Human Systems Integration

As a leader in the field of human systems integration (HSI), CAE applies rigorous HSI methodologies to research and development (R&D), acquisition, capability management, and technology programs in the design of new systems and capabilities to optimize and enhance human-system performance.

CAE provides user-centric analysis, design, experimentation, and end-to-end solutions to address the growing challenge of how well humans can learn, use, and exploit technological advances. CAE is consistently working within the HSI domain to optimize designs that will ensure humans can effectively interact with their work environment.

CAE's simulation-based scenario driven approach enables the investigation of the impact of alternative concepts, designs, requirements, and decisions on human/system performance, training, and personnel. Our user-centered, simulation-based approach engages the full range of stakeholders and supports operational planning, acquisition teams, systems engineering programs, and design and development teams in making mission critical operational and design decisions.

CAE is consistently working to advance the field of human systems integration to optimize designs that will best fit how humans interact with their work environment.

Mission/function/task analysis

To build a better system, the designer must understand the user, the work, and the environment. Our HSI experts excel at the development of mission scenarios and concepts of operations and support. Our team works extensively with current and future operators and maintainers to facilitate knowledge elicitation sessions and design reviews. Through function and task analyses of those scenarios and the conduct of design reviews, our team generates user-validated project requirements and design inputs which are used by system designers to build user-centered systems. This technique also provides the foundation for developing live, virtual, and table-top exercises that measure the operational efficiency and business continuity capabilities within a single organization or across multiple organizations within all levels of government and private sector.

Human factors and human system integration plans

CAE's HSI professionals, in collaboration with the customer, develop HSI plans for complex system development projects. These plans are generated using industry-accepted human systems integration tools and processes based on international standards from the defence, nuclear, aviation, and marine communities. HSI plans are used to support the development of a system throughout the entire system engineering life cycle, ensuring the system is designed with the user requirements in mind.

Interface and workspace design

Interface and workspace design are fundamental human systems integration tasks involving the design of system interfaces such as graphical user interfaces, workspaces, operator consoles, vehicle layouts and maintenance access spaces. Interface and workspace design are critical system tasks as they impact user-system efficiency, safety, and comfort. CAE works with both the system designers and the end users to develop operator and maintainer interface style guides and detailed design specifications for user interfaces and associated workspaces. Our team has extensive experience designing operational interfaces including command and control systems, vehicle crew stations, and command centres.

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User evaluations

CAE works with system designers to evaluate the usability and utility of system interfaces, workspace layouts, and vehicle layouts using highly-structured user evaluation methodologies, resulting in prioritized feedback to the development team. Evaluation methodologies range from heuristic assessments relying on the expertise of CAE HSI resources to human-in-the-loop evaluations involving the user community performing realistic tasks with the system under evaluation. Our team excels at the use of virtual simulation to evaluate and measure the effectiveness of system designs through the development process. When the final systems are completed, our team has extensive experience repeating those virtual experiments during field trials to ensure the interaction between the user and the system meets expectations and requirements as defined in the virtual environment.
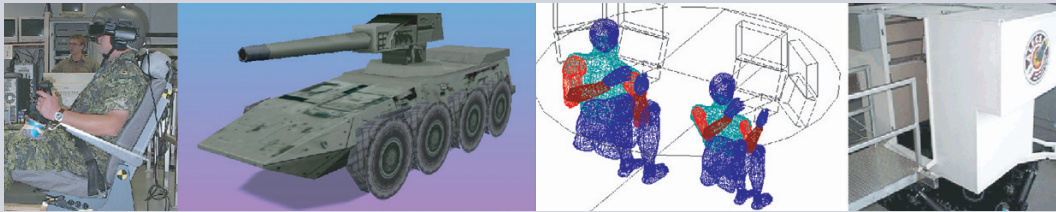
Human behaviour modeling

CAE is a leader in the application of human behaviour modeling techniques to compare system performance, evaluate design alternatives for immersive and real vehicle simulations, and predict human performance and workload prior to virtual and field-based trials of real systems. The application of human behaviour representations within virtual environments allows designers to predict system performance during development and to provide realistic training scenarios without expending the associated costs of developing complex human-in-the-loop or live simulations involving multiple operators. CAE is using its extensive experience in developing behaviour models to enhance computer generated force simulation realism for application in simulated mission rehearsal, training, and experimentation environments.

Simulation-based design reviews

Our HSI and modeling and simulation teams work together to develop visualizations of system designs, as well as standalone or distributed synthetic environments, for use in design reviews with future users to evaluate the system in the context of relevant operational scenarios. Our in-house labs can be configured for simulation-based design reviews.

Project example – Multi-Mission Virtual Vehicle

The Multi-Mission Virtual Vehicle (MMVV) program was a collaborative effort by the Canadian Department of National Defence and General Dynamics Canada to design and evaluate a series of advanced vehicle concepts that included multi-mission capabilities in a network-centric environment. The MMVV integrates with additional unmanned tactical air and ground vehicles for remote target identification and engagement. CAE's HSI team provided the full-scope HSI support for the MMVV project. This support included the development of the MMVV human-machine interface (HMI), which includes a 360° panoramic camera system (PCS), thermal imagery, integrated tactical navigation and battle management systems, automatic target detection and recognition, a full-spectrum defensive aids suite (DAS), and the multi-mission capability. Additional support was provided through the conduct of extensive user reviews to evaluate the HMI and assess operational concepts pertaining to the role of the MMVV within the force structure. Distributed constructive and virtual simulation-based lab evaluations were performed to evaluate the effectiveness of the multi-mission capability and interoperability of the proposed MMVV technologies within the theatre of operations.

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