Man-machine Integration Design and Analysis System (MIDAS)

Objective

Man-machine Integration Design and Analysis System (MIDAS) is a human performance modeling and simulation tool that facilitates the design, visualization, and computational evaluation of complex man-machine system concepts. 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 CAD environment. The virtual human within the MIDAS software is comprised of a physical (anthropometric) character linked to a

Source: NASA NextGen-Airportal and AvSAFE IIFDT Simulation

computational cognitive structure that represents human capabilities and limitations. The cognitive component is made up of visual and auditory perception model, an attention allocation model, a memory model, a decision maker and a response selection mechanism. MIDAS's hybrid architecture combines a continuous simulation with the Micro Saint Sharp discrete event simulation tool. The latter sequences the MIDAS tasks according to task priorities and serves as the input interface for the user to build and organize the operator's procedures. The complex interplay among bottom-up and top-down processes enables the emergence of unforeseen, un-programmed behaviors. MIDAS outputs include dynamic visual representations of the simulation environment, timelines, task lists, workload along 7 resource channels, situation awareness driven by the SEEV attention allocation model, and human error vulnerability illustrated by task completion times and rates.

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 completing parallel approach, descend and land operations at airports. Recent advances have enabled MIDAS to generate: multi-operator performance predictions (advanced flight and ATC crew) in a closed loop fashion (e.g. attention driven by dynamic information content), monte carlo simulations, and performance predictions using distributed simulations. Current research includes validating three models of nominal Closely Space Parallel Operations (CSPO) in the NextGen aviation environment. Future MIDAS efforts will build on the validated CSPO models to predict human performance in candidate NextGen off-nominal operations.

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