



NASA SBIR 2009 Phase I Solicitation

A1.04 Aviation External Hazard Sensor Technologies

Lead Center: LaRC

Participating Center(s): AFRC, GRC

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 affordable sensors. 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. This subtopic solicits technology that is focused on developing capabilities to detect and evaluate hazards. The development of human interfaces, including displays and alerts, is not within the scope of this subtopic 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, such as new sensor technologies in conjunction with existing X-band airborne radar, to improve hazard detection and quantification of hazard levels are of interest.

At this time, the following hazards are of particular interest: in-flight icing conditions, wake vortices, and turbulence. Proposals associated with sensor investigations addressing these hazards are encouraged, and some suggestions follow. Emphasis on vortices and icing is not intended to discourage proposals targeting other or additional hazards such as reduced visibility, terrain, airborne or ground obstacles, convective weather, gust fronts, cross winds, and wind shear.

To enable remote detection and classification of in-flight icing hazards for the future airspace system and emerging

aircraft, NASA is soliciting proposals for the development of sensor systems for the detection of icing conditions. Examples include the following practical remote sensing systems:

- Low-cost, ground-based, vertical-pointing with potential scanning capability X-band radar that can operate unattended around the clock (24/7/365) and provide calibrated reflectivity and velocity data with hydrometer/cloud particle classification (based upon the reflectivity and velocity data).
- Low-cost, high-frequency (> 89 GHz) microwave or infrared radiometer technology capable of providing air temperature, water vapor, and liquid water measurements for both ground-based and airborne applications.

Wake vortex detection in the terminal area is of particular interest, because closer spacing between aircraft is necessary to facilitate the high-density operations expected in NextGen. 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. Proposed techniques shall provide range-resolved clear air wind and aerosol measurements in the near-IR wavelength region from 1.5 microns to 2.1 microns. Wind and aerosol measurement with

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.