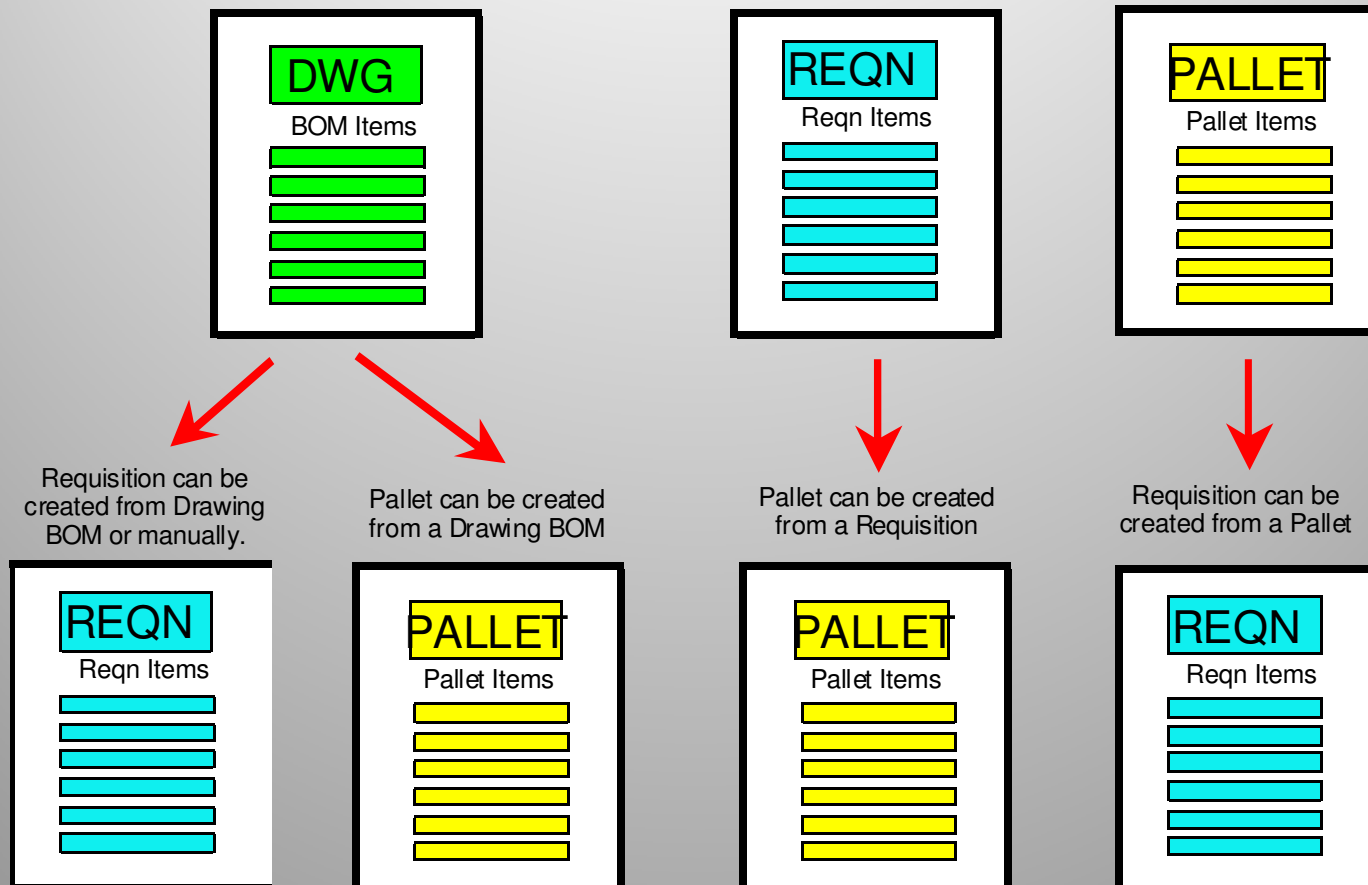
Material Deliveries Must Be Scheduled to Meet Required Delivery Dates

Required Delivery Date

Need Date

Stores Buffer Time

Work Order Schedule

Production Planned Start Date

Production Planned Finish Date
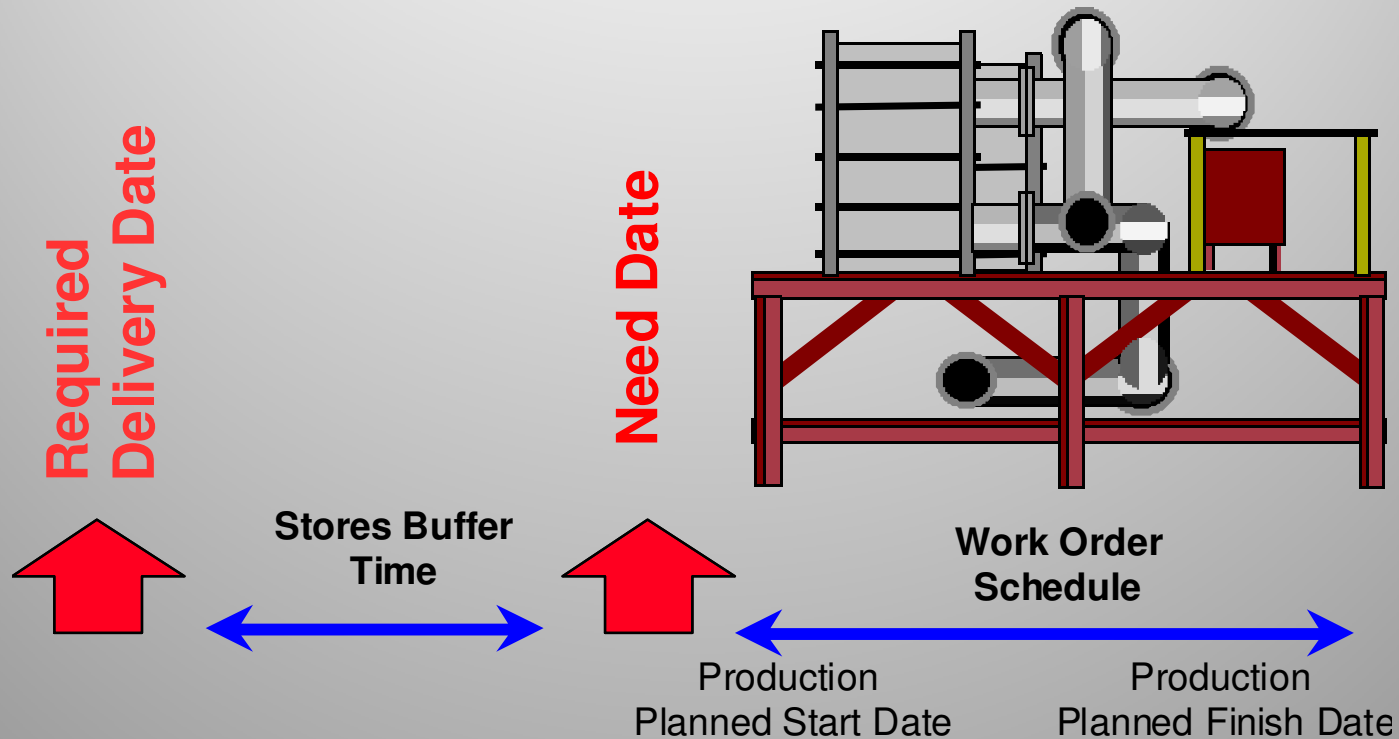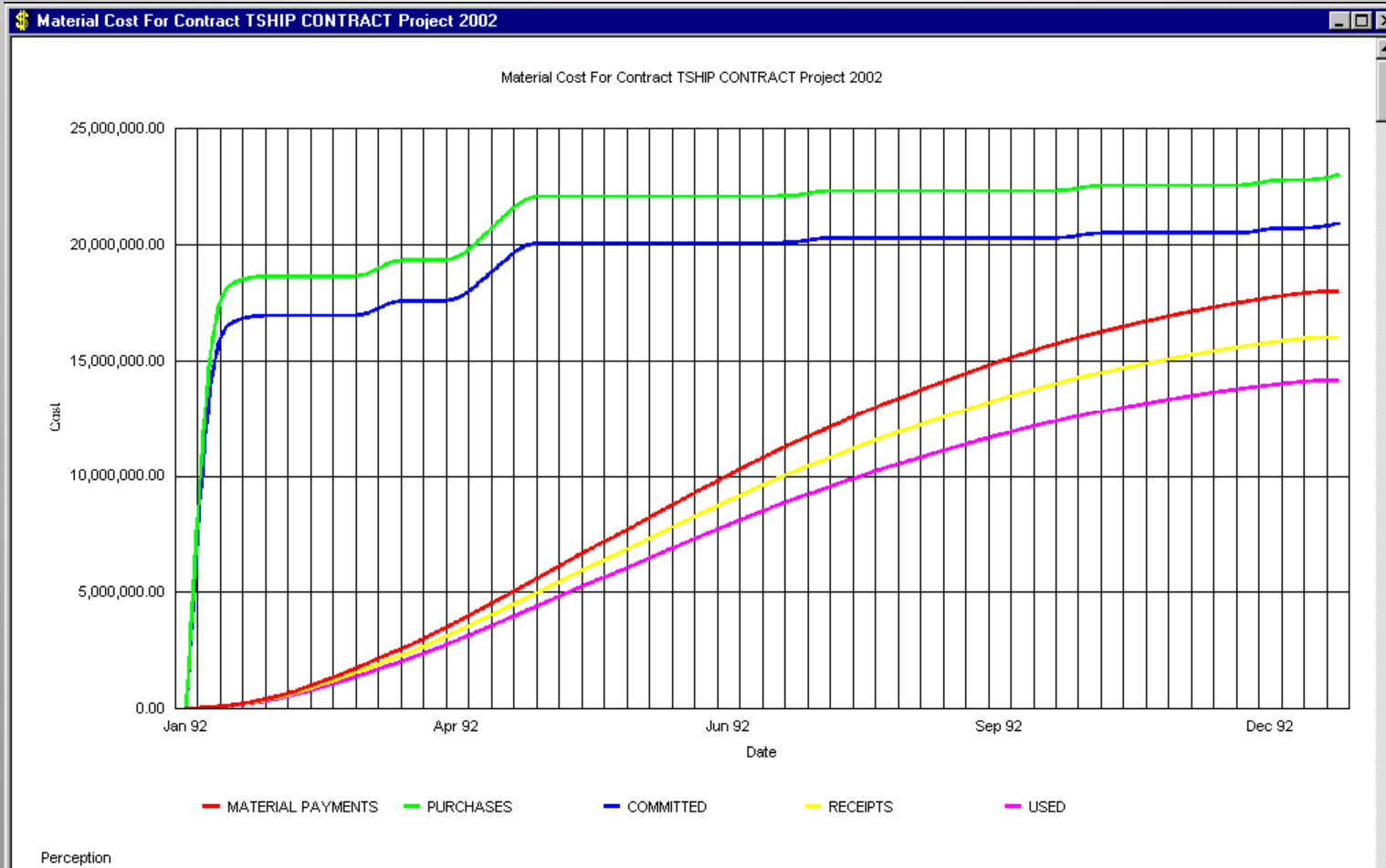
Tracking Material Costs

PERCEPTION supports a <u>Parts Catalog</u> that can be used in the following areas of the system's capabilities:

- **<u>Cost estimating</u> that identifies detail material requirements using Part IDs from the catalog.**

- **<u>Stock inventory control</u>, where stock items are managed in the Parts Catalog.**

- **<u>Standard Direct Purchase Material</u> Items that provide the means for bulk purchasing benefits.**

- **<u>Production pallet planning</u> and management functions using standard parts (stock and/or direct purchase items) from the catalog.**

- **<u>Engineering drawing bills of material</u> using standard parts (stock and/or direct purchase items) from the catalog.**

Storage & Warehouse Controls

• *PERCEPTION* allows real-time tracking of warehouse materials.

• *PERCEPTION* allows same type commodity to be stored in any number of different storage locations.

Vendor Invoice Controls

PERCEPTION provides functions for entering vendor invoices to cross check against purchase order requirements and delivery status information.

The system's accounting interface provides the means to electronically transfer the vendor invoice transactions directly to the shipyard's Accounts Payable system.

Customer Billings

- **Immediate Time & Material Charges**

- **Milestone Progress Billings**

- **Fee-Based Charges**

The system's accounting interface provides the means to electronically transfer the vendor invoice transactions directly to the shipyard's Accounts Receivable system.

PERCEPTION
EVM Cost Tracking & Forecasting Projects

- *PERCEPTION* tracks cost and schedule performance at both detail and summary levels.

- 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

- ❑ **Labor Hours**

- ❑ **Labor Dollars**

- ❑ **Overhead Dollars**

- ❑ **Material Dollars**

- ❑ **Purchased Services**

- ❑ **Total Dollars**

Tracking & Managing Costs and Schedules

❑ **Original Estimated Costs & Schedules**

❑ **Baseline Costs & Schedules**

❑ **Current Plan Costs & Schedules**

❑ **Actual Costs & Schedules**

Tracking & Managing Costs and Schedules

- **By SWBS (Ship Systems)**

- **By PWBS (Ship Zones, Hull Blocks & Assemblies)**

- **By Shipyard Chart of Accounts (Work Centers)**

- **By CLIN (Contract Line Item)**

Each project has a <u>hierarchy</u> of information managed by the system, <u>flowing</u> from lowest level details to the highest level summary.

The "Contract" is the highest project level

The "Project" is the highest operations project level

The WBS is an intermediary hierarchy depending on the project requirements.

Contract

A contract may have <u>multiple</u> projects (par.ex. multiple ship programs).

Project

WBS   WBS   WBS

WBS   WBS

Cost Items   Material Requisitions   Work Orders
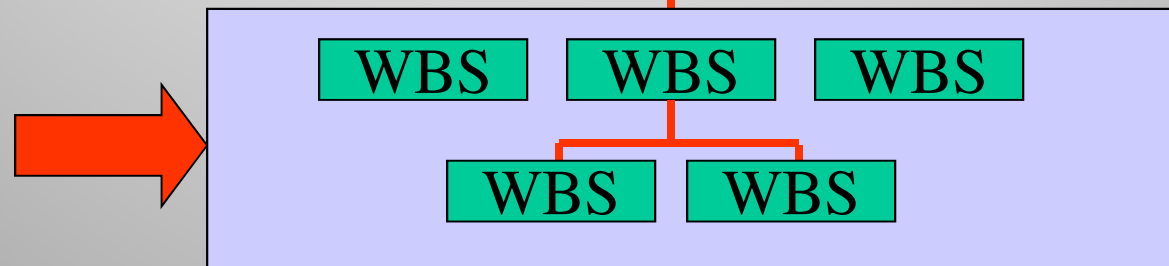
Cost Estimate   Material Resources   Labor Resources

The lowest level of project information

Project documents & transactions can reference one or more different work breakdown structures.
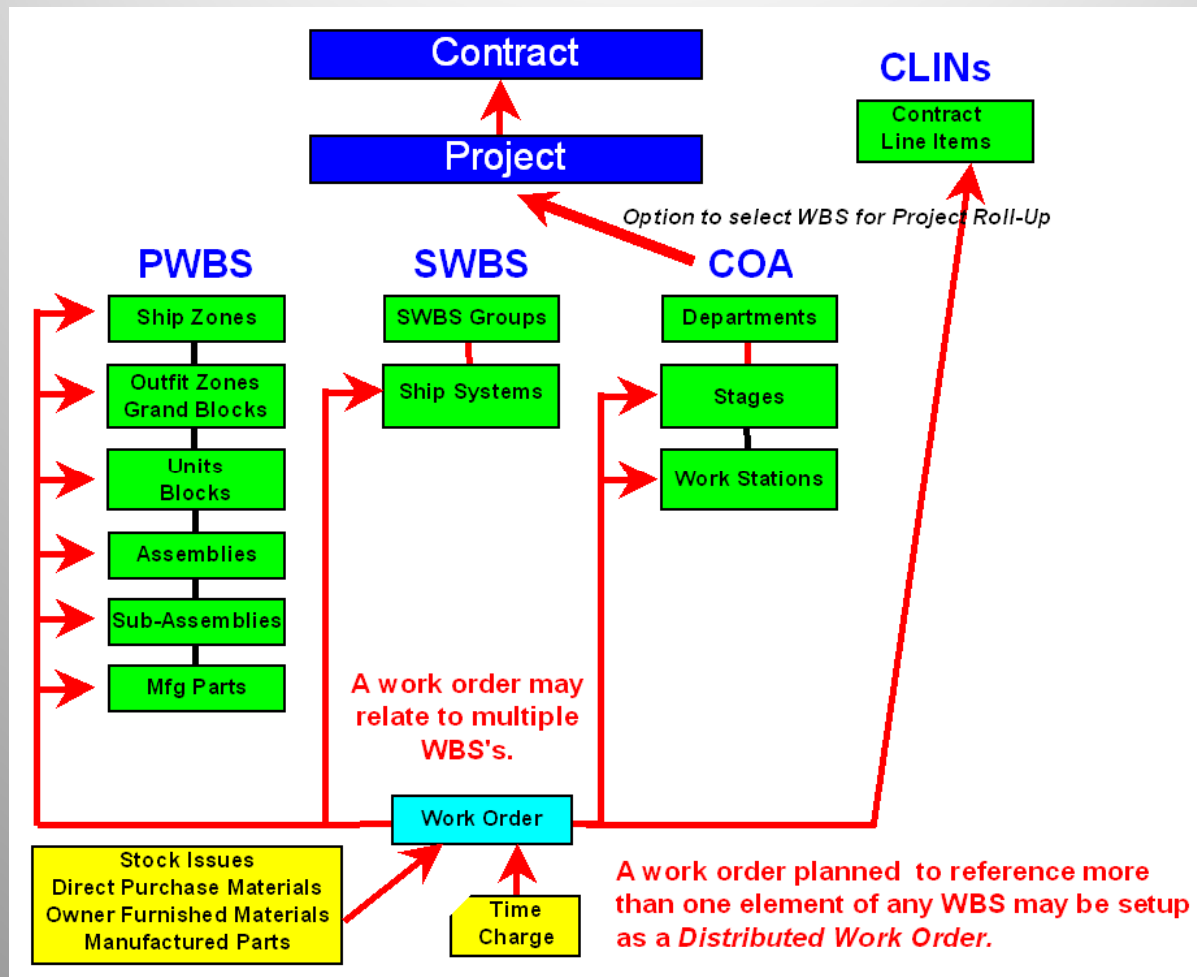
Multi-Ship Program Management Cost & Schedule Consolidation
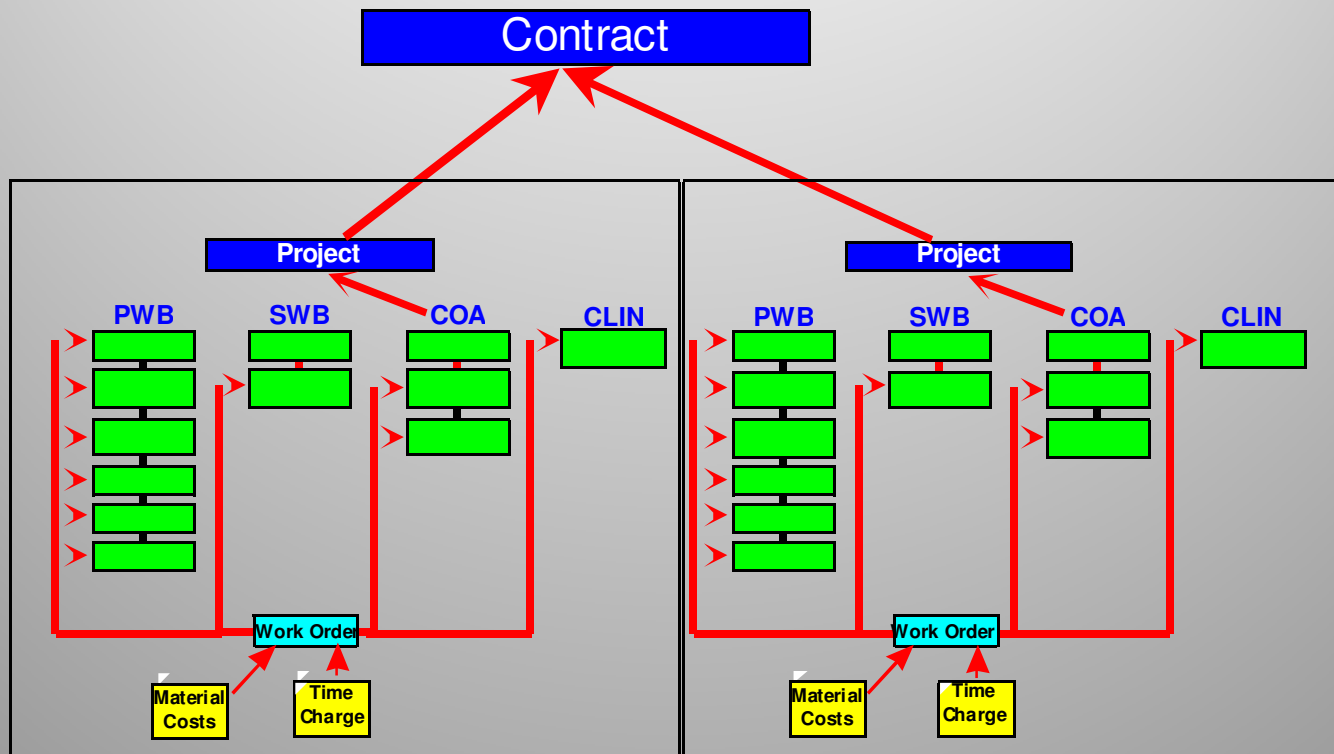
Tracking & Managing Costs and Schedules

- **BAC: Budget At Completion**

- **MR: Management Reserves**

- **BCWS: Budgeted Cost of Work Scheduled**

- **BCWP: Budgeted Cost of Work Performed (aka Earned Value)**

- **ACWP: Actual Cost of Work Performed**

- **EAC: Estimated Cost At Completion**

- **EAC Trend for 100% Progress**

- **Planned, Actual, & Manual Progress**

- **Estimated & Trend Completion Schedule**

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**

Sample Graphic Reports
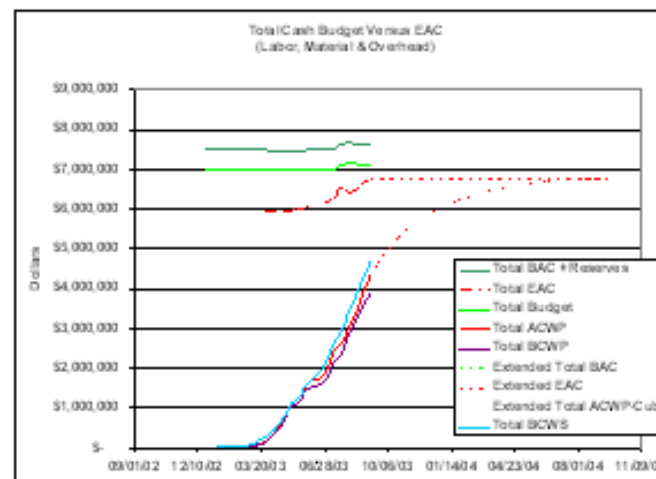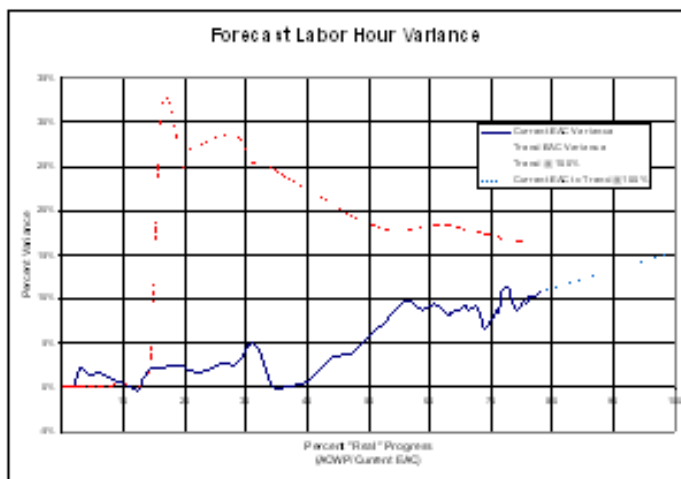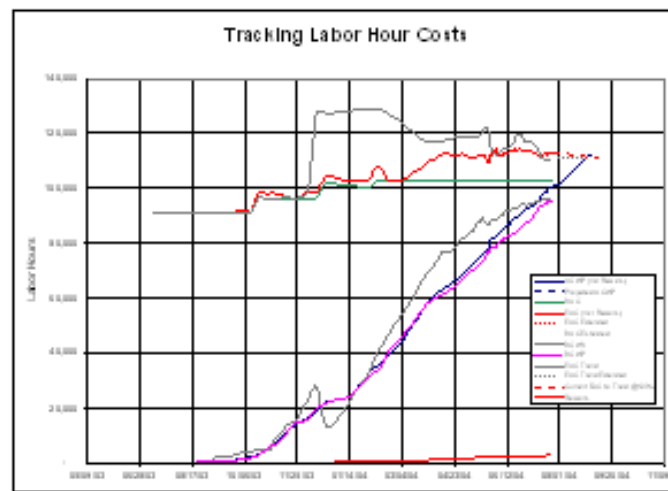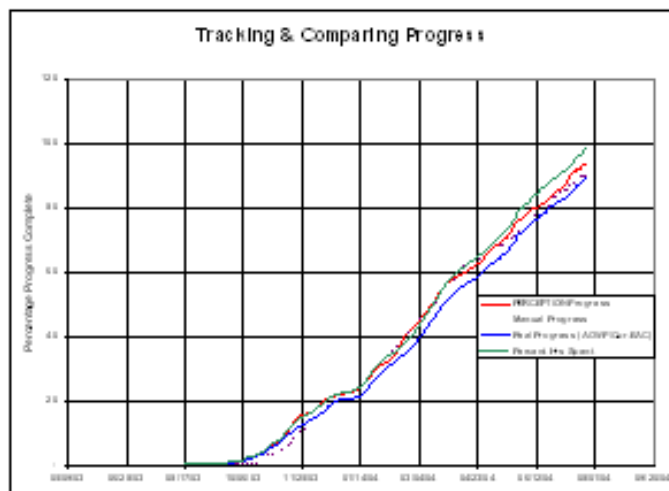
Many Reporting Formats
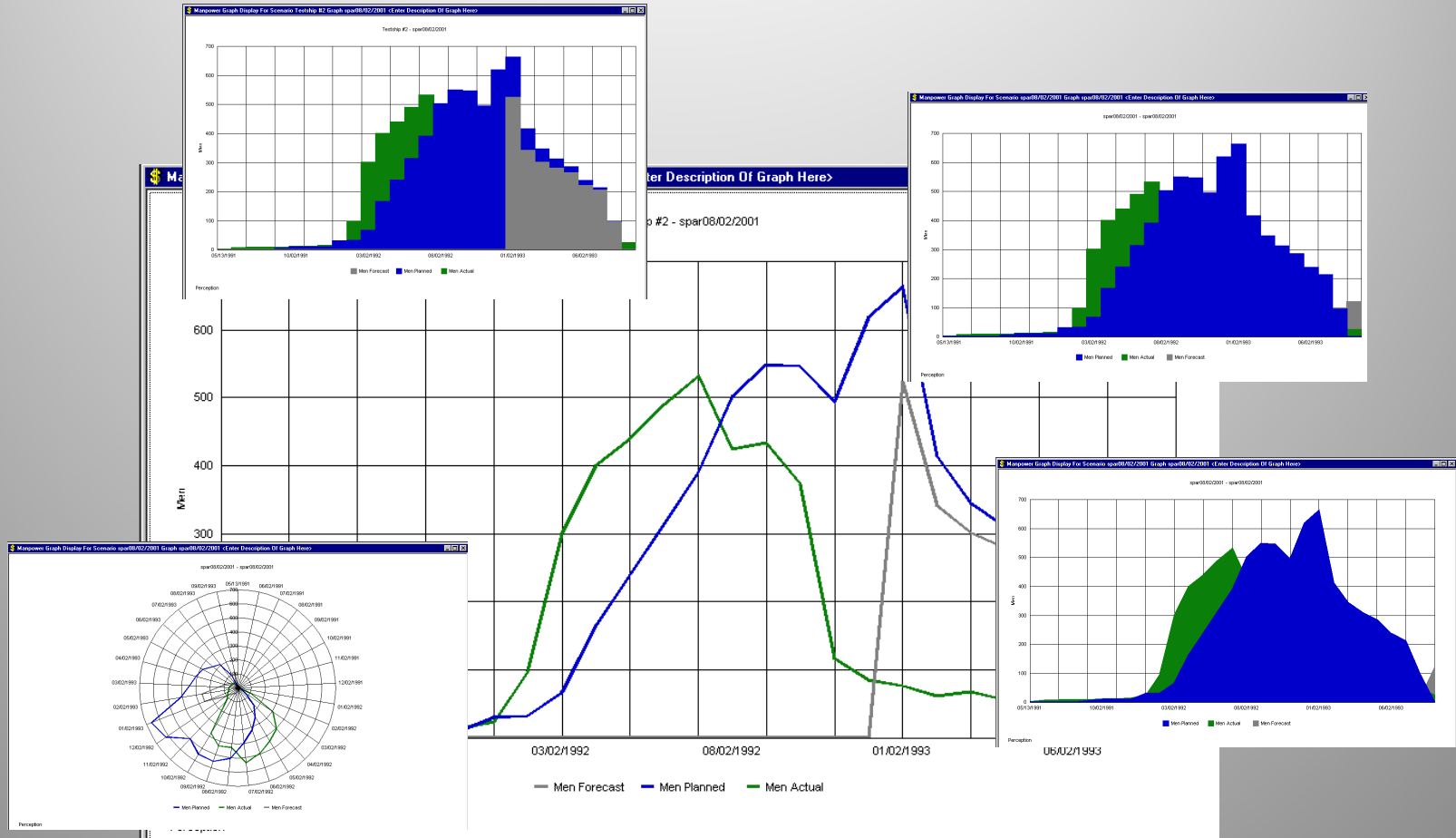
SWBS Summary Progress Reports Available At Group and Account Levels.

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(Date format: MM/DD/YYYY)

SPAR Associates, Inc.

SWBS Group Progress Report (PROG02)

Contract TSHIP CONTRACT - T-SHIP Series Contract

Project: 0 to ZZZZZZZZ   Group: 0 to ZZZZZZZZ

Group	Description	Percent Progress Planned	Percent Progress Actual	Ahead	Weeks Ahead	BCWS	BCWP	Actual Hours	Schedule Ahead	Budget	EAC	ETC	Savings
Project 2002	Effective Date: 01/14/1993	Severn Bulk Carrier (work orders)											
		68.66	68.04	-0.62	-0.33	698,984	692,646	660,706	-6,338	1,017,998	984,817	324,111	33,181
0	STEELWORK	90.85	95.36	4.51	3.65	431,102	452,518	450,719	21,416	474,528	474,895	24,176	-367
1	ACCOMODATIONS OUTFIT	16.55	26.00	9.45	4.70	9,138	14,358	16,020	5,221	55,222	58,120	42,100	-2,898
2	CARGO SYSTEMS OUTFIT	56.66	64.47	7.81	1.58	31,964	36,370	26,925	4,406	56,418	44,712	17,787	11,706
3	MECHANICAL SYSTEMS OUTFIT	38.56	32.92	-5.64	-1.47	31,921	27,265	20,641	-4,656	82,784	73,453	52,812	9,331
4	PIPING SYSTEMS	55.66	48.02	-7.64	-3.40	45,891	39,601	26,504	-6,290	82,450	62,160	35,656	20,290
5	MACHINERY SYSTEMS	54.17	39.12	-15.05	-6.11	15,112	10,913	7,712	-4,199	27,899	23,832	16,120	4,067
6	ELECTRICAL SYSTEMS	38.33	8.95	-29.38	-9.20	22,242	5,195	4,821	-17,047	58,027	55,591	50,770	2,436
7	PRODUCTION SERVICES	57.24	62.95	5.71	3.99	73,617	80,951	81,089	7,334	128,601	131,270	50,181	-2,669
8	OWNER CHANGES	55.12	16.71	-38.41	-25.13	13,485	4,089	4,282	-9,396	24,466	32,702	28,420	-8,236
9	DESIGN & DRAWING	88.80	77.66	-11.14	-8.93	24,512	21,436	21,993	-3,076	27,603	28,084	6,091	-481
	Group Totals for Project - 2002	68.66	68.04	-0.62	0.62	698,984	692,695	660,706	-6,289	1,017,998	984,817	324,111	33,181

Critical Information: Weeks Ahead (or behind), Scheduled Hours Ahead (or behind) & Labor Hours EAC

Labor Hours

Contract: 1999-01 to WBS-Various
Project: 2002 to 2002
Work Center: 0 to ZZZZZZZZ

Work Center	Description	Percent Progress		Weeks Ahead	% Diff	Current Labor Hours				Final Hours			
		Planned	Actual			BCWS	BCWP	Actual Hours	Schedule Ahead	Budget	EAC	ETC	Savings
T01	Steel Fabrication	100.00	88.96	-746	-11.04	66,936	59,546	61,253	-7,390	66,936	68,851	7,598	-1,915
T02	Steel Assembly	100.00	100.00	8	0.00	198,324	198,324	199,069	0	198,324	199,069	0	-745
T03	Steel Erection	100.00	98.88	-753	-1.12	64,799	64,073	56,093	-726	64,799	56,728	635	8,071
T04	Steel Weldout	100.00	94.29	-759	-5.71	93,817	88,460	98,253	-5,357	93,817	104,201	5,948	-10,384
T05	Mould Loft	100.00	100.00	17	0.00	13,802	13,802	11,420	0	13,802	11,420	0	2,382
T06	Material Control	100.00	71.46	-758	-28.54	28,981	20,710	19,874	-8,271	28,981	27,811	7,937	1,170
T07	Planning and Control	100.00	75.82	-758	-24.18	19,327	14,654	13,816	-4,673	19,328	18,222	4,406	1,106
T09	Drawing Office	100.00	79.68	-781	-20.32	37,603	31,994	31,993	-5,609	37,603	37,603	5,610	0
T10	Production Services											,775	-3,366
T11	Carpenter's Shop											,462	333
T15	Miscellaneous											,661	2,007
T21	Joiner Shop											,511	-1,826
T22	Rigging Shop	100.00	72.77	-759	-27.23	21,515	15,656	10,724	-5,859	21,515	14,738	4,014	6,777
T23	Outfit Shop	100.00	55.26	-765	-44.74	28,606	15,808	14,627	-12,798	28,606	26,470	11,843	2,136
T24	Pipe Shop	100.00	62.31	-766	-37.69	42,939	26,755	26,504	-16,184	42,939	42,534	16,030	405
T25	Machine Shop	100.00	62.02	-765	-37.98	12,023	7,457	7,712	-4,566	12,023	12,435	4,723	-412
T26	Electrical Shop	100.00	25.84	-770	-74.16	18,660	4,822	4,821	-13,838	18,660	18,660	13,839	0
T31	On-Board Joinerwork											,201	-3,684
T32	On-Board Rigging											,494	6,208
T33	On-Board Outfit											,355	7,810
T34	On-Board Pipework											,115	13,396
T35	On-Board Electrical											,885	3,991
T36	Maintenance	100.00	3.54	-783	-96.46	39,367	1,394	0	-37,973	39,367	37,972	37,972	1,395
	Report Totals	100.00	68.40	-603	-31.60	,014,390	693,895	660,525	-320,495	1,014,393	979,538	319,013	34,855

Summary Progress Reports by Production Work Centers

Know what production process cost & schedule needs management attention

Chesapeake Marine
PWBS Zone Progress Report (PROG04)
ct TSHIP CONTRACT - T-SHIP Series Contract - Production Demo

Project: 2002 to 2002 Zone: 0 to ZZZZZZZZ

Zone		Percent Progress		Weeks		Current Labor Hours				Final Hours			
		Planned	Actual	Ahead	Ahead	BCWS	BCWP	Actual Hours	Schedule Ahead	Budget	EAC	ETC	Savings
Project 2002	Effective Date: 01/05/1993	Severn Bulk Carriers (Detail Work Orders)											
	Default WBS - SWBS Project Totals:	65.37	67.93	2.56	1.38	663,105	689,077	660,525	25,972	1,014,393	984,555	324,030	29,838
A	Tank Top Midships	100.00	100.00	0.00	0.00	29,184	29,184	33,004	0	29,184	33,004	0	-3,820
B	Lower Side Tanks Midships	100.00	100.00	0.00	0.00	52,132	52,132	56,825	0	52,132	56,825	0	-4,693
C	Upper Side Tanks Midships	92.67	99.00	6.33	13.86	56,006	59,829	58,519	3,823	60,433	58,918	399	1,515
D	Spar Deck Tween Hatch	100.00	100.00	0.00	0.00	18,380	18,380	12,669	0	18,380	12,669	0	5,711
E	Screen Bhds	89.55	98.84	9.29	16.00	15,644	17,267	14,928	1,624	17,470	15,104	176	2,366
F	Aft Peak Units	90.59	96.10	5.51	2.00	17,591	18,661	17,640	1,070	19,418	18,355	715	1,063
G	Fore Peak Units	65.09	96.46	31.37	14.43	25,673	38,044	36,426	12,371	39,440	37,763	1,337	1,677
H	Cross Tanks	100.00	100.00	0.00	0.00	11,743	11,743	11,672	0	11,743	11,672	0	71
I	Shedder Plates											205	170
J	Hoppers											46	2,005
K	Machinery Deck											0	-19
L	Main Deck & Engine Room Bhd											0	-684
M	Loop Belt Unit											0	-406
N	Deckhouses & Funnel											,278	350
P	Aft Shell Units	92.91	99.00	6.09	8.14	15,199	16,195	17,886	997	16,359	17,992	106	-1,633
R	Engine Room Tank Top	100.00	100.00	0.00	0.00	6,788	6,788	8,296	0	6,788	8,296	0	-1,508
S	Tank Top Fwd E Aft	100.00	100.00	0.00	0.00	10,004	10,004	10,555	0	10,004	10,555	0	-551
T	Lower Side Tanks Fwd & Aft	100.00	100.00	0.00	0.00	21,507	21,507	26,709	0	21,507	26,709	0	-5,202
U	Upper Side Tanks Fwd & Aft	63.76	93.81	30.05	5.43	10,855	15,970	17,882	5,115	17,024	19,062	1,180	-2,038
00	Misc. Ship-Wide	37.68	45.58	7.90	1.86	18,983	22,963	15,977	3,980	50,379	40,632	24,655	9,747
10	Stern <Aft Peak>	88.90	86.82	-2.08	-1.14	5,376	5,251	4,838	-126	6,048	5,573	735	475
13	Aft Peak	93.14	96.84	3.70	2.14	1,919	1,995	1,355	76	2,060	1,399	44	661
20	Engine Room	36.79	32.66	-4.13	-4.00	7,867	6,985	6,394	-883	21,386	19,579	13,185	1,807
21	Engine Room Below Floor Plates	100.00	100.00	0.00	0.00	4,211	4,211	4,394	0	4,211	4,394	0	-183
22	Engine Room Above Floor Plates	53.09	48.10	-4.99	-2.86	17,686	16,024	13,279	-1,662	33,314	27,608	14,329	5,706
23	Engine Room M:												
24	Engine Room M:												
25	Engine Room Co												
26	H.F.O. Tank												
27	Engine Room Ca												
28	Funnel												
29	Main Control Room	2.56	11.27	8.71	0.86	9	39	39	30	346	346	307	0
40	Sea Lift Cargo Deck	45.49	49.33	3.84	1.86	3,052	3,310	3,065	258	6,710	6,213	3,148	497

Summary Progress Reports by Production Modules & Ship Zones

Know what ship zone/production interim product costs & schedule needs management attention

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WORK-PAC Trade Progress Report (PROG15)

Labor Hours

Contract: 1999-01 to WBS-Various
Project: 2002 to 2002
Trade: 0 to ZZZZZZZZ

Trade	Description	Percent Progress		Weeks Ahead	% Diff	Current Labor Hours				Final Hours			
		Planned	Actual			BCWS	BCWP	Actual Hours	Schedule Ahead	Budget	EAC	ETC	Savings
T01	AIR TOOL ROOM	50.08	38.01	-9	-12.07	1,976	1,499	1,389	-476	3,945	3,654	2,265	291
T02	BLACKSMITHS	100.00	66.91	-11	-33.09	1,963	1,313	1,145	-650	1,963	1,711	566	252
T04	BURNERS	100.00	91.05	-22	-8.95	53,160	48,402	48,934	-4,758	53,160	53,745	4,811	-585
T05	CARPENTERS - SHIP	100.00	91.28	-14	-8.72	40,172	36,669	31,417	-3,503	40,172	34,417	3,000	5,755
T06	CHIPPERS/CAULKERS	100.00	86.26	-22	-13.74	14,267	12,307	7,988	-1,960	14,267	9,260	1,272	5,007
T07	CRANEMEN	100.00	72.51	-14	-27.49	20,793	15,077	16,788	-5,716	20,793	23,151	6,363	-2,358
T08	DRILLERS/REAMERS	51.12	36.43	-4	-14.69	358	255	215	-103	700	643	428	57
T09	ELECTRICIANS	62.47	39.27	-9	-23.20	16,824	10,575	9,691	-6,249	26,929	24,678	14,987	2,251
T10	FITTERS	100.00	97.01	-33	-2.99	71,509	69,371	66,572	-2,138	71,509	68,621	2,049	2,888
T11	FURNACEMEN - SLAB	100.00	100.00	8	0.00	1,415	1,415	1,279	0	1,415	1,279	0	136
T12	JOINERS	22.89	20.83	-1	-2.06	7,980	7,263	8,016	-718	34,866	38,485	30,469	-3,619
T13	LABOURERS	53.49									,368		-6,516
T14	MACHINISTS	100.00									,730		778
T15	MOULD LOFT	100.00									1		2,395
T16	PAINTERS	64.64									,556		694
T17	PIPE FITTERS	86.29									,986		1,368
T18	PLUMBERS	43.13	32.75	-3	-10.38	6,231	4,731	4,732	-1,499	14,447	14,447	9,715	0
T20	PUNCH SHED	100.00	93.45	-20	-6.55	12,142	11,347	10,044	-795	12,142	10,748	704	1,394
T21	RIGGERS	100.00	75.87	-24	-24.13	32,745	24,844	20,574	-7,901	32,745	27,116	6,542	5,629
T22	SHEET METAL WORKERS	26.64	57.19	9	30.55	3,084	6,619	5,653	3,535	11,573	9,884	4,231	1,689
T23	STAGE BUILDERS	84.81	55.91	-9	-28.90	19,488	12,846	15,148	-6,641	22,977	27,093	11,945	-4,116
T24	STOCKYARD - S												,514
T25	STORESMEN												,247
T26	NIGHT MANAGE												,092
T28	WELDERS - ELE												,921
T29	NIGHT FOREME												0
T30	PREPARATION FITTER	100.00	97.33	-22	-2.67	17,692	17,220	17,263	-472	17,692	17,736	473	-44
T31	ON-BOARD PIPE WORKERS	100.00	81.74	-15	-18.26	41,584	33,991	29,280	-7,593	41,584	35,822	6,542	5,762
T32	ON-BOARD STEEL OUTFITTERS	48.51	54.13	1	5.62	8,893	9,924	8,534	1,031	18,333	15,765	7,231	2,568
T33	ON-BOARD ELECTRICIANS	100.00	100.00	12	0.00	654	654	1,188	0	654	1,188	0	-534
T34	ON-BOARD SHEET METAL WORKERS	89.99	79.66	-8	-10.33	24,846	21,994	21,993	-2,852	27,610	27,610	5,617	0
T35	ON-BOARD JOINERWORKERS	100.00	57.06	-21	-42.94	16,568	9,454	9,793	-7,114	16,568	17,163	7,370	-595
T36	QUALITY CONTROL	100.00	75.71	-19	-24.29	6,900	5,224	4,023	-1,676	6,900	5,314	1,291	1,587
T37	WELDERS - TACKING	0.00	100.00	8	100.00	0	0	0	0	0	0	0	0
	Report Totals	89.24	77.09	-402	-12.15	775,763	670,140	656,486	-105,623	869,313	857,278	200,792	12,035

Summary Progress Reports by Shipyard Trade/Craft

Know what production trade cost & schedule needs management attention

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Comparing Production Costs with Estimate

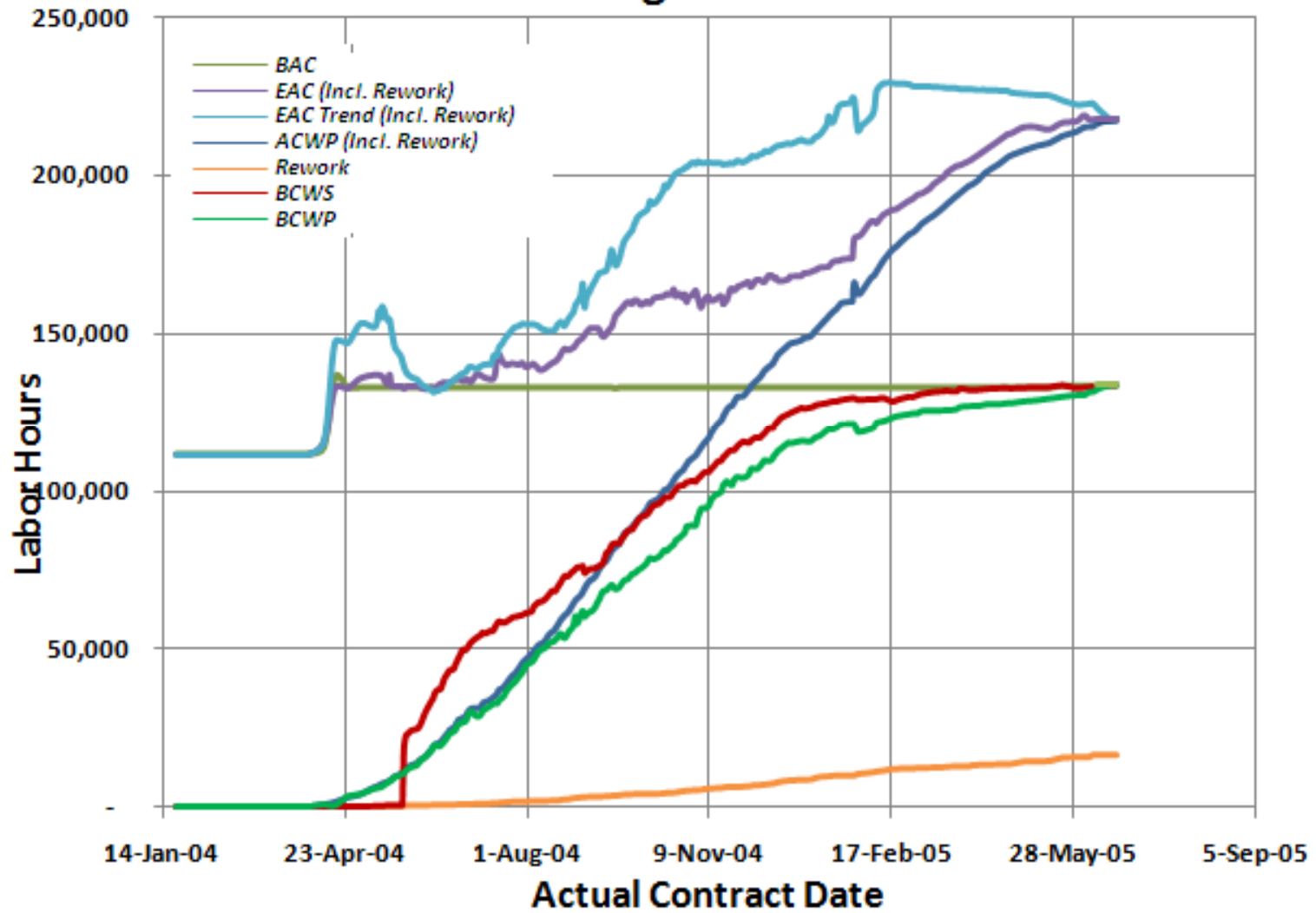**SPAR Associates, Inc.**

(Date format: MM/DD/YYYY)

SWBS Group - Estimate vs Production Labor/Material Status Report (EvsP02)
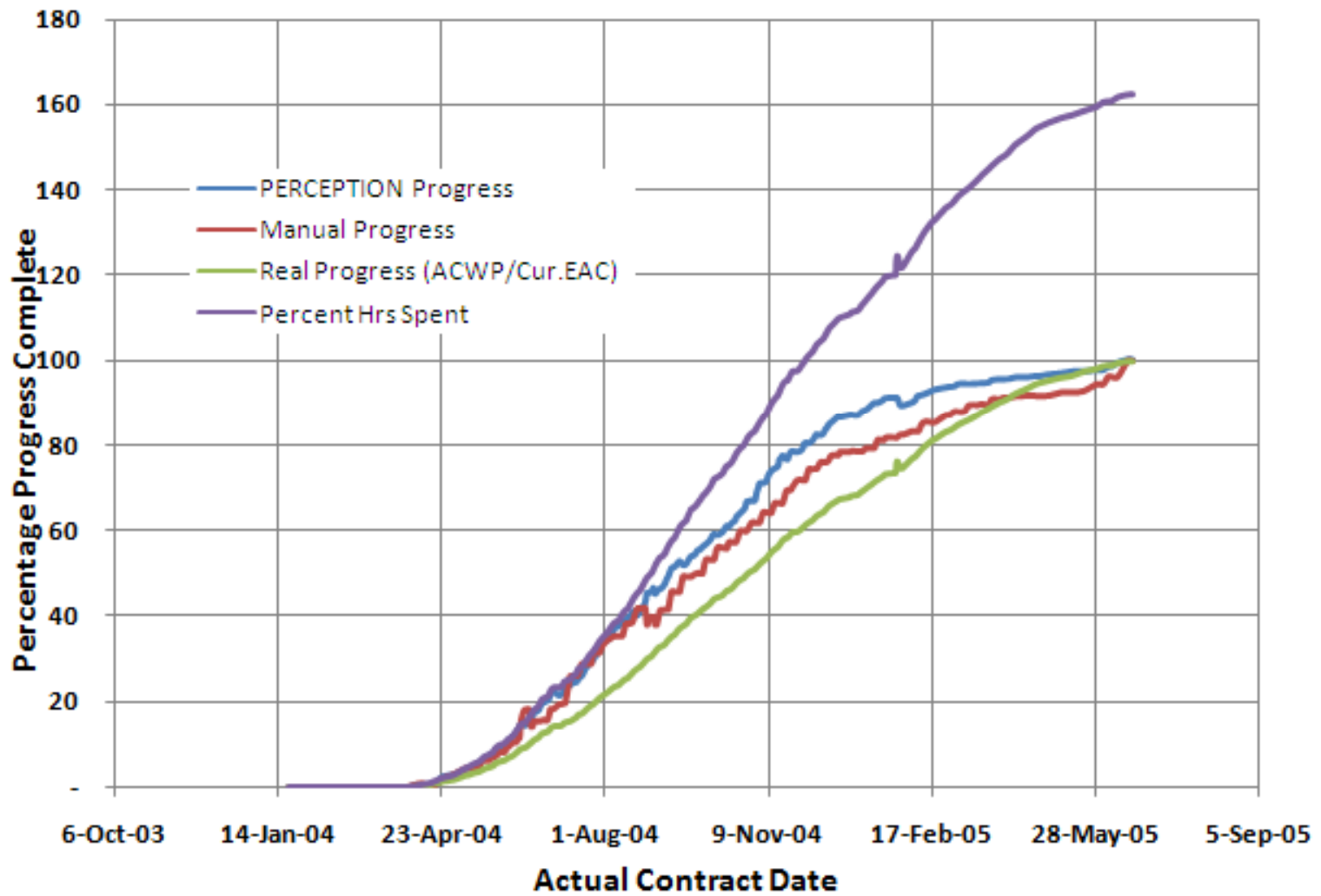
Contract TSHIP CONTRACT - T-SHIP Series Contract

Project Range: 0 to ZZZZZZZZ Group Range: 0 to ZZZZZZZZ

Group	Description	Estimated Hours	Production Budget Hours	Actual Hours	EAC Hours	Estimated Material Cost	Budget Material Cost	Committed Material Cost
Project 2002	Severn Bulk Carrier (work orders)	1,106,520	1,017,998	660,706	984,817	32,080,543	29,193,294	25,982,032
0	STEELWORK	515,791	474,528	450,719	474,895	17,150,061	15,606,555	13,889,834
1	ACCOMODATIONS OUTFIT	60,024	55,222	16,020	58,120	1,932,770	1,758,821	1,547,103
2	CARGO SYSTEMS OUTFIT	61,324	56,418	26,925	44,712	1,910,240	1,738,318	2,193,595
3	MECHANICAL SYSTEMS OUTFIT	89,983	82,784	20,641	73,453	2,708,477	2,464,714	2,108,533
4	PIPING SYSTEMS	89,620	82,450	26,504	62,160	2,603,448	2,369,138	687,686
5	MACHINERY SYSTEMS	30,325	27,899	7,712	23,832	849,100	772,681	1,376,678
6	ELECTRICAL SYSTEMS	63,073	58,027	4,821	55,591	1,699,813	1,546,830	1,981,189
7	PRODUCTION SERVICES	139,784	128,601	81,089	131,270	2,446,215	2,226,055	376,916
8	OWNER CHANGES	26,593	24,466	4,282	32,702	465,386	423,501	255,146
9	DESIGN & DRAWING	30,003	27,603	21,993	28,084	315,034	286,681	1,565,350
	Grand Total	**1,106,520**	**1,017,998**	**660,706**	**984,817**	**32,080,543**	**29,193,294**	**25,982,032**

Tracking Labor Hour Costs

Legend:
- BAC
- EAC (Incl. Rework)
- EAC Trend (Incl. Rework)
- ACWP (Incl. Rework)
- Rework
- BCWS
- BCWP

Y-axis: Labor Hours (250,000 / 200,000 / 150,000 / 100,000 / 50,000 / -)

X-axis: Actual Contract Date (14-Jan-04, 23-Apr-04, 1-Aug-04, 9-Nov-04, 17-Feb-05, 28-May-05, 5-Sep-05)

Tracking & Comparing Progress

Tracking Various Labor Hour EACs

Legend:
- BAC
- CPI EAC
- SPI EAC
- SCI EAC
- SPAR Trend EAC
- SPAR EAC
- Manual Progress EAC

Y-axis: Labor Hours

X-axis: % Real Progress (ACWP/Current EAC)

Reporting Schedule Variances

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(Date format: MM/DD/YYYY)

SPAR Associates, Inc.
Work Order Listing Report (WO04)
Project/SWBS Account/WC/WO Sort
:t TSHIP CONTRACT - T11

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(Date format: MM/DD/YYYY)

SPAR Associates, Inc.
Work Order Listing Report (WO05)
Project/Zone/Planned Start Sort
:t TSHIP CONTRACT - T32

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Center	Work Order	Heading		Unit	Acct	Auth	Planned Start	Planned Finish	Actual Start	Actual Finish	Sta	Budget Hours	Actual Hours	Over Run	Premium Hours	After Close	Rework Hours	% Prog
																	0	100.00
																	0	100.00
																	0	100.00
																	0	100.00
																	0	100.00
																	0	100.00
Project 2002		Effective Date:	01/14/1993	Severn Bulk Carrier (work orders)													0	0.00
Zone 00		MISC TOTAL SHIP															0	0.00
T32	24600	FABRICATE RIGGING		246	N	12/23/1992	02/02/1993	06/19/1992	00/00/0000	*	384	75.00		0	0	0	0.00
T36	60300	UNLOAD MCC CONNECT		603	N	12/23/1992	07/26/1993	00/00/0000	00/00/0000	LS	373	0.00		0	0	0	0.00
T23	30413	31-40 BBOARDS+TIMBER		304	N	01/05/1993	02/02/1993	09/23/1992	10/02/1992	C	497	490.00		0	0	0	100.00
T33	30422	WAY 21-30 TOP PACKED		304	N	01/05/1993	01/26/1993	07/21/1992	09/10/1992	C	277	285.00 *		0	0	0	100.00
T33	30442	CLEAR BERTH + HULL		304	N	01/05/1993	02/17/1993	00/00/0000	00/00/0000	LS	3,451	0.00		35	0	0	0.00
T33	31900	WT + OIL TIGHT DOORS		319	N	01/05/1993	05/14/1993	00/00/0000	00/00/0000	LS	111	0.00		0	0	0	0.00
T36	60600	FAB NAVAID FITTINGS		606	N	01/05/1993	02/09/1993	00/00/0000	00/00/0000	LS	870	0.00		0	0	0	0.00
T23	30423	WAY 31-40 TOP PACKED		304	N	01/12/1993	02/02/1993	10/02/1992	10/09/1992	C	277	260.00		0	0	0	100.00
T33	30404	WAY 41-50 SET+PACKED		304	N	01/12/1993	02/09/1993	10/01/1992	10/30/1992	C	456	370.00		13	0	0	100.00
T33	30414	41-50 BBOARDS+TIMBER		304	N	01/12/1993	02/09/1993	08/20/1992	10/30/1992	C	497	328.00		11	0	0	100.00
T33	30436	JACKING SHORES+LUGS		304	N	01/12/1993	02/02/1993	00/00/0000	00/00/0000	LS	324	0.00		0	0	0	0.00
T33	30438	ROPE + STRAP TIMBERS		304	N	01/12/1993	02/02/1993	07/06/1992	11/06/1992	C	787	0.00		8	0	0	100.00
T33	30440	18 DRAG CHAINS+BOXES		304	N	01/12/1993	02/17/1993	00/00/0000	00/00/0000	LS	1,628	0.00		34	0	0	0.00
T36	60200	MASTS CABLING		602	N	01/12/1993	04/21/1993	00/00/0000	00/00/0000	LS	180	0.00		0	0	0	0.00
T31	16790	SIDELIGHTS SHOPWORK		167	N	01/20/1993	06/22/1993	08/12/1992	00/00/0000	*	152	41.00		0	0	0	0.00
T33	30424	WAY 41-50 TOP PACKED		304	N	01/20/1993	02/09/1993	10/12/1992	10/30/1992	C	277	147.00		0	0	0	100.00

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Tracking Performance Costs & Status On-Line

$ Project Details Information

| Details | Material Status | Totals | Indexes | Variances | Notes | Baseline | Options | Milestones | Characteristics |

Contract: TSHIP CONTRACT
Description: Severn Bulk Carriers (Detail Work Orders)
Project: 2002

Effective Date: 01/14/1993

	Budgeted Cost of Work Scheduled	Budgeted Cost of Work Performed	Actual Cost of Work Performed	Budgeted Cost	Estimated at Completion	Reserves
Man-Hours:	693,209	689,077	660,525	1,014,393	984,555	100000.00
Rate/Hour:	17.30		16.27		16.16	
Labor Cost:	11,989,786	11,918,328	10,748,477	17,545,014	15,907,329	1,730,000

	Budget + Reserves	Less EAC	Less Rework	=	Labor Margin	Estimated Remaining Labor	
Man-Hours:	1,114,393	984,555	8,503		121,335	324,030	NOTE: Rework included in ACWP or EAC
Labor Cost:	19,275,014	15,907,329	147,150		3,220,535	5,158,852	

	Start	Finish				
Planned	09/12/1991	09/17/1993	Total Progress	67.93 %	(Closed 58.26 %	In-Process 9.67 %
Actual	05/13/1991	00/00/0000	Total Planned	68.34 %	(Behind -0.41 %	-0.21 weeks)
			Total Manual	58.20 %	Number of Work Packages:	2529
					Budgeted Hours:	1,014,393.00

PERCEPTION System's Integration

CAD Systems

Accounting Systems
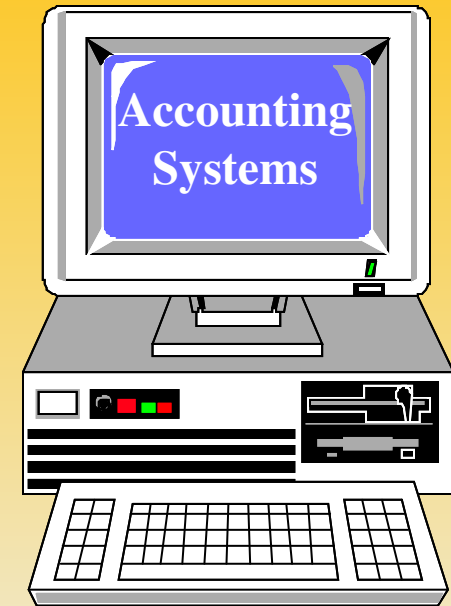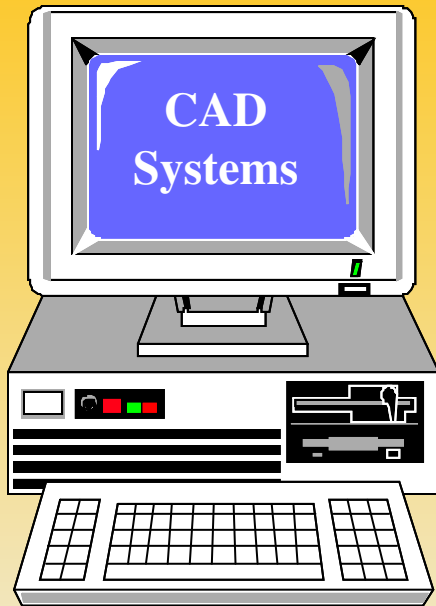
PERCEPTION

Desktop & Internet Products

Volo View Express
Acrobat Assistant
Internet Explorer
Outlook Express

Microsoft Access
Microsoft Excel
Microsoft FrontPage
Microsoft Outlook
Microsoft PowerPoint
Microsoft Word

SPAR
ASSOCIATES, INC.

Interfaces With Accounting Systems

PERCEPTION

System Transactions

- Time Charges
- Purchases
- Stock Usage & Adjustments
- Customer Invoices
- Vendor Invoices

Accounting Systems

Payroll

General Ledger

Accounts Payable

Accounts Receivable

Established Interfaces With Popular Accounting Systems

PERCEPTION

Great Plains

ACC-PAC

Peachtree

Quick Books

Generic Export Transactions for other systems

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***

PERCEPTION Tool Room Management

- **Control Check-out & Returns of Small Tools**

- **Track Tool Usage**

- **Track Tool Repairs**

- **Track Tool Costs & Purchasing Sources**

Miscellaneous PERCEPTION Features

Customizing Display Layouts

PERCEPTION offers a number of features that allows the user to customize the system windows & reports.

Modified Data Window (En español)

Project Details Information for the Estimating Environment

Details | Options | Milestones | Characteristics

La identificación del contrato: R-27

identificación de Proyecto: 270

	El trabajo	la Materia
Las horas	551,752.50	
El costo	5,517,525.00	9,375,711.92
La ganancia	926,944.26	566,058.72
Los Costos Administrativos	993,154.53	738,337.37
El Costo de arriba	2,758,762.50	0.00
El impuesto local	0.00	234,392.92
Los subtotales	10,196,386.29	10,914,500.93

Proyecte la Descripción

Lead ship (Sample Detail Estimate)

La Fecha del comienzo: 00/00/0000

La Fecha del fin: 00/00/0000

El Coste total: 21,110,887.22

El Riesgo mínimo: 21,110,887.22

El Riesgo máximo: 21,110,887.22

Data Window Designer

All columnar worksheets, free-form data windows and most system reports can be edited & customized by the user:

1. Text Headings & Data Field Labels can be modified to suit specific user requirements. This includes using non-English text and Windows-supported non-English alphabetic characters.

2. Un-needed data columns and free-form data fields can be hidden from displayed view.

3. Data Fields re-arranged and re-sized in free-form data windows.

On-Line User Help

On-Line Help is only a click away:

Help is available by section of user manuals and by index reference.
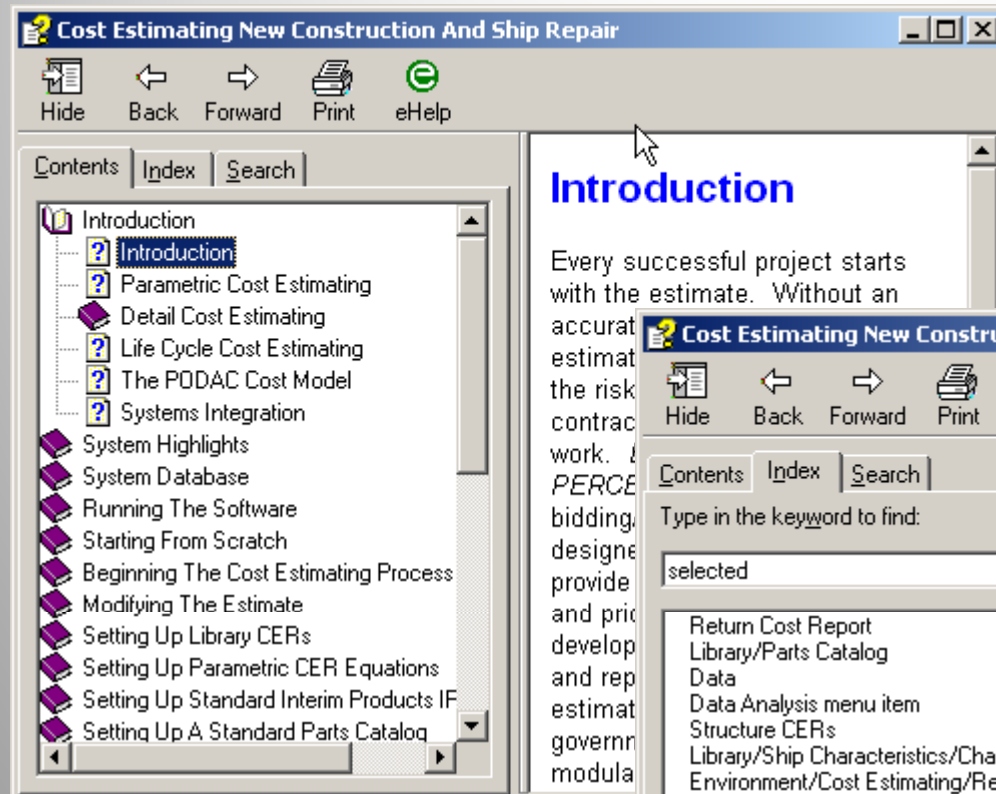
Help also is available by keyword search.
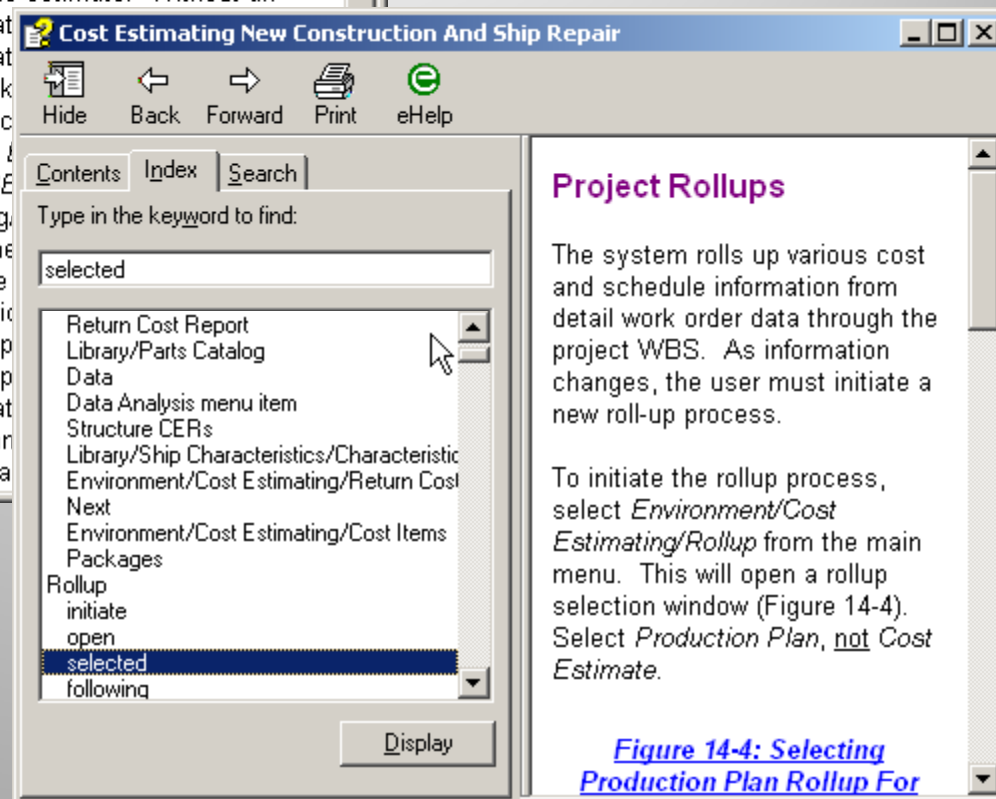
Training Tutorials

PERCEPTION system includes a wide range of training tutorials depending upon the user's specific needs and scope of system functions authorized to use.

These tutorials minimize training and re-training costs. They can be exercised any time for the user's convenience.

Training Tutorials:

PERCEPTION Software

PERCEPTION is a WIN32 application based on PowerBuilder Version 11.51. PowerBuilder is a 4GL software development tool that enables new software development 10-times faster than 3GL tools. PowerBuilder expedites fast & easy interfacing/integrating with other WIN32 and .NET applications.

It is a two-tier Client/Server System which also can be operated over the Internet using a remote central database.

PERCEPTION Database

PERCEPTION uses the SyBase SQL Anywhere database, a powerful RDBMS system which includes a self-tuning query optimizer and dynamic cache sizing features. Unlike other large-scale database systems, these features minimize any database administration functions for the user.
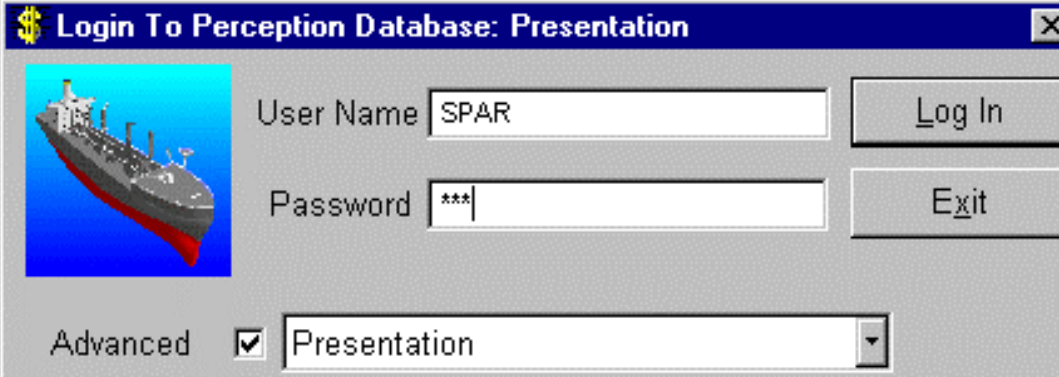
SQL Anywhere can integrate securely and reliably to databases using enterprise-class synchronization. This is the only synchronization technology to link with leading mobile devices, Sybase, Oracle, Microsoft, MySQL and IBM databases in the enterprise.

Sybase, now an SAP company, will be servicing all future SAP software systems.

System Security

All users are required to log into the system with their name and password.

Each user also is formally assigned authorized areas of the software to access and restricted from all others.

SPAR Associates, Inc.

Over 35 Years Providing

- **Shipyard management software**

- **Software development services**

- **Training & maintenance support**

- **Planning & scheduling services**

- **Independent cost estimating services**

- **Management consulting**

Over 35 Years Serving the Shipbuilding & Repair Industry