



Automated Cost Estimating Integrated Tools

Exploiting ACE to Create Build-Up Estimates

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Bottom-up estimating is an extremely helpful technique in cost estimating as it allows for highly detailed system estimates. While the process of getting raw data to support the estimate can be like pulling teeth, using ACEIT to determine your estimate doesn't have to be. This presentation describes the basic steps in constructing an ACE model to support a build up estimate.



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THIS BRIEF ARE ENTIRELY
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REPRESENT OR PORTRAY
REAL NASA MISSION
OPERATIONS FACTS OR
FIGURES.**



Outline

- **What is bottom-up cost estimating**
- **Benefits to using ACEIT**
- **Cost model structure layout**
- **Creating reports**
- **Applying risk analysis**
- **Running simplified what-if scenarios**
- **Summary**



What is bottom-up cost estimating?

- Sometime referred to as “grass roots” estimating, this methodology identifies and estimates each activity/part of a mission/product and then rolls up the individual results to produce a total project estimate (2004 NASA Cost Estimating handbook)
- Usually involves three steps:
 - Estimate the cost of each activity/part that composes the work package or product (e.g. labor and material costs)
 - Total the estimates at each activity or part level
 - Calculate an overall project estimate (this estimate is the cost rolled up to the top level or the sum of all the items at the level below it)
- Data is usually provided by those who are directly involved or very familiar with each particular work activity or part (i.e. technical personnel)
- Drawback: costly (significant time and money required to create estimate), may not be readily responsive to “what-if” requirements, progress can be delayed waiting for accurate data
- Benefit: intuitive, defensible, provides insight into major cost contributors, and leads to a fairly accurate estimate (caveat: if the work content is well understood)



Benefits to using ACEIT

- **ACEIT is a standard framework with built in functionality structure**
- **ACEIT is flexible**
 - Cost estimating inputs (e.g. manhours, labor rates, quantity) can be entered as constant data or phased over time
 - Inputs can also be adjusted using industry approved algorithms and databases to model inflation, learning, and phasing
- **ACEIT integrates statistical and risk analysis to quantify uncertainty in estimates**
- **Can be used to support what-if scenario analysis after the model has already been constructed**



Cost model structure layout

- **Most effective structure for a bottom-up cost model involves using the standardized Work Breakdown Structure (WBS)**
 - Easily recognizable by those likely to review estimate
 - Lends itself to easy cost categorization (i.e. labor, material, travel, etc.)
- **Can structure model so that cost inputs can be entered as separate elements while cost results are displayed in groups (e.g. cost by WBS, total FTE labor cost, total material cost, etc.) using Category Column functionality**
- **Helpful to create as descriptive a unique ID as possible for each element**

Sample NASA Mission Ops WBS

Note: This is a derivative of the full CxP WBS and was chosen to simulate a more real-world perspective on the activities in a bottom-up WBS.

WBS	Description
1.6.1	Project Management
1.6.1.1	Business Management
1.6.1.2	Mission Operations Administration
1.6.7	Mission Operations
1.6.7.1	Operations Management
1.6.7.2	Operations Integration
1.6.7.3	Flight Design and Dynamics Production and Operation:
1.6.7.4	Mission Operations Planning Production and Operation
1.6.7.5	System Flight Control Operations



Cost model structure layout

Sample Screen Shot of Data Input Layout

Recurring WBS layout for FTE & material cost inputs

	WBS/CES Description	WBS/Item Number	Approp	Unique ID	Point Estimate	Phasing Method	Equation / Throughput	Fiscal Year	Units	Start Date	Finish Date
69	FTE Labor Rate		0103	LRate_FTE		C		100	SK		
70	LEO FTE Data Entry										
71	Project Management	1.6.1		MO_ISS_PM_FTE		IS	[Input Throughput]				
72	Business Management	1.6.1.1		MO_ISS_PM_BM_FTE		IS	[Input Throughput]				
73	Mission Operations Administration	1.6.1.2		MO_ISS_PM_MsnOpsAdmin_FTE		IS	[Input Throughput]				
74	Mission Operations	1.6.7		MO_ISS_MsnOps_FTE		IS	[Input Throughput]				
75	Operations Management	1.6.7.1		MO_ISS_MO_OpsMgmt_FTE		IS	[Input Throughput]				
76	Operations Integration	1.6.7.2		MO_ISS_MO_Opsln_FTE		IS	[Input Throughput]				
77	Flight Design and Dynamics Production and Operations	1.6.7.3		MO_ISS_MO_FDDOps_FTE		IS	[Input Throughput]				
78	Mission Operations Planning Production and Operations	1.6.7.4		MO_ISS_MO_MsnOpsPlan&Prod_FTE		IS	[Input Throughput]				
79	System Flight Control Operations	1.6.7.5		MO_ISS_MO_SysFitControlOps_FTE		IS	[Input Throughput]				
80	Lunar FTE Data Entry										
81	Project Management	1.6.1		MO_Lunar_PM_FTE		IS	[Input Throughput]				
82	Business Management	1.6.1.1		MO_Lunar_PM_BM_FTE		IS	[Input Throughput]				
83	Mission Operations Administration	1.6.1.2		MO_Lunar_PM_MsnOpsAdmin_FTE		IS	[Input Throughput]				
84	Mission Operations	1.6.7		MO_Lunar_MsnOps_FTE		IS	[Input Throughput]				
85	Operations Management	1.6.7.1		MO_Lunar_MO_OpsMgmt_FTE			[Input Throughput]				
86	Operations Integration	1.6.7.2		MO_Lunar_MO_Opsln_FTE			[Input Throughput]				
87	Flight Design and Dynamics Production and Operations	1.6.7.3		MO_Lunar_MO_FDDOps_FTE			[Input Throughput]				
88	Mission Operations Planning Production and Operations	1.6.7.4		MO_Lunar_MO_MsnOpsPlan&Prod_FTE			[Input Throughput]				
89	System Flight Control Operations	1.6.7.5		MO_Lunar_MO_SysFitControlOps_FTE			[Input Throughput]				
90	LEO Material Data Entry										
91	Project Management	1.6.1	0103	MO_ISS_PM_Material			[Cost Throughput]		SK		
92	Business Management	1.6.1.1	0103	MO_ISS_PM_BM_Material			[Cost Throughput]		SK		
93	Mission Operations Administration	1.6.1.2	0103	MO_ISS_PM_MsnOpsAdmin_Material			[Cost Throughput]		SK		
94	Mission Operations	1.6.7	0103	MO_ISS_MsnOps_Material		TY	[Cost Throughput]		SK		
95	Operations Management	1.6.7.1	0103	MO_ISS_MO_OpsMgmt_Material		TY	[Cost Throughput]		SK		
96	Operations Integration	1.6.7.2	0103	MO_ISS_MO_Opsln_Material		TY	[Cost Throughput]		SK		
97	Flight Design and Dynamics Production and Operations	1.6.7.3	0103	MO_ISS_MO_FDDOps_Material		TY	[Cost Throughput]		SK		
98	Mission Operations Planning Production and Operations	1.6.7.4	0103	MO_ISS_MO_MsnOpsPlan&Prod_Material		TY	[Cost Throughput]		SK		
99	System Flight Control Operations	1.6.7.5	0103	MO_ISS_MO_SysFitControlOps_Material		TY	[Cost Throughput]		SK		
100	Lunar Material Data Entry										
101	Project Management	1.6.1	0103	MO_Lunar_PM_Material		TY	[Cost Throughput]		SK		
102	Business Management	1.6.1.1	0103	MO_Lunar_PM_BM_Material		TY	[Cost Throughput]		SK		
103	Mission Operations Administration	1.6.1.2	0103	MO_Lunar_PM_MsnOpsAdmin_Material		TY	[Cost Throughput]		SK		
104	Mission Operations	1.6.7	0103	MO_Lunar_MsnOps_Material		TY	[Cost Throughput]		SK		
105	Operations Management	1.6.7.1	0103	MO_Lunar_MO_OpsMgmt_Material		TY	[Cost Throughput]		SK		
106	Operations Integration	1.6.7.2	0103	MO_Lunar_MO_Opsln_Material		TY	[Cost Throughput]		SK		
107	Flight Design and Dynamics Production and Operations	1.6.7.3	0103	MO_Lunar_MO_FDDOps_Material		TY	[Cost Throughput]		SK		
108	Mission Operations Planning Production and Operations	1.6.7.4	0103	MO_Lunar_MO_MsnOpsPlan&Prod_Material		TY	[Cost Throughput]		SK		
109	System Flight Control Operations	1.6.7.5	0103	MO_Lunar_MO_SysFitControlOps_Material		TY	[Cost Throughput]		SK		
110											
111											
112											
113											
114											
115											

Descriptive yet simple Unique IDs

ALL DATA ARE NOTIONAL

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Cost model structure layout

Sample Screen Shot of Calculation Layout

	WBS/CES Description	WBS/Item Number	Approp	Unique ID	Point Estimate	Phasing Method	Equation
17	LEO Total Estimate			MO ISS Est\$			
18	Project Management			MO ISS PM Est\$			
19	Business Management	1.6.1.1		MO ISS PM BM Est\$			
20	Business Management - Labor Costs	1.6.1.1	0103		F	MO ISS PM BM FTE * LRate FTE	
21	Business Management - Material Cost	1.6.1.1	0103		F	MO ISS PM BM Material	
22	Mission Operations Administration	1.6.1.2		MO ISS PM MsnOpsAdmin Est\$			
23	Mission Operations Administration - Labor Costs	1.6.1.2	0103		F	MO ISS PM MsnOpsAdmin FTE * LRate FTE	
24	Mission Operations Administration - Material Cost	1.6.1.2	0103		F	MO ISS PM MsnOpsAdmin Material	
25	Mission Operations	1.6.7		MO ISS MsnOps Est\$			
26	Operations Management	1.6.7.1		MO ISS OpsMgmt Est\$			
27	Operations Management - Labor Costs	1.6.7.1	0103		F	MO ISS MO OpsMgmt FTE * LRate FTE	
28	Operations Management - Material Cost	1.6.7.1	0103		F	MO ISS MO OpsMgmt Material	
29	Operations Integration	1.6.7.2		MO ISS OpsInt Est\$			
30	Operations Integration - Labor Costs	1.6.7.2	0103		F	MO ISS MO OpsInt FTE * LRate FTE	
31	Operations Integration - Material Cost	1.6.7.2	0103		F	MO ISS MO OpsInt Material	
32	Flight Design and Dynamics Production and Operations	1.6.7.3		MO ISS MO FDDOps Est\$			
33	Flight Design and Dynamics Production and Operations - Labor Costs	1.6.7.3	0103		F	MO ISS MO FDDOps FTE * LRate FTE	
34	Flight Design and Dynamics Production and Operations - Material Cost	1.6.7.3	0103		F	MO ISS MO FDDOps Material	
35	Mission Operations Planning Production and Operations	1.6.7.4		MO ISS MO MsnOpsPlan&Prod Est\$			
36	Mission Operations Planning Production and Operations - Labor Costs	1.6.7.4	0103		F	MO ISS MO MsnOpsPlan&Prod FTE * LRate FTE	
37	Mission Operations Planning Production and Operations - Material Cost	1.6.7.4	0103		F	MO ISS MO MsnOpsPlan&Prod Material	
38	System Flight Control Operations	1.6.7.5		MO ISS MO SysFitControlOps Est\$			
39	System Flight Control Operations - Labor Costs	1.6.7.5	0103		F	MO ISS MO SysFitControlOps FTE * LRate FTE	
40	System Flight Control Operations - Material Cost	1.6.7.5	0103		F	MO ISS MO SysFitControlOps Material	
41	Lunar Total Estimate			MO Lunar Est\$			
42	Project Management	1.6.1		MO Lunar PM Est\$			
43	Business Management	1.6.1.1		MO Lunar PM BM Est\$			
44	Business Management - Labor Costs	1.6.1.1	0103		F	MO Lunar PM BM FTE * LRate FTE	
45	Business Management - Material Cost	1.6.1.1	0103		F	MO Lunar PM BM Material	
46	Mission Operations Administration	1.6.1.2		MO Lunar PM MsnOpsAdmin Est\$			
47	Mission Operations Administration - Labor Costs	1.6.1.2	0103		F	MO Lunar PM MsnOpsAdmin FTE * LRate FTE	
48	Mission Operations Administration - Material Cost	1.6.1.2	0103		F	MO Lunar PM MsnOpsAdmin Material	
49	Mission Operations	1.6.7		MO Lunar MsnOps Est\$			
50	Operations Management	1.6.7.1		MO Lunar OpsMgmt Est\$			
51	Operations Management - Labor Costs	1.6.7.1	0103		F	MO Lunar MO OpsMgmt FTE * LRate FTE	
52	Operations Management - Material Cost	1.6.7.1	0103		F	MO Lunar MO OpsMgmt Material	
53	Operations Integration	1.6.7.2		MO Lunar OpsInt Est\$			
54	Operations Integration - Labor Costs	1.6.7.2	0103		F	MO Lunar MO OpsInt FTE * LRate FTE	
55	Operations Integration - Material Cost	1.6.7.2	0103		F	MO Lunar MO OpsInt Material	
56	Flight Design and Dynamics Production and Operations	1.6.7.3		MO Lunar MO FDDOps Est\$			
57	Flight Design and Dynamics Production and Operations - Labor Costs	1.6.7.3	0103		F	MO Lunar MO FDDOps FTE * LRate FTE	
58	Flight Design and Dynamics Production and Operations - Material Cost	1.6.7.3	0103		F	MO Lunar MO FDDOps Material	
59	Mission Operations Planning Production and Operations	1.6.7.4		MO Lunar MO MsnOpsPlan&Prod Est\$			
60	Mission Operations Planning Production and Operations - Labor Costs	1.6.7.4	0103		F	MO Lunar MO MsnOpsPlan&Prod FTE * LRate FTE	
61	Mission Operations Planning Production and Operations - Material Cost	1.6.7.4	0103		F	MO Lunar MO MsnOpsPlan&Prod Material	
62	System Flight Control Operations	1.6.7.5		MO Lunar MO SysFitControlOps Est\$			
63	System Flight Control Operations - Labor Costs	1.6.7.5	0103		F	MO Lunar MO SysFitControlOps FTE * LRate FTE	
64	System Flight Control Operations - Material Cost	1.6.7.5	0103		F	MO Lunar MO SysFitControlOps Material	

Labor costs are phased in this cost model
(FTE Quantity x Labor Rate)

Material costs are direct inputs in this cost model

ALL DATA ARE NOTIONAL



Cost model structure layout

Sample Screen Shot of Category Columns Layout

ACE 7.1a - [AUC Sample Model.aceit - All Columns (BY2009\$K)]

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	WBS/CES Description	Cost Category	CxP Phase	3 Digit WBS Level	WBS	Category 5	Category 6	Category 7	Category 8	Category 9	CES # Editable	Unique ID
17	LEO Total Estimate											
18	Project Management		LEO	Project Management	1.6.1							MO ISS Es
19	Business Management		LEO	Project Management	1.6.1.1							MO ISS PM Es
20	Business Management - Labor Costs	Labor	LEO	Project Management	1.6.1.1							MO ISS PM BM Es
21	Business Management - Material Cost	Material	LEO	Project Management	1.6.1.1							
22	Mission Operations Administration		LEO	Project Management	1.6.1.2							MO ISS PM MsnOpsAdmin Es
23	Mission Operations Administration - Labor Costs	Labor	LEO	Project Management	1.6.1.2							
24	Mission Operations Administration - Material Cost	Material	LEO	Project Management	1.6.1.2							
25	Mission Operations		LEO	Mission Operations	1.6.7							MO ISS MsnOps Es
26	Operations Management		LEO	Mission Operations	1.6.7.1							MO ISS OpsMgmt Es
27	Operations Management - Labor Costs	Labor	LEO	Mission Operations	1.6.7.1							
28	Operations Management - Material Cost	Material	LEO	Mission Operations	1.6.7.1							
29	Operations Integration		LEO	Mission Operations	1.6.7.2							MO ISS OpsInt Es
30	Operations Integration - Labor Costs	Labor	LEO	Mission Operations	1.6.7.2							
31	Operations Integration - Material Cost	Material	LEO	Mission Operations	1.6.7.2							
32	Flight Design and Dynamics Production and Operations		LEO	Mission Operations	1.6.7.3							MO ISS MO FDDOps Es
33	Flight Design and Dynamics Production and Operations - Labor Costs	Labor	LEO	Mission Operations	1.6.7.3							
34	Flight Design and Dynamics Production and Operations - Material Cost	Material	LEO	Mission Operations	1.6.7.3							
35	Mission Operations Planning Production and Operations		LEO	Mission Operations	1.6.7.4							MO ISS MO MsnOpsPlan&Prod Es
36	Mission Operations Planning Production and Operations - Labor Costs	Labor	LEO	Mission Operations	1.6.7.4							
37	Mission Operations Planning Production and Operations - Material Cost	Material	LEO	Mission Operations	1.6.7.4							
38	System Flight Control Operations		LEO	Mission Operations	1.6.7.5							MO ISS MO SysFitControlOps Es
39	System Flight Control Operations - Labor Costs	Labor	LEO	Mission Operations	1.6.7.5							
40	System Flight Control Operations - Material Cost	Material	LEO	Mission Operations	1.6.7.5							
41	Lunar Total Estimate											
42	Project Management		Lunar	Project Management	1.6.1							MO Lunar Es
43	Business Management		Lunar	Project Management	1.6.1.1							MO Lunar PM Es
44	Business Management - Labor Costs	Labor	Lunar	Project Management	1.6.1.1							MO Lunar PM BM Es
45	Business Management - Material Cost	Material	Lunar	Project Management	1.6.1.1							
46	Mission Operations Administration		Lunar	Project Management	1.6.1.2							MO Lunar PM MsnOpsAdmin Es
47	Mission Operations Administration - Labor Costs	Labor	Lunar	Project Management	1.6.1.2							
48	Mission Operations Administration - Material Cost	Material	Lunar	Project Management	1.6.1.2							
49	Mission Operations		Lunar	Mission Operations	1.6.7							MO Lunar MsnOps Es
50	Operations Management		Lunar	Mission Operations	1.6.7.1							MO Lunar OpsMgmt Es
51	Operations Management - Labor Costs	Labor	Lunar	Mission Operations	1.6.7.1							
52	Operations Management - Material Cost	Material	Lunar	Mission Operations	1.6.7.1							
53	Operations Integration		Lunar	Mission Operations	1.6.7.2							MO Lunar OpsInt Es
54	Operations Integration - Labor Costs	Labor	Lunar	Mission Operations	1.6.7.2							
55	Operations Integration - Material Cost	Material	Lunar	Mission Operations	1.6.7.2							
56	Flight Design and Dynamics Production and Operations		Lunar	Mission Operations	1.6.7.3							MO Lunar MO FDDOps Es
57	Flight Design and Dynamics Production and Operations - Labor Costs	Labor	Lunar	Mission Operations	1.6.7.3							
58	Flight Design and Dynamics Production and Operations - Material Cost	Material	Lunar	Mission Operations	1.6.7.3							
59	Mission Operations Planning Production and Operations		Lunar	Mission Operations	1.6.7.4							MO Lunar MO MsnOpsPlan&Prod Es
60	Mission Operations Planning Production and Operations - Labor Costs	Labor	Lunar	Mission Operations	1.6.7.4							
61	Mission Operations Planning Production and Operations - Material Cost	Material	Lunar	Mission Operations	1.6.7.4							
62	System Flight Control Operations		Lunar	Mission Operations	1.6.7.5							MO Lunar MO SysFitControlOps Es
63	System Flight Control Operations - Labor Costs	Labor	Lunar	Mission Operations	1.6.7.5							
64	System Flight Control Operations - Material Cost	Material	Lunar	Mission Operations	1.6.7.5							

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Creating reports

■ Available PO\$T reports that show results:

● Time Phased Report

- Displays the totals and yearly base year or then year values for a single case
- Commonly used for creating budget reports, viewing the estimate in a constant year, creating summary-level reports, and viewing risk-adjusted budget reports

● Sand Chart

- A chart with multiple stacked areas or columns listed by fiscal year
- Used to view costs graphically by appropriation or any other category

● Delta Report

- Lets you quickly find changes or differences between two or more cases
- Often used in highlighting the difference between different versions of the same estimate, comparing the results from different estimates, and determining the high risk elements in the estimate

● RISK Chart

- Cumulative distribution chart that is typically called S-curve chart
- Used to view the probabilities of a possible cost value

■ When setting up the report results view, data can be filtered or summarized via category columns



Creating reports

Sample Time Phased Report

Time Phased Report for Point Estimate in AUC Sample Model.aceit

Costs in BY2009 \$K

BaseYear ▼

ALL DATA ARE NOTIONAL

Time Phased Results for Point Estimate

Costs in BY2009 \$K	Total	2009	2010	2011	2012	2013
WBS						
Mission Ops Total Estimate	\$33,602.766	\$2,350.000	\$4,540.704	\$6,725.820	\$8,905.429	\$11,080.813
LEO Total Estimate	\$11,551.383	\$825.000	\$1,570.352	\$2,312.910	\$3,052.714	\$3,790.407
Project Management	\$3,354.917	\$275.000	\$473.008	\$670.970	\$868.922	\$1,067.017
Business Management	\$1,618.306	\$125.000	\$224.336	\$323.657	\$422.974	\$522.339
Business Management - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
Business Management - Material Cost	\$118.306	\$25.000	\$24.336	\$23.657	\$22.974	\$22.339
Mission Operations Administration	\$1,736.611	\$150.000	\$248.672	\$347.313	\$445.948	\$544.678
Mission Operations Administration - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
Mission Operations Administration - Material Cost	\$236.611	\$50.000	\$48.672	\$47.313	\$45.948	\$44.678
Mission Operations	\$8,196.466	\$550.000	\$1,097.344	\$1,641.940	\$2,183.792	\$2,723.390
Operations Management	\$1,639.293	\$110.000	\$219.469	\$328.388	\$436.758	\$544.678
Operations Management - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
Operations Management - Material Cost	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Integration	\$1,639.293	\$110.000	\$219.469	\$328.388	\$436.758	\$544.678
Operations Integration - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
Operations Integration - Material Cost	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Flight Design and Dynamics Production and Operations	\$1,639.293	\$110.000	\$219.469	\$328.388	\$436.758	\$544.678
Flight Design and Dynamics Production and Operations - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
Flight Design and Dynamics Production and Operations - Material Cost	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Mission Operations Planning Production and Operations	\$1,639.293	\$110.000	\$219.469	\$328.388	\$436.758	\$544.678
Mission Operations Planning Production and Operations - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
Mission Operations Planning Production and Operations - Material Cost	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
System Flight Control Operations	\$1,639.293	\$110.000	\$219.469	\$328.388	\$436.758	\$544.678
System Flight Control Operations - Labor Costs	\$1,500.000	\$100.000	\$200.000	\$300.000	\$400.000	\$500.000
System Flight Control Operations - Material Cost	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Lunar Total Estimate	\$22,051.383	\$1,525.000	\$2,970.352	\$4,412.910	\$5,852.714	\$7,290.407
Project Management	\$6,354.917	\$475.000	\$873.008	\$1,270.970	\$1,668.922	\$2,067.017
Business Management	\$3,118.306	\$225.000	\$424.336	\$623.657	\$822.974	\$1,022.339
Business Management - Labor Costs	\$3,000.000	\$200.000	\$400.000	\$600.000	\$800.000	\$1,000.000
Business Management - Material Cost	\$118.306	\$25.000	\$24.336	\$23.657	\$22.974	\$22.339
Mission Operations Administration	\$3,236.611	\$250.000	\$448.672	\$647.313	\$845.948	\$1,044.678
Mission Operations Administration - Labor Costs	\$3,000.000	\$200.000	\$400.000	\$600.000	\$800.000	\$1,000.000
Mission Operations Administration - Material Cost	\$236.611	\$50.000	\$48.672	\$47.313	\$45.948	\$44.678
Mission Operations	\$15,696.466	\$1,050.000	\$2,097.344	\$3,141.940	\$4,183.792	\$5,223.390
Operations Management	\$3,139.293	\$210.000	\$419.469	\$628.388	\$836.758	\$1,044.678

- This is a standard Time Phased Report showing the annual phasing results for both Mission Ops Phases (LEO and Lunar)
- Results for labor and material are displayed for both parent and child WBS breakdowns



Creating reports

Time Phased Report for Point Estimate in AUC Sample Model.aceit

Costs in BY2009 \$K

BaseYear

ALL DATA ARE NOTIONAL

Time Phased Results for Point Estimate

Costs in BY2009 \$K	Cost Category	Total	2009	2010	2011	2012	2013
WBS, Filtered by Cost Category							
Mission Ops Total Estimate	Material	\$2,102.766	\$250.000	\$340.704	\$425.820	\$505.429	\$580.813
LEO Total Estimate	Material	\$1,051.383	\$125.000	\$170.352	\$212.910	\$252.714	\$290.407
Project Management	Material	\$354.917	\$75.000	\$73.008	\$70.970	\$68.922	\$67.017
Business Management	Material	\$118.306	\$25.000	\$24.336	\$23.657	\$22.974	\$22.339
Business Management - Material Cost	Material	\$118.306	\$25.000	\$24.336	\$23.657	\$22.974	\$22.339
Mission Operations Administration	Material	\$236.611	\$50.000	\$48.672	\$47.313	\$45.948	\$44.678
Mission Operations Administration - Material Cost	Material	\$236.611	\$50.000	\$48.672	\$47.313	\$45.948	\$44.678
Mission Operations	Material	\$696.466	\$50.000	\$97.344	\$141.940	\$183.792	\$223.390
Operations Management	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Management - Material Cost	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Integration	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Integration - Material Cost	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Flight Design and Dynamics Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Flight Design and Dynamics Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Mission Operations Planning Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Mission Operations Planning Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
System Flight Control Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
System Flight Control Operations - Material Cost	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Lunar Total Estimate	Material	\$1,051.383	\$125.000	\$170.352	\$212.910	\$252.714	\$290.407
Project Management	Material	\$354.917	\$75.000	\$73.008	\$70.970	\$68.922	\$67.017
Business Management	Material	\$118.306	\$25.000	\$24.336	\$23.657	\$22.974	\$22.339
Business Management - Material Cost	Material	\$118.306	\$25.000	\$24.336	\$23.657	\$22.974	\$22.339
Mission Operations Administration	Material	\$236.611	\$50.000	\$48.672	\$47.313	\$45.948	\$44.678
Mission Operations Administration - Material Cost	Material	\$236.611	\$50.000	\$48.672	\$47.313	\$45.948	\$44.678
Mission Operations	Material	\$696.466	\$50.000	\$97.344	\$141.940	\$183.792	\$223.390
Operations Management	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Management - Material Cost	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Integration	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Operations Integration - Material Cost	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Flight Design and Dynamics Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Flight Design and Dynamics Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Mission Operations Planning Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
Mission Operations Planning Production and Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
System Flight Control Operations	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678
System Flight Control Operations - Material Cost	Material	\$139.293	\$10.000	\$19.469	\$28.388	\$36.758	\$44.678

Sample Time Phased Report

➤ This is a filtered Time Phased Report showing the annual phasing results for both Mission Ops Phases (LEO and Lunar)

➤ Using category columns, only results for material costs are displayed for both parent and child WBS breakdowns



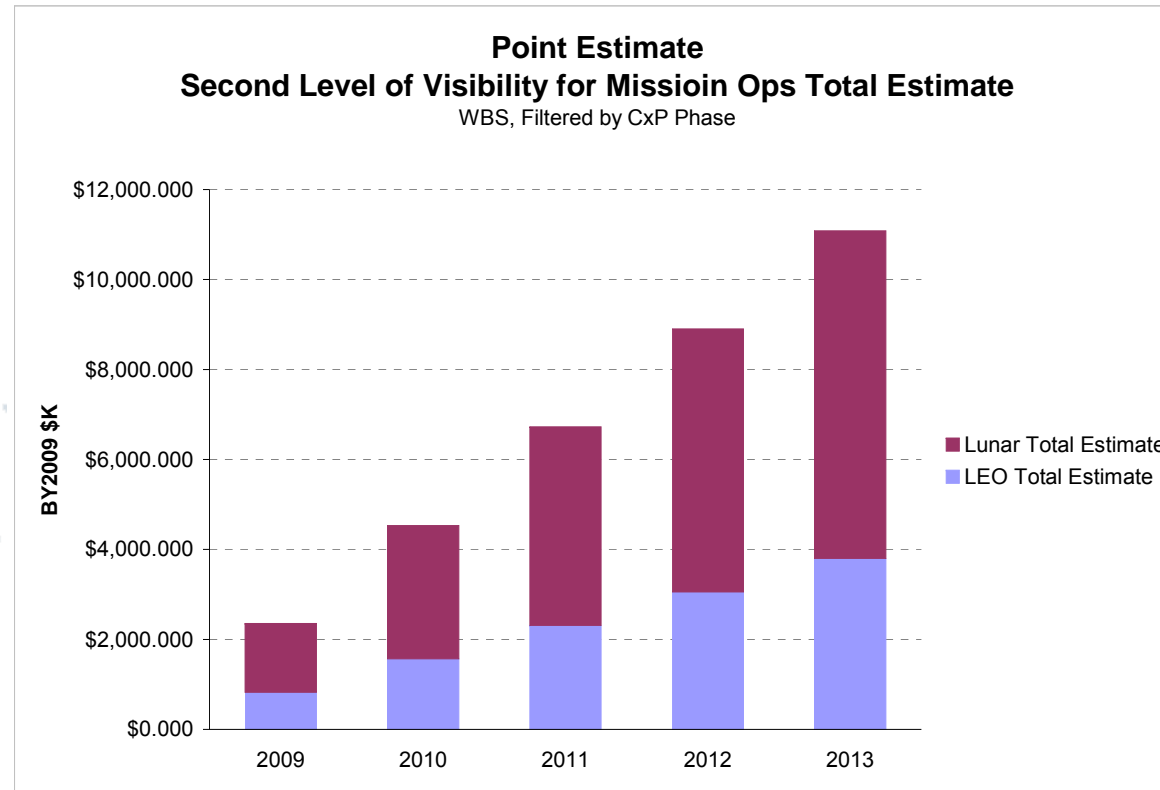
Sample Sand Chart

- This is a filtered Sand Chart Report showing the annual phasing results for both Mission Ops Phases (LEO and Lunar)
- Using category columns, results are summarized by CxP Phases

Sand Chart for Point Estimate in AUC Sample Model.aceit
Costs in BY2009 \$K

ALL DATA ARE NOTIONAL

Sand Chart



BaseYear Mission Ops Total Estimate

Time Phased Results for Point Estimate

Costs in BY2009 \$K		2009	2010	2011	2012	2013
WBS, Filtered by CxP Phase	CxP Phase					
Mission Ops Total Estimate		\$2,350.000	\$4,540.704	\$6,725.820	\$8,905.429	\$11,080.813
LEO Total Estimate	LEO	\$825.000	\$1,570.352	\$2,312.910	\$3,052.714	\$3,790.407
Lunar Total Estimate	Lunar	\$1,525.000	\$2,970.352	\$4,412.910	\$5,852.714	\$7,290.407



Applying risk analysis

- **To conduct risk analysis, you need uncertainty inputs for your cost elements**
 - Probability distribution (e.g. normal, lognormal, triangle, etc.)
 - Bounds
 - Possible low / high values for element (e.g. 85% / 120% of point estimate with distribution percentile at the 10th or 85th percentile)
 - General distribution characteristics (e.g. mean, standard deviation)
- **Uncertainty inputs should represent defensible values for the cost input**
 - Based on historical values
 - Based on subject matter expert (SME) opinions
- **Uncertainty entered on input drivers of the estimate**
 - Labor rates
 - Headcounts
 - Material and labor costs



Applying risk analysis

Sample Screen Shot Risk Analysis Layout

WBS/CES Description	Unique ID	Point Estimat	Equation / Throughput	Distribution Form	PE Position in	Spread	Skew	Low (% of PE)	High (% of PE)	Low (Percentile)	High (Percentile)	C of
Mission Operations	MO Lunar MsnOps Est\$											
Operations Management	MO Lunar OpsMgmt Est\$											
Operations Management - Labor Costs			MO Lunar MO OpsMgmt FTE * LRate FTE									
Operations Management - Material Cost			MO Lunar MO OpsMgmt Material									
Operations Integration	MO Lunar OpsIn Est\$											
Operations Integration - Labor Costs			MO Lunar MO OpsIn FTE * LRate FTE									
Operations Integration - Material Cost			MO Lunar MO OpsIn Material									
Flight Design and Dynamics Production and Operati	MO Lunar MO FDDOps Est\$											
Flight Design and Dynamics Production and Oper			MO Lunar MO FDDOps FTE * LRate FTE									
Flight Design and Dynamics Production and Oper			MO Lunar MO FDDOps Material									
Mission Operations Planning Production and Operati	MO Lunar MO MsnOpsPlan&Prod Est\$											
Mission Operations Planning Production and Oper			MO Lunar MO MsnOpsPlan&Prod FTE *									
Mission Operations Planning Production and Oper			MO Lunar MO MsnOpsPlan&Prod Material									
System Flight Control Operations	MO Lunar MO SysFitControlOps Est\$											
System Flight Control Operations - Labor Costs			MO Lunar MO SysFitControlOps FTE *									
System Flight Control Operations - Material Cost			MO Lunar MO SysFitControlOps Material									
*INPUT VARIABLES	*IN VAR											
FTE Labor Rate	LRate_FTE		100	Triangular	Mode			85	120	10	90	
LEO FTE Data Entry												
Project Management	MO_ISS_PM_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Business Management	MO_ISS_PM_BM_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations Administration	MO_ISS_PM_MsnOpsAdmin_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations	MO_ISS_MsnOps_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Operations Management	MO_ISS_MO_OpsMgmt_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Operations Integration	MO_ISS_MO_OpsIn_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Flight Design and Dynamics Production and Operations	MO_ISS_MO_FDDOps_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations Planning Production and Operations	MO_ISS_MO_MsnOpsPlan&Prod_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
System Flight Control Operations	MO_ISS_MO_SysFitControlOps_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Lunar FTE Data Entry												
Project Management	MO_Lunar_PM_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Business Management	MO_Lunar_PM_BM_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations Administration	MO_Lunar_PM_MsnOpsAdmin_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations	MO_Lunar_MsnOps_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Operations Management	MO_Lunar_MO_OpsMgmt_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Operations Integration	MO_Lunar_MO_OpsIn_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Flight Design and Dynamics Production and Operations	MO_Lunar_MO_FDDOps_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations Planning Production and Operations	MO_Lunar_MO_MsnOpsPlan&Prod_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
System Flight Control Operations	MO_Lunar_MO_SysFitControlOps_FTE		[Input Throughput]	Triangular	Mode			85	120	10	90	
LEO Material Data Entrv												
Project Management	MO_ISS_PM_Material		[Cost Throughput]	Triangular	Mode			85	120	10	90	
Business Management	MO_ISS_PM_BM_Material		[Cost Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations Administration	MO_ISS_PM_MsnOpsAdmin_Material		[Cost Throughput]	Triangular	Mode			85	120	10	90	
Mission Operations	MO_ISS_MsnOps_Material		[Cost Throughput]	Triangular	Mode			85	120	10	90	
Operations Management	MO_ISS_MO_OpsMgmt_Material		[Cost Throughput]	Triangular	Mode			85	120	10	90	

Risk is not applied at the calculation level

Risk is applied to all cost inputs

ALL DATA ARE NOTIONAL

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Applying risk analysis

- **Correlations between values should be addressed if they are not functionally related**
 - When the values of two variables depend on each other, you should correlate them to increase the accuracy of your risk analysis results
 - Two behaviors of correlation:
 - Positive – Indicates that two assumptions increase or decrease together
 - Negative – Indicates that an increase in one assumption results in a decrease in the other assumption
 - Cost elements that are often correlated:
 - Labor rates among similar job positions
 - Material costs among similar parts in a product
- **In bottom-up cost estimating, it is always a best practice to apply correlation for a better risk distribution at the very top level**



Applying risk analysis

Sample Screen Shot of Risk Analysis Correlation Layout

ACE 7.1a - [AUC Sample Model.aceit - RISK Basic (BY2009\$K)]

File Edit View Documentation Calc Cases Reports Tools Window Help

RISK Basic

	WBS/CES Description	Unique ID	Point Estimate	Equation / Throughput	Distribution Form	PE Position in Distribution
67	*INPUT VARIABLES	*IN_VAR				
68						
69	FTE Labor Rate	LRate_FTE		100	Triangular	Mode
70	LEO FTE Data Entry					
71	Project Management	MO_ISS_PM_FTE		[Input Throughput]	Triangular	Mode
72	Business Management			[Input Throughput]	Triangular	Mode
73	Mission Operations Administration			[Input Throughput]	Triangular	Mode
74	Mission Operations			[Input Throughput]	Triangular	Mode
75	Operations Management			[Input Throughput]	Triangular	Mode
76	Operations Integration			[Input Throughput]	Triangular	Mode
77	Flight Design and Dynamics Production and Opera			[Input Throughput]	Triangular	Mode
78	Mission Operations Planning Production and Opera			[Input Throughput]	Triangular	Mode
79	System Flight Control Operations			[Input Throughput]	Triangular	Mode
80	Lunar FTE Data Entry					
81	Project Management					
82	Business Management					
83	Mission Operations Administration					
84	Mission Operations					
85	Operations Management					
86	Operations Integration					
87	Flight Design and Dynamics Production and Opera					
88	Mission Operations Planning Production and Opera					
89	System Flight Control Operations					
90	LEO Material Data Entry					
91	Project Management					
92	Business Management	MO_ISS_PM_BM_Material		[Cost Throughput]	Triangular	Mode
93	Mission Operations Administration	MO_ISS_PM_MsnOpsAdmin_Material		[Cost Throughput]	Triangular	Mode
94	Mission Operations	MO_ISS_MsnOps_Material		[Cost Throughput]	Triangular	Mode
95	Operations Management	MO_ISS_MO_OpsMgmt_Material		[Cost Throughput]	Triangular	Mode
96	Operations Integration	MO_ISS_MO_OpsIn_Material		[Cost Throughput]	Triangular	Mode

RISK Grouping and Correlation

Selected Grouping

Group ID: Lunar Mission Ops Material Cost New Delete

- Assign "D" to the dominant element in the Group.
- Assign a value of 0.0 (none) to 1.0 (complete) correlation to each Group member.
- Otherwise, use "Assign Correlation of" utility to create a matrix that contains the same value.
- In either case, adjust individual rows to generate the matrix of interest.
- NOTE: Correlation defined in this manner is IN ADDITION TO and NOT INSTEAD OF functional correlation.
- ACE simulates Pearson Product-Moment correlation (not rank correlation).

Add Row... Remove Row Assign Correlation of: 0.75

	WBS/CES Description	Total	Strengt	105	106	107	108	109
105	Operations		0.8660	1.000	0.750	0.750	0.750	0.750
106	Operations Integration		0.8660		1.000	0.750	0.750	0.750
107	Flight Design and		0.8660			1.000	0.750	0.750
108	Mission Operations		0.8660				1.000	0.750
109	System Flight Control		0.8660					1.000

Apply OK Cancel Help

Risk correlation matrix for all material inputs in the lunar mission ops WBS level (1.6.7)



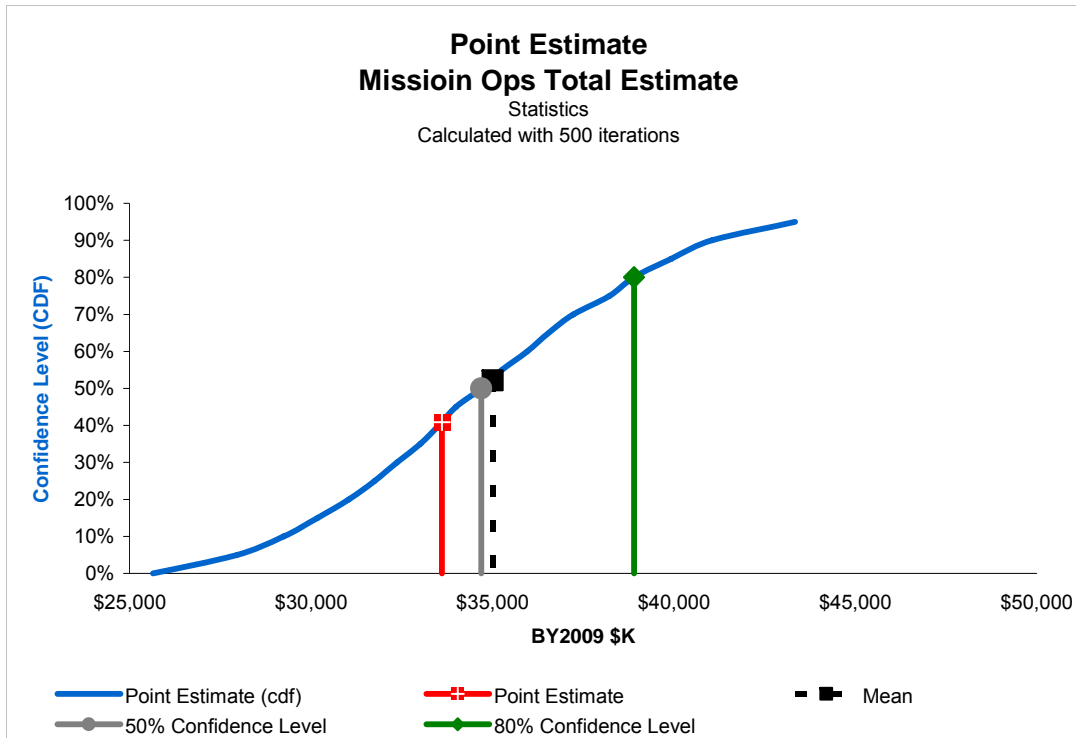
Applying risk analysis

RI\$K Chart for Point Estimate in AUC Sample Model.aceit

Costs in \$K (BY2009 Total), 500 iterations

ALL DATA ARE NOTIONAL

RI\$K Chart



Sample RI\$K Chart

S Curve shows that there is a 41% chance that the total Mission Operations cost will come in under our point estimate.

Mission Ops Total Estimate
BaseYear

RI\$K Statistics in 5% intervals

Cumulative Distribution Function	0%	5%	10%	15%	20%	25%	30%	35%	40%
Cost Values	\$25,640.764	\$27,955.515	\$29,241.809	\$30,174.301	\$31,039.849	\$31,747.941	\$32,376.000	\$33,017.683	\$33,517.543

Markers	Cost	Confidence
Point Estimate	\$33,602.766	40.9%
Mean	\$35,007.954	52.2%
50% Confidence Level	\$34,693.983	50.0%
80% Confidence Level	\$38,902.091	80.0%



Running simplified what-if scenarios

- **ACEIT can help non-cost modelers run what-if scenarios using your existing cost model**
 - Create a what-if input worksheet where variable cost elements (e.g. labor rate, FTE headcount, material cost etc.) can be organized and modified
 - Create a PO\$T case in a new worksheet that is linked to existing bottom-up ACE cost model
 - PO\$T will add a “Calculate” macro button on top of worksheet
 - This worksheet will look like a simplified copy of your ACE model
 - Link input cells in PO\$T case worksheet to corresponding cells in what –if input worksheet
 - Create required PO\$T reports using this case
 - Adjust variable cost elements per what-if scenario guidance
 - Hit “Calculate” button
 - Use PO\$T to update reports



Running simplified what-if scenarios

Sample Screen Shot of Input Worksheet

Microsoft Excel - What If Scenario Worksheet.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

A50 fx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	What If Scenario															
2																
3	Variable Cost Element															
4	Labor Rate (\$K)	110	\$K													
5																
6	Variable FTE Count Yearly Phasing	2009	2010	2011	2012	2013										
7	LEO FTE Data Entry															
8	Project Management															
9	Business Management	1	2	3	4	5										
10	Mission Operations Administration	1	2	3	4	5										
11	Mission Operations															
12	Operations Management	1	2	3	4	5										
13	Operations Integration	1	2	3	4	5										
14	Flight Design and Dynamics Production and Operations	1	2	3	4	5										
15	Mission Operations Planning Production and Operations	1	2	3	4	5										
16	System Flight Control Operations	2	3	4	5	6										
17	Lunar FTE Data Entry															
18	Project Management															
19	Business Management	1	3	6	9	12										
20	Mission Operations Administration	5	10	15	20	25										
21	Mission Operations															
22	Operations Management	5	8	12	16	20										
23	Operations Integration	3	6	9	12	15										
24	Flight Design and Dynamics Production and Operations	1	3	6	9	12										
25	Mission Operations Planning Production and Operations	1	3	6	9	12										
26	System Flight Control Operations	5	10	15	20	25										
27	LEO Material Data Entry															
28	Project Management															
29	Business Management	25	30	35	35	40	\$K									
30	Mission Operations Administration	50	50	50	50	50	\$K									
31	Mission Operations															
32	Operations Management	10	20	30	40	50	\$K									
33	Operations Integration	10	20	30	40	50	\$K									
34	Flight Design and Dynamics Production and Operations	10	25	25	45	55	\$K									
35	Mission Operations Planning Production and Operations	10	20	30	40	50	\$K									
36	System Flight Control Operations	20	30	40	50	60	\$K									
37	Lunar Material Data Entry															
38	Project Management															
39	Business Management	25	25	30	40	50	\$K									
40	Mission Operations Administration	50	50	50	50	50	\$K									
41	Mission Operations															
42	Operations Management	10	20	50	60	75	\$K									

Enter values for what-if scenario here

Input Worksheet / What If Scenario Case / Delta Report / Sheet2 / Sheet3



Running simplified what-if scenarios

Sample Screen Shot of PO\$T Case Worksheet

Microsoft Excel - What If Scenario Worksheet.xls

File Edit View Insert Format Tools Data Window Help

D73 System Flight Control Operations

Hit Calculate button to run new case

What If Scenario Case

F:\Tecolote\AUC 2009\AUC Sample M...
Costs in BY2009\$K

Calculate

WBS	Cost Interpretation	Total	2009	2010	2011	2012	2013
FTE Labor Rate	\$K	110					
LEO FTE Data Entry							
Project Management							
Business Management			1	2	3	4	5
Mission Operations Administration			1	2	3	4	5
Mission Operations							
Operations Management			1	2	3	4	5
Operations Integration			1	2	3	4	5
Flight Design and Dynamics Production and Operations			1	2	3	4	5
Mission Operations Planning Production and Operations			1	2	3	4	5
System Flight Control Operations			2	3	4	5	6
Lunar FTE Data Entry							
Project Management							
Business Management			1	3	6	9	12
Mission Operations Administration			5	10	15	20	25
Mission Operations							
Operations Management			5	8	12	15	20
Operations Integration			3	6	9	12	15
Flight Design and Dynamics Production and Operations			1	3	6	9	12
Mission Operations Planning Production and Operations			1	3	6	9	12
System Flight Control Operations			5	10	15	20	25
LEO Material Data Entry							
Project Management							
Business Management	\$K		25	30	35	35	40
Mission Operations Administration	\$K		50	50	50	50	50
Mission Operations							
Operations Management	\$K		10	20	30	40	50
Operations Integration	\$K		10	20	30	40	50
Flight Design and Dynamics Production and Operations	\$K		10	25	25	45	55
Mission Operations Planning Production and Operations	\$K		10	20	30	40	50
System Flight Control Operations	\$K		20	30	40	50	60
Lunar Material Data Entry							
Project Management							
Business Management	\$K		25	25	30	40	50
Mission Operations Administration	\$K		50	50	50	50	50
Mission Operations							

Values from input worksheet will transfer here

Input Worksheet | What If Scenario Case | Delta Report | Sheet2 | Sheet3

ALL DATA ARE NOTIONAL

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Running simplified what-if scenarios

Sample Delta Report

Delta Report for AUC Sample Model.aceit

Costs in BY2009 \$K

BaseYear

ALL DATA ARE NOTIONAL

Delta Comparison

Costs in BY2009 \$K	Point Estimate	What If Scenario Case	Delta (Δ)	Percent Δ	Threshold
WBS					
Mission Ops Total Estimate	\$33,602.766	\$80,380.000	\$46,777.234	139.21%	High
LEO Total Estimate	\$11,551.383	\$40,495.000	\$28,943.617	250.56%	High
Project Management	\$3,354.917	\$12,475.000	\$9,120.083	271.84%	High
Business Management	\$1,618.306	\$3,745.000	\$2,126.694	131.41%	High
Business Management - Labor Costs	\$1,500.000	\$3,520.000	\$2,020.000	134.67%	High
Business Management - Material Cost	\$118.306	\$225.000	\$106.694	90.19%	High
Mission Operations Administration	\$1,736.611	\$8,730.000	\$6,993.389	402.70%	High
Mission Operations Administration - Labor Costs	\$1,500.000	\$8,470.000	\$6,970.000	464.67%	High
Mission Operations Administration - Material Cost	\$236.611	\$260.000	\$23.389	9.88%	Medium
Mission Operations	\$8,196.466	\$28,020.000	\$19,823.534	241.85%	High
Operations Management	\$1,639.293	\$6,935.000	\$5,295.707	323.05%	High
Operations Management - Labor Costs	\$1,500.000	\$6,820.000	\$5,320.000	354.67%	High
Operations Management - Material Cost	\$139.293	\$115.000	(\$24.293)	(17.44%)	High
Operations Integration	\$1,639.293	\$5,210.000	\$3,570.707	217.82%	High
Operations Integration - Labor Costs	\$1,500.000	\$5,060.000	\$3,560.000	237.33%	High
Operations Integration - Material Cost	\$139.293	\$150.000	\$10.707	7.69%	Medium
Flight Design and Dynamics Production and Operations	\$1,639.293	\$3,670.000	\$2,030.707	123.88%	High
Flight Design and Dynamics Production and Operations - Labor Costs	\$1,500.000	\$3,520.000	\$2,020.000	134.67%	High
Flight Design and Dynamics Production and Operations - Material Cost	\$139.293	\$150.000	\$10.707	7.69%	Medium
Mission Operations Planning Production and Operations	\$1,639.293	\$3,695.000	\$2,055.707	125.40%	High
Mission Operations Planning Production and Operations - Labor Costs	\$1,500.000	\$3,520.000	\$2,020.000	134.67%	High
Mission Operations Planning Production and Operations - Material Cost	\$139.293	\$175.000	\$35.707	25.63%	High
System Flight Control Operations	\$1,639.293	\$8,510.000	\$6,870.707	419.13%	High
System Flight Control Operations - Labor Costs	\$1,500.000	\$8,360.000	\$6,860.000	457.33%	High
System Flight Control Operations - Material Cost	\$139.293	\$150.000	\$10.707	7.69%	Medium
Lunar Total Estimate	\$22,051.383	\$39,885.000	\$17,833.617	80.87%	High
Project Management	\$6,354.917	\$12,080.000	\$5,725.083	90.09%	High
Business Management	\$3,118.306	\$3,580.000	\$461.694	14.81%	High
Business Management - Labor Costs	\$3,000.000	\$3,410.000	\$410.000	13.67%	High
Business Management - Material Cost	\$118.306	\$170.000	\$51.694	43.70%	High
Mission Operations Administration	\$3,236.611	\$8,500.000	\$5,263.389	162.62%	High
Mission Operations Administration - Labor Costs	\$3,000.000	\$8,250.000	\$5,250.000	175.00%	High
Mission Operations Administration - Material Cost	\$236.611	\$250.000	\$13.389	5.66%	Medium
Mission Operations	\$15,696.466	\$27,805.000	\$12,108.534	77.14%	High
Operations Management	\$3,139.293	\$6,925.000	\$3,785.707	120.59%	High
Operations Management - Labor Costs	\$3,000.000	\$6,710.000	\$3,710.000	123.67%	High
Operations Management - Material Cost	\$139.293	\$215.000	\$75.707	54.35%	High
Operations Integration	\$3,139.293	\$5,165.000	\$2,025.707	64.53%	High
Operations Integration - Labor Costs	\$3,000.000	\$4,950.000	\$1,950.000	65.00%	High
Operations Integration - Material Cost	\$139.293	\$215.000	\$75.707	54.35%	High
Flight Design and Dynamics Production and Operations	\$3,139.293	\$3,625.000	\$485.707	15.47%	High
Flight Design and Dynamics Production and Operations - Labor Costs	\$3,000.000	\$3,410.000	\$410.000	13.67%	High

- This is a Delta Report showing the difference between the Point Estimate (baseline) results and the new What If Scenario at the total levels
- Report will categorize the deltas into high, medium, or low percentage differences
- Percentage differences will be highlighted in red, orange, or tan for high, medium, or low, respectively



Summary

- **ACEIT is a very flexible cost estimating tool that can handle all kinds of bottom-up cost estimating situations**
- **ACEIT suite integrates statistical and risk analysis tools to quantify uncertainty in estimates**
- **Can be used by non cost modelers to support what-if scenario analysis after the model has already been constructed**