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Information as a Key Resource:
The Influence of RMA and Network-Centric Operations on the Transformation of the German Armed Forces

By Dr. Sabine Collmer

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The Influence of RMA and Network-Centric Operations on the Transformation of the German Armed Forces

By Dr. Sabine Collmer[*]

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Table of Contents

1. Security, War and Technology[1]

Information technology has had an almost unparalleled influence on the modernization and transformation of the armed forces in Western societies in recent years. Many areas of the US military in particular have been specially equipped with modern network-shaped technology since the 1990s, with the aim of achieving a qualitatively new degree of precision and speed in military operations. The *Revolution in Military Affairs* (RMA), and its implementation in the doctrine of *Network-Centric Warfare* (NCW), have become new military strategy paradigms for the US armed forces. Along with the security policy redefinition of the threat situation following the end of the Cold War, this development constitutes the strongest impetus for change in the armed forces of Western European countries. This discussion must begin with a warning that the development being described is more complex than it may appear at first glance. The desire to attribute the transformation of the armed forces solely to technological innovation and a techno-deterministic impetus is one-dimensional and falls far short of the truth. The concept underpinning the revolution in military affairs comprises a multitude of factors such as security policy, military strategy and socio-political decisions in addition to the technological ones, all of which exert their own influence in tandem with the new technology. For this reason, an explanation that attributes the changes in the armed forces of Western Europe solely to the considerable speed of technological innovation must necessarily be incomplete. Instead, technological progress appears to be embedded in political, social and strategic changes and decisions. A contribution that seeks to analyze the influence of RMA must consequently always take into account a whole cluster of causes and effects.

New security policy constellations, new actors on the world stage and an increasing asymmetry of force form the background to contemporary armed conflicts. Nowadays, fragile and failing states and power vacuums during regime transformations, as well as poverty, a lack of prospects and shadow globalization, have replaced bloc confrontation and nuclear overkill as threats to world peace. A large number of actors – ranging from guerilla groups and partisans, warlords, pirates and arms dealers to mafia groups, terrorists and corrupt public servants – are contributing to the destabilization of many regions of the world. As the key technology of globalization, information technology plays an important role in this regard and is also making 'information' increasingly significant as a key resource in warfare. This is where the concepts of information warfare and network-centric operations developed under the RMA paradigm come into play.

This essay will analyze the influence exerted by the paradigm of the *Revolution in Military Affairs* on the transformation of the Western military in general, and the situation in the German armed forces in particular. The characteristic features of RMA are best understood by gaining an insight into its origins. Once the term has been defined, a brief historical outline will clarify how the concept of war has changed under the influence of RMA and NCW. The discussion will be based on the US armed forces' most recent campaign in Iraq. Subsequently, this paper will analyze the status of efforts to transform the German armed forces, describe the state of the art implementation of the new Bundeswehr Concept for Network Centric Operations (NCO), and present the results of a survey of student officers on the topic of RMA and transformation.

The different reception accorded to RMA in the US and Europe and the varying speeds of implementation have led to warnings of a transatlantic technology gap and increasing interoperability problems in multinational operations. The nature and extent of the gap between US and European armed forces will be discussed below, and will be followed by an evaluation of the opportunities and risks posed by RMA in light of the changed global security situation.

2.   The Origins of RMA: Background and Definition of the Term

The term *Revolution in Military Affairs* refers to theories on the future of warfare, and is thus usually linked with proposals for technological and organizational changes to the armed forces. The concept originated in the US, and has been viewed since the early 1990s as the most significant innovation in conventional warfare (Müller/Schörnig 2001). The focus is on using information and communications technology for the armed forces, in the belief that this makes a radically different and qualitatively superior form of warfare possible.

The analysis conducted by Soviet academics and military strategists in the 1970s of the changed orientation of US defense policy following the end of the Vietnam War had already determined that the introduction of such high-tech weapons systems as cruise missiles and stealth technology would put the West in a position of qualitative superiority over the Warsaw Pact nations. Thus, the then Chief of the General Staff of the Red Army, Marshall Nikolai Ogarkov, spoke in 1982 of a "military-technical revolution" (MTR) within the US military, which Soviet troops would be unable to equal for a generation or two (see Erger 2005:2). The idea of a revolutionary change was subsequently adopted by the US strategic community when it launched a discussion on the further military revolutions needed in the US. Operation Desert Storm in 1991 is generally seen as the starting point for the discourse on RMA, which replaced the term MTR (see Biddle 1998; Sterner 1999; Erger 2005). During the Gulf War in 1991, the US military used PGM[2], laser-guided weapons and satellite-guided navigation (GPS[3]) for the first time against the primarily Soviet-equipped Iraqi army. Operation Desert Storm was an overwhelming success by military standards, as the war was won very rapidly and American losses were kept to a minimum. A characteristic aspect of this type of warfare was already becoming evident, namely the concept of the 'clean war', in which unnecessary losses are avoided. "The success of Desert Storm also transformed the expectations of what was achievable by military means. Now that the Cold War had ended, war – if one had the ability to fight and win as in Iraq – appeared once again to be a useful tool for politics. Since blurred images of precision bombardment dominated the TV coverage of war and the military control over pictures was tight, the war appeared to be clean, almost a technical problem waiting to be solved. Politicians and the military leadership recognized the potential of the new kind of war" (Erger 2005:2). The avoidance of losses, which can cause a feared shift in public opinion and hence a loss of legitimacy for a military operation, has become a fundamental objective today in times of a shift towards the "post-heroic society", a

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[2]   PGM = Precision Guided Munitions.
[3]   GPS   = Global Positioning System.

society with shrinking acceptance of casualties - and RMA is seen by many as some kind of remedy.

In the US, the Office of Net Assessment (ONA) and its director, Andrew W. Marshall, assumed hegemony over RMA discourse in the ensuing period. The Gulf War in 1991 had shown that approaches already existed at the operational level for a revolutionary new form of warfare. However, proponents of this strategy, such as Andrew Krepinevitch, argued that this needed to be supplemented by organizational reforms in the military (Krepinevitch 1994). Operation Allied Force in Kosovo in 1999 ultimately gave the international public a preview of what the high-tech wars of the future might look like. References were made to "surgical" interventions and targeted precision strikes. German commentators were initially skeptical and cautious about the effects of RMA on warfare: "Traditional combat between troops involving direct mortal danger has been replaced by the destruction or neutralization of a very distant, and hence invisible, opponent and its infrastructure. In the wars of the future, the post-modern soldier will be a data processor at a PC, who will record, forward and process digitalized signals, thereby enabling the combat mission to be run in a quasi aseptic manner, featuring precise weapon use and a high level of information while leaving death out of the equation" (Stockfisch 2000:9). NATO spokesman Jamie Shea popularized the notorious term "collateral damage" in his daily media conferences from NATO headquarters, which is also connected to the important issue of casualties. Both the choice of terminology and RMA's idealized promises caused major controversy among a European general public that was becoming increasingly critical of these security policy issues.

John Arquilla and David Ronfeld, who are apologists for information warfare and cyberwar, can also be numbered among the guiding intellectual forces behind network-centric operations in the broader sense. Their article entitled "Cyberwar is Coming!" which has since become famous, already predicted in 1993 that new forms of conflict would emerge in which advanced technology would play a fundamental role. They call this kind of warfare "cyberwar", and point out that the idea of an "electronic battlefield" alone falls far short of the complete picture. Instead, they emphasize that cyberwar relates first and foremost to the strategic control of information during wartime. The authors were already warning at the time that the US military required wide-ranging restructuring (Arquilla/Ronfeld 1998). John Arquilla reaffirmed his theories once again in an online interview in 2001: "What we realized ten years ago is that if you can control information flows, an opposing military cannot function [...] Cyberwar techniques will transform military operations in the 21st century as much as the aircraft immediately transformed warfare both on land and sea in the early days of the 2nd World War [...] I think that's a terrible problem for our military, if we remain unwilling to reform and redesign our military institutions based on the implications of these information technologies" (Arquilla 2001). Cyberwar involves a conflict with "weapons" in the virtual domain, with the weapons in this context being information technology tools. The aim of cyberwar is to disrupt the opponent's computer systems in such a way that they are no longer able to perform their task. For this reason, the opponent's critical infrastructure is the main target of attacks in a cyberwar[4]. Although scenarios had already been developed for the targeted disruption of dams, nuclear

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[4] A document entitled "Information Operations Roadmap" was finally published in October 2003. It was signed by Secretary Rumsfeld, and deals with the broad spectrum of "information warfare" and "electronic warfare", from psychological operations (PsyOps) to attacks on enemy computer networks in the way that Arquilla and Ronfeldt had urged (see Brookes 2006). The National Military Strategic Plan for the War on Terrorism published on February 1, 2006 also emphasizes the importance of military "Information Operations (IO)" (see Pace 2006).

power plants and power stations during the war against Serbia in 1999, these were never implemented due to the uncertain legal position and assessment of cyberwar under international humanitarian law. At the time, the Pentagon's legal department warned against the risks of a cyber offensive which may not have been covered by the international law of war. Instead, a decision was taken to paralyze Serbian infrastructure using conventional means (3sat 2005).

Another problem, as Bruce Berkowitz put it, was that instruments of cyber warfare, although developed within junior ranks of the US military, were just too new to the top commanders, who tended to rely instead on traditional means of warfare. "The Air Force, Army, and Navy had lots of ways to spoof or jam a radar network so a bomber could pass by safely. They even had psychological warfare materials designed to make a Serb airman or soldier want to go back home to his mommy in Novi Sad. But no one wearing a uniform was thinking about a plausible way to make the owner of a steel factory in Smederevo worry about losing his stash in Nicosia" (Berkowitz 2003:150).

Ideas on RMA finally arrived in the inner circle of the US political system when George W. Bush was sworn in as the 43rd President of the United States in January 2001. Shortly after taking office, Bush ordered a complete review of the US military. Aggressive reformers and staunch advocates of RMA arrived at the Pentagon in the shape of Donald Rumsfeld and Paul Wolfowitz, who immediately launched a far-reaching transformation of the US armed forces. In October 2001, Arthur Cebrowski, a retired Navy vice admiral was appointed as the first Director of the Pentagon Force Transformation office and from then took the lead in transforming military thinking about future readiness and combat needs of the United States. A Department of Defense strategy paper from 2001 went so far as to equate the key term of "transformation" with the development and implementation of fighting strength profiles, which confer revolutionary or asymmetric advantages on specific units, as opposed to simple "modernization", which aims to maintain and improve fighting strength (DoD 2001). Thus, the reforms embarked upon by the US military are not restricted to a purely technological improvement or increase in fighting strength, but instead involve a dramatic or revolutionary change in the structure and organization of the armed forces. Three levels of warfare are identified: in addition to the physical level (where such operational activities as engagement, maneuvers, and defense occur) and the cognitive level (where the processes of recognition, evaluation and comprehension of a situation occur, along with the command and morale of the troops), the information level is now coming to the fore. The information level holds a special position within the RMA paradigm because, as has been stressed, an assumption exists that it has an inordinately large influence on an army's fighting strength. Thus, superiority at this level can also compensate for inferiority at the physical level (see Plogmann 2005:39-41). Modern information technology is consequently the most important key technology for attaining information sovereignty.

Some of RMA's potential appears to have been fulfilled during the US campaign in Afghanistan in 2001. In the difficult and inaccessible terrain of the Hindu Kush, precision weapons, satellite-supported network-centric command, and reconnaissance from unmanned Predator drones (known as UAV's[5]) were used in combination with a small number of well-trained and flexible special units. Most of the basic ground troops were in fact provided by the local Northern

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[5] UAV = Unmanned Aerial Vehicle.

Alliance. This constellation, which presented a low risk to the US troops, resulted in only a single American losing his life in Afghanistan by the end of November 2001[6] (Erger 2005:3).

The main document outlining the RMA strategy of the US military, named "Joint Vision 2020", is an update of Joint Vision 2010 from 1996 (see Shalikashvili 1996; Sheldon 2000). This document describes all of the main efforts made to transform the US military. The introduction defines the objective: the US' position of supremacy is to be secured with the assistance of armed forces that will be more rapid, lethal and precise by 2020 than they are today. To attain this objective, progress must be made in integrating core competencies in the individual branches of the armed forces. This emphasizes the issue of "jointness" in the armed forces: "To build the most effective forces for 2020, we must be fully joint: intellectually, operationally, doctrinally, and technically" (Sheldon 2000:2). "Full spectrum dominance" has been identified as the military's main objective, which aims to achieve superiority of action across the entire spectrum of armed conflicts – from major wars to regional conflicts to humanitarian aid and disaster relief.

The frequency with which the terms "information" and "information technology" are used in the document illustrates the significance being attributed to them in relation to other factors in terms of ensuring the superiority of the US military. "Information superiority", which goes beyond the pure collection and analysis of large volumes of data, is to be combined with the capability to rapidly achieve "decision superiority"[7]. To this end, extensive secret service resources are to be used in conjunction with surveillance and reconnaissance to create a *global information grid* (GIG), or information technology-based network environment. The Joint Chiefs of Staff who published Joint Vision 2020 envisaged this as consisting of a globally operated network with a technical basis and experts who can be brought in at any time (not only in the event of war) to analyze and interpret the huge volumes of data (Sheldon 2000:12). The Joint Vision lists the following operational concepts: dominant maneuver, precision engagement, focused logistics, full dimension protection, information operations and joint command and control. Joint Vision 2020 also contains information on interoperability issues and on multinational operations (Sheldon 2000; Theile 1999). The next chapter makes a further reference to the central importance of information technology in achieving the objectives identified which, in combination with intellectual innovation, should result in the desired changes being made to the doctrine and organization of the armed forces.

In general, Joint Vision 2020 and its predecessor document are highly abstract strategy papers, which outline the overall planning for the US armed forces without going into technical and organizational details. This format is provided by the term "Network-Centric Warfare" (NCW), which emerged at the end of the 1990s and has since attained a status in the military comparable to that of the term "e-business" in industry (Plogmann 2005:48). Since then, NCW has become the central concept of RMA. Networking all entities within a single area of operations seeks to overcome existing range-based restrictions, while simultaneously increasing reaction speed and precision. NCW distinguishes between three levels in a network: sensors, deciders and (weapons) systems (or effectors) (see Alberts et al. 2000). The following diagram illustrates the interaction between the three levels:

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[6]   The individual in question was a CIA agent, who was killed during the prison uprising in Mazar-i-Sharif.

[7]   This reminds significantly to the OODA-loops concept of John Boyd, a U.S. strategist and fighter pilot, who claimed that the key to success in conflict is to operate inside the opponent's decision circle and to outpace the ability of the foe to react effectively in time (Hammond 2001:5).
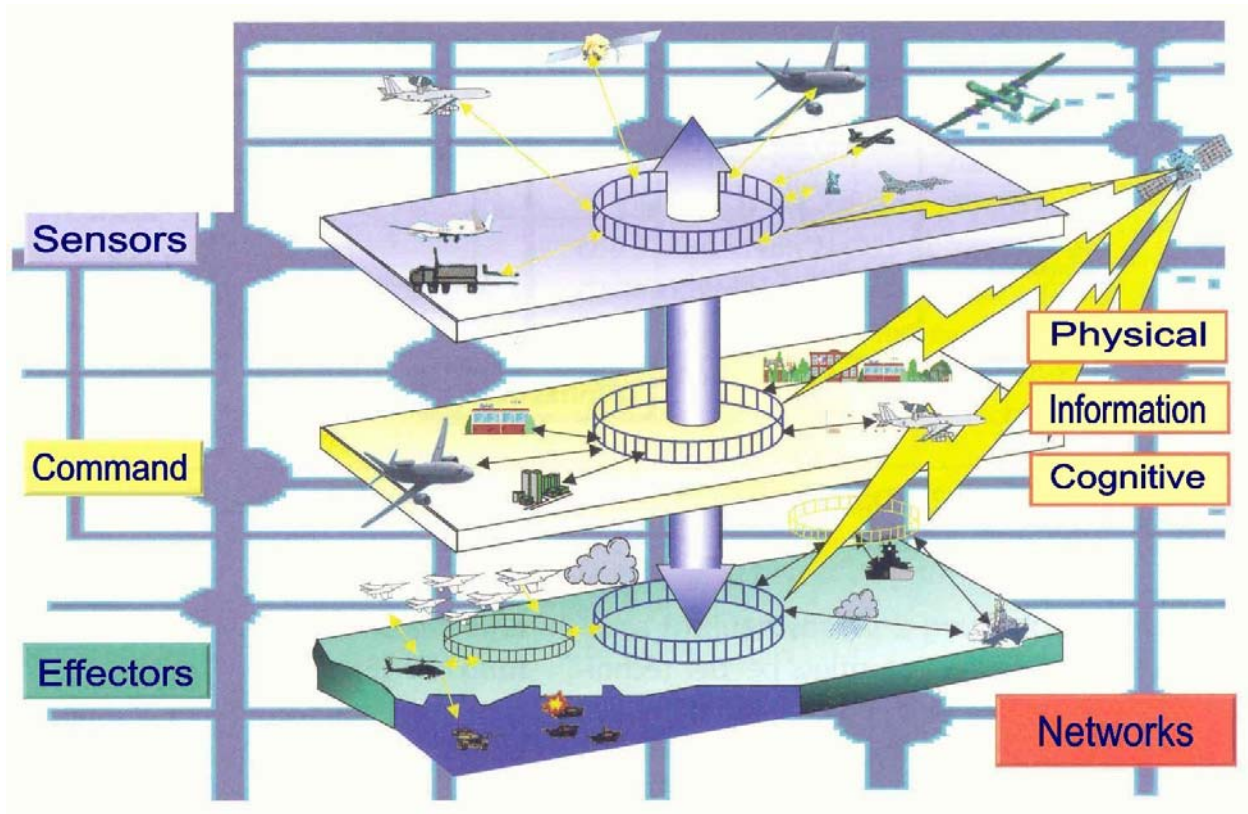
The three levels of network-centric operations (*Source: Wellbrink 2005:21*).

Sensors are devices and technology for recording information. Decisions on how to proceed are made at the decider (or command) level, which will then affect the (weapons) systems (or effectors) level, where appropriate. The decisive element in this context is that range and speed can be increased immensely with the assistance of information technology. The close networking of the information level with the physical and cognitive levels is of equal importance. The ideal scenario would thus result in self-synchronization, where all of the entities merge into a single collectively functioning entity. Another characteristic is that each weapons platform benefits from a comprehensive battle picture, which far exceeds the data it could collect on its own. This picture is composed of an amalgamation of data from all of the other available sensors (Wellbrink 2005). However, how are these NCW ideals being implemented in practice? What effect do they have on warfare? Operation Iraqi Freedom, the war being waged by the US and its allies against Iraq since 2003, is considered by military observers to be the first test case involving the large-scale implementation of the NCW concept.

3. New War? The Effects of RMA on Warfare

Elements of NCW were first used on a large scale in the military offensive conducted by the US and its allies in 2003 during the war in Iraq. The proponents of NCW were enthusiastic: "We have crossed the threshold of a new form of warfare" (Graefe 2005:1). The military command (CENTCOM in this case) was connected with almost all units of the US armed forces via direct data links (e-mail, video conferences). Radar data were sent in real time to ships, aircraft, tanks and other combat units, and most were equipped with friend-foe identification to enable the commanders to gain a precise overview. Furthermore, mission data, maps, satellite images, operation videos of previous missions and up-to-date information on stock, weapons and the condition of devices and vehicles could be retrieved via a form of intranet (Fitschen 2005).

A kind of "war without a front" was conducted as part of the strategy of "maneuver warfare", which involves using the space available for surprise maneuvers and maneuverability. Furthermore, the wide-ranging freedom of action resulted in flexible action at all command levels in conjunction with the networking in an *all-actors-network* (Fitschen 2005:89).

Operation speed also increased immensely, primarily due to more rapid access to information. Use was made not only of the AWACS airborne early warning system, but also of the JSTAR[8] ground early warning system, which is not affected by weather, and unmanned drones such as Global Hawk and Predator and mini-UAV's (Fitschen 2005:90). Long-distance reconnaissance was performed using a selection of drones with different ranges. Some observers are speaking of a "virtualization" of war, as the Global Hawk drone, for example, flies at an altitude of 20 km and is equipped with sensors and a SAR[9] radar for performing high-altitude reconnaissance which can remain undetected on the ground. High-altitude reconnaissance of this kind has extremely good resolution, with a football remaining recognizable at a flight altitude of 10 km. This system provided half of the target coordinates of the Iraqi air force and a large number of the coordinates of Iraqi ground units. These actions correspond to the "sensor" level of the NCW concept.

Notable innovations were also employed at the "command" or "decider" level. The DSCS[10] satellite system thus enabled non-interceptable communication links to be used at the strategic level. The Global Hawk drones and cruise missiles were guided with assistance from the MILSTAR system. Furthermore, most of the US ground troops were equipped with GPS-supported systems, and use was also made of the IRIDIUM satellite telephone. Although these digital technologies enabled more data to be processed more quickly, weak spots were also revealed in this context. Not all ground troops were equally well-equipped, which resulted in communication problems and a vulnerability to *friendly fire* incidents. In addition, not all of the communication systems were able to cope with the high speed of operations (Fitschen 2005:91). The entire field of C4ISRT (*command, control, communication, computers, intelligence, surveillance, reconnaissance and targeting*) thus remains the Achilles heel of the NCW concept.

Finally, a trend continued at the third level of "effectors" or weapons systems that had already begun to emerge in the Gulf War in 1991 and the war in Kosovo, namely an increase in long-

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[8]   JSTAR = Joint Surveillance Targeting Attack Radar System.
[9]   SAR   = Synthetic Aperture Radar.
[10] DSCS   = Defense Satellite Communication System.

range precision weapons and the use of light units supported by special operation forces (SOF). The precision munitions is guided to its target by laser, infrared, or satellite signals, and is thus unaffected by weather and the time of day. Of the estimated 29,000 bombs that were deployed, 70% were precision-guided (see Fitschen 2005:92). An impressive example of the enormous increase in the speed of war fighting is the fact that a process such as locating and destroying enemy missile positions using air-to-surface missiles, which still took around two days during Operation Desert Storm in 1991, now takes only two minutes using the NCW variant (Plogmann 2005). Special units, whose broad spectrum of tasks ranges from obtaining information to coordinating air strikes to performing commando operations, also assume greater significance. Unlike heavy armored formations, these units are considered indispensable to NCW (Schreer 2003). Special infantry units are also able to rely on substantially improved equipment under NCW conditions. New materials have helped to create a combat uniform that is both lighter and allows greater freedom of movement than earlier variants, while at the same time being completely bulletproof - at least as far as the torso is concerned. This has been made possible by a new liquid material (STF), which is used in combination with Kevlar. If a bullet strikes the uniform, the material converts itself into a solid substance that prevents the projectile from penetrating the soldier's body (Johnson 2004). To further increase the war fighting capabilities of infantry troops, research is currently being conducted into the manufacture of a combat uniform capable of closing around a wound in the event that the wearer is injured, and which is able to secrete medication if needed or stiffen automatically into a splint around a broken leg[11] (Rögener 2005).

However, alongside all of the information on increases in efficiency and effectiveness, lessons learned papers and after-action reports also revealed shortcomings caused by technological flaws and equipment deficiencies (see Fitschen 2005). It is also becoming clear that the dispute between the advocates of transformation and the traditionalists in the US military has not yet been resolved. While the former Secretary of Defense Rumsfeld increasingly supported light and flexible units like the new *Stryker Brigade*, the After Action Report by the Third Infantry Division evokes the continued importance of armored units, which use heavy battle tanks and armored personnel carriers (see US Army 2003). All in all, the example of the war in Iraq in 2003 shows that a war based on NCW results not only in the increased networking of all participants in the network, but also extends the radius of the actors' information horizon and generally steps up the pace of the warfare. Although the ideas in the Joint Vision and NCW were not fully implemented, observers agree that the latest campaign in Iraq marked a turning point in military history: "Clausewitz would have been amazed to discover that an army can defeat an opponent with three times the numerical superiority without incurring major losses. Thanks to modern information systems, the 'fog of war' can be reduced to a small cloud" (Plogmann 2005:92).

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[11] Although this may sound like science fiction, it is actually already being tested using nanotechnology. The American Institute for Soldier Nanotechnology (ISN), which was founded in 2002, is working on an "intelligent uniform" that contains tiny computers integrated into the combat uniform, which derive their energy from the soldier's movements or can measure the biochemical processes in the body and secrete drugs to combat exhaustion, where necessary (see Rögener 2006).

4. The Bundeswehr and RMA

4.1 *The Transformation of the German Armed Forces*

The Bundeswehr has not exactly suffered from a shortage of reforms in the past. The Army alone has already undergone four structural reforms since German reunification and the integration of the two German armies. The Bundeswehr's new orientation has meant that it has been engaged since 2001 in the most fundamental change since German unification. Alongside the impetuses being generated by new security policy actors in world affairs, the challenges posed by RMA in the US currently constitute the strongest driving force behind the transformation of the German armed forces.

This was not always the case, however. Observers have criticized the Federal Republic of Germany's defense policy in the 1990s for having either ignored the significance of information technology as the driving force behind the transformation in warfare or dismissing it in a techno phobic manner as "exotic technology" with few advantages (Mey 2000). The constantly shrinking defense budget made inevitable by the discourse on the so-called "peace dividend" after the Cold War also played a role, and ruled out armaments involving new technology. Ultimately, Germany's abstinence from RMA has been attributed to the then Defense Minister, Volker Rühe, who was politically ambitious but did lack vision, and thus considered only his own career plans when choosing not to oppose the cuts to the defense budget (see Lungu 2004). An evaluation of public opinion on security and defense policy during the 1990s reveals a clear trend towards an increasing loss of significance by the armed forces. Germans' attitudes and opinions reflected their hopes for a new start which would bring economic prosperity and political stability to all. The armed forces – even if they were "reunified" – played a fairly secondary role in this context in the eyes of many Germans (see Collmer 2002; Bulmahn 2004). This trend was also reflected in political decisions on the future direction of the Bundeswehr. Observers believe that politicians remained skeptical about RMA until the end of the 1990s. Thus, a summary of the situation in the German armed forces in 1998 stated that: "Strategic information warfare across the depth of a battlefield is still very much in the conceptualization stage" (Laird/Mey 1999:86). The FRG's defense concept at the time still retained a strict territorial orientation, and the term "projection of power" did not appear at all in official Bundeswehr literature, to the surprise of foreign observers (Lungu 2004:266). Despite repeated involvement in various foreign operations, the Bundeswehr's "wake up call" only came with the Kosovo crisis and the war against Serbia in 1998-1999. The new global security situation and the acute crisis on Europe's doorstep led to the conclusion that a concept of purely territorial defense could no longer be maintained.

The *Verteidigungspolitische Richtlinien* [Defense Policy Guidelines – VPR] of May 2003 and the *Konzeption der Bundeswehr* [Bundeswehr Concept – KdB] of August 2004 ultimately reflected the paradigm shift in the tasks of the Bundeswehr. In addition to traditional homeland defense, these include the "more probable international conflict management operations" (Bundeswehr Online 2005). The transformation aims to improve operational capabilities in areas ranging from conflict prevention and crisis management to combating terrorism. "Three-block war" scenarios, which simultaneously involve armed conflict, stabilization operations and humanitarian aid, are considered likely and pose new challenges for army troops in particular. However, while the US concept is focusing on the element of "jointness" between the branches, the Bundeswehr is concentrating on a capabilities oriented concept: "Our partners' experiences

in Afghanistan and the war in Iraq show that a broad spectrum of capabilities, ranging from 'combat' to 'nation-building', can be covered more efficiently through stronger differentiation within the armed forces in terms of their specialist capabilities. The force categories identified in the KdB – *Eingreifkräfte* (Response Forces; EingrKr)[12], *Stabilisierungskräfte* (Stabilization Forces; StabKr)[13] and *Unterstützungskräfte* (Support Forces; UstgKr)[14] – implement this necessary task and operation-related differentiation of structures and equipment" (Voll 2005:21). And the White Paper for German Security Policy states: "Depending on operational demands, there will be different levels of capability in the response, stabilization and support forces. All force categories, however, will be networkable to the extent that they can support each other effectively." (White Paper 2006:107).

The Bundeswehr defines the term "transformation" as follows: "Transformation is the shaping of a continuous, foresighted process of adaptation to a changing security policy environment, to increase the operational capabilities of the Bundeswehr and maintain them in the long term" (Thiele 2005:7). This definition emphasizes the long-term perspective of evolutionary change, in contrast to the US definition which highlights the revolutionary element, as shown above. The German approach places a clear emphasis on the new defense policy concept of the *"Armee im Einsatz"* [deployment force] and interoperability between the branches of the armed forces and with international partners. The commitment to make around 25% of the force available to the NATO Response Force, while simultaneously enhancing the European Union's rapid reaction forces through a significant contribution to the EU Battle Groups, constitute major undertakings by the Bundeswehr, which will drive forward and structure the transformation into a deployment force.

Network-centric operations [*Vernetzte Operationsführung* – NetOpFü] capabilities are a core element of the transformation. Echoes of the concept of NCW can be found in the definition of the term: "NetOpFü means the command and deployment of armed forces on the basis of a joint interoperable Bundeswehr communication and information system across all command levels, which connects all relevant individuals, locations, units, facilities and sensors and effectors with one another. Information superiority is to be attained and ultimately translated into superiority of action in this manner" (*Teilkonzeption* [Concept Paper] 2005:10). The security policy grounds justifying foreign deployment of the Bundeswehr diverge from the US concept. Ensuring stability in conjunction with multinational partners and faith in preventive crisis intervention are central tenets of German security policy: "This is closely linked to reflections on conflict avoidance and prevention which basically adhere to the general principle that prevention is better than the cure. The basic idea that you should not destroy what you have set out to protect is an important framework condition for external intervention in domestic conflicts. The use of force should naturally be very limited and very selective" (Thiele 2005:10). Although German politicians responsible for security and defense are reaffirming their willingness "to achieve freedom and human rights, and stability and security, using military means where necessary" (Struck 2004), they are simultaneously emphasizing that this must occur in accordance with international law and solely with the aim of preventing crises and resolving conflicts. Furthermore, the Bundeswehr's leadership has come to realize that armed forces are not equally well-suited to fighting every form of organized violence (Weiler 2002). As historical experience

[12] *Eingreifkräfte* (Response Forces): a total of 35,000 are to be made available.
[13] *Stabilisierungskräfte* (Stabilization Forces): a total of around 70,000 are to be made available.
[14] *Unterstützungskräfte* (Support Forces): a total of around 147,000 are to be made available.

has shown, regular units tend to exhibit significant disadvantages whenever non-state actors succeed in countering the conventional superiority of regular troops through asymmetric means (van Crefeld 1998; Daase 1999; Koch 2002). Given the current threat analysis, support for multilateral security provision constitutes a fundamental principle of German security and defense policy. The unmistakable rejection of a unilateral approach to global warfare marks a crucial distinction between the German and American positions. This is underlined firmly in the new White Paper (2006) which states: "German security policy is multilateral in character. Together with the member states of the European Union, Germany is committed to active multilateralism. No state in the world nowadays is able to ensure its security on its own" (White Paper 2006:29).

4.2 Implementing the New Bundeswehr Concept: Equipment-Related Examples

According to the new Bundeswehr Concept, both response forces and stabilization forces should be "combat qualified" (Voll 2005:22) and achieve "operational interplay" (op.cit.). They thus require compatible equipment. An example is the "*Infanterist der Zukunft*" [Infantryman of the Future – IdZ], which is a comprehensive equipment package for ground troops containing some C4ISR elements. Distribution to paratroopers, mountain troops and light infantry troops began in 2004.

IdZ involves equipping infantry units composed of ten soldiers with computer and radio headsets, satellite positioning, a digital compass, night vision equipment, binoculars with an integrated laser rangefinder and a modular protective vest (SZ 2004). The modular combat kits are already being used in Kosovo and Afghanistan. The centerpiece of IdZ consists of C4I capability, namely the NAVICOM for voice and data communications and a PDA[15] - the Navipad - equipped with wireless LAN. The following quote describes the way in which the components result in an improved grasp of the situation during an operation:

 "Each soldier in the group knows where his comrades are. Not just in the group, but also at higher levels [...] The laser rangefinder is incorporated into a pair of binoculars. Range data gathered by the rangefinder also are transmitted via the wireless local area network to the Navipad, which may then be shared with the squad members or transmitted to other units. In addition, IdZ squads are equipped with a digital camera called a Vector that can transmit data wirelessly. It can be used for reconnaissance purposes as a remote observation device or to identify individuals at checkpoints during peacekeeping operations. Imagery captured by the camera can be transmitted back to headquarters or used by the squad to create three-dimensional digital pictures of buildings or other objectives it may have to attack or secure" (Kenyon 2004:3).

Another example of a technological innovation that is important to C4ISR capabilities is the army information system for computer-supported operation command (HEROS), which ensures interoperability with EUROCORPS and the German-Netherlands Corps and is already being used in operations today. Other elements include tactical command equipment (FAUST) and other systems with C2 functions, such as C@S for the navy and the German Air Force Command and Control Information System (GAFCCIS) for the air force. In order to create more network-

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[15]   PDA = Personal Digital Assistant.

oriented C2 infrastructure, military planning intends to adopt a command information system that achieves interoperability between FAUST and HEROS. In terms of ISR capabilities, the Bundeswehr's UAV's should be mentioned, which supply infrared recordings. In addition, several variants of HALE (High Altitude) UAV's and MALE (Medium Altitude) UAV's were in planning (Adams et al. 2004:48ff). In December 2006 the first German reconnaissance satellite system SAR-Lupe (Synthetic Aperture Radar) was launched into orbit, it has a spatial resolution of less than one meter and will deliver up-to-date and highly detailed images from virtually all regions of the world. The whole system consists of five identical satellites, which will be launched in intervals of six months. With its high-resolution radar SAR-Lupe provides a repetitive, worldwide reconnaissance capability with perfect picture quality, independent of weather and lighting conditions (Treude 2007:5).

Overall, the Concept Papers on Information Operations and Network-Centric Operations show that the Bundeswehr is embarking on far-reaching restructures of the armed forces in relation to RMA concepts. However, this comprehensive process of transformation is still in its initial phase, and this is especially true of the paradigm shift in equipment planning. Procurement must move away from the traditional approach of purchasing successor models of existing systems, with all procurement procedures instead being evaluated on the basis of their suitability for the new tasks. The budget will also play a crucial role in this regard. While the inventory on the condition of the Bundeswehr submitted in 1999 was still lamenting the inadequate equipment and lack of funds (German Federal Ministry of Defense 1999), this trend began to change in 2006. The draft budget for 2006 allocates 23.88 billion euros to the defense budget, with an annual increase in the *Einzelplan 14* [budget section 14] totaling one billion euros as of 2007[16] (German Federal Ministry of Defense 2006). However, the cost of foreign operations not receiving financing from other sources is deducted from this. Observers consider precisely these costs of the Bundeswehr's foreign operations to be "the big unknown" in the defense budget, as they are incapable of accurate prediction due to political uncertainties.

5.   Attitudes of Bundeswehr Student Officers to the Transformation

The transformation of the Bundeswehr is currently taking the form of new structures, the adaptation of materiel and equipment planning, and a new training concept with a greater orientation towards the capability profile of a deployment force. However, what is the attitude of the career soldiers who will be affected by these changes in the future? What do they know about the planned changes, and to what extent do they support the clear breaks with traditional armed forces structures? A survey on the attitudes of Bundeswehr student officers conducted in 2005 gauges the mood among the next generation of leaders in the German armed forces (Steffens 2005).

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[16] In other words, defense expenditure should increase to a total of 24.28 billion euros in 2007, 24.58 billion euros in 2008 and 24.88 billion euros in 2009 (see German Federal Ministry of Defense 2006).

The survey of German officers is based on a representative study conducted by Thomas Mahnken and James FitzSimonds among American officers in 2000 and 2001 (Mahnken/FitzSimonds 2003). For the survey performed at the University of the Bundeswehr in Munich, the questionnaire that had been used in the US was translated into German and sent to the target group online via an e-mail distributor. The questionnaire contained 31 individual questions on attitudes and positions on RMA and the transformation of the armed forces. Due to the non-representative sample (N=288), which focuses on young student officers, the survey conducted at the University of the Bundeswehr in Munich cannot be considered to be representative of the entire German officer corps. However, it does highlight opinions and attitudes among the next generation of German military leaders, and provides the only existing empirical basis for researching the attitudes of German soldiers in this area so far.

The survey looks at three thematic areas in detail: the influence of RMA on threat perception, the influence of RMA on the nature of war, and the influence of RMA on the future structures of the armed forces. In principle, the survey revealed that young Bundeswehr officers have a positive attitude towards RMA, with 96% being convinced of the benefits. They believe that armed forces that work with modern information and communications technologies enjoy a substantial advantage over armies that do not make use of these resources. However, the respondents can also see the possible advantage to potential opponents, with 82% being aware that their opponents are also making use of the possibilities opened up by technology and that this could potentially have consequences for their own armed forces. Furthermore, a large number of the respondents consider information systems and technical networks to be highly susceptible to disruption (88%), and thus that attacks on computer networks will become a central element of military operations in the future (88%).

Will RMA bring about a lasting change in the nature of war? Will RMA result not only in changes to war fighting on land, at sea and in the air, but also extend to space in the future? For the US armed forces, the significance of space to operational command is already a fixed element of strategic planning, even though a series of international disarmament treaties still currently restrict the use of space for military purposes (Mahnken/ FitzSimonds 2003:37). Thus, the *Quadrennial Defense Review* (QDR) of 2001 and the new QDR of 2006 emphasize the key role of monitoring and supporting US military operations from space. RMA advocates believe that future operations will use space more intensively, such as for missile defense, with anti-satellite systems and decision support[17]. The student officers surveyed are clearly aware of this development, as 80% of them assume that greater use will be made of space in the future, and two out of three (66%) also see the need for the Bundeswehr to engage in long-term planning for operational command from space.

These outcomes show a high level of correspondence with the results of the survey conducted by Mahnken and FitzSimonds (2003), who nonetheless warn against deriving a simplified interpretation of officer attitudes from an overview of all of the answers. While the study indicates a high level of approval for information technology-related changes to warfare, this approval remains abstract unless the complementary answers on the willingness of their own ranks - i.e. the respondents' units or branches of the armed forces - to change are also taken into

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[17] The QDR of February 2006 refers to "space-enabling capabilities" and explains that the newly-created position of Executive Agent for Space enables all activities related to the use of space for military purposes to be coordinated (see QDR 2006).

account. The authors summarize this idea as follows: "Our survey found, that the U.S. armed forces are highly supportive of information-age ways of war, at least in the abstract. [...] A large number felt that we either are, or may be undergoing 'radical' change to information-age ways of warfare. What exactly 'radical' change is, however, is open to interpretation. The officers we surveyed tended to equate transformation with marginal improvements to current weapons and doctrine rather than the development of fundamentally new capabilities. A majority believed that today's dominant systems – tanks, manned aircraft, and aircraft carriers – would be as important in twenty years as they are today. And the vast majority of officers were unwilling to reduce force structure or readiness to invest in new approaches to warfare" (Mahnken/FitzSimonds 2003:105-106).

This ambivalence is also reflected in the answers provided by the German officers who participated in the survey. To gauge attitudes on the influence of RMA on the armed forces, the respondents were shown various statements and asked to indicate whether they agreed or disagreed with them. An overwhelming majority of 99% of the respondents agreed with the statement that it is very important that the armed forces conduct joint operations. Under RMA conditions, actions restricted to individual branches of the armed forces are becoming increasingly obsolete. 77% also agreed that the need to maintain individual branches of the armed forces will diminish over time. It would thus be logical that respondents also agree to their own branch of the armed forces being reduced, so that the funds released in this way could be invested in new approaches to warfare. However, the level of agreement declined radically at this point. Only one in ten respondents agreed with this statement, while 90% of the respondents opposed a reduction in their own branch of the armed forces. The reason given by the author of the study is that: "Despite the recognized importance of the 'joint' approach and the potential abolition of the individual branches of the armed forces, the student and candidate officers are proud of their membership of a particular branch of the armed forces and hence reject a reduction" (Steffens 2005:89). The limits to transformation described by Mahnken and FitzSimonds with respect to the US armed forces were clearly reached at this juncture in terms of agreement to revolutionary changes caused by RMA and NCW. The Bundeswehr must thus pay greater attention in the future to informing those affected about the nature and extent of the planned change, and communicating what is meant by "transformation" in the Bundeswehr and how it will influence the function of individuals within the organization as a whole. If the statement made at the outset is true, namely that the relationship between technical and social change constitutes a complex set of interactions, then it would be incorrect to try to reduce the transformation of the defense sector to the mere inherent logic of technological progress, given that this transformation is occurring in a multi-layered socio-political context. Clarity could be achieved in this context by publishing clear political and strategic guidelines in documents of principle containing information on the security and military policy objectives and interests of the Federal Republic of Germany. Besides the *Verteidigungspolitische Richtlinien* [Defense Policy Guidelines – VPR] of May 2003 and the *Konzeption der Bundeswehr* [Bundeswehr Concept – KdB] of August 2004 the newly published *Weißbuch* [White Paper] of October 2006 are indispensable documents in the effort to communicate the reorientation of the Bundeswehr and thereby increasing the acceptance of the idea and the effects of transformation within the armed forces.

6.   Is There a Gap? Transatlantic Interoperability and Criticism of RMA

The discourse on RMA had, and still has, different focuses in the US and Europe. As has been shown above, the US has also made more progress than the European armed forces in implementing guidelines aimed at launching a "defense transformation". Although the need to transform the armed forces of the member states was formally acknowledged as a reform goal at the NATO Summit in Prague in 2002, the term NCW has not actually entered NATO's terminology. Great Britain refers to *Network-Enabled Capabilities* (NEC), while Sweden refers to *Network-Based Defense* (NBD), and the Federal Republic of Germany introduced the term *Vernetzte Operationsführung* (NetOpFü) [Network-Enabled Operations] for usage by the Bundeswehr. While all of these terms indicate the central significance of the network, the terminological differences are not mere nuances, but instead reflect cultural differences and diverging aims. As a British observer remarked in light of the different developments in the US and Europe, the term RMA refers to:

"[…] the need for radical change in military processes, capabilities and structures to exploit the increasingly rapid advances in information technology. The British system of governance has little use for 'catalytic' language of this kind – that is, expressions used in a formal sense to invoke and sustain rapid change. [...] The British 'empirical' approach favors evolution over revolution. The establishment does not easily accept longer-term vision and is suspicious of academic models for the future that are not born of experience but rather inspired by predictions of what technology can deliver" (Codner 2005:12).

The British NEC model emphasizes jointness, the integration of the branches of the armed forces and the deeper integration of the strategic, operational and tactical levels of command and control. However, there is a systematic mistrust of the thesis that "information sovereignty" has singular significance as a decisive factor in war. Instead, the recent past has shown that ending a war also depends on the ability to threaten and implement suitable means of compulsion (Codner, op.cit.). Codner further argues that an interoperability gap is not only opening up at the technological level, but also at the level of the different military cultures. Training in the British armed forces is based on the principle of achieving the greatest possible flexibility in terms of operation types, with the aim of enabling British troops to switch rapidly from a combat operation to a stabilization operation to a police operation. Thus, the British military leadership rejects the idea of having units specialize in such areas as stabilization and reconstruction functions in post-war societies. However, this train 'down' approach[18] (Dandeker 1999:59) to military training is intensifying the problems of interoperability with the US armed forces.

As regards the Bundeswehr, Franz-Josef Meiers is predicting not only a deployment gap (the main effects of the restructure on the three force categories described in Chapter 4 will only be attained in 2010), but also a capability gap (although the Ministry of Defense's procurement plans went in the right direction, they were only able to be implemented as of 2007 at the earliest). A further complicating factor is a budgetary gap (the rising cost of international operations and the commitment of substantial resources to such long-term military projects as the Eurofighter and A400M are not being absorbed by an increased budget, but have instead resulted

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[18]   Dandeker states that "it makes sense to train the armed forces for war fighting and then to train 'down', as it were, to cater for the needs of missions in which a more restrained use of force is appropriate" (op.cit., p.59).

in structural underfinancing. This, in turn, is forcing modernization projects to be cut, reduced or cancelled (see Meiers 2005:20[19]).

A comparative study of European and US capability profiles in relation to C4ISR capabilities arrives at the conclusion that Europe is drawing from its experiences in the Balkans and Afghanistan and that this brought about a change of opinion towards rearmament with C4ISR capacities. This research group, located at the Georgetown University in Washington, is skeptical of the popular thesis in the US that Europe is antiquated in terms of technology. They rather warn of US navel-gazing, which prevents a realistic view of the European situation (Adams et al. 2004). The increasing gap between Europe and the US in their view is not due to a lack of suitable technology at the pan-European level, given the existence of large, established transnational armaments groups in the form of BAE Systems, the European Aeronautic Defense and Space Company (EADS) and Thales, which are well able to keep pace with their US competitors. Instead, Adams et al. (2004) identify the EU-wide shortage of resources as the cause of the problem: "The deployment gap comes down to a budget gap". Furthermore, a decidedly different strategic-political vision in Europe leaves its traces on the acquisition of new C4ISR capacities.

Another important issue is the difficult and time-consuming way, in which an integrated Europe proceeds in order to find a common ground in security and defense policy and this is consequently also curbing the speed of the military transformation. EU politicians have noticed this and as a reaction to it, encouraged the foundation of a transnational defense agency, which was ultimately inaugurated on July 14 2005 as European Defense Agency (EDA). Their core tasks are the evaluation of common military capabilities, harmonizing of operative demands, and coordination of armor research as well as the promotion of the European technological and industrial basis defense industry (Bauer 2004:73). Since its founding 24 European nations joined. This clearly opens opportunities for future common European acquisition and procurement.

The discussion towards a capabilities gap leads to a related aspect: the critical discussion of the potentialities and capabilities of RMA and NCW. Critics of RMA and NCW maintain that these concepts do only function in a very narrowly defined framework. In the view of Martin Hoch (2000), the RMA concept includes the promise of "western dominance" in times when this dominance is severely questioned in other sectors. Because democratic societies have a specific interest in the fact that the public opinion in the respective country is kept in favor of a military warlike mission abroad, politicians are keen on employing any measure that pledges to keep the death toll to a minimum. Thus, as history shows that wars bring about a high risk of losses on the own side, those who are being held politically responsible for them are very willing to adopt methods that seemingly promise a considerable reduction of own losses and a minimization of collateral damage. This effect is to be achieved through extensive air campaigns and generally combat from a distance. However, the idea of a "clean war" is not validated by the war tales of the last view years: Neither does Wesley Clark's (2002) story of the campaign against Serbia support this thesis nor the ongoing war against Iraq.

The aim, to cut off the enemy's combat effectiveness by massive technological superiority, or to deter him to even start a war, does only function, when we deal with an enemy that works on the basis of a similar rationale that we do. This is normally the case for state actors. The alleged

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[19]   Lange also arrives at similar conclusions (2005).

advantages of the NCW-concept may reverse itself into a disadvantage however, when dealing with a completely different organized enemy: "Possible enemies will by no means refrain from their intent to go to war just because of the conventional competitive edge of the USA, instead they will prefer to lead armed conflicts asymmetrically" (Hoch 2000:52). The current development towards the increasing occurrence of "small wars" or "irregular wars" (Collmer 2003), in which the classic division between combatants and non-combatants is blurring, means a huge challenge for regular armed forces, in which they struggle to survive (van Creveld 1998; Borgu 2003). A connected argument of the proponents of NCW stresses the thesis, that a long war of attrition can be avoided by NCW means, in that the concept of information warfare directly interferes with the enemies will to fight the war. However: "A comprehensive knowledge of the enemy is assumed here – an assumption which is by no means certified […]. The interfering with the decision making process of the enemy, but also the concept, to decapitate the enemies center of gravity, has to be based on a comprehensive knowledge of the enemy, so far this is not a given thing." (Mey 2003:5).

Finally critics warn not to over-estimate the role of technology in its war deciding capacity. "Thorough analysis points to the fact, that technological advantages alone do have only little or no measurable impact on the outcome of a war. Decisively influential are in fact the skills and abilities of the soldiers as well as the employed tactics and the way how they are employed (Mey 2003:6). An organizational argument can be added to this: When implementing NCW, the differences between the branches of the armed forces have to be considered: "The transition to, and the application of NCW is easiest when moving from a platform centric force. That's why NCW is particularly applicable to air forces and navies and somewhat easier to implement […] but an army is different. Army is far more people centric than platform centric, and the land environment is far more demanding and complicated then either air or maritime environments. It has cities, buildings, mountains, jungles and of course civilians." (Borgu 2003:7). Michael Codner (2005) therefore is ultimately skeptical how long the "hype" surrounding NCW-oriented transformation can be maintained and thereby describes a well-known effect in this context:

"It is probable that a new US Administration or Secretary of Defense will decide that 'transformation' has had its day, that the establishment is now immune to its catalytic effect, and that Congress will need a new label to which to provide funding. Words such as 'metamorphosis' or 'transmogrification' come to mind!" (Codner 2005:19).

Concluding one can say, that the RMA-paradigm and its realization in the NCW-concept make a variety of assumptions in that it raises a couple of expectations, which have not been entirely proven so far. Furthermore, as far as the European situation is concerned, it seems to depend on a wide range of security policy and military strategy decisions, which are taken on a national as well on a transnational level, as to how successful European armed forces will implement this concept. To confer the U.S. American capabilities profile on European forces would not only be rather illusionary, but politically unwise, as it depends heavily on the final design of the role definition the European countries are willing to provide in terms of acting as a global security actor. It will be most interesting to witness the developments in the next few years.

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