

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

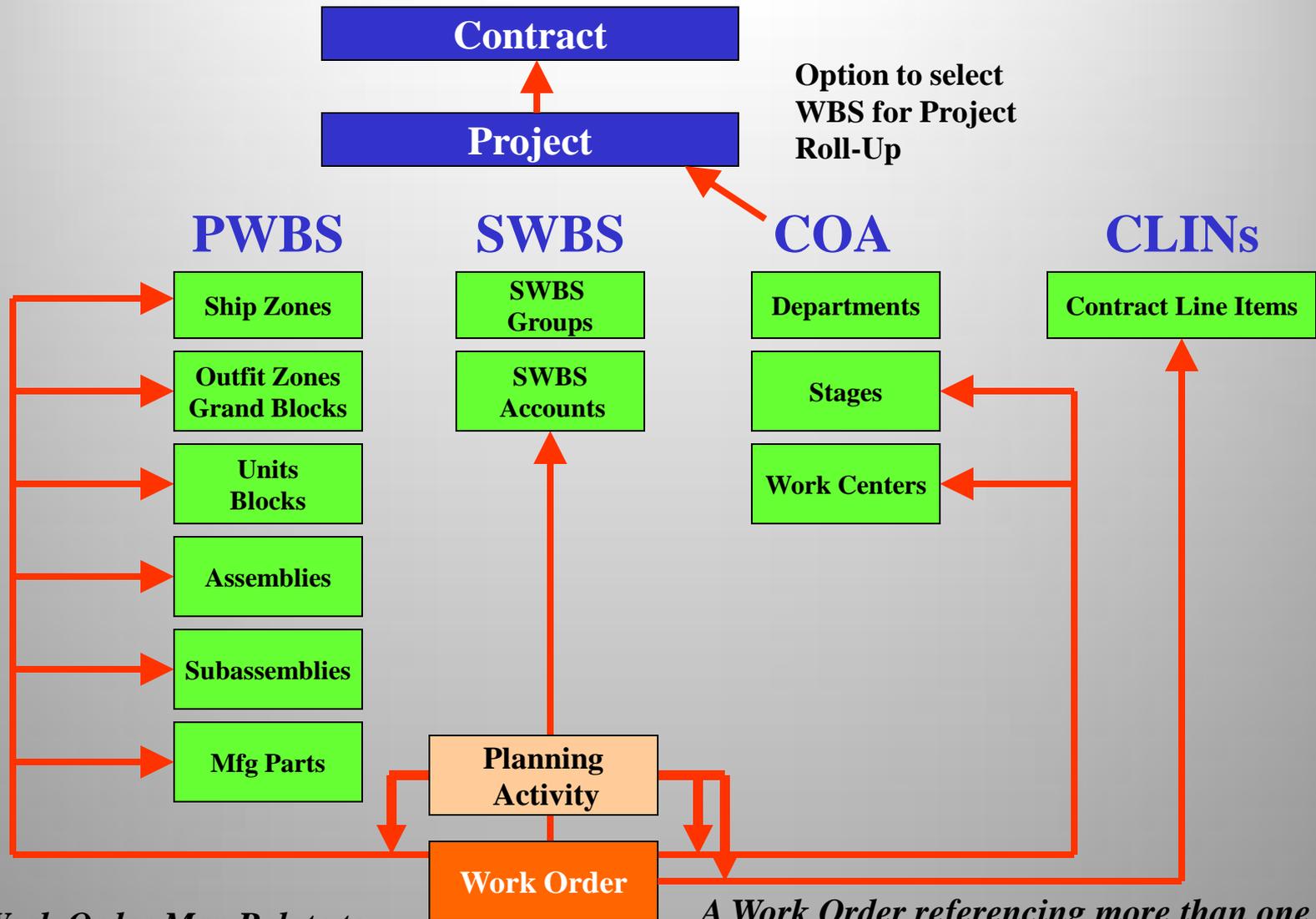
- *PERCEPTION* tracks cost and schedule performance.
- Forecasts are made by the system based upon earned value methods
- Trends are developed by the system to provide management with improved visibility of changes to contract performance.



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.



Contract

Project

PWBS

SWBS

COA

CLINs

Ship Zones

SWBS Groups

Departments

Contract Line Items

Outfit Zones
Grand Blocks

SWBS Accounts

Stages

Units
Blocks

Work Centers

Assemblies

Subassemblies

Mfg Parts

Planning Activity

Work Order

Pallet

Pallet

Requisition

- 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

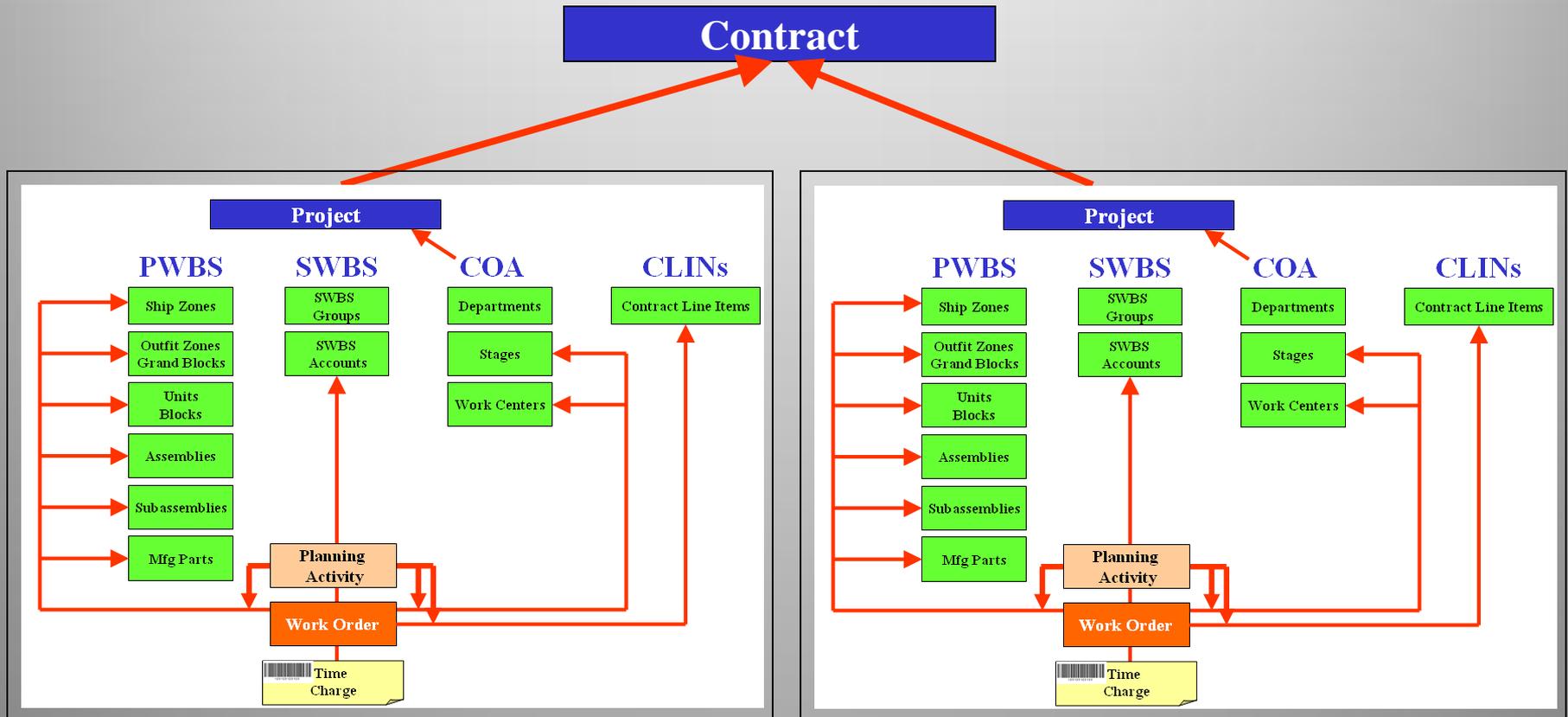


Tracking & Managing Costs and Schedules:

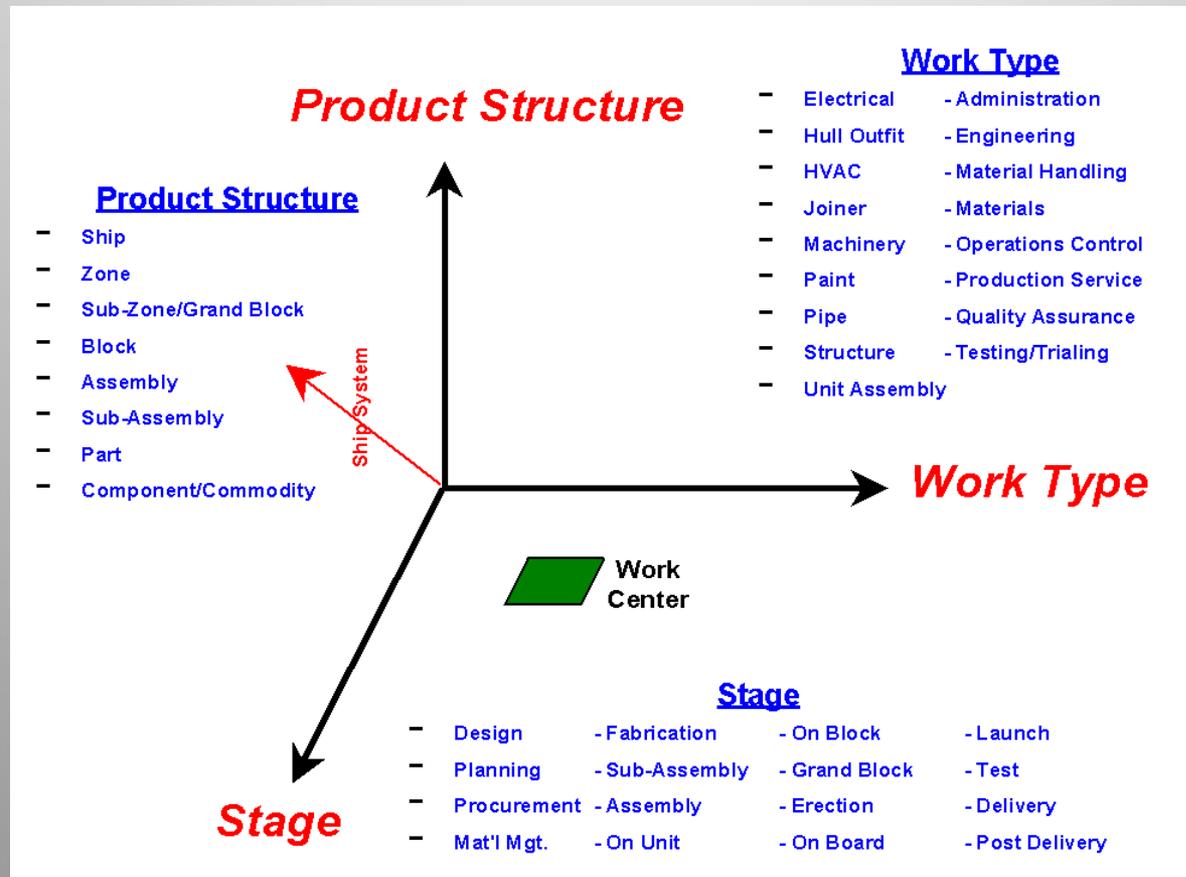
- Labor Hours
- Labor Dollars
- Overhead Dollars
- Material Dollars
- Purchased Services
- Total Dollars
- Weeks Ahead/Behind Schedule
- Forecast Finish Date



Multi-Ship Program Management Cost & Schedule Consolidation



Managing Costs & Schedule by Interim Products and Manufacturing Process



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.



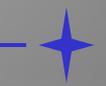
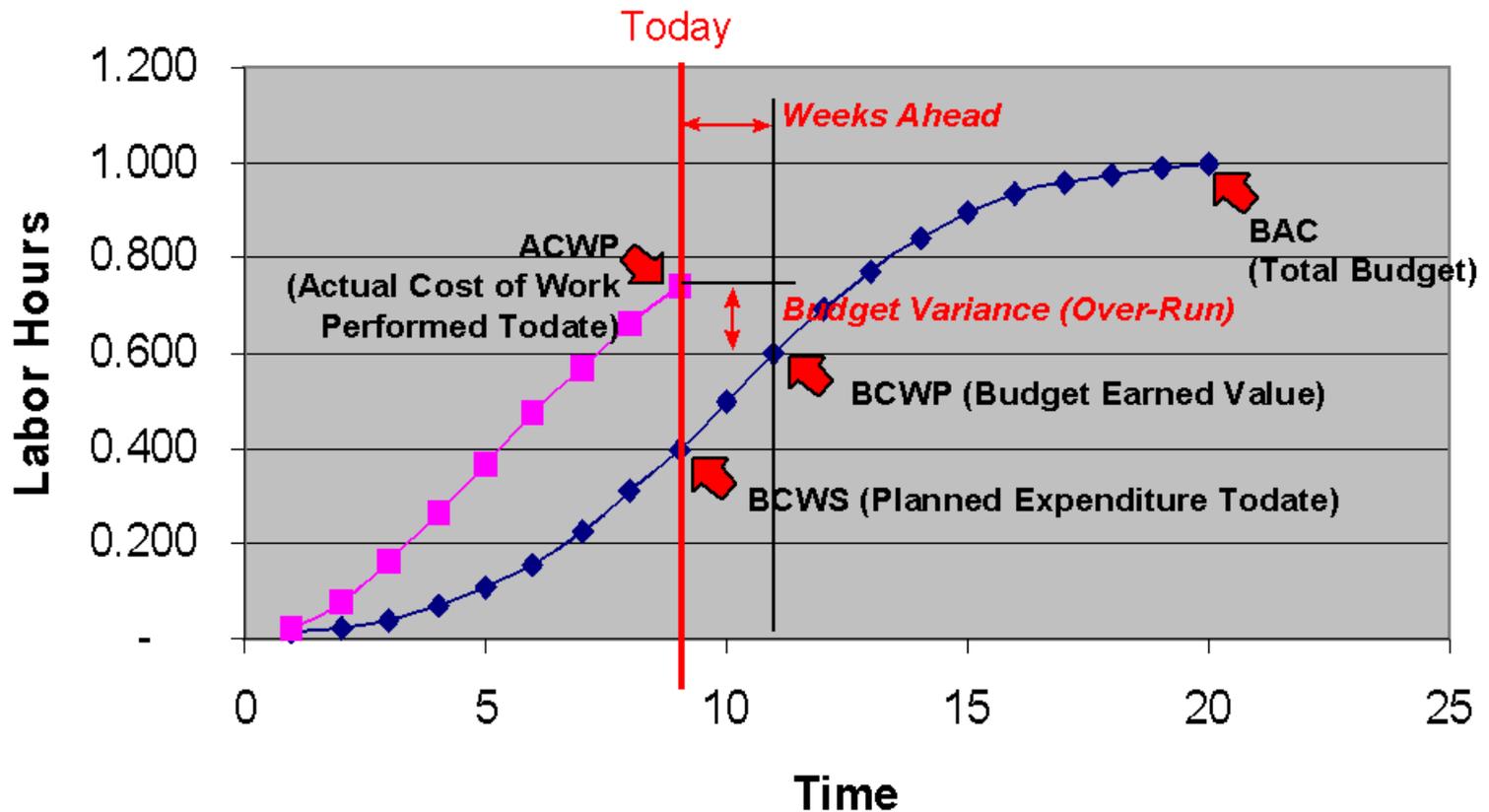
Tracking & Managing Costs and Schedules:

- **BAC: Budget At Completion**
- **MR: Management Reserves**
- **BCWS: Budgeted Cost of Work Scheduled**
- **BCWP: Budgeted Cost of Work Performed**
- **ACWP: Actual Cost of Work Performed**
- **EAC: Estimated Cost At Completion**
- **EAC Trend for 100% Progress**
- **Planned & Actual Progress**
- **Calendar Schedule Variance**
- **Calendar Variance Trend for 100% Progress**



Compiling Cost & Schedule Performance Information

Measuring Schedule Performance



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

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Chesapeake Marine

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SWBS Group Progress Report (PROG02)

Contract TSHIP CONTRACT - T-SHIP Series Contract - Produ

Project: 2002 to 2002 Group: 0 to ZZZZZZZZ

Group	Description	Percent Progress	Weeks	Current Labor Hours				Final Hours					
				Planned	Actual	Ahead	BCWS	BCWP	Actual Hours	Schedule Ahead	Budget	EAC	ETC
Project 2002	Effective Date: 01/05/1993	Seyvern Bulk Carriers (Detail Work Orders)											
		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
0	STEELWORK	88.10	95.34	7.24	6.27	414,871	448,988	450,538	34,117	470,923	474,632	24,094	-3,709
1	ACCOMODATIONS OUTFIT	14.07	26.00	11.93	5.80	7,769	14,358	16,020	6,589	55,222	58,120	42,100	-2,898
2	CARGO SYSTEMS OUTFIT	50.60	64.47	13.87	3.64	28,548	36,370	26,925	7,822	56,418	44,712	17,787	11,706
3	MECHANICAL SYSTEMS OUTFIT	33.91	32.92	-0.99	-0.27	28,072	27,265	20,641	-807	82,784	73,453	52,812	9,331
4	PIPING SYSTEMS	52.19	48.02	-4.17	-1.80	43,027	39,601	26,504	-3,426	82,450	62,160	35,656	20,290
5	MACHINERY SYSTEMS	48.60	39.12	-9.48	-2.50	13,560	10,913	7,712	-2,647	27,899	23,832	16,120	4,067
6	ELECTRICAL SYSTEMS	33.67	8.95	-24.72	-8.98	19,536	5,195	4,821	-14,341	58,027	55,591	50,770	2,436
7	PRODUCTION SERVICES	55.23	62.95	7.72	5.21	71,024	80,951	81,089	9,926	128,601	131,270	50,181	-2,669
8	OWNER CHANGES	51.85	16.71	-35.14	-24.66	12,686	4,089	4,282	-8,596	24,466	32,702	28,420	-8,236
9	DESIGN & DRAWING	86.99	77.66	-9.33	-7.27	24,013	21,436	21,993	-2,576	27,603	28,084	6,091	-481
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



WORK-PAC Center Progress Report (PROG14)

Labor Hours

Contract: 1999-01 to WBS-Variou
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												
T07	Planning and Control												
T09	Drawing Office												
T10	Production Services												
T11	Carpenter's Shop												
T15	Miscellaneous	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
T21	Joiner Shop	100.00	22.71	-765	-77.29	27,301	6,200	6,616	-21,101	27,301	29,127	22,511	-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	100.00	29.76	-764	-70.24	27,921	8,309	9,404	-19,612	27,921	31,605	22,201	-3,684
T32	On-Board Rigging	100.00	56.46	-766	-43.54	34,902	19,706	16,201	-15,196	34,903	28,695	12,494	6,208
T33	On-Board Outfit	100.00	25.65	-778	-74.35	54,178	13,897	6,014	-40,281	54,178	46,369	40,355	7,810
T34	On-Board Pipework	100.00	33.90	-781	-66.10	39,510	13,394	0	-26,116	39,511	26,115	26,115	13,396
T35	On-Board Electrical	100.00	25.14	-775	-74.86	15,876	3,991	0	-11,885	15,876	11,885	11,885	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



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				Current Labor Hours				Final Hours					
	Planned	Actual	Ahead	Weeks 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		94.92	91.04	-3.88	-5.57	2,332	2,237	2,082	-95	2,457	2,287	205	170
J	Hoppers		76.70	99.00	22.30	28.00	11,345	14,644	12,741	3,299	14,792	12,787	46	2,005
K	Machinery Deck													
L	Main Deck & Engine Room Bl													
M	Loop Belt Unit													
N	Deckhouses & Funnel													
P	Aft Shell Units													
R	Engine Room Tank Top													
S	Tank Top Fwd E Aft													
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 Machinery Deck		48.64	25.19	-23.45	-7.86	9,417	4,877	4,352	-4,540	19,361	17,276	12,924	2,085
24	Engine Room Main Deck		32.37	30.80	-1.57	-0.57	7,274	6,921	6,741	-353	22,472	21,887	15,146	585
25	Engine Room Control Room Flat		33.37	9.50	-23.87	-9.00	281	80	80	-201	842	842	762	0
26	H.F.O. Tank		33.31	0.00	-33.31	-12.57	110	0	0	-110	331	331	331	0
27	Engine Room Casing		27.97	18.77	-9.20	-3.71	1,093	733	635	-359	3,907	3,383	2,748	524
28	Funnel		0.00	0.00	0.00	0.00	0	0	0	0	82	82	82	0
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

WORK-PAC Trade Progress Report (PROG15)

Labor Hours

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

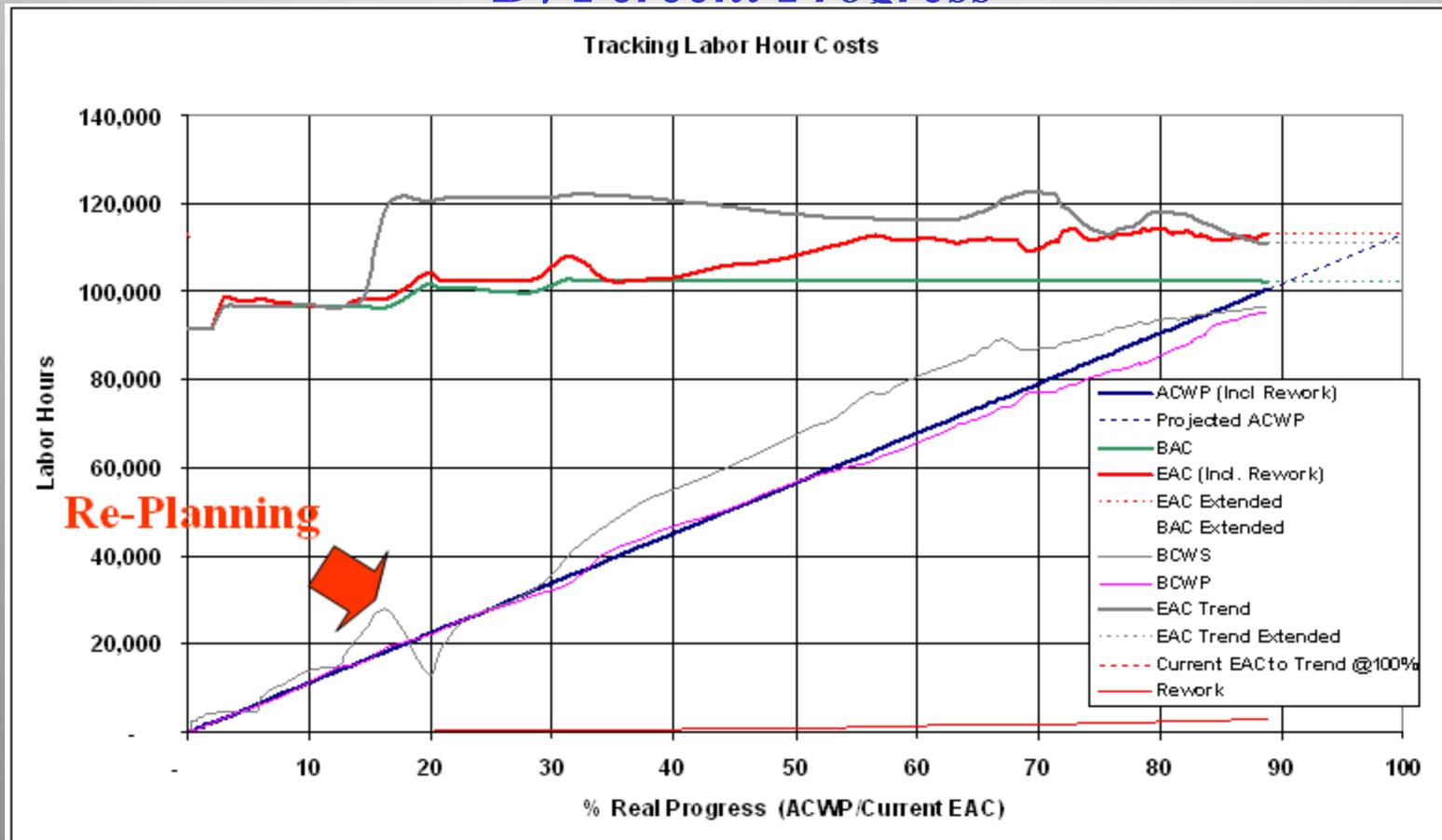
Trade	Description	Percent Progress		Weeks Ahead	% Diff	Current Labor Hours				Final Hours			
		Planned	Actual			BCWS	BCWP	Actual Hours	Schedule Ahead	Budget	EAC	ETC	Savings
T01	AIR TOOL ROOM	50.08	38.01	-9	-12.07	1,976	1,499	1,389	-476	3,945	3,654	2,265	291
T02	BLACKSMITHS	100.00	66.91	-11	-33.09	1,963	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	38.80	-10	-14.69	13,443	9,751	12,279	-3,692	25,131	31,647	19,368	-6,516
T14	MACHINISTS	100.00	73.96	-12	-26.04	11,259	8,327	7,751	-2,932	11,259	10,481	2,730	778
T15	MOULD LOFT												2,395
T16	PAINTERS												694
T17	PIPE FITTERS												1,368
T18	PLUMBERS												0
T20	PUNCH SHED												1,394
T21	RIGGERS												5,629
T22	SHEET METAL WORKERS												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 - STEEL	100.00	70.14	-19	-29.86	10,107	7,089	8,853	-3,018	10,107	12,621	3,768	-2,514
T25	STORESMEN	100.00	72.13	-16	-27.87	9,422	6,796	5,897	-2,626	9,422	8,175	2,278	1,247
T26	NIGHT MANAGER	83.31	52.98	-11	-30.33	7,053	4,485	3,907	-2,568	8,466	7,374	3,467	1,092
T28	WELDERS - ELECTRIC	100.00	90.77	-26	-9.23	265,342	240,851	249,866	-24,491	265,342	275,263	25,397	-9,921
T29	NIGHT FOREMEN	52.21	4.07	-30	-48.14	4,554	355	355	-4,199	8,723	8,723	8,368	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	1,586
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



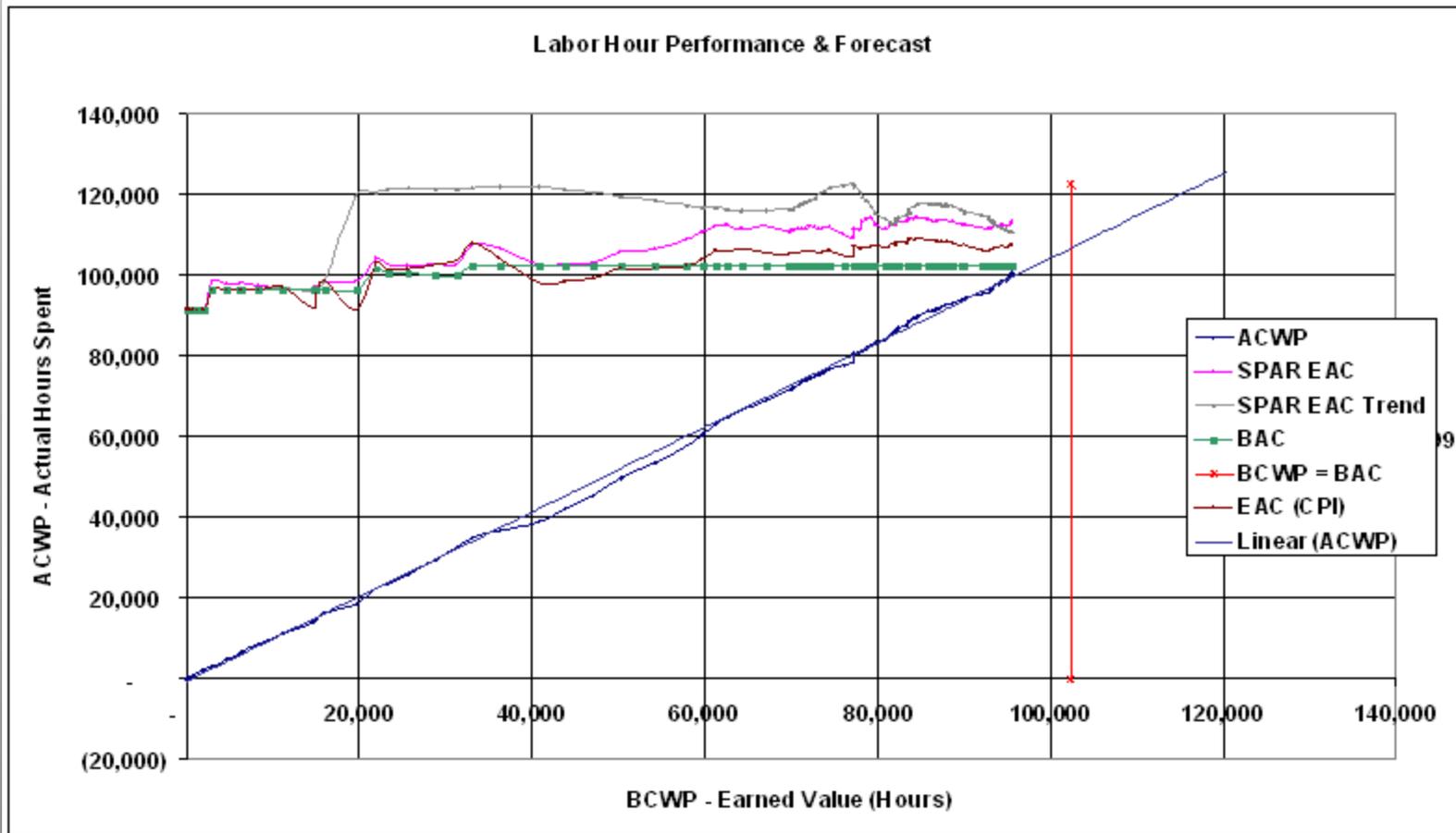
Tracking Performance Costs

By Percent Progress

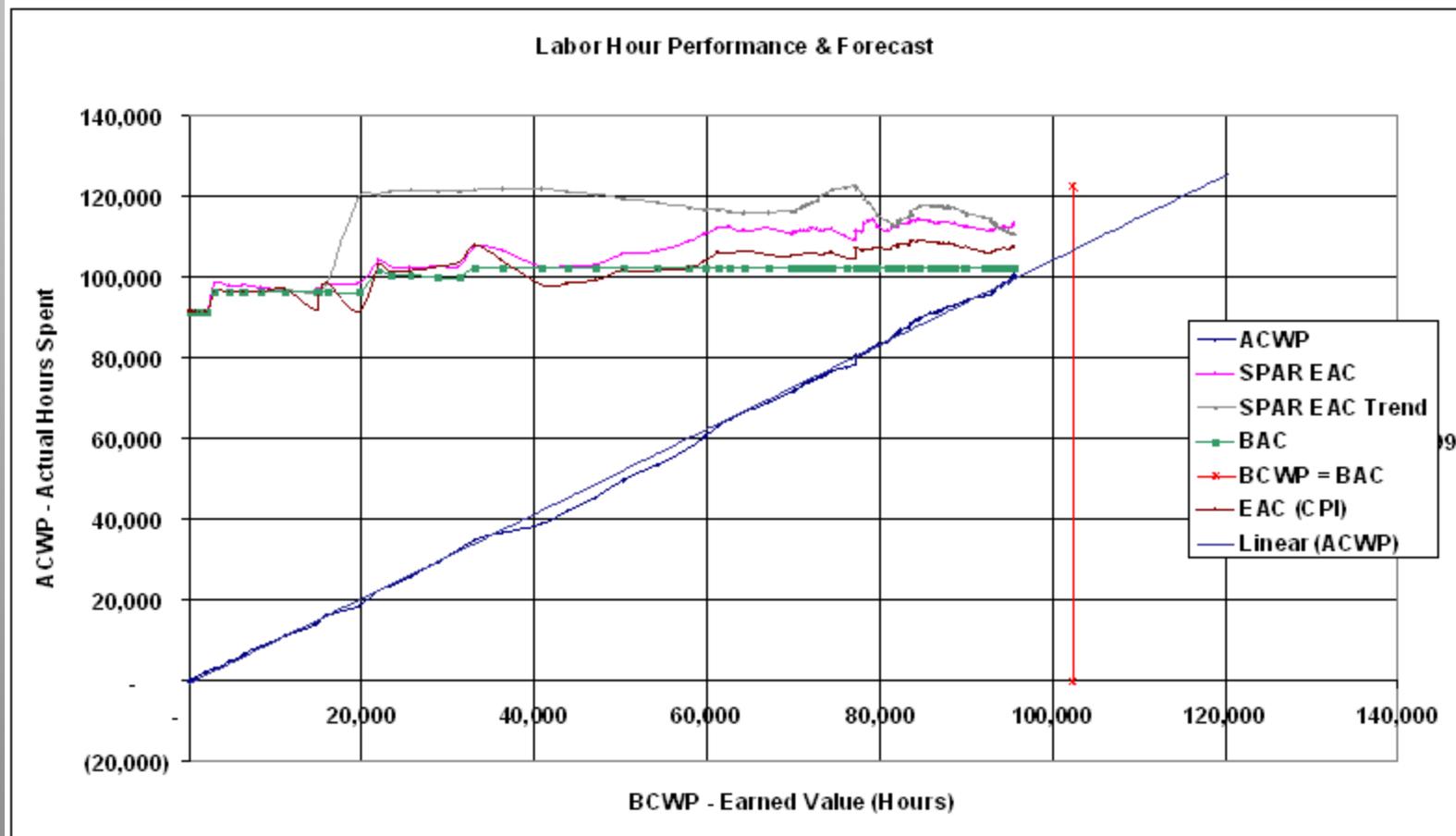


Tracking Performance Costs

By Earned Value



Tracking EAC Confidence

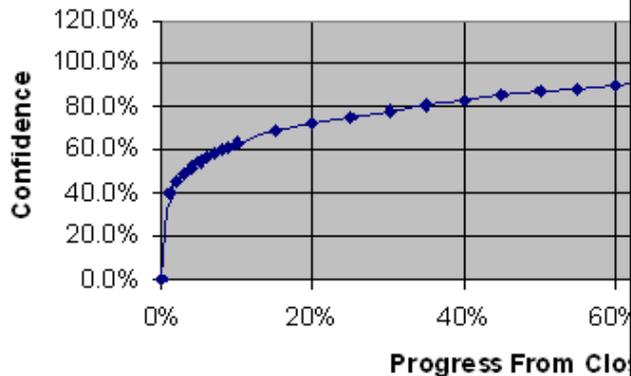


Confidence in EAC is a composite of 3 factors:

- **F(closed)** = Degree of total work completed
- **F(open)** = Degree of work orders still open
- **F(performance)** = Consistency of budget performance of completed work orders (via normal distribution).

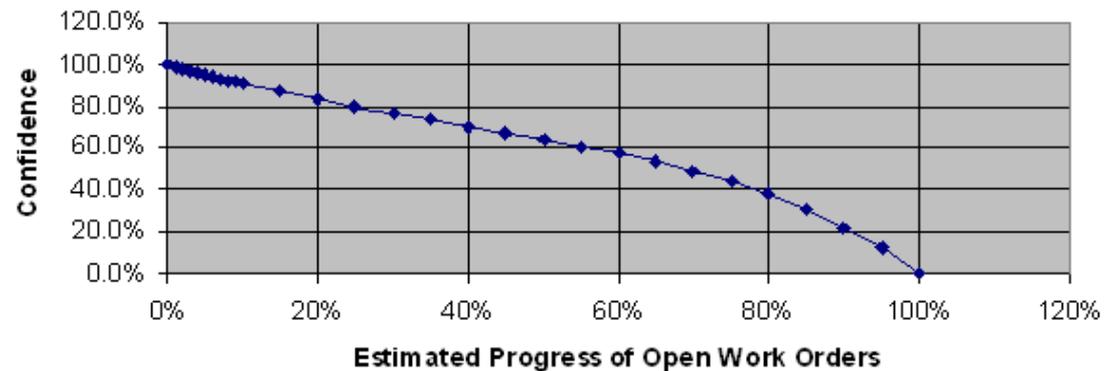
EAC Confidence From Completed Work

$$\text{Confidence} = \text{PC}^{0.2}$$

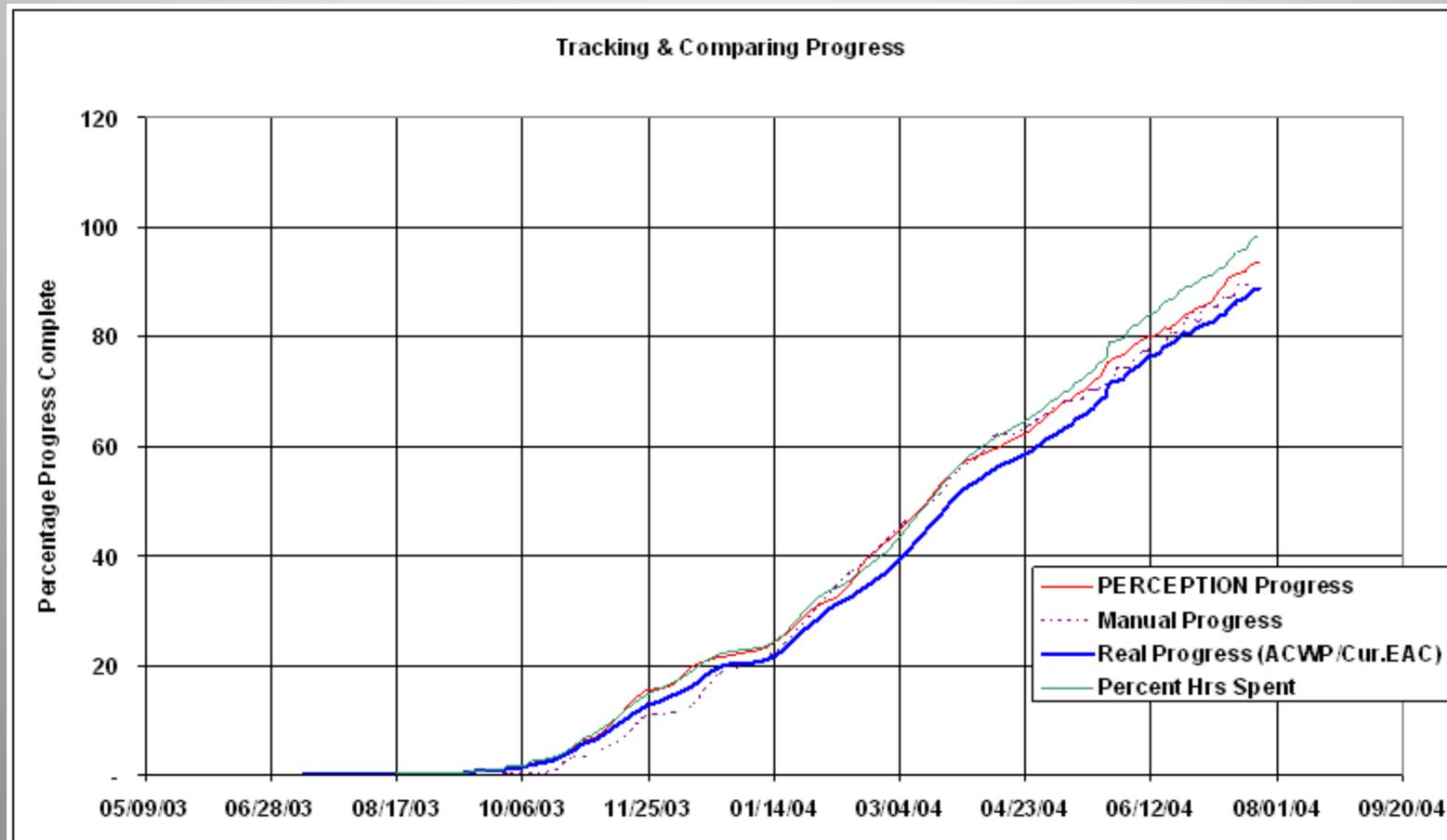


EAC Confidence From Open Work

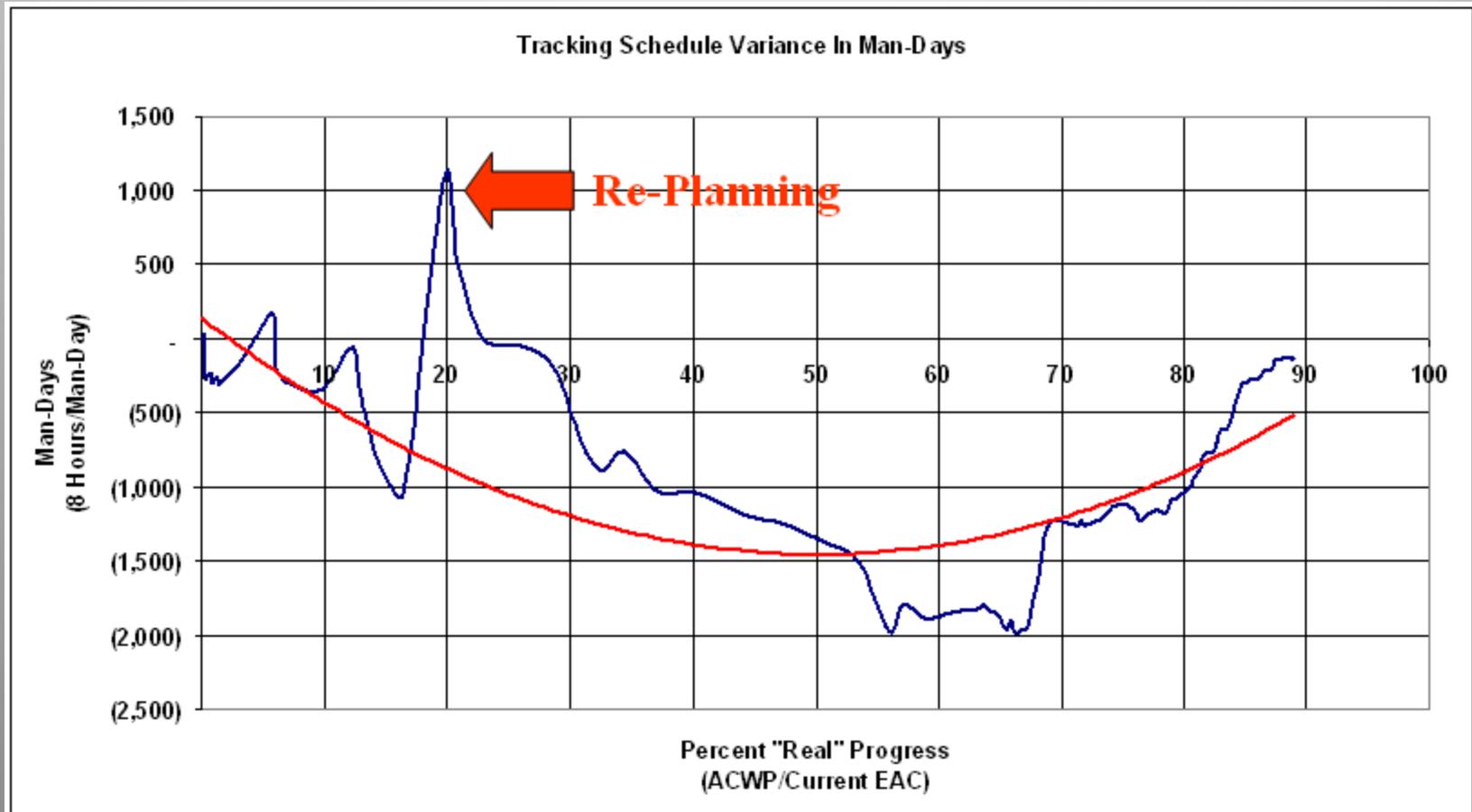
$$\text{Confidence} = (1 - \text{PI}) \cdot e^{(\text{PI} \cdot \text{PI})}$$



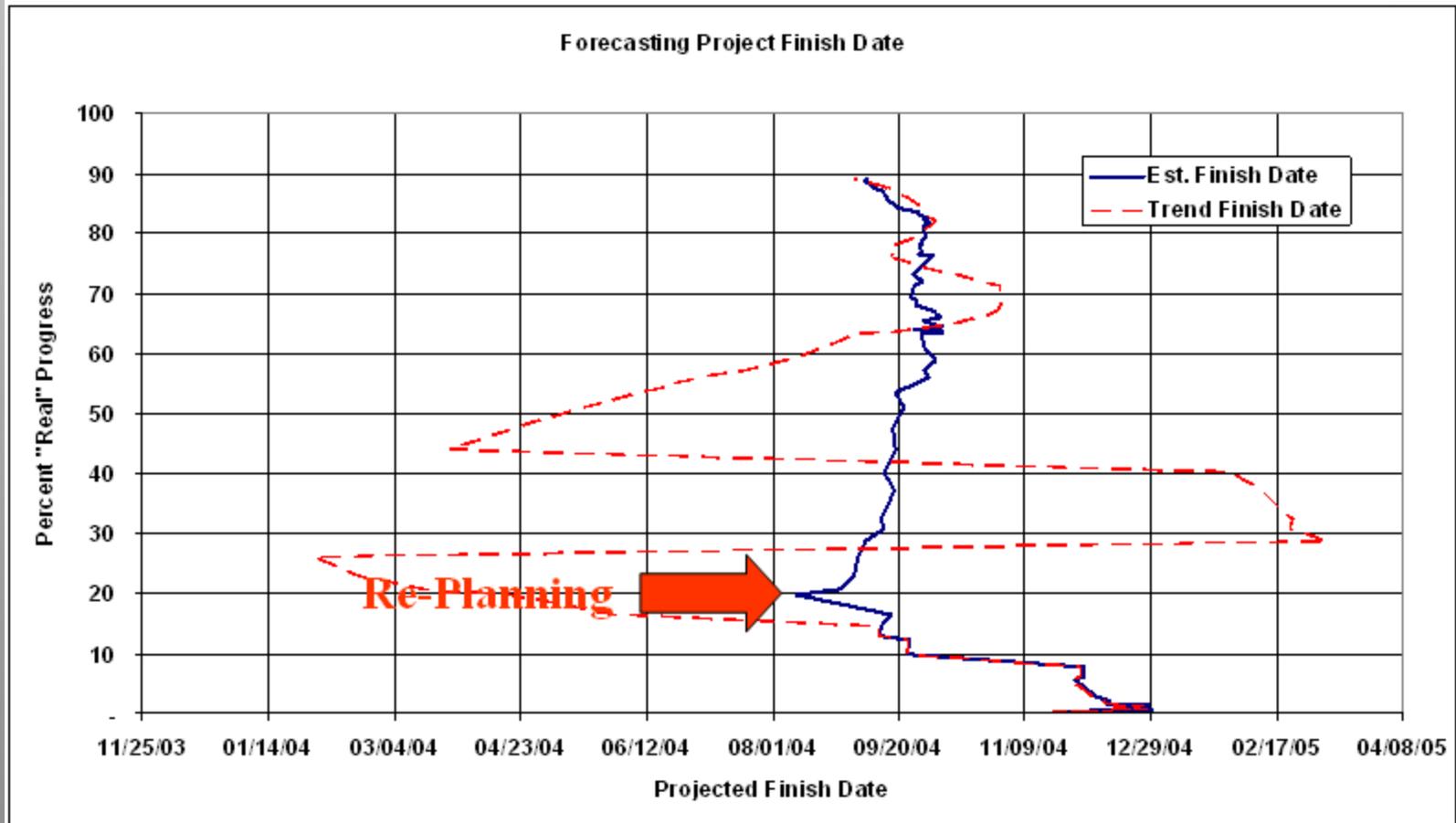
Tracking Progress



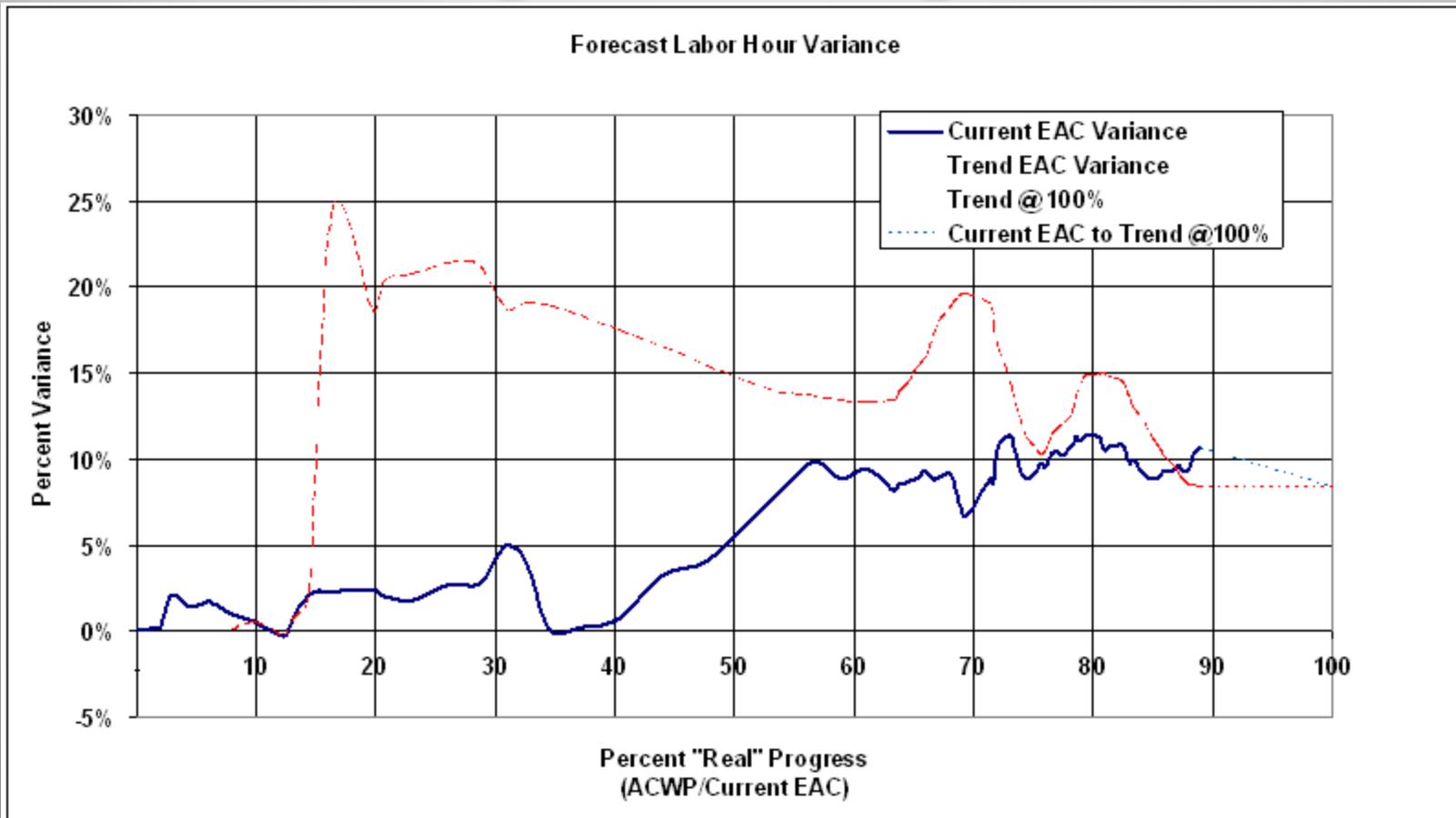
Tracking & Forecasting Schedule Variance



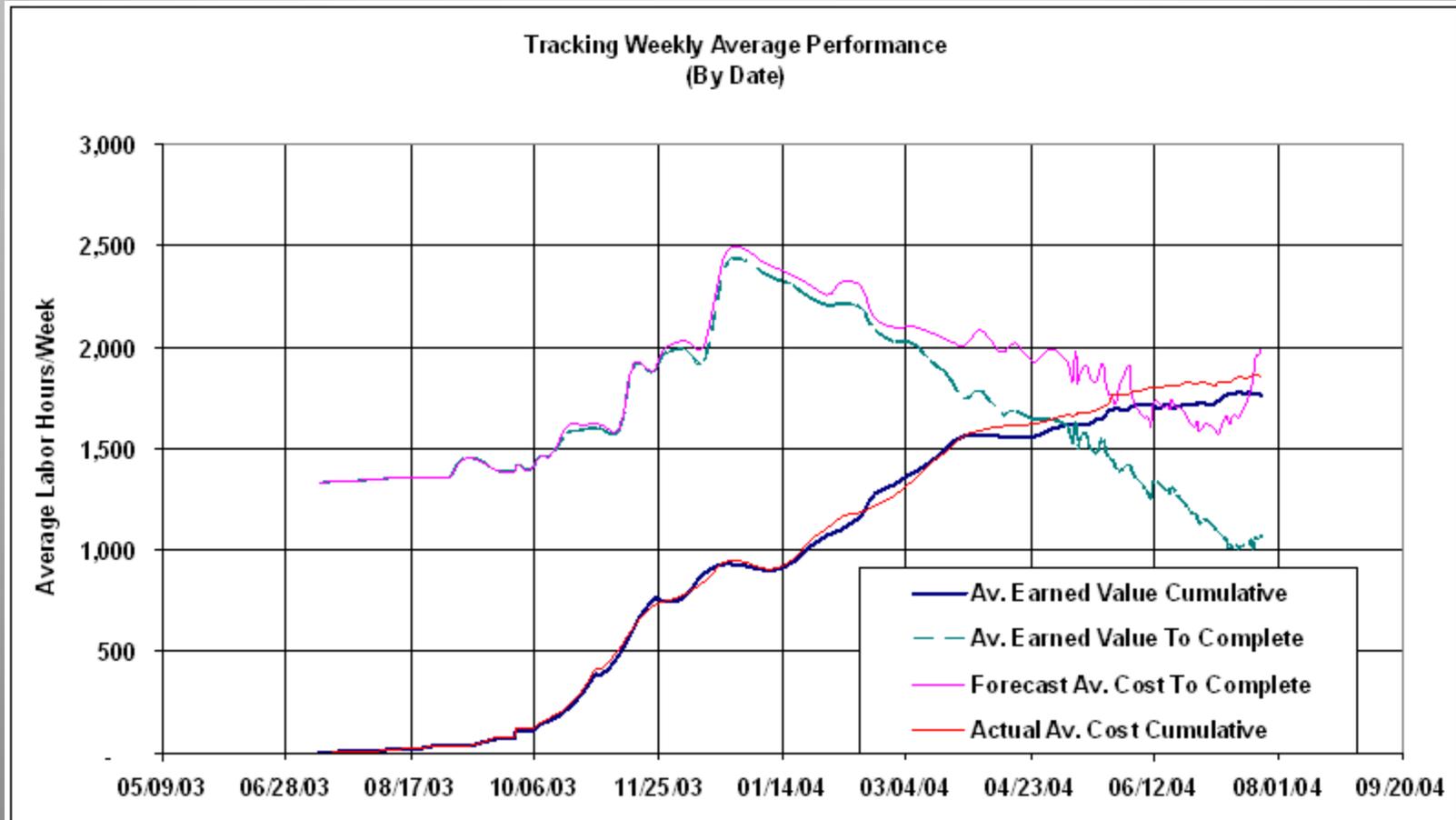
Tracking & Forecasting Schedule Variance



Tracking & Forecasting Over-Budget/Savings Variance

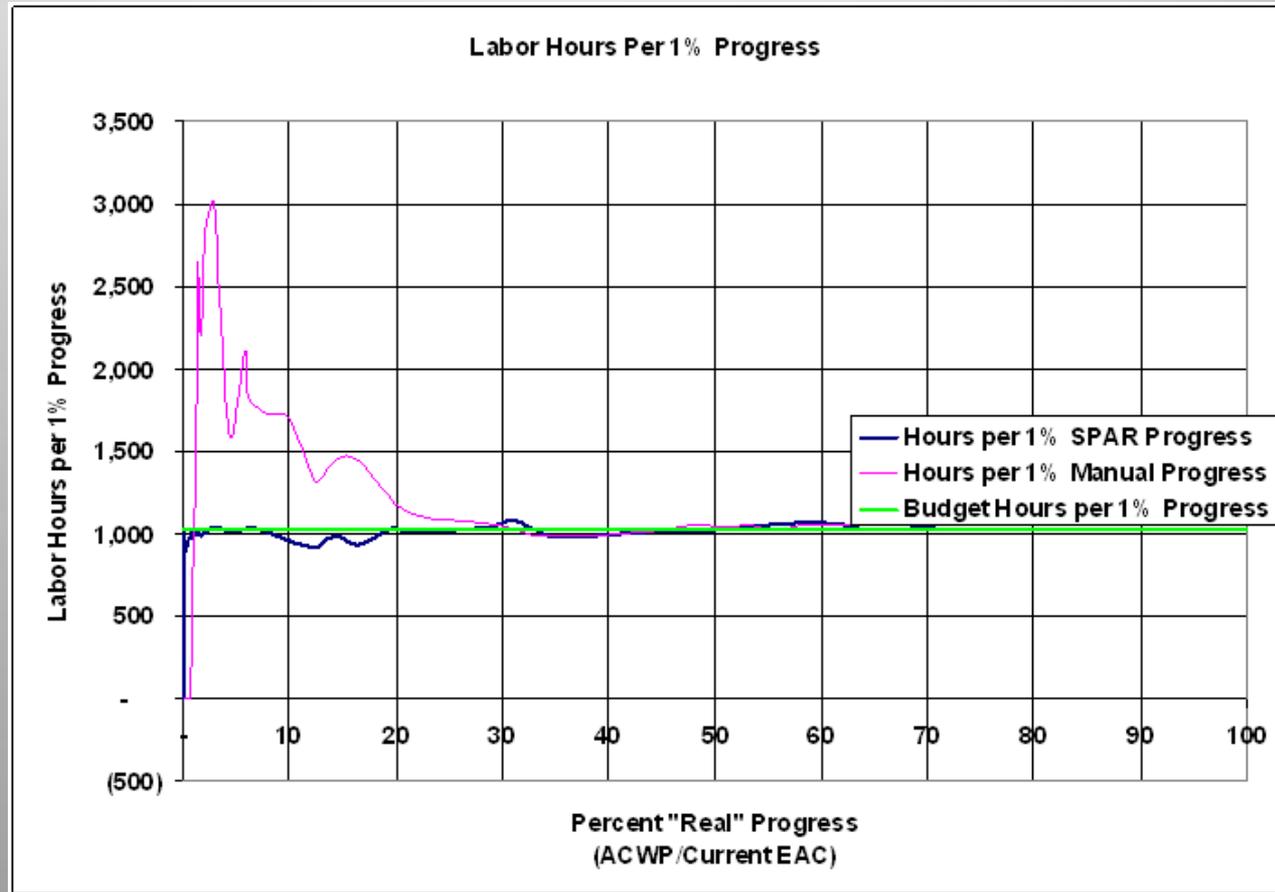


Tracking & Forecasting Earned Value Performance



Tracking Cost per 1% Progress

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



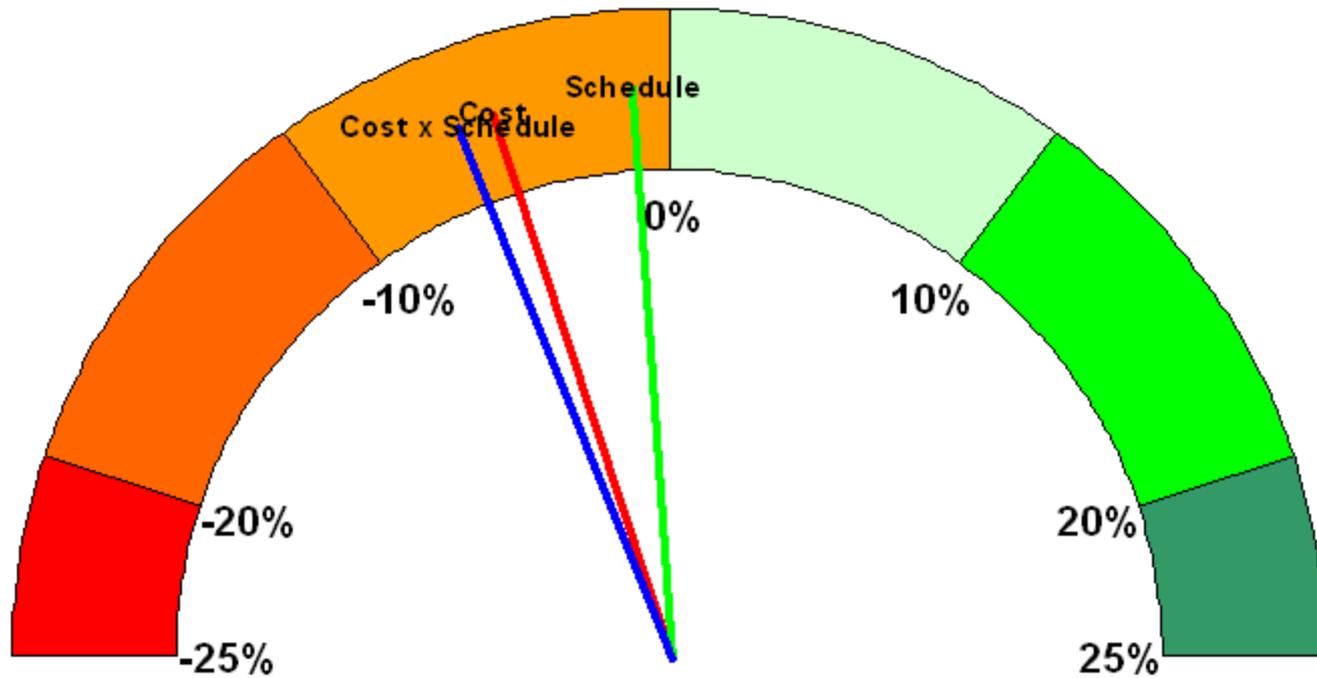
Tracking Performance Indexes

- **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** ($0.5 CPI \times [1 + SPI + SPI \times (BCWS-BCWP)/BAC]$)
- **TCPI: To-Complete Performance Index**
($(BAC-BCWP)/(EAC-ACWP)$)

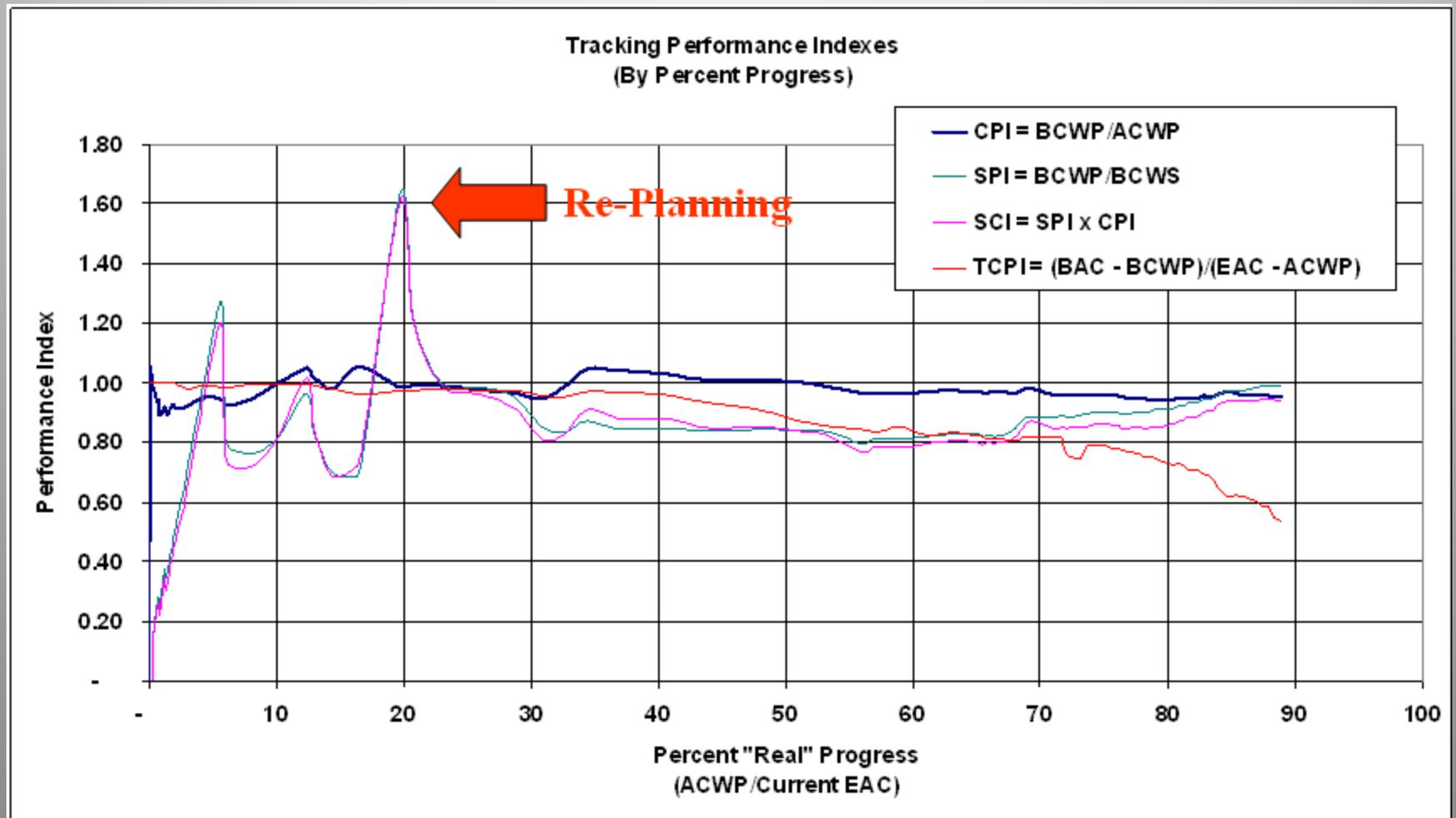


Total Contract Performance Summary

Performance Variances



Tracking Performance Indexes



Tracking & Managing Dollar Costs and Schedules:

- ❖ Direct Labor Costs
- ❖ Overheads Costs
- ❖ Material & Subcontract Costs
- ❖ Management Reserves



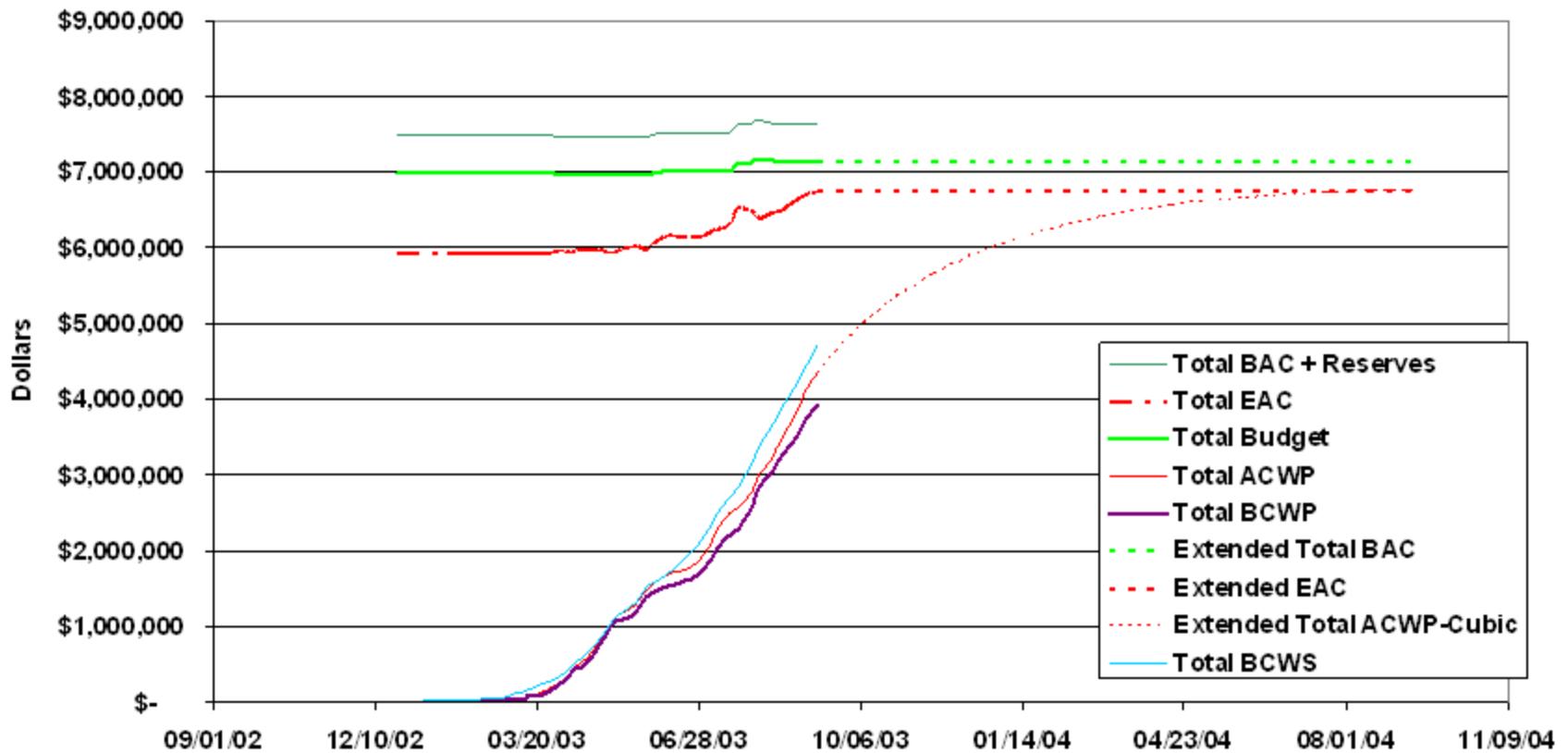
Tracking & Managing Dollar Costs and Schedules

- **Direct Labor Costs**
- **Overheads Costs**
- **Material & Subcontract Costs**
- **Management Reserves**

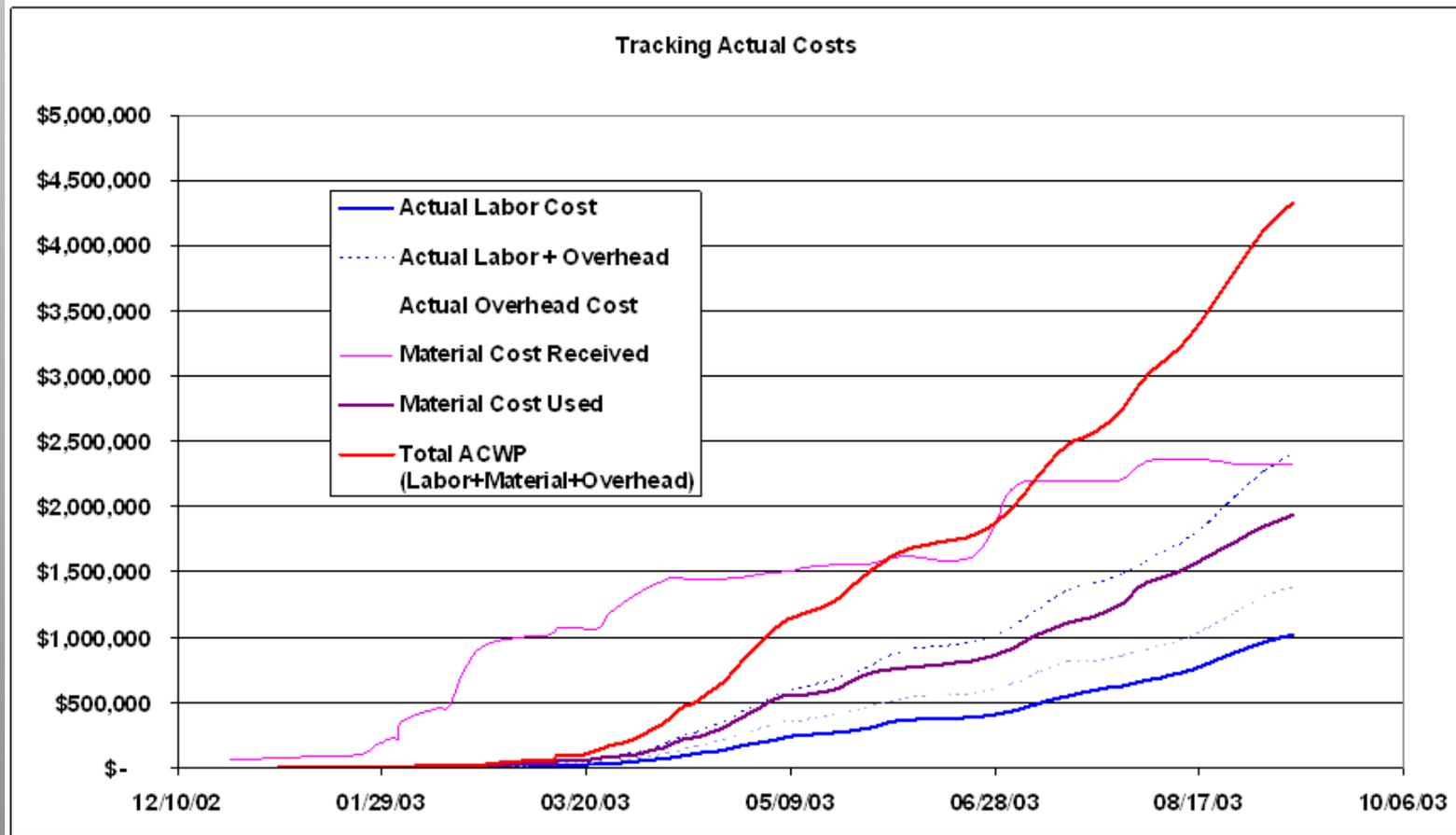


Total Cash Budget Vs EAC

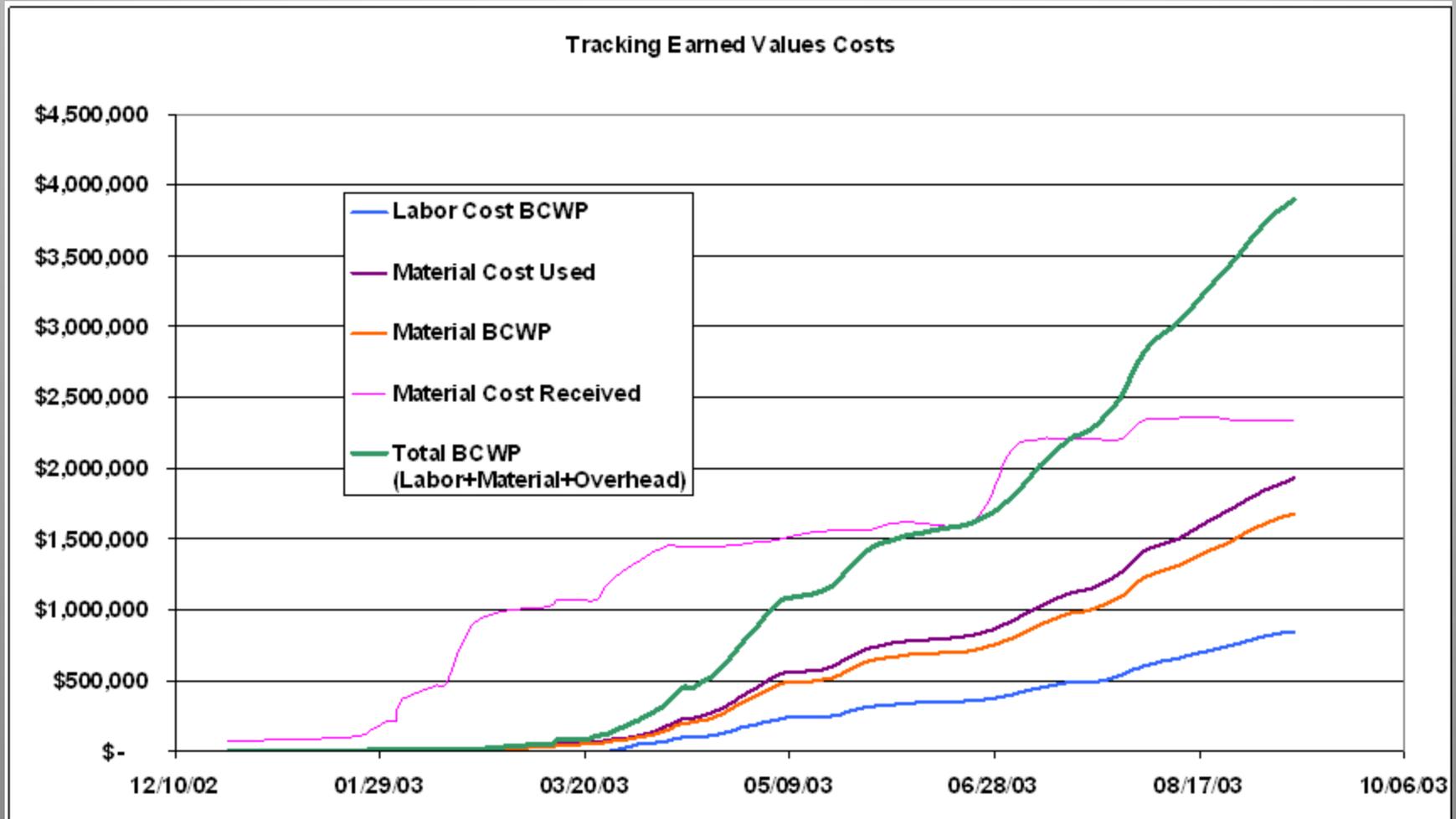
Total Cash Budget Versus EAC
(Labor, Material & Overhead)



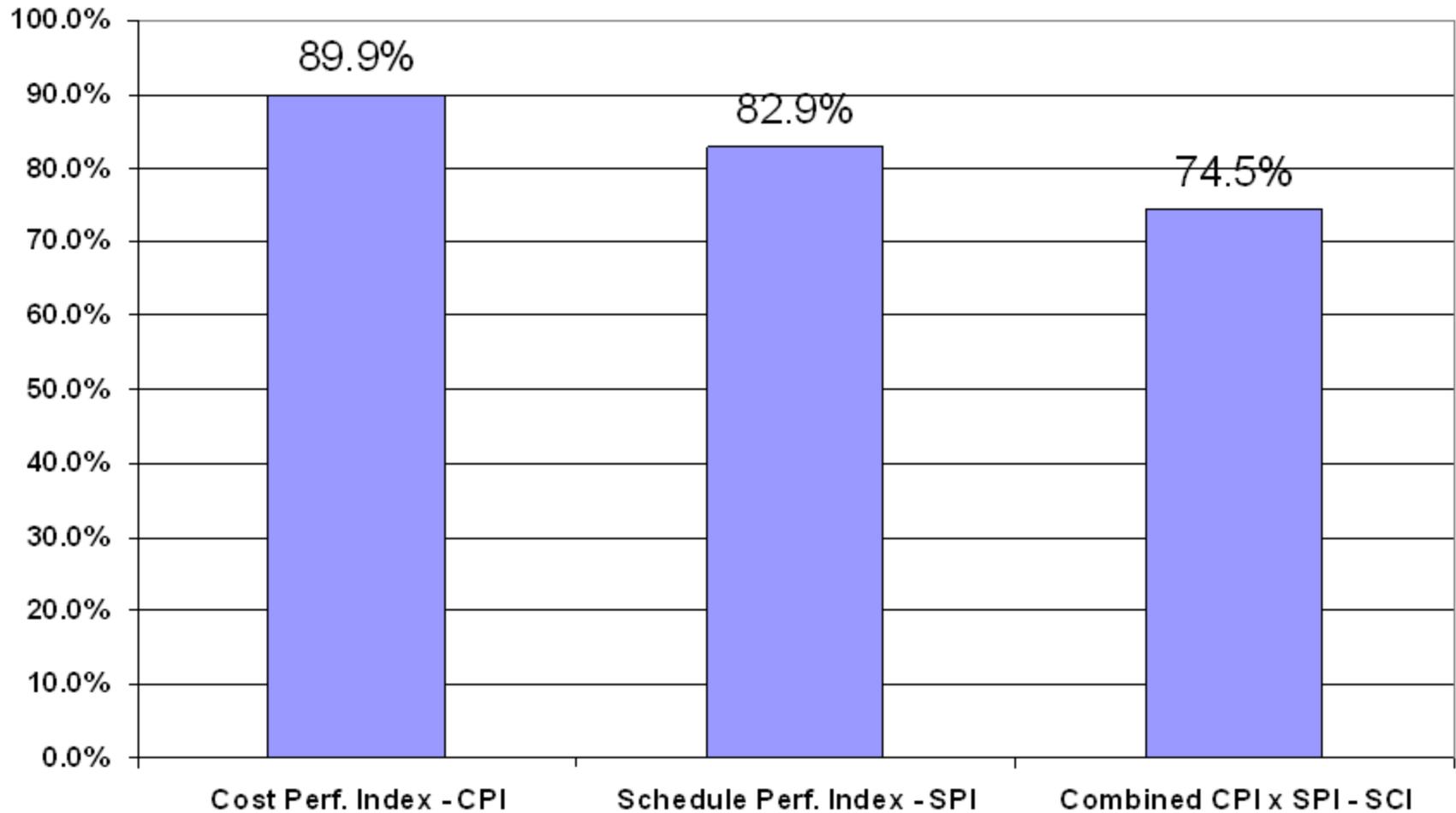
Tracking Actual Costs



Tracking Earned Value Costs



Overall Performance Index (Labor, Material & Overhead Dollars)

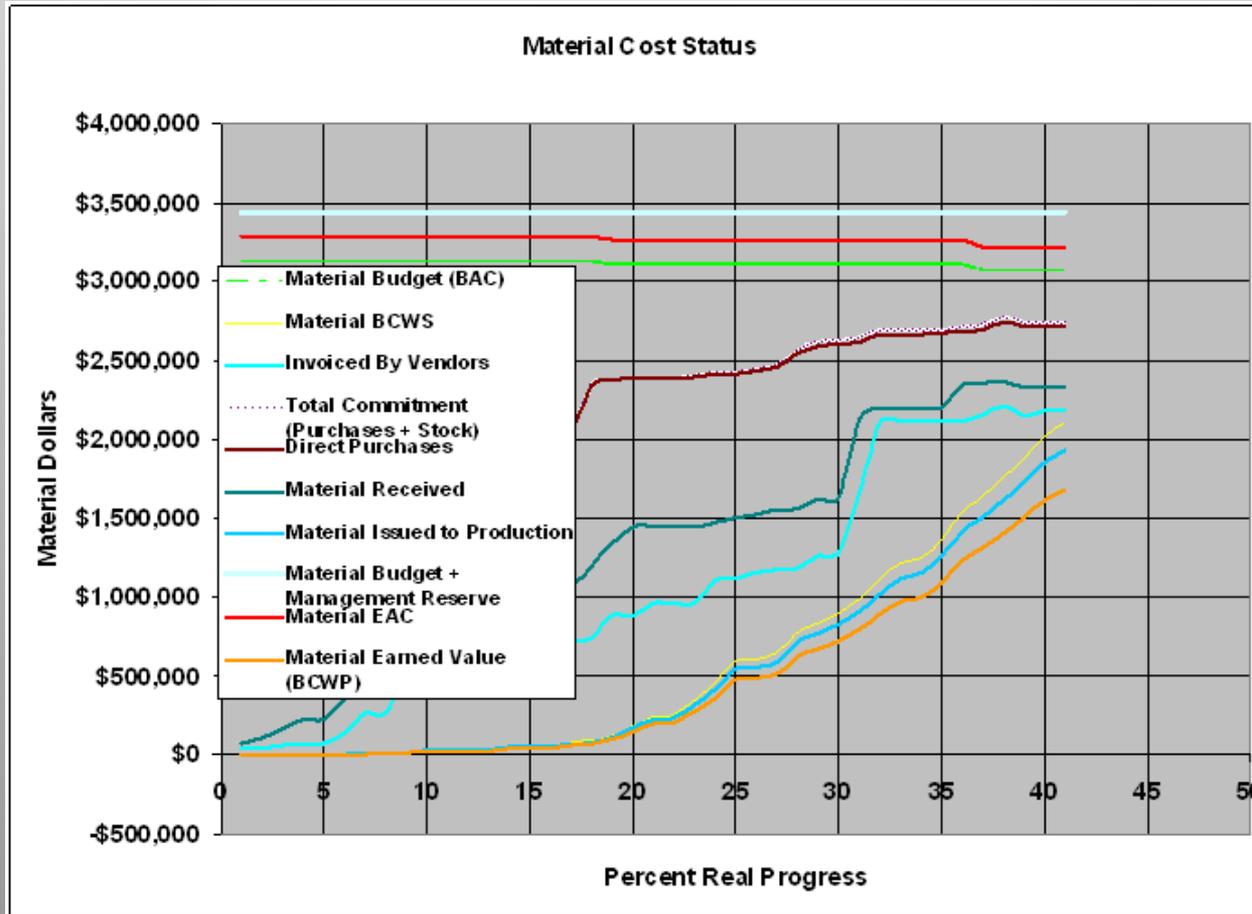


Tracking & Managing Material Costs and Schedules

- **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

Project Details Information									
Details	Material Status	Totals	Indexes	Variations	Notes	Baseline	Options	Milestones	Characteristics
Contract	TSHIP CONTRACT		Description	Seyvern Bulk Carriers (Detail Work Orders)					
Project	2002								
	Budgeted Cost of Work Scheduled	Budgeted Cost of Work Performed	Actual Cost of Work Performed	Budgeted Cost	Estimated at Completion	Reserves	Effective Date:	01/14/1993	
Man-Hours:	693,209	689,077	660,525	1,014,393	984,555	1,000,000			
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			<i>NOTE: Rework included in ACWP or EAC</i>	
Labor Cost:	19,275,014	15,907,329	147,150	3,220,535	5,158,852				
	Start	Finish	Total Progress	67.93 %	(Closed	58.26 %	In-Process	9.67 %	
Planned	09/12/1991	09/17/1993	Total Planned	68.34 %	(Behind	-0.41 %		-0.21 weeks)	
Actual	05/13/1991	00/00/0000	Total Manual	58.20 %			Number of Work Packages:	2529	
							Budgeted Hours:	1,014,393.00	



Material Cost/Schedule Status

🚩 Project Details Information for the Production Environment

Details
Material Status
Overall Status
Indexes
Variances
Notes
Baseline
Options
Milestones
Characteristics

Contract TSHIP CONTRACT Description Severn Bulk Carrier (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
Mat'l Cost	20,044,883	19,863,117	18,697,496	29193294.00	29,193,294
			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:

Mat'l Purchased	Taxes And Duty	Freight	Stock Reserved	Stock Issued	Total RMA	Total Committed	Total Paid Invoices
25,982,032	+ 2,858,024	+ 274,833	+ 274,938	+ 310,079	- 36,789	= 29,663,116	24,293,199

Total Purchased Cost Status: Mat'l Cost

Delivered	Pending QA	Rejected QA	Accepted QA	RMA	Issued	Unused
24,683,010	144,799	156,776	24,381,435	36,789	18,387,417	6,295,593



Combined Labor & Material Cost/Schedule Status

Project Details Information for the Production Environment									
Details	Material Status	Overall Status	Indexes	Variances	Notes	Baseline	Options	Milestones	Characteristics
Contract	TSHIP CONTRACT		Description					Severn Bulk Carrier (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	Rework		
Man-Hours	698,984	692,695	660,706	1017998.00	984,817	88,522	8,503		
Rate/Hour	18.00		17.35		16.57		17.31		
Labor Cost	12,581,716	12,468,515	11,462,875	18,323,964	16,316,924	1,593,396	147,150		
Overhead	10,065,372	9,974,811	9,170,300	14,659,171	13,053,539	1274716.78			
Mat'l Cost	20,044,883	19,863,117	18,697,496	29,193,294	29,193,294	2,887,249	0		
TotalCost	42,691,971	42,304,842	39,330,671	62,176,429	58,563,756	5755361.78	147,150		
	Total Reserves:			5,755,362					
	Total Budget + Reserves:			67,931,791	Estimated Remaining Hours				
	Less Total EAC:			58,563,756	324,111				
	Less Current Total Rework Cost:			147,150	NOTE: Rework included in ACWP and EAC				
	Net Cost Margin:			9,220,884					



Cost/Schedule Performance Indexes

Project Details Information for the Production Environment										
Details	Material Status	Overall Status	Indexes	Variations	Notes	Baseline	Options	Milestones	Characteristics	
Contract	TSHIP CONTRACT		Description	Severn Bulk Carrier (work orders)						
Project	2002									
Note: Rework included	CPI Cost Performance Index	SPI Schedule Performance Index	CCPI Combined Cost Performance	TCPI To-Complete Performance Index	CPI measures how well expenditures are meeting planned budgets in accomplishing stated progress.					
	Man-Hours	1.05	0.99	1.05	1.00	SPI measures how well expenditures are meeting planned schedules in accomplishing stated progress.				
	Labor Cost	1.09	0.99	1.09	1.07	CCPI measures combined cost and schedule performance.				
	Overhead	1.00	1.00	0.66	1.00	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.				
	Mat'l Cost	1.00	1.00	1.00	1.00					
	TotalCost	1.96	1.78	2.45	1.15					
<p>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.</p>										



Cost/Schedule Variance Analysis

Project Details Information for the Production Environment										
Details		Material Status	Overall Status	Indexes	Variance	Notes	Baseline	Options	Milestones	Characteristics
Contract		TSHIP CONTRACT		Description		Severn Bulk Carrier (work orders)				
Project		2002								
						Effective Date:		01/14/1993		
		<i>Note: Rework included</i>								
		Current Cost Variance (BCWP-ACWP)	Current Schedule Variance (BCWP-BCWS)	Current Forecast Final Cost Variance (BAC-EAC)	Trend Forecast Final Cost Variance					
Man-Hours		31,940	-6,338	33,181	29,043					
Labor Cost		1,004,750	11,806,919	2,007,040	1,408,436					
Overhead		803,800	-91,272	1,605,632						
Mat'l Cost		1,165,621	-181,766	0	-3,555,153					
Total Cost		2,974,171	11,533,881	3,612,673						
		Planned Finish	09/17/1993							
		Weeks Ahead	-0.33	Trend:	-1.76					
		Projected Finish	09/20/1993	Trend:	09/29/1993					



Cost/Schedule Baseline Plan Status

Project Details Information for the Production Environment									
Details	Material Status	Overall Status	Indexes	Variances	Notes	Baseline	Options	Milestones	Characteristics
Contract	TSHIP CONTRACT		Description			Severn Bulk Carrier (work orders)			
Project	2002					01/14/1993			
	Project Totals	Work Order Totals	Baseline Totals	Baseline BCWS	Baseline BCWP				
Budget Hours	1,017,998.00	1,018,212.00	0.00	0.00	0.00				
Actual Hours	660,706.00	660,706.00							
Budget Labor Cost	18,323,964.00	18,327,816.00	0.00						
Actual Labor Cost	11,462,875.00	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	05/13/1991								
Actual Finish	00/00/0000								
Progress	68.04 %								
Budget Mat'l Cost	29,193,294.00		0.00						
Number of Work Orders	2181								



Tracking Manpower Requirements

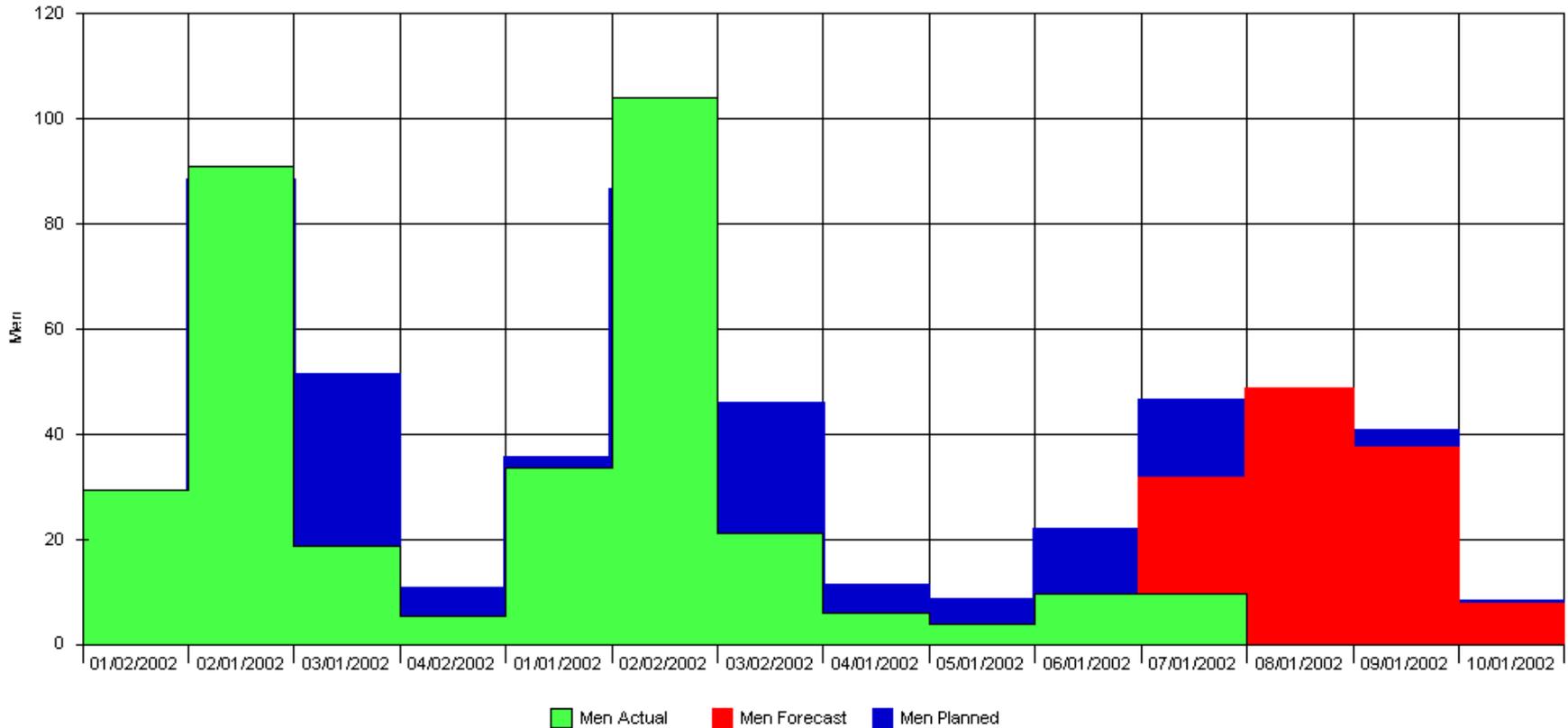
- **As Planned in Baseline**
- **As Currently Planned**
- **As Actually Expended To Date**
- **As Forecast to Complete**

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.

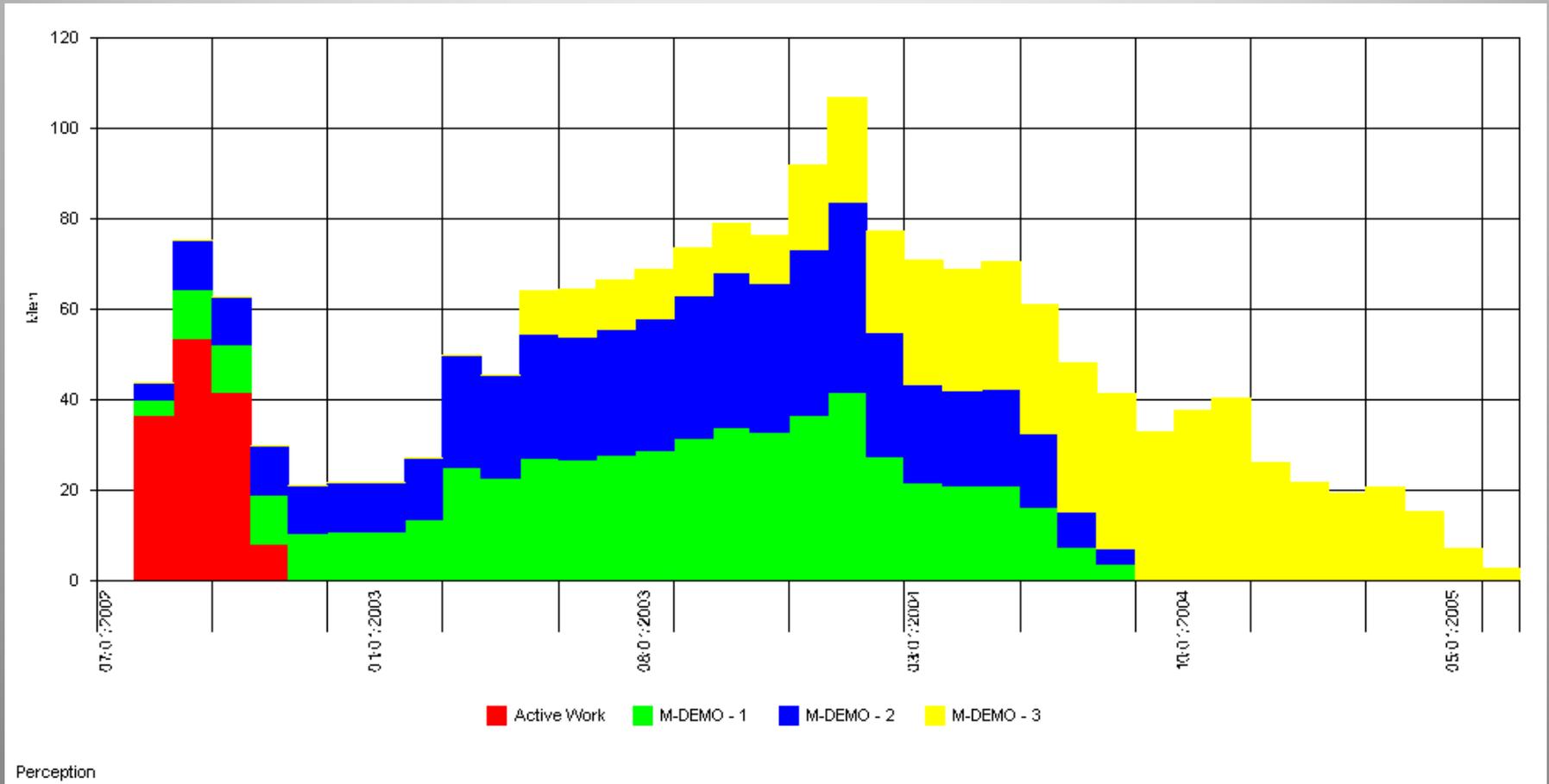


Tracking Manpower Requirements (Planned Vs Actual Vs Forecast)



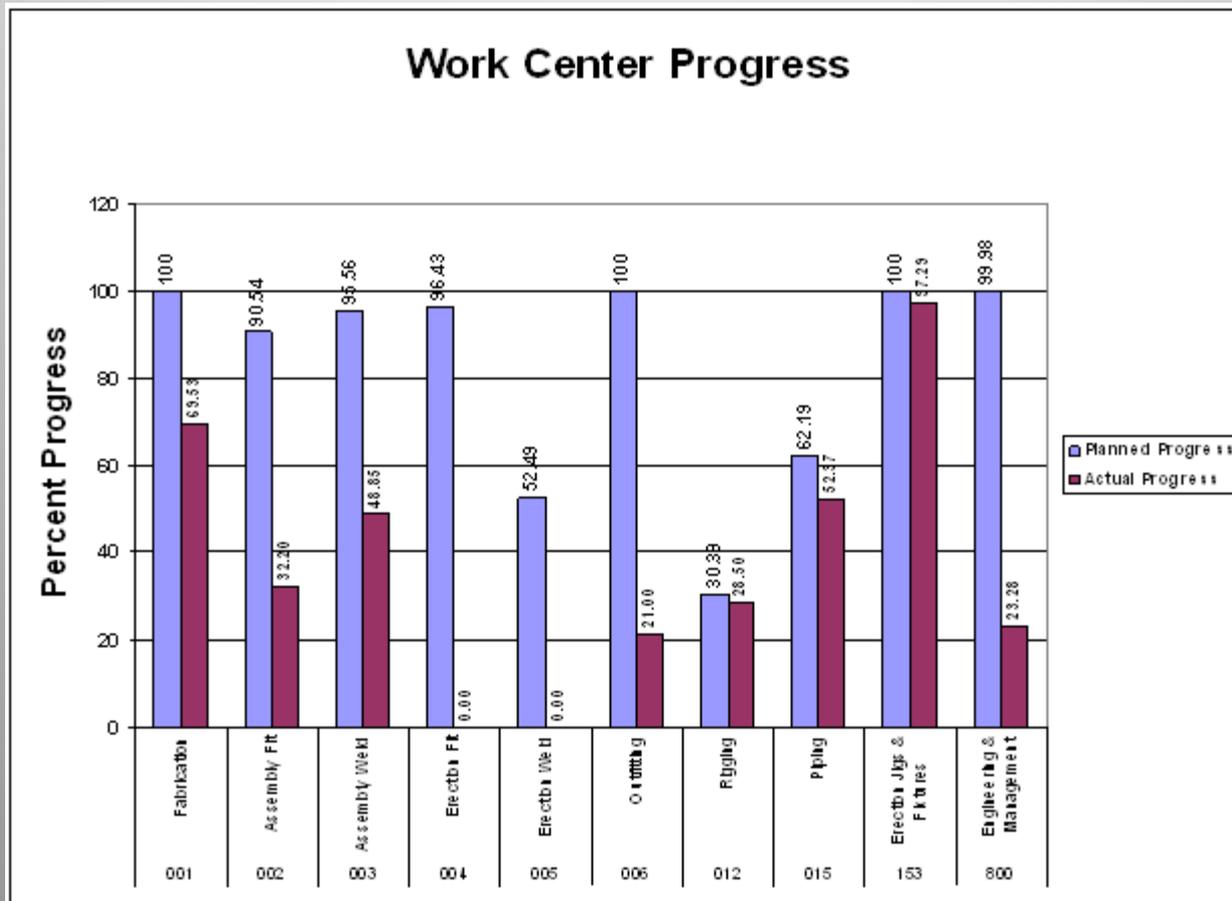
Perception

New Work Manpower Modeled On Top Of Active Work Manpower

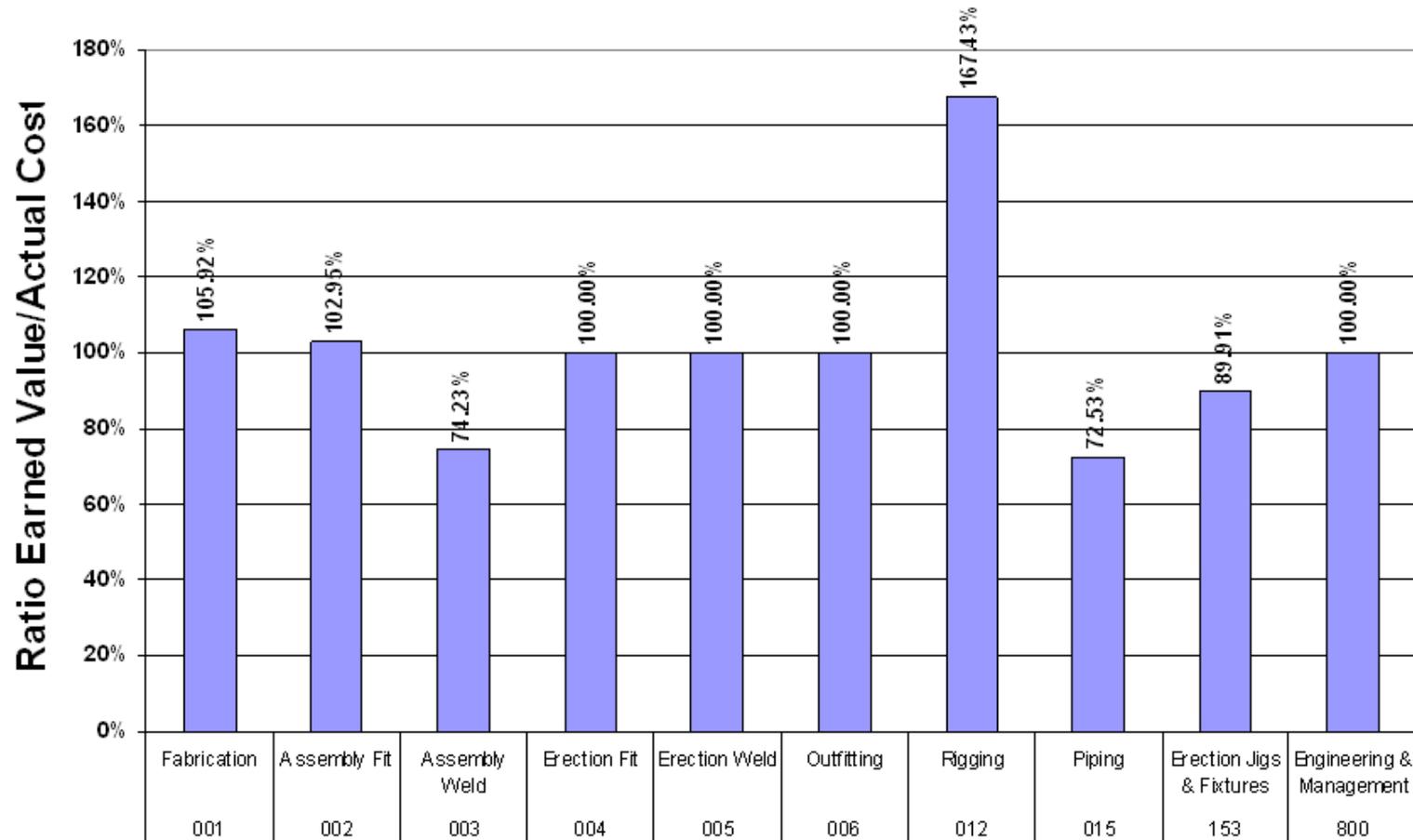


Perception

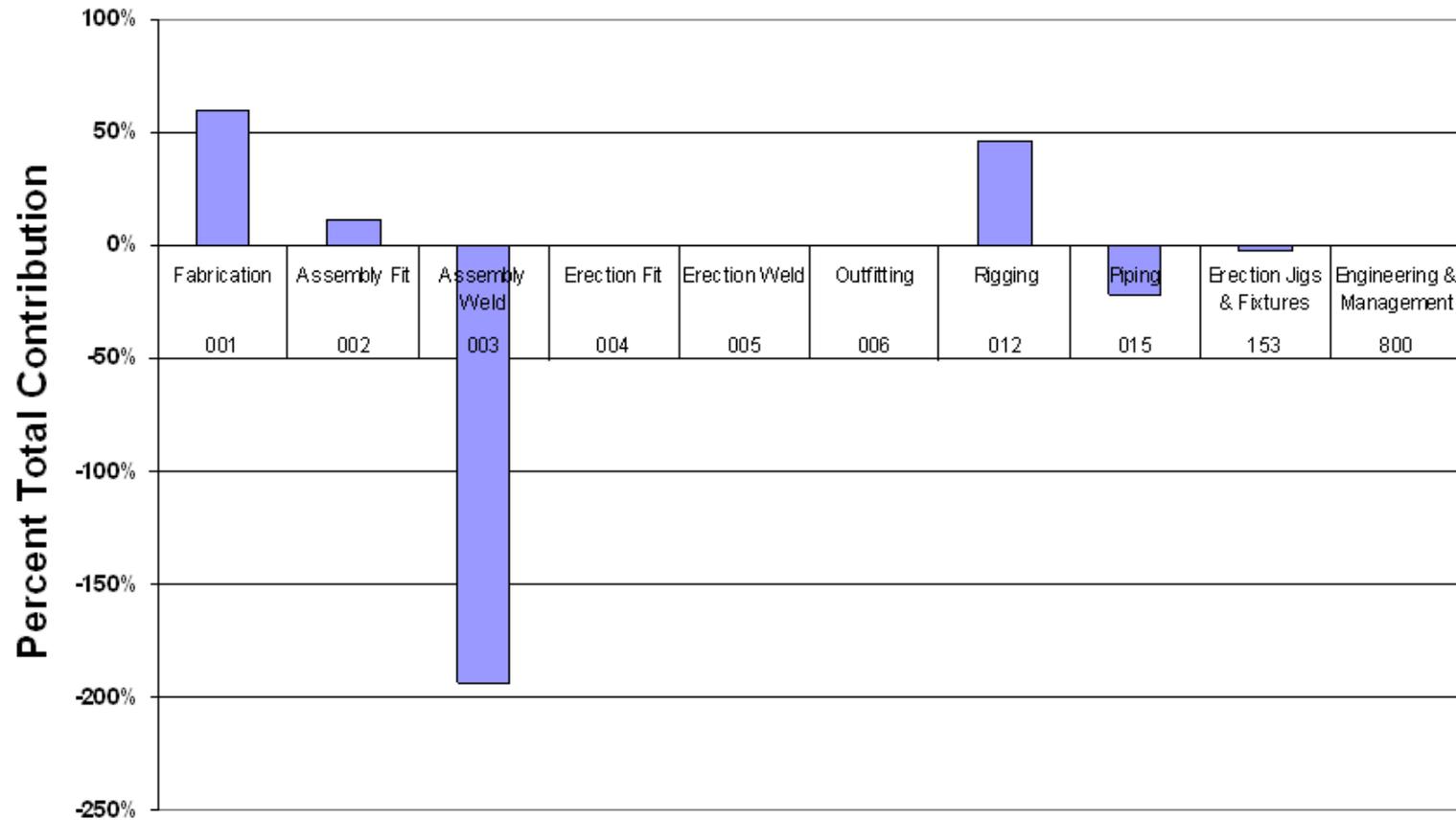
Measuring Work Center Performance



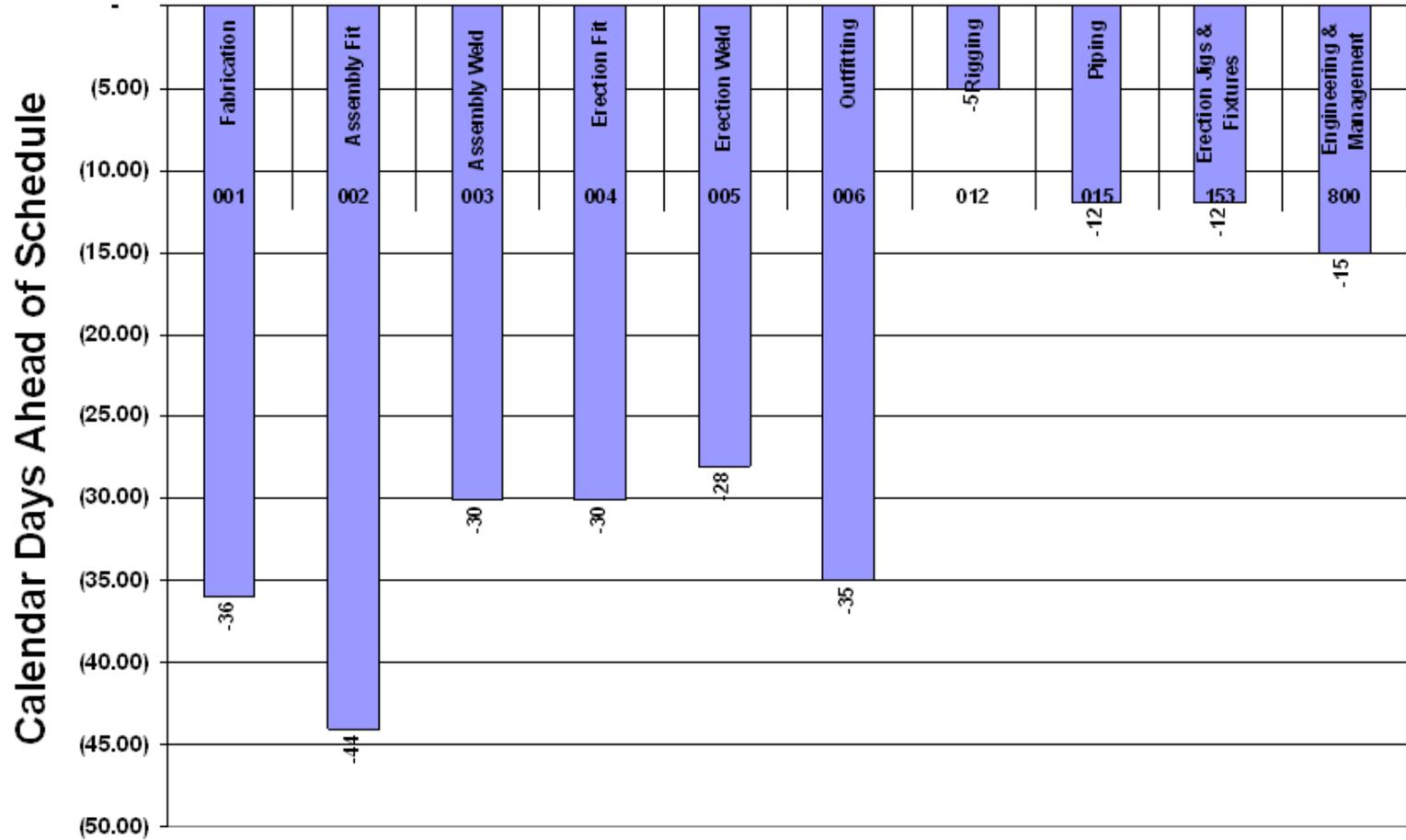
Work Center Current Labor Hour Efficiency



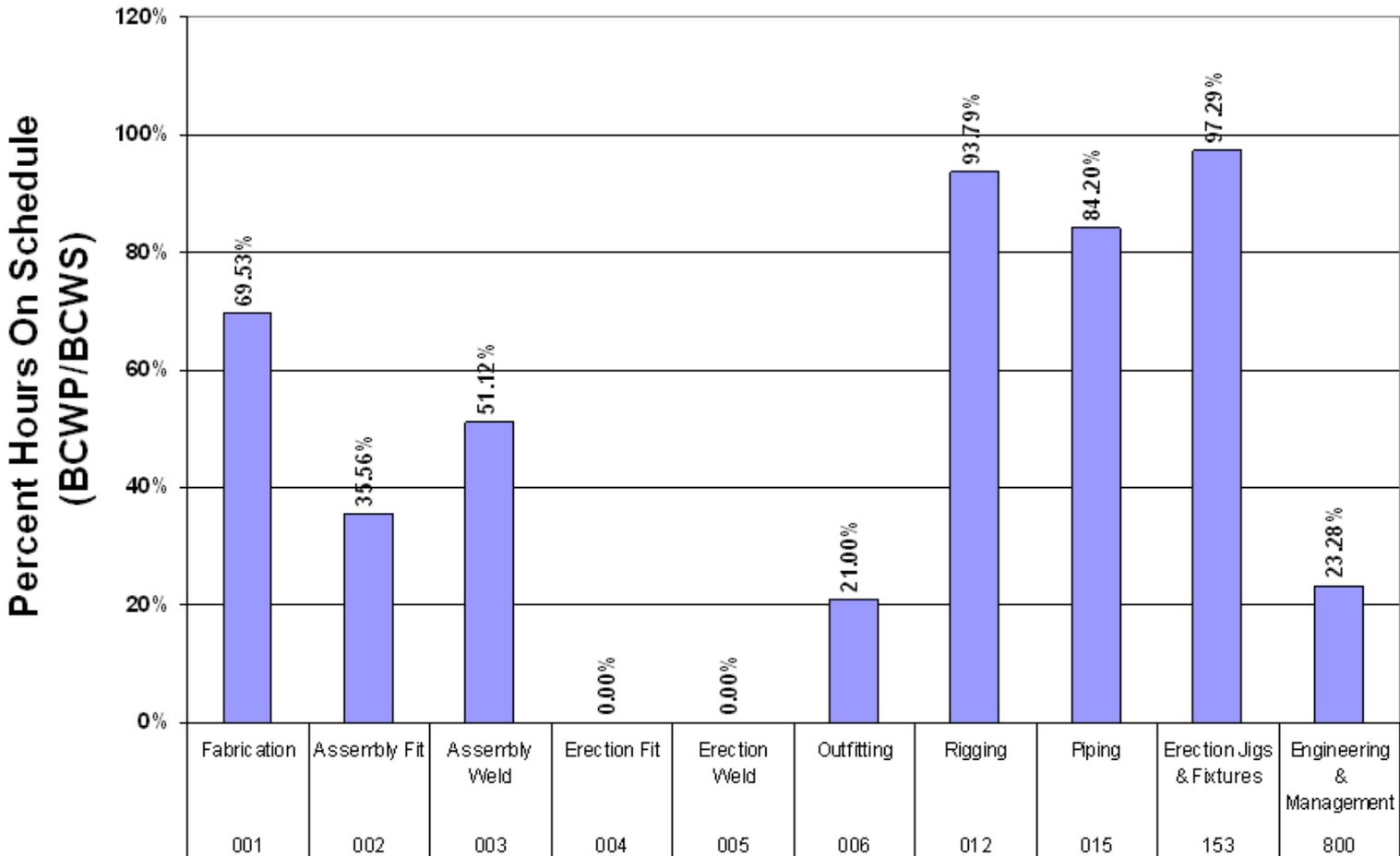
Work Center Contribution to Current Total Project Savings/Losses



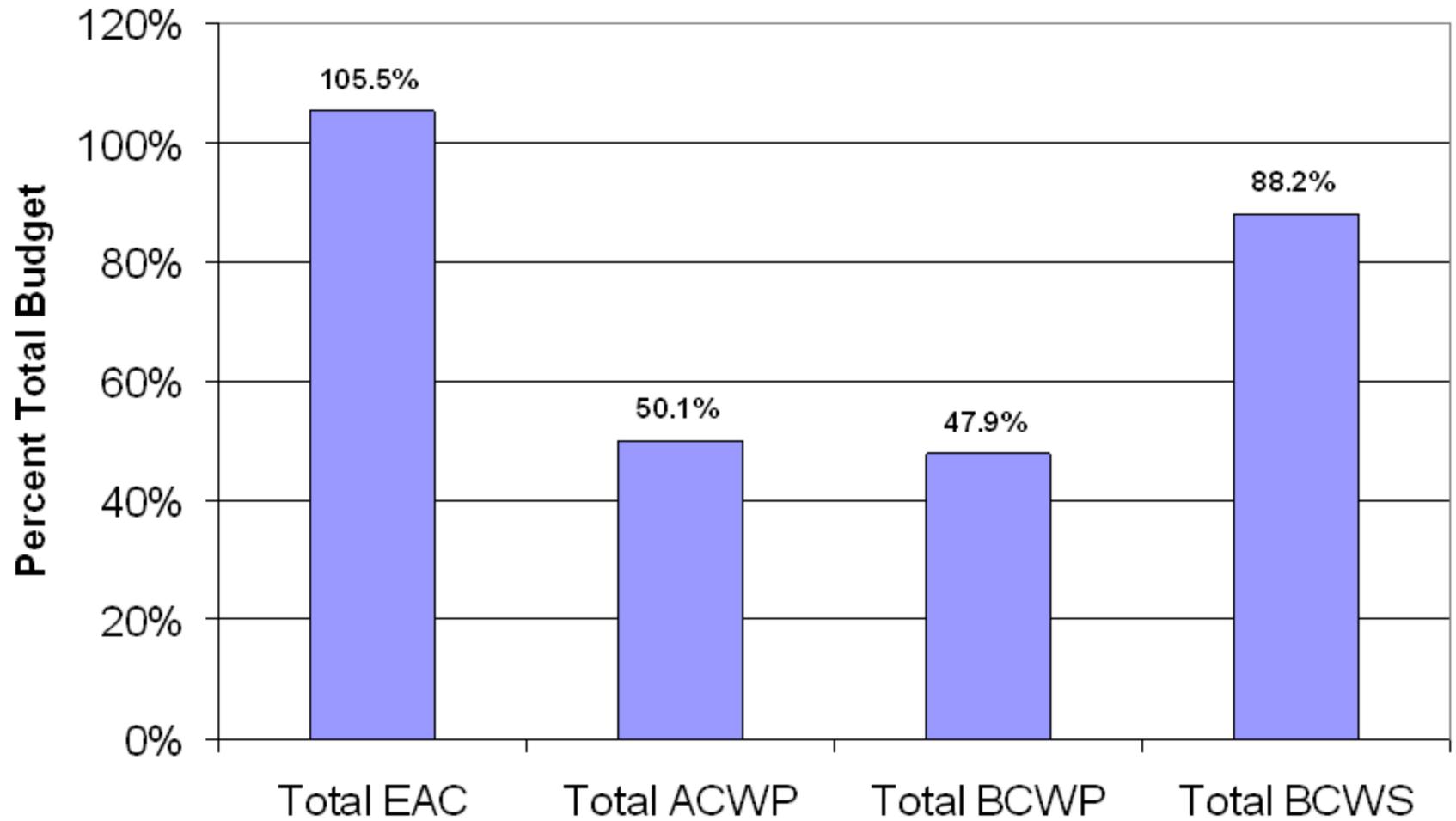
Current Work Center Schedule Variance



Current Work Center Schedule Efficiency



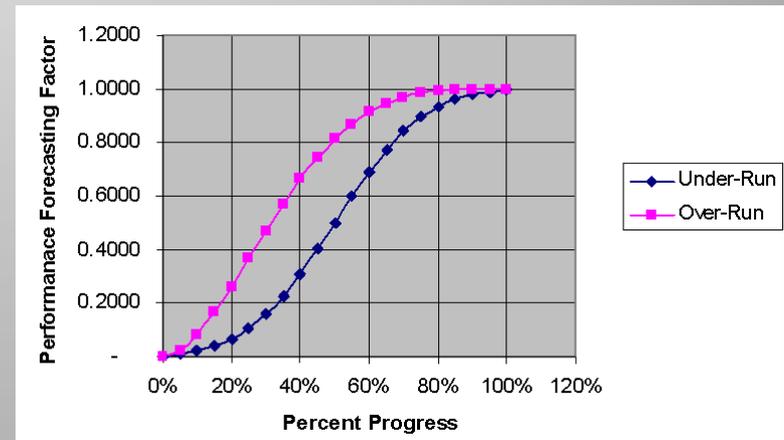
Overall Work Center Performance (Based on Available Work Orders)



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:

$$\text{Progress} = 100 \times (\text{ACWP}/\text{EAC})$$



Measuring Earned Value

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

$$BCWP = [Progress \times BAC] / 100$$

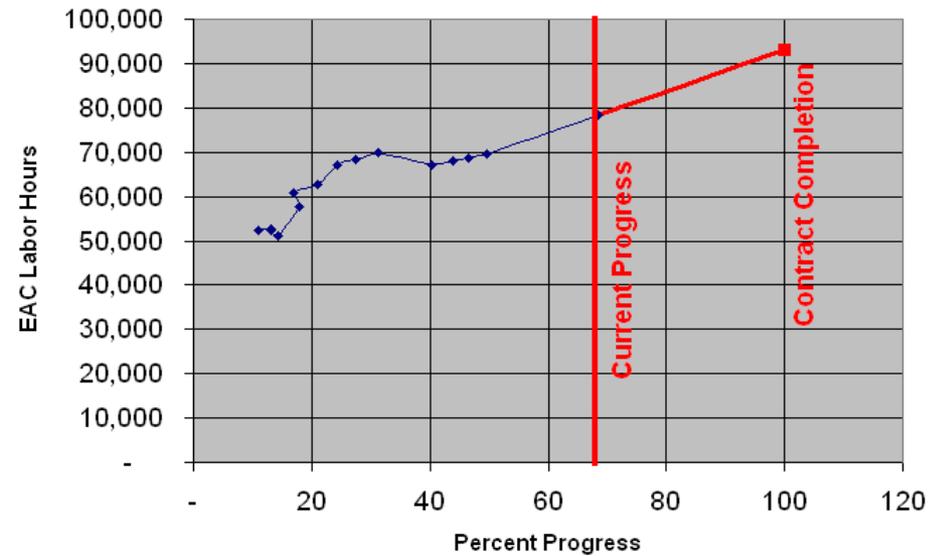


Measuring Trends

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.

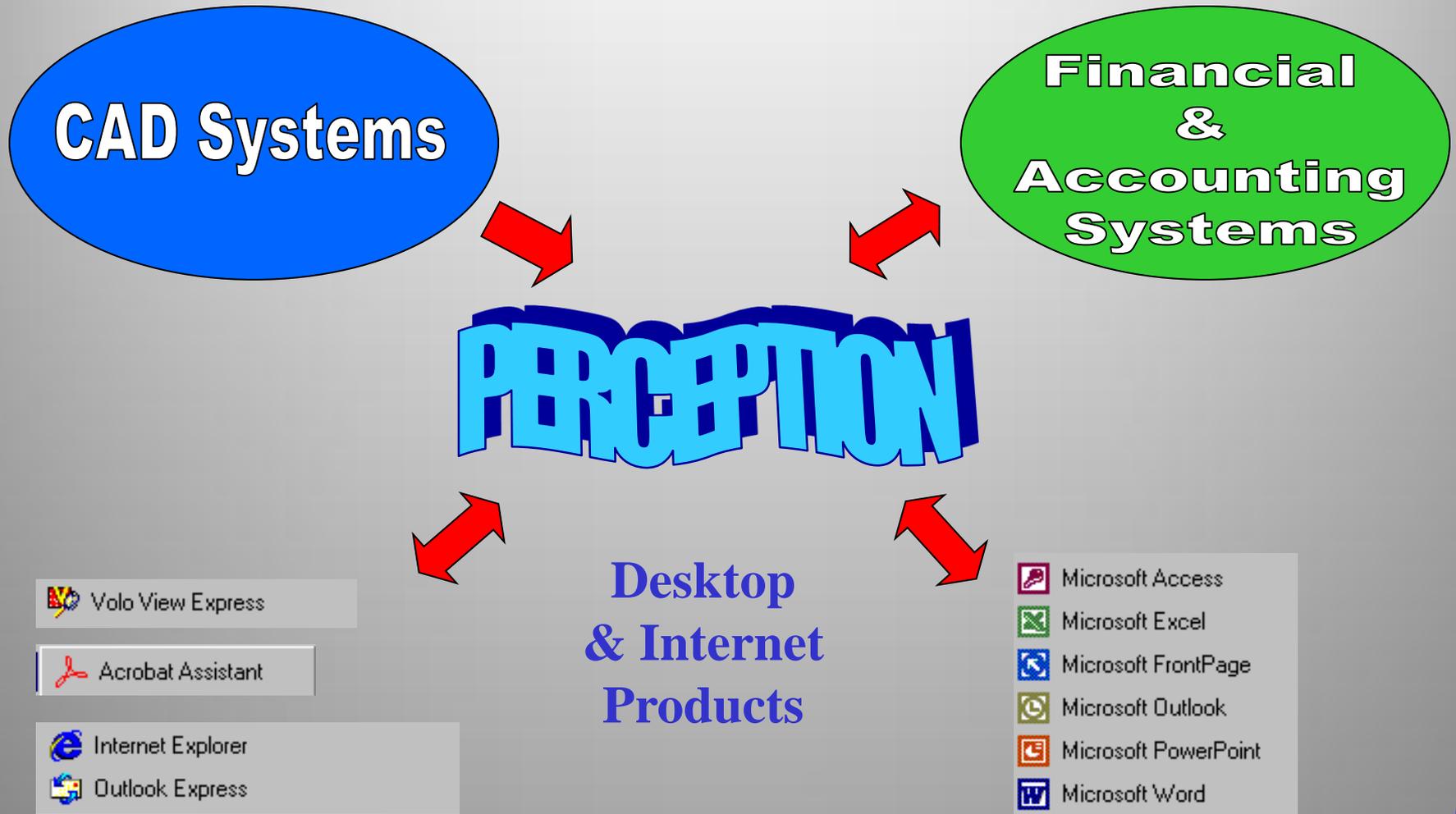
Tracking & Measuring EAC Trend



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



System's Integration



System's Integration

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

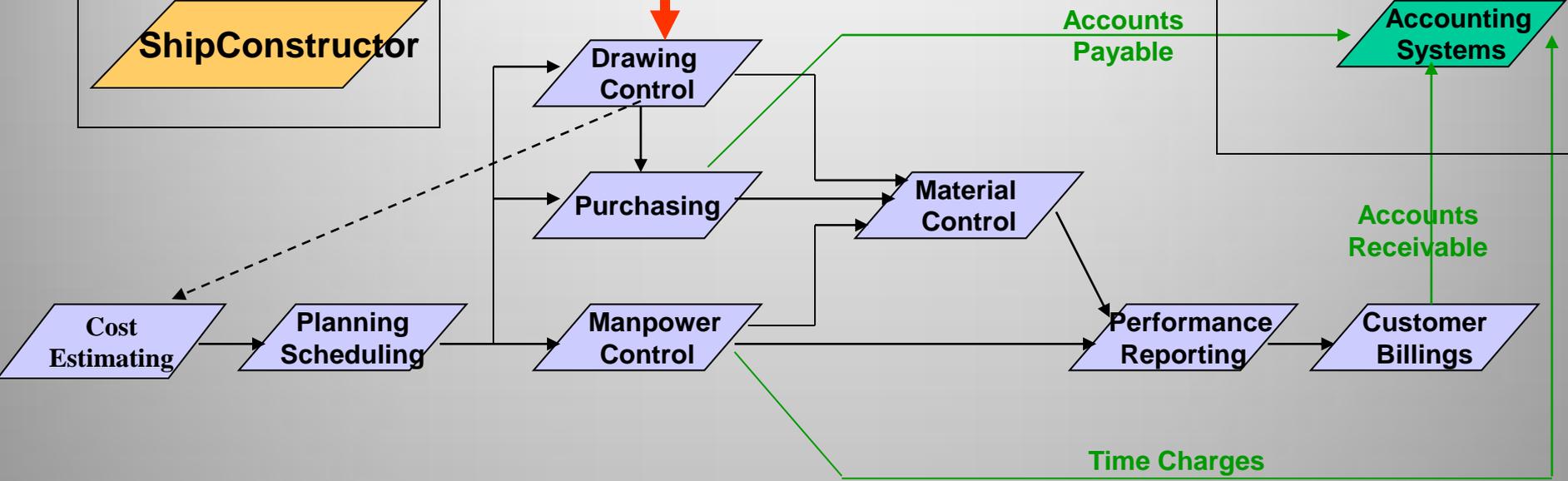
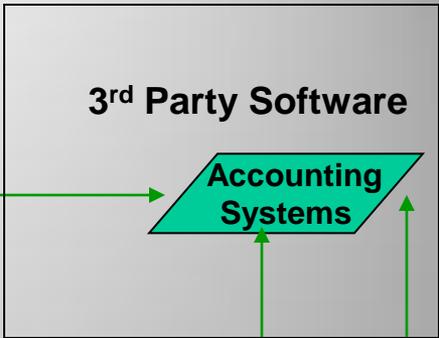
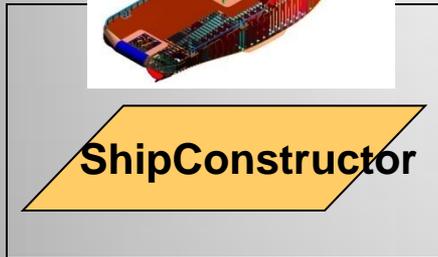
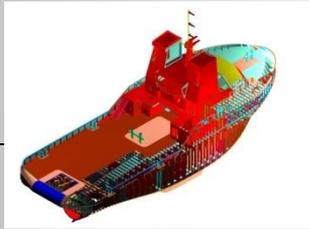
- ARL's *ShipConstructor*
- The Navy's *ASSET* Ship Concept Model
- Proteus Engineering's *Flagship* suite
- Intergraph's *GSCAD*
- Autodesk's *AutoCAD* general design system
- Rebis' *AutoPLANT* piping system design and engineering system
- Bentley's *MicroStation* general design system



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

