Session I -2
"How Should Countries Deal with New Threats and Adapt to the Revolution in Military Affairs?"

New Problems, New Answers?
The Revolution in Military Affairs in an Era of Changing Security Concerns

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Introduction

The notion that the state of the military art is in the midst of a revolution in military affairs (RMA) – the argument that radical changes in military and military-related technologies are fundamentally and radically changing the manner in which military forces organise, operate and fulfil their strategic functions – continues to be debated within strategic and defence studies. Nevertheless, there is a body of opinion that insists that an RMA is currently extant.[2] From this body of opinion, a predominant understanding of this RMA is beginning to emerge – that the current RMA is essentially technical in nature, and that it first manifested itself during the 1991 Gulf War against Iraq.[3]

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[1] The author wishes to thank Morten Hansen for his assistance in some background research for this paper.

[2] For instance, James Adams, *The Next World War: Computers Are the Weapon and the Front Line Is Everywhere* (New York: Simon & Schuster, 1998); John Arquilla & David Ronfeldt (eds.), *In Athena's Camp: Preparing for Conflict in the Information Age* (Santa Monica: RAND, 1997); William S. Cohen, *Annual Report to the President and the Congress* (Washington, DC: The Pentagon, 1999); Eliot A. Cohen, "A Revolution in Warfare", *Foreign Affairs*, vol. 75, no. 2 (March/April 1996), pp. 37-54; Lawrence Freedman, "The Revolution in Military Affairs", *Adelphi Paper*, no. 318 (1998); Robin F. Laird and Holger H. Mey, *The Revolution in Military Affairs: Allied Perspectives*, Washington, DC: National Defense University Institute for National Strategic Studies, 1999; Michael O'Hanlon, *Technological Change and the Future of Warfare* (Washington, DC: Brookings Institution Press, 2000); Bill Owens, *Lifting the Fog of War* (New York: Farrar, Straus and Giroux, 2000); Barry R. Schneider & Lawrence E. Grinter (eds.), *Battlefield of the Future. 21st Century Warfare Issues*, Air War College Studies in National Security, no. 3 (Maxwell Air Force Base, Alabama: Air University, 1995); Keith Thomas (ed.), *The Revolution in Military Affairs: Warfare in the Information Age* (Canberra: Australian Defence Studies Centre, 1997); Alvin and Heidi Toffler, *War and Antiwar: Survival at the Dawn of the 21st Century* (Boston: Little, Brown & Co., 1993).

[3] Frank Kendall, "Exploiting the Military Technical Revolution: a Concept for Joint Warfare," *Strategic Review*, Spring, 1992, pp. 23-30; Michael J. Mazaar, *et al., Military Technical Revolution: a Structural Framework*, Final Report of the Study Group on the Military Technical Revolution, Center for Strategic and International Studies (CSIS), Washington, DC, March, 1993, pp. 17-39;

The fundamental issue here is that no military force can afford to be static in nature and capability. Military and military-related technologies necessarily change, and existing capabilities and equipment eventually become obsolete. To remain relevant and effective, all military forces have to undergo periodic change, both in terms of its hardware and capabilities as well as in terms of its doctrines and strategies.

This paper will argue that the RMA is potentially extremely problematic. It is still a matter of debate as to what this process will mean for the very nature of war and strategy, let alone military operations and tactics. Military organisations may find it extremely difficult to not only absorb new capabilities, but adapt to new *modus operandi* as well. This problem is only exacerbated by the extremely high costs of modern weapons systems, which being already a problem for the United States can only be an even greater problem for smaller states. Finally, there is the issue of relevance to prevailing strategic conditions. Given current strategic conditions, the RMA may create an armed forces that will be excellent for strategic tasks that are rapidly becoming less and less likely.

Understanding the RMA

Key Characteristics

The driving force behind this RMA is information processing, which manifests itself in three key aspects: information dominance, precision weaponry, and joint-service operations. Information dominance promises to disperse the fog of war for friendly commanders and thicken it for the enemy. A network of sensor systems will gather data in order to generate real-time, continuous, target-quality information on all significant enemy assets. Advanced command, control & communications (C^3) will then transform this data, along with information on friendly forces, into a single real-time near-perfect picture of the battle space available to all commanders. This will enable commanders to target, shape and distort the enemy's understanding of the same battle space.[4]

Secondly, improvements in precision targeting render increasingly likely the prospects of single-shot kills. Together with information dominance, precision weapons promise near-certain destruction, which for friendly forces, promises to make warfare much more efficient than ever, and to make desired strategic outcomes almost guaranteed. The RMA-ed military can therefore utterly dominate the battlespace. It is the ability to guarantee the destruction of the most important targets (that is, intensive destruction) that determines military success, rather than indiscriminate saturation bombings (that is, extensive destruction) as was witnessed in World War Two. This might allow a relatively small force to defeat a much larger enemy formation.

[4] Mark Hewish, "Fishing in the Data Stream," *International Defense Review*, July, 1994, p. 51.

Long-range standoff-range weapon systems may be particularly important because they can strike from locations that are beyond the range of most hostile weapons.[5]

Finally, information technology allows for the networking of all aspects of the military organisation – that is, jointness – that generates a net effect far greater than the sum of its parts. Networking facilitates a common organisation-wide awareness of the battle space, and this promises to generate force multiplier effects as a result of allowing any emerging target to be engaged and destroyed by precision weapons launched from any platform that is within range. If all three aspects of the RMA hold true, this will likely result in an armed forces that is an increasingly lethal and capable of levels of precise destruction previously unattainable.[6]

The Singapore Pattern of RMA – Improving Firepower

The Singapore Armed Forces (SAF) has embraced the notion of an existing RMA. However, given the country's unique geopolitical and geostrategic problems, the problems of taking on board the RMA are even greater. The high costs of modern military technologies simply mean that the SAF cannot afford to 'get it wrong'.

The SAF has always emphasised modern weapons platforms and systems. Nowhere else is this more obvious than in airpower. The air force is today by far the most modern in Southeast Asia, comprising a combination of close-range and beyond visual range combat and weapons systems variants. KC-135 air refuelling aircraft gives combat aircraft at least some force projection capability. The army comprises combined arms divisions with integrated armoured and artillery, a rapid deployment airmobile division, and a variety of legacy and modern combat systems both purchased abroad and locally produced. The SAF recently concluded its first networked brigade-level exercise with apparent success. Its navy has, over the last 10 years, undergone fairly dramatic transformation in terms of platforms and capabilities. Significantly, the navy has the largest number of missile launchers of any Southeast Asian navy, and is the first in the region to introduce stealth technologies. Coinciding with the material development of the SAF's capabilities has been the transformation of its military doctrines.[7] The organisation has moved from what was an essentially counter-insurgency doctrine to a more conventional military posture throughout much of the 1970s, to an increasing emphasis on joint warfare and networked

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[5] Ryan Henry and C. Edward Peartree (eds.), *The Information Revolution and International Security* (Washington, DC: Center for Strategic and International Studies, 1998).

[6] See Robert W. Chandler, *The New Face of War: Weapons of Mass Destruction and the Revitalization of America's Transoceanic Military Strategy* (McLean, VA: AMCODA Press, 1998).

[7] Bernard Fook Weng Loo, "From Poisoned Shrimp to Porcupine to Dolphin: Cultural and Geographic Perspectives of the Evolution of Singapore's Strategic Posture", in Amitav Acharya and Lee Lai To (eds.), *Asia in the New Millennium: APISA First Congress Proceedings, 27-30 November 2003* (Singapore: Marshall Cavendish Academic, 2004), pp.352-375.

operations. In 1994, the SAF adopted the Integrated Warfare concept as the basis for military doctrine, emphasising the need for regular joint-level training.

In spite of these strengths, the SAF is clearly not prepared to remain static. A key interest has been technologies that facilitate the integration of guided weapons from diverse sources into its various air and naval platforms, as well as the adaptation and improvement of these missiles' performance. Here, access to software source codes is an important consideration in Singapore's various defence acquisitions, and a cause of constant irritation has been United States governmental restrictions on the transfer of such codes. This is especially pertinent as the overwhelming majority of air platforms and weapons systems have been acquired from the United States. Israel's willingness to supply Singapore with source codes is one reason for its success in marketing defence systems to the city-state.[8]

Networking the SAF

These combat capabilities are augmented by potentially revolutionary developments in the area of command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) infrastructure comprising an island-wide fibre-optic and microwave network linking air and naval surveillance capabilities, and can provide virtual real-time updates of the battle situation.[9] The SAF is the only military organisation in Southeast Asia with that capacity and capability to provide round-the-clock integrated monitoring across the entire spectrum of security concerns. The integration of air, ground and naval sensors, combined with the SAF's investments into computerised command and control provide a potentially significant advantage over any putative regional adversary. This C4ISR infrastructure is the result of fairly long-term planning, beginning as early as 1991, when MINDEF had requested proposals for a Singapore-wide command, control, communications and intelligence network, based on microwave and fibre-optic channels and including links to air and maritime surveillance assets.[10] During the early 1990s, at the level of the individual serves, there were already intra-service networks such as the Armed Forces Command Post,[11] the Air Force Systems Brigade,[12] and the navy's central sea surveillance facility, using data from shore-based military and civilian radars, ships at sea, maritime patrol aircraft and shore-based electronic and signals intelligence.[13]

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[8] "RSAF turns to Israel for EW", *Jane's Defence Weekly*, October 10, 1992, p. 5.

[9] *Defence of Singapore 1994-95* (Singapore: Ministry of Defence, 1994), p. 60.

[10] *Asian Defence Journal*, May 1991, p. 76.

[11] David Boey, "Defending Singapore: a fragile city-state's approach to defence and security", MA dissertation, University of Hull, 1996, p. 48.

[12] "Enhanced national air defence capability", MINDEF Internet Webservice, July 13, 1998.

[13] David Boey, "Singapore's fleet gets boost from Navy 2000", *International Defense Review*, 12/1995, pp. 67-8; "Regional maritime air power evolves", *Asia-Pacific Defence Reporter*, February-March 1999, p. 19.

Recently, Singapore has started to demonstrate real interest in satellite technologies. A Nanyang Technological University-Surrey University satellite project, in conjunction with the Singaporean Defence Science Organisation National Laboratories, will be the first locally designed and built platform.[14] This satellite is intended for environmental monitoring purposes, but surely provides the technological platform for the exploitation and deployment of military-specific satellites in the future. The SAF is also interested in further funding for Israel's Ofeq satellites.[15] Other efforts include a joint project between Singapore Telecom and Taiwan's Chungwa Telecom, called ST-1, which was built by the Anglo-French Matra-Marconi company and is designed for both broadcasting and telecommunications (including data, telephony and multimedia) purposes. Its 'footprint' is pretty much Asia-wide.[16] Singapore Telecom also announced in January 2001 that it would lease 15 transponders on Apstar V, a Chinese-owned but US-built satellite due for launch in 2003.[17] Projects further down the line include X-SAT, a 100-kg micro-satellite locally designed and built and scheduled for launch aboard India's Polar Satellite Launch Vehicle by 2006.[18] This will be the first of a planned 'equatorial belt' of Singaporean micro-satellites, ultimately providing Singapore (and potentially other users located close to the equator) with round-the-clock access to clearer and faster satellite communications.[19]

There have been several projects involving unmanned aerial vehicle (UAV) technology, including the Tailsitter (smaller than a golf bag) and the Sparrow, a palm-sized device. Singaporean defence industries are also currently developing a large-scale UAV known as LALEE (Low-Altitude Long Enduring Endurance), which is intended as a battle management drone deployed at altitudes of about 60,000 feet.[20] In addition, the E-2C Hawkeyes contribute significantly to the overall intelligence effort. The E-2Cs have been upgraded locally with a new mission control system.[21] Possible future developments being considered include a JSTARS-type platform integrating Northrop Grumman's MESA radar. A more likely scenario is the

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[14] http://www.ntu.edu.sg/eee/news/satellite06/index.html.

[15] *Jane's Defence Weekly*, 5 July 2000, p. 2.

[16] "Singapore's first satellite to launch in May", *Singapore Bulletin*, March 1998, p. 17.

[17] "China to launch APSTAR V in 2003", Xinhua news agency, January 8, 2001; "Loral and APT satellite agree to joint ownership of APSTAR-V satellite", Loral website, http://www.loral.com/inthenews/020923.html

[18] Radhakrishna Rao, "Delhi's commercial space ambitions lifted as Nanyang becomes fifth overseas client", *Flight International*, February 15, 2003.

[19] Paula McCoy, "Work on first made-in-Singapore satellite to begin", *Straits Times*, December 12, 2001.

[20] Andrew Doyle, "Singapore recruits Rutan to work on long endurance UAV", *Flight International*, May 15, 2001, p. 5.

[21] "Eyes and ears of air force upgraded", *Straits Times*, April 24, 2001.

installation of a distributed network employing the LALEE UAV as a platform performing a range of C4ISR functions.[22]

There has been an increasing emphasis on joint-level operations and the networking infrastructures required to support increasing jointness. In 1989 the air force established a Tactical Support Wing, which became Tactical Air Support Command (TASC) in 1991 with responsibility for planning, coordinating and providing air support for the army and navy. One key TASC activity is operating UAVs in support of the army. In 1994, the Integrated Warfare concept was adopted as the basis for a doctrinal framework that attempted to integrate and exploit synergies through a joint-service command and control system. In 1992, it was reported that the SAF planned operations based on a radio-electronic combat doctrine that integrated electronic warfare with reconnaissance, physical disruption and deception.[23] This doctrinal emphasis increased greatly under the Army 21 planning blueprint, which was written in the context of the RMA and emphasises the development of information capabilities, deriving from the integration of all C4ISR systems to achieve dominant battlefield awareness.[24] At the tactical level, recent developments include the Advanced Combat Man System, aimed at improving soldiers' situational awareness, firepower and battlefield survivability. The system is based on a suite of advanced sighting and aiming devices linked to a backpack computer.[25] In another project looking to the future land battlefield, the Singapore defence industrial network has been developing a system using unmanned robotic land warfare systems.[26] Naval vessels have incorporated increasingly sophisticated combat information centres. The modified Lafayette-class frigates will be equipped with a C4I suite integrating ship management, weapons control and communications under the Intelligent Naval Defence Platform 21 programme.[27]

Absorbing the RMA

Overcoming Organisational Obstacles

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[22] David Boey, "Development of LALEE drone started 3 years ago, says Mindef's Chief Scientist", *Business Times* (Singapore), May 11, 2001; David Boey, "Singapore's new drones make public debut", *Business Times*, February 26, 2002.

[23] Prasun K. Sengupta, "Singapore and the Army 2000 plan", *Military Technology*, 7/1992, p. 73.

[24] "Building the 21st century warrior - Army 21", *Pioneer*, May 1999, p. 13; *Defending Singapore in the 21st century*, p. 30.

[25] David Boey, "ST Elec in project to hone soldiers' hitting power", *Business Times* (Singapore), February 26, 2002.

[26] Denesh Divvanathan, "ST Engg plans foray into China, South America", *Straits Times*, March 9, 2002.

[27] "Naval shipbuilding programmes Asia and the Middle East", *Naval Forces*, 1/2000, p. 48; "Singapore orders La Fayette frigates", *Asia-Pacific Defence Reporter*, April-May 2000, p. 39.

For most states embarking on their RMA agendas, these technologies possess a significant potential to negatively impact on organisational structures and work processes. For mature conventional military organisations, the change might be even more important, dramatic and disturbing – leading to quite plausibly fundamental changes in the structure of the military organisation and the doctrines with which these military organisations engage in armed conflict.

Even the most modern of military organisations is essentially an industrial-era organisation, characterised by centralised controls and processes manned by a large body of staff, fairly rigid hierarchies, and high degrees of functional specialisations. Such organisations regard information as a means to an end, whereas the current information revolution sees information as an end in itself. Martin Van Creveld argues that such industrial-era organisations tend to suffer from "information pathology" – one example being how rapidly growing message traffic in Vietnam clogged the extant military signals networks, with little or no ability to differentiate from low to high-priority signals.[28] Such an industrial-era model may have been good where the competitive advantage lay in maximizing output (and information was the tool for maximizing output), but may be ill adapted to situations where the focus of attention shifts to information as the end product.[29]

In the case of the SAF, current thinking is encapsulated in its IKC2 concept (integrated knowledge-based command and control), which emphasises network-enabled and knowledge-based warfighting and tactical and operational decision-making, utilising the full range of C4ISR capabilities.[30] While it is probably incorrect to read too much into this, it is nevertheless interesting – and potentially informative – that this new strategic concept retains emphasis on command and control. The key weakness will likely be the tendency to retain rigid hierarchical command and control structures. It is not entirely clear if transformational technologies can work well in traditional force structures and hierarchies. Some debates within the SAF regarding the future shape of the organisation are beginning to argue, however, that the SAF should adopt a "flatter and more network-based system".[31] Others argue that the organisation ought to be re-organised around brigades rather than divisions.[32]

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[28] Martin Van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), pp. 247-48.

[29] W. Richard Scott, *Organisations: Rational, Natural, and Open Systems* 2nd ed. (Englewood Cliffs, NJ: Prentice-Hall, 1987), pp. 76-92.

[30] Jacqueline Lee *et al.*, "Realising Integrated Knowledge-Based Command and Control: Transforming the SAF", *Pointer Monograph* No.2 (Singapore: SAFTI Military Institute, 2003).

[31] Seet Pi Shen, "The revolution in military affairs (RMA): challenge to existing military paradigms and its impact on the Singapore Armed Forces", *Pointer*, vol. 27, no. 2 (April-June 2001), p. 16.

[32] Fong Kum Kuen, "A quantum leap towards knowledge warfare: revolution in military organizations in the SAF", *Pointer*, vol. 27, no. 2 (April-June 2001), pp. 80, 92, 94.

Another potential problem, one that may prove even more intractable, is the conscript nature of the SAF. Can one expect a soldier to be fully trained in networked operations in 2 years of full-time active service and another 10 years of reserve training (up to 40 days a year of military training in the reserves) on the new technologies and capabilities? The danger then is in dividing the armed forces into two entities – a 'smart' transformed active service, and a 'dumb' version.

Affording the Revolution in Military Affairs

Value for money – translated into economy, efficiency and effectiveness – is becoming an increasing priority for all government agencies, especially the armed forces, which is almost always the single largest consumer of public resources. For small states like Singapore, this is an even more difficult problem to overcome. For the modern military organisation, this aim translates into the minimisation of the so-called 'tail end' of the military (the non-combat, support side) to the 'teeth end' (the combat side). Ron Matthews argues that value for money has become even more important in the current RMA, given the increasing high costs of emerging weapons systems and technologies.[33] Current combat systems are simply a lot more expensive than their predecessors, and this has resulted in a kind of structural disarmament, whereby states and military organisations can afford ever-decreasing numbers of new weapons systems and platforms. Nowhere is this more prevalent than in air power, as successive generations of combat aircraft are becoming more and more expensive.[34] A case in point is the Singapore air force's fourth generation combat aircraft programme, which has resulted in the acquisition of 12 F-15SGs as a replacement for the existing fleet of A-4SUs and F-5Es.

Against this pattern of ever-increasing costs of new weapons systems and platforms, even the advanced countries find the required expenditures prohibitive. The identified solution has been to move towards off-the-shelf purchase (often accompanied by licensed production) and collaborative procurement or weapons research development (such as the Eurofighter Typhoon and the F-35 Joint Strike Fighter). Singapore is one participant in such collaborative programmes, having joined the Joint Strike Fighter (JSF) programme in 1999 as a 'Level 3 participant'.[35] In February 2003, this participation was upgraded to a 'security cooperation participant' at a cost of

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[33] Ron Matthews, "Managing the revolution in military affairs", paper presented at IDSS Conference on Revolutions in Military Affairs: Processes, Problems and Prospects, 22-23 February 2005.

[34] David Kirkpatrick and P. Pugh, "Towards the Starship Enterprise – are the Current Trends in Defence Unit Costs Inexorable?", *Aerospace* (May 1983). Kirkpatrick argues that this acquisition cost is increasing by approximately 10% each year. See David Kirkpatrick, "Starship Enterprise Revisited – Prospects for the 21st Century", *The Hawk Journal*, RAF Staff College (1995).

[35] 'Singapore joins JSF, Australia stays out', *Defense News*, 10 May 1999; 'Singapore signs letter of intent for Joint Strike Fighter Programme', MINDEF News Release, 22 February 2003.

US$50m in the system design and development phase.[36] This may lead to substantial industrial cooperation and an order for the aircraft for Singapore's air force. Such international collaborations appear to be an attractive option, but as Matthews shows elsewhere, this can be problematic.[37] These measures are designed to mitigate the problems of affordability for the RMA, but these problems remain.

Senior SAF officials are aware of the potential longer-term impact of the escalating cost of new equipment.[38] This is especially the case since the SAF envisages transformation across-the-board. For the SAF, developing RMA-type capabilities in the prevailing tough budgetary environment is clearly a major challenge, given than defence spending is less than 2% of the US or 12% of Japan's military spending. With the deceleration of Singapore's economic growth and the emergence of new demands imposed by counter-terrorism measures on the overall security budget, there is little prospect that defence budget can expand significantly in real terms as long as the government maintains military spending within the long-established self-imposed cap of 6% of GDP.

Facing New Security Challenges

Operations Other Than War

However, conventional wars are being increasingly supplanted by insurgencies and civil wars.[39] The soldier today is more likely to be deployed in such non-traditional (and unfamiliar) roles including peace operations, humanitarian and disaster relief, and counter-terrorism – so-called operations other than war (OOTW) – rather than the traditional defence of the state against foreign invasion. However, these OOTW roles are inherently problematic,[40] and require skill sets different from those demanded by conventional military operations, which typically does not

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[36] Andrew Doyle, 'Sharper focus', *Flight International*, 19 February 2002, p. 59.

[37] Ron Matthews, *European Arms Collaboration*, Harwood Academic Press (1992), ch. 3; and Ron Matthews, 'International Arms Collaboration: The Case of Eurofighter', *International Journal of Aerospace Management*, Vol. 1, No.1 (February 2001), pp. 73-9.

[38] See, for example, comments by Chief Defence Scientist Professor Lui Pao Chuen, 'Weapons of the future: let's think out of the box', *The Straits Times*, 12 July 2003.

[39] *SIPRI Yearbook 2002* lists 57 major armed conflicts in the period of 1990 and 2001, of which only 3 can be considered inter-state conflicts. These are what Mark Kaldor termed as "old" and "new" wars. See Mary Kaldor, *New and Old Wars: Organized Violence in a Global Era* (Cambridge: Polity Press, 1999).

[40] Michael W. Doyle, "Discovering the Limits and Potential of Peacekeeping", in Olara A. Otunnu and Michael W. Doyle (eds.), *Peacemaking and Peacekeeping for the New Century* (Oxford: Rowman and Littlefield, 1998), pp. 8-12.

occupy very much attention in the training regimes of modern militaries.[41] Indeed these OOTW skills might even run against the grain of the more traditional warrior skills a soldier is supposed to have. In peace operations, for instance, the mission aim is to avoid conflict and casualties; soldiers are expected to display non-threatening behaviour, which runs against the grain of their training. There is increasing recognition of the different challenges that peace operations impose on militaries, and the acceptance of the need for specialised training – such as the creation of the Pearson Peacekeeping Centre in Canada.

The Singapore experience in the 2005 tsunami disaster relief operations appears to refute the argument concerning specialised OOTW training.[42] This operation involved more than 1200 personnel. Airlift assets – C-130 and Fokker-50 aircraft, Chinook and Super Puma helicopters – flew some 250 missions carrying more than a million pounds of cargo and 4000 people.[43] Heavy sealift assets moved engineering equipment – bulldozers, excavators and cranes to establish beach landing points and clear supply routes from the coast to the devastated areas. The airlift and sealift assets that the SAF deployed are conventional military assets, and reflect the armed forces' continuing focus on conventional military defence. However, the fact that 21st Division was subsequently identified as the specialist agency for future OOTW missions might constitute tacit recognition of the need for specialised OOTW training.

Fighting the Global War on Terror

It is always tempting to employ the military in counter-terrorism efforts. Military organisations almost always have the necessary manpower and the skills for counter-terrorism. Inasmuch as terrorist bases and facilities can be located, through the use of ISR capabilities that are the purview of military organisations, these can be attacked and destroyed by either the careful insertion of trained military operatives or the precise application of standoff-range firepower. Even the more passive counter-terror measures – such as the guarding of critical infrastructure – resonates with that most mind-numbingly boring yet necessary of military tasks – the provision of guard and sentry posts. Tapping this reservoir of manpower resources for counter-terrorism efforts therefore appears to make sense.

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[41] Charles Moskos *et al.* (eds.), *The Postmodern Military: Armed Forces after the Cold War* (Oxford: Oxford University Press, 2000).

[42] See Bernard Loo and Joshua Ho, "SAF: A flexible force to deal with the unexpected", *IDSS Commentary 05/2005*, 31 January 2005.

[43] See Gail Wan, "Fast Aid", Pioneer No. 328 (February 2005).

However, a cautionary note is needed.[44] The principles of counter-terrorism are not entirely consonant with the principles of conventional warfare. The military mindset focuses on proactive problem-solving – find the problem and then fix or destroy it. It is reflected in two axioms – 'Never send in a man when a bullet will do'; and 'Firepower is cheaper than manpower'. Success can then be easily determined – at least, if the threat emanates from another state's regular conventional forces. However, firepower is a whole lot more expensive in the highly politicised milieu of counter-terrorism, where the critical effort resides in so-called "hearts and minds" measures.

Even when military force can be brought to bear in counter-terrorism, for example, when terrorist bases are located, the application of firepower has to be very carefully calibrated, sop as to not incur unnecessary levels of destruction, especially collateral damage. In any case, terrorists and their bases are not so easy to locate and destroy, otherwise the problem would not be as intractable as it seems. Counter-terrorism more typically involves passive security measures – the guarding of critical infrastructure and installations, which more resemble law enforcement and policing. In both law enforcement and counter-terrorism, the measure of success is reflected in the absence of incidents. Restraint in the use of force is desirable in counter-terrorism, but this may run against the grain of the military mindset.

Singapore's security planners have been increasingly pre-occupied with the emergence of the asymmetric challenges posed by terrorist organisations, accentuated by the 11 September 2001 attacks in the US and the December 2001 arrest of 15 members of Jemaah Islamiah (JI). The Singapore government saw these developments as a validation of the long-established idea of Total Defence, which involves non-military and military agencies in ensuring Singapore's security. [45] Indeed, the Singapore government took the concept a step further with the announcement in November 2001 that a 'homeland security' strategy would be adopted, involving closer cooperation between the military, law enforcement and customs and immigration agencies.[46]

Conclusion

Military transformation is a necessarily difficult process; for middle powers, it is even worse. To ignore transformation, however, is not possible, if only because one has to keep within touching distance of technological changes. To embrace transformation, however, is not

[44] See Kumar Ramakrishna and Bernard Loo, "The US Military and Non-Conventional Warfare: Is Firepower Cheaper than Manpower?", IDSS Commentary No. 34, 21 July 2005; and Bernard Loo, "The Military and Counter-Terrorism", IDSS Commentary No.89, 8 December 2005.

[45] 'Sept 11 proves need for Total Defence, says DPM Tan', *The Straits Times*, 27 October 2001.

[46] Lydia Lim, 'S'pore to have "homeland security"', *The Straits Times*, 5 November 2001.

guarantee of maintaining extant military standards and position either. It requires a leap of faith, because the middle power is embarking on a journey in which there are no clear road maps that can guide policy-making.

This is certainly the case for the SAF. Several key questions face the SAF: can the SAF be ready for it, what of the RMA is essential, affordable and operationable, and does the organisation have the right organisational systems that can best evolve and exploit advanced technologies for greater effectiveness in warfighting? For the SAF, doctrines would have to fit onto available technologies until they are able to develop the same for specific military applications, given that the SAF lacks the material wherewithal to put the technological cart before the doctrinal horse. This transformation process requires as its cutting edge the employment of extremely expensive high-end precision-guided munitions.

The organisation recognises that this is uncharted territory, and that it is making up the rules of the game as it goes along. On the plus side, Singapore has developed a reasonably credible military industrial complex, that has at least on paper designed weapons systems and capabilities specific to the SAF's unique conditions. Furthermore, the SAF has a fairly mature conventional military capability and at least a nascent joint warfare capability that allows it to make the transformation to new types of warfare relatively painless. The SAF has also put in place a strategic concept that can theoretically leverage on the national advantages of a well-educated populace, computer literacy, and relatively high levels of technological expertise. Furthermore, there are signs that the SAF is beginning to rethink its operational structures. Whether the SAF will emerge from this experiment with its capacity to remain relevant to the strategic demands of the state – whether in conventional defence of the island to the ever-increasing range of operations other than war – remains to be seen.