THRUST AREA II;
SYNTHETIC AND VIRTUAL ENVIRONMENTS

Major Performers
The University Of Iowa
TARDEC Simulation Laboratory
NSF I/UCRC For Virtual Proving Ground Simulation
US Department Of Transportation
CADSI
John Deere

Accomplishments
Implicit Integrators For Stiff Models, With Speed-Up Of 1,000
Real-Time, High Fidelity Simulation
Topology-Based Linear Algebra
Dual Coordinates
Multi-Rate Integration
Off-Road Virtual Proving Ground Modeling Methods

Transitions
Implicit Integrators And Linear Solvers Transitioned To CADSI DADS Product
Real-Time Dual Coordinate Software Implemented On TARDEC Simulators
Off-Road Virtual Proving Grounds For TARDEC Simulators And The National Advanced Driving Simulator (NADS)
SYNTHETIC AND VIRTUAL ENVIRONMENTS

OBJECTIVE: CREATE HIGH FIDELITY, REAL-TIME SOLDIER-IN-THE-LOOP VIRTUAL PROVING GROUNDS

- Develop Real-Time Integrators for High-Fidelity Vehicle Models
- Model High Frequency Subsystems and Tire/Track-Soil Interaction
- Create Virtual Environment Modeling Methods for Simulators
  - TARDEC Turret- and Ride-Motion Simulators
  - National Advanced Driving Simulator (NADS)
- Integrate and Implement ARC-Developed Real-Time Subsystem Models for Use on Simulators
- Develop Parallel Processing Methods and Implement on TARDEC High-Performance Computing Systems
- Demonstrate Results on State-of-the-Art Simulators and Transition for Army and Commercial Use on TARDEC and NADS Simulators
ARC-II, TRUST II PROJECTS

1. Off-road Synthetic Environment Modeling and Simulation

Objective/Need: Create off-road virtual environment database representation methods
- Three-dimensional dynamic terrain simulation and visualization
- Three-dimensional tire-soil interaction
- Scenarios for off-road vehicle simulation at various levels of fidelity.

Benefit: Fundamentally new off-road vehicle simulation capabilities, to enable military and commercial off-road vehicle and equipment design. Compatible implementations on TARDEC simulators and the NADS.

2. Numerical Methods for High Fidelity, Real-Time Simulation

Objective/Need: Develop algorithms to enable efficient simulation of high fidelity vehicle system and subsystem models. Enable real-time operator-in-the-loop simulation and support optimization tasks in vehicle dynamics.

Benefit: Improved vehicle simulation capabilities by means of more efficient numerical algorithms for high fidelity/real-time vehicle dynamic simulation.
3. Parallel Computation for High Fidelity Real-Time Simulation

Objective/Need: Utilize TARDEC’s High Performance Computing (HPC) multiprocessor and motion-based simulators to carry out high fidelity, real-time, virtual proving ground simulation for vehicle system design.

Benefit: A fundamentally new virtual proving ground capability for vehicle subsystem and system design, exploiting extensive simulator and HPC facilities at TARDEC. A comparable capability for both military and commercial applications with the NADS.

4. Integrated ARC Tools for Virtual Proving Ground Simulation

Objective/Need: Integrate ARC developed simulation tools for real-time virtual proving ground simulation, using advanced driving simulators. Implement and test families of tools integrated on TARDEC and NADS simulators.

Benefit: A new suite of real-time vehicle subsystem models, integrated into advanced driving simulators for vehicle subsystem and system design.