

estimate

estimate • analyze • plan • control

SCAF Feb 2011

“More Successful Projects Through Parametric Estimation of Total Ownership Costs & Project Schedules”

David Simms

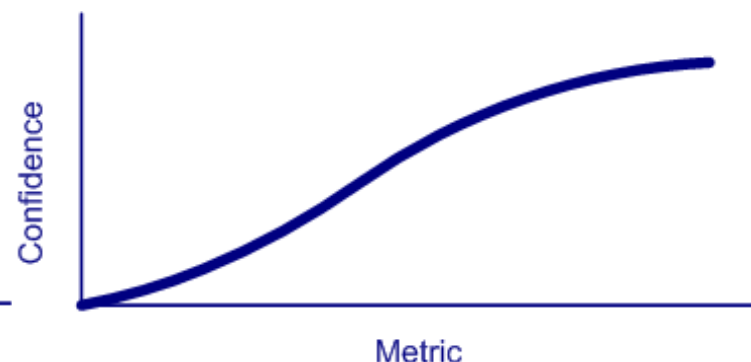
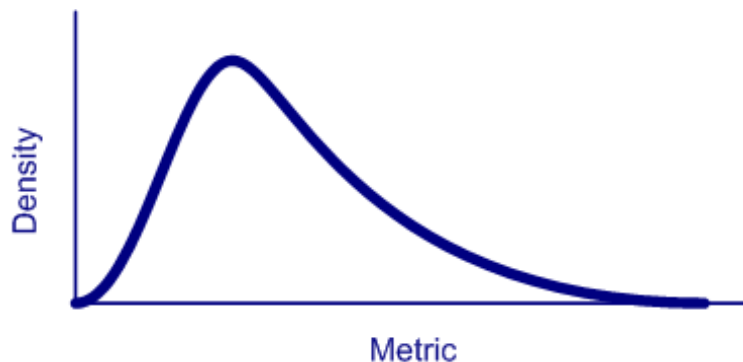
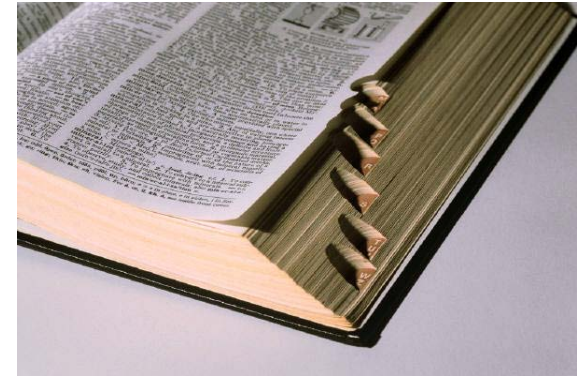
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ESTIMATION & PLANNING:

An Estimate Defined

- An **estimate** is the most knowledgeable statement you can make **at a particular point in time** regarding:
 - Effort / Cost
 - Schedule
 - Staffing
 - Risk
 - Reliability
- Estimates more precise with progress
- ***A WELL FORMED ESTIMATE IS A DISTRIBUTION***





Some of the most important business decisions about a project are made at the time of *minimum knowledge* and *maximum uncertainty*.

Project Health Warning



**Bad Estimates
Can Seriously
Damage Your
Organisation**

**New Estimate
Needed by Friday
New UAV
Qty 500 (Maybe)
Range 1000 miles
That's all I know!**

Estimation Is Critical To Project Success

- Unrealistic expectations based on inaccurate estimates are the single largest cause of software failure." *Futrell, Shafer and Shafer, "Quality Software Project Management"*
- Fundamental Estimating Questions
 - How much effort is required to complete an activity?
 - How much calendar time is needed to complete an activity?
 - What is the total cost of an activity?
- The single most important task of a project: setting realistic expectations

Parametric Estimating Can Help

Delusions of Success: How Optimism Undermines Executives' Decisions

(Source: Richard Hartley, HBR)



Problem: Humans seem hardwired to be optimists

Routinely exaggerate benefits & discount costs

- Optimism: from cognitive biases & organizational pressures
 - Exaggerate talents & degree of control
 - Attribute negative consequences to external factors
- Anchoring: (relying too heavily on one piece of information) magnifies optimism
 - Most pronounced for new initiatives
- Solution: Temper with “outside view”
 - Supplements traditional forecasting w/ statistical analysis of analogous efforts
 - Don’t remove optimism, but balance optimism & realism

“When pessimistic opinions are suppressed, while optimistic ones are rewarded, an organizations ability to think critically is undermined”

Common Challenges In Estimating



- High effort and expenses associated in producing estimates & Proposals
- Significant investment in time is required to generate numbers
- Weak accuracy in numbers, (source data), can lead to cost overruns
- Frequent customer requests for estimate revisions cause even more expenses
- Lack of understanding of cost risk
- Difficulty in calibrating “Engineering Judgment”

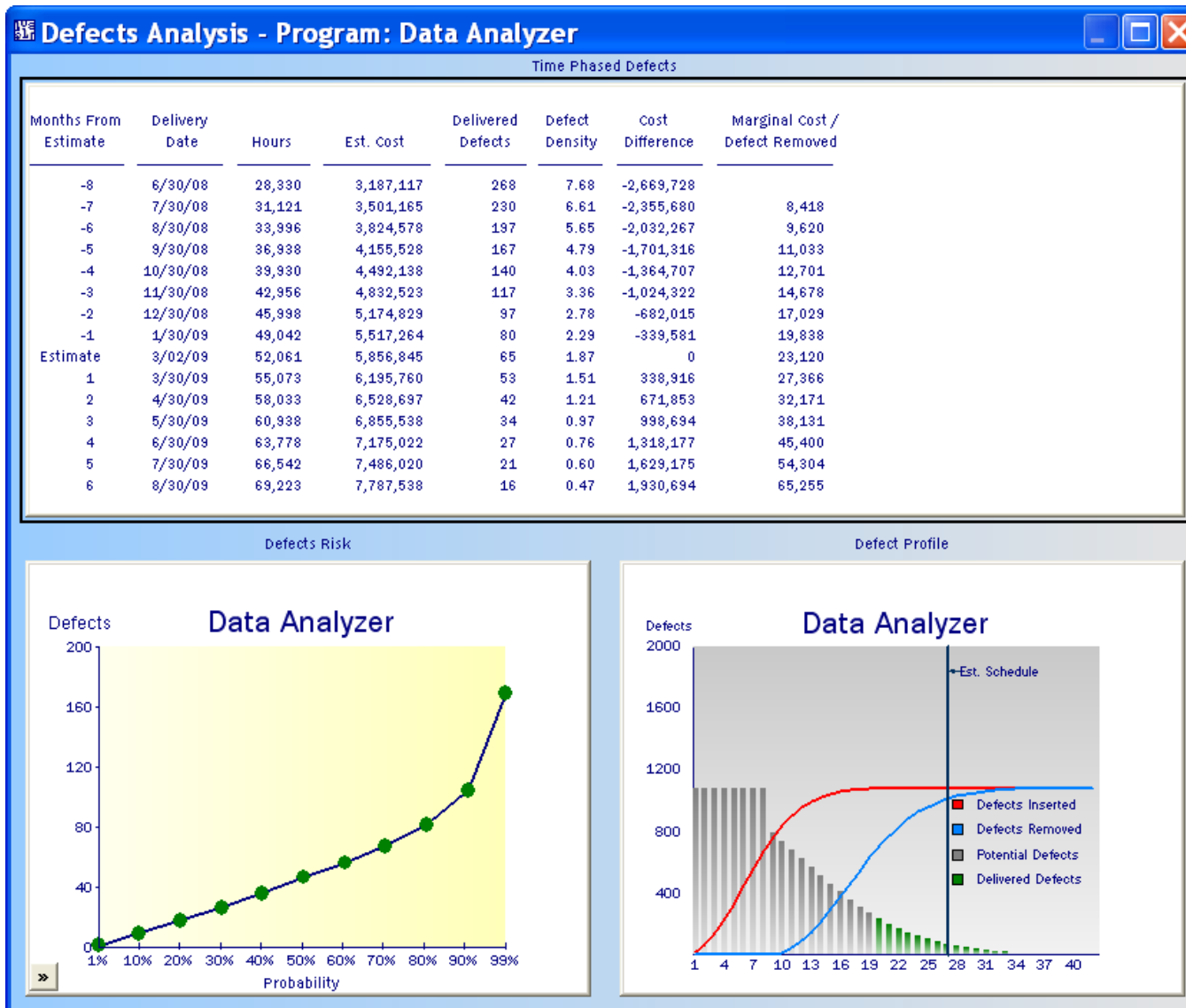
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Scheduling

- Once tasks (from the WBS) and size/effort (from estimation) are known: then schedule with confidence
- Determine primary objectives
 - Best time
 - Least cost
 - Least risk
- Determine secondary objectives
 - Evaluation of schedule alternatives
 - Effective use of resources
 - Communications

Parametric Estimating Can Help

Deploying Before Complete Leads To Program Disasters: You Better Understand Schedule



Poor Estimates Effect on Projects

- Inaccurate estimates can reduce project success:
 - Poor implementations
 - Critical processes don't scale
 - Emergency staffing
 - Cost overruns caused by underestimating project needs
- Scope creep
 - Forever changing project goals
 - Frustration
 - Customer dissatisfaction
 - Cost overruns and missed schedules
 - Project Failures

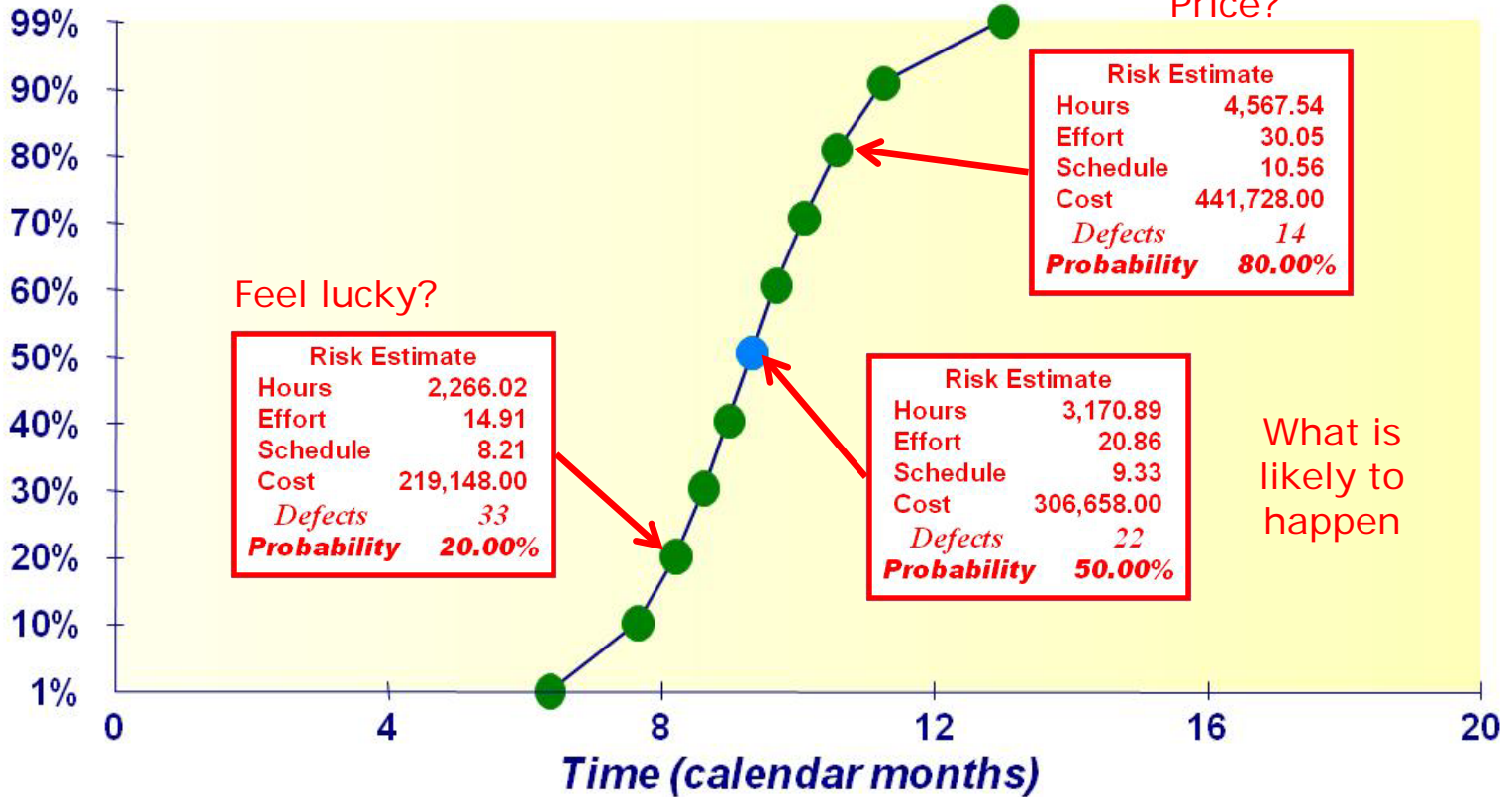
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Estimating Schedule Risk

Schedule Probability

Example Application 1

Probability



Understand the risk before you commit!

Parametric Schedule Estimate Reduces "Death March" Projects

- PERSONNEL CAPABILITIES & EXPERIENCE

Analyst Capabilities

Low

Analyst's Application Experience

Nom

Programmer Capabilities

Low

Programmer's Language Experience

Low

Development System Experience

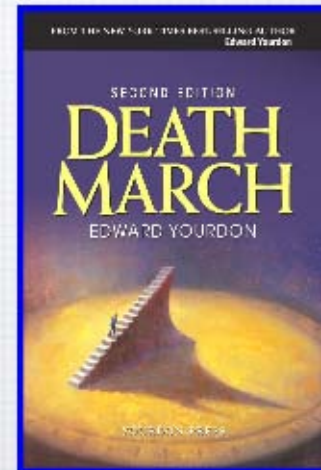
Low

Target System Experience

Low

What is a "death-march" project?

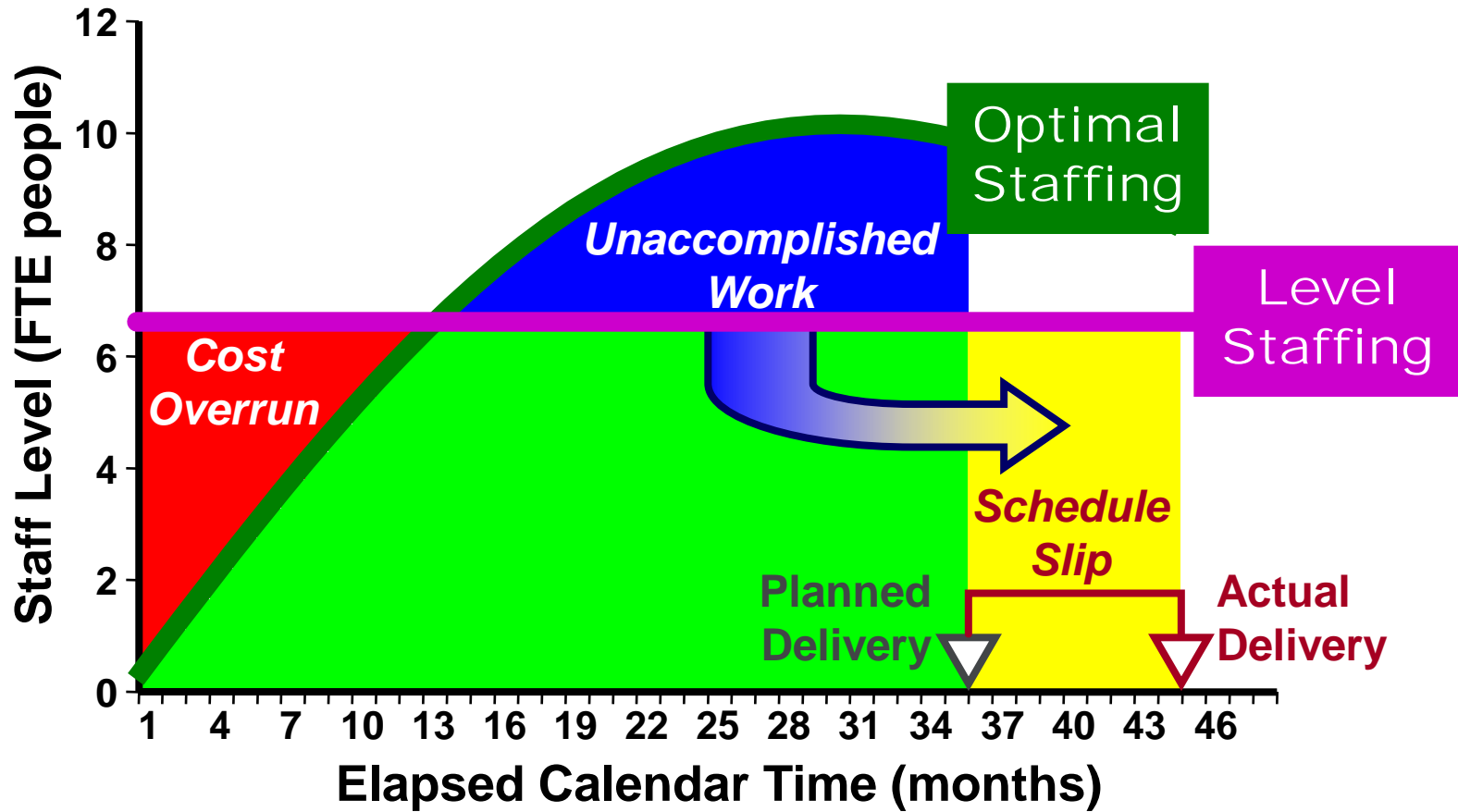
- * **Origin:** "extreme" sports, ultra-marathon, triathlons, etc.
- * **Almost always:** Significant schedule pressure -- project must be finished in *far* less than "nominal" time.
- * **Often:** Staffing shortages -- project must be done with significantly fewer people than in a "normal" project
- * **Sometimes:** budget limitations -- inadequate funding to pay for people, development tools, and other resources.
- * **Inevitably:** greater risks (>50% chance of failure), more pressure, unpleasant politics
- * **Almost always:** heavy overtime (more than just 10-20% extra effort), personal sacrifices, increased burnout, higher turnover, lower productivity, lower quality
- * **Increasingly often:** significant corporate consequences (e.g., bankruptcy), lawsuits, personal legal liabilities



Brooks' Law

- **Brooks's law** is a principle in [software development](#) which says that "adding manpower to a late software project makes it later".
- It takes some time for the people added to a project to become productive, new workers on the project must first become educated about the work that has preceded them.
- Communication overheads increase as the number of people increases. Everyone working on the same task needs to keep in sync, so as more people are added they spend more time trying to find out what everyone else is doing.

Avoid "Death Marches" and Failed Projects



Project Management Challenges Addressed By Schedule & Effort Estimation



- The most important business decisions about a project are made at the time of *minimum knowledge* and *maximum uncertainty*.
- Adding and/or changing means more time and/or more effort
- When a project is in trouble *ask for more time* rather than more people. *Deferring functionality* common approach to asking for more time
- Increasing concurrency is usually not a solution (e.g. designing several releases concurrently)

Parametric Estimating Can Help

Reducing Project Duration Can Be Modeled With Parametrics

- Approaches to shortening Schedule
 - Reducing scope (or quality)
 - Adding resources
 - Concurrency (perform tasks in parallel)
 - Substitution of activities
- Shorten the overall duration of the project
 - Crashing
 - Looks at cost and schedule tradeoffs
 - Gain greatest compression with least cost
 - Add resources to critical path tasks (within limits of Brooks Law)
 - Limit or reduce requirements (scope)
 - Changing the sequence of tasks
 - Fast Tracking
 - Overlapping phases, activities or tasks that would otherwise be sequential
 - Involves some risk, May cause rework

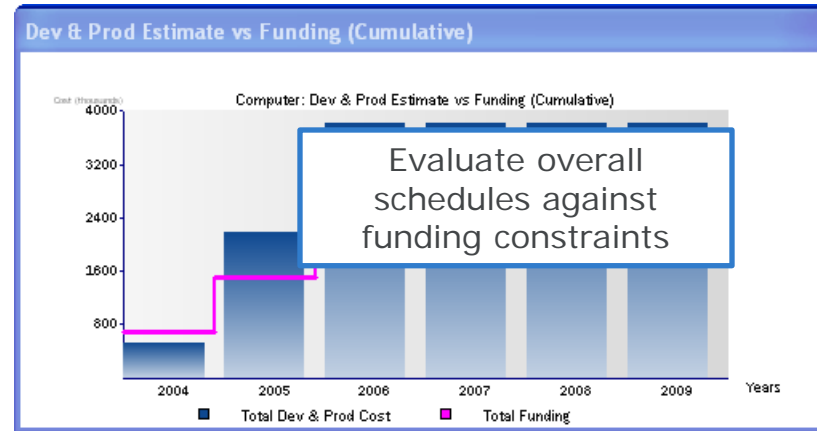
Parametric Estimating Can Help

Schedule Trades using Parametrics

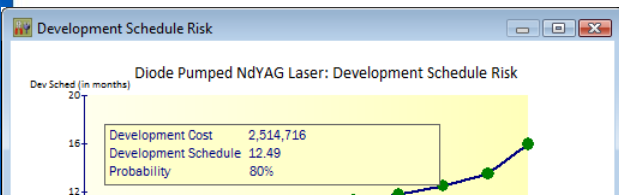
Development Allocation by Month

Months	Staff FTE	Hours	Labor Cost	Material	Total
1: Jan-11	71.7	10,900	1,810,263	81,609	1,891,872
2: Feb-11	115.1	17,496	2,874,884	201,479	3,076,363
3: Mar-11	114.3	17,374	2,832,003	468,550	3,300,553
4: Apr-11	89.9	13,668	2,237,171	538,592	2,775,763
5: May-11	67.8	10,308	1,675,429	430,818	2,106,247
6: Jun-11	48.3	7,343	1,179,467	184,994	1,364,461
7: Jul-11	34.5	5,238	827,517	166,939	994,456
8: Aug-11	23.7	3,597			
9: Sep-11	11.2	1,703			
10: Oct-11	9.2	1,406			
11: Nov-11	8.3	1,268			
12: Dec-11	7.8	1,190			
13: Jan-12	7.7	1,174	177,545	18,998	196,544
14: Feb-12	0.9	129	19,541	2,094	21,635

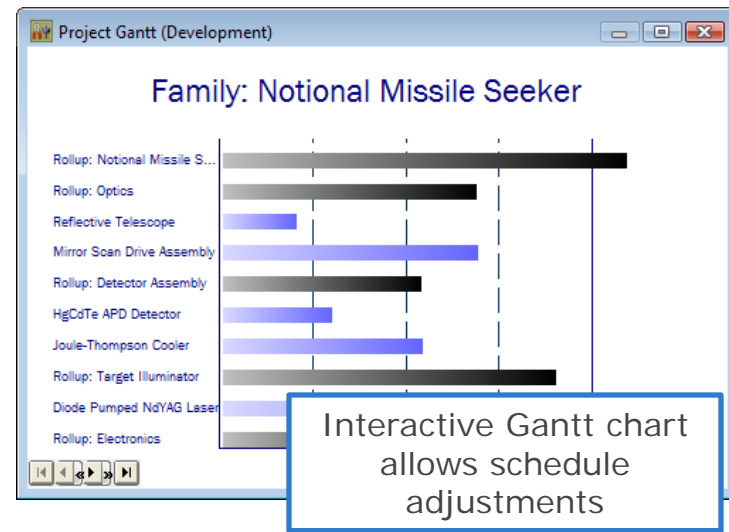
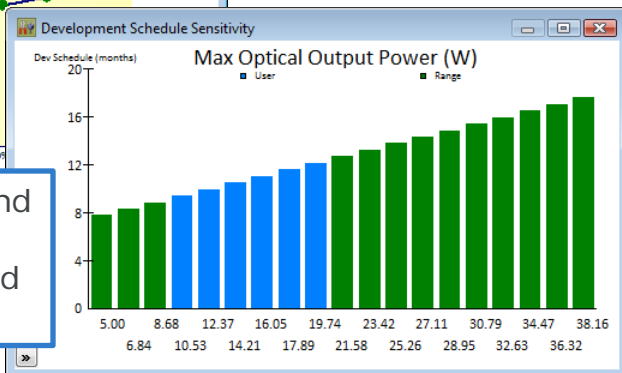
Review resource requirements over time



Parametric estimate development schedules or allows you to enter your own schedule. Penalties will be assessed for compressed or extended schedules



Schedule sensitivity and risk charts show schedule ranges based on specific inputs



Interactive Gantt chart allows schedule adjustments

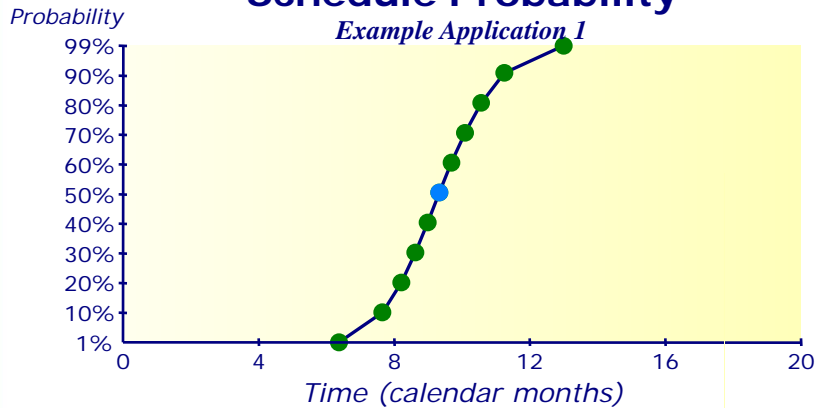
Project Risks Included In Planning Decisions

(Example SEER-SEM Outputs)



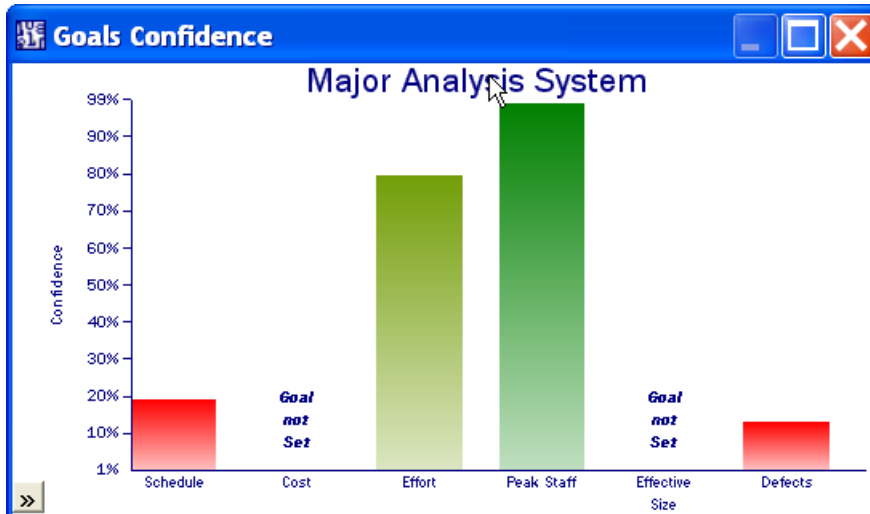
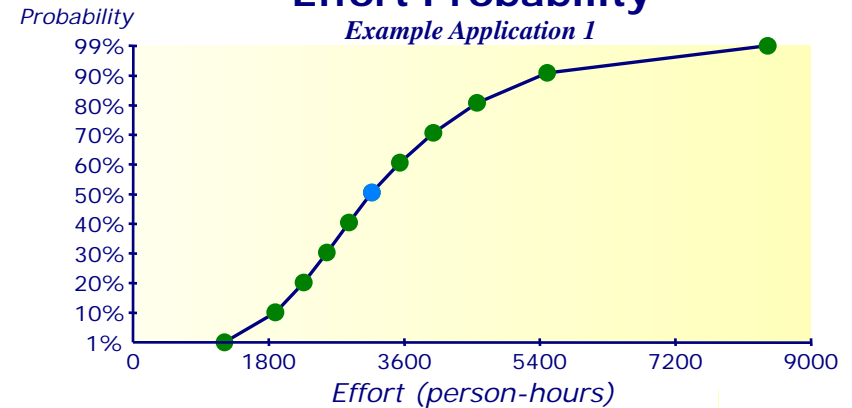
Schedule Probability

Example Application 1



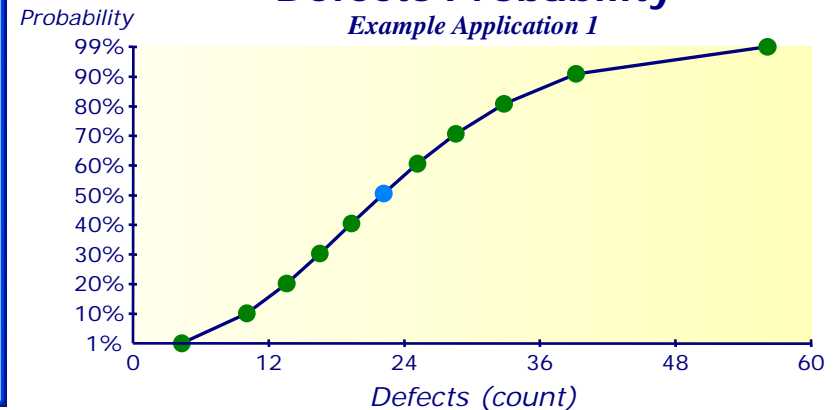
Effort Probability

Example Application 1



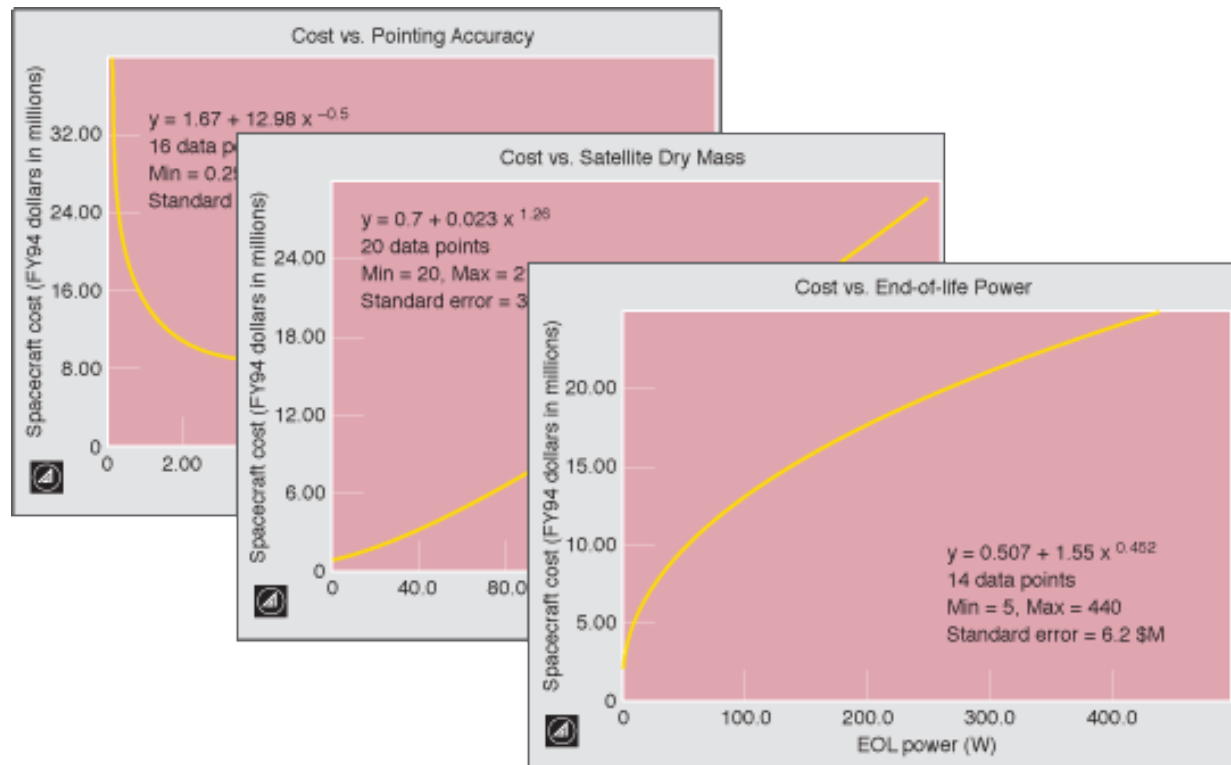
Defects Probability

Example Application 1

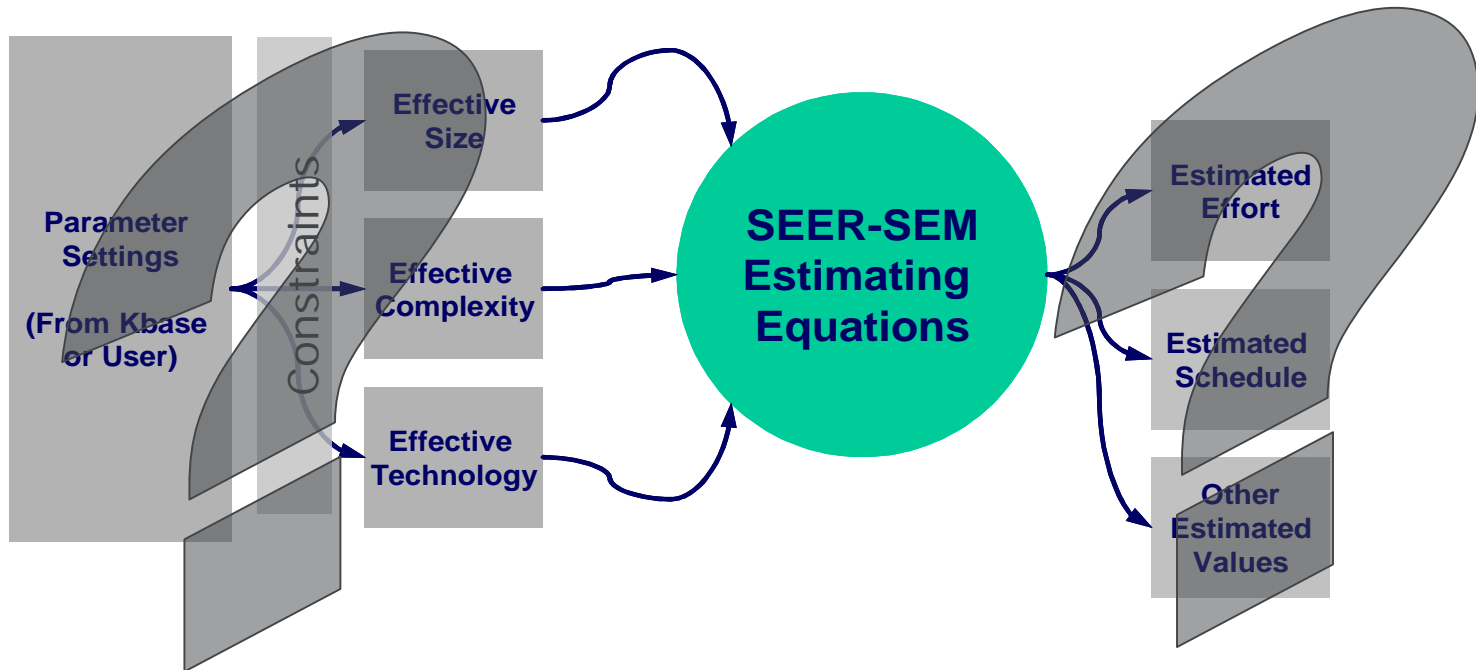


Parametrics Forecast The Future Based On The Past

- Method for estimation of future based on analysis of past events and trends
- “Parameters” that appear to have driven what happened in the past are identified, and connected to past experience through mathematical relationships.



Uncertainty in Estimation - Parametrics can help



“There's no sense being exact about something if you don't even know what you're talking about.”

“What is not surrounded by uncertainty cannot be the truth.”



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