

# Linking NCW and Coalition Interoperability: Understanding the Role of Context, Identity and Expectations

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## Abstract

The rise of NCW as a concept of operations has been accompanied by a significant reshaping of the nature and tasking of the ADF. In particular the link between effective implementation of NCW and coalition interoperability is now becoming apparent. To achieve coalition interoperability the ADF will have to ensure not only technological but organisational and social parity with the military forces of other nations.

At a macro-level, there are many obvious factors capable of shaping coalition interoperability including doctrine, legal frameworks, technology, command philosophy, and rank/skill parity. Less obvious however, are the underlying or micro-level processes that determine whether such factors will enable or inhibit coalition interoperability. This paper investigates these processes by examining the interrelated notions of context, identity and expectations, and how they provide a basis for coalition interoperability in the face of what appear to be intractable organisational differences. By investigating the micro-level processes underlying different modes of national interaction, practical organisational strategies can be developed to mitigate against macro-level constraints on coalition interoperability.

The importance of context, identity and expectations to interoperability is borne out by the different 'modes' of national interaction open to coalitions. By analysing the experiences of Australian Defence Force personnel returning from the Middle East, we compare and contrast the effects of two such modes: liaison and embeddedness. Each provides a distinct contextual frame within which multiple and superordinate identities shape expectations about fundamentally important issues including the disclosure of information, trust, and the nature of participant interaction. This exploration of data from personnel returning from the MEAO provides a real world example of Network Centric Warfare in a multinational coalition context.

## 1 Introduction

The rise of Network Centric Warfare (NCW) as the dominant logic of military operations has been accompanied by a significant reshaping of the nature and tasking of the Australian Defence Force (ADF). As part of its 'core business' the ADF is now expected to operate within a networked context. Moreover, these networks are likely to be multilateral. This situation raises the issue of coalition interoperability and the extent to which it can be achieved. This paper explores how coalition interoperability depends not simply on technological factors.

At a macro-level, there are many obvious factors capable of shaping coalition interoperability. These include doctrine, legal frameworks, technology, command philosophy, and rank/skill parity. Less obvious however, are the underlying or micro-level processes that determine whether such factors will enable or inhibit coalition interoperability on the ground. This paper investigates these processes by examining issues of context, identity and expectations, and how they provide the 'glue' of coalition interoperability.

The importance of context, identity and expectations to interoperability is borne out by the different 'modes' of national interaction open to coalitions. By analysing the experiences of ADF personnel returning from the Middle East Area of Operations (MEAO), we compare and contrast two such modes to show how they enabled coalition interoperability: *liaison* and *embeddedness*. By investigating the micro-level processes underlying the different modes of interaction, practical strategies can be developed to mitigate against macro-level constraints on coalition interoperability.

## 2 The rise of coalition interoperability

Coalitions are a combination of systems (i.e., persons, groups, organisations, or States) brought together for a particular and time limited purpose. They involve the amalgamation of diverse interests, structures and resources (see Ryan, 2000a, 2000b, 2000c). As Matte (2006) observes, coalition operations are “*ad hoc* in nature and diverse in composition” (p. 78). Coalition commanders therefore must often contend with “huge differences in operational-level realities such as goals, training, capabilities, equipment, logistics, culture, doctrine, intelligence and language” (Silkert, 1993, p. 14) in a time pressured environment. As such, coalitions necessarily involve the need for interoperability and shared command to achieve their goals.

Since the 1990s, coalitions have been the preferred means of conducting military operations, including operations other than war. Ryan (2000a) suggests that there are three main types of military coalitions: traditional military/state alliances; UN and/or regional organisations; and military coalitions formed to deal with international threats. The antecedents of modern military coalition operations can be seen in the joint command structure of World War II and the Cold War era (see, Cronin, 1994; Dixon, 1993; Illingworth, 2002; Peters et al., 2001; Charpentier et al., 1998; Ryan, 2000a, 2000b) multilateral treaties (e.g., NATO and ANZUS), agreements (i.e., BSA and STANAGs) and organisations (i.e., ASCC). The current global security situation has seen the emergence of coalition arrangements that go beyond the former alliance arrangements:

*During the Cold War, the NATO allies had the benefit of years of stability to **develop and exercise common command and control procedures and infrastructure**. However, post-Cold War coalition operations are much more likely to resemble a “come as you are” party with some of the “party-goers” being first time acquaintances. (Charpentier et al., 1998, emphasis added, pp.2-3).*

Expanding the pool of potential coalition partners outside of traditional alliances provides an increase in the number and diversity of forces that can be deployed. However it also reduces the leverage that is available in working with traditional partners, that is, the capacity to draw on those with whom one has established a working relationship. Before moving on, let us briefly examine the major issues of coalition interoperability in the Australian context.

### 2.1 The Australian situation

Australia’s operations in Afghanistan, Iraq, the Solomon Islands and East Timor demonstrate that coalitions, drawing on but limited to existing alliances or treaty organisations (Malik, 1998), are one of the more likely contexts for future Australian military operations. The Australian Defence White Paper (2000) clearly identifies interoperability as an essential objective of force development. This requirement grew out of the ADF’s continued involvement, and deployment, in multilateral coalition operations. As former Defence Minister Senator Robert Hill identified in 2002 “We are seeing a fundamental change to the notion that our security responsibilities are confined largely to our own region. The ADF is both more likely to be deployed and increasingly likely to be deployed well beyond Australia” (Hill, 2002). As such the ADF is seeking to create a flexible and networked force with integrative and interoperability capabilities that will enable it to participate in the type of coalitions that currently typify military operations. According to Ryan (2000a):

*The advent of truly multilateral coalition operations as a part of the ‘core’ business of the Australian Defence Force (ADF) means that Australian planners are going to have to come to terms with the sort of uncertainty that plagued coalitions in the past. The key issue that needs to be addressed is that of interoperability – not merely at the tactical level, but in coordination of political and theatre specific aims (p. 19).*

As such an understanding of the nature of coalition interoperability is fundamental to both the short and longer term goals of the ADF.

## 3 The challenge of coalition interoperability: Cooperation across fault lines

Military coalitions offer benefits that are inaccessible to isolated organisations (Clark & Moon, 2001; Ryan, 2000a, 2000b). They allow commanders to exploit the specialised capabilities of coalition partners and provide a greater number of ‘hands to the wheel’. Having said this, coalitions also contain fault lines, that is, issues capable of restricting the extent to which these advantages are realised. According to Matte (2006) “coalition warfare presents problems of time and structure that combine to create very complex challenges” (p. 78). Most obviously, these challenges relate to differences in technology, doctrine, organisational structure and legal

frameworks that emerge between coalition partners. A DSTO study of ADF personnel deployed to the MEAO identified these issues as capable of impeding their ability to collaborate with US counterparts, and vice-versa. The same study found that ADF personnel identified the nebulous construct of 'command philosophy' and a perceived lack of parity regarding rank and skill-level, while not as obvious as technological differences, nonetheless inhibited coalition interoperability.

As is suggested above, coalitions contain a tension between diversity and commonality (Ryan, 2000a, 2000b). On the one hand, coalition partners are valued for their unique abilities, the result of years of technical and/or organisational progress. On the other hand, they are also valued for commonality, that is, their readiness to 'plug into' existing systems set in place by dominant coalition partners. From this later point of view, unique skills or ways of doing things are potential 'sticking points' needing to be addressed rather than qualities that might provide the commander with problem-solving leverage. Add to this time pressure, unpredictability, high tempo and generally hazardous operating environments, such is the case when responding to natural disasters or civil/political instability, and cooperation becomes even more difficult. Indeed, when a coalition requires the combination of materiel *and* personnel from different nations, the effect of national differences is compounded (McCann & Pigeau, 2000; Peters et al., 2001; Ryan, 2000a, 2000b).

Despite the fact that it has been observed for some time (see Kennedy, 1983) the challenge of achieving coalition interoperability must not be seen as static. As the context of military operations becomes more complex, so too does the challenge. This is most apparent in the current 'war on terrorism' in which a seamless blending of military and non-military organisations is envisioned. According to Illingworth (2002):

*The attacks of '911' against the United States and the War on Terrorism reemphasize the need to implement greater interoperability among joint and coalition forces across strategic, national, military, and police intelligence agencies, emergency responders, non-government organizations, as well as joint and coalition military branches (p. 1).*

In the counter-terrorism context, the consequences of not adequately addressing the challenge of interoperability have already been demonstrated. It is now well known that in the months prior to the terrorist attacks of September 11, 2001, the agencies of the US intelligence community had amassed a considerable amount of information pointing to a planned attack on the American mainland (United States House Committee, 2002). Yet, despite the fact that many of these agencies cross-detailed people to each other, the extent to which this information was shared between them was minimal. Instead, information relating to the terrorists' plans (e.g., meetings held, visas granted, pilot training conducted, etc.) was kept largely within the boundaries of the agency that 'owned' it. According to members of the Intelligence Community, cooperation across agency boundaries had long been impeded by a complex, thorny, and largely informal phenomenon colloquially termed "the Wall" (United States House Committee, 2002, p. 363). Here, the non-technical roots of a breakdown in coalition interoperability are laid bare. The lack of disclosure between agencies in a networked and ostensibly cooperative arrangement was not due to a lack of secure communication facilities but rather an inability to manage the psycho-social dynamics (e.g., trust and distrust) that emerge in intergroup activities.

The above example presents some salient lessons for scholars of coalition interoperability in military environments. At the very least, to achieve coalition interoperability, a dynamic range of integrative and divisive forces that operate within and between groups involved in time pressured and hazardous activities must be addressed (Illingworth, 2002; Peters et al., 2001; Ryan, 2000a). It is clear from our data collected from ADF personnel returning from the MEAO, and from other sources, that a robust understanding of coalition interoperability successes and failures cannot be gained by simply using one metric. As Handley, Levis and Bares (2001) explain:

*In a coalition, systems from different organizations are joined together to resolve a specified mission in a specified domain. The goal of the systems is to obtain a shared understanding of the mission and then act together to effect transformations on the domain to accomplish the mission. In order for this to occur, each individual system must understand the domain, its abilities within this domain, and which systems are best for actions within the domain (p. 3).*

This demands the master question of the field: How can coalition interoperability be achieved in the face of major fault lines that span technology, doctrine, organisational structure and so on? In the following section, past attempts to answer the question are briefly reviewed.

## 4 Attempts to address the challenge

There are a variety of real world operations (e.g., Operation Allied Force, Desert Shield, Desert Storm, INTERFET) that have provided data on military coalition interoperability. Illingworth's (2002) overview of American coalition operations identifies compatibility and technical limitations as one of the central hurdles that needs to be addressed in a coalition operation, particularly given the increased involvement of "first responder, strategic intelligence, national intelligence, police intelligence" (p. 8) who traditionally have sat outside of military operations. Peters et al. (2001) reported that the most "severe challenge" to Operation Allied Force was the "lack of interoperable, high volume secure communications" (p. 56). Importantly Operation Allied Force had the benefit of "almost 50 years of NATO training, exercises, and interoperability standards ... nevertheless, Operation Allied Force revealed some serious interoperability problems remain" (p. 55).

At this time there appear to be two perspectives on how best to approach the question of coalition interoperability. One response advocates a technological driven solution which typically offers little practical consideration of the human dimensions; the other advocates that technology is not sufficient in and of itself to provide a complete solution to the challenge of interoperability. Let us briefly consider these two positions and a direction forward.

### 4.1 Technology as primary and sufficient

The issue of technical capability is of such obvious importance in military operations that it is unsurprising that operational researchers have focused on its contribution to interoperability (Nutwell & Prince, 2000). What is concerning is the degree to which many of the metrics developed for evaluating and improving coalition operational performance contain little in the way of substantive acknowledgement of non-technical aspects (see, Charpentier et al., 1998; Clark and Moon, 2001; Matte, 2006; Tolk, 2003a, 2003b). In essence the implied position is that the primary limiting factor for interoperability is a technical one and once the appropriate technological solution is found then interoperability will flow. The dominance of technical interoperability has been bolstered by the advent of NCW, which has been articulated in some forums as a largely technical capability – but as with technical interoperability the material focus in NCW overlooks the purpose of the networks:

*NCW is not about technical networks; it doesn't focus on technologies ... While the technical domain is an important enabler, the social components and the processes related to conducting a military operation that will be using the information are important as the technical ability to interchange data related to this information (Tolk, 2003a, p. 1).*

Tolk (2003a) proposes that although technical reference models (e.g. LISI, NTRM, NCOE, NCF, NOSI and NMI) are only sufficient for technical level issues they also "can contribute to gaining an understanding of how various layers of interoperability can be dealt with" (2). As such it is important to be sensitive to the technical interoperability but our evaluations of interoperability need to include more than one domain.

### 4.2 Technology necessary but insufficient

Ryan (2000a) proposes that the "real 'revolution in military affairs' that is currently in progress has little to do with technology" (p. 1) and coming to grips with coalition interoperability requires an awareness of connectivity, communication and context in terms broader than simply the material/technical level. Similar sentiments are expressed by Tolk (2003a):

*To deal with organizational interoperability above the technical interoperability, the domain of data and information has to be lifted up into the domain of knowledge and awareness (p. 7)*

Charpentier et al. (1998) warns that although the issues of connectivity and standardisation, which have emerged from operational experience, are important and need to be addressed, it is also necessary to be aware of the non-material aspects that are being screened out by the prominence of these technological challenges. As Silkert observes (1993) "once established, a coalition normally requires coordination of effort to achieve common political, economic, and social objectives; agreed strategic plans to achieve military objectives; and of course unity of command" (p. 78). So although technology (and in particular, communications) has consistently been at the forefront of interoperability questions – partly because it is an enabler of interoperability and partly because

it is amendable to modification – it is important to remember that technology is only one part of the interoperability formula.

Clothier et al. (1997) proposed that interoperability is constituted by two aspects or forms: planned and flexible. Planned interoperability is based in the technological domain and uses the strategies of standardising infrastructure, systems and protocols – all of which can be developed in advance and in a largely context independent way. Flexible interoperability utilises the human domain and seeks to find solutions that are not necessarily technological based. Charpentier et al. (1998) has argued that we need to understand this “human level, where differences between coalition partners in culture, personal values, military expectations, religions, and societal values are proving to be less tractable than differences in message formats and communication protocols” (p. 1).

### 4.3 A middle path?

The human dimension is a significant interoperability enabler (see Clark and Jones, 1999) but it has yet to be fully incorporated into interoperability evaluations and management. The Levels of Information Systems Interoperability (LISI) model (See Appendix E), developed by the US Department of Defense, has provided a robust framework for exploring technological and information domains. Kasunic and Anderson’s (2004) review of LISI proposed that while it was effective for measuring technical compliance, systems interoperability and operational interoperability it was not an effective measure of organisational and cultural dimensions. Clark and Moon (2001) have augmented and extended LISI with their Organisational Interoperability Model (OIM). The OIM model can be used with LISI to create a more detailed picture of interoperability (See Appendix B – Figure 3). As Clark and Moon (2001) note “ways are found around interoperability gaps but not necessarily by technological means” (2) and as such we need to be able to conceptualise an interoperability spectrum that is inclusive of technical and non technical enablers. The Transformational/Intent model of Command and Control (CSSS Working Group, 1998) provides a good overview of one way of describing this spectrum from the C2 perspective (See Appendix B – Figure 1 and 2). As Clark and Jones (1999) report the C2S Study described “the type of C2 support provided to the factors in the C2 model was categorised into five layers. These layers of support range from the very abstract type of support given by an organisational framework, to the very concrete support supplied by communications infrastructure” (p. 3). The NCW metric model (See Appendix C) offers an attempt to build from the organisational/technical aspects of command and control into a whole of force framework. This direction offers some promising opportunities but much of the operational analysis remains at the technical metric level.

The next steps in this process will be to continue to populate models of interoperability with known human dimension aspects so that a more detailed descriptive and analytical framework can be developed. Coalition interoperability analysis needs to be sensitive to the fact that:

*The problems that arise from such temporary groupings run the gamut from the technical difficulties of assembling workable federated networks based on national command, control and communication systems to linguistic, cultural, doctrinal and organizational differences between the nations (Charpentier et al., 1998, p. 3).*

Although the combined LISI/OIM models recognise that coalition interoperability has a human dimension it does not fully describe the behaviours and activities that enable interoperability. As such, this model provides good fidelity at a macro-organisational level but its capacity to provide concrete recommendations falls away sharply at the meso and micro levels. The development of this next level of detail will require a recognition that coalitions are forms of ‘collective action’ and as such their success or failure cannot be measured solely at the macro level (see Appendix D). As noted above with regards to ‘the Wall’, the focus must shift to see equipment as the add-on and personnel as the core:

*People are why we have a good capability – why we’re doing so well. We empower them, we equip them, we lead them and they do the rest. And we all know that is the way we do business. (Houston cited in Baxter 2006, 8)*

In the remaining sections of this paper, we extend our current understanding of the human dimensions of coalition interoperability by recognising that interoperability is fundamentally about people’s capacity to achieve collective aims, sometimes in spite of the very system that is meant to enable cooperation. To demonstrate how we can augment the current models we will focus on what we term ‘modes of interaction’ - observer, liaison and

embeddedness – and argue that these modes offer insight into how people perceive a coalition context, their sense of identity within that coalition and finally their expectations as a coalition member.

## 5 Modes of interaction

‘Modes’ of interaction are simple, interpersonal ways that groups use to improve their awareness of one another’s activities. Here, three modes of interaction are discerned - *observer*, *liaison* and *embeddedness*. Tight definitions of these are difficult to discern and important ways in which they differ from one another are outlined in the following section. For the purpose of this section, definitions of these are:

- **Observer** - a group member simply observes another group’s activities;
- **Liaison** - a group member is assigned to another group to undertake basic activities necessary for ensuring unity of purpose.
- **Embeddedness** - a group member becomes part of another group for all intents and purposes.

To illustrate how ADF personnel utilised these modes of interaction to manage coalition interoperability, this section draws on data obtained from a DSTO study of ADF personnel deployed to the MEAO. This study comprised interviews of over 100 ADF personnel between 2003 and 2005. Interviewees were asked to provide their opinion on a range of issues, including command and control, information sharing and working within the US-led coalition.

To begin our data shows that the achievement of interoperability was a salient issue amongst our interviewees and one not solely restricted to the technical domain. Many spoke of their concern about interoperability inhibitors such as inconsistent or non-existent communication technologies or differing legal frameworks:

*...there was no connectivity because the headquarters where the Americans were to where we lived was 500 metres apart and there were no lines, there was nothing, right?*

*The whole American approach is different to the Australian approach. You know, on the legal side, yes, and in every respect.*

Our interviewees revealed that they dealt with these interoperability issues with what they had at hand – most notably their interpersonal and organisational networks. As they had limited capacity to directly address the large scale technical and doctrinal inhibitors, they chose instead to address these challenges indirectly through liaison or embedded personnel. This approach was particularly obvious with respect to gaining information about broader operational activities being conducted by the US, as one interviewee explained:

*Even if you didn’t know who to go to, to get the information, you’d email our liaison officer, say in [ ] and then he would get it for you that day because he was there working with the Americans...part of the success was having those liaison officers in the right places. Without a doubt.*

The advantage of having liaison or embedded personnel in Headquarters was immediately apparent to those interviewees faced with a plethora of international differences when working with counterparts. One interviewee spoke of how an USAF officer embedded within an Australian RAAF contingent provided invaluable assistance with regard to raising the general level of an awareness about US processes:

*He knew what we didn’t know about working with an American wing in combat. So he was kind of critical to helping the guys through the labyrinth of what’s different...the exchange positions are absolutely critical to your interoperability.*

Other interviewees spoke about using liaison positions strategically as a way to work around fault lines. As one interviewee explains, this provided a means by which to input into the decision-making of US commanders.

*The way we got around that was to put two Australians as liaison officers...We had one in the Commander’s ship, and then at the next level up in the carrier, we had a liaison officer on the Admiral’s staff, which meant that we had two entry points into the American command and control system that...gave us a chance to put our views across if we didn’t think that they were being considered.*

These examples illustrate a number of important points. They show that ADF personnel deployed as part of a larger US-led coalition were aware of issues that could potentially undermine the extent to which coalition interoperability could be achieved and actively worked to overcome these. They also show that in addressing these challenges they were aware the most effective and practical approach was one that involved other people. Specifically, liaison and embedded personnel provided an effective way to devise work-arounds, reduce uncertainty, and ensure input into coalition command decisions.

The temptation to explain the behaviours illustrated above as idiosyncratic must be resisted. Indeed, the words of ADF personnel expressed above identify issues that have been previously noted by other researchers of coalition interoperability. Rather than idiosyncratic, these behaviours portray an important means through which *actual* interoperability is achieved. Put another way, these behaviours enabled coalition interoperability in spite of the obvious barriers. In the following section, these modes of interaction are examined to reveal the ways in which they may be used to expand our current models of coalition interoperability.

## 6 Expanding our vision of interoperability: Integrating the human dimension

In this section, we propose the first steps towards a detailed inclusion of human dimension issues into coalition interoperability models. The LISI model provides us with an example of the fine grained analysis that can be used to assess the degree of connectivity and interaction. It would be inappropriate to assume that this can be simply applied to the psycho-social issues suggested above, however we believe that a fine grained analysis of this type is possible. There are a range of psychometric tools available for understanding inter- and intrapersonal behaviour but before drawing on these, a framework within which salient dimensions for analysis can be identified must be produced. The OIM model offers one of the most obvious framework to which this kind of analysis could be connected.

The modes of interaction defined above reveal important dimensions of coalition interoperability that are not explicitly included in existing models. Yet the role these modes play in enabling coalition interoperability demands their closer analysis. As a first step, it is necessary to outline the key differences between these modes of interaction with regard to important organisational and psycho-social variables. Determinations regarding the level of difference are based on an inductive reasoning drawing on comments from ADF personnel and general organisational and interpersonal theory. This comparison is shown in Table 1.

*Table 1. Comparison of modes of interaction across key organisational and psycho-social variables*

<b>Comparative categories<sup>1</sup></b>	<b>Observer</b>	<b>Liaison</b>	<b>Embedded<sup>2</sup></b>
Degree of difficulty in establishing mode	Low	Moderate	High
Short term benefit (to parent organisation)	Moderate	High	Low
Long-term benefit (to parent organisation)	Low	Moderate	High
Knowledge sharing enabled by mode	Low	Moderate	High
Degree of inclusivity in host organisation	Low	Moderate	High
Potential to influence command <sup>3</sup>	Low	Low	Moderate
Need for parity of rank/skill	Low	Moderate	High
Need for doctrinal compatibility	Low	Moderate	High
Need for linguistic consistency	Low	Moderate	High
Need for cultural understanding	Low	Low	Moderate
Influence of personal values	Low	Moderate	High
Influence of societal values	Low	Moderate	High

Table 1 shows that as you move across the modes of interaction there is an increasing sensitivity to organisational, cultural and personal differences. Accompanying this, there is an increase in access to information and the ability to directly contribute to command decision making. At the embedded level, access to information is greatest but this is associated with a displacement of original organisational loyalties to that of the host organisation (this can be either another coalition partner or the coalition itself). Given the level of access

<sup>1</sup> These categories are drawn from key factors identified in the coalition interoperability research discussed above.

<sup>2</sup> Embeddedness involves the adoption of a superordinate identity overriding that of the parent organisation.

<sup>3</sup> The potential to influence command is always associated with rank. This determination attempts to encompass a range of possible command positions.

available to embedded personnel, this mode can require a greater level of organisational effort to establish. It is also likely to provide the greatest long-term benefit to both the parent and host organisation.

While Table 1 represents intuitive differences between these modes with respect to organisational and psycho-social variables, it shifts us from a common-sense understanding of these modes to the beginnings of a more analytically useful description. It is likely to be the case that other dimensions of comparison are involved in these modes. Further analysis is required to reveal these dimensions and the exact nature of how the modes may differ in their contribution to coalition interoperability. Drawing on data such as that gathered from the MEAO is one possible method of progressing this.

The development of a fully mature coalition interoperability framework will include broad characteristics identified in existing models (e.g., LISI, OIM) and organisational and psycho-social characteristics such as those outlined in Table 1. The inclusion of these finer-grained distinctions into LISI and/or OIM provides a means by which both analytical detail and pragmatic opportunities can be devised. Clearly, OIM in its current form opens the way for the inclusion of more specific organisational, psychological and social factors that bear significantly on coalition interoperability. Our analysis shows that when this domain is explored at a finer grained level we can reveal tangible strategies for achieving interoperability. As such, this work offers a contribution to both operational and exercise/training domains.

Table 1 provides an insight into the modes of interaction involved in different types of coalition arrangements. This moves us from a macro-level picture to a 'meso' or mid-level one, showing how types of organisational arrangement are operationalised in the behaviours of personnel. In Table 2 we continue this analysis down to the micro level to reveal the way particular coalition contexts influence the identities, expectations, and behaviours of those engaged in different modes. For explanatory purposes, the determinations made in Table 2 are based on the context of disclosure between coalition groupings.

*Table 2. Identities, expectations, and behaviours for different modes in a disclosure context*

<b>Context: Disclosure of information<sup>4</sup></b>	<b>Observer</b>	<b>Liaison</b>	<b>Embedded</b>
Identity (primary reference group)	Parent organisation	Parent organisation	Host organisation
Expectations	Nil disclosure	Limited disclosure	Full disclosure
Level of trust involved	Conditional trust	Agreement based trust	Identity based trust
Information flow	One way	Limited two way	Free two way

Whereas Table 1 provides an insight into broad organisational and psycho-social dimensions that differentiate the modes of interaction, Table 2 offers a deeper view of *how* these dimensions may play themselves out in the expectations, identity and behaviour of personnel. For example, Table 1 differentiates the modes on the dimension of knowledge sharing in that the observer mode is associated with low knowledge sharing and the embedded mode with high knowledge sharing. Table 2 presents an understanding of this difference in terms of how these modes (in a particular context) influence people's identity - their perceived primary reference group - and their expectations. The particular sub-dimensions of identity, expectations, trust and contextually-relevant behaviour are informed by accounts from ADF personnel deployed to the MEAO. At this level we can begin to see the kind of fine-grained detail that LISI offers as part of its sub-dimensions. We can also see how different meso-level characteristics might influence each other.

By linking the levels of macro (organisation), meso (mode of interaction) and micro (the ways identity and expectations interact in a context) we provide an insight into the human dimension of coalition interoperability, in this case from within the MEAO. In a relatively short space we have shown how tangible progress in the human dimension can be achieved. This provides a cautionary note against assuming the intractability of human dimension issues relevant to coalition interoperability. Indeed, comments from ADF personnel working within the US-led coalition in the MEAO (which are consistent with other coalition research) suggest that technology is often the most intractable factor. Fundamentally, the most interoperable components are the people involved. We have explored how existing organisational arrangements or 'modes of interaction' are significant enablers of coalition interoperability.

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<sup>4</sup> Disclosure is the conscious decision to provide information that is not freely or immediately available to all parties. Data from the MEAO interviews reveals that disclosure is a particularly powerful indicator of coalition interoperability

## 7 Conclusions

A consistent observation from operations is that solutions to interoperability issues tend to be based on personnel rather than materiel. Individuals and groups find ways to work around disconnects and incompatibilities in technology and organisations. A thorough understanding and evaluation of modes of interaction (and the human dimension of NCW coalition interoperability in general) can provide ‘solutions’ that may be far easier, and more cost effective, to implement than seeking to achieve technological interoperability alone. Also given the diverse nature of coalition partners it is more likely that there will be significant differences:

*Equipment considered standard, even basic, in most western armies, is simply not present in the inventories of many military contingents from developing countries. The equipment multinationals bring with them is not likely to be interoperable* (Allard, 1995 cited in Faughn, 2001, p. 13).

Importantly as Tolk (2003a) warns “investing in technical interoperability does not necessarily lead to an increase in operational interoperability”. We need to consider how to use the oldest capability available to military commanders, their personnel, to leverage off technological and organisational resources to achieve operational success.

In this paper we have briefly reviewed the rise of coalition operations, identified the importance of coalition interoperability for the ADF and examined the existing approaches to evaluating coalition interoperability. On the basis of data collected from the MEAO and other coalition research, it has been argued that current modelling techniques such LISI and OIM, while moving in the right direction, do not take into account important interpersonal behaviours that enable coalition interoperability. These behaviours are most obvious in the context of liaison and embeddedness relationships. In this paper, we have endeavoured to distil the important ways in which these arrangements differ from one another and the key psychological factors underlying their enabling effect.

At the very least this analysis shows that improvements in interoperability do not have to await shifts in the largely immobile structures of doctrine, technology or international policy. Rather, such improvements can be made by actively engaging with the way personnel ‘on the ground’ currently think and behave. This is, in essence, the principle of ‘learning by doing’. It requires a fundamental shift in perception that recognises the most flexible elements of military forces are the people involved and not exclusively technology. The shift towards NCW offers a rich opportunity to capitalise on this idea. We have provided a preliminary example of how to approach this analysis. This framework identifies a range of intuitive connections between behaviours, identity and organisational processes. What is required is a more detailed engagement with this issue. We need to move beyond asking whether the human dimension plays a role in coalition interoperability – because it so obviously does - and ask questions of how it does so.

## 8 Appendix A – List of acronyms

ADF	Australian Defence Force
AP	Allied Publications
ASCC	Air Standardization Coordinating Committee
ANZUS	Australia, New Zealand & USA security treaty (1951)
BSA	Basic Standard Agreement
DoD	Department of Defense (USA)
DSTO	Defence Science and Technology Organisation (Australia)
INTERFET	International Force East Timor
LISI	Levels of Information Systems Interoperability
MEAO	Middle Eastern Area of Operations
NATO	North Atlantic Treaty organisation
NTRM	NC3TA technical reference model (NATO)
NCOE	NATO Common Operating Environment
NCF	NATO Common Funded Reference Models for Functional Configurations
NC2TA	NATO Consultation, Command and Control (C3) Technical Architecture
NOSI	NATO Reference Model for Open Systems Information Exchange
NMI	NCETA Reference Model for Interoperability
OIM	Organisational Interoperability Maturity model
RAAF	Royal Australian Air Force
STANAG	Standardization Agreements
USAF	United States Air Force

## 9 Appendix B

Source: Clark & Jones (1999)

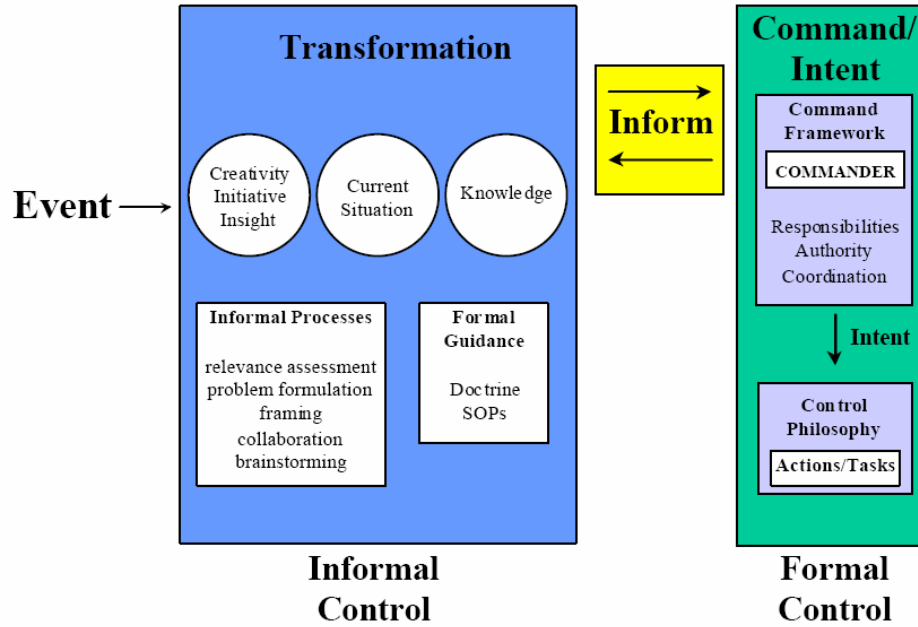


Figure 1. Transformation/Intent Model of C2

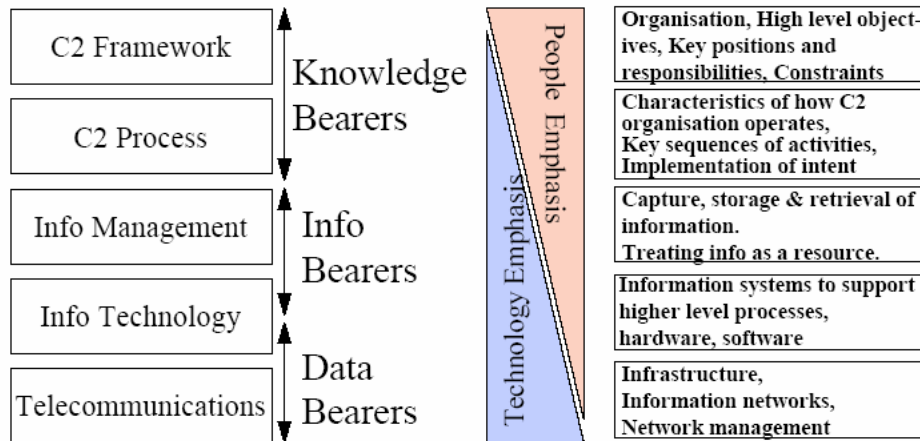


Figure 2. Layers of C2 Support

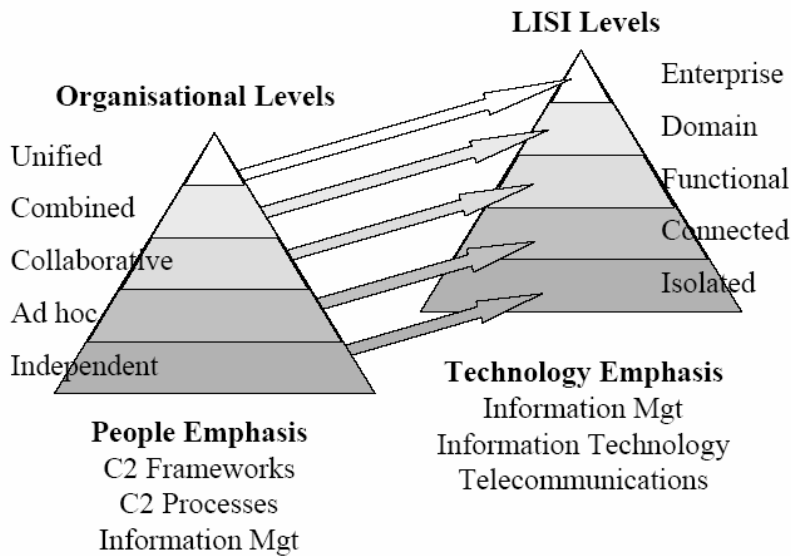


Figure 3. Alignment between Organisational Model and LISI

## 10 Appendix C

Source: Tolk (2003a)

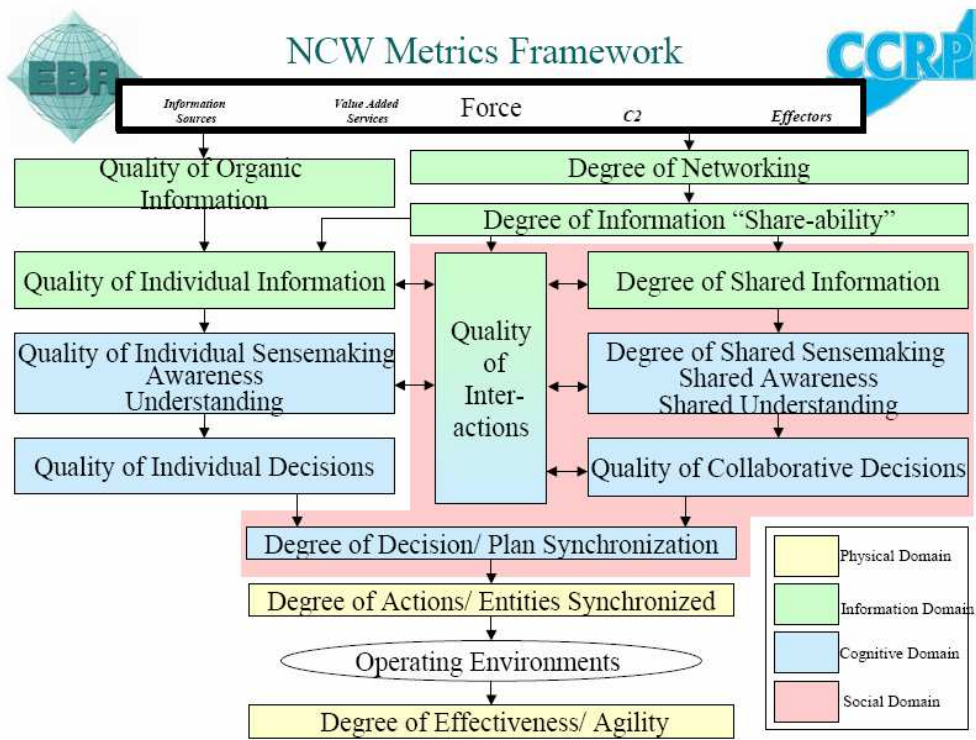
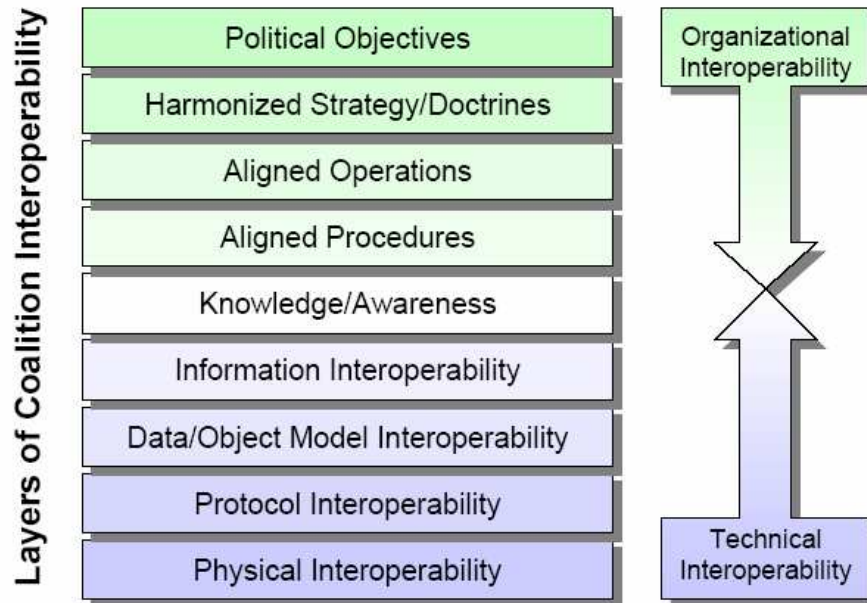


Figure 4: Network Centric Warfare Metrics Framework

## 11 Appendix D

Source: Tolk (2003a)



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**Figure 5: The Layers of Coalition Interoperability**

## 12 Appendix E

Source: Tolk (2003a)

<b>LEVEL</b> (Environment)			<b>Interoperability Attributes</b>					
			<b>P</b> rocedures	<b>A</b> pplications	<b>I</b> nfrastructure	<b>D</b> ata		
<b>Enterprise Level</b> (Universal)	<b>4</b>	<b>c</b>	Multi-National Enterprises	Interactive (cross applications)	Multi-Dimensional Topologies	Cross-Enterprise Models		
		<b>b</b>	Federal Enterprise					
		<b>a</b>	DoD Enterprise	Full Object Cut & Paste		Enterprise Model		
<b>Domain Level</b> (Integrated)	<b>3</b>	<b>c</b>	Domain	Shared Data (Situation Displays Direct DB Exchanges)	WAN	DBMS		
		<b>b</b>	Service/Agency Doctrine, Procedures, Training, etc.	Group Collaboration (White Boards, VTC)		Domain Models		
		<b>a</b>		Full Text Cut and Paste				
<b>Functional Level</b> (Distributed)	<b>2</b>	<b>c</b>	Common Operating Environment (DII-COE Level 5) Compliance	Web Browser	LAN	Program Models and Advanced Data Formats		
		<b>b</b>		Basic Operations (Documents, Maps, Briefings, Pictures Spreadsheets, Data)				
		<b>a</b>	Program Standard Procedures, Training, etc.	Advanced Messaging (Parsers, E-Mail+)	Network			
<b>Connected Level</b> (Peer-to-Peer)	<b>1</b>	<b>d</b>	Standards Compliant (JTA, IEEE)	Basic Messaging (Plain Text, E-mail w/o attachments)	Two Way	Basic Data Formats		
		<b>c</b>		Data File Transfer				
		<b>b</b>	Security Profile	Simple Interaction Text Chatter, Voice, Fax, Remote Access, Telemetry)	One Way			
		<b>a</b>						
<b>Isolated Level</b> (Manual)	<b>0</b>	<b>d</b>	Media Exchange Procedures	N/A	Removable Media	Media Formats		
		<b>c</b>	Manual Access Controls		NATO Level 3	Manual Re-entry	Private Data	
		<b>b</b>						NATO Level 2
		<b>a</b>						NATO Level 1
		<b>o</b>						No Known Interoperability

Figure 1: The Level of Information System Interoperability (LISI) Model

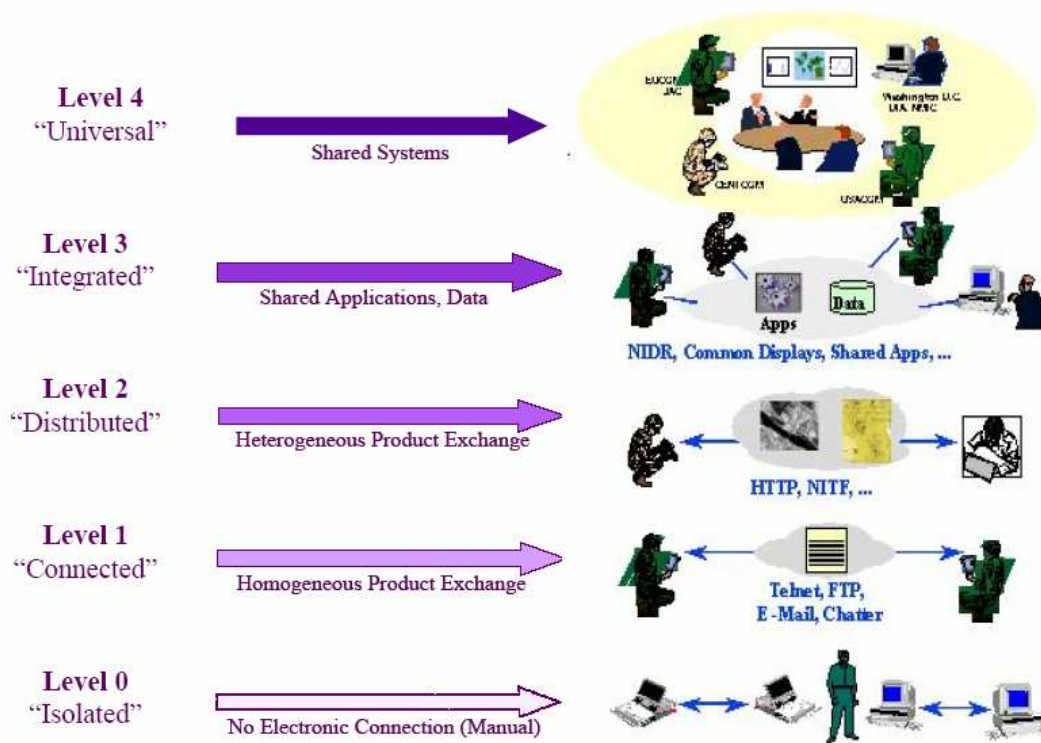


Figure 2: Levels of Interoperability proposed by LISI

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