**PI: Lawrence Townsend/University of Tennessee**
**Title: Advanced Forecasting Methodologies for Solar Particle Event Radiation Exposures**

**Abstract:** This proposal is a successor to our previously funded proposal, Advanced Warning Methodologies for Solar Particle Event Radiation Exposures (NAG5-12477). The previous work focused on the development of methods using Bayesian inference and artificial intelligence for reliably predicting proton flux, dose and dose rate versus time profiles for use in predicting ionizing dose effects in humans, electronics or other components due to solar energetic particle (SEP) event protons. That work was successful in that the methods developed were shown to be capable of providing reasonably accurate ¿nowcasts¿ of doses from SEP events that are independent of the magnitudes of the events. The methodology is also unaffected by shielding configurations since it depends only upon the magnitudes of the local dose values used as input and is independent of their sources. The work proposed herein would extend our current methodology in two areas: (1) improving numerical techniques to permit faster and more robust calculations and (2) making a connection between our work and ongoing work in the space physics community. The goal of these parallel efforts is to make faster and more reliable forecasts of flux, dose, and dose rate versus time profiles through the use of more efficient numerical methods and the connection to applicable solar observables. We also propose to deliver a prototype dose forecasting software package with an associated user and training manual at the completion of this investigation. This would be the first step in transferring a research product to a user. The proposed work supports the goals and objectives of the Sun Earth Connection (SEC) Living With a Star (LWS) program through the development of knowledge of advanced warning capabilities for SPE radiation exposures to human in space, thus linking to the goals of the NASA Vision for Space Exploration. Predicting the occurrence and magnitude of SEP events prior to coronal mass ejection (CME) and/or flare occurrence is presently beyond the space science community¿s capabilities. While our currently funded project has made significant progress towards providing a reliable warning system capable of accurately predicting particle fluxes and doses shortly after SPE particles begin to arrive, we see two urgent needs: (1) the investigation of more efficient numerical techniques and (2) the investigation of connections between our work and ongoing work in the space and solar physics communities. The proposed work involves investigations of solar energetic particle effects in human radiation exposures and therefore is directly relevant to human exploration missions in deep space including extended human expeditions to the lunar surface and Mars. The methods could also be used for missions in low-Earth orbit, such as the International Space Station. The methods are also applicable to radiation exposures of spacecraft electronics, for both human and robotic missions.