

**Interoperability and Network-Centric Warfare:  
US Army Future Force and  
German Army in 2015**

**A Monograph  
by  
LTC (GS) Thorsten Alme  
German Army**



**School of Advanced Military Studies  
United States Army Command and General Staff College  
Fort Leavenworth, Kansas**

**AY 04-05**

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 074-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> 052605	<b>3. REPORT TYPE AND DATES COVERED</b> Monograph	
<b>4. TITLE AND SUBTITLE</b> Interoperability and Network-Centric Warfare: US Army Future Force and German Army in 2015			<b>5. FUNDING NUMBERS</b>	
<b>6. AUTHOR(S)</b> Lieutenant Colonel (GS) Thorsten Alme, German Army				
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> US Army Command and General Staff College School of Advanced Military Studies 250 Gibbon Ave. Fort Leavenworth, KS 66027			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> U.S. Army Command and General Staff College Fort Leavenworth, KS 66027			<b>10. SPONSORING / MONITORING AGENCY REPORT NUMBER</b>	
<b>11. SUPPLEMENTARY NOTES</b>				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited.			<b>12b. DISTRIBUTION CODE</b> A	
<b>13. ABSTRACT (Maximum 200 Words)</b> US and German security strategies portray future warfare as coalition warfare. Thus, successful military operations depend on assured Interoperability of coalition forces. This paper asks for the state of Interoperability between German Forces in 2015 and the US Army Future Force. The reader will be informed about the US Future Force, whose characteristics and implications on foreign nation's Interoperability are evaluated. Special consideration is given to technical and behavioral Interoperability. The monograph assesses the projected capabilities of the German Bundeswehr in the year 2015 with regard to Network-Centric Warfare (NCW). Technical and behavioral Interoperability are again the main focus. According to the findings of the paper, German Bundeswehr forces in 2015 will be prepared for integration into the US Army Future Force. The single most important factor for assuring this capability will be an appropriate funding in the next ten years.				
<b>14. SUBJECT TERMS</b> Interoperability, Future Force, German Army, Combined Operations Network-Centric Warfare			<b>15. NUMBER OF PAGES</b> 71	
			<b>16. PRICE CODE</b>	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> U	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> U	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> U	<b>20. LIMITATION OF ABSTRACT</b> none	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)  
Prescribed by ANSI Std. Z39-18  
298-102

**SCHOOL OF ADVANCED MILITARY STUDIES**

**MONOGRAPH APPROVAL**

LTC (GS) Thorsten Alme

**Title of Monograph:** Interoperability and Network-Centric Warfare:  
US Army Future Force and German Army in 2015

Approved by:

\_\_\_\_\_  
Michelle Miller, LTC USA (Ret.)

Monograph Director  
Command and  
General Staff College, CTAC

\_\_\_\_\_  
Kevin C.M. Benson, COL, AR

Director,  
School of Advanced  
Military Studies

\_\_\_\_\_  
Robert F. Baumann, Ph.D.

Director,  
Graduate Degree Programs

## **Abstract**

INTEROPERABILITY AND NETWORK-CENTRIC WARFARE: US ARMY FUTURE FORCE AND GERMAN ARMY IN 2015 by LTC Thorsten Alme, German Army, 71 pages.

US and German security strategies portray future warfare as coalition warfare. Thus, successful military operations depend on assured Interoperability of coalition forces. This paper asks for the state of Interoperability between German Forces in 2015 and the US Army Future Force.

The reader will be informed about the US Future Force, whose characteristics and implications on foreign nation's Interoperability are evaluated. Special consideration is given to technical and behavioral Interoperability.

The monograph assesses the projected capabilities of the German Bundeswehr in the year 2015 with regard to Network-Centric Warfare (NCW). Technical and behavioral Interoperability are again the main focus.

According to the findings of the paper, German Bundeswehr forces in 2015 will be prepared for integration into the US Army Future Force. The single most important factor for assuring this capability will be an appropriate funding in the next ten years.

## TABLE OF CONTENTS

<b>List of Figures</b> .....	<b>v</b>
<b>Introduction</b> .....	<b>1</b>
Purpose and Methodology .....	4
Literature Review.....	6
<b>I United States Visions, Concepts and Doctrine</b> .....	<b>8</b>
National and Joint documents.....	8
US Army Concepts .....	12
Network Centric Warfare/Operations (NCW/NCO).....	17
<b>II Coalition Operations – Criteria for Interoperability</b> .....	<b>22</b>
Historical vignettes .....	24
<b>III C<sup>4</sup>ISR (Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance) in the Unit of Employment</b> .....	<b>30</b>
Unit of Employment Concept.....	30
Battle Command in the UEx.....	32
UE and Multinationality .....	38
Implications.....	41
<b>IV Future Capabilities of the German Bundeswehr</b> .....	<b>46</b>
Political and Conceptual Framework (Bundeswehr) .....	46
Current battle command capabilities and future developments (until 2015) .....	50
Ensuring Interoperability .....	54
German Bundeswehr 2015.....	57
<b>Conclusion and Recommendations</b> .....	<b>59</b>
<b>Appendix: Acronyms</b> .....	<b>63</b>
<b>BIBLIOGRAPHY</b> .....	<b>66</b>

## List of Figures

Figure 1	Current to Future Force .....	13
Figure 2	Current and Future Force Operations.....	16
Figure 3	Information Superiority .....	18
Figure 4	Notional UEx Composition matrix.....	31
Figure 5	Composition of the Common Operational Picture.....	36
Figure 6	Projected German Army Intervention Forces in 2010.....	49
Figure 7	Evolution of future German Battle Command Systems .....	52

## Introduction

*We must all hang together, or assuredly we shall all hang separately.*  
Benjamin Franklin (1706 - 1790)

Although the above quote illustrates a well known situation under unsteady partners over two hundred years ago, it is still applicable. Only the threat has changed over the years: In the late 18<sup>th</sup> century, British Expeditionary forces who endangered the founders-to-be of the United States of America, and now international terrorists who surfaced around the 9-11 attacks. When Benjamin Franklin urged the necessity to act together in a form of coalition he fully understood the paramount importance of cohesion. Today, that cohesion of the coalition for the Global War on Terrorism (GWOT) is again what we need most in order to succeed. But even if the political will of the nation's leadership as well as the motivation of their people are in full support for the GWOT, the outcome is very much determined by the capabilities which we bring into the fight. If in 1776 a relatively inexperienced army of colonialists was able to defeat the British in a prolonged war, this was to a great extent achieved by the ability to integrate large numbers of volunteers. Two hundred years and some Revolutions in Military Affairs<sup>1</sup> later, integration of volunteers (such as Coalition partners or Allies) has become a much more complicated issue. Due to technological innovation, Interoperability of allied forces is currently the major challenge on the way to military success.

Although innovation is not new to the military (actually, the military frequently is the driving factor for innovation), it has often failed to adapt to new technologies. Examples for military failure caused by neglecting the technological "signs of the time" are quite easy to find. The Austrians losing the Battle of Koenigsgraetz 1866 [use of railroad and telegraph], the defeat of France 1940 [use of

---

<sup>1</sup> RMA's are changes composed of a complex mix of tactical, organizational, doctrinal and technological innovations. They necessarily implement a new conceptual approach to warfare. (Definition by Murray and Knox). Ref. to MacGregor Knox and Williamson Murray (ed.), *The Dynamics of Military Revolution 1300-2050*, Cambridge 2001: p. 11-12.

tanks, radios, Sturzkampfbomber<sup>2</sup>] or Iraq misjudging US supremacy in Operation DESERT STORM 1991 [army night fighting capabilities, use of airpower] may be applicable illustrations.<sup>3</sup>

The western world is currently transforming from the industrial age to the information age. Changes to our society can be seen almost everywhere – from the way we read our newspapers (online), the place where we shop (internet), to the domain where we intend to win wars (information domain). Even though this does not mean the elimination of industrial type processes, it poses major implications for how information is disseminated. In industrial type societies, information is usually pushed from the “owner” to all that might be in need for it. Alberts and Hayes attribute the feature “smart, smart” to these “push” processes due to the need for a high-quality decision for the right recipients as well as the proper timing.<sup>4</sup> The information age goes far beyond! Here, information is posted by the “owner” and will be “pulled” by any user at any time. Processes of distribution, consuming time and further resources, are now obsolete.

The private market economy has long understood the advantages of the new paradigm. A simplified, but very applicable example illustrates how much the private sector has adapted. Whenever a Wal-Mart customer buys a light bulb at the counter, this bulb will be automatically reproduced at the production plant of General Electric some thousand miles away. No intermediate levels are involved in this decision. However, all 36 departments, which comprise a typical Wal-Mart store, as well as other Wal-Mart stores in the vicinity, have access to this information. The process is enabled by network-centric (business) operations which in fact dramatically improve effectiveness. This is achieved by directly connecting a sensor (scanner at

---

<sup>2</sup> Sturzkampfbomber = German term for “dive bomber”

<sup>3</sup> Refer to Eliot Cohen and John Cooch, *Military Misfortunes*, New York 1990: p. 5-28 and 197-230 for a more detailed discussion of the neglect of RMA.

<sup>4</sup> David S. Alberts and Richard E. Hayes, *Power to the Edge: Command, Control in the Information Age*. CCRP Publications Series, 2003: p. xiv

the check-out counter) with an asset (production plant).<sup>5</sup> By establishing new technology and automated procedures Wal-Mart gained a substantial advantage over its competitors. For the economic realm, such advantage can be equaled with future profit – thus, Wal-Mart could largely increase its net earnings. This example also illustrates that networked environments can handle situations where large numbers of transactions play a dominant role. Wal-Mart systems face about 90 millions transactions per week, handle over 100,000 products in stock, and deal with up to 1,800 suppliers, simultaneously. It is just impossible for human beings to get grasp of that environment, but networks can. Networks self-synchronize and generate an outstanding level of situational awareness, encompassing all “market-field operating systems.”<sup>6</sup>

United States Armed Forces are focused on installing a very similar structure for the Future Force.<sup>7</sup> Network-Centric Warfare/Operations (NCW/NCO) systems will enhance the situational awareness and mission effectiveness.

Thus it is very likely, that future US-led multilateral operations will depend on other nations NCW/NCO-based Interoperability. Any nation failing to keep up with the US in this capability will become increasingly non-interoperable. Such a nation will be either not capable of being a coalition partner at all, or only capable for specific missions without much support by US forces.

Today, the German Bundeswehr<sup>8</sup> does not have an adequate NCW/NCO capability. The Armed Forces are in the middle of a prominent shift towards information technology. Although

---

<sup>5</sup> As outlined by Arthur K. Cebrowski, (Vice Admiral, USN) and John J. Garstka, Network-Centric Warfare: Its Origin and Future, in *Proceedings*, published by US Naval Institute, Annapolis, January 1998.

<sup>6</sup> For a more detailed view on network use at Wal-Mart and in the business world refer to David S. Alberts/ John J. Garstka/ Frederick P. Stein, *Network Centric Warfare – Developing and Leveraging Information Superiority*, CCRP publication series, Washington 2003: p.45-48. Alberts points at Wal-Mart in the first place, but does also mention the growing number of already transformed businesses, such as Dell, FedEx, UPS, Capital One and others. The understanding of “self-synchronization” will be discussed at the end of chapter I.

<sup>7</sup> The Future Force concept describes the layout of US Army forces around and beyond 2010. For a more detailed discussion of the Future Force see chapter II of this monograph.

no detailed concept for NCW/NCO exists currently, the requirement has been emphasized significantly in the new conceptual framework of the forces. The German Bundeswehr intends to maintain Interoperability with the US Forces by transformation - a process mainly determined by the actual level of funding.

## **Purpose and Methodology**

The purpose of this monograph is

- (1) to inform the reader about US and German policy guidelines, the theory of NCW/NCO and the US Army Future Force,
- (2) to assess the depending aspects of Interoperability and Multinationality resting in all these issues, as well as
- (3) to analyze the future capabilities of the German Bundeswehr regarding a NCW/NCO-related Interoperability.

The research question is therefore: Will an integration of German forces into a United States Army Unit of Employment in the year 2015 be feasible? This question will be answered with special regard to the networked character of the US Army Future Force.

The perspective is not a technological one. Although the analysis will generally depict technology as the dominant factor for 21<sup>st</sup>-century Interoperability throughout the paper, I am rather interested in possible mission effects on multinational operations than the detailed details of systems. The perspective is therefore clearly the strategic and operational level.

Conducting Network-Centric Warfare requires numerous changes for the US Army; however, some basic characteristics of US forces seem to remain the same: Multinationality will continue to be a tenet of US Operations. The monograph assesses whether this can be proved by

---

<sup>8</sup> “Bundeswehr” is the official notation of the German Armed Forces. This terminology will be used throughout the monograph.

doctrinal analysis or not. The reason for this endeavor is obvious: Despite the actual day-to-day reality, it would be hopeless to ask for aspects of multinational integration, if there is even no political or doctrinal foundation for it in US policy and doctrine.

Most probably, establishing NCW/NCO-capabilities will allow nations to be part of US-led coalitions. After trading mass for tempo in future wars, the US perhaps can not afford to mix own digitized forces with analog ones – the only effect would be a slower operational tempo and higher casualties. NCW/NCO therefore seems to be a “showstopper”. Foreign nations’ armies have to maintain a certain level of Interoperability to participate. This monograph will discuss the implications of NCW/NCO on Interoperability. I will assess the requirements driven by the US Army transformation<sup>9</sup> as well as foreign nation’s future capabilities. The German Army will be the main area of interest of this monograph.

Four main parts comprise the paper. Additionally, an Introduction and a Conclusion frame these four major areas of analysis.

First, current US Joint and Army doctrine as well as concept papers on US Army transformation will be assessed. This serves to create a common basis of understanding on the object of analysis. A specific center of attention will be the aspects of Multinationality and Interoperability. (Chapter I)

Second, common criteria for successful integration of Multinational Forces (focused on the aspects of battle command) will be isolated and depicted as stage-setter. These criteria serve as reference for both the requirements developed in the next chapter as well as the capabilities

---

<sup>9</sup> Transformation in the understanding of the US DoD is defined as “a process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people and organizations that exploit our nation's advantages and protect against our asymmetric vulnerabilities to sustain our strategic position, which helps underpin peace and stability in the world.” Donald H. Rumsfeld, Secretary of Defense, *Transformational Planning Guidance 2003*, Washington April 2003. [TPG 2003]: p. 3

shown in chapter IV of the research. Some historical examples will show how the lack of Interoperability can cause either friction or real operational risk. (Chapter II)

Third, it will be analyzed which specific requirements regarding Interoperability of Multinational Forces evolve out of the new concepts resting within the Future Force in general and the Unit of Employment (UE) in particular. Main focus will be the subject of Battle Command. (Chapter III)

Lastly, the author analyzes future capabilities of the German Army as an example for any comparable foreign nation's military. As an important assumption to the monograph's approach, it is understood that major programs to improve the German Army on this sector will be procured, developed and introduced into the force as planned. This also illustrates the rather abstract nature of the paper. The level of achievement regarding the posted criteria for Interoperability will be assessed. Impediments for an integration into a Unit of Employment (with the German Army as one example) will be examined. The author intends to develop recommendations . (Chapter IV)

## **Literature Review**

Some aspects of the topic of this paper such as Future Force or NCW/NCO are currently the object of a broad discussion in the military community on the brink of the military information age. The concept of NCW/NCO is apparently not a new one and it is also well received outside of closed military circles. This might be caused by the similarity of NCW/NCO to some procedures used in the market economy. For illustrative reasons it might be helpful to point out that a single Google<sup>®</sup>-query for the phrase "Network-centric warfare" leads to more than 65.000 results - even "Army transformation" scores with 31.000. However, quite often these sources may be outdated or of questionable quality or authorship. Consequently, this paper refrains from an extensive use of the Worldwide Web except to find primary sources or information on official and maintained websites. These primary sources or secondary scholarly

publications are used wherever possible. US strategic documents and concepts, US Army strategic papers and visions are all available to the public and therefore easily accessible.

Concepts that have not yet matured exist as draft versions and are mostly available at the US Army Command and General Staff College. A reasonable amount of official sources used in the monograph are still in the process of development. Effective September 29<sup>th</sup>, 2004, of the 28 concepts related with the Army's Future Force, only 6 are approved, 5 are in the status of a final draft and 17 are still under development.<sup>10</sup> Even the Future Force capstone document, *The Army in Joint Operations* (US Army Training and Doctrine Command Pamphlet [TP] 525-3-0), had not been approved at that time.

Extensive literature exists on coalitions and coalition warfare only with respect to the Cold War situation or previous periods. With respect to the Information Age, literature is limited mostly to publications in professional journals or to publications issued by think tanks like RAND or CCRP.<sup>11</sup> Information is also found in publications issued by military institutions such as the individual War Colleges of the Armed Forces or the National Defense University.

In the case of assessing the situation of the Bundeswehr, the author had to rely on open sources. German Armed Forces information release procedures do not permit the use of official German documents in papers intended for unlimited distribution. Although these papers are only classified as "Verschlußsache – Nur für den Dienstgebrauch,"<sup>12</sup> it is not possible to use or directly quote them in the paper without restricting access to the monograph. Therefore, it was necessary to rely on open sources which were widely available. The subject of "Transformation" is extensively published in Germany as well.

---

<sup>10</sup> Refer to US Department of the Army, TRADOC, *Army Concept Development and Experimentation Campaign plan, Status Briefing as of 29Sep04*, Fort Monroe 2004.

<sup>11</sup> RAND Corporation is a nonprofit institution in the field of policy and military. CCRP is the Command and Control Research Program, sponsored by the US DoD.

<sup>12</sup> This classification corresponds with the US "For Official Use Only".

# I United States Visions, Concepts and Doctrine

*The empires of the future are the empires of the mind.*  
Winston Churchill 1874-1965

Although the right of preemption has been a principle of US security policy for a long time, the true implementation of this paradigm came with the Bush administration in 2001. In the year after the 9-11 terrorist attacks on the American homeland, the White House issued the new National Security Strategy (NSS) of the United States of America. The NSS addresses the unparalleled military strength that the United States enjoys after the cold war and promotes a more active way of ensuring protection for Americans. The aim is not only to make the world safer, but “*better*.”<sup>13</sup> This moral commitment can be seen as a guiding factor for the current Bush administration.

This chapter will evaluate how the subsequent conceptual framework supports the NSS. The focus will always be on aspects that influence the integration of non-US forces (Multinationality and Interoperability). Therefore the paper focuses on the National Military Strategy, the Joint Vision of the Chairman of the Joint Staff and subordinated Army Visions and concepts.

## National and Joint documents

### National Security Strategy (NSS 2002)

Despite the apparent “verbal” unilateralism in current US foreign and security policy, nearly all of the recent wars and military operations have been fought within coalitions or alliances.<sup>14</sup> Operations DESERT STORM (Iraq 1991), UPHOLD DEMOCRACY (Haiti 1994),

---

<sup>13</sup> George W. Bush, President of the United States, The White House, *National Security Strategy 2002*, Published by: U.S. Government Printing Office, Washington, DC, September 2002. [NSS 2002]

<sup>14</sup> The differentiation between both concepts is twofold: the question for an enduring nature and the aspect of pre-conflict existence. Alliances already exist before a given conflict and they usually endure

ENDURING FREEDOM (Worldwide 2001-ongoing) and IRAQI FREEDOM (Iraq 2003-ongoing) are examples. They are all substantial and demonstrate varying composition and size. Multinationalism, directly addressed in the NSS,<sup>15</sup> obviously proves to be another principle of US strategy and is therefore one of the ways to achieve the overarching end of the strategy. Another way of doing so is to create capable assets such as “*remote sensing, long-range precision strike, and ... maneuver and expeditionary forces.*”<sup>16</sup> Thus, Force transformation is the means to achieve this. Finally, the United States will have the forces that build and maintain its defense beyond the new challenge.

#### National Defense Strategy (NDS 2004)

According to the NDS 2004, the last of the four defense objectives directs the Department of Defense (DoD) to “strengthen alliances and partnerships to contend with common challenges.”<sup>17</sup> A “close cooperation with those [allies] committed to the principles of freedom, democracy and opportunity” is well promoted. It also provides a transformation focus for the DoD by addressing eight capability areas. Two of these (“Conducting Network-Centric Operations” / “Increasing Capabilities of Partners”) are directly applicable to the topic of this monograph. Although relatively abstract due to the strategic nature of the document, especially the focus on increasing the capabilities of partners, the NDS offers a first impression of possible solutions in a strategic setting. Allies might be willing to participate in operations, but their limited financial resources cause substantial technological disparities on the battlefield. This assessment will be revisited later on in the paper.

---

longer. Coalitions are often formed ad-hoc and they are not intended to last longer than the conflict termination. For a more detailed discussion refer to US Department of Defense, Joint Chiefs of Staff, Joint Publication 1-02 (Dictionary of Military and Associated Terms), Keywords “Alliance”, “Coalition”. [JP 1-02]

<sup>15</sup> NSS 2002, principle III: “Strengthen alliances to defeat global terrorism ...”: p.5

<sup>16</sup> NSS 2002: p.29

<sup>17</sup> Richard B. Meyers, Chairman of the Joint Chiefs of Staff. *National Military Strategy of the United States of America 2004*. Washington 2004: p. 1 [NMS 2004]

### National Military Strategy (NMS 2004)<sup>18</sup>

By default, the NMS translates the broad strategic goals of NSS and NDS into more executable military objectives and joint operating concepts. The NMS deducts from the superior documents and addresses the relevant issues mentioned in the NDS. The document mentions the need for Multinationality in order to support all of the three military objectives given in the document.<sup>19</sup> It also explains how the NDS' capability areas are converted into procedural or structural changes, Some of the changes will lead to a requirement for future families of systems that have to be procured by the US Armed Forces Acquisition program. In the case of the area of "conducting Network-Centric Operations" the NMS points on the future Global Information Grid (GIG), a military "internet"- style net which connects forces, agencies and the national leadership in an collaborative information environment. According to the NMS, the GIG is the single most important enabler of synergistically planned and simultaneously executed operations. It will be key to achieve information and decision superiority.<sup>20</sup>

### Joint Vision 2020<sup>21</sup>

Although the Joint Vision 2020 was issued by General Shelton, the Chairman of the Joint Chiefs of Staff, in June 2000 and the "Vision" formally is now integrated into the actual NMS, it still provides additional insight in how the ultimate goal of future war fighting, full spectrum dominance, might be achieved. The current NMS does not negate the ideas of the JV 2020<sup>22</sup> – it

---

<sup>18</sup> NMS 2004

<sup>19</sup> These objectives are: Protect the United States, Prevent Conflict and Surprise attack, Prevail against adversaries. Refer to NMS 2004: p. 7-13

<sup>20</sup> Information Superiority is the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. (JP 1-02).

<sup>21</sup> Henry H. Shelton, Chairman of the Joint Chiefs of Staff, prepared by Joint Staff/J5; Strategy Division, *Joint Vision 2020*. Published by: U.S. Government Printing Office, Washington, DC, June 2000. [JV 2020]

<sup>22</sup> JV 2020, Interoperability and Multinational Operations, p.15-17 and Joint Command and Control, encompassed by new technology: p. 31-33

develops and updates the details. The basic principle of Interoperability as foundation of joint, multinational and interagency operations is well represented in the NMS 2004. Concepts based on the Joint Vision 2010 and 2020 are not necessarily obsolete. They are consistent with the NMS.

#### DoD Transformation Planning Guideline (TPG 2003)

Secretary of Defense Donald H. Rumsfeld has directed the transformation process for the US military in 2003 by issuing the Transformation Planning Guidance (TPG).<sup>23</sup> In contrast to the more political motivated documents mentioned above, the TPG rather administers the further staff work of subordinated elements below the DoD level. It sets timelines and gives guidance on focus areas and basic layout of subsequent documents such as the adapted and transformed new Joint Concepts and the respective Service Transformation Roadmaps. The TPG hereby tasks the Military Departments and the Service Chiefs to develop concepts for the needed core capabilities.<sup>24</sup>

With relevance to the monographs focus, the TPG addresses Multinationality and Interoperability as follows:

*The Security Cooperation Guidance provides instruction on implementing our new defense strategy through regional partnerships, [...]. As the U.S. military transforms, it is **in our interest** to make arrangements for international military cooperation to ensure that rapidly transforming U.S. capabilities can be applied effectively with allied and coalition capabilities. U.S. transformation objectives should thus be used to shape and complement foreign military developments and priorities of likely partners, both in bilateral and multilateral contexts.*<sup>25</sup>

*“A **central element of transforming** our force is interoperability—the ability to bring all relevant information and assets to bear in a timely, coherent manner.”*<sup>26</sup>

---

<sup>23</sup> Donald H. Rumsfeld, Secretary of Defense, *Transformational Planning Guidance*, Washington April 2003. [TPG 2003]

<sup>24</sup> TPG 2003: p. 13 and 19

<sup>25</sup> TPG 2003: p. 8. Emphasis added by the author.

<sup>26</sup> TPG 2003: p. 29. Emphasis added by the author.

The Secretary of Defense has set terms of reference for the development of Joint Operations Concepts by issuing a variety of principles in the TPG. As an example, he stresses the importance of a Superior Information Position, a shared situational awareness, self-coordination and a more rapid speed of command, all assured by a well-networked and interoperable force. Network-Centric Operations are seen as the enabler for successful transformation.

## **US Army Concepts**

### The Army Vision, Army Transformation Roadmap (ATR 2004)

In contrast to former Chiefs of Staff of the Army, General Peter J. Schoomaker has decided to introduce not only a single “Vision” but a family of documents and publications to implement the Joint Vision 2020 and the NMS 2003. The Army promotes its future by the following pamphlets, all dedicated to serve strategic communications: Based on the Army Strategic Planning Guidance (ASPG) the Army issued “The Way Ahead“, “Our Army at War“, “Relevant and Ready“, and “Serving a Nation at War.”<sup>27</sup>

The senior leadership’s Vision<sup>28</sup> is to move towards a “Campaign Quality Army with Joint and Expeditionary Mindset”. The three major issues for this transformation are Modularity of Forces, independent echelon-above-brigade Headquarters and Network-Centric Battle Command. Once established, the force will increase the Combatant Commanders ability to gain superiority in the full range of military operations. The US Army will be more responsive, lethal, versatile, agile, survivable and sustainable than any other formation before.

---

<sup>27</sup> all brochures and papers available by: Department of the Army, Army Strategic Communications, Washington, DC or at [www.army.mil/references](http://www.army.mil/references) [assessed at Nov 2004]; ASPG is section I of: US Department of the Army, *The Army Plan FY 2006-2023*, Washington DC. [ASPG]

<sup>28</sup> Although not explicitly mentioned, “Senior leadership” in the context of this paper should be understood as both, the Secretary of the Army and the Chief of Staff, Army.

## EVOLVING ARMY TRANSFORMATION

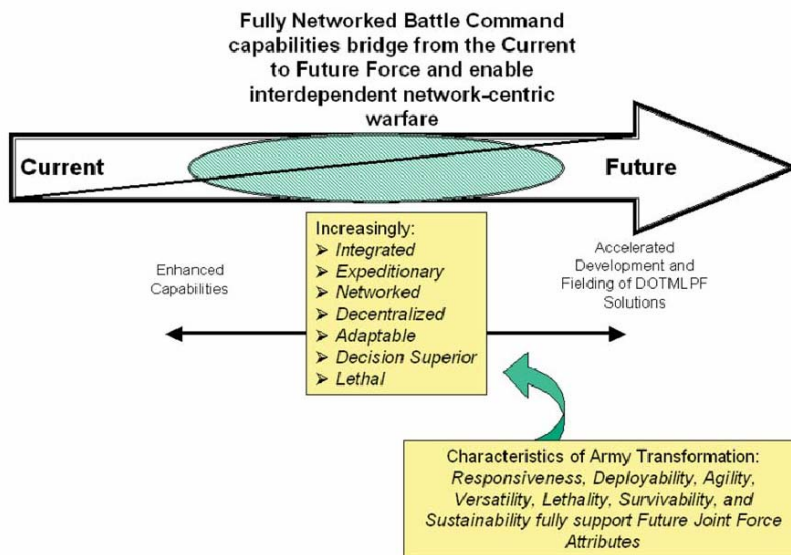


Figure 1 **Current to Future Force**  
 In: Department of the Army, *The Army Plan FY 2006-2023*, Washington DC, Section I, p. 10.

This process is not to be seen as a closed system, it is permanent under assessment to always stay ahead of the threat. Transformation of the Current Force, which stands for the operational Army of today, into the Future Force will never end, because “the [term] Future Force stands for the operational force the Army continuously seeks to become.”<sup>29</sup> Figure 1 illustrates this process towards the future, as seen by the Army senior leadership.

Although not excessively stressed in the Army’s strategic documents, Multinationality will be a fundamental aspect of the fight. Within the Army’s scope the major impact will be in the area of Battle Command. Respective national capabilities “*must be leveraged to enable interdependent network-centric warfare [...] within joint, interagency and multinational full spectrum operations.*”<sup>30</sup>

<sup>29</sup> ASPG: p. 10

<sup>30</sup> ASPG: p. 9

In 2003 and 2004 the Army issued a Transformation Roadmap, which describes the execution of Army transformation.<sup>31</sup> This document has to be seen as an annual update and summary of strategies, initiatives and accomplishments. It is consistent with the documents mentioned above.

### Future Force Concept

The Future Force Concept stands in line with previous concepts of comparable issues. It follows the Army After Next (AAN) initiative and the Force XXI concept of 1994.<sup>32</sup> These previous concepts differed significantly, both in form and function. While Army XXI should have been a product-improved Army leading to the AAN, the Army After Next itself was a totally different Army. It was designed to be more strategically and tactically mobile, more versatile, more lethal, and logistically unencumbered.

Emerging from the Objective Force Concept of 2001, the Future Force Concept in 2003 took over basic aspects of that concept without major changes. Most of the changes made so far were of a more dialectical nature. In particular the unwanted wording of “Legacy Force” materialized into “Current Force”. “Objective Force” was renamed “Future Force” in order to avoid the mental model of achieving success by seizing an objective and resting in it. The term “Interim Force” of the Objective Force Concept was by pure logic no longer needed on the way from Current to Future. The Future Force therefore apparently inherits a good quantity of these early ideas.

What is the main framework of the concept and how are multinational and coalition forces influenced by this?

---

<sup>31</sup> US Department of the Army, Army Transformation Office, *2004 Army Transformation Roadmap*, Washington 2004. [ATR 2004]

<sup>32</sup> US Department of the Army, TRADOC Pamphlet 525-5, August 1994, *Force XXI Operations*.

The Future Force can be described<sup>33</sup> by the three major areas of contribution to campaign success:

The Future Force is designed for **Operational maneuver from strategic distances**. Being modular and scalable, units of the Future Force can be easily tailored according to any requirements. They offer a speed of operations never known before, facilitated by rapid deployment of forces and operations conducted immediately on arrival. Heavy logistical infrastructures are avoided by a strategic-to-battlefield distribution that reduces the overall footprint of the supporting organization.

As current concepts already imply, the Future Force will also conduct **shaping operations** in order to obtain the initiative from the enemy. Though there might be no profound conceptual change, the real advantage lies in how that will be done in the future. Units of the Future Force are able to improve the current conduct of operations by a very high level of situational understanding and by decisive tactical combat. New technology and leadership with effective decision-making will ensure these capabilities.<sup>34</sup> The units of the Future Force are also capable of conducting **forcible entry operations** and defeating enemy 'entry denial' operations.

Lastly, the Future Force will conduct **decisive and joint-enabled operations**. Operations will be simultaneous and distributed. Most likely, the future battlefield will be non-contiguous. Enemy decisive points and centers of gravity will be attacked directly, wherever possible. The Future Force is designed to achieve a desired effects on an enemy system, not for seizing and holding objectives. Effects-based operations are therefore incorporated by the concept.

---

<sup>33</sup> For a quick overview refer to: Commanding General US TRADOC, *The Army Future Force: Decisive 21<sup>st</sup> Century Landpower*, Fort Monroe August 2003. [www.tradoc.army.mil/dcsdcs](http://www.tradoc.army.mil/dcsdcs) [assessed in July 2004].

<sup>34</sup> This is where Network-Centric Operations and the new family of vehicles, the Future Combat System (FCS), are nested into the concept.

Ultimately, this style of warfare is a sharp distinction to the sequential and deliberate campaigns of the Industrial Age.

Information Age Operations will always be carried out jointly – they will give emphasis to a rapid strategic response, build by synchronized shaping and decisive operations, distributed throughout the entire Joint Operations Area. The Army’s Future Force will deliver the appropriate land forces to this concept. Figure 2 illustrates the new paradigm:

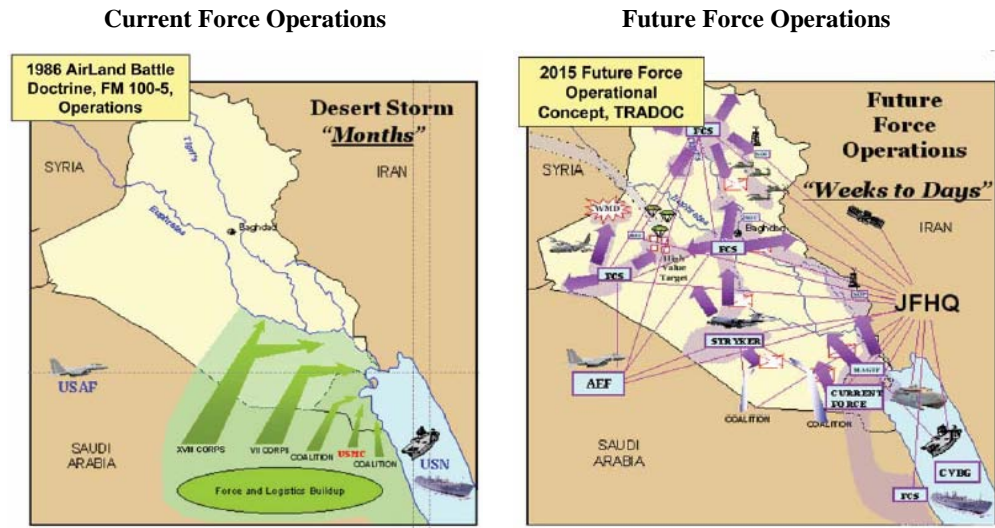


Figure 2 **Current and Future Force Operations**  
In: Department of the Army, *United States Army Transformation Roadmap 2003*, Washington DC, pp. I-9 and I-10.

Although the transformation to the Future Force is undertaken as a national effort, Multinationality is integral part of the concept. Driven by national policy and doctrine, the Future Force Land Component might very likely be composed out of forces from very different countries with a wide range of capabilities. Interoperability may be a significant issue. Integration of Multinational forces was always a test for the military leader – due to the special nature of NCW/NCO it will become a real challenge.

## Network Centric Warfare/Operations (NCW/NCO)

### NCW/NCO Concept layout<sup>35</sup>

The premise of NCW/NCO is to shift the today's platform-centric force with hierarchical information flow to a force where information is available in an "information space." Users (e.g. single warfighters, leaders on multiple levels, the political leaders, supporting agencies) will have real-time access to information in this space. The information space is best explained with characteristics of the current World Wide Web. Although information is stored in various servers around the world, in principle all users will have access. Denial of entry might restrict access if needed by a variety of protecting measures, such as passwords and firewalls.

The main effect of this change will be a dramatically shorter time needed to transmit information from a source to the user. Additionally, all users will have a much more comprehensive operational awareness than at any previous period. Alberts/Garstka/Stein define shared battlespace awareness and operational picture:

*Shared battlespace awareness emerges when all relevant elements of the warfighting ecosystem are provided with access to the COP. This means that battlespace awareness must be viewed as a collective property (a type of collective consciousness). It does not exist at just one place (node) in the battlespace, but rather at all relevant nodes in the battlespace— across echelons and functional components. The degree of detail that is portrayed in an operational picture can and most likely will vary by echelon. ... The degree to which the information content of an operational picture can vary across echelons to enable relevant information to be portrayed clearly and unambiguously to decision makers and actors ...*<sup>36</sup>

Both will lead to a new level of information advantage,<sup>37</sup> which will provide the major contribution for winning future wars.

---

<sup>35</sup> As described in U.S. Department of Defense, *Network Centric Warfare - Report to Congress*, Published by: U.S. Government Printing Office, Washington, DC, 27 July 2001, [http://www.dodccrp.org/NCW/NCW\\_report/report/ncw\\_main.pdf](http://www.dodccrp.org/NCW/NCW_report/report/ncw_main.pdf) [Online 05 August 2004], pages 3-1 to 3-17. Refer also to Alberts/Garstka/Stein.

<sup>36</sup> Albert/Garstka/Stein: p. 135

<sup>37</sup> NCW - Report to Congress, page iv. The desired level of advantage is "superiority", for a definition see below.

This consideration is not an absolute, but a relative one, as figure 3 illustrates. To win the “information war” it would be sufficient to achieve a situation where the own information is more relevant, accurate and timely than the enemy’s. However, there is an absolute aspect too: The friendly side always needs to gain at least a level of information, sufficient for executing an operation – by simultaneously denying the same to the enemy.

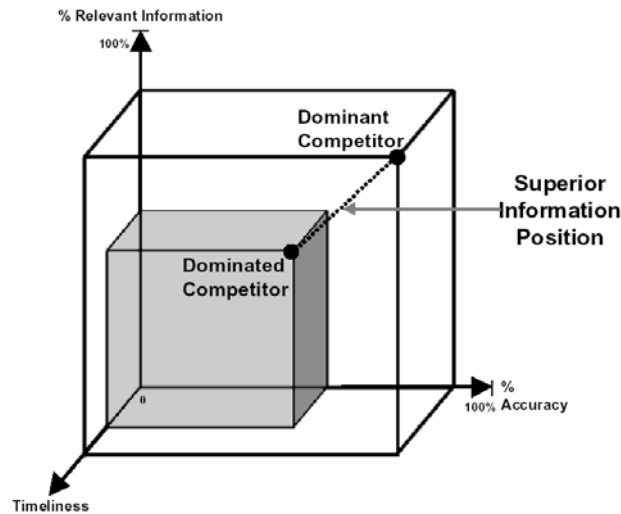


Figure 3 **Information Superiority**  
 in: Alberts/Garstka/Stein, *NCW*, p. 34. The value of Information is determined by the three characteristics Timeliness, Accuracy, Relevance.

Information superiority<sup>38</sup> by shared situational awareness and knowledge among the Joint Force is seen as decisive. Therefore, the concept of NCW/NCO is key to all joint transformation.<sup>39</sup>

According to Metcalf’s Law, one of the fundamental rules of networks, the number of potential information interactions in a network increases exponentially with the number of nodes

<sup>38</sup> Information superiority — “That degree of dominance in the information domain which permits the conduct of operations without effective opposition.” (JP 1-02) or “Information Superiority is a state that is achieved when a competitive advantage is derived from the ability to exploit a superior information position,” see Alberts/Garstka/Stein: p. 34.

<sup>39</sup> NCW - Report to Congress, page iv

(or network members).<sup>40</sup> Thus, for “n” nodes the number of potential information interactions will be approximately “n<sup>2</sup>.” Given the large number of network nodes in future military networks, this could easily lead to an information overflow and a resulting chaos. Nevertheless, Alberts/Garstka/Stein believe that the real power of a network lies in “*establishing a direct relationship between information interactions and value*,” which is “*the heart of value creation in the information age*.” Such networks create value and not chaos, because they self-synchronize. Single nodes in an Information Age network clearly understand the command intent, they are all competent on their level and they trust the information as well as their peers. As a result, most potential interactions never take place and there will be only some islands of dense and intense interaction at any given time: Chaos will be inhibited by self-coordination of the nodes.”<sup>41</sup>

Transforming towards NCW/NCO will have major impact on US warfighting.

Comparable to effects of the internet on the economy, it will change more than only one realm.

In particular, there will be effects on three distinct areas:

- The physical domain (connecting all sensors, platforms and units of the force in a robust network),
- The information domain (facilitate situational awareness by installing a common operational picture [COP]) and
- The cognitive domain (the mind of the warfighter, the ability to assess the COP and the will to lead).

Out of all three domains, the physical and the information domain might be relatively easy to change – it generally involves an increase in monetary resources. On the contrary, the cognitive domain by nature calls for a change in convictions as well as attitudes and will be therefore more revolutionary than the others. Alberts, Garstka and Stein point out,

*... there is also a fundamental new hypothesis that suggests that unlocking the full power of the network also involves our ability to affect the nature of the*

---

<sup>40</sup> Alberts/Garstka/Stein: p. 252

<sup>41</sup> The US DoD uses the term self-coordination instead of self-synchronization. Refer to TPG 2003: p. 10. and Alberts/Hayes: p. 27, 36.

*decisions that are inherently made by the network, or made collectively, rather than being made by an individual entity.*<sup>42</sup>

How military hierarchies deal with such implications remains to be seen. It might be, that we have to let go our old paradigm of a single decision maker and leader atop our formations. Maybe NCW/NCO will bring us into a new realm, where decisions are either very much decentralized or done by a decision board? This issue will be revisited later in the paper, when implications of the Unit of Employment concept are discussed.

### The Aspect of Interoperability in NCW/NCO

As shown in the National Security Strategy, the National Military Strategy and the Joint Vision 2020, Multinationality is seen as of high importance for future war fighting. US forces will wherever possible take action in a coalition environment. The concept of NCW/NCO reflects this essential part of national strategy by addressing:

*“Future operations will be Joint and Combined. Their effectiveness will depend upon the ability of DoD to share information and to collaborate externally as well as internally. Therefore, interoperability is a key parameter in all DoD operational and systems architectures.”*<sup>43</sup>

*“Interoperability is critical as a precondition for NCW.”*<sup>44</sup>

Implementation of the above-mentioned challenges is important for success. Nevertheless, the physical domain is relatively easy to transform. It is characterized by exceptionally heterogeneous hard- and software.<sup>45</sup> This calls for a huge common financial effort. Interoperability in future wars will depend on synchronized multinational development and procurement today.

---

<sup>42</sup> Alberts/Garstka/Stein: p. 105

<sup>43</sup> NCW - Report to Congress, page 5-13

<sup>44</sup> NCW - Report to Congress, page 11-8

<sup>45</sup> E.g. hardware like computer networks, communication equipment, sensors and weapon systems and software like program languages, transfer protocols and web-based engines.

Purpose of this chapter was to evaluate the theoretical, doctrinal and conceptual framework that either invites non-US forces to join a coalition or rejects such attempts. I have found a twofold answer:

First, The United States of America will not operate unilaterally by default. Although the United States will not wait for consensus in case of an imminent threat to the nation and thus the possibility to act without the support of allies is always present, this is not the declared policy of the Bush administration. All doctrine subsequent to national policies consistently support this tenet of Multinationality, from the NMS level to Army concept papers for tactical echelons. Coalition size, internal cohesion and participating nations, of course, will vary in the future according to any specific conflict situation.

Second, this policy also calls for an enhanced, namable effort to achieve the Interoperability which is definitely needed for this endeavor. Even if the special implications of the US Army Future Force on Interoperability will be discussed later on, a general deduction from recent operations clearly supports that requirement.<sup>46</sup> Again, that issue is identified and addressed consistently throughout all levels of authority.

---

<sup>46</sup> See Michele Zanini and Jennifer Morrison Taw, *The Army and Multinational Force Compatibility*, RAND – Arroyo Center, Santa Monica 1999: p. 49-65, for US-foreign nation compatibility and inter-service compatibility issues in Operations DESERT STORM and UPHOLD DEMOCRACY as well as during IFOR.

## II Coalition Operations – Criteria for Interoperability

*Under us white, neat, puffy clouds, and formations of black German bombers against that background ... Great noise in my headphones. I am not listening, why should I? I don't understand a thing anyway. Suddenly, how strange, a voice in polish, shouting: 'Attack!'*<sup>47</sup>

*J.R. Kowalski, Member of the Polish Air Force in Britain, September 1940*

*It is better to fight Allies than to be one of them.  
Napoleon Bonaparte (1769 - 1821)*

*What experience and history teach us is this: that people and governments never learn anything from history, or have ever acted upon it.  
Hegel (1770-1831)*

The renowned historian Paul Kennedy assumes that coalitions, at least most of them, come alive simply due to motives of sheer self-interest<sup>48</sup>. He points out the need for protection as the usually predominant issue. This might be true for the time Kennedy dealt with (the first half of the 20<sup>th</sup> century including WW I and II), but in today's world some additional motives might be added: the ideal of peace and freedom probably and the hope for future influence (especially in the economic sphere) certainly.

This motivation and the depicted will of the United States to act in coalitions increase the likelihood of more coalition operations in the future. Such operations by default require a high Interoperability of forces. Sometimes the main focus of the operation might even shift towards “enabling Interoperability,” e.g. by logistical or technical support, in order to achieve political ends.

In the past, Interoperability has been understood as the capability to use a common language. Today, it is a much broader concept. NATO defines Interoperability in a very mechanical manner as

---

<sup>47</sup> Robert Gretzyngier, *Poles in defence of Britain : a day-by-day chronology of Polish day and night fighter pilot operations, July 1940 - June 1941*, London, 2000: p.89

<sup>48</sup> Paul Kennedy, *Military Coalitions and Coalitions Warfare over the past century*, in: Neilson, Keith (ed.), *Coalition Warfare – An uneasy accord*, Waterloo, Ontario, CA 1983, p.3.

*“the ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use this services so exchanged to enable them to operate effectively together.”<sup>49</sup>*

Michael Codner of the Royal United Services Institute for Defense Studies (RUSI) adds depth to the NATO definition (which was also adopted by the US Joint Community<sup>50</sup>) by introducing some dimensions to the topic.<sup>51</sup> He describes Interoperability with aspects of

- Organization,
- Logistics,
- Technology and
- Behavior (Strategic Concepts – Doctrines – Culture).

Organizational aspects describe issues caused by the attempt to combine entities which are designed for very different levels of war (Grand strategic, Military strategic, operational, tactical). By choosing the Armies of the USA and Germany and limiting ourselves to combined operations, the operational and tactical levels of war are hereby determined. Interoperability issues do not differ very much on this level – there are very few specific ‘operational level assets’, which are not actually of tactical nature. The logistical supply, as a prominent exception, will in most operations remain under national or service auspice and will not become an issue of Interoperability. Under this circumstance, logistical problems are more of a quantitative than a qualitative nature and can therefore be disregarded as well.<sup>52</sup>

Only the last two dimensions are of higher interest for the purpose of this monograph. While the aspect of technology is most obvious, the behavioral aspect needs clarification. Behavioral Interoperability is based on paradigm that different military systems have different behavior patterns or mental models. These are based on the strategic setting, the systems doctrine

---

<sup>49</sup> NATO, Allied Administrative Publication 1 (AAP1)

<sup>50</sup> refer to JP 1-02, keyword: “Interoperability”

<sup>51</sup> Michael Codner, *Hanging Together*, Whitehall paper 56, RUSI, London 2003: p. 30f.

<sup>52</sup> The only exception to this would be a system-immanent shortage of supply to a specific nation.

and its culture. “Systems are interoperable, when they are likely to respond in similar ways to a particular situation.”<sup>53</sup>

Based on Codner’s classification, I will later on identify characteristics for a successful integration of multinational forces into a US Future Force led operation. Before doing so, some historical vignettes depict the results of a lacking Interoperability in battle. The vignettes focus on behavioral aspects. Vignettes depicting technical Interoperability issues are very rare. In the past, it seems as if it was always possible to mitigate such shortfalls by other means – an aspect of Interoperability which will fundamentally change with the Future Force.

**Comment [stu1]:** Einfuegen: nur behavioral aspects da keine beispiele fuer technology findbar – wird sich aendern mit NetWar

## Historical vignettes

War as a human undertaking is known since the beginning of recorded history. Empires, kingdoms and nations have waged armed struggle to gain land, influence or power. To a certain degree, war was mostly an exclusive affair of the respective entity and its concrete opponent.

War was often waged by building a coalition in order to gain greater combat power, to spare valuable own troops, or to share the burden of the economic side effects. There is a vast list of coalitions known to history: Starting as early as the alliances of the Greek, the exploitation of indigenous forces by the Romans, the multinational forces taking part in the Christian crusades against the Muslim empire, medieval alliances with ever-changing loyalties, the wars of the Napoleonic era up to the more contemporary fighting of WW I, WW II, Korea, Vietnam and the Gulf Wars. The most recent experience is Operation Enduring Freedom, currently fought by a coalition of 21 nations<sup>54</sup>.

Though a lot of the above were extremely successful, some lack of positive outcome of the efforts invested. To a certain level, this was not always caused by an inevitable superior

---

<sup>53</sup> Codner: p. 51.

<sup>54</sup> US Central command homepage, <http://www.centcom.mil/Operations/Coalition/joint.htm> [assessed on 16 October 2004].

enemy, but by lacking Interoperability in coalition warfare. Over the next few pages the paper proceeds to illustrate some historic facets and the observations with regard to Command and Control of Coalition forces.

#### The Polish Air force in the Battle of Britain (1940)

Following the September 1939 defeat of Poland by the German Third Reich, many Polish airmen escaped to France, and later to Great Britain, in order to fight against Germany. The vast majority of them joined the “Polish Air Force” stationed in England after 1939; Some participated in the Battle of France in early 1940. Even defeated, the Polish exile government contributed to the anti-German alliance by committing military forces.<sup>55</sup> Nearly all of the foreign pilots had been flying for several years, and some had already experienced aerial combat. Nevertheless, British officials decided additional training was necessary prior to an assignment within the Royal Air Force. The main rationale for this decision was rather the poor language skills than anything else.<sup>56</sup> Proper command of the English language was an absolute prerequisite for successful integration into the British air defense system, which was dependent on fighter guidance by ground based operation centers via vocal radio communication. Polish fighter pilots improved their language skills over the time. But records of their performance show that the lack of language skills had caused real issues. Some planes were damaged or destroyed due to airmen not being able to properly understand the manuals which were written in English.

The language problem caused some operational problems too. British pilots had been exhausted by the extended flying hours in order to win the early Battle of Britain. Yet, Polish pilots were initially not allowed to fly at night, since in night missions success depends on an

---

<sup>55</sup> Other forces have been airborne troops in England as well as strong Polish army forces in Syria. The contribution summed up to 195,000 soldiers in 1945. Refer to <http://www.nationmaster.com/encyclopedia/Polish-contribution-to-World-War-II> [assessed on 19.10.2004]

<sup>56</sup> Gretzyngier: p. 4-6

accurate communication of vital target and air control information to the pilot.<sup>57</sup> Only after intense training Polish pilots were allowed to conduct night missions in 1941. Despite their excellent tactical skills, their contribution to the fight was constrained.

#### Legations Relief Expedition during the Chinese Boxer Rebellion (1900)

Although anti-foreign tensions already existed in China in the late nineteenth century, relations worsened when a British missionary was murdered, allegedly by members of the Chinese “Boxer” secret society. Western nations pressed the Chinese Imperial Court to disband and outlaw this nationalist and anti-Christian movement. In consequence, the Boxers started to harass and threaten the foreign population in Peking. In order to protect at least the legations, Western nations sent some 450 guards, made available from warships near the Chinese harbor of Taku. Instead of calming down the situation, the arrival of the guards led to more hostilities and finally to the siege of the Peking legation quarter. A first relief attempt, undertaken by the British Admiral Edward Seymour with 2000 men, failed due to poor planning and fierce Boxer resistance. The Western nations subsequently decided for a full scale operation.

The force was composed of US, British, Italian, German, Russian and Japanese forces –a truly multinational operation. This time, due to the much larger force of about 20,000 soldiers,<sup>58</sup> success was on the side of the allied nations. The relief expedition fought its way from Taku up to Peking, defeated the boxer and rescued the besieged legations. Although it was a military success in the first place, the operation demonstrated issues of poor Interoperability.

At an incident during the battle for Yang Tsun (nearly half way to Peking), four American soldiers died by fratricide. Russian artillery accidentally fired on advancing US troops. This error was a misunderstanding of Russian artillery officers, who just adopted target range

---

<sup>57</sup> Gretzyngier: p. 195

<sup>58</sup> Richard O’Connor, *The Spirit Soldiers: A Historical Narrative of the Boxer Rebellion*. New York, 1973: p. 219

information given by the British. The Russians did not understand that the British used 'yards' to measure distances, rather than the Russian use of the metric system.<sup>59</sup>

The Boxer rebellion campaign also showed the ever-present strive for national advantage. Although it was decided among the parties to attack simultaneously at an agreed time, the Russians tried to reach the besieged legations before the others.<sup>60</sup> Due to the hasty advance the Russian contingent lost their orientation in the dark and attacked the wrong objective. This led to a rush by the other nations to whatever objective was attainable and subsequently to much higher operational risk.

Lack of Interoperability in this case was caused by both, different doctrine and procedures as well as conflicting strategic goals.

#### 1<sup>st</sup> Battalion, Gloucestershire Regiment (UK) in Korea (1951)

1951 was a tough year for the United Nations. After having faced the danger of nearly total defeat in South Korea at the end of August 1950, UN forces under US leadership managed to turn the tide of the war and gain back initiative. After a series of setbacks and wins a more stable condition was achieved in April 1951. UN forces defended a line roughly along the 38<sup>th</sup> parallel and the Imjin-gang River. One of the defending units on phase line KANSAS was 1<sup>st</sup> Battalion Gloucestershire [Gloster] Rgt (LTC Carne, UK) as part of the British 29 Bde (Brigadier Brodie, UK). 29 Bde herself was under operational control of the 3<sup>rd</sup> US Infantry Division (MG Soule, US)<sup>61</sup>.

On the night of 22<sup>nd</sup> to 23<sup>rd</sup> April 1951 the Chinese Army launched a major offensive. They hit the sector of 29 Bde with at least two divisions abreast. In consequence 1<sup>st</sup> Bn Gloster

---

<sup>59</sup> O'Connor: p. 157

<sup>60</sup> Benjamin R. Beede, ed. *The War of 1898, and U.S. Interventions, 1898-1934*, New York, 1994: 46-47.

<sup>61</sup> 3<sup>rd</sup> Infantry Division in April 1951 was composed of US, British, Belgian, Puerto Rican and Philippine forces. Refer to Billy C. Mossman, *Ebb and flow, November 1950-July 1951*, Washington, D.C., Center of Military History, United States Army: p. 411ff.

Rgt was isolated after almost two days of heavy fighting. Having inflicted enormous losses on the Chinese 187<sup>th</sup> and 188<sup>th</sup> division, the Glosters finally fought for their survival against Chinese forces surrounding their positions. Having already lost too much combat power to conduct a breakthrough to friendly UN forces<sup>62</sup>, the only hope rested in a relief attack, planned by 3<sup>rd</sup> InfDiv for the next day. A previous attempt of 29 Bde had already failed earlier.

A major misunderstanding between Allies of same native tongue but different culture caused the loss of many soldiers. Asked by the Commander 3<sup>rd</sup> InfDiv on how the situation of 1<sup>st</sup> Bn Gloster Rgt was, Brigadier Brodie answered: “A bit sticky; things are pretty sticky down there.”<sup>63</sup> Driven by British understatement, Brodie could not clearly communicate the real urgency of the situation to General Soule, who himself was not used to such understatement either. Soule therefore believed the situation with 1<sup>st</sup> Bn Gloster Rgt was unpleasant but sustainable. He misjudged the situation, told the battalion to hold the positions and soon realized that the window of opportunity for a relief attack had closed due to strong Chinese reinforcements. In effect 1<sup>st</sup> Bn Gloucestershire Regiment was lost more than 90 percent of its personnel during the subsequent battle!<sup>64</sup>

Following an official inquiry on this incident, General Ridgeway<sup>65</sup> attributed the “quiet understatement” of Brigadier Brodie as key to the issue.<sup>66</sup>

Over the last pages, some historic examples of flawed Interoperability with the resulting danger for the operation’s outcome have been shown. Even if in some cases these issues did not fully prevent success, they added friction and an enlarged need for coordination to the process.

---

<sup>62</sup> Anthony Farrar-Hockley, *The British part in the Korean War*, London HMSO, 1990: p.128 and Mossman: p.415.

<sup>63</sup> Farrar-Hockley: p.127

<sup>64</sup> Out of 662 men, 622 were either KIA, WIA, MIA or POW. Refer to Farrar-Hockley: p.135.

<sup>65</sup> In his function as Commander-in-Chief, United Nations Command (Gen Ridgeway was also the Supreme Commander U.S. Army Pacific and Commander-in-Chief, Far East).

<sup>66</sup> Mossman: p.429.

Neither have all aspects of Interoperability the same importance, nor do they keep their ranking over time. New technology will definitely cause change. However, since verbal interaction as one of today's most important means of communication relies on a common language, a lack of respective capabilities affects the Interoperability between allies like nothing else.

With respect to Codner's classification, aided by the vignettes above and as a result of the authors personal experiences in multinational operations<sup>67</sup>, some criteria seem to be more applicable for assessing Unit of Employment and German Forces in 2015 than others. In the next two chapters, the analysis will focus on:

- Technological aspects
- Doctrinal and procedural aspects
- Cultural aspects

Warfighting is a human undertaking. This realization is essential to transformation. Money can easily buy smart technology and training can equalize procedural differences, but the real challenge will always be to "transform away" unwanted situational behavior caused by different cultural backgrounds. *"Differences in discipline, work ethic, class distinction, religious requirements, standards of living, traditions – all can cause friction, misunderstanding and cracks in cohesion."*<sup>68</sup> Although behavioral transformation will hopefully not pose a problem for US-German Interoperability, it remains to be principally addressed for coalitions.

---

<sup>67</sup> The author has been assigned as a Plans Officer to the Bundeswehr Operations Command, J5 (Plans&Policy) in 2001-2003. He served on the strategic/operational level preparing German Armed Forces contributions for Operations ENDURING FREEDOM and ISAF.

<sup>68</sup> Wayne Skillet, Alliance and Coalition Warfare, in: *Parameters*, US Army War College Quarterly, Summer 1993: p. 83; for further illustration of cultural interoperability see Ann Fitz-Gerald, Multinational Land Force Interoperability: Meeting the challenge of different cultural backgrounds, in: *Choices*, vol. 8, no. 3, Institute for Research on Public Policy, Montreal 2002: p. 2-24.

### III C<sup>4</sup>ISR (Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance) in the Unit of Employment

*The need to fight quickly led man to invent appropriate devices to gain advantages in combat, and these brought about great changes in the form of fighting. Carl von Clausewitz, Book Two, Chapter One<sup>69</sup>*

#### Unit of Employment Concept<sup>70</sup>

The 2004 Army Transformation Roadmap depicts the Army's transformation comprised of three major components: transforming culture, processes and capabilities.<sup>71</sup> The two different types of Unit of Employments (X and Y) will address all three echelons of transformation when established until 2010. They will perform tasks currently resting in the three elements of Division, Corps and Army headquarters. Due to the more advanced development of the Unit of Employment X (UEX) concept,<sup>72</sup> the author intends to focus on this entity for the ongoing discussion. The underlying basic concepts are very similar for both, UEX and UEY.

The future US Army UEX as the principal war fighting headquarters are tailorable, higher-level echelons elements that can integrate and synchronize Army, Joint and Multinational forces for full spectrum operations. At higher tactical and operational levels of war, the UEX links ground and joint forces, and orchestrates ground operations. The headquarters will be organized, designed and equipped to fulfill functions as the Army Forces Headquarters (ARFOR) and Joint Force Land Component Command (JFLCC) in smaller scale contingencies, simultaneously when

---

<sup>69</sup> Carl von Clausewitz, *On War*, Ed. and transl. by Michael Howard and Peter Paret, Princeton 1989: p. 127

<sup>70</sup> US Department of the Army, TRADOC Pamphlet 525-3-92, *Unit of Employment*, (approved concept, 2 June 2003) and *UE Operations White Paper*, (not issued to the public)

<sup>71</sup> ATR 2004: p. viii

<sup>72</sup> ATR 2004: p. 3-6

needed. A UEx can also become a JTF headquarters after being augmented by the Regional Combatant Command.

The UEx controls up to six ground maneuver brigades (or Units of Action<sup>73</sup>) and an additional, tailored mix of multifunctional units. These tailored packages can include (1) fires brigades, (2) maneuver enhancement brigades, (3) Reconnaissance, Surveillance, and Target Acquisition (RSTA) brigades,<sup>74</sup> (4) aviation brigades or (5) sustainment brigades. With the Future Force concept there will be no 'UEx template'. The mission package will always be tailored according to the respective tasks.

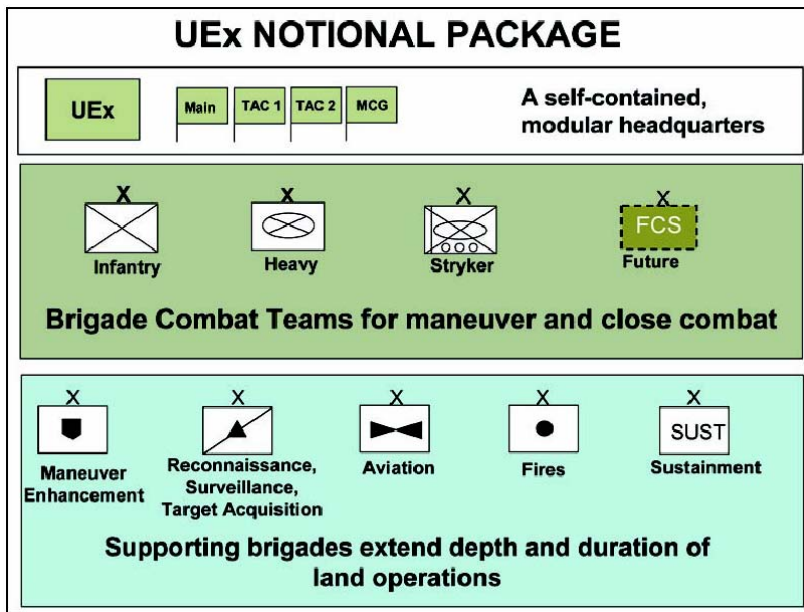


Figure 4 **Notional UEx Composition matrix**  
in: Department of the Army, *Army Transformation Roadmap 2004*, p. 3-6.

<sup>73</sup> At the time of writing, there is no clear, doctrinally specified term for the subordinate units of a UE. Various terms, “brigade”, “brigade combat team”, as well as “Unit of Action”, are used throughout Army documents.

<sup>74</sup>The RSTA-Brigade will synchronize all of the dedicated collection assets available in a UEx. ATR 2004: p. 3-8/9.

Figure 4 illustrates a three tier notional composition of a UEx. Any force package will be assembled by designating the middle tier assets (up to six UAs) and the bottom tier supporting UAs to a selected UEx headquarters.

The subordinate Unit of Actions are network-enabled to achieve vivid improvements in situational awareness. This significantly improved ability to collect and process information by employing organic sensors, as well as rapid access to information from UEx and higher, will provide commanders with the timely, accurate intelligence necessary to achieve decision superiority.<sup>75</sup> This decision superiority will permit the UAs to maneuver forces and apply lethal as well as non-lethal effects throughout its area of influence.

### **Battle Command<sup>76</sup> in the UEx**

Napoleons foreign minister, Charles Maurice de Talleyrand (1754-1838) truly stated, that he is “*more afraid of an army of 100 sheep led by a lion -than of an army of 100 lions led by a sheep*”. Apparently, leadership qualities have always been seen as paramount for military success. Little has changed since that period. However, today’s technology provides the commander with increased situational awareness and a near real-time ability to influence action!

The UEx will reach a new peak in supporting commanders’ battle command by using capabilities resting in the power of Network-centric technology, flexible command structures, and knowledge dominance. The network is the base of Future Force operations. It ensures availability of pertinent intelligence, collaboration during planning, integration of capabilities and

---

<sup>75</sup> Decision superiority is based on the concept of information superiority, which was discussed in chapter I section “NCW.”

<sup>76</sup> Battle Command is defined as „the exercise of command in operations against a hostile, thinking enemy.“ US Department of the Army, FM 3-0: p. 5-1, and FM 6-0: Glossary-1. ATR 2004 adds that Battle Command is the art and science of applying leadership and decision making processes to achieve mission success. Refer to *ATR 2004*: p. 5-17.

a proactive-oriented execution cycle. It enables forces to make better and timelier decisions than an adversary.

Flexible command post structures will have positive effects too. Tailored to the mission, the UEx' command post will have reduced in-theater footprint and vulnerability. It will also guarantee C<sup>4</sup> of autonomous operations along different lines of operations by a self-sufficient employability of the functional command post elements Main, TAC 1, TAC 2 and MCP.<sup>77</sup>

To date, earlier ideas of utmost dependence on reachback capability of the UE Headquarters have gradually been decreased in importance. TRADOC Pamphlet 525-3-0.1 (Future Force Battle Command) identified the possibility of a full echelonment of UE Command Posts. This concept would possibly "*break the WWII paradigm of command post organization.*"<sup>78</sup> Searching for a solution to further reduce in-theater footprints, TRADOC found the idea of "outsourcing" functions to a Home Station Operations Center (HSOC). Although not deployed, a HSOC is active 24 hours /7 days a week - it disburdens the Deployed Command Posts (DCP) from various tasks, such as future planning or Operational Net Assessment (ONA). A HSOC acts very much like a normal Main CP. Planning, undertaken by a HSOC, could enhance performance just by not being influenced by direct impressions and impediments of a hostile in-theater environment. Currently, only the Main Command Post in a UEy will demonstrate the ability of staying at the garrison.<sup>79</sup> Nevertheless, it might also be deployed into the Area of Responsibility, if needed. In the author's view, echelonment will definitely be reconsidered for the UEx and other echelons once the very high requirements for data transfer are answered by an enhanced info-structure.

---

<sup>77</sup> TAC = **T**A**C**tical Command Post ; MCG = **M**obile **C**ommand **G**roup.

<sup>78</sup> Department of the Army, TRADOC Pamphlet 525-3-0.1 (Future Force Battle Command), Jan 2004; p. 41-46. This structure was also mentioned in the UE Operations White paper version 2.4 as of February 2004.

<sup>79</sup> US Department of the Army, TRADOC Task Force Modularity, *Army Comprehensive Guide to Modularity (version 1.0)*: p. 4-5.

TRADOC Pamphlet 525-3-0.1 also addresses internal staff organization. The basic organization of today's battle staffs descend from ideas of the Napoleonic era. Dividing staffs into cells and sections, (e.g. G1-G9 or J1-J9), produces detailed knowledge by staff officers in a rather narrow field of expertise. Unfortunately, information needed by the commander to formulate decisions usually rests in more than one staff section. Coordination, facilitated either by doctrinal processes (MDMP, SOP)<sup>80</sup> or by supervision of the Chief of Staff, is consequently paramount to creating tailored and relevant decision support.

However, future battle command fostered by collaboration and self-synchronization could facilitate the commander's decision in a different manner. By merging sections into joint functions, TRADOC Pamphlet 525-3-0.1 promotes an improved staff structure that comprises five main functional areas:<sup>81</sup>

- Command Integration
- Fires and Effects
- Maneuver and Support
- Information Superiority and
- Sustainment.

As of November 2004, the Army decided not to implement such proposed staff structures to full extent. Only the UEy staff will be functionally structured as described in this section. The UEx staff remains principally structured in the well-known G-staff structure. Only some elements of a functional structure are implemented.<sup>82</sup>

---

<sup>80</sup> MDMP = Military Decision Making Process; SOP = Standard Operating Procedures.

<sup>81</sup> TRADOC Pamphlet 525-3-0.1, Annex B: p. 47-55

<sup>82</sup> The process of designating a staff structure for the two UE's was highly discussed in the recent time. It may be therefore not excluded that there might be additional changes to the structure in the future. As of November 2004 the UEy staff is build around joint functions including Operational ISR, Operational maneuver, Operational Fires and effects, Operational protection, Operational sustainment and force projection and Operational command and control. However, the *Army Comprehensive Guide to Modularity* also depicts a G-staff structure for the UEy.

In a UEx command post some coordinating and special staff sections are combined in either 'ISR' or 'Force Application' cells. The TAC also incorporates a Protection and a Sustainment cell. These are however no cross-section functional cells but renamed divisional command post cells.

As in the case of the Command Post echelonment issue, the author strongly believes staff organization will change in future staffs. A functional structure, as principally described in TRADOC Pamphlet 525-3-0.1, is expected in the 2015 timeframe.

### Equipment and Technology

In the “stone age of command,”<sup>83</sup> commanders were either completely surrounded by their armies or placed themselves in the very center of a front. Almost every soldier must have been able to see his commander’s flag. The commander, in return, was able to observe the entire battlefield. This was necessary due to the absence of the present-day real-time battlefield communications.<sup>84</sup> Today’s commanders have an unprecedented situational awareness that includes the position of all friendly forces, logistical statuses, and intelligence information. Operation IRAQI FREEDOM saw systems that critically improved the commander’s ability to act aggressively and win decisively.<sup>85</sup> Most of the 7+1 capabilities<sup>86</sup> which the US Chief of Staff, Army, identified in the *Army Transformation Roadmap 2004* have already been put into practice. Not surprisingly, these capabilities are far from mature status.<sup>87</sup>

According to the initial Army publication on Operation IRAQI FREEDOM , *On Point*, the most appreciated Army Battle Command System (ABCS) in OIF was probably the Force XXI Battle Command Brigade-and-Below (FBCB2).<sup>88</sup> This system enabled the tracking and display of own forces’ locations. FBCB2 is only one of the systems which ultimately shall produce a Common Operational Picture (COP). The current enemy situation is generated by the All Source

---

<sup>83</sup> Martin van Crefeld, *Command in War*, Harvard 1985: p. 41ff

<sup>84</sup> Martin van Crefeld: p. 41ff.

<sup>85</sup> Gregory Fontenot (et al.), *On Point*, Combat Studies Institute, Fort Leavenworth, 2004: p. 394.

<sup>86</sup> Friendly Forces location, Current Enemy situation, BOS Staff Estimates, Graphic Control measures, Fragmentary orders, Commanders SITREP, Fire support coordination + Joint and coalition interoperability.

<sup>87</sup> *ATR 2004*: p. 5-18 and Fontenot: p. 394.

<sup>88</sup> Refer to Fontenot: p. 394. Within the Army, the system is also known as Blue Force Tracking (BFT), which is actually only a part of the whole system.

Analysis System (ASAS); the Joint picture and most of the logistical information is contributed by the Global Command and Control System-Army (GCCS-A) / Global Combat Support System-Army (GCSS-A) and fire support is pictured by the Advanced Field Artillery Tactical Data System (AFATDS)<sup>89</sup>. Figure 5 depicts the composition of the COP:

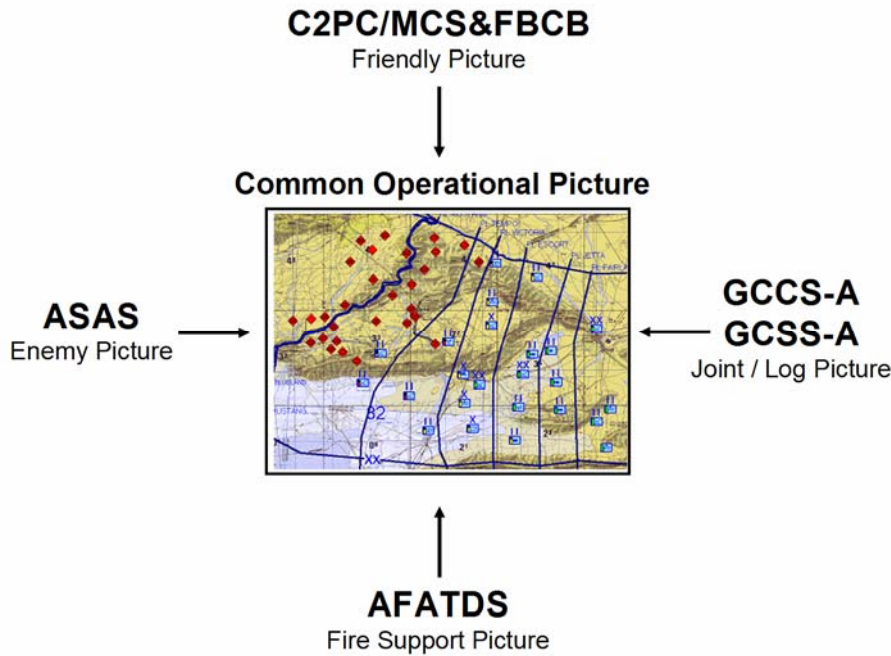


Figure 5 Composition of the Common Operational Picture

Without proceeding to deep into the technological realm, it can be stated that FBCB2 competes with various, very similar systems like MCS<sup>90</sup> and C2PC<sup>91</sup>. Army-wide, more than 4,000 different applications compete for bandwidth resources and cause a major problem for the

<sup>89</sup> System descriptions may be found in: US Army, Office of the Assistant Secretary of the Army (ALT), *United States Army Weapon Systems 2004*, Washington 2004.

<sup>90</sup> MCS = Maneuver Control System. MCS assists staffs with planning and monitoring battles. It produces five-paragraph mission orders, graphic overlays, messages, fragmentary orders and task organization templates.

<sup>91</sup> C2PC = Command & Control PC. Very similar to MCS, C2PC was developed for USMC and Navy. It is based on Commercial off-the-shelf (COTS) devices such as laptops. C2PC was used with great success by V. Corps during OIF after the deliberate decision by the Commanding General, LTG Wallace, not to use MCS as the primary Battle Command System in V. Corps. See Fontenot: p. 394.

communications infrastructure<sup>92</sup>. The problem is even greater in the joint environment. The US Army and the Marine Corps recently decided to coordinate their efforts more closely. C2PC has been selected by both services for brigade-and-above communications and FBCB2 for brigade-and-below.

After-action reviews of Operation IRAQI FREEDOM have also identified additional areas of concern: (1) Battle command on the move and operational maneuver was obstructed by heavy and inflexible communication networks like MSE<sup>93</sup>, which caused the need to “maneuver the net”; (2) a current enemy picture (reliable red force tracking, real-time and persistent); and (3) joint / combined Interoperability.<sup>94</sup> All of these issues have been worked on since and will be solved by 2015. As shown in the next section, the US Army Future Force comprises of a new generation of enhanced technology, mitigating the problems of OIF.

OIF presented an indication on how battle command will operate in the Future Force of 2015. The US Army will improve and develop systems that overcome the above-mentioned impediments.

First, the Future Force relies on a robust network, freeing the warfighter from the logic of supporting communications systems. An internet-like system will provide access across the entire battlespace. The technological leap is expected around 2012, when the Army has outmoded MSE by fielding the Warfighter Information Network – Tactical (WIN-T) and the new family of software-programmable Joint Tactical Radio Systems (JTRS)<sup>95</sup>. This technology enables LandWarNet, the Army’s (or merged with USMC units ashore: Land Component’s)

---

<sup>92</sup> ATR 2004: p. 5-19.

<sup>93</sup> MSE = Mobile Subscriber Equipment. MSE is predominantly based on radio links and suffered in OIF from the lengthy distances between the headquarters and forward elements of up to 500 km. See Reiner Schwiebert, IRAQI FREEDOM - Hat Network Centric Warfare die Feuertaufe bestanden? In: *Soldat und Technik*, 2-2004: p. 28.

<sup>94</sup> Fontenot: p. 394-395.

<sup>95</sup> Schwiebert: p. 30.

subsystem in the Global Information Grid (GIG). One major difference to today's concept is the Internet Protocol based architecture of the net. Channelized, point-to-point connectivity is no longer required or desired. To a much higher extent than today, the necessary technology will be included into new platforms as an integral system element. The Future Combat System (FCS) is already designed to achieve this requirement.

In addition, the Future Force will have at its disposal a truly integrated Battle Command System which offers the same technology in garrison, in training and in war and which is more able to integrate information of all battlefield operating systems than any system before.<sup>96</sup> Thus, users will be much more familiar with the system capabilities than they probably were in OIF, where a good quantity of equipment was fielded during or just before the hostilities. The future BCS is an open structure, a "system-of-systems" allowing enlargements and application upgrades without changing the complete BCS. It will rely rather on fixed standards instead of fixed design. Though the Future Force Battle Command System will be very much like Microsoft Windows<sup>®</sup> and contributing Battlefield Operating Systems like Windows<sup>®</sup> - applications.

## **UE and Multinationality**

As seen in OIF, integration of foreign nation's elements into existing US units raises concerns. Following a discussion of Joint Interoperability in OIF, Colonel Fontenot, the lead author of *On Point*, mentions "*Interoperability proved even more difficult for coalition members, partly for technical and partly for security reasons.*"<sup>97</sup> He argues, a huge effort was necessary to incorporate only the 1<sup>st</sup> UK division into OIF, even though today's Battle Command is not yet completely network-centric. "As the Army moves towards the Future Force and joint

---

<sup>96</sup> TRADOC Pamphlet 525-3-0.1: p. 28-29.

<sup>97</sup> Fontenot: p. 417. Though the technical issue will be discussed in this monograph, the security issue offers a whole new set of problem. For a first access to the topic refer to: Susan McGovern, *Information security requirements for a coalition wide area network*, Thesis, Naval Postgraduate School, Monterey: June 2001.

transformation proceeds, the gap is likely to grow wider.”<sup>98</sup> On the other hand, the Future Force Concept clearly states “[t]he UE will be capable of command and control (C2) of all Army, joint, and multinational forces” and “[t]he UE will also have the inherent capacity to interact effectively with multinational forces.”<sup>99</sup> As a matter of fact, the term “multinational” appears 24 times in the concept. It is no exaggeration to state that the UE concept truly encompasses Multinationality. The Unit of Employment Concept follows the national and doctrinal documents and implements national policies.

The concept developers are also very aware of Interoperability issues. They did not expect a “plug and play” scenario like an experienced commercial hardware/software solution. The concept dedicates the whole Annex E to Interagency and Multinational Interoperability.<sup>100</sup> The foreseeable technology gap is depicted as one of the most challenging issues.<sup>101</sup> Other issues mentioned are dissimilar doctrines and unfamiliar procedures, problems already experienced in history. The UE concept paper goes beyond the problem identification. It submits solutions too. The main argument of the paper regarding Interoperability solutions is the following: It is important not only to discuss how foreign units can be prepared to fit into an UE but also, how an UE can be organized, trained or equipped in order to incorporate units.<sup>102</sup> The means to do so are various. They range from the establishment of Joint Interagency Control Groups and a Joint National Training Center in case of Joint Interoperability to shared security protocols or multinational organizations, embedded early on in battle labs. The most common means to improve Interoperability in the near term still remains the liaison element. This topic will be discussed in the next section in greater detail.

---

<sup>98</sup> Fontenot: p. 418. See also Zanini/Taw: p. 39-40 for an assessment of making foreign nation units compatible by loaned C<sup>4</sup> equipment or tags (attached sensors to mark foreign vehicles).

<sup>99</sup> TRADOC Pamphlet 525-3-92: p. 6

<sup>100</sup> TRADOC Pamphlet 525-3-92: Annex E

<sup>101</sup> TRADOC Pamphlet 525-3-92: Annex E, p. 67

<sup>102</sup> TRADOC Pamphlet 525-3-92: Annex E, p. 67

### Digital Liaison

Besides the above mentioned sub-command posts Main, TAC 1+2, MCG, the detailed command post structure of the UEx initially outlined a great variety of Liaison Elements.<sup>103</sup> Although the majority of these were focused on liaison to Joint Centers, some have been exclusively designated to connect non-networked allies into the LandWarNet (Digital Liaison Teams). In recent concept papers, this allocation has been altered in the UE refinement process— all Joint and Digital Liaison teams will finally be pooled at UEy level.<sup>104</sup>

Due to the complete network capability of organic UE assets and other US Future Force units, Digital Liaison Teams will most likely be employed to connect Multinational and Interagency units. Digital Liaison Teams will be equipped with US network technology (hardware and Battle Command Systems), capable of providing sufficient connectivity to the Multinational unit.

This concept is not new. The most prominent historical examples of liaison teams to multinational units including access to command systems in contrast to a pure information exchange (e.g. in order to make use of close air support), stem from Operation DESERT STORM 1991 and Operation ENDURING FREEDOM in AFGHANISTAN 2002.<sup>105</sup> In these cases, Special Forces, taken out of Special Forces Operational Detachments Alpha (SFODA), supported coalition partners with secure radio, video telephone conference systems and wide/local area network stations. In practice, the team strength is determined by mission and conditions. However, in recent missions a typical team comprised 6 to 12 special operators.<sup>106</sup>

---

<sup>103</sup> TRADOC COCOM briefing “UEy and UEx - Designing a Campaign Quality Army with Joint and Expeditionary Capabilities”, 8 July 2004, unpublished.

<sup>104</sup> *Army Comprehensive Guide to Modularity*: p. B-1.

<sup>105</sup> Bruce Swatek, *Role of Special Forces Liaison Elements in future multinational operations*, MMAS thesis, Fort Leavenworth 2002: p. 18-22, 56. This Special Forces Liaison Elements (SFLE) are also known as Liaison Coordination Element (LCE) or Coalition Support Team (CST): p. 3.

<sup>106</sup> Swatek: p. 45; and Chadwick Storlie, The liaison Coordination Element, in: *Special Warfare*, Spring 1999: p. 41

SFODAs supported the Land Component in recent wars –the UE has these assets incorporated in its structure in future wars. Due to the limited size of the Digital Liaison Teams in a UEy of only 19 servicemembers,<sup>107</sup> and the typical size of such teams, it does not seem achievable to sufficiently support more than three or four Command Posts. It therefore remains to be seen how many different Multinational units can actually be connected to the LandWarNet.

Furthermore, even if Digital Liaison Teams provide some connectivity, this does not upgrade a whole unit into the network-centric realm. It always remains an improvised solution since nearly all other elements of that multinational force besides the command posts will still work in an analog mode.

## **Implications**

The purpose of depicting elements of Battle Command in the UE was to set the stage for a brief analysis of implications for Interoperability of foreign forces possibly joining a UE. Foreign nations must be aware of the US development towards a Future Force is not only another structural alteration as many before, but has an impact on their own capabilities. Due to the non-technical focus of this paper, only major implications of the process will be discussed. The fundamental message will not change with the quantity of examples given!

### Planning and executing an operation

Before the Future Force, military planning was very similar in almost any armed forces of the western hemisphere. The US Army “Military Decision Making Process” (MDMP) does not differ very much from the German, British or French decision-making process. The

---

<sup>107</sup> *Army Comprehensive Guide to Modularity*: p. B-1.

procedure of parallel planning stems from NATO principles<sup>108</sup> and is widely understood. Staff procedures are well known due to intense international training over the recent years. The Future Force will dramatically change staff procedures. Operational and tactical planning develops from “sequenced or parallel planning“ to “collaborative planning“. The major difference is the dependence of real collaborative planning on a Common Operational Picture and on the technology to work with shared information, databases and knowledge. Collaboration happens when planners of different echelons work together either by being collocated or by being part of a network.

In the Future Force, commanders and planners will not actually meet as often as they do today. Available information technology like Video Teleconferences (VTC), remote file sharing and virtual planning shops abolish the need to physically assemble. Consequently, Future Force planner will alter the habits and techniques of planning very much from today’s approach. Planners who do not have access to the new technology will most likely remain in the traditional realm of planning: Particular planning steps, discrete and preplanned occasions for piecewise information exchange, and approval given in traditional briefings. As a result, traditional force planners lose the present doctrinal Interoperability that was achieved by comparable procedures. Future Force planning processes will very unlikely incorporate specific coordinating measures, required only when (traditional) Multinational forces have to be integrated.

Even if collaboration is possible, the products of this process will not look like the well known traditional operation orders. Most of these products will not even be published in paper or as an overlay. They will be distributed electronically and in Battle Command System specific data formats.<sup>109</sup> It remains for that reason a challenge to create the necessary documents and their

---

<sup>108</sup> As an example refer to NATO, SC Europe and Atlantic, *Bi-SC Guidelines for Operational Planning (GOP)*, January 2001.

<sup>109</sup> MCS and C2PC already provide this functionality as of today. It was widely used in OIF and changed the way of distributing orders. Refer to *Unites States Army Weapon Systems 2004*: p. 146/147 and Fontenot: p. 394f.

updates for Multinational forces. Digital Liaison Teams can offer some assistance, but time delay and possible copy errors will significantly impede coalition Interoperability.

Networked forces distribute information during the execution phase of a campaign in a different way than today, as shown in Chapter One. Rather than deciding on who must be addressed, they provide information into a common data base and anyone who needs information of that type pulls it from the source. This process is very fast and adaptable. It ensures decision superiority and allows an unprecedented operational tempo. As before, traditional Multinational forces are reliant on “translated” information by their Digital Liaison Teams. Although possible, this necessity slows down the speed of information, endangers decision superiority and, in consequence, reduces the overall operational tempo. Like convoy operations of WWII, the slowest ship sets the pace for all. In the authors view, executing a future battle with units of very different operational tempo produces more challenges than benefits for a combined forces commander. Commanders will very likely try to circumvent those challenges. The ways how that can be done will be discussed in the conclusion. These are the real risks of imperfect Interoperability.

#### Fires

A second implication lies in the altered method of combined forces mutual fire support. Formerly, an element within the division or corps headquarters was responsible to control fire support and finally release fires. A manual check of reported blue force positions and locations, possibly backed up with a direct request for information to “uncleared” units, would ensure that own operational fires do not harm friendly forces. This process was not always successful and it wasted time. In the Future Force, locations of friendly forces are well known due to tracking systems and a net-wide accessibility of that data. Networked fires can be released much quicker because the most time consuming process of manually checking for friendly forces in the target area is no longer necessary. Theoretically, it would be possible to release fires after a fully

automated decision!<sup>110</sup> This could dramatically decrease the decisive time from locating a target to having effects on it - from some minutes to the pure time needed for firing the weapons (whatever platform the fire control system uses)<sup>111</sup> plus the time physically needed by the weapon/effector to reach the target.

Multinational forces that want to be truly integrated into the Future Force have to pay an “entry fee” before they can do so. To be part of the networked fires system they have at least to be completely equipped with a “Blue force tracking system” that is interoperable with Future Force standards. This capability is critical for the process. It would corrupt the whole process of releasing fires, if Multinational forces vehicle or unit locations must be checked manually. The former advantage resting in having fires quicker on a target than an enemy can possibly react would be nullified. It seems unlikely that a mix of such forces would be in the best interest of the US forces: The lack of technological Interoperability leads directly to procedural Interoperability. Even the use of Digital Liaison Teams would not significantly improve this situation. Although Multinational force headquarters could hereby be integrated into the network, hundreds or thousands of combat and combat support vehicles would still not appear on the screen.

#### Command Culture and Staff Structures

Among others, commanding a force means visualizing the battlefield and describing ones intent to the force. Since the US Army’s style of command is described as driven by “Auftragstaktik”(mission command),<sup>112</sup> the aspect of “describing” the intent and supplying the force with assets needed for the mission are essential factors. One of the controlling factors

---

<sup>110</sup> TRADOC Pamphlet 525-3-0.1: p. 87f. This pamphlet however identifies the possible need for a “man-in-the-loop“, a human decisionmaker who controls the automated process despite the fact that this slows down the process.

<sup>111</sup> One tenet of networked fires is effects-based thinking. Only the designated effect on the target defines the assets used to apply force. Because in an networked environment all assets are linked, a single call for an effect on an enemy target could result in fires from a Beyond-line-of-Sight cannon, a MLRS system or even an air force fighter/bomber on station. Refer to TRADOC Pamphlet 525-3-0.1: p. 87f.

<sup>112</sup> FM 6-0: p. 1-14.

allowing more or a less freedom of action is controlling access to information. Although this controlling measure does not improve staff officers satisfaction it is widely used in the military. To facilitate real “Auftragstaktik” commanders need to refrain from deciding on who might need information and who might not. In “Auftragstaktik”, this is part of the subordinate’s responsibility. That is what network-centric battle command is all about. Commanders have lost this very control measure, because intent and information are disassociated. In the Future Force leaders need to concentrate on formulating the intent in a way that does not need to be amended by information distribution. Although this might not be a revolution to the extent of a Revolution in Military Affairs, it is surely a cultural change. Forces, which stay behind in the traditional way of “expecting information to be distributed and allocated”, face challenges that might cause a cultural Interoperability issue.

A very similar Interoperability issue might be caused by Multinational force staff officers who are not familiar with functional staff structures. This is because day-to-day routine staff work as well as operational planning demands an intense exchange of information and ideas between different levels of staff and command. Officers unfamiliar with procedures that have evolved from functional cell structures will, at least initially, face difficulties to interact with the correct staff person or section.

As described earlier, Home Station Operations Centers will become increasingly important over the time. Given reliable connectivity, HSOC will take a leading role in analyzing specific problem areas as well as planning branches, sequels, or contingencies. It will also organize much of the personnel replacement and materiel resupply. Similar to the Interoperability problems caused by unfamiliar staff structures, the echelonment of headquarters challenges multinational partners. Armed forces, which are used to interacting face-to-face with their counterparts, will need to adapt to an environment where personal contacts are no longer feasible or even possible. The respective counterpart in a HSOC might be some thousand miles away at his home station. Though it will still be possible to cope with an unfamiliar functional

staff structure in a US Army unit's Main Command Post, TAC or MCG by temporary co-location and "asking ones way through", this would not be an option for fixing interaction problem with an HSOC. Interoperability will only be assured, if Multinational forces have both, the technology to reach a superior HSOC and the procedural understanding and experience of its tasks.

Chapter III has analyzed the US Army Unit of Employment concept under the aspect of Interoperability and Multinationality. It depicted the cornerstones of that concept, assessed the changing nature of battle command in an NCW/NCO environment and considered possible implementations for force integration. Several critical foreign nation Interoperability issues have been identified during the discussion. In Chapter IV the paper turns to an allied nation's capabilities with regard to network-centric warfare. A closer look on the German Bundeswehr will facilitate this requirement for Interoperability and systems integration with allies or coalition partners.<sup>113</sup>

#### **IV Future Capabilities of the German Bundeswehr**

*To be able to cope with its tasks, the Bundeswehr will have efficient forces capable of being employed rapidly and effectively in combined operations with other nations' forces.  
(German Defense Policy Guidelines 2003)<sup>114</sup>*

#### **Political and Conceptual Framework (Bundeswehr)**

Similar to the process of the United States the characteristics of the Bundeswehr are largely determined by the German Defense Policy Guidelines (DPG). This document defines political ends to be met by the Armed Forces. This policy statement is based on German

---

<sup>113</sup> The German Bundeswehr only one nation that transforms it's military towards NCW/NCO. For an overview of other nations attempts see Zanini/Taw: p. 17-25; for the UK only see Paul Robinson and Iain Pickard, The UK approach to future Command and Inform (C4ISR), in: *Journal of Defence Science*, vol. 8, no. 3: p. 179-190.

<sup>114</sup> Bundesministerium der Verteidigung, Bundesminister der Verteidigung, *Defence Policy Guidelines*, Berlin, May 2003: p. 20 [German DPG 2003]

interests<sup>115</sup> and on political agreements between the two coalition partners of the current German government, the Social Democratic Party (SPD) and the Green Party (Die Grünen). Like many others, the German political scholar Holger Mey denotes “good and stable German-US relations” as one of our vital interests.<sup>116</sup> Integration of forces is consequently one of the ways to ensure this mutual interest. Acknowledging Interoperability of forces as the single most important means to guarantee integration, the German DPG resides in the logic of this argumentation by stating: “A high degree of interoperability is the crucial prerequisite for multinational missions and combined operations.”<sup>117</sup>

As a subsequent document, the “Concept for the Bundeswehr (CFTB)” defines force structure and capabilities needed. Since the German DPG has been renewed in May 2003, a renewed CFTB has been issued in August 2004.<sup>118</sup>

Although the CFTB incorporated some major changes to the German Bundeswehr, earlier Army concepts on transformation, such as the “Army Plan”, “The German Army 2020 concept paper”; the “Concept for C<sup>4</sup>-support” and the one for Army Digitization<sup>119</sup> remain valid. These documents highlight the need for information superiority in combat and a Joint/Combined Common Operating Picture. Like the US Armed Forces, the German Bundeswehr has recognized Interoperability as paramount in this process. The CFTB 2004 also identifies the establishment of

---

<sup>115</sup> The government of the Federal Republic of Germany does not issue a NSS like the US administration. Instead, German interests are rather defined by common understanding, party politics and society-wide discussion. For an good description of the process and an assessment see Holger H. Mey, *Deutsche Sicherheitspolitik 2030*, Report Verlag, Frankfurt/Main 2001 and Egon Bahr, *Deutsche Interessen*, Btb Verlag 2000.

<sup>116</sup> Mey, *Deutsche Sicherheitspolitik 2030*: p. 91.

<sup>117</sup> DPG 2003: p.19.

<sup>118</sup> Bundesministerium der Verteidigung, GenInsp/Fü S VI 2 – *Konzeption der Bundeswehr* (Restricted – FOUO), Berlin August 2004. Although the original document has not been published, a non-restricted version, which highlights the main features of the reform, does exist. Refer to Dr. Peter Struck, Bundesminister der Verteidigung, *Grundzüge der Konzeption der Bundeswehr*, Berlin 2004, [http://bundeswehr.de/misc/pdf/broschueren/broschuere\\_kdb.pdf](http://bundeswehr.de/misc/pdf/broschueren/broschuere_kdb.pdf); Online; [accessed on 09 Dec 2004]

<sup>119</sup> All of the documents (“Konzeption des Heeres / Army Plan”; „Das Deutsche Heer 2020 / The German Army 2020“; “Führungsunterstützungskonzept / Concept for C4-support“; “Konzeptionelle Vorgaben für das Heer (Digitalisierung) / Concept for Digitization of th Army“) are “Restricted – FOUO”. Therefore they have not been issued to the public.

technical and structural preconditions as the primary goal on the way to NCW/NCW capabilities.<sup>120</sup>

Contrary to the US Armed Forces, there has not yet been a detailed concept for NCW/NCO<sup>121</sup> in the German Bundeswehr. Now the CFTB 2004 includes overarching guidelines for a German NCW/NCO - a more comprehensive concept is likely to be expected.<sup>122</sup>

In the near future, the German Bundeswehr will transform into a more expeditionary and deployable force. Operations for conflict prevention and crisis solution are of most importance. Homeland defense with conventional forces is no longer the primary task.<sup>123</sup> Therefore, the German Bundeswehr structure change. Although the five basic organizational areas (the three services Army, Navy, Air Force; Joint Support Service; Central Medical Service) will retain their organizational responsibilities, the Armed Forces will be grouped in one of three new categories. 35,000 troops will form the Intervention Forces; 70,000 troops are part of the Stabilization Forces; and 147,500 troops will form the Support Forces. German contribution to Multinational mission such as the NATO Response Force (up to 15,000 troops), forces according to the European Headline Goal (up to 18,000), as well as to the UN Standby Agreement (up to 1,000) will exclusively stem from this category. Until 2015 only the Intervention Forces will have a mature NCW capability.<sup>124</sup> The German Army assigns 20,500 troops to the Intervention Forces - one mechanized division and the division for special operations (DSO). Figure 6 illustrates the Army's contribution to the Intervention Forces.

---

<sup>120</sup> Struck, *Grundzüge*: p. 18.

<sup>121</sup> NCW/NCO is addressed as "Vernetzte Operationsführung (NetOpFü)" in the German Armed Forces.

<sup>122</sup> The new Concept for the Bundeswehr 2004 addresses NCW as one of four principles of the transformation process of the Bundeswehr. Along with this the Concept identifies Command and Control Systems as the main effort in procurement in the area of C<sup>2</sup>-capabilities.

<sup>123</sup> German DPG: p. 16 and Struck, *Grundzüge*: p. 11. Contrary to past documents, the defense of the Germany is no longer primarily bound to the geographical borders of the Federal Republic of Germany but to the much broader aspects of "Freedom of Action" and to locations where the security of Germany is threatened. This might even be abroad.

<sup>124</sup> Struck, *Grundzüge*: chapter 5.

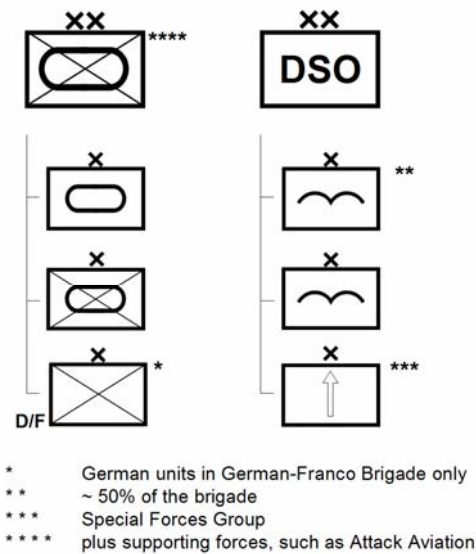


Figure 6 **Projected German Army Intervention Forces in 2010**

Despite doctrinal and structural transformation, future German forces will be shaped by two additional external elements: the Federal legal framework and the Armed Forces budget. Both elements are highly unpredictable. The legal framework could be substantially changed during one 4-year parliamentary term (e.g. operational limitations, duration and conditions of the conscription), causing second and third order effects on the structure. As an example, this happened in 2004 when (1) the German Bundestag changed laws simplifying the deployment of troops and allowing the use of tear gas on missions abroad, and (2) a renewed discussion on abolishing the conscription evolved within the SPD. The influence of the Bundeswehr on such processes is relatively small. However, possible effects are relatively large.

Budgetary restrictions heavily influence modernization and transformation due to the limited flexibility of the German defense budget. Spending only 1.4 % of the GDP in 2004 (Euro 23,81 billion) for the armed forces, Germany ranks last in-ratio among all NATO nations.<sup>125</sup> Due

<sup>125</sup> Nicole A. Manara, *Military Trends in Germany: Strengths and Weaknesses*, Center for Strategic and International Studies, Washington 2004: p. 5.

to the in-ratio large force, 75 % of the budget are fixed costs for personnel, maintenance and facility management. Only 24.6 % (or Euro 5,92 billion) of costs are investments.<sup>126</sup> A comparison of the roughly US\$ 8 billion of Germanys total annual procurement with the estimated US\$ 200 billion (estimated, 10-year period)<sup>127</sup> for the Global Information Grid (GIG) and its maintenance alone illustrates the real imbalance of efforts.

Adjustments in the running budget like those changes in 2004 (a reduction of approximately Euro 400 million) can only be balanced by dramatically reducing the investment sector. Caused by a still weak economic situation in Germany (which will further decrease the federal tax income and increase social welfare budgets), reductions in future budgets and subsequently in military procurement are very likely to occur.

### **Current battle command capabilities and future developments (until 2015)**

As of 2004, the German Bundeswehr has not developed or introduced a joint network, which is capable of supporting NCW/NCO. Partial capabilities exist in the services only to different extents. While the Air Force, as part of the NATO integrated Air Defense System, is highly integrated and the Navy has the ability to share a common naval operating picture, the Army is mostly still working in the analog environment. Latest developments in the Army are focused on an Army-wide Command and Control System<sup>128</sup> including the ability to transfer data to the other services.

---

<sup>126</sup> Budget figure are taken from the official Bundeswehr budget plan 2004; See <http://www.bundesfinanzministerium.de/bundshaushalt2004/html/ep14/ep14.html> [accessed on 11 Dec 2004].

<sup>127</sup> See Tim Weiner, *Pentagon envisioning a costly internet for war*, The New York Times, 13 November 2004 Late Edition, Section A, Page 1.

<sup>128</sup> The main parts of that program have been the Army C2 system HEROS and the command post network project. Refer to B. Stingel and Boyd Buchin, , *Network Centric Warfare – Ganzheitliche Sichtweise moderner Operationsfuehrung*, in: *IT-Report Mai 2003*, Report Verlag, Bonn, May 2003.

However, most of the existing systems do not work netted but isolated<sup>129</sup> – relying on sharing information by interfaces such as Link 16.<sup>130</sup> Because of this limited and restricted nature of the systems, the German Secretary of Defense announced the abandonment of C2-programs, which do not support a joint and multinational approach.<sup>131</sup> Other current procurement programs have also been cancelled in order to release funds for future innovation, i.e. Information Technology (IT)-systems.

As a result, battle command in the German Army as an entity is still reliant on traditional staff work, information “distribution,” and point-to-point, but hierarchical communication. Computer and other IT-systems are widely used, but hardly ever for collaboration and networked battle command. Although a veritable force, successfully accomplishing missions that range from peacekeeping in Georgia to hunting terrorist with Special Forces in Afghanistan, the Bundeswehr of 2004 is still exists in the legacy of its Cold War’s posture.

#### Future Command and Control Systems

The Bundeswehr has clearly embarked towards NCW/NCO.<sup>132</sup> Around the year 2015, the German Armed Forces disposes of a three-tier architecture of command and control systems. Figure 7 illustrates the evolution of systems from 2004 to 2012.

---

<sup>129</sup> Wolfgang Schneiderhan, Chief of Defense, German Bundeswehr, *Speech in front of the Federation of German Industries*, November 18th, 2003; transcript in: [www.bmvg.de/archiv/reden/inspekteure/031118\\_gi\\_network.php](http://www.bmvg.de/archiv/reden/inspekteure/031118_gi_network.php), [Assessed 05 December 2004].

<sup>130</sup> Link 16 is a version of a NATO standard data format agreed in Standardization Agreement STANAG 5516. For a technical description refer to Adam Baddeley, *Ground-to-air Communications, Upwards and onwards*, in: *Military Technology*, May 2004: p. 28.

<sup>131</sup> Dr. Peter Struck, German Secretary of Defense, *Speech at the 12<sup>th</sup> Forum on Security Policy Berlin*, transcript in: [www.bmvg.de/archiv/reden/minister/040126\\_punktuation\\_struck\\_tagung.php](http://www.bmvg.de/archiv/reden/minister/040126_punktuation_struck_tagung.php), [Assessed 05 march 2004]

<sup>132</sup> Schneiderhan, *speech*: part III and Wolfgang Schneiderhan, Chief of Defense German Bundeswehr, *German Bundeswehr, NATO--cornerstone of German Security and Defence Policy*, *Nato's Nations And Partners For Peace: Welcome to the Club: Prague Summit*, Uithoorn, 2002. Iss. 4: p. 99-100

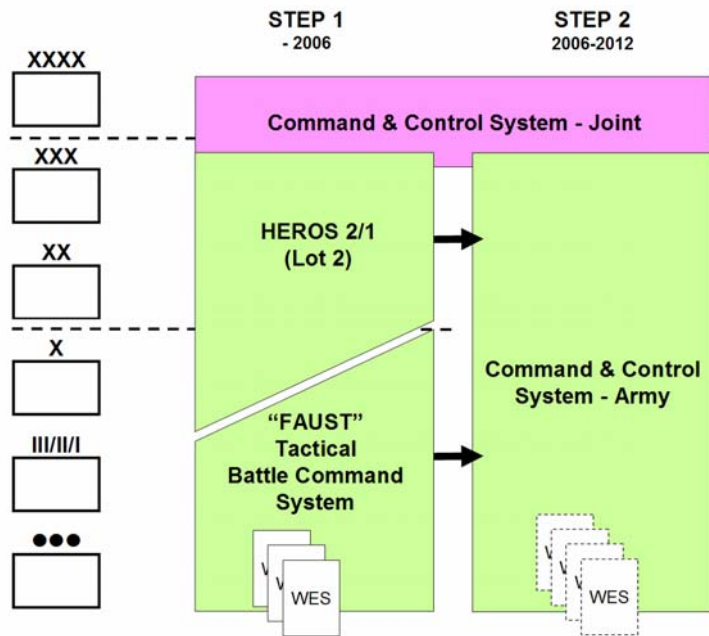


Figure 7 **Evolution of future German Battle Command Systems**  
 Adapted from Brendel, Peter (et al.), Gefechtsfeldführungssystem FAUST, in:  
*Soldat und Technik*, 07-2003: p. 33. WES = Weapons Engagement System

The top level will be the “Führungsinformationssystem Streitkräfte” [FüInfoSys SK or Command & Control System – Joint, (CCS-J)]<sup>133</sup>, which connects all three services, coalition partners, the national command structure and deployed contingents. It integrates existing systems wherever possible and relies on custom software solutions like SAP/R3<sup>®</sup> and the Internet protocol. The realization of the Joint C<sup>4</sup>-System began by releasing the appropriate funds for the fiscal year 2004 and beyond.<sup>134</sup> The development will be incremental with the implementation of a national intelligence feed into the system in 2005 as a first milestone for base functionality. Simultaneously, the Bundeswehr improved its ISR capability dramatically by launching the bi-

<sup>133</sup> A detailed system description can be found in Mark Lichtenhagen and Uwe List, Das Führungsinformationssystem der Streitkräfte, in: *Soldat und Technik*, September 2004: p. 24f.

<sup>134</sup> Schneiderhan, *Speech*: part III and German Bundeswehr Online, *Neues System fuer bessere Führungsfähigkeit*, [http://www.bundeswehr.de/forces/heer/041209\\_fuesys.php](http://www.bundeswehr.de/forces/heer/041209_fuesys.php) [accessed on 11 Dec 2004].

national reconnaissance satellite system SAR-LUPE together with France. With structural and procedural changes in the intelligence community that are already in place,<sup>135</sup> Germany will have satisfied a significant requirement identified by NATO in the Defence Capabilities Initiative.

Further segments of that system encompass “geographical information handling”, “message management and creating a COP” as well as an order development tool.

Integrated into the systems architecture of the Command & Control System – Joint are service oriented systems of the second tier like the “Führungsinformationssystem Heer” [FüInfoSys H or Command & Control System – Army, (CCS-A)]. This system will be developed and fully implemented by 2012. It relies on technology already in use within current Battle Command Systems<sup>136</sup> like HEROS 2/1 at the higher tactical level or FAUST at the lower one (“Step 1”) – systems, which will later on merge into the CCS-A (“Step 2”). The capabilities are very similar to the well known US BCS like MCS, FBCB2 or C2PC, described in Chapter 3. It will have the capacity to integrate coalition partners and to exchange information up and down.

The last tier is formed by various Weapon Engagement Systems, located directly at the end of the process, such as artillery, engineer or attack aviation management and planning tools. These isolated solutions exist today in great numbers and have to be merged into the CCS-A as well.

Germany has recognized the need for a networked BCS. Coherent, joint solutions are either under development or already partly introduced into the force. Although a final estimate of German BCS capabilities in 2015 remains to be determined by actual procurement in the next ten years, German policies for transformation set the forces main effort in investments on the right

---

<sup>135</sup> Most important, the Bundeswehr has centralized intelligence assets by establishing the ‘Bundeswehr Centre for Strategic Reconnaissance’.

<sup>136</sup> For detailed descriptions refer to Peter Brendel (et al.): p. 33f and ESG Elektroniksystem- und Logistik GmbH Online, *Product information HEROS 2/1 Los 2*, [www.esg.de/pdf/heros\\_d.pdf](http://www.esg.de/pdf/heros_d.pdf), [accessed on 11 Dec 2004].

target: technology for information superiority. Additionally, it seems to be no issue for the German defense industries to design and deliver adequate systems. Size and experience of the major corporations will allow an effective transformation of the German Bundeswehr towards NCW/NCO.<sup>137</sup> Germany will therefore very likely be part of the NCW/NCO community, with systems and elements very similar to the US BCS.

In order to avoid a lone German solution and to achieve a second German defense policy goal of “Establishing Interoperability”, Germany has embarked on several initiatives. The next segment will discuss these critical initiatives.

## **Ensuring Interoperability**

Interoperability was defined either as “*a systems characteristic to respond in similar ways to a particular situation*” or as “*the ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use this services so exchanged to enable them to operate effectively together.*”<sup>138</sup> To ensure this capability, nations take part in standardization programs, undertake multinational Concept Development & Experimentation and participate in final Interoperability exercise to prove their capabilities.

### Interoperability Programs

Germany has been participant in some Interoperability Programs, such as ATCCIS, Link 11/16/22 or MIP.<sup>139</sup> The most recent program of these three is the “Multinational Interoperability

---

<sup>137</sup> Refer to Tom Enders, Transformation und Network Enabled Capabilities – Folgerungen fuer die Deutsche Industrie; in: *Soldat und Technik*, vol. Januar 2004; Report-Verlag, Bonn; 2004 and Michael K. D. Krüger and Holger H., Mey, *Vernetzt zum Erfolg?*, Institut fuer Strategische Analysen / Report Verlag, Bonn, 2003: p. 57-67

<sup>138</sup> Refer to chapter II

<sup>139</sup> ATCCIS = Army Tactical Command and Control Information System based on NATO decision MC 245 (18 June 1976), ATCCIS merged into MIP; Link 11/16/22 are versions of a NATO standard data format agreed in Standardization Agreement STANAG 5516.

Program<sup>140</sup> (MIP)”, a non-formal, voluntary NATO initiative that tries “*to achieve international interoperability of Command and Control Information Systems at all levels from corps to the lowest appropriate level, in order to support combined and joint operations; and pursue the advancement of digitization in the international arena, including NATO.*”<sup>141</sup> MIP is the forum that intends to link the German HEROS 2/1 with ten similar BCS of the other MIP members. Further 15 associate members like Australia, Poland or NATO’s Allied Command Transformation (ACT) are taking part in the program to gain some property regarding this program. MIP comprises of standardization and security agreements, specialized workgroups and experimentation series. When MIP is successfully implemented, the German BCS can exchange data with others trouble-free and in real-time, e.g. with the US Army’s MCS. Exercise results have already proved a basic functionality – a full operational capability will depend on further efforts and an increased bandwidth for the heavy data stream.

#### Concept Development & Experimentation

Due to the very nature of Interoperability the paramount importance is not to develop technologies for NCW/NCO under concealment but to collaborate with partners. The German Bundeswehr follows this principle by taking part in multinational programs of Concept Development & Experimentation (CD&E). One of those is the Multinational Limited Objective Experiment (MN LOE) series.<sup>142</sup> The program, which embraces the four exercises MN LOE 1+2, Multinational Experiment 3 (MNE 3) in February 2004 and finally MNE 4 in 2005, focuses on online collaboration, Operational Net Assessment and Command & Control. MNE 3 evaluated

---

<sup>140</sup> For all information on MIP, refer to [www.mip-site.org](http://www.mip-site.org). Full members are currently 11 nations: Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Turkey, the UK and the USA. [assessed on 12 December 2004]

<sup>141</sup> MIP homepage [www.mip-site.org](http://www.mip-site.org) [accessed on 11 Dec 2004].

<sup>142</sup> This series is experimental and studies hardware needs as well as methods for a distance collaboration in operational planning. Initial partners were the USA, Great Britain, Canada, Australia and Germany. The program is controlled by the Joint Forces Command, Norfolk. See JFCOM Online, [www.jfcom.mil/about/experiments/multinational.htm](http://www.jfcom.mil/about/experiments/multinational.htm) [accessed on 12 Dec 2004].

the ability of coalition members and the NATO Response Force to develop and assess processes and organizations. The exercise also identified technology requirements to support effects-based planning and operations.

For the German Bundeswehr, Multinational Concept Development & Experimentation events like MNE 3 and 4 identify remaining challenges on the way to a final Interoperability. To a certain extent, success in this environment might be defined as “being able to recognize friction and to revise own BCS and procedures accordingly.” Problems occurring during experimentation exercises are of much less disastrous effects than problems occurring during an actual operation, where real soldiers are deployed.

As a second order effect, MNE 3 in 2004 proved the ability of a Bundeswehr headquarters to cope with a transformed staff structure and composition as found in the participating US Standing Joint Forces Headquarters. It also demonstrated the smooth integration of German staff and general staff officers into a collaborative environment.<sup>143</sup>

#### Multinational Exercises

Short of a real mission, multinational exercises verify Interoperability in an outstanding manner. The use of military hardware in a mission-like setting with outside-of-laboratory use of equipment finally shows the ability to be part of the respective coalition. The German Bundeswehr has always taken part in multinational exercises and will do so during the transformation process.<sup>144</sup>

Most recently, the Bundeswehr took part in exercises such as ALLIED WARRIOR 04, ALLIED ACTION 04 or Combined Joint Task Force Exercise 04-2. In all of these exercises,

---

<sup>143</sup> See German Bundeswehr Online, *Reale Player in einer virtuellen Welt*, [http://www.bmvg.de/sicherheit/transformation/040220\\_mne3.php](http://www.bmvg.de/sicherheit/transformation/040220_mne3.php) [accessed on 12 Dec 2004].

<sup>144</sup> Schneiderhan, *NATO-cornerstone*: p. 96.

headquarters employed networked BCS. Germany demonstrated appropriate capabilities by making use of “Step 1” BCS like HEROS 2/1 and FAUST.

## **German Bundeswehr 2015**

The German Bundeswehr of 2015 will be expeditionary, deployable, and most important, networked. Battle Command System like Command & Control System – Joint and Command & Control System – Army will be integrated and in place. Weapon Engagement Systems will be incorporated into the structure – the sensor-to-shooter link will be established!

A sample engagement might look like this: A German reconnaissance vehicle “Fennek” supported by a tactical UAV identifies a target and will place this information /request for fire into the tactical net. The reconnaissance patrol will in consequence be supported by coordinated fire from any effector available and suitable. This support might include German Army artillery, German Air Force close air support or, due to the successful MIP, Coalition fire support. The enemy target will be effectively engaged according to the desired effect.

Technological Interoperability of German forces and the US Future Force will be achieved. The designated German forces, transformed and interoperable in 2015, will be capable to take part in any type of mission, over the full range of military operations. As earlier discussed, all contributing factors like

- policy goals (Multinational participation and interoperable forces),
- transformational concept (NCW/NCO; information superiority),
- technological development (Joint and Army BCS; MIP) and
- structural reforms (three force categories)

are supporting the German Bundeswehr transformation. However, the speed of the process is predominantly determined by budgetary conditions. Besides requesting appropriate funds, the Bundeswehr leadership might not directly influence the financial situation – they may find themselves in the position to decide only on how to mitigate insufficient funding. The basic

principle should then be rather to limit the footprint of NCW/NCO to fewer forces than to extend the timeline. Nevertheless, the screening criteria for any solution will be a “vertical completeness of Systems” across all echelons and services: Every single Bundeswehr capability must be included, but not necessarily to a full extent. Vertical completeness in this understanding means for example the integration of all tactical vehicles of the (generic!) brigades “1” to “6” into a likewise complete Army and Joint network, but to entirely omit brigades “7” to “16.”

Behavioral (doctrinal and cultural) Interoperability with the Future Force as deduced in Chapter III appears to be insignificant for the Bundeswehr. Recent experiences such as multinational exercises and conceptual experiments indicate that military leaders in the Bundeswehr can easily adapt to the new paradigms of NCW/NCO. The German Bundeswehr has definitely realized NCW/NCO affecting the operational art and the traditional way of decision making.<sup>145</sup> Though this process might possibly challenge the cognitive capabilities of military leaders, it is corresponding to the basic principles of German leadership philosophy. Furthermore, due to the tenets of shared situational awareness, self-synchronization and collaboration, NCW/NCO will end the “leadership by information apportionment,” as described before. Even contrary to this flaw, it can become the renaissance of mission command.<sup>146</sup>

---

<sup>145</sup> Schneiderhan, *Speech*, chapter III. Implications of NCW/NCO on the German understanding of battle command are explicitly discussed in: Alexander Sollfrank, *Digitalisierung verändert Operationsführung des Heeres*, in: *Soldat und Technik*, 03-2003: p. 20-25.

<sup>146</sup> Schneiderhan, *Speech*, chapter III

## Conclusion and Recommendations

*It must be considered that there is nothing more difficult to carry out nor more doubtful of success nor more dangerous to handle than to initiate a new order of things.*  
*Machiavelli (1446-1507)*

This monograph analyzed the US attitude towards coalition warfare and Multinationality as well as discussing aspects and criteria of Interoperability. This paper focused on the US Army Future Force in the year 2015, its apparent implications on Interoperability and an assessment of capabilities of the German Bundeswehr with regard to NCW/NCO, representative for any foreign nation of equal economic and military potential.

As the analysis demonstrates, all US documents consistently support the tenet of Multinationality from national policy papers to operational concepts. Obviously, multilateralism is the preferred concept to unilateralism. Coalition warfare is in the best interest of the United States. Furthermore, all assessed documents postulate an enhanced effort to actually achieve Interoperability. Foreign nations consequently can expect further requests for support in the future, as they do today. As coordination problems, unnecessary casualties, or failure of operations in historic coalitions already have shown, Interoperability of forces and systems is a predominant enabler of mission success in coalition warfare. With respect to the specific characteristics of the US Future Force, technical and behavioral Interoperability seem to be most important. Consequently, these criteria were chosen for an assessment of Interoperability of the Future Force and the German Bundeswehr 2015.

With a focus on battle command, the paper argued the Future Force certainly poses some Interoperability issues for US Allies. Despite the technical aspect of ensured information exchange, which can be solved by increased development and procurement, the Future Force concept calls for behavioral change, which takes more effort. For example, the way to plan and execute operations or the way to mutually support each other with fires will significantly change.

Foreign nations can only be fully integrated into an operation, if they transform in the same way as the US forces. The German Bundeswehr has recognized this paradigm shift, stemming from the specifics of NCW/NCO. Policies and concepts emphasize the need for transformation into an expeditionary, deployable and, most importantly, a networked force. Germany, similar to the United States, is determined to act in coalitions. Appropriate structures and systems, which enable the German Bundeswehr to integrate into an US-led coalition, are very likely to be available by 2015. Behavioral aspects of transformation do not seem to create any problems – leaders of all levels in the German Bundeswehr have already adapted to the new pattern.

An integration of German forces into a United States Army Unit of Employment in the year 2015 is feasible. Size and duration of such possible integration are largely determined by the budget of the German Bundeswehr for the next ten years. A potential contingent might be Joint, of division-size, employable in full spectrum operations and capable for Network-Centric Operations.

The overarching policy of participating in coalition missions will live on. Though war-time technology sharing is no longer feasible in NCO, the consequence of failing to transform, *ceteris paribus*, would be inevitable a necessary separation of forces.<sup>147</sup> This could logically only be achieved either by space or by time.

Forced to separate by space, non-interoperable German forces in such circumstances would very likely be required not to operate in the main effort, where the more capable US forces would fight. Equal burden sharing would be no option, even if desired. German Forces could not

---

<sup>147</sup> “*Ceteris paribus*” in this case means that especially the operational end state remains unchanged and that one paradigm of the operation is to strive for the highest effectiveness possible. Steven Metz discusses in length the possibility of balancing military effectiveness against the political objective of coalition cohesion. Refer to Steven Metz, The effects of technological asymmetry on coalition operations, in: Thomas J. Marshall ed. (et al.), *Problems and Solutions in future Coalition Operations*, US Army War College, SSI, Carlisle 1997: p. 62-64 and also Brian Nichiporuk, *Forecasting the effects of Army XXI Design upon Multinational Force compatibility (RAND Study)*, Santa Monica, CA, 2000: p. 14-26. For possible mitigation see: Zanini/Taw: p. 38-44.

effectively support US troops, and vice versa. However, recent lessons from OIF show difficulties identifying “less dangerous” or “less decisive” areas anyway, especially in the contemporary environment of a non-contiguous battlefield. Separation by space in such a setting means to be employed in a less “prestigious” or “decisive” area of responsibility, but still taking approximately identical operational risks.

Separation in time most probably means arriving after the decisive phase of an operation. Forces of higher combat effectiveness (like the US Future Force) are more likely to be employed by the Force Commander either in early entry phases of an operation or in the decisive action. Due to limited capabilities, non-networked forces of the German Bundeswehr would be most likely employable for “Phase 4 operations (post-conflict)” only.

Although both consequences offer some participation, they also show how limited the German governments options would be. Even if a future German administration might wish to employ forces in decisive operations, lacking Interoperability would not allow that choice. Room for maneuver in the political and diplomatic realm would be very limited for the German government.

To avoid a situation as described, some initiatives might be undertaken in the course of the next ten years. The list below provides an initial set of recommendations for action by the German Bundeswehr. These recommendations are applicable for other nations as well:

- (1) Foremost, an appropriate, multi-year funding for German forces transformation must be assured. In a situation of further reductions in military program budgets, “transformational” procurement must be given a higher priority than to traditional aspects, such as weapons platforms.
- (2) Due to the very comprehensive nature of NCW/NCO a “vertical completeness of systems” must be pursued. Having complete integration within a defined force seems to offer more benefits than having a large, but only partially networked force.
- (3) Training efforts with respect to US/German staff integration must be intensified in order to maintain or increase current capabilities.

- (4) Exchange programs focusing on tactical and operational level headquarters (UEX and UEy) must be increased.
- (5) The German Bundeswehr doctrine should correspond with transformed US Joint and US Army doctrine, procedures and techniques, if applicable.

Not all of the actions listed require additional funding. Some are attainable by reallocating funds within the budget. Some are even free of cost. However, funding is just a minor challenge in this issue. The German Bundeswehr with the present Chief of Staff, General Schneiderhan, has already decided to preserve Interoperability with the US and other partners; it is of utmost importance to keep on track. Due to the very nature of a Network-Centric Warfare, value can only be created if the network is complete and all-embracing. Confronted with potential budget reductions, the Bundeswehr leadership must continue the transformation process at all costs – even if that leads to negative second order effects in other areas, e.g. changes in conscription or the troop strength. The real decision is not about money, it is about the German military's place in 10-15 years: Already arrived in the Information Age or still resting in the Industrial Era?

*The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man.*  
*George Bernard Shaw (1856-1950)*



*However beautiful the strategy, you should occasionally look at the results.*  
*Sir Winston Churchill (1874-1965)*



## Appendix: Acronyms

<b>AAN</b>	Army After Next
<b>AAP</b>	Allied Administrative Publication
<b>ABCS</b>	Army Battle Command System
<b>ACT</b>	Allied Command Transformation
<b>AFATDS</b>	Advanced Field Artillery Tactical Data System
<b>AOR</b>	Area of Responsibility
<b>ARFOR</b>	Army Forces
<b>ASAS</b>	All Source Analysis System
<b>ASPG</b>	Army Strategic Planning Guidance
<b>ATCCIS</b>	Army Tactical Command and Control Information System
<b>ATR</b>	Army Transformation Roadmap
<b>BCS</b>	Battle Command System
<b>BCT</b>	Brigade Combat Team
<b>Bde</b>	Bridade
<b>Bn</b>	Battalion
<b>C2PC</b>	Command and Control Personal Computer
<b>C4</b>	Command, Control, Communications and Computers
<b>CCRP</b>	Command and Control Research Program
<b>CCS-A</b>	Command & Control System – Army (Germany)
<b>CCS-J</b>	Command & Control System – Joint (Germany)
<b>CD&amp;E</b>	Concept Development & Experimentation
<b>CFTB</b>	Concept for the Bundeswehr
<b>CONUS</b>	Continental United States
<b>COP</b>	Common Operational Picture
<b>CP</b>	Command Post
<b>CST</b>	Coalition Support Team
<b>DA</b>	Department of the Army
<b>DC</b>	District of Columbia
<b>DCP</b>	Deployed Command Posts
<b>DoD</b>	Department of Defense
<b>DOTMLPF</b>	Doctrine, Organizations, Training, Materiel, Leadership, Personnel and Facilities
<b>DSO</b>	Division [for] Special Operations
<b>FAUST</b>	Fuehrungsaustattung Taktisch (Germany)
<b>FBCB2</b>	Force XXI Battle Command Brigade-and-Below
<b>FCS</b>	Future Combat System
<b>FM</b>	Fiel Manual
<b>FORSCOM</b>	Forces Command
<b>FOUO</b>	For Official Use Only
<b>FüInfoSys H</b>	Führungsinformationssystem Heer
<b>FüInfoSys SK</b>	Führungsinformationssystem Streitkräfte
<b>FY</b>	Fiscal Year
<b>GCCS-A</b>	Global Command and Control System-Army
<b>GCSS-A</b>	Global Combat Support System-Army
<b>GDP</b>	Gross Domestic Product
<b>German DPG</b>	German Defense Policy Guidelines
<b>GIG</b>	Global Information Grid
<b>GOP</b>	Guidelines of Operational Planning (NATO)
<b>GWOT</b>	Global War on Terrorism
<b>HEROS 2/1</b>	German Battle Command System
<b>HQ</b>	Headquarters
<b>HSOC</b>	Home Station Operations Center
<b>ISAF</b>	International Security Assistance Force

<b>ISR</b>	Intelligence, Surveillance and Reconnaissance
<b>ISR</b>	Intelligence, Surveillance and Reconnaissance
<b>IT</b>	Information Technology
<b>JFC</b>	Joint Force Commander
<b>JFLCC</b>	Joint Forces Land Component Commander
<b>JP</b>	Joint Publication
<b>JTF</b>	Joint Task Force
<b>JTRS</b>	Joint Tactical Radio Systems
<b>JV</b>	Joint Vision
<b>KIA</b>	Killed in action
<b>LCE</b>	Liaison Coordination Element
<b>LTC</b>	Lieutenant Colonel
<b>LTG</b>	Lieutenant General
<b>MCG</b>	Mobile Command Group
<b>MCS</b>	Maneuver Control System
<b>MDMP</b>	Military Decision-Making Process
<b>MEADS</b>	Medium Extended Air Defense System
<b>MG</b>	Major General
<b>MIA</b>	Missing in action
<b>MIP</b>	Military Interoperability Programm
<b>MN</b>	Multinational
<b>MN LOE</b>	Multinational Limited Objective Experiment
<b>MNE</b>	Multinational Experiment
<b>NATO</b>	North Atlantic Treaty Organization
<b>NCW/NCO</b>	Network-Centric Warfare / Network-Centric Operations
<b>NDS</b>	National Defense Strategy
<b>NETCOM</b>	Network Enterprise Technology Command
<b>NetOpFü</b>	Vernetzte Operationsführung (Network-Centric Operations)
<b>NMS</b>	National Military Strategy
<b>NSS</b>	National Security Strategy
<b>OCONUS</b>	Outside Continental United States
<b>OIF</b>	Operation IRAQI FREEDOM
<b>OpTempo</b>	Operations Tempo
<b>POW</b>	Prisoner of War
<b>RAND®</b>	US non-profit research organization
<b>RMA</b>	Revolution in Military Affairs
<b>RSTA</b>	Reconnaissance, Surveillance, Target Aquisition
<b>RUSI</b>	Royal United Services Institute for Defense Studies
<b>S&amp;T</b>	Science & Technology
<b>SAP/R3®</b>	German Software
<b>SAR-Lupe</b>	Synthetic Aperture Radar Lupe (German-French system)
<b>SBCT</b>	Stryker Brigade Combat Team
<b>SFLE</b>	Special Forces Liaison Element
<b>SFODA</b>	Special Operations Forces Detachment Alpha
<b>SOF</b>	Special Operations Forces
<b>SOP</b>	Standard Operating Procedures
<b>SPD</b>	Sozialdemokratische Partei Deutschland
<b>STANAG</b>	[NATO] Standardization Agreement
<b>TAC</b>	Tactical Command Post
<b>TP</b>	TRADOC Pamphlet
<b>TPG</b>	Transformation Planning Guidance
<b>TRADOC</b>	US Training and Doctrine Command
<b>UA</b>	Unit of Action
<b>UAV</b>	Unmanned Aerial Vehicle
<b>UE</b>	Unit of Employment
<b>UEx</b>	Unit of Employment X

<b>UEy</b>	Unit of Employment Y
<b>UK</b>	United Kindom
<b>UN</b>	United Nations
<b>US</b>	United States
<b>US Army</b>	United States Army
<b>USA</b>	United States of America
<b>USMC</b>	United States Marine Corps
<b>VTC</b>	Video Tele-Conference
<b>WIA</b>	Wounded in action
<b>WIN-T</b>	Warfighter Information Network – Tactical
<b>WW I / II</b>	World War I /World War II

## BIBLIOGRAPHY

- Alberts, David S., Garstka, John J. and Stein, Frederick P. *Network Centric Warfare*, CCRP Publications Series, Washington 1999.
- Alberts, David S. and Hayes, Richard E. *Power to the Edge: Command, Control in the Information Age*. CCRP Publications Series, 2003.
- Anonymous. Systems concepts for integrated air defense of MN mobile crisis reaction forces, NATO research and technology organization, *Proceedings*, Neully-sur-Seine (France), 2001.
- \_\_\_\_\_. Army Builds Joint And Interdependent Force; *Defense Daily*, Jun 9, 2004. Vol. 222, Iss. 49, p. 1.
- \_\_\_\_\_. How "transformational" is US Army transformation? *Military Technology*, Bonn: Oct 2003. Vol. 27, Iss. 10, p. 67-74.
- Baddeley, Adam. *Ground-to-Air Communications: Upwards and Onwards*, Military Technology Bonn: May 2004. Vol. 28, Iss. 5, p. 21-28.
- Bahr, Egon. *Deutsche Interessen*, Btb Verlag 2000.
- Beede, Benjamin R. ed. *The War of 1898, and U.S. Interventions, 1898-1934*, New York, 1994.
- Bonin, John A and Crisco, Telford E Jr. The Modular Army, *Military Review*, Fort Leavenworth: Mar/Apr 2004. Vol. 84, Iss. 2, p. 21-27.
- Bundesministerium der Verteidigung. Bundesminister der Verteidigung, *Defence Policy Guidelines*, Berlin, May 2003.
- \_\_\_\_\_. GenInsp/Fü S VI 2 – *Konzeption der Bundeswehr*, VS-NfD, Bonn 2004
- \_\_\_\_\_. *Haushalt / Budget plan 2004*; Online, <http://www.bundesfinanzministerium.de/bundeshaushalt2004/html/ep14/ep14.htm> [accessed on 11 Dec 2004].
- \_\_\_\_\_. *InspHeer – Weisung fuer die Weiterentwicklung des Heeres*, VS-NfD, Bonn 2004.
- \_\_\_\_\_. Online, *Neues System fuer bessere Fuhrungsfaehigkeit*, [http://www.bundeswehr.de/forces/heer/041209\\_fuesys.php](http://www.bundeswehr.de/forces/heer/041209_fuesys.php) [accessed on 11 Dec 2004].
- \_\_\_\_\_. Online, *Reale Player in einer virtuellen Welt*, [http://www.bmvg.de/sicherheit/transformation/040220\\_mne3.php](http://www.bmvg.de/sicherheit/transformation/040220_mne3.php) [accessed on 12 Dec 2004].
- Bush, George W. The White House, *National Security Strategy 2002*, Published by: U.S. Government Printing Office, Washington, DC, September 2002.
- Cebrowski, Arthur K. (et al.). *NATO Transformation: Problems and Prospects*, 'The Atlantic Council' publication, Washington, DC 2004.
- \_\_\_\_\_. and John J. Garstka. *Network-Centric Warfare: Its Origin and Future*, in *Proceedings*, published by US Naval Institute, Annapolis, January 1998.

- \_\_\_\_\_. *Transformation and the changing character of war?* Office of Force Transformation publication, Online: [www.oft.osd.mil](http://www.oft.osd.mil) [accessed on 23sep2004].
- Clagget, C.D. *Two-way street or two-way mirror: Will Canada's future Army be able to interoperate with the US Army After Next at the operational and tactical level of war?*, US Army Command and General Staff College, SAMS Monograph, Leavenworth, 2001.
- Clausewitz, Carl von. *On War*, Ed. and transl. by Michael Howard and Peter Paret, Princeton 1989.
- Cohen, Eliot and Cooch, John. *Military Misfortunes*, New York 1990.
- Codner, Michael. *Hanging Together*, Whitehall paper 56, RUSI, London 2003.
- Crefeld, Martin van. *Command in War*, Harvard University Press, Cambridge, USA 1985.
- Enders, Tom. Transformation und Network Enabled Capabilities – Folgerungen fuer die Deutsche Industrie; in: *Soldat und Technik*, vol. Januar 2004; Report-Verlag, Bonn; 2004.
- ESG Elektroniksystem- und Logistik GmbH Online, *Product information HEROS 2/1 Los 2*, Online [www.esg.de/pdf/heros\\_d.pdf](http://www.esg.de/pdf/heros_d.pdf), [accessed on 11 Dec 2004].
- Farrar-Hockley, Anthony. *The British part in the Korean War*, London HMSO, 1990.
- Fitz-Gerald, Ann M. Multinational Land Force Interoperability: Meeting the challenge of different cultural backgrounds, in: *Choices*, vol. 8, no. 3, Institute for Research on Public Policy, Montreal 2002: p. 2-24.
- Fontenot, Gregory. (et al). *On Point – The United States Army in Operation Iraqi Freedom*, Combat Studies Institute, Leavenworth 2004.
- Gericke, Thomas J. *MEADS – Transatlantic cooperation in 21<sup>st</sup> century air and missile defence*, Nato's Nations And Partners For Peace, Uithoorn:2004. Vol. 49, Iss. 2, p. 42-47.
- Gordon, Phillip H. and Shapiro. Jeremy; *Allies at War*, McGraw-Hill, New York 2004.
- Gretzyngier, Robert. *Poles in defence of Britain : a day-by-day chronology of Polish day and night fighter pilot operations, July 1940 - June 1941*, London, 2000.
- Heineman, Troy K. C4 and ISR: Testing for the Future, *Military Intelligence Professional Bulletin*, Ft. Huachuca: Jan-Mar 2004. Vol. 30, Iss. 1, p. 52-57.
- Jablonsky, David. Army transformation: A Tale of two doctrines, *Parameters*, Carlisle Barracks: Autumn 2001. Vol. 31, Iss. 3, p. 43-62.
- Johnson II, Douglas V. *Future Leadership: Old Issues, New Methods*. Strategic Studies Institute, U.S. Army War College Carlisle, PA 2000.
- Kennedy, Paul. Military Coalitions and Coalitions Warfare over the past century, in: Neilson, Keith (ed.), *Coalition Warfare – An uneasy accord*, Waterloo, Ontario, CA 1983.
- Knox, MacGregor and Murray, Williamson ed. *The Dynamics of Military Revolution 1300-2050*, Cambridge 2001.
- Lichtenhagen, Mark and List, Uwe. Das Führungsinformationssystem der Streitkräfte, in: *Soldat und Technik*, September 2004.

- Lilleyman, Phil. *British Army 2000: The future army*, Engineer Washington: Apr 1998. Vol. 28, Iss. 2, p. 22-26.
- Manara, Nicole A. *Military Trends in Germany: Strengths and Weaknesses*, Center for Strategic and International Studies, Washington 2004.
- Marich, L.L. *Enhancing command and control in MN operations*, Army War College, Research paper, Carlisle, 2002.
- Marshall, Thomas J. (Ed., Et al.). *Problems and solutions in future Coalition operations*, Strategic Studies Institute, US Army War College, Carlisle 1997.
- Maurer, Martha. *Coalition Command and Control*. National Defense University, Washington, DC 1994.
- McGovern, S.C., *Information security requirements for a coalition wide area network*, Naval Postgraduate School, Masters thesis, Monterey, 2001.
- McGovern, Susan. *Information security requirements for a coalition wide area network*, Naval Postgraduate School, Thesis, Monterey: June 2001.
- Metz, Steven. The effects of technological asymmetry on coalition operations, in: Thomas J. Marshall ed. (et al.), *Problems and Solutions in future Coalition Operations*, US Army War College, Strategic Studies Institute, Carlisle 1997.
- Mey, Holger H. and Krüger, Michael K. D. *Vernetzt zum Erfolg?*, Institut fuer Strategische Analysen / Report Verlag, Bonn 2003.
- \_\_\_\_\_. *Deutsche Sicherheitspolitik*, Report-Verlag, Frankfurt am Main 2001.
- Meyers, Richard B. Chairman of the Joint Chiefs of Staff. *National Military Strategy of the United States of America 2004*. Washington 2004.
- Millen, R.A. *Tweaking NATO: The case for integrated MN divisions*, Strategic Studies Institute, US Army War College, Carlisle 2002.
- Montgomery, C P R. *The Royal Navy and future joint operations*, Rusi Journal London: Apr 2002. Vol. 147, Iss. 2, p. 68-72.
- Mossman, Billy C. *Ebb and flow, November 1950-July 1951*, Washington, D.C., Center of Military History, United States Army.
- Nationmaster.com. Online <http://www.nationmaster.com/encyclopedia/Polish-contribution-to-World-War-II> [accessed on 19.10.2004].
- NATO. Allied Administrative Publication 1 (AAP1).
- \_\_\_\_\_. Multinational Interoperability Program, Online [www.mip-site.org](http://www.mip-site.org) [accessed on 11 Dec 2004].
- \_\_\_\_\_. SC Europe and Atlantic, *Bi-SC Guidelines for Operational Planning (GOP)*, January 2001.
- \_\_\_\_\_. Standardization Agreement STANAG 5516.
- Nichiporuk, Brian. *Forecasting the effects of Army XXI Design upon Multinational Force compatibility (RAND Study)*, Santa Monica, CA, 2000.

- O'Connor, Richard. *The Spirit Soldiers: A Historical Narrative of the Boxer Rebellion*. New York, 1973.
- Potts, David. (Ed.), *The Big Issue: Command and Combat in the information Age*, reprint by DoD Command and Control Research Program, 2003.
- Robinson, Paul and Pickard, Iain. The UK approach to future Command and Inform (C4ISR), in: *Journal of Defence Science*, vol. 8, no. 3: p. 179-190.
- Rumsfeld, Donald H. US Secretary of Defense, *Transformational Planning Guidance*, Washington April 2003.
- Schneiderhan, Wolfgang. Chief of Defense, German Bundeswehr, *Speech in front of the Federation of German Industries*, November 18th, 2003; transcript Online: [www.bmvg.de/archiv/reden/inspekteure/031118\\_gi\\_network.php](http://www.bmvg.de/archiv/reden/inspekteure/031118_gi_network.php), [Accessed 05 December 2004].
- \_\_\_\_\_. Chief of Defense, *German Bundeswehr, NATO--cornerstone of German Security and Defence Policy*, Nato's Nations And Partners For Peace: Welcome to the Club: Prague Summit, Uithoorn, 2002. Iss. 4, p. 93-100.
- Schoomaker, Peter J and Vassalo, Anthony W. The Way Ahead, *Military Review*, Fort Leavenworth: Mar/Apr 2004. Vol. 84, Iss. 2, p. 2-16.
- Schwiebert, Reiner. IRAQI FREEDOM - Hat Network Centric Warfare die Feuertaufe bestanden? In: *Soldat und Technik*, 2-2004.
- Shelton, Henry H. Chairman of the Joint Chiefs of Staff, prepared by Joint Staff/J5; Strategy Division, *Joint Vision 2020*. Published by: U.S. Government Printing Office, Washington, DC, June 2000.
- Skillet, Wayne. Alliance and Coalition Warfare, in: *Parameters*, US Army War College Quarterly, Summer 1993.
- Sollfrank, Alexander. Digitalisierung verändert Operationsführung des Heeres, in: *Soldat und Technik*, 03-2003: p. 20-25.
- Stingel, B. and Buchin, Boyd. Network Centric Warfare – Ganzheitliche Sichtweise moderner Operationsführung, in: *IT-Report Mai 2003*, Report Verlag, Bonn, May 2003.
- Storlie, Chadwick. The liaison Coordination Element, in: *Special Warfare*, Spring 1999.
- Struck, Dr. Peter. Bundesminister der Verteidigung, *Grundzüge der Konzeption der Bundeswehr*, Berlin 2004, Online [http://bundeswehr.de/misc/pdf/broschueren/broschuere\\_kdb.pdf](http://bundeswehr.de/misc/pdf/broschueren/broschuere_kdb.pdf); Online; [accessed on 09 Dec 2004].
- \_\_\_\_\_. German Secretary of Defense, *Speech at the 12<sup>th</sup> Forum on Security Policy Berlin*, transcript Online [www.bmvg.de/archiv/reden/minister/040126\\_punktuation\\_struck\\_tagung.php](http://www.bmvg.de/archiv/reden/minister/040126_punktuation_struck_tagung.php), [accessed 05 march 2004].
- Swatek, Bruce. *Role of Special Forces Liaison Elements in future multinational operations*, MMAS thesis, Fort Leavenworth 2002.
- Toomey, Christopher J. Army Digitization: Making it Ready for Prime Time, *Parameters*, Carlisle Barracks: Winter 2003/2004. Vol. 33, Iss. 4, p. 40-53.

- U.S. Central Command. Online, <http://www.centcom.mil/Operations/Coalition/joint.htm> [accessed on 16 October 2004].
- U.S. Department of Defense, Network Centric Warfare - Report to Congress, Published by: U.S. Government Printing Office, Washington, DC, 27 July 2001, [http://www.dodccrp.org/NCW/NCW\\_report/report/ncw\\_main.pdf](http://www.dodccrp.org/NCW/NCW_report/report/ncw_main.pdf).
- \_\_\_\_\_. Joint Chiefs of Staff, Joint Publication 1-02 (Dictionary of Military and Associated Terms).
- U.S. Department of the Army. Army Transformation Office, *2004 Army Transformation Roadmap*, Washington 2004.
- \_\_\_\_\_. FM 3-0.
- \_\_\_\_\_. FM 6-0.
- \_\_\_\_\_. Office of the Assistant Secretary of the Army (ALT), *Unites States Army Weapon Systems 2004*, Washington 2004.
- \_\_\_\_\_. *The Army Plan FY 2006-2023*, Washington DC.
- \_\_\_\_\_. TRADOC, *Army Concept Development and Experimentation Campaign plan, Status Briefing as of 29Sep04*, 2004.
- \_\_\_\_\_. TRADOC COCOM briefing “UEy and UEx - Designing a Campaign Quality Army with Joint and Expeditionary Capabilities”, 8 July 2004, unpublished.
- \_\_\_\_\_. TRADOC Commanding General. *The Army Future Force: Decisive 21<sup>st</sup> Century Landpower*, Fort Monroe August 2003. Online [www.tradoc.army.mil/dcsdcs](http://www.tradoc.army.mil/dcsdcs) [accessed in July 2004].
- \_\_\_\_\_. TRADOC Pamphlet 525-5, *Force XXI Operations*, August 1994.
- \_\_\_\_\_. TRADOC Pamphlet 525-3-0.1, *Future Force Battle Command*, Jan 2004.
- \_\_\_\_\_. TRADOC Pamphlet 525-3-9, *Objective Force-Fires and Effects*, coordinating draft, 2 July 2003.
- \_\_\_\_\_. TRADOC Pamphlet 525-3-92, *Unit of Employment*, approved concept, 2 June 2003.
- \_\_\_\_\_. TRADOC Task Force Modularity, *Army Comprehensive Guide to Modularity (version 1.0)*.
- \_\_\_\_\_. TRADOC, UE Operations White paper version 2.4 as of February 2004.
- U.S. JFCOM. Online, [www.jfcom.mil/about/experiments/multinational.htm](http://www.jfcom.mil/about/experiments/multinational.htm) [accessed on 12 Dec 2004].
- Weiner, Tim. *Pentagon envisioning a costly internet for war*, The New York Times, 13 November 2004 Late Edition, Section A, Page 1.
- Young, Thomas-Durell (et al.). *Multinational land formations and NATO – Reforming practices and structures*, Strategic Studies Institute, US Army War College, Carlisle 1997.

Zanini, Michele and Taw, Jennifer Morrison. *The Army and Multinational Force Compatibility*,  
RAND – Arroyo Center, Santa Monica 1999.