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Coalition Transformation: An Evolution of People, Processes and Technology to Enhance Interoperability

Developing Coalition Interoperability

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ABSTRACT

The need to increase capability by improving effectiveness of existing and future assets is a consequence of many factors including the nature of our adversaries, politics and a tightening budget. While budgetary pressures are fueling the rate of national changes suggesting a transformation, political influences are helping to drive coalition transformation.

This paper assumes coalition operations are the desired situation. While this is the case, it pulls at the root of a nation's need to be independent and maintain a level of secrecy in doctrine and tactics. NITEworks is a UK government and industry collaboration addressing the very complex, multi stakeholder environment that raises and seeks solutions to these and similar issues. Principally, NITEworks is a consortium comprising 9 partner companies and 31 associates who's aim is to develop and execute experiments in order to demonstrate force structure and interoperability issues by studying operational concepts, doctrine and tactics.

This paper briefly reviews the current NITEworks's themes and studies a recently completed project in more detail known as the Multi National Experiment 3. This project offered a good learning opportunity and environment to exchange ideas related to Effects Based Planning (EBP) in a multinational and multi-agency environment. It is noted that while opportunities exist for improving the experimental design, these vignettes offer excellent insights for all stakeholders.

A number of conclusions were reached both project specific and of a broader nature, the differences between US and coalition partners' approaches to experimentation being a consistent theme and a considerable influence. This in particular is expected to be a significant ongoing challenge. In addition, it is noted that while Effects Based Planning offers the potential for improved coalition and UK military operations, this analysis suggests that if poorly implemented it will detract from current operations planning capabilities. The UK should adopt an EBP process that meets its own national

requirements first and foremost, and consider interoperability with coalition partners as second order issue.

By taking a brief look at the influencing factors affecting Combat Identification, it is suggested that the answer may fallout, while being considered simultaneously, of solutions and architectures designed to solve Situational Awareness and Command & Control. At a company level, it is worthy of note that BAE SYSTEMS' participation in NITEworks is an excellent opportunity to be at the core of an enterprise striving to deliver true solutions to its customer.

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Abbreviations

AMS	Alenia Marconi Systems
BAE SYSTEMS	Not An Acronym
BMEC	Battlespace Management Evaluation Centre
CBM (L)	Command and Battlespace Management (Land)
CC&II	Command and Control Information and Infrastructure
CID	Combat Identification
CTFHQ	Coalition / Combined Task Force HQ
DAES	Directorate of Analysis, Experimentation and Simulation.
DEC	Disasters Emergency Committee
DFID	Department For International Development
DSTL	Defence Science and Technology Laboratory
EBO	Effects Based Operations
EBP	Effects Based Planning
EDS	Not An Acronym
ENIF	Experimental Network Integration Facility
FCO	Foreign and Commonwealth Office (UK)
HMCE	HM Customs & Excise
HQ	Head Quarters
IFI	Indirect Fires Integration
IFPA	Indirect Fire Precision Attack
IFS	Indirect Fires System
JDCC	Joint Doctrine and Concepts Centre
JFCOM	US Joint Forces Command
JFHQ	Joint Force Head Quarters
LoD	Lines of Development
MBDA	Matra, BAE SYSTEMS Dynamics, Alenia
MES	Marconi Electronic Systems
MNE3	Multi National Experiment 3
MoD	Ministry of Defence (UK)
MRO	Maintenance, Repair and Overhaul
NCO	Network Centric Operations
NEC	Network Enabled Capability
NITEworks	**N**etwork **I**ntegration **T**est and **E**xperimentation **Works**
RTD&E	Research, Technology, Development and Evaluation
SDR	UK's Strategic Defence review
UK	United Kingdom
US	United States
WIN-T	Warfighter Information Network - Tactical

1.0 Background

April 1977 saw the formation of British Aerospace (BAe) as a nationalised corporation by the merger of the British Aircraft Corporation, Hawker Siddeley Aviation, Hawker Siddeley Dynamics and Scottish Aviation. In January 1981 BAe formed as a public limited company (PLC), acquiring the assets and business of the nationalised corporation. In 1999, BAe saw one of the largest acquisitions in its history with the purchase of Marconi Electronic Systems (MES). Due to the vertical[1] nature of the merger, this almost doubled the size of the company in terms of manpower, turnover and technology base.

BAE SYSTEMS is now modeled as a systems company delivering solutions to customer requirements. This includes prime contractor and systems integrator in air, sea, land and space with an order book of £46.0 billion and sales of £12,572 million [1]. With presence across all five continents and more than 100,000 employees worldwide, BAE SYSTEMS is now truly a global business.

In addition, the company has a full in-service support and logistics organization. In this way it can work with customers both in specifying solutions to their needs, and offering the management and operation of their facilities, as well as training, repair and overhaul of products and the provision of professional logistic support.

An important market for BAE SYSTEMS is North America, where it has grown to become one of the top 10 suppliers to the US Department of Defense. With operations in 30 US states and the District of Columbia, annual sales of more than $5 billion are generated, supporting more than 25,000 jobs. This is through the design, development, integration, manufacture and support of a wide range of advanced aerospace products and intelligent electronic systems for government and commercial customers. Looking forward, BAE Systems is a leader in battlespace awareness/C4ISR programs, contributing to nearly every major DoD C4ISR program.

[1] Complementary rather than duplicative. Value was to be derived from removing duplicative head offices, product testing, procurement department's etc rather than removing a competitor and gaining market share.

2.0 Introduction

“ [Concerning] engines of war, the invention of which has long since reached its limit, and for the improvement of which I see no further hope in the applied arts ...”

Sextus Julius Frontius, Roman engineer

Clearly, as Julius Frontius would have found out with hindsight, there is always space for improvement, which by default is accompanied by change. A move to improve the capability of existing forces while seamlessly integrating new additions within a constrained budget is but one challenge and due to its scale has been termed transformational. A further improvement driven by need and politics within the context of changing adversaries is the requirement for friendly nations to effectively fight along side one another.

This requirement is seemingly obvious although pulls at the root of a nation’s need to be independent and maintain a level of secrecy in doctrine and tactics. If Effects Based Warfare and Network Centric Operations (NCO) are the future at an international level, this provides difficulties for national security since a net suggests nodes with duplex information flow. Coalition operations based around NCO (required to deliver a result from a modified ‘smaller’ force) where a node may be a unit from any coalition force, clearly presents a number of new challenges.

This paper briefly reviews the fiscal background that is to some extent, driving the changes desired. The US economic outlook is discussed with associated pressures on the US defence budget. It is postulated that since the US is driving technology in most areas of the defence arena principally by shear weight of financial commitment, coalition forces required to work alongside the US must plug into their network. For this reason, fiscal pressures that are significant factors forcing the pace of change in the US will affect all interested parties in many areas, including timing. While politics and other influencing factors are integral, they are not covered here with supporting documentation referenced.

This paper then discusses one element of UK Governments response. It is clear that for the UK armed forces to meet the obligations asked of them, the government and industry must work in collaboration looking at how the UK as a whole can address the requirement it faces internally and as a coalition partner. The venture established to address these issues is known as NITEworks, which is discussed in its broadest terms. A specific line of work being conducted within NITEworks is covered in more detail however; this being the development of a vehicle for coalition synthetic experimentation aimed at improving UK/US/NATO interoperability.

3.0 Economics Forcing The Issue

Transforming the procedures and application of current and future assets is important for at least two reasons; it enhances our militaries effectiveness and affordability. This chapter explores why affordability is an important issue now in the US as it has been in Europe. We will explore how the US defence budget may move over the coming five to ten years and what pressures are being exerted on it. Since the US is likely to drive coalition operating procedures to some extent, understanding why they are making changes as well as what they are doing, is important to the UK, Australia and others as they define their defence concepts.

International and national economics are clearly very complex subjects with many variables having affect. While the cyclical nature of the system is appreciated, there are certain unprecedented factors that flag concerns and these are discussed briefly below.

3.1 Global Pressures On US Government Spending.

The US Trade Deficit is worsening and while the US is experiencing reasonable economic growth, this is not reducing the risks associated with the large and growing current-account deficit. With American demand recovering faster than that of US exporters' markets, the external imbalance, and hence the US's need to import capital from abroad, is likely to grow. However, investing in the US is likely to be considerably less attractive than in the late 1990s when investment returns in the US were high. The combination of these two issues is assisting the gradual slide in the value of the US dollar. This is a concern since many countries such as China, Taiwan and Japan have US$ reserves that are at record levels with 40% of the US bond market currently foreign owned, principally by Asian banks [2]. If the dollar continues to drop this will place further upward pressure on long-term interest rates in the US with associated economic consequences.

The point here is that while Asia is happy to support US debt in order to offset appreciation of its own currencies and hence maintain export competitiveness, its ability and appetite to continue with this over a five to ten year period needs to be taken seriously when we review Asia's own internal problems. However, chances are that before this becomes a very serious problem, the US Treasury is going to need to reduce its current account deficit.

3.2 US National Discretionary Spending

Observations made when considering the influences on US Debt [3].

- By 2020 with current income and spend projections, the Government will have difficulty affording Medicare, Social Security and interest on debt.
- Over that time period, the un-funded requirements on the US treasury will amount to approximately $17 trillion.
- In 2008 the baby boomers will begin to retire placing huge pressure on the state. An interesting note is that in

    - 1945 there was 42 workers per retiree
    - Now there is 3.5 workers per retiree
    - 2008 there will be 2 workers per retiree

This level of debt projection is unsustainable and is being funded in an unprecedented way, principally Asian Banks. It has knock-on affects for exchange rates, interest rates, inflation, taxation and unemployment to name a few and even with a growth market, it is hard to see how the US can ignore much longer making reductions in spending and/or increasing taxation.

3.3 The US Defence Budget in Light Of This

The defence budget, as with all government department spending, will be under review with downward pressure likely to be significant [4]. While the defence and security of the nation will be overarching drivers, transformation initiatives and key focus areas such as Network Centricity, Joint Operations & Comms, Intelligence, Special Operations and rapid reaction modular forces will top the priority lists.

The defence budget is experiencing bottom-up pressure as well. The MRO budget is set to grow with above average usage in Afghanistan and Iraq, while capital procurement and hence replacement slips to the right. In addition, the manpower expenses look to rise with an increase in the Army of about 40,000, improvement in terms & conditions (average cost per soldier per year increasing to $100,000) and an unusually good retention rate. Currently the Army, Navy and Marines spend 2/3 of their budget on manpower (this includes pensions, medical insurance, housing benefits and other out of pocket expenses) with the Air Force spending 1/3, although this is partly due to different accounting practices. For example, of the $18Bn FY04 the Marine Corps has, only 13% is discretionary in terms of procurement & RTD&E. This will also be the first to be eaten up if reductions are imposed.

A point to draw from this is that even if there is a defence budget rise, it may have to absorb current supplementals, while financing increasing MRO and manpower costs, consequently reducing the amount available to industry.

3.4 Capability Requirements Ever Changing

With this in mind, it is evident that the accessible defence budget will at best remain flat while considerable improvements in capability are being sort. As a congressman mentioned, “we don’t just want to be competitive, we want to be dominant.” Coalition partners are under similar financial pressures and as importantly, need to develop their

affectivity while ensuring they are able to perform joint, international operations with increasing safety and interoperability.

The political and operational drivers for developing coalition interoperability are equally important and are not addressed in detail in this paper.

4.0 UK Government and Industry Response

"Isn't it astonishing that all these secrets have been preserved for so many years just so that we could discover them!!"

Orville Wright

In order to develop and facilitate the UK's response to the national and international requirement for joint operations as defined in the UK's new chapter of the Strategic Defence Review (SDR) [5], a MoD / industry test & experimentation group has been formed. The group is known as NITEworks (standing for **N**etwork **I**ntegration **T**est and **E**xperimentation **Works**) [6] who's mission statement reads '*A MoD/Industry partnership providing an experimental environment which allows our customer community to assess the benefits of NEC and the options for its effective and timely delivery.*' The consortium comprises 9 partner companies and 31 associates (appendix I) who's aim is to develop and execute experiments in order to demonstrate force structure and interoperability issues by studying operational concepts, doctrine and tactics.

The overall effort is MoD directed and industry managed. BAE SYSTEMS is the prime lead while a 'best fit' individual from one of the partner companies manages each experiment, a sample being discussed below. Clearly the scale of the UK defence industry requires co-operation between vendor to user and in this venture, vendor to vendor. Each company bringing its strengths and niche capabilities to common user defined problems.

One of the principle differences between this and the US's approach is the focus on modification of current procedures within existing assets to enhance the vision of a 'Network Enabled Capability' (NEC). While developing and projected platforms are introduced to the scenarios, it would appear at least that it is not to the same extent as the US approach. Their approach is very much aimed towards new technologies and programs forming environments such as Constellation, FORCEnet, WIN-T and the GiG interface between these.

4.1 A BRIEF BIOGRAPHY

In terms of defence industry, government / industry partnerships, progress has been rapid. BAE SYSTEMS and the MOD signed a contract on the 16th December 2002 to scope and price NITEworks, which at that time was called ENIF. The initial Scoping Study was a joint industry and MOD working team, which developed terms of reference for the group as well as a Kill-Chain Development pilot project. Importantly, a significant number of companies participated during the Scoping Study including QinetiQ (the lead BAE SYSTEMS partner), General Dynamic UK, Thales UK, EDS, AMS and LogicaCMG.

Since the Scoping Study, several milestones have been reached, including:

- Successful completion of the NITEworks Industry Day attended by approximately 100 individuals from ~30 companies and held on the 4th of March 2003.
- Formal opening of the Battlespace Management Evaluation Capability (BME Capability) on 26th March 2003 by Sir Jock Stirrup, Deputy Chief of the Defence Staff (Equipment Capability),
- Occupation by a joint MoD/BAE SYSTEMS/QinetiQ team of purpose built NITEworks facilities on the ground floor of Brennan House Farnborough 28 April 2003,
    - BAE SYSTEMS and MoD signed the NITEworks contract 21 July 2003, and
    - The Minister for Defence Procurment Lord Bach officially launched NITEworks on 28 August 2003.

NITEworks is modestly sized (~60 full-time equivalents), with personnel drawn from the civilian and military sides of MoD in addition to a number of industrial partners. In the broadest terms NITEworks delivers verified capability options to the MoD Customer/Stakeholders in response to customer-initiated questions as well as opportunities identified from within NITEworks. These are the combination of experimental resources (human, technical, analytical) and contextual information

(understanding the battlespace and business background across all lines of development, appreciating viability of potential interventions, technological possibilities etc), which affords the NITEworks Solution Concepts Team a broad, well-considered understanding of the issues. This enables them to produce timely, appropriate and compelling evidence to support viable interventions (into acquisition, doctrine or any other area) to improve NEC.

The flow of evidence to the Customers/stakeholders is driven by an iterative Question/Response cycle in which the Solution Concepts Team, drawing upon the experimental resources and context information described above, conducts high-level analysis. From this they report key decision-points to the Customer as cases for detailed experimentation (where merited) are developed. This ensures that:

- Questions/issues are considered to an appropriate depth, dictated by the form, quality, quantity and timeliness of the evidence required to deliver change (e.g. revised doctrine, equipment option) in the real world.
- Both the Customer/Stakeholder and the *Solution Concepts Team* have a common understanding of the evidence sought from and the knowledge encapsulated in NITEworks. This ensures the full effect of experimental resources and context information are included, both in responding to customer-initiated questions and identifying new intervention opportunities.
- Where detailed experimentation is merited, a *NITEworks Theme* (experiments framed in response to specific questions) or a Show & Tell Demonstration (to identify and illustrate opportunities beyond the well-defined question) is justified, planned and executed.
- *Context Information* is continually captured, refined and extended by feedback from the analytical process and experimental results.

4.2 THE NITEWORKS APPROACH

There are four important points that differentiate NITEworks from previous initiatives;

- The tempo of NITEworks operations - appropriately verified options are rapidly generated in line with MoD plus end-user time requirements.
- The proactive generation of opportunities in addition to the response to specific, directed questions.
- The combination of *Experimental Resources* and consolidated *Context Information*, allowing truly informed consideration of NEC issues.
- The continual feedback of analytical and experimental experience to refine and extend the *Context Information* base over time.

With this approach NITEworks offers a refreshing methodology in industry to industry and industry to government collaboration within the defence sector. It aims to develop relationships across the UK designed to deliver the best possible NEC related advice and solutions, regardless of current boundaries. Principally, NITEworks strives to be;

- a world-class decision support service to MoD senior management. This will enable the Customer to make capability trade-off decisions of a quality and at a tempo never before experienced.
- a small but powerful entity, with the potential to federate its experimentation capability in the UK and with coalition partners. It's people and processes will be drawn from industrial and governmental organisations on a 'best athlete' basis.
- recognised as an objective expert in military processes, architectures and systems management, anticipating customer needs as well as responding to requests.
- a flexible organisation, capable of rapid NEC solution development, including analysis and conceptualisation of changes to all Lines of Development across the battlespace.

Importantly, NITEworks will support customer decision-making, not supplant it.

It is also important to understand that it will not own the resource capability in-house to exploit the advice it provides. Chosen vehicles for NEC insertion through a close relationship with the MoD will emerge helping it to deliver faster, better and cheaper solutions.

4.3 CURRENT PROJECTS / THEMES

This section takes a brief look at the current projects underway within the NITEworks consortium. Then in chapter 5, the current 'Mulit National Experiment 3' (MNE3) is reviewed in more detain. In MNE3, NITEworks was tasked by the MoD to become the primary vehicle for coalition synthetic experimentation aimed at improving UK/US/NATO interoperability.

4.3.1 Indirect Fires Integration (IFI)

The IFI Theme team is working with MoD stakeholders to identify and investigate improvement options to support the progressive integration of extended range precision attack capability into the UK's Indirect Fire System (IFS). For the purposes of the IFI Theme, extended range precision attack constitutes the introduction of Indirect Fire Precision Attack (IFPA) and Guided Multiple Launch Rocket System (GMLRS) munitions, in conjunction with C4I and ISTAR systems including their integration into the battlespace.

A Workshop was held with stakeholders in February to identify key aspects of the targeting process, and the Theme was approved to proceed to an Experiment in September 2004, which will feed intervention opportunities in EP05 and EP06 and the IFPA Capability Integration Plan. The main Lines of Development likely to be impacted are Equipment, Concepts & Doctrine and Structures. The Experiment will involve 3 (UK) Div HQ as 'players' and will examine how the HQ staff interact with NEC technology within an Effects Based Planning context.

As well as a wide range of staff from across the MoD stakeholder community, other NITEworks partners have been engaged to input on relevant systems, including LogicaCMG, General Dynamics United Kingdom, AMS, MBDA and QinetiQ.

4.3.2 Command and Battlespace Management (land)

The Command and Battlespace Management (Land) initiative will build upon the BOWMAN foundation to provide a battle management system. A Common Battlefield Application Toolset (ComBAT), Infrastructure (I) and armoured Platform Battlefield Information System Application (P BISA), commonly known as ‘CIP’ will be at its heart.

The current mechanism for command and control on the battlefield is based largely on manual processes for the monitoring and planning of operations. It relies on the use of hand-written logs, manual mapboards and hand-drawn overlays. Below the Brigade level there is limited Communications and Information Systems support. Moreover, at the tactical level, there is no automated command and control support for fighting vehicle crews who operate in a cramped, stressed and complex environment, which imposes unique constraints on communication and information systems.

The CBM(L) theme is being developed with the assistance of a range of MoD stakeholders together with input from the NITEworks Alliance Partners. Work is in progress to take a capability based approach to theme definition to determine the appropriate candidate questions for potential experimental questions.

The aim is to determine what capability increments and programme improvements will assist in the delivery of the CBM(L) programme as a coherent capability by focussing on the Functions in Combat (using the capability baseline defined by the customer community) to provide credible evidenced based outputs.

4.3.3 ISTAR (Collection and Exploitation Coordination)

NITEworks has been tasked by the MOD to address how the UK can achieve fast improvements in the ISTAR process, particularly collection and exploitation coordination. This hinges around the UK's Collection Coordination and Information Requirements Management (CCIRM) process and the US's adoption of the Planning Tool for [ISR] Resource Integration, Synchronization and Management (PRISM). At present 2 particular lines of investigation are being considered:

- Investigate UK IRM Process. Concentration on UK doctrine and process, in UK independent and US-led coalition contexts, to address known and perceived front end (i.e. information requirements) issues.
- Investigate Impact of US adoption of (and potential UK use of) PRISM. This requires access to US process & technical knowledge which is being pursued by DEC (ISTAR), the question sponsor.

4.3.4 Kill Chain Development (KCD)

The focus of this on going theme will be to explore across all relevant Lines of Development (LoD), capability improvements to UK kill chain effectiveness in the 2006-2008 timeframe and in addition, the impact when acting as part of a US-led coalition.

There are 2 planned, and overlapping, periods of activity to this theme;

Stage one is complete and focused on tactical-level battlespace architectures, seeking to baseline existing air tactical target location, acquisition and tracking capabilities followed by exploration of alternative solutions. Early impressions suggest that the experiment plan has delivered valuable data regarding equipment, process, training and 'people' issues.

Stage two that will fill 2004 addresses follow-on activities post Stage 1 and focuses on operational HQ-level decision making (including human, process and equipment components) coherent with any follow-on MoD studies.

Potential industry participants should have demonstrable domain expertise in the following KCD related areas:

- Human Factors specialist(s), especially regarding decision making processes and behaviours.
- Command & Control specialist(s) covering:
    - o Data links
    - o C2 processes
    - o Decision Making processes
    - o Information Management Systems
    - o ISR collection

4.3.5 Mulit National Experiment 3

This theme is discussed in more detail in Chapter 5 below and for completeness, a brief discussion is given here.

NITEworks was tasked by the MoD to become the primary vehicle for coalition synthetic experimentation aimed at improving UK/US/NATO interoperability. The first step to achieving this requirement was MNE3, where NITEworks supported the MoD led by Command Battlespace Management (CBM) during this coalition experiment conducted in early Feb 04.

MNE3 aimed to build on lessons learned from previous multi-national experiments and to explore concepts and supporting tools for Effects-Based Planning (EBP) within a coalition environment. The purpose was to assist the development of future processes, organisations and technologies at the Joint Task Force level of command.

MNE3 concluded in Feb04, since then NITEworks has been working closely with CBM and other MoD stakeholders (including JFHQ, JDCC, DEC CC&II and DAES) to

complete the UK report detailing MNE3's conclusion and recommendations. This report was published in May 04.

5.0 NITEworks: Multi National Experiment 3 – an Overview

This chapter covers the analytical overview of MNE 3, this being the third MN experiment in the series led by US Joint Forces Command (JFCOM) J9. Broadly speaking, the MNE 3 team assessed and developed an operational level Effects Based Planning (EBP) concept using a present day Afghanistan scenario and examined the process, organisation and technology required to support EBP. Three reports have been published by the MoD on this subject with parts I & II [7, 8] referenced below.

The six Multi Interoperability Council (MIC) nations being Australia, Canada, France, Germany, UK & US plus NATO took part in the experiment, which ran from 2-20 February 2004. UK participation was led by D CBM/J6, with participants drawn from the MOD (JDCC, DEC(CCII), DFD, DIS, DAES & CJFO/JFHQ), Other Government Departments (FCO, DFID & HMCE) and industry organisations.

Organisations participated at various levels and following DAES intervention, NITEworks was asked to support the analytical activities of the experiment. The UK presence within the experiment was hosted at Dstl's Joint Command & Battlespace Management Applied Research Technology Demonstrator facility.

Not with standing UK involvement, MNE 3 planning was conducted in an internationally distributed manner, with all nations' military and civilian players co-operating via a computer networked Collaborative Information Environment (CIE). MNE 3 is the most recent and largest of this coalition experimentation series with its successor, MNE 4 being planned for February/March 2006.

5.1 MNE 3: Specific Aims And Objectives

The aim of MNE 3 was to build on lessons identified from previous coalition experiments and explore concepts and supporting tools for EBP within a coalition environment, specifically at the Coalition Joint Task Force (CJTF) (Operational) Level of Command.

Effects Based Planning is the core concept under consideration in this theme. Conceptually EBP seeks to translate strategic objectives into operational level effects principally founded on the notion of Effects Based Operations (EBO), described by JFCOM as '*a process for obtaining a desired strategic outcome or "effect" on the enemy, through the synergistic, multiplicative, and cumulative application of the full range of military and non-military capabilities at the tactical, operational, and strategic levels*', [9]. At certain levels EBP is already undertaken in military operations within the UK and it was with this experience that JDCC generated a prototype multinational EBP concept for MNE 3. This prototype described a systematic approach for planning EBO and took account of other core UK military tenets such as mission command and the manoeuvrist approach.

For the UK MoD in particular, this work aimed to:

- Influence the development of the EBP process internationally.
- Assist in the management of EBP to UK military doctrine.

Supporting these aims, 21 UK experimental questions were defined [8], which were taken from the Joint Experimentation Database (JED) and were agreed within the UK after the coalition experimental objectives were determined.

5.2 Coalition Experimental Objectives

The coalition agreed to build on the lessons identified in LOE 1 and LOE 2[2] and to incorporate these into the three experimental objectives, supported by equivalent objectives covering logistics planning:

- Develop and assess processes to support coalition EBP

[2] Limited Objective Experiments 1 & 2 – US JFCOM J9 events that preceded MNE 3 which examined collaborative working, information sharing and ONA.

- Develop and assess organisations to support coalition EBP, focussing on structures and skill sets
- Identify technology requirements to support coalition EBP

Importantly, MNE 3 was principally a quasi-experiment[3], which focused on learning about and improving the multinational EBP process by using an integrated coalition with distributed headquarters.

5.3 A Few Details

As mentioned, the approach used was quasi-experimental where independent variable manipulation was not controlled in a rigorous manner. In order to consider EBP using a Collaborative Information Environment (CIE) with coalition partners, as the theme required a single, real world Afghanistan scenario/vignette was developed. This scenario-based approach was used to test each of the Coalition and UK experimental objectives.

The experiment employed the global Coalition Federated Battle Lab (CFBL) Network to link coalition partners. The global experimental audience was approximately 400, with 118 actual participants in the CTFHQ and 43 in the NRF. A total of 59 UK personnel participated of which approximately 23 were experimental participants who came from operational backgrounds. US JFCOM, in contrast, provided mostly contracted retired officers as their experimental personnel.

5.4 Overall Conclusions

A number of conclusions were made in the documentation supporting this theme [7], a pertinent sample of which is presented here. Clearly there are a number of positives and space for further development and improvement.

[3] A Quasi experiment is recognized as a natural experiment where the independent variables are not manipulated but dependent variables are measured over time. This is not of classical rigorous design.

- MNE 3 offered a good learning opportunity and environment to exchange ideas related to EBP in a multinational and multi-agency environment. Although the UK obtained useful insights from participating, these were overshadowed to some extent by weak experimental design, poor setting of the initiating conditions required to undertake campaign planning of any sort, and a minimalist approach to the control of the experiment itself.
- Considerable differences between US and coalition partners' approaches to experimentation were identified during MNE 3. These are expected to be a significant ongoing challenge.

EBP offers the potential for improved coalition and UK military operations. This analysis suggests that if poorly implemented it will detract from current operations planning capabilities. The UK should adopt an EBP process that meets its own national requirements first and foremost, and consider interoperability with coalition partners as second order issue.

Note: A number of limitations to the MNE 3 analysis are discussed in the publicly available supporting documentation [7, 8] that should be read as is appropriate. In fact an extensive list is recorded in Part II [8], one headline being;

- The experiment was not constructed to address the JEF[4] questions and few objective data were collected to answer the particular questions. The answers to the questions are based on subjective analysis and there was no control group undertaking conventional planning.

[4] Specific questions identified in Part II [X]

6.0 Combat Identification; Supporting the Result

Having discussed the government /industry partnership and particularly the Multi National Experiment 3, that is in place to develop the top level architectural design of the supporting infrastructure that may provide battlespace awareness and transformed operational capabilities, a corollary of this work is reviewed. Combat Identification (CID) is an interesting one since it overlaps so many areas of the kill chain depending on the context of service and situation. As figure 6.1 below illustrates, it shares space with a number of important themes.

Therefore in this chapter some of the issues behind CID are discussed and the technologies and programs currently being supported within BAE SYSTEMS to support them.

5.1 Combat Identification – Defining The Problem

At all levels of command, and in all theaters of conflict a great premium is placed on combatants' knowledge of what is going on around them. The modern warfighter must not only identify friend and enemy, but also define the level of threat and determine the position of all non-combatants in the area. Further, the degree to which non-combatants might compromise the mission or to what degree the non-combatants might graduate to full fledged shooters is a dimension of urban warfare and the asymmetric enemy that our forces are likely to face.

The problem of identifying all entities in a theater battle space is complicated, and each service component has a different set of problems and doctrinal objectives that make identification either more or less essential in a given battle. The UK Ministry of Defence (MoD) defines CID as comprising the following three elements [10]:

- Situational Awareness; Increase combat effectiveness through positive identification of friend or foe via a timely, high fidelity common operating picture.
- Target Identification; Protecting friendly forces from inadvertent attack by their own side (or at least minimizing the risk of its occurrence) through the positive identification of all potential targets in the battlespace.
- Tactics, Techniques and Procedures; Developed to enhance joint Situational Awareness and Target Identification capability because no purely technical solution exists.

6.2 COMBAT IDENTIFICATION – THE LIKELY MAKE-UP

The problem of reducing fratricide is clearly non-trivial with no one-ticket item providing the solution. The problem covers the dynamic and non-dynamic battlespace, Joint Force including coalition operations plus technical and less tangible influences. This last contributor points to the human factors element where decision making is influenced by stress, arousal, workload, fatigue and training [11]. Figure 6.1 below is a 2-dimention visualization of this ‘space’. It illustrates that there will be elements of CID that stand alone, such as IFF transponders or even glo-tape. However, solving the problems of C2 and Situational Awareness with the intent of assisting joint force operations and the transformational construct being pursued by the DoD (to develop a lighter, more agile, capability driven effects based fighting force), a large portion of CID issues will be resolved.

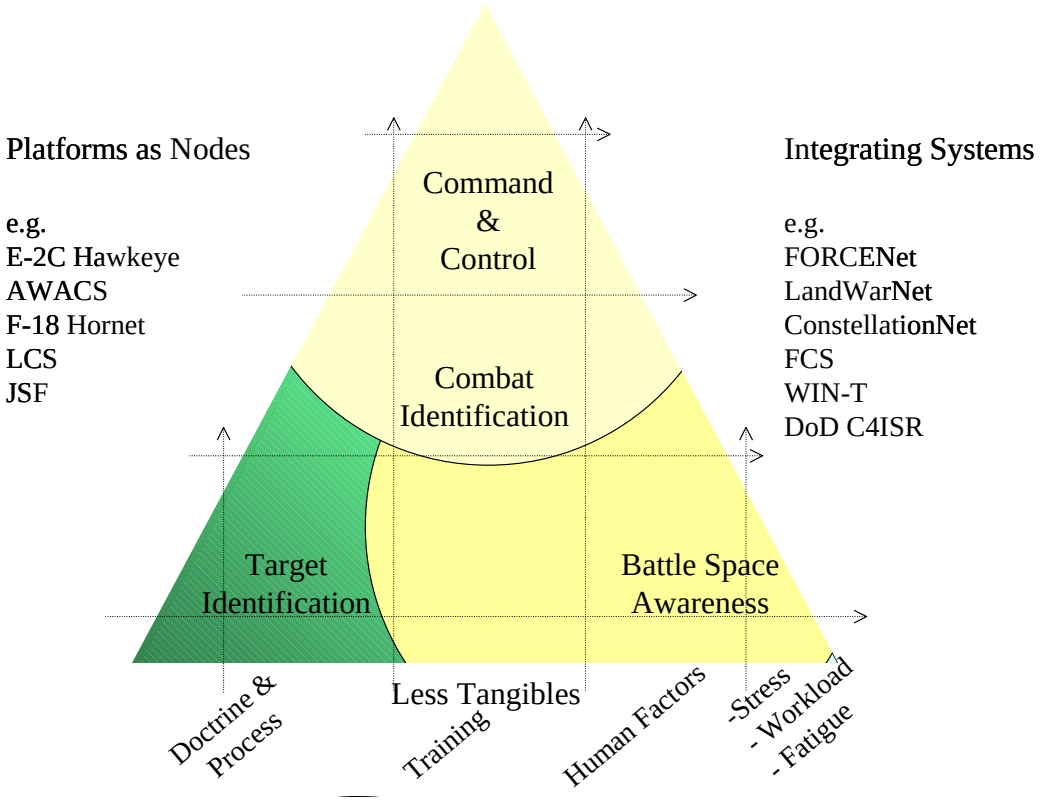

Figure 6.1: Illustration of the CID interdependencies aimed at Joint Fratricide Reduction

6.3 COMBAT IDENTIFICATION—A THEATER COMMANDER MUST DEFEAT THE ENEMY

Combat identification of battle space entities is needed to prosecute the enemy and defeat forces in the field. Enemy aircraft must be identified to all combat forces, and the enemy's intentions must be made clear in order for engagement decisions to be made at each level. Enemy soldiers, vehicles and weapons sites must be identified in order that they may be targeted. Non-combatants and 'innocent civilians' must be identified, located and isolated in order to control the battle space. Each CID activity is designed to facilitate two things: kill the enemy and preserve friendly forces, including non-combatants.

CID is viewed by each service component in a different light[5] depending on their doctrine and perception of the enemy threat [12].

6.4 COMBAT IDENTIFICATION—DOD INITIATIVES

Below are types of CID techniques and procedures that are under consideration in one form or another throughout DoD. The market value of any given type of CID depends upon the combat application and criticality of the CID process.

Visual ID: Combat (*ground-to-ground*) and thermal (*air-to-ground*) Identification Panels, Phoenix Junior Lights and Glo-Tape (*vehicle and infantry*) are the low-tech solution to identify ground troops in Iraq. Visible with (FLIR) sensors, thermal sights or night vision goggles respectively; the systems are relatively cheap and effective although clearly not difficult for a capable enemy to interpret.

Passive ID: This type of identification defines a battle space entity without using any active means. When one tasks the entire network fusion process to identify combat entities the passive assets are the most readily available as they do not require an overt hostile act and can be used during lead-up to a theater war.

Positional ID: In some combat scenarios forces can be identified by their position in the space. For instance any vehicle beyond a certain line on the map is a “bad guy”, or anything in a “kill box” is a target. DoD is looking at how to identify forces through GPS linkage to battlefield orders and relative to known friendly forces as a way of identifying entities and passing the CID over the net.

Network ID: Developing the analysis of networks and grid communications. When a network is identified as suspect, further analysis can determine, not only enemy entities and locations, but often may determine intentions. This type of CID contributes greatly to “situation awareness”.

[5] ‘How will the US Military Identify Friend or Foe in Modern Theater Battle Spaces?’ February 2004

Threat Profile ID: Knowing how the enemy acts in given situations often may be used to identify enemy forces. Taken a step further, knowing how the friendly forces are expected to act contributes to identifying the friendly forces in a battle space.

Sensor Integrated ID: This is the Holy Grail of the situation awareness community. If all sensor data could be combined into a communications system where individual combatants would know the identity of everything and everyone in a battle space, a solution is borne. Most of the DoD money is being spent to provide commonality and robust communications and computing capability that will provide near real time integration of sensor data to critical levels of command. Aircraft radars and sensors, ship borne radars and sensors, ground based radars and sensors, along with various airborne and space based sensors could, in concept, provide the ultimate picture of a given battle space. This appears to be the goal and much of the DoD CID money is directed at pieces of the puzzle.

Intelligence ID: Signals intelligence and communications intelligence have long provided the military with a good idea of how to identify battle space players. However, as the war develops COMINT and SIGINT become less reliable because the traditional methods of gathering and providing the information remain somewhat cumbersome. Efforts are underway to improve the gathering and real time analysis and distribution of the information in order to identify combat entities. Human intelligence is pretty good at defining a given enemy situation. However, getting that information to the critical command node in time to effectively identify targets and assess battle space situations is a problem. The Intelligence ID problem certainly receives a great deal of attention in DoD, but identifying and quantifying the market is made difficult be the classified nature of the business.

6.6 THE LINK

BAE SYSTEMS has a number of technologies that are world class, distributed data fusion and human factors to name a few. Integrating these to solve situational awareness and C2 issues comparable to themes, scenarios and architectures being developed in NITEworks, is likely to provide a solution by default to the problem of CID.

7.0 Conclusions

7.1 Shifting fiscal pressures and the changing nature of our adversaries are helping to drive transformation. As importantly, the political landscape that the current US administration is in a will deal with in the foreseeable future is likely to focus attention on coalition transformation allowing joint operations.

7.2 This requirement for coalition operations pulls at the root of a nation's need to be independent and maintain a level of secrecy in doctrine and tactics. This core value still presents a challenge to international operations.

7.3 NITEworks is a very promising vehicle for developing UK government and industry collaboration in addressing the complex, multi stakeholder environment that drives the MoD's vision of a Network Enabled Capability. This should improve the effectiveness of UK forces whether they work unilaterally, jointly and/or as part of a coalition.

7.4 The recently completed Multi National Experiment 3 (MNE3) theme offered a good learning opportunity and environment to exchange ideas related to Effects Based Planning (EBP) in a multinational and multi-agency environment. Opportunities exist for improving experimental design, setting of the initiating conditions required to undertake campaign planning and the control of the experiment itself.

7.5 The conclusion of MNE3 is that the UK needs to address its national Network Enabled Capability as a priority to solving coalition interoperability. Considerable differences between US and coalition partners' approaches to experimentation were identified during MNE 3. These are expected to be a significant ongoing challenge.

7.6 In addition it is noted that BAE SYSTEMS' participation in NITEworks is an excellent opportunity to be at the core of an enterprise striving to deliver true solutions to its customer.

7.7 BAE SYSTEMS has a number of technologies that are world class, distributed data fusion and human factors to name a few. Integrating these to solve situational awareness and C2 issues comparable to themes, scenarios and architectures being developed in NITEworks, is likely to provide a solution by default to the problem of CID.

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Appendix I: Partner and Associate Companies Forming NITEworks at Time of Writing.

(*alphabetical order*)

PARTNERS

BAE SYSTEMS
AMS Limited
EDS Defence Limited
General Dynamics UK Limited
LogicaCMG
MBDA UK Limited
Raytheon Systems Limited
Thales UK
Qinetiq

ASSOCIATES

Advantage (TA Group)
Aerosystems International
CAE
CSC
Diagonal Security (Claritas)
Defence Strategy & Solutions
Detica
Esys
FR Aviation
Frazer Nash
Helyx
Hi-Q
HVR
IBM
Insys
Janes
Lockheed Martin
Marconi Communications
Marconi Selenia
Northrop Grumman
Redstone
RJD Technology
Rockwell Collins
Roke Manor
SAIC
SciSys
SCS
Stasys
Ultra
Vega
Westland