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Basic Information:

Solicitation #:	MDA11-031
Title:	Improved Techniques for Optimistic Modeling
Technology Area:	**Information Systems**

POC Information:

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Description:

The Missile Defense Agency has advocated the use of optimistic modeling techniques in its M&S architectures that model the complete Ballistic Missile Defense System, especially for the performance assessment mission with its need to use very-high fidelity models while maintaining reasonable run-times. Optimistic modeling is a methodology to allow a simulation to take full advantage of parallel processing by distributing models across all available processors and letting them run at maximum processing efficiency and concurrency, yet still maintaining causally correct ascending time order and preventing periods of coexisting alternate truth states. Models execute optimistically assuming that the processing of the next current event will not become invalid due to the arrival of an earlier event processed on another compute node. If an earlier event should arrive, rollback techniques are used to undo the modeling computations to the point of the divergence, and then continue to race forward. This allows for significantly reduced run-times or improved real-time responsiveness when running complex simulations. Unfortunately, optimistic modeling caries the additional burden for developers to write code to implement rollbacks in addition to models they are developing. Writing rollback code is a relatively straight forward technique, but the errors that arise from mistakes are exceptionally difficult to diagnose. These errors often manifest themselves infrequently and are often subtle, revealing themselves in nearly correct behavior. If mistakes in writing rollback code can be prevented or detected early, then it will be far cheaper and faster to develop optimistic models. Furthermore, there is a strong desire to re-architect existing non-optimistic code into optimistic simulations. Techniques and tools that would allow the imbedding of existing time-stepped simulations and tactical code into optimistic simulations would greatly increase the adoption of optimistic modeling techniques throughout the MDA M&S community and greatly benefit the agency.

Objective:

To develop tools and techniques to improve development of optimistic models and simulations to:

Phase I:

- Analyze the three different phases of simulation development (Design, Coding, and Maintenance) for both the development of new optimistic models and conversion of existing non-optimistic code. - Identify techniques that can be developed into tools to assist model implementers in reducing the effort during these development phases. - Determine which are more valuable to pursue based on return on investment for that technique. - Develop a detailed concept description and development plan for tools based on one or more of the identified valuable techniques.

Phase II:

- Develop the tools identified in phase 1 to an initial capability level.

Phase III:

- Use developed tools in support of MDA modeling and simulation efforts.

References:

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SBIR Keyword(s):

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- Computer Systems
  - Information Technology
- Training and Education
  - Simulation
- Modeling
- Engineering

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