Human Systems integration division

Man-machine Integration Design and Analysis System (MIDAS)

Objective

The Man-machine Integration Design and Analysis System (MIDAS) is a human performance modeling and simulation environment that facilitates the design, visualization, and computational evaluation of complex man-machine system concepts in simulated operational environments. This human performance modeling methodology enables the design and evaluation of procedures at early phases of a design concept.

Approach

MIDAS is a 3-D rapid prototyping research methodology that was developed to allow evaluation of operational concepts and procedures through the use of computational representations of a human operator in a virtual CAD environment. The virtual human within the MIDAS software is comprised of a physical (anthropometric) character that is linked to a computational cognitive structure that represents human capabilities and limitations. The cognitive component is made up of a perceptual mechanism (visual and auditory), memory, a decision maker and a response selection architectural component. The complex interplay among bottom-up and top-down processes enables the emergence of unforeseen and unscripted behaviours. MIDAS's hybrid architecture combines a continuous simulation with the Micro Saint Sharp discrete event simulation tool. The latter serves as MIDAS' scheduler and as the input interface for the user to build and organize the operator's procedures. MIDAS outputs include dynamic visual representations of the simulation environment, timelines, task lists, cognitive loads along 6 resource channels, situation awareness driven by the A-SA/SEEV attention allocation model, human error vulnerability and human performance quality.

Impact

MIDAS offers an integrated human performance-modeling environment to simulate, evaluate and visualize notional designs and procedures in a human-out-of-the-loop/virtual operational environment in a safe and cost efficient manner. MIDAS has been used to model military missions performed in an Apache helicopter and soldiers wearing protective gear, civil tiltrotors and commercial jets flying approaches, 911 operators responding to emergencies, virtual renditions of the shuttle cockpit, International Space Station Modules that incorporates a virtual rendition of the Space Life Sciences glove box, and commercial aircraft at airports. Recent advances have enabled MIDAS to generate multi-operator performance predictions, improved closed loop modeling capabilities (e.g. workload threshold drives time estimates and subsequent task schedule), improved integration of performance moderator functions (e.g. simple fatigue model), enhanced three stage memory model, enabled monte carlo simulation capability, enabled distributed simulation capability, and enabled stochastic human performance in response to various HSI environments.

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