



Boeing Defense, Space & Security
Phantom Works

Strategic Development and Experimentation

Integrating Excel, R, and ACEIT for a Comprehensive Analysis Package

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Overview of Project

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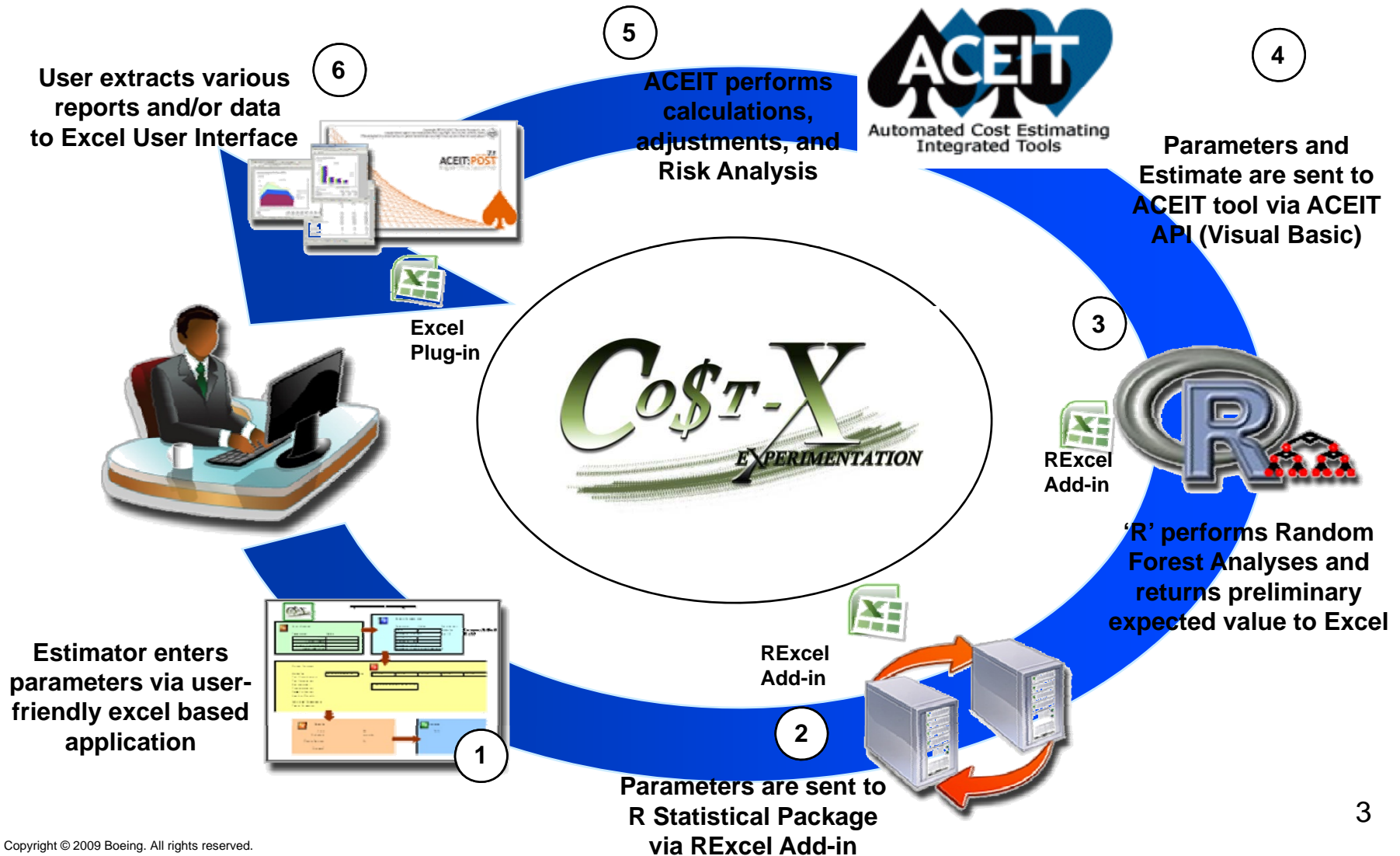


- Objective
 - Estimate the costs of simulation-based experimentation
 - Develop a standard process and toolkit
 - Be accurate, consistent, easy-to-use, and value-added
- Customer Constraints
 - Use standard cost estimating tools
 - Incorporate standard processes
 - Base on historical data
- Our recommendations
 - Develop toolkit using ACEIT suite of tools as backbone
 - Incorporate other analytical tools as needed



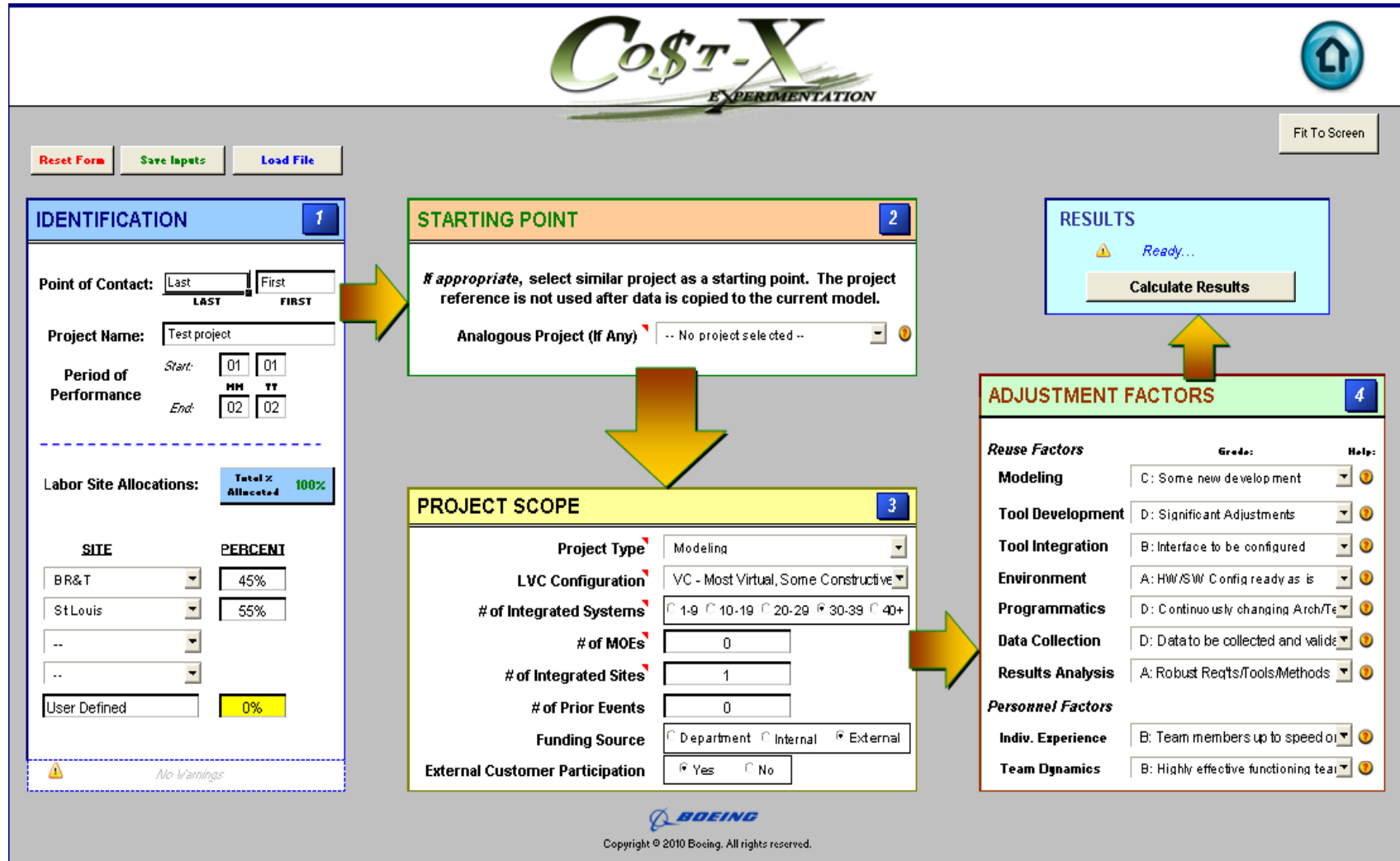
Co\$t-X Process

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Co\$t-X User Interface

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The screenshot displays the Co\$t-X EXPERIMENTATION user interface. At the top, there is a navigation bar with a home icon and a "Fit To Screen" button. Below the navigation bar are three buttons: "Reset Form", "Save Inputs", and "Load File".





The interface is divided into four main sections, each with a numbered tab:

- IDENTIFICATION (1):** Contains fields for "Point of Contact" (Last, First), "Project Name" (Test project), "Period of Performance" (Start/End dates), and "Labor Site Allocations" (Total % Allocated: 100%). A table lists sites and their percentages: BR&T (45%), StLouis (55%), and User Defined (0%).
- STARTING POINT (2):** Includes a text instruction: "# appropriate, select similar project as a starting point. The project reference is not used after data is copied to the current model." and a dropdown menu for "Analogous Project (If Any)" (No project selected).
- PROJECT SCOPE (3):** Contains fields for "Project Type" (Modeling), "LVC Configuration" (VC - Most Virtual, Some Constructive), "# of Integrated Systems" (1-9, 10-19, 20-29, 30-39, 40+), "# of MOEs" (0), "# of Integrated Sites" (1), "# of Prior Events" (0), "Funding Source" (Department, Internal, External), and "External Customer Participation" (Yes, No).
- ADJUSTMENT FACTORS (4):** A table with columns for "Reuse Factors", "Grade", and "Help". Factors include Modeling, Tool Development, Tool Integration, Environment, Programmatics, Data Collection, Results Analysis, Personnel Factors, Indiv. Experience, and Team Dynamics.

Arrows indicate the flow from IDENTIFICATION to STARTING POINT, then to PROJECT SCOPE, and finally to ADJUSTMENT FACTORS. A "Calculate Results" button is located in the RESULTS section, which is currently showing "Ready..." with a warning icon.

At the bottom of the interface, the Boeing logo and copyright information are displayed: "Copyright © 2010 Boeing. All rights reserved."

When “Calculate Results” button is selected

- Random Forest model is executed via call to R statistical package 
 - Returns preliminary costs estimate, prediction intervals, and quantiles
- Visual Basic macros transfers data to/from ACE model 
 - Formats the data for ACE (“Create_ACE_Import_Data”)
 - Opens the ACE application
 - Loads the indicated ACE model
 - Transfers required data to the ACE model (“Export_to_ACE AceSession”)
- ACE model is executed (via Visual Basic macro) 
 - ACE performs additional calculations and modifications
 - Cost Risk/Uncertainty Analysis is performed
 - Results passed back into Excel (“Get_ACE_results”)
- Summary page populated with data 
 - Options to print / view additional reports

R Excel Interface

Call to R Random Forest Model

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R Console
 File Edit Misc Packages Windows Help
 Copyright (C) 2009 The R Foundation for Statistical Computing
 ISBN 3-900051-07-0

Observation:													
LVC	Num. Systems	Num. MOE	Num. Exp.	Funding. Source	Ext. Cust. Ir	Environment							
CV	15	1	2	IRAD	y	C							
% Intervals:		70											
Probabilities:													
	0	0.02	0.04	0.06	0.08	0.1	0.12	0.14	0.16	0.18	0.2	0.22	0.24
Specify slow or fast quantile algorithm:						fast							
Note: slow means 100 forests (more accurate)													
fast means 1 forest													

OUTPUT													
Prediction	Raw estimate (mean) from Random Forest Model												
Estimated Hrs	11257.56												
Prediction Intervals:													
Lower	6203.2												
Upper	13304.78												
Lower & Upper Prediction Interval Based on Percentile selected													
Quantiles													
	333.1163194	1308.370475	1486.597	2467.541	2495.363037	3084.802	4223.0						248.442

Inputs

Outputs

Various inputs from Front End feed Random Forest Model

Specify Prediction Interval

Probabilities for which quantiles will be returned


Raw estimate (mean) from Random Forest Model

Lower & Upper Prediction Interval Based on Percentile selected

Quantiles associated with above Probabilities; Represents CDF

ACE Import Data Sheet used to transfer data via macros (1 of 2)



ACE Import Row Data		Cost Data		Cost or Non-cost
WBS/CES Description	Link ID	Cost Phasing Method	Approp	Fiscal Year
				Units
				Total
				FY 2
				
<input type="button" value="Back to Front End"/>				
Identification				
Point of Contact	POC			Mourikas, Karen
Project Name	ProjName			ACEIT Conference 2011
Start Date (MMYY)	Start_Dt			01OCT2010
End Date (MMYY)	End_Dt			31JAN2011
Labor Data				
Labor Rate 1	Labor_Rt_1			\$ 50.00
Labor Site 1	Labor_Site_1			BRT_Labor
Labor Site Percentage1	Labor_Site_Perc_1			30%
Labor Rate 2	Labor_Rt_2			\$ 120.00
Labor Site 2	Labor_Site_2			TX_Labor
Labor Site Percentage2	Labor_Site_Perc_2			20%
Labor Rate 3	Labor_Rt_3			\$ 70.00
Labor Site 3	Labor_Site_3			CA_Labor
Labor Site Percentage3	Labor_Site_Perc_3			40%
Labor Rate 4	Labor_Rt_4			\$ 150.00
Labor Site 4	Labor_Site_4			NM_Labor
Labor Site Percentage4	Labor_Site_Perc_4			10%
Scope Data				
Type of Project	Proj_Type			Project Type : Constructive = 3
LVC Category	LVC_Type			LVC Category : CV = 2 3
Number of Unique Systems	Systems_N			# of Systems : 1 to 9 = 1 2
Number of MOEs	MOE_N			1
				2

“ACE Import Data” sheet contains prepared data from Excel Front End

Values from hidden linked excel pages

Values from Front End

Translated values From Front End

ACE Import Data Sheet (2 of 2)

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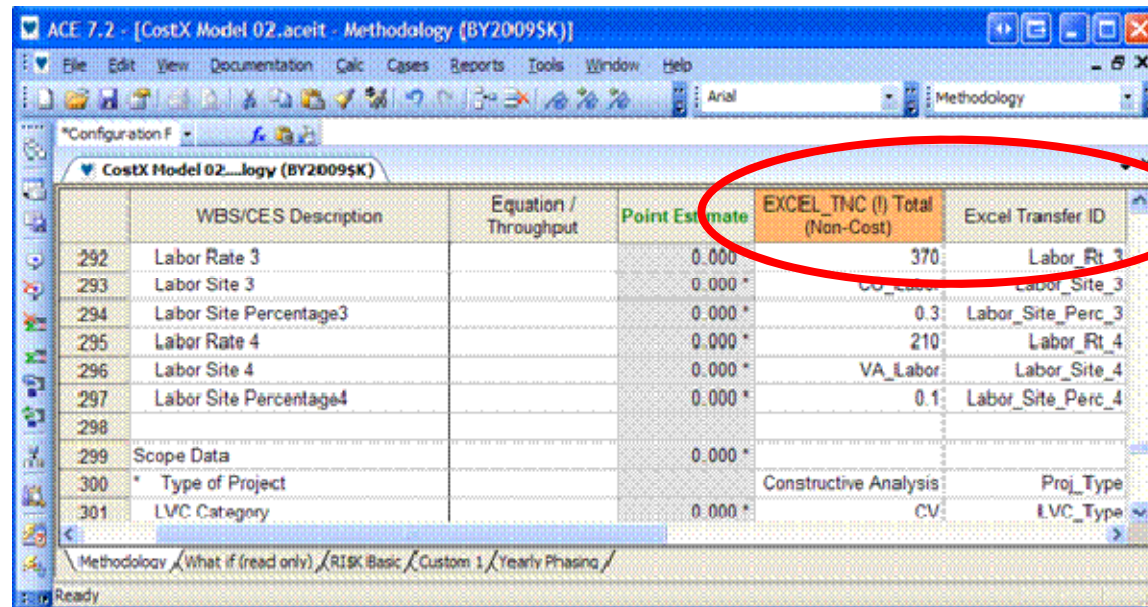


WBS/CES Description	Link ID	Cost I	Apprc	iscal	Inits	Total	FY
Number of Sites During Execution	Sites_N						1
Number of Related Past Experiments	Rel_Exp_N						2
Funding Source	Cust_Fund_I						2
External Customer Participation	Cust_Inv_I						1
Scope Parameters from Front End							
Translated values							
Funding Source : Customer = 2 Customer Participation : Yes = 1							
ReUse Factors							
Modeling	Model_ReF						D
Tool Development	Tool_ReF						C
Tool Integration	Int_ReF						D
Environment	Env_ReF						D
Programmatics	PM_ReF						C
Data Collection	Data_ReF						C
Analysis Results	Analysis_ReF						C
Individual Experience	Exp_ReF						C
Team Dynamics	Team_ReF						C
ReUse & Learning Parameters from Front End							
R Results							
RF Estimated Hours	RF_Hrs						11257.56316
RF Hrs Prediction Interval Low	RF_Hrs_PIL						6203.199988
RF Hrs Prediction Interval High	RF_Hrs_PIH						13304.77674
Random Forest values							
RF Estimate							
Prediction Interval based on selected percentile (70%)							

ACE Model accepts imported data from Excel

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- ACE model updated to accept input from Excel via two columns of data
 - Excel Transfer ID Column
 - Contains ID strings to identify data in Excel model
 - EXCEL_TNC (!) Total (Non-Cost) Column
 - Receives values generated in Excel and makes available to the ACE model



	WBS/CES Description	Equation / Throughput	Point Estimate	EXCEL_TNC (!) Total (Non-Cost)	Excel Transfer ID
292	Labor Rate 3		0.000	370	Labor_Rt_3
293	Labor Site 3		0.000 *	CO_Labor	Labor_Site_3
294	Labor Site Percentage3		0.000 *	0.3	Labor_Site_Perc_3
295	Labor Rate 4		0.000 *	210	Labor_Rt_4
296	Labor Site 4		0.000 *	VA_Labor	Labor_Site_4
297	Labor Site Percentage4		0.000 *	0.1	Labor_Site_Perc_4
298					
299	Scope Data		0.000 *		
300	* Type of Project			Constructive Analysis	Proj_Type
301	LVC Category		0.000 *	CV	LVC_Type

ACE Excel linkages



- Excel's "ACE Import Data" worksheet talks to ACE model
 - Excel!'ACE Import Data!'Link ID' column must be identical to the "Excel Transfer ID" column in the ACE model

WBS/CES Description	Link ID	Co	Ap	Fl	Un	Total	Cost or Non-cost
Labor Rate 1	Labor_Rt_1						\$100.00
Labor Site 1	Labor_Site_1						BRT_Labor
Labor Site Percentage1	Labor_Site_Perc_1						50%
Labor Rate 2	Labor_Rt_2						\$150.00
Labor Site 2	Labor_Site_2						WA_Labor
Labor Site Percentage2	Labor_Site_Perc_2						15%
Labor Rate 3	Labor_Rt_3						\$370.00
Labor Site 3	Labor_Site_3						CO_Labor
Labor Site Percentage3	Labor_Site_Perc_3						30%
Labor Rate 4	Labor_Rt_4						\$1.00
Labor Site 4	Labor_Site_4						User_Labor
Labor Site Percentage4	Labor_Site_Perc_4						5%

ACE Import Data Sheet in Excel

WBS/CES Description	Point Estimate	EXCEL_TNC (Total (Non-Cost))	Excel Transfer ID
Labor Data	0.000 *		
Labor Rate 1	0.000 *	100	Labor_Rt_1
Labor Site 1	0.000 *	BRT_Labor	Labor_Site_1
Labor Site Percentage1	0.000 *	0.5	Labor_Site_Perc_1
Labor Rate 2	0.000 *	150	Labor_Rt_2
Labor Site 2	0.000 *	WA_Labor	Labor_Site_2
Labor Site Percentage2	0.000 *	0.1	Labor_Site_Perc_2
Labor Rate 3	0.000 *	370	Labor_Rt_3
Labor Site 3	0.000 *	CO_Labor	Labor_Site_3
Labor Site Percentage3	0.000 *		Labor_Site_Perc_3
Labor Rate 4	0.000 *	1	Labor_Rt_4
Labor Site 4	0.000 *	VA_Labor	Labor_Site_4
Labor Site Percentage4	0.000 *	0.1	Labor_Site_Perc_4

ACE model

Processing within ACE model

- Data input to ACE model
 - Random Forest estimate and prediction data
 - Probabilities and Quantile data (CDF) translated as multipliers
 - All Input parameters, excluding identification text fields
 - Categorical (text) data transferred into numerical values
- Parametric adjustments to raw estimate
 - Random Forest model calibration
 - Regression adjustments based on additional parameters
 - Final estimate
- Risk calculations
 - Custom Cumulative Distribution Function (CDF)
 - 1000 iterations
 - Risk defined for Random Forest estimate
 - Applies to final estimate

Data transferred into ACE model

CostX Model 0...y (BY2010\$K)					
	WBS/CES Description	Unique ID	EXCEL_TNC (!) Total (Non-Cost)	Excel Transfer ID	
445	Identification				
448	Start Date (MM/YY)				
449	End Date (MM/YY)				
450					
451	Labor Data				
452	Labor Rate 1				
453	Labor Site 1				
454	Labor Site P				
455	Labor Rate 2				
456	Labor Site 2	XL			
457	Labor Site Percentage2	Labo			
458	Labor Rate 3				
459	Labor Site 3	XL			
460	Labor Site Percentage3	Labo			
461	Labor Rate 4				
462	Labor Site 4	XL			
463	Labor Site Percentage4	Labo			
464					
465	Scope Data				
466	Type of Project				
467	LVC Category				
468	Number of Unique Systems				
469	Number of MOEs	XL_MOE_N	2	MOE_N	
470	Number of Sites During Execu	XL_Sites_N	1	Sites_N	
471	Number of Prior Events	XL_Rel_Exp_N	2	Rel_Exp_N	

	WBS/CES Description	Unique ID	EXCEL_TNC (!) Total	Excel Transfer ID	Approx
475	Project Starting Point				Ref_Proj
476					
477	ReUse Factors				
478	Modeling	XL_Model_ReF	B	Model_ReF	
479	Tool Development		C	Tool_ReF	
480	Tool Integration		B	Int_ReF	
481	Environment	XL_Env_ReF	B	Env_ReF	
482	Programmatics	XL_PM_ReF	B	PM_ReF	
483	Data Collection	XL_Data_ReF	B	Data_ReF	
484	Analysis Results	XL_Analysis_ReF	B	Analysis_ReF	
485	* Team Factors				
486	Individual Experience	XL_Exp_ReF	C	Exp_ReF	
487	Team Dynamics	XL_Team_ReF	B	Team_ReF	
488					
489	* Results from Random Fores				
490	RF Estimated Hours	XL_RF_Hrs	5228.09051707939	RF_Hrs	
491	RF Hrs Prediction Interval Low	XL_RF_Hrs_PIL	1197.63633885797	RF_Hrs_PIL	
492	RF Hrs Prediction Interval High	XL_RF_Hrs_PIH	10268.9914094023	RF_Hrs_PIH	

ID data

Labor data

Scope data

Unique IDs start with "XL" to identify as passed in via Excel

Reuse / Learning

RF Estimate/Prediction data

Estimate manipulations

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
* RF Calculate / Pre Adjusted			Translated to \$ per site
*Project Estimate in \$			
Proj Est \$ Total	Proj_Total_\$		916,360. (53%) *
Proj Est \$ Site 1	Site1_\$	Hrs_Site1*Labor_Rate_1	365,326.20 (53%) *
Proj Est \$ Site 2	Site2_\$	Hrs_Site2*Labor_Rate_2	140,042. (53%) *
Proj Est \$ Site 3	Site3_\$	Hrs_Site3*Labor_Rate_3	340,971. (53%) *
Proj Est \$ Site 4	Site4_\$	Hrs_Site4*Labor_Rate_4	70,021. (53%) *
*Project Estimate in Hrs: Calcula			
Proj Est Hrs Total	Proj_Total_Hrs	XL_RF_Hrs.EXCEL_TNC	6,089. (53%) *
Site Point Estimate in Hrs	Site_Total_Hrs		Random Forest Estimate – in hours
Proj Est Hr Site 1	Hrs_Site1	Proj_Total_Hrs*Labor_Percent_1	1,827. (53%) *
Proj Est Hr Site 2	Hrs_Site2	Proj_Total_Hrs*Labor_Percent_2	1,218. (53%) *
Proj Est Hr Site 3	Hrs_Site3	Proj_Total_Hrs*Labor_Percent_3	2,436. (53%) *
Proj Est Hr Site 4	Hrs_Site4	Proj_Total_Hrs*Labor_Percent_4	609. (53%) *
			Hours allocated to sites

- Raw estimate from Random Forest (in hours) to be adjusted in ACE model incorporating additional parameters from CostX Front End

Model Calibration & Adjustments

- Random Forest model calibrated based on residual values
- Additional parametric equations applied to Random Forest raw estimate
 - Utilizing additional parameters from front end
 - Adjustments determined via regression and analysis

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
*Calibration Adjustment			
*Generally overestimates low cost, underestimates high cost			
*Linear I			
*-0.3342			
*Num Site Adjustment			
*Do not			
*Adjust if more than 1 site involved			
Regress	* Based on Linear Regression of Hrs (Y) per Num		
Regress	Num Site Regression Coefficient A	Site Reg Coeff A	2143.6 2144 *
Calibrati	Num Site R		
	Num Site =		
Num Sites /		Upg_I	XL_SP_Upg.EXCEL_TNC 0. *
		Upg_Pct	If(Cont_NoDB_I = 1, 0.1, -.25) -0.25 *
Num Site A		Upg_Adj_Est	BU_Supt_Adj_Est * (1+Upg_Pct*Upg_I) 3,962. (61%) *
Num Site Max Adjustment	Site_Adj_Max	Site_Adj_Amt+CommEffects_Adj_Est	4,403. (61%) *
Num Site Adjusted Estimate	Site_Adj_Est	If (Site_Adj_Amt- CommEffects_Adj_Est > 0, CommEffects Adj Est+Site Adj Amt/2.	4,403. (61%) *

Final Adjusted Point Estimate

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
*Final Adjusted Total Hours			
Final Point Estimate Hours	Final_PE_Hrs	AOA_Adj_Est	3,425. (53%)
PE Site Estimates Hrs			3,425. (53%)
Proj Est Hr Site 1	Adj_Hrs_Site1	Final_PE_Hrs*Labor_Percent_1	1,027. (53%)
Proj Est Hr Site 2	Adj_Hrs_Site2	Final_PE_Hrs*Labor_Percent_2	685. (53%)
Proj Est Hr Site 3	Adj_Hrs_Site3	Final_PE_Hrs*Labor_Percent_3	1,370. (53%)
Proj Est Hr Site 4	Adj_Hrs_Site4	Final_PE_Hrs*Labor_Percent_4	342. (53%)
* Final Adjusted Total \$			
Proj Est \$ Total	Final_PE_\$		515,452. (53%)
Proj Est \$ Site 1	Adj_Site1_\$	Adj_Hrs_Site1*Labor_Rate_1	205,495.99 (53%)
Proj Est \$ Site 2	Adj_Site2_\$	Adj_Hrs_Site2*Labor_Rate_2	78,773. (53%)
Proj Est \$ Site 3	Adj_Site3_\$	Adj_Hrs_Site3*Labor_Rate_3	191,796. (53%)
Proj Est \$ Site 4	Adj_Site4_\$	Adj_Hrs_Site4*Labor_Rate_4	39,387. (53%)

Hours allocated to sites

Translated to \$ per site

- Final Point Estimate derived from raw estimate from Random Forest

Custom Cumulative Distribution Function from Random Forest (CDF)

- Random Forest returns Estimated Hrs
 - Median value
 - Average prediction from collection of trees
 - As a “Raw Estimate”
- Quantiles = estimates associated with the Probability Distribution
 - Output from R Random Forest model
- Multiplier used in ACE Custom CDF definition
 - Quantile / Estimated Hrs
 - Multiplier of 1 refers to the Raw estimate
- RQuantiles = name of CDF for ACE model

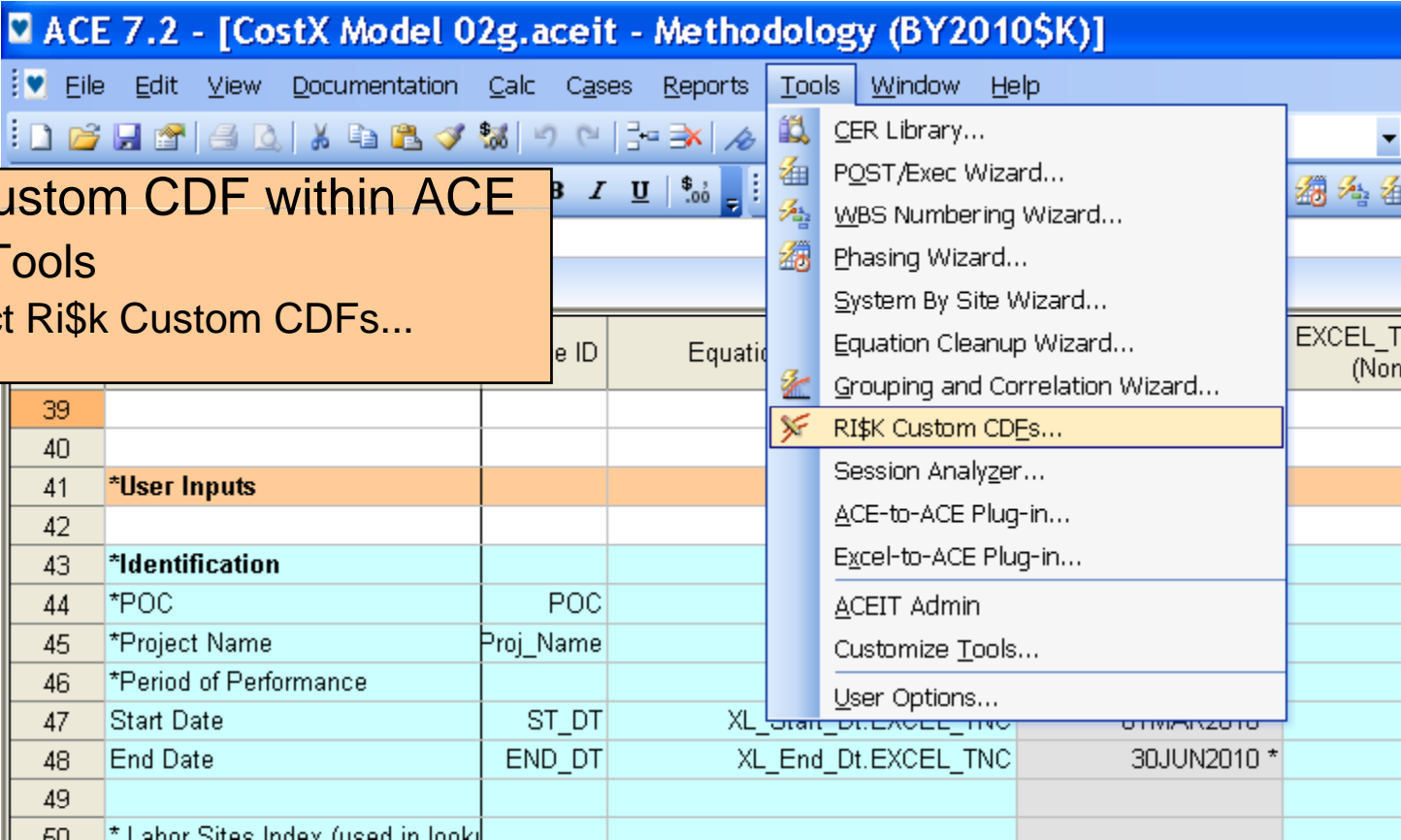
OUTPUT	
Prediction:	
Estimated Hrs	11257.56

Prob	Quantiles	Multiplier
0	333.1163194	0.02959
0.02	1308.370475	0.116221
0.04	1486.5973	0.132053
0.06	2100.00037	0.186133
0.1	3084.802459	0.273833
0.12	4223.009991	0.374609
0.14	5784.563517	0.513833
0.16	6285.5	0.558336
0.18	8399.198341	0.746094
0.2	9248.442368	0.821531
0.22	9248.442368	0.821531
0.24	9248.442368	0.821531

ACE RPred CDF name	RQuantiles
--------------------	------------

Custom Cumulative Distribution Function in ACE

- To view Custom CDF within ACE
 - Select Tools
 - Select Ri\$K Custom CDFs...



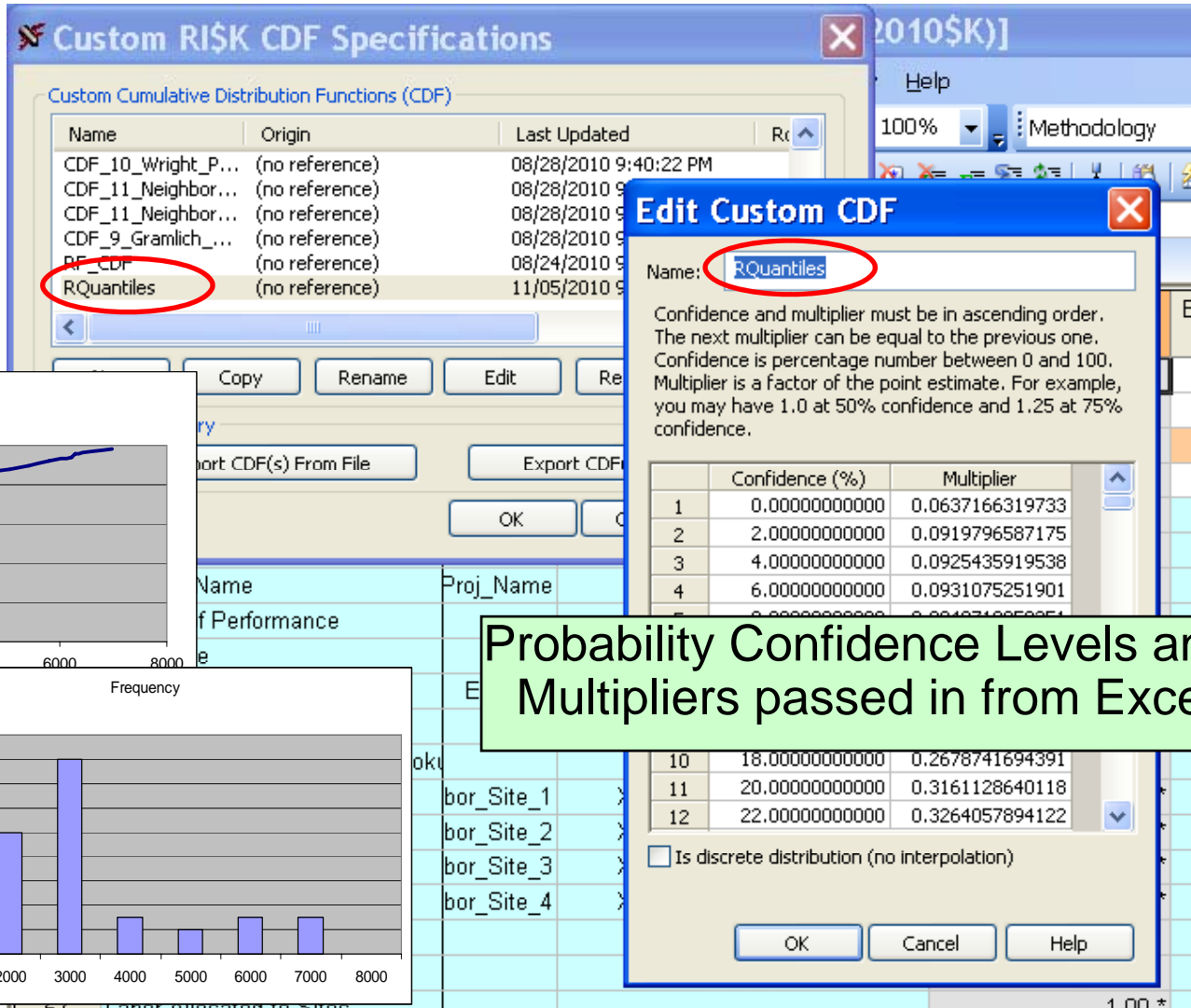
The screenshot shows the ACE 7.2 software interface. The title bar reads "ACE 7.2 - [CostX Model 02g.aceit - Methodology (BY2010\$K)]". The menu bar includes File, Edit, View, Documentation, Calc, Cases, Reports, Tools, Window, and Help. The Tools menu is open, and the option "RI\$K Custom CDFs..." is highlighted. Below the menu, a table is visible with columns for "e ID" and "Equation".

e ID	Equation
39	
40	
41	*User Inputs
42	
43	*Identification
44	*POC POC
45	*Project Name Proj_Name
46	*Period of Performance
47	Start Date ST_DT XL_Start_Dt.EXCEL_TNC 01MAY2010
48	End Date END_DT XL_End_Dt.EXCEL_TNC 30JUN2010 *
49	
50	* Labor Sites Index (used in look

ACE Custom Cumulative Distribution Function

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Name of CDF from Excel



Custom RI\$K CDF Specifications

Name	Origin	Last Updated
CDF_10_Wright_P...	(no reference)	08/28/2010 9:40:22 PM
CDF_11_Neighbor...	(no reference)	08/28/2010 9:40:22 PM
CDF_11_Neighbor...	(no reference)	08/28/2010 9:40:22 PM
CDF_9_Gramlich...	(no reference)	08/28/2010 9:40:22 PM
RF_CDF	(no reference)	08/24/2010 9:40:22 PM
RQuantiles	(no reference)	11/05/2010 9:40:22 PM

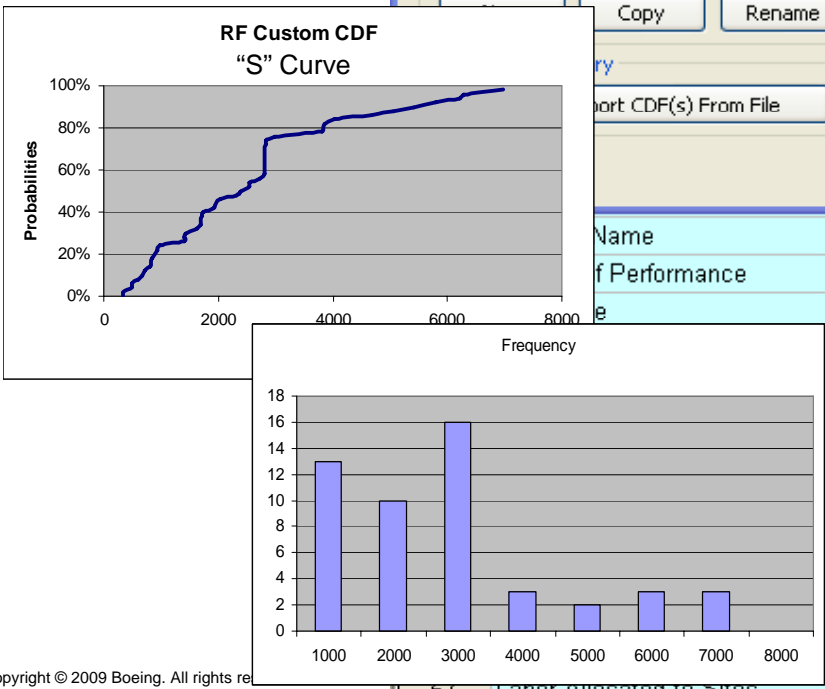
Edit Custom CDF

Name: RQuantiles

Confidence and multiplier must be in ascending order. The next multiplier can be equal to the previous one. Confidence is percentage number between 0 and 100. Multiplier is a factor of the point estimate. For example, you may have 1.0 at 50% confidence and 1.25 at 75% confidence.

	Confidence (%)	Multiplier
1	0.000000000000	0.0637166319733
2	2.000000000000	0.0919796587175
3	4.000000000000	0.0925435919538
4	6.000000000000	0.0931075251901
5	8.000000000000	0.0936714584264
6	10.000000000000	0.0942353916627
7	12.000000000000	0.0947993248990
8	14.000000000000	0.0953632581353
9	16.000000000000	0.0959271913716
10	18.000000000000	0.2678741694391
11	20.000000000000	0.3161128640118
12	22.000000000000	0.3264057894122

Is discrete distribution (no interpolation)



Probability Confidence Levels and Multipliers passed in from Excel

Cost Risk Applied to Point Estimate

WBS/CES Description	Unique ID	Point Estimate	Distributi on Form	PE Position in Distribution	CDF Keyword	Random Seed
*Project Estimate in Hrs: Calculated from RF						
Proj Est Hrs Total	Proj_Total_Hrs	2,645. (55%)*	CDF	Undefined	RQuantiles	1687442

CDF applied to Raw estimate

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
*Final Adjusted Total Hours			
Final Point Estimate Hours	Final_PE_Hrs	Final Estimate	1,950. (55%)*
PE Site Estimates Hrs			1,950. (55%)*
Proj Est Hr Site 1	Adj_Hrs_Site1	Final_PE_Hrs*Labor_Percent_1	97. (55%)*
Proj Est Hr Site 2	Adj_Hrs_Site2	Final_PE_Hrs*Labor_Percent_2	487. (55%)*
Proj Est Hr Site 3	Adj_Hrs_Site3	Final_PE_Hrs*Labor_Percent_3	1,267. (55%)*
Proj Est Hr Site 4	Adj_Hrs_Site4	Final_PE_Hrs*Labor_Percent_4	97. (55%)*

Final Estimate allocated to sites

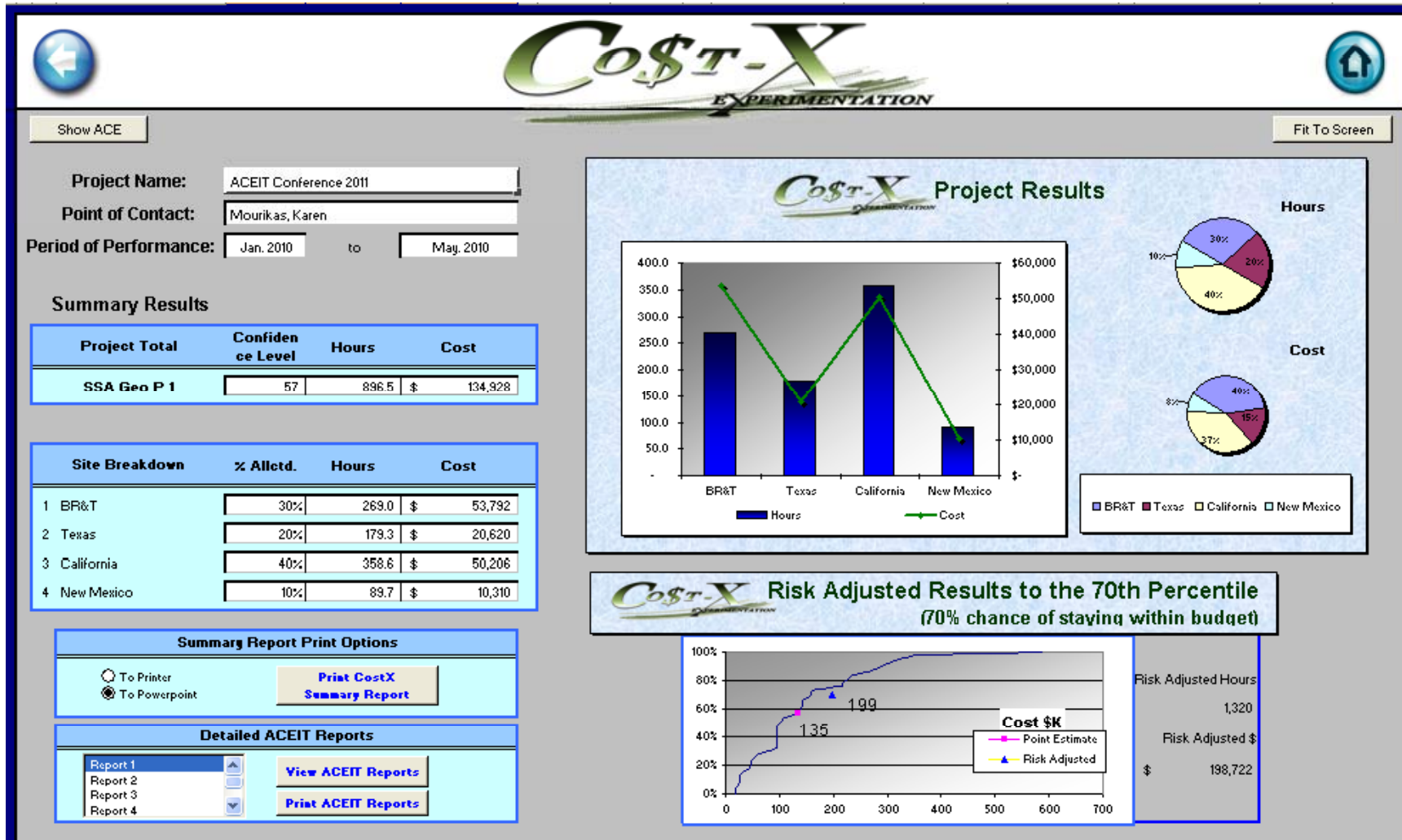
Specify Cost Risk Percentile

* Risk Calculations			
* Risk Quantiles	Three levels of risk for flexibility	Can be easily changed	
Low Risk Percentile	RiskConf_Low	50. *	50
Middle Risk Percentile	RiskConf_Mid	70. *	70
High Risk Percentile	RiskConf_High	85. *	85

WBS/CES Description	Unique ID	Point Estimate		
*Final Adjusted Total Hours				
Final Point Estimate Hours	Final_PE_Hrs	1,950 (55%)		
RiskConf_PE		RiskConf(@Final PE Hrs, Final PE Hrs,1)		55. *
*Final Adjusted RA Hours				
Final RA Low Hours	Final_RA_Low_Hrs	RiskCost(@Final_PE_Hrs,RiskConf_Low)	50%	1,853. *
Final RA MidHours	Final_RA_Mid_Hrs	RiskCost(@Final_PE_Hrs,RiskConf_Mid)	70%	2,409. *
Final RA HighHours	Final_RA_Hi_Hrs	RiskCost(@Final_PE_Hrs,RiskConf_High)	85%	3,285. *

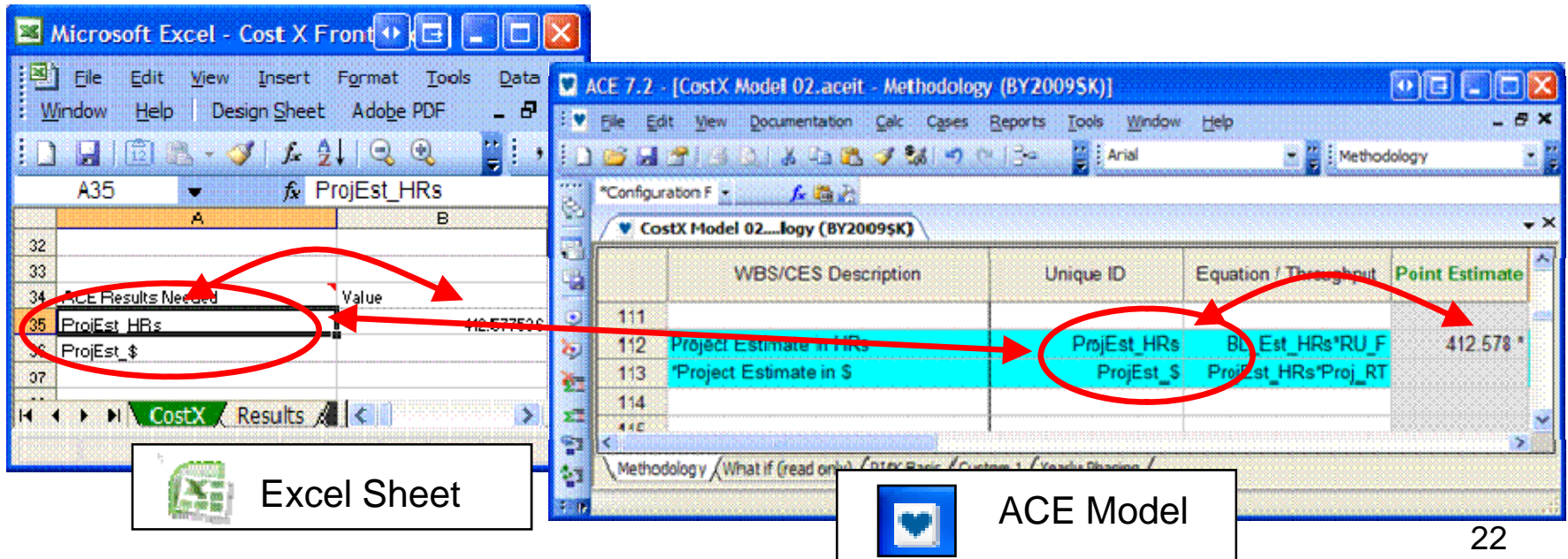
Co\$t-X Summary Results

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Results returned from ACE to Excel

- Values from ACE placed in corresponding columns in Excel
 - Excel's column A contains the "Unique ID" names from ACE
 - i.e. "ProjEst_HRs"
 - The "Point Estimate" column in ACE contains the value associated with the Unique ID and passed to column B in excel



The image displays two software windows side-by-side. On the left is Microsoft Excel, and on the right is ACE 7.2. Red circles and arrows highlight the data transfer process. In the ACE Model window, a table with columns 'WBS/CES Description', 'Unique ID', 'Equation / Throughput', and 'Point Estimate' is shown. Row 112 is highlighted in cyan and contains 'ProjEst_HRs' in the Unique ID column, 'Bl Est_HRs*RU_F' in the Equation column, and '412.578' in the Point Estimate column. Red arrows point from this row to the corresponding cells in the Excel spreadsheet: 'ProjEst_HRs' in cell A35 and '412.578' in cell B35. Below the Excel window is a label 'Excel Sheet' with an Excel icon. Below the ACE window is a label 'ACE Model' with a heart icon.

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
	111		
Project Estimate in Hrs	ProjEst_HRs	Bl Est_HRs*RU_F	412.578
Project Estimate in \$	ProjEst_S	ProjEst_HRs*Proj_RT	
	114		

Labor Rates Lookup Tables

- Look up tables contain labor rates per year
 - MatVal(@Hrly_RatesM, Labor_Site_1, Labor_Rate_Col)
 - Project Start Year determines which labor rate to use

WBS/CES Description	Unique ID	FY 2009	FY 2010	FY 2011	FY 2012
*Rates Per Site Inflated by 4% from 2009		2009	2010	2011	
Hourly_Rates Matrix	Hrly_RatesM				
Alabama		100.0	104.0	108.2	
Arizona		110.0	114.4	119.0	
BR&T		120.0	124.8	129.8	
California					
Colorado					
Kansas					
New Mexico					
Philly					
St Louis					
Texas					
Virginia					
Washington					
UserDefined		220.0	228.8	238.0	

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
First Year of Rates in DB	FIRST_YR	2008	2,008. *
Project Start Year Column in DB	Start_Yr_Col	DATEYR(ST_DT) 2008	2. *
Labor Rate Column in DB	Labor_Rate_Col	If(Start_Yr_Col > 3, 3, Start_Yr_Col)	2. *

ReUse Lookup Tables

WBS/CES Description	Unique ID	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
* ReUse Factor Matrix Headers		A	B	C	D	E
Reuse Factors Matrix						
	FactorM					
Modeling		0.25	0.5	1		
Tool Development		0.8	1	1.5		
Tool Integration		0.5	0.8	1		
Environment		0.3	0.7	1		
Programmatics		0.5	0.7	1		
Data Collection		0.6	0.8	1		
Analysis Results		0.75	0.85	1		
Team Experience (individual)		0.8	0.9	1	1.25	1.4
Team Dynamics		0.7	0.85	1	1.25	1.4

ReUse Factor Table

- Reuse data determines cost savings/penalties
 - A ~ Cost Savings
 - E ~ Cost Penalties

WBS/CES Description	EXCEL_TNC #	Total (A-E)
ReUse Factors		
Modeling	D	
Tool Development	B	
Tool Integration	C	
Environment	B	
Programmatics	C	
Data Collection	C	
Analysis Results	C	

ReUse Factor Values

WBS/CES Description	Unique ID	Equation / Throughput	Point Estimate
*Matrix Lookups and Functions			
*Factor Lookup			
Modeling	Mod_F	MatVal(@FactorM, 1, Mod_RU)	1.25 *
Tool Development	Tool_F	MatVal(@FactorM, 2, Tool_RU)	1.00 *
Tool Integration	Int_F	MatVal(@FactorM, 3, Int_RU)	1.00 *
Environment	Env_F	MatVal(@FactorM, 4, Env_RU)	0.70 *
Programmatics	Prog_F	MatVal(@FactorM, 5, Prog_RU)	1.00 *
Data Collection	Data_F	MatVal(@FactorM, 6, Data_RU)	1.00 *
Analysis Results	Ana_F	MatVal(@FactorM, 7, Ana_RU)	1.00 *

Matrix Lookup

Next Steps for 2011

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- Data Collection/Analysis
 - Collect new data (on-going)
 - Automatic database update (in-work)
 - Analyze additional data (on-going)
- Model
 - Investigate ACEIT 7.2 features
 - Cat(), RLookup(), Random Number generator from ACEIT
 - Create additional reports (in-work)
 - Cost Risk Assessment Report
 - Detailed Baseline Report