



INFORMATION MANAGEMENT AND DECISION ARCHITECTURES

The Information Management and Decision Architectures Branch of the Naval Research Laboratory (NRL) is seeking proposals for innovative research and development in information technology. Current and anticipated areas of research focus include:

- 1) Virtual simulations and mixed reality systems that support operational uses, situational awareness, and training, for both kinetic and non-kinetic missions. Current application areas include mobile augmented reality, virtual training environments, and interactive and automated dismounted infantry simulation and training. Research topics include information visualization techniques, adaptive user interfaces, interfaces for controlling one's avatar, multi-user distributed collaboration, system architecture and database designs, integration of novel hardware and software, training effectiveness evaluation, novel assessment techniques, adaptive training, and simulation fidelity. In all cases, NRL is interested in human factors evaluations, usability-based methodologies to quantify the costs and benefits of design choices, and understanding how system fidelity and training objectives interact and expressing results in terms of improvements in the field or live exercises.
- 2) Visual analytics systems to support multiple visual representations and multi-variate visualizations. Current work focuses on understanding of multiple data layers. Research topics include system architectures, large-scale displays (especially tiled display systems), multi-variate representations, statistical analysis techniques, and coordinated data views. In all cases, NRL is interested in human factors evaluations, new visualization metaphors, and measuring or assessing information overload.
- 3) Human Systems Integration research involving the following topics: real time physiological and behavioral measures of warfighter cognitive workload; new interfaces and interaction techniques for supervising unmanned systems; methods for training small unit decision making; new approaches for predicting and scheduling team member's tasking to enhance performance; evaluating different strategies for cross-culture trust generation.
- 4) Information management technologies that maximize the effectiveness of an enterprise (e.g., military operations) by improving its ability to act upon information that is produced and consumed within the enterprise and externally. Technologies that are of particular interest include: data management and exploitation technologies that apply emerging mathematics and information science to improve machine processing of large amounts of data, leading to a better understanding of information presented to decision makers; tools that reduce barriers to effective information use by providing intelligent notifications, mediation, access control, and

persistence services; tools to assess information quality and suitability; tools that support automated management of information. Decision architecture research that supports understanding, modeling, prototyping and evaluating effective systems that discover, process, disseminate, visualize and present information in support of military decision making. Of particular interest is research into the following topics: identify and assess essential characteristics of decision making processes, and analyze the quality of these processes; identify and analyze the essential characteristics and parameters of decision making within application domains (e.g., C2, logistics, weather forecasting); and identify, study and specify notations, techniques, methods and tools that support understanding and improving these decision processes.

- 5) Application of multi agent research and related technologies for enhancing decision support capabilities in the Global Information Grid (GIG). Areas of interest may include, but are not limited to, new techniques for mixed-initiative interactions (e.g., human-agent collaboration) as well as the application of machine learning technologies and other artificial intelligence approaches to enable flexible multi-agent coordination and teamwork in open and dynamic environments. We are also interested in the application of game theory to model agent behaviors and interactions to gain an understanding of asymmetrical warfare environments. Additional areas of interest also include new techniques for building and maintaining ontologies, new approaches for utilizing such ontologies to support subsequent agent reasoning, and application of web services and semantic web services. Operational domains of interest include, but not limited to, improving human interaction with autonomous systems, threat detection within cyber-warfare, maritime domain awareness and Stabilization, Security, Transition and Reconstruction Operations (SSTRO). Research issues dealing with autonomous systems and cyber warfare involve new algorithms for anomaly detection and pattern recognition when handling very large datasets, and techniques to improve the ability of humans to process and understand the results from these algorithms. Within the domain of SSTRO, we are interested in improving information sharing between government and non-government organizations using web technologies.
- 6) Parallel and distributed simulation technology. The emphasis is on advanced Modeling and Simulation (M&S) architectures, particularly for distributed systems. The latter includes classical cluster and shared memory architectures, as well as geographically distributed large-scale simulations. Areas of current interest include the formal description of math and physics-based models for building composable systems, natural environmental effects servers for M&S architectures, and web-based DoD technology.

Address White Papers (WP) to 5580baa@nrl.navy.mil. Allow one month before requesting confirmation of receipt of WP, if confirmation is desired. Substantive contact should not take place prior to evaluation of a WP by NRL. If necessary, NRL will initiate substantive contact.