

# Acquisition Issues for Network Enabled Capability

**Richard Ellis**

UK Defence Science and Technology Laboratory (Dstl)

*and* Stratum Management Ltd

N131

Dstl Malvern

St Andrews Road

Malvern

Worcestershire

WR14 3PS

United Kingdom

+44 (0)1684 771484

[rkellis@mail.dstl.gov.uk](mailto:rkellis@mail.dstl.gov.uk)

[richard.ellis@stratum-management.co.uk](mailto:richard.ellis@stratum-management.co.uk)

## Abstract

This paper explores some of the acquisition challenges associated with the introduction of a network enabled/network centric capability. It has been written from the perspective of the UK's Network Enabled Capability (NEC) initiative, but aims to discuss general issues that will be of interest and value to all those involved in acquiring, deploying and maintaining similar systems.

There are many challenges and constraints inherent in trying to develop a system of systems to deliver a network centric/network enabled capability. There is an understandable pressure to deliver capability as soon as possible, and to see an early return on investment in NEC, but the task is too large (and too expensive) to achieve immediately. The rollout of NEC will be iterative, with different elements of the overall capability developed and deployed asynchronously by a wide range of different acquisition programmes and systems, against a background of developing requirements and rapidly advancing technology.

This paper discusses four principal acquisition themes (maintaining coherence, managing change, managing expectations and political will, and financial approvals) from the viewpoint of NEC and proposes some potential solutions to the considerable challenges that NEC will present.

## 1. Introduction

This paper discusses some of the practical aspects of the acquisition and support activities necessary to fulfil the UK's aspirations for Network Enabled Capability (NEC). It includes an overview of NEC and a discussion of the context in which NEC is to be delivered. It then

reviews some of the difficulties that are likely to be encountered in the delivery and support of NEC, selecting four specific areas that will present particular challenges.

The paper has been written from the viewpoint of the UK's NEC initiative, but it is hoped that many of the lessons and issues will be equally applicable to programmes being conducted in other countries, including the US NCW initiative and other programmes aimed at enhancing operational effectiveness and efficiency through the improved use of information.

The views and opinions expressed in this paper are those of the author, and should necessarily not be taken to represent the views of the UK Ministry of Defence, the Defence Science and Technology Laboratory or Stratum Management Ltd.

## 2. NEC Scope and Content

NEC is a developing concept, and, as ever with a bold initiative in its early stages, different stakeholders and observers have different views as to its scope and content. The author works in the central NEC research team in Dstl, and offers the following characterisation.

NEC can be seen a series of interlinked capability developments aimed at supporting and enabling a new range of operational concepts including Knowledge Superiority, Battlespace Exploitation and Effects Based Operations. The capabilities can be grouped under a number of core themes:

- Robust Information Infrastructure. An infrastructure that can provide the underpinning information transfer and management services using a combination of fixed and deployable communications assets, combined with operational units and systems ("Net Ready Platforms") capable of accessing the infrastructure wherever services are available.
- Adaptable Capability. The capability to support mutually aware, task based communities, dynamically created and configured to meet the specific needs of a mission and capable of co-ordinated employment of sensors, C2 and weapons. This capability includes an implicit capability for interoperability between applications and personnel to achieve the missions goals.
- Full Information Exploitation. A capability to ensure that all elements in the battlespace are using a coherent representation of the operation, sharing information on the operational situation, the intent of friendly forces and the interpretation of the enemy's likely courses of action. This will include access to all suitable data sources, supported by appropriate real time search, discovery and retrieval mechanisms.
- Synchronised C2. The capability to conduct effects based planning, deciding the best mix of military, financial and political measures to meet the aims of the missions, followed by the generation and coherent execution of multiple dynamic plans,

monitoring and adjusting plans and operations to ensure that effects are deconflicted and synchronised.

In addition to these equipment capability aspects, it has been recognised that there is a need to develop the UK's capability to acquire and manage NEC related systems. These capabilities have given rise to a further theme, Responsive Acquisition, which includes:

- Co-ordinated Requirements Definition. The development of capability requirements that recognise and support the development of other systems and capabilities being acquired, both military and non-military.
- Programme Alignment. The continuous alignment of evolving and dependent programmes, ensuring coherent timescales and the timely delivery of appropriate and adequate supporting capabilities.
- Technology Exploitation. The development of programmes and systems that can exploit new technologies as they develop, to maintain a battle winning edge.
- Interoperability Management. A continuous process of addressing interoperability within and between UK forces and other government departments (OGDs), multinational partners and non-governmental organisations (NGOs).
- Demonstration of Benefit. The development of models and analysis to allow the demonstration of NEC related operational benefit of potential and proposed acquisitions and incremental enhancements, in support of acquisition funding bids.

This paper may be seen as part of the process of discussing and developing the practical aspects of some of the issues in this acquisition theme.

### **3. NEC Timescales and Opportunities for Delivery**

NEC has become a high profile aspiration in the UK Ministry of Defence (MOD), as demonstrated by recent speeches to the House of Commons by the UK Secretary of State for Defence, Geoffrey Hoon<sup>1</sup>, and by the Deputy Chief of Defence Staff (Equipment Capability), who has echoed his remarks by underlining the importance that will be given to NEC related capabilities in future acquisitions.

There is, therefore, a natural desire to see an early improvement in capability through NEC. Unfortunately, the delivery of NEC is complex and involves many interdependent programmes. The programme is too large, expensive and complex to be rolled out as a single acquisition, and will have to be phased in over a number of years, with operational capability developing as different elements are provided.

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<sup>1</sup> Speech to the House of Commons on the publication of Strategic Defence Review – A New Chapter, 18 July 2002.

Three opportunities present themselves for the delivery of NEC:

- New Acquisitions. New acquisition programmes present the best opportunity for incorporating the required capabilities to support NEC. However, we are not yet in a position to accurately define these capabilities, and it will be some years before capability acquired through this route will be available to the front line.
- Incremental System Updates. As systems reach natural incremental upgrade points, the opportunity can be taken to incorporate changes that support NEC. In the UK some work has already been undertaken to characterise changes that are likely to be "NEC-friendly", even in the advance of a detailed definition of NEC requirements. These include developments that support the wider sharing of information, the communication of plans, expression of intent and communication of commanders' interpretation of the picture. As the NEC concept develops, these incremental update guidelines can be defined more closely.
- Quick Wins. In some cases, it is possible to identify situations where a relatively small spend could provide a rapid and significant gain in interoperability or information sharing. These opportunities should be actively sought and exploited, as they provide a valuable route to providing early support to operational capability.

The delivery of NEC will involve coordinating all these approaches, applied to a wide range of new and existing systems, within an overall vision and plan for delivering the desired capability.

#### **4. Acquisition Challenges for NEC**

Implementing the wide ranging remit of NEC brings many acquisition challenges, some of which are discussed in more detail in later sections of this paper.

One of the most serious challenges is achieving and maintaining coherence across a multitude of programmes at different stages in their acquisition lifecycle and based on different generations of technology. In addition to coordinating UK programmes, NEC brings additional demands relating to interoperability with military allies, with public domain sources and with NGOs, through the use of flexible, open interfaces, based on industry standards.

This coherence has to be maintained against a shifting background, with permanent, unpredictable and unavoidable change affecting requirements, technology, interoperability constraints, funding and the progress of individual programmes.

NEC currently has a strong political will behind it, with everyone from the Secretary of State for Defence downwards expounding its virtues. However, experience suggests that this impetus will not last without evidence that NEC is being delivered. Part of the challenge of achieving a successful acquisition of NEC will be support to maintain the visibility of the value of the concept,

and to show that it can deliver the benefits that have been so widely trumpeted. However, this will need to be done without overstating the likely benefits, and with a mind to trimming some of the excess hype that can attend the launch of a new initiative to ensure that expectations on capability and timescales are realistic and manageable.

A final challenge addressed in this paper is that of managing financial and contractual aspects. The UK's acquisition system has been overhauled over the last few years with the introduction of Smart Acquisition [MOD, 2002]. This valuable development, which is echoed by developments in other NATO and non-NATO countries, has assisted in refocusing effort in defence acquisition on the capabilities required, rather than supporting assumptions regarding the type of system to be purchased, and has placed value for money at the centre of decision making. However, the financial underpinning of Smart Acquisition is arguably more suited to the procurement and support of large, enduring programmes, and less well suited to the dynamic, flexible approach that will be required for the successful acquisition of NEC.

Each of these issues is discussed in more detail in the following sections.

## 5. Maintaining Coherence Across Acquisition Programmes

The aspirations of NEC will not be met by acquisitions in a single programme or a small number of programmes. Although core information technology and C2 programmes will form the focus of NEC, the implications of adopting a shared information approach and presenting a coherent picture to all operators will affect almost all acquisition programmes.

The range of programmes involved in NEC creates an unprecedented problem in maintaining coherence. Each of the programmes will have their own independent (and in some cases conflicting) timescales, requirements, challenges, funding and priorities. In many cases they will have a different "customer" in the Ministry of Defence, as their principal support is for a different military domain, or different operational or non-operational organisation. Within this diverse mix, it will be necessary to manage a coherent development of capability, with the synchronised and coordinated delivery of services and systems.

The interrelationships between programmes take a number of forms, each with their own challenges:

- **Interoperability Constraints.** Interoperating systems need to share compatible interface standards and a shared definition (or *ontology*<sup>2</sup>) of information to be transferred. Interoperability constraints of this type will be familiar to many military programme managers, but have not always been well handled in the past.

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<sup>2</sup> *Ontology* is used in this context to indicate a definition of the objects that can be communicated and their inter-relationships. A commonly quoted definition is "A specification of a representational vocabulary for a shared domain of discourse -- definitions of classes, relations, functions, and other object." [Gruber 1993] A rich shared ontology, which goes beyond traditional data models, will be required if NEC systems are to successfully share and process concepts such as intent, understanding and plans.

- Provision of Essential Components and Services by One Programme to Another. If the expected benefits of coherence and economies of scale are to be achieved, it may be expected that some acquisition programmes will have to rely on others to provide essential system components (such as software applications or toolsets) or services (such as information transfer services). This situation will not be welcomed by many project managers who will recognise a risk to the delivery of their project over which they have little or no control. This will require close cooperation between the acquisition programmes, and a satisfactory mechanism for defining responsibilities and resolving differing priorities in the delivery of the components. Problems caused by this type of interdependency will not cease on initial supply of the component, as the delivered systems and the component itself will require to be supported and updated through life.
- Timescale Interdependencies. Each programme will have its own timetables for the delivery of its principal capability. History suggests that many of these timetables will vary during the development of the system, due to delays caused by changed funding priorities, unexpected difficulties in developing the capability or for other reasons. Where programmes are self contained these slippages may be little more than an inconvenience. However, where there are complex interdependencies, a small delay in one programme may cause serious degradation in capability in others.

One common root in the challenges created by these interdependencies (and hence in meeting the challenges) is the tension between local management decisions, in the interest of the specific programme, and decisions that are in the interest of the overall operational capability.

There are a number of potential activities that can help ameliorate the problems caused by the complex interrelationships the NEC will bring. None of these will, on its own, resolve all the problems, but each can play a part in making NEC more successful.

- Maintaining an Overall Picture of Programme Interdependencies. In order to make a start in managing the interrelationships between programmes it is first necessary to understand what they are. This involves investigating and documenting the programme interdependencies and common interests, and presenting it in a manner that acquisition coordinators and individual Programme Managers can use. The UK's Integration Authority has a programme of this nature in hand, and this will provide invaluable support to acquisition authorities.
- Building Understanding and Trust Between Programmes. Programme Managers are rightly wary of trusting the delivery of their project to another programme which they do not understand or have any control over. In order to make informed decisions, staff from interrelated programmes need to be familiar with each others' requirements, timescales, constraints, difficulties and pressures. Gaining this familiarity will support more informed decision making, will increase the trust and confidence between programmes and will encourage the earlier identification of problems and identification of fallback measures and solutions. It will, however, require a significant investment in effort by acquisition staffs.

- Balanced Power over Programme Managers. A balance will need to be struck between the independence of Programme Managers in the acquisition of their programmes, and the ability of someone "higher" in the NEC organisation to intervene to impose a new requirement, or to force a Programme Manager to follow a course that is more likely to lead to a coherent system, even if it is at the detriment of the individual system. Examples might include the imposition of a solution for a particular (bespoke or Commercial Off the Shelf (COTS)) software application, or the imposition of a new interface standard, overriding previous interface requirements. Of course, such changes could not be imposed without some consideration of cost, and changes in funding profiles would have to be included in the management of these new requirements.

The type of oversight and control by a third party discussed here will be anathema to many Programme Managers, for whom fixed requirements, firm prices and the responsibility to solve the problem and manage risks in the most cost effective manner free of outside interference are seen as basic tenets of good management and systems engineering. However, it is considered that some move in the direction of external oversight and control will be required if a coherent capability is to be delivered.

In addition to its direct impact on programmes, the existence of an empowered authority, able to resolve problems between programmes will improve the confidence of Programme Managers when they are forced or opt to rely on other programmes for essential services and components.

## 6. Managing Change

A key to the successful acquisition of NEC will be the management of change. The timescales for military systems are extremely long when compared against many of the related activities. During the typical 25 year life of a system (and even during a typical 5 year development period) there will be many changes that will have a significant impact on the programme. These include:

- Technology. Information technology changes beyond recognition within ten years. New technologies appear and become commonplace in the workplace and in the home, and there will be a valid desire to see them exploited in the battlespace. Technologies seen as a sound basis for systems disappear, and their support disappears with them. Examples of rapid change include the facts that HTML, the core language of the internet and intranets, is only 12 years old and Java has yet to reach its seventh birthday.
- Requirements. Requirements change continuously, driven by changes in doctrine, operational policy and national stance. Few would have predicted one year ago the new focus on homeland defence and anti-terrorism operations that we are now seeing; and the Berlin Wall only came down 13 years ago, heralding a fundamental change in global military requirements. It is impossible to predict the equivalent changes that might take place in the coming decade.

- Interoperability Drivers. No country has complete control of the standards and protocols that will be required to operate with others. While there are some de facto and stated standards, these evolve over time, as new applications develop and historical standards are overtaken by new capability demands.
- Undertaking NEC. NEC is bringing many new challenges. As we work further in this area we will learn new ways of doing things and new constraints that will improve system acquisition and performance.

The impacts of the inevitable changes in technology, requirements, interoperability constraints and acquisition method will be exacerbated by the interrelated nature of the NEC related programs. A small change in one programme may have serious and unforeseen consequences in another. As discussed in the previous section, these cross programme impacts will need careful management if they are not to disturb the overall initiative.

In order to manage this level of change, it is not sufficient to assume that changes will be small and self contained, and that new influences to a programme can be managed on a case by case basis. However, there are some approaches that can ameliorate the problem.

Since we know that things are going to change, and the cause of those changes may well be beyond our control, it is necessary to adopt a project management approach that *accepts that change is going to happen*. Potential solutions should be studied to ensure that they will be robust in the face of changes to known requirements and current assumptions. Solutions should have the capacity to absorb new requirements, and to adapt their capability to match new circumstances.

Achieving these design objectives may have an impact throughout the system, and it has to be accepted that there will be a cost /capability trade-off to be made. A flexible, robust, adaptable solution will cost more to develop and maintain than a brittle design precisely matched to current assumptions and requirements. This means that a hard choice will have to be made regarding the initial operating capability of a system. If it is to be robust and able to provide a sound basis for support into the future, then it will either be less capable than a precisely matched solution, or it will cost more. This message is often a hard one to accept, but continued insistence on producing the best solution today, without consideration for tomorrow will have a lower cost effectiveness in the long term<sup>3</sup>.

The impact of change can also be reduced by undertaking smaller programme increments within a larger overall framework. This incremental approach has been adopted in principle by many NATO nations, including the UK, and it is particularly well suited to the delivery of NEC.

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<sup>3</sup> Further discussion on the funding of NEC systems is given in the next section.



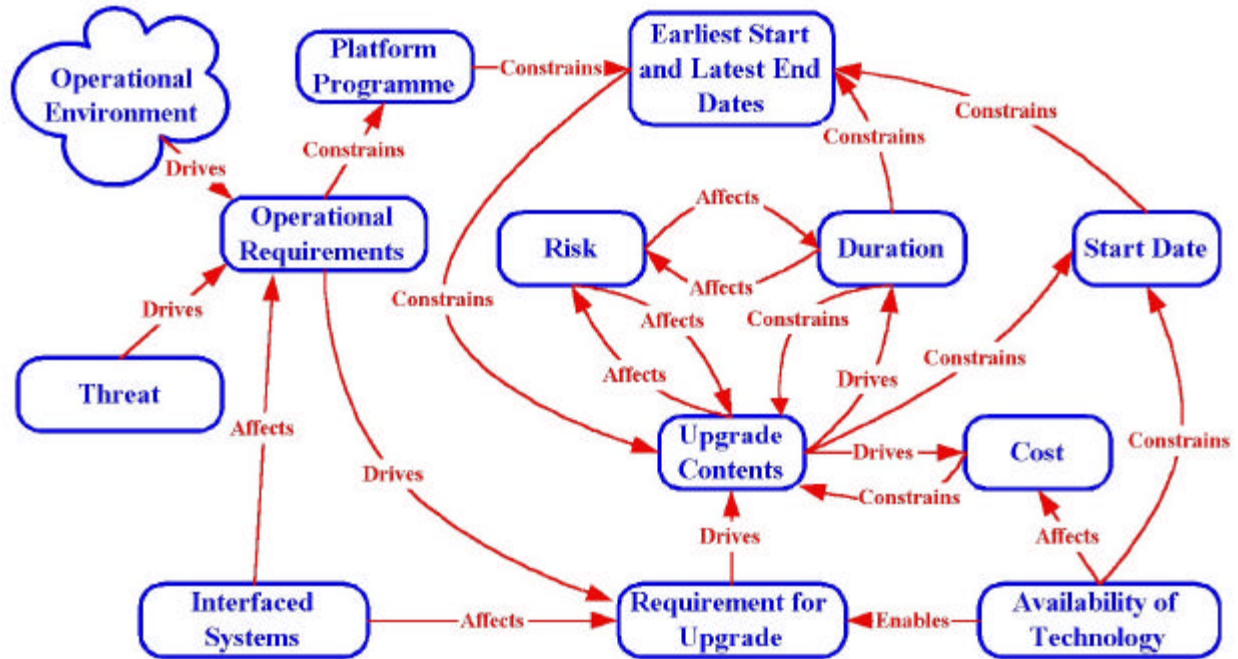


Figure 1 – Management of Platform Upgrades

The level and frequency of change in systems will inevitably lead to the concurrent fielding of systems at different levels of capability. This in itself creates a number of challenges, including the management of the rollout of new capabilities. This complex process involves a wide range of stakeholders with conflicting interests, and successful resolution will require understanding of many viewpoints and interests. There are many tightly interrelated factors to be considered in managing system development and in planning individual upgrade events. These include cost, time required to implement the upgrade, time required for preparation, risk, obsolescence pressures, availability of components, platform programmes, links with other programmes and specific operational demands (Figure 1). These various aspects will need to be assessed and traded off in any particular upgrade, and this will require input and understanding by all stakeholders. The complex interrelationship between the various stakeholders will be simplified by clear understanding of their individual aims and responsibilities. Managing the upgrade process will require the co-operation and support of all stakeholders.

## 7. Maintaining Political Will

As discussed earlier in this paper, there is currently strong political support for NEC. This is valuable for those involved in this field, but experience suggests that this political support will decline over time unless NEC can show that it can deliver.

NEC has a lot of potential, and the operational benefits are easy to visualise, while the infrastructure and acquisition challenges are not so obvious. This may lead to inflated expectations as to the timescales within which operational benefits can be rolled out. NEC has the capacity to deliver, but the desired capability will not be delivered overnight. Expectations

will need to be managed to ensure that they are realistic, balancing the future operational gains against manageable timescales.

This can be achieved by a range of methods, including the following issues:

- Regular briefings on progress and plans to a wide range of stakeholders, to ensure that the overall message regarding NEC is not distorted.
- Identifying, through a better understanding of NEC, where rapid acquisition action could bring significant benefits to the front line. Examples might include providing bridging between networks, providing single (or coherent) software packages to a range of C2 systems to encourage coherence.
- Employing believable and realistic OA and simulations to demonstrate likely gains that can be expected from NEC, as well as any attendant and unavoidable drawbacks.
- Experimentation to demonstrate selected concepts, giving stakeholders a realistic view of potential future capability.
- Gathering evidence from the research, development and operations of other countries, where it is relevant to the UK's plans.
- Drawing on experience from previous initiatives, where appropriate, to demonstrate the operational advantages of some of the concepts, but also to highlight the difficulties in delivering a coherent, battlespace-wide capability against the background of real world acquisition and support activities.

It is hoped that activities such as these will deflate overhyped expectations, while providing a sound and realistic assurance that NEC will deliver the desired battle-winning edge within useful timescales.

## **8. Finance and Contractual Issues**

In defence acquisition that has been a welcome trend in the last few years towards tighter financial management and a drive to obtain greater value for money. This understandable and desirable aim has led in the UK and elsewhere to an approvals system [see for example MOD, 2002] that demands a robust and precise assessment of predicted spend over the lifetime of a system or capability before financial approval is given and funds released.

This approach has many advantages in supporting an objective assessment of the total costs of a project, and is well suited to the acquisition of large, stable, well understood systems, where costs can be accurately modelled, the future path of the acquisition can be predicted accurately, and firm bids can be obtained from industry to undertake the work. However, many NEC related

acquisitions will not meet these criteria, and for these systems the lack of flexibility and unreasonable demands of such a system can threaten the value for money that can be obtained.

In many core NEC related acquisitions it will be impossible to accurately predict the cost of providing a specified capability further than, say, four years ahead. Even if the requirements for a system remain unchanged (as discussed earlier in this paper, this may not be the case), the pace of change in technology and the paucity of accurate cost models to predict the through life costs of complex systems based on commercial components [see for example Ellis, 2000] will mean that whole life costs will be impossible to predict. This situation will be exacerbated by the interrelated nature of many NEC capabilities, and minor changes in one area may have a significant impact on the cost/capability calculations in another.

Coupled with this difficulty is the challenge of demonstrating the operational improvements that will be generated by NEC related investments. If NEC is to be a success, there will be a need to support submissions for funding with valid and supportable evidence that the enhancements of equipment capability will provide improved operation effectiveness and that they represent value for money. Given that the overall NEC capability will be generated by a large number of individual acquisitions and incremental upgrades, and that some spending will be necessary to provide infrastructure with no direct tangible benefit, providing this evidence is not a simple task.

One solution would be to use the standard approvals system, knowing that the information being provided is inaccurate and unreliable. This approach will support initial rollouts of NEC related equipments, but it may be expected to cause unexpected volatility in funding lines as the errors in prediction are uncovered. In some cases this will lead to excess funds having been approved, as technology moves faster than had been predicted, and capability is delivered more cheaply than expected. While a short term bonus for the acquisition authorities this does not represent prudent use of funds and will generate a lack of confidence in other predictions. The other case is that a capability will turn out to be more expensive than expected, and the military will end up with a system that is late, or less capable than required unless additional funds are allocated, possibly at the expense of other military capabilities.

In order to avoid this situation, it is proposed that the following approaches are considered:

- The overall funding profile and priorities for NEC related activities should be discussed and agreed with the funding authorities. It must be accepted that this profile will have inaccuracies beyond the initial years, and that within this overall profile there may be changes to how money is spent to deliver the optimum programme of equipment capability.
- Incremental approval is given for smaller increments of funding, with capability expectations being agreed over a rolling window covering only the next three to four years.
- The programme is subjected to regular financial oversight, to ensure value for money is being sought and achieved and financial probity maintained.

NEC is unlike most previous undertakings, and if it is treated as the same as any other large project then there will be difficulties. These proposals would support the smooth rollout of NEC within an appropriate and acceptable level of financial oversight.

## 9. Conclusions

This paper has discussed the general scope and content of the UK's NEC initiative, and explored a number of acquisition related issues. A number of conclusions have been reached which, it is hoped, are of value to NEC and to other similar network centric initiatives.

NEC presents an unprecedented challenge in maintaining coherence across a wide range of interdependent acquisition programmes. Meeting this challenge will be facilitated by the development and maintenance of an overall picture of the interdependencies, and improved liaison and understanding between programme teams. However, in order to successfully maintain coherence, there is a need for additional controls over individual project programmes and system implementations.

NEC will be acquired against a background of continuous and unavoidable change in technology, requirements and interoperability constraints. The management of NEC related acquisition programmes will have to recognise the reality of these changes, and reflect the need to absorb change both in system design and in programme management. It must be recognised that building systems that are flexible and robust in the face of unexpected demands and developments will cost more than building systems that simply meet today's demands and expectations, but that these additional costs will represent a cost effective approach in the long term.

NEC has strong political support at present, but there is a danger that it will be seen as a panacea. There is a need to continue to demonstrate that NEC will provide valuable operational capability, while ensuring that expectations are realistic.

The standard funding and approval arrangements developed under the UK's Smart Acquisition initiative are not necessarily well matched to the development of a dynamic, distributed, evolving capability such as NEC. This difficulty is compounded by the challenge of demonstrating gains in the operational effectiveness of each of the large number of individual acquisitions and upgrades that will be required by NEC. Increased flexibility and changes in financial oversight will be required if NEC is to deliver its full potential.

## 10. References

[Alberts, 2001] Alberts, David S. and others. *Understanding Information Age Warfare*. Washington, CCRP Publication Series, 2001

[Ellis, 2000] Richard Ellis. *Management Issues in the Use of Commercial Components in Military Systems (presented at RTO Systems Concepts and Integration Panel (SCI) Symposium, Budapest, Hungary, 23-25 October 2000)*. NATO, 2001

[Gruber, 1993] Gruber, T. R. *A Translation Approach to Portable Ontology Specifications*. Knowledge Acquisition, 5(2), 1993)

[MOD, 2002] *The MOD Acquisition Handbook "Faster, Cheaper, Better: A Guide to Smart Procurement"*, Edition 4, June 2002