**PI: Homa Karimabadi/SciberQuest, Inc.**

**Title: A Novel Data Mining Tool with Autonomous and Analytical Capabilities for Space Weather Studies**

**Abstract:** This proposal describes a research and development plan aimed at the Tools and Methods component of the LWS Targeted Research and Technology program. Our main objective is to adapt and bring in a new technology in data mining called Relevant Input Processor Network (RIPNet), which has proven very effective in other fields, into space sciences. Our recent application of this technique to space physics has demonstrated superior performance metrics (speed, accuracy, etc.) compared to standard techniques such as artificial neural net. The great speed advantage of RIPNet over traditional techniques (minutes rather than many hours and days) makes it an ideal desktop application and will be a key to its widespread use among experimentalists. RIPNet also offers a powerful reverse engineering capability. By this we mean that the outcome of the algorithm (i.e., the predicted model) is an analytical function with proper dependencies on the input parameters. The culmination of this work will be customized data mining software that can be used as a stand-alone application or be integrated into existing and future space physics data assimilation infrastructures (e.g., the Virtual Observatory). Consistent with the notional areas of interest for NASA¿s Living With a Star (LWS), our new technology should significantly increase science return from the data and enable development of more comprehensive physics-based understanding of the integral system linking the Sun to the Solar System through advanced knowledge discovery techniques (e.g., autonomous event detection, reverse engineering of time series data, etc.) that our software will provide. Although the focus of this work is on the development of a new type of data mining software, our research task also includes use of this software for a problem of great relevance to the LWS program. That is modeling of relativistic electron enhancements at Geosynchronous and Low Altitude Orbits which poses potential hazard to Earth-orbiting satellites and cosmonauts. We, however, emphasize that our software will be of general applicability and we plan to use it in the future for detection and modeling of events in the solar wind (e.g., CMEs, shocks, etc.) among others Our use of intelligent data analytic tools, i.e., computer algorithms which probe more deeply into data than first generation methods, will constitute a key step in modernization of data analysis in space physics. This in turn will help expedite the march toward a mature model of the coupling between regions and the global response of geospace to solar variations. As such, our work addresses NASA¿s objective of exploring the Sun-Earth system to understand the Sun and its effects on Earth, the Solar System and the space environmental conditions that will be experienced by human explorers.