MINISTRY OF DEFENCE

Network Enabled Capability

NEC

Network Enabled Capability

Foreword

We live in a world where change is both far reaching and fundamental. It is also key to all that we do in Defence, and we must ensure that we stay ahead of the curve. As the Secretary of State made clear in the White Paper entitled 'Delivering Security in a Changing World', Networked Enabled Capability (NEC) is at the heart of our transformation to defend against the principal security challenges of the future.

NEC is about the coherent integration of sensors, decision-makers, weapon systems and support capabilities to achieve the desired effect. It will enable us to operate more effectively in the future strategic environment through the more efficient sharing and exploitation of information within the UK Armed Forces and with our coalition partners. The bottom line is that it will mean better-informed decisions and more timely actions leading to more precise effects.

NEC is not a pipe dream. It is shaping our current and future force structures and requirements, and it is imperative that Defence as a whole understands and supports this transformation. Over the next few years, for example, there are several major programmes - Skynet 5, Cormorant, Falcon, Bowman and DII - which will contribute to the high capacity network required to support NEC to enable us to effectively share timely information from the foxhole to the stores depot and from the sensor to the shooter.

Whilst NEC is focussed on operations, it needs to be implemented, co-ordinated and supported across all aspects of Defence activity if it is to realise its full potential. It is our individual and collective duty to understand the key tenets and the potential which NEC offers, and to engage actively and constructively in its development. Only by ensuring that we understand the scope of this transformation, will we harness NEC's full potential to make a fundamental difference to the way we operate.

This Handbook has been endorsed by the Command and Battlespace Management Board and will be reviewed on an annual basis. We strongly encourage you to use it to further your understanding of NEC and, by your own engagement, to take its message forward.

VCDS

2ND PUS

MINISTRY OF DEFENCE

Introduction

Network Enabled Capability

The achievement of military effect will, in future, be significantly enhanced through the networking of existing and future military capabilities, under the banner of Network Enabled Capability (NEC). NEC has already been widely debated throughout Defence, so it is important now to establish and disseminate a common view of NEC amongst the wider Defence community – the Armed Forces, the MoD Civil Service, MoD agencies, Defence Industry and Academia – to help people to "know and understand" NEC.

The latent power of networks is not new. Technological advances over time, like the telegraph, telephone, fibre optics and satellite, have enabled the development of more extensive networks, and therefore the better exchange of information. These advances will continue to enable the wider and faster sharing of information, but this must be optimized through the parallel development of our people, by means of education and individual and collective training, in order to realise the full potential of NEC. Developments in technology and of our people will need to be accompanied by new concepts, procedures and structures.

There are already a number of misconceptions about NEC. At this early stage, it is essential that the full potential of NEC should not be constrained by narrow thought and rigidly-defined boundaries. NEC will transform the UK approach to military operations. It offers a new way of not just *"doing things better"* but of *"doing better things"*. NEC is therefore being directed across all Defence Lines of Development (DLODs), within a managed Defence change programme.

Aim

The aim of this NEC Handbook is to describe NEC in order to develop a common understanding within the wider Defence community.

Structure

This Handbook seeks to describe how NEC will support the pattern of operations depicted in the Defence White Paper *Delivering Security in a Changing World* in the short to medium term, whilst looking, in the longer term, to realise the guidance in the Joint High Level Operational Concept (Jt HLOC) and support the implementation of Effects Based Operations (EBO) within a wider cross-Government Effects Based Approach (EBA). The NEC Handbook seeks to stimulate innovative thinking and debate, and is deliberately wide-ranging to allow the future incorporation of emerging concepts, technological advances and ideas.

This NEC Handbook is presented in 2 Parts:

- Understanding NEC – Part 1 is designed to explain what we mean by NEC and highlight the benefits to be gained through the use of networks to share information and integrate and optimize military capabilities for employment in EBO.

- NEC Development – Part 2 describes how NEC will be developed over time. It identifies the strong governance of NEC within the Command and Battlespace Management (CBM) Programme and illustrates the progression through the NEC States towards the full transformation of military capability.

3 Commando Brigade during Operation TELIC

In their Post Operation TELIC Report, 3 Commando Brigade stressed the importance of being able to fuse the information from a number of sensors in order to achieve an effect and that no one sensor or system proved decisive.

On one occasion when 42 Commando came under fire from a battery of Type 59-1 130 mm towed guns, the firing point was located by the Weapon Locating Radar ARTHUR. This information was passed to a RN Sea King Mark 7 Airborne Early Warning helicopter equipped with Searchwater Radar, which was able to track the gun battery's hasty withdrawal from its firing position. This information was then passed to an Army Phoenix Ground Control Station, which re-tasked an Unmanned Aerial Vehicle (UAV). This located the gun battery and tracked it to a fall back position near Al Basrah. Using the target data gathered by the UAV, coalition aircraft were able to attack the gun battery, whose destruction was confirmed afterwards by the UAV.

Part 1

Understanding NEC

This part of the NEC Handbook is fundamental to the wider understanding of NEC throughout Defence and in the wider Defence community. It will form the basis for the training and education of all Defence personnel about the scope, benefits and challenges of NEC.

Description

The potential of NEC and the power of networking spans the whole of Defence, and has implications for both the operational and non-operational environments. In the operational environment, it will enable Shared Situational Awareness (SSA) and distributed collaborative working. It will improve the integration of weapon systems, Command and Control (C^2) nodes, and Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) systems to enable commanders to achieve appropriate, timely and precise effects. Beyond the operational theatre, NEC will enable better-focused support from within the UK base to the operational area, and better information-sharing, more effective decision-making and improved ways of working in the day-to-day business of Defence.

This description aims to encapsulate the *wider* attributes of NEC. Our understanding of NEC will continue to develop, so it is important not to constrain the future direction of NEC by an overly-restrictive definition. The potential of NEC is captured in the following statement:

Networked Enabled Capability offers decisive advantage through the timely provision and exploitation of information and intelligence to enable effective decision-making and agile actions. NEC will be implemented through the coherent and progressive development of Defence equipment, software, processes, structures, and individual and collective training, underpinned by the development of a secure, robust and extensive network of networks.

NEC will pervade many aspects of Defence daily business in the UK and overseas. The Defence workforce should be able to identify their contribution to the delivery of the Defence Mission, and the success of operations, through their own work, enabled by the emerging network. Although not an exhaustive list, the bullets below *illustrate* the likely impact of NEC:

- Provision of timely information and intelligence drawn from a broad range of sources to support the political and military decision-making processes.
- Integration of sensors, decision-makers, weapons platforms and support capabilities to enable agility and thus permit commanders to better synchronise effects.
- Enhanced Force Protection and the reduction of fratricide.
- Increased interoperability and collaboration within and between Services, components and government organizations, both nationally and internationally.
- Optimizing the efficient use of available resources in a robust operational support structure, by improving the precision and timeliness of logistic, medical and personnel information.
- Improving the sharing of Defence information, where appropriate, beyond traditional boundaries through a resilient information infrastructure.

Agility – an extract from Joint HLOC

Agility is essentially a human-centric attribute, epitomised by the enduring ability of our people to think creatively, to be resourceful and imaginative and to adapt with versatility to the unexpected. However it also has a strong physical dimension. Therefore operational agility will embrace personnel, structures, equipment and procedure. At its heart are four attributes for which we will equip and structure: responsiveness, robustness, flexibility and adaptability, all of which will underpin future individual and collective training. Agility is an instinctive quality in organisations that share information efficiently and which empower their subordinates.

Extending the Defence Network

The Defence network has already grown beyond its traditional boundaries. Armed Forces capability deployed on operations is already being supported by military and non-military organizations. In future the Defence Medical Interoperability Capability Programme (DMICP) will be linked to National Health Service systems to enable the sharing of appropriate medical information as a National resource. The Joint Logistic Picture (JLP) will, in future, be able to share appropriate information between MoD agencies and Defence Industry to provide better support to deployed forces.

The UK's Manoeuvrist Approach emphasizes the four functions of Shape, Attack, Protect and Exploit. After 2020, these will be achieved through the network-wide expression of command intent, and a degree of Shared Situational Awareness that promotes much better tempo and greater freedom of manoeuvre. At present, commanders expend considerable effort coordinating or deconflicting force elements, most often by procedural planning. Fleeting opportunities pass unnoticed or prove too difficult to pursue. A network that provides Shared Situational Awareness will reduce to a minimum this need for procedural deconfliction. NEC also offers an opportunity to reconfigure the structure of our forces, and to change the way in which we fight, generating fighting power that is currently latent at the seams between Service components and military functions. Joint Fires and Time Sensitive Targeting are emerging examples of mechanisms that can unlock this latent fighting power. To do so requires battlespace resolution that is much higher than currently available, and not just in the physical domain. However, aware that resolution will be variable and seldom perfect, we must build flexibility into our way of operating, so that we are not constrained only to being able to operate where we have a 'perfect' view. The use of re-configurable, cross-component agile mission groups is an important expression of this agility. They could be widely dispersed in the battlespace, masking intent, and only converge at the point of action to achieve the mass required for overwhelming force and decisive action.

In future, we envisage Mission Command relevant to the Information Age, through the network-wide expression of command intent and an adaptive command and control process. Although the UK believes that our command philosophy is robust, we perceive an urgent need - and the means - to change control mechanisms. Better communication leads to the temptation to over-control; conversely, when communications fail, an over-dependence on technology can be exposed. So the UK doctrine of Mission Command needs to endure, and the network will allow the commander to communicate his intent more clearly, and to a greater part of his forces than before. However, the commander will need to be aware, especially in coalition operations, of the cultural differences that can cause intent to be misinterpreted, and a combination of personal contact and network interaction will be required to minimise this risk. Control should then be reduced to the minimum, with the commander exerting only a light touch on the tiller. Tempo will be increased as subordinates are empowered to grasp the fleeting opportunities without reference to higher command, but secure in the knowledge that higher command is aware of what is happening.

NEC will enable Decision Superiority through Shared Situational Awareness within task-orientated communities of interest that exploit collaborative processes in a single Information Domain. This relatively simple idea conceals considerable complexity. First, Shared Situational Awareness is not just about having the same data, it will require a common understanding of the operational context and of the prevailing situation and imperatives; it therefore is a human construct and is the result of an interaction between information and personal attributes. Collaborative processes require an iterative exchange of information that progressively adds value and deepens the understanding of participants. 'Chat rooms' are a limited example of the sort of tool that is required. The idea of communities of interest recognizes that not all force elements can - or should - have access to all information. But the network also needs to be rapidly re-configurable to allow unexpected links to be formed for specific purposes. Finally, the single Information Domain is the most testing of all ideas, not for technological but for cultural reasons, both national and international. The key to unlocking this conundrum is twofold: first, we must drive to ensure that security barriers only exist where absolutely necessary, and are not just the result of bureaucratic inertia; and secondly, we need to be able to apply restrictions only to information within the network, and not to access to the networks, by the tagging and encryption that is now technically possible.

- Accelerating the establishment of common standards and facilitating the sharing of data with Industry partners to improve acquisition processes.

- Enabling effective UK home defence through inter-agency operational support to police, customs and coastguard etc.

- Enabling the development of more effective command and management structures, and better ways of working within Defence.

NEC and Future Operations

The Joint High Level Operational Concept (Jt HLOC) has recently been endorsed by the Chiefs of Staff as the head-mark for how we should seek to conduct military operations in 2020. NEC is at the heart of the way of operating described in Jt HLOC. The anticipated contribution of NEC is summarized in the box above:

Span of NEC

NEC will impact in different ways across the strategic, operational and tactical levels of command. Command and force elements will be progressively integrated into an interoperable information and intelligence infrastructure, which will form the essential 'kernel' of NEC. This will ensure robust command and control, enable the rapid dissemination of command intent, and generate Shared Situational Awareness. In turn, we will achieve winning tempo through Decision Superiority, which will permit the highly precise and agile employment of capabilities to achieve desired effects.

NEC at the Strategic Level

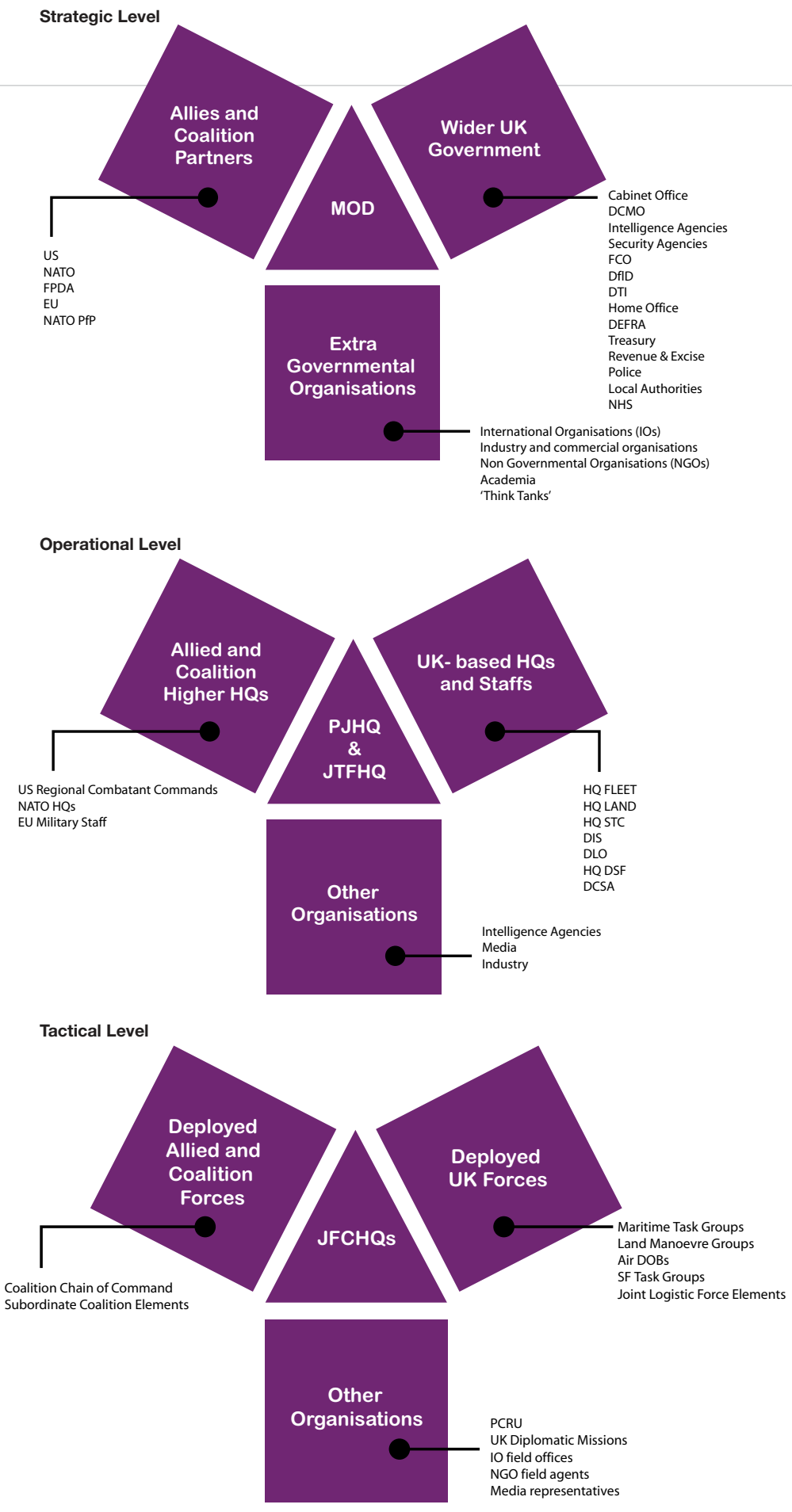
At the Strategic Level of command, improved networks and greater interoperability will enable better cross-government planning and the more effective management and direction of campaigns. Military operations directed through the Defence Crisis Management Organisation (DCMO) will benefit from networked strategic intelligence and the ready availability of campaign planning information, thus providing Shared Situational Awareness. The MoD will, in time, be able to collaborate freely with Other Government Departments (OGDs), as well as Allies, coalition partners and extra-governmental organizations, to enable much more coherent campaigning. Day-to-day operational and logistic support will also benefit from improved ways of working, based on the growing ability to share information throughout Defence, as well as improving processes for the MoD as a Department of State.

NEC at the Operational Level

At the Operational Level of command the NEC "kernel" reaches out from the Permanent Joint Headquarters (PJHQ) to the deployed UK Headquarters, to Allied and coalition partner higher HQs and, within the UK, to the Front Line Commands (HQs Fleet, Land and Strike), HQ DSF, and the DIS, DLO and DCSA.

NEC at the Tactical Level

At the Tactical Level of command, NEC will enable the improved presentation of information and intelligence to commanders, force-wide sharing and understanding of command intent, distributed collaborative working, and the networked integration of sensors, decision-makers and effectors.



Mission Command

NEC should be viewed as an enabler of Mission Command, giving it new expression, by allowing it to thrive in a context where the commander can articulate his intent and then allow subordinate commanders to execute that intent in the knowledge that they share the same situational understanding, thus negating the need to interfere unless absolutely necessary – not, as some would see, enabling the commander to over-control. NEC will need to provide a commander with the ability to command at all times and control when appropriate – if necessary whilst on the move.

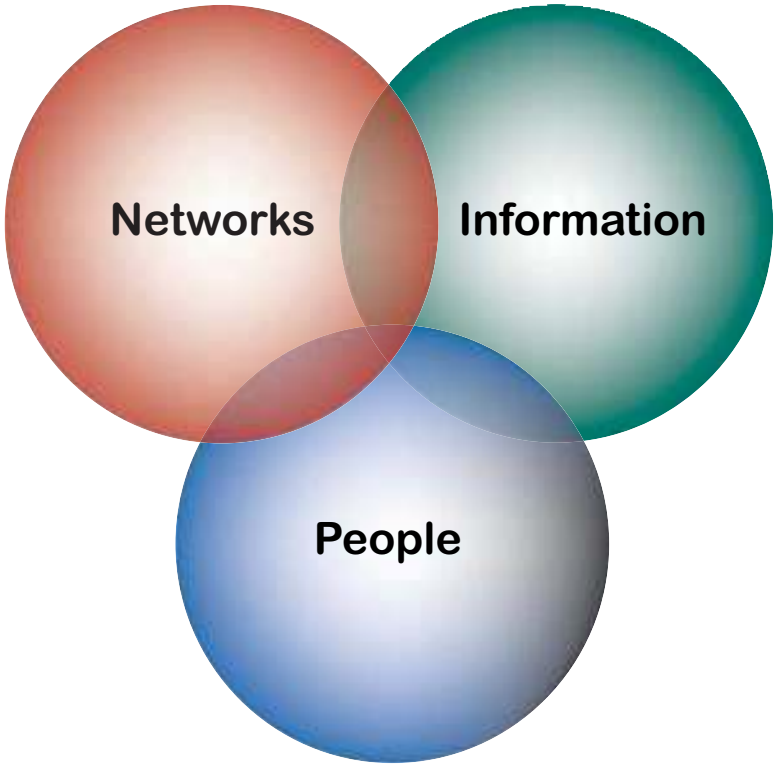
Whilst the diagrams previous page illustrate network-enabled interactions at the Strategic, Operational and Tactical levels of command, there are also significant network linkages, for example, from the Strategic direct to the Tactical Level of command and vice-versa. Whenever this degree of connectivity is available, there may be a need to establish protocols to prevent over-control happening.

Air Support in Afghanistan

In operations against the Taleban, US Special Forces were mounted on horseback because of the poor terrain and were given the ability to designate targets using lasers for the Joint Direct Attack Munition (JDAM) that was carried on a number of aircraft such as the F-14, F-15E, B-1, and B-52. In this example, having detected where the Taleban were hiding, Special Forces passed the necessary target information to an F-14 which was supporting them. It ran out of munitions but the on-station AWACS put it in touch with a B-52 bomber inbound on another mission. The F-14 passed the target data to the B-52 which switched to the new mission and successfully engaged the target.

Three Dimensions of NEC – Networks, Information and People

NEC has three overlapping and mutually dependent dimensions, all of which will require continued development to achieve its full realization. Whilst the development of these dimensions is covered in more detail in Part 2, this section offers a broad description of the scope of each, and explains some of the related issues that will impact throughout Defence.



Networks

At the heart of NEC is a network of networks to distribute information. A networked information environment will provide a pan-Defence capability to acquire, generate, distribute, manipulate and utilize information. This process of utilizing information applies equally to the operational and non-operational environment. In one, the desired outcome may be an effect in the operating space and, in the other, it may be the enabling of operational support and the timely provision of logistic and medical supplies.

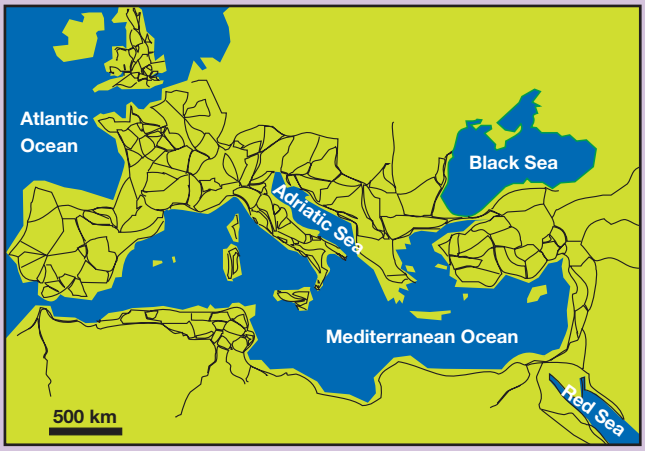
NEC Equipment Acquisition

In the near future, significant enhancements to the UK CIS and ISR capability inventory will begin to fundamentally change the way we operate. Examples include BOWMAN, CORMORANT, FALCON, SKYNET 5, WATCHKEEPER, ASTOR and DII(FD). Whilst not everybody will be familiar with the names of these programmes, the impact when they are delivered and in service will be significant. The potential for information to be shared between the Joint Operational Area and the UK will be greatly enhanced, enabling better decision-making and better support to theatre.

A Network of the Past

Mankind has long used the power of networks to establish bonds between individuals, groups and nations. The Roman Empire built its first roads around 300 BC, and continued building them until the height of the Roman Empire in about 200 AD. Quality and design standards were specified, with a "first class" road having a minimum width of 5 metres and a drained stone surface.

The road network was fundamental to the success of the Empire. Key cities and major towns were linked by road. The Romans used this road network for the rapid delivery of messages, the movement of troops and resources, and to enable cultural exchange and trade, as well as for political control. During the 500 years of the Roman Empire, 80,000 Km of roads were built, with Rome at the centre, much of which is the basis of the current modern road network.



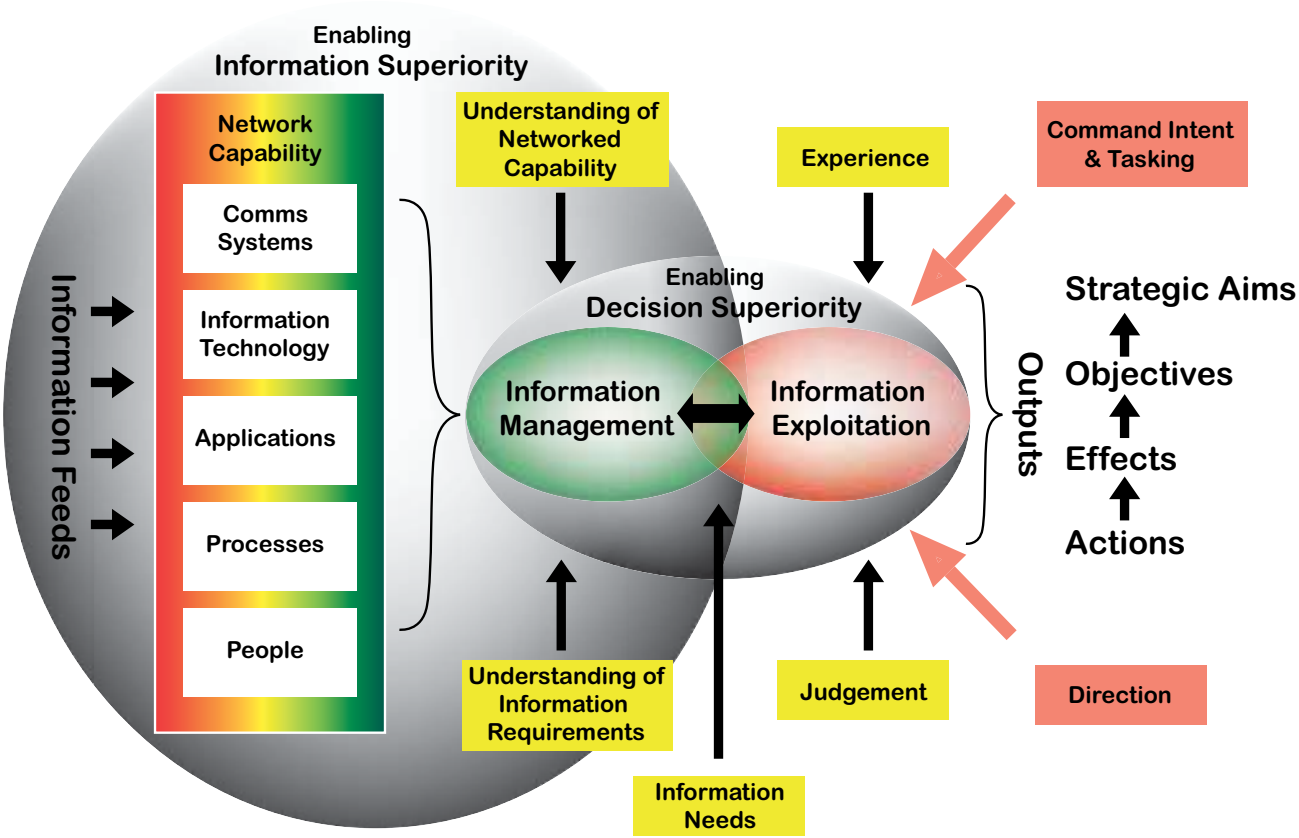
The diagram over the page represents a Generic Networked Information Environment and shows that information is gathered from a variety of sources, enters the network, is managed and then exploited leading to a decision to achieve a particular outcome.

Whatever the desired outcome, the first step will be to acquire the appropriate information and then use the network to make it available to the planners and decision-makers. It is possible to gain *Information Superiority (IS)* over one's adversary through the effective collection and management of information. *Decision Superiority* will be enabled through the effective exploitation of that information to support command decisions.

The Defence network is still developing and will be underpinned by the Global Information Infrastructure (GII) – including the Defence Information Infrastructure (DII), extending from the UK home base outwards. This will need to be secure and robust, to protect our information and ensure the availability of information throughout operations. Computer Network Defence (CND) is intended to protect the network from Computer Network Attack (CNA) by detecting, reacting to and recovering from such attacks. CND is conducted within the overall umbrella of Information Assurance (IA), which is concerned with all aspects of protection of information from attack, and ensuring the resilience of the network.

However, whilst a network can move information from one area, location or source to many others, in ever-increasing volumes and in near-real time, it is the human ability to do something with it that makes information "powerful".

Generic Networked Information Environment



Information

Information for Decision Making

Decision makers, at all levels, will need to identify what information is required and available to support their decisions and know how to obtain it. As now, they will also need to know when a decision needs to be made and how long they can afford to wait for more information. In essence, decision makers will still need to know how much information is required to make the optimal decision, whilst avoiding the risks of procrastination.

The key to NEC is effective information management. The availability and use of information has always been essential, but we have not always been as effective as we should be at making it available.

As newer information systems are introduced, the function of *Information Management (IM)* will grow in importance and effective IM tools will become a key enabler. All personnel will need to improve their IM skills and, in particular, its sub-set of *Information Administration (IAdmin),* so that decision-making can be improved by more effective *Information Exploitation (IX)*. The NEC focus will always be directed ultimately to operational effectiveness, but the improvement of IM, IX and IAdmin will also become increasingly relevant in the non-operational environment.

Decision support tools will help to reduce the cognitive workload of decision-makers but, in the majority of situations, a person will still make the final decision. Decision support tools will help to assist in finding information, structure and present information in the most appropriate manner, and combine disparate types of information to draw inferences for presentation to the decision-maker. Commanders at all levels will have more information available on which to base decisions, and each well-founded decision they make will contribute to the overall achievement of Decision Superiority.

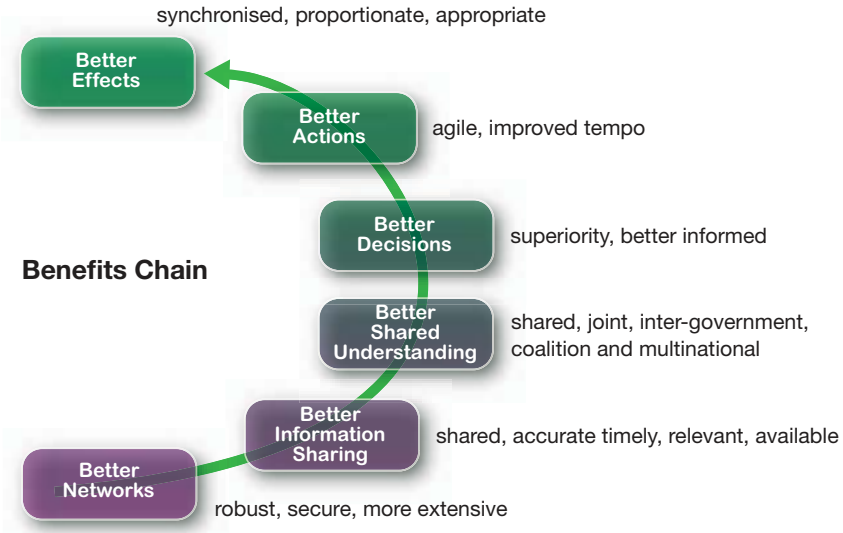
Information Sharing

Networks are now demonstrating the ability to move information around quicker, and make it available to more people – often simultaneously. The potential advantage of this is recognised within NEC. To maximise the benefits of being able to share information, it is essential that common standards are developed and processes established to

automate information sharing. There is an increasing willingness to share information more widely, but we must do better.

People

The people dimension of NEC focuses on the requirement to educate and train all Defence personnel so that they can use their skills, knowledge and experience to exploit it and contribute to its future development. People will need to learn how to share and find information from multiple sources and then use that information to plan and then make decisions. Whilst it is true that we have always needed this skill, in future NEC will provide network-based information management and decision support tools to help with the process. Training will be required to build trust and confidence between people across organisations who may have to collaborate on a distributed and temporary basis. Certain skills will be generic to all users, like Information Communication Technology (ICT) Fundamental Skills, and elements of IM and IX, but there will also be a need for specialists in some areas, for example Computer Network Defence (CND), to help to reduce the vulnerabilities of NEC and ensure continued confidence in the security and accuracy of our information. NEC will impact on Defence personnel in different ways; some will see and experience the benefits of NEC on a daily basis, others will not, and so are likely to remain sceptical. The education process will need to emphasize the cumulative benefit of NEC to Defence, rather than to each individual. But in time, NEC will touch all of us.



Operational Location of Personnel (OPLOC) during Op TELIC

OPLOC is a system designed to track personnel on operations. During Op TELIC, the procedures put in place ensured that UK personnel were tracked to an extent that has never been achieved before. In addition to its primary role of tracking people in and out of theatre, innovative users soon discovered that OPLOC could additionally be used in unforeseen ways. These included: tracking civilians during a planned evacuation operation; tracking detainees and internees; pursuing military police enquiries; managing accommodation and force protection planning; supporting medical planning and tracking vaccination status, and managing complex movement manifests.

Internet Access

"There are more people with Internet access than without and more people with digital television than without... digital Britain is certainly on its way." - Ofcom – Aug 2004

The Battle of Britain

The Battle of Britain from July to September 1940 was, arguably, one of the earliest battles to be largely decided by networked information. The RAF's newly-built array of radar stations and visual observation posts was voice-networked with a hierarchy of command and control nodes, via 'filter centres' which ensured the coherence and completeness of the situational information presented to commanders. Consequently, the RAF commanders were able to scramble scarce fighter aircraft from ground alert when enemy aircraft were reported, thus avoiding wearing down the pilots through relentless (and often fruitless) combat air patrolling, and ensuring that the out-numbered RAF fighter force was concentrated, in both time and space, against key elements of the much larger enemy air order of battle.

The Germans, who had not developed their use of radar to the same extent as the British, could not understand why their losses were mounting over the Channel until their intelligence staffs identified the significance of the RAF's radar network. The Germans then attacked some radar stations, with apparent success. However, the considerable resilience and redundancy of the RAF's early-warning network, despite the seeming vulnerability of individual radar stations, mitigated the operational impact of the German attacks on the effectiveness of the fighter defence. Baffled, the Germans switched targets again after only 3 days, allowing the RAF's early-warning network to continue to contribute valuable information to RAF commanders throughout the rest of the Battle. The effective networking of sensors, deciders and effectors was of decisive importance to the RAF's victory in the Battle of Britain.

Evolution of Communications

The military have always been adaptable to technological change. Over time the forces have adapted to changes in weapons; from swords and lances; to musket and cannon; to rifles and machine guns; and to rifled artillery and laser guided bombs. A similar development in time occurred in Information Communication Technology (ICT). Initially runners and messengers on horseback exchanged battlefield information, later changes saw semaphore with flags, the telegraph and Morse code, analogue telephones, radio, microwave, SATCOM, digital telephone and now mobile telephones with camera and video technology. NEC exists at the forefront of this ever more rapid evolution.

Benefits of NEC

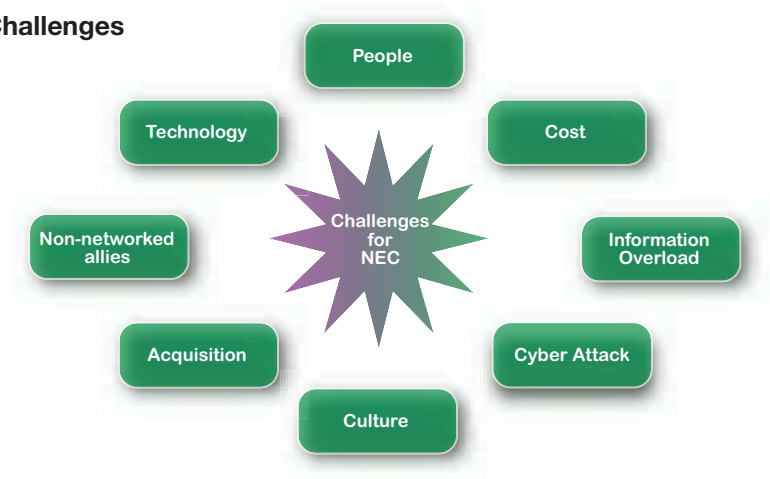
The ultimate benefit of NEC is the ability to generate better actions to realise better effects and thus lead to success on operations. In the short term, as network capability improves, shared information will become more readily available. Routine tasks will be automated, and new standard operating procedures and working practices will enable higher-tempo operations. With the ability to reach back and across to a broad range of information sources, we will be able to develop a better shared understanding of the situation. This will enable improvements to the quality and tempo of decision-making, which in turn will lead to more coherent, concurrent and responsive actions, resulting in more timely and appropriate effects. Whilst the Equipment Programme will deliver the hardware and software, the real benefits will only be realised over time with the sustained training and education of all Defence personnel. The fuller realisation of the benefits of NEC can only result from changes in organizational processes and individual behaviours.

The Benefits Chain previous page shows how the fundamental NEC benefits are related. Each contributes to the next, resulting, ultimately, in Better Effects in the operating space.

Challenges of NEC

As well as benefits, NEC will pose significant challenges. The primary challenge is to fully incorporate the human dimension into the development of NEC. All our people will require appropriate education and training to utilize increasingly-available information. They will need to use all available system tools to exploit information, and they will need time to adapt to a more open culture, requiring greater sharing and trust between colleagues and coalition partners. The procedural and technical challenges should not be underestimated. Capability development will often be complex and require the integration of new and legacy systems, whilst assuring that the overall Equipment Programme provides for future upgrades. This will require more flexible acquisition processes and appropriate partnerships with industry. Whilst many of our principal allies are also networking their military capability, there will be some coalition partners and organisations that do not; operating with non-networked forces will require careful consideration. These challenges will be accompanied by the need to avoid information overload and guarantee a robust network. The growing threat from cyber attack, to which we will become more vulnerable as our dependence on the network increases, must also be contained through new measures. It will be necessary to plan for graceful degradation, rather than network collapse, and to ensure the provision of reversionary modes of communication to sustain the key elements of the network of networks. Financial constraints will necessitate careful prioritisation and rigorous balance of investment decisions. Although significant, these challenges should be viewed against a backdrop of evolutionary long-term development.

Challenges



NEC Development over Time – The NEC Maturity States

For the UK, the complexity, scale of effort and cost of developing military capabilities to meet the full aspirations of NEC in a single bound is prohibitive. NEC will have to be developed over time. Some existing capability may be upgradeable to contribute to the aspirations of NEC; other existing capability may not. New capabilities, however, will need to be designed and delivered as net-ready. At any given moment, the Armed Forces will operate in communities that are at different

stages of NEC development. To acknowledge this evolutionary approach, 3 NEC States have been defined, as follows:

- **Initial** – Based on current doctrine, organisations, processes and equipment where improvements to operational capability can be made in the short term. It is characterised by minor organisational changes and equipment enhancements, such as using data links to replace voice. Work to achieve this State will be characterised by interconnection.

- **Transitional** – Medium term improvements in operational capability will be generated by incremental changes to current doctrine, processes, training and equipment, validated by appropriate experimentation and exercises as part of the development cycle. This will be supported by major organisational change and the integration of technical systems to give greatly improved Shared Situational Awareness through better information management. Work to achieve this State will be characterised by integration.

- **Mature** – Maximum advantage will be gained from the optimal exploitation of information, delivered through developed doctrine, organisations, process and equipment, together with personnel appropriately selected, educated and trained. It is typified by the dynamic creation of mission groups enabled by distributed collaborative working. This longer term evolution is built on the lessons learnt from the earlier states. Work to achieve this State will be characterised by synchronization.

A View of Future Operations

The final vignette is an aspirational view of future operations and is intended to paint a picture to reflect the aspirations of Joint HLOC and to encourage forward thinking. Elements of this view are already achievable, other aspects will need process and organisational change, and still others will require wider changes across all DLODs. The reality is that this aspirational view will not be delivered without the direct input from personnel at all levels throughout Defence, who have the foresight and the will to maximise the benefits and potential of NEC.

Future Network Enabled Operations

The Armed Forces will continue to be armed, trained and equipped to conduct conventional and non-conventional warfighting operations. The UK MOD will need to be capable of projecting forces to counter asymmetric threats which use non-traditional methods of fighting, whilst at the same time be able to conduct Peace Support Operations, possibly in the same Joint Operational Area (JOA) and continue to provide security to the UK Home Base. Future operations will increasingly be conducted within the spotlight of the media ensuring that operations will have more immediate political impact.

NEC will increasingly influence the way that operations is conducted. Campaign planning will be assisted at all levels by the development of NEC. Commanders will have more accurate and reliable information and intelligence, which will improve situational awareness and enable timely decision making, faster and more collaborative battle planning and the wider dissemination of the Commander's intent. Fully integrated ISTAR assets will contribute to the Enemy Picture which is combined with the Friendly and Neutral Picture through the Joint Operations Picture (JOP). Personnel, units, weapon systems and logistic assets will be monitored into and move within the JOA. As maritime, land, air and SF assets deploy, live and synthetic training as well as mission rehearsal will allow the coherent integration of appropriate mission groups for specified tasks and selected effects.

Network-enabled warfighting force elements will have the ability to operate at a higher tempo. Intelligence gathered from multiple sources will be fused and presented to those who need it at whatever level. Commanders will be able to synchronise the use of joint strike assets from all components, with some assets seamlessly integrated with Coalition forces to target both fleeting and static targets. At sea, the air threat will be significantly reduced by precision sensor detection and picture aggregation, and the integrated operational picture will swiftly identify hostile ships, submarines and aircraft, enabling force protection and simultaneous threat identification. In the air, secure data links will enable platforms to be all informed and retasked at will, providing capabilities to other components whilst protecting the joint force. Some will operate from aircraft carriers poised over the horizon. Visibility of littoral operations, enhanced by reduced terrain clutter, will enable the conduct of precise Commando raids and the linking up with fully interoperable land forces. On the ground, fully digitised formations will benefit from previously unknown Shared Situational Awareness, giving manoeuvre formations the freedom of action to achieve surprise through the selected concentration of force and synchronisation of shock action utilising precision weapons from the Joint and multinational force.

Weapon systems and personnel will be sustained by resources tracked and monitored throughout the operating space. This will enable the rapid refurbishment and redeployment of assets for follow on operations. Some force elements in the JOA will be re-tasked to prepare for inter-agency relief effort for the provision of humanitarian aid, and others will focus on a dispersed and disjointed asymmetric threat. Rules of Engagement (ROE) will be amended and the Campaign Plan will continue to develop subsequent operations and the restoration of normality.

Communication Trends

The Ofcom Communications Market Report 2004:

Time spent online increased eight-fold
(2 hours a week in 1999 to 16 hours a week in broadband households in mid-2004).
Broadband is now potentially available to 88.7% of households.
50,000 new broadband subscribers per week.
More than one third of internet households have Broadband.
Time spent on mobile phone calls has recently almost tripled
(from an average of 10 minutes a week to 27 minutes).

What do I need to do now?

1. Do the NEC e-learning training.

2. Actively learn new information related skills as training becomes available.

3. Learn and use information management procedures for your unit/department.

4. Think how best to share your information.

5. Understand the threat from cyber attack and know what to do to counter it.

Part 2

NEC Development

NEC affects the whole of Defence – both the operational and the non-operational environments. It is essential, therefore, that the development of NEC is properly directed and coordinated to ensure that its pan-Defence potential is properly harnessed. Within the non-operational environment, this is done as part of a number of initiatives that together address personnel, equipment, management, infrastructure and corporate services within the context of the Defence Change Programme, under the direction of the Change Delivery Group. Within the operational environment, the development of NEC is directed by the Joint Capability Board (JCB) led by DCDS(EC), and the Command and Battlespace Management (CBM) Management Board led by VCDS on behalf of the Chiefs of Staff (COS).

The CBM Programme and NEC Governance

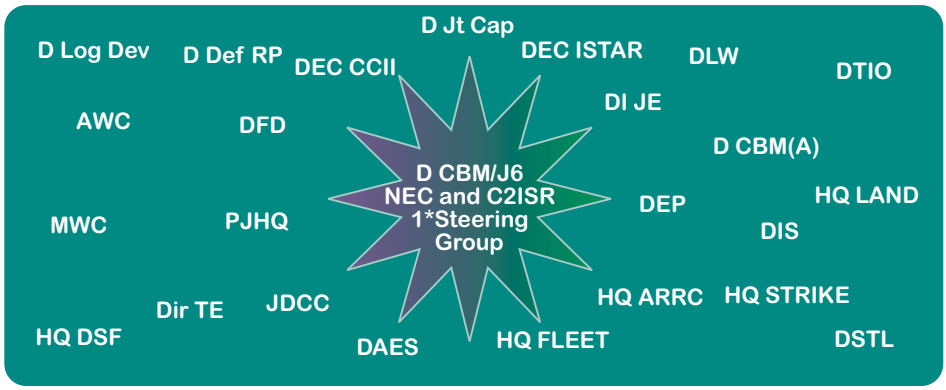
The CBM Programme is directed by VCDS through the 3* CBM Management Board, and controlled by the 2* CBM Executive Group, chaired by DG Info. Coherence with the Defence Change Programme is achieved through VCDS' and DG Info's membership of the Change Delivery Group.

The CBM Programme is centred around 7 High level Goals (HLGs) aligned to the components of the Defence Capability Framework[1] each with a 2* owner responsible for driving through the required change coherently across all Defence Lines of Development (DLODs). The HLGs are in turn broken down into specific Change Objectives (COs) owned at the 1* level. CO Owners are responsible for delivering, in conjunction with other stakeholders, the outputs required to achieve their objectives. Additional momentum is provided by the identification of 3* champions responsible directly to COS through the CBM MB for the delivery of specific outputs or groups of outputs that are particularly critical or complex. The Governance arrangements for the CBM Programme and for NEC implementation are shown below and further detail can be found on the CBM Programme website:

4/3* CBM Management Board
VCDS
DCDS(C), Policy Director, DCDS(EC), DCDS(Pers), DCDL, DCDS(Health), CDI, CJO, ACDS(RP), DG Info, ACNS, ACGS, ACAS

2* CBM Executive Group
DG Info
ACDS(Ops), ACDS(Pol), ACDS(RP), CM(IS), DGT&E, ACDS(Log Ops), DGJDC, DGIC, DCJO(Op Sp), ACNS, ACGS, ACAS

Delivery of specific outputs remains the responsibility of the 1* CO owners and is coordinated through their respective steering groups. It is the NEC & C2ISR 1* Steering Group that provides the primary focus for the development of the command and control 'kernel' of NEC, with wide stakeholder representation as shown below:



The CBM Programme is squarely focused on exploiting the potential of NEC. It is aimed at the transformation of Defence capability, in terms of speed, precision, agility, deployability, reach and sustainability in order, in time, to enable us to operate in the manner described in the Jt HLOC. The Programme comprises 7 High Level Goals (HLGs), based on the Defence Capability Framework (DCF), as shown over the page:

In order to achieve these HLGs, 5 broad capability groups[2] have been identified: appropriate connectivity, information and intelligence, the right people, shared situational understanding and agile groupings, which build upon the 3 dimensions of NEC. In turn, these have been analyzed to identify the key building blocks (see over the page) that will realize NEC within the Operating Space. These building blocks will be delivered through the mechanism of the CBM Programme's HLGs and COs.

Appropriate Connectivity – Delivering the Networks

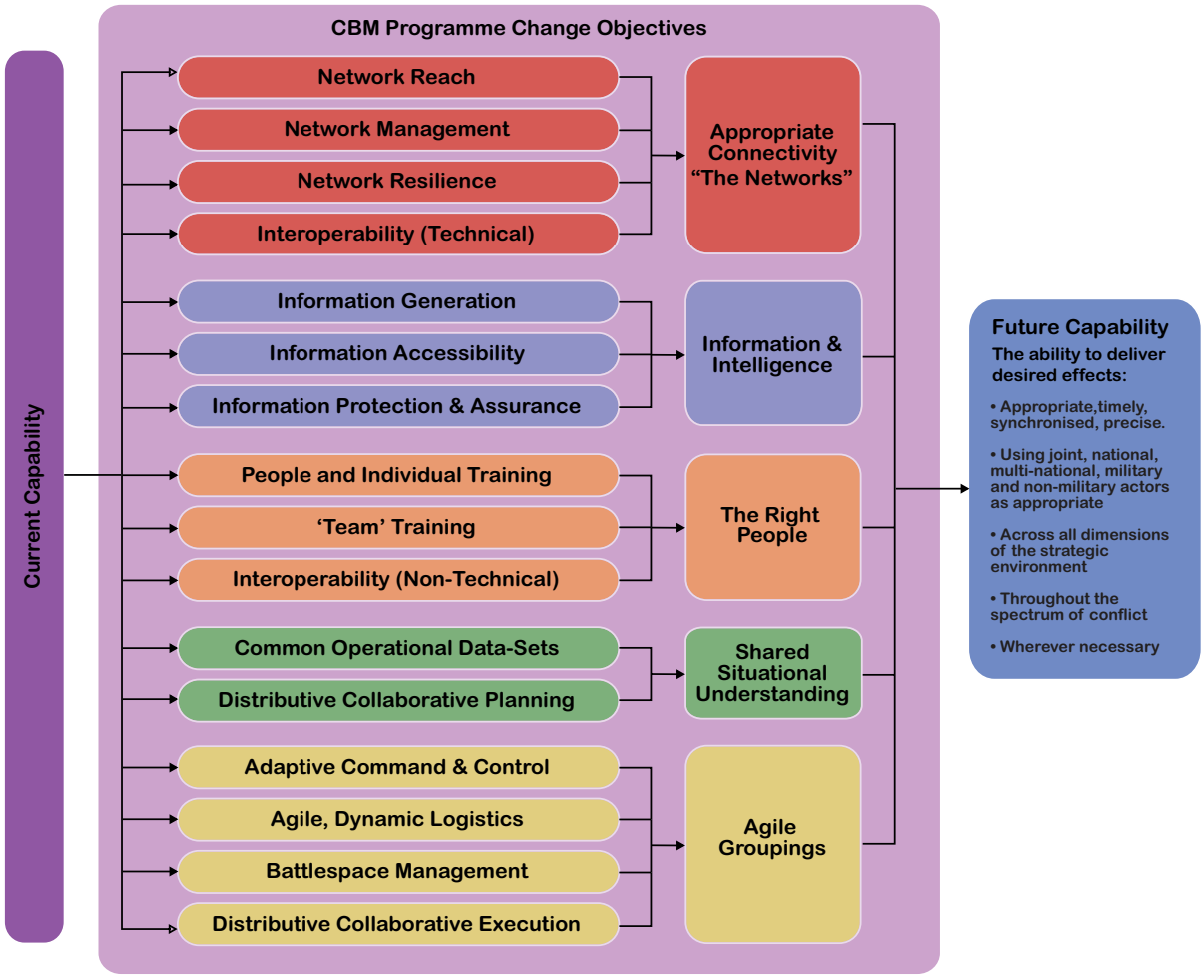
CM(IS) is responsible, on behalf of DCDS(EC), for the delivery of the

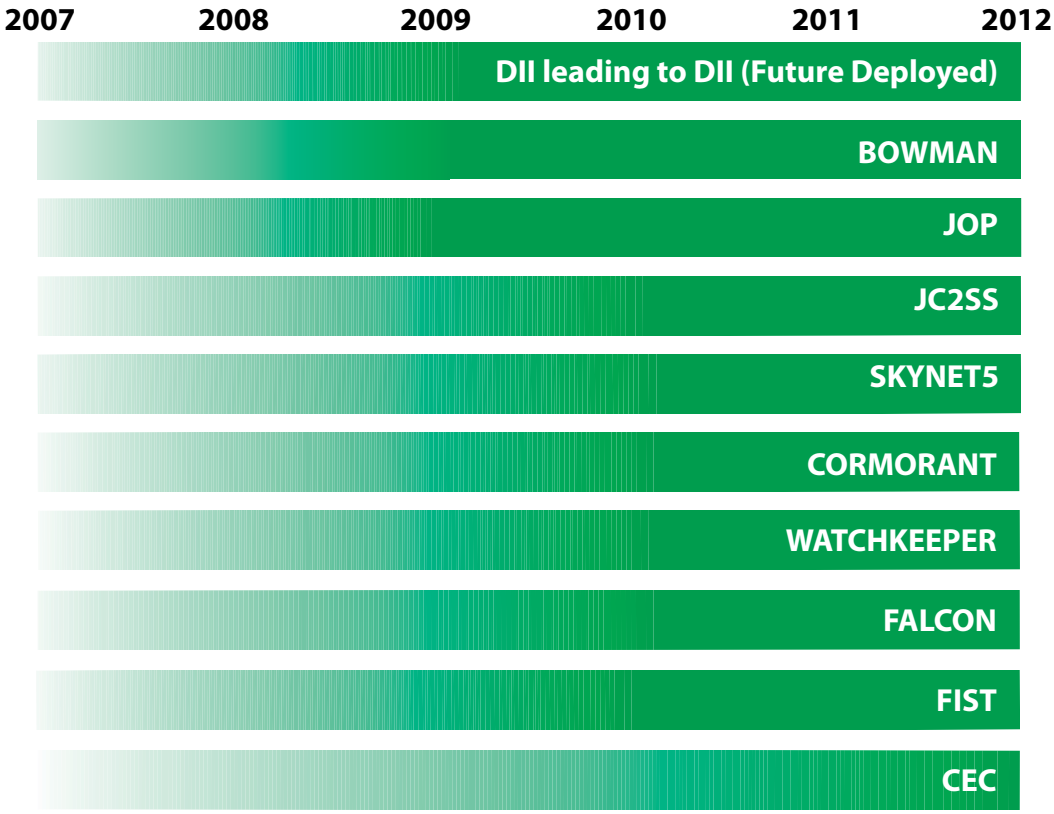
1 Prepare, Project, Command, Inform, Operate, Protect and Sustain.

2 These 5 building blocks were evolved from analysis of Joint HLOC and the previously published NEC Themes, which were identified as Effects Synchronisation, Agile Mission Grouping, Dynamic Collaborative Interworking, Shared Understanding, Full Information Accessibility, Resilient Information Infrastructure and Inclusive Flexible Acquisition. The NEC Themes have not been republished in this handbook.

HLG	DCF	Description	Owner
1	Prepare	Prepare the command and control elements of our forces to operate at optimum tempo in order to meet current and future military tasks	DCJO(Op Sp)
2	Command	Optimise the tempo of command in order to make campaign-winning decisions across the full spectrum of integrated and joint operations nationally and internationally	DGJDC
3	Inform	Develop an effective information management capability in order to enhance decision superiority in integrated and joint operations nationally and multinationally	DG Info
4	Project	Enhance the command and control capability of our force projection in order to contribute to rapid decisive effect	DCJO(Op Sp)
5	Operate	Enhance the conduct of operations within the whole battlespace in order to win	ACDS(Ops)
6	Protect	Enhance the protection of our CBM capability throughout all dimensions of the battlespace in order to conduct successful operations	ACDS(Ops)
7	Sustain	Enhance logistic C2 in order to enable and sustain the required operational tempo	ACDS(Log Ops)

CBM Programme Building Blocks





NEC Integration leading to Synchronisation

- **DII** - Defence Information Infrastructure - from UK home base to deployed unit level
- **BOWMAN** - Secure voice and data within land environment
- **JOP** - Joint Operations Picture to enable Shared Situational Awareness
- **JC2SS** - Joint C2 Support Strategy to integrate joint and single Service C2 Systems
- **SKYNET 5** - Increasing satellite communication capability
- **CORMORANT** - Deployable operational level communications bearer
- **WATCHKEEPER** - Unmanned Aerial Vehicles
- **FALCON** - Deployable tactical level communications bearer
- **FIST** - Future Integrated System Technology for dismounted infantrymen
- **CEC** - Collaborative Engagement Capability to enhance air and missile defence

underlying network of networks, and for the provision of the applications that will sit upon it. Ultimately, this will provide appropriate connectivity and functionality with those actors and agencies with which we will need to operate, whilst retaining appropriate security, and ensuring that Defence is served by a suitably resilient information infrastructure.

This will be achieved through the implementation of the Joint Capability Board (JCB) NEC Delivery Strategy, which aims to: define the work needed to achieve the Mature State of NEC; shape the Network; change acquisition processes; express plans in an NEC context and facilitate interconnection and integration of existing programmes. The Equipment Plan to deliver this information infrastructure is described within DCDS(EC)'s 'NEC Equipment Roadmap'. The full Roadmap and supporting data can be viewed on the NEC Website; however, an illustrative example showing delivery dates is above:

Information and Intelligence

The second dimension of NEC – 'Information' – is being delivered by developments to our ability to generate, access and protect information. DGIC, on behalf of CDI, is responsible for delivering the necessary ISTAR processes, structures and enablers that will generate the required information and intelligence. DG Info is responsible, firstly, for the development of our ability to manage our information to ensure that those that need it are able to access it when and wherever necessary and, secondly, for the development of our ability to protect and assure the integrity of our information.

The Right People

The third dimension of NEC, that of developing people and teams equipped to exploit the benefits of NEC, is the responsibility of DCDS(Pers), and is being delivered through the NEC People and Training Campaign Plan.

This NEC Handbook is the first part of a wider education process to ensure that all our personnel "know and understand" NEC. Other areas of work include the identification of those skills and competencies required in a

Use of Force XXI Battle Command Brigade and Below (FBCB2) Blue Force Tracker (BFT) on Op TELIC

The US satellite-enabled FBCB2 tracking system was issued at short notice to British sub-units on Op TELIC to show the centre of mass of UK forces to both US and UK headquarters. Only 47 systems were issued to the UK and minimal training was given in the timescale allowed. Although it was primarily deployed to enhance command and control it also served to reduce fratricide. Additionally, units gained much greater utility as follows:

2 RTR used a combination of the satellite imagery and the positioning capability in FBCB2 to identify targets for urban raids. During operations in Az Zubayr and Al Basrah, information was provided on likely insurgent operating bases. These were, generally, houses in urban neighbourhoods. Using FBCB2, these locations could be pinpointed and could be reached rapidly using FBCB2 for navigation. This achieved surprise and also minimized the impact of collateral damage through misinterpreting information.

A company commander in the 1 RRF battlegroup used FBCB2 to de-conflict the movement of his company group in order to get to the line of departure for a company group attack. At the time of this movement it was approximately D+2 and south-east Iraq was congested with US and UK forces. The coordination of movement was challenging: the company group had to cross a main supply route aligned perpendicular to their axis of advance. The route was heavily trafficked and crossing a battlegroup, which the company group was part of, was going to prove difficult. The company commander used FBCB2 to identify a gap in the traffic on the MSR and then coordinated the move of his sub-unit comprising approximately 20 armoured vehicles. This allowed him to generate tempo which resulted in the objective being seized 12 hours before the other battlegroup objectives were seized.

The use of this FBCB2 system was proven to have: improved individual sense-making; enhanced quality of interactions; improved shared sense-making; and, ultimately, increased mission effectiveness relative to previous operations and training without FBCB2/BFT.

networked environment, for example the ability to conduct Collaborative Distributed Working and improve networked Information Exploitation to support decision-making. Specialists in Information Management and Computer Network Defence will need to be trained, and recruiting, retention and career implications addressed. The NEC Education and Individual Training Strategy will touch all areas of Defence from the Defence Academy, the single-Service schools and colleges, to the Civil Service College, and joint training establishments, and will also need to reach out to those not currently in training through the medium of e-learning.

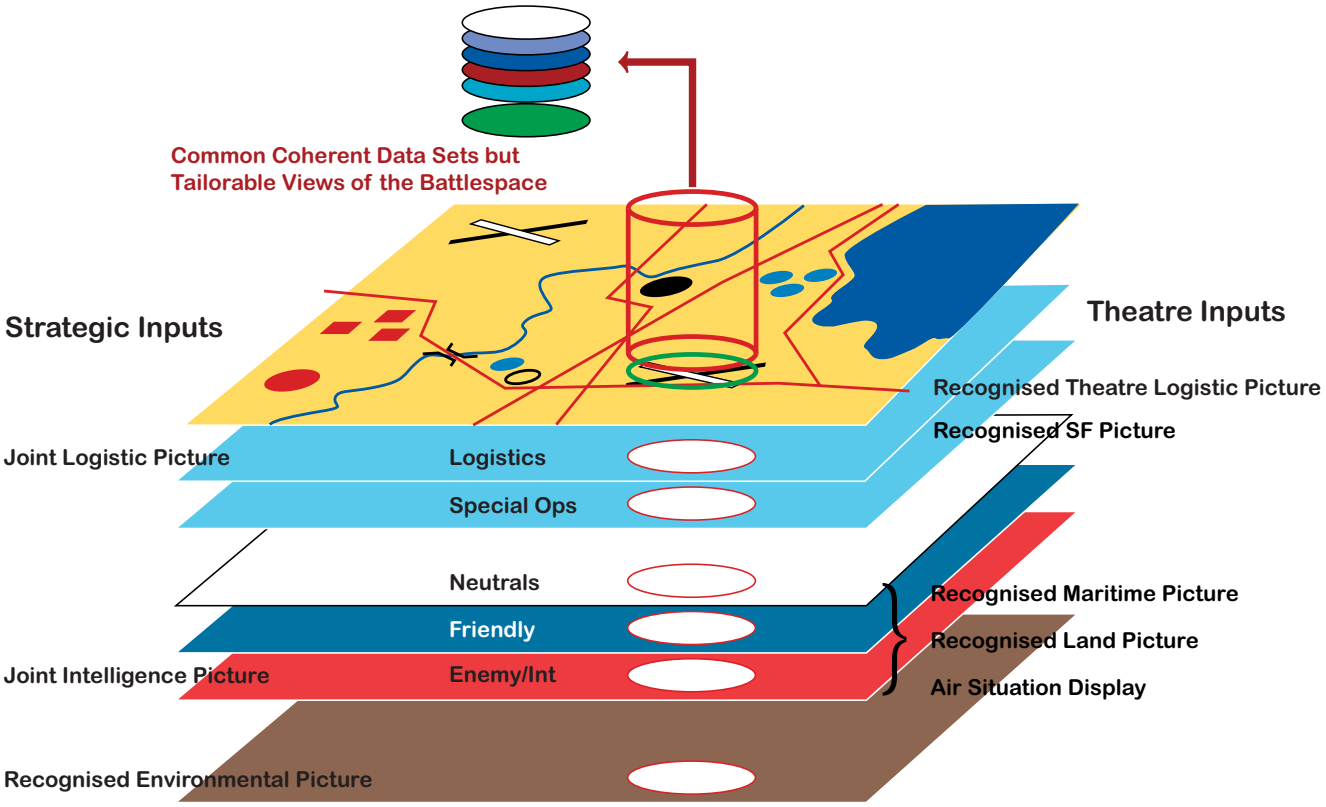
As well as training individuals, there is a requirement to train teams, especially command teams – commanders and their staffs – in order to ensure that they are able to draw maximum benefit from the networked environment. Individuals, teams and larger groups of people will need to learn about interoperability within and between distributed and temporary communities of interest, and understand the impact of networked operations on existing processes, doctrine and organizational structures. DCJO(Op Sp) is responsible for the training of Joint Task Force and Component Commanders and their HQ staffs, whilst Front Line Commands remain responsible for the training of lower-level tactical commanders and their staffs.

Shared Situational Awareness

The development of the three dimensions of NEC described above will enable the generation of Shared Situational Awareness. The ability to generate, access and protect information, and the ability to share it throughout the network, will allow force elements to operate from common data-sets (or 'pictures') of operational information that are consistent throughout the operating space, and that draw on the same underlying environmental and reference information. The development of our ability to widely share command intent, conduct collaborative distributed planning, and then to mission rehearse in a highly realistic fashion, will allow us to move towards Shared Situational Awareness.

The primary focus in the near term is the development of the Joint Operations Picture (JOP), championed by CJO, which will consist of the UK Common Operations Picture (COP) and the JOPWeb. The UK COP will consist of a number of views, or "pictures", of the battlespace. The JOPWeb is a tool that can, amongst other things, collate operational reports and returns that reflect the most current information.

Pictorial Representation of the Joint Operations Picture (JOP)



Ongoing digitisation of the Land Environment, further developments of our tactical data links, and the development of DII (Future Deployed) will, in time, allow the JOP to extend down to the lower tactical levels of command. The diagram above is a pictorial representation of the JOP:

Agile Groupings

Finally the combination of Appropriate Connectivity, Information and Intelligence, the Right People and Shared Situational Awareness (and ideally Understanding), will enable the use of agile groupings across joint, national, multi-national, military and non-military boundaries as appropriate. Such groupings will often be swiftly formed and optimized to conduct a specific mission or task and, once it is completed, will rapidly regroup for the next. This demands highly adaptive command and control, responsive logistics, dynamic battlespace management and a high level of collaborative distributed working skills, underpinned by strong mutual understanding and trust.

Integrated Research, Analysis and Experimentation

The complexity of NEC demands that, if it is to be delivered in an efficient and effective manner, its coherent development across all DLODs must be informed by the purposeful and effective use of research, analysis and experimentation. To ensure that this development is coherent, efficient and properly exploited, integrated analysis and experimentation campaign plans will be used to support the development of NEC within the operating space. Nominated 2* officers will sponsor each campaign plan, supported by a community of 1* stakeholders.

Acquisition for NEC

Implementing a change of the magnitude of NEC will impact on all DLODs, including the acquisition of equipment and the SMART Acquisition process which supports it. The Acquisition for NEC (AfNEC) workstream is investigating what changes may be required to existing processes to improve the long term coherent development of NEC. There is a clear aspiration to ensure newly-acquired equipment is “net ready” and capable of being rapidly upgraded as technology develops.

Cooperative Engagement Capability (CEC)

Cooperative Engagement Capability (CEC) provides a revolutionary advancement in air and missile defence by combining and distributing sensor data from all CEC-equipped platforms. The result is an integrated, netted, air defence system that greatly enhances detection, tracking and identification of air targets, as well as providing engagement coordination. CEC does not replace any single system; rather it enhances war-fighting capabilities inherent in existing and future combat systems, and will be fitted to the Type 23 Frigate and Type 45 Destroyer.

Joint Doctrine and Concepts Centre (JDCC) Strategic Trends

The JDCC Strategic Trends Paper is available online at www.jdcc-strategictrends.org. The paper looks forward to 2030 in order to identify future trends across 7 dimensions, three selected examples are below:

More pervasive, international and differentiated media and more complex operations, often in coalition, will complicate attempts to explain the reason for military action and will also make operational security more challenging.

In many areas the rate of technological innovation will remain high. Technically derived advantages in military capability may be less enduring but is most likely to be achieved via the integration of several different innovations.

The increases in the speed, connectivity, and pervasiveness of information, and communications technology will continue unabated, requiring continual adaptation by UK defence systems.

Glossary

AfNEC	Acquisition for NEC
CBM	Command and Battlespace Management
CC	Component Commanders – Maritime, Land, Air, Logistic and Special Forces
CDI	Chief of Defence Intelligence
CIS	Communications and Information Systems
CJO	Chief of Joint Operations
CM(IS)	Capability Manager (Information Superiority)
CNA	Computer Network Attack
CND	Computer Network Defence *Actions taken to prevent the disruption, denial, degradation, destruction or exploitation of communications and information systems, or the information that they store and process (This definition is under review with a new working definition as: "The actions taken protect from, detect, react to, and recover from, a computer network attack")*
CO	Change Objective
COS	Chiefs of Staff
DCDS (EC)	Deputy Chief of Defence Staff (Equipment Capability)
DCDS (Pers)	Deputy Chief of Defence Staff (Personnel)
DCF	Defence Capability Framework *Command, Inform, Prepare, Project, Operate, Protect, Sustain*
DCJO (Op Sp)	Deputy Chief of Joint Operations (Operations Support)
DCMO	Defence Crisis Management Organisation
DCSA	Defence Communications Support Agency
DEFRA	Department of Environment, Food and Rural Affairs
DfID	Department for International Development
DGIC	Director General Intelligence Collection
DG Info	Director General Information
DII	Defence Information Infrastructure
DIS	Defence Intelligence Service
DLO	Defence Logistics Organisation
DLOD	Defence Lines of Development
DOB	Dispersed Operating Base
DSF	Director Special Forces
DTI	Department of Trade and Industry
EBA	Effects Based Approach
EBO	Effects Based Operations
EU	European Union
FCO	Foreign and Commonwealth Office
FLC	Front Line Commands – FLEET, STRIKE, LAND
FoI	Freedom of Information
FPDA	Five Power Defence Agreement
GII	Global Information Infrastructure
HLG	High Level Goal
HLOC	High Level Operational Concept
IA	Information Assurance *Information Assurance is defined as protecting and defending information and information systems (by ensuring their availability, integrity, authentication, confidentiality and non-repudiation).*
IAdmin	Information Administration *The structuring and handling of information, in adherence with the organisation's conventions and standards, to enable it to be stored, archived, located and retrieved efficiently whilst ensuring its integrity.*
ICT	Information Communication Technology
IM	Information Management *Information Management (IM) is a set of integrated management processes and services that enable and support the capability for collectors, producers and users to store, locate, retrieve and transform information, allowing it to become the right information in the right form and of adequate quality to satisfy the demands of the commander or organisation.*
IS	Information Superiority *State of relative advantage in the information domain achieved by getting the right information to the right people at the right time in the right form whilst denying an adversary the ability to do the same.*
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
IX	Information Exploitation *The sharing and use of information to support situation awareness, planning and decision making and the coordination of desired effects.*
JCB	Joint Capability Board
JFCHQ	Joint Force Component Headquarters
JLP	Joint Logistic Picture *A derived set of Defence-wide logistic information requirements to support SSA and decision-making by Commanders, enabling an informed and assessed view of personnel, medical, materiel and equipment and asset management*
JOA	Joint Operational Area
JOP	Joint Operations Picture *The total set of shared information on a particular operation, or Joint Operations Area, available through a secure information environment on CIS networks to support situational awareness and decision-making by UK commanders, and facilitate information sharing with allies and partners.*
JTFHQ	Joint Task Force Headquarters
LOD	Lines of Development
MB	Management Board
NATO	North Atlantic Treaty Organisation
NEC	Network Enabled Capability
NGO	Non Governmental Organisation
NHS	National Health Service
OGD	Other Government Departments
OPLOC	Operational Location of Personnel
PCRU	Post Conflict Reconstruction Unit
PfP	Partnership for Peace
PJHQ	Permanent Joint Headquarters
ROE	Rules of Engagement
RTLP	Recognised Theatre Logistic Picture *A derived set of theatre-specific logistic information requirements providing SSA in support of decision-making in the battlespace, with coverage forward from the APOE/SPOE across the Coupling Bridge and throughout the deployed space for PJHQ, FLCs, the DTLOG, JTFHQ, the JFLogC and other Maritime, Land, Air and SF Components.*
SSA	Shared Situational Awareness
STC	Strike Command
WFE	Warfighting Experimentation *A subset of OA experimentation that involves the participation of military personnel, in an appropriate operational role, in an environment which allows all Lines of Development to be considered.*

Produced by DCIC Design Graphics on behalf of D CBM/J6
Published by Ministry of Defence UK © 01/05 C100