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Business Case & Acq Strategy Session



GSAW2000
Marilee Wheaton, TRW, Session Chair
24 February 2000

PCs in Satellite C & C Systems

Jeff Davis - Raytheon

- Line is blurring between control center and office
 - PCs used in online, orbit ops and mission management
 - PC tools are now available for these functions
 - Microsoft Office available on the control station display
- Why PCs (compared to UNIX workstations)
 - Lower cost for required performance with portability
 - Powerful laptops run ops software remotely
 - Availability of tools, GUIs, languages, C&C COTS
 - Ease to use as developer or user
 - Rapid technology advances for PCs and their tools
 - Two or three displays per machine with audio
 - NT permits assigning a real-time task to a secondary processor

E-Business and the Ground Station

Joe Duffy - Oracle Service Industries

- **E-business benefits transfer to ground station & space systems**
 - Most everything will be done on Internet in the future
 - Heavy processing at ground systems may not be web based
 - Don Tapscott - *The Digital Economy*
 - Personalizing application to the user
 - Having user design products for themselves
 - Winners and losers - sales people replaced with web
 - Impact social, cultural, political, technology, economy, environment
- **Rapid pace of technology, economic and Internet impacts**
 - Retain customers & keep them happy <== program convergence
- **Boundaries between organizations' products are blurring**
- **Functions are becoming self-service**
- **Use increased data to select the high payoff activities**
- **Address commonality & business processes when choosing COTS**

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The Impact of Team Performance on Cost

Jairus Hihn - JPL

- **Study to measure team performance on cost & schedule**
 - JPL, TRW, Aerospace, GSFC study
 - **Web based tools to evaluate advanced design team performance**
 - JPL has one to two studies per week (provides lots of data in 8 months)
 - Caltech looking at concurrency, schedule and team performance
 - Tools and process saves JPL teams up to 40% of effort
 - **Huge savings and quality improvements due to innovation**
 - Innovation increases with job satisfaction & ability of management to field ideas
 - **Team performance is enabled by equipment, but is increased by**
 - Growth & creativity, trust, participation, good listening, respect, commitment, accountability, customer preparation & participation, clear decision method
 - **Each team defines their own team satisfaction questions**
 - Articulate issues in their own words, plus some standard items
 - Bottom line showed up on the questions at TRW, but not at the other teams
 - **Collecting JPL data weekly for rapidly identifying & resolving issues**
 - Will be able to track changes in performance to changes to actual events
 - Provides an objective & non-threatening way to address issues with team leads



Software Cost Estimation for Future Ground Systems

Nancy Kern - The Aerospace Corporation, East

- **Study on improving size estimate for large OO developments**
 - Survey of 15 professional organizations for OO cost databases
 - No databases identified
 - OO cost data collection for large ground system developments
 - Surveyed OO programs to see if OO costs are lower
 - Initial discussions said OO costs were not cheaper (learning curve....)
 - One participant suggested a possible payback on third or later OO project
- **Black box (no modification) or white box (mods) reuse is not free**
 - To modify a small percentage of code costs disproportionately more
 - Need to understand the application to know what to modify (white box)
 - Have to perform integration and system-level testing on black box
- **COTS implementation cost study**
 - Glue code, COTS volatility... are factors in USC COCOT's COTS cost tool
 - Chris Abts, COCOTS developer says glue code proportional to system size

Survey of Business and Technical Considerations for Product Line Development Dan Vanderwarker - The Aerospace Corporation, East

- **Survey was distributed to GSAW 99 and others**
 - Buyer and developer have different perspectives, payoffs...
 - Identifies the needs and issues for the GSAW ground system community
 - Mailed to GSAW 99 participants (obtained 40 responses)
 - Average of 10 years of experience; many responded to both buyer and seller
 - Survey may be posted at GSAW web site
 - **Business, technical and organizational issues were addressed**
 - Component testing & project complexity were important to buyers & developers
 - Buyer concerns - cost saving, satellite support domains, customer interface...
 - Developers wanted stable requirements, good component documentation....
 - Both were not as concerned with the how of developments...
 - Buyers were less concerned with DoD standards than commercial standards...
 - **Additional data collection and analysis is planned**
 - GSAW population valued commercial standards

CAIV Trades Using COCOMO II

Lori Vaughan - TRW

- **CAIV implementation tenet is to lower ownership life cycle costs**
 - CONOPS and architectural trades fit into the CAIV trade space process
 - Use CAIV to empower process improvements & technology changes
- **COCOMO II CAIV trade for fixed end date & cost case study**
 - Example includes custom versus vendor database
 - Explored legacy versus custom code
- **Address requirements satisfaction, cost and risk**
 - Evaluate degree of requirements satisfaction for each solution (COTS, legacy, custom, hybrid)
 - Provide a matrix with the detailed cost factors
 - For each cost factor, look at the relative costs for each solution
 - Perform a risk sensitivity chart looking at optimistic... conservative software development factors (tools, team proficiency....)

Business Case Considerations

- **Operating system's stability, security, administration & ease of use**
- **Change is coming - prepare for Internet impacts**
 - Use internal Internets to take advantage of web technology for TT&C
 - Security, guaranteed access, time of delivery, priority, QOS... issues
 - Consider Internet appliances for lower-tech tasks to reduce costs
 - Investigate payback of Internet for integrating activities (procurement ...)
 - Improve agility in fielding systems by using web, latest COTS
 - Transition functions to self-service (automate manual processes)
- **Stay flexible for the unexpected paradigm or technology change**
- **Use team satisfaction surveys to improve team performance**
 - Prototype survey on design team (fast turnaround), then use for missions
 - Happy teams have higher performance (lowers mission costs)
 - Have each team define their survey questions with an expert's help
 - Both soft (trust, respect...) and hard issues (customer preparation, clear decision process...) should be addressed

Business Case (continued)

- **Cost estimation**
 - Software reuse - consider software understanding and testing costs
 - COTS - glue code is much less a cost driver than COTS assessment, integration, and test
 - Need to update the development and business process to efficiently utilize COTS and legacy software
 - Learning to live within the COTS or legacy software limitations (versus pay the price for customization or custom code)
 - OO learning curve increases cost for initial program, then decreases
 - Machine generated code (GUI...) has to be designed and tested
- **The survey of product line buyers and developers identifies mutual concerns with product complexity and testability, in addition to buyer or developer unique considerations.**
 - Consider the top issues when developing or procuring a product line.
 - Risk areas include items with high buyer interest, but low developer interest

Business Case (continued)

- **Use CAIV trade process for exploring architecture and CONOPS options**
 - **Ensure the cost estimation tool addresses COTS and legacy code impacts**
 - **Address degree of requirement satisfaction in using COTS or legacy**
 - **Evaluate architecture, development process and CONOPS impacts of using COTS or legacy**
 - **Prepare a risk checklist**
 - **Breakdown individual cost factors and compare costs for COTS, legacy or custom solutions**

Notable Quotes

- **The line is blurring (for PC use) between ops centers & office**
 - Jeff Davis
- **Skate to where the puck is going (aim for the future trends)**
 - Joe Duffy
- **Innovation (and cost savings) increase when team members are satisfied by their work and supervisors can field their ideas.... Sometimes soft data is needed to measure team performance.**
 - Jairus Hihn
- **Amount of COTS glue roughly depends on system size and how well the product matches its intended use. This finding concurs with one of Randy Jensen's papers. Cost increases due to COTS understanding and integration (less so for the glue code).**
 - Nancy Kern

Notable Quotes (Continued)

- **Both buyers and developers of product lines have substantial similarity of interests which should be explored to improve cooperation.**
 - Dan Vanderwarker
- **Be sure your software cost estimation tool addresses COTS and legacy code impacts. This can be a significant, though frequently omitted, cost factor.**
 - Lori Vaughan