



TARDEC Program Reviews VTC for RDECOM S&T Advisors

How CRES-GV will change Ground Vehicle Performance Analysis

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Problem Statement



Problem:

Ground vehicle development projects make high impact design and requirement decisions with limited knowledge

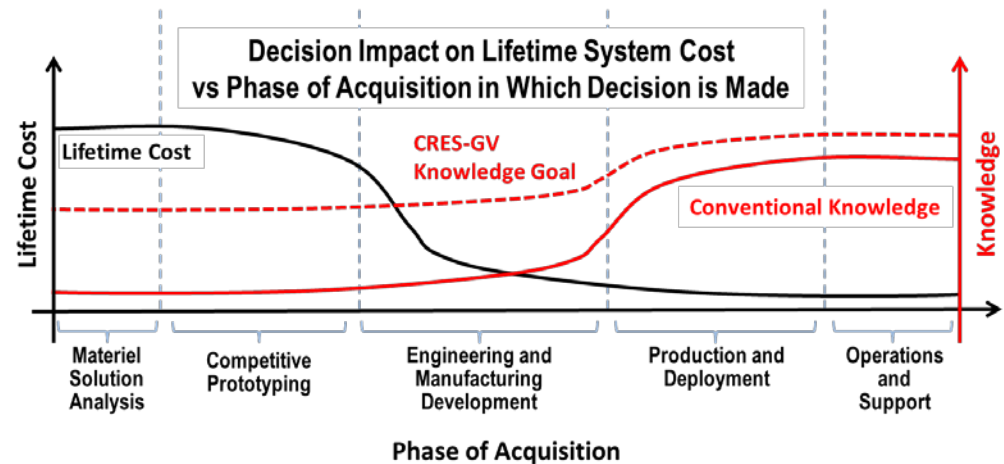
Why:

Have very limited knowledge, especially in the early stages of a program

Example:

Towing Requirement

- Vehicle Mass?
- Engine Size?
- Radiator Size?
- Tire dimension?





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Current Performance Analysis



- Experience
 - Extrapolate past project experience into future
 - Rule of Thumb
- Testing
 - Slow & expensive
 - Need to have a prototype system
- Low Fidelity Modeling
 - Current trade space tools use low fidelity models
 - Typically no physics or system interactions
 - Based on subject matter expert opinion
 - Can require custom programming of trade space tools
 - Slow & expensive
- Limited High Fidelity Modeling
 - Single physics models
 - System interactions not modeled
 - Require time and expert analyst
 - Often not done due to resource constraints





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CRES-GV Performance Analysis



- Multiphysics performance analysis
 - Co-simulation of critical systems to capture interactions
 - Example: Vehicle Dynamics, Vehicle Powertrain, Vehicle Cooling, Terrain
 - Requires High Performance Computer Cluster (HPC)
- Analysis of entire vehicle trade space
 - Use High Performance Computing clusters (HPC) to examine 1000's of vehicle permutations
 - Span entire design space
- Streamlined, web-enabled process
 - Connection to Trade Space Tools
 - Database of validated results
 - Streamlined & simplified interface for normal users
 - PM & PEO offices, contractors
 - Interface for advanced users
 - Government Power Users
- Collaboration between TARDEC, ERDC, HPCMP





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CRES-GV Priorities per GV PEOs



End-To-End Mobility Solver

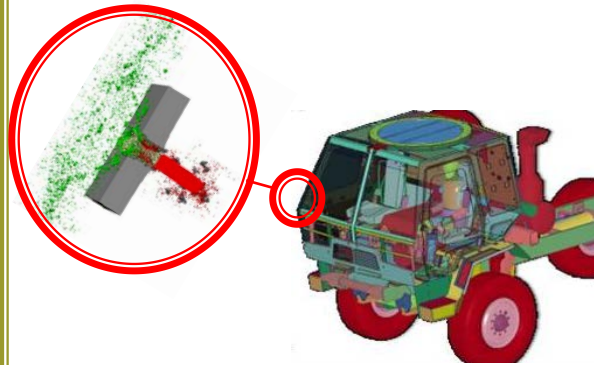


Off Road Mobility M&S

- Detailed Track/Tire – Soil Model
- Detailed Vehicle Dynamics
- Powertrain M&S Integration

#1

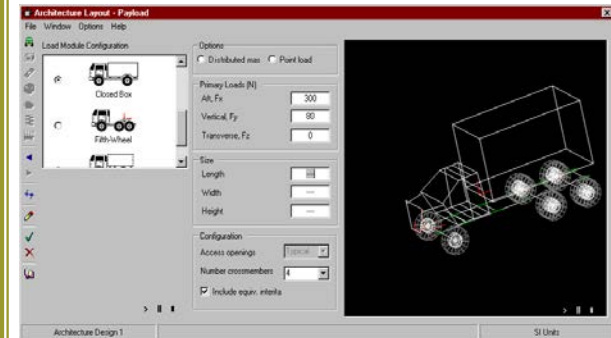
Systems Level Ballistic Penetration



- System level armor model
- Weld, joint effects
- Attachment modeling
- Virtual live-fire test

#3

USMC FACT & GCS WSTAT: Provide Rapid Physics- Based Data to Systems Tradespace Tools



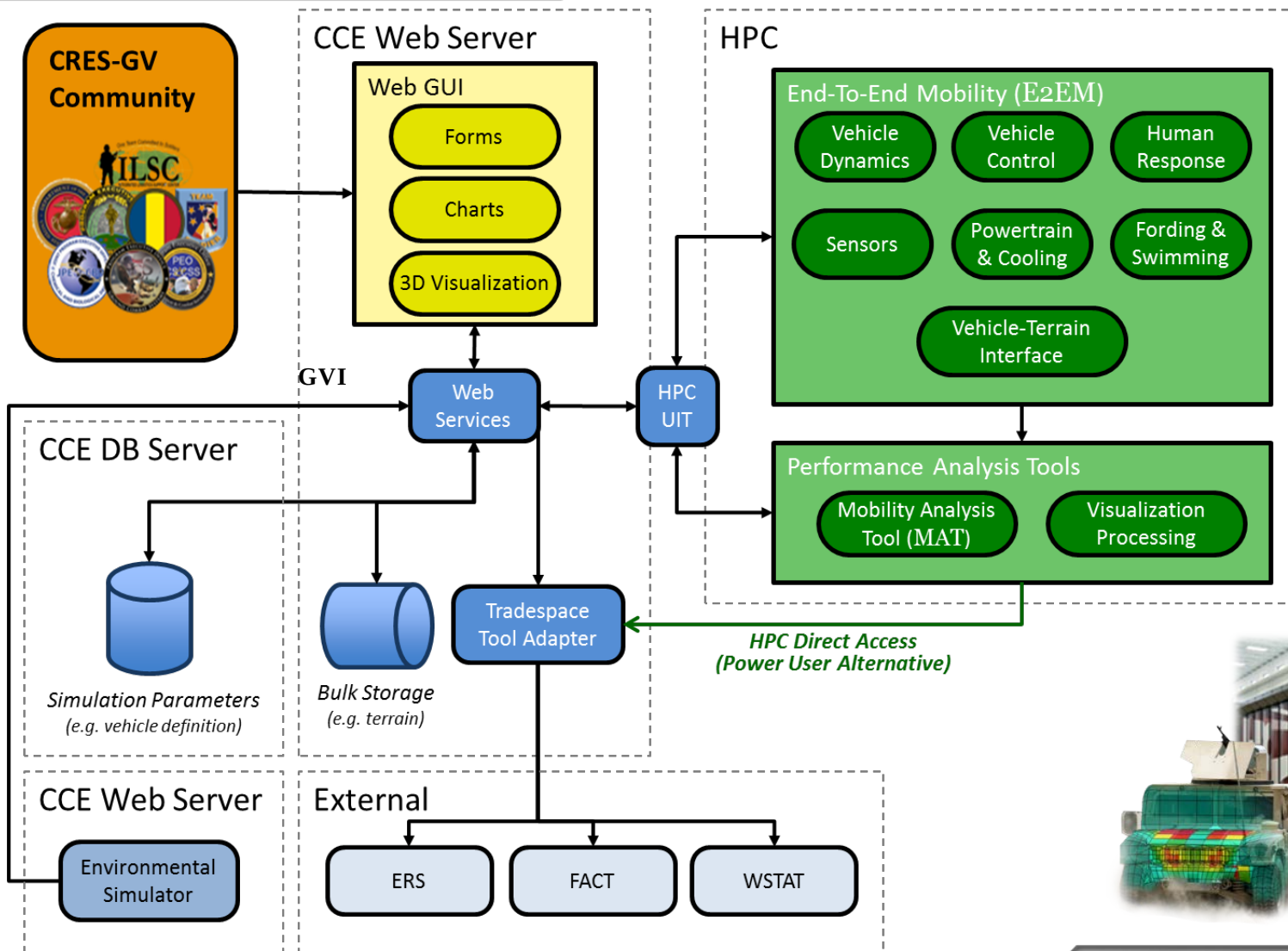
- Dynamics & Mobility
- Power-train
- Survivability
- Thermal & Signatures
- Antenna & Sensor placement
- Ergonomics
- Cost implications

#2



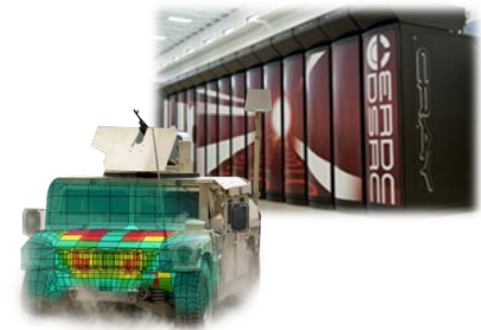
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CRES-GV Mobility Product Architecture



End-To-End Mobility Solver

Goal: Physics based approach to evaluate off-road mobility





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CRES-GV Products



- End-To-End Mobility (E2EM)
 - Physics based tool for mobility with multi-physics simulation of terrain mechanics and vehicle systems and components (e.g., suspension, running gear, and powertrain)
- Systems Level Armor Protection (SysLAP)
 - Physics based tool for modeling integrated armor systems for vehicle platform survivability against blast, impact, and penetration
- Performance Analysis Tools
 - Tool suite for analyzing HPC physics data from E2EM and SysLAP; enable trade space exploration and systems engineering
- Ground Vehicle Interface (GVI)
 - User interface for intuitive access to the analysis capabilities of the CRES-GV tools by SME power users and tradespace analysts

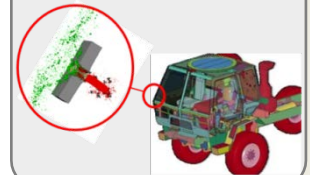
End-To-End Mobility Solver

Goal: Physics based approach to evaluate off-road mobility



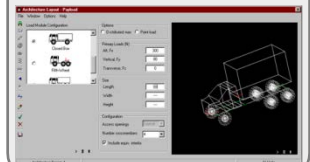
Systems Level Ballistic Penetration Solver

Goal: Physics based evaluation of armor "as-integrated" on a platform



USMC FACT & GCS WSTAT: Provide Rapid Physics-Based Data to Whole Systems Tradespace Tools

Goal: Physics based approach to assess design concept tradespace





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CRES-GV Takeaways



- Many program decisions are made with limited knowledge today
- CRES-GV will positively impact vehicle performance analysis
 - HPC enabled, physics based, trade space analysis
 - Focus on providing physics based models early in program life-cycle
 - Co-simulation to model system interactions
 - Streamlined, web-enabled process
- Software releases in FY15-17
- Collaboration between TARDEC, ERDC, HPCMP
- Payoff
 - Early design flaw detection
 - Reduced development time
 - Better mission-suitable designs
 - Lower life cycle costs

