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Adapting C2 to the 21st Century

TITLE OF PAPER

IMPROVING C4ISR BETWEEN UK AND US FUTURE LAND FORCES

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ABSTRACT

1.   Improving interoperability between US/UK Land Systems in the 2015 timeframe has been identified as a high priority requirement. In Dec 04, the UK and US signed the Land Battlespace Memorandum of Understanding (MOU) with the US Army covering LBS. Under this the C4ISR Project Arrangement (PA) seeks to deliver significant improvements in C4ISR capability through a two-phase programme of work, to be completed by 2014.

2.   Phase 1 is a two-year systematic review of US/UK C4ISR planned interoperability capability on the basis of current programmes, and to assess options for improvement that will be required within the 2015 timeframe.

3.   Phase 2 will involve the completion of a US/UK programme that plans to deliver improved interoperability capability across all UK (and US equivalent) lines of development.

4.   The C4ISR PA will address, both directly and indirectly, the following areas:

- The need for multinational Interoperability between UK and Coalition CBM systems, especially with the US and NATO.

- The need for coherent Shared Situational Awareness.

- The ability to manage the information and data layer.

- The need for Combat Id.

- Need common, secure and resilient information infrastructure.

5 Phase 1 is underway and progressing by means of a combination of concepts and doctrine development informed by experimentation.

This paper will explain the rationale behind the PA and the results of the work undertaken so far. It will also discuss some of the issues encountered under a bilateral programme of work which is Network Enabled/ Network Centric rather that hardware centric, which is the basis of more conventional activities.

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Introduction

History

In the past there has been ad hoc cooperation between the UK and the UK on army equipment programmes, notably Apache and the defunct Tracer Programme.

In several years ago it became clear that cooperation in the land environment required a more structured approach, and this lead to the Land Battleslpace Memorandum of Understanding which was signed on 15 December 2004 by Brig Moore (Director Equipment Capability Ground Manoeuvre) in the UK and Brig Gen Cartwright in the US.

The MoU has a wide scope and several PAs are at different stages of maturity. However the most pressing need was to look at and plan for interoperability in the C4SIAR arena, and this is the PA that is most mature in terms of bilateral working and progress.

PA

Following the signature of the overarching MoU, the first priority was to address C4ISR issues. The aim of the C4ISAR PA was to be "The objective of this LBS PA is to enable C4ISR interoperability and integration between U.S. future force and UK land battlespace within a Combined and Joint force environment to support integrated coalition operations in the Network-Centric/Network Enabled paradigm of 2014 and beyond. ". However in the early stages of the discussions, it was clear that there was a major disconnect between the UK and the US in terms of project timescales. Whereas the US activity was part of a major programme of record, in the UK there are a number of programmes that make up the future land programme which are coordinated but do not make up a single entity.

In order to address this, the PA was split into two phases, not least to provide a baseline for future UK programme activity

Phase 1 is a two-year systematic review of US/UK C4ISR planned interoperability capability on the basis of current programmes, and to assess options for improvement that will be required within the 2015 timeframe.

Phase 2 will involve the completion of a US/UK programme that plans to deliver improved interoperability capability across all UK (and US equivalent) lines of development.

This was essentially a pragmatic choice driven by the UK's need in formal staffing terms to establish an activity to interface with the US FCS office.

The current programme, which is still in phase 1, is seeking to explore potential solutions. In doing so we have had to meeting US processes and aspirations which tend to be more experimentation driven with the UK processes which are concepts and doctrine driven.

UK organisational context

This may be an unusual heading at this stage in a paper, but it is disproportionately important at this stage.

As a NEC programme, the PA interfaces with a large number of UK and US systems. However, it is not just an equipment programme, as it calls heavily on other lines of development (a UK term - DOTLMPF in US terms). This is somewhat different approach to UK's involvement in JSF, where participating in the programme from the start and buying a major piece equipment from the US has been forcing a number of issues in a more traditional acquisition sense.

FCS is a NCW programme, and this is evident from their overview slide. This has the network at the centre, and at the centre of this there is the critical element of SOSCOE. There is no UK equivalent slide from a programme centric point of view, but in the PA we have been effectively creating this. The FCS programme naturally assumed that the FRES programme was a its UK counterpart, whereas it is a rather more vehicle centric programme roughly equal in scope if not size to the manned vehicle element of the FCS programme.

UK/US interoperability is managed by the interoperability commission, and the PA is a tiger team of the 2* interoperability commission working group. This provides high level governance, but again this is not part of a programme in the sense of having a set of requirements or dedicated funding.

It is also worthy on note that NEC in the UK is a concept or aspiration rather that a funded programme. From a UK perspective, DEC CCII takes the lead on coordinating issues across the sponsor organisation. From an executive point of view the Integration Authority is charged with "improving the clarity and delivery of NEC", which not a NEC programme office. In practice this means architectures (what should I build?), assurance (am I building it right?), and assistance(help!).

Although the UK is going through major changes in its acquisition community, it is worth pointing out that there are currently around a 160 separate IPTs, but a relatively light structure for inter-IPT coordination. This is in the process of changing through a number of initiatives, but a key tenant of the Smart Acquisition initiative was that an output focused IPT leader was king.

CONCEPTUAL AND DOCTRINAL PROVENANCE FOR THE US/UK C4ISR PA

It has been important to ensure that the conceptual and doctrinal provenance underpinning the US/UK C4ISR work is coherent and endorsed by both sides. To that end, a mutual High-level Vision Paper and Concept Document have been developed. The paragraphs that follow are drawn from these two documents.

Future Operating Environment. The UK Centre for Doctrine and Concept Development's summary of the military dimension of Strategic Trends suggests that when military forces are deployed on operations:

 'conventional military superiority will be met by asymmetric tactics such as: denying force entry to theatre; disabling force multipliers (such as communications and information systems); disrupting enablers (including logistical arrangements); and avoiding direct combat.'

The UK Future Manoeuvre Sub Concept goes on to assess that, in the land environment, the existing trend will continue towards a continuum of operations. The tidy distinctions between pre-conflict, conflict and post-conflict activities may become less relevant and operations may merge into an amalgamation of phases and activities. The task of ISTAR will be particularly complex, as adversaries may mount operations from within the cover of the local population, making it difficult to differentiate between friend, foe or neutral party. The need to assess and share intelligence rapidly to determine an adversary's intent will provide a considerable challenge.

Against this backdrop, decisive joint (and combined) operations will be conducted principally on the land, and forces will be required to switch adeptly from one posture to another. As a result, force structures should be balanced and adaptable enough to meet most operational challenges, including the rapid transition between different types of military activity. Thus, whilst the Land Component's Brigade and below forces should still be prepared to fight in symmetric, less dense, open-terrain warfare, they should principally expect to fight less well-defined opponents in various types of non-linear, asymmetric warfare. Forces will need to operate with a range of possible coalition forces with the closest co-operation being with US Forces.

This increasingly asymmetric threat spectrum will make the tactical environment of 2014+ very challenging for US and UK Crisis Response Operations (CRO) forces. As they continue to co-operate in CRO, US/UK warfighting elements must work closely to accomplish mission objectives within a dynamic and complex operational environment. It is anticipated that US and UK brigades deployed on such operations will need to exchange information for the purpose of Command and Control and battlefield situational awareness within a very dynamic tactical environment. The transfer of battle command information will occur in a near-real time-exchange between US and UK units at the halt and on the move. It should be noted that by 2014, those elements of the US Army that are FCS-equipped will be a genuinely networked force and, to be an effective military ally, the relevant UK force elements must be able to interoperate effectively with it. If they are not, they will only be able to co-operate at a significantly reduced level of battle effectiveness.

Conceptual and Doctrinal Provenance. The work under the C4ISR PA is founded upon the assumption that, within US forces, the FCS-equipped Brigade Combat Team (FCSBCT) will form the ground manoeuvre core of any US Crisis Response and that this will be mirrored on the UK side by the FRES-equipped Brigade Group at the core of the future UK Joint Medium Weight Capability (UKJMWCAP). Of course, many operations may be instigated by the insertion of Light or Special-purpose Forces but, in the majority of cases, a rapidly-deployable, "medium-weight" element of the type represented by the US FCSBCT and UK FRES Bde Gp will be required to provide the combination of mobility, firepower, protection and communications necessary for the delivery of rapid manoeuvre and effect and the sustainment of follow-on and stabilization operations.

The provenance of these assumptions is based upon a concepts, doctrine and force development (CD&FD) audit trail, conducted concurrently by the US and UK joint authors, that describes the baseline for the work. These are summarized as follows:

- **UK Policy Drivers**.   The policy requirements for UK/US interoperability are described in full within DSG 2005 and include:

  Influence.   To contribute to the UK's international influence by enhancing bilateral or multinational relations with:

  (1)   The US, by contributing capable forces at an equal command level or below in a similar timescale to US forces.

  (2)   NATO, by contributing capable forces to the NATO Response Force (NRF).

- **US Policy Drivers**.   The policy requirements for the UK/US interoperability objectives and intended effects are described within the Department of Defense (DoD) Quadrennial Defense Review 2005. The QDR 2005 directs a strong multinational interoperability and cooperative effort with allies and other coalition nations to influence future adversaries from undertaking potential adversarial actions. The intent is to demonstrate an overmatch position thereby preventing the use of terrorist extremism, use of Weapons of Mass Destruction, and influence other nations decision-making prior to undertaking a strategic military build up.

- **UK Conceptual Provenance**.   UK Defence Strategic Guidance (DSG), the UK Joint High Level Operational Concept (Jt HLOC), and the UK Joint Doctrine and Concepts Board-endorsed Future Land Operational Concept (FLOC) espouse the need for rapid deployment and agile forces that exploit the Effects Based Approach (EBA). Both papers also advocate that force packages should be 'tailored' or 'optimised' on deployment according to operational need and that they be capable of operating effectively at the tactical level with coalition forces and, especially, with US Forces.

- **US Conceptual Provenance**.   The Current Joint Operational Concept Family of documents consisting of Joint Functional Concepts, Joint Integrating Concepts, and Joint Operational Concept direct the capabilities for the future DoD joint fighting force. The documents direct capabilities related to Command and Control, Force Application, Battlespace Awareness, and Protection functional areas. To meet these capabilities, the US FCS-equipped forces must attain interoperability across U.S. services and multinational partners. The US/UK C4ISR PA supports these efforts through the establishment of solutions to exchange Red/Blue/White SA, Collaborative Planning solutions, and Joint Fires among others. The objective is to be able to conduct combat operations off-the-ramp in either a symmetric or asymmetric threat environment.

Experimentation Development

In was recognised early during the scoping of the C4ISR PA that a System of Systems Systems Engineering approach would be required to address the many facets of improving US/UK C4ISR interoperability. Experimentation is seen as an integral part of this System of Systems approach and supports all stages of the programme from early pre-concept and concept definition activities with the investigation of interoperability options and migration strategies, to assessment activities with the investigation and evaluation of candidate interoperability mechanisms, and through to demonstration and implementation with the incorporation of evolving systems and interoperability solutions. Experimentation is seen as a means of accelerating and de-risking the acquisition cycle thereby assisting with the earlier introduction of capability into service.

The C4ISR PA focuses on technical C4ISR interoperability experimentation aspects while fully embracing findings from concept, doctrine and Tactics Techniques and Procedures (TTP) battlelab experiments. Indeed through iteration and feedback the technical experimentation informs concept, doctrine and TTP development. C4ISR PA experimentation builds on extensive US Army developed facilities and draws together previous UK investments in simulation and modelling to provide a comprehensive experimentation capability.

The C4ISR PA experimentation capability uses the US Army run annual series of technical experiments for the FCS programme based around the FCS Systems Engineering Experimentation Laboratory (SEEL). This is combined with FCS Lead Systems Integrator experimentation and development activities and the USAF led biennial Joint Expeditionary Force Experiments (JEFX). This series of experiments is used in a progressive way to investigate, develop and evaluate interoperability options and capabilities against an evolving C4ISR PA incremental capability implementation roadmap.

Depending on the nature of investigations, experiments utilise a mix of virtual (models and simulations), live (real equipments and systems) and surrogate systems (current systems used to represent a future capability) to achieve their objectives. The C4ISR PA experimentation capability comprises of a mix of high fidelity models representing current and future C4ISR systems and a live virtual and constructive environment that enables the interfacing of live systems to a real-time simulation environment such as DIS and HLA. Additionally, the FCS SEEL provides for rapid prototyping with hardware and software in the loop which enables promising technology or early system developments to be investigated as part of the overall experimentation environment.

C4ISR PA experimentation is focusing on two prime areas:

- The definition, development and introduction of interim US/UK C4ISR interoperability capability to support current forces;

- The identification, definition and development of future (2015) net-centric/net-enabled US/UK C4ISR interoperability capabilities, and the development of migration strategies from current force solutions to achieve this future capability.

Areas of investigation for C4ISR PA experimentation cover the development of options to achieve the required high level C4ISR interoperability capabilities and specific system or interoperability mechanism assessments. The high level C4ISR interoperability capability investigations include:

- Provision of tactical level command and control and collaborative planning capabilities;
- Improving the quality of situational awareness exchanges in terms of level of coverage and latency and assessing the contribution this can make to avoiding fratricide and increasing the tempo and agility of coalition operations;
- Improving targeting and combined network fires;
- Exploitation of novel ground sensor systems.

Specific system or interoperability mechanism investigations include:

- The definition of interoperability translators;
- Examination of the effectiveness of tactical communications system interoperability gateways and the determination of their optimal deployment;
- The definition of net-centric/net-enabled infrastructure enablers.

Results So Far

The USAF JEFX'06 in April 2006 was the first occasion where the C4ISR PA could exploit coalition experimentation. Experiment objectives were focused on a mix of near term capabilities and systems and medium term emerging capabilities primarily in the land/air environment. Many of the capabilities were of interest as potential net-centric/net-enabled coalition interoperability mechanisms. JEFX'06 comprised a mix of live, virtual and surrogate components with many live fly assets and a complete coalition CAOC. The USAF focus was on the use of the Continuous Air Planning and Execution (CAPE) and the Non Traditional ISR Information Services (NTISR-IS) approaches with land forces as an integral part of this.

The FCS programme focus was on joint interoperability to provide situational awareness, to request and support time sensitive targeting missions using the continuous theatre air planning and architecture, and to extend forward intelligence, surveillance and reconnaissance (ISR) using capabilities planned for FCS Spin Out 1. This included the FCS System of Systems Common Operating Environment (SOSCOE), Battle Command Services, and Unattended Ground Sensors (UGS). There was a particular emphasis on closing the seams between the US Army and Air Force to reduce fratricide, to provide an accurate blue picture, to provide extended ISR for CAS missions, and to enhance joint combat effects. JEFX'06 also proved FCS integration with current US land force systems which in turn provided a useful mechanism for UK current forces to access early FCS spin out capabilities. Additionally, new net-centric battlespace communications enabling capabilities were proven together with the use of a new efficient tactical message exchange format.

The latest C4ISR PA SEEL EXperiment (SEELEX) # 5 established the value of using high fidelity models to represent future systems that could be scaled to full size deployments, in this case to investigate brigade and below interoperability, and real-time simulations to represent a range of potential future interoperability options. SEELEX#5 was focused on the investigation of range of tactical level interoperability exchange options for the current and future force and a number of key infrastructure enablers for operation in a net-centric/net-enabled environment. Of particular importance was an examination of the effectiveness of these options when deployed at different echelon levels at brigade and below.

Experiments considered the near-real-time exchange of blue and red situational awareness information using a variety of communications exchange mechanisms and different situational awareness architectures corresponding to current and future force configurations. The results of these experiments proved the value and effectiveness of the proposed interoperability options and identified significant operational benefits of lower level interoperability. The findings will help de-risk further option and solution development and will help define new interoperability requirements and the need for core infrastructure enablers on current and future programmes.

The results of JEFX'06 and SEELEX#5 have both helped to inform and de-risk capability development options for the C4ISR PA and are being used to structure a series of further SEELEX experiments in 2007 and 2008 and for JEFX'08 in 2008.

Challenges

Governance
The importance of the role of governance, certainly form a UK perspective has taken some people by surprise. It comes down to one of clarity of purpose and the money following that clarity.

In the UK, despite continued internal and external scrutiny and criticism, the governance at project level both in term of requirement and the acquisition by the IPT is tight and well defined. I would suggest that this is rather more difficult at the next level up at capability level in current UK parlance. UK has several programme offices with Senior Responsible Owners, but the Venn diagram is far from straight forward, especially as key equipment programmes contribute to multiple capability areas. Superimposing international interfaces on that, in particular the interfaces with NATO and the US adds to the complexity.

PA has been pushing at the edge of what we mean by NEC and how we manage it for reasons touched on through out this paper:
The prospect of significantly improvements in military capability and interoperability through relatively minor changes to existing projects. However as each of those projects has its own governance and funding tying them together sufficiently closely is a major exercise in stakeholder management, especially as in practice from a UK point of view they are a mixture of legacy, future legacy and new projects. In seeking to establish the interface between future Kk and US land forces it assumes organisational and technical stability in the UK and US future land programmes in the widest sense, which is not necessarily so.

This has turned the PA into a major exercise in stakeholder management both nationally and internationally. Again this has had different drivers in the US and the UK. Form a UK perspective, the need effectively to form a virtual programme with a similar system boundary to FCS along with the need to establish a credible funding profile have been drivers. This has been complicated to say the least, and a key element has been a very constructive relationship with the British Embassy staff in Washington who have been particularly helpful

Last but not least there is the subject of security. It is inappropriate to go into a lot of detail in open forum, but it is no surprise to know that we have regarded security as a key enabler from the outset of the PA. To give an example, historically UK has accredited is systems on a system by system basis. We are now moving towards a more system of systems approach, which reflects the reality of NEC. The PA obviously extends this argument further into the international arena. Suffice to say that we have been very aware that we could come up with best concept and doctrine and the most elegant technical solutions, but if we ignored security we would not be permitted to plug it all together.

Culture
This should not be overstated, but there has clearly been a period of getting to know each other over the past few years.

This has taken a number of forms. Firstly there has been the straight team dynamics of figuring out ways of working across the pond. Whilst we are not unusual in this respect we have nonetheless had to work at it. One complication has been that the US FCS programme, as a programme of record is working on a much firmer foundation that the UK's aspirations for NEC. The fact that the UK team have been bootstrapping the programme from nothing has taken a considerable effort had that effort has not been available for "real work".

It would not be unfair to say that US friends would mind be saying that some of them have been rather surprised by their own regulatory framework, and from time to time I have heard "but they're the Brits, why can't we give it to them?" Rules is rules, as they say. These things need to be accommodated both in terms of time and effort.

Conclusions

This is a real life example of engineering NEC and NCW, all the more interesting as we have had to accommodate the differences in these similar but not identical concepts.

In programme management terms we have had to work with the challenge that we need to coordinate a number of UK programmes to interface with one very large US one – FCS. In practice this has only been possible because it has been very obvious from the outset that both sides were very keen for this to happen. It would have been very easy for things to fall apart at a number of stages.

It is still early days, but we now have a agreed UK US land concept, which again has been generated thought a hybrid process trying to satisfy both the UK and US concepts and doctrine communities.

We have a draft roadmap of how we think we can get incremental improvements in military capability, and we have completed the first of an ongoing series of bilateral experiments to test the assumptions that this is based on. All we have to do now is deliver.

Although it is easy to focus on equipment, the success of the PA depends on overall coherence and political will on both sides of the Atlantic, but those of us involved are keen to seen this succeed as the prize is a significant improvement in front line capability.

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