
The Revolution in Military Affairs and the Global Defence Industry: Reactions and Interactions

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The belief that modern militaries are on the cusp of a Revolution in Military Affairs (RMA), driven in particular by recent advances in information technologies (IT) has long been an increasingly powerful and persuasive school of military thought. For more than a decade, in fact, it has been fashionable to acknowledge the IT-led RMA when talking about the future of warfare and war-fighting. To date, however, views about the prospective impact of the RMA on defence industry have shown much less tendency to converge. Hence, while many leading proponents of military reform agree that armed forces must be “transformed” along the lines of the IT-led RMA, the impact of this thinking on national defence industries has varied widely and its implications for international defence industry is not yet clear.

In November 2007, the S. Rajaratnam School of International Studies in Singapore convened a conference to discuss current trends and developments in various national defence technological and industrial bases around the world, and their capacity to influence and contribute to the Revolution in Military Affairs (RMA). This conference attracted experts from four continents to discuss the future of the RMA, trends and developments in the global defence industry, and the potential interlocking relationship between the two. Several excellent papers were presented at this conference. These papers formed the basis of the articles published in this edition of *Security Challenges*.

This edition of *Security Challenges* includes articles on the interaction between the IT-led RMA and defence industry in the US, China, Europe, Japan, Korea, Australia and Malaysia. In order to set the scene for these more specifically focused articles, this introductory article:

- Summarises the questions conference participants were asked to address;
- Explores what is meant by the term RMA and the nexus between that and emerging notions of “network centric warfare”;
- Advances some generic propositions about what implementing the RMA might mean for defence industry.

Focus Questions

As its name suggests, the RMA implies dramatic changes in the way war is to be fought, managed, and organised. Whereas RMAs are generally inspired by technological innovations—gunpowder, railroads, the internal combustion engine, radio, the integrated circuit, etc.—an actual RMA only occurs when these breakthroughs are married with concomitant innovations in doctrine, tactics, and organisation. An RMA, therefore, both enables and demands considerable structural, institutional, and conceptual changes in how militaries prepare for war.

Consequently, one should expect that the current IT-led RMA raises many questions for the future of the global defence industrial base. How will the RMA, if it does come about, impact the global defence industry, which is supposed to provide the wherewithal for implementing an RMA? How will it function in an environment that calls for sweeping changes in military structure, doctrine and strategy, and which will likely give greater criticality to certain, perhaps novel, military capabilities the detriment of other, perhaps more traditional, capabilities? What new technologies and systems is the defence industry expected to provide to transformed militaries, and how would it supply these? How will traditional defence industries fare in the 'brave new world' of network-centric warfare? What might be the role of commercial dual-use enterprises—particularly those in the IT sector—in delivering the required technologies to the RMA? Will new suppliers necessarily arise, while old ones necessarily fall? In other words, will the global military-industrial complex—forged in the Second World War and set during the Cold War—have to transform itself as well, and, if so, can it?

In turn, how might developments in the global defence industry affect the course of the RMA itself? Do national defence sectors, by way of delivering 'the art of the possible', limit national RMAs to what these industries can develop and manufacture for their militaries? How might globalisation affect the diffusion of RMA-related technologies and therefore the implementation of the RMA itself? In particular, how and in what ways might some countries, through overseas arms transfers and international defence industrial collaboration, become *exporters* of the RMA, and what might be the implications of such globalisation? In other words, how might these two institutions, the RMA and the global defence industry, interact and react to each other in the future?

Finally, is the whole argument about the RMA simply a false one in the first place? Is it valid to speak of contemporary militaries being on 'the cusp of an RMA'? Do militaries really need to so radically overhaul themselves? If not, then what is the future of military innovation and modernisation, short of a true RMA, and again, what is the interconnection between that future and the defence industry?

What Do We Mean By the RMA?

Overarching these more specific questions, however, is on-going debate about what we mean by the RMA. The Revolution in Military Affairs is a sweeping if often ambiguous term used to describe an ambitious effort—a ‘paradigm shift’, if you will—to revamp the manner in which militaries will conduct warfare in the future. For most, the RMA is seen as a process of *discontinuous*, *disruptive*, and *revolutionary* change. Andrew Krepinevich, for example, has argued that a revolution in military affairs occurs when

the application of new technologies into a significant number of military systems combines with innovative operational concepts and organizational adaptation in a way that fundamentally alters the character and conduct of a conflict. It does so by producing a dramatic increase ... in the combat potential and military effectiveness of armed forces.¹

For its part, the RAND Corporation defines an RMA as a fundamental alteration

in the nature and conduct of military operations which either renders obsolete or irrelevant one or more core competencies in a dominant player, or creates one or more core competencies in some dimension of warfare, or both.²

Finally, according to the (now-disbanded) US Department of Defence’s Office of Force Transformation, the RMA is

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 under peace and stability in the world.³

In their contribution to this volume, Dombrowski and Ross trace the development of US thinking from the earlier RMA concepts to the notion of military transformation that dominates the rhetoric of the incumbent Bush Administration. After probing the rhetoric, Dombrowski and Ross conclude that the substance of the US transformation enterprise is more about incremental, evolutionary change than discontinuous, disruptive innovation. That said, however, the Dombrowski and Ross analysis does suggest that, even if US defence transformation is no more than ‘modernisation plus’, it is still a complex, risky undertaking in which US governments seek to enhance their military capabilities by exploiting information and knowledge superiority,

¹ Andrew Krepinevich, ‘From Cavalry to Computer: The Pattern of Military Revolutions’, *The National Interest* (Fall 1994), p. 30.

² Richard O. Hundley, *Past Revolutions, Future Transformations* (Santa Monica, CA: RAND, 1999), quoted in ‘Transformed: A Survey of the Defence Industry’, *The Economist* (20 July 2002), p. 7.

³ US Department of Defence, Office of Force Transformation (OFT), *Elements of Defence Transformation* (Washington, DC: Office of the Secretary of Defence, October 2004), p. 2.

thereby creating opportunities for the private US defence industrial sector to reap renewed profits from defence sales at home and abroad.

The RMA is also an *effects-* and *capabilities-based* approach. Effects-Based Operations (EBO) imply a shift away from ‘traditional’ attrition-based warfare in favour of attacking the enemy so as to achieve certain political-military results, e.g., his willingness to fight. The emphasis on capabilities means adopting a defence strategy based less on fixed threat scenarios than on the anticipated capabilities of a likely adversary and, in turn, on the required capabilities of military forces needed to deter or defeat such an enemy. As such, the RMA is about achieving capabilities and effects and no longer about sheer numbers.

In this regard, the current RMA model has been inexorably linked to the emerging notions of *network-centric warfare* (NCW), sometimes also referred to as ‘network-enabled capabilities’ or ‘network-based defence’—the operative word, of course, being ‘networked’. According to the NCW concept, the ongoing revolution in information technologies (IT) makes possible significant innovation and improvement in the fields of sensors, seekers, data management, computing and communications, automation, range, and precision. Correspondingly, NCW seeks to exploit these breakthroughs in information technology in order to achieve exponential improvements in battlefield knowledge, connectivity, and response. Network-centric warfare, again according to US Office of Force Transformation,

generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, high tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization.⁴

Moreover, NCW is about the “linking of people, platforms, weapons, sensors, and decision aids into a single network” that “creates a whole that is clearly greater than the sum of its parts”, resulting in “networked forces that operate with increased speed and synchronization and are capable of achieving massed effects”.⁵ In other words, the RMA is seen to be *synergistic* and *holistic*, entailing the integration and employment of Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems, platforms, and weapons (particularly smart munitions) in ways that increase their effectiveness and capabilities beyond their individual sets. This bundling together is reminiscent of Admiral William Owens’ “system of systems” concept, in that it entails the linking together of several types of discrete and even disparate systems across a

⁴ US Department of Defence, Office of Defence Transformation, *Network-Centric Warfare: Creating a Decisive Warfighting Advantage* (Washington, DC: US Department of Defence, 2003), p. 2.

⁵ OFT, *Elements of Defence Transformation*, p. 8.

broad geographical, interservice, and electronic spectrum in order to create new core competencies in warfighting.

In this context, it is instructive to note that Australia, a close follower of US military innovation, has embraced NCW thinking while apparently being more agnostic about some of the more far-reaching visions of the RMA proponents. As Hall and Wylie point out in their contribution to this volume, NCW in Australian lexicon and practice is fundamentally about improving the integration and connectivity of the Australian Defence Force, and it is conceived as a dynamically evolving but not as a revolutionary military instrument.

Nowhere was this commitment to the RMA more pervasive than within the US Department of Defence (DoD) under Secretary Donald Rumsfeld from 2001 to 2006. Under his stewardship, the RMA—or ‘defence transformation’, as it was later rebranded—became the guiding principle of the US military. Terms such as ‘information superiority’, ‘situational awareness’, ‘network-centric warfare’, ‘precision-strike’, ‘deployability’, ‘flexibility’, and ‘jointness’ were given increasing credence in Rumsfeld’s Defence Department, and belief in the power of RMA to bring about a dramatic expansion in the capabilities and effectiveness of the US military became almost an article of faith.

In general, as the US military sought to transform itself, it has particularly emphasised acquiring the following capabilities:

- A highly networked organism of command, control, communications, computing, intelligence, surveillance, and reconnaissance (C4ISR) systems, weapons, and platforms;
- Improved, shared situational awareness, both of the immediate battlespace and beyond;
- More accurate, stand-off engagement capacity;
- Greater speed, agility, rapid deployability, and flexibility;
- Jointness and interoperability.⁶

Not surprisingly, US interest in the RMA has had considerable resonance throughout the rest of the world. Many militaries take their intellectual and conceptual cues from the US armed forces, and consequently they have closely followed US efforts to transform its forces to determine what lessons they may learn from its experiences.

⁶ Andrew Ross, ‘Transformation: What is it? What Does it Mean for Industry?’, PowerPoint briefing presented to the conference on Defence Transformation in the Asia-Pacific: Meeting the Challenge, Honolulu, Hawaii, 30 March-1 April 2004, p. 2.

The process by which military technology and ideas diffuse among states (and even non-state actors) has been explored in an oft-cited book of essays edited by Goldman and Eliason. They point out that the process by which military technologies diffuse is anything but deterministic and, instead, is highly susceptible to local conditions.⁷ This perspective is corroborated by the variety of national experiences explored in contributions to this volume.

As James points out in his contribution to this volume, for example, the West Europeans tend to view the IT-RMA through the prism of transatlantic defence cooperation. That said, however, both European governments and European defence companies are acutely conscious of the competitive pressures exerted by US defence suppliers across the full spectrum of European defence business; US technological and resource strengths in the area of the RMA only compound this problem. Consequently, James argues that, while transatlantic arms collaboration is necessary and critical to the future of European defence capabilities, a strengthened European defence technological and industrial base is the optimal way to ensure that such cooperation is balanced and in European interests.

In contrast to this fundamentally emulative diffusion of the RMA enterprise, Ding's analysis in this volume of China's pursuit of an 'RMA with Chinese characteristics' underscores the importance of strategic competition in the diffusion of IT-RMA capabilities among both military users and their suppliers. Moreover, Ding's analysis of China's experience in acquiring and leveraging advanced military-relevant technologies provides a fascinating corroboration of Goldman and Ross's point that the *hardware* (i.e., sensors, command and control systems) associated with the IT-RMA diffuse more readily than IT-RMA-related *software* (i.e., tactics, doctrine, and organisational forms).⁸

Implementing the RMA: Implications for Defence Industry

In an earlier study of the RMA and defence transformation, Bitzinger wrote:

[The RMA] implies more than a simple overlay of new technologies and new hardware over existing force structures; it requires fundamental changes in military doctrine, operations, and organization. Hardware and technology are obviously crucial and primary components when it comes to transformation—they are fundamental building blocks in a modern, IT-based RMA centred on network-centric warfare and reconnaissance-strike complexes. Transformation is not supposed to be just a techno-fix, however. It entails fundamentally changing the way a military does its business—doctrinally, organizationally, and institutionally. It also requires advanced systems integration skills to knit-together disparate military systems into complex operational networks. *Finally, it demands elemental*

⁷ Emily O. Goldman and Leslie C. Eliason (eds), *The Diffusion of Military Technology and Ideas* (Stanford, CA: Stanford University Press, 2003), p. 8.

⁸ Emily O. Goldman and Andrew Ross, 'Conclusion', in Goldman and Eliason, *The Diffusion of Military Technology and Ideas*, p. 382.

changes in the ways militaries procure critical military equipment, and reform of the national and defence technological and industrial bases that contribute to development and production of transformational systems ... [D]efence transformation entails much more than the 'mere' modernization of one's armed forces.⁹

As noted above, therefore, a transformed military would have important implications for those industrial sectors that will supply the armed forces with the means it needs to carry out its missions. RMA proponents, in fact, have often argued that the defence industrial bases around the world will have to undergo their own 'revolutions'. In the United States, for example, the Office of the Under Secretary of Defence for Industrial Policy (OUSD/IP) released a study in early 2003—entitled *Transforming the Defence Industrial Base: A Roadmap*—which laid out several recommendations for aligning US defence industrial policy in accordance with Rumsfeld's transformational vision. This document recommended that the US DoD treat the *national* industrial base—both civilian and defence-specific—as a cluster of “effects-based sectors”—such as combat support, power projection, precision engagement, etc.—that could support defence transformation. OUSD/IP also proposed that acquisition decision-making be reorganised around operational effects and *not* “programs, platforms, or weapons systems”.¹⁰ In particular, the report recommended that the Defence Department strive to identify new sources of industrial-technological innovation amongst small or non-traditional firms that often do not supply directly to the DoD.¹¹

As Dombrowski and Ross point out elsewhere in this volume, however, developments in the US defence industrial base have tended to diverge from the above 2003 Roadmap. In particular, Dombrowski and Ross point out that the US government increasingly lacks the in-house technical knowledge and managerial capabilities necessary to procure transformational systems. At the same time, when it comes to transformational systems—even in the area of IT solutions—systems integration remains a critical core competency of prime contractors. Consequently, the traditional defence industry is still the ‘go-to’ guys when it comes to assembling the key components of the RMA.

More generally, contributors to this volume were also asked to gauge the extent to which the RMA and defence transformation has the *potential* to affect to defence industry in the following ways:

- ***Shifting defence work from suppliers of legacy systems to suppliers of transformational systems.*** Firms that provide the

⁹ Richard A. Bitzinger, *US Defence Transformation and the Asia-Pacific Region: Implications and Responses* (Canberra: Australian Strategy Policy Institute, 2006), p. 11 (emphasis added).

¹⁰ Office of the Under Secretary of Defence for Industrial Policy (OUSD/IP), *Transforming the Defence Industrial Base: A Roadmap* (Washington, DC: Department of Defence, February 2003), p. 2.

¹¹ *Ibid.*, pp. 13-5.

military with systems or services that support defence transformation could profit at the expense of firms that supply only (or mainly) non-transformational products, particularly so-called legacy platforms, such as heavy armoured vehicles or unguided weapons.

- **Shifting defence work in favour of firms that undertake large-scale systems integration work on behalf of the military.** Many large-scale transformation projects have entailed the use of firms acting as Lead Systems Integrators (LSIs). LSIs manage very large, complicated acquisition programs that require amalgamating several disparate pieces of military hardware (and, increasingly, software) into a single functioning 'system of systems'. In the United States in particular, LSIs have become increasingly instrumental for managing large multiplatform systems, such as the Future Combat System (Boeing/SAIC) or the US Coast Guard's Deepwater program (Lockheed Martin/Northrop Grumman).¹² As LSIs, these firms are given considerable authority to create, design, and execute a comprehensive solution to a pressing military need, including hiring and overseeing subcontractors, managing costs and schedules, and even setting requirements.
- **Shifting defence work from large megafirms to smaller, specialised suppliers.** Small, 'boutique' defence contractors, providing highly specialised systems or services, could be more nimble and responsive to the needs of a transformed armed force, particularly when it comes to NCW solutions. Large, traditional defence firms, because they are more oriented toward large-scale weapons programs, may actually lack the manpower skills to engage in certain kinds of esoteric innovation.
- **Opening up more defence work to specialised foreign firms.** As a corollary to the last point, foreign firms that can provide esoteric transformational technologies *not commonly found* in defence industrial bases could find a more receptive audience in a transformed US military. For example, one of the US Navy's prototypes for the Littoral Combat Ship (LCS) utilises a unique Australian-supplied trimaran hull.
- **Shifting defence work toward suppliers of dual-use commercial systems.** If commercial off-the-shelf (COTS) technologies—particularly information technologies—are truly destined to fundamentally alter the prosecution of future warfare, then non-traditional defence contractors who can engage in civil-military

¹² Deepwater is a multifaceted program to outfit the US Coast Guard with new surface vessels, helicopters, patrol aircraft, and unmanned aerial vehicles, and to link their operations with a state-of-the-art C4ISR network in a system-of-systems approach.

integration (CMI) could become more critical suppliers to the military. In particular, companies such as Microsoft, Sun, and Cisco could benefit at the expense of traditional defence firms.¹³

As the contribution by Dombrowski and Ross to this volume shows, these themes are particularly relevant to the US defence industry's response to the US Defence Department's pursuit of the RMA-based 'defence transformation'. Other contributions to this volume highlight the fascinatingly diverse spectrum of experience in this area.

For example, Hall and Wylie point out that Australia's emulation of the US model of NCW seems to have led to the domination of relevant Australian defence industry activities by local subsidiaries of overseas—particularly US—suppliers. In contrast, James shows how European defence suppliers have sought to exploit the burgeoning US demand for NCW capability—within the constraints of US restrictions or reluctance to rely on foreign suppliers—by acquiring second-tier US firms already established in the US market.

Tight US controls on the overseas transfer of RMA-related technologies mean, however, that such acquisitions have not had commensurate impact on the international diffusion of such technology. Indeed, both the contributions by Takahashi and by Moon and Lee emphasise the importance of such controls in reinforcing incentives for, respectively, the Japanese and South Korean governments to encourage local industry involvement in the development, supply, and support of RMA-relevant capabilities.

Obviously, government-sponsored demand for RMA capabilities is a key driver of the interaction between the RMA and the local defence industry. But the contributions by Ding, Moon/Lee, and Takahashi suggest that China and South Korea stand out in terms of the extent to which the government has intervened to ensure that the national industrial base develops and maintains the capacity to supply and support RMA-related capabilities. Indeed, statist efforts to achieve (more or less) self-reliance in RMA capabilities are as much a reflection of national defence industrial policy as they are a reinforcing element. This model of purposeful state intervention stands in sharp contrast to the inevitably more fissionary and—to date—inconclusive debate among European nations described by James.

At the same time all contributors acknowledge the cost, schedule, and technical risks inherent in the development and procurement of RMA-relevant capabilities. Hall and Wylie suggest that, in procuring advanced

¹³ See Ronald O'Rourke, *Defence Transformation: Background and Oversight Issues for Congress* (Washington, DC: Congressional Research Service, 9 November 2006), pp. 14-15; Peter J. Dombrowski and Andrew L. Ross, 'Transforming the Navy: Punching the Feather Bed?', *Naval War College Review* (Summer 2003); OUSD/IP, *Transforming the Defence Industrial Base: A Roadmap*.

NCW capabilities, Australia is prepared to tolerate significantly reduced sovereign control over those capabilities in an effort to reduce the risk involved in procuring them to levels acceptable to Australian citizens and their elected representatives. At the other end of the spectrum, Ding shows the lengths to which China has been prepared to go in attempting to leverage indigenous civilian technology in establishing an “RMA with Chinese characteristics”. Finally, Balakrishnan, in her study of Malaysia, underscores the high barriers that the RMA presents to nations with only rudimentary defence industries—one which even access to advanced civilian technologies may not be able to solve. Overall, therefore, exploiting the RMA obviously requires a relatively high ‘critical mass’ of resources, technologies, industrial capabilities, military capacity, and resolve missing from most countries.

Conclusion

The contributions to this volume provide few—if any—definitive answers to the focus questions put to authors involved. That said, however, some common themes do emerge.

Analysis of the defence industry’s response to the IT-RMA in the United States, Europe, and Australia suggest that it is too soon to pronounce the demise of established defence suppliers. In these cases, established suppliers have demonstrated a remarkable capacity to adapt to the new commercial environment. At this stage, however, such adaptability does seem disproportionately dependent on acquisition of smaller, emerging IT-RMA related businesses.

In addition, all of the contributors seem to corroborate the Goldman/Ross thesis that countries seeking to take the IT-RMA route to modernisation will find it easier to absorb the hardware of the RMA than it will be to address the associated doctrinal, organisational, and institutional demands inherent in this process. Virtually every contributor recognises that adoption of the IT-RMA enterprise will likely entail far-reaching changes to the software of defence transformation—the ‘vision thing’, as it were—but that the resilience of existing bureaucratic and organisational mores, and their resistance to radical change, will continue to be strong and difficult to overcome.

This is not to say that the IT-RMA is having no impact on military organisations. Quite the contrary, but the picture that repeatedly emerges is one of military organisations engaged in a relatively rapid evolution in military affairs that is not so much a disruptive, discontinuous process of change as it is a sustaining process of innovation. If there was a true RMA in effect, we should expect to see a concomitant dynamism in the business relationship between a rapidly evolving military customer and its primary suppliers, both in the defence industry and, increasingly, in *non*-defence sectors. The fact that no contributor highlighted such far-reaching changes in the traditional

defence business/supplier model tends to corroborate the argument that realising the IT-RMA vision will be a contingent, 'business-as-usual' enterprise.

Indeed, one surprising feature of the country studies analysed in this volume is the relative paucity—to date, at least—of the contributions by commercial, dual-use enterprises to the supply and support of national RMAs. At this stage of the global RMA, only China seems more prepared to exploit the RMA potential its commercial IT sector than, for example, the US or Western Europe, and this may be more a reflection of the 'necessity-is-the-mother-of-invention' realities of Chinese technological development, than any preference on the part of the Chinese military. Of course, circumstances may change and opportunities may emerge to the point where civilian, dual-use suppliers will become more attractive to military consumers as prime contractors—particularly in countries with high aspirations for military-technical achievement but relatively weak defence industrial bases, such as South Korea and India (and possibly Malaysia?)—but this process may be as evolutionary as the overall implementation of the RMA itself.

Overall, the contributions to the volume tend to confirm that, as Goldman and Ross have argued, the diffusion of the RMA is highly contingent on domestic factors. Beyond technological requirements and capacities, the scope, speed and extent of any such diffusion will depend on the interaction of strategic necessity, culture, and doctrine, as well as institutional and organisational mindsets.¹⁴ In the final analysis, while the process of military transformation should perhaps be taken with a good deal of salt, it certainly is not a useless enterprise. None of these criticisms should be construed to say that the ideas behind the information technologies-led RMA are not relevant, or that network-centric warfare and new reconnaissance-strike concepts does not have the potential to make a significant contribution to future military capabilities and effectiveness and perhaps, in the long run, truly alter the character and conduct of warfare. In sum, while the Revolution in Military Affairs may turn out to be much less 'revolutionary' than originally conceived, this does not make the global implementation of RMA-derived military changes any less critical to track and assess.

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¹⁴ Goldman and Ross, 'Conclusion', p. 402.