

Configurable Aerospace Command and Control (CACC)

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ABSTRACT

The Configurable Aerospace Command and Control (CACC) program is an evolving concept for a virtual Command and Control (C2) capability that is responsive to the dynamic nature of the future AF operations. It is driven by the needs of the future Joint Force Air Component Commander (JFACC) to be able to respond to a variety of operational scenarios ranging from Major Regional Conflicts (MRC) to Operations Other Than War (OOTW). To respond to this spectrum of requirements with the new Expeditionary Aerospace Force (EAF) concept, key elements of the C2 capability will have to be deployed with the Expeditionary Air Forces (EAFs). To meet the demands of rapid response and minimal airlift, the initial deployed elements will, of necessity, be limited in physical capacity. Heavy dependence will be made of reachback to in-garrison assets to perform many of the C2 functions in collaboration with the deployed elements. As the operation proceeds, the C2 field requirements and needs will change with the evolution of the operation. The CACC will demonstrate the ability of a C2 information system to adapt to the changing needs of dynamic battle management.

The program's goal is to develop, prototype, and demonstrate technologies for a forward command center infrastructure serving the needs of key decision-makers and staffs of future EAFs. More specifically, the CACC will provide mobile, scaleable, distributed command and control capabilities for forward deployed elements of EAFs and will include dynamically reconfigurable computing and communications architectures, enhanced collaboration environments, intelligent information management facilities, and embedded training and performance enhancement tools. The research and development efforts under the CACC will be focused on technologies that provide deliverable capabilities in the following four core capability areas:

- Mobile, Scaleable, Adaptive Distributed Architectures
- Enhanced Visualization and Collaboration Environments
- Dynamic Information Tailoring
- Integrated Training / Intelligent Performance Enhancement

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A. Mobile, Scaleable, Adaptive Distributed Architectures

With the ever-widening scope of operational environments in which air power is being employed, Air Force C2 nodes must provide commanders with the appropriate functionality to support a variety of operational scenarios from Major Regional Conflicts (MRC) to Operations Other than War (OOTW). Furthermore, given the mandate for rapid expeditionary deployments into these evolving crisis environments, the C2 infrastructure must be one that is able to adapt dynamically to the unfolding scenario without system downtime or the need for large contingents of system administrators to reengineer the computing or communication architectures. The limited resources available early in a deployment must be able to support a considerable variety of application tools and permit non-discontinuous transitions among them as the situation dictates. This dynamic system reconfigurability should encompass both the physical and functional realms. In other words, the hardware footprint must be variable-sized based on what equipment can be airlifted into theater in a given amount of time, and the functionality provided by the application software must be able to evolve seamlessly to respond to changing operational needs. For example, consider a humanitarian relief scenario. Upon arrival a DIRMOBFOR and his staff will need mobility scheduling and tracking functionality with reachback to the TACC at Scott AFB. If civil strife erupts shortly thereafter, and air support is needed, a JFACC may be sent forward and demand intelligence, ATO monitoring capabilities with reachback to the ROSC, in addition to mobility tools. The hardware, software, and communications infrastructures need to adapt and evolve to the changing nature of the mission without breaking the stride of the battle rhythm. CACC envisions intelligent, scaleable resource-aware distributed architectures to make this a reality.

B. Enhanced Visualization and Collaboration Environments

The distributed nature of future EAF employment scenarios demands collaboration tools and visualization environments that support virtual C2 teams by enabling more natural human-machine interfaces, truly shared workspaces, and simpler functionality. Today's emerging collaboration environments provide either a general-purpose workspace-oriented model or an application-specific model that tightly integrates the mode of collaboration to the overall process being performed. Each environment, while ideally suited for one process or user, may fail when used in a differing contextual process. Yet, command centers need to support multiple environments for the multiple roles and processes they execute. The CACC provides an infrastructure that allows multiple collaboration environments to exist and interact within the command center architecture. Thus, the ATO planning team can utilize a collaborative environment geared towards the efficient, distributed production of mission sorties while the Commander and his staff can simultaneously use a completely different collaborative environment, which is best suited for strategic assessment and development. Moreover, the CACC infrastructure allows the two environments to interact so that ATO planners can join, exchange, and present information to the Commander while each remains within their specialized collaborative metaphor.

As another aspect of configurability, these next-generation environments must adapt to the hardware and communications limitations imposed by operational realities. Audio and video tools, for instance, must be able to dynamically modify their bandwidth demands (e.g. with reduced quality) if higher-priority traffic is inbound. The command center must provide the right amount of collaboration and visualization support based upon the deployed resources, and must

adjust, up or down, that support as resources are added or consumed. The CACC will prototype such advanced tools and interfaces.

C. Dynamic Information Tailoring

In an increasingly data-intensive C2 environment, commanders and their staffs need tools at their disposal that permit the rapid assimilation of pertinent, mission-critical information and the filtering out of spurious inputs to facilitate rapid, accurate, and more confident decision-making. The danger of information or cognitive overload is an increasing reality in fast-paced evolving crises. To avoid this hazard, the CACC program will investigate intelligent agent-based technologies to enable decision-centric presentation of “precision-targeted” information in response to user requirements (JFACC, AADC, DIRMOBFOR), specific mission needs (airlift, ISR, time-critical targets), or distinct functional demands (strategy, targeting, assessment). The objective will be an information system that automatically responds to dynamic crisis scenarios with seamless transitions through application domains, presentation layouts, and collaboration sessions with minimal technical staff intervention. The payoff for this approach is ensuring commanders get *what* they want, *when* they want it, and *how* they want it.

D. Embedded and Integrated Training

The Air Force Command and Control Training and Information Center (C2TIC) has identified the need for enroute theater qualification training and “plug and play” online training capabilities. The rapidly mobile nature of expeditionary operations will necessitate effective and swift preparation of C2 staffs for their operational environment. Additionally, the maintenance of finely honed skills will be a challenge the longer troops are away from their garrison training facilities. To address these needs, the CACC program will endeavor to integrate embedded training functionality to the infrastructure it develops. This training can include currency training, theater certification, and scenario-based exercise generation to drill staff responsiveness and procedural knowledge. The technologies involved include intelligent tutors, pedagogical training tools (versus on-line briefs), and user-tailored coaching.