

# Capability Engineering for C4ISR

Defence organizations around the world are focused on building modern, agile forces – forces that are built for rapid deployment and are interoperable with multinational and multi-agency teams. The development of the modern force has seen a shift in procurement theory from platform-centric solutions to capability-based solutions. Emphasis is on the development of a ‘system of systems’, recognizing the importance of the ‘people, process, and materiel’ elements of a capability. This transformation has identified four main challenges to capability development:

- System-of-systems performance;
- Operational effectiveness;
- Personnel roles, responsibilities, and organizational structures; and
- Human performances issues, such as situational awareness, task performance, decision making under stress, workload, and collaboration.

The cornerstone to today’s modern forces is an effective C4ISR capability – Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance – a capability that is interoperable, integrative, efficient, and effective in responding to today’s demanding mission needs. CAE Professional Services applies a capability engineering (system-of-systems) approach to C4ISR capability development, offering a framework to address the key challenges to capability development, while identifying cross-system interdependencies and supporting broad visibility for stakeholders. Our team uses simulation-based evaluation tools to analyze alternative capability solutions in the evolving defence environment.

## Capability requirements analysis

C4ISR scenario and mission development and definition in a system-of-systems environment demands an overarching, common and integrating architectural framework to capture dynamic and multi-faceted interface relationships. CAE Professional Services’ multidisciplinary teams use the latest generation of groupware and decision support tools to ensure that these dynamics are captured in the rapid conduct of capability-level requirements analysis.



## Capability design

Our experience with the decomposition of C4ISR scenarios and missions into C4ISR system functions identified the limitations of existing architectural frameworks such as the Department of Defense Architectural Framework (DoDAF). CAE Professional Services has extended DoDAF’s Operational, Technical, and System Views structure to include Human Views. Human Views address the human performance element of a capability – how the users interact with the system in terms of situational awareness, workload, task performance, and training. This extension increases the options for closing the capability gap in data fusion and command centre design by seeking an optimized blend of people, processes, and technology.



## Capability performance metrics and trade-off studies

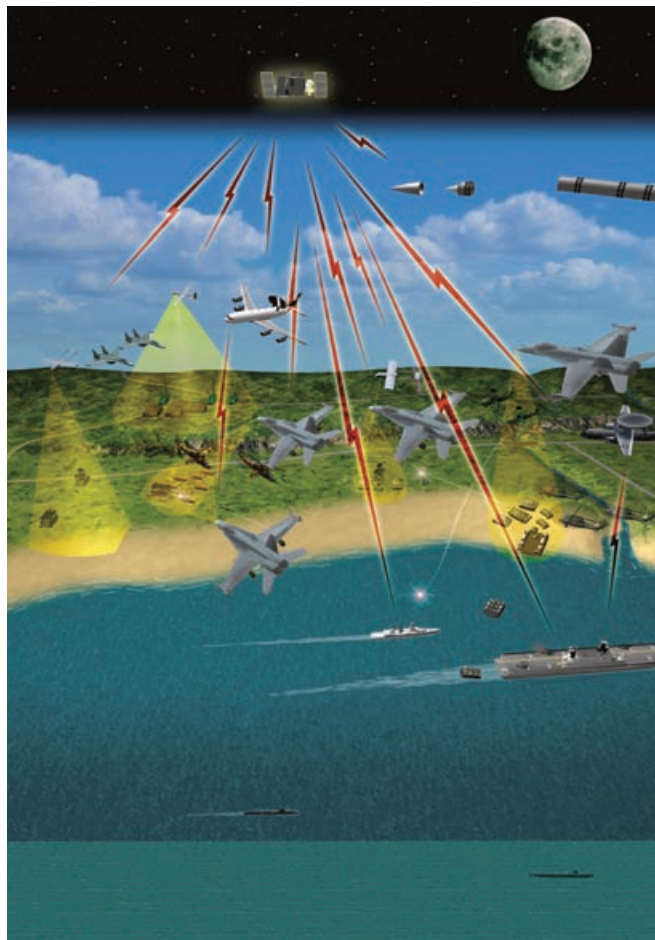
CAE Professional Services' capability engineering approach takes the "as is" and incorporates an analytical environment with simulation-based analysis tools to define capability performance metrics and to conduct trade-off studies to achieve the optimal "to be" end state. Our expertise includes the development of enterprise-level simulations and uses a variety of leading-edge architectural analysis tools to support the evaluation and design of alternative capabilities for C4ISR performance.

## Human impact analysis

Our user-centred, simulation-based approach allows the CAE Professional Services team to predict and analyze the impact of alternative C4ISR designs on human performance for both individuals and teams. This includes impact studies on task performance, workload, and situational awareness as well as on personnel systems to address issues such as recruitment, occupational trade structures, and career and promotional paths.

## Project example

CAE Professional Services is currently involved in a C4ISR Study sponsored by the Department of National Defence. The first phase involved completion of a structured analysis to determine how a Capability Engineering approach could assist Force planning. It involved establishing the operational context, reviewing and assessing existing data and developing a detailed work program. Subsequent phases will include generation of architectural views of 'As Is' and 'To Be' systems with a view to identifying overlaps and prioritizing gaps. The study outcomes will be used by the Department to revise the current C4ISR Campaign Plan and adjust the capital acquisition project portfolio.



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