

Texas A&M University-Commerce Federal Initiatives Request FY 2010

Title: Development of an advanced artificial science and engineering research infrastructure to facilitate innovative computational modeling and analysis of complex electromagnetic wave propagation phenomenologies.

Description: The objectives of this proposal are twofold: (1) to implement and operate a high-powered computing grid (a virtual computing environment) that will facilitate the solution of interdisciplinary computational and engineering models, and (2) to develop a computational model of complex electromagnetic wave transmission, propagation, and reception, and analyze that model using new *Computational Science* methods within the virtual computing environment.

Relevance and Background: The emergence of high-performance computing, *computational simulation/science/engineering* along with *theoretical analysis* and *physical experimentation* have advanced discovery, learning and innovation.

The overall purpose of this project is to apply computational scientific methods to develop and implement an advanced electromagnetic wave transmission, propagation, and reception model. This will allow researchers to design and evaluate the performance of a wide range of radio frequency transmitter and receiver system configurations within a virtual computing environment. Because the model is studied within a virtual computing environment, there is no need to build a large number of physical prototypes.

Establishing this *Computational Science* model is of interest to industry because it provides scientists and engineers the robust modeling and simulation tools necessary to test and analyze the impact of various radio frequency system design alternatives. Within the artificial research environment, researchers will be able to define various transmitter and receiver system parameters, and allow environmental factors to randomly vary within specified range limits to determine an overall system configuration. The best overall performance design can be realized across the widest range of environmental alternatives. The novelty here is the use of *Computational Science* techniques to discover the complex interaction of factors such as antenna patterns, atmospheric effects on various components of the transmitted signal, transmitter and receiver performance characteristics, etc. Impacts of other signals on the overall performance of the specific link under analysis are also of interest. Investigating these impacts requires the resulting model possess the ability to account for large numbers of transmitters, the effects of terrain, varying atmospheric conditions, etc.

We are seeking funds to acquire, develop, implement and operate an advanced artificial science and engineering research infrastructure, consisting of a powerful multiprocessor "grid" computing system, and associated analytical software, such as simulation, numerical and statistical analysis, data mining algorithms, and artificial intelligence methodologies. This virtual computational grid environment will be used to facilitate modeling and analysis of complex electromagnetic wave propagation problems, as well as many other *Computational Science* models. The "grid" will be made available to other Universities and those in industry wishing to model a variety of interdisciplinary problems. Immediate results of this work will be used to develop a teaching curriculum for the study of *Computational Science* methodology.

Amount Requested: \$1,296,740

Budget/Cost**Year 1**

Graduate Research Assistant	\$141,523
Undergraduate Research Assistants	\$18,724
Faculty Salaries	\$85,221
Equipment: Computer, Servers, Software, Licenses, Maintenance	\$223,000
Travel and Conference fees	\$8,000
Educational Materials	\$5,000
Total for Year 1	\$481,468

Year 2

Graduate Research Assistants	\$86,872
Undergraduate Research assistants	\$18,725
Faculty Salaries	\$85,221
Travel and Conference fees	\$8,000
Educational Materials & Supplies	\$5,000
Total for Year 2	\$203,818

Years 3, 4 & 5 are the same as Year 2.

Year 3	\$203,818
Year 4	\$203,818
Year 5	\$203,818

Total for Years 1-5 **\$1,296,740**

Anticipated Non-Federal Resources: Unknown.

Agency/Agencies Targeted: Dept. of Defense, others

Background and Contacts:

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