RIVET: Rapid Interactive Visualization for Extensible Training

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The new NASA mandate calls for missions of unprecedented remoteness and duration. Challenges include high system complexity, and low training time and tolerance for error. Human capabilities remain relatively fixed and current training and instruction tools are inadequate. The RIVET team (UPenn, Orbetic, and NASA JSC) are providing computer based integrated training and instruction tools that are visually intuitive and adaptable to user skill level and context.

As humans travel longer and further in space, the tasks they need to perform will increase in variability, complexity, uniqueness, and expediency, yet there will be decreasing experience, training time, and tolerance for error. Human performance failure due to inadequate accommodation of human cognitive limitations and capabilities is a major concern on future space missions. If human cognitive performance capabilities are surpassed due to inadequate design of tools, interfaces, tasks or information support systems, mission failure or decreased effectiveness or efficiency may result. Identifying, locating, processing or evaluating information to make decisions and perform critical tasks in short time-frames in nominal and emergency situations, with limited crew size, relying on strictly local resources is extremely subject to human error.

This project will prototype and deliver an extensible (scalable) embedded training system (RIVET) based on graphical and speech interfaces for the user and procedural and non-programming interfaces for task training developers. RIVET is an instructional task visualization and embedded training tool that:

- Is based on rapid generation of procedures by non-programming methods.
- Is designed for multiple application environments (e.g., operations, maintenance, medical).
- Is sympathetic to the various manners in which instructions are provided to crew today, but which permit transformations between forms to accommodate individual preferences or work conditions.
- Is extensible (scalable) by instruction authors or other individuals, whether in flight or on the ground.
- Supports a variety of output media including 3D virtual reality (VR), navigable animations, 2D movies, text, and speech.
- Provides user interaction tools appropriate to both training and operational environments (e.g. portable systems or hands-free voice actuation).

The significance of these objectives and the methodology for procedural task simulation is that crew training and instruction will be enhanced with the concomitant expectation that human errors will be reduced, infrequent tasks can be quickly refreshed, and novel problems may be tackled. If instruction and training materials can be created, visualized, and validated by individuals who need not possess deep computer programming skills, the number and skill level of people engaged in producing this material may result in cost-savings at NASA as well.