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Title:

Non - technical Interoperability in Multinational Forces.

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This paper is the 10th in a set of 13 presented to the 9th ICCRTS by staff of the Defence Scientific and Technical Laboratory (Dstl) and QinetiQ plc, relating to 'command in the network enabled era'. The papers are based on research undertaken for the United Kingdom Ministry of Defence's 'Network Enabled Capability' programme and, unless otherwise stated, are covered in whole or in part by Crown Copyright

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Abstract

Interoperability in multinational forces generally refers to compatibility of hardware and software. Connectivity alone, however, does not confer capability and must be accompanied by interoperability of people, process, and organisation. We have labelled these latter aspects 'non-technical interoperability' (NTI). The purpose of this item of work was to develop a valid framework describing the factors that underpin NTI to allow UK MOD to understand these aspects of interoperability better and to mitigate potential frictional factors in multinational forces. Recent work has involved an assessment of the framework by military subject matter experts to validate its structure and content further. In addition, a Multinational forces Co-operability Index has been developed with a view to aiding the assessment of whole-system interoperability.

Background

The period since 1990 has seen increasing attention paid to multinational military forces. Experiences in the Arabian Gulf and the former Yugoslavia have demonstrated the substantial strategic advantages to be gained through coalition and alliance operations. Operating in multinational forces is nothing new for the British Armed Forces. For example, as Connaughton [1] points out, as far back as the early Eighteenth Century, it was rare for the Duke of Marlborough to undertake a campaign with more than 50% of his forces drawn from the United Kingdom. It is interesting to note then, that recent commentators, for example Palin [2], have observed that multinational forces raise a new set of challenges for the military personnel involved. There are at least two reasons for this in the period since the end of the cold war. On the one hand, the level in the military hierarchy at which regular multinational interaction takes place has lowered. For example, the British Army of the Rhine would typically have co-ordinated with its allies at Corps or Division level. Nowadays, multinationality occurs *within* Brigades. In addition, there is the challenge of operating with unfamiliar nations. Compared to the certainties of the NATO alliance, where trust could be built over a number of years, the UK is likely to operate in *ad hoc* coalitions with non-traditional partners. Multinational commanders are likely to inherit 'coalitions of the willing', designed to meet political-strategic, rather than operational and tactical, requirements.

In order for an alliance or coalition to operate effectively, it is essential that national contingents can achieve as high a degree of interoperability as is possible. NATO doctrine stresses that interoperability is: "the ability of systems, units, or forces to provide services to and accept services from other systems, units, and forces and to use these services so exchanged to enable them to operate effectively together" [3]. Interoperability has generally been taken to imply the compatibility of different contingents' military hardware and software, for example, weapons systems or communication and information systems. More recently, however, it has been recognised that this 'technological interoperability', while essential, cannot, in isolation, ensure the capability of the multinational force [4]. Connectivity alone does not confer capability. The command and control element of a military force can be characterised as a complex socio-technical system [5] where personnel, processes, procedures, and organisational structures interact with technology to deliver capability. Clearly, in an alliance or coalition environment, interoperability of technology must be accompanied by interoperability of people, process, and organisation in order that a combined military capability can be achieved. We have labelled these latter aspects 'non-technical interoperability' (NTI)[1].

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[1] This term appears to have first been used by Clark and Moon [10].

Friction in Multinational Forces

There are a number of potential inefficiencies associated with low NTI. As Van Creveld [6] suggested, low NTI can result in Clausewitzian 'friction'[2] in any complex military organisation whether joint, combined, or both [7]. US Marine Corps Doctrine makes a useful distinction between frictional factors that are external to the force, for example enemy action or the weather, and those that are located internally, for example poor co-ordination and complex command relationships.[3] Our studies have focussed specifically on non-technical frictions that manifest themselves within multinational forces. Van Creveld suggested that "the friction within a machine - human or mechanical - increases in proportion to the number of its parts". We have respectfully sought to refocus and extend this metaphor. It is our contention that it is the *quality of fit* between those parts in combination with the number that determines the degree of friction generated. This quality of fit is largely a product of interoperability, both technical and non-technical.

Friction within a multinational force implies a reduction in the efficiency of the command and control capability of that force. These performance decrements may manifest themselves in a variety of ways, for example poor planning and decision making or an inability to achieve co-ordination of effects. Commentators such as Kiszely [8] have observed that the frictions generated within multinational forces have the potential to result in 'tempo drag'. This potential restriction in the ability to generate tempo may be a particular danger to those forces that, in recent years, have focussed on smaller, lighter units that achieve operational advantage through manoeuvre and the ability to achieve and control operational tempo.

Development of a Non-Technical Interoperability Framework

Study Aims. In order to operate effectively in a multinational force, it is essential first to understand, and second, where possible, to intervene to mitigate factors with the potential to engender friction. The purpose of this item of work was, therefore, to develop a practical, valid, framework describing the factors that underpin NTI with the intention of supporting future commanders. This paper briefly summarises the output of studies carried out by CHS QinetiQ and its collaborators at Dstl and Vega to derive and exploit a valid baseline of the main non-technical challenges associated with working in multinational forces. These studies were funded under the UK MOD's Corporate and Applied Research Programmes. It is stressed that it is not an aim of this work to make value judgements or criticisms regarding different nations' approaches. Rather the purpose of the research is to identify sources of incompatibility with a view to raising awareness of these issues and, where possible, to make recommendations as to how they might better be managed. Moreover, it has not been an aim of this work to document specific differences between individual nations. The aim at this stage has been to produce a framework of generic factors representing continua upon which national contingents might vary.

Review and interview study. The overall aim of the work described in this paper was to identify non-technical factors that have the potential to undermine optimal interworking in multinational forces. During the initial phase of this work, a scoping study [9] and a wide-ranging document search and review were conducted. Based on the findings of this early work, a series of interviews were conducted with personnel who had previous experience of working in multinational forces. A semi-structured interview template was developed with the intention of guiding participants in some areas, but also allowing them an opportunity to raise topics they believed to be important, and not to

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[2] Clausewitz observed that "Everything is very simple in war, but the simplest thing is difficult. These difficulties accumulate and produce a friction".

[3] This having been said, we should remember that multinational forces are likely to be susceptible to a range of external frictions, not least attempts by red forces to undermine and break cohesion in coalitions and alliances. These issues were outwith the remit of the current studies.

be constrained by set questions. 45 interviews were conducted. Participants, who were mostly British officers, had either served in multinational operations (e.g. Bosnia, the Gulf, Sierra Leone, Kosovo) or had worked in a multinational setting (e.g. HQ ARRC). All three services were represented in the study and personnel ranged in rank from Army Captain to 3* General. The majority of interviews lasted over an hour. By far the majority of participants held the rank of Major / Lieutenant Colonel or service equivalent. Interviews were taped for later analysis in conjunction with interviewers' field notes. This initial analysis identified a wide range of issues as important, for example incompatibilities in national and military–technical language, differences in command styles between contingents, lack of preparation of personnel, and attitudes to information sharing. Structuring these 'soft' issues presented a challenge, however, owing to the myriad of linkages between the factors identified. Clearly a framework was important to enable the exploitation of the baseline findings.

Related work. The second major phase of the work was aimed at organising the large and complex set of information generated by the interview and review studies into a coherent framework. The literature review revealed that other research teams were engaged in similar work, notably Australia's DSTO [4,10]. Clark and Moon [10] attempted to provide a valid and comprehensive toolkit for interoperability assessment by coupling the pre-existing US DOD Levels of Information Systems Interoperability (LISI) model [11] with an Organisational Interoperability Maturity model (OIM) developed at DSTO by Clark and Jones [4]. Whereas the LISI model can be used to underpin assessment of technical interoperability, the OIM was developed specifically to provide a means for assessing the organisational factors that contribute to joint and multinational interoperability. The OIM was based on the structure of the LISI model. Five levels of organisational interoperability: Unified, Combined, Collaborative, Ad Hoc, and Independent, were defined.

A review of this work suggested that the DSTO model might provide a useful top-level framework for the data captured in our own studies. Thus, the main focus of our analysis became an attempt to overlay the factors identified through the interview and literature review studies onto the four basic attributes of the DSTO model, described below. In this regard, it was noted that the DSTO structure had not been developed 'bottom up' from primary data such as interviews, but rather was constructed 'top down' based on the expertise of the analysts involved. As such, it was argued that success in this exercise would lend support to the basic structure of the OIM and provide a degree of validation owing to the separate data sets involved. It was further anticipated that, owing to the richness of the data collected in the QinetiQ studies, it might be possible to expand the OIM framework by adding detail and sub-categories to the original high level model. At this stage, it was also decided that the term 'organisational interoperability' might be too narrow for the data captured in our interview and review studies. Our work had confirmed that, amongst others, social, personnel, and process factors were as prevalent in the data as organisational issues. For this reason, we decided to name our framework the Non-Technical Interoperability Framework to stress the contribution of the widest possible range of non-technical issues.

The non-technical interoperability framework. Clark and Jones [4] proposed 4 enabling attributes of organisational interoperability. These were: Preparedness, Understanding, Command Style, and Ethos. These and their basic definitions were taken as a starting point for the QinetiQ analysis. Issues identified in the earlier interview study were categorised and incorporated into the framework. Following the development of the prototype NTI, two military judgement workshops were run where a small number of subject matter experts, representing the land, air, and maritime environments, were exposed to the framework and invited to comment on its structure and content. A number of changes were made to the framework following those meetings, thus strengthening its claims to validity. The latest iteration of the top-level framework is illustrated in Figure 1. This top-

level structure is described briefly below. The full NTI framework [12] provides a more detailed breakdown of each of the attributes.

Preparedness. This attribute refers to how ready a contingent is to interoperate with multinational partners. In the framework, preparedness has been divided into 2 top-level areas: organisational preparedness and the preparedness of personnel. ***Organisational preparedness*** mainly relates to the compatibility of structures and processes and includes, TTP (tactics, techniques, and procedures), rules of engagement, structure, doctrine, and unit / formation experience. The issue of unit / formation experience is important; clearly there is likely to be less friction within a multinational force where military organisations have collaborated in the past and have, for example, developed common or compatible procedures. ***Preparedness of personnel*** focuses on the readiness of the individuals involved to contribute to multinational environments and is based upon selection, training and prior individual experience. The results of a recent survey [13] suggest that previous multinational experience with one nation provides good preparation for later deployments, even where those later deployments involve contact with entirely different contingents.
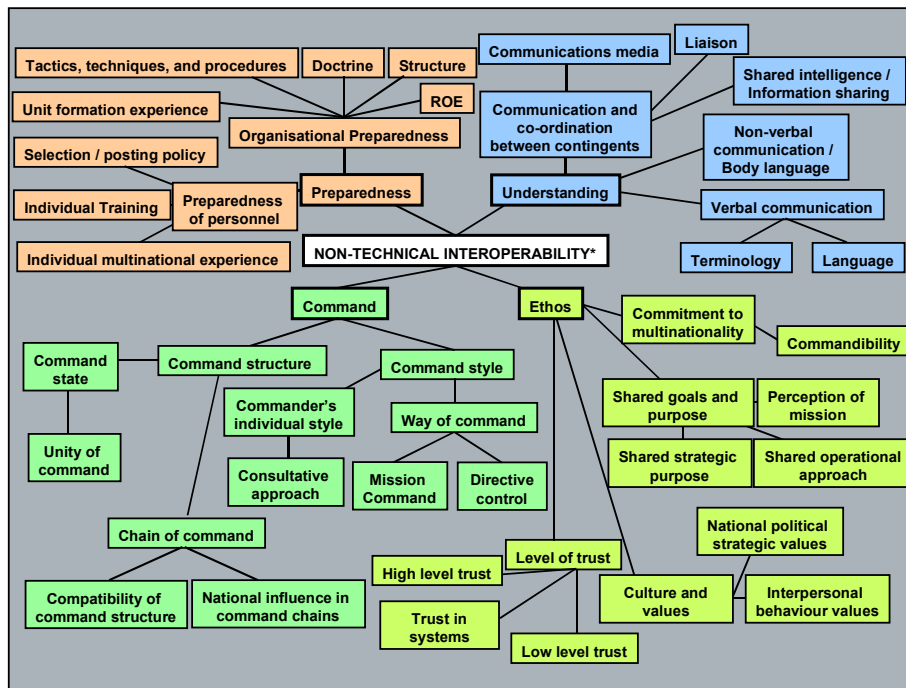

Figure 1. The non-technical interoperability framework

Understanding. Clearly, it is necessary for participating nations to have a shared understanding of the situation in order to respond in a compatible and co-ordinated fashion. Communication and co-ordination are considered to be key factors in achieving shared understanding. ***Communication:*** The primary issue of concern in multinational interworking tends to be achieving adequate levels of competence in one spoken language. While national language is a major factor in this, it should be recognised that other issues such as the availability of a shared, standardised military-technical terminology are also essential. ***Coordination between contingents:*** A number of factors have the potential to increase or decrease the friction that is experienced within multinational forces. Willingness to exchange information and intelligence is one. This study suggests that provision for smooth liaison between coalition partners, usually enabled by the exchange of competent, well-prepared liaison officers, is essential to co-ordination and the achievement of shared understanding.

Command. This is the attribute that describes how decisions are made and how authority and control are allocated or delegated. This has been broken down into two parts. ***Command Style:*** Command style consists of way of command and the commander's individual style. Way of command refers to the extent to which control is delegated and the level of supervision of operational conduct. The issue here is not the relative merits of the diverse styles of command, for example the British approach to 'mission command', that may be represented within a coalition, rather, it is the potential for incompatibility between those command styles that may lead to friction. Commander's individual style refers to personality and leadership qualities, and the ability to adapt this to the extra challenge of coalition operations. According to Connaughton [1], this factor was essential to the success, or otherwise, of Anglo-American co-operation during World War II: "in the majority of cases it was personal rather than international relations which dictated the friction or the lack of it" (p18). ***Command Structure:*** This is made up of chain of command and command state. It is clear that the relatively simple command organisation that is the norm in single-nation forces is unlikely to exist in future multinational forces, especially in *ad hoc* coalitions and in non-warfighting operations. Keithley and Ferris [16] suggest that the main objective of a command and control system is to achieve unity of effort. They point out that "complete unity of command is seldom achievable in coalition operations. Unity of purpose and unity of effort are usually the most one can hope for".

Ethos. The ethos attribute is concerned with the culture, values, goals and aspirations of an organisation. These factors have an important part to play in the degree of trust that can be achieved in a multinational organisation. ***Level of trust:*** Trust between the contingents that make up the multinational force is an important enabler of interoperability. Regrettably, it is not a given. For the purposes of this analysis, it is useful to distinguish between three different areas of trust in a MNF: personal trust between senior commanders, personal trust at low levels in the command chain, and trust in systems such as structures and processes. ***Shared goals and purpose:*** It is important here to make a distinction between the sharing of goals and purpose at the strategic and grand strategic levels and issues relating to sharing campaign and mission goals at the operational level which will be very much tied up with similarities / dissimilarities in approach and perception. ***Culture and values:*** Here, it is important to distinguish between what is referred to as 'national political strategic values' relating to what is done, when, and under what circumstances, and a micro level that relates to similarities and differences in values, beliefs and attitudes relating to all aspects of interpersonal behaviour.

The Multinational forces Co-operability[4] Index (MCI)

This study has developed an information framework that provides the customer with a valid description of non-technical factors that have the potential to have an impact upon the command and control capability of multinational military forces. This knowledge base can be exploited in a number of ways. As was suggested above, it is essential first to understand the factors that have the potential to engender friction and second, where possible, to intervene to mitigate them. Both technical and non-technical aspects of multinational force interoperability should be assessed so that commanders / planners can manage or mitigate potential areas of friction. While the non-technical interoperability framework provides information that can be used as the basis for an informal appraisal of friction in working with other nations, it was deemed to be important to develop a tool to allow for more structured assessments. It is proposed that such an assessment would have utility:

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[4] The term co-operability has been treated here as equivalent to 'non-technical interoperability'. It was coined by a recent French-German-UK-US Working Group and implies "…successfully bridging differences in doctrine, organisation and culture. Achieving co-operability allows different coalition partners not only to exchange data, but to understand its implications and to synchronize operations". [15]

- before an exercise / operation with a view predicting and minimising friction;
- during an exercise / operation with a view to identifying and mitigating friction;
- after an exercise / operation, as part of the after action review / lessons identified process;
- as part of officer / staff training, for example using case studies;
- as part of pre-deployment unit preparation.

This requirement has, in part, been addressed through the development of a Multinational forces Cooperability Index (MCI). This provides users with a means for deriving an assessment of the coalition's performance, predicted or observed, on each of the major factors identified in the NTI framework. The MCI allows the identification of potential risks to operational effectiveness in MNF and assists in the prioritisation of risk factors. The MCI is structured as a table. The 4 main NTI attributes (Preparedness, Understanding, Command, and Ethos) are dealt with in turn. Each row represents one of the NTI sub factors. Two examples are provided below in Figure 2. These are Rules of Engagement, which falls under the Preparedness attribute, and Language, which is part of Understanding. Risk assessment for each sub factor is made using an interoperability rating scale across each row. 6 'anchor' statements, covering high to low non-technical interoperability are provided for each of the topic areas. By providing a score for each factor, assessments can be made either for the multinational force as a whole or between the individual nations involved in the coalition / alliance. It is noted that further research is required to achieve validation of this scoring scheme and to cross calibrate the scales used.

Score =	1	2	4	8	12	16
Terminology *(From Understanding attribute)*	Military-technical terminology is standardised across national contingents	'Formal' terminology acknowledged	General doctrine covers some aspects of terminology	Separate ways of working, lack of standardised terminology used among co-operating forces	Willingness to move towards standard terminology, but no action taken or progress made	No standardised terminology used
ROE *(From Preparedness)*	Coalition-specific ROE that are accepted and understood by all	High levels of common interpretation and implementation of ROEs	Similar interpretations and implementation of the compatible ROE	Similar ROE, but some differences in its content and context, additional guidance required	Willing to consider compatible ROEs, but still independent	Lack of consistent ROE, differences in its content and context and no standard approach in the employment

Figure 2 Multinational forces Co-operability Index - Examples

Potential interventions

Used in combination, the NTI framework and the MCI can provide an indication of areas that have the potential to undermine smooth interworking within a multinational force. These tools can therefore be used as diagnostic instruments. Mitigation of potential frictions requires that appropriate interventions are identified. Although in many cases these are likely to be situation specific, a number of relatively generic improvements to enable multinational military co-operation have been identified during the course of our work. A few of these are outlined in the following paragraphs to provide examples.

Process standardisation. Further standardisation of process between the UK and its potential coalition partners should be sought. Clearly this is most feasible within an alliance setting. Nevertheless, information captured during this programme suggested that, for example, full standardisation of military-technical terminology has not been achieved, even within NATO.

Language ability. Development of shared understanding based on effective communication is a major hurdle in multinational forces. The UK, for example, requires more officers with second language ability and more availability of translators. It may be dangerous to rely upon the current pre-eminence of the English language in multinational forces; for example, this may be challenged in future European co-operation. In addition, personnel with English as their first language can benefit from advice on how better to speak English to non-native English speakers. It is interesting that this point, which was raised by interviewees in our study, is being addressed by an independent US initiative to deliver training to NATO personnel in former Yugoslavia [14].

Training and education. There is a requirement to ensure that personnel who are likely to be involved in multinational operations are aware of the factors that underpin non-technical interoperability. The NTI framework provides a first step in this process in that it illustrates the generic issues that are likely to cause friction in such environments and, as such, allows individuals to be prepared for such differences to arise. It is important that personnel are prepared for the likelihood of multinational operations throughout their careers. In view of this, it is desirable that officer-training syllabuses, across the three services, include the issues described in the framework. This general training can be supplemented by nation-specific information in the run up to operations or exercises.

Training content. It is anticipated that the creation and maintenance of a nation-specific database based upon the NTI framework and covering all potential coalition partners would be unrealistic at present. It may, however, be possible to create such a tool for two or three major partners, for example, the USA. A more feasible approach to providing information for non-familiar partners would be to bring in individuals who have had exchange postings to a particular nation. Those individuals could use the NTI framework or the MCI to derive information relating to potential frictions between the nations concerned. The information derived could then be incorporated into a structured brief.

Combined training. Multinational exercises are deemed to be extremely valuable in providing personnel with experience of non-technical frictions, but opportunities are currently rare owing to cost and administrative complexity.

Experience. Our studies [13, 17] have illustrated that participants draw heavily on their previous experience of multinationality in adapting to new deployments. This appears to have been the case even where the new deployment or posting was to an environment where they would not be working with the nations they had experienced previously. Thus, it can be suggested that there is scope for the process of posting to be examined to ensure that young officers gain appropriate and valuable experience of multinationality early in their careers.

Liaison. Effective liaison is essential to achieving shared understanding in multinational forces. Liaison officers (LNOs) are unlikely to be replaced by technology [18]. Rather new technology will increase the requirement for high quality LNOs. Selection and preparation should be improved, with potential LNOs identified within the peacetime establishment of formation HQs. It is notable that, of the LNOs interviewed during the course of this study, it was the more experienced personnel who believed that there is a requirement for improved preparation for their role. There is also be a need to educate others about the role and heighten the profile of the LNO.

Conclusions

Clearly, not all of the issues raised in the studies described are within the power of multinational commanders to correct. Nevertheless, awareness of this class of problems can, at least, allow problems to be anticipated and, where possible, prepared for. Equally, a number of issues have been raised that both individual nations and, potentially, standing alliances are in a position to address. For example, an improvement in the way some native English speakers use the English language in multinational settings might provide a relatively simple 'quick fix'. More ambitious might be the area of cultural-awareness training. Our work has identified some areas where such learning might

focus in order to improve multinational teamworking, for example raising awareness of differences in attitudes to hierarchy or way of command in a foreign contingent. The NTI framework and the MCI tool have been developed with a view to supporting diagnosis of potential frictional factors in multinational forces and the formulation of a practical solution set.

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