NASA SBIR 2011 Phase I Solicitation

A1.01 Aviation External Hazard Sensor Technologies

Lead Center: LaRC

Participating Center(s): ARC

NASA is concerned with new and innovative methods for detection, identification, evaluation, and monitoring of in-flight hazards to aviation. NASA seeks to foster research and development that leads to innovative new technologies and methods, or significant improvements in existing technologies, for in-flight hazard avoidance and mitigation. Technologies may take the form of tools, models, techniques, procedures, substantiated guidelines, prototypes, and devices.

A key objective of the NASA Aviation Safety Program is to support the research of technology, systems, and methods that will facilitate transformation of the National Airspace System to Next Generation Air Transportation System (NextGen) (information available at www.jpdo.gov). The general approach to the development of airborne sensors for NextGen is to encourage the development of multi-use, adaptable, and effective sensors that will have a strong benefit to safety. The greatest impact will result from improved sensing capability in the terminal area, where higher density and more reliable operations are required for NextGen.

Under this subtopic, proposals are invited that explore new and improved sensors and sensor systems for the detection and monitoring of hazards to aircraft before they are encountered. The scope of this subtopic does not include human factors and development of human interfaces, including displays and alerts, except where explicitly requested in association with special topics. Primary emphasis is on airborne applications, but in some cases the development of ground-based sensor technology may be supported. Approaches that use multiple sensors in combination to improve hazard detection and quantification of hazard levels are also of interest.

At this time, there are some areas of particular interest to NASA, and these are described below. They are provided as encouragement but not intended to exclude other proposals that fit this subtopic. These areas of interest include two specific hazards to aircraft and specific advancements in fundamental radar technology. The interest in radar technology can be considered to be independent of the interest in the two hazards. While NASA is interested in all aviation hazards, wake vortices and turbulence are of particular interest. Proposals associated with remote sensing investigations addressing these hazards are encouraged. This emphasis is not intended to discourage proposals targeting other or additional hazards such as reduced visibility, terrain, airborne obstacles, volcanic ash, convective weather, lightning, gust fronts, cross winds, and wind shear.

Airborne detection of wake vortices is considered challenging due to the fact that detection must be possible in nearly all weather conditions, in order to be practical, and because of the size and nature of the phenomena. Proposals are encouraged for the development of novel coherent and direct detection lidar systems and associated components that allow accurate meteorological wind and aerosol measurements suitable for wake vortex characterization. Lidar development includes, but is not limited to, novel transceiver architectures, efficient signal processing methodologies, wake processing algorithms and real time data reduction and display schemes. Improvements in size, weight, range, system efficiency, sensitivity, and reliability based on emerging technologies are desired.

NASA has made a major investment in the development of new and enhanced technologies to enable detection of turbulence to improve aviation safety. Progress has been made in efforts to quantify hazard levels from convectively induced turbulence events and to make these quantitative assessments available to civil and commercial aviation. NASA is interested in expanding these prior efforts to take advantage of the newly developing turbulence monitoring technologies, particularly those focused on clear air turbulence (CAT). NASA welcomes proposals that explore the methods, algorithms and quantitative assessment of turbulence for the purpose of increasing aviation safety and augmenting currently available data in support of NextGen operations.

In order to detect and/or discriminate some meteorological hazards, future radars will need multi-frequency and/or polarimetric capabilities. NASA seeks new system/component designs and hazard detection applications for airborne weather radars based upon extending the current design to incorporate multi-frequencies and/or polarimetric capabilities. In addition, the current generation of weather radar is fundamentally limited by its ability to scan the airspace; consequently, NASA is seeking novel designs and enhancements to produce electronically scanned antennas/radars.