NASA SBIR 2011 Phase I Solicitation

A1.19   Technologies for Improved Design and Analysis of Safety-Critical Dynamic Systems

Lead Center: ARC

The NASA Aviation Safety program seeks proposals to support the development of robust human interactive, dynamic, safety-critical systems. The aviation Safety program is particularly interested in methods and tools that support predictive analysis of Human - Automation Interaction of mixed initiative systems in complex environments.

Information complexity in aviation systems is increasing exponentially, and designers and evaluators of these systems need tools to understand, manage, and estimate the performance and safety characteristics early in the design process. NASA seeks innovative design methods and tools for representing the complex human-automation interactions that will be part of future safety-critical, dynamic, mixed initiative systems. In addition, NASA seeks tools and methods for estimating, measuring, and/or evaluating the performance of these designs throughout the lifecycle from preliminary design to operational use - with an emphasis on the early stages of conceptual design. Specific areas of interest include the following:

- Computational/modeling approaches to support determining appropriate human-automation function allocations with respect to safety and reliability. Specifically these methods should focus on metrics that describe the robustness and resilience of a proposed human - automation function allocation.

- Analysis tools and methods that improve the application of human-centered design principles to the design and certification of mixed human-automated systems.

- Design and analysis methods or tools to better predict and assess human and system performance in relevant operational environments (e.g., future generations of air traffic management) , particularly in regards to procedural errors. Specifically, this work should include performance estimates that account for differences in training and proficiency.

- Analysis tools to support the use of mixed initiative systems in off-nominal conditions.

- Tools that provide validated human performance analysis early in the design process.

Proposals should describe novel design methods, metrics, and/or tools with high potential to serve the objectives of the Human Systems Solutions element of NASA's Aviation Safety Program's System-wide Safety Assurance Technologies project. Successful Phase I proposals should provide a literature review that on which the proposed

work is based, a detailed schedule, and should culminate in a final report that specifies, and a Phase II proposal that would realize, tools that improve the analysis process for human-automation systems in aerospace, or improves the ability to assess effectiveness of such systems during the design phase. All proposals should discuss means for verification and validation of proposed methods and tools in operationally valid, or end-user, contexts.