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estimate

estimate • analyze • plan • control

Improving Baseline Execution – A Parametric Approach

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SEER by GALORATH

Presenter

- Steve Sultzer
  - Director of Federal Services Consulting for Galorath, Inc.
    - Galorath is the manufacturer of the SEER estimation suite of parametric tools
  - Over 25 years in software development/engineering management
  - Over 15 years in software cost and schedule estimation
  - Directly support the Space and Missile System Center (SMC)

Software American Idol

SEER by GALORATH

- What is the shortest reasonable schedule (Preliminary Design to Program Test) to develop a program with 40,000 lines of new code?

  A. 3 months B. 8 months

  C. 12 months D. 23 months

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  Yes No

- What is the probability of Preliminary Design being completed on 7,000 lines of new code in one month (with high staffing intensity)?

  A. Less then 20% B. 40%

  C. 70% D. 95%

CALL IN WILL BE AVAILABLE TO CAST YOUR VOTE!

Program Reviews

- There are many types of program reviews
  - Software American Idol
  - Integrated Baseline Reviews (IBR)
  - Program Management Reviews
  - Portfolio Reviews
  - Executive Management Reviews
- These reviews often look at project documentation, budget (overall hours and dollars), schedule (IMS), and staffing plans

REVIEWS OFTENTIMES MISS A CRITICAL ISSUE – IS THE BASELINE EXECUTABLE?

What's Missing in Many Reviews?

- **Review of the executability of the program**
  - Are the hours for each task or activity reasonable, and do they follow the current basis of estimate?
  - Is the schedule achievable?
    - Can the tasks be accomplished in the durations provided?
    - Is there sufficient slack in the schedule to account for risk realization?
    - Is the critical path analysis complete and reasonable?
  - Is the Staffing plan viable relative to task hours and schedule?

THESE ITEMS ARE THE MOST IMPORTANT TO THE EXECUTABILITY OF A PROGRAM!!!

How Can Parametric Tools Help?

- Parametric tools allow for basis of estimate information to be used to generate effort hours, schedule durations, and risk ranges for the development activities
- Basis of estimate information, including sizing metrics and programmatic information, are inputs to the model
- Output from the parametric model can be presented to technical or management team members to provide reasonable ranges for effort hours, schedule durations, risk, and staffing

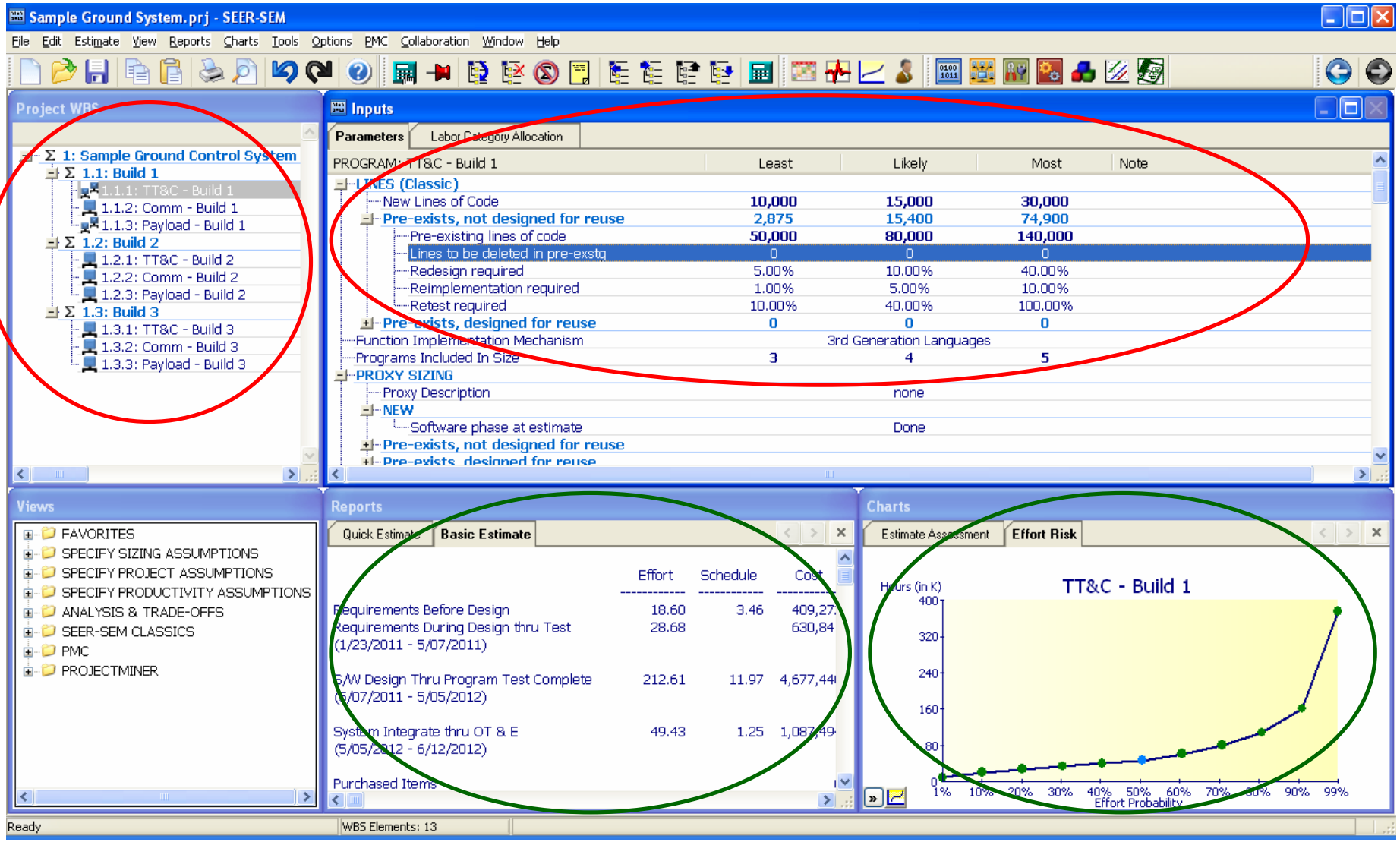
THIS PRESENTATION WILL SHOW HOW THIS CAN BE DONE USING SEER PARAMETRIC MODELS

SEER for Software

- Software estimation, planning, and project monitoring application from Galorath, Inc.
- Uses software sizing and a description of the CSCI's to generate cost, schedule, and risk estimates
- Allows for trade-off analysis between effort and schedule
- We will use SEER for Software for the examples in this presentation.
- This same analysis is practical in other developmental areas (Hardware, IC, etc.)

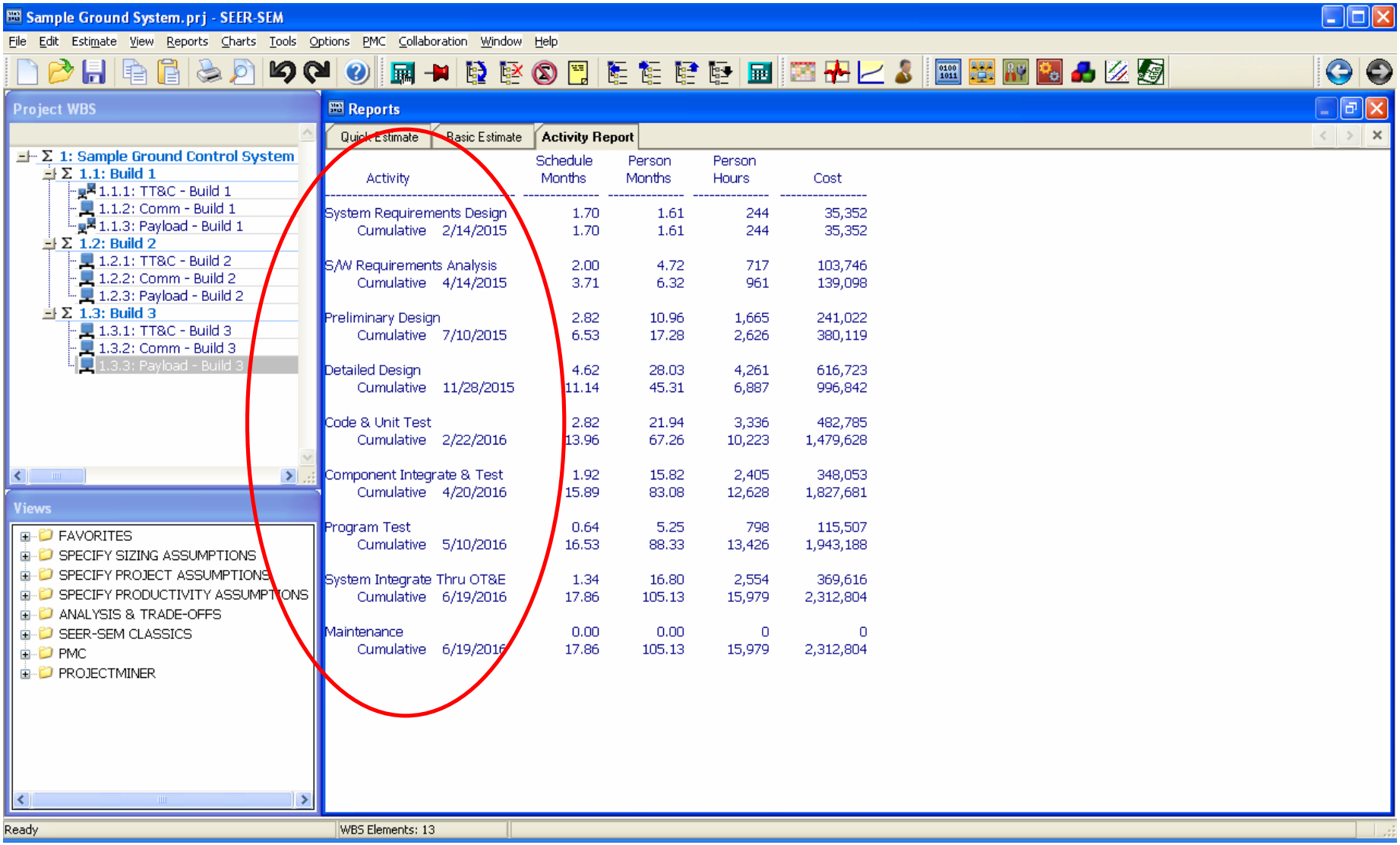
Example Software Program

- We will use a development effort with three builds and three CSCI's as an example

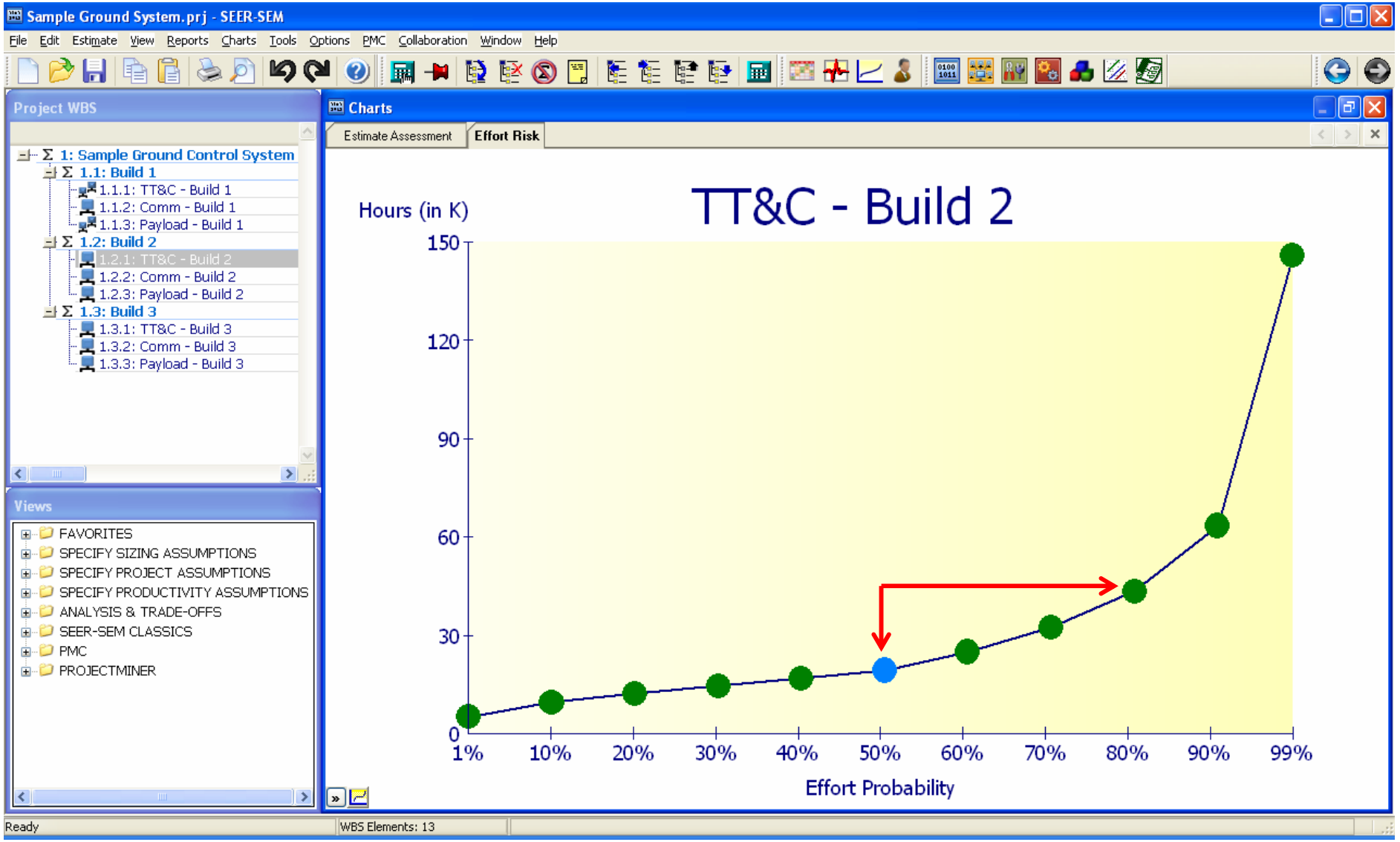


General Output from the Model

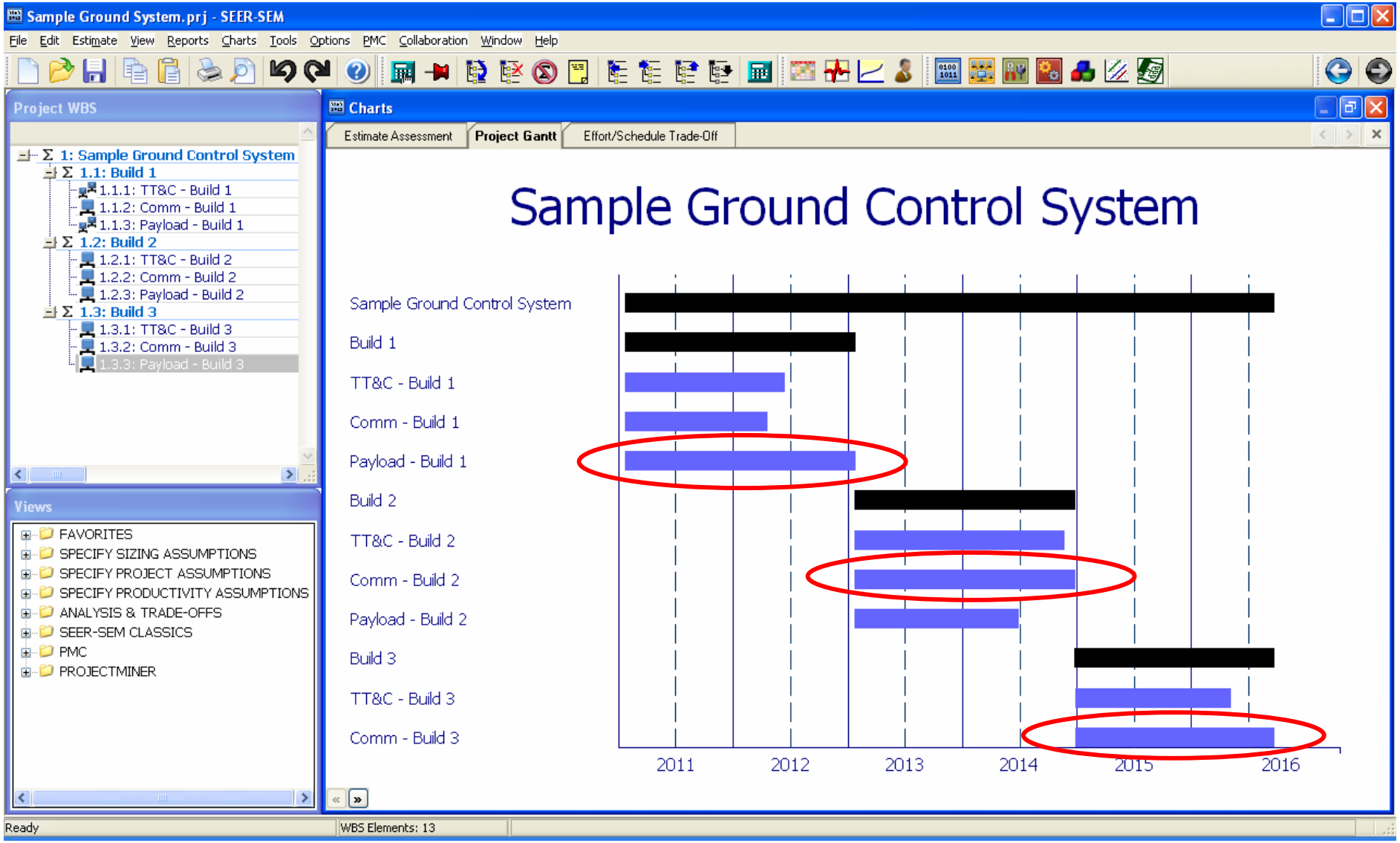
- SEER uses 8 major software development activities



SEER Provides Risk Sensitivity



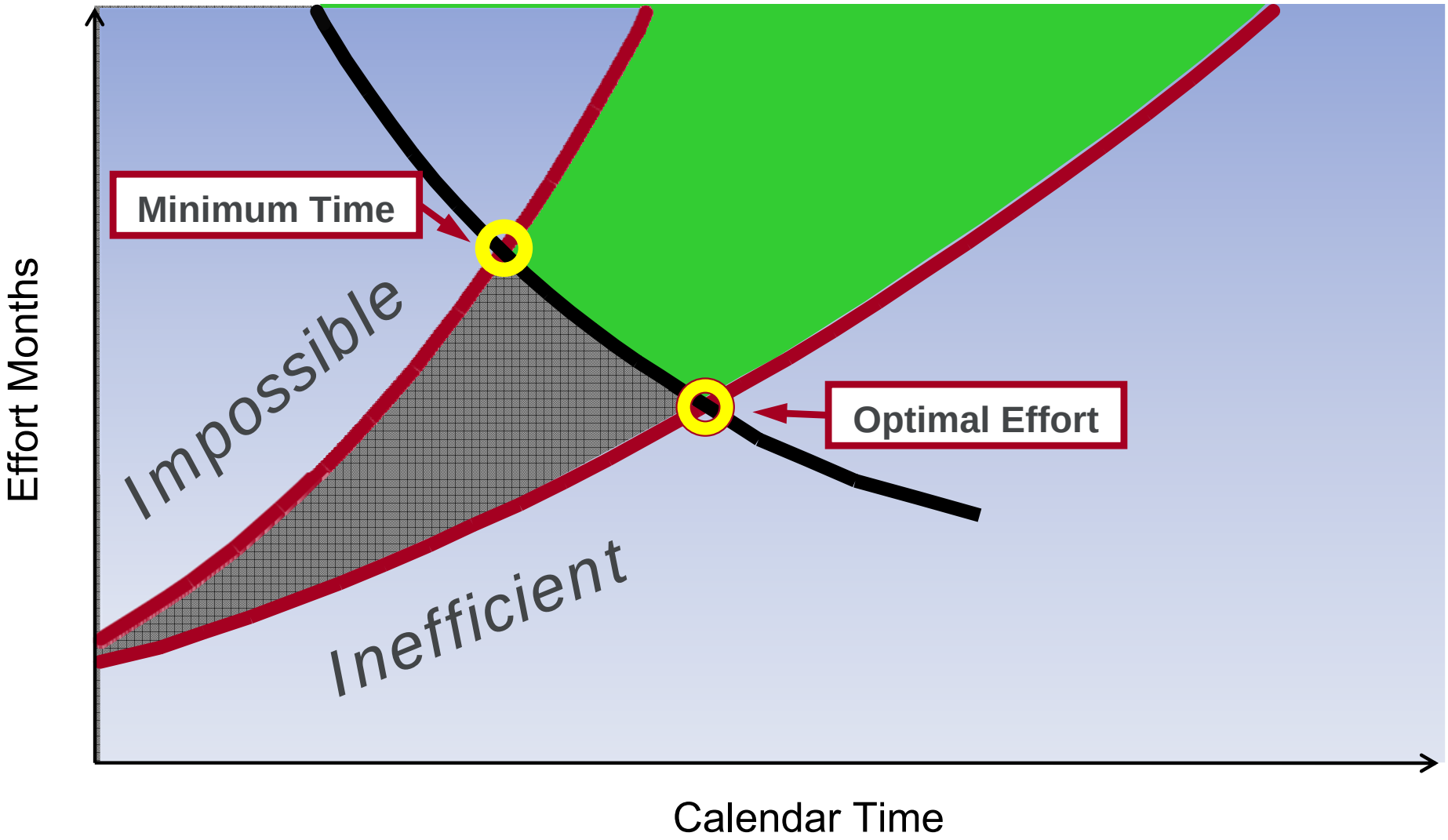
High-Level Critical Path Analysis



Effort and Schedule Trade-offs

- All software projects can be achieved in many different ways, depending on the staffing intensity
- If a software project is schedule sensitive, shorter schedule can be achieved (to a point) through staffing the project more aggressively. However, this will result in higher overall costs
- A more relaxed staffing plan can lower the cost of the project. However, staffing levels can be inefficiently low, which can reduce any savings
- There is a range of reasonable options for effort and schedule trade-offs. In SEER, the end points of this range are called Minimum Time and Optimal Effort

Effort / Schedule Trade-offs



IT IS NOT UNUSUAL FOR CRITICAL PATH ITEMS TO BE DEVELOPED AT MINIMUM TIME AND OTHERS AT OPTIMAL EFFORT

Data Can be Exported From SEER

- Activity effort and schedule information from SEER can be exported for analysis

Min Time

	Pre-Design		Det-Design		Code		Item Test		Program Test	
	Schedule	Effort	Schedule	Effort	Schedule	Effort	Schedule	Effort	Schedule	Effort
Build 1										
TT&C - Build 1	2.53	4,656	4.14	11,822	2.09	7,598	2.41	9,441	0.8	3,158
Comm - Build 1	2.35	778	3.84	1,992	2.35	1,559	1.6	1,124	0.53	373
Payload - Build 1	3.81	8,866	6.23	22,687	3.81	17,760	2.6	12,803	0.87	4,249
Build 2										
TT&C - Build 2	3.48	2,823	5.69	7,223	3.48	5,655	2.37	4,077	0.79	1,353
Comm - Build 2	3.66	2,936	5.98	7,513	3.66	5,881	2.49	4,240	0.83	1,407
Payload - Build 2	2.71	1,473	4.43	3,769	2.71	2,950	1.85	2,127	0.62	706
Build 3										
TT&C - Build 3	2.58	1,155	4.22	2,956	2.58	2,314	1.76	1,669	0.59	554
Comm - Build 3	3.29	2,143	5.39	5,483	3.29	4,293	2.24	3,095	0.75	1,027
Payload - Build 3	2.82	1,665	4.62	4,261	2.82	3,336	1.92	2,405	0.64	798

(Schedule is in months, effort in hours)

SEER Can Export Risk Information

	1%	10%	20%	30%	40%	50%	60%	70%	80%	90%	99%
WBS Element Description	Sample Ground Control System										
Risk Development Schedule Months											
Risk Development Effort Months											
WBS Element Description	Build 1										
Risk Development Schedule Months											
Risk Development Effort Months											
WBS Element Description	TT&C - Build 1										
Risk Development Schedule Months	11.4	14.97	16.55	17.72	18.75	19.75	21.65	23.73	26.25	29.93	39.87
Risk Development Effort Months	43.8	97.83	131.16	160.33	189.33	220.37	289.17	379.32	511.2	753.85	1758.19
WBS Element Description	Comm - Build 1										
Risk Development Schedule Months	12.32	14.49	15.49	16.25	16.92	17.58	18.51	19.55	20.83	22.74	27.99
Risk Development Effort Months	12.52	20.05	24.34	27.96	31.48	35.16	40.9	48	57.84	74.83	137.73
WBS Element Description	Payload - Build 1										
Risk Development Schedule Months	18.21	22.49	24.47	25.97	27.31	28.62	30.56	32.73	35.39	39.33	50.11
Risk Development Effort Months	105.85	196.55	251.48	299.28	346.61	397.17	482.05	589.8	742.54	1013.73	2069.62
WBS Element Description	Build 2										
Risk Development Schedule Months											
Risk Development Effort Months											
WBS Element Description	TT&C - Build 2										
Risk Development Schedule Months	16.67	20.6	22.38	23.73	24.93	26.09	28.49	31.12	34.32	39.02	51.71
Risk Development Effort Months	34.24	63.65	81.17	96.29	111.16	126.96	164.69	213.94	285.75	417.4	959.35
WBS Element Description	Comm - Build 2										
Risk Development Schedule Months	17.19	21.47	23.4	24.84	26.13	27.37	29.24	31.31	33.86	37.63	47.91
Risk Development Effort Months	34.03	65.23	83.88	99.97	115.81	132.64	161.1	197.2	248.32	338.93	690.5
WBS Element Description	Payload - Build 2										
Risk Development Schedule Months	12.41	15.71	17.22	18.36	19.37	20.36	21.76	23.32	25.24	28.08	35.83
Risk Development Effort Months	15.49	30.92	40.43	48.77	57.07	65.98	80.29	98.49	124.3	170.2	349.3

Risk Data Summary

	Schedule Risk		Effort Risk	
	20%	80%	20%	80%
Build 1				
TT&C - Build 1	84%	133%	60%	232%
Comm - Build 1	88%	118%	69%	164%
Payload - Build 1	85%	124%	63%	187%
Build 2				
TT&C - Build 2	86%	132%	64%	225%
Comm - Build 2	85%	124%	63%	187%
Payload - Build 2	85%	124%	61%	188%
Build 3				
TT&C - Build 3	86%	127%	65%	204%
Comm - Build 3	87%	123%	67%	185%
Payload - Build 3	87%	118%	66%	162%

These ranges can be applied to each of the activities

Data Provided to Review Team

- Data exported from SEER can be combined to present valuable information for the team

		Minimum Time							Optimal Effort						
	50%	Effort Hours			Schedule Duration			Peak	Effort Hours			Schedule Duration			Peak
	ESLOC	50%	20%	80%	50%	20%	80%	Staff	50%	20%	80%	50%	20%	80%	Staff
Build 1															
TT&C - Build 1															
Preliminary Design	39,896	4,656	2,771	6,429	2.5	1.5	3.5	12	3,317	1,974	4,580	3.0	1.8	4.1	7
Detail Design		11,822	7,036	16,322	4.1	2.5	5.7	19	8,422	5,013	11,629	4.9	2.9	6.8	11
Code and Unit Test		7,598	4,522	10,490	2.1	1.2	2.9	24	5,413	3,222	7,473	2.5	1.5	3.4	14
Item Test		9,441	5,619	13,035	2.4	1.4	3.3	26	6,726	4,003	9,287	2.9	1.7	3.9	15
Program Test		3,158	1,879	4,360	0.8	0.5	1.1	26	2,250	1,339	3,106	1.0	0.6	1.3	16
Comm - Build 1															
Preliminary Design	7,167	778	539	886	2.4	1.6	2.7	2	557	386	634	2.8	1.9	3.2	1
Detail Design		1,992	1,378	2,267	3.8	2.7	4.4	3	1,425	987	1,623	4.5	3.1	5.2	2
Code and Unit Test		1,559	1,079	1,775	2.4	1.6	2.7	4	1,116	772	1,271	2.8	1.9	3.2	3
Item Test		1,124	778	1,280	1.6	1.1	1.8	5	804	557	916	1.9	1.3	2.2	3
Program Test		373	258	425	0.5	0.4	0.6	5	267	185	304	0.6	0.4	0.7	3
Payload - Build 1															
Preliminary Design	55,000	8,866	5,614	10,496	3.8	2.4	4.5	15	6,291	3,983	7,447	4.5	2.9	5.4	9
~~Detail Design~~		~~22,687~~	~~14,365~~	~~26,856~~	~~6.2~~	~~3.9~~	~~7.4~~	~~24~~	~~16,098~~	~~10,193~~	~~19,056~~	~~7.4~~	~~4.7~~	~~8.7~~	~~14~~
Code and Unit Test		17,760	11,245	21,023	3.8	2.4	4.5	31	12,602	7,979	14,918	4.5	2.9	5.4	18
Item Test		12,803	8,107	15,156	2.6	1.6	3.1	32	9,085	5,752	10,755	3.1	2.0	3.6	19
Program Test		4,249	2,690	5,030	0.9	0.6	1.0	32	3,015	1,909	3,569	1.0	0.7	1.2	19

(Percentages are confidence levels of the estimate)
(Red text represents critical path items)

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Total schedule = 11.9 months

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Conclusions

- Parametric tools can be used to generate effort and schedule ranges which can be compared to the Baseline plan
- Information from a parametric tool can be used by technical folks or management to help determine program executability
- Planning problems identified and addressed early in a program will save substantial effort and/or schedule downstream

Wrap-up

- Questions?
- Please feel free to contact me:
  - Steve Sultzer sdsultzer@galorath.com
- Thank you for your attention!