THE INTERNATIONAL

C2 JOURNAL

VOLUME 5, NUMBER 3, 2011

SPECIAL ISSUE

Integrating Air, Land and Sea Operations: C2 Teams and their Technologies

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Focus & Convergence for Complex Endeavors

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The Need for Dynamic Airspace Management in Coalition Operations

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Abstract

The United States' Central Command (CENTCOM) has highlighted Airspace Command and Control (AC2) as an area where national, ISAF, and NATO systems can deliver enhanced benefits to forces in the Afghanistan theater of war through leveraging a new CENTRIXS-ISAF (CX-I) Afghanistan Mission Network (AMN). There is a need to streamline AC2 procedures and find the right mix of battle command systems to most effectively and efficiently perform AC2 planning and execution in a coalition environment on CX-I/AMN. The Coalition Attack Guidance Experiment (CAGE), conducted in May 2010, took the constructs developed by a CENTCOM Operational Planning Team AC2 Working Group and experimented with solutions that can have a direct positive operational effect in the near term; CAGE also focused on future capabilities and potential solutions. This manuscript will identify how CAGE contributed to evolving coalition AC2 operations toward Dynamic Airspace Management - a mission-execution centric approach - versus today's planning-centric processes. The efficacy of the U.S. Army's Tactical Airspace Integration System (TAIS) Dynamic Airspace Collaboration Tool (DACT), as demonstrated during CAGE, will be analyzed as one tool available today to improve coalition AC2 processes on CX-I/AMN.

Introduction

The United States' Central Command (CENTCOM) has highlighted Airspace Command and Control (AC2) as an area where national, International Security Augmentation Force (ISAF), and North Atlantic Treaty Organization (NATO) battle command systems can deliver enhanced benefits to forces in the Afghanistan theater of war through leveraging a new CENTRIXS-ISAF (CX-I) Afghanistan Mission Network (AMN) (CENTCOM 2009, 1-14). In addition to establishing and maintaining free flow of operational AC2 data between Coalition/NATO forces on CX-I/AMN, there is also a need to find the right mix of battle command systems to most effectively and efficiently perform AC2 planning and execution in a coalition environment.

Execution of AC2 today is heavily reliant on chat tools. While providing a rudimentary text messaging collaboration capability, these tools lack the capability to present a common visualization and representation of data and they do not offer 3D collaboration or approval of airspace requests in real time. Most AC2 functions revolve around a deliberate planning process and the procedures do not adapt well to time sensitive mission execution requirements—requirements which demand real-time changes to airspace, coordinated with all applicable airspace stakeholders in order to facilitate immediate approval.

The Coalition Attack Guidance Experiment (CAGE)

Under the auspices of the CENTCOM CX-I/AMN Operational Planning Team (OPT), several workshops and experiments were held to address these issues. The Coalition Attack Guidance Experiment (CAGE), conducted in May 2010, served as a venue to experiment with solutions for ISAF that can have a direct, positive operational effect in the near term, and to also focus on future capabilities and improvements. The Canadian Forces Warfare Centre (CFWC) executed CAGE at their Joint Battle Lab in Ottawa, Canada. (National Defence Headquarters 2010, 1)

The aim of CAGE was to analyze battlespace management and integration technologies and processes to identify opportunities to increase situational awareness, freedom of maneuver, effectiveness of fires, and AC2 processes. CAGE, a human-in-the-loop experiment, utilized experienced operations personnel in a representative Afghanistan scenario to focus on both joint fires support and AC2 domains within the ISAF shared command and control AMN configuration. (National Defence Headquarters 2010, 1)

Although other commands and agencies design and execute what may appear to be similar events, CAGE was unique in several respects. For example, AGILE FIRES is a Joint U.S. Army and U.S. Air Force experiment that focuses on improved AC2 processes, procedures, and C2 systems, but it does not currently incorporate coalition mission threads and players. Other exercises such as ALLIED AURORAS, the Coalition Warrior Interoperability Demonstration (CWID), and the Joint Forces Expeditionary Experiment (JFEX) series of exercises incorporate coalition play, but they are broad in scope and do not fully focus efforts on the subset of AC2 gaps and issues against real world scenarios and ongoing missions in Afghanistan.

U.S. Army Battle Command systems that participated in CAGE were the Tactical Airspace Integration System (TAIS) with a web-based Dynamic Airspace Collaboration Tool (DACT), Advanced Field Artillery Tactical Data System (AFATDS), Aviation Mission Planning System (AMPS), Command Post of the Future (CPOF), and Global Command and Control System-Army (GCCS-A). These U.S. Army systems interfaced and interoperated with the Canadian Land Combat Support System (LCSS) and programs common to both nations, including the Joint Automated Deep Operations Coordination System (JADOCS), Theater Battle Management Core System (TBMCS), and Air Defense System Integrator (ADSI). NATO's Integrated Command and Control (ICC) system was also integrated within the Canadian Joint Fires Support testbed to analyze the evolving coalition C2 shared AMN configuration for the ISAF in Afghanistan. CAGE was designed to provide an operationally relevant, realistic experiment with the ISAF Regional Command South (RC-S) order of battle, real-world products, Afghanistan terrain database, and scenario. Focusing CAGE on the current fight provided a mechanism to produce revised Concepts of Employment (CONEMPs) and Tactics, Techniques, and Procedures (TTPs) that could be rapidly provided back to the warfighter to influence immediate improvements, versus the usual experiment paradigms that focus on the future force and technologies. (National Defence Headquarters 2010, 1)

CAGE was split into two conditions with each condition exercising three operational experiment phases (Figure 1). Phase 1 was cordon and search. Phase 2 was transition to occupy and expand the area captured in Phase 1 into a coalition Forward Operating Base (FOB). Phase 3 was insurgent counter-attack against the newly established, immature FOB.

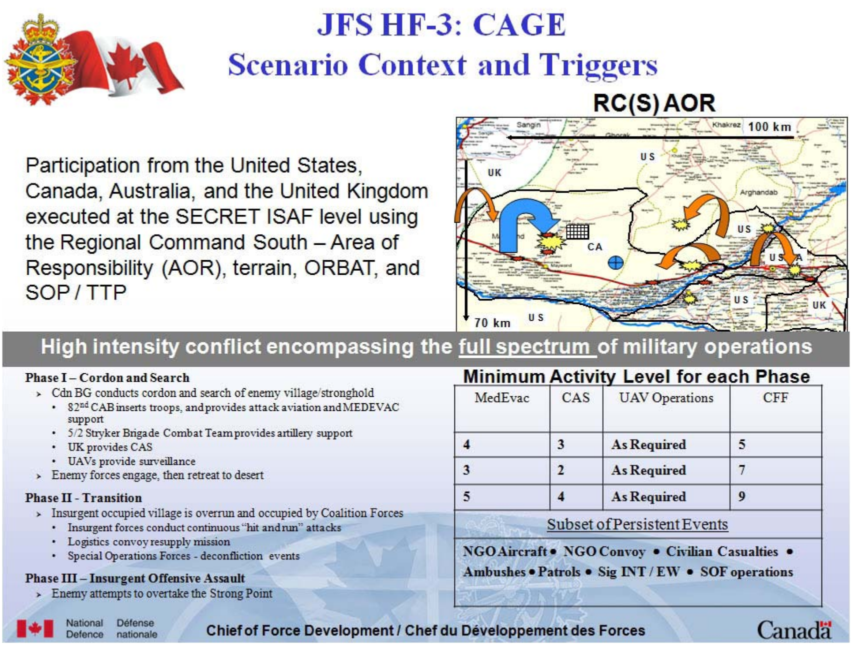

Figure 1. CAGE

Condition 1 consisted of operations “as-is”, and did not leverage other nations’ net-capable tools. Cells were established to replicate a Canadian Task Force Kandahar (TFK), a U.S. Army Combat Aviation Brigade Task Force Pegasus (TFP), and a Higher Control (HICON) to provide an interface to elements such as the ISAF Regional Command-South (RC-S) airspace cell, the U.S. Air Force Control and Reporting Center (CRC), and other key nodes. During Condition 1, airspace coordination and execution involved exchanging data messages between national systems using sendmail protocols, shared network folders, Voice Over Internet Protocol (VOIP), and a chat program. TFK primarily used JADOCS, TFP used TAIS, while RC-S headquarters and the CRC used JADOCS and ICC.

In Condition 2, the TAIS DACT (Figure 2) was exposed for use by all commands. The DACT is a web accessible, 3D mapping thin client that allows any user on the network to observe and participate in the AC2 planning or execution process with TAIS. The DACT, powered by an open 3D mapping engine developed by NASA, can be accessed by navigating to the TAIS server via a web browser. Once approved by the TAIS operator, the DACT user has access to a host of information from the TAIS. This includes visual and textual representations of the Airspace Control Order (ACO), Airspace Control Means Requests (ACMRs), and airtracks. DACT users also have the ability to create, draw, and submit their own ACMRs and track the status of those ACMRs. Users of the DACT can also collaborate with other DACT users or TAIS operators on an ACMR, interactively modifying Airspace Control Measure (ACM) information in real-time. Condition 2 allowed CAGE participants to visualize current and immediate changes to the airspace, plus near-real-time airtracks, to assist them in making expeditious decisions.

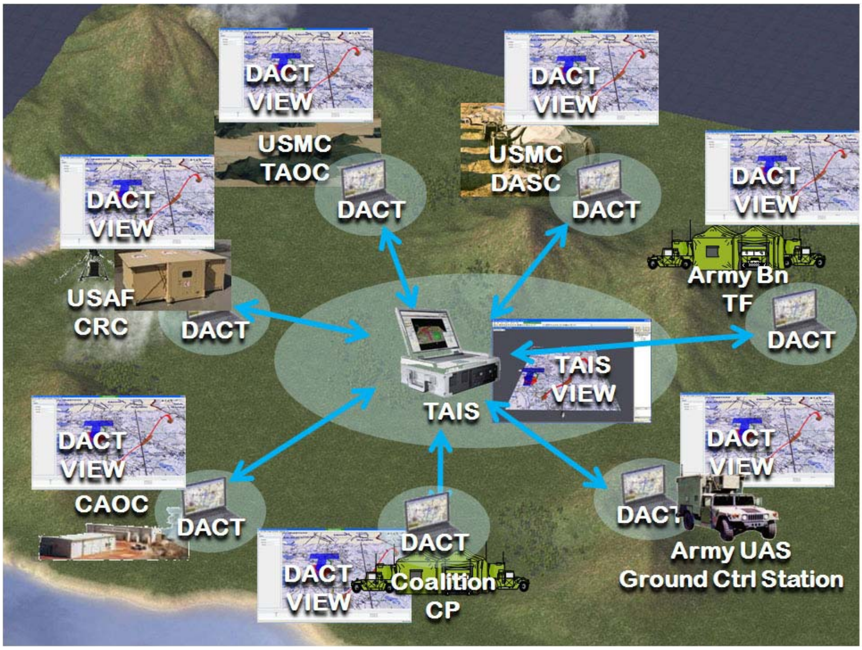

Figure 2. TAIS and DACT Shared Visualization and Collaboration

The dominant driver of airspace requests during CAGE was immediate missions that did not need to be approved by the Joint Forces Air Component Commander (JFACC)/Airspace Control Authority (ACA) at the Aerospace Operations Center (AOC). Since the USAF CRC was granted authority for these missions, they did not need to be submitted to TBMCS at the AOC for inclusion in the daily ACO or change ACO. Missions requiring rapid response, such as MEDEVACs, fire missions, and close air support were initiated at the task force level and communicated to RC-S for deconfliction approval and CRC clearance. RC-S, using VOIP and chat would communicate back with the requesters to discuss intentions, changes, conflicts, and other pertinent details. Once a consensus had been reached by all stakeholders, the requests would be approved or denied accordingly.

RC-S and CRC role players found that one of the most useful mechanisms for deconflicting and clearing airspace in Condition 1 was to use the Global Area Reference System (GARS) grid to designate areas to clear. TFK used JADOCS to construct airspaces based on the GARS grid, and would communicate those grids over chat and VOIP. These grid values could be quickly and easily communicated to the CRC for rapid clearance.

Once the DACT was introduced as part of Condition 2, RC-S and CRC were able to work more efficiently by sharing the same airspace picture and receiving access to full 3D visualization with terrain. The CRC role player from the U.S. Joint Forces Command (JFCOM) stated that the 3D visualization of airtracks and airspace volumes provided great benefit in fulfilling his mission as the CRC. Both RC-S and the CRC were able to discern aircraft and airspace conflicts within seconds of the ACMR being submitted to the TAIS. This was particularly evident during TFP fire missions where the AFATDS would generate a precise Munition Flight Path (MFP). This MFP clearly showed the arc which the munitions would follow, and made it very easy to determine if aircraft flying under the arc were in any danger from the fire mission.

During a High Mobility Artillery Rocket System (HIMARS)/Army Tactical Missile System (ATACMS) fire mission, as soon as AFATDS had the firing solution calculated, it transmitted ACMRs representing the Position Area Hazard (PAH), the Target Area Hazard (TAH), and the Munition Flight Path (MFP) trajectory arc to the TAIS (Figure 3). TAIS immediately checked ACM-to-ACM conflicts for incoming ACMRs against the current Unit Airspace Plan. The ability to immediately visualize the geometries and their relation to other geometries greatly increased the RC-S headquarters' ability to clear fire missions and significantly decreased the amount of time required for approval. The ability to visualize the aircraft in three dimensions against those fire mission geometries enabled the CRC to make informed, immediate decisions regarding airspace clearance. RC-S and the CRC, enabled with the DACT, were able to clear cross-boundary airspace for fires where U.S. Army firing batteries were supporting a Canadian fire mission in under a minute. This was a significant achievement and it highlights the importance of seamless digital transference of time critical data to enable knowledge management and situational understanding.

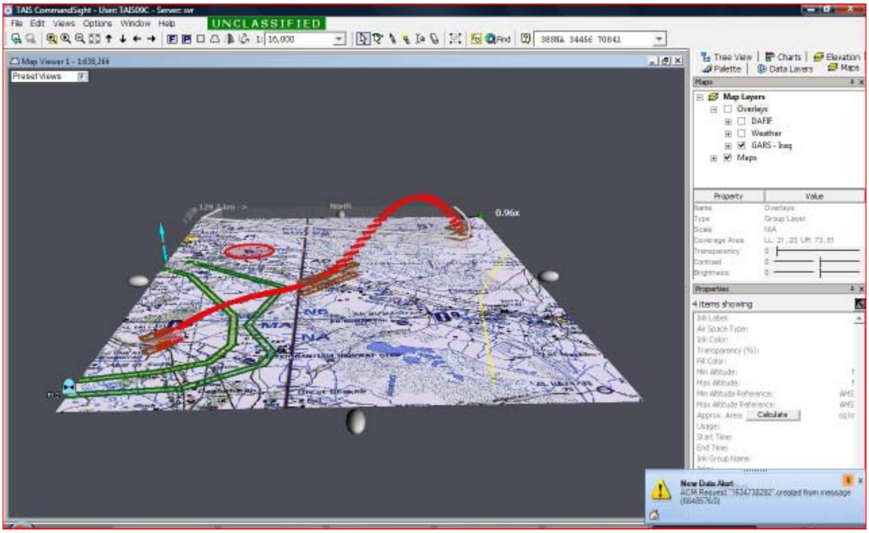

Figure 3. Munition Flight Path as Seen on TAIS or DACT

Users agreed that the data made available through the DACT was invaluable. At any given time, the users had complete visibility of the current and pending airspace. This was particularly evident at the RC-S/CRC cell in the CAGE HICON work area, where five users simultaneously used the DACT to monitor current and in-progress airspace actions.

Although the TAIS DACT is but one component of moving from static, planning-centric processes toward more dynamic airspace management, CAGE clearly demonstrated the value of shared collaboration, visualization, and situational understanding to enable more timely approval practices with lower inherent risk by leveraging common tools available over a shared mission network. U.S. Army Battle Command systems will continue to explore opportunities to evolve toward dynamic airspace management in future experiments.

Army Battle Command envisions a consortium of capabilities on a common hardware platform. This effort, known as Battle Command Convergence, will consolidate maneuver, fires, logistics, and airspace C2 functions into a common architecture. The Command Post of the Future (CPOF) will form the basis for this product line consolidation with a supporting effort of enhanced web services. These additional web services beyond the DACT will provide even more opportunity to explore how to improve coalition processes and enhance C2 for all forces.

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