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Atmospheric and Environmental Sciences Department

Subcontract with University of Florida

Sponsor: Defense Advanced Research Projects Agency (DARPA)

Dates: June 1, 2010-May 31, 2012

Amount: \$197,595

Lightning Initiation, Propagation, Attachment, Upper Atmosphere and Ionospheric Effects

The most sophisticated level of streak photography carried out to date will be used to record the luminous components propagating along triggered lightning channels. Imaging will be restricted to the wavelengths of ~ 320 - 400 nm (or sub-bands), using near UV lenses fitted with specialized optical filters. These records will achieve an unprecedented combination of temporal (~ 1 μ s) and spatial resolution (0.5 m), documenting continuously (i.e. no gaps as with framing cameras) what occurs along the channel throughout the course of a flash. Such records will provide not only new information on their own, but complement and underpin the interpretation of many other records to be acquired in pursuing multiple NIMBUS goals. The work proposed here has particular relevance toward addressing Task 1 of the primary contract.

In Phase I, a pair of near UV streak camera systems would be prepared and subsequently deployed at the ICLRT, Camp Blanding FL, for participation in triggered lightning field studies over a 6-8 week period during the summers of 2010 and 2011. After the field studies, the photographic data collected will be catalogued and correlated with other datasets to identify the highest priority cases for detailed examination consistent with rapid advancement of the broader project's research goals. Analysis of the streak images will be carried out by the author (more than three decades experience in this area), to yield as deliverables: 1) leader propagation speeds, 2) step lengths, 3) step intervals, 4) upward connecting streamer lengths (attachment process), and, if desired, 5) temporal profiles of relative light intensity as a function of height.

In Phase II, refinements and adjustments identified via the first two years of field work will be implemented in the third and fourth summers. The final analysis of all acquired data will be carried out during the fourth year, in accordance with the needs and goals of the full team under the direction of Principle Investigator Dr. M. A. Uman. There are no proprietary claims for this work.

The cost per year would be: Phase I, \$ in year 1, \$ in year 2; Phase II, \$ in year 1, \$ in year 2.

The rationale for this approach is simple. Streak photography offers an excellent methodology to identify and quantify what is happening along the lightning channel. The specific implementation proposed here would be the highest order of such recording ever undertaken. Without question, it will provide, on its own and in concert with other planned observations, critical data for development and verification of any potentially valid model of the lightning process. The attachment process would be the main focus initially. Later, the focus could shift to the initiating leader phase (typically upward positive leaders) or any other discharge aspect identified as a priority. This technique allows for considerable flexibility and adjustment, even within a given field campaign. An example of what this technique can provide is presented in the next section.