Towards Quantifying the Benefits of NEC

Georgia Court Dstl/UK MOD Room 1021, A2 Building Dstl Farnborough Ively Road, Farnborough Hampshire, GU14 0LX, UK Tel: 0044 1252 455971 Fax: 0044 1252 455585 e-mail: gcourt@dstl.gov.uk	Alison Parr QinetiQ Room 1024, A50 Building Cody Technology Park Ively Road, Farnborough Hampshire, GU14 0LX, UK Tel: 0044 1252 392866 Fax: 0044 1252 394311 e-mail: ajparr@qinetiq.com

INTRODUCTION

The UK places Network Enabled Capability (NEC) as one of its highest priorities for future investment in research, acquisition and people. A recent Defence White Paper [1], states that the continued transformation of UK forces is dependent on exploiting the benefits of NEC.

Analysis and experimentation has a key role in helping UK MOD to identify:

- *where will NEC deliver most benefit to defence;*
- *what can be traded off to pay for it;*
- *what changes are required to processes, equipment, training etc, to deliver the desired transformation.*

Analytical support is being provided in three main ways:

- *"Knowledge-mining" previous work on quantifying the value of information. NEC as a coherent concept is new, but many of its elements have been under analysis for the last few years.*
- *Influencing ongoing studies and experiments to include NEC options in their analysis;*
- *Providing decision support to the MOD acquisition communities from a benefits-led perspective. This activity is helping the MOD to identify the high level benefits that could be achieved in delivering NEC.*

This paper provides examples of the types of benefits that are being identified and quantified and the methods that have been used in deriving them.

1.0 KNOWLEDGE MINING

NEC is about the coherent integration of sensors, decision-makers and weapon systems along with support capabilities[1]. It is not just about equipment; it is also about exploiting the benefits to be obtained from transformed doctrine and training, and optimised command and control structures[1]. NEC as a coherent concept is new, but many of its elements (equipment, processes, structures, and training) have been under analysis for many years. This existing knowledge has been brought together to provide a compendium of evidence, grouped against the themes that describe the characteristics of network-enabled operations. For each of the themes this paper provides a description of its characteristics, an example of its expected benefit and an overview of the method used. The examples demonstrate that the UK has applied a number of different methods, each of which has delivered a different insight into the benefits of NEC.

Theme 1: Resilient information infrastructure and full information accessibility. This theme is defined in two parts. The first is "Ensuring information is managed coherently across the battlespace and that the potential for secure and assured connectivity is provided to all battlespace users". The second is "Enabling users to search, manipulate and exchange relevant information of different classifications captured by, or available in, sources internal and external to the battlespace".

An example of benefit from investment in the capability implied by Theme 1 has been identified through the use of campaign modelling. The UK campaign model CLARION[2] was

[1] Delivering Security in a Changing World: Future Capabilities, July 2004

used to explore the balance of investment in anti-armour capability. The analysis illustrated that investment in a networked long-range precision capability (the coherent integration of sensors, information infrastructure, IFPA[3] weapons and decision-makers) reduced the demand for direct fire assets, which were used more efficiently. The benefits were significantly less if investment was made in only weapons or only in information capabilities. The measures of effectiveness used to measure the benefit of NEC were the same measures that would be used to decide whether to invest in a weapon or platform (such as time to achieve campaign objective). This approach allows decision-makers to balance their investment across capabilities including information capabilities, weapons and platforms to achieve the best value for defence.

Theme 2: Shared understanding. This is defined as "Enabling each user to generate an understanding of the battlespace that is appropriate and adequate to their task and consistent with the understanding of other users."

An example of the benefits of shared understanding, in this case facilitated by a shared common picture, was found using a combination of techniques. Analysis of defending airspace under tight Rules of Engagement suggested that the provision of a common operating picture to weapon system operators and the commander controlling authority to engage, plus an appropriate doctrine to take advantage of this, generated major improvement in the likelihood of correctly identifying an authorised target. The analysis used systems level modelling combined with capability chain assessments that take account of equipment capabilities and decision-making processes. Linear programming was used to identify optimum networked air defence mixes that provided the greatest likelihood of correct identification of targets.

Theme 3: Dynamic collaborative working. This is defined to be "Enabling agile command and control within and between mission groups through the ability to concurrently plan and execute operations in a way that is dynamic, continuous and synchronised."

Warfighting experiments with digitised[4] forces provided evidence of the benefits of dynamic collaborative working. The experiments used man-in-the-loop collective simulations. It was found that agile command and control delivered significant improvements to the effectiveness of digitised forces in warfighting experiments compared to forces for which only the timeliness and reliability of information was improved (with no corresponding changes in synchronisation, op tempo or scheme of manoeuvre). By assessing the effectiveness of units, the benefits of agile command and control can be compared with other improvements in capability such as equipment or training enhancements.

Theme 4: Agile Mission Grouping. This is defined to be "Enabling the dynamic creation and configuration of task orientated mission groups that share understanding and that employ and co-ordinate available assets to deliver the desired effect."

An example of the benefits of agile mission grouping was identified by stochastic simulation of kill chains. The analysis illustrated that the ability to prosecute a high priority target through network-enabled fire using any of land, sea and air systems reduced the time taken and increased the ability of decision-makers to choose the most suitable assets. The main measure of effectiveness was the time taken to prosecute the target; this allows decision

---

[2] The CLARION model is an event driven partially stochastic combat model operating at Brigade level and above. CLARION is used primarily in analysing the impact, at the operational level, of changes in organisation or equipment.

[3] Indirect Fire Precision Attack

[4] The digitised force had a regularly updated map display in each vehicle showing all blue vehicle locations and believed red positions from contact reports. Each vehicle was able to use the system to directly call for indirect fire support. The brigade tactical operations centre had the ability to transmit text orders and map overlays to each vehicle.

makers to include agile mission grouping when considering alternative ways of improving the capability to prosecute time sensitive targets.

Theme 5: Effects Synchronisation. This is defined to be "Achieving the desired effects through the synchronisation of activities within and between mission groups."

Historical analysis identified examples of the operational benefit of synchronising effects. Evidence from the analysis of 160 land and air campaigns indicates that multiple surprise is important to military success at the campaign level. The analysis showed that if an attacker can keep a defender continually off balance by having a cycle of information gathering, assessment, decision and delivery of effect (i.e. NEC) faster than the defender's, then the chances of success are greatly enhanced. Analysis of 79 amphibious operations demonstrates a link between an attacker having C3 superiority and reduced time to achieve campaign success.

Theme 6: Inclusive Flexible Acquisition. This is defined to be "Co-ordinating processes across MOD, OGDs and industry that promote the rapid insertion of new technologies and facilitates coherence between acquisition programmes and the incremental delivery of NEC capability."

Acquisition for NEC (AfNEC) is the UK programme to identify the changes and improvements required in current acquisition structures, processes, culture and relationships to deliver NEC. It is postulated that five high level benefits could be achieved by improving the acquisition process in order to deliver NEC: "Reduced Cost of Integration Risk", "Greater Military Capability with fewer Assets", "More Agile Acquisition", "Greater Cost Savings" and "Increased Shareholder Value for Industry". AfNEC has used a benefits-led approach to demonstrate causal links between the proposed changes and the expected benefits.

The AfNEC programme piloted a programme of revised processes and behaviours. These pilots were studied and lessons identified collected. A form of decision support analysis, Benefits Analysis, was applied to collate evidence from the pilot activities and relate this in a causal-link manner to the AfNEC benefits. A benefits analysis tool was used to capture and structure the changes demonstrated within the pilot programmes and to build a map relating these to the five high level benefits of the AfNEC Programme.

Analysis of the map showed that enablers and blockers to delivering capability could be identified and recommendations could be made as to areas for change. Key performance indicators for each change process were also identified, which could be used for monitoring the benefits and therefore the success of any initiative.

Overall Conclusions from the Knowledge Mining Activity

This paper uses examples of the evidence collected to illustrate the key features of the knowledge mining activity. The evidence from existing studies, experiments and assessment of acquisition processes indicates that NEC offers the potential to deliver effects better, quicker, and cheaper than is currently the case.

Lessons from the Knowledge Mining Activity

The evidence collated so far has been generated using a wide range of methods. It demonstrates that the key to providing an understanding of the benefits of NEC is not the use of one particular method but the application of the full range of analytical techniques, each providing a different insight. The methods used include historical analysis, simulation modelling (from engagement up to campaign level), benefits mapping, time-line analysis and linear programming.

The choice of measures of effectiveness is as important as the method used. In order to address the crucial issue of what can be traded off to pay for NEC, the measures chosen must include the same measures as those used to assess the benefit of other capability enhancements. This is essential to allow investment in NEC to be balanced with other

possible investments. The examples given in this paper all use these types of measures and demonstrate how they can be applied in a NEC context.

2.0 OUTLINE OF NEXT STEPS

The activities described in this paper are initial steps of a process of identifying the benefits of NEC. The process is intended to help inform MoD on three key NEC questions that need to be addressed:

- Where does NEC deliver most benefit to defence?
- What can be traded off to pay for it?
- What changes are required to processes, structures, equipment etc., to deliver the desired transformation?

The knowledge mining activity will continue. For the first five of the themes, this will take the form of identifying further evidence from existing work and to continue to influence planned and ongoing studies and experimentation to contribute to the understanding of NEC. For "Inclusive Flexible Acquisition" benefits analysis will continue to provide support to a number of MoD Acquisition organisations in the delivery of NEC. The results of these analyses are being used to inform MoD on how it could improve capability management, how it could deliver more integrated capability, and how best to get new technology pull through.