

A Basis of Estimate (BOE) Tool for Project Estimates

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Abstract

- This Basis of Estimate tool is under development at NASA Langley Research Center, for use in formulating and documenting project build-up estimates, as part of an effort to improve the quality and documentation of proposals.
- The tool runs in the Microsoft Excel environment, using Excel sheets for input and output. Some salient features include: subsystem groupings and user-set variable time durations for resource input; an extensive capability for description and documentation of estimating rationale; a comprehensive collection of standard output formats, including detailed output in matrix form, to enable users to create new output combinations or perform ad hoc data analysis; range input and output capability with interface to probability analysis tools; capability to import data from parametric costing tools; and the parallel capability to be used as a project cost recording tool.

Overview

- Background
- Description
 - Input, global
 - Input, local
 - Documentation
 - Output
- Other features
- Demonstration
- Discussion/Questions

NASA Cost Estimating

- In the current budget environment and for the foreseeable future, NASA is expected to:
 - Do as much or more with less –
 - Annual budgets are decreasing in real terms, while...
 - NASA's mission is expanding overall

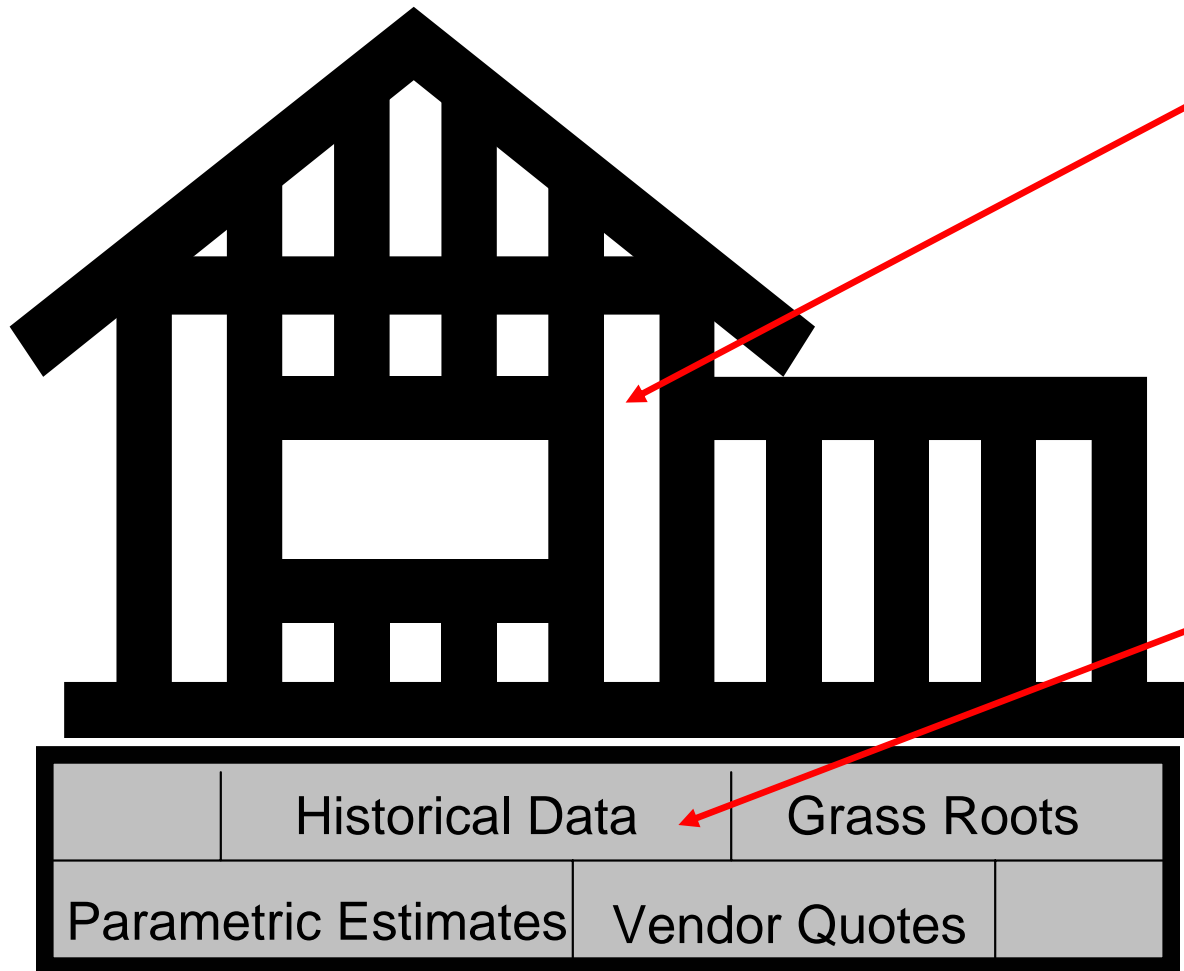
And therefore we need to:

- Improve project planning and cost estimating
- Do a better job of justifying project cost and schedule
- Adhere to existing and new NASA policy, including requirements for
 - Cost Risk Management
 - Earned Value Management
 - Independent Cost Estimates

What are our needs?

- Need standard process for capturing **basis of estimate**
 - Pricing templates are a good start, **but** also need to document **underlying rationale** for the estimate
 - Underlying project assumptions, technical requirements and definition
 - Contractor estimates (contractor assumptions & BOE)
 - Staffing requirements, phasing, & CS/contractor split
 - Quantity and cost of materials
 - Fabrications costs, Wind tunnel time, etc.
 - Need standard/consolidated database for storing and reviewing BOE
 - Need to present a strong, uniform, credible cost proposal
- Need to preserve BOE rationale from estimate into implementation
 - Implementation baseline needs to flow from estimating process
 - Need capability to quickly re-baseline in response to changing schedule and requirements
- Need good basis for historical records
 - Need well defined and documented baseline to compare with implementation and learn where we were right/wrong

If the house is the Estimate



The Work Breakdown Structure – is the framework upon which an estimate is built.

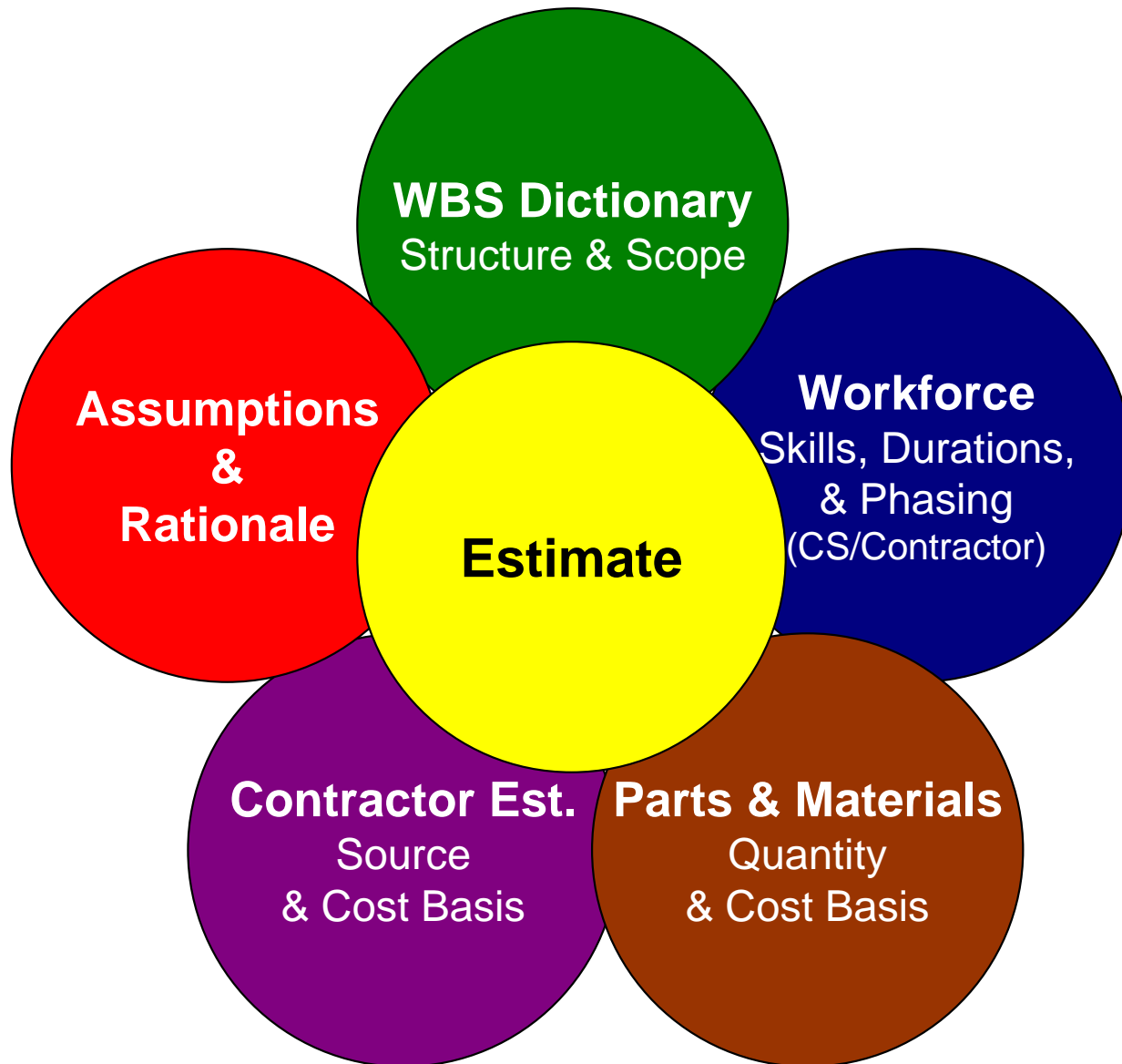
The Basis of Estimate (BOE) – assumptions and rationale are the foundation

The estimate is only as good as the foundation

What is a BOE Tool?

- A database tool that facilitates the tasks of:
 - Structuring the plan input – WBS (define/use)
 - Collecting all of the cost elements
 - Contractor estimates (contractor assumptions & BOE)
 - Staffing requirements & CS/contractor split
 - Quantity and cost of materials
 - Fabrication costs, Wind tunnel time, etc.
 - Documenting the **rationale for each** costed WBS element

What does a BOE tool capture?

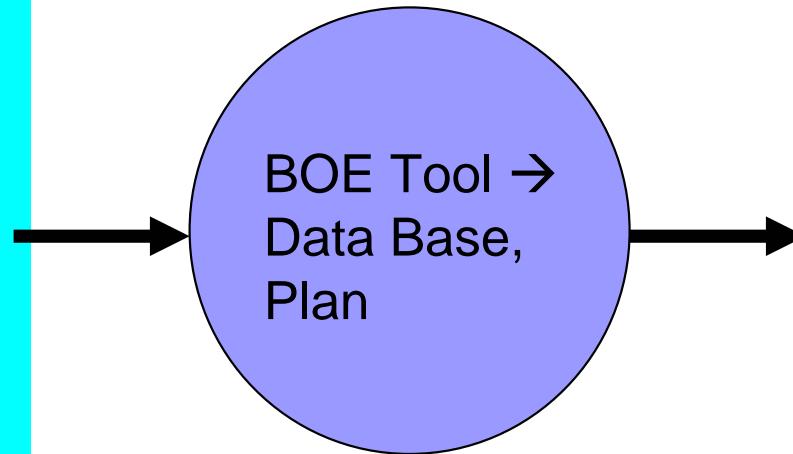


What are the benefits of a BOE tool?

- Provides common format for projects to collect and record project definition
- Provides a complete documented record to support estimate
- Can be easily updated to reflect programmatic changes
- Can be used for “what if” trades
- Provides common output
 - Improves the perceived credibility of estimates
 - Easily interpreted, self-contained estimate for reviewers
- Can be “exported” as a project cost baseline to support cost management
- Facilitates recording of project history
 - Provides single source, complete, self-consistent estimate
 - Supports comparison of estimates to performance

BOE Tool input, output

- Historical data
- Vendor quotes
- Grass roots engineering estimates
- Parametric estimates
- Constraints: Schedule, Funding, etc.
- Pricing data



- Reviewers
- Senior management
- Project implementation staff

Decision to start an in-house tool

- Commercial packages exist, but:
 - Are costly, and no common organizational one yet chosen
 - When or if chosen, will probably not be commonly distributed
 - While very capable functionally, are not as flexible as spreadsheet-based tool for
 - Customizing to organization preferences
 - Full range of documentation
- Heritage: existing spreadsheet-based tools could serve as a starting point
 - Parametric model with detailed output could provide initial data structure, initial code
 - Visual Basic, embedded in Excel, could provide adequate programming capability
 - Existing pricing tools could provide organization-unique structure, rates
- Accessibility: desired to make it easy for potential experimental users (guinea pigs) to access and use prototype tool
 - Everyone has spreadsheet application
 - Interfaces to other applications are relatively easy from spreadsheet environment
- Decided to do prototype work in spreadsheet tool, then, at some later date, decide whether to change platform

Near-term goals of BOE Tool

- Provide standard formats for collecting and recording project information
 - Enable the efficient use of the standard formats to document the plan, in real time, as it is formulated, including both:
 - Quantities: resources, schedule
 - Text: estimating rationale, background assumptions, etc.
 - Enable the efficient use of the same standard formats to record the actual history of the plan (both quantities and rationale), in real time, as it is implemented

- But also have flexibility to provide for non-standard documentation of unique parts and aspects of project
 - Front end processing (derivation of input beyond the scope of simple text)
 - Secondary or alternate estimates

- Enable efficient re-calculation of cost and schedule as the plan is
 - drafted
 - executed

Description, Input

Global Input:

- Schedule
 - Global start date
 - List of phase milestones, user-defined

- Financial parameters
 - Base year for constant dollar input, output
 - Inflation rates
 - Options for calculation, including monthly or annually, calendar or fiscal year

- User-defined lists for values of some input parameters
 - Skills (functions)
 - Performing organizations
 - Input range multipliers (probability distributions)

Snapshot: Globals

Phase Definition

input start year -----> 2008

Phase label	Length, months	Date Calc	Phase Description (notes)	Cum months
<ph> (calendar year start)	0	xxx		0
Pre	0	xxx	Pre-start	0
Delay	3	xxx	Delay	3
MT&C	10	xxx	Development	13
SC_I&T	19	xxx	Spacecraft I&T	32
MO&DA	69.5	xxx	Mission Ops & Data Analysis	101.5
End	1	xxx	End	102.5
		xxx		102.5
		xxx		102.5
		xxx		102.5
		xxx		102.5
		xxx		102.5
		xxx		102.5

<end>

b Add Performing Org below selected cell/row
Delete Performing Org at selected cell/row

Note: Changed label here is not reflected
Input sheets must be updated manually

<org> List for: **Performing Organization**

- LaRC
- LaRC_CERES
- ATK/Swales
- AS&M
- AMA
- Raytheon
- NGST
- SDL
- SSAI
- Futron
- MTI
- TBD_1
- NA

<end>

Snapshot: Globals

```

List for:
<skill> Skills:
Systems Engineering
Electronics/Power Eng/Design
Mech/Structural Eng/Desn
Thermal Eng
Drafting/Layout
Optics Eng
Laser Eng
Fab/Tooling (Design)
Fab/Tooling (Technician)
Assembly (Technician)
Packaging/Bench Tech
Integration & Test (Eng)
Integration & Test (Tech)
Software Eng/Design
Software Programming
Atmos Sci & SW
Data Reduction
Operations
Project Management
Planning/Schedules
Data/Doc
Config. Mgmt.
Risk, QA Eng
Risk, QA Tech
Project Scientist
Receiver
Admin
Procurement
TBD_1
???
NA
<end>
    
```

<prob>	List for: Probability distributions:	(For later use)					
		Low factor	Modal factor		High factor	Variance	Low tail
		L	M	H	VC	L-tail	H-tail
	Mid_range	0.85	1	1.15	0	0	0
	Low_range	0.95	1	1.05	0	0	0
	High_range	0.75	1	1.25	0	0	0
	Skew_high	0.95	1	1.25	0	0	0
	Skew_low	0.75	1	1.05	0	0	0
	Zero_all_cost	0	0	0	0	0	0
<end>	Zero_range	1	1	1	0	0	0

Local Input:

- Subsystem-oriented input format
 - Within grouping, individual item inputs
 - Designed to aid planning by grouping resources associated with task
- Variable durations
 - Each subsystem has user defined time periods
 - User enters durations of time periods, program calculates resulting schedule, relation to phases and milestones, etc.
 - User enters resource quantity for each time period
 - Since time periods are variable and user defined, many options are possible
 - But user must be careful
 - Default time period is months, to encourage planning at minimum desirable level of granularity, and, during implementation, data recording
- Labor: staffing level, for individual persons or groups
 - Civil service, regular (contract)
- Direct cost, by constant or real-year dollars
- Cost per unit: input resource unit as base and cost per unit
 - Allows import of intermediate results (e.g., labor months) from other cost elements, to be used as basis for new resource element
- Organization unique, with custom pricing algorithms
 - Fabrication, Wind tunnel

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Snapshot: Staffing, a little closer

		WBS num	Global	Labor (Civil Service, Contractor)										Purchases, I
<H>		<wbs>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>	<LB>
		1		2	2	2	2	2	2	2	2	2	2	2
Local		2		2	2	2	2	2	2	2	2	2	2	2
CM&O (Center Manager		3												
Yes	Include CM&O	4												
	note (add)	5												
	note (delete)	6												
		7												
	Title/desc		Instrument Manager/ I&T Manager	Mechanical Engineer	Structural Analyst	Thermal Analyst	Electronics Engineer	Flight Software Engineer	Software V&V Engineer	Contamination Control Engineer	Resident Engineer			Title/desc
(note on dollars)	Type		Eng	Eng	Eng	Eng	Eng	Eng	Eng	Eng	Eng	Eng		Type
	Skill		Integration & Test (Eng)	Mech/Structural Eng/Desn	Mech/Structural Eng/Desn	Thermal Eng	Electronics/Power	Software Eng/Design	Software Eng/Design	Contam Engrn	Systems Engineering			Skill
2007 base yr \$	Name		TBD	TBD	TBD	TBD	TBD	Ena/Desian TBD	x. Xxx / Rayther	TBD	x. Xxx / MTI	TBD		Name/ label
1000 (\$K) Cost Units	Perf. Org		LaRC	LaRC	LaRC	LaRC	LaRC	LaRC	Raytheon	LaRC	MTI	LaRC		Perf. Org
\$K2007 \$label	Directorate		SysEng	SysEng	SysEng	SysEng	SysEng	SysEng	Science	SysEng	SysEng	SysEng		Directorate
	CS grade or Contractor		14	13	13	13	13	CON	CON	14	CON	14		unit of issue
	CS step or input salary		5	5	5	5	5	150	150	5	150	5		purch qty
Oct 2007	start month start year		1740	1740	1740	1740	1740	1824	1824	1740	1824	1740		Type\$ BOE add'l
	BOE additional note													
	Probability Distribution		Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range		
	Dependence Coefficient		x	x	x	x	x	x	x	x	x	x		
period num <P>	input duration months	cum elapsed months	end date	Phase	Staffing Level	LOE	LOE	LOE	LOE	LOE	LOE	LOE	LOE	LOE
1	3	3	.12/31/07	Delay										
2	1	4	.1/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.1	0.25
3	1	5	.2/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.1	0.25
4	1	6	.3/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.1	0.25
5	1	7	.4/31/08	MT&C		1	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.25
6	1	8	.5/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.1	0.25
7	1	9	.6/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.25	0.25
8	1	10	.7/31/08	MT&C		1	0.5	0.5	1	0.5	0.5	0.5	0.25	0.25
9	1	11	.8/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.25	0.25
10	1	12	.9/31/08	MT&C		1	0.5	0.1	0.5	0.5	0.5	0.5	0.25	0.25
11	1	13	10/31/08	MT&C		1	0.5	0.05	0.5	0.5	0.5	0.5	0.25	
12	1	14	.11/31/08	SC_I&T		0.5	0.5	0.05	0.5	0.5	0.5	0.5		
13	1	15	.12/31/08	SC_I&T		0.5	0.5	0.05	0.5	0.5	0.5	0.5		
14	1	16	.1/31/09	SC_I&T		0.5	0.4	0.05	0.2	0.2	0.2	0.2		
15	1	17	.2/31/09	SC_I&T		0.5	0.4	0.05	0.2	0.2	0.2	0.2		
16	1	18	.3/31/09	SC_I&T		0.5	0.4	0.05	0.2	0.2	0.2	0.2		
17	1	19	.4/31/09	SC_I&T		0.5	0.4	0.05	0.2	0.2	0.2	0.2		

Snapshot: Input, labor description

WBS num	Global <wbs>	Labor (Civil Service, Contractor)					
		<LB>	<LB>	<LB>	<LB>	<LB>	<LB>
1	10	10	10	10	10	10	10
2	1	1	1	1	1	1	1
3							
4							
5							
6							
7							
Title/desc		Instrument I&T Mgr	Mechanical Integration	Electrical Integration	Instrument Rep (Boulder)	Contamination Contol Engineer	MO Lead
Type		Eng	Eng	Eng	Eng	Eng	Sci
Skill		Instrument I&T Mgr	Mechanical Integration	Electrical Integration	Instrument Rep (E	Contamination Cc	MO Lead
Name		TBD	Bruce Wolff	Roy Zalemeda	TBD	Carl Maag	W. Vogler
Perf. Org		LaRC	SSAI	SSAI	TBD_1	MTI	SSAI
Directorate		Science	Science	Science	Science	Science	Science
CS grade or Contractor		14	CON	CON	CON	CON	CON
CS step or input salary		5	150	150	150	150	150
Productive Hrs/Yr		1740	1824	1824	1824	1824	1824
BOE additional note							
Probability Distribution		Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range
Dependence Coefficient		x	x	x	x	x	x

Snapshot: Input, variable durations

period num	input duration months	cum months elapsed	end date	Phase	Staff
<P>					
1	3	3	.12/31/07	Delay	
2	1	4	.1/31/08	MT&C	
3	1	5	.2/31/08	MT&C	
4	1	6	.3/31/08	MT&C	
5	1	7	.4/31/08	MT&C	
6	1	8	.5/31/08	MT&C	
7	1	9	.6/31/08	MT&C	
8	1	10	.7/31/08	MT&C	
9	1	11	.8/31/08	MT&C	
10	1	12	.9/31/08	MT&C	
11	1	13	.10/31/08	MT&C	
12	1	14	.11/31/08	SC_I&T	
13	1	15	.12/31/08	SC_I&T	
14	1	16	.1/31/09	SC_I&T	
15	1	17	.2/31/09	SC_I&T	
16	1	18	.3/31/09	SC_I&T	
17	1	19	.4/31/09	SC_I&T	

28	1	30	.3/31/10	SC_I&T
29	1	31	.4/31/10	SC_I&T
30	1	32	.5/31/10	SC_I&T
31	1	33	.6/31/10	MO&DA
32	1	34	.7/31/10	MO&DA
33	1	35	.8/31/10	MO&DA
34	1	36	.9/31/10	MO&DA
35	3	39	.12/31/10	MO&DA
36	3	42	.3/31/11	MO&DA
37	3	45	.6/31/11	MO&DA
38	3	48	.9/31/11	MO&DA
39	3	51	.12/31/11	MO&DA
40	3	54	.3/31/12	MO&DA
41	3	57	.6/31/12	MO&DA
42	3	60	.9/31/12	MO&DA
43	3	63	.12/31/12	MO&DA

Snapshot: Input, resource entry in time

note (delete)		EEE Parts Engineer	EEE Parts Engineer	MA Mgr	MA Tech	MA Tech	MA Tech	SW QA Engr	Title/desc		
(note on dollars)	Type	Eng	Eng	Eng	Eng	Eng	Eng	Eng	Type		
2007 base yr \$	Skill	ower	ower	Risk, QA Eng	Risk, QA Tech	Risk, QA Tech	Risk, QA Tech	Software Eng	Skill		
1000 (\$K) Cost Units	Name	Eng/Design	Eng/Design	-	-	-	-	-	Name/ label		
\$K2007 \$label	Perf. Org	TBD	TBD	LaRC	LaRC	TBD_1	DCAA	TBD_1	Perf. Org		
	Directorate	LaRC	LM	LaRC	LaRC	OSMA	OSMA	OSMA	Directorate		
	CS grade or Contractor	SysEng	SysEng	OSMA	OSMA	OSMA	OSMA	OSMA	unit of issue		
	CS step or input salary	13	CON	13	12	CON	CON	CON	purchase qty		
Oct start month	Productive Hrs/Yr	5	150	5	5	150	0	150	Type\$		
2007 start year	BOE additional note	1740	1824	1740	1740	1824	1824	1824	BOE add'l		
	Probability Distribution	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range	Mid_range			
	Dependence Coefficient	x	x	x	x	x	x	x			
period num	input duration months	cum months elapsed	end date	Phase	Staffing Level	LOE	LOE	LOE	LOE	LOE	LOE
<P>	months	elapsed	date								
1	3	3	.12/31/07	Delay							
2	1	4	.1/31/08	MT&C	0.5	0.5	0.5	0.5	1	0.3	
3	1	5	.2/31/08	MT&C	0.5	0.5	0.5	0.5	1	0.3	
4	1	6	.3/31/08	MT&C	0.5	0.5	0.5	0.5	1	0.3	
5	1	7	.4/31/08	MT&C	0.5	0.5	0.5	0.5	1	0.3	
6	1	8	.5/31/08	MT&C	0.5	0.5	0.5	0.5	1	0.3	
7	1	9	.6/31/08	MT&C	0.5	0.5	0.5	0.5	1	0.3	
8	1	10	.7/31/08	MT&C	0.25		0.5	0.5	1	0.3	
9	1	11	.8/31/08	MT&C	0.25		0.5	0.5	1	0.3	
10	1	12	.9/31/08	MT&C	0.25		0.5	0.5	1	0.3	
11	1	13	.10/31/08	MT&C	0.25		0.5	0.5	1	0.3	
12	1	14	.11/31/08	SC_I&T	0.25		0.5	0.5	1	0.3	
13	1	15	.12/31/08	SC_I&T	0.25		0.5	0.5	1	0.3	
14	1	16	.1/31/09	SC_I&T	0.1		0.1	0.2	0.5		

Snapshot: Input, purchases, direct

note (delete)				Atmos	Title/desc	Title/desc
(note on dollars)				Sci & SW	Type	Subcontracts
2007	base yr \$	Cost Units	Skill	Sci & SW	Skill	Atmos Sci & SV
1000 (\$K)	\$label	\$label	Name	TBD / SS	Name/ label -	Name/ label
\$K2007			Perf. Org	SSAI	Perf. Org	TBD_1
			Directorate	Science	Directorate	None
			CS grade or Contractor	CON	unit of issue	\$1/Unit
			CS step or input salary	120	purch qty	\$K/Unit
Oct	start month		Productive Hrs/Yr	1824	Type\$	BaseYr
2007	start year		BOE additional note		BOE add'l	BOE add'l
			Probability Distribution	Mid_range	Mid_range	
			Dependence Coefficient	x	x	
period num	input duration months	cum months elapsed	end date	Phase	Staffing Level	Units Purcha (fractions of)
<P>	months				LOE	\$K
1	3	3	.12/31/07	Delay		
2	1	4	.1/31/08	MT&C		
3	1	5	.2/31/08	MT&C		
4	1	6	.3/31/08	MT&C		
5	1	7	.4/31/08	MT&C		
6	1	8	.5/31/08	MT&C		
7	1	9	.6/31/08	MT&C		
8	1	10	.7/31/08	MT&C		110
9	1	11	.8/31/08	MT&C		20
10	1	12	.9/31/08	MT&C		5
11	1	13	.10/31/08	MT&C		5
12	1	14	.11/31/08	SC_I&T		5.25
13	1	15	.12/31/08	SC_I&T		5.25
14	1	16	.1/31/09	SC_I&T		5.25
15	1	17	.2/31/09	SC_I&T		5.25
16	1	18	.3/31/09	SC_I&T		5.25
17	1	19	.4/31/09	SC_I&T		5.25
18	1	20	.5/31/09	SC_I&T		5.25

Snapshot: Input, cost per unit

note (delete)		RTD labor		Subcontracts, fab, etc.		Trav, CS		Supplies/Misc	
(note on dollars)	Title/desc	Eng	Title/desc	Subcontracts	Title/desc	Travel_Civil	Supplies/Misc	Title/desc	
2009 base yr \$	Type	TBD_1	Type	NA	Type	Labor	Labor	Type	
1000 (\$K) Cost Units	Skill	-	Skill	-	Unit Label	months	months	From/To	
\$K2008 \$label	Name	LaRC	Name/ label	LaRC	Name/ label	-	-	Name/ label	
	Perf. Org	R&T	Perf. Org	None	Perf. Org	LaRC	LaRC	Perf. Org	
	Directorate		Directorate		Directorate	None	None	Directorate	
	CS grade or Contractor	15	unit of issue		\$1/Unit			Num Trav	
	CS step or input salary	5	purch qty	12	\$K/Unit	1.25	0.5	\$1/Day/Trav	
Oct start month	Productive Hrs/Yr	1740	Type\$	BaseYr	Type\$	BaseYr	BaseYr	BOE add'l	
2008 start year	BOE additional note		BOE add'l		BOE add'l			BOE add'l	
Probability Distribution		Mid_range		Mid_range		Mid_range		Mid_range	
Dependence Coefficient		x	x	x	x	x	x		
period num	input duration months	cum months elapsed	end date	Phase	Staffing Level	Units Purchased (fractions OK)	Units	Units	Number days of travel
<P>	months				LOE	\$K			
1	0	0	.9/31/08	-					
2	1	1	.10/31/08	FY09	4.3	12.5	4.3	4.3	
3	1	2	.11/31/08	FY09	4.3	12.5	4.3	4.3	
4	1	3	.12/31/08	FY09	4.3	12.5	4.3	4.3	
5	1	4	.1/31/09	FY09	4.3	12.5	4.3	4.3	
6	1	5	.2/31/09	FY09	4.3	12.5	4.3	4.3	
7	1	6	.3/31/09	FY09	4.3	12.5	4.3	4.3	
8	1	7	.4/31/09	FY09	4.3	12.5	4.3	4.3	
9	1	8	.5/31/09	FY09	4.3	12.5	4.3	4.3	
10	1	9	.6/31/09	FY09	4.3	12.5	4.3	4.3	
11	1	10	.7/31/09	FY09	4.3	12.5	4.3	4.3	
12	1	11	.8/31/09	FY09	4.3	12.5	4.3	4.3	
13	1	12	.9/31/09	FY09	4.3	12.5	4.3	4.3	
14	1	13	.10/31/09	FY10	4.3	12.5	4.3	4.3	
15	1	14	.11/31/09	FY10	4.3	12.5	4.3	4.3	
16	1	15	.12/31/09	FY10	4.3	12.5	4.3	4.3	
17	1	16	.1/31/10	FY10	4.3	12.5	4.3	4.3	
18	1	17	.2/31/10	FY10	4.3	12.5	4.3	4.3	
19	1	18	.3/31/10	FY10	4.3	12.5	4.3	4.3	

Snapshot: Input, cost per unit, horizontal format

Purchases, input Units							Desc/Task	Type	Unit Label	Name/ Label	Perf. Org	Directorate	note \$/Unit	\$/Unit	Type	\$ Basis of estimate
1	2	3	4	5	6	7										
<P1>	98	1					Reserve on LaRC Reserve	monthly larc costs	-	TBD_1	None	0	0.15	RealYr		15% of LaRC costs; import fro
<P1>	98	2					Reserve on instru Reserve		-	TBD_1	None	0	0.3	RealYr		30% of instrument costs; impo

period num>	1	2	3	4	5	6	7	8	9	10	11	12	13
ration in months>	1	1	1	1	1	1	1	1	1	1	1	1	1
months elapsed>	1	2	3	4	5	6	7	8	9	10	11	12	13
<end date>	.10/31/0	.11/31/0	.12/31/0	.1/31/08	.2/31/08	.3/31/08	.4/31/08	.5/31/08	.6/31/08	.7/31/08	.8/31/08	.9/31/08	.10/31/0
Phase	Delay	Delay	Delay	MT&C	MT&C	MT&C	MT&C	MT&C	MT&C	MT&C	MT&C	MT&C	MT&C

Units purchased (fractions OK)

11.47	11.47	11.47	314.09	314.09	315.51	319.97	373.94	329.17	511.55	432.69	424.18	826
-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----

Snapshot: Input, fabrication hours

note (delete)		Title/desc	Title/desc	fab design	Fab EDTU/STA	Fab FU	Title/desc
(note on dollars)		Type	Type (fab)	Eng	Tech	Tech	Type
2009 base yr \$		Skill	Name/ label	-	-	-	Tunnel
1000 (\$K)	Cost Units	Name	Perf. Org	LaRC	LaRC	LaRC	Name/ label
\$K2009	\$label	Perf. Org	Directorate	R&T	SysEng	SysEng	Perf. Org
Nov start month		Directorate	CS grade or Contractor				Directorate
2008 start year		CS step or input salary	Productive Hrs/Yr	fab qty	1740	1650	Frac hvy gas
		BOE additional note	Hrs/Yr			1650	HPAir,lb/day
		Probability Distribution	Mid_range	Mid_range	Mid_range		
		Dependence Coefficient	x	x	x		
period num	input duration months	cum months elapsed	end date	Phase	Direct Staf Labor Hours	Hours	Days of use (fractions of)
<P>	months					Hours	
1	5	5	.3/31/09	Delay			
2	0.1	5.1	.4/3/09	Desn & Fab			
3	0.9	6	.4/31/09	Desn & Fab			
4	1	7	.5/31/09	Desn & Fab			
5	1	8	.6/31/09	Desn & Fab			
6	1	9	.7/31/09	Desn & Fab			
7	1	10	.8/31/09	Desn & Fab		4912.2807	
8	1	11	.9/31/09	Desn & Fab		4912.2807	
9	1	12	.10/31/09	Desn & Fab		4912.2807	
10	1	13	.11/31/09	Desn & Fab		4912.2807	
11	1	14	.12/31/09	Desn & Fab		4912.2807	
12	1	15	.1/31/10	Desn & Fab		4912.2807	
13	1	16	.2/31/10	Desn & Fab		4912.2807	
14	1	17	.3/31/10	Desn & Fab		4912.2807	
15	1	18	.4/31/10	Test EDU		4912.2807	
16	1	19	.5/31/10	Test EDU		2456.14035	2333.33333
17	1	20	.6/31/10	Test EDU			4666.66667
18	1	21	.7/31/10	Test EDU			4666.66667
19	1	22	.8/31/10	Test EDU			4666.66667
20	1	23	.9/31/10	Test EDU			4666.66667
21	1	24	.10/31/10	Test EDU			4666.66667
22	1	25	.11/31/10	Test EDU			4666.66667

Snapshot: Input, wind tunnel days

note (delete)		Title/desc	Title/desc
(note on dollars)		Type	Tunnel
2007 base yr \$	Skill	Tunnel	Transonic Dynamics Tunnel
1000 (\$K) Cost Units	Name	Name/ label	-
\$K2007 \$label	Perf. Org	Perf. Org	TBD_1
	Directorate	Directorate	CtrOps
	CS grade or Contractor	Frac hvy gas	
	CS step or input salary	HPAir,lb/day	
Oct start month	Productive Hrs/Yr		
2007 start year	BOE additional note		
	Probability Distribution	Mid_range	
	Dependence Coefficient	x	
period num	input duration months	cum months elapsed	end date
<P>	months		Phase
			Days of use
			Staf (fractions OK)
			Days
1	3.5	3.5	.1/16/08 MT&C
2	1	4.5	.2/16/08 MT&C
3	1	5.5	.3/16/08 MT&C
4	1	6.5	.4/16/08 MT&C
5	1	7.5	.5/16/08 MT&C
6	1	8.5	.6/16/08 MT&C
7	1	9.5	.7/16/08 MT&C

BOE Documentation:

- Narrative type documentation in WBS dictionary format – space is flexible
 - Description of work, product
 - Basis of estimate – explanation of quantities

- May be entered in two ways
 - As stand-alone document (sheet) contained in BOE tool file
 - At subsystem level in local input/output elements
 - With additional space per element
 - Or may be displayed in both ways, using links

- Spreadsheet environment also allows more flexible documentation and derivation
 - Front end (pre-calc) of input quantities
 - More free-form documentation
 - Input from more complex functions and models

Snapshot: WBS doc in dictionary format

WBS	Title	Description	Basis of Estimate Rationale
1.0	Project Management		
1.1	Project Management	Planning, organizing, directing, coordinating, controlling, and approval processes used to accomplish overall Project objectives	<ul style="list-style-type: none"> * Staff positions to the project. Level of effort base on experience from previous projects including CERES, SAGE, SABER, and scaled to the reduced scope of the CERES FM5 effort. * Project management responsibilities are reduced after instrument delivery for integration with the spacecraft, and early operations. * Project management is transferred to the existing CERES project in SD for the operational portion of the mission. * Purchased ODIN Computer & Communications Services <ul style="list-style-type: none"> - Trio service for 5 key project personnel @ \$150/mo each - Workstations are estimated at 1.5K/yr for each FTE, calculations are preformed on a separate sheet, and captured on the summary sheets - WebEx (large user) @ \$138/mo * Charges associated with reviewers for formal reviews (1.1.2) are incorporated in the "Engineering Consultation" WBS 2.3, and travel in WBS 1.4 * NPP Project Review staffing (WBS 1.1.3) is covered within existing WBS 1, 2, 4, 7 staffing levels. * Travel CS and contractor (WBS 1.1.4) is estimated based on FTE (\$15K/yr/FTE) and WYE (\$7.5K/WYE) based on current and previous usage on domestic projects with project sites in CA, CO, and DC. Calculations are preformed on a separate sheet
1.1	Civil Service travel		Estimate: \$15K per CS labor year (FTE)
1.1	Misc. Expense		Estimate: 5% of LaRC Costs
1.1.1.1	ODIN		Estimate: 1.5K CS labor year (FTE)
1.1.4.2	Contractor travel		Estimate: \$7.5K per contractor labor year (WYE)
1.2	Planning & Controls	Business and administrative organizing, controlling, and approval processes used to accomplish overall Project objectives	<ul style="list-style-type: none"> * Staff positions to the project. Level of effort base on experience from previous projects including CERES, SAGE, SABER, and scaled to the reduced scope of the CERES FM5 effort. * Resource management responsibilities are reduced after instrument delivery * Project financial control is transferred to the existing CERES project in SD for the operational portion of the mission. * Schedule support (WBS 1.2.2) level is based experience from previous projects scaled by the scope and duration of the FM5 effort. Support is reduced following delivery of the instrument, as the schedule responsibility transfers to the NPP project. * Procurement support (WBS 1.2.3) is provided during the active portion of the contract, with some token support through early mission operations. * Configuration management (WBS 1.2.4) level is based on capturing existing CERES paper documents, and project generated presentations and correspondence during the instrument build, organizing instrument package following instrument delivery, and low level maintenance
1.3	Risk Management	Development, maintenance, tracking, and analysis of project risk database	<ul style="list-style-type: none"> * Staff positions to the project. Level of effort base on experience from previous projects including SABER and GIFTS, and scaled to the reduced scope of the CERES FM5 effort. * LOE reduced following instrument delivery and spacecraft integrations as the number is risks requiring tracking is significantly reduced.

Snapshot: WBS doc in local subsystem i/o

<lv>	WBS# 2.1	Title Systems Engineering Organization TBD_1 Responsible: Person Estimator
Describe	Oversight of SE & TA functions including requirements, ICDs, plans, V&V, CCB, wavers, and etc.	
BOE	* Staff position to the project. Level of effort base on experience from previous projects including CERES, SAGE, SABER, and scaled to the reduced scope of the CERES FM5 effort. * Tasks to be accomplished include, but not limited to: <ul style="list-style-type: none">- Review existing CERES FM-5 requirements and data, and recommend any requirements changes that are necessary.- Review existing CERES gnd cal plan & make recommendation for improvements that are feasible within the NPP delivery requirements.- Support weekly telecons, vendor, and science team interactions- Participate with the IM and CERES technical team (LaRC/NGST) in reviewing spacecraft ICDs to ensure that scientific objectives can be met- Participate with the IM & CERES technical team (LaRC/NGST) in all instrument trades studies, and make recommendations to the PI and PM.- Oversee ground calibration planning and execution- Review any deviations, and in collaboration with the technical team and PI, make recommendations to the PM regarding remedial actions, or exceptions.- Participate with the IM and CERES technical team (LaRC & NGST) in reviewing all spacecraft I&T procedures to ensure they w- Participate with the IM and CERES technical team in review of all flight operations planning (early ops & normal ops) to ensure	

Description, Output

Output:

- High level WBS-list summaries
 - By month, year, phase
 - In popular formats

- Low level output in subsystem i/o sheets
 - Per person, item
 - By month
 - Hours, dollars

- Detailed output in matrix form
 - Designed for use with Excel pivot function
 - To allow users to produce new output combinations
 - To enable ad hoc analysis

Presented at the 2008 SCEA-ISPA Joint Annual Conference and Training Workshop - www.iceaaonline.com

Snapshot: System Totals, Big View

<Totals>	Choose L, M, H	Global decimal places	note	Run date, time: calc start	2/29/2008, 3:34:52 PM
Sum	(Low, Mode, High case)	2 labor hours		calc finish	2/29/2008, 3:35:44 PM
Totals	M	3 dollars			
		1 schedule			
		3 FTE months			

	LABOR HOURS					LABOR (FTE) YEARS			SCHEDULE SUM		REAL YEAR DOLLARS										RY DOLLARS						
	Eng	Tech	PM+	Science	Total	Civil Service	Con-tractor	Total	Start Month	End Month	Civil Serv Labor	Contract Labor	Fab/Assy	Wind Tunnel	Subcon-tracts	Con-sultants	Equip-ment	Supplies /Misc.	Mat-erials	Test Services	Simulator Services	Civil Serv Travel	Re-serves	CM&O	Total		
Sum	46000.5	0	15129.9	250261	311391.4	38.2	134.228	172.428	0	93	5895.35	20054.8	0	0	10783.3	158.363	0	1598.84	0	0	0	623.943	7195.11	1528.22	47837.91		
<start output>																									47837.87		

1.1_ProjMgmt	0	0	8613	0	8613	4.85	0.1	4.95	0	45	667.6	15.526	0	0	0	0	0	38.95	0	0	0	0	0	0	722.075		
1.2_Plan&Control	0	0	5969.71	0	5969.71	1.675	1.675	3.35	0	93	210.791	226.066	0	0	0	0	0	0	0	0	0	0	0	0	0	436.857	
1.3_Risk Mgmt	0	0	547.2	0	547.2	0	0.3	0.3	0	15	0	38.814	0	0	0	0	0	0	0	0	0	0	0	0	0	38.814	
2.1_SysEng	0	0	0	5742	5742	3.3	0	3.3	0	93	600.308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600.308	
2.2_SEng_Spnt	11801.6	0	0	0	11801.62	4.9	1.796	6.696	0	45	639.571	282.516	0	0	0	0	0	0	0	0	0	0	0	0	0	922.087	
2.3_SEngConsult	10005	0	0	0	10005	5.75	0	5.75	0	93	823.059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	823.059	
3.1_SafetySpt	0	0	0	609	609	0.35	0	0.35	0	33	39.836	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39.836	
3.2_MA	7895.1	0	0	0	7895.1	2.458	1.983	4.442	0	93	272.813	309.59	0	0	0	0	0	0	0	0	0	0	0	0	0	582.403	
4.1_SciMgmt	0	0	0	20967	20967	12.05	0	12.05	0	93	2270.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2270.444	
4.2_InstrPerf	0	0	0	10731.2	10731.2	0	5.883	5.883	0	32	0	838.047	0	0	0	0	0	0	0	0	0	0	0	0	0	838.047	
4.3.1_SCFupgr	0	0	0	2042.88	2042.88	0	1.12	1.12	0	93	0	148.397	0	0	390.86	0	0	0	0	0	0	0	0	0	0	0	539.257
4.3.2.1_ConvToNF	0	0	0	15494.9	15494.88	0	8.495	8.495	0	60	0	1116.45	0	0	0	0	0	0	0	0	0	0	0	0	0	1116.45	
4.3.2.2_RDR	0	0	0	1824	1824	0	1	1	0	33	0	127.573	0	0	0	0	0	0	0	0	0	0	0	0	0	127.573	
4.3.2.3_SciCode	0	0	0	75882.9	75882.94	0	41.603	41.603	0	93	0	5684.28	0	0	0	0	0	0	0	0	0	0	0	0	0	5684.278	
4.3.3_SciAlgo	0	0	0	59128	59128	0	32.417	32.417	0	93	0	5014.23	0	0	0	0	0	0	0	0	0	0	0	0	0	5014.233	
4.3.4_SciSEng	0	0	0	4076.64	4076.64	0	2.235	2.235	0	45	0	285.108	0	0	0	0	0	0	0	0	0	0	0	0	0	285.108	
5.0_Payload	0	0	0	0	0	0	0	0	0	69	0	0	0	0	8852.8	0	0	0	0	0	0	0	0	0	0	8852.795	
7.1_MOPlan	0	0	0	4438.4	4438.4	0	2.433	2.433	0	18	0	378.62	0	0	0	0	0	0	0	0	0	0	0	0	0	378.62	
7.2_MOImp	760	0	0	23119.2	23879.2	0	13.092	13.092	0	93	0	2292.18	0	0	0	0	0	0	0	0	0	0	0	0	0	2292.178	
7.3_MOTrain	0	0	0	9332.8	9332.8	0	5.117	5.117	0	32	0	819.51	0	0	0	158.363	0	0	0	0	0	0	0	0	0	977.874	
9.2_Data Proc Fac	0	0	0	16872	16872	0	9.25	9.25	0	93	0	1562.61	0	0	409.683	0	0	0	0	0	0	0	0	0	0	1972.291	
9.3_Inst Sim	2188.8	0	0	0	2188.8	1.2	0	1.2	0	69	141.19	0	0	0	0	0	61.965	0	0	0	0	0	0	0	0	203.155	
10.1_PLdl&Tspt	13350	0	0	0	13350	1.667	5.729	7.396	0	34	229.737	915.272	0	0	0	0	0	0	0	0	0	0	0	0	0	1145.01	
1.1_Trav_CS_new	0	0	0	0	0	0	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0	623.943	0	0	623.943		
1.1.1.1_ODIN_CS	0	0	0	0	0	0	0	0	0	93	0	0	0	0	0	0	62.394	0	0	0	0	0	0	0	0	62.394	
1.1.4.2_Trav_Con_	0	0	0	0	0	0	0	0	0	93	0	0	0	0	1129.92	0	0	0	0	0	0	0	0	0	0	1129.923	
1.1_MiscExpense	0	0	0	0	0	0	0	0	0	93	0	0	0	0	0	0	1435.53	0	0	0	0	0	0	0	0	1435.526	
98.1_LarcReserve	0	0	0	0	0	0	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0	0	4539.26	0	0	4539.264	
98.2_InstrReserve	0	0	0	0	0	0	0	0	0	69	0	0	0	0	0	0	0	0	0	0	0	0	2655.85	0	0	2655.845	
99.1_LarcCM&O	0	0	0	0	0	0	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1148.434	
99.2_InstrCM&O	0	0	0	0	0	0	0	0	0	69	0	0	0	0	0	0	0	0	0	0	0	0	0	1148.43	0	379.786	

Snapshot: System Totals, Closer

<Totals>	Choose L, M, H	Global decimal places	
Sum	(Low, Mode, High case)	2 labor hours	note
Totals	M	3 dollars	
		1 schedule	
		3 labor months, years	

	LABOR HOURS					LABOR (FTE) YEARS			SCHEDULE SUM		REAL YEAR DOLL	
	Eng	Tech	PM+	Science	Total	Civil Service	Con-tractor	Total	Start Month	End Month	Civil Serv Labor	Contract Labor
Sum	52138.7	0	14582.7	244670	311391.4	38.2	134.228	172.428	0	93	5895.35	20054.8
<start output>	-----											
***	-----											
1.1_ProjMgmt	0	0	8613	0	8613	4.85	0.1	4.95	0	45	667.6	15.526
1.2_Plan&Control	0	0	5969.71	0	5969.71	1.675	1.675	3.35	0	93	210.791	226.066
1.3_Risk Mgmt	547.2	0	0	0	547.2	0	0.3	0.3	0	15	0	38.814
2.1_SysEng	5742	0	0	0	5742	3.3	0	3.3	0	93	600.308	0
2.2_SEng_Sppt	11801.6	0	0	0	11801.62	4.9	1.796	6.696	0	45	639.571	282.516
2.3_SEngConsult	10005	0	0	0	10005	5.75	0	5.75	0	93	823.059	0
3.1_SafetySpt	609	0	0	0	609	0.35	0	0.35	0	33	39.836	0
3.2_MA	7895.1	0	0	0	7895.1	2.458	1.983	4.442	0	93	272.813	309.59
4.1_SciMgmt	0	0	0	20967	20967	12.05	0	12.05	0	93	2270.44	0
4.2_InstrPerf	0	0	0	10731.2	10731.2	0	5.883	5.883	0	32	0	838.047
4.3.1_SCFupgr	0	0	0	2042.88	2042.88	0	1.12	1.12	0	93	0	148.397
4.3.2.1_ConvToNF	0	0	0	15494.9	15494.88	0	8.495	8.495	0	60	0	1116.45
4.3.2.2_RDR	0	0	0	1824	1824	0	1	1	0	33	0	127.573

Snapshot: Org-specific Output View

Total Cost

Fiscal Year

2007 2008 2009 2010 2011 2012 2013

Cost Estimate (real-year \$K):

<i>Civil Service Direct Labor</i>	-	1,268.783	1,306.997	1,107.147	705.359	420.067	389.719
<i>Project staff</i>	-	141.791	106.144	50.551	14.604	-	-
<i>Science and Engineering</i>	-	1,126.992	1,200.853	1,056.596	690.755	420.067	389.719
<i>Wind Tunnel</i>	-	-	-	-	-	-	-
<i>Fabrication</i>	-	-	-	-	-	-	-
<i>Test - Aircraft</i>	-	-	-	-	-	-	-
<i>Simulation (SCAP)</i>	-	-	-	-	-	-	-
<i>Procurement</i>	-	8,962.391	5,322.015	4,275.972	4,000.656	3,242.320	2,747.311
<i>Project Contractor Labor</i>	-	1,494.020	3,274.088	3,494.628	3,323.908	2,658.059	2,262.017
<i>Fabrication</i>	-	-	-	-	-	-	-
<i>WindTunnel_Services</i>	-	-	-	-	-	-	-
<i>WindTunnel_VariableCosts</i>	-	-	-	-	-	-	-
<i>Test - Aircraft</i>	-	-	-	-	-	-	-
<i>Simulation (SCAP)</i>	-	-	-	-	-	-	-
<i>S&E_Services (stop FY07)</i>	-	-	-	-	-	-	-
<i>Subcontracts</i>	-	7,233.576	1,578.694	507.555	445.843	415.448	339.539
<i>Consultants</i>	-	-	158.363	-	-	-	-
<i>Equipment</i>	-	-	-	-	-	-	-
<i>Supplies</i>	-	234.795	310.869	273.788	230.906	168.812	145.755
<i>Materials</i>	-	-	-	-	-	-	-
<i>WindTunnel_DirChgPower</i>	-	-	-	-	-	-	-
<i>CS FTE Travel</i>	-	150.559	145.562	116.658	69.871	40.066	36.775
Total Center Costs	-	10,381.732	6,774.575	5,499.777	4,775.886	3,702.453	3,173.805

Snapshot: Fiscal Year Dollar Totals

<\$RYbyFY>

Last calc finish: 3/21/2008, 12:27:35 PM

Sum

to go to worksheet f

Real Year Dollars

select cell on row o

By Fiscal Year

\$K_RY

then click "find shee

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
--	------	------	------	------	------	------	------	------	------	------

Sum	0	13419.51	8201.812	6567.068	5708.091	4433.935	3797.779	3392.749	2316.931	0
-----	---	----------	----------	----------	----------	----------	----------	----------	----------	---

<start output>

	1	2	3	4	5	6	7	8	9	10
***	-----									
1.1_ProjMgmt		306.300	195.158	129.475	91.143					
1.2_Plan&Control		186.770	111.476	44.807	37.820	14.361	14.769	15.172	11.683	
1.3_Risk Mgmt		28.917	9.898							
2.1_SysEng		125.333	108.426	135.068	79.454	38.661	39.976	41.335	32.055	
2.2_SEng_Sppt		418.030	274.192	187.505	42.359					
2.3_SEngConsult		195.814	169.399	87.927	73.020	75.503	78.070	80.725	62.602	
3.1_SafetySpt		16.571	14.336	8.929						
3.2_MA		299.711	164.206	55.875	12.359	12.779	13.214	13.663	10.596	
4.1_SciMgmt		133.592	346.180	418.392	387.085	280.344	248.550	257.000	199.304	
4.2_InstrPerf		249.839	353.942	234.266						
4.3.1_SCFupgr		154.838	121.993	87.850	26.777	37.912	38.990	40.054	30.843	
4.3.2.1_ConvToNPP		123.377	159.419	257.258	366.844	209.552				
4.3.2.2_RDR		15.422	63.345	48.805						
4.3.2.3_SciCode		185.066	562.507	961.790	945.226	925.405	815.248	728.254	560.782	
4.3.3_SciAlgo		104.099	261.775	487.565	1355.582	891.801	797.525	737.357	378.528	
4.3.4_SciSEng		37.424	139.360	105.311	3.012					
5.0_Payload		7012.139	993.607	216.913	223.141	229.772	177.228			
7.1_MOPlan		250.610	128.010							

Snapshot: Monthly Dollar Totals

Sum Dollars, Inflated		Last calc finish: 3/21/2008, 12:27:35 PM														
inflation mults_Reg	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0281	1.0558	1.0558	1.0558
inflation mults_CS	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.034	1.0692	1.0692	1.0692
Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Calendar Year	2007	2007	2007	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008
Cum Months Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Sum	13.626	13.626	13.626	1419.4	1419.4	1421.1	1426.4	1490.5	1437.3	1654	1560.3	1550.2	2055.6	646.13	641.82	
<start output>																
Cum Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
***	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
1.1_ProjMgmt	0	0	0	34.033	34.033	34.033	34.033	34.033	34.033	34.033	34.033	34.033	34.033	33.843	33.843	33.843
1.2_Plan&Control	0	0	0	20.752	20.752	20.752	20.752	20.752	20.752	20.752	20.752	20.752	20.752	21.423	17.024	17.024
1.3_Risk Mgmt	0	0	0	3.213	3.213	3.213	3.213	3.213	3.213	3.213	3.213	3.213	3.213	3.299	3.299	3.299
2.1_SysEng	0	0	0	13.926	13.926	13.926	13.926	13.926	13.926	13.926	13.926	13.926	13.926	14.457	14.457	14.457
2.2_SEng_Sppt	0	0	0	44.261	44.261	44.261	47.944	44.261	46.189	54.475	46.189	46.189	44.468	35.023	35.023	
2.3_SEngConsult	0	0	0	21.757	21.757	21.757	21.757	21.757	21.757	21.757	21.757	21.757	21.757	22.586	22.586	22.586
3.1_SafetySpt	0	0	0	1.841	1.841	1.841	1.841	1.841	1.841	1.841	1.841	1.841	1.841	1.911	1.911	1.911
3.2_MA	0	0	0	36.21	36.21	36.21	36.21	36.21	36.21	27.483	27.483	27.483	28.342	28.342	28.342	
4.1_SciMgmt	0	0	0	10.578	10.578	10.578	10.578	10.578	10.578	23.375	23.375	23.375	24.266	24.266	24.266	
4.2_InstrPerf	0	0	0	27.76	27.76	27.76	27.76	27.76	27.76	27.76	27.76	27.76	29.693	29.693	29.693	
4.3.1_SCFupgr	0	0	0	0	0	0	0	0	0	118.44	25.909	10.487	10.769	11.033	11.033	
4.3.2.1_ConvToNPP	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.281	10.558	10.558	13.83
4.3.2.2_RDR	0	0	0	0	0	0	0	0	0	5.141	5.141	5.141	5.279	5.279	5.279	
4.3.2.3_SciCode	0	0	0	20.563	20.563	20.563	20.563	20.563	20.563	20.563	20.563	20.563	41.597	41.597	41.597	
4.3.3_SciAlgo	0	0	0	11.567	11.567	11.567	11.567	11.567	11.567	11.567	11.567	11.567	19.835	19.835	19.835	
4.3.4_SciSEng	0	0	0	3.393	3.393	3.393	3.393	3.393	3.393	3.393	3.393	10.281	10.558	10.558	10.558	
5.0_Payload	0	0	0	779.13	779.13	779.13	779.13	779.13	779.13	779.13	779.13	779.13	779.13	800.05	17.596	17.596
7.1_MOPlan	0	0	0	12.852	12.852	14.137	14.137	14.137	14.137	20.563	53.978	53.978	53.978	55.427	19.795	13.197

Snapshot: Monthly Hour Totals

<Hrs,LM> Last calc finish: 3/21/2008, 12:27:35 PM
 Sum, Hours or Labor Months, by Month

to go to worksheet for a subsystem:
 select cell on row of subsystem,
 then click "find sheet" button

Hours or Labor months
 1 (1 = hours, 2 = FTE labo

Month Calendar Year	Oct 2007	Nov 2007	Dec 2007	Jan 2008	Feb 2008	Mar 2008	Apr 2008	May 2008	Jun 2008	Jul 2008	Aug 2008	Sep 2008	Oct 2008	Nov 2008	Dec 2008	Jan 2009	Feb 2009	Mar 2009
Cum Months Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Sum	152	152	152	3626.6	3626.6	3641.8	3699.8	3702.6	3801.4	4514.9	4688.4	4790.2	5556.6	5674.7	5645.8	4568.2	4477	4477
<start output> Cum Months ***	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.1_ProjMgmt	0	0	0	449.5	449.5	449.5	449.5	449.5	449.5	449.5	449.5	449.5	391.5	391.5	391.5	116	116	116
1.2_Plan&Control	0	0	0	297	297	297	297	297	297	297	297	297	297	236.2	236.2	141.95	81.15	81.15
1.3_Risk Mgmt	0	0	0	45.6	45.6	45.6	45.6	45.6	45.6	45.6	45.6	45.6	45.6	45.6	45.6			
2.1_SysEng	0	0	0	145	145	145	145	145	145	145	145	145	145	145	145	72.5	72.5	72.5
2.2_SEng_Sppt	0	0	0	580.45	580.45	580.45	638.45	580.45	603.25	733.75	603.25	603.25	559.75	449.25	449.25	227.55	227.55	227.55
2.3_SEngConsult	0	0	0	290	290	290	290	290	290	290	290	290	290	290	290	145	145	145
3.1_SafetySpt	0	0	0	29	29	29	29	29	29	29	29	29	29	29	29	14.5	14.5	14.5
3.2_MA	0	0	0	491.1	491.1	491.1	491.1	491.1	491.1	378.85	378.85	378.85	378.85	378.85	378.85	134	134	134
4.1_SciMgmt	0	0	0	108.75	108.75	108.75	108.75	108.75	108.75	253.75	253.75	253.75	253.75	253.75	253.75	290	290	290
4.2_InstrPerf	0	0	0	364.8	364.8	364.8	364.8	364.8	364.8	364.8	364.8	364.8	380	380	380	380	380	380
4.3.1_SCFupgr	0	0	0	0	0	0	0	0	0	79.04	79.04	79.04	79.04	79.04	79.04	79.04	79.04	79.04
4.3.2.1_ConvToNPP	152	152	152	152	152	152	152	152	152	152	152	152	152	152	199.12	199.12	199.12	199.12
4.3.2.2_RDR	0	0	0	0	0	0	0	0	0	76	76	76	76	76	76	76	76	76
4.3.2.3_SciCode	0	0	0	304	304	304	304	304	304	304	304	304	598.88	598.88	598.88	598.88	598.88	598.88
4.3.3_SciAlgo	0	0	0	152	152	152	152	152	152	152	152	152	253.84	253.84	253.84	253.84	253.84	253.84
4.3.4_SciSEng	0	0	0	50.16	50.16	50.16	50.16	50.16	50.16	50.16	50.16	152	152	152	152	152	152	152
5.0_Payload	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.1_MOPlan	0	0	0	152	152	167.2	167.2	167.2	243.2	638.4	638.4	638.4	638.4	228	152	152	152	152
7.2_MOImp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.3_MOTrain	0	0	0	0	0	0	0	0	0	0	0	0	0	516.8	516.8	516.8	486.4	486.4

Presented at the 2008 SCEA-ISPA Joint Annual Conference and Training Workshop - www.iceaaonline.com

Snapshot: Local sheet output, hours

Run date, time: 3/26/2008, 11:38:48 AM

<output>

<Output By Month>

<Labor hours>

<Calendar Month, Year>		Project	Project	Configuration	Scheduling_la	Risk managen	Safety_labor(s	<chk>	<Total Labor Hours>
Nov	2008	0	0	0	0	0	0	0	0
Dec	2008	0	0	0	0	0	0	0	0
Jan	2009	0	0	0	0	0	0	0	0
Feb	2009	0	0	0	0	0	0	0	0
Mar	2009	0	0	0	0	0	0	0	0
Apr	2009	130.5	130.5	39.2	130.5	39.2	65.3		535
May	2009	145	145	43.5	145	43.5	72.5		594.5
Jun	2009	145	145	43.5	145	43.5	72.5		594.5
Jul	2009	145	145	43.5	145	43.5	72.5		594.5
Aug	2009	145	145	43.5	145	43.5	72.5		594.5
Sep	2009	145	145	43.5	145	43.5	72.5		594.5
Oct	2009	145	145	43.5	145	43.5	72.5		594.5
Nov	2009	145	145	43.5	145	43.5	72.5		594.5
Dec	2009	145	145	43.5	145	43.5	72.5		594.5
Jan	2010	145	145	43.5	145	43.5	72.5		594.5
Feb	2010	145	145	43.5	145	43.5	72.5		594.5
Mar	2010	145	145	43.5	145	43.5	72.5		594.5
Apr	2010	145	145	43.5	145	43.5	72.5		594.5
May	2010	145	145	43.5	145	43.5	72.5		594.5
Jun	2010	145	145	43.5	145	43.5	72.5		594.5
Jul	2010	145	145	43.5	145	43.5	72.5		594.5
Aug	2010	145	145	43.5	145	43.5	72.5		594.5
Sep	2010	145	145	43.5	145	43.5	72.5		594.5
Oct	2010	145	145	43.5	145	43.5	72.5		594.5
Nov	2010	145	145	43.5	145	43.5	72.5		594.5
Dec	2010	145	145	43.5	145	43.5	72.5		594.5
Jan	2011	145	145	43.5	145	43.5	72.5		594.5
Feb	2011	145	145	43.5	145	43.5	72.5		594.5
Mar	2011	145	145	43.5	145	43.5	72.5		594.5
Apr	2011	145	145	43.5	145	43.5	72.5		594.5
May	2011	145	145	43.5	145	43.5	72.5		594.5
Jun	2011	145	145	43.5	145	43.5	72.5		594.5
Jul	2011	145	145	43.5	145	43.5	72.5		594.5
Aug	2011	145	145	43.5	145	43.5	72.5		594.5
Sep	2011	145	145	43.5	145	43.5	72.5		594.5
Oct	2011	145	145	43.5	145	43.5	72.5		594.5
Nov	2011	145	145	43.5	145	43.5	72.5		594.5
Dec	2011	145	145	43.5	145	43.5	72.5		594.5
Jan	2012	145	145	43.5	145	43.5	72.5		594.5
Feb	2012	130.5	130.5	39.2	130.5	39.2	65.3		535
Totals		5046	5046	1513.8	5046	1513.8	2523	20688.6	20688.6
Labor(FTE)years		2.9	2.9	0.87	2.9	0.87	1.45		

<>

Snapshot: Local sheet output, hours, closer

progress note: xxx
Run date, time: 3/26/2008, 11:38:48 AM

<output>

<Output By Month>

<Labor hours>

<Calendar Month, Year>		Project	Project	Configuration	Scheduling_la	Risk managen	Safety_labor(s	<chk>	<Total Labor Hours>
Nov	2008	0	0	0	0	0	0	0	0
Dec	2008	0	0	0	0	0	0	0	0
Jan	2009	0	0	0	0	0	0	0	0
Feb	2009	0	0	0	0	0	0	0	0
Mar	2009	0	0	0	0	0	0	0	0
Apr	2009	130.5	130.5	39.2	130.5	39.2	65.3		535
May	2009	145	145	43.5	145	43.5	72.5		594.5
Jun	2009	145	145	43.5	145	43.5	72.5		594.5
Jul	2009	145	145	43.5	145	43.5	72.5		594.5
Aug	2009	145	145	43.5	145	43.5	72.5		594.5
Sep	2009	145	145	43.5	145	43.5	72.5		594.5
Oct	2009	145	145	43.5	145	43.5	72.5		594.5
Nov	2009	145	145	43.5	145	43.5	72.5		594.5
Dec	2009	145	145	43.5	145	43.5	72.5		594.5
Jan	2010	145	145	43.5	145	43.5	72.5		594.5
Feb	2010	145	145	43.5	145	43.5	72.5		594.5
Mar	2010	145	145	43.5	145	43.5	72.5		594.5
Apr	2010	145	145	43.5	145	43.5	72.5		594.5
May	2010	145	145	43.5	145	43.5	72.5		594.5
Oct	2011	145	145	43.5	145	43.5	72.5		594.5
Nov	2011	145	145	43.5	145	43.5	72.5		594.5
Dec	2011	145	145	43.5	145	43.5	72.5		594.5
Jan	2012	145	145	43.5	145	43.5	72.5		594.5
Feb	2012	130.5	130.5	39.2	130.5	39.2	65.3		535
Totals		5046	5046	1513.8	5046	1513.8	2523	20688.6	20688.6
Labor(FTE)years		2.9	2.9	0.87	2.9	0.87	1.45		

<>

Snapshot: Local sheet output, dollars

<Output By Month>		<Dollars, Real Year>									
<Calendar Month, Year>		Project I	Project I	Project Manag	Project Manag	Project Manag	Project Manag	Configuration	Configuration	Scheduling_la	Scheduling_
Nov	2008	0	0	0	0	0	0	0	0	0	0
Dec	2008	0	0	0	0	0	0	0	0	0	0
Jan	2009	0	0	0	0	0	0	0	0	0	0
Feb	2009	0	0	0	0	0	0	0	0	0	0
Mar	2009	0	0	0	0	0	0	0	0	0	0
Apr	2009	9.595	2.495	0	9.595	2.495	0	2.837	0	9.458	0
May	2009	10.691	2.78	0	10.691	2.78	0	3.16	0	10.532	0
Jun	2009	10.721	2.787	0	10.721	2.787	0	3.167	0	10.556	0
Jul	2009	10.751	2.795	0	10.751	2.795	0	3.174	0	10.579	0
Aug	2009	10.781	2.803	0	10.781	2.803	0	3.181	0	10.602	0
Sep	2009	10.811	2.811	0	10.811	2.811	0	3.188	0	10.626	0
Oct	2009	10.841	2.873	0	10.841	2.873	0	3.195	0	10.649	0
Nov	2009	10.871	2.881	0	10.871	2.881	0	3.202	0	10.673	0
Dec	2009	10.902	2.889	0	10.902	2.889	0	3.209	0	10.696	0
Jan	2010	10.932	2.897	0	10.932	2.897	0	3.216	0	10.72	0
Feb	2010	10.963	2.905	0	10.963	2.905	0	3.223	0	10.745	0
Mar	2010	10.993	2.913	0	10.993	2.913	0	3.231	0	10.769	0
Apr	2010	11.024	2.921	0	11.024	2.921	0	3.238	0	10.793	0
May	2010	11.055	2.929	0	11.055	2.929	0	3.245	0	10.817	0
Sep	2011	11.559	3.121	0	11.559	3.121	0	3.367	0	11.224	0
Oct	2011	11.591	3.13	0	11.591	3.13	0	3.375	0	11.251	0
Nov	2011	11.623	3.138	0	11.623	3.138	0	3.383	0	11.277	0
Dec	2011	11.656	3.147	0	11.656	3.147	0	3.391	0	11.304	0
Jan	2012	11.688	3.156	0	11.688	3.156	0	3.399	0	11.331	0
Feb	2012	10.549	2.848	0	10.549	2.848	0	3.067	0	10.223	0
Totals		389.17	103.78	0	389.166	103.781	0	114.022	0	380.074	0
<output end>											

Custom Output in near real-time

- Custom output can be quickly produced from matrix output with “pivot tables”
 - MS Excel capability
 - Using any fields in data base

Snapshot: Output By Year By Phase

Phase	Data	FY									Grand Total
		2008	2009	2010	2011	2012	2013	2014	2015		
Delay	Sum of Civil_Service_Labor_Total_\$\$K	0									0
	Sum of Procurement_Total_\$\$K	34.41066									34.41066
	Sum of WindTunnel_DirChgPower_\$\$K	0									0
	Sum of CS_Travel_\$\$K	0									0
	Sum of Reserve_\$\$K	5.1615									5.1615
	Sum of CM&O_\$\$K	1.3059									1.3059
	Sum of Total_\$\$K	40.87806									40.87806
	Sum of CS_DirectFTE(Labor Yrs)	0									0
Sum of On-site_Contractor_WYE(Labor Yrs)	0.24999									0.24999	
MT&C	Sum of Civil_Service_Labor_Total_\$\$K	1268.7821	149.16764								1417.94974
	Sum of Procurement_Total_\$\$K	8927.98043	1459.92031								10387.90074
	Sum of WindTunnel_DirChgPower_\$\$K	0	0								0
	Sum of CS_Travel_\$\$K	150.55867	16.95808								167.51675
	Sum of Reserve_\$\$K	2603.9197	363.91501								2967.83471
	Sum of CM&O_\$\$K	427.39094	65.66879								493.05973
	Sum of Total_\$\$K	13378.63184	2055.62983								15434.26167
	Sum of CS_DirectFTE(Labor Yrs)	9.76266	1.07085								10.83351
Sum of On-site_Contractor_WYE(Labor Yrs)	10.46669	2.02331								12.49	
SC_I&T	Sum of Civil_Service_Labor_Total_\$\$K		1157.83099	777.61717							1935.44816
	Sum of Procurement_Total_\$\$K		3862.08979	3029.02405							6891.11384
	Sum of WindTunnel_DirChgPower_\$\$K		0	0							0
	Sum of CS_Travel_\$\$K		128.60426	82.96906							211.57332
	Sum of Reserve_\$\$K		801.31234	605.133							1406.44534
	Sum of CM&O_\$\$K		196.34486	148.32667							344.67153
	Sum of Total_\$\$K		6146.18224	4643.06995							10789.25219
	Sum of CS_DirectFTE(Labor Yrs)		8.12076	5.09988							13.22064
Sum of On-site_Contractor_WYE(Labor Yrs)		20.70148	17.13994							37.84142	
MO&DA	Sum of Civil_Service_Labor_Total_\$\$K			329.52958	705.35913	420.06705	389.71983	392.7228	304.55658		2541.95497
	Sum of Procurement_Total_\$\$K			1246.94363	4000.65771	3242.31537	2747.31081	2426.83281	1617.7632		15281.82353
	Sum of WindTunnel_DirChgPower_\$\$K			0	0	0	0	0	0		0
	Sum of CS_Travel_\$\$K			33.68922	69.87105	40.06638	36.77469	36.41268	28.03905		244.85307
	Sum of Reserve_\$\$K			252.37051	749.8539	589.8384	502.65135	428.3964	292.5549		2815.66546
	Sum of CM&O_\$\$K			61.46373	182.34957	141.64641	121.32243	108.38442	74.01636		689.18292
	Sum of Total_\$\$K			1923.99667	5708.09136	4433.93361	3797.77911	3392.74911	2316.93009		21573.47995
	Sum of CS_DirectFTE(Labor Yrs)			2.07074	4.17489	2.325	2.07501	2.00004	1.50003		14.14571
Sum of On-site_Contractor_WYE(Labor Yrs)			6.99071	22.74741	17.68254	14.45001	13.20003	8.57499		83.64569	
Total Sum of Civil_Service_Labor_Total_\$\$K		1268.7821	1306.99863	1107.14675	705.35913	420.06705	389.71983	392.7228	304.55658		5895.35287
Total Sum of Procurement_Total_\$\$K		8962.39109	5322.0101	4275.96768	4000.65771	3242.31537	2747.31081	2426.83281	1617.7632		32595.24877
Total Sum of WindTunnel_DirChgPower_\$\$K		0	0	0	0	0	0	0	0		0
Total Sum of CS_Travel_\$\$K		150.55867	145.56234	116.65828	69.87105	40.06638	36.77469	36.41268	28.03905		623.94314
Total Sum of Reserve_\$\$K		2609.0812	1165.22735	857.50351	749.8539	589.8384	502.65135	428.3964	292.5549		7195.10701
Total Sum of CM&O_\$\$K		428.69684	262.01365	209.7904	182.34957	141.64641	121.32243	108.38442	74.01636		1528.22008
Total Sum of Total_\$\$K		13419.5099	8201.81207	6567.06662	5708.09136	4433.93361	3797.77911	3392.74911	2316.93009		47837.87187
Total Sum of CS_DirectFTE(Labor Yrs)		9.76266	9.19161	7.17062	4.17489	2.325	2.07501	2.00004	1.50003		38.19986
Total Sum of On-site_Contractor_WYE(Labor Yrs)		10.71668	22.72479	24.13065	22.74741	17.68254	14.45001	13.20003	8.57499		134.2271

Snapshot: Dollars By Performing Org

Sum of Total_\$K	FY								
Performing org.	2008	2009	2010	2011	2012	2013	2014	2015 (blank)	Grand Total
LaRC_CERES	358.76	368.94	331.10	264.69	230.20	238.03	246.12	190.86	2228.70
NGST	7012.14	993.61	216.91	223.14	229.77	177.23			8852.80
SSAI	1006.29	2438.06	2868.289	3092.40	2471.37	2070.02	1935.33	1263.63	17145.39
Raytheon	57.83	43.55	24.40	4.18					129.97
ATK/Swales	38.56	79.18							117.74
ATK/SD	48.19	15.40							63.59
TBD_1	3929.19	3478.49	2598.04	1942.77	1462.68	1274.61	1182.46	840.16	16708.41
LaRC	857.00	709.52	480.72	172.98	39.92	37.89	28.84	22.28	2349.14
LM-ODIN	8.22	11.25	11.56	7.93					38.95
Futron	28.92	9.90							38.81
MTI	19.28	39.59	27.11						85.98
OSMA	16.57	14.34	8.93						39.84
LM	38.56								38.56
(blank)									
Grand Total	13419.51	8201.81	6567.07	5708.09	4433.93	3797.78	3392.75	2316.93	47837.87

Snapshot: Labor Years By WBS Level 1

WBS_1	Data	FY								Grand Total
		2008	2009	2010	2011	2012	2013	2014	2015 (blank)	
1	Sum of CS_DirectFTE(Labor Yrs)	3.00006	1.76238	1.03734	0.72486	0	0	0	0	6.52464
	Sum of On-site_Contractor_WYE(Labor Yrs)	1.05003	0.44995	0.09996	0.09996	0.09996	0.09996	0.09996	0.07497	2.07475
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	4.05009	2.21233	1.1373	0.82482	0.09996	0.09996	0.09996	0.07497	8.59939
2	Sum of CS_DirectFTE(Labor Yrs)	4.49584	3.30009	2.37919	1.15008	0.70008	0.70008	0.70008	0.52506	13.9505
	Sum of On-site_Contractor_WYE(Labor Yrs)	0.87503	0.57091	0.3	0.04998	0	0	0	0	1.79592
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	5.37087	3.871	2.67919	1.20006	0.70008	0.70008	0.70008	0.52506	15.74642
3	Sum of CS_DirectFTE(Labor Yrs)	1.2126	0.73746	0.38326	0.09996	0.09996	0.09996	0.09996	0.07497	2.80813
	Sum of On-site_Contractor_WYE(Labor Yrs)	1.22499	0.62502	0.13336	0	0	0	0	0	1.98337
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	2.43759	1.36248	0.51662	0.09996	0.09996	0.09996	0.09996	0.07497	4.7915
4	Sum of CS_DirectFTE(Labor Yrs)	0.81249	2.03751	2.37501	2.10003	1.425	1.2	1.2	0.9	12.05004
	Sum of On-site_Contractor_WYE(Labor Yrs)	5.60829	12.05831	15.63079	18.84741	14.08254	10.85001	9.60003	6.075	92.75238
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	6.42078	14.09582	18.0058	20.94744	15.50754	12.05001	10.80003	6.975	104.80242
5	Sum of CS_DirectFTE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of On-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	0	0	0	0	0	0	0	0	0
7	Sum of CS_DirectFTE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of On-site_Contractor_WYE(Labor Yrs)	1.62502	3.79167	3.3	2.74998	2.49996	2.49996	2.49996	1.67496	20.64151
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	1.62502	3.79167	3.3	2.74998	2.49996	2.49996	2.49996	1.67496	20.64151
9	Sum of CS_DirectFTE(Labor Yrs)	0.24167	0.43754	0.24584	0.09996	0.09996	0.07497	0	0	1.19994
	Sum of On-site_Contractor_WYE(Labor Yrs)	0	1.99992	2.49996	1.00008	1.00008	1.00008	1.00008	0.75006	9.25026
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	0.24167	2.43746	2.7458	1.10004	1.10004	1.07505	1.00008	0.75006	10.4502
10	Sum of CS_DirectFTE(Labor Yrs)	0	0.91663	0.74998						1.66661
	Sum of On-site_Contractor_WYE(Labor Yrs)	0.33332	3.22901	2.16658						5.72891
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0						0
	Sum of Total_LaborYears	0.33332	4.14564	2.91656						7.39552
99	Sum of CS_DirectFTE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of On-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	0	0	0	0	0	0	0	0	0
98	Sum of CS_DirectFTE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of On-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Off-site_Contractor_WYE(Labor Yrs)	0	0	0	0	0	0	0	0	0
	Sum of Total_LaborYears	0	0	0	0	0	0	0	0	0
(blank)	Sum of CS_DirectFTE(Labor Yrs)									
	Sum of On-site_Contractor_WYE(Labor Yrs)									
	Sum of Off-site_Contractor_WYE(Labor Yrs)									
	Sum of Total_LaborYears									
Total Sum of CS_DirectFTE(Labor Yrs)		9.76266	9.19161	7.17062	4.17489	2.325	2.07501	2.00004	1.50003	38.19986
Total Sum of On-site_Contractor_WYE(Labor Yrs)		10.71668	22.72479	24.13065	22.74741	17.68254	14.45001	13.20003	8.57499	134.2271
Total Sum of Off-site_Contractor_WYE(Labor Yrs)		0	0	0	0	0	0	0	0	0
Total Sum of Total_LaborYears		20.47934	31.9164	31.30127	26.9223	20.00754	16.52502	15.20007	10.07502	172.42696

Other features

- Quick re-calculation
 - Provides immediate turn-around
 - Aids analysis, etc.

- Import capability
 - Time period flexibility facilitates import from other estimating methods
 - In-house parametric model output is in same format

- Range output
 - Built in Low-Mode-High factor sets on all item-level inputs
 - Output exportable to in-house probability tools for calculation of output probability distributions

Snapshot: parametric model output, mech

<Hrs,FTE> Run date, time: 9/21/2007, 2:52:42 PM

Sum to go to worksheet for a subsystem:
 Hours or Labor months select cell on row of subsystem,
 By Month then click "find sheet" button

Hours or Labor months
 2 (1 = hours, 2 = FTE months)
 x avg hrs/labor month (global)
 (dropped; now in subsys)

	2007												2008						
	Jan			Apr			Jul			Oct			Jan		Apr		Jul		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
manual sum	32.37	39.28	100.5	195.71	133.12	135.31	94.08	69.64	37.92	22.23	21.01	17.94	18.5	17.13	23.13	21.55	24.91	22.31	21.17

<start output>

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

import_larc	10.72	6.66	27.2	42.82	13.04	15.99	7.32	6.82	8.69	5.89	5.7	4.7	5.37	4.73	7.73	6.73	7.23	5.93	6.73
import_larc (2)	10.72	6.66	27.2	42.82	13.04	15.99	7.32	6.82	8.69	5.89	5.7	4.7	5.37	4.73	7.73	6.73	7.23	5.93	6.73
mech2v3,CETA	1.96	16.67	36.08	100.3	95.83	91.62	67.55	44.38	8.19										
brd2t3,JADE	2.24	2.4	2.53	2.28	1.97	1.87	2.22	2.28	2.94	0.38									
chip2o,TKR	4.72	4.72	4.79	4.79	5.72	5.98	5.81	5.49	5.56	6.26	6.26	5.19	4.74	4.73	4.73	6.94	9.4	9.4	6.66
sware2o,sample	0.96	1.12	1.65	1.65	2.47	2.81	2.81	2.8	2.8	2.76	2.3	2.3	1.97	1.89	1.89	0.1			
imp_generic_2r1	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

	0 LHour decimal places										period output progress note:		Finished
	1 \$ decimal places										Run date, time: 9/21/2007		
<period output>													
month	1	2	3	4	5	6	7	8	9	Totals			
<hours>													
System Eng	96	833	938	1043	846	297	219	145	27	4444			
Design Eng	72	610	1280	2167	1744	548	388	238	44	7091			
Structural Anal	55	454	957	1623	1305	407	291	179	33	5304			
Thermal Anal	19	149	313	532	429	136	98	60	11	1748			
Optical Eng	0	0	0	0	0	0	0	0	0	0			
Drafting	16	125	1065	2228	1756	412	303	200	37	6142			
Fab+, HW	0	0	55	5326	6313	10216	7561	4999	923	35393			

Snapshot: range factors on input

In Globals:

List for:		(For later use)						
		Low factor	Modal factor			Variance	Low tail	High tail
<prob>	Probability distributions:	L	M	H	VC	L-tail	H-tail	
	Mid_range	0.85	1	1.15	0	0	0	
	Low_range	0.95	1	1.05	0	0	0	
	High_range	0.75	1	1.25	0	0	0	
	Skew_high	0.95	1	1.25	0	0	0	
	Skew_low	0.75	1	1.05	0	0	0	
	Zero_all_cost	0	0	0	0	0	0	
<end>	Zero_range	1	1	1	0	0	0	

In Local input:

Nov	start month	CS step or input salary	5	150	5	125
2008	start year	Productive Hrs/Yr	1740	1740	1740	1740
		BOE additional note				
		Probability Distribution	Mid_range	Mid_range	Mid_range	Mid_range
		Dependence Coefficient	x	x	x	x
period num	input duration months	cum elapsed date	Phase	Staffing Level	LOE	LOE
<P>	months				LOE	LOE
1	5	5	.3/31/09 Delay			
2	0.1	5.1	.4/3/09 Desn & Fab			
3	0.9	6	.4/31/09 Desn & Fab	2.5	2.5	2.5
4	1	7	.5/31/09 Desn & Fab	2.5	2.5	2.5
5	1	8	.6/31/09 Desn & Fab	2.5	2.5	2.5
6	1	9	.7/31/09 Desn & Fab	2.5	2.5	2.5
7	1	10	.8/31/09 Desn & Fab	2.5	2.5	2.5
8	1	11	.9/31/09 Desn & Fab	2.5	2.5	2.5

Snapshot: Beta Sum input

RANDOM VARIABLE SUMMATION		5000	Input iterations		
WITH BETA DISTRIBUTED VARIABLES		0.05	Probability reporting increment		
			(Default = 0.05)		

<ELEMENTS>	LOW	MODE	HIGH	VAR COEF	LOW TAIL	HIGH TAIL	DEP COEF
<BEGIN>							
Program Mgmt	6.2428	8.3659	10.8432	0.665	0.2	0.2	1
Systems Engineering	10.0426	12.727	15.6661	0.665	0.2	0.2	1
Mission Assur. & Safety	1.9859	2.645	3.4126	0.665	0.2	0.2	1
Science	13.1244	14.58267	16.04093	0.665	0.2	0.2	0.1
Payload	72.45317	88.09993	104.8646	0.665	0.2	0.2	1
Spacecraft	0	0	0	0.665	0.2	0.2	0
Mission Ops	3.691061	4.101179	4.511297	0.665	0.2	0.2	0.5
Launch System	0	0	0	0.665	0.2	0.2	0
Ground System	18.03934	20.04371	22.04808	0.665	0.2	0.2	0.5
System I&T	0	0	0	0.665	0.2	0.2	0
E&PO	1.14103	1.267811	1.394592	0.665	0.2	0.2	0
Phase E	29.75309	35.00363	40.25418	0.665	0.2	0.2	0.5
<END ELEMENTS>							
	156.4734	186.8368	219.0356				

Snapshot: Beta Sum output

element	low	mode	high	var coef	alpha1	alpha2	mean	stdev	skew	kurt	m1	m2	m3	m4
START ELEMENTS AS SIMULATED														
Program M	1.456	8.243	16.759	0.659	3.543	4.191	8.466	2.58	0.127	2.481	8.466	78.333	778.058	8183.563
Systems E	3.904	12.676	22.609	0.662	3.749	4.114	12.824	3.138	0.035	2.452	12.824	174.289	2488.593	37049.01
Mission As	0.499	2.639	5.245	0.663	3.641	4.217	2.698	0.795	0.088	2.472	2.698	7.912	24.804	82.077
Science-si	9.732	14.602	19.433	0.664	3.978	3.954	14.597	1.623	-0.012	2.472	14.597	215.701	3225.382	48778.49
Payload-si	36.483	88.402	144.289	0.67	3.927	4.151	88.894	17.884	0.023	2.562	88.894	8221.826	787849	77912232
Mission Op	2.737	4.107	5.465	0.659	3.913	3.89	4.105	0.46	0.009	2.479	4.105	17.065	71.791	305.528
Ground Sy	13.377	20.049	26.71	0.66	3.911	3.907	20.047	2.245	0.026	2.448	20.047	406.935	8360.296	173757.3
E&PO-sim	0.846	1.263	1.689	0.659	3.863	3.93	1.264	0.142	-0.005	2.481	1.264	1.618	2.097	2.749
Phase E-s	17.54	34.984	52.467	0.668	4.019	4.026	34.989	5.807	0.02	2.507	34.989	1257.927	46376.2	1749713
END ELEMENTS AS SIMULATED														
Number ite	5000													
OUTPUT SUM FROM SIMULATION METHOD:														
Sum	86.576	187.663	294.668	0.757	5.529	5.794	188.185	29.631	0.026	2.586	188.185	36291.53	7160584	1.44E+09
OUTPUT SUM FROM ANALYTIC METHOD:														
Sum	86.576	187.193	294.668	0.76	5.577	5.889	187.791	29.458	0.029	2.586	187.791	36133.15	7112119	1.43E+09
END OUTPUT														

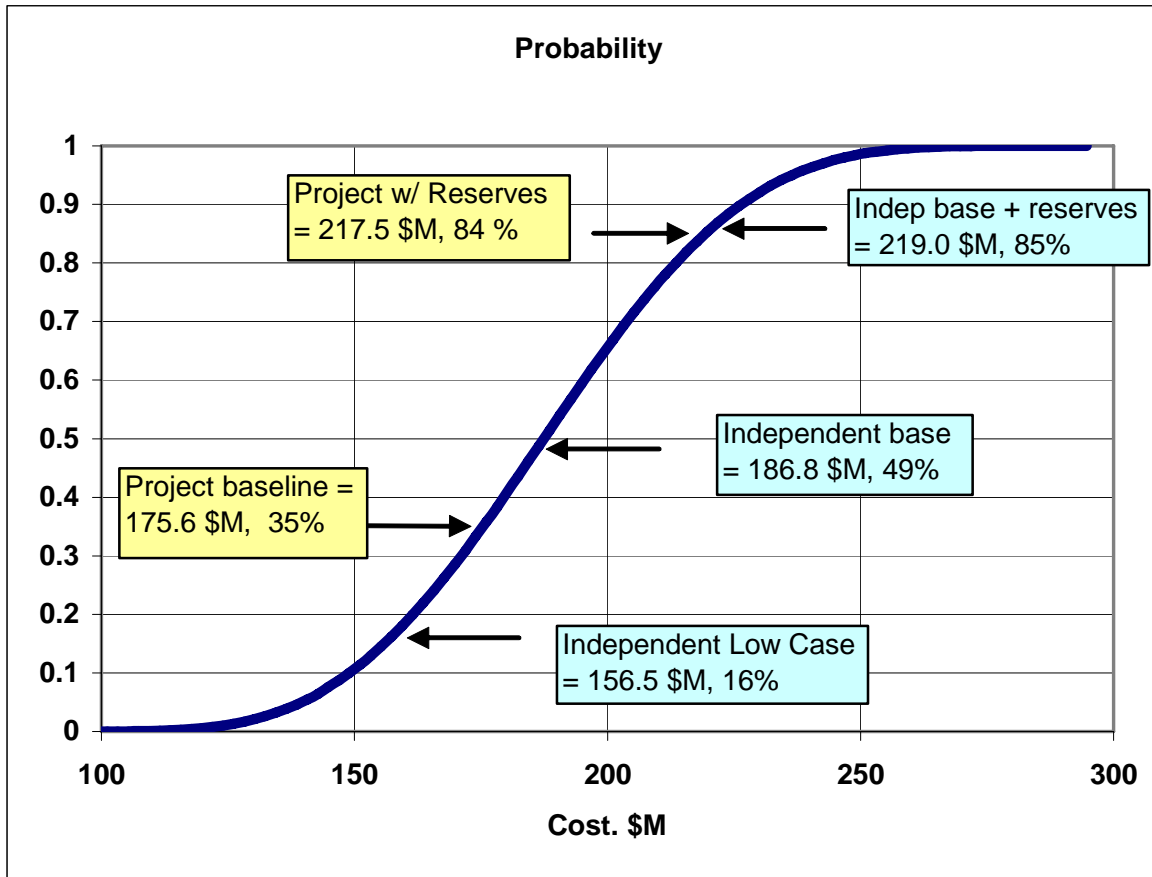
Snapshot: Beta Plot input, output

INPUT		0.05	Probability reporting increment			
LOW	MODE	HIGH	V coef	L Tail	H Tail	
86.576	187.193	294.668	0.76	0	0	
						(plot values
OUTPUT	(below and to right)					and percentiles -->)
low	mode	high	var coef	alpha1	alpha2	range
86.576	187.193	294.668	7.60E-01	5.589234	5.902035	208.092
mean	stdev	skew	kurt			
187.7898	29.42803	2.85E-02	2.587162			
zmode	zmean	zsd	zplow	zphigh		PERT Beta zsd = 1/6
0.483522	0.48639	0.141418	1.73E-08	1		0.166667
iterations in:						0.84851
3 calcpams						
0 checkparams						
0 CalcEndPointsBeta						

Probability	Dist. value		
0.0005	106.884	frac of point val	
0.01	123.695	0.814	
0.05	139.541	0.919	
0.1	149.19	0.982	
0.15	156.098	1.028	
0.2	161.781	1.065	
0.25	166.773	1.098	
0.3	171.331	1.128	
0.35	175.606	1.156	
0.4	179.699	1.183	
0.45	183.684	1.209	
0.5	187.619	1.235	
0.55	191.561	1.261	
0.6	195.563	1.287	
0.65	199.687	1.315	
0.7	204.008	1.343	
0.75	208.631	1.373	
0.8	213.713	1.407	
0.85	219.524	1.445	
0.9	226.625	1.492	
0.95	236.619	1.558	
0.99	253.249	1.667	
0.9995	271.208	1.785	

Snapshot: Beta Plot output, prettier

Estimate of Probability Cumulative Distribution



Probability	Cost
95%	237
90%	227
85%	220
80%	214
75%	209
70%	204
65%	200
60%	196
55%	192
50%	188
45%	184
40%	180
35%	176
30%	171
25%	167
20%	162
15%	156
10%	149
5%	140

Other features

- Store cost data
 - Same format for planning (default monthly time periods) can be used for storing actual resource use as project is implemented
 - Simple capability to store file at any point in time, capturing actual cost to date and plan to complete as of that moment in time

- Export to other tools, programs
 - Output in matrix form is easily exportable to other applications
 - E.g., output in monthly periods to earned value tools
 - Can export either estimated or actual data

Demonstration

- Input
- Calculation
- Output
- Parameter mods, re-calcs
- Interfaces
- Pivot table use

Potential improvements to TOOL

- Improve input/output
 - Enhance, refine formats
 - Improve user friendliness
 - Expand scope of standard input (programmatic, technical, etc.)
 - Import from parametric modeling of project subsystems
 - Add hyper-links to non-spreadsheet project documentation
 - Add custom reports for proposal preparation
 - Facilitate recording of actual data in implementation

- Evolution of application to more data-base-like implementation
 - But will still run in MS Excel environment

- Algorithm development
 - Improvements to pricing calculations
 - To better model actual costs, as opposed to ideal planned costs
 - Expand range inputs to probability distributions (Monte Carlo simulation)
 - To better quantify, understand uncertainty
 - Expand rule-based computational capabilities
 - Schedule dependence capabilities
 - Rules for effects of schedule constraint
 - Etc.

Potential improvements to PROCESS

- Expand user base of BOE Tool
 - Provide training and support to new users

- Add secondary and parametric cost estimates to process
 - At lower WBS levels
 - Independent estimates at sub-assembly level
 - Individual boards, mechanical parts and assemblies, I&T
 - Use as feedback to grass roots process at subsystem level
 - Use to indicate areas needing emphasis in grass roots estimate
 - At higher WBS level
 - For additional feedback to project plan

- Establish archiving/configuration management process
 - To preserve original baseline
 - To record and store realized project definition and cost in implementation

Additional Material (Back-up)

Key Desirable Features (from Jan., 2007)

- **Simple spreadsheet or form interface**
 - Excel or Excel like interface already familiar to teams (i.e no special training or quirks)
- **WBS Driven**
 - Hierarchical, top down (pre-defined structure consistent with NPR-7120.5D)
 - Comprehensive – includes WBS numbers, titles, and descriptions/scope
 - Partitionable – data entered by numerous work package managers can be merged
 - Evolutionary – starts with high level framework and evolves as tasks are added
- **Comprehensive BOE**
 - Sufficient data fields and standard check-box inputs to define BOE
- **Interfaces to Center Cost Estimation Tool**
 - Automated/semi-automated download of labor, procurement, and facilities data to center's existing estimation tool
 - Alternately merge tools
- **Interface to Schedule Tool**
 - Semi-automated or reasonable manual process for synchronizing data in schedule tool with schedule data in BOE tool (duration, start date, end date)
- **Readily usable Outputs**
 - A few standard (moderately configurable) outputs for project team analysis, proposal, and reviews.
 - Simple queries with Excel compatible output for ad hoc analysis, and plotting

BOE Tool and Compliance with NASA 7120.5

- Project definition (CADRe* parts A and B)
 - A significant portion of this information will be included in the BOE tool standard report, but a large part of it (technical definition, in particular) probably will not.
 - However, existing project documentation may be sufficient for this, because:
 - There is some flexibility in the required CADRe formats for this information.
 - And in many cases, contractors are being employed to translate existing project documentation into the desired formats .
- LCCE (Life Cycle Cost Estimate, CADRe part C)
 - BOE tool output should easily satisfy the requirements for reporting the current project point estimate.
 - In addition, the BOE tool content will probably add value, to the extent that the BOE assumptions are thoroughly documented and closely linked to the specific parts of the estimate to which they apply.
- Risk-based LCCE (includes cost probability distribution)
 - The BOE tool currently provides data (low, mode, high input and output) to support the development of a cost probability distribution, with the remainder of the effort being done outside the BOE tool with probability analysis tools.
 - Capability for incorporating the entire task in the BOE tool is currently planned.
- Earned Value Management
 - BOE tool input templates are designed to be used for recording project actual costs to a level that should meet EVM requirements.
 - BOE tool flexibility in defining work packages and milestones should accommodate EVM data needs (e.g., tracking of key areas of interest, or of identified risk areas, etc.)
 - If desired, the capability to calculate EVM products can be added to the BOE tool.
 - i.e., for “informal” EVM analysis or pre-calculation
- * CADRe = Cost Analysis Date Requirement

Snapshot: parametric model output, board

<Hrs,FTE>
Sum
Hours or Labor Months
By Month

Run date, time: 9/21/2007, 2:52:42 PM

to go to worksheet for a subsystem:
select cell on row of subsystem,
then click "find sheet" button

Hours or Labor months
2 (1 = hours, 2 = FTE months)
x avg hrs/labor month (global)
(dropped; now in subsys)

	2007												2008							
	Jan	2	3	Apr	5	6	Jul	8	9	Oct	11	12	Jan	14	15	Apr	17	18	Jul	19
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	19
manual sum	32.37	39.28	100.5	195.71	133.12	135.31	94.08	69.64	37.92	22.23	21.01	17.94	18.5	17.13	23.13	21.55	24.91	22.31	21.17	21.17

<start output>

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	

import_larc	10.72	6.66	27.2	42.82	13.04	15.99	7.32	6.82	8.69	5.89	5.7	4.7	5.37	4.73	7.73	6.73	7.23	5.93	6.73	
import_larc (2)	10.72	6.66	27.2	42.82	13.04	15.99	7.32	6.82	8.69	5.89	5.7	4.7	5.37	4.73	7.73	6.73	7.23	5.93	6.73	
mech2v3,CETA	1.96	16.67	36.08	100.3	95.83	91.62	67.55	44.38	8.19											
brd2t3,JADE	2.24	2.4	2.53	2.28	1.97	1.87	2.22	2.28	2.94	0.38										
chip2o,TKR	4.72	4.72	4.79	4.79	5.72	5.98	5.81	5.49	5.56	6.26	6.26	5.19	4.74	4.73	4.73	6.94	9.4	9.4	6.66	
sware2o,sample	0.96	1.12	1.65	1.65	2.47	2.81	2.81	2.8	2.8	2.76	2.3	2.3	1.97	1.89	1.89	0.1				
imp_generic_2r1	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

	0 LHour decimal places										period output progress note:	Finished
	1 \$ decimal places										Run date, time:	9/21/2007, 2:52:41
<period output>	month	1	2	3	4	5	6	7	8	9	10	Totals
<hours>												
System Eng	156	151	146	103	78	56	52	41	49	6	838	
Design Eng	74	91	105	110	95	81	74	72	91	12	805	
Structural anal	7	11	14	15	11	8	7	16	22	3	114	
Thermal anal	7	11	14	15	11	8	7	16	22	3	114	
Parts Eng	15	18	21	22	24	24	22	18	22	3	189	
Layout	15	15	14	15	16	37	92	19	5	1	229	
Pkging/Bench Tecl	19	18	18	19	20	21	19	67	98	13	310	
Fab+, HW	9	9	9	9	10	10	9	46	68	9	189	
Tool,T/GSE	0	0	0	0	1	6	17	11	12	2	49	
Pgm Mgt	10	11	11	10	9	8	10	12	15	2	97	
Planning, Cntl	10	11	12	10	9	9	10	12	16	2	101	
QA eng	7	7	8	7	6	6	7	8	10	1	67	
Data/Doc	11	12	12	11	10	9	11	13	17	2	107	

Biographies, Contact info

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- Rosemary Baize is based in Hampton, Virginia and works at NASA Langley Research Center as the Bid and Proposal Team Lead. She is responsible for identifying new opportunities and developing competitive solutions consistent with the customer's technical, cost, and schedule constraints. She works with proposal team(s) from mission concept development through final proposal submission.
- Ms. Baize began her career with NASA in 1988 as an aerospace engineer. During her tenure, she has served as a Test Engineer, a wind tunnel Facility Safety Head, Business Manager for the Technology Commercialization Program Office, New Business Lead, Earth and Space Science Program Office, and New Business Lead and Acting Assistant Branch Head, Climate Science Branch. In addition, she spent two years at Kennedy Space Center as a Technology Commercialization Manager.
- Ms. Baize received her undergraduate degree in Aeronautical and Astronautical Engineering from Purdue University. She received an M.S. in Aerospace Engineering from the University of Michigan. Most recently, she obtained an M.B.A. from the College of William & Mary with an emphasis in marketing and finance.
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