Practical Design Issues of Simulation-Based Acquisition

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Overview of Presentation

- Simulation-Based Acquisition (SBA)
- Design Issues
- Case Study
  - Virtual Systems Integration Lab for the Army
- Recommendations
- Conclusions
- Questions?

Simulation-Based Acquisition circa 1998

- Definition from U.S. ARMY PEO STRI (1998)*:
  - "Simulation Based Acquisition (SBA) is a major initiative…intended to make smart use of M&S technologies to equip our forces with quality systems of high military worth, in less time, and at lower cost than traditional means.

    "The concept behind SBA is that the M&S tools can be integrated and matured throughout the system lifecycle process ..."

- Overall Goal: Field the best systems for the future military force in the shortest time and at the lowest cost.

*http://www.peostri.army.mil/PRODUCTS/SBA/definition.jsp

Simulation-Based Acquisition circa 2006

- We have not achieved full-adoption of SBA across the DoD
- SBA success has been limited
  - OSD study suggests that over 80% of models developed on 22 major programs are unique to that program.
  - Most are owned by the prime, not the government
  - Leads to increased development time
  - Leads to increased cost to the government

- We remain on the ground floor of SBA
- The Overall Goal is still the same

What are the Design Issues?

- Two major kinds: Technical and Political

- Both are co-dependent but can be analyzed separately
- Both present thorny challenges, but are not insurmountable

Technical Challenges

Government Perspective	Industry Perspective
-Need high fidelity models	-Need accurate data
-Need data security	-Need IP protection
-Need system of systems	-Need subsystem requirements
-Need interoperability	-Need cooperation

- SUMMARY: We need a solution for the Govt to maintain control of model assets, while providing Industry the data it needs to do its job.

Technical Challenges

- Main challenge is data access
- Model validation cannot be done without access to accurate data
- The current workaround is to maintain isolated model repositories
- However, this workaround defeats interoperability and cooperation
- There is no unified tool for virtual systems integration

- The result is that full systems cannot be simulated reliably or at all under current resource constraints

Political Challenges

Government Perspective	Industry Perspective
-Want to own models	-Want to own models
-Want more control	-Want job security
-Want best solution	-Want less competition
-Want more cost-savings	-Want fewer restrictions

- SUMMARY: We need a solution that allows the sharing of simulation models in a way that does not penalize or overly burden the creators.

Political Challenges

- Main challenge is simulation reuse
- The Govt will not get cost-effective SBA without model reuse
- The biggest Industry players stand to lose the most from SBA
- The current environment breeds specialized simulations of limited reuse that are costly to build

- Simulation reuse and interoperability is painful for industry to implement, and will not happen without greater Govt mandate

Other Challenges: Myths of SBA

- Myth 1: Job security is endangered by SBA.
  - Truth: Existing designers are given new tools to do their jobs better. Potential for new service contracts are created by model maintenance.

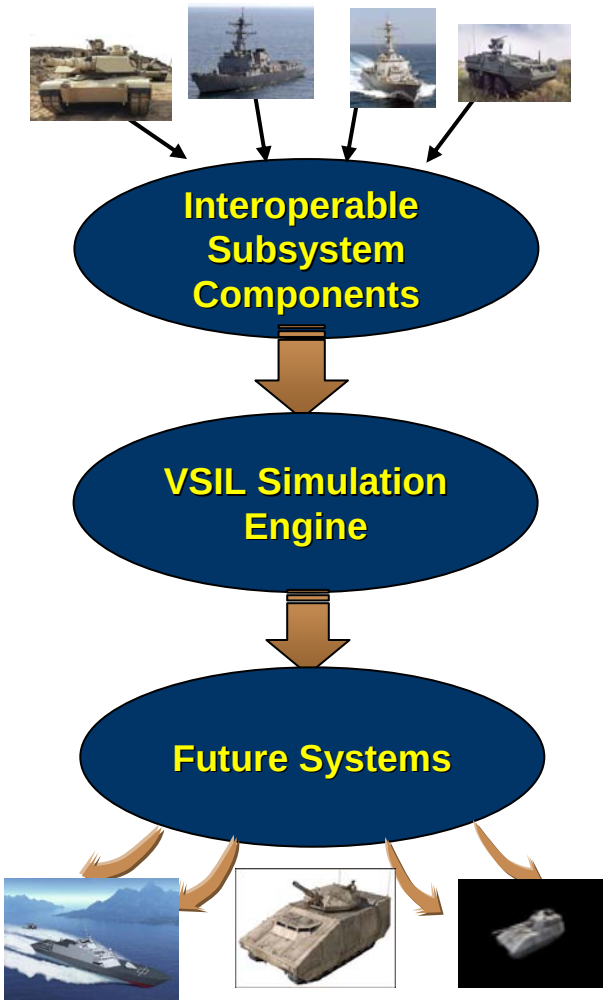
- Myth 2: SBA processes will "break the system."
  - Truth: The current system is unlikely to accomplish all DoD transformation goals under shrinking budgets. The current system has mission-critical problems and SBA is a feasible and mandated solution.

Case Study

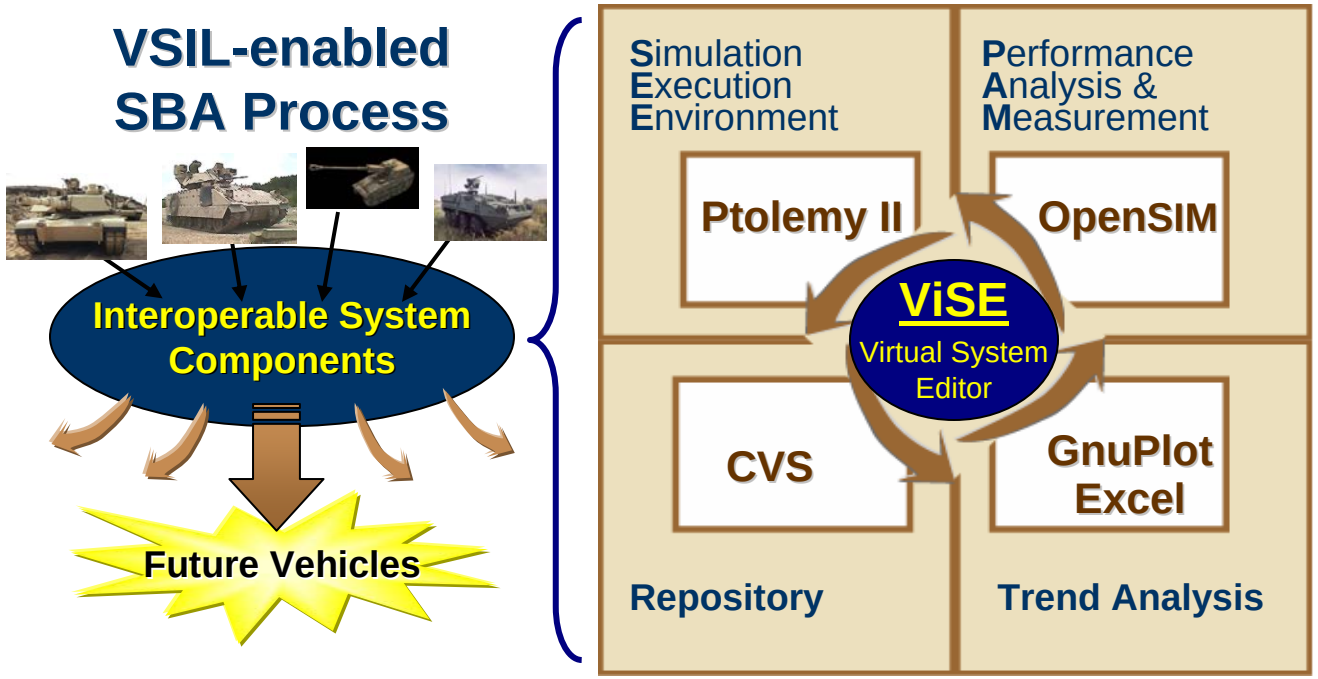
- Virtual System Integration Lab (VSIL) for the U.S. Army
  - VSIL is an SBA toolset for accelerating systems engineering
  - VSIL is a flexible system integration suite for virtual prototyping & simulation that tests all aspects of prototype designs prior to committing to a physical prototype

VSIL Objectives

- Enhance next-generation vehicle design and development
- Improve efficiency of simulation development
- Perform cost-benefit analysis on component models up to full deployments

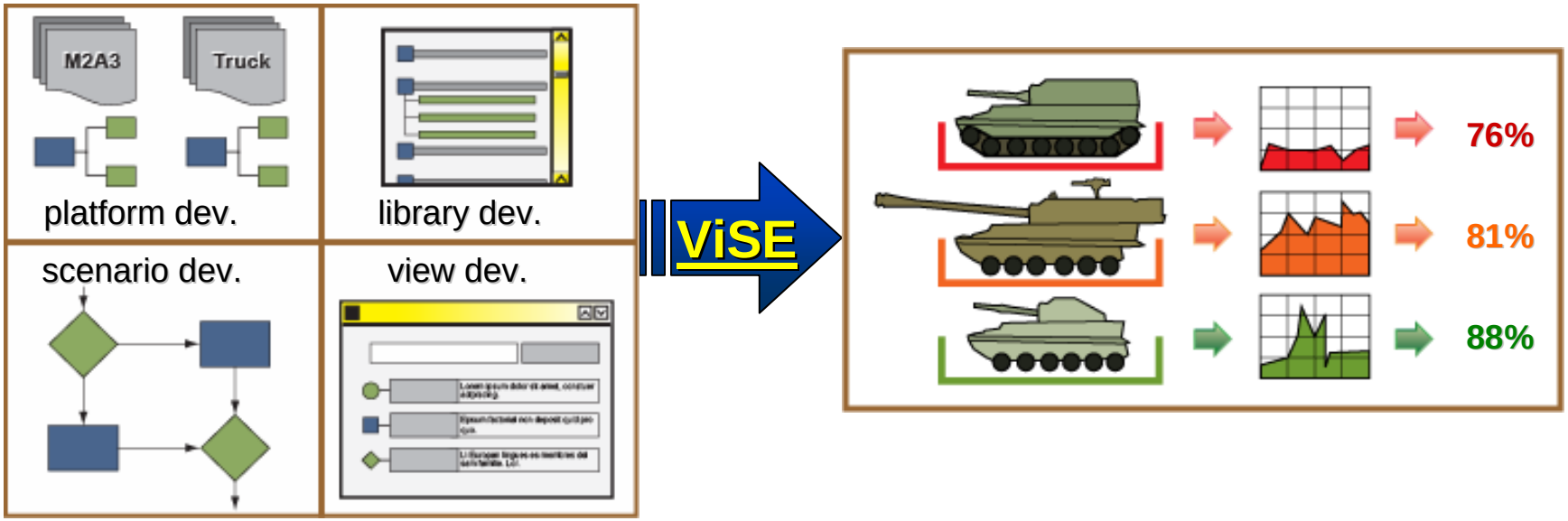


Results: VSIL-enabled SBA



- Transforms development process from one where a vehicle design is based on history of direct ancestors to a process where new vehicle design benefits from development of all previous vehicles

Results: Virtual Systems Editing



- Through the Virtual Systems Editor (ViSE), VSIL provides an integrated design, development, and simulation toolset to enable automated component trade off analysis and requirements generation.

Lessons Learned from VSIL

- SBA process adoption depends on the availability and fidelity of component models of interest
  - (e.g., Mobility, Drive-train, Suspension, Mechanical)
- SBA processes require well-populated component libraries
  - The components should be modeled at level which they are swapped for tradeoff analysis (e.g., Line Replaceable Units)
- Need model import capabilities for industry-standard formats
  - Flexibility is key for leveraging existing models and new models
  - Domain expertise is critical and an underestimated bottleneck

Lessons Learned from VSIL

- Powerful and user-friendly tools make a world of difference
  - Increases the efficiency of Govt validation
  - Reduces the penalty on Industry for adopting SBA
  - Actual usage reduces anxiety and builds confidence in the tool
- Interface-based Modeling & Simulation solves many IP issues
  - Enables reusability, gives Industry a layer of abstraction to protect its IP
- Time savings can be roughly calculated by the number of engineering iterations reduced
  - The VSIL enabled the vehicle systems engineer to do trade-off studies over 4x faster by reducing development iterations

Recommendations for Effective SBA Tools & Processes

- Populate centralized repositories that are government owned and operated. But let Industry maintain proprietary repositories with interface-based model access.
  - Interface with decentralized repositories based on service agreements
  - Provides Govt and support contractors real data to use
- Require the delivery of component models developed under contract
  - Govt & Industry need standardized tools to handoff and evaluate models
- Govt needs tools to effectively manage SBA and M&S
  - Govt needs more automated M&S capabilities

Conclusions

- SBA has not failed – we simply need more adoption
- SBA design challenges can be overcome – but more buy-in and mindset change required
- SBA has many circular dependencies between Government & Industry
- Govt will not get best solution when the competition is limited

Conclusions

- Ultimately, the Government's degree of push for SBA will determine its effectiveness. For SBA to be truly effective there needs to be more give and take between government control and industry free reign
- Need more leadership from within Govt to make this happen
- War-time atmosphere makes process change harder but motivating
- More transformation is required, SBA is key to Defense transformation

Questions?

- Please address questions to Kevin Tang, ktang@cybernet.com