

Quantitative Software Management

Using Metrics – What the Numbers Tell Us: A Focus on Estimating Donald M. Beckett

QSM, Inc.

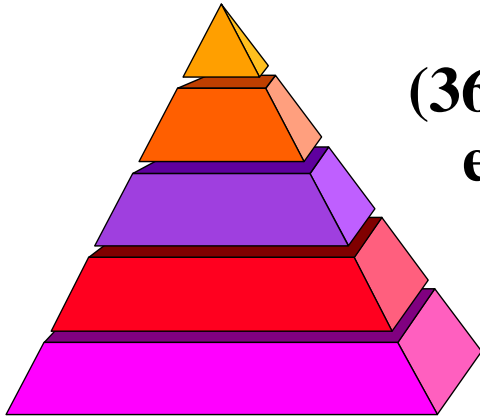
2000 Corporate Ridge, Suite 900

McLean, VA 22102

(360) 697-2640, fax: (703) 749-3795

e-mail: don_beckett@qsm.com

<http://www.qsm.com>



Outline

- **How good of an estimator are you?**
- **The politics of numbers**
- **How accurate are our estimates?**
- **Modeling projects based on actual performance**

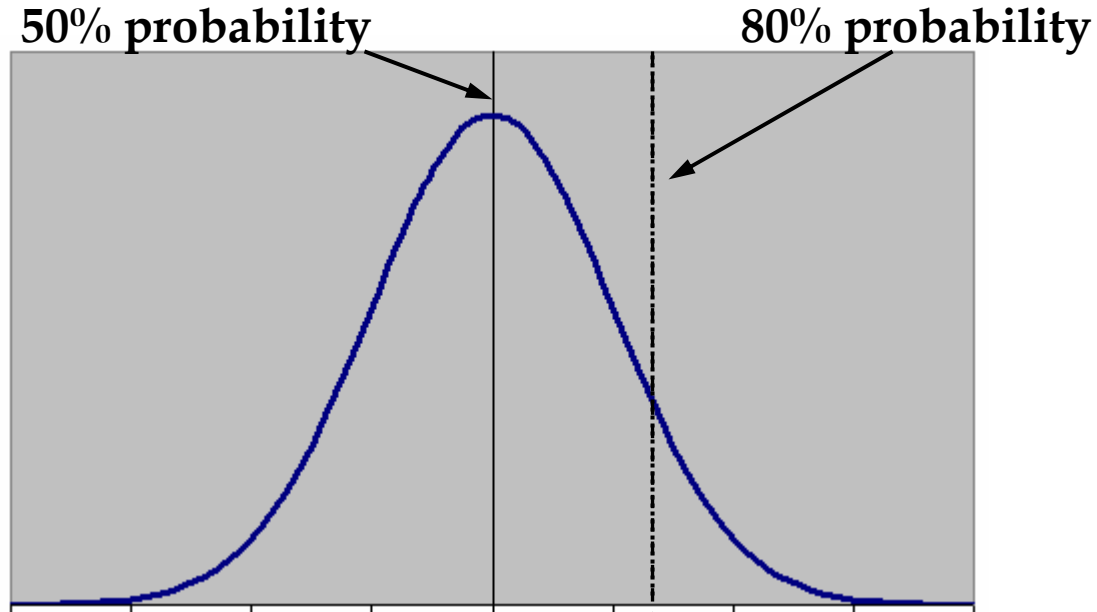
How Good of an Estimator are You?

- **Most of us resist expressing the degree of uncertainty that exists**
- **Estimates frequently understated because**
 - **Bad news isn't welcome**
 - **Information required to estimate accurately is unavailable**
 - **Competitive pressure**
 - **Unfounded productivity assumptions**
 - **No empirical basis for estimating (lack of data)**
 - **Failure to account for project growth**
 - **Easier to ask for forgiveness than permission**

The Politics of Numbers

- **“There are three kinds of liars: liars, damned liars, and statisticians” – Mark Twain**
- **“Figures don’t lie; but often liars figure”**
 - - Anonymous
- **Numbers are not neutral**
 - **How they are presented, the story they tell, and the expectations of those who receive them are all important**
 - **Software measurement practitioners are not neutral observers outside of organizational politics**

The Politics of Numbers



Is an estimate the most likely outcome for cost, schedule, and quality

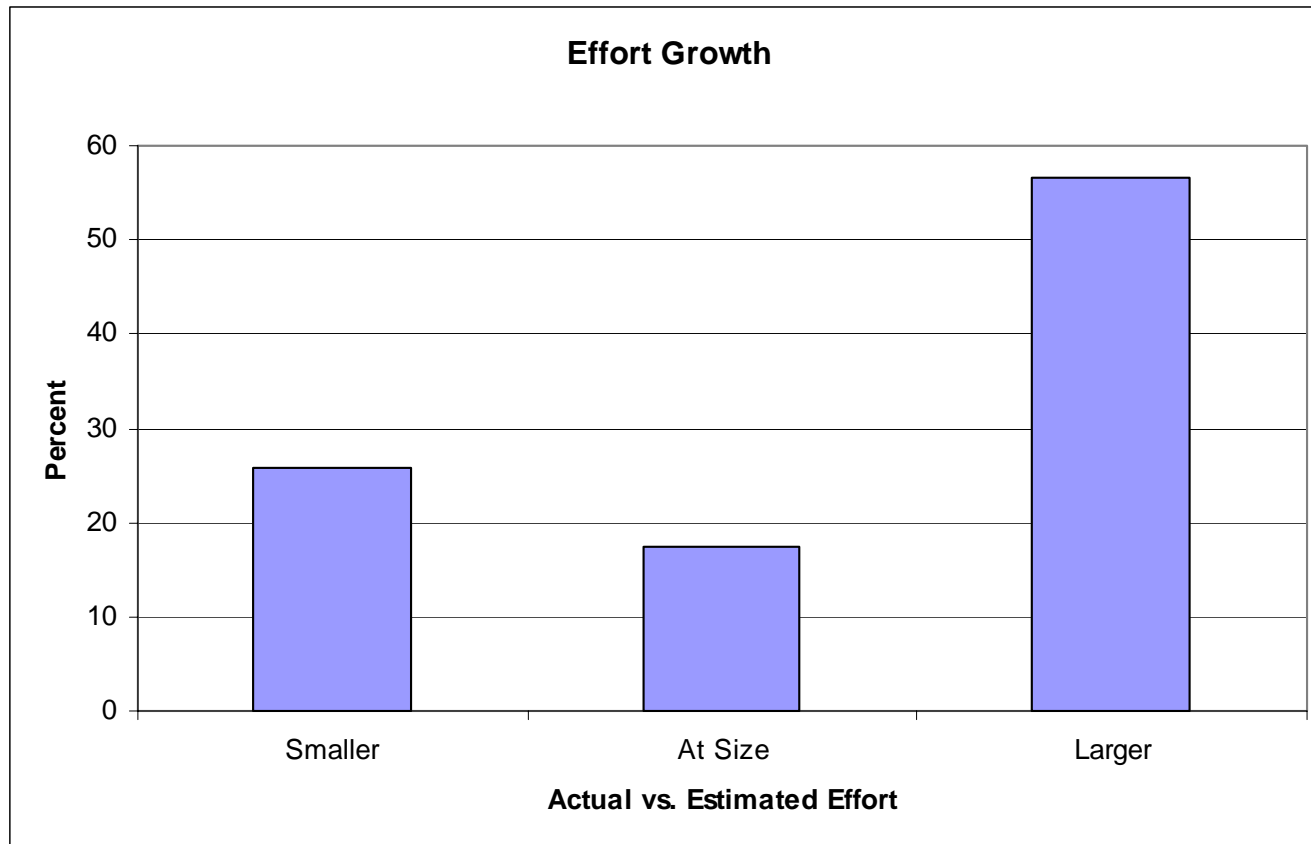
Or

Does an estimate set limits that define failure if exceeded?

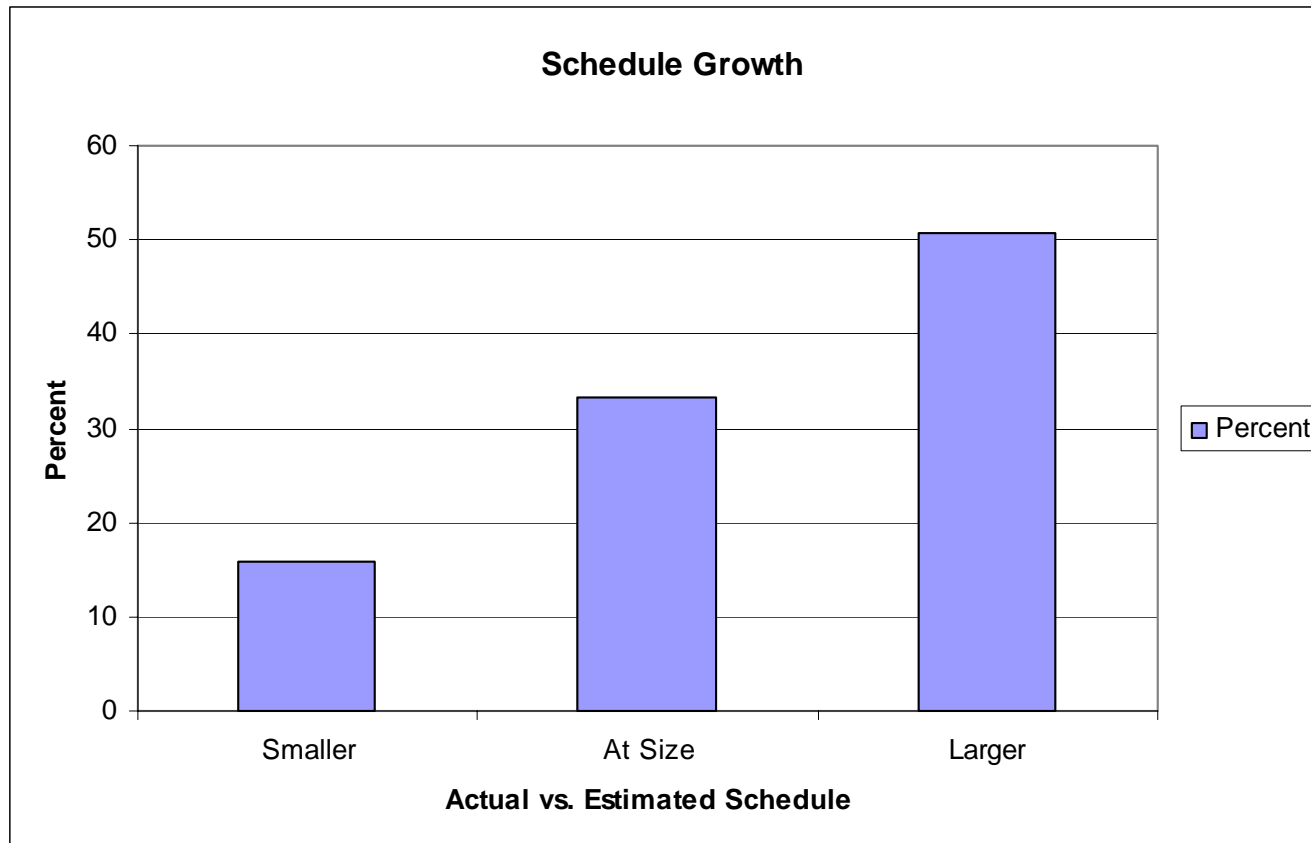
How Accurate are our Estimates?

- **Analyzed % deviation from plan for schedule, effort, and size**
- **Deviation data optional in QSM database**
 - Many projects do not report
 - Results (and observations) should be viewed as preliminary
- **Cancelled projects not included in study**

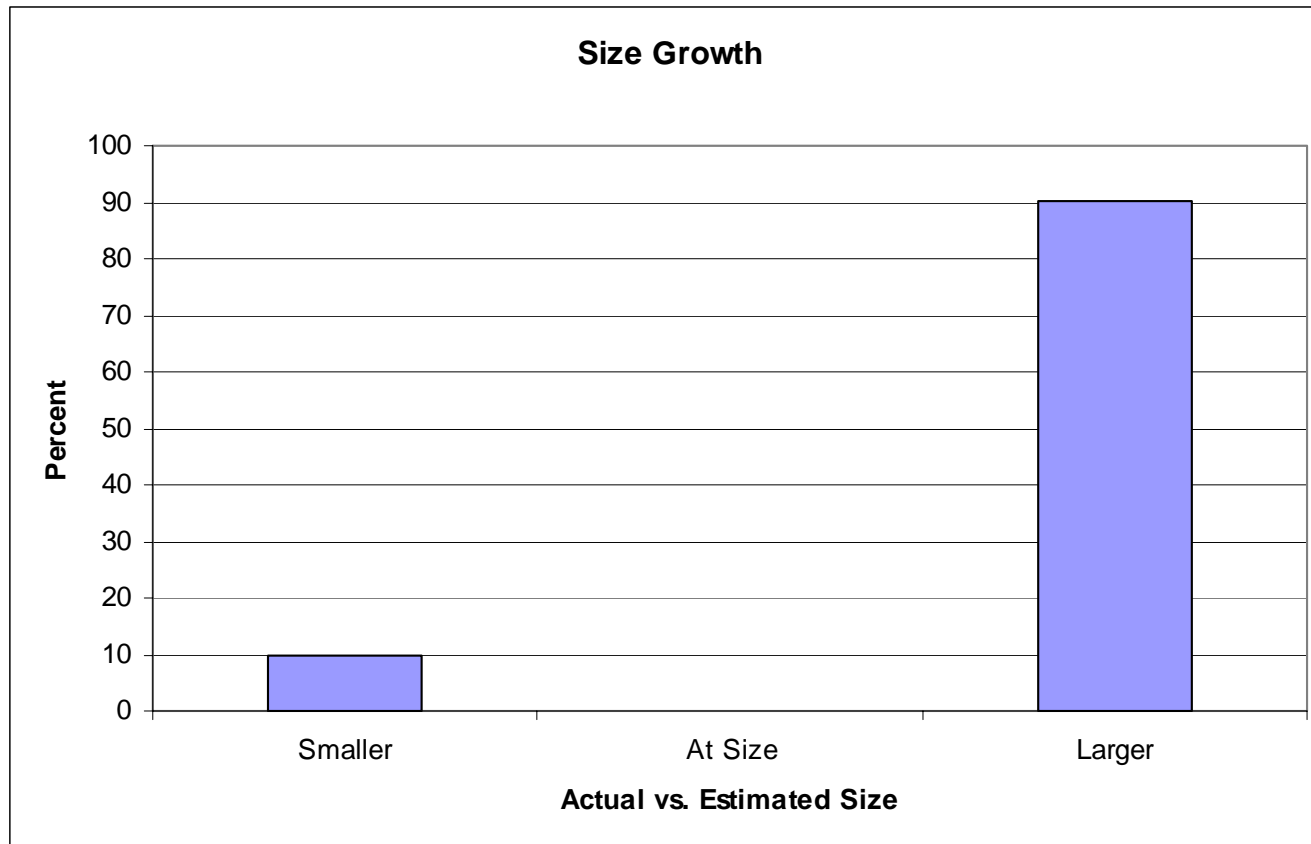
Actual vs. Estimated Effort



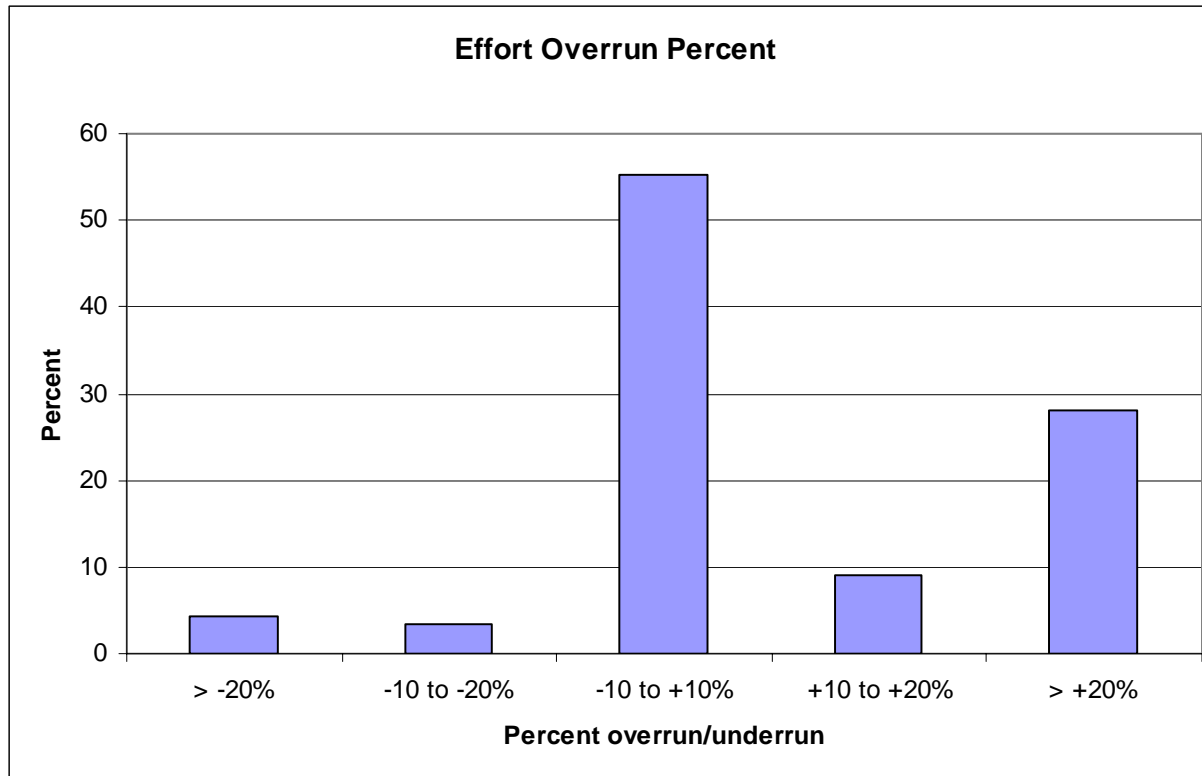
Actual vs. Estimated Schedule



Actual vs. Estimated Size

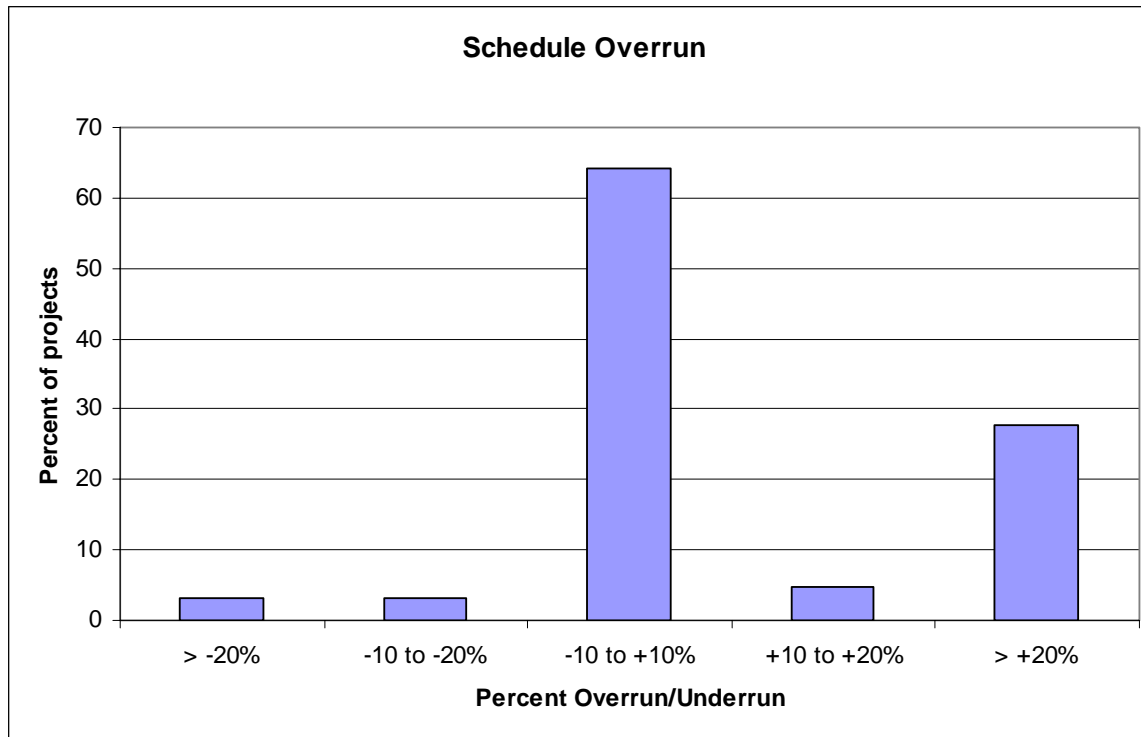


Viewed Differently



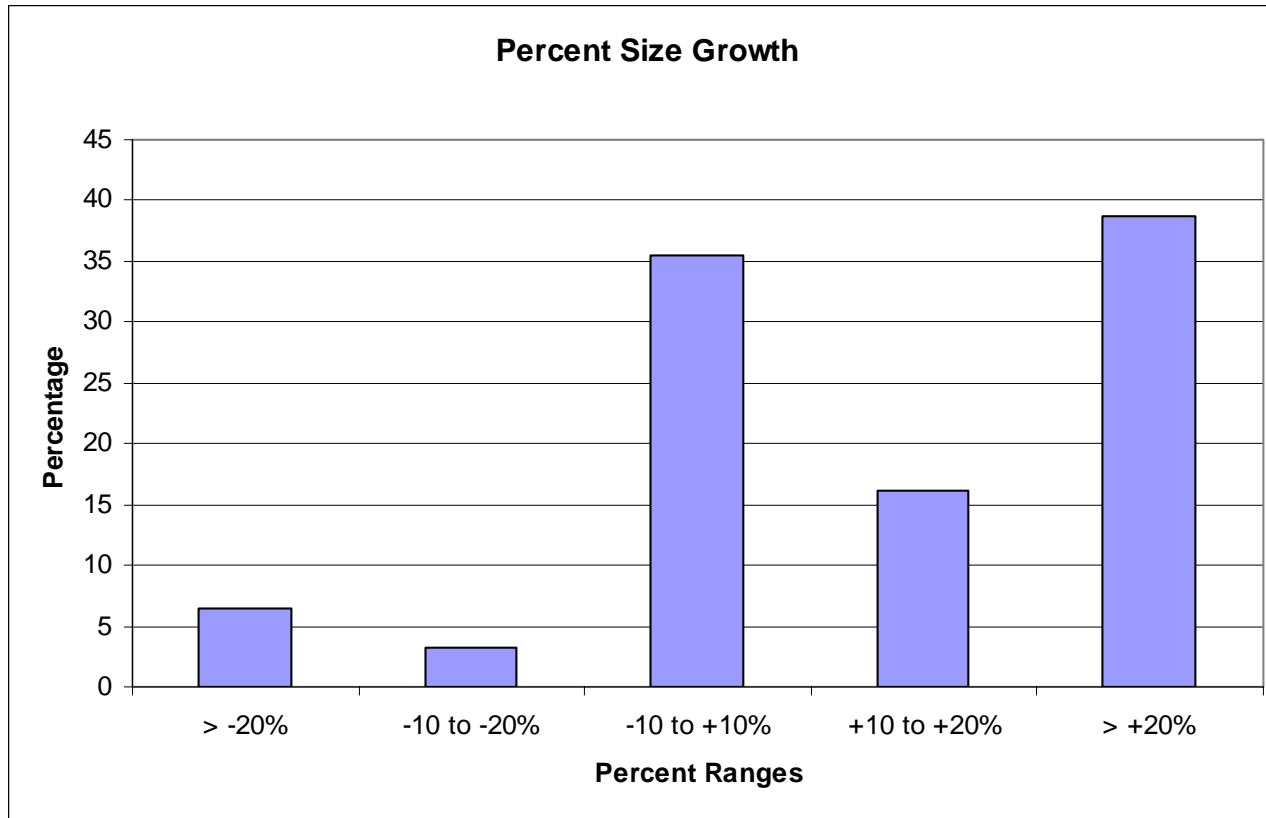
A majority of projects were within 10% of their estimated effort

Viewed Differently



Most projects were within 10% of their estimated schedule

Viewed Differently



Project size was either well estimated or significantly underestimated

In Summary

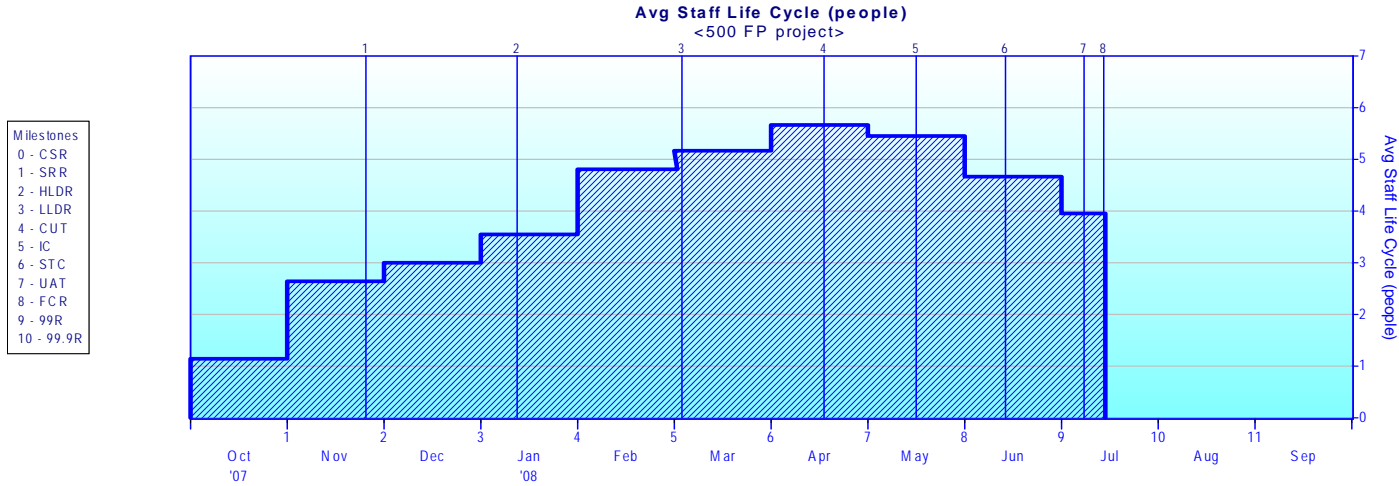
- **Average schedule growth is 8%**
- **Average cost/effort growth is 16%**
- **Average size growth is 15%**
- **So how can we use this information to create more accurate estimates?**

Modeling Increased Size

- **Create best project estimate based on proposed size**
 - Use historically based productivity
 - Account for project constraints (staff, effort, schedule)
- **Create estimate based on 15% size growth**
 - Does this account for projected schedule & effort growth?

500 FP Project

Staffing & Probability Analysis



SOLUTION PANEL - <500 FP project>

	C&T	Life Cycle	
Duration	6.7	9.4	Months
Effort	29	37	PM
Cost	493.4	643.6	\$ (K)
Peak Staff	5.7	5.7	people
MTTD	1.823	1.823	Days
Start Date	12/23/2007	10/1/2007	
	PI=16.5	MBI=3.8	Eff FP=500

9.4 months duration

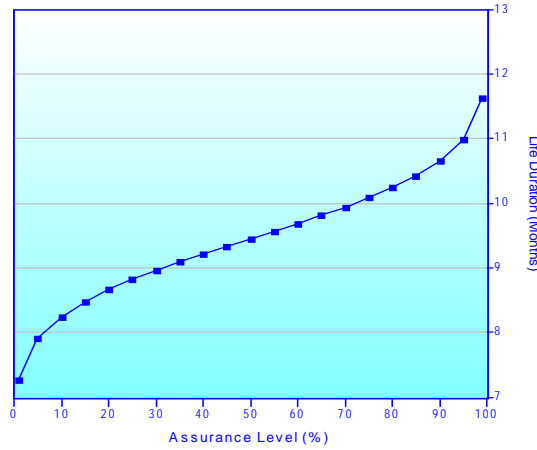
37 person months effort

50% probability

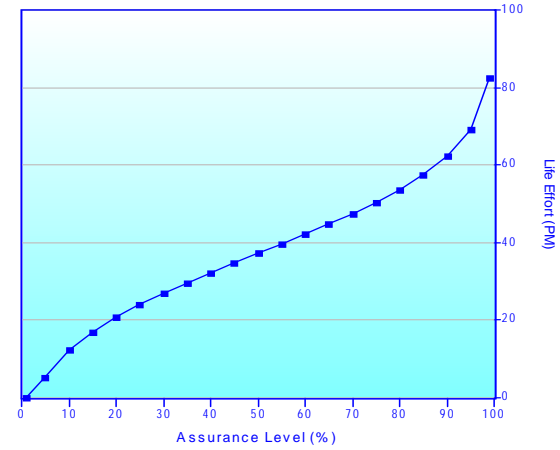
500 FP Project

Evaluate Probability of Current Estimate

Life Duration (Months) Risk Profile
<500 FP project>



Life Effort (PM) Risk Profile
<500 FP project>



Likely outcomes 10.2 months schedule, 43 effort months

Life Duration (Months) Risk Profile - Probability demo
<500 FP project>

Assurance Level (%)	Life Duration (Months)
1	7.26
5	7.90
10	8.25
15	8.48
20	8.66
25	8.82
30	8.96
35	9.09
40	9.21
45	9.33
50	9.45
55	9.57
60	9.69
65	9.81
70	9.94
75	10.08
80	10.24
85	10.42

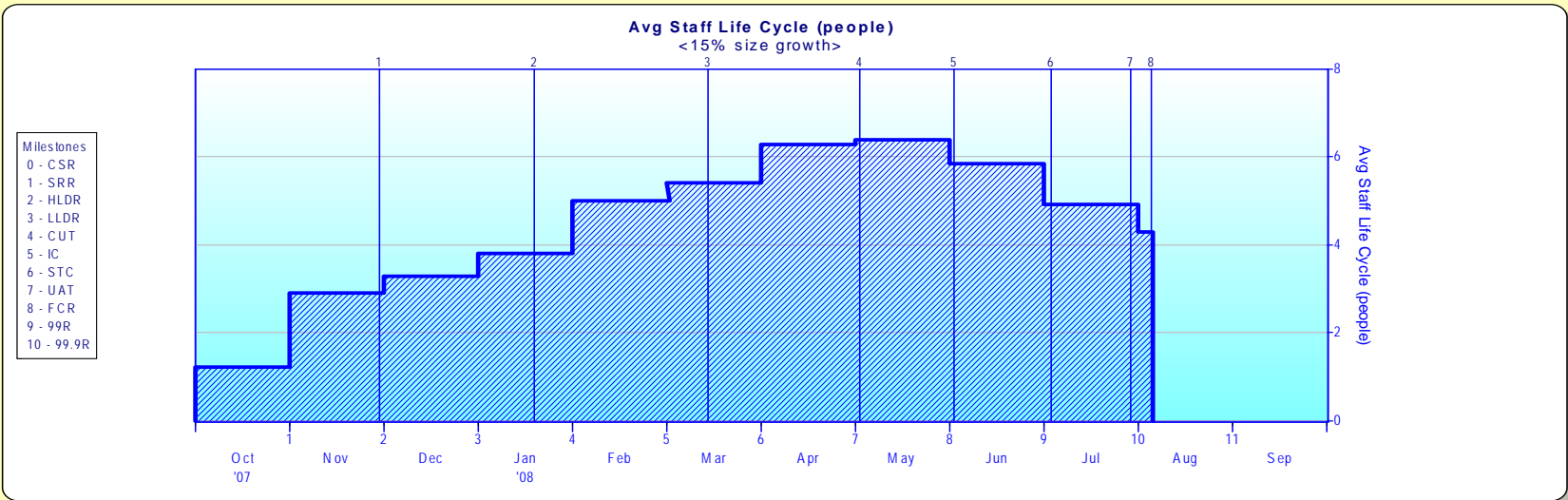
Life Effort (PM) Risk Profile - Probability demo
<500 FP project>

Assurance Level (%)	Life Effort (PM)
1	0.00
5	5.11
10	12.20
15	16.99
20	20.79
25	24.05
30	26.98
35	29.69
40	32.27
45	34.75
50	37.20
55	39.65
60	42.13
65	44.71
70	47.42
75	50.35
80	53.61
85	57.41

Project: Probability demo

15% Growth (575 FP)

Staffing & Probability Analysis



SOLUTION PANEL - <15% size growth>

	C&T	Life Cycle	
Duration	7.3	10.2	Months
Effort	35	46	PM
Cost	603.7	787.5	\$ (K)
Peak Staff	6.5	6.5	people
MTTD	1.681	1.681	Days
Start Date	12/28/2007	10/1/2007	
PI=16.5		MBI=3.4	Eff FP=575

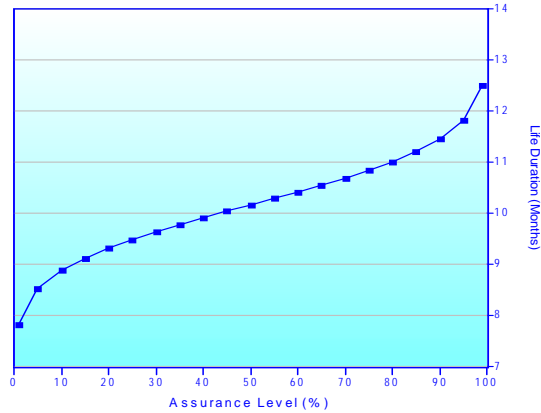
10.2 months duration

46 person months effort

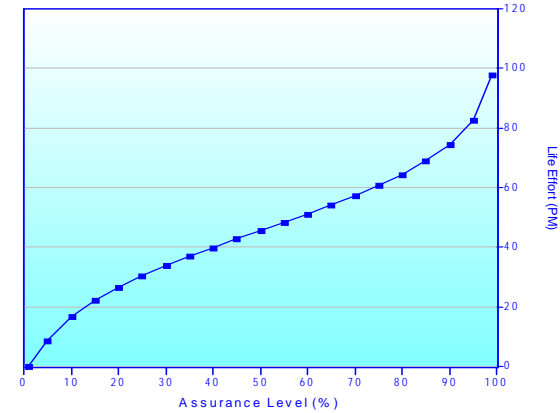
15% Growth (575 FP)

Evaluate Probability of Current Estimate

Life Duration (Months) Risk Profile
<15% size growth>



Life Effort (PM) Risk Profile
<15% size growth>



Life Duration (Months) Risk Profile - Probability demo
<15% size growth>

Assurance Level (%)	Life Duration (Months)
1	7.83
5	8.51
10	8.88
15	9.12
20	9.32
25	9.48
30	9.63
35	9.77
40	9.91
45	10.03
50	10.16
55	10.2
60	10.41
65	10.55
70	10.69
75	10.84
80	11.00
85	11.20

Life Effort (PM) Risk Profile - Probability demo
<15% size growth>

Assurance Level (%)	Life Effort (PM)
1	0.00
5	8.61
10	16.76
15	22.27
20	26.64
25	30.39
30	33.76
35	36.89
40	39.85
45	42.71
50	45.52
55	48.33
60	51.19
65	54.15
70	57.28
75	60.65
80	64.40
85	68.77

Project Probability demo

Averages close to numbers predicted for effort and schedule growth (10.2 duration and 43 staff months of effort)

Conclusions

- **Project estimates tend to understate size, schedule, and cost/effort**
- **Estimating schedule to 80% probability and effort to 60-65% probability can account for this**
- **Estimating based on predicted 15% size growth also accounts for this**
- **Remember: the numbers presented are often viewed as limits. Don't commit to something with a 50% failure rate**

Questions?