Manhattan Island is engulfed in smoke and dust after the collapse of World Trade Center's Twin Towers

The UK Approach to future Command & Inform (C4ISR)

Key to abbreviations & acronyms

C&I	Command and Inform
CEA	Campaign Effectiveness Analysis
CoI	Communities of Interest
COP	Common Operational Picture
EBO	Effects Based Operations
HLOC	High Level Operational Concept
I&W	Indicators & Warnings
ISR	Intelligence Surveillance and Reconnaissance
JOA	Joint Operational Area
MN	Multinational
NEC	Network Enabled Capability
NGO	Non-Governmental Organisation
NRT	Near Real Time
OGD	Other Government Departments
SSA	Shared Situational Awareness

By Lieutenant Colonel I D R Pickard

'The command system…will remain a key force multiplier and advantage… opponents will seek to contest this through electronic warfare, computer network attack and asymmetric techniques' [1]

Recent work at the UK Joint Doctrine and Concepts Centre has concentrated on developing a future High Level Operational Concept for UK Armed Forces to articulate how the components of the Defence Capability Framework[2] (Command, Inform, Operate, Prepare, Project, Protect and Sustain) will be realised and harmonised out to 2020. We first set the scene by looking at the strategic environment and the nature of future operations. We then looked in detail at the nature of future Command and Inform (C&I) to give a framework for the other components and, more particularly, to give a conceptual basis for the significant investment now being made in Network Enabled Capability.

Future environment

Although the risks of armed conflict on a Cold War scale may have reduced there is increasing turbulence world wide with persistent mid- to low-intensity threats, a trend that is likely to continue. Threats will increasingly include terrorists, rogue states and other, non-state, actors who may not be easy to identify or locate. None of these are likely to observe international law and moral conventions

We will face adversaries whose structures lack traditional nodes and whose Centres of Gravity will be hard to define and attack

to the extent that we do. We can expect them to continue asymmetric attacks on our Strategic and Operational Centres of Gravity but across a much wider battlespace[3].

At the same time Globalisation, the interconnection of world-wide resources, economics and information, will create conditions where intentional effects can lead very rapidly to unintended consequences. Potential adversaries will rapidly adapt to this complex environment, where cause and effect will be hard to predict. We will face adversaries whose structures lack traditional nodes and whose Centres of Gravity will be hard to define and attack.[4] They may choose to operate where our strengths are mitigated and theirs are maximised, such as the complex terrain of urban areas. It is judged that there will increasingly be a move away from a geometric, Jominian[5], model of the battlespace toward a model that is non-linear and non-contiguous in both space and time.

Arguably, the structure, processes and equipment of the UK Armed Forces remain best suited to operations against symmetric adversaries in a geometric, industrial-age, battlespace.

ing as a shaper of public opinion, we are likely to be called upon for rapid intervention in order to avert crises and to respond to humanitarian disasters.

Operations in 2020 are as likely to be in *ad hoc* coalitions of the willing, as they are to be with established allies. The technological capabilities of potential coalition partners will range from those who stay abreast of US Transformation, to those who retain some form of interoperability to those who do not. It is also likely that many non-military organisations with whom we need to operate in the battlespace will lack compatible C&I capabilities. Therefore, whilst technological interoperability is a major issue, culture, organisational structure, procedures and training will influence significantly the effectiveness of all organisations involved in joint or combined operations.[7]

It is likely that tolerance within our society to friendly, adversary and civilian casualties, collateral damage and damage to the environment will diminish, whilst legal imperatives will increasingly constrain our freedom to operate and train. For sound legal and operational reasons in our pluralistic society we will require an audit trail of opera-

Our compelling need is to adapt to the new Strategic environment

There is, therefore, a compelling need to adapt to the new environment and move away from forces that are physically and conceptually heavy, relatively inflexible and strategically immobile, toward lighter, more agile and mobile forces. Although UK Armed Forces should remain optimised for warfighting, trends derived from recent operational experience indicate that we will still need to undertake a wide range of other operations from peacekeeping and counter-terrorism to power projection and deliberate intervention. The full range of operations may take place simultaneously in the same battlespace, the so-called 'Three Block War'[6]. With 24-hour international media increasingly act-

tional decisions and consequences. Adversaries, on the other hand, will rarely operate under such constraints, giving them the asymmetric advantage.

Against this background emergent nanotechnology, information technology (communications, data processing and fusion, information collection, distribution and dissemination), power sources, satellites and advanced sensors offer the potential to revolutionise our ability to C&I. There is a growing realisation, however, that although technology is rapidly delivering more information the processes needed to manage this information have not kept pace:

To achieve the desired effect in some circumstances it may still be necessary for British soldiers to 'take the bayonet to the Queen's enemies' as the only way of affecting an adversary's capability and will

'The Information Management challenge is about to overwhelm us'[8].

If we are to maximise the leverage offered by technology, it will be necessary to prevent commanders and their staffs being swamped by information and thus more efficient Knowledge and Information Management (KIM) techniques are required, which must encompass technology, procedures, training and structures.

Network Enabled Capability

UK Armed Forces intend to exploit emerging technology through the adoption of a Network Enabled Capability (NEC)[9]. It allows us to exploit the potential of 'network' technologies and enables integration with emerging US concepts. NEC promises to deliver Shared Situational Awareness (SSA)[10], a condition where force elements achieve a common or, at least, consistent understanding of both the Strategic and Operational level contexts and the prevailing tactical situation. Despite advances in technology, however, information will never be complete. The electro-magnetic spectrum will continue to be constrained by power, propagation, bandwidth and enemy action and it is highly unlikely, therefore, that we could ever realise a complete picture of our own forces' dispositions and intentions, let alone those of an adversary.

Military operations will continue to be characterised by a degree of uncertainty: the so-called 'fog of war'. This uncertainty will be exacerbated by the political imperative for speedy decisions. These two factors together mean that, as today, many critical decisions will continue to be made on the basis of incomplete information. Furthermore, although blue forces will gain advantage by degrading an adversary's C&I capability, reliance on advanced C&I capabilities represents an increasing vulnerability. This vulnerability can be considered in three specific areas; systems attack (to which COTS technology is likely to be particularly vulnerable), intrusion and misinformation (whose effect will be magnified by networks) and, finally, the danger that the uninformed may have unrealistic expectations of a 'high tech' military's ability to achieve success at minimal or no cost.

Future operations

UK Joint Vision seeks to realise the full potential of the Manoeuvrist Approach[11] and articulates Effects Based Operations (EBO) as the best way to achieve this. EBO are focused on actions and their influence on behaviour, rather than simply on targets and attrition. The concept is not new; good commanders have in the past intuitively understood and applied a wide range of effects, but it is intended to develop a system that will deliver the right effect more consistently. It is envisaged that a lexicon of effects will give specifics, such as reassure, persuade, deter, coerce or destroy. The overriding aim, however, will be to influence will.

Effects fall into two broad categories: physical (often called kinetic), that can be targeted against capability and cognitive, that can be targeted against will. They can be primary and subsequent (second, third, fourth order etc), intended and unintended. Effects can be applied to friendly, adversary and neutral parties, across the seven dimensions of the Strategic environment[12] by using each of the Instruments of Power[13]. To unlock the full potential of EBO, future commanders will need to exploit a much richer information environment than hitherto. It is important to emphasise, however, that to achieve the desired effect in some circumstances it may still be necessary for British soldiers to 'take the bayonet to the Queen's enemies' as the only way of affecting an adversary's capability and will.

Future ethos

Over-reliance on past lessons can lead to the phenomenon of 'preparing for the last war', which is a high-risk strategy at a time of rapid geo-political and technological change. We propose a more

Agility will allow us to counter the unexpected with more confidence

balanced approach that recognises the value of historical analysis but demands a forward-looking posture underpinned by an ethos of *agility, optimum tempo and persistence*.

Agility is a core ethos of mind, function, equipment and procedure. It will fundamental to future operations and has four attributes, which can be measured: responsiveness, robustness, flexibility and adaptability. *Responsiveness* is the speed with which force elements recognise the need for action or change relative to an adversary and is, therefore, a measure of how quickly we can seize the initiative. We must assume that in future, when faced by an asymmetric threat, we may start from a position of disadvantage. In this case speed will be critical if we are to regain the initiative. *Robustness* is not just the degree to which forces remain effective following degradation, but also the ability to conduct different missions with the same capability. We can no longer afford 'single note' instruments (i.e. dedicated organic capabilities). *Flexibility* is the ability to operate along multiple paths and present an adversary with complex and unpredictable futures. It also seeks to avoid the trap of foreclosing options at too early a stage in planning. In addition it will allow us to overcome system failure or enemy action by ensuring we are not dependent upon a single course of action or only one way of operating. Most importantly of all, a*daptability* is the aptitude of force elements to learn rapidly about their operating environment, particularly when faced with the unexpected, to recognise the need for change[14] and then reconfigure to succeed. Whilst agility describes notions of speed of reaction, or even proaction, it need not substitute speed for mass. Indeed, agility can be exploited to achieve mass from a dispersed force, if that is deemed desirable to, for example, mask blue force intentions. Commanders will seek to achieve and maintain *Decision Superiority*[15] at all levels in order to gain and retain the initiative. Better SSA will be a major contribution to Decision Superiority but also requires more responsive and adaptive command processes, to improve the decision-action cycle and deliver decisive operational advantage in the form of enhanced *tempo*.

Tempo is the rate or rhythm of activity relative to an opponent; higher tempo allows a commander to get inside the adversary's decision-action cycle by exploiting information and acting on it before the adversary has time to react. Tempo must, however, always be viewed as 'speed within context'; in certain operating environments we may wish to pick the correct time to act and timing can be more important than time *per se.* We will require commanders who have an intuitive 'feel' for the precise moment when they have sufficient information to take or seize the initiative, without waiting too long and losing it.

Finally, tempo allows the sudden massing of effects to achieve surprise. In a highly networked force, where the tactical level of command is fully empowered, a high degree of synchronisation may manifest itself as 'swarming'. These natural opportunities for simultaneity, whereby an adversary is overwhelmed by threats so that he is unable to concentrate on any one, or even establish priorities, are key to achieving operational momentum and to shattering an adversary's cohesion. The overall effect of tempo is reinforced by *persistence*, an ability to maintain effects over time, should this prove necessary.

Optimum tempo will shatter an enemy's cohesion in warfighting and ensure effects are delivered in the best sequence in other operations

Command
The authority for the direction, coordination and control of joint and integrated forces[16]

SSA, together with widely shared Command Intent[17] should allow forces to grasp and generate

fleeting opportunities and to cross traditional environmental (land, sea, air) and functional boundaries (intelligence, operations, logistics etc), confident that it will not lead to unintended effects such as fratricide and collateral damage. The result should be an ability to create effects at optimum tempo. There is tension, however, with on the one hand the responsiveness, creativity and freedom of action that the concept of agility seeks to enable and, on the other hand the degree of control required to ensure tactical actions are harmonised with the required effects at the Operational and Strategic levels. We should strike the balance between the two by empowering all levels of command, but allowing higher commanders to 'reach forward' and exert control when appropriate – in other words an 'adaptive' C2 system.

There is a danger, however, that the continual oversight that networks provide can allow senior commanders, politicians and even their advisors to exercise detailed control on an almost minute-by-minute basis. This can emasculate subordinate commanders, lead to a reluctance to take risks or to innovate and encourage a tendency to 'interfere-forward'. It will require high quality leadership to ensure that this does not happen and that subordinates feel free to exercise freedom of action. If we get it right it will, however, be an expression of *Mission Command*[18] for the Information Age.

It follows that in all operations commanders will need to strike an appropriate balance between centralised and decentralised operations, also to ensure that they maintain clear lines of responsibility.

The key to resolving the tension between the two will be a shared information environment that uses a richer, more broadly distributed and better understood *Command Intent*. This will set the conditions for both information flow and individual action. C*ollaborative planning* will allow Command Intent to be engineered concurrently, allowing all force elements to understand the Strategic context but to be focused on the Operational or Tactical commander's intent. SSA should allow *optimum synchronisation*[19] between force elements but, if it slips, higher level commanders must be ready to reassert control.

Collaborative planning will be a key element of Shared Situational Awareness

The ideal will be minimal corrections on the 'command tiller' to re-establish synchronisation, followed by re-delegation to the lowest possible level. Although difficult to achieve (doubly so in coalition operations, where cultures and command philosophies vary), the prize is higher tempo and improved agility. Future training must examine the tension between centralised and decentralised modes. For the bulk of force elements, particularly at the tactical level, the decentralised mode is the most challenging. At higher levels, training should emphasise the identification of those occasions where reversion to the centralised mode is appropriate.

The role of understanding

An operational environment that emphasises agility and tempo will require commanders who have the confidence and flexibility to exploit fleeting opportunities and who allow subordinates the freedom of action to use their initiative. Above all, commanders will need what Frederick the Great termed 'coup d'oeil' - the inner light of understanding derived from experience and intuition that will allow them to make sense of a chaotic, non-linear, battlespace. They will not only need to understand this environment, they will need to be comfortable in it.

Collaborative planning and execution

A shared information environment will allow commanders and staffs at all levels and functions to interact immediately a plan is initiated, in other

Force Elements will be mission and not environmentally organised. C2 structures will be more responsive

words to plan collaboratively. This is very different from the traditional approach, where multi-disciplinary teams at each level of command develop plans sequentially and then cascade orders downward. Firstly, because everyone is continuously aware of the Strategic and Operational level context, collaborative planning will be an important element of SSA. Secondly, it should allow much earlier identification of critical paths such as logistics. Thirdly, since force elements are privy to the same information as higher HQs they should be more likely to respond correctly to fleeting opportunities.

Finally, it should reduce the time required to synchronise operations. Force elements may even be able to prepare for operations before being ordered to do so and plan on the move, as already demonstrated in US Experimentation. Subordinate HQs at every level should be able to initiate their part in the operation with SSA allowing continual adjustment and coordination across virtual flanks[20].

Networked information will allow force elements to remain dispersed for as long as possible, which will enhance Force Protection and minimise logistic footprints. As mission planning evolves, force elements would assemble virtually, across component and echelon, to form *agile mission groups*, coming together physically only at critical junctures, to maximise concentration of force whilst achieving economy of effort. The composition of mission groups would vary according to the specific capabilities required and the scale and duration of the task.

This virtual assembling could also mask intent, by providing unpredictable patterns of operation and increasing the likelihood of surprise. This concept would, however, have major implications for logistic support compared with traditional operations. The understanding of Command Intent by logistic commanders will be critical, as will their own speed and freedom of manoeuvre. On the downside, the inability to interact in person and for commanders to exercise their physical presence may erode mutual trust and cohesion and it will be essential to maintain formed teams at certain levels of command. Unit integrity and mutual trust are critical to making Mission Command work at the tactical level and must not be sacrificed in a headlong rush for agility.

Staff organisation will also require to become more agile. The availability of information on a network should erode the tendency to stovepipe information within traditional staff branches. Smaller HQs would help cross fertilisation and it may be that the traditional J1-J9 staff branches are no longer appropriate. Future HQ structures could, for example, extend the current PJHQ philosophy of adopting task-oriented planning and execution groups, who take ownership of operations from inception to completion.

Coalition C2

Coalition warfare will require us to work with a wide range of capabilities and cultures. Cross-component and coalition C2 should be viewed as a requirement to initiate and coordinate tasks[21]. Technological capability, along with these human and organisational attributes can be used to describe the need to firstly, *integrate*[22] for combat operations with key allies that are able to exploit the future information environment, but perhaps only *inter-operate*[23] with other MN forces. In the extreme case of allies with no digitised capability or strong cultural barriers we will *de-conflict* entirely, although we will still seek unity of purpose.

It is the organisational, doctrinal and cultural aspects that are the real barriers to interoperability

Integrated forces will exchange near real time information over secure links using shared procedures, a common command ethos and deep understanding of cultural differences. Inter-operable

The control of forces consumes time. The objective of control is to contribute, not to interfere

forces are likely to use reversionary techniques and processes such as liaison officers and standing procedures. De-conflicted forces will share a 'unity of purpose' within the coalition but separate their activities in space and time in order to prevent them becoming an unacceptable drag on coalition tempo.

In most cases it is the organizational, doctrinal and cultural aspects, not just the technological issues, which are the real barriers to interoperability. Of all these security is probably pre-eminent.

It, more than anything else, inhibits the flow of information within the military, between Government departments and within a coalition. Differences between coalition partners will continue to cause friction. In particular, the British way of command may sit uneasily with the preference amongst others for more detailed control. The key will be to retain unity of coalition effort, if not the traditional view of unity of command. It is likely that some allies, even if they have the technology, will have cultural differences that inhibit the desired tempo. It follows that UK Armed Forces will require commanders and staffs who have the patience, tact, flexibility and cultural empathy needed to minimise these difficulties. These qualities will also be required to manage relations with non co-operative agencies, such as NGOs, who can create both positive and negative effects.

Control

Control is about guiding an operation: ideally commanders will exercise a degree of control consistent with the objectives at their level. Command should, however, be de-coupled from control wherever possible because control of forces consumes time and may hinder rather than help tempo. Put another way, the objective of control is to contribute, not to interfere. Therefore the exploitation of technology to 'reach forward' is valuable only if it contributes to success. The imperfect interpretation of Command Intent,[24] combined with chaos in the physical domain, may lead to operations becoming desynchronised and, therefore, the need for a measure of control to realign tactical actions with Strategic and operational level goals.

There is a strong link between the complexity of the operating environment, what constitutes optimum tempo for that environment and how much control might be exerted to achieve it, as demonstrated by the way Army C2 has developed in Northern Ireland over the years[25]. Finally, Campaign Effectiveness Analysis is a crucial element of control. It is what allows commanders to detect discontinuities, adverse outcomes or simply the wrong effects occurring in the battlespace. With that immediate feedback, control can be exerted to shape the correct outcome.

Inform

The acquisition, collation, processing, management and distribution of information[26]

The majority of our current information systems are compartmentalised by component, sub component, echelon and weapon system. Although recognised maritime and Air pictures exist and can currently be merged into a nascent Common Operational Picture (COP)[27], a Recognised land Picture is some way off. Therefore, a truly Joint operational Picture is a distant aspiration and, as a result, UK Armed Forces do not yet enjoy SSA.

In addition to SSA, 'Inform' is required to enable EBO by enhancing the information currently available (such as infrastructure nodal analysis, military capability and environmental data), but also to give more detailed knowledge covering culture, Value Sets[28], leadership structure, and the information needed for CEA, for red, white and blue components in the battlespace.

A new information paradigm[29]

Theoretically SSA would give every platform and individual access to all information. The laws of physics and finance suggest, however, that this is not achievable whilst the Information Management challenge presented by our current level of digitisation suggests that it may not even be desirable. Instead, we need a structured environment where sufficient information for comprehensive SSA is made available to those who need it. Above all, the current information 'push' paradigm, where producers determine what users need, needs to be replaced by an information 'post

The Information domain should consist of predetermined and reconfigurable Communities of Interest

and pull' paradigm, where users state the requirement or extract what they need from 'bulletin boards'. This has enormous cultural implications, particularly for communities who have traditionally 'released' information as they saw fit.

Communities of interest

The detail of SSA required will vary at each level of command and a single picture will not satisfy all. It follows that the battlespace should be configured for efficient information sharing by identifying *Communities of Interest* (CoI), within which information flows can be matched to reflect the differing perspectives of commanders and staffs, as well as their capacity to handle information. It should also permit access to wider communities on demand, with information communities reconfiguring as required. Although 'pull' will be dominant we should also have a culture that encourages all entities in the battlespace to 'push' information intelligently where they perceive a need elsewhere.

Of primary importance is that information communities are dynamic and not constrained by echelon, component or functional boundaries. Whilst this may seem a prescription for anarchy, experimentation shows that communities rapidly coalesce and adapt as operations develop[30], even if full freedom is given at the outset. In order to inform EBO, CoI must reach into the Instruments of Power and the information domains of coalition partners, OGDs and, when appropriate, NGOs. Examples of CoI could include: Military Strategic level planners, task groups formed to undertake a particular line of operation and high data rate, pre-configured sensor-shooter groups.

Organising ISR

To achieve Decision Superiority commanders will need to secure information ahead of adversaries. An information position, however, is time and space sensitive and should not be considered permanent or enduring. It follows that we will need to focus our information gathering resources at the time and place of our choosing and that we will need an Intelligence Surveillance and Reconnaissance (ISR) management process to ensure that this happens and that high value assets are used effectively, even with conflicting priorities.

The UK is unlikely to afford a collection system capable of permanent watch on a global scale *'We cannot be all-seeing all the time – we simply do not have the resources'* [31].

It is, however, within our means to exploit a wide range of sources (military, diplomatic, allied, media) to provide Indicators & Warnings (I&W) which can cue a narrower focus to give a more concentrated regional view[32]. This approach *could* result in the UK entering a crisis in a position of information weakness. In this case an initial disadvantage could be offset by the creation of pre-populated Knowledge Bases for likely crisis areas and exploiting Knowledge Bases held by other sympathetic parties[33].

All information has potential relevance at all levels of command. The notion of organic ISR will apply less in future

Information support to EBO

Compared with the coarse-grained I&W system, EBO will require much wider, richer information[34]. In particular it will cover all dimensions of the Strategic environment with an ability to analyse adversary Value Sets, strengths, vulnerabilities[35] and the physical environment[36] for a Joint Operational Area (JOA). Finally, EBO requires us to understand and track measures of effectiveness for CEA. The effects based philosophy seeks to achieve cognitive effects, which are difficult to measure. We need, therefore, a better understanding of how events impact upon an adversary's mind, which will depend upon correctly identifying reliable secondary and tertiary indicators of behaviour.

Analysing information

Analysis is the task of converting data into useful information. The detailed information needed for EBO implies an increased amount of processing, due to the far higher number of information sources. It is imperative that it is analysed using common processes across the Joint Force, otherwise differing interpretations could lead to the delivery of divergent effects. Some raw data will have immediate utility, but some will require assessment by specialists to enrich it and to avoid being deceived by an adversary. This concurrent process will require careful management for the following reasons:

- Processing can destroy information. The producers of information cannot know all the uses to which it might be put or the significance of some details for particular organisations. This reinforces the 'post before processing' paradigm so that information is not lost through processing[37].

- It will be important to get information into wider CoIs early and it will no longer always be appropriate for specialists to release the product of their analysis as completed packages. Agility demands earlier and wider exposure of potentially useful information, for which we will need better visualisation techniques if we are to make sense of it.

- The formatting and indexing of this less structured information must be carefully managed if correlation is to be made between key items of information within a CoI. New KIM techniques may become critical enablers for the integration of information streams, although the most complex correlation will continue to be undertaken by experienced commanders.

Exploiting information

The initial composition of a CoI would be determined as a result of the EBO process; it would then be primed by an intelligent 'push' of information. This initial burst must contain Command Intent and other critical information needed to set the context for subsequent information flow and exploitation. The information required by a predetermined CoI (e.g. a dedicated sensor-shooter team), is likely to be well structured. For more flexible CoIs that have been created for a specific task the priming package is, however, less likely to be complete and will generate a greater need to 'pull' information. This, in turn, could lead to adjustment of CoI composition.

A CoI should also push any new information deemed useful for others back into the wider domain. This inward and outward flow of information will encourage better synchronisation of elements; an essential requirement for increased tempo. A further benefit of synchronisation should be fewer information gaps; this will lead to fewer requests for information and allow bandwidth to be preserved for swift responses to the unexpected.

Disseminating information

The future information architecture must be joint, reliable, robust, secure, interoperable with other MN forces and integrated with digitised forces. It is likely to be federated, linking established and emergent CoI in a common domain. If it is to benefit from rapid advances in technology and avoid early obsolescence it needs to be based on commercially available protocols and standards[38]. Ideally, it would enable a real and NRT capability at formed unit level. The only restrictions on access to information should be on the basis of classification, sensitivity or granularity. Managing access will, however, be made more complex by the need to support EBO.

Content-based information security processes and technology will enable a single structured information domain[39]; essential to a 'pull' based information handling approach. This could permit 'virtual' collaborative planning, thus permitting dispersal within or beyond the theatre of operations. Moreover, the availability of Reachback to major databases and functions in the UK should help reduce deployed footprints. Databases will require careful management. Information formats will also need to make best use of available bandwidth, particularly at tactical levels where the bandwidth is narrowest and the rate of messaging highest. Paradoxically this could require a return to the discipline of formal staff processes, which have been eroded by the advent of e-mail[40].

Maintaining information

Given the role of information in the EBO process, Information Assurance will be imperative to ensure its availability, integrity, authentication, confidentiality[41] and timeliness. The information domain will need careful protection; of both its physical elements and the information it contains within it. This is a critical vulnerability that will be discussed in the 'Protect' element of the HLOC. Apart from the need in a democracy to audit decision making, there will be an increasing need to provide information that is precise, timely and evidential in order to prove the legality of military action, particularly where pre-emptive self-defence is concerned.

As the legitimacy of our decision making is determined by reference to information that is reasonably available to us, timely collation and dissemination has an additional impetus. There will also be the need rapidly to produce evidence in order to rebut adverse or incorrect media assertions. As a result, we must maintain an audit trail of all information flows that lead to decisions.

Summary

- The future battlespace will be complex and uncertain. Globalisation has created conditions where effects are very closely coupled with multiple, possibly unintended, consequences. Proliferation of information and weapon technologies is expected to continue but tolerance to casualties and collateral damage will diminish. Legal imperatives will constrain our freedom to operate and this will give our adversaries an asymmetric advantage.

- EBO could realise the full potential of the manoeuvrist approach. Effects are physical and cognitive, primary and subsequent, intended and unintended. They can be applied to friendly, adversary and neutral parties, across the seven dimensions of the Strategic environment using each of the Instruments of Power. EBO seeks to exploit the full lexicon of effects; therefore its full potential lies across a wide spectrum of operations.

- Future operations are as likely to be in *ad* hoc coalitions of the willing, as they are to be with established allies. The technological capabilities of potential coalition partners will range from those that attempt to stay abreast of US Transformation to those that cannot. In most cases it is the organizational, doctrinal and cultural aspects, not just the technological issues, which are the barriers to interoperability. Therefore we will need to *integrate* fully for warfighting with certain allies but perhaps only *inter-operate* with others. In the extreme case we may need to *de-conflict* entirely in space and time from those allies that do not share communication structures, processes or culture. The key will then be to retain 'unity of purpose' within the coalition.

- UK operations will be underpinned by an ethos of agility. This core ethos is characterised by responsiveness, robustness, flexibility and, most critically, adaptability. It is an attitude of mind and a benchmark for future capabilities, structures and procedures that will better enable UK Armed Forces to deal with the unexpected.

- The immense power of new information tools may go to waste until we understand which relationships between command and control are most relevant to the information age. We should decouple command from control in order to exploit the new information tools. Control should only be exercised if it *contributes*.

- The Command and Inform (C&I) goal is to enable Effects Based Operations (EBO) to guide highly responsive, mission-oriented force elements that exert synchronised freedom of action throughout the battlespace. It is underpinned by Shared Situational Awareness, a condition where force elements achieve a common understanding of both the operational context and the tactical situation. The net result will be a significant operational advantage through a step change in agility and tempo. The Command core concept is an enduring vision of Mission Command relevant to the Information Age. It promotes high tempo through the creativity and initiative of well-informed subordinate commanders. It relies on a network-wide expression of Command Intent and a high degree of SSA. An adaptive C2 process will seek to reduce the inevitable tension between desired freedom of action and the synchronisation of effects

needed to align strategic and Operational level goals with tactical actions. The result will be an agile joint force fully empowered to exploit with resilience the most fleeting of opportunities in the battlespace. Linked to the idea is the delivery of Decision Superiority, generated by SSA within and between task-orientated Communities of Interest. It will exploit a federated information architecture in order to enable collaborative processes within a single information domain.

Notes

1 JDCC, Strategic Analysis Programme, Summary of Implications, Pilot Iteration.

2 The UK Joint Vision, JDCC, 15 June 2001.

3 Defined as the three environments of Land, Sea and Air, plus time, the Electro-Magnetic Spectrum (EMS) and the computer generated dimension.

4 A current description of Al Q'aida as birds, which generally travel alone but come together to form a flock in response to 'swarming' stimuli, may indicate the shape of adversaries to come.

5 In his seminal work, 'Summary of the Art of War' Jomini described the geometric battlefield with boundaries and positive control lines that has characterised land warfare in the Industrial Age from the time of Napoleon through to the present day. In particular, he articulated the requirement for a base, an objective, lines of operation and lines of supply. It was never a very successful way of describing the Maritime and Air environments and is ill suited to warfare in the Information Age.

6 'In one moment of time, our service members will be feeding and clothing displaced refugees - providing humanitarian assistance. In the next moment, they will be holding two warring tribes apart - peacekeeping. Finally, they will be fighting a highly lethal mid-intensity battle. All in the same day, all within three city blocks'. Gen C C Krulak, Comdt USMC.

7 Thea Clark and Dr Terry Moon, Interoperability for Joint and coalition Operations, ADF Journal No 151 Nov/Dec 01.

8 V Adm M Stanhope, DCINC FLEET, at the Fleet Study Period, Maritime Warfare Centre, 26 Nov 02.

9 'Linking sensors, decision makers and weapons systems so that information can be translated into synchronised and over whelmingly rapid effects'. D/CM(IS)2/1(106/02) dated 29 May 02.

10 Situational Awareness (SA) is defined as 'the understanding of the operational environment in the context of a commander's (or staff officer's) mission (or task)' - JWP 0-01.1.

11 An approach to operations in which shattering the enemies overall cohesion and will to fight is paramount. It calls for an attitude of mind in which doing the unexpected, using initiative and seeking originality is combined with a ruthless determination to succeed. British Defence Doctrine, JWP 0-01, 2nd Edition.

12 Economic, political, military, legal, ethical and moral, cultural, physical – JDCC Strategic Analysis, Pilot Iteration.

13 Diplomatic, Military and Economic.

14 In other words, to avoid 'groupthink', a recognised situation in close knit groups whereby challenging the 'truth' can be perceived as disloyal or disruptive.

15 'The application of knowledge by commanders to make quality decisions directing assigned forces and harnessing additional support at the right time, such that they preserve operational flexibility and maintain the initiative in the battle space'. DG Info (CBM) working definition May 02.

16 Definitions are taken from the Defence Capability Framework D/JDCC/7/1, 13 Sep 02.

17 Command Intent is a statement that focuses on the decisive elements of how a mission should be accomplished. It must be rich enough to convey intent but simple enough to be unambiguous. The key is to leave sufficient room for initiative and interpretation by individual commanders. Adapted from Network Centric Warfare - Developing and Leveraging Information Superiority 2nd Edition Aug 99 p34. David S Alberts et al, DoD C4ISR Co-operative Research Programme.

18 A style of command that seeks to convey understanding to subordinates about the intentions of the higher commander and their place within his plan, enabling them to carry out missions with the maximum freedom of action and appropriate resources. Adapted from British Defence Doctrine, JWP 0-01, 2nd Edition.

19 Optimum synchronisation not only includes time and space but is achieved when primary and secondary effects are being generated in harmony with Command Intent, in particular the Strategic and operational goals.

20 The disruption caused by the fuel tanker strike in the UK during winter 2000 is an example of so-called 'self synchronisation'. Lacking any national leadership or formal organisation, but armed with a common intent to move the government on the fuel tax issue, and informed by mass media telecom and the Internet, disparate groups acted in concert to create havoc. This concept is not as revolutionary as some would claim. A 1930's German Army pamphlet stated: 'the emptiness of the battlefield requires fighters who think and act on their own and can analyse any situation and exploit it decisively and boldly'. The German Army system demanded that, when necessary, the various Arms should co-ordinate and act together without direction from above. In J Storr, A Command Philosophy for the Information Age. Ed D Potts, The Big Issue, SCSI No 45, Mar 02.

21 As described in the US DoD 'Levels of Information Systems Interoperability' (LISI). This sees seven support layers for C2: *C2 Frameworks*, which constrain and support processes, which can be organisational, legal, philosophical, financial or conceptual in nature; *C2 Processes* that identify key activities, individuals and groups and illustrate how the C2 organisation works; *Information Management* that captures stores and retrieves information; and finally, *Information Technology*; and *Communications Links*. The emphasis on the higher level of support (C2 Frameworks and Processes) is toward people. It highlights again the importance of the human element of command. Further Human Sciences research may be needed to optimise the development of future C2 structures, processes and training, whereas 'pure' technology has more emphasis at the lower levels (IT and Communications Links). A development of the LISI model (by Thea Clark and Dr Terry

Moon, in 'Interoperability for Joint and Coalition Operations', ADF Journal No 151 Nov/Dec 01) derives levels of interoperability from four enabling attributes: *Preparedness* considers what doctrine, experience and training enable organisations to work together; *Understanding* asks what level of information and knowledge sharing exists and how it is used; *Command Style* addresses how roles and responsibilities are delegated or shared; and *Ethos* determines the levels of trust, culture, values and goals that are shared.

22 'Combine or be combined with to form a whole'. Concise Oxford Dictionary, 10th Edition.

23 'Able to operate in conjunction'. Concise Oxford Dictionary, 10th edition.

24 There is a human factors issue when conveying an experienced commander's thoughts to less experienced subordinates through the information domain; where the 'lense of human perception' can complicate the process. Whilst doctrine and training make the process more predictable, intent is often misinterpreted.

25 A good example of an 'adaptive C2' system that works well is UK Army operations N Ireland, a very politically sensitive operating environment. Land forces in N Ireland have had an 'all informed' voice radio system for twenty years, whereby the GOC (if he chooses) or any other commander can listen to any tactical radio net. This has proved very powerful for Media Ops staff, for example, who can listen to an incident as it unfolds and issue a very rapid and credible account, before other organisations who may wish to give a different version of events. Although the GOC and Brigade commanders could in theory 'interfere forward' on the tactical net, in the authors experience this happens very rarely. Long experience has taught that this creates uncertainty and confusion at a time when tactical commanders have to think and act very fast indeed. In other words, it does not *contribute* to the success of the operation. Any corrective action tends takes to take place 'off line' between commanders and staffs, so that the integrity of the chain of command is maintained and not undermined

26 Definitions are taken from the DCF.

27 The COP is a subset of the JOP that shows the current, Near-Real-Time picture. The JOP is a much broader information tool. See 'Inform: Exploit' below for a full description of the COP and JOP.

28 Those 'values' held by an individual, group, organisation, regime or nation, which form the basis of their Strategic Centre of Gravity. This involves understanding a potential adversary's psychology, plus the formative factors (cultural, religious, ideological, historical, economical and political) that drive his intentions, objectives and modus operandi.

29 'A technical example, pattern or model'. Concise Oxford Dictionary, 10th Edition.

30 US experimental experience indicates that CoI self configure very rapidly once information starts circulating around a net work. Personal communication from Vice Admiral Cebrowski, Head of the US DoD Office of Transformation.

31 CDS Speech to RUSI, 10 Dec 01.

32 The 'cue-scan-focus' approach. Maj Gen R Fulton, UK MoD Capability Manager (Information Superiority) in a speech to the RUSI C4ISR Conference 10 Sep 02.

33 It is likely that soon most major NGO's, for example, will have accessible databases for areas where they operate. It is likely, also, that these Knowledge Bases will have been built up over many years and will represent a body of knowledge that the military could not hope to replicate in normal operational time frames.

34 The elements of information 'width' or reach are: Sharing by Functional area; Sharing by Alliance/Coalition; Sharing by component/echelon; Sharing latency; Sharing by security level; Sharing by number of nodes; Continuity over time; and Geographic range. The elements of information richness are: Completeness; Correctness; Currency; Accuracy or precision; Consistency; Assurance; Timeliness; and Relevance. P 95 - 100, Information Age Warfare, David S Alberts, John J Gartska, Richard E Hayes and David A Signori, DoD C4ISR Co-operative Research Programme, 2001.

35 The JDCC-led Potential Generic Adversary project has a well-advanced study examining the motivational and capabilities aspects of future adversaries.

36 Geophysical, hydrographic and meteorological data for forces' manoeuvre generally, propagation information for surveillance sensor tasking and weapon performance limitations.

37 Information Age Transformation, David S Alberts, DoD C4ISR Co-operative Research Programme, 2002.

38 It is industry's view that in future military orders will be such a small part of their overall business that, as they are reliant on large volume/small margin production, investment in 'bespoke' military standards will not be cost effective. RUSI C4ISTAR Conference 24 - 25 Sep 2002.

39 JFCOM presentation to NATO CDE Conference Oct 02.

40 It is useful to reflect that Army operational 'Staff Duties' originated in order to facilitate message transmission using Morse Code on telegraph and, later, HF radio - in other words to make full use of restricted bandwidth.

41 JWP 3-80 dated Jun 02.