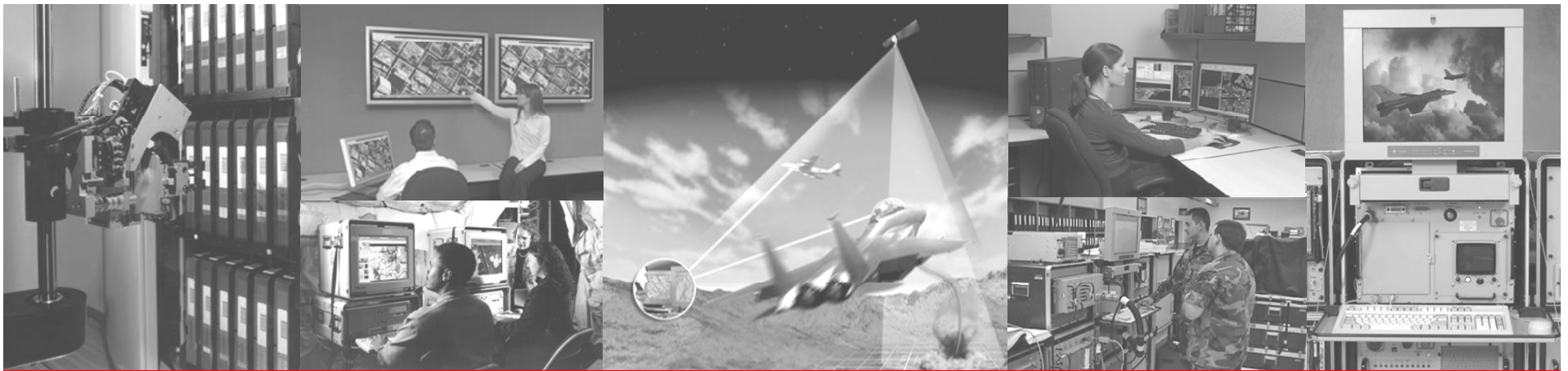


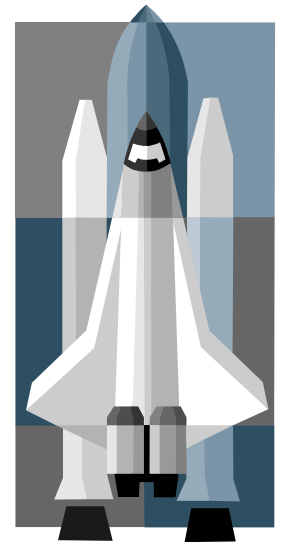
The pitfalls of collecting measurement data across a diverse environment

Lori Saleski
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Our journey — some background

- Long history of data collection at BAE Systems
 - Forever process improvement
- 25 years at BAE Systems in software engineering
 - Calibrate parametric tools including COCOMO/CoStar
 - Measure software productivity and efficiency
- Past three years of focused collecting data to develop parametric tools
 - Systems engineering (for systems engineering estimation model)
 - SE hours and COSYSMO size drivers
 - Total engineering (for TE estimation model)
 - TE hours and COSYSMO size drivers, software and hardware metrics
 - Working with a non-co-located BAE Systems team
 - Borderless environment: NetMeeting, telecons, some travel



Our role in data collection

- Developed collection tools (template, database, etc.) to facilitate data collection
 - Continued to make updates along the way
- Trained data collectors who were resident on a program
 - Combination of training class and one on one
 - Training one on one, or one program at a time, worked best
- Facilitated data collection as it progressed
 - Provide guidance and answered questions
 - Reviewed data and provide feedback
 - Investigated anomalies
 - Worked side by side



How did we get started?

- Established the following:
 - Criteria for the targeted data collection points
 - Template to drive consistency in the collection process
 - Definitions for terminology used: Get everyone on the same page
 - Common structure (task codes, CI, LOC, etc.) to map data into
 - Weighting factors (if applicable)
 - All data may not be equal; some may be more complex and difficult and should be identified as such
 - Guidance and examples
 - Provide expectations of what range of values the data should have



The investment in establishing a good foundation for data collection is worth every hour spent on it

Management buy-in is critical

- Communicate with management early and often
- Train management — don't think it's a waste of your time
 - Provide training similar to what data collectors get
 - Take time to address questions and concerns
- Plan for periodic stakeholder reviews with a key management team
 - Feedback and guidance



Management can and should be trained

The long road of data collection

- It takes as long as you think,
and longer



Here's why —

Have we just talked past each other?

- Misunderstanding of what we wanted for data
 - Could signify a change in data collection process is needed
 - Template should reinforce training, not the other way around
- Template needed clarification or change in terms
 - “System type” too generic and open to interpretation
- Definitions didn’t cover all common situations
 - Deliverable versus non-deliverable test equipment
 - Resulted in mapping hours to different locations
- Examples too limited
 - Program is all software or all hardware
 - Most common scenario is a mix of each. How, then, to categorize this program?



Reduce confusion, gain consistency

'Uncommon' work breakdown structure (WBS)

- Common structure not as “common” as we hoped
 - Not common across lines of business
 - Not common within a line of business
 - Many customer-defined or ad hoc
- Selected a common task structure that best represented all
 - Based on MIL-STD-881
 - Provided cross-reference matrix to assist with mapping
- Tasks performed by a different group than usual
 - For example, mechanical performs a task that is typically system engineering
 - Allocate hours to the group that typically performs the work (how it would be bid)
- Engineers cross-charged to other disciplines
 - Don't care who did the work; it's who owns the task

Turn “uncommon” into “common”

People bring their own definitions to the table

- Extend definitions and examples
 - Keep them simple, or they may not be read
 - Don't put critical or key information in the last sentence
- Where possible, have the same person or group collect and map the more error-prone areas
 - Leverage established expertise
- Still getting different answers?
 - Change the context
- For example:
 - We used a basis of estimate (BOE) entry field for specific metric data
 - BOE has many different contexts, commonly used in proposals
 - We were frequently asked how to fit a BOE into our one entry field
 - Changed term to “justification of XXX”
 - No more questions



Avoid using overloaded terms

Expect changes, because changes will come

- You may not realize what you are missing until data collection is under way
 - Be prepared to extend data collection tools and templates
 - Be flexible — go back and revisit data points
- For example:
 - We asked for engineering life-cycle phase durations in months
 - e.g., concept definition in 6 months
 - Then we asked for the date span of those same phases (month/year)
 - e.g., concept definition January '09 to June '09
 - Then we asked for the durations of key activity in those phases (no gaps or down time)
 - e.g., concept definition January '09 to June '09, 4 months without gap



Make changes to improve consistency

Consistency, consistency, consistency

- Review early, review often, review, review, review
- Leverage common team knowledge as part of review
 - Use the data collection experience of your team — each is different
- Drive consistency in data collection
 - Listen for differences in data collection methods or activities
 - Listen for unusual or atypical assumptions
 - Investigate further to ensure they will result in consistent data
- Put data in context
 - Requirements in a database versus in the source document
 - Interfaces in a list versus on a diagram
- Identify the key points in the data collection process to hold reviews (don't wait until the end).
 - If they took the wrong path early on ...

Review for consistency

Is the devil in the details?

- Lines of code
 - Counting logical LOC
 - Not all logical LOC counters are alike (different rule sets for counting)
 - Up to X percent difference
- Hardware metrics
 - Metrics by major components
 - What about common subcomponents?
 - Duplication of data?
- Drawing counts
 - Added new vs. modified
 - Needed to distinguish
 - Not revisions



Details count! Don't ignore them

Other unique issues

- Larger programs
 - Harder to account for everything that went into a large effort
 - Longer duration, harder to locate data and documentation from way back in the beginning
 - Personnel turnover; some history is lost
 - Documentation will not necessarily exist for every piece required data
- Classified programs
 - Can make data collection pretty challenging
 - How do you discuss sensitive data or answer questions?
 - How do you review the data?
 - No examples, no references
 - Tougher to validate that data is consistent and what you were looking for



Tailor data collection to the program

Like it or not, you are the coach

Some of these traits are in everyone

- “The accountant” — all the numbers add up backward, forward, sideways, X different ways, and it all ties together
 - Sometimes you have to know when to rein them in
- “The detail-oriented individual” — each piece of data has a heritage, and it is commented on in the file
 - Need to recognize whether you have the key data you need, within all the detail
- “The master of engineering judgment” — the data may be just fine, but no need for backup material for reference because “they were there”
 - Need to confirm data using backup information and references, to verify the judgment



Like it or not (cont'd)

- “The trail blazers” — no matter what guidelines or templates you provide, they will still collect the data in their own way (attachments, colors, highlighting, etc.)
 - If the data you need is there, just go with it
- The world of “my project is different from other projects”
 - “And therefore, my data looks different from everyone else’s”
 - Products may differ, but process and metrics typically are not so different
- Key in all these cases is to make sure that you get the data that you are looking for. **Be persistent!**

**Persistence leads to consistency — OR —
know and manage your target audience**

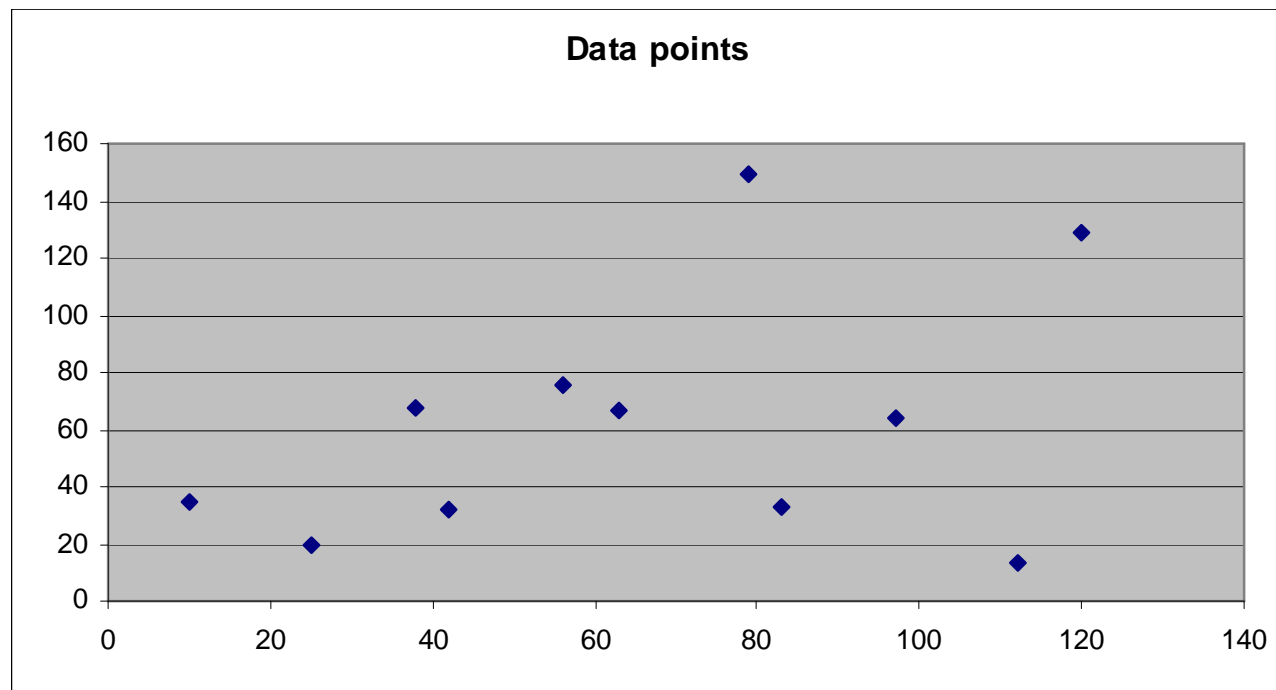
Tying all the pieces together

- When all the data points come together, what did we end up with?



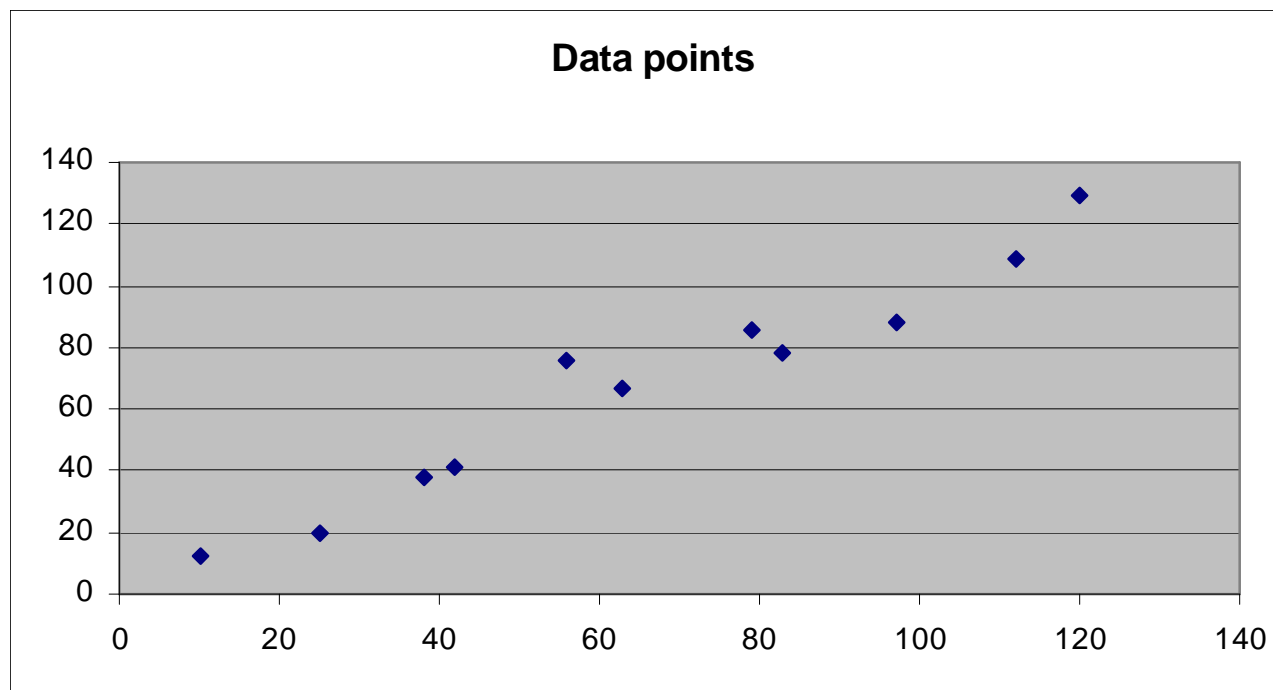
Data collection isn't just collection

- At first, the data may be somewhat dispersed
- Outliers with a cause are OK; outliers without a cause are suspect
 - Need to peel back the onion
 - Anything unusual about the data collection
 - Invalid assumptions?



It's also analysis

- Review your analysis charts
 - Review charts along the way, not just at the end
 - Part of review cycle, allowing for adjustments



Collect, analyze, iterate

When all is said and done

- After all is said and done, did we accomplish what we hoped?
 - More complicated than it seems
 - Takes much longer than anyone anticipated
- Was this helpful?
 - Can you use our lessons learned in your quest for data?
- And the moral of our story is ...
 - Consistency, consistency, consistency

- Go forth and collect good and consistent data....



Consistency, consistency, consistency

Questions?



Lori Saleski, Project Engineering Manager,

BAE Systems

lori.a.saleski@baesystems.com

603-885-6353