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COALITION COMMAND AND CONTROL IN THE NETWORKED ERA

IMPROVING COALITION BLUE FORCE SITUATIONAL AWARENESS FOR LAND TACTICAL OPERATIONS

(I-085)

TOPIC: COALITION INTEROPERABILITY

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ABSTRACT

During recent conflicts, there have been many examples of how Coalition Blue Force Situational Awareness (CBFSA), principally between US and UK forces, could be improved leading to more efficient and effective battle management, increased operational tempo and contributing to reduced fratricide. A US/UK project to develop a CBFSA Capability Concept Demonstrator (CCD) achieved a major break-through by demonstrating inter-operability between the US family of Blue Force Tracking systems and the UK Bowman system as an early forerunner to the Multi-lateral Interoperability Programme and a parallel development on Coalition Combat Identification. The aim of this paper is to publicise this new capability by presenting a review of the need for CBFSA, describing the prototype capability and the development and assessment trials, and then reflecting on the technical and military findings and their implications for a future operational capability. What at first might appear to be a simple case of connecting the systems together and exchanging messages between them grossly underestimates the issues involved. Robust connectivity both within and between national systems is key to achieving acceptable end-to-end information exchange performance. However, matching security measures between nations with different policies presents significant challenges. Also, differences in US and UK military doctrine requires clear and well understood concepts of use and careful management of expectations for such a capability. The CCD provided significant risk-reduction for the project in all of these areas ahead of transformation to an operational capability.

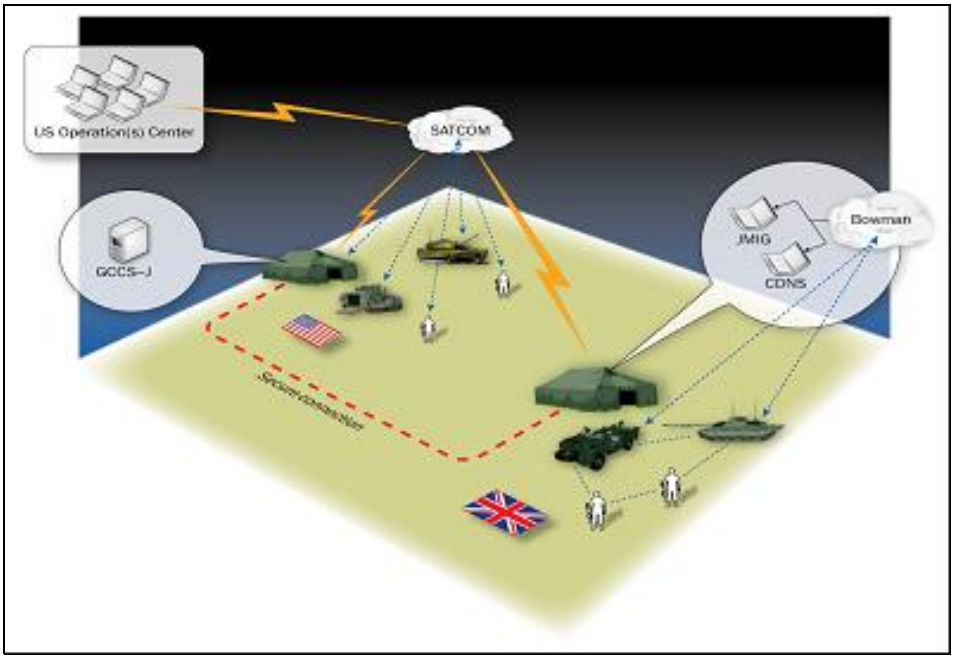
N.B. The paper is unclassified and therefore necessarily avoids the classified aspects of the project.

INTRODUCTION

CBFSA[1] is a joint US/UK project, the purpose of which is to develop and evaluate technical options for the exchange of BFSA [2] data between UK Bowman and the US family of BFT [3] systems. The project has successfully completed a series of technical development and assessment trials that have demonstrated both a working capability and the nature of the real operational benefits that can be achieved. The aim of this paper is to publicise this new capability by presenting a review of the need for CBFSA on coalition operations, describing the prototype capability and the development and assessment trials, and then reflecting on the technical and military findings and their implications for a future operational capability from the authors' point of view (at an unclassified level).

Background

CBFSA is the subject of a formal Project Arrangement between the US Secretary of Defense and the UK Secretary of State for Defence dated June 2004 [1]. The project has been under development since June 2004 as a forerunner to wider coalition efforts such as MIP [4] and a parallel development on CCID [5].



The project is jointly sponsored by the UK MoD and the US DoD. The UK military lead was delegated to Deputy Directorate of Equipment Capability, Tactical Command & Battlespace Management supported by the Defence Procurement Agency (BATCIS IPT [6]). The US military and technical lead was delegated to US Strategic Command's Army Component, SMDBL [7].

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1 Coalition Blue Force Situational Awareness
2 Blue Force Situational Awareness – general information on own force locations often with a modest time delays.
3 Blue Force Tracking – this differs from BFSA in that it provides a near-real-time picture of platform positions.
4 Multi-lateral Interoperability Programme
5 Coalition Combat Identification
6 Bowman And Tactical Command Information Systems Integrated Project Team
7 Space & Missile Defense Battle Lab

The authors of this paper, Andrew H Smith and Rick Koon, were respectively: the UK Trials Director and co-leader of the assessment programme on behalf of the BATCIS IPT and the US Trials Manager and co-leader of the assessment programme on behalf of SMDBL.

Why invest in CBFSA ?

Defence planning is made on the assumption of alliance and coalition operations in scenarios that are difficult to predict and which often arise at short notice. Thus the nature and composition of a force structure to meet military requirements will be specific to that requirement and based upon a general and flexible military capability. The successful execution of fast moving operations demands an accelerated decision-action cycle, increased tempo of operations, and the ability to conduct operations within combined/multinational formations.

A number of assessments of potential increases in the speed of operation of digitized land forces (sub-unit to battlegroup) due to enhanced shared awareness [2], [3], found blue losses to be significantly reduced. The planning and early manoeuvre phase of hasty attacks (up to crossing the line of departure) was significantly quicker compared to non-digitized units [2], [3].

One of the lessons learned from operations in Iraq was that coalition partners were unable to see digitized battlefield representations of each other. A quick fix to this problem was to provide coalition partners with US systems (i.e. FBCB2 [8]) that would provide such capability. During these operations, a company commander in the 1 RRF battlegroup used FBCB2 to de-conflict the movement of his company group in order to get to the line of departure for a Company group attack. The company group had to cross a main supply route which was heavily trafficked. The Company commander used FBCB2 to identify a gap in the traffic on the Main Supply Route and then coordinated the move of his sub-unit. This allowed him to generate tempo which resulted in the objective being seized 12 hours before the other battlegroup objectives were seized [4].

Several different analyses of fratricidal incidents in many operations show that failures in command and control (C2) along with situational awareness contribute to around 40% of incidents [5], [6], [7], [8], [9], [10].

The UK is currently fielding the Bowman system. One of its capabilities is to provide the information necessary to develop a BFSA COP [9] at both the tactical and operational levels. The Bowman system is not directly compatible with any existing US BFSA system.

The CBFSA project was designed to address the problems US and UK tactical combatant commanders face in maintaining situational awareness between forces in an increasingly digitized environment. The need for national systems to exchange BFSA (i.e. the wider contextual picture) and BFT (i.e. low-latency specific platform movements, to support CCID) information is crucial to reducing fratricide and improving battle-space situational awareness. CBFSA will <u>not</u> provide CCID, rather an overall situational awareness capability.

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[8] Force XXI Battle Command Brigade and Below – a tactical C2 system also known as Blue Force Tracker.
[9] Common Operating Picture

CBFSA CAPABILITY CONCEPT DEMONSTRATOR

The CBFSA project employed a CCD to develop interoperability between the UK Bowman system and the US family of BFSA systems. The UK Bowman system including ComBAT [10] and known collectively as BCIP [11]. The US family of systems includes GCCS [12], C2PC [13] and US BFT/BFSA devices such as FBCB2, MTS [14], and Talon Reach. In addition to demonstrating interoperability, the project is supporting the US development of CONOPS [15] and TTPs [16] and the UK development of CONUSE [17] and SOPs [18] for CBFSA. An imperative of the CBFSA project was to complement existing US and UK equipment programmes i.e. it should not delay or disrupt them or require additional capability to be delivered by them.

The CBFSA technical architecture is described in a System Architecture Document for CBFSA (Unpublished) The figure below shows a simplified, schematic view of the CBFSA technical architecture. It shows all the major components of the system and the general information flows between them.

The trials were successful, meeting their key objectives and gathering valuable military utility and technical performance data [11]. CBFSA is the only system of its type that works and has been demonstrated to do so, which should give sponsors, procurement managers and end users considerable confidence in future coalition situational awareness programmes. Very encouraging feedback was received during the capability demonstrations, especially from some of the VIP visitors including General Pace the incoming US Chairman of The Joint Chiefs of Staff and Air Marshall Sir Glenn Torpy the UK Commander of Joint Operations.

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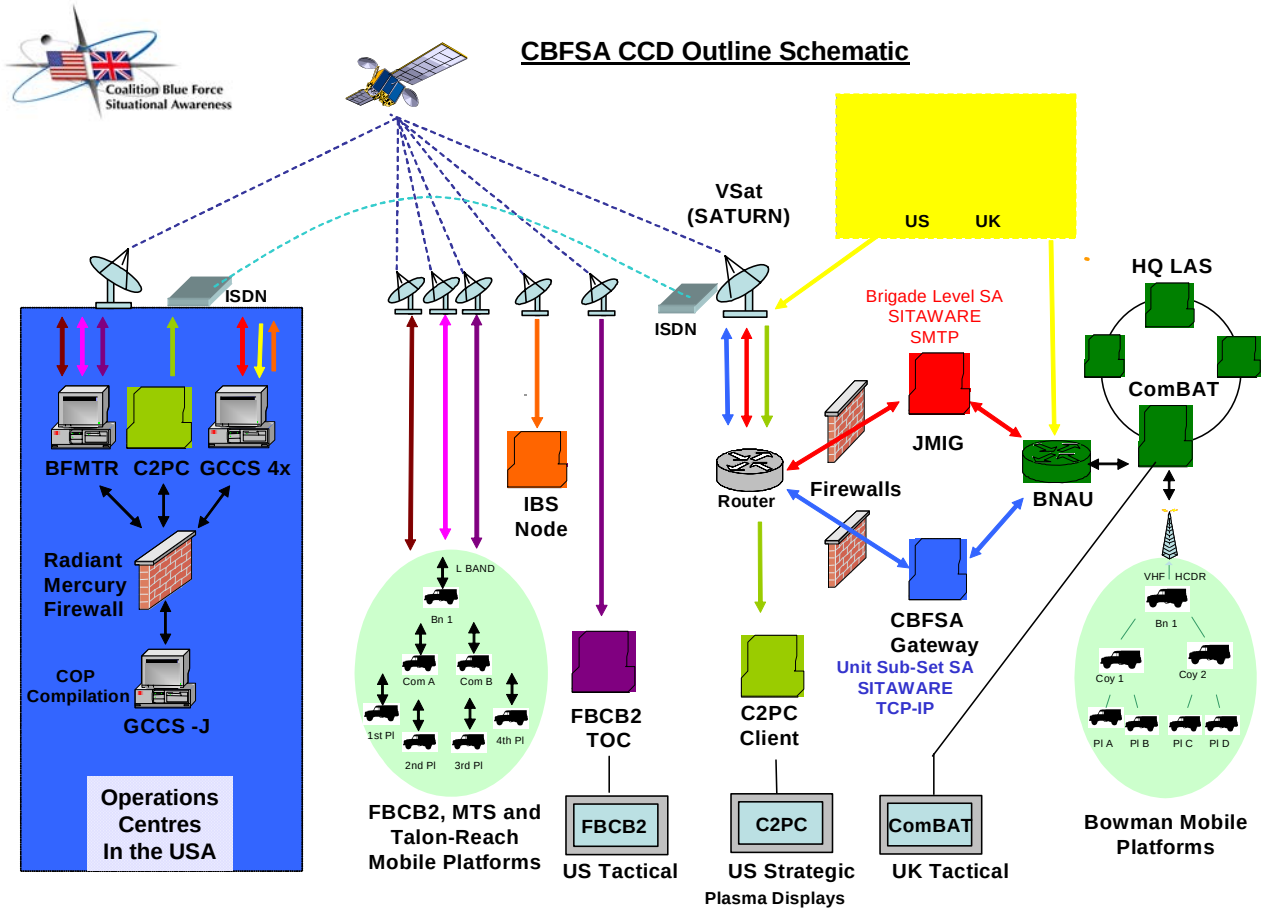
[10] Common Battlefield Application Toolset
[11] Bowman, Infrastructure, Platform Battlefield Information Systems Application and ComBAT.
[12] Global Command and Control System
[13] Command & Control for the Personal Computer
[14] Movement Tracking System
[15] Concept of Operations
[16] Tactics, Techniques, and Procedures
[17] Concepts of Use
[18] Standard Operating Procedures



The components located in the US are to the left of the figure, those in the co-located UK/US Bde HQ are in the centre and upper right and the US and UK vehicles operating on the ground around the UK trials area are on the lower left of centre and lower right.

Key elements of the CCD are the JMIG [19], CBFSA Gateway, a software segment in GCCS that translates UK Situational Awareness Messages to US OTH-G [20] message format, as are two UK firewalls and a US Radiant Mercury firewall. The diagram also shows that the gateways exchange data using UK SITAWARE [21] messages employing either TCP-IP [22] (i.e. as with the CBFSA Gateway) or as SMTP [23] e-mail attachments (i.e. as with JMIG).

Computer generated forces were used to provide realistic volumes of information flowing across the CBFSA gateways in both directions as the number of real US and UK vehicles available were very limited. The forces and their movements were produced using the US ModSAF [24] now known as OneSAF. Separate computers were used for the US and UK forces for security reasons. A QinetiQ message generator was used to compile the location report messages, again operating on separate computers for the US and UK forces.

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[19] Joint Messaging Interface Gateway – the multi-purpose gateway delivered as part of the Bowman system.
[20] Over-The-Horizon Gold - an information exchange message format.
[21] Situational Awareness
[22] Transmission Control Protocol-Internet Protocol – an international information exchange standard.
[23] Simple Mail Transfer Protocol – an international e-mail standard.
[24] Modular Semi-Automated Forces – a computer tool that models military equipment activities on the battlefield.

CBFSA has been a real success, demonstrating the value of CCDs in exploring new system concepts using a mixture of prototype and in-service technologies.

Trials Programme

The overall purpose of the CBFSA trials programme was to support the technical development, performance evaluation, military utility assessment and promotion of the prototype capability to key US and UK stakeholders.

Technical Development Trials These were undertaken to explore technical options and develop, integrate and test the components of the CBFSA communications and information exchange capability as part of a spiral development process. These trials were conducted in the US at Northrop Grumman in McLean VA and the SMDBL in Colorado Springs from January to May 2005.

The spiral development process is a widely used method for systems design and development. Within each circle of the spiral the system is progressively constructed and tested, examining solution options, building upon earlier achievements, identifying and resolving issues, integrating components and evaluating performance to realise a deliverable capability.

Given the potential technical, security and commercial restrictions on instrumenting some of the CBFSA components, the required performance metrics and the means to make these were identified and tested early on. The metrics were then employed both as part of the technology development process and to later underpin the military utility assessments.

Assessment Trials These were to undertake controlled practical assessments of the military utility of the CBFSA capability and to demonstrate it to key CBFSA stakeholders. These were conducted during CWID [25] in June 2005 at Portsmouth and an OFT [26] on the Salisbury Plain Training Area in September 2005 at Larkhill. The demonstrations were aimed at key US and UK stakeholders who would have direct involvement in formally establishing the military requirement, approving future business cases and procuring the operational capability.

Assessment Trials Approach

The CBFSA FRD [27] (Unpublished) provided an agreed US/UK basis for evaluating the performance and assessing the military utility of CBFSA. Using a US experimental technique, a series of Critical Operational Issues were derived from the FRD. These and a corresponding series of objectives and performance and effectiveness measures provided an initial framework for the design of the assessment trials plan [12]:

COI 1: Does the system exchange blue force tracking and blue force situational awareness data between national systems ?
COI 2: Can the CBFSA solution support sustained operations ?
COI 3: Can the user define, interrogate and exchange relevant situational awareness data ?
COI 4: Does the CBFSA architecture solution satisfy the US and UK security requirements ?

[25] Coalition Warrior Interoperability Demonstration
[26] Operational Field Trial
[27] Functional Requirements Document

The assessment framework was enhanced after CWID with two additional questions to more fully embrace the CBFSA CCD objectives as follows:

1. Does the CBFSA solution provide operational benefits ?
2. What new or modified CONOPs, TTPs etc. are required for CBFSA ?

A key feature of the assessment trials was the military utility assessment of the capability. The approach adopted was to employ a modest range of military coalition scenarios within which a small group of US and UK soldiers could operate real US and UK tactical systems inter-connected by CBFSA. This would enable the users to provide first-hand feedback about the value of CBFSA in those scenarios, based on their military skills and experience. The approach of showing end users the system operating under moderately realistic settings was judged to be far more likely to yield considered and evidenced feedback than simply demonstrating the capability to users in a laboratory environment.

By operating CBFSA in conjunction with, albeit a very small number, of US and UK tactical systems in moderately realistic settings, it became possible to evaluate the system performance and gather data to support a subsequent analysis of the wider implications of CBFSA on UK systems.

Trials Measures & Controls

The measures of performance related to the information exchange characteristics of the gateway equipment (JMIG, CBFSA, GCCS COE [28], firewalls and the communications links) and in the national tactical systems where additional traffic was required to exploit the CBFSA capability.

These were:

a. End-to-end information flow timelines in both directions (including key waypoints enroute).
b. Information flow success, message rate, message size, and processor loadings at the gateways (between the COE and JMIG or CBFSA inc comms links and firewalls).
c. Information flow success, message rate, message size, fragmentation and re-tries within the UK tactical system (i.e. BCIP).
d. Incidence of failure (compare gateway equipment with wider systems).

Generally these measures were quantitative, however, the failure measure was qualitative due to the prototype nature of the configuration and some of the components.

The main focus of the performance measures was on the gateway equipments and UK tactical systems rather than the US tactical systems.

The measures of utility related to the value of the CBFSA capability in representative tactical scenarios, operating in conjunction with existing national tactical systems. It was considered most important to distinguish the additional value of CBFSA from the baseline value of that achievable with existing national tactical systems. These measures were:

a. Compliance of the CCD capability with the FRD.
b. General military value for battle procedures.
c. Military value in defensive operations.
d. Military value in offensive operations.

[28] Common Operating Environment

e. Military value in peace support operations.
f. Military implications at the Bde HQ.
g. Readiness of the capability for transition into service.

Generally these measures were qualitative, however, the strength of views expressed on the military value were quantitative.

The controls employed were:

a. Information architecture (*governed by the US/UK system configurations but, in particular, the communications link options between the US and UK i.e. SATURN* [29] *or ISDN* [30]).
b. Information flow rates across the gateways (*governed by settings*).
c. Information flow rates over the tactical systems (*governed by settings*).
d. Information flow volumes (*governed by the computer generated forces*).
e. Extent & nature of vehicle movements (*governed by the scenario*).
f. The CBFSA facilities used to manage the information exchanges (*JMIG or CBFSA gateway*).

Trials Data Gathering

The data collection process gathered the information necessary to produce the required measures of performance and utility, but also to record the wider context in which the data were obtained and provide explanations for any unexpected findings.

The methods employed were:

a. FRD Assessment Panel
b. Observation
c. Questionnaires
d. End-to-end Message Timings
e. System Logs
f. Ad hoc Interviews

FRD Assessment Panel A small group from within the CBFSA project team was assembled to work through the FRD and assess the extent of the CCD capability against each of the 48 requirements. The assessment considered three possibilities: full compliance, partial compliance and non-compliance. For each of the latter two an explanation of the nature of the shortfall and the required corrective action to achieve full compliance was recorded.

Observation Observers located in the Bde HQ during the assessment trial sessions recorded specific events (such as the end-to-end information flow timelines) and general events or activities to assist the results analysis. The latter included events such as times when equipment in the HQ stopped working, when units on the ground stopped working, and problems or barriers that needed to be overcome and the effects that these problems had on data latency and running of the trial. Simple observations such as the time difference between the various HQ workstations were also recorded.

Questionnaires A series of questionnaires were issued to the military participants, and some visitors, to obtain their considered views about the CBFSA capability.

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[29] Space Applications Technology Research Utility Network
[30] Integrated Systems Digital Network – an international commercial data communications service.

The questionnaires were:

a. Skills (tailored to US or UK participants).
b. Defence scenario (modified between CWID 05 & OFT).
c. Offence scenario (modified between CWID 05 & OFT).
d. Peace support scenario (not used at CWID, but modified for OFT).
e. General issues (prepared between CWID 05 & OFT).
f. Bde HQ issues (prepared between CWID 05 & OFT).

A difficult balance was eventually struck between the questionnaires being closed and thus too specific and constraining in the range of views that could be recorded and being open and thus too broad in scope and vague about what was the question being asked.

The Skills questionnaire was closed with either tick box or simple specific answer responses. The Defence, Offence, Peace Support and General questionnaires were in two parts. The first part being four or five statements with which the respondent was asked to either: Very Strongly Disagree, Strongly Disagree, Disagree, Agree, Strongly Agree or Very Strongly Agree. Each statement had space underneath for the respondent to explain and support their response. The second part being two open questions about the respondents top three advantages and disadvantages of CBFSA in the scenario or generally. The second part of the General questionnaire asked how CBFSA might be improved and what the respondent would tell their colleagues about CBFSA. The Bde HQ questionnaire comprised eight moderately open questions intended to capture a wider range of implications of the deployment of CBFSA.

End-to-end Timings These were used to determine the overall information flow timelines between the UK and the US systems as part of the evaluation of the capability. To achieve this, specific vehicles were tracked as they travelled around set routes by observers situated within the HQ. When the vehicles reached a pre-designated checkpoint the vehicle became stationary and notification was sent from to the HQ by radio. At this point a timer was started. If the vehicle being tracked was a US vehicle (FBCB2, Talon Reach or MTS) the FBCB2 and C2PC workstations were monitored for movement on their display. Times were recorded when the vehicle symbol moved to the correct checkpoint on the displays (observed directly from the terminal system log). Times were then recorded when the information reach the CBFSA Gateway and Watchkeeper, G3 Ops or vehicle terminals on the UK. This allowed the tracking and timing of positional information as it travelled within the US system and across the gateway to the UK SA picture. When UK vehicles were being tracked the same timings were taken, but in the reverse order with the tracking beginning on the UK workstations (a nominated UK vehicle usually at the Coy level).

System Logs BCIP system logs (syslogs) were gathered from every Bowman terminal at the end of each day during the trials. US system logs were created by the FBCB2 and GCCS systems, however, as the US team did not intend to conduct further performance evaluations on their systems, these equipment logs were not captured.

The Bowman syslogs contain information on all the data sent and received by each terminal. Algorithms were prepared to filter and collate the information contained within them. This allowed a high level analysis on the performance of the networks to be conducted. Analysis on the Bowman data collected each day was performed to determine the percentage of (Own Station Position Report) OSPR or CPR messages received compared against the number of messages sent up the chain of command. This allowed the performance of individual units and the chain of command as a whole to be assessed.

The Ethereal® tool was deployed on two BCIP terminals to monitor traffic at the IP level on the outside of the UK JMIG and CBFSA Gateway firewalls and, for a limited period, on the UK Bde HQ LAS. This allowed the Technical team to confirm that messages were being exchanged correctly and if not to examine what was being transmitted in order to rectify any problems encountered. It also allowed data on the actual size of messages being passed between the US and UK or passing over the LAS to be determined. This allows the information exchanges to be expressed in the terms normally used for communications data rates (i.e. kbits/sec).

The C2PC Visual Connection Display tool was used to monitor traffic flow over the US/UK communications link to obtain an alternative view of the data exchange rates.

Ad hoc Interviews These were conducted throughout the course of the exercise when users had spare time. These were usually to find answers to specific queries or issues that had arisen.

REFLECTIONS ON THE CBFSA CCD TRIALS FINDINGS

The CBFSA CCD, trials and demonstrations were a real success, demonstrating that US/UK CBFSA works and has military utility. Due to their security classification many of the detailed findings cannot be reported in this paper, however, in the following paragraphs the authors have provided their reflections on some of the key issues to be addressed when transitioning this capability into service.

Robust Connectivity

It goes without saying that reliable, robust and secure communications are required for CBFSA with sufficient capacity for the volumes of information to be exchanged. Achieving this in the mobile tactical battlefield in a practical manner and at a realistic cost is not so straightforward. We shall consider two aspect of this issue for CBFSA: the current US and UK solutions to their national BFSA requirements and the communications link between the US and UK national systems.

National BFSA Solutions The US and UK currently employ different solutions to the BFSA aspects of their national battlefield communications. Both employ GPS [31] to determine the locations of platforms and digital data communications to pass the information up the command chain, in particular to the brigade HQ or TOC [32].

The US commonly employ satellite communications to pass information back to an operations centre where it is collated and re-broadcast to all those who are authorized and equipped to receive it. The UK employ the new Bowman system which uses terrestrial communications throughout. Bowman provides VHF CNR [33] which is used for local BFSA between individual platforms (a platform can be either a vehicle mounted or manpack radio) on a command net. Bowman also provides a HCDR [34] typically used as a brigade net down to most (but not all) company/squadron Command Post vehicles. Bowman UDTs [35] are configured to consolidate and send position reports up the command chain using the VHF and HCDR nets as appropriate.

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[31] Global Positioning System
[32] Tactical Operations Centre
[33] Combat Net Radio
[34] High Capacity Data Radio – part of the Bowman capability.
[35] User Data Terminals – part of the Bowman capability.

The US approach reduces the number of 'hops' the information makes from the original sender to the final recipient. Each hop incurs a time delay while the system waits for a preset time before compiling and sending a new report. This is intended to help regulate the data traffic on the communications bearers. Importantly, the CTP [36] re-broadcast involves only one further hop wherever the recipient is located in the command chain. The CTP is in a suitable form, possibly with some filtering or unit 'rollup', to feed into a COP.

The UK approach incurs hops between each level of command through which the information passes both up the command chain and where appropriate back down again. This is considered acceptable for BFSA using LOPs [37], but incurs considerable latency at higher levels of command e.g. in the brigade LOP. This is the equivalent of the US COP and ideally would be fed into the COP if latency was not an issue. An option exists to send location reports directly from platforms to the brigade LOP, thus bypassing command levels, avoiding hops and minimising latency. The minimal latency brigade LOP could then be disseminated to those who require it. This approach is not used currently by the UK as the message traffic load this would place on the VHF and HCDR nets, the bottleneck that would be created at the brigade LOP UDT and the corresponding latency in the disseminated picture are considered to be prohibitive. The situation may change if a UK proposal to procure a DBS [38] is taken up. The CBFSA trials and subsequent scalability study examined options for creating a separate minimal latency CBFSA LOP at the brigade level without adversely affecting the normal UK reporting and LOP creation processes. Workable solutions were found.

The US can maintain a COP, filter and feed it into a coalition picture and also disseminate parts of the coalition picture to US forces with latencies in the order of minutes. Similarly the UK can maintain a CBFSA LOP at brigade, feed it into a coalition picture and disseminate parts of the coalition picture to a limited number of UK forces with latencies in the order of minutes. Neither of the national tactical data communications infrastructures were 100% reliable, each for different reasons, however when both were operating correctly good performance levels were observed. Consequently users need to be attentive to ensure that when element of the picture (COP or CBFSA LOP) have not updated for some time, it is because they have not moved rather than there being a communications infrastructure failure. The challenge for the communications infrastructure providers and managers is to raise their respective systems reliabilities to avoid a loss of confidence by the user community.

US/UK CBFSA Communications Links A series of issues needed to be considered to establish robust US/UK links for CBFSA:

a. Communications link(s), protocols and addresses between national infrastructures.
b. Connection points in the respective national systems.
c. Agreed messages and formats.
d. Gateway equipment.
e. Agreed terminology, unit/equipment descriptions and symbology.
f. Security protection measures between the two national systems.

The latter two of these will be considered later on in this paper.

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[36] Common Tactical Picture
[37] Local Operating Pictures
[38] Direct Broadcast Satellite

Two links were examined: ISDN which is an international standard service available from most telecoms providers and potentially also in military theatres of operation as Tac ISDN (ISDN-2 was employed on these trials providing two 64kbps channels coupled to give a 128kbps IP [39] service) and SATURN which is an SMDBL capability offering a high speed, high volume information distribution service that ensures the war fighter has satellite communications access on demand. SATURN uses commercial satellite services as an extension of the military satellite communications capabilities. A comparison between these alternatives was conducted. After initial teething problems ISDN performed reliably as expected. SATURN suffered occasional outages attributed to the low priority given to the experimental capability over operational military channels. The authors now understand that SATURN is unlikely to become an operational capability for CBFSA. Further alternatives are being investigated. For the purpose of the CCD, both links provided connectivity between the CBFSA trials US Bde TOC in the UK and the US Mission Management Center Testbed at the SMDBL, Colorado Springs, CO.

Early in the project it was agreed that the UK SITAWARE message format should be employed to exchange data between the UK and US as it supported all the necessary data fields, offered sufficient flexibility and is to be delivered as part of the Bowman programme. Three gateway equipments and software were employed: a GCCS software segment in the US Mission Management Center Testbed was created to accept and translate UK SITAWARE messages to US OTH-G message format, the JMIG as it also is to be delivered as part of the Bowman programme and a prototype CBFSA gateway based on a Bowman UDT with a slightly modified version of ComBAT. A comparison was conducted between the JMIG and CBFSA gateways. The advantage of JMIG is that it is already contracted as part of the Bowman programme, but requires two UDTs; one to semi-automatically compile the UK SITAWARE message and another to create the SMTP message and send it outside Bowman. The CBFSA gateway would require enhancement of the delivered BCIP software (i.e. a minor contract change) but uses only one UDT and employs almost entirely standard ComBAT functionality to create the CBFSA LOP and exchange UK SITAWARE messages with non-Bowman systems (i.e. once set-up, messages are sent and received fully automatically). Without the need for manual intervention, a higher sustained message exchange rate can be achieved.

Both communications link options performed well when operating correctly as did all three gateways. The challenge for the communications infrastructure providers is to find a suitable alternative to ISDN for situations where it is not available. A small number of IP timings/end-of-message problems from the CBFSA trials remain to be resolved, which are not considered to be insurmountable despite causing disruption to information exchanges at the user level.

Security Considerations

Security protection is an important part of military information systems for obvious reasons, however, it is equally important to strike an appropriate balance between protection measures and flexibility to meet the user's operational needs.

There are important differences between the US and UK security schemes for classifying, protecting and releasing information. For example the FBCB2 system operates at the unclassified level while Bowman and GCCS-J are UK and US, classified, system high respectively (N.B. the CBFSA link between FBCB2 and Bowman platforms is via GCCS-J). The UK needs to consider carefully if BFSA information needs to be classified above the unclassified level and if it doesn't

[39] Internet Protocol – an international information exchange standard.

what steps might be taken to down-classify parts of the Bowman system to relieve some of the current operating constraints on the sharing of these data with coalition partners.

Accredited US and UK firewalls were used almost entirely successfully to exchange the tightly controlled and relatively limited set of CBFSA information and the US Radiant Mercury firewall did not pass all the desired fields in the UK message due to development time constraints[40]. A reason for not wishing to modify either the US or UK accredited firewalls is that the time taken for re-accreditation after change have been made is very significant, understood to be in the order of twelve plus months.

The firewall performances observed didn't add significantly to the end-to-end CBFSA message timings, consequently security issues are not considered to impose unsatisfactory constraints of the limited set of CBFSA information exchanged using UK SITAWARE messages.

Harmonising US and UK Doctrine

The CBFSA FRD laid down a CONOPS[41] [13] that satisfied UK and US doctrinal elements for the CCD stage of the project. It was universally agreed that, although a great deal of doctrine is common and familiar to both countries, at the transition stage there will be a need for both countries to follow their own doctrinal template (i.e. prepare appropriate national documentation for the agreed common methods of working).

Of particular concern, especially from UK parties, is the degree of certainty demanded by US and UK doctrine respectively before engaging a potential enemy target or location and whether or not that level of certainty, that the target is not in fact a friendly entity, can be delivered by CBFSA. CBFSA is not an alternative to CCID so it will not confirm the identity of platforms at a particular location at the current time. UK doctrine requires that if an enemy is thought to be in an area and if there is a possibility that friendly elements have been or might also be in that area, visual confirmation that a target is not friendly must be obtained before engaging. The worry is that with the increasing use of FBCB2 (i.e. BFT), US forces may be inclined to believe that CBFSA offers similar real-time positional accuracy and that friendly units are located where they are shown to be on the FBCB2 display screen (i.e. if a vehicle or vehicles are not where they are shown to be and are thought to be enemy targets, they may be engaged in error, albeit consistent with current US doctrine). In an attempt to allay this fear, it is worth noting that with message latencies in the order of minutes, FBCB2 also does not guarantee that friendly units are located where they are shown to be on the display screen (i.e. with good going terrain, vehicles can travel several km in say five minutes. If working correctly and set-up appropriately, CBFSA can offer similar latencies to those achievable with FBCB2, at least down to those UK HCDR equipped platforms.

Current US capability enables a CTP, with all BFT equipped platforms included, to be broadcast to all those capable of receiving it. Whether or not a recipient chooses to display all the elements included in the picture is under his control. With the roll-out of Bowman with terrestrial radios, modest communications capacity and reach, UK users will need to manage the exchange of location reports more carefully and proactively to ensure that those who need BFSA information receive

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[40] Due to development time constraints an existing Radiant Mercury rule-set was used by SMDBL. The existing rule-set only allowed a limited number of fields in the OTH-G message format to pass. Given additional development time and funding a revised rule-set could be created that would allow all desired fields from UK SITAWARE to be passed through the Radiant Mercury.

[41] Current UK terminology has changing (CONOPS etc). A UK Joint Doctrine & Concepts Centre (JDCC) brochure explaining the new language (seven step process etc.) was circulated in December 2005. This report employs the earlier terminology as it applied to the CBFSA project in 2005.

what they need rather than all that's available (at the brigade level). Procurement of DBS could change this, enabling a similar approach to broadcasting the CTP or COP, but is currently unfunded.

Although some doctrinal differences exist between the US and UK forces which need to be addressed, the key issue is considered to be the management of user expectations for CBFSA through a combination of training (ideally US/UK collective training) and familiarisation.

Managing User Expectations

CBFSA has been demonstrated to work satisfactorily with a combination of in-service and some prototype technologies. Very encouraging feedback was received from senior US and UK visitors to both CWID and the CBFSA OFT. It is believed that if an urgent operational requirement should arise, it should take only a matter of a few months to resolve the outstanding technical issues and transition the capability into service so that training and familiarisation could start. The latter are not expected to present a significant additional burden to the current equipment training programmes, although training for system managers and possible additional manpower in the brigade TOC/HQ must not be forgotten.

The role of the Liaison Officer in a digital environment will differ significantly from what he does now, if only from the high technical expertise that will be required. C2DC [42] have written a paper on this [14]. CBFSA will facilitate his role as he will have better situational awareness and will be able to offer better advice to the HQ to which he is attached. The Liaison Officer will need to know the capabilities and limitations of CBFSA and need to troubleshoot if there are any data/ equipment/technical problems. The fact that the US TOC will have UK icons appearing on FBCB2 and vice versa for the UK HQ will inevitably lead to the liaison officers answering queries on UK and US unit titles, roles, capabilities, history, tradition etc.

The most important expectations to be managed are exactly what CBFSA can provide to coalition tactical users on the battlefield from brigade down to fighting platform level. CBFSA is not a substitute for CCID and is not intended as a BFT capability. All users can expect a better picture with CBFSA than without it, however, confidence in the achievable picture latency, for a given set-up of the systems, and a clear appreciation of what this means with respect to actual locations of units and platforms on the ground are vital. Command information priority trade-offs are likely to be necessary, especially on the UK side, to obtain a sufficiently good CBFSA LOP with acceptable latencies and numbers of units/platforms included (say within 10 km of the coalition boundary) without adversely affecting other information flows over the Bowman infrastructure.

The CBFSA trials found that users at brigade and to a lesser extent at unit level considered CBFSA to be of significant value for a range of types of operation. Users also considered that, due to the latencies involved, CBFSA would be of much less value at sub-unit and fighting platform level. Indeed some users argued that information which was out-of-date by more than a few minutes at this level could actually be dangerous. This is a matter that commands on both sides must address to decide if this is a real cause for concern or one where the advantages outweigh the disadvantages especially if well defined doctrine and appropriate training are employed.

[42] Command & Control Development Centre – part of the UK Land Warfare Centre

Summary

The CBFSA project has been a real success, demonstrating the value of CCD type activity in exploring new system concepts using a mixture of prototype and in-service technologies. The CBFSA CCD has proven the viability of exchanging BFSA data between BOWMAN and the US family of tactical Blue Force systems, whilst at the same time capturing vital knowledge about user requirements and behaviours to inform subsequent programmes such as the MIP and CCID.

CBFSA transition to service, however, is complicated by the maturity of the UK BCIP programme and the requirements of forthcoming coalition operational deployments. It is likely that there will be some pause, in line with the BCIP 5 delivery schedule, before a CBFSA-like capability would be required on current planned coalition operations. In the interim there remains opportunity to develop and de-risk CBFSA and progress the transition planning through a further phase of CCD activity.

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Of particular note is the very positive and co-operative manner in which the US/UK team of soldiers, civilians and contractors worked together. The trials were supported on the US side by SMDBL, STRATCOM [43] and PM FBCB2 [44] and on the UK side by the DDEC TacCBM [45], BATCIS IPT, BTT [46], C2DC including the BOWTAGs [47] North & South, General Dynamics and QinetiQ. The team, over a short period of time, have generated considerable project momentum and were considered to have offered very good value for money.

[43] Strategic Command
[44] Project Manager, Force XXI Battle Command Brigade and Below
[45] Deputy Directorate of Equipment Capability Tactical Command & Battlespace Management
[46] Bowman Trials Team
[47] Bowman Training Advisory Groups

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