

# Work Book

## Cost Estimating Using *PERCEPTION® ESTI-MATE™*

Revised 14 July 2006



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## 1.0 Introduction

*PERCEPTION ESTI-MATE* is a state-of-the-art PC Windows-based system designed to provide a powerful new estimating capability. *PERCEPTION ESTI-MATE* 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.

This document provides a step-by-step process for using *PERCEPTION ESTI-MATE* to develop an estimate. Additional information and instructions are available from the “*PERCEPTION Cost Estimating User Manual*” and from the PowerPoint training tutorials available for a variety of subject matters.

The document titled “*Getting Started with PERCEPTION*” describes many of the mechanics of the system, how to navigate through all the various functions and generally how the system operates and can be modified by the user.

### **System Benefits**

*PERCEPTION ESTI-MATE* offers many benefits:

- The system has flexible features to address almost any estimating situation, whether for commercial or government requirements, new construction or ship repair.
- The system offers a toolbox of easy-to-use functions to help the estimator expedite the process and ensure the estimate is both complete and accurate.
- The system allows cost data to be cataloged in convenient and easy-to-use database libraries.
- The system cost libraries ensure all estimators are using consistent information. When the libraries are updated, current information is immediately available to all users.
- The system libraries can be configured to accurately define standard shipyard production processes to ensure every estimate is complete, nothing is missing.

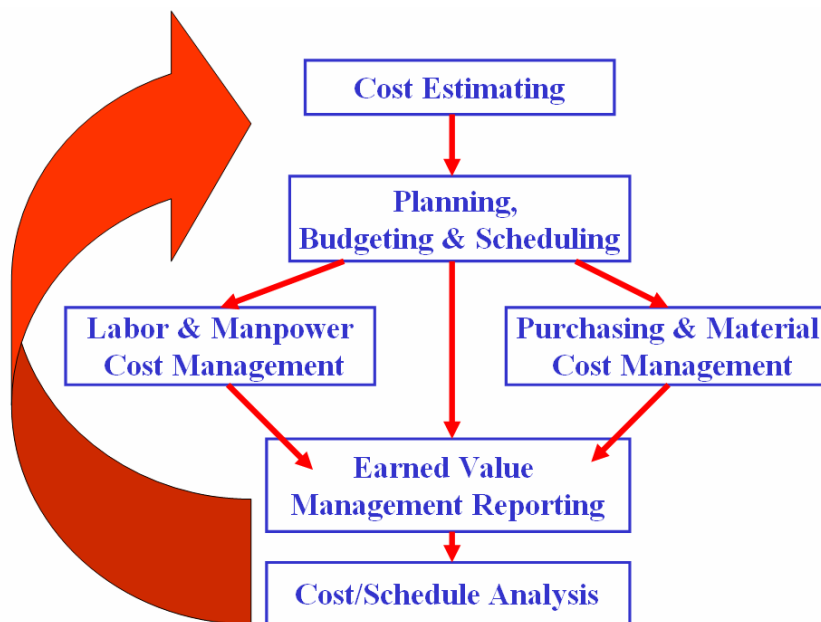
Especially for the estimator, the system is a tool that provides an array of functional capabilities:

- Automated Cost Escalation

- Global Edits and Update Features
- Application of Learning Curves
- Complexity & Productivity Factors
- Cost Trade-Off
- Cost Risk Analysis
- Return Cost Data Analysis
- User Documentation of Cost Estimate
- Tracking of Estimate Sources and Changes
- Central database of important cost information
- *An estimating tool that is easy to use and easy to learn*

## **Systems Integration**

*PERCEPTION ESTI-MATE* is a module of the comprehensive *PERCEPTION* shipyard resource planning and management system (Figure 1-1). *PERCEPTION* fully integrates the primary business processes of the shipyard: cost estimating; planning and scheduling; purchasing & material control; work orders and time charge management; job costing and cost/schedule performance reporting and forecasting. *PERCEPTION* interfaces easily with a variety of financial accounting systems for payroll, accounts payable and receivable, and general ledger. It also interfaces with various CAD systems, including ShipConstructor, AutoCAD, AutoPLANT and others.



**Figure 1-1: *PERCEPTION*, an Integrated Shipyard Planning & Management System**

## 2.0 The Estimate

This work book begins with the end result, the estimate. From here, we will go through the steps showing how the finished estimate was developed.

**Warning: If your database already has the project described below on its database, choose a different project number if you wish to follow these instructions and enter your own data.**

Figures 2-1 through 2-4 show several of the many cost estimate reports which can be generated at many levels of detail, user-selections, and specific formats. *ESTI-MATE* also has features for using filters on the estimating data and for specifying special sort requirements. The user should review the manual titled “*Getting Started with PERCEPTION*” where these features are described.

07/13/2006 15:33:05 (Date format: MMDD/YYYY)		Chesapeake Marine							Page 1 of 1				
SWBS Group Summary Report (SUM02)													
Contract SAMPLES - Sample Projects													
Project 1001 - Research & Hydrographic Ship													
Project Range: 0 to ZZZZZZZZ			Group Range: 0 to ZZZZZZZZ										
Group	Description	Labor Hours	Labor Cost	Material Cost	SubCon Hours	SubCon Cost	Travel Cost	Direct Cost	Taxes	Indirect Cost	Total Cost	Profit	Total Price
1	Structures	78,295	1,722,501	1,994,475	0	0	0	3,716,976	0	2,392,463	6,109,438	610,944	6,720,382
2	Propulsion Systems	3,750	82,500	3,640,000	0	0	0	3,722,500	0	539,925	4,262,425	426,243	4,688,668
3	Electric Systems	4,387	96,518	1,259,828	0	0	0	1,347,346	0	270,747	1,618,093	161,809	1,779,903
4	Electronics & Communications	4,000	88,000	663,700	0	0	0	751,700	0	189,644	941,344	94,134	1,035,478
5	Auxiliary Systems	103,716	2,281,745	5,488,114	0	0	0	7,769,859	0	3,510,755	11,280,614	1,128,061	12,408,675
6	Outfit & Furnishing Systems	88,412	1,945,061	10,479,408	0	0	0	12,424,469	0	3,688,655	16,113,324	1,611,332	17,724,657
7	Armament Systems	0	0	0	0	0	0	0	0	0	0	0	0
8	Technical Support Services	33,907	745,959	0	0	0	0	745,959	0	932,449	1,678,408	167,841	1,846,249
9	Shipyard Production Support	4,238,403	93,244,873	0	0	0	0	93,244,873	0	116,556,091	209,800,963	20,980,096	230,781,060
10	Fees & Insurance	4,435,776	97,587,078	0	0	0	0	97,587,078	0	121,983,848	219,570,926	21,957,093	241,528,019
Project: 1001 Totals		8,990,647	197,794,235	23,516,525	0	0	0	221,310,760	0	256,064,777	471,375,537	47,137,554	518,513,990
Contract: SAMPLES Totals		8,990,647	197,794,235	23,516,525	0	0	0	221,310,760	0	256,064,777	471,375,537	47,137,554	518,513,990

Figure 2-1: Sample High Level Cost Estimate Summary by SWBS Groups

07/13/2006 15:36:58 (Date format: MMDD/YYYY)		Chesapeake Marine							Page 1 of 3				
Cost Item Value Report by SWBS Groups(CI14)													
Contract SAMPLES - Sample Projects													
Project Range: 0 to ZZZZZZZZ			Zone Range: 0 to ZZZZZZZZ			Assembly Range: 0 to ZZZZZZZZ			Division: 0 to ZZZZZZZZ				
Group Range: 0 to ZZZZZZZZ			Outfit Zone Range: 0 to ZZZZZZZZ			Sub Assembly Range: 0 to ZZZZZZZZ			Shop: 0 to ZZZZZZZZ				
Account Range: 0 to ZZZZZZZZ			Unit/Block Range: 0 to ZZZZZZZZ			MGF Part Range: 0 to ZZZZZZZZ			Center: 0 to ZZZZZZZZ				
Work Center Range: 0 to ZZZZZZZZ			CL/Is Range: 0 to ZZZZZZZZ			Planned Start: 01/01/1950 to 01/01/2050							
Cost Item	Description	Labor Hours	Labor Cost	Material Cost	SubCon Hours	SubCon Cost	Travel Cost	Direct Cost	Taxes	Indirect Cost	Total Cost	Profit	Total Price
Project 1001 - Research & Hydrographic Ship													
Group 1 - Structures													
Center 0 - Spar Center													
100.1	Fore Peak Section - Subcontract	0	0	1,005,355	0	0	0	1,005,355	0	120,643	1,125,997	112,600	1,238,597
100.3	Bulwarks	4,539	99,861	15,816	0	0	0	115,677	0	126,724	242,401	24,240	266,641
100.4	Sea Chests	61	1,346	1,223	0	0	0	2,569	0	1,829	4,398	440	4,838
100.6	Decks	10,370	228,142	195,662	0	0	0	423,804	0	308,657	732,461	73,246	805,707
100.7	Foundations, Machinery Spaces	1,259	27,701	10,493	0	0	0	38,194	0	35,886	74,080	7,408	81,488
100.8	Foundations, Outfit Systems	2,141	47,097	30,582	0	0	0	77,679	0	62,540	140,219	14,022	154,241
100.9	Longitudinal Bulkheads	353	7,774	8,835	0	0	0	16,609	0	10,778	27,387	2,739	30,126
100.10	Masts & Spars	11	245	218	0	0	0	463	0	333	796	80	876
100.11	Ramps	1,391	30,602	34,775	0	0	0	65,377	0	42,426	107,803	10,780	118,583
100.12	Shell & Support Structures	6,244	137,374	223,010	0	0	0	360,384	0	198,479	558,862	55,886	614,748
100.13	Superstructure	31,127	684,796	158,158	0	0	0	842,954	0	874,974	1,717,929	171,793	1,889,721
100.14	Stacks	31	673	874	0	0	0	1,546	0	946	2,492	249	2,741
100.15	Stern Peak Section	19,253	423,572	267,406	0	0	0	690,978	0	561,553	1,252,531	125,253	1,377,784
100.16	Transverse Bulkheads	1,514	33,318	42,069	0	0	0	75,387	0	46,696	122,083	12,208	134,291
Group: 1 Totals		78,295	1,722,501	1,994,475	0	0	0	3,716,976	0	2,392,463	6,109,438	610,944	6,720,382
Group 2 - Propulsion Systems													
Center 0 - Spar Center													
200.1	Diesel Direct Drive	3,750	82,500	3,640,000	0	0	0	3,722,500	0	539,925	4,262,425	426,243	4,688,668
Group: 2 Totals		3,750	82,500	3,640,000	0	0	0	3,722,500	0	539,925	4,262,425	426,243	4,688,668

Figure 2-2: Sample Detail Level of Cost Estimate Items

**Chesapeake Marine**  
**Cost Item Listing by SWBS Groups(CI02)**  
 Contract SAMPLES Sample Projects

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

Center	Cost Item	Heading	Qty	UoM	Labor CER	Mat'l CER	Labor Hours	Labor Cost	Material Cost	Extended Cost	Last Updated
<b>Project 1001 Research &amp; Hydrographic Ship</b>											
<b>Group 1 - Structures</b>			<b>0.00</b>								
0	100.1	Fore Peak Section	267.41	MTON	0.0000	3,759.6000	0	0	1,005,355	1,005,355	07/13/2006
0	100.3	Bulwarks	15.82	MTON	267.0000	1,000.0000	4,539	99,861	15,816	115,677	07/13/2006
0	100.4	Sea Chests	1.22	MTON	50.0000	1,000.0000	61	1,346	1,223	2,569	07/13/2006
0	100.6	Decks	195.66	MTON	53.0000	1,000.0000	10,370	228,142	195,662	423,804	07/13/2006
0	100.7	Foundations, Machinery Spaces	10.49	MTON	120.0000	1,000.0000	1,259	27,701	10,493	38,194	07/13/2006
0	100.8	Foundations, Outfit Systems	30.58	MTON	70.0000	1,000.0000	2,141	47,097	30,582	77,679	07/13/2006
0	100.9	Longitudinal Bulkheads	8.83	MTON	40.0000	1,000.0000	353	7,774	8,835	16,609	07/13/2006
0	100.10	Masts & Spars	0.22	MTON	51.0000	1,000.0000	11	245	218	463	07/13/2006
0	100.11	Ramps	34.78	MTON	40.0000	1,000.0000	1,391	30,602	34,775	65,377	07/13/2006
0	100.12	Shell & Support Structures	223.01	MTON	28.0000	1,000.0000	6,244	137,374	223,010	360,384	07/13/2006
0	100.13	Superstructure	158.16	MTON	196.8100	1,000.0000	31,127	684,796	158,158	842,954	07/13/2006
0	100.14	Stacks	0.87	MTON	35.0000	1,000.0000	31	673	874	1,546	07/13/2006
0	100.15	Stern Peak Section	267.41	MTON	72.0000	1,000.0000	19,253	423,572	267,406	690,978	07/13/2006
0	100.16	Transverse Bulkheads	42.07	MTON	36.0000	1,000.0000	1,514	33,318	42,069	75,387	07/13/2006
<b>Group: 1 Totals</b>							<b>78,295</b>	<b>1,722,501</b>	<b>1,994,475</b>	<b>3,716,976</b>	
<b>Group 2 - Propulsion Systems</b>			<b>0.00</b>								
0	200.1	Diesel Direct Drive	5,000.00	KW	0.7500	728.0000	3,750	82,500	3,640,000	3,722,500	07/13/2006
<b>Group: 2 Totals</b>							<b>3,750</b>	<b>82,500</b>	<b>3,640,000</b>	<b>3,722,500</b>	
<b>Group 3 - Electric Systems</b>			<b>0.00</b>								
0	300.1	Cable, Hanger, Tubes & Instl Materials -	9,935.71	SHIPSET	0.0000	8.8200	0	0	0	0	07/13/2006
0	300.2	Appliances, Mahinery Spaces, Exterior De	9,935.71	SHIPSET	0.0000	0.4600	0	0	4,570	4,570	07/13/2006
0	300.3	Lighting - Machinery Spaces, Exterior De	9,935.71	SHIPSET	0.0000	1.4700	0	0	14,606	14,606	07/13/2006
0	300.4	Wheelhouse Electrical Systems (Not Inclu	1.00	SHIPSET	0.0000	265,641.8300	0	0	265,642	265,642	07/13/2006
0	300.5	Switch Boards, Disconnect Switches & Ti	1,592.78	KW	0.0000	11.4200	0	0	18,190	18,190	07/13/2006
0	300.6	Ship Service Generator	1,327.32	KW	0.4470	561.8000	593	13,053	745,686	758,738	07/13/2006

**Figure 2-3: Sample Detail Level of Cost Estimate Items Showing Cost Estimating Relationships (CERs)**



Estimate Date
07/13/2006

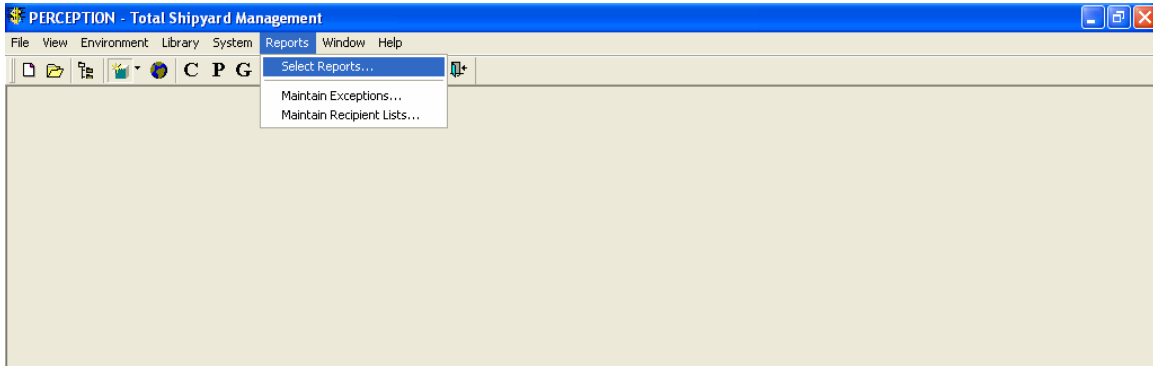
<b>TO CUSTOMER</b>	<b>ESTIMATE</b>	<b>PROPOSAL FROM</b>
Fast-Cat Ferries 970 West Street Annapolis MD 21401 USA		SPAR Associates, Inc. 927 West Street Annapolis MD 21401 USA

Contract SAMPLES - Sample Projects  
Project 1001 - Research & Hydrographic Ship

Cost Item #	Quantity	UoM	Description	Unit Price	Extended Cost
<b>Account 100</b>			<b>Structures</b>		
100.1	267.41	MTON	Fore Peak Section - Subcontract	4,631.83	1,238,596.92
100.3	15.82	MTON	Bulwarks	16,854.66	266,640.70
100.4	1.22	MTON	Sea Chests	3,965.43	4,837.82
100.6	195.66	MTON	Decks	4,117.89	805,707.12
100.7	10.49	MTON	Foundations, Machinery Spaces	7,768.16	81,487.98
100.8	30.58	MTON	Foundations, Outfit Systems	5,043.86	154,241.11
100.9	8.83	MTON	Longitudinal Bulkheads	3,411.75	30,125.77
100.10	0.22	MTON	Masts & Spars	3,980.18	875.64
100.11	34.78	MTON	Ramps	3,409.51	118,582.75
100.12	223.01	MTON	Shell & Support Structures	2,756.60	614,748.34
100.13	158.16	MTON	Superstructure	11,948.16	1,889,721.38
100.14	0.87	MTON	Stacks	3,151.11	2,741.47
100.15	267.41	MTON	Stern Peak Section	5,152.33	1,377,783.90
100.16	42.07	MTON	Transverse Bulkheads	3,192.09	134,291.29
			<b>Total for Acct: 100</b>		<b>6,720,382.19</b>
<b>Account 200</b>			<b>Propulsion Systems</b>		
200.1	5,000.00	KW	Diesel Direct Drive	937.73	4,688,667.50
			<b>Total for Acct: 200</b>		<b>4,688,667.50</b>
<b>Account 300</b>			<b>Electric Systems</b>		
300.1	9,935.71	SHIPSET	Cable, Hanger, Tubes & Instl Materials - Machinery Spaces, Exterior Decks & Deck House	0.00	0.00

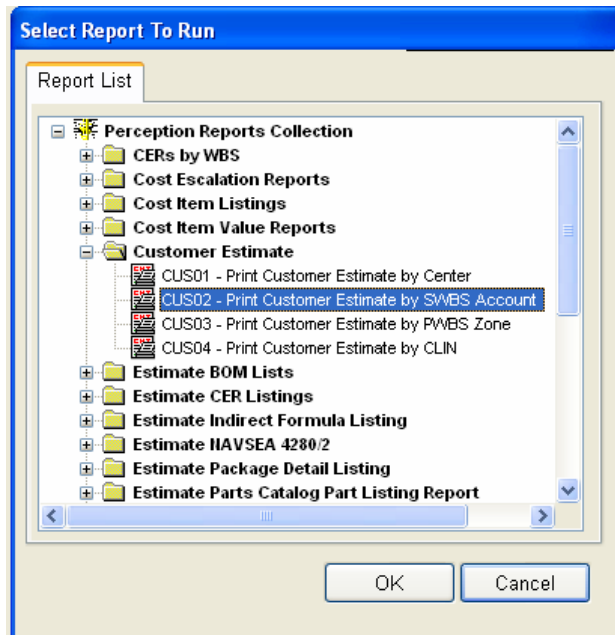
*Figure 2-4: Sample Customer Formatted Cost Estimate Report*

To generate a report, go to the system's main menu for Reports (Figure 2-6).



**Figure 2-6: Main Menu for Reports**

Click on Select Reports, which will pop up a window with all the various report selections (Figure 2-7). Each line in this window is preceded by either a plus-sign (“+”) or a minus-sign (“-”). The lines with the plus-sign must be clicked to open up specific report selections.



**Figure 2-7: Report Selection Window**

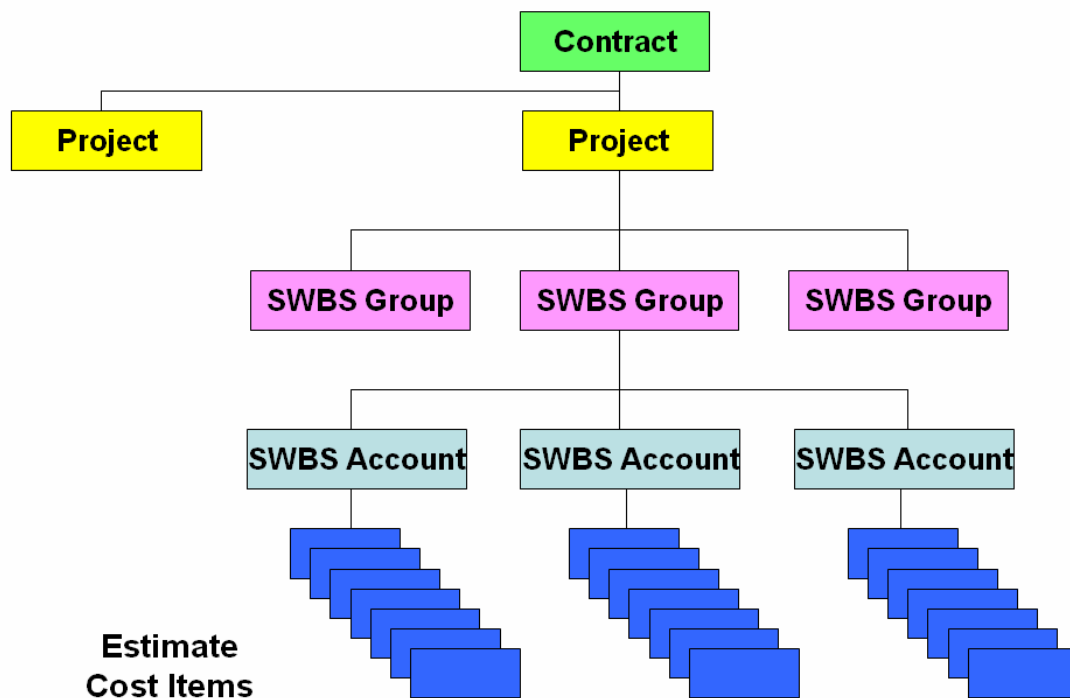
Once the type report has been selected the system will present another window for the user to specify the project and other report options. “*Getting Started with PERCEPTION*” describes this in more detail.

### 3.0 Creating a New Project

An estimate requires a project be defined. In the case of *PERCEPTION ESTI-MATE*, the project actually must be defined at several levels: Contract ID, Project ID and Project WBS. This enables the estimate to be summarized at various levels of detail.

The Contract ID is the primary identifier. Under the contract ID, the project ID must be defined. This configuration allows a contract to have multiple “projects”, such as for series ship production and/or separating non-recurring engineering from production, etc.

Each Project ID then requires its work breakdown structure. For this sample estimate, we are using an abbreviated two-level SWBS<sup>2</sup> comprising of SWBS Accounts cataloged below SWBS Groups. Figure 3-1 illustrates this hierarchy.





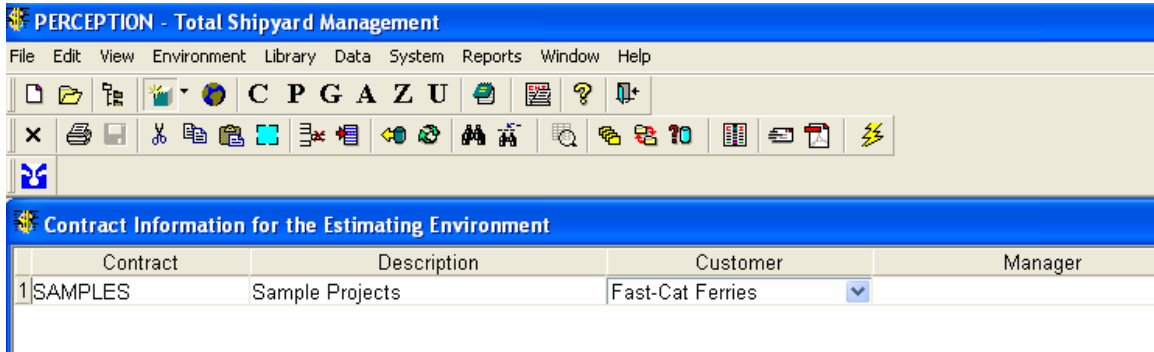
*Figure 3-1: Hierarchy of a Project Work Breakdown Structure*

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<sup>2</sup> Ship work Breakdown Structure, SWBS, can be devised to almost any scheme and configuration. The U.S. Navy SWBS is one well-known configuration. However, shipyards typically have their own versions of SWBS. Different schemes and configurations are typical to differentiate the requirements of new construction and ship repair. *PERCEPTION* allows different SWBS for each and every project developed on the database.

## Create a Contract


To create a new Contract, click on the  button located on the system tool bar. This will open the Contract worksheet window (Figure 3-2). Click on the Add  button on the tool bar to begin entering information that identifies the contract. Note that there is very little that needs to be defined for the contract record.

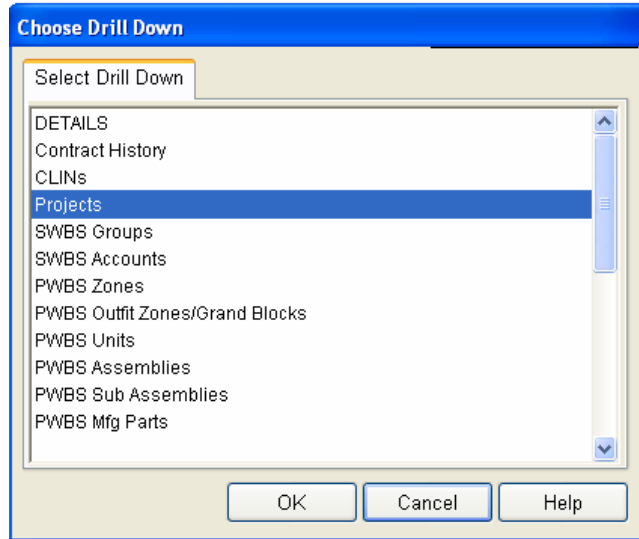


*Figure 3-2: Defining a New Contract.*


Click on the  button to save the new contract record.

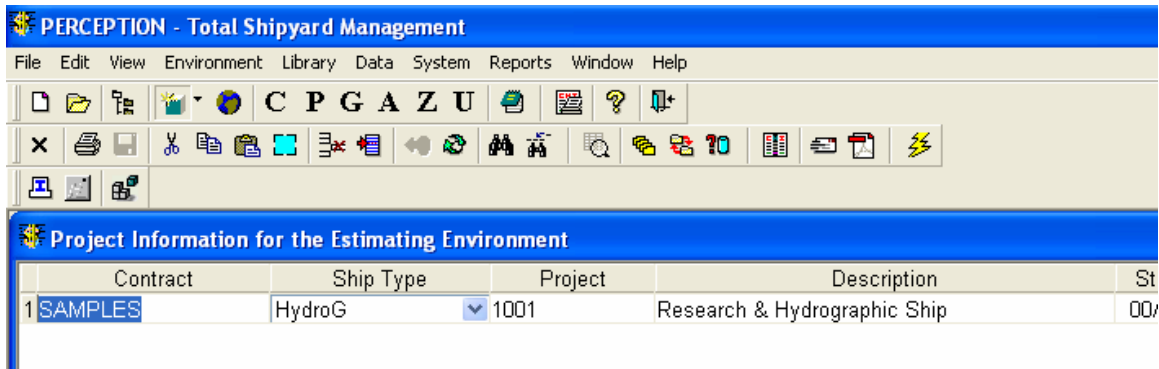
## Create a Project

Click on any data field on the contract record. Then click on the  button to begin the drill-down process for defining the rest of the work breakdown structure. The system will pop up the drill-down selections (Figure 3-3).





**Figure 3-3: Drill-Down Selections**

Select Projects, and the system will open the project record worksheet (Figure 3-4). Click on the Add  button on the tool bar to begin entering information that identifies the project.





**Figure 3-4: Project Record Worksheet**

If there are multiple projects for the contract, continue entering each project with the Add  button.

Click on the  button to save the new project record.


### **Create SWBS Groups**

To create the SWBS Groups, click again on the  Drill-Down button and select SWBS Groups. This will open the SWBS Group worksheet (Figure 3-5). Click on the Add 


button on the tool bar to begin entering information that identifies each of the SWBS Groups. All that is needed to define are each SWBS Group number and its description.

	Contract	Project	Group	Description
1	SAMPLES	1001	1	Structures
2	SAMPLES	1001	10	Fees & Insurance
3	SAMPLES	1001	2	Propulsion Systems
4	SAMPLES	1001	3	Electric Systems
5	SAMPLES	1001	4	Electronics & Communications
6	SAMPLES	1001	5	Auxiliary Systems
7	SAMPLES	1001	6	Outfit & Furnishing Systems
8	SAMPLES	1001	7	Armament Systems
9	SAMPLES	1001	8	Technical Support Services
10	SAMPLES	1001	9	Shipyards Production Support



**Figure 3-5: SWBS Groups Worksheet**

Click on the  button to save them to the database.

If the same set of SWBS Groups is being used for multiple estimates, they can be copied to the project using the Estimator’s Toolbox. The *PERCEPTION ESTI-MATE User’s Manual* provides instructions on how to use the toolbox for this purpose.

Close the SWBS Group worksheet (Click on the  button at the upper right corner of the SWBS Group worksheet) and you will be back to the Project worksheet.


### **Create SWBS Accounts**

To create the SWBS Accounts, click again on the  Drill-Down button and select SWBS Accounts. This will open the SWBS Account worksheet (Figure 3-6). Click on the Add  button on the tool bar to begin entering information that identifies each of the SWBS Accounts that you will need for the estimate. All that is needed to define are each SWBS Account its account number and its description. Note that the SWBS Group for each SWBS Account is determined automatically by the system<sup>3</sup>.

<sup>3</sup> Other SWBS Group options and formulations are described in “Getting Started with PERCEPTION.”

	Contract	Project	Account	Description	Group	S
1	SAMPLES	1001	100	Structures	1	OC
2	SAMPLES	1001	1000	Fees & Insurance	10	OC
3	SAMPLES	1001	200	Propulsion Systems	2	OC
4	SAMPLES	1001	300	Electric Systems	3	OC
5	SAMPLES	1001	400	Electronics & Communications	4	OC
6	SAMPLES	1001	500	Auxiliary Systems	5	OC
7	SAMPLES	1001	600	Outfit & Furnishing Systems	6	OC
8	SAMPLES	1001	700	Armament Systems	7	OC
9	SAMPLES	1001	800	Technical Support Services	8	OC
10	SAMPLES	1001	900	Shipyard Production Support	9	OC

**Figure 3-6: SWBS Accounts Worksheet**


Click on the  button to save the SWBS Accounts to the database.


If the same set of SWBS Accounts is being used for multiple estimates, they can be copied to the project using the Estimator's Toolbox. The *PERCEPTION ESTI-MATE User's Manual* provides instructions on how to use the toolbox for this purpose.

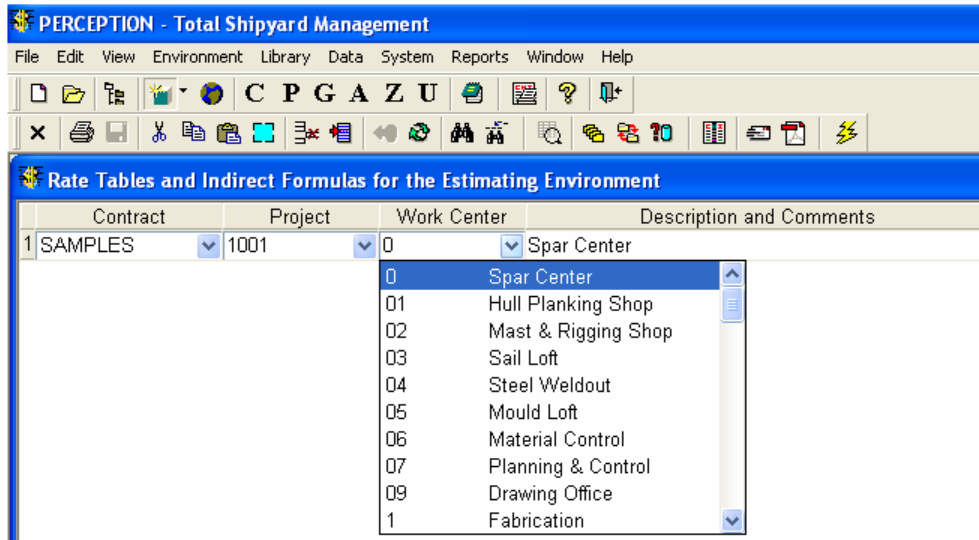
Close the SWBS Account worksheet and you will be back to the Project worksheet.

### **Create Labor & Profit Rates**

Each project defined on the database operates under its own set of labor, profit and indirect cost rates. These rates must be defined separately for each work center assigned to the project.

To create the project labor and profit rates, click again on the  Drill-Down button and select Rate Tables. This will open the Rate Table worksheet (Figure 3-6).

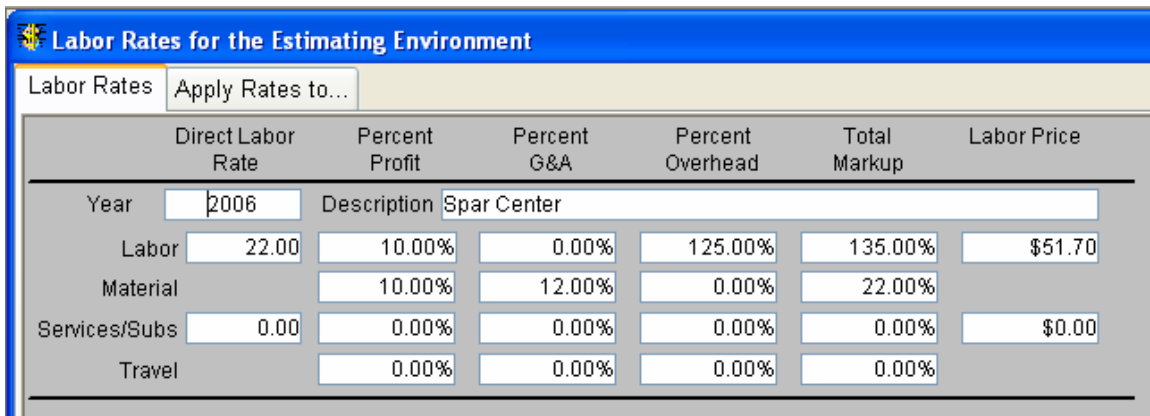
Click on the Add  button on the tool bar to begin assigning work centers that you will need for the project. To identify what centers you can use, you must select them from the Work Center drop-down list. If the centers you need are not listed in the drop-down, you will need to set them up on the database library as described in "Getting Started with *PERCEPTION*."



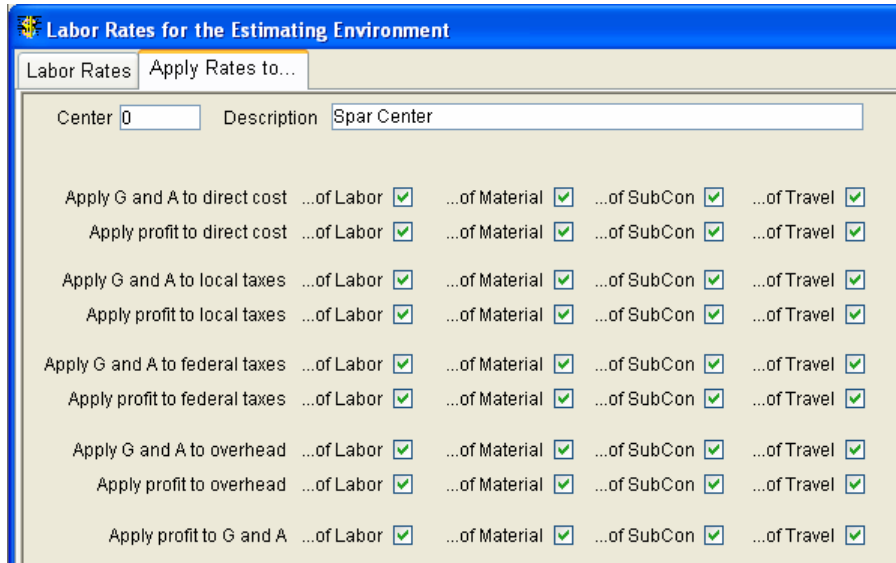
**Figure 3-6: Assigning Project Work Centers**

Once you have identified the work center(s) for the project, click on the Save button, then double click on the work center record and the system will pop up the rate table window (Figure 3-7). This is a two-tab window.

The first tab provides cells for the user to enter the labor rate, and percentages for profit, overhead, etc. If only a standard all-inclusive labor rate is needed, enter that in the Labor Rate cell and leave the overhead and profit cells for labor without entries. Other cells may or may not be needed for the estimate.




The second tab (Figure 3-8) provides options for the user to identify what indirect costs should be applied to what costs.



**Figure 3-8: Options for Applying Indirect Costs & Profit**

If multiple work centers are used for the project, repeat the above steps for each work center on the project.

Click on the  button to save the rates for the project to the database.

If the same set of work centers and rates is being used for multiple estimates, they can be copied to the project using the Estimator's Toolbox. The *PERCEPTION ESTI-MATE User's Manual* provides instructions on how to use the toolbox for this purpose.

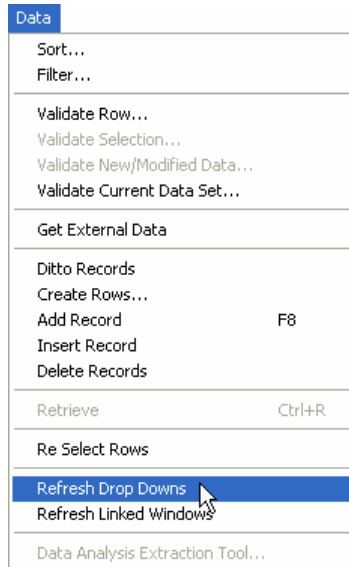
Close the Rate Table window.

## **Making Changes**

If at any time you need additions, deletions and changes to any information required for the estimate, these changes can be made directly by opening up the related worksheet windows described above, making the changes, and saving them to the database<sup>4</sup>.

If these changes affect any of the drop-down lists on a worksheet, the drop-down list can be refreshed by clicking on Data/Refresh Drops Downs from the main menu (Figure 3-9).

<sup>4</sup> It is often convenient to have open at any one time various worksheet windows. The user can jump from window to window using the window list displayed under Window on the main menu. Windows also may be cascaded, layered or tiled for added convenience.




***Figure 3-9: Refreshing Worksheet Drop-Down Lists***

This refreshing of drop-down lists needs to be done to each open window where the modified drop-down list is used.

## 4.0 Create Detail Cost Items

With the project and its WBS defined, along with the project rate tables, the stage is set to enter details of the cost estimate.

From the Project worksheet, click on the  Drill-Down button and select Cost Items<sup>5</sup>.

This will open the Cost Items worksheet (Figure 4-2). Click on the Add  button on the tool bar to begin entering information that identifies each of the Cost Items that you will need for the estimate.

Each cost item has the following basic information<sup>6</sup>:

1. Project WBS: Contract, Project, & SWBS Account (If the user enters the SWBS Account, the system will automatically determine the SWBS Group under which it belongs. Refer to “*Getting Started with PERCEPTION*” for further discussions about this and other SWBS formulation available).
2. Quantity
3. Unit of Measure (for example, meters)
4. Labor Hour CER (for example, 23.7 hours per meter)
5. Material Cost CER (for example, \$45.98 per meter)

Note that the SWBS Group for each SWBS Account is determined automatically by the system. Also, since the cost item worksheet was open from the drill-down from the project, the Contract and Project numbers also are determined automatically by the system.

Cost items can be added manually, item by item (such as for vendor quotes), or from using various automation techniques and database libraries discussed below.

---

<sup>5</sup> Another approach is to drill-down from the Project to the SWBS Accounts and drill-down from each account to the cost items. That way, the cost items entered automatically will be assigned to the SWBS Account to which they are linked via the drill-down.

<sup>6</sup> The Cost Item worksheet provides many additional columns of information, many the results of extended costs computed by the system. For convenience, the user may re-arrange the columns so that the columns of most use will appear together at the left of the worksheet. “*Getting Started with PERCEPTION*” provides instructions on how to re-arrange the column order.

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C P G A Z U

Cost Item Information for the Estimating Environment

Contract	Project	Cost Item	SWBS Acct	Description	Quantity	UoM	Labor Unit Hours (CER)	Material Unit Cost (CER)	
1	SAMPLE	1001	100.1	100	Bow Section - Subcontract	267.41	MTON	0.0000	3,759.6000
2	SAMPLE	1001	100.10	100	Masts & Spars	0.22	MTON	51.0000	1,000.0000
3	SAMPLE	1001	100.11	100	Ramps	34.78	MTON	40.0000	1,000.0000
4	SAMPLE	1001	100.12	100	Shell & Support Structures	223.01	MTON	28.0000	1,000.0000
5	SAMPLE	1001	100.13	100	Superstructure	158.16	MTON	196.8100	1,000.0000
6	SAMPLE	1001	100.14	100	Stacks	0.87	MTON	35.0000	1,000.0000
7	SAMPLE	1001	100.15	100	Stern Peak Section	267.41	MTON	72.0000	1,000.0000
8	SAMPLE	1001	100.16	100	Transverse Bulkheads	42.07	MTON	36.0000	1,000.0000
9	SAMPLE	1001	100.3	100	Bulwarks	15.82	MTON	287.0000	1,000.0000
10	SAMPLE	1001	100.4	100	Sea Chests	1.22	MTON	50.0000	1,000.0000
11	SAMPLE	1001	100.6	100	Decks	195.66	MTON	53.0000	1,000.0000
12	SAMPLE	1001	100.7	100	Foundations, Machinery Spaces	10.49	MTON	120.0000	1,000.0000
13	SAMPLE	1001	100.8	100	Foundations, Outfit Systems	30.58	MTON	70.0000	1,000.0000
14	SAMPLE	1001	100.9	100	Longitudinal Bulkheads	8.83	MTON	40.0000	1,000.0000
15	SAMPLE	1001	1000.1	1000	Contingencies	44,357,762.88	COST	0.1000	0.0000
16	SAMPLE	1001	200.1	200	Diesel Direct Drive	5,000.00	KW	0.7500	728.0000
17	SAMPLE	1001	300.1	300	Cable, Hanger, Tubes & Instl Materi	9,935.71	SHIPSET	0.0000	8.8200
18	SAMPLE	1001	300.10	300	Habitation Areas - Cable, Hangers, L	366.54	SHIPSET	2.5040	57.8700
19	SAMPLE	1001	300.2	300	Appliances, Mahinery Spaces, Exte	9,935.71	SHIPSET	0.0000	0.4600
20	SAMPLE	1001	300.3	300	Lighting - Machinery Spaces, Exteri	9,935.71	SHIPSET	0.0000	1.4700
21	SAMPLE	1001	300.4	300	Wheelhouse Electrical Systems (No	1.00	SHIPSET	0.0000	285,641.8300
22	SAMPLE	1001	300.5	300	Switch Boards, Disconnect Switche	1,592.78	KW	0.0000	11.4200
23	SAMPLE	1001	300.6	300	Ship Service Generator	1,327.32	KW	0.4470	561.8000
24	SAMPLE	1001	300.7	300	Emergency Diesel Generator	265.46	KW	0.7960	601.5200
25	SAMPLE	1001	300.8	300	Electrical Labor - Machinery Spaces	9,935.71	SHIPSET	0.2682	0.0000
26	SAMPLE	1001	300.9	300	Misc. Aux. Power Mat'ls	1,592.78	KW	0.0000	0.7800
27	SAMPLE	1001	400.1	400	Integrated Navigation System & Elec	1.00	SHIPSET	4,000.0000	663,700.0000

Figure 4-2: Project Cost Item Worksheet

Click on the  button to save the cost items for the project to the database.

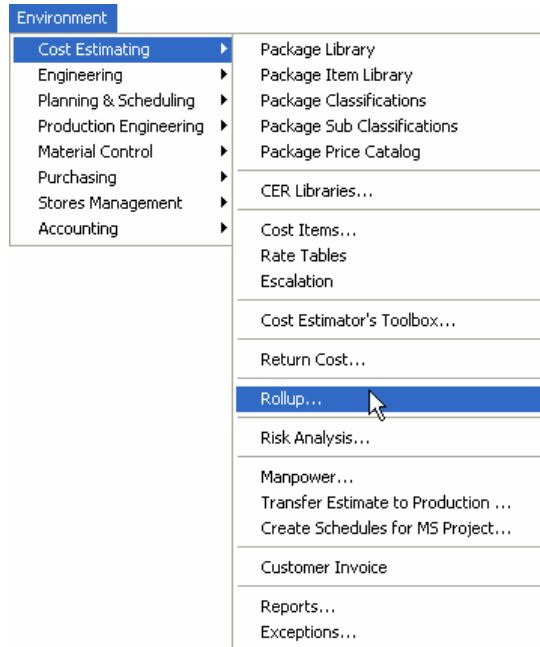
## Making Changes

If at any time there need additions, deletions and changes to any information required for the estimate, these changes can be made directly by opening up the related worksheet windows, making the changes, and saving them to the database.

## WBS Rollups

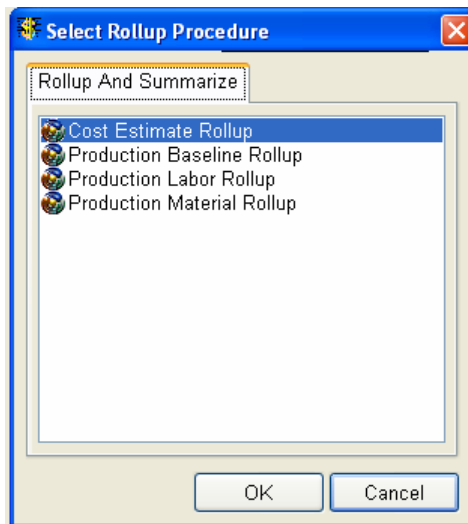
In order to ensure that all changes are correctly rolled up through the project WBS, the user should always perform a “rollup” function prior to generating reports.

Figure 4-3 shows how to access the rollup function from the main menu.



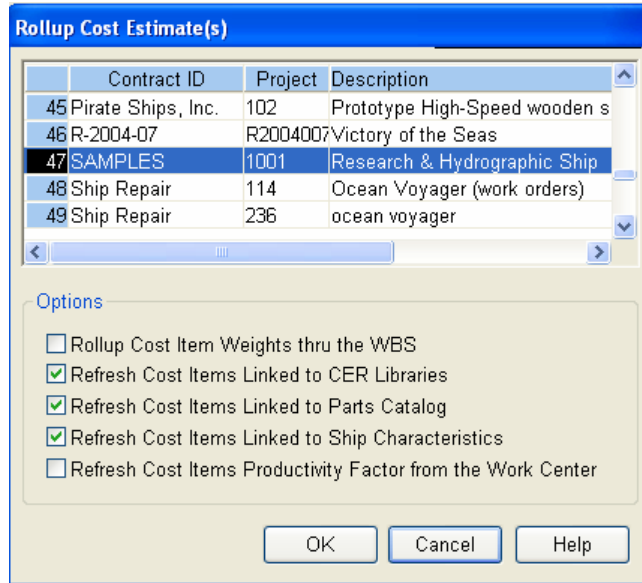
**Figure 4-3: Initiating a Cost Estimate Rollup to the Project WBS**

The system will pop-up a rollup procedure selection window (Figure 4-4).



**Figure 4-4: Rollup Procedure Selection Window**

*PERCEPTION* provides several rollup functions. Select Cost Estimate Rollup and the system will pop-up an options window (Figure 4-5).



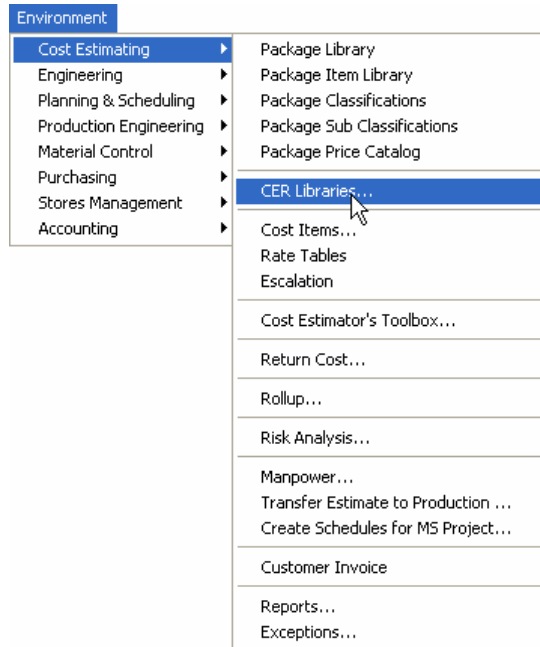
**Figure 4-5: Rollup Option Window**

At the top of the window, select your project. At the bottom of the window, select whatever special options are also required. More discussions about these options are discussed below. Click on the OK button for the rollup to begin.

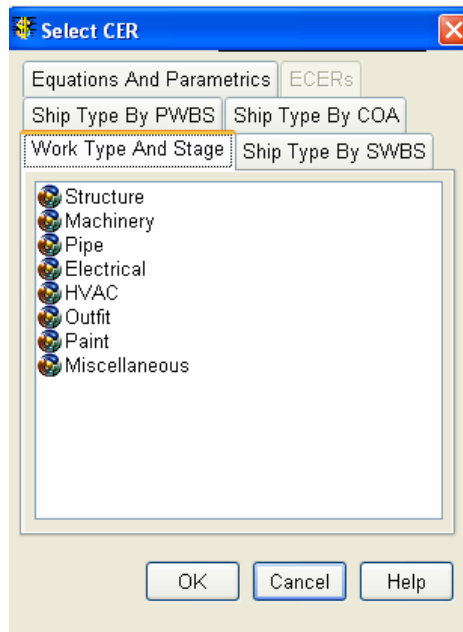
### ***Using Library CERs***

The system provides various libraries for storing the shipyard's standard CERs. Using standards makes for more consistent estimates. However, the library CERs always can be modified and expanded to make them more accurate and include more and more cost data that can be quickly and easily accessed by the estimators from the database. Figure 4-6 shows how to access the CER libraries from the main menu.

Figure 4-7 shows the various libraries available for the CERs, which can be cataloged by work type. Figure 4-8 shows samples of structural CERs, while Figure 4-9 shows samples of more elaborate equation CERs.



**Figure 4-6: Accessing CER Libraries**



**Figure 4-7: Various Libraries for CERs**

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C P G A Z U

Structure CER Information for the Estimating Environment

CER ID	Description	UoM	Standard Labor CER	Productivity Factor	Factored Labor CER	Material CER	Cn
1SF3	FWD Tank Tops	STON	78.0000	1.0000	78.0000	1000.0000	2/24/19
2SF4	Fwd Lower Side Tanks	MTON	35.0000	1.0000	35.0000	1000.0000	2/24/19
3SF5	Fwd Upper Side Tanks	MTON	45.2500	1.0000	45.2500	1000.0000	2/24/19
4SM7	Long 1' Bulkhead Units	MTON	40.0000	1.0000	40.0000	1000.0000	2/24/19
5SS1	Deckhouse	MTON	52.0000	1.0000	52.0000	1000.0000	2/24/19
6SS2	Funnel	LTON	62.0200	1.0000	62.0200	1000.0000	2/24/19

Figure 4-8: Sample Structural CERs

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C P G A Z U

Parametric Equations for the Estimating Environment

CER ID	Description	Equation	UoM	Labor/Material Flg
1 Warfage	Warfage charges per metter LOA per day	5.00* LOA	DAYS	<input type="radio"/> Labor <input checked="" type="radio"/> Mate
2 TEST1	Testing Equations	1.E+06	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
3 TEST3	Testing Equations	log(10) + LOG(10)	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
4 TEST6	Testing Equations	log(10)	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
5 TEST8	Testing Equations	EXP(2)	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
6 TEST4	Testing Equations	2 ^2	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
7 TEST7	Testing Equations	LOG(10)	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
8 TEST2	Testing Equations	exp(2) + EXP(2)	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
9 TEST5	Testing Equations	2 ^2 + 2 ^3	EA	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
10 Z Steel Hours	Steel Hours	weight * (4.00a + 3.00b + 6.00c + 14.00d + 5.00e + 5.00f) / 100		<input type="radio"/> Labor <input checked="" type="radio"/> Mate
11 PIR40CS-2>15	Remove & renew 2" CS pipe > 15 meters	4*( QTY) *.8	M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
12 PIR40CS-2<3	Remove & renew 2" CS pipe < 3 meters	4*(3+ QTY) /2	M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
13 PIR-CS40<4DK-700	Rem & Renew CS Pipe <4M - 8" IPS/SCH 10.6*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
14 PIR-CS40<4DK-600	Rem & Renew CS Pipe <4M - 6" IPS/SCH 7.9*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
15 PIR-CS40<4DK-500	Rem & Renew CS Pipe <4M - 5" IPS/SCH 6.6*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
16 PIR-CS40<4DK-400	Rem & Renew CS Pipe <4M - 4" IPS/SCH 5.3*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
17 PIR-CS40<4DK-300	Rem & Renew CS Pipe <4M - 3" IPS/SCH 4*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
18 PIR-CS40<4DK-1300	Rem & Renew CS Pipe <4M - 20" IPS/SCI 26.4*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
19 PIR-CS40<4DK-250	Rem & Renew CS Pipe <4M - 2.5" IPS/SC 3.3*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
20 PIR-CS40<4DK-200	Rem & Renew CS Pipe <4M - 2" IPS/SCH 2.6*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
21 PIR-CS40<4DK-1200	Rem & Renew CS Pipe <4M - 18" IPS/SCI 23.8*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
22 PIR-CS40<4DK-1100	Rem & Renew CS Pipe <4M - 16" IPS/SCI 21.1*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
23 PIR-CS40<4DK-1000	Rem & Renew CS Pipe <4M - 14" IPS/SCI 18.5*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
24 PIR-CS40<4DK-900	Rem & Renew CS Pipe <4M - 12" IPS/SCI 15.8*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
25 PIR-CS40<4DK-800	Rem & Renew CS Pipe <4M - 10" IPS/SCI 13.2*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
26 PIR-CS40<4DK-150	Rem & Renew CS Pipe <4M - 1.5" IPS/SC 1.95*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
27 PIR-CS40<4DK-125	Rem & Renew CS Pipe <4M - 1.25" IPS/S 1.62*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
28 PIR-CS40<4DK-100	Rem & Renew CS Pipe <4M - 1" IPS/SCH 1.3*(4+QTY)*.75		M	<input checked="" type="radio"/> Labor <input type="radio"/> Mate
29 Pickup	Pickup after Block Assembly	weight * .05		<input checked="" type="radio"/> Labor <input type="radio"/> Mate
30 Move	Move Block to Sandblast and paint	weight * .05		<input checked="" type="radio"/> Labor <input type="radio"/> Mate

Figure 4-9: Sample Equation CERs

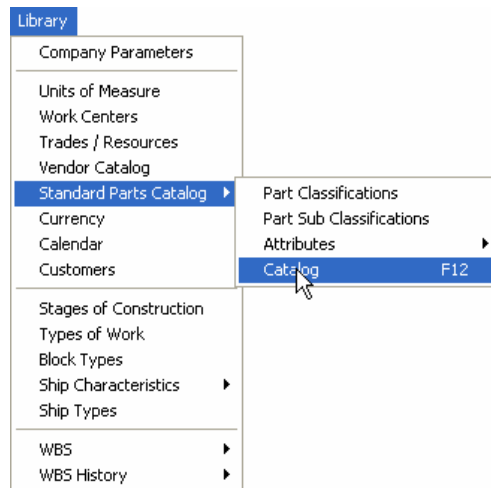
Library CERs can be referenced on a project cost item, or they can be invoked by clicking on the  button on the toolbar; the system will automatically create a new cost item for the CER selected and the estimator only needs to add a quantity to complete the item.

The “PERCEPTION Cost Estimating User Manual” provides detailed instructions for installing CERs in all libraries and using them in project cost items.


When CERs are changed, the changes can be reflected immediately in any estimate using them by performing a rollup as described above and selecting the option to Refresh Cost Items Linked to CER Libraries.

## ***Using the Parts Catalog***

The system provides supports a comprehensive Parts Catalog that can store all manners of shipyard materials from direct purchase to stock and manufactured parts. If the *PERCEPTION* functions for purchasing and material control are in use, costs for items in the Parts Catalog will be updated on a continuous basis. Using material costs of items managed by the Parts Catalog makes for more consistent and complete estimates. Figure 4-10 shows how to access the Parts Catalog from the main menu.



***Figure 4-10: Accessing the Parts Catalog from the Main Menu***

Standard Parts can be referenced on a project cost item, or they can be invoked by clicking on the  button on the toolbar; the system will automatically create a new cost item for the part selected and the estimator only needs to add a quantity to complete the item.

The “*PERCEPTION Cost Estimating User Manual*” provides detailed instructions for installing items in the Parts Catalog and using them in project cost items.

When costs on the Parts Catalog are changed, the cost changes can be reflected immediately in any estimate using them by performing a rollup as described above and selecting the option to Refresh Cost Items Linked to Parts Catalog.

## Using Ship Characteristics

Often, various cost items are based upon the same parameter, such as ship displacement, GRT, or LOA, etc. To reduce input efforts and help minimize data entry errors from repetitive data entries, cost items can relate quantity to parameters defined in the project Ship Characteristics table<sup>7</sup>. Ship characteristics (Figure 4-11) can be either single value parameters (e.g., LOA = 100) or parametric equations (e.g., CuNo<sup>8</sup> = LOA x Beam x Depth).

Characteristic	Characteristic Type	Description	UoM	Value	Equation
1 Cb	Architectural	Block coefficient	Number	0	$-2E-05 * SVII + 0.5895$
2 CuNo	Architectural	Cubic Number - Metric	CUM	0	$LBP * Beam * Depth$
3 Beam	Dimensions	Maximum Beam	Meters	15.357	$0.1279 * LOA + 5.125$
4 Depth	Dimensions	Depth of Hull	Meters	8.7449	$0.0933 * LOA + 1.2809$
5 Draft	Dimensions	Designed Draft	Meters	5.7285	$0.0588 * LOA + 1.0245$
6 Freeboard	Dimensions	Freeboard draught	Meters	0.2564	$Depth - Draft$
7 LBP	Dimensions	Length Between Perpendiculars	Meters	73.964	$(-8E-05 * LOA + 0.9312) * LOA$
8 LOA	Dimensions	Length Overall	Meters	80	
9 EMGEN	Machinery	Emergency generator	KW		$0.2 * EMGEN$
10 GENSET	Machinery	Diesel generator	KW		$0.1197 * SVII + 548.24$
11 MAINENG	Machinery	Main Engine	KW	5000	
12 Thruster-B	Machinery	Bow Thruster	KW		$0.1027 * SVII + 145.32$
13 CruiseSpeed	Operational	Cruise Speed	KTS	15	
14 DWT	Operational	Dead Weight Tons	MTON	750	
15 Endurance	Operational	Endurance	DAYS	3000	
16 MaxSpeed	Operational	Max Speed	KTS	18	
17 Crew	Personnel	Crew	PERS		$0.0038 * CuNo + 14.607$
18 Cost	Production	Sum All Costs (SWBS 100-900)	COST		
19 Hours	Production	Sum Production Hours (SWBS 100-700)	HOURS		
20 Months	Production	Construction Schedule	MONTH	48	
21 BOW	Structure	Bow Section	MTON		$0.1562 * SVII * .26303$
22 BULB	Structure	Bulbous Bow	MTON		
23 BULWARKS	Structure	Bulwarks	MTON		$0.1 * SSI$
24 CHESTS	Structure	Sea Chests	MTON		$0.12312 * CuNo / 1000$
25 DBTMS	Structure	Double Bottoms	MTON		$0.1562 * SVII * 0.0$
26 DECKS	Structure	Decks	MTON		$0.1562 * SVII * .19246$
27 FNDS-MS	Structure	Foundations, Macchiner Spaces	MTON		$0.159157 * (MAINENG + GENSET + EMGEN) / 1000$
28 FNDS-OF	Structure	Foundations, Outfit Systems	MTON		$3.07801 * CuNo / 1000$

**Figure 4-11: Project Ship Characteristics Table**

The “*PERCEPTION Cost Estimating User Manual*” provides detailed instructions for defining ships characteristics and using them in project cost items.

When project ship characteristics are changed, the changes can be reflected immediately in any estimate using them by performing a rollup as described above and selecting the option to Refresh Cost Items Linked to Ship Characteristics.

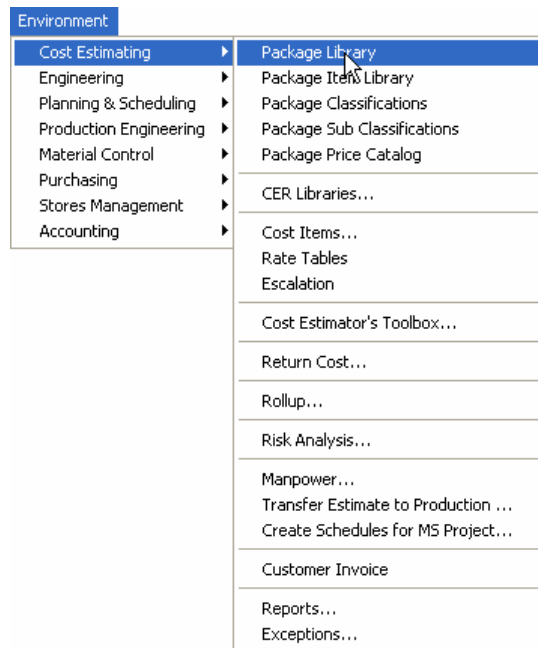
<sup>7</sup> The Ship Characteristics table can be accessed from the Project worksheet and the drill-down selection of DETAILS. This opens the tab window where this table can be opened.

<sup>8</sup> CuNo = cubic number; this formulation applies to the metric version of cubic number. The American version that uses feet as the measure of length must have a division by 100 added to the equation.

## Using Standard Packages

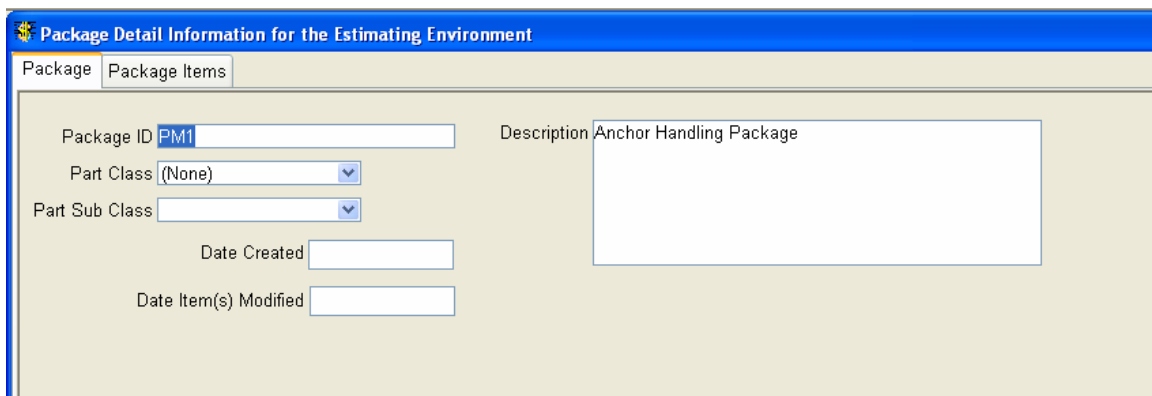
Besides the libraries of CERs, *PERCEPTION ESTTI-MATE* provides a facility for storing standard packages of cost items. A standard package can be any number of cost items. Package items can reference current costs from the Parts Catalog, can use library CERs and can use project ship characteristics.

Figure 4-12 shows how to access the standard package library.



**Figure 4-12: Accessing Standard Package Library for Cost Estimating**

Figure 4-13 shows a sample standard package in the library and figure 4-14, the Package Items tab, shows the list of cost items defined for that package.



**Figure 4-13: Sample Standard Package**

Package	Package Items	Package ID	Package Item ID	Description	Quantity	UoM	Labor Hours	Material Cost	Sub Hours	Travel Cost	Work Center
1	PM1	01	Anchor	2.00	EA	250.00	\$50,000.00	0.00	\$0.00	25	5
2	PM1	02	Bow Windlass	0.00	EA	500.00	\$18,000.00	0.00	\$0.00	25	5
3	PM1	03	Collomatic Winch	0.00	EA	100.00	\$3,600.00	0.00	\$0.00	25	5
4	PM1	04	Anchor Rode	0.00	EA	500.00	\$50,000.00	0.00	\$0.00	25	5

**Figure 4-14: Sample Standard Package Cost Items**


When a package is invoked by clicking on the  button from the toolbar, the system copies the items from the package directly into the project cost item worksheet.

Figure 4-15 shows a sample standard package for dry docking. Note that the quantity columns could be linked to the project ship characteristics table where both GRT and days in dock would be specified. When the package is applied to the estimate in the Cost Item worksheet, the system would apply these quantities automatically.

Package	Package Items	Package ID	Package Item ID	Description	Quantity	UoM	Labor Hours	Material Cost	Sub Hours	Travel Cost	Work Center
1	Drydocking	001	Prepare Drydock	1.00	GRT	0.00	\$0.00	0.00	\$0.00	10	9
2	Drydocking	002	Drydocking - first Day	1.00	GRT	0.00	\$0.00	0.00	\$0.00	10	9
3	Drydocking	003	Drydocking - Follow Days	1.00	GRT	0.00	\$0.00	0.00	\$0.00	10	9
4	Drydocking	004	Warfage	1.00	DAYS	0.00	\$0.00	0.00	\$0.00	10	9
5	Drydocking	005	Undocking	1.00	GRT	0.00	\$0.00	0.00	\$0.00	10	9

**Figure 4-15: Sample Standard Package cost Items (Dry Docking)**

The “*PERCEPTION Cost Estimating User Manual*” provides detailed instructions for defining library of standard packages and using them to generate project cost items.

## Using Prior Estimates

If the same set of Project Cost Items was used in prior estimates, they can be copied in whole or in part to the new project using the Estimator’s Toolbox. The *PERCEPTION ESTI-MATE User’s Manual* provides instructions on how to use the toolbox for this purpose.

The copying of these cost items to the new estimate, however, is not without modifications. The new project labor rates and any material cost escalation effective between the dates of the two estimates will be applied by the system to the earlier cost items.