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The Role of Technology in National Defence

by MS Celia Ong

INTRODUCTION

Throughout history, technology has influenced the nature of warfare significantly. From machine guns, tanks, submarines and tactical aircraft that were used in the battlefields of World War 1, technology has progressively brought forth nuclear weapons, strategic bombers, inter-continental missiles, precision-guided munitions and integrated communications-satellite-computer systems that have profoundly affected the way nations prepare their defence.[1] Today's technology has reached quite a sophisticated level, producing weapons systems that are said to be "smart". Future advanced technology - such as artificial intelligence, neural and network, and image processing - will produce weapons systems which will not only be "smart" but intelligent as well.[2]

This essay reviews the implications of technology for national defence and Singapore's approach to the use of technology in defence.

IMPLICATIONS FOR NATIONAL DEFENCE

Just as technology and national defence have long been inter-related, technologists (developers of new technology for defence) and soldiers (executors of national defence and consumers of technology) have long been strategic partners in developing technological solutions in enhancing national defence capability. Soldiers look to the technologists to develop new technology that would enhance defence capabilities by improving operational performance, increasing systems reliability and providing greater mission flexibility while reducing costs, maintenance requirements and time required for the development and production of the technology.[3] Technologists look to defence as a market where their ideas can attract resource support to be tested operationally and as a consumer of their efforts.

Why Invest in Technology?

Technology is often seen as a panacea in national defence, capable of providing a comparative advantage in maintaining national security, prestige and influence. All major powers have equipped their military forces with the best available technology to give them decisive advantages over their opponents.[4]

The major powers also maintain research and development capabilities to avoid being caught without any counter-measures and outwitted in a technological sense. They even conceal their projects from public view to prevent potential opponents from developing counter-measures or similar technology themselves. Nations who feel threatened or have ambitions to extend their borders would accelerate their pace of military innovation for fear that if they lag behind, it would be difficult for them to catch up in terms of higher quality technology. This is because the amount of time required to develop new technology, engineer it into a weapon and manufacture the operational system is greater than that required for developing new technology. By the time the system is delivered, it no longer contains the latest available technology.

Advantages

Proponents who argue for greater investment in sophisticated technology for strategic forces would cite the following advantages that technology offers.[5]

Technology enhances tactical victory. Superior technology can therefore deter potential opponents even beyond the real increase in military power it provides. It can be employed to counter missile attacks by renegade nuclear powers, defeat aggressors with fewer casualties on all sides and help deter challenges to national security. Wars will continue to be fought with technology. As borne out by the Gulf War in 1991, there is no substitute for technological superiority. The armed force that is able to harness and integrate sophisticated technology effectively into its operational doctrine will preserve the lead over its opponents and gain potential victory against numerically superior opponents.

Technology yields payoffs and spin-off uses. The development and integration of advanced technology will yield many payoffs such as enhanced operational performance and reliability, increased training realism and effectiveness, reduced purchase and operating costs, and simplified maintenance requirements. Defence-related research will also yield technologies that offer non-defence spin-off uses such as in jet transport aircraft and digital computers.

Technology optimises soldiers' skills. The approach in using technology to warfare takes advantage of the citizen soldiers who have grown up with high technology and are particularly adept at using complex machines, electronics devices and computers. It will also overcome constraints imposed by limited human resources.

Technology reduces surprise. A strong technology research programme, supplemented by an aggressive intelligence programme, will reduce the chances of being surprised by a dramatic advance in an opponent's technology. The intelligence programme would have uncovered any new technologies with potential military applications, on which other nations might be developing.

Technology provides allies with assistance. High technology weapons that confer a strong advantage on the battlefield provide an option for providing military assistance to allies. This is preferable to sending fighting troops to their defence. For example, providing an ally with advanced fighter aircraft and the training to operate them could be as effective as sending troops to its defence, but much preferable in political terms.

Limitations

There are, however, limits to how aggressive a defence technology programme a nation needs. Firstly, new or emergent technology can only produce real advantages when they replace old ones. When a new system is introduced, improvements come rapidly and cheaply. However, after several successive generations, it becomes increasingly difficult to achieve the force multiplication which one initially seeks.

Secondly, given the long gestation period for developing new systems, the very latest weapons when delivered are out-of-date in terms of what technology could offer. Thirdly, although new technology can enhance defence capabilities, it disrupts established postures and procedures, thus compounding the uncertainties and risks posed by foreign threats. As the US's Strategic Defence Initiative has illustrated, while economic costs and potential benefits of advanced technology are enormous, uncertainties confounding threat assessments, performance evaluations and doctrinal justifications for defence systems are also enormous.[6]

Fourthly, as propounded by critics who view application of technology in defence with suspicion, existence of arms undermines international stability. Lastly, investment in high technology has come - often mistakenly - to be seen as the solution to problems which are essentially political. The technological "quick fix" may seem to permit reduction of military establishments by substituting high technology for manpower. It may also seem to offer much cheaper and more powerful means of destruction, such as nuclear weapons.

How Technology Should be Used?

Before one promotes technology to be in service of a robust and flexible defence of national values and interests, one would want to ask the following questions. What technology should be exploited to enhance defence? What technology should be pursued? At what pace and scale? How is the "right" technology to be identified, developed, integrated and applied so that the synergistic effects of component systems could contribute to the overall strategic deterrence system of national defence? Between technology and doctrine, which should be paramount? Should technology serve doctrine and so produce weapons that fit preconceptions and preferences? Or should doctrine be adapted to make best use of what technology has to offer? How can the economic, political and security risks attending these choices be assessed and minimised? The decisions would require visionary insights and a confident grasp of how technology would evolve and fit into the overall operational settings, given that the typical life cycle of modern sophisticated defence systems is about three to four decades. One would also have to consider the fact that the solutions proposed by the technologists for today's defence problems may also influence future research and development in technology and future defence procurement and expenditure, and the overall defence posture. This would also require the consideration of how scarce defence resources could be diverted from ongoing procurement to future research.

SINGAPORE'S APPROACH TO USE OF TECHNOLOGY IN DEFENCE

The mission of the Singapore Armed Forces (SAF) is to protect Singapore's interests, sovereignty and territorial integrity from external threats.[7]

Its strong deterrence capability provides the foundation for peace and security in Singapore and inspires confidence in Singapore as a dynamic economy and a safe location for foreign investors, contributing to Singapore's growth and prosperity. As CDF, LG Bey Soo Khiang, puts it:

"A strong SAF also assures foreign investors, a crucial ingredient for Singapore's success, that Singapore is a safe place for long-term investments".[8]

Technology as a Force Multiplier

The SAF's size and effectiveness are constrained by Singapore's small population and lack of natural resources. For the SAF to maintain its credibility as a modern fighting force, it has to continuously upgrade its equipment and people, and strives to be at the forefront of technological development. It achieves them through the force multiplier effects of technology. The effectiveness and fighting capability of each soldier is multiplied through better weaponry, tightly integrated defence command-and-control systems, and efficient operational and logistics systems.[9] CDF, LG Bey Soo Khiang, again:

"An important edge we must have is the ability to absorb new and advanced technology ... Not only to absorb them, but to integrate them into a system so that we can fight as an integrated and complete system..."[10]

Though technology is important, it is the effective integration of technology into a system that will be the key to warfare success.

Being Smart Buyers of Technology

BG (NS) Lee Hsien Loong, then Second Minister for Defence (Services), said in 1989, "... We had to be smart buyers of weapon systems, and smart users of weapon systems. The Ministry of Defence needed highly competent engineering and scientific staff. We sought people who would know how to evaluate and buy the right equipment and weapons, and then modify, develop and upgrade them to suit the SAF's special

requirements and tactics. Such people add value to our purchases and make every defence dollar spent on hardware count. This is what defence technology is about".[11]

BG (NS) Lee's statement is proven in the SAF's ability in developing the new "Bionix" Infantry Fighting Vehicle and upgrading the existing systems such as the RSAF's A4 Super Skyhawks, the Army's AMX-13 Armoured Personnel Carriers and Oerlikon guns[12] and the Navy's Missile Gunboats (MGBs). The development and upgrading of the systems were achieved through joint collaboration with the local defence industries (Singapore Technologies) and MINDEF's Defence Technology Group. The upgraded Super Skyhawks have more powerful, fuel-efficient and reliable engines similar to those used in F-18 fighters.[13] The upgraded MGBs feature the powerful Harpoon anti-ship missile, which can disable large ships such as destroyers.[14]

The SAF has also embarked on upgrading its F-5 Fleet. The upgrade will extend their usefulness by another 10 to 15 years and give the upgraded aircraft improved fighting capabilities comparable to new and more modern fighters, such as F-16s, but only at a fraction of the cost of buying the new aircraft. In the process of acquiring, modifying, mastering and maintaining and upgrading weapon systems, MINDEF and the SAF have also acquired the knowledge and skills in the latest technology.

Acquiring superior technology, as in acquiring new technology and upgrading existing system, is a complex process. Technology cannot be learned and developed overnight. This would require the SAF to continuously assess its mission and need for technology. It would also require MINDEF to continuously source among the defence suppliers of the world and assimilate the right technology and weaponry in equipping the SAF to meet its operational needs and develop the necessary support infrastructure for the SAF.

Another aspect to being on the technological frontier is the training and development of human resources. Given the increasing complexity of modern warfare, maintaining a technological edge alone is not enough to sustain the SAF's effectiveness. The soldiers must therefore be trained to fight tomorrow's war. They must reach a high level of technological expertise to be able to use highly sophisticated weapon systems. These systems also maximise Singapore's advantage of having highly educated citizen soldiers.

CONCLUSION

Technology will remain vital to national defence. It will change the way the armed forces operate in their core competencies and reshape their operational strategies. A key feature of a credible armed force will be its ability to exploit technology, to create a synergistic effect among its operating systems and organisations.

Technology can be tailored to specific environments leading to highly effective weapon systems that win wars, without having to rely on the other countries' technology plans and priorities and weapon concepts. For example, the British were the first to employ the concept of flying air-planes from ships but they failed to incorporate carrier aviation into the British Royal Navy. They were then focused on the problem of combating in the confined waters of the North Sea, the Mediterranean Sea and the Atlantic Ocean. Instead, the Americans and Japanese were the first to develop carrier aviation due to their need to travel long distances and fight major naval engagements.

To maintain a prudent degree of military superiority over potential opponents, steady efforts will be required to examine and understand how new and evolving technology could be exploited to provide superior weapons and supporting system for the armed force. New technology should release the constraints upon present operating practices rather than being constrained by them. The rewards from new technology will not come from one-to-one substitutions of better weapons for old ones. New types of weapon systems may have to be developed and tested to understand their potential for altering the art of war.

There are, however, dangers in allowing oneself to become mesmerised by technological promises. The capacity for devastation which military technology has provided, while imposing great caution, makes the potential cost of error literally incalculable. When viewing future technology, one should also avoid taking a one-dimensional view as it takes more than technology to revolutionise warfare. One must also zealously guard against neglecting the non-technological dimensions, which include the military organisational

structures and operational concepts. In this way, one can then be confident of remaining a master of technology rather than becoming a hostage to it.

ENDNOTES

1. Asa A. Clark IV, "The Role of Technology in U. S. National Security : An Introduction", in *Defense Technology*ed. Asa A. Clark IV and John F. Lilley (Praegar Publishers, USA, 1989), p. 3.

2. Ministry of Defence, *Defence of Singapore 1992-1993*, Public Affairs Department, Singapore, p. 52.

3. Asa A. Clark IV, op. cit. p. 4.

4. Steven Canby, *Introduction, The Impact of New Military Technology*, edited by Jonathan Alford,(Gower Publishing Company Limited, 199 1), p. 1.

5. Victor A Utogff, "Military Technology : Options for the Future", in *The American Military in the 21st Century* ed. Barry M. Blechman et. al. (St. Martin's Press, Inc., 1993), pp. 146-148. This article provides a very detailed account of the advantages of the application of technology in the military arena.

6. Asa A. Clark IV and John F. Lilley, *Defense Technology*, Praegar Publishers, USA, 1989, pp. xiii to xv.

7. Ministry of Defence, op. cit., p. 18.

8. Arujunan Narayanan, "Singapore's Strategy for National Survival", in *Asian Defence Journal*, 1/97, pp. 6-15.

9. Ministry of Defence, op. cit., p. 51.

10.M. Chew, *Our Sky Our Country The Republic of Singapore Air Force*, 1993, p. 185.

11.M. Chew, op. cit., p. 166.

12.Ministry of Defence, op. cit., pp. 24-25.

13.Ministry of Defence, op. cit., p. 36.

14.Ministry of Defence, op. cit., p. 39.

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Military Technology - Its Progress, Emerging Trends and Applications

by MAJ Chung Wei Ken

INTRODUCTION

Emerging military technology has continued to change the conduct of wars, from the battlefield of Waterloo to the recent Gulf War. From doctrines, strategies to the infrastructures, transport and logistics support, every facet of today's military operations has been permeated. Despite the advances in technology, the actual strategic principles changed very little through the years; that is economy of force, concentration of effort, surprise and mobility. Technology allows us to take better advantage of them, to improve mobility, to produce more effective surprises, to concentrate more quickly and to have more devastating firepower. This essay briefly shows how technology has aided the military through the wars.

Technological solutions are mostly accompanied by changes in doctrine, organisation, manpower, etc., in order that technology can be exploited to the fullest. Though the pace of technology is rapidly changing, the change is largely evolutionary than revolutionary - for example, the platforms used in the two World wars remained largely unchanged. One emerging trend of technology is that the commercial sector now takes the initiative from the military in most areas, especially in areas of computing, composite applications, software engineering, biotechnology, etc. which have commercial benefits. Other emerging trends are the shortening of windows of effectiveness and increased sophistication in support infrastructure. Lastly, two emerging technological applications are elaborated, i.e. information technology and total combat systems integration in the military. The essay concludes by providing some recommendations on how to further enhance our modernisation effort in view of the emerging trends.

Technology Introduced Through The Wars

Technological solutions never come alone, but are nearly always accompanied by changes. Changes in military technology are closely intertwined with changes in military doctrine. In addition, changes in doctrine, organisational structure, manpower criteria and training methodologies are also important ingredients for the successful exploitation of technology. This section illustrates how technology has emerged through the wars and along with it changes in doctrine, organisation and manpower.

During the Battle of Waterloo, 140 000 troops gathered on less than three miles of front line contact with their muskets. About a century later, trench warfare was the mode of battle in World War I. The advent of the machine gun and artillery enabled sizeable firepower to be delivered with considerable destruction. However, mobility and support efforts improved negligibly. Battlefield manoeuvres were almost non-existent. Tanks were introduced but not utilised to its full effects. Troops still gathered in high numbers, crowding shoulder to shoulder in their network of trenches. Without mobility and intelligence about the enemy, the newly acquired firepower served little purpose. At this stage, technology was not stretched and contributed little to the war efforts. Even the advent of the tank was not exploited with an effective doctrine.

World War II (WWll) saw the maturity of the tank and the aircraft. Armies were organised to capitalise on this capability. Mobility began to gain on firepower. Electronic communications afforded dispersion rather than concentration of forces. Naval forces were employing sonars whilst the air elements were equipped with radars. The Americans introduced amphibious landing and the Germans the U-boat as well as the V2 rocket. Tactically the blitzkrieg operations employed by the Germans took the world by surprise. The desert war was the cradle of effective British army-air cooperation and the use of the RAF in the tactical role to support the ground troops. The jet engine aircraft entered into service. Nuclear technology was invented and it ended WWII. The combination of technology and doctrine served as a force multiplier. The organisation of

troops were not amassed with huge numbers. Technical know-how in operations was crucial. Focus was placed on the technological edge after the war.

In the Vietnam war, ground force mobility was improved with the use of helicopters (Air Cavalry) to ferry massive numbers of troops to operational areas. Sensor technologies were adapted, from its intended use on the Demilitarised Zone (DMZ) by the Americans to defeat the North Vietnamese Army (NVA) and the Viet Cong in their forward bases. Using a combination of seismic sensors, infrared sensors and firepower from artillery and helicopters, the Americans inflicted severe blows on the NVA and Viet Cong. The Gulf War witnessed the emergence of stealth technology, precision laser guided bombardment and round-the-clock battlefield surveillance by RPVs. The period since WWII saw an accelerating transformation of military technology. Military leaders adapted doctrines to technology or vice versa. Organisation, manpower sizing and training were likewise effected to gain on the multiplying factor of technology.

Technology - Evolutionary or Revolutionary?

Apart from nuclear technology, which is revolutionary, the rest of military technology remained mainly evolutionary in nature since WWII. For example, the artillery is much the same as it had been in WWII. The tank is no more than a logical progression, taking advantage of the improvements in automotive technology and production engineering. Military development has been largely evolutionary, changing the forms of weapons to take advantage of lessons learnt in combat and of modern engineering ability. The soldier's basic tool, the rifle, is a good example; from the bolt-action repeating weapon, carefully machined from solid steel with wooden support, firing a heavy bullet of about 8mm calibre to ranges of 1500m-2000m, it has now become a lightweight automatic weapon of 5.56mm calibre, largely of pressed metal and plastic, with a maximum effective range of no more than 600m. The reduction in range and calibre has come about due to demonstrated facts that a soldier cannot see targets beyond 500m in range, even in the best conditions. The platforms too have not changed much; the aircraft, tank and ship remain much the same as they were. However the packaging inside has changed to deliver greater fire power, longer range, faster speed, better manoeuverability, etc.

Emerging technology really took off with the advent of electronics. This, followed by the microchip, the microcomputer and similar developments, has allowed weapons effectiveness to be enormously increased. Microchips enabled miniaturisation which in turn allowed smaller and smaller weapons to be equipped with their own electronic brains. More sensing and computing power were being built into the same amount of space. As a result, from 1950s onwards, successive generations of guided weapons appeared for use on land, at sea and in the air. As each new generation of weapons entered service, the lethality and precision of combat increased by leaps and bounds. For example, the rocket is simply a self propelled projectile moving towards a distant target. When the rocket is fitted with a computer to calculate its course, a radio to receive instructions, a radar to detect a target or infrared sensors to allow it to find the hot engine of an aircraft, it becomes a guided missile with a high probability of a kill.

Technology Initiative - Military or Commercial?

Technology has not always taken the lead from the military. In the past, it was the innovations or inventions in the civilian sector that was caught on by the military. The first practical breech-loading rifle was built by John Dreyse in the 19th century, a manufacturer of locks. One reason for this is that before the 19th century, the technological support needed for warfare took a relatively small proportion. Today, military leaders recognise the impact of technology in the military and have embraced it as an important part of the military arms. Another reason is that military organisations tended to be less flexible than most large bureaucratic structures. The compartmentalisation that is a necessary outcome of military secrecy often makes it difficult to engage in a free exchange of ideas, thus preventing the assembly of all the bits and pieces needed to create a new invention.

Nevertheless, the military is better placed than any other organisation to put a new concept into fruition due to the tremendous resources that the military possesses. The postwar (after WWII) period provided the conditions which supported the rapid and dramatic advances in military technology. Firstly, the experiences

of WWIl established the importance of technology to the nation's security - the realisation of technological sophistication over numerical superiority, i.e., quality over quantity. Secondly, the outbreak of the Cold War fostered a clear imperative for sustained efforts in the West, led by the United States, to maintain the technological edge in the world. Lastly, the advent of microelectronics.

In view of the tremendous advances taking place every few years, there could be no question that each country's effective military power depended on its armed forces continuously keeping abreast technologically. The United States emerged from WWll as the technological and economic leader of the world. By 1990, 342 000 engineers, or 18% of all US engineers, were employed in defence or defence related work. 26% of all US electrical and electronics engineers worked on military projects, while 43% of all aerospace engineers were engaged in defence.[1] Within this environment, military technology progressed more rapidly than commercial technology during the years following the war.

With the end of the Cold War, fundamental changes in the security environment as well as increased economic power of Europe and the East Asia shifted the focus of the West from military concerns. As emphasis on defence declines, so too does the priority assigned to developing and deploying new defence technologies. Development and production plans for numerous other cold war weapons have already been scaled back or cancelled. Examples are the cancellation of the US Army's plans for a new high tech tank to counter a future Soviet armoured threat and the scaling back in technologies in the European Fighter Aircraft programme. In fact, the end of the Cold War has spurred cutbacks in military spending not only in the United States and Europe but around the world as well, with the exception of East Asia and the Middle East. Meanwhile, commercial technologies have become more sophisticated. Technologies that were once the sole preserves of the military - automated information processing systems, mobile communications and advanced miniaturised electronics - are now dominated by the requirements of the commercial market. Through the process of market competition, research efforts in these fields are advancing faster than corresponding efforts in defence industries. So it seems that after about four decades of military lead from the 1950s onwards, the initiative in emerging technology is now taken back by the commercial sector. It must be noted that the pace of technology is not curtailed but still accelerated, albeit now in the commercial sector.

Trends and Applications of Emerging Technology

In this section, some trends and two applications of emerging technologies are discussed. They are: the growing importance of commercial technology, the proliferation of information technology, the multiplying effect of integrating all combat systems, the windows of effectivity and, lastly, the increasing sophistication in the support infrastructure.

Growing Importance of Commercial Technology

R & D spending on commercial technologies is increasingly less affordable in the military, especially after the **c**old war. While much of the private sectors' investments **a**re directed towards technologies of little relevance to the military, the overlap between commercial and military technologies is growing. One area where the military no longer leads is in computing and the baton is now in the hands of the commercial sector. The pace of change in computing is so rapid, the industry expanding so exponentially, new directions are being found so quickly, that military sponsored research can never keep up. Getting timely and detailed information will demand creative use of commercial systems and technologies. This will produce an intimate intertwining of commercial and military applications. Progressively the military will make use of COTS (Commercial off-the-shelf) or "Dual-use" equipment. COTS equipment are commercial products purchased for incorporation in defence systems without adaptation. One example is the incorporation of readily available laptop personal computers into existing data processing, logistics and command and control networks which have yielded substantial returns. Dual-use technology refers to technology that has both military and commercial applications. Efforts in adaptation and innovation are needed; for example the microchips that make precise missile guidance possible also turn up in children's toys and in automobiles.

The trend towards more rapid technological progress in commercial markets is likely to accelerate over the coming decade. In fact, of the 21 technologies listed in the 1991 US DoD Critical Technologies plan, 15 were identified as having significant commercial applications, including high performance computing, composite applications, biotechnology and software engineering, amongst others. According to the US Office of Technology Assessment, "the ability of the military to achieve and maintain leading edge technology in the future will depend in many cases on the health of the corresponding industry in the commercial sector of the economy".[2]

Proliferation of Information Technology

This technology has found its place not only in the heart of weapons systems but also in the personnel administration, planning, record keeping and many aspects of logistics such as requisitioning, keeping track of spare parts; in short the "business of war". Today, it is almost impossible to be computer illiterate. This technology offers cost efficiency. Computers, however, can and will do more. Fed with the necessary software, computers can be made to identify threats and even cause appropriate weapons to be directed and activated automatically. Throughout the 60s and 70s, the automated battlefield has been the subject of much speculation. However, the development has not proceeded far largely because many of the potential war environments are too complicated to be "understood" by even the best available computer programs. Therefore, the effectiveness of this technology lies in the modelling and quantifying of the fields which they deal with. This explains why areas where computers are effectively used are those which are easiest to quantify, namely personnel administration, logistics, intelligence and finally the operation of certain weapons in certain environments. There are negative aspects associated with information technology such as security threats, e.g. viruses, hackers, bugs, etc. Nevertheless, the benefits far outweigh the disadvantages and this is a technology that will continue to dominate the emerging technologies.

Towards Integration of all Combat Systems

The war with Iraq demonstrated that military gains are not simply in incremental improvements in military platforms and sub-systems, but that exponential increase in military power is achievable through the complete integration of all combat systems. The cybernetic nature of newly emerging technologies constitutes a pervasive influence on all aspects of military planning, doctrine and posture. Weapons and non-weapons elements, like devices for surveillance, data handling, target acquisition, guidance or electronic countermeasures, both old and new, are assembled in increasing complex weapon systems. Consequently, a growing measure of integration within the military posture and organisation is required. Another reason is the increasing complexity of the military organisations and of the battlefield. Whether applied in centralised or decentralised modes, operations on the battlefield will depend heavily on complex information technology. The expeditious nature of future war, where an immediate response is vital for victory is yet one more reason. The overall impact or ability of one's fighting capabilities will increasingly depend on how the weapons systems, infrastructure and efforts are coordinated at macro level. In the integration efforts, redundancy in the setup is a crucial factor as the control of the battlefield will be lost if the C^3I structure collapses.

Smaller Windows of Effectiveness

Emerging technologies lead to a higher effectiviteness at a cost of less flexibility. A new weapon has a very narrow window of high effectiveness. Beyond that window, the weaponry is blind and mute. Technology rarely stands still for very long because it is always in a constant state of change. Each new technology entering into the scene will soon find a counter-measure. Hence, the window of effectiveness becomes smaller and lasts a shorter period of time.

Increasing Sophistication in the Support Infrastructure

Support infrastructure comprises research, development, institutional and technical support that create an environment whereby emerging technologies can be maintained, evolved and harnessed. Technical activities

such as development of engineering methods, measurement tools, development and characterization of materials, compilation and validation of technical data must be sustained. Complexities in the emerging technologies employed in the battlefield demands a capable logistics system to sustain the effort. Personnel aside, a sophisticated and mobile logistics system is needed to prevent long down time and ensure sufficient spares holding.

Facilities such as telecommunications systems, computer centres and computer networks that interconnect research laboratories, universities and industries serve as mechanisms for diffusion. Already MINDEF and the SAF are tapping from the universities via seminars and joint research programmes. Through the use of internet, exchange of ideas within security bounds are also encouraged. Another area concerns in-country support. Increasingly, countries realise the need for less dependency on the original equipment manufacturer. Suppliers of new technology are drawn to joint ventures with the intent that technology transfer can be effected. This will ensure indigeneous support, improving response time in recovery and allowing the expertise to upgrade the systems in future.

Other areas which are already well coordinated at the national level for economical rather than military reasons are the encouragement of more high technological investments and the build up of engineering and scientific resources. In so doing, a strong technological base is founded and will aid in the sustainability of technologies.

Conclusion

Singapore spends up to 6% of our GDP on defence. Force modernisation and sustainability is one of the four key objectives of the SAF. With modern warfare becoming increasingly complex, the SAF has to keep up with developments in defence technology. Upgrade and acquisition efforts under the modernisation programme ensures that the technological edge is maintained and that each soldier is equipped with maximum firepower. There is no other alternative for this small nation but to use quality over quantity, which technology can provide. Our population size is small compared to our neighbours, and in the words of our CDF, LG Gen Bey Soo Khiang - "The manpower shortage faced by the SAF has to be dealt with through organisational restructuring and re-engineering, proper training and education and applying technology to enhance firepower and capabilities while using less manpower". We are in an era where conditions of emerging technologies favour the SAF. The conditions are the need for a highly educated force, a vibrant economy which provides the financial backing, a good technological base and the demise of the Cold war which led the West to cutback on defence spending, thus attracting many defence industries into this region to peddle their wares and keen on cooperation.

Sustainability ensures that the operational level of the SAF can be maintained in times of crisis. An effective integrated logistics system studying the reliability patterns and usage level of spares will guarantee sufficient stockpile for use. The build-up of the local defence industries' capabilities will provide the essential defence materials and services without reliance on the original equipment manufacturer.

The process of research, development and production of military technologies takes a period of at least ten years. Forward planning means designing now for the future. Budget though available, is a constraint and new weapons are getting more expensive. We must make intelligent use of technology, strike a balance in terms of the integrated logistics to support the growth, without failing prey to unwarranted technological optimism. With its narrow window of effectiveness, the SAF has to be very selective in its acquisition of emerging technology - technologies that are tailored for our terrain and environment.

New technologies often demand a rethinking or revision of doctrine to exploit their full potential. Though new technology needs to be integrated with the existing, the integration should not lead to a loss of independence and flexibility. Doctrines must be revised not at individual levels only but more importantly at an integrated level, to deliver a multiplying blow in the battlefield.

Rapid advances in commercial technologies will present tremendous opportunities for military applications. These opportunities can only be realised if we can make necessary reforms in the procurement practises to

gain access to these technologies on a timely basis, and invest in applied research to identify, modify and incorporate commercial components into military systems. Establishment of government - industry partnership is another avenue to venture into.

Lastly, Singapore is a small country, unlike the United States. The United States emphasises on the generation of new technologies as they have a huge defence budget. We invest in applications and diffusion. However with the little we have, if we invest wisely, select the right strategic technologies, assimilate commercial or dual use technologies and develop the doctrine and infrastructure that exploit the technologies to the fullest, we will be a modern technological force to be reckoned with.

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The Impact of Modern Technology on the Offence/Defence Balance

by LTC Tan Chor Kiat

INTRODUCTION: Technology and War

Technology has influenced the causes that lead to wars and the goals for which they are fought; the blows with which campaigns open and the victories with which they end; the relationship between the armed forces and the societies that they serve; planning, preparation, execution and evaluation; operations, intelligence, organisation and supply; objectives, methods, capabilities and missions; command, leadership, strategy and tactics; and even the very conceptual frameworks employed by thinkers on war and its conduct.[1]

Such is the influence of technology on war that it has been suggested that Clausewitz's "paradoxical trinity of people (or primordial violence, hate, enmity), military (the commander and his army who handle the chance, fog, friction of war) and government be "squared" by including technology as another major group of variables of war.[2]

Impact of Technology on Warfare

Since World War I (WWI), a number of new technologies of significant strategic importance have emerged. The tank, combining mobility, firepower and survivability, brought an end to trench warfare. Submarines opened up the depths of enormous ocean areas for military use and became a serious challenge to traditional surface forces. Similarly, aircraft opened the skies for military use and added a new dimension to land and naval warfare. Both sonar and radar were of critical importance to the battles of the Atlantic and the Pacific, and radar to the Battle of Britain in WWII. Nuclear weapons have increased by many orders of magnitude man's ability to cause devastation. Aircraft and ballistic missiles have made homelands far away from the battlefield vulnerable to attack. Long-range aircraft and ballistic missiles together with the nuclear propulsion of ships - in particular submarines - have reduced the importance of forward bases in potentially less stable areas. And military systems have found their way into space.[3]

Do technological developments favour the defender or attacker? One way to find out would be to review the effects of technology on a historical perspective and extrapolate to conclude whether modern technology indeed favours the defender or the aggressor. This however would be controversial and probably inconclusive because most of these wars were fought with one side having a definite lead in weapons technology, and as such, there can be hardly any doubt that the offence/defence balance would shift in favour of that side.[4] Moreover, there was often a gap between the analyses of military historians and the perceptions of statesmen.[5] For example, most observers (Montross, Wright, Gibson, Alexandroff) perceived that during the interwar years, military technology favoured the defender while only a minority proponents of armoured warfare (Liddel Hart, Fuller, de Gaulle, Guderian) felt otherwise.[6] Thus the balance of military technology based on historical analysis alone becomes difficult to classify.

The scope of this paper is, therefore, to identify key technology areas and draw conclusions or make predictions about the impact of new weapons technology on the offence/defence balance. Examples of the use of these technology in recent wars will also be highlighted whenever possible. As the paper is purely based on technology, the effects of cost benefits will not be highlighted.

NATURE OF TECHNOLOGY

Offensive and Defensive. The nature of new weapons technology is such that it will be exploited for both offensive and defensive purposes. In combat, both the aggressor and the defender will engage in offensive and defensive operations. In spite of limitations imposed by weather, terrain, etc., the potential consequences of new weapons technology for either are compelling and will probably lead to the

development of new tactical options for offensive and defensive operations.[7]The different tactical usage of tanks by the Germans and the French during WWII was a typical example. It can thus be concluded that the offensive or defensive character of a weapons system must be defined by both its intrinsic characteristics and the tactical doctrine which determines its use.[8]

Strategic and Tactical. Military concepts of the offence and defence must be further subdivided into strategic (theatre-wide) and tactical (local) components. For example, despite a defensive doctrine at the theatre level, NATO doctrine includes a variety of offensive operations, including local brigade and division level armoured counter-attacks and deep penetration air raids into the enemy's depth. Similarly, in the maritime sector, amphibious operations and strike missions by carrier-borne aircraft are planned despite the overall defensive doctrine.[9]

NEW TECHNOLOGY AREAS

Currently, apart from nuclear weapons, the main new technologies seem to be missile and anti missile technologies, surveillance and target acquisition (STA) systems, electronic warfare (EW) and the command, control, communication and computer (C^4) technologies. Continuous technological improvements to armoured fighting vehicles (AFVs) and aircraft have also enabled them to dominate the battlefield since WWII.

Missile and Anti-Missile Technologies

Missile Technology. Missile technology consists mainly of precision guided missiles (PGM), cruise missiles (CM) and tactical ballistic missiles (TBM).

Precision Guided Missiles. Compared to unguided weapons, PGM has a probability of neutralizing hard targets, like tanks, and of destroying the critical parts of larger objects. PGMs were extensively used by the Allied forces against the Iraqi forces during the Gulf War in 1991 to destroy vital installations and to disrupt withdrawing tank columns by demolishing critical bridges. In defensive roles, it can expected to be used against offensive manoeuvre forces like armoured columns.

Cruise Missiles. CM pose problems similar to those presented by low-flying stealth aircraft. Deployed on submarines, surface ships or long-range aircraft, their deep penetration capability can be further increased by launching the missiles from less well-defended direction. Launched from submarines and long-range aircraft, CM could for the first time pose a conventional threat to critical targets in the opponent's homeland. In naval warfare, CM would give smaller ships a weapon range which aircraft carriers can barely match.

Tactical Ballistic Missiles. Guidance technology permits effective use of TBM with a variety of warheads against different categories of important targets. They could be used tactically against air bases and other key targets, to prevent aircraft taking off and to delay and disrupt other aspects of the adversary's defence. They could also be used as a political tool against civilian installations like the use of V1 and V2 rockets by the Germans in WWII against Britain; and the use of Scud missiles by the Iraqi forces against Israel during the 1991 Gulf War. Active defence against this threat is technically feasible, but it would cost far more than the TBM force. Passive defence measures seem to be a much better option.

Anti-Missiles Technology. President Reagan's vision of a Ballistic Missile Defence (BMD) which could effectively protect the US and its allies from the treat of large scale nuclear ballistic missile attacks seemed to have been replaced by a defence against a small attack. Whether this goal is practical remains to be seen. Even if it is technically feasible, the cost of such a defence force would be far greater than the ballistic missile force. An example was the use of Patriot missiles against Scud missiles during the 1991 Gulf War. The Patriot missile not only costs many times more than the Scud missile but was also not foolproof against the Scud. In some instances, it was not able to hit the Scud missile while in others, the destruction of the Scud was too near the target and as such, the debris caused considerable damage to the target as well.

The Offence/Defence Balance. PGM, CM and TBM are all tactically offensive weapons which increase significantly the capability for rapid destruction of key targets that are important to the adversary's ability to respond. The use of such systems in the 1991 Gulf War has shown that using conventional BMD to destroy the missile before it reaches the target area is not a foolproof solution and at the same time costs significantly more than the adversary's missile force. Moreover, the cost required to develop a comprehensive anti-missile shield like the US's Strategic Defence Initiative (SDI) would be too high and possibly beyond reasonable justification. As such, present trends appear to constitute a strengthening of the tactical offensive nature of missiles at the expense of defence.[10]

Surveillance and Target Acquisition

General. In general, STA systems will be able to provide an accurate near real time picture of the enemy and terrain instead of depending solely on the less convincing verbal reports and interceptions of electromagnetic radiation. The main STA systems are imaging satellite, radar and electro-optics.

Technology available. Imaging satellites are now able to detect and locate ships, provide a rough classification of them, and, most of the time, determine their speed and course. They are also able to provide similar information about land targets, such as trains, columns of vehicles, aircraft on the ground, etc. Radars have also been dramatically improved since WWII. Such sensors can now be airborne, like the AWACS, seaborne, or even miniaturised to be mounted onto a jeep, e.g. ground surveillance radar. Their ranges also vary from hundreds of kilometres to tens of kilometres, depending on their operational requirements. Thermal imagers (TIs) have enabled reconnaissance and surveillance to be carried out over twenty four hours under any light conditions. TIs are also be able to see through conventional smoke screen and can be mounted on helicopters, remotely piloted vehicles (RPVs), land platforms or simply manportable.

The Offence/Defence Balance. In the realm of manoeuvre warfare, the ability to achieve the element of surprise through bold strategic manoeuvres is often synonymously link to the success of the operation. Examples are the landing of US forces at Inchon during the Korean War and the blitzkrieg style penetration by Ariel Sharon which encircled the Egyptian Third Army during the Yom Kippur War in 1973. With the advent of modern STA systems however, the element of surprise can be expected to be even harder to achieve. This would certainly create a dilemma for the commander of the manoeuvre force as he would be faced with the prospect of having to conduct a predictable operation or risk the loss of significant forces if he was to choose bold manoeuvres, since bold manoeuvres are often associated with high risk manoeuvres. It can thus be argued that the defender will stand to benefit more from the modernisation of STA systems. With respect to the tactically offensive nature of targeting warfare, both the aggressor and the defender will have equal chances of exploiting STA systems to enhance their targeting efforts.

Command, Control, Communication, Computerisation (C^4) and Electronic Warfare (EW)

Command, Control, Communication, Computerisation. Considerable efforts have been made to create a digitised battlefield through improved sensor systems, increased communication capacities and automated data handling. But only limited progress has been made in understanding how man absorbs, sorts and weighs data to extract the information which will allow him to make faster and wiser decisions.[11] A poorly structured C^4 organisation would be disastrous to both the aggressor and defender. The failure in command and control during the Malayan Campaign caused delay positions to be abandoned and bridges blown prematurely, thus forcing withdrawing British troops on the far side to abandon their heavy equipment. The initial inability of Montgomery's forces to create a corridor through the Axis minefields during the battle at El Alamein was also typical of C^4 failure. It could thus be argued that the side that could most effectively exploit and assimilate C^4 technologies into their doctrines would be favoured.

Electronic Warfare. Sensor and communication systems are vulnerable to EW. The aggressor employs EW to jam the defender's C^4 and sensor systems to facilitate his advance. The defender, on the other hand, uses EW to protect his C^4 and sensor systems and to disrupt the aggressor's command and control capabilities.

Both sides also exploit EW to monitor each others' communications. In the 1973 Middle East conflict, both sides engaged in widespread monitoring of communications, as well as ECM and ECCM. "Point" jamming was directed against air defence radars whose frequencies were known, or could be detected, and "barrage" jamming was successfully used against tanks to disrupt communications. Like C4, it seems that neither the aggressor or the defender has an edge over the other with EW technology.

The Offence/Defence Balance. Since both the aggressor and offender depend just as much on C^4 and EW, it seems apparent that C^4 and EW technologies are neutral and would favour the side that could better assimilate the technologies in their doctrines.

Armour vs Anti-Armour Technologies

Armour. Despite the belief in some circles that the tank will soon become as anachronistic as the battleship, it would be surprising if there is any marked decline in the use of armoured fighting vehicle (AFV) as the main land weapon platform in most countries today. Since WWII, the use of AFVs with tactical air support has been consistently in favour of the aggressor using the famous blitzkrieg doctrines in WWII and the Airland Battle doctrines during the 1991 Gulf War. Mechanised infantry has also been incorporated into the fighting doctrines to destroy anti-tank weapon positions so as to facilitate the advance of the armoured forces. With the introduction of advanced armour protection and early warning systems, AFVs have not only become more lethal, but also more survivable.

Anti-Armour. On the other hand, more effective types of anti-tank weapon systems have also emerged, such as anti-tank missiles, helicopter gunships, fixed wing aircraft specially designed for close support missions, minelets and bomblets which could be delivered by means of rocket artillery as well as from the air. These weapons and ammunition, together with electronic sensors and other surveillance devices, could confront the armour forces with a much more formidable defensive barrier that is currently possible. In short, armoured forces can no longer depend on infantry or tactical air support alone to sanitise the battlefield. In fact, they could suffer huge losses instantaneously when engaged by their enemy with multiple hit capabilities like smart bomblets.

The Offence/Defence Balance. Even if it would be dangerously reminiscent of the Maginot **l**ine mentality to assume that the defender could present an impenetrable barrier, the fact remains that the new technology offers the possibility of not only inflicting severe losses on the aggressor armoured forces but also of imposing considerable delays to their advance, thus providing more time for redeployment and reinforcement moves.[12] Unless armoured forces have an answer to the modern threats, technology has increasingly tended to favour the defender.

Aircraft and Air Defence

While the increasing effectiveness of SAM systems has, for all practical purposes, disposed of most of the threat of a medium altitude attack, it will continue to be extremely difficult for ground based radar installations to detect hostile aircraft flying close to the surface. Although the airborne radar could help to make good this deficiency, such a facility might prove highly vulnerable in a tactical context. The advent of the stealth fighter and bomber which could reduce the detection ranges of surveillance and defence systems further enhanced the aggressor's capability to inflict damage to the defender. Such was the case in the 1991 Gulf War where the US F-117 Stealth fighter was able to penetrate and destroy most of the early warning radars prior to the Allied air offensive. The view is apparently that, with the aid of diversionary tactics, ECM equipment and stealth technology, it should be possible for the attacking aircraft to reach their targets without sustaining prohibitive losses and the strikes against the main bases could have material impact on the course of the air battle, even if comparatively few of the enemy aircraft were actually destroyed on the ground. Therefore, technology in this area tends to benefit the aggressor more than the defender.

Effect of Nuclear Weapons

The main new complication is that the defender, even though deprived of a large portion of his initial strength in the course of the first battle, would still retain enormous firepower to hurt the attacker far more dangerously than it was ever possible before for a defensive force to do so. Similarly, to the aggressor, even if he achieves an unqualified victory, would not enjoy the fruits because he had paid an excessive price. In fact, he could still lose his country to the blows that his defeated adversary is able to inflict. As such, nuclear weapons have not worked totally to the advantage of the attacker.[13] This was fundamentally a nuclear deterrent, and based on the fact that the nuclear umbrella provided by the US was significant in deterring extensive communist aggression during the Cold War period (for example, against Japan). The effects of nuclear weapons could arguably be favourable to the defender.

CONCLUSION

It does seem possible to draw the tentative conclusion that, taken together, new technologies will make manoeuvre forces like the AFVs more vulnerable in the coming decade, particularly when operating in high density formations. This is likely so due to the significant advancement in surveillance (e.g. satellite borne surveillance) and highly effective weapon systems (PGW, TBM, CM, etc.). And if we take both Fuller's and Liddell Hart's view that mobility, striking power, and protection are the essential characteristics of an offensive weapon,[14] it is thus tempting to conclude that the defence stands to gain over the offence with respect to manoeuvre forces.

Nevertheless, if we adopt Colin Gray's definition that the offensive weapon is a weapon that has the reach to hurt an enemy at a distance,[15] the odds may now be against the defender. This is apparently so as modern technology (PGM, CM, TBM, stealth aircraft etc.) has enabled the aggressor to inflict substantial damage on the defender at long ranges without having to manoeuvre his forces. And since there do not seem to be any developments under way which offer countervailing possibilities (BMD is either too expensive and/or not foolproof), present trends appear to constitute a clear strengthening of the offence at the expense of the defence.

As for the effects of nuclear weapons, although they are undoubtedly devastating if used offensively, they were assessed to favour the defender more as a form of nuclear deterrent.

ENDNOTES

1. Martin Van Crevald, Technology and War, (The Free Press, 1989), p. 311.

2. Michael I. Handel, War, Strategy and Intelligence, (Frank Cass, 1989), p. 60.

3. Erik KIippenburg, ADELPHI PAPERS No 237, Strategy: The Impact of Technology, p.42.

4. Erik Klippenburg, ADELPHI PAPERS No 145, New Conventional Weapons and East-West Security Part II, p. 26.

5. Jack S. Levy, International Studies Quarterly (1984) 28,The Offensive/Defensive Balance of Military Technology:A Theoretical and Historical Analysis, p. 233.

6. Ibid.

7. Erik Klippenberg, ADELPHl PAPERS No 145, New Conventional Weapons and East-West Security Part II, p.26.

8. Jack S. Levy, International Studies Quarterly (1984) 28, The Offensive/Defensive Balance of Military Technology: A Theoretical and Historical Analysis, p. 226.

9. Richard Burt, ADELPHI PAPERS No 126, New Weapons Technologies, Debate and Directions, pp.12-13.

10.Erik Klippenberg, ADELPHI PAPERS No 237, Strategy: The Impact of Technology, p 46-47.

11.Ibid.

12.Trevor Cliffe, ADELPHI PAPERS No 89, Military Technology and the European Balance, p. 20

13.Stefan T. Possony and J E Pournelle, The Strategy of Technology, Winning the Decisive War, pp. 184-185

14.Jack S. Levy, International Studies Quarterly (1984) 28, The Offensive Defensive Balance of Military Technology: A Theoretical and Historical Analysis, p. 225

15.Colin S Gray, Weapons Don't Make War: Policy, Strategy, and Military Technology, (University Press of Kansas), p.31.

BIBLIOGRAPHY

1. Martin Van Crevald, Technology and War, (The Free Press, 1989).

2. Michael I. Handel, War. Strategy And Intelligence,(Frank Cass, 1989)

3. Erik KIippenberg, ADELPHI PAPERS No 237, Strategy: The Impact of Technology.

4. Erik KIippenberg, ADELPHI PAPERS No 145, New Conventional Weapons and East-West Security Part II

5. Jack S. Levy, International Studies Quarterly (1984) 28,The Offensive/Defensive Balance of Military Technology: A Theoretical and Historical Analysis.

6. Richard Burt, ADELPHI PAPERS No 126, New Weapons Technologies Debate and Directions.

7. Major General E. Longhouser, Keynote Address,1994 Armoured Warfare Conference.

8. Trevor Cliffe, ADELPHI PAPERS No 89, Military Technology and the European Balance

9. Stefan T. Possony and J. E. Pournelle, The Strategy of Technology: Winning the Decisive War,(University Press of Cambridge, Inc).

10.Colin S. Gray, Weapons Don't Make War: Policy, Strategy, and Military Technology. (University Ress of Kansas).

11.William H. McNeill, The Pursuit of Power, (Basil Blackwell Publisher Limited).

12.Colonel T.N. Dupuy, The Evolution of Weapons and Warfare, (The Bobbs-Merrill Company, Inc.).

13 Kenneth Macksey, The Impact of Science on Weapon Development and Modern Battles (Arms and Armour Press).

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Airpower as the "Fulcrum" of Modern Conventional Warfare?

by LTC Goh Teck Seng

Introduction

The success of airpower during Desert Storm was part inspiration for the essay topic; but a little preamble is in order. Airpower, as it was employed in the Gulf, exemplified classic textbook prescriptions on the subject with all the awesomeness that it implied. The centrepiece of Desert Storm, the air campaign, was clinically (and one may add, also brutally) executed, achieving such spectacular success that the assertion was subsequently made that "airpower (had) won the Gulf War".[1]

If the pronouncement that "airpower (had) won the Gulf War" is indeed valid, the premise underlying it is that airpower has come into its own. The "coming of age" of airpower suggests a wider evolutionary development, and it is that airpower has achieved relative dominance vis-a-vis land and maritime power as the "fulcrum" in modern conventional warfare. Is such an observation valid?

This essay devotes itself to answering the question. Its central argument affirms that airpower is now, and will foreseeably be, the dominant element in conventional warfare. The argument rests upon the proposition that technology has conferred an asymmetrical advantage on offensive airpower to such an extent that its inherent strengths can now be fully exploited on the modern battlefield. In this, the Gulf air war is used as a basis to focus the discussion. The essay also takes a historical glance backwards to highlight, as a reinforcing argument, that airpower's dominance in conventional warfare was acknowledged, though not unanimously, even in the past.

Getting the Perspective Right: The "What" and "Why" of Airpower Dominance

It is necessary to first define "airpower" in order to provide an analytical focus for answering the twin questions of the :what" and "why" of airpower dominance. Airpower is defined here broadly as "the ability to project military force by or from a platform in the third dimension above the surface of the earth".[2] Operationally, airpower is the sum-total of capabilities encompassing surveillance, reconnaissance, air mobility, aerial supply, air-to-air refuelling, strategic bombing, air interdiction, close air support, offensive counter-air and air defence.[3]

To assert that airpower is dominant is not to argue that it is supreme; the two conditions are mutually exclusive. Airpower is not "supreme" in conventional warfare as it cannot, in and of itself, win the war on land or at sea. But it has certainly become the dominant factor to the extent that it plays a role in creating the preconditions for victory and in facilitating, in a decisive way, the attainment of that victory. Such is the definition of "airpower dominance" adopted in this essay. Its underlying logic is a relative and not an absolute one, since airpower, in the context of combined-arms operations, is ultimately only a key, and not the singular, determinant of victory.

In this sense, the view of airpower expressed here is not a vindication of the "Douhetian" maxim on airpower with its conviction that "command of the air" is in itself a sufficient determinant of victory.[4] Rather, the position taken is that airpower constitutes a dominant combat element and that its dominance derives from its ability to contribute decisively to victory on land and at sea.

The precise meaning of airpower's "decisive contributions to victory" (and hence the validity of the "airpower dominance" thesis) can be established within the Clausewitzian paradigm. If war, in Clausewitzian terms, is about "compelling (one's) opponent to fulfill (one's) will",[5] the decisiveness of airpower, and thus its growing dominance, lie, then, in its increased efficacy in realising such an outcome through attacking the adversary's

"centre(s) of gravity". After all, a "centre of gravity" is that part of an adversary which, if destroyed, will cause his collapse since it is "the hub of all power and movement on which everything depends".[6]

In so far as the enemy's "centre(s) of gravity" extend beyond the tactical level to embrace targets at the operational and strategic levels,[7] striking them would require a combat instrument with the capabilities to manoeuvre over great distances into the enemy's depth and to mass fires wherever and whenever required. Only airpower is best placed to perform such a role given its inherent strengths of flexibility, speed of response, reach and punch.[8] The air front being indivisible, these qualities then give airpower the unique ability to transcend land and maritime barriers, thereby endowing it with a disproportionately dominant influence in both dimensions. If "command of the air" defines the centrality of airpower's contributions to victory, the key to it resides in airpower's ability to first achieve air superiority and then to strike the enemy's "centres of gravity" across temporal, geographical and "level of war" divides.

Treating the question of airpower dominance with a Clausewitzian slant reaffirms, in part, what General Billy Mitchell elucidated in 1930 in his visionary claims for airpower.[9] He noted then that:

"*The advent of air power which can go to the vital centres of gravity ... and entirely neutralise or destroy them put a completely new complexion on the old system of war. It is now realised that the hostile main army in the field is a false objective and the real objectives are the vital centres. The old theory that victory meant the destruction of the hostile main army, is untenable. Armies themselves can be disregarded by airpower if a rapid strike is made against the opposing centres*".[10]

Mitchell was, of course, trumpeting airpower in typical "Douhetian" style as a war-winning instrument of combat. He contended that an adversary could be defeated with airpower striking his "vital centres", leaving the field armies intact; but the aspiration of airpower being able to wrest victory all on its own remains unfulfilled to this day. Nevertheless, the essence of Mitchell's prophetic assertion must not be missed; and it is to do with the enormous potential of airpower in influencing the military outcome if it could strike, with impuity, at the enemy's "centres of gravity"

Technological "Push" and the "Take-off" of Airpower Dominance

Gradually but surely, airpower has been asserting itself as an increasingly potent factor in conventional war. The single most important variable that has altered the calculus of conventional capability mix and elevated airpower to a dominant status is technology.[11]

Compared to land and maritime forces, airpower is unique in its reliance on technology.[12]Because an air force is a technology-intensive outfit, technological progress, or the lack of it, must ultimately determine the potential and limits of airpower. Technological advances have traditionally yielded military advantages from the earliest times and in so doing, changed the relative balance between offensive and defensive capabilities.[13] In this, emerging and existing technologies presently favour airpower at the cutting-edge. To the extent that airpower is offensive by definition, technological advances have conferred an asymmetrical advantage on the offence. In the event, the offence/defence balance has tilted in favour of offensive airpower. If airpower has become dominant as a result, it is because it is now relatively invulnerable and exponentially more capable, thanks to stealth, electronic warfare (EW) and precision munitions technologies supported by equally impressive advances in information warfare capabilities.[14]

As an elaboration, stealth technology (having reduced the radar cross-section of a B-2 reportedly to just one-thousandth that of the B-52) will significantly degrade the three key functions of any air defence system: surveillance, fire control and kill probability.[15] Stealth, when employed effectively with EW, will render offensive airpower virtually indefensible against. To this is added the greater "punch" of airpower through precision weaponry that promises an exchange ratio, for example, against armour of 50:1.[16] A yet more significant force-multiplier lies in information warfare capabilities with the exploitation of space-based, airborne and ground-based sensor and C4I (Communications, Computers, Command, Control and Intelligence) systems: through the fusion of all-source intelligence and real-time data transmission, such

capabilities will enhance not only "dominant battlespace awareness" and "operational synchronisation" but also the tempo of war as decision time-cycles have been shortened.[17]

The new "strategic leverage of airpower"[18] has important implications in terms of opening up new vistas in conventional warfare. Pre-eminently, it points up the possibility of striking the enemy's "centres of gravity"- essentially his sources of power - with immunity and with such precisely-aimed blows, and at such a high tempo, as to cause "strategic paralysis" within a compressed timeframe. If such a "strategic paralysis" - akin to what Fuller had envisioned in "Plan 1919"[19], but on a grander scale - can be achieved with airpower, the need for a decisive land assault or the "climatic" sea battle would diminish accordingly.

Until the maturation of the key enabling technologies mentioned, the inherent strengths of airpower could not be fully exploited. For airpower was not invulnerable and its ability to decisively destroy an adversary questionable, especially with regard to his "centres of gravity". From the Clausewitzian perspective, airpower could not so easily "compel (one's) opponent to fulfill (one's) will" in the past because technology was a limiting factor. But the marriage of cutting-edge technology with airpower's inherent strengths offers the prospect presently of transforming the role of land and maritime forces to just that of consummating a victory rather than achieving it.[20]Herein lies the pre-eminence of airpower as an instrument of conventional war.

History as Both Inspiration and Affirmation of Airpower Dominance

Historically, airpower has enjoyed an edge (albeit a controversial one) over land and maritime power, if only because of its inherent qualities alone. Such a margin of advantage was not at first obvious as airpower existed only in a nascent form in the First World War.[21] The Second World War nevertheless established with greater clarity and forcefulness the ascendancy of airpower. For as Colonel John Warden, the architect of the Desert Storm air campaign, highlighted, "no country has won a war in the face of enemy air superiority since the German invasion of Poland in 1939".[22]

Admittedly, the post-World War Two record of the decisiveness of airpower is not an unmixed one. Analysts have heaped condemnations as well as sung praises about the effects of strategic bombing on the Axis Powers;[23] critics of airpower's unfulfilled promises in Korea and Vietnam have been balanced by advocates highlighting the constraints that limited its effective employment in these wars;[24] while still others had remained skeptical of airpower's potential contributions even as recently as during the Gulf War.[25]

But airpower has, on balance, been on the ascendancy. Criticisms of airpower's less-than-decisive role in the various wars can be rebutted on both empirical and analytical grounds. For a start, strategic bombing did undermine the morale of the German and Japanese populations and the industrial capacities of the Axis economies, as, for instance, in reducing Nazi tank and aircraft production, respectively, by 35% and 31% in 1944.[26] If airpower did not perform as expected in the Vietnam and Korean Wars, it was because its employment was politically constrained; but where airpower was allowed full rein, it was decisive, as in repelling the Viet Cong attack on Khe Sanh in 1967 and in compelling a North Vietnamese agreement at the Paris Peace talks through Operation Linebacker II in 1972.[27]

Even conceding in the abstract that airpower "failed" in all these cases, the cardinal point remains that no wars can be won without air superiority. This fact alone institutionalises the relative dominance of airpower, for "without control of the skies, no military power - land or maritime - can perform effectively".[28]

What this brief historical review illuminates is the trend of the growing dominance of airpower. It suggests that airpower has in the past been recognised as the dominant combat element as much as presently. The following two quotes, four decades apart from each other, illustrate this point well:

"*Today, airpower is the dominant factor in war. It may not win a war by itself, but without it no major war can be won".*[29]

Adm Arthur Radford, USN (1954)

"Airpower is the decisive arm so far, and I expect it will be the decisive arm into the end of the campaign, even if ground forces are added to the equation (emphasis added) ... If anything, I expect airpower to be even more decisive in the days and weeks ahead".[30]

Gen Colin Powell, CJCS (1991)

Therefore the debate on the decisiveness of airpower is not one of recent pedigree, but it has lately gained a new saliency because of airpower's dramatic success in the Gulf War. If history inspires, the recent Gulf War only reaffirms the pre-eminence of airpower. As one analyst put it, "(t)he ... perceived importance of airpower changed irreversibly (emphasis added) in the popular imagination after the night of 16 January 1991 ... during the opening hours of Desert Storm".[31]Indeed, the contention in the aftermath of the Gulf War is not so much whether airpower is dominant as whether it foreshadows a "revolution in military affairs".[32] In the event, the longstanding debate on the relative status of airpower in conventional warfare would appear to be swinging in favour of the airpower advocates.

The Gulf War as "the Apotheosis of Airpower"

If the Gulf War marked "the apotheosis of twentieth-century airpower",[33] it was because airpower's inherent strengths were finally mated with technological advances.[34] Airpower was decisive in Desert Storm through its employment in the aggregate of stealth, EW, precision stand-off attack and information-enhancement capabilities.[35] Equally, airpower won because the Coalition air forces fought as a system, exploiting its C4I capabilities and achieving "dominant battlespace awareness".[36] From the outset, stealthy, low-observable platforms such as the F-117s were able to penetrate Iraq's dense air defence networks with ease, and in combination with EW, blinded and eventually incapacitated a high proportion of Iraqi air defence systems. In a word, offence decisively routed the defence.[37]

The air campaign then succeeded so well that air supremacy was achieved in slightly over a week following the launch of Desert Storm.[38] With air supremacy achieved, the Coalition air forces then struck at will, and with great ferocity, at what were Iraq's "centres of gravity" based on the "five-ring" strategic model developed by Colonel John Warden.[39] The post-Clausewitzian "five-ring" model advocated waging an "inside-out" war with simultaneous strikes on "a nation"s leadership (the innermost target), key production, infrastructure, a population's support for its government and fielded military forces (the outermost ring)– in that order.[40]

"Centres of gravity" in the five strategic rings were systematically struck, reflecting the Clausewitzian belief that this was a decisive way to weaken the enemy's will. For this, the Coalition relied heavily on the F-117. Accounting for only 2% of the total attack sorties, it struck 40% of the strategic targets, underlying the leverage of both modern platforms and stealth.[41] Further, by employing Precision-Guided Munitions (PGMs), these deep strikes disrupted, with great effect, Iraq's "central nervous system", bringing about a quick "strategic paralysis". "Strategic paralysis" was cost-effectively achieved with just 20 000 tons of bombs compared with the over 8 million tons dropped in Vietnam over seven years and the 200 000 tons dropped on Germany's sixty-nine oil refineries alone during a twelve-month period in World War Two.[42] Another telling indicator of the cost-effectiveness of airpower was the aircraft loss rate: it was a mere 0.25% in the Gulf War in contrast to the 9.7% figure in World War Two; 2% in Korea and during Linebacker II; and 1% in the Yom Kippur War.[43] More significantly, PGMs altered the target/sortie ratios so markedly that the differential between precision and non-precision weaponry was 13:1, or "a better than an order-of-magnitude difference",[44] suggesting dramatically improved combat effectiveness for the same air effort.

The sum impact on the land campaign of these effective air strikes across the full spectrum of tactical, operational and strategic-level targets was two-fold: it undermined Iraq's offensive capability by destroying about 50% of its armour and artillery in Kuwait;[45] and it dislocated and demoralised Iraq's frontline divisions so severely that resistance melted away even before the Coalition ground manoeuvres began.[46] What airpower had done, in effect, was to "unburden ground commanders of any need to undertake a (massive)

frontal assault"against the Iraqis;[47] or as one analyst put it, " thanks to air, the ground offensive resembled less a blitzkrieg than the Oklahoma land rush".[48]

But technology in itself was not deterministic of airpower's success; what Desert Storm clearly demonstrated was also the "three-dimensionality" advantage of airpower.[49] Technology sharpened airpower at the cutting edge only to the degree that it was able to exploit airpower's inherent strengths of speed, reach, flexibility and punch. In so far as it succeeded in so doing, it enabled airpower to "turn a flank from above, unconstrained by terrain or natural barriers".[50]Only airpower, with its combination of lethality and freedom of manoeuvre, can bring firepower to bear anywhere and almost simultaneously in a way that "an army advancing along a flank or a fleet steaming at sea cannot".[51] The Gulf air war, with its demonstration of "operational simultaneity" further crystallised the "hyperwar" concept in which the dominance of airpower was incontrovertible.[52] Colonel John Warden summed up the point about airpower well,

"*The world has witnessed a new kind of warfare (in the Gulf) - hyperwar. It has seen airpower become dominant. It has seen unequivocally how defenceless a state becomes when it loses control of the air ... It has seen the awesome power of the air offensive - and the near impossibility of defending against it ... We have moved from the age of the horse and the sail through the age of the battleship and the tank to the age of the airplane. Like its illustrious ancestors, the airplane will have its day in the sun (emphasis added) ...*"[53]

If, as Colonel Warden claimed, "the airplane will have its day in the sun", has that day arrived? The "dawn" has certainly long broken on airpower given its growing dominance; but to have "its day in the sun", airpower must revolutionise the conduct of warfare. This is not yet self-evident, but the success of airpower in Desert Storm, in crossing key operational thresholds in terms of its cost-effectiveness and force-multiplying effects, seems to suggest new possibilities.[54] If nothing else, Desert Storm animated the potency of airpower even more persuasively.

Airpower Dominance: A Universal Truism?

The thesis of airpower's dominance in conventional warfare is undoubtedly valid, but it must be qualified. The question is, "Is airpower good for all times and all places, irrespective of context?" Answering the question necessitates a return to basics, "What are the pre-requisites for effective airpower employment in conventional wars?"

The Gulf War itself manifested a good many of the pre-requisites. Minimally, airpower success implies possessing a comparative superiority in airpower capabilities. This means, in operational terms, having an offensive capability sufficient to overcome the defence and then to strike the enemy's "centres of gravity" with relative immunity. Of course, the Coalition air forces possessed such a wide asymmetrical advantage in capabilities, leadership and training standards that victory in Desert Storm was almost assured.[55] This may be unique to the Gulf War, but the salient need to maintain a relative superiority in airpower was nevertheless underlined. The point remains that air forces that cannot employ stealth, EW or PGM capabilities better than their potential adversaries will not realise the full effects of airpower. Yet, apart from the technical base required, the costs of acquiring such capabilities may be prohibitive: to take an extreme example, the unit price of a stealth B-2 is an estimated US$ 800 million.[56] This begs the question: "How 'stealthy' can a middle-rung or even an advanced air force become, not to speak of lesser, 'flying-club' standard air forces?"

Secondly, the operational environment must be conducive to the effective application of airpower in terms of both the geographic setting and the nature of the target system. Geography is an influencing factor: air attacks have always been more effective in the arid deserts with the (often) clear skies than in temperate areas with their frequent mists, fogs and clouds or in the tropical zones with their heavy blinding rainfall and lush natural cover.[57] As for target systems, these must minimally facilitate the clear identification of "centres of gravity".[58] By this pre-requisite, a sufficiently modern, industrialised state (with sufficient critical nodes) [59] is better suited to the effective employment of airpower than an agrarian, underdeveloped society.

Thirdly, airpower must not be politically constrained, as it is not amenable to being used in "penny packets" with "pin-prick" effect.[60] Its potency lies in its being employed decisively and unambiguously as an instrument of war. The contrast in airpower effectiveness between the Vietnam War (with its notorious political meddling) and the Gulf War (with its relatively political 'hands-off' approach) underlines this vital point.[61]

These, then, are the necessary operational, geographical, environmental and political pre-conditions for the success of airpower. The validity of the "airpower as the dominant arm" thesis needs to be tempered by consideration of this fact. Nonetheless, airpower is decisive, all things being equal.

Conclusion: The Rise and Rise of Airpower Dominance?

Airpower has clearly risen in dominance relative to land and maritime power, especially given that it began institutional life largely as an auxilliary arm. Its dominant role presaged the Gulf War; what Desert Storm did was to establish the pre-eminence of airpower in unequivocal terms. Airpower is now, more than ever, the "fulcrum" of combined-arms warfare; the "flaming sword of national security", and no longer the 'blunt axe'.[62] The fusion of technology with its inherent qualities has transformed airpower into the exponential force-multiplier that it now is. Specifically, this is realised through airpower's relative invulnerability and its ability to strike an adversary's "centres of gravity" by exploiting the "three-dimensionality factor.

If the dominance of airpower is not in doubt, its ability to be the panacea for all "military ills" needs to be qualified. Provided the right pre-conditions obtain, the much-touted "flaming sword of national security" may well strike like the "blunt axe". This notwithstanding, airpower has proven its ability to be decisive in conventional warfare.

Looking ahead, the question remains: "Is airpower destined for an even more dominant role, to the extent of being the sole determinant of victory in future wars?" Will Douhet and Mitchell be vindicated in their visionary claims for airpower? The answer is clearly "no" until a "Revolution in Military Affairs" (RMA) occurs that is able to leverage the potency of airpower through the appropriate doctrinal and organisational changes.

Airpower is dominant presently because technology has favoured the offence over the defence. But given the enduring dialectic between offence and defence in military affairs, it is not yet the "End of History". To be sure, an RMA will not occur if technological counters to stealth, EW, PGM and information-warfare capabilities emerge. In the event, airpower, too, will lose its dominance. But for now and foreseeably, given the relentless push of cutting-edge technology favouring airpower, the thesis that it is the dominant combat arm remains unchallengeable. Therefore in any foreseeable future war, the vital and first blow will still come from the air.

Endnotes

1. Richard Hallion, Storm Over Iraq: Air Power and the Gulf War (Washington: Smithsonian Institution, 1992), p. 1.

2. Air Vice-Marshal R.A. Mason, "Current Air Power Developments" in Desmond Ball (ed.), Air Power: Global Developmentsand Australian Perspectives (Rushcutters Bay, New South Wales: Pergamon Press, 1988), p. 48.

3. Professor Sir Ronald Mason, "Technological Trends: Capabilities and Air Power" in Philip Sabin (ed.), The Future of UK Air Power (London: Brassey's Publisher, 1988), p. 99.

4. Donaldson Frizzell, "Early Theories of Air Strategy", Military Strategy, Vol 7, August 1973, pp. 16-17.

5. H. Rothfels, "Clausewitz" in Edward Mead Earle (ed.), Makers of Modern Strategy: Military Thought from Machiavelli to Hitler (Princeton: Princeton University Press, 1971), p. 102.

6. Michael Howard, Clausewitz (Oxford: Oxford University Press, 1983), p. 39.

7. This essay distinguishes the three levels of war on which airpower makes its impact.The "strategic level" concerns the overall conduct of the war with a focus on resource allocation and specific weights to be given to each theatre of war. The "operational level" is below the "strategic" and deals primarily with how to achieve the strategic ends of war with the resources allocated. It is the level at which plans are developed for the actual employment and deployment of land, air and maritime forces in the course of a campaign. The "tactical level" is the lowest level of war; it is the level at which opposing forces actually confront each other with all the operational needs that this implies.

8. Air Chief Marshal Sir David Harcourt-Smith, "Conclusions" in Sabin (ed.), op. cit., p. 233.

9. Hallion, op. cit., p. 7.

10. William Mitchell, Skyways (Philadelphia: J.P. Lippincott, 1930), p. 253. Quoted in ibid.

11. For a brief and concise review of what future technologies can offer airpower, see Peter Grier, " New World Vistas", Air Force Magazine, March 1996, pp. 22-25. The article is a condensation of "New World Vistas: Air and Space Power for the 21st Century", a principal study by the USAF Scientific and Advisory Board released in November 1994. The study aimed to identify technologies that could maintain US air and space superiority for decades to come.

12. Dr Richard Hallion, "Doctrine, Technology and Air Warfare: A Late Twentieth-Century Perspective", The Airpower Journal, Vol 1, No 2, Fall 1987, p. 16.

13. John Guilmartin, Jr, "Technology and Strategy: What are the Limits?" in Two Historians in Technology and War (Washington: Strategic Studies Institute, 1994), p. 14.

14. "Information warfare" is defined here simply as "actions taken to achieve information superiority by affecting adversary information and information systems while leveraging and protecting our information and information systems". In operational terms, it is encapsulated in a Command, Control, Communications and Intelligence (C4I) capability. See Admiral Jeremy Boorda, "Leading the Revolution in C4I", Joint Force Quarterly, Autumn 1995, p. 14; and Commander William Rhode, "What is Info Warfare", Proceedings, February 1996, p. 35..

15. Group Captain A.G.B. Vallance, "The Future: Offensive Air Operations", The RUSI Journal, Vol 136, No 2, Summer 1991, p. 24.

16. Ibid.

17. General John Shalikashvili, "Joint Vision 2010: America's Military - Preparing for Tomorrow, Joint Force Quarterly, Summer 1996, p. 39.

18. Benjamin S. Lambeth, "The Technology Revolution in Air Warfare", Survival, Vol 39, No 1, Spring 1997, p. 66.

19. Brian Holden Reid, "J.F.C. Fuller's Theory of Mechanized Warfare", The Journal of Strategic Studies, Vol 1, No 3, December 1978, p. 298.

20. Ibid. Indeed, the Americans (and none other than the USAF Chief of Staff, General Fogelman) have spoken of the "American way of war" based precisely on the predominance of airpower. For details, see John T. Correll, "The New American Way of War", Air Force Mgazine, April 1996, pp. 20-23; and John T. Correll, "The Rediscovery of Strategic Airpower", Air Force Magazine, November 1996, p. 29.

21. Guilmartin, op. cit., p. 15.

22. Colonel John Warden, The Air Campaign: Planning for Combat (Washington: Pergamon-Brassey's, 1989), p. 10. A case in point was airpower's disruptions of German efforts to repel the Allied invasion after D-day in June 1944. The German Panzer Lehr division lost 220 vehicles (approximately, 10% of its strength) to air attacks during its drive from its base at Le Mans to Normandy, but more critically, it was badly dislocated as a fighting unit and entered the battle in uncoordinated and ineffective "penny-packets". Two other Panzer

divisions, transferred from Russia, covered the 1000-mile long journey in only five days, but because of air attacks, took another nine days to cover the 200 miles to the frontline, by which time the battle was lost.

23. Dr Alan Stephens, "Alive and Well: The Air School of Strategic Thought", Australian Defence Force Journal, No 121, November/December 1996, pp. 9-10.

24. Ibid., p. 18.

25. Hallion, "Storm Over Iraq", op. cit., pp. 2-3. Among the skeptics were a Harvard economist, John Kenneth Galbraith, who warned that "Americans should react with a healthy skepticism to the notion that air power will decide the outcome of the war in Kuwait and Iraq". (Incidentally, Galbraith was a director of the US Strategic Bombing Survey at the end of World War Two). Others such as the ex-Army Chief of Staff General Edward Meyer predicted an estimated 10,000 to 30,000 American casualties, apparently discounting the airpower factor.

26. Stephens, op. cit., p. 9. How airpower succeeded under the right circumstances, or otherwise failed because of a lack of them, in Vietnam was also covered by other analysts; see Robert A. Pape, "Coercive Air Power in the Vietnam War", International Security, Vol 15, No 2, Fall 1990; and Mark Clodfelter, The Limits of Air Power: The American Bombing of North Vietnam (New York: The Free Press, 1989).

27. Ibid., p. 19.

28. Hallion, "Storm Over Iraq", op. cit., p. 5.

29. Ibid., p. 1.

30. Ibid., p. 201.

31. Lambeth, op. cit., p. 65.

32. Ibid.

33. R.A. Mason,"The Air War in the Gulf", Survival, Vol XXXIII, No 3, May/June 1991, p. 225.

34. Hallion, "Storm Over Iraq", op. cit., p. 7. The air campaign was conducted in four phases. Phase 1 was directed at Iraq's offensive air and C3I capabilities to gain air superiority and to achieve "strategic paralysis"; Phase 2 was to suppress Iraqi air defences in Kuwait; Phase 3 was a full-scale offensive against Iraq's field armies in Kuwait; and Phase 4 was support of the ground manoeuvres.

35. Benjamin S. Lambeth, "Technology and Air War", Air Force Magazine, November 1996, p. 50.

36. Eliot Cohen, "The Meaning and Future of Air Power", Orbis, Spring 1995, p. 192.

37. Gary Waters, The Strategic Air Lessons of the Gulf War, Australian Defence Studies Centre (ADSC) Working Paper No 6 (Canberra: ADSC, 1992), p. 6.

38. Eliot A. Cohen and Thomas A. Keaney, Revolution in Warfare? Airpower in the Persian Gulf (Annapolis: Naval Institute Press, 1995), p. 48.

39. Hallion. "Storm Over Iraq", op. cit., p. 116.

40. Ibid., p. 117. For details of the "five-ring" model, see Col John A. Warden "The Enemy as a System", The Airpower Journal, Vol IX, No 1, Spring 1995, pp. 44-54.

41. Cohen and Keaney, op. cit., p. 190.

42. Col John A. Warden, "Employing Air Power in the Twenty-first Century" in Richard H. Shultz and Robert L. Pfaltzgraff (ed.), The Future of Air Power in the Aftermath of the Gulf War (Maxwell Air Force Base, Alabama: Air University Press, 1992), p. 76.

43. Vallance, op. cit., p. 24. Aircraft loss rates are measured in terms of the number of aircraft lost in combat per 1000 sorties.

44. Ibid., p. 205. To get a sense of the contrast, consider this: twelve sorties by F-111s delivering unguided Mk 82 bombs required 162 Mk 82s to cover two targets; by comparison, the same number of sorties by F-117s and F-111s covered twenty-six precision targets with only twenty-eight bombs.

45. Ibid., p. 209.

46. Ibid., p. 101. An estimated 10,000 Iraqi troops were killed in the air offensives, and by the time the Coalition land campaign began, 20%-40% of Iraqi soldiers had deserted.

47. Lambeth, "The Technology Revolution", op. cit., p. 66.

48. Hallion, "Storm Over Iraq", op. cit., p. 253.

49. Ibid.

50. Ibid.

51. Ibid., p. 254.

52. Warden, "Employing Air Power in the Twenty-first Century" in Shultz and Pfaltzgraff (ed.), op. cit., p. 81.

53. Ibid., p. 82.

54. Cohen, "Revolution in Warfare?", op. cit., pp. 209-212.

55. Mason, "The Air War in the Gulf", op. cit., pp. 226-227.

56. Vallance, op. cit., p. 24.

57. Dr Edward N. Luttwak, "Air Power in US Military Strategy" in Schultz and Pfaltzgraff (ed.), op. cit., p. 21.

58. Ibid., p. 24.

59. One such critical node for the proper functioning of a modern, industrialised society is its electricity distribution network. For a competent analysis of how this can be targeted by airpower to achieve selected effects, see Daniel T. Kuehl, "Airpower vs. Electricity: Electric Power as a Target for Strategic Air Operations", The Journal of Strategic Studies, Vol 18, No 1, March 1995, pp. 237-266.

60. Cohen, "Revolution in Warfare?", op. cit., p. 226.

61. Kenneth P. Werrell, "Air War Victorious: The Gulf War vs. Vietnam", Parameters, Vol XXII, No 2, Summer 1992, p. 49.

62. Hallion, "Storm Over Iraq"?, op. cit., p. 264.

BIBLIOGRAPHY

BOOKS

1. Ball, Desmond (ed.), Air Power: Global Developments and Australian Perspectives, Rushcutters Bay, New South Wales: Pergamon Press, 1988.

2. Cohen, Eliot and Keany, Thomas, Revolution in Warfare? Airpower in the Persian Gulf, Annapolis: Naval Institute Press, 1995.

3. Hallion, Richard, Storm Over Iraq: Air Power and the Gulf War, Washington: Smithsonian Institution, 1992.

4. Sabin, Philip (ed.), The Future of UK Air Power, London: Brassey' s Publisher, 1988.

5. Shultz, Richard and Pfaltzgraff, Robert (ed.), The Future of Air Power in the Aftermath of the Gulf War, Maxwell Air Force Base, Alabama: Air University Press, 1992.

6. Warden, John (Colonel), The Air Campaign: Planning for Combat, Washington: Pergamon-Brassey's, 1989.

MONOGRAPHS/WORKING PAPERS

1. Guilmartin, John Jr, "Technology and Strategy: What are the Limits?" in Two Historians in Technology and War, Washington: Strategic Studies Institute, 1994.

2. Waters, Gary, The Strategic Air Lessons of the Gulf War, Australian Defence Studies Centre (ADSC) Working Paper No 6, Canberra: ADSC, 1992.

JOURNAL ARTICLES

1. Boorda, Jeremy (Adm), "Leading the Revolution in C4I", Joint Force Quarterly, Autumn 1995.

2. Cohen, Eliot, "The Meaning and Future of Air Power", Orbis, Spring 1995.

3. Hallion, Richard (Dr), "Doctrine, Technology and Air Warfare: A Late Twentieth-Century Perspective", The Airpower Journal, Vol 1, No 2, Fall 1987.

4. Lambeth, Benjamin S., "The Technology Revolution in Air Warfare", Survival, Vol 39, No 1, Spring 1997.

5. Lambeth, Benjamin S., "Technology and Air War", Air Force Magazine, November 1996.

6. Mason, R. A., "The Air War in the Gulf", Survival, Vol XXXIII, No 3, May/June 1991.

7. Rhode, William (Cdr), "What is Info Warfare", Proceedings, February 1996.

8. Shalikashvili, John (Gen), "Joint Vision 2010: America's Military - Preparing for Tomorrow, Joint Force Quarterly, Summer 1996.

9. Stephens, Alan (Dr), "Alive and Well: The Air School of Strategic Thought", Australian Defence Force Journal, No 121, November/December 1996.

10. Werrell, Kenneth P., "Air War Victorious: The Gulf War vs. Vietnam", Parameters, Vol XXII, No 2, Summer 1992.

11. Vallance, A.G.B. (Gp Capt), "The Future: Offensive Air Operations", The RUSI Journal, Vol 136, No 2, Summer 1991.

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Know The Enemy and Know Yourself : A Look at America's Defeat in Vietnam

by MR Ronald Hee

Know the enemy and know yourself

In a hundred battles you will never be in peril.

When you are ignorant of the enemy but know yourself

Your chances of winning and losing are equal.

If ignorant both of your enemy and of yourself

You are certain in every battle to be in peril.[1]

Vietnam. The word still resonates for Americans. It was the only war they ever lost, and, perhaps they never fully understood why. The reasons for that defeat, despite all of America's apparent advantages, have been explored thoroughly in countless books and articles. At the risk of over-simplification, the basic reason may well lie in the 2,500-year-old writings of SunTzu.

In Vietnam, the Americans clearly failed to understand the nature of their enemy, and the conflict in which they were engaged. What is even more telling is that the Americans blundered into a war without fully understanding their own aims. Defeat, even with an overwhelming military advantage, was perhaps the inevitable result.

After the war, General Maxwell Taylor echoed Sun Tzu almost word for word:

First, we didn't know ourselves. We thought we were going into another Korean War, but this was a different country. Secondly, we didn't know our South Vietnamese allies. We never understood them, ... and we knew even less about North Vietnam .... So, until we know the enemy and know our allies and know ourselves, we'd better keep out of this dirty kind of business.[2]

Since at least the Spanish-American War at the beginning of this century, all American actions overseas have been couched and explained in terms of good versus evil. World War I was fought as "the war to end all wars", and World War II, to "make the world safe for democracy". In 1952, flushed with victory in the Second World War, and fighting the good fight against godless communism in Korea, the incoming president, Dwight Eisenhower, summed up the US foreign policy ethic, by proclaiming, "you [the American people] have summoned me ... to lead a great crusade - for freedom in America and freedom in the world".[3]

It was Eisenhower who made the first decision on the slippery slope leading to full American involvement in Vietnam. He talked of falling dominoes in Indochina, and the threat communism would pose to the United States, should Indochina turn communist.[4] All non-communist states were to be supported in this fight, regardless of their credentials. This meant in 1952, support for the French, even if this also meant supporting a colonial power against popular indigenous insurrection. By the time of the French defeat at Dien Bien Phu, American aid had exceeded US$2 billion.[5]

By 1954, communism seemed clearly on the offensive; the "loss" of China in 1949, the bitter stalemate in Korea and the partition of Vietnam into north and south, following the French defeat. Domestically in America, there were the McCarthy anti-Communist witch-hunts. The result was an "anti-Communist panic", [6] and blind opposition to any state deemed communist.

The Geneva Accords of 1954 called for the temporary partition of Vietnam, subject to "free general elections by secret ballot ... in July 1956 under the supervision of an international commission".[7]But if these elections were held, both the South Vietnamese and their American supporters surmised, the charismatic leader of the North, Ho Chi Minh, would win, and Vietnam would be "lost" to communism. But in supporting the cancellation of these elections, the Americans violated their own principle of the right of self-determination. The result was America's support for a regime that, though anti-Communist, possessed neither the support of the people, nor believed in democratic principles.

In calling for the temporary partition of Vietnam, the Geneva Accords did not establish either North or South Vietnam as sovereign states. "South Vietnam was a sovereign state only because Diem [the South Vietnamese leader] said it was."[8] While expressing doubts that the 1956 elections involving the North and the South would be a free one, the Americans chose to ignore the fact that in the South, Diem had rigged an election to give himself 99% of the vote.[9] In violating their own principles, the American leadership failed to understand how poorly this would go down with the American people. This failure to understand themselves would lead to a massive popular protest against the war, mortally dividing the country.

In 1961, the next US president, John Kennedy, pledged to Diem that "our primary purpose is to help your people maintain their independence".[10] But the belief that US military and economic aid alone, however massive, was enough, showed a lack of understanding of the nature of their client, and showed a lack of understanding of the nature of the war as well.

The South Vietnamese army was built up along American lines, and trained to fight a conventional war, not a guerrilla war. The officers were promoted according not to efficiency, but for their loyalty to "Diem".[11] As for the rank and file, "they would not fight, for the good reason that they had nothing to fight for".[12] And without the necessary political, social and economic reforms, "the US plan to end the insurgency was foredoomed from its inception, for it depended on Vietnamese initiatives to solve a Vietnamese problem".[13]

For the type of war the Americans were fighting, it is possible to turn again to Sun Tzu. Although he wrote of war in general, it is possible to read in another of his famous verses, clear directions on how to fight a guerrilla war:

All warfare is based on deception.

Therefore, when capable, feign incapacity.

When active, inactivity.

When near, make it appear that you are far away.

When far away, that you are near.

Offer the enemy a bait to lure him.

Feign disorder and strike him.

When he concentrates, prepare against him.

Where he is strong, avoid him.

Anger his general and confuse him.

Pretend inferiority and encourage his arrogance.

Keep him under a strain and wear him down.

When he is united, divide him.

Attack where he is unprepared.

Sally out when he does not expect you.[14]

It is fitting to note that the Chinese and their Vietnamese compatriots read and followed closely what Sun Tzu wrote, and unashamedly copied him practically wholesale. Mao Zedong summarised the lessons of Sun Tzu in his famous dictum, as:

When the enemy advances, we retreat!

When the enemy halts, we harass!

When the enemy seeks to avoid battle, we attack!

When the enemy retreats, we pursue![15]

The type of war the Americans were engaged in, is the type of war a democracy cannot fight effectively; in an insurgency appears a war without end and without goal. Eisenhower himself once said that no democracy could fight a 30-year war, and reckoned that six years, the duration of World War II, is the absolute maximum a democracy could sustain. Sun Tzu in turn, wrote:

"When the army engages in protracted campaigns the resources of the state will not suffice.... There has never been a protracted war from which a country has benefited".[16]

Counting from the time the Americans took over from the French in mid-1950s, to the fall of Saigon in 1975, the Americans were involved for a good 20 years, and in actual combat for about 8.

The Viet Cong and the North Vietnamese relished the fight. They knew the enormous strengths of their enemy - and his weaknesses, mainly a lack of patience and morale. These in turn were their strengths. To the Communists, this was a War of Independence they had been fighting since at least 1945; against the Japanese, the French, and now, a new foreign invader.

The people of the South, they saw, were brothers held in bondage by a puppet regime, in turn propped up only by foreign bullion and bayonets. Hence it was their duty to liberate their brothers and complete the fight for freedom. The Americans little realised that they were facing a determined population, inured to hardship, and led by capable and astute leaders.

Seen in this light, the American bombing of the North may well have been counter-productive. It served as sufficient reason for the northern leaders to stir their people to greater effort and sacrifice. And the reality was that bombing could not work against a rural economy. With all vital supplies coming in from factories operating safely in China and Russia, and almost all the North's weapons coming from captured supplies, what was there for the bombers to hit? Even along the Ho Chi Minh trail, the massive bombing efforts availed little; bombers "could not work against an enemy who moved his goods on human backs....".[17]

Using bombers is the American way of war - an expensive technological solution that promised significant gains for insignificant outlay in human lives. At least in the case of Vietnam, this solution did not work.

On the ground, the lavishly equipped American troops found themselves set against an elusive enemy, deciding the time and place of each violent skirmish, each encounter designed to minimise the Americans'

firepower advantage, and maximise the Viet Cong's manpower advantage. Despite heavy losses, the Viet Cong believed they were winning if for every ten of theirs, one American lay dead or dying. Under these conditions, against an entire population willing to fight and die, eventually the Americans realised they needed more troops in the country than they could spare, or the American people were willing to allow. By 1967, the Americans already had half a million men in Vietnam. Attuned to public pressure, President Johnson balked in horror at the military's request for an additional 200 000, with no guarantee that even this would be enough.[18]

There was a telling exchange between an American colonel and his Vietnamese counterpart after the war. The American said, "You know, you never defeated us on the battlefield" The Vietnamese replied, "That may be so, but it is also irrelevant".[19] At every battle, the Americans may never have been defeated, but the war was won not on the battlefield, but in the hearts and minds of the Vietnamese people - and the American people.

In seeking a military solution, the Americans were blinded by their technological advantage, and failed to realise that the war would be fought and won on a higher plane - in terms of morale, perceived virtue, and diplomacy. In a sense, Vietnam was a public relations war. By painting themselves as a people fighting for their independence against a powerful foreign aggressor, the Vietnamese were able to ride the tide of world opinion. The 1968 Tet Offensive was a key example. Despite losing big on the battlefield, with the Viet Cong all but wiped out, the communists were perceived as the victors. The Americans, in having to fight in their own embassy grounds, and the South Vietnamese, in having to fight in their own capital, were seen as the losers.

In such a war of images, a protracted war for hearts and minds, it was the Americans who were at the disadvantage - they were the ones with "crippling liabilities [of] limited time, inadequate manpower, and diminishing political resources".[20]

It is with some irony that, with American dominance of the airwaves, it was the Vietnamese who were best able to use the media. In such a war of images, the US military failed to properly utilise the media. It can be said that at least part of the Vietnam War was lost on the television sets in American homes across the nation; "...whether ordinary people, who prefer peace to war in any country, whether ordinary people can sustain a war effort under that kind of daily hammering [of television reports] is a very large question".[21]

The Americans had failed to understand the nature of their own military, the enemy, and the very war they were fighting. They also failed to understand their own people; "No nation, no people ... should be asked to fight for a cause when its own government has failed to justify it wholly and completely .... Without such popular support, the drive, the total effort, and the persistence essential to win were absent".[22]

The military history of America indicates that its people are willing to sacrifice a great deal of effort and lives for objectives deemed honourable and legitimate - witness the four-year effort against Nazi Germany, at the cost of over 400,000 lives. Yet in the case of Vietnam, with deaths less than 57,000, this popular support was not there. "The American people will support even a costly war for a just cause, but they will withdraw their support when they no longer see a reasonable chance for realising a preferred or acceptable outcome... [in] Vietnam... casualties were being sustained with no apparent progress towards [any] understandable or acceptable definition of victory".[23]

It can be claimed with some justification that the Americans never lost the Vietnam War, as there was never a formal declaration of war. But without this declaration, and clear reasons spelling out the need for such a war, the American leadership at the very onset, deprived themselves of much public support. Without such an outright declaration of war, the Johnson Administration had to tread very carefully; even though US honour was at stake in the defence of South Vietnam, this defence could not be unrestrained.

The use of air power was meant as a means to minimise the ground involvement. As has been pointed out earlier, this was a failure. And as more American "grunts" hacked their way through the jungles and padi fields, there was no big victory, no milestone, no liberated city, to show the folks back home that their boys

were winning, were there fighting and dying for a purpose. Hence the grisly practice of "body counts" - "very quantitative, very scientific, and very misleading".[24]

Even among the US political leadership, there was "persistent confusion as to what type of war the nation was fighting and, as a direct consequence, confusion as to how to end the war".[25]Damningly, a senior McNamara assistant added in 1966 that "the reasons why we went into Vietnam to the present depth are varied; but they are now largely academic. Why we have not withdrawn from Vietnam is, by all odds, one reason ... to avoid humiliation".[26]

Ironically, the American leaders received enough advice to know that Vietnam would be a long-drawn, inconclusive and expensive conflict. So "why had the Americans not heeded their own warnings? Because they were cocky, over confident, sure of themselves, certain that they could win at a bearable cost".[27]

The result was far different. In tangible terms, the war cost 56 962 Americans killed,[28] and drained the treasury of US$236 billion.[29] The cost in intangible terms have been even higher; a country mortally divided, loss of international prestige and influence, economic recession and inflation. A high price to pay for the lesson that, before getting into any conflict, "know the enemy and know yourself".

Now there are five circumstances in which victory may be predicted:

He who knows when he can fight and when he cannot will be victorious.

He who understands how to use both large and small forces will be victorious.

He whose ranks are united in purpose will be victorious.

He who is prudent and lies in wait for an enemy who is not, will be victorious.

He whose generals are able and not interfered with by the sovereign will be victorious.[30]

With Sun Tzu's words in mind, and with the 20-20 vision of hindsight, it seems very clear which side was going to win, and which was going to lose, the Vietnam War.

Endnotes

1. Sun Tzu, The Art of War, translated by Griffith, S.B., p. 84.

2. Karnow, S., Vietnam: A History, p. l9.

3. Cooper, C.L., The Last Crusade, p. 13.

4. Sheehan, N., The Pentagon Papers, pp. 27 - 28

5. Cooper, op cit., p. 135.

6. Thomas, J., Jr., Sentimental Imperialists, p. 254.

7. Sheenan, op cit., p. 51.

8. Ambrose, S.E., Rise to Globalism, p. 274.

9. Cooper, op cit., p. 151

10. Schlesinger, A.M. Jr., ed., The Dynamics of World Power, p. 482.

11. Cooper, op cit., p. 200.

12. Ambrose, op cit., p. 328.

13. Cooper, op cit., p. 86.

14. Sun Tzu, op cit., pp. 66-69.

15. ibid., p. 51. A direct paraphrase of Sun Tzu, ibid., p. 96, "When the enemy is at ease, be able to weary him; when well fed, to starve him; when at rest, to make him move."

16. ibid., p. 73.

17. Ambrose, op cit., p. 323.

18. Sheehan, op cit., pp. 527 - 535.

19. Kamow, op cit., p. 17.

20. Taber, R., The War of the Flea, p. 89.

21. Maclear, M., Vietnam: The Ten Thousand Day War, p. 221

22. Brown, op cit., p. 25.

23. Record, J., Hollow Victory, p. 137.

24. Cooper, op cit., p. 202.

25. Thomson, op cit., p. 264.

26. Sheehan, op cit., pp. 491 - 492.

27. Ambrose, op cit., p. 293.

28. Maclear, op cit., p. 312.

29. ibid, p. 355.

30. Sun Tzu, op cit., pp. 82-83.

BIBLIOGRAPHY

1. Ambrose, S.E., Rise to Globalism: American Foreign Policy, 1938-1980, 2nd rev ed., (US, Penguin, 1980).

2. Arrnbuster, F.E., Gastil, R.D., Kahn, H., Pfaff, W., Stiliman, E., Can We Win in Vietnam? (US, Frederick A Praeger, 1968).

3. Brown, W.A., The Last Chopper: The Denouement of the American Role in Vietnam,1963-1975 (US, Kernikat, 1976).

4. Cooper, C.L., The Lost Crusade: The Full Story of US Involvement in Vietnam from Roosevelt to Nixon (Great Britain, MacGibbon & Kee, 1971).

5. Karnow, S., Vietnam: A History (New York, Viking, 1983).

6. Maclear, M., Vietnam: The Ten Thousand Day War (US, Thames Methuen, 1981).

7. May, E.R., "Lessons" of the Past: The Use and Misuse of History in American Foreign Policy (US,Oxford University Press, 1973).

8. Taber, R., The War of the Flea: A Study of Guerrilla Warfare, Theory and Practice (US, Paladin, 1977).

9. Thomson, J., Jr., Sentimental Imperialists: The American Experience in East Asia (US, Harper & Row, 1981).

10. Record, J., Hollow Victory: A Contrary View of the Gulf War (US, Brasseys, 1993).

11. Schlesinger, A.M., Jr., ed., The Dynamics of World Power (New York, Chelsea House, 1983), vol. IV, Part 2.

12. Sheehan, N., Smith, H., Kenworthy, E.W., Butterfield, F., The Pentagon Papers: The Secret History of the Vietnam War (US, Bantam, 1971).

13. Sun Tzu, The Art of War, translated by Griffith, S.B. (London, Oxford University Press, 1963).

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Fighting With Fire

by LTC Tony Teo Meng Soon

INTRODUCTION

In 1453, Mohammed II of Turkey helped bring an end to the Byzantine Empire when he attacked Constantinople with 68 giant bombards. The city walls of Constantinople were battered for 47 days and finally a breach was created to allow the infantry to storm the city. Mohammed II's use of artillery revolutionised siege warfare.[1] He knew how to fight with fire better than the garrison forces.

Since Mohammed II, there have been many revolutions in artillery tactics brought about by technological innovations and the creative use of fire. In most instances, new tactics were made possible through technological breakthroughs in areas concerning firepower, mobility and communications. In the 1620s, King Gustavus Adolphus of Sweden developed mobile field guns capable of keeping up with the infantry[2] and heralded in the era of true field artillery. Since then, the Europeans have been at the forefront of developing artillery tactics. "Fighting with fire" is the rallying cry for artillerymen all over the world to explore new artillery tactics that will change the face of combined arms operations.

This essay explores the future of "fighting with fire" on the battlefield. Its purpose is to stimulate debates between the artillerymen and their manoeuvre counterparts on the issue of how best artillery fire should be employed in combined arms operations of the future.

TRADITIONAL FIELD ARTILLERY TASKS

The two main tasks of field artillery have been the provision of close fire support to the infantry and cavalry/armour forces, and counterbattery fire. In the Franco-Prussian War (1870-1871), an artillery duel would usually be conducted in an effort to silence the opposition's artillery. This would be followed by fire support in the close-in phase of the battle. Counterbattery fire would assume higher priority because of the need to protect one's own infantry from the shells of enemy guns. The latter were usually more lethal than small arms fire. But to survive in a counterbattery environment, friendly artillery must keep most of its guns silent in routine operations, and to ensure that the guns that fire do so in unison. This is contrary to the provision of continuous close support.

These contradictory roles brought about a great divorce within field artillery. The infantry developed its own artillery in the form of "trench artillery" in World War I to overcome protective obstacles and machine gun posts. The Germans in 1910 were the first to introduce trench artillery in the form of a mortar known as *minenwefer* or mine thrower.[3] These mortars were valued because they were placed close enough to the infantry for direct communication with them. At a time when artillery pieces were moving further and further to the rear, this ease of liaison was greatly appreciated.

EVOLUTION IN ARTILLERY TACTICS

Very often in history, it is found that artillery tactics had evolved around two main factors - mobility and firepower. Light guns, pulled by two men in the battlefield, were first introduced in the 1620s by King Gustavus. It was the first time that artillery could keep pace with the infantry. In firepower terms, these light guns could fire three rounds in the time that it took a musketeer to fire one. With superior mobility and firepower, Gustavus achieved devastating results in the Thirty Years' War (1618-1648).[4]

In World War I, the battles of 1914 demonstrated that infantry mobility in the battlefield was a secondary consideration to firepower. Trench warfare was the product of superior firepower over mobility. To restore mobility, neither side had the necessary firepower.[5] By 1918, there was a 2-3 fold increase in the number of guns per 1000 infantrymen in the British, French and German forces.[6] Despite the introduction of the tank,

aircraft and machine guns - all capable of delivering firepower - the artillery was expected in 1916-17 to inflict mass destruction on the enemy in order to reduce own casualty rate. This tactic was a war of material resources and was soon replaced by a more sustainable one - that of artillery providing sufficient fire to spare the infantry the long fight. The adoption of "neutralisation" fire in 1917-18 has lasted until this day in most armies.

On the eve of World War II, artillery was a neglected arm. Theories of armour and mobility flourished and were seen as alternatives to the dominance of firepower, and, with the exception of the USSR, the armies of the major powers were organised and equipped to fight accordingly. The war ended with the victory of superior Allied firepower, which was achieved by massing artillery according to traditional principles, and enhancing it with advances in technology and organisation. Artillery tactics were woven in combined arms operations to influence manoeuvre. The weight of fire would stop the enemy's armoured thrust; it could also create a breech for friendly armour to punch through.

Fighting with fire evolved significantly after World War II. Faced with a much larger Warsaw Pact enemy, the western armies had to find ways to overcome the odds. Hence, it was the introduction of tactical nuclear artillery shells capable of attacking the rear echelons of the enemy. These gave artillery forces the capability to achieve both tactical and operational-level objectives. Fortunately, there was never a need to fire one in anger.

Today, the need to attack deep targets before the close-in battle is joined has become an important task of the field artillery in most modern armies. This was reinforced in the 1991 Gulf War where the US artillery employed tactical missiles (range of more than 100km) to great effect. Allied forces also conducted artillery raids across the border to hit high value targets and to lure the enemy artillery to open fire and reveal its location. The effectiveness of artillery raids may be summarised by this account: a captured Iraqi commander pointed out that out of his 100 tubes of artillery, 11 were destroyed by aircraft but 77 were destroyed by artillery fire.[7]

With the downsizing of many modern armed forces, will the future artillery be large enough to fulfil all its major tasks effectively? Or is there a better way to employ the limited artillery to achieve victory in a combined arms scenario? The number of tubes per 1000 infantrymen has dropped significantly since 1918. For example, the Germans only had 4 artillery pieces per 1000 infantrymen in 1986 compared to 13 at the end of World War I.[8] Will advances in technology, especially in the areas of ammunition and communication, provide the answer to the dominant artillery tactics of the future?

"ARTILLERY CONQUERS, INFANTRY OCCUPIES"

There are two conflicting trends in the use of artillery. One emphasizes the use of indirect fire to assist the manoeuvre forces in carrying out their mission. The other sees artillery as the battle winner on its own and all the infantrymen have to do is to mop up the enemy after the artillery has done its job. The first is associated with the principle of neutralisation while the second depends on destructive fire.

The conflicting trends alternate in their ascendancy. In World War I, the British artillery fell into the trap of "artillery conquers, infantry occupies". The British Army learnt a hard lesson on the Somme (Jul 1916) that this idea did not work. In World War II, the British approach was reversed and was predominantly geared to neutralisation. This contrasted with that of the Red Army in World War II, where artillery was tasked with inflicting casualties and destroying material.

Despite the advances in artillery ammunition technology, the idea that artillery could "conquer" so that the infantry might occupy has its own skeptics. Supporters would point to the 1991 Gulf War where Allied forces managed to get thousands of Iraqi to surrender after the preliminary aerial and artillery bombardment. One anecdote from the war described an Iraqi position that was attacked by massed dual-purpose conventional munitions (bomblets) fire from American field artillery. The defenders scurried to a nearby bunker only to have a laser-guided Copperhead 155mm shell fly through the door of the bunker. Realising the futility of flight, the rest of the enemy unit surrendered.[9] Skeptics would say that not all enemies in the future are

likely to be as compliant as the Iraqis were in 1991. Just look at the resilience of the Viet Cong during the Second Indochina War.

Lessons learnt from the two world wars suggest that artillery is best used for its "neutralising" and not "destructive" effect. It would be more profitable to explore how artillery fire could play a dominant role in manoeuvre warfare through better fire-mobility and more fire-variety.

MANOEUVRE OF FIRE

Since the 1950s, doctrines had emphasized the importance of manoeuvre supported by fire. Today, this doctrine is slowly being replaced by one that relies on fire-mobility and its exploitation by manoeuvre. This very concept of manoeuvre of fire is not a new innovation. The French Army in 1916 practised a similar doctrine by the name of manoeuvre de feu. The image evoked was of a modern "scientific" commander manipulating groups of explosions, as Napoleon or Frederick the Great might have manoeuvred battalions of grenadiers. The reality was more prosaic due to limitations in the weapon systems of that time and the hierarchical nature of their command and control system.[10]

Dominant firepower will not reduce the need to manoeuvre; it does however hamper enemy movement which may ultimately tie the enemy down to positional warfare. Conventional artillery fire alone is unlikely to win a war or create a decisive political bargaining opportunity. It can, however, stop the enemy from creating a stalemate by eliminating first its artillery. Manoeuvre and firepower will remain interdependent, but firepower should assume priority.

With more capable weapon, ammunition and communication systems, today's artillery possesses superior fire-mobility and fire-variety. Unlike its predecessor in World War I, artillery can now practice manoeuvre by fire in a decisive manner. The longer reach of guns allow the massing of fire across sectors to influence the battle at short notice; the availability of artillery delivered mines and radio jammers allow for the creation of instant obstacles to slow down or delay the movement of enemy reserve forces. This concept is also enabled by the wide use of RPVs (now UAVs) to acquire and track targets for the artillery.

How then to translate "manoeuvre of fire" into artillery tactics?

Train to Think Manoeuvre

First, the training of commanders will have to focus on the operational art of using artillery at the decisive point in space and time schwerpunkt. The Germans in World War I believed that the artillery's schwerpunkt should coincide with the manoeuvre's. This is only possible when the artillery commanders are well versed in the present day operational art and are able to appreciate the tactical situation well.

Whereas a French battery commander in World War I tended to be a graduate of the Ecole Polytechnique, a school that might best be described as a combination of the Massachusetts Institute of Technology and West Point, his German counterpart was a product of either a cadet school or a gymnasium. Thus, while the German artillery officer was certainly no mathematical illiterate, the French gunner was usually more comfortable in the world of numbers. The German artillery officer, on the other hand, was a tactician before he was a technician.[11]

The same focus should apply today and into the future so as to produce artillery officers capable of directly and massing artillery to enhance own manoeuvre and restrict the enemy's. There will be a fundamental shift from the present concept of using artillery mainly for close support and this affects the manoeuvre commanders.

Synchronising Close Support

Next, better synchronisation is required between manoeuvre and fire. Admittedly, it will be difficult to convince the infantry and armoured officers to operate with less close support artillery. Many armies have began the process of removing brigade artillery from their ORBAT. This is driven partly by the desire to reduce the number of weapon systems in the ORBAT as well the general trend towards downsizing. Coupled with the trend of fighting deep, the number of guns available for close support will be reduced if there is no change to the present method of allocating fire support.

Manoeuvre commanders have had very good fire support since the introduction of combat radio in World War II and its proliferation in the Korean and Vietnam Wars. Combat radio has enabled anyone equipped with one to call for fire support. In the Vietnam War, fire support thus became an utility - just like turning on the tap when you need water.

The idea that fire support is an utility must change. Artillery fire must provide decision in the battle and not as an economy-of-force measure. With limited artillery, there is now an urgent need to synchronise the close support requirement of the manoeuvre brigades. The traditional method of allocating fire support will change. Artillery commanders must seek out opportunities to mass fire in close support roles in order to create a paralysis of command in the opposing brigade's sector. Longer gun range and more reliable communications are the keys to this concept.

Return of Massed Fire

Massing fire is making a come-back. It has been practised in all the previous major wars but in a different manner. Then, guns had to be physically massed in order to provide weight of fire. The Germans, unlike the French or American, were good at massing multiple-division artillery groups in World War II. Their increased reliance on mass fire helped starved off the inevitable collapse of its position on the eastern front from 1941-44.[12]

The introduction of the "silver bullet" or nuclear artillery shell in the post-World War II period reduced the need to mass conventional artillery. With the demise of such tactical nuclear shells in the post-Cold War era, massing fire is making a return. In the Vietnam war, the American brigade fire support coordination centre was able to plan and execute multi-battalion fires. In the Gulf War, multiple-launch rockets and guns were massed in daring artillery raids across the frontline. With massed fire, the battle-winning contribution of artillery was re-emphasized.

ENGINE FOR DOCTRINAL GROWTH

Manoeuvre of fire doctrine will be driven by advances in military technology. The main engine for doctrinal growth is new artillery ammunition although the advent of heli-portable 155mm guns will drastically improve tactical mobility across the battlefield. Smart ammunition with onboard target seeker will give artillerymen greater accuracy against high value targets such as armoured vehicles and command posts. Coupled with mine-dispensing shells, artillery fire can effectively stop a mobile column in its tracks.

To fix the enemy, anti-personnel mines and radio jammers may be dispensed by artillery shells. Add to these are cargo shells capable of dispersing large numbers of dual-purpose bomblets. It is foreseeable that a right mix of ammunition would enable a small force to fix a much larger one.

In the development stage are shells that can capture and transmit back live imagery of the target area. These can be fired prior to and after an engagement to determine target location and later assess target damage. Shells carrying GPS fuzes are also being experimented. These will provide real-time corrections to the firing data which will enable predicted fire to be practised with greater effectiveness.

CONCLUSION

A Chinese general in 1944 once said that with artillery, he commands a division, without it he would be commanding three regiments of infantry. Artillery is the essential additive which makes all-arms formations. Another observation is that modern approaches to warfighting in many armies today have transformed thinking at operational and higher tactical levels, but have tended to gloss over the realities at the bottom end. The fundamental reality is that infantry platoon frontages is still what it was in 1945. The defining infantry attacks are going to look very similar to those of Falklands or Korea or World War II. Future artillery tactics must continue to "stick to knitting" - neutralise the enemy so that the manoeuvre forces may close in. Future artillery tactics must do this better because the public will not accept high battle casualty rates.

Having said that, advances in technology and manoeuvre warfare are pushing artillery to take on another important role. Artillery tactics will see an increase in the emphasis on mobility and counter-mobility tasks. Fire-mobility and fire-variety will be the twin pillars to this development. Together, they will create the opportunities for manoeuvre. Future tactics must fulfil both roles - close support and manoeuvre fires - equally well and with a reduced artillery ORBAT. That is the artilleryman's challenge.

Endnotes

1. Dastrup, B. L., The Field Artillery - History and Sourcebook, Greenwood Press, Westport, USA, 1994, p. 5.

2. ibid, p. 11.

3. Gudmundsson, B. I., On Artillery, Praeger Publishers, Westport, USA, 1993, p. 73

4. Dastrup, op cit., p. 12.

5. Bailey, J.B.A., Field Artillery and Firepower, The Military Press, Oxford, 1987, p128-129.

6. ibid, p.127.

7. Bellamy,C.,Expert Witness, A Defence Correspondent's Gulf War 1990-91, Brassey (UK), 1993.

8. Bailey, op cit., p127, 318.

9. Dastrup, op cit., p. 73.

10. Gudmundsson, op cit., p.109.

11. ibid, p. 22-23.

12. Dastrup, op cit., p.126.

Bibliography

1. Reid, B. H.,Firepower and the Meeting Engagement, British Army Review Issue No.100, Apr 92, p. 30-36.

2. Jary, S., Gunners, British Army Review Issue No. 116, Aug 97, p. 56-64.

3. McCausland, J. (LT-COL), The Gulf Conflict: A Military Analysis, ADELPHI Paper 282, Nov 93.

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The Anti-Ship Missile - A Revolution in Naval Warfare

by MAJ Stephen Sim

PREDATOR OF THE SEA

On 21 Oct 1967, the Eilat, an Israeli destroyer burst into flames and sank into the Mediterranean amidst a thick cloud of smoke. She had been struck by two Russian-made SSN-2 missiles fired by a small Egyptian Osa fast attack craft which did not even bother to leave Alexandria Harbour. The missile came to be known the world over as the Styx.

The incident created shock waves throughout the Western world, which had, until then, largely ignored the destructive powers of the anti-ship missile and its potential in winning a decisive naval battle. The ensuing years saw the Western countries in a frenzy to develop their own anti-ship missiles and shipboard defence systems, the latter to protect the ships against these missiles. These early efforts laid the foundation for the emergence of the present day anti-ship missile which are faster, smaller, smarter, more accurate and more deadly over longer ranges compared to those in the 1960s.

The first real test of the modern anti-ship missile came in the Falklands War in 1982. The British destroyer HMS Sheffield, an advanced modern warship, was destroyed by a single French made Exocet fired from an Argentinean Super Etendard fighter aircraft. Two more Exocets were subsequently used with success against the large container ship, Atlantic Conveyor. Such was the lethality of the anti-ship missile which left even the most heavily armed and defended warships vulnerable. The advent of the anti-ship missile signaled the end of guns and artillery as the mainstay of naval weapons. Naval tactics and operations as well as the design of warships also saw radical transformations as a consequence. Indeed, the anti-ship missile is nothing short of a revolution in naval history for it ushered in the modern age in naval warfare, the abandoning of archaic and traditional war fighting methods and the dependence on science and technology to achieve military success.

BIRTH OF A MENACE

Although the anti-ship missile has its roots as a simple radio-controlled glider bomb developed by Siemens-Shuckert Werke of Germany in 1915, its first operational use was during World War II. In the summer of 1944, Allied ships in the English Channel were bombarded by German made Mistels. The Mistel was actually a composite aircraft consisting of a Ju 88 rebuilt with a gigantic warhead (approximately 7000 lbs) in place of the crew compartment and guided by radio from a fighter which flew to the target area actually mounted above the pilotless bomber. The missile was crude and rudimentary and had limited success against the Allied ships. Its smaller cousin, the HS 293, essentially a 2304 lb bomb propelled by an underslung rocket, had far more success. Some 2300 HS 293s were launched during World War II and it had the distinction of being the first missile ever to destroy a warship in battle when it sank the escort HMS Egret on 27 August 1943. The HS 293 had a manual guidance system which required an operator to steer the missile to its intended target via radio remote control. The missile was air-launched and had a range of up to 11 miles.

Like the Germans, the Americans also used missiles during World War II. In May 1945, Bats hung under the wings of US Navy PB4Y-2 Privateer patrol bombers sank many Japanese ships, including a destroyer from a range of 20 miles. The 1880 lb missile distinguished itself from all other missiles in those days in that it had a much more advanced guidance system made possible by a small radar in the nose. The missile homed in on the radar reflections from the target ship - the first appearance of active radar homing technology.

Strangely enough, American missile development seemed to have taken a step backwards in the immediate post-war period when it opted for the manually guided Bullpup. The air-launched missile was produced in huge quantities for use by many American aircraft ranging from the A-4 Skyhawks and the F-104 to the P-3 Orion. The first batch of Bullpups entered service in 1959. It was crude in comparison with the Bat and was

essentially a 250 lb bomb with a rocket at the back. The missile was guided to its target by an operator through a miniature joystick on the launch aircraft.

While the Americans abandoned radar guidance in the 1950s, the Swedes adopted the radar homing technology from the Bat. A collaboration between a group of Swedish companies and a British rocket-motor supplier saw the introduction of the RB 04 in 1958. The missile utilised active-radar homing and had a range of 20 miles. It was designed to be air-launched (such as from the AJ37A Viggen) and had a 661 lb warhead. The RB 04 had a true "fire-and-forget" capability. As soon as the launch aircraft had sighted the distant target on radar, it could cue the missile's own radar to lock on, and the aircraft would release the missile. The aircraft could then turn away immediately, leaving the missile to home on the target by itself.

THE MODERN AGE

Up until the late 1950s, all anti-ship missiles were either rocket-propelled bombs or essentially small airplanes packed with explosives, and could be launched only by an aircraft. The next major development arrived in the form of the Russian-made SSN-2 Styx. The missile had a range of 26 miles and a speed of 600 mph. Its guidance system was considerably more sophisticated than those mentioned earlier. Mid-course guidance was either through auto-pilot or radio-command guidance, while the terminal guidance could have active-radar or infra-red homing. With a launch weight of 5550 lbs and a warhead of 882 lbs, the Styx could destroy all but the largest warship, and cause severe damage to the latter. Perhaps the most significant feature of the Styx was that it was packaged into aluminum box launchers which were then installed on small fast patrol boats (FPBs) such as the Komars and Osas which displaced no more than 250 tons. This effectively gave small FPBs the fire-power to threaten their more illustrious brethren, the destroyers and cruisers. Indeed, capital ships armed only with guns were at the mercy of these fast-moving missile-armed FPBs and this was amply demonstrated in the sinking of the Eilat.

The next stage of development of the missile was the introduction of sea-skimmers, such as the Russian SSN-7 which had active-radar homing and a range of up to 35 miles. It was also the first missile to combine sea skimming with submerged launch capability. The SSN-7 was developed in an era when it was realised that reaching a heavily armed warship bristling with radar equipment required that the missile come in as low above the water as possible to avoid radar detection. Sea-skimmers are held by radio altimeter and autopilot at a very low height above the sea to avoid radar detection. Examples of other early sea skimmers include the Israeli Gabriel, the Swedish RB 08 and the Norwegian Penguin.

By the late 1960s, the missiles bore much resemblance to the modem ones which we are familiar with today. The missiles were no longer merely bombs with a rocket attachment at the back, nor small airplanes packed with explosives, but had purpose-built rocket propulsion, cruciform wings and were compact, sleek and aerodynamic. The missiles were usually small enough to reduce the possibility of radar detection at long ranges and were agile and fast to avoid being shot down by shipboard defences. In addition, most were sea-skimmers to further make radar detection difficult. Terminal pop-up attacks were also frequently incorporated to present the missile radar seeker a better view of its target prior to homing as well as to confuse the target ship's defences in the last few vital seconds before impact. The missile warheads had a delay fuze to ensure hull penetration prior to detonation of the explosives in order to inflict maximum damage to the target

The present day anti-ship missile is epitomised by the Harpoon, a "fire-and-forget" cruise missile built by MacDonnell Douglas. The Harpoon entered service with the US Navy in 1976 as the Block lA. The Block lA was powered by a small turbojet engine which gave it a range in excess of 60 miles. It was armed with a 500 lb penetration/blast type warhead which was capable of disabling all ships except large cruisers and carriers. Mid-course guidance was by a strapdown inertial platform and the terminal guidance was active homing through a Texas Instruments frequency-agile radar. The missile was equipped with a host of ECCM (Electronic Counter Counter-measures) such as passive-homing, re-acquisition and fly-through recovery, etc. that ensured a high kill probability. The terminal phase can either be a sea-skim or a pop-up manoeuvre. The Harpoon can be launched from aircraft, ships (including FPBs) and submarines. Several versions of the

Harpoon have been developed over the years incorporating improvements in the range, the guidance system and ECCM features.

The greatest rival to the Harpoon is arguably the Exocet, built by Aerospatiale of France. Like the Harpoon, the Exocet has a "fire-and-forget" capability, a mid-course inertial guidance and active-radar homing in the terminal phase. However, unlike the Harpoon, the Exocet has rocket propulsion giving it a higher cruise speed but a shorter maximum range. The rocket propulsion also enables the missile to be fired at only a few seconds notice. The Exocet is a sea-skimmer, cruising at an altitude of 8 feet all the way to the target. Detonation of the warhead can be either through delay action or proximity fuze.

The Harpoon and Exocet have been widely exported to navies around the world and both missiles have demonstrated operational success particularly during the Falklands War in 1982 and the Gulf War in 1991. Such reported successes have made the anti-ship missile almost mandatory on modern warships and its incorporation into the ship's weaponry has greatly influenced modern ship design and even naval operations.

Technology Evolution

Until the Eilat saga in the mid l960s, the primary anti-ship weapons were naval guns and, to a lesser extent, torpedoes. In spite of modern sophisticated fire control systems, gun fire is relatively inaccurate since the ballistics of the ammunition is heavily dependent on meteorological conditions such as wind, temperature, precipitation, etc. This limitation, together with the small warhead on most gun ammunition, meant that more rounds would be needed to achieve the same degree of damage to the enemy vessel which would otherwise be inflicted by a single anti-ship missile.

As a result of this limitation, heavier calibre guns were mounted on warships to increase the lethality and range. This was evident during World War II which saw the commissioning of mammoth guns with calibre ranging from 15-in to 18-in on the battleships. Artilleries of such calibre require platforms of monstrous proportions. For instance the Yamato of the Japanese Navy, armed with nine 18-in guns in three turrets, was 263m long and displaced an outrageous 71 659 tons - the largest and most heavily armed battleship ever to put to sea. The more familiar Iowa of the US Navy, armed with nine 16-in guns in three turrets, measures 270m and displaced 55 710 tons. Yet in spite of such grandeur and spectacle, the humble FPB could have easily inflicted substantial damage on the colossal Yamato and Iowa with the longer range, greater accuracy and a more lethal warhead, which the anti-ship missile offers.

Torpedo-armed ships are likely to be FPBs due to the short ranges of torpedoes. In this case, high speed and manoeuvrability are essential to enable the FPB to get close enough to the enemy ship and fire the torpedoes. As torpedoes are of much shorter ranges than guns and missiles, the FPB would be subjected to enemy fire well before it is in a position to launch its torpedoes. Although torpedo-armed FPBs are still very much in use in many navies in the world, their roles are generally limited to strike operations against gun boats or the harassment of merchant shipping. Against missile-armed warships, the torpedo-armed FPB is virtually helpless.

The anti-ship missile scores on many counts over guns and torpedoes. For example, a single Exocet is able to strike an enemy ship beyond the horizon (up to 20 miles) at high sub-sonic speed with deadly accuracy and deliver a 364 lb warhead that is sufficient to inflict considerable damage and incapacitate all but the largest warship. Two or more salvoes would be capable of disabling the latter. In contrast, to achieve such ranges, a gun calibre of about 15-in or greater would be needed, and more rounds would have to be expended due to inherent inaccuracies of ballistic flight. While the Exocet firer is free to manoeuvre upon releasing the weapon, the gun platform has to maintain a constant lock-on using the fire control system or gun fire director, and this exposes the ship to subsequent attacks.

As mentioned earlier, a huge platform would be needed for mounting heavy calibre guns. The anti-ship missile, on the other hand, is light and compact and can be found on small FPBs, giving the latter a destructive power equivalent to a large gun-armed capital ship. For example, the Harpoon RGM-84A weighs only 1470 lb, a third of which is the warhead, and it can be fired from a 21- in tube of a submarine. Eight

Harpoons can easily be mounted on a FPB displacing no more than 250 tons. FPBs are much cheaper compared to destroyers and frigates, and present an inexpensive solution to third world countries in search of a capable and modern naval force. Following the sinking of the Eilat, large numbers of missile-armed FPBs were acquired by navies throughout the world. The appearance of the anti-ship missile marked the end of the big guns of World War II and battleships were largely consigned to the annals of military history and in naval museums.

Besides giving the FPBs the fire power of much larger warships, the anti-ship missile enables large warships to specialise in other aspects of naval warfare such as AAW and ASW. For instance, firing compact missiles at frigates and destroyers means that they are able to dispense with large calibre guns for anti-ship operations. In place of guns, other weapons and equipment may be fitted, such as surface-to-air missiles, electronic warfare systems, ASW systems, etc. Only small calibre guns are retained on the ships for anti-air defence and anti-ship missile defence.

The anti-ship missile also triggered the development of hard-kill and soft-kill anti-ship missile defence systems (ASMD). As a result of the proliferation of the anti-ship missile, most modern warships such as destroyers and frigates, and to a lesser extent, corvettes and FPBs, are equipped with ASMD systems for protection. Such defence systems were non-existent before the 1950s. The need for hard-kill missile defences saw a new generation of highly accurate, small calibre guns with astonishingly high rates of fire designed strictly to shoot down incoming missiles. Examples of such guns are the Vulcan Phalanx and the Goalkeeper. Short range missiles such as the Israeli Barak and the British Sea Wolf, were also developed to shoot down incoming anti-ship missiles. In addition, chaff systems have also become common place, even in FPBs, to provide some form of protection against anti-ship missiles. The anti-ship missile had not merely influenced the development of existing weapons and equipment but was also responsible for the emergence of entirely new technology.

INFLUENCES ON NAVAL OPERATIONS

The pivotal factor influencing the way modern warships operate is the missile's lethality and effectiveness over long ranges. Not only do missiles extend the range of a ship's striking power, but the ship extends the range of missiles even more. As such, modern naval battles are fought over long distances and involve, almost without exception, an exchange of missile fire.

Effectively, the range of the missile only extends to the distance at which the force is able to locate the enemy ship. There is very little value in having missiles with ranges in excess of 40 miles when the detection means reaches to little more than the visual horizon. The need to maximise the range of the missile imposes tremendous demands on shipboard sensors such as radar, electronic warfare, long range air surveillance, etc. Development of radar and electronic warfare systems have progressed at a frenetic pace since the early 1960s and long range air surveillance from maritime patrol aircraft have become a common feature in present day naval operations. Targeting accuracy have been greatly enhanced through the availability of the NAVSTAR Global Positioning System and improvements in missile guidance technology. Modern missiles are quite capable of hitting their targets even after a flight of some 100 miles or more.

Early naval battles involving gun battles were close range, straight forward affairs where both sides attempted to fire as early and as many rounds as possible against the enemy ship. Such exchanges often involved heavy casualties on both sides and bore very little subtlety and sophistication. The modern naval battle, in contrast, has evolved into a cat and mouse game fought at long ranges, the objective being to localise and engage the enemy ship without revealing and exposing oneself to enemy fire. Such encounters are necessarily complex and heavily dependent on technology and military hardware.

ENTERING THE NEXT MILLENNIUM

The evolution of the anti-ship missile continues as it attempts to adapt and overcome advances in ASMD technology. In 1993, the US Navy conducted a test at Point Mugu. A number of anti-ship missiles, including the Exocet MM38, Harpoon Block lDs and straight flying supersonic targets, were fired with a view to testing

their invulnerability to shipboard defences - all missiles were shot down. It was obvious that the development of ASMD technology has reached a point as to render current anti-ship missiles ineffective. Defence industries all over the world have stepped up their efforts to develop a new generation of anti-ship missiles capable of defeating the advanced shipboard defence systems of today.

Several fundamental requirements shape the design of the new generation anti-ship missile. First of all, the missile should be capable of attacking not only when the target is isolated on the open sea, but also when it is in a bay, among islands, surrounded by other vessels, or even in harbour. Similarly, the missile should have "fire-and-forget" capability to minimise the risk to the launch platform and allow several salvoes to be fired in rapid succession. To increase the probability of reaching the target, the missile should have low observability characteristics. This implies an ability to cruise at sea-skimming height at high speed and approach the target from any direction using a dog-leg track at supersonic speeds. For a high kill probability, the missile should strike close to the waterline and ideally in the vicinity of the engine room. It should also penetrate the hull prior to detonation.

Given the above conditions, the anti-ship missile of the 21st century is likely to be powered by a ramjet engine. Ramjet propulsion combines the long range of a turbojet and the high speed of a rocket. Another significant advantage which it offers is throttle control. A ramjet powered missile will be able to achieve an initial cruise to the target area at a relatively low supersonic speed (about Mach 2) at sea-skimming altitude, followed by a sudden pop-up manoeuvre and a furious Mach 3.5 zigzag dive onto the target. At Mach 3.5, the missile is able to cover 35 kilometres in half a minute, or over one kilometre in one second. This will leave very little warning time for the shipboard defences to react and hence enhance the probability of reaching the target. The new generation missile is likely to have dual seekers to enhance the probability of hitting the intended target and achieving a kill. An active-radar system provides autonomous guidance and all-weather capability, while an infra-red imaging system provides the precision and increases the probability of hitting the engine room. Other target-imaging options are millimetric wave and laser radars.

It is obvious that the anti-ship missile of the 21st century will be radically different from those that we know today. The missile represents an amalgamation of microwave, airframe, propulsion, ordnance, control and computer technologies. As we enter the next millennium, we witness yet another transformation in the design and capabilities of the anti-ship missile. Within a short span of some 30 years, the anti-ship missile has positioned itself as the pillar of the warship's offensive capability. With increased capabilities, complexity and virtually no competitors, it will remain so for many years to come.

Bibliography

1. Trevor N. Dupuy, International Military and Defense Encyclopedia, Brassey's (US), Inc.

2. Nels A. Parson, Jr., Missiles and the Revolution in Warfare, Harvard University Press, 1962.

3. Robert Berman & Bill Gunston, Rockets & Missiles of World War III, Bison Books, 1983

4. Richard K. Betts, Cruise Missiles - Technology, Strategy, Politics, Brookings Institution, 1981

5. Armada International Staff; Supersonic Anti-ship Missiles Needed, Armada International, Aug/Sept 1993.

6. Roy Graybrook, Anti-ship Missiles - Pay Your Money and Take Your Choice, Asia-Pacific Defence Reporter, Aug/Sep 1994.

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Long Term Presence of the United States in the Asia Pacific

by MAJ Michael Chua Teck Leong

Introduction

The past twenty over years have seen tremendous growth and prosperity in Asia's economies, notwithstanding the current gloom arising from the currency crisis. Many people have attributed this tremendous growth and development to the continued presence of substantial US military forces and America's alliance relationships in the region. This strong military presence has created a stable security environment that allows Asian governments to concentrate on economic development and growth and pay less attention to military and arms buildup. As SM Lee Kuan Yew said:

'The challenge of this region - unlike the Middle East or South Asia or the Balkans - is not to achieve peace and prosperity, but to maintain the peace that exists so that the prosperity can continue'.[1]

This challenge to maintain peace depends very much on the continued US presence in the region, the very same concerns raised when the US withdrew from Vietnam in the years following the Vietnam War. Unlike the withdrawals then in 1975, further withdrawals now would not be balanced by the forces that were left in Republic of Korea (ROK) and Japan. The reduction is unlikely to be replaced by other force deployment and as such the force reduction would also signify a substantial reduction of US commitment to the region. This in turn would lead to changes in the balance of power and security environment in the region.

At this point, I would like to establish the definition for the word "long-term" as referring to the period after the year 2020. This time frame is not quite that distant into the future to make this discussion academic but yet it still allows for substantial changes to take place in the geo-political situation in Asia-Pacific. This time frame would also allow for the possibility of the reunification of North and South Korea (a widely expected event but the timing is substantially delayed by the current economic crisis), which would have a significant bearing on the issue of US presence in the region.

Before proceeding further, we shall take a brief look at the present US forces disposition in the Asia Pacific region. As it currently stands, the US has forces deployed in ROK, Japan, Diego Garcia and Guam. The major force component numbering approximately 47 000 troops is located in Japan, the major US base being located in Okinawa with additional bases spread over various locations on Honshu Island. The bulk of the remaining US forces is located in ROK with an estimated 35 000 US troops deployed in bases such as Osan, Yongsan, Kunsan, etc. In Singapore, the US has a small logistic support HQ that provides support for ships and forces transiting through the region. There are also Marine Pre-position Squadrons located in Diego Garcia and Guam, which form part of the strategic network of bases for supply and equipment that would be needed for the conduct of contingency military operations.

Importance of US Presence to the Region

The need to analyse this issue of long-term US presence must be assessed with the understanding of how this presence has contributed to the economic growth of the region. As it is, the US force deployment has provided a non-threatening presence in Asia-Pacific that serves as an umbrella for the continued development and progress for the countries in this region. It has allowed for the phenomenal growth and economic success that was the envy of the rest of the world, notwithstanding the current economic crisis.

The nuclear umbrella afforded to Japan under the US-Japan Treaty is an important factor in reducing Japan's incentive to develop its own nuclear capability. This is very relevant today in the light of recent nuclear tests and the development of nuclear arms by both India and Pakistan. Japan's dependence upon American nuclear deterrence is reassuring to Asians, who are worried about the possible resurgence of a militarily strong Japan.

The importance of US presence is best reflected by this quote from SM Lee:

'Its presence makes a difference, and makes for peace and stability in the region. This stability serves the interests of all, including that of China'.[2]

Factors influencing the long term prospects of US presence

In the next few sections of this essay, we will look at some of the more important factors that will determine the future of US presence in the region.

Treaty Commitments

The existing bilateral and multi-lateral treaty commitments between the US and certain Asian nations represent the most basic and fundamental reason for the US to maintain its presence in the region. US treaty partners in the region include Japan, Korea, Australia, Thailand, Philippines and a number of island nations in the Pacific. In addition, US obligations to Taiwan could also be considered as legally binding under the terms of an ambiguously framed Taiwan Relations Act.

On closer examination of the treaties that the US is committed to in the region, there are only two countries where US forces are stationed in-country as part of the overall treaty requirements. In all other cases, the activation of US assistance and the commitment of US military forces take place only during periods of hostility. Actual physical presence of US forces in the allied country partner typically occur when there are bilateral and multilateral war-games and exercises and only for short periods of time.

At the present moment, the US has nearly fifty allies - some nominal and some de facto. But only in five of these countries, namely Germany, Japan, Korea, Italy, and the United Kingdom, are there more than 10 000 US service personnel stationed. Clearly, treaty commitments alone need not lead to the establishment of a permanent troop presence.

Nonetheless the major treaty commitment that will have an impact on US force presence would be the US-Japan Security Treaty and the Mutual Defence Treaty with South Korea. It is important to note that the strategic circumstances that led to the signing of both these treaties in the fifties have changed tremendously. The feared scenarios of worldwide communist domination in the fifties and the Cold War in the eighties have been dramatically transformed by the ending of the Cold War in 1989. The changes in the strategic environment and threat perception have led to, and will continue to demand, the reassessment of the rationale and the scope of the treaties.

A prime example of how changing national interests and priorities can lead to a reassessment of the value of treaty commitment can be seen from the suspension of New Zealand's participation in the 1951 ANZUS Treaty between Australia, New Zealand and the US. The implementation of a declaration requirement for warships possessing nuclear arms led to the suspension of the treaty in 1986 as it was against US policy to declare the possession or otherwise of nuclear weapons. This example shows that treaty commitments can and will be terminated or suspended when they no longer serve the national interest. Once it is determined that the costs of maintaining the obligations of the treaty relationship exceeds the benefits derived, then it is likely that the treaty becomes redundant.

Isolationism

US involvement and engagement in global affairs and international issues are not always a 'sure thing'. Throughout American history there have always been factions within the political leadership who argued for less US involvement and commitment where American interests are not threatened or at stake. An example of an isolationist view would be that expressed by Patrick Buchanan, the 1996 US Presidential candidate:

'In 1956, at the high-water mark of American power, the US stood aside as Soviet tanks crushed the Hungarian revolution. With that decision, Dwight Eisenhower and John Foster Dulles told the world that, while we support freedom in Central Europe, America will not go to war with Russia over it. What we need is a new nationalism, a new patriotism, a new foreign policy that puts America first, and not only first, but second and third as well'.[3]

There are others, less prominent than Buchanan, but who are nonetheless persuasive in their arguments. Ted Carpenter, Director of Cato Institute, argued that the international system has always been unstable and unpredictable, and would remain so in the future. However, such instability per se does not threaten America's security and in a post-Cold War world, there may be many localised disputes that are irrelevant to US security interests. He argued that for a threat to be considered as vital, 'it should have a direct, immediate and substantial connection with America's physical survival, its political independence, or the preservation of its domestic freedom'. As such, he argued that 'the preservation of America's Cold War system of alliances is ill-advised'.[4]

However, there are also those who argue for the maintenance of an international military role. William Hawkins, Director of the Hamilton Center for National Strategy, argued that war is a constant threat throughout most of recorded human history. Citing a Swedish study on this issue, he noted that there since 3600 BC, there have been 14 531 wars and only 292 years of peace. As such, he argued that the US should not be lulled into complacency with the ending of the Cold War and reduce its military capability or its leadership role in international affairs.[5]

The support for the continuation of US involvement and in particular US's interests in Asia is best summed up by this quote from President Bill Clinton, who said:

'I am going to China for one reason: To advance America's interests. America's future will not be secure if Asia's is in doubt'.[6]

From this statement and those of other prominent American statesmen, I am inclined to believe that the neo-isolationists form a minority and their views would not be the dominant factor on the issue of US military presence in the Asia Pacific Region.

US National Interests/Military Strategy

At the baser level, continued US involvement in the region is largely a function of US national interests and its global military strategy. A review of statements issued by US government officials would give a broad indication of American intents in the region. On the economic front, American long-term interests in the region can be represented by this quote from William Perry, Former US Secretary of Defence, who said:

'For all intents and purposes, our economy has become interdependent with those of East Asia. Thus our vital interests dictate that we will be increasing rather than decreasing our connection with East Asia'.[7]

In the long term, US economic interests and ties with the region are likely to increase and so will its need to maintain political and military influence in the area.

Joseph S. Nye, the former Assistant Secretary of Defense, captures the broad US stance from the military viewpoint in this statement,

'The US recognizes the need for a strong forward United States military presence in the Asia-Pacific region to protect vital American interests. As the East Asia Strategy Report makes clear, reductions resulting from the end of the Cold War have been accomplished, no further changes in war-fighting capability are currently planned; the United States will maintain a force structure requiring approximately 100,000 personnel in the Asia-Pacific region. The continuing United States security presence is viewed by almost every country in the region as a stabilizing force'.[8]

From the military strategic viewpoint, the policy of maintaining a forward presence is one of the pillars in US national military strategy. It is also in line with the force structuring proposals presented in the US quadrennial military review in 1997 and the aim of maintaining a force capability able to conduct two minor regional confrontations (MRCs) on a concurrent basis. This concept of forward presence is the direct result of the limited strategic lift capability available to transport the military equipment and forces needed to meet projected requirements of the MRCs. It would be better to have the troops and equipment in place in likely trouble spots than having to move them across vast distances.

The need for pre-positioning and forward presence becomes evident when we review some of the likely flash points in Asia. These include the Gulf region, Israel, Korean Peninsula, Spratly Islands, ROC, India and Pakistan. While places such as the Gulf and Israel are not quite within the Asia Pacific region, it should be noted that a substantial amount of US forces in Japan, particularly the carrier task groups, are devoted to contingencies in these places.

From the perspective of forward positioning of US forces close to the potential trouble spots, it is clear that the forces stationed in Korea and Japan fulfil this function. It is also unlikely that the threat situation would improve significantly, vis-a-vis the present, even in the long term to lessen the need for forward presence. As such, we can conclude that the stationing of US forces in Korea and Japan will remain an integral part of US military strategy.

In addition, the physical force presence has the effect of reaffirming US commitment to the region by demonstrating its willingness to risk the lives and limbs of American soldiers in the defence of a foreign country. Such symbolism cannot be demonstrated if the troops are to be based in Guam or Hawaii, even if the actual distances from some of the potential trouble spots are not significantly further away when we compare these alternative locations.

Host Nation Financial Support of US Forward Presence

The existing five-year special agreement to provide financial support for US forces has made it an attractive option to continue its stay in Japan. Japanese financial support (so-called ��host-nation support��) covers more than 70% of US non-salary costs in Japan. This has the effect of making it cheaper for the US to maintain her troops in Japan than to station the same forces back in CONUS. In comparison, host nation support for US forces in Germany is estimated to be at 10% of the level of funding in Japan. This is despite the fact that the overall force levels in both countries are quite similar.

In the longer term, it is unlikely that such generous terms as provided by the present agreement can be sustainable. With the expiration of the agreement at the end of fiscal year 2001 (March 2002), Japan will have no choice but to reduce these expenditures. While a reduction of funding is to be expected, it is also possible that a substantial portion of the funding could still be retained.

The Korean government too contributes to the upkeep of US forces stationed there, though the terms are much less generous than those provided by Japan. ROK provides support to United States Forces Korea (USFK) through both direct and indirect means. Direct support is provided through the direct cost-sharing programme. The cost-sharing support provided by ROK to offset USFK's won-based costs is applied to construction, logistics, and local national labour requirements. In addition, the ROK government provides rent-free bases and facilities and foregoes taxes and customs for American troops.

For the US government, it makes sound economic sense to continue with the existing hosting arrangements even if it is at a reduced funding level. It is definitely cheaper to station its military forces permanently in Japan and to a lesser extent in ROK than to station them in CONUS or even in the state of Hawaii or in Guam.

Nationalism

In a world of sovereign nations, hosting of another nation's military force seems highly incompatible with the notion of independence, particularly if there is an absence of external threat. Thus it is no longer a simple question of US willingness to remain in the Asia Pacific region but also the additional question of having a willing host to accommodate the permanent presence of a foreign military power. This problem was clearly demonstrated in the case of the US Subic Naval Base in the Philippines. The failure of the US government to renew its lease agreement with the Philippines government was the direct result of nationalistic sentiments and the intense debates and campaigning on this issue during the Philippines national elections.

The uncertainty in the Korean peninsula lies not so much in the possibility of the reunification but more in the matter of the timing. Notwithstanding recent border incursions by the midget submarine and the lone North Korean Commando, the prospects of reunification remain good. The basis for this conclusion can be traced to the fact that North Korea is virtually isolated on the diplomatic front, with its allies Russia and China extending diplomatic relations with ROK in 1990 and 1992 respectively. The North Korean economy is also on the verge of economic collapse with its GNP being less than one-twentieth that of ROK. Famine and poverty is widespread and living conditions are way below those of the South. Unless there is a desperate last grasp attempt by the North Koreans to retain their grip on power, it is likely that the reunification would take place once the South has managed to resolve its present economic woes.

The likely outcome following the Korean reunification would be the elimination of the rationale for further US military presence in the peninsula. There would no longer be any threat of a North Korean invasion and hence no requirement to station US forces for the defence of the South. The withdrawal of USFK is also expected to call into question the need for the maintenance of US forces in Japan. With the withdrawal of forces in Korea, Japan would be the only Asian country having such a strong US presence. This would be a difficult proposition to sell to the local Japanese population.

Local opinions on continued US force presence in Okinawa appear to be poor. Resistance to a US proposal to establish a new helicopter base in place of an older facility has resulted in a stalemate. Problems with the crimes committed by American GIs such as the highly publicised rape cases have created poor public impressions and have increased resistance to their continued stay.

At the national level, the questioning of the rationale, implementation and continuation of the US-Japan Security Treaty has surfaced time and again. Shintaro Ishihara, the former Transportation Minister and nominee for Prime Minister, said this with regards to the treaty,

'The raison d'etre of the Treaty - that Japan would provide the front line of defense for the American-led postwar order in Asia against expanding communism - has collapsed. Consequently, the US-Japan Security Treaty is gradually losing its significance and will eventually become totally obsolete'.[9]

Taking a more moderate stance is former Prime Minister Morihiro Hosokawa who supported the maintenance of the US-Japan Security Treaty but added, 'it should be realistically possible to transfer the main Marine bases in Okinawa to Hawaii or Guam'.[10] Public opinion surveys seem to indicate the same sentiments expressed by Mr. Hosokawa i.e., two-thirds of the Japanese people want to maintain the alliance but also want the US military presence reduced.[11]

Besides the views of individual politicians and surveys of the general population, it is the official stance of the political parties that would play a greater part in determining the future direction for the US-Japan Security Treaty. In this respect, the main opposition party, the Democratic Party of Japan, has taken the stance of maintaining the US-Japan Security Treaty but with the option of doing away with the permanent stationing of American military forces in Japan. Given the strong showing by the Democratic Party at the elections of October 1996 and the gains during the senate elections in July 1998, there is a strong possibility that the party could form the government in future elections.

On balance, I am doubtful that the current security arrangements in Japan can be sustainable in the longer term, particularly after the Korean reunification. The voice of Japanese people in the July elections for the Upper House has been clear in their rejection of the status quo and the traditional approach taken by the

LDP in the handling of the economy and the financial crisis. If the LDP is unable to win over the voters under the leadership of a new Prime Minister, then it is likely that there would be a new ruling party in Japan. More importantly, new policies would be implemented and these policies may differ significantly from those established by the present government. Under these circumstances, aspects of the Security Treaty will have to be modified and in particular, there is a good chance that the troop presence will be greatly reduced.

If the US is to leave Japan, could there be other countries that can assume Japan's role in providing host nation support? Unfortunately, the same nationalistic sentiments that can potentially force the US out of Japan is just as likely to prevent the establishment of new bases elsewhere. As yet, no other countries have come forward to offer host nation support. The preliminary attempts by the US to discuss basing arrangements with Thailand have been rebuffed (though it appears that the Thais are now re-considering). It may still be possible for the US to re-locate their facilities from Japan and Korea. However, it is likely that the scale and the nature of the presence would be much smaller and possibly in the form of Marine Pre-positioning Squadrons and other temporary attachments.

Conclusion

The continued presence of the US forces in the Asia Pacific region is tied largely to the developments in the Korean Peninsula and the political changes in Japan, and these appear to be unfavourable in the longer term. While it is in the US national interests and overall strategy to preserve the present status, it nonetheless needs to abide by the wishes of the host nations if it is required to leave. For other nations in the region, there is little that can be done to influence the outcome as nationalistic interests in Japan and Korea rather than the perceived benefits to the region would dominate the decision processes.

As much as there is a consensus that long-term US presence would be beneficial to the region and is desired by most countries in the region, it is unlikely that a third country would 'volunteer' to replace Japan or Korea as a host nation. At most, we would see the provision of logistic support or access agreements as that currently practiced by the Singapore government or the emergence of Pre-positioned Squadrons similar to those in Diego Garcia and Guam.

For Singapore, we have consistently supported US presence in the region. This has been amply demonstrated by our political leaders as seen from by this statement by Professor Jayakumar,

'In our discussions with US leaders and in their announcements, they have recently reiterated their strong commitment to the region. Singapore's position has always been to welcome and encourage US involvement and presence in the region'.[12]

ENDNOTES

1 Speech by Lee Kuan Yew at International Institute for Strategic Studies Conference entitled 'Maintaining Peace in the Asia Pacific', 12 Sep 1997.

2 ibid.

3 Patrick J Buchanan, The Wanderer, 'A New Nationalism', March 15, 1990.

4 Ted Galen Carpenter, USA Today Magazine, 'Uncle Sam as the World's Policeman: Time for a Change', January 1991.

5 William R. Hawkins, National Review, 'New Enemies for Old', September 17, 1990.

6 Newsweek, June 20, 1998

7 Speech by William J. Perry to the Japan Society, New York City, 'Ever Vigilant in the Asia-Pacific Region', Sept. 12, 1995.

8 Speech by Joseph S. Nye Jr., Pacific Forum Center for Strategic and International Studies/Japanese Institute of International Affairs Conference, San Francisco, 'Strategy for East Asia and the U.S.-Japan Security Alliance', March 29, 1995.

9 Shintaro Ishihara, New Perspectives Quarterly, 'A Japan That Can say No', Summer 1990.

10 Morihiro Hosokawa, Speech to Japan-America Society in Seattle, March 12, 1996.

11 7% favored the alliance with the U.S. but 67% wanted the bases reduced. Asahi Shimbun poll published on May 15, 1996.

12 Straits Times, 'Jaya says growing big-power ties good for Asia', March 13, 1998.

Bibliography

1. Patrick J Buchanan, The Wanderer, 'A New Nationalism', March 15, 1990.

2. Ted Galen Carpenter, USA Today Magazine, 'Uncle Sam as the World's Policeman: Time for a Change', January 1991.

3. William R. Hawkins, National Review, 'New Enemies for Old', September 17, 1990.

4. Shintaro Ishihara, New Perspectives Quarterly, 'A Japan that can say No', Summer 1990.

5. Morihiro Hosokawa, Foreign Affairs, 'Are US Troops in Japan Needed? Reforming the Alliance', July/August 1998.

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Book Review:

The Pentagon Wars

Reviewed by MAJ Tan Yan Yee

In *The Pentagon Wars: Reformers Challenge the Old Guard*, James Burton has written a highly readable and compelling account of the endless bureaucratic battles fought from the late seventies to the mid eighties between the Pentagon establishment and the Reform Movement, a loosely formed informal group of mid-level military and civilian professionals within the Pentagon. These reformers campaigned for reliable low-cost weapons (as opposed to high-tech and expensive weapons) and for realistic operational testing to demonstrate their relative effectiveness. In doing so, they sought to revamp the Pentagon weapon procurement process, in order to give US taxpayers the best defence for their tax dollars (at least in their opinion). For a number of years from the mid seventies to the mid eighties, the Movement gained *much publicity* and even *national prominence*, with feature stories in the New York Times and the Washington Post. Burton is eminently qualified to write about the Reform Movement, having worked in the Pentagon for 14 years and being at the heart of the Movement throughout its most influential days (when the Military Reform Caucus counted among its members more than one hundred congressmen and senators, both Democrats and Republicans) until his retirement from the US Airforce in 1986.

The first half of the book deals with the Reform Movement - its origins and objectives, and how the system reacted to its criticisms. That the Reform Movement comprised highly intelligent and credible people is undoubted. Burton lists as its intellectual leaders Airforce Colonel John Boyd, who developed the Boyd Cycle (more commonly known as the OODA loop) and who was an early advocate of manoeuvre warfare within the US armed services, as well as civilian analyst Pierre Sprey. For its efforts, the Movement gained some successes, notable among them the passage of the "Testing Reform Bill" by Congress in Sep 1983, and the cancellation of the Army's DIVAD air defence gun due to cost overruns and poor test results in 1985. Burton also credited Boyd and Sprey as being the "fathers" of the F-16 and A-10, and for having contributed significantly to the development of the F-15, F/A-18 and the F-117 aircraft.

The second half of the book deals with Burton's personal experiences in promoting the reform agenda within the Pentagon, often with adverse consequences to his career. In particular, it depicts his efforts to get the Army's Bradley Fighting Vehicle tested under realistic combat conditions, and modified based on the test results. More significantly, partly as a result of the Bradley episode, Congress passed legislation that required all new weapon systems to undergo live-firing tests before commitment to production. Unfortunately for the Reform Movement, the Reform agenda did not quite take root within the Pentagon. Once the principal players had passed from the scene, the Movement petered out and it was back to "business as usual". This is evident from the US Navy's fiasco over the A-12 programme in the early nineties.

Although Burton took pains to document his facts with congressional testimony, interviews, internal Pentagon documents and articles from the popular and military press, one cannot help but feel that he has merely presented a one-sided interpretation of several key events described in the book. According to Burton, the Pentagon is full of incompetent, mean-spirited and dishonest people who are more concerned with personal advancement and aggrandisement than with producing cost-effective weapon systems that would protect the lives of US soldiers in battle. More seriously, he highlights examples that purportedly show the system as rewarding dishonesty and yes-men, and punishing those who speak the truth against their superiors' wishes. It is difficult to accept (as is implied in Burton's book) that only the Reformers were concerned about the nation's welfare and the safety of the troops in battle. Burton painted a world which is largely black and white, whilst in reality there would have been many shades of grey. Men of goodwill often hold different opinion, and one cannot help but feel that this insight seemed to have escaped Burton.

Nevertheless, the book is essential reading not only for practitioners of the military weapon procurement process, but also for all serious students of bureaucratic politics in the civil service. By providing a relatively credible insider's account of Pentagon decision-making and the outcome of those decisions, it serves as a precautionary tale of how a combination of factors can sometimes lead to misguided decisions with

disastrous consequences. Bureaucracies everywhere are generally resistant to changes; they also have a tendency to keep growing and eating up a bigger proportion of the national budget. Although it is difficult to imagine our famously efficient civil service here in Singapore being in similarly unflattering circumstances, we must always guard against any complacency. This we will have to do by setting measurable performance standards and benchmarks for our civil service, and constantly reviewing them to ensure their continued relevancy. More crucially, the people at the top of the civil service must be of the highest quality, capable not only of visionary thinking but also able to translate good ideas into reality. Unlike the US, we are a small country that does not have the resources to squander. Moreover, if things were to go wrong, it is much more unlikely that Singapore, with the top-down approach and consensus-building nature of our society, will ever see the emergence of a Reform Movement like the one described in Burton's book!

*The abovementioned title is available for borrowing at the **SAFTI MI Library**. The catalog references are:*

The Pentagon Wars: Reformers Challenge the Old Guard

James Burton

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Book Review:

War And The Media

Reviewed by MR Aaron Loh

In *War and the Media,* Miles Hudson and John Stanier address the ambivalent relationship between governments and media organisations in the waging of war. The book is organised chronologically, tracing a history of major conflicts from the Crimean War (1854-1856) through the Vietnam War to the Balkan conflict (1991-1996), and attempts to give a historical perspective on the development of the media's role in reporting and influencing conflicts, and even deciding whether conflicts actually take place.

Among the issues analysed is the media's role in the forming of public opinion. According to Hudson and Stanier, it is primarily the media itself that determines what the public thinks, since there is no other consensual public opinion available. This is particularly true where foreign policy is concerned. Unlike home affairs, the public has no personal experience that can be brought to bear as a corrective to what may be reported. It is also due to this vulnerability that the media can be used as an offensive tool. Through historical examples, the authors illustrate how countries involved in conflict can harness the media. Among others, Hudson and Stanier cite the example of the Balkan crisis, when Serbian leader Slobodan Milosevic first moved into Kosovo. Gaining control of television, radio and the press in Belgrade, he utilised the media to whip up ethnic hatred against the Albanian population in Kosovo. Indeed, the entire Balkan conflict is, according to the authors, an exemplary example of how the effects of media manipulation can quickly get out of control. This potential abuse of the media's power in turn raises issues regarding its regulation, especially during periods of conflict. In the arena of media regulation, the authors cite examples such as the "D system" used in World War II and the "pool system" which allied forces imposed during the Gulf War against Iraq. In the former, the co-operation of the press was solicited through the use of "D-notes" that revealed sensitive information, but editors were asked not to print it. The "pool" system extended protection and access to journalists in exchange of the right to censor their copy. Other points raised include the utilisation of the media to gain international support for warfare, as well as the importance of the choice of media representatives in such situations.

In addition to these points, Hudson and Stanier also raised potential problems in this close relationship between the media and the waging of war. According to them, one of the most alarming trends which has emerged in the latter half of the 20th century has been the growing ability of the media to pressure governments into unwise actions. On a smaller scale, this resulted in debacles such as the US Delta-Force insertion into Tehran. On a larger scale, the entire UN involvement in Somalia, led by the US, is read as the result of a government bowing to public opinion. This public opinion itself was in turn inordinately influenced by a media that is at its heart a capitalist body, driven by the need for the next hot-selling story. Nevertheless, the importance of the media in modern conflicts, in the estimation of the authors, is of foremost significance, as evident in the final chapter of the book where they posit that "public relations will be an essential, perhaps the most essential, element of any future conflict".

Hudson and Stanier did their best to address an issue that is perhaps, in all fairness, too large and complex to be dealt with within the purview of any one book. According to the authors, their aim was "... at least to have achieved some recognition of the complexities and importance of the subject". That is perhaps all that they have achieved. While the structure of the book supposedly allows the reader to appreciate both the pervasiveness of the media's effects on conflict, as well as the development of this relationship, it essentially dilutes the arguments put forward. Hudson and Stanier found it necessary to walk the reader through each conflict, peppering these accounts with snippets regarding the media. A result of this approach is that there is no comprehensive, coherent picture that emerges of the development of war reporting and its effects. Similarly, any applications or "lessons" that could be learned by those reading the book have to be excavated from the morass of information that has been provided.

The credentials of the authors are, of course, impeccable. Miles Hudson was formerly head of the British Overseas Affairs Department, as well as the Political Secretary at the Foreign Office between 1970 and 1974.

John Stanier was the first officer in the British Army to hold the post of Director of Public Relations, becoming Chief of the General Staff from 1982 to 1985. Still, one cannot help but wonder why a book entitled *War and the Media* was not written, at least in part, by someone heavily involved in the commercial media. This perhaps explains the book's critical lack of depth regarding modern media communications technology and the impact that this has had on modern war correspondence. In addition, the media's perspective and philosophy regarding their trade is conspicuously absent; the opinions expressed in the book is heavily biased towards the military when a more balanced view would have been more constructive.

The end result is that *War and the Media* is painfully short on new things to say about this very important relationship, and is unfocused on the things that it does address. What is perhaps most ironic is that in painting a picture of a media which is largely amoral, sensationalistic and requiring regulation, the writers of the book seem unaware that, in their predominantly one-sided account of media relations, they are perpetrating a similar, if lesser, injustice.

*The abovementioned title is available for borrowing at the **SAFTI MI Library**. The catalog references are:*

War And The Media

Miles Hudson and John Stanier

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1 Miles Hudson and John Stanier, *War and the Media,* New York University Press, New York, 1998.

MR Aaron Loh is currently a staff writer with the Defence Policy Office. An Overseas Merit Scholar, he graduated with a BA (Hons) degree in English Literature from the University of Cambridge, UK. He also holds an MA degree in English and American Literature from Stanford University,USA.

Personality Profile:

Simon Bolivar

Simon Bol'var, also known as *The Liberator*, was a South American Creole soldier and statesman who led the revolutions against Spanish rule in Venezuela, Ecuador, Colombia, Peru, and Bolivia. He was president of both Colombia (1821-30) and Peru (1823-29).

Simon Bol'var was born on 24 July 1783 in Caracas, Venezuela. The son of a Venezuelan aristocrat of Spanish descent, Bol'var was born into a family of Creole land-owning elite. His father, Don Juan Vincente, died when Bol'var was three, leaving him in the capable hands of his mother, Dona Maria. As a young boy, Bol'var was distinguished as witty, enthusiastic and idealistic among his peers. His mother died when he was nine, and Bol'var was placed in the guardianship of his uncle, Estaban Palacios, who administered his inheritance and provided him with tutors. At the age of 16, Bol'var was sent to Europe to complete his education. For three years he lived in Spain and in 1801 he married Maria Teresa, the young daughter of a prominent Spanish nobleman, and returned with her to Caracas to assume the lifestyle of landed gentry. However, the young bride died of yellow fever less than a year after her marriage.

Vowing never to marry again, Bol'var undertook a second trip to Europe in 1804, at a time when Napoleon was approaching the pinnacle of his career. In Paris he re-met a former childhood tutor, Simon Rodriguez, who guided him to the writings of such European rationalist thinkers as Locke, Hobbes and Rousseau. The idea of independence for Hispanic America took root in Bol'var's imagination, and his mind, filled with ideas of freedom, liberty and human rights, found monarchy and all its trappings repugnant. In Rome, on the Monte Sacro, he vowed that he would dedicate himself to the cause of South American emancipation. Guided by Rodriguez, Bol'var became a dedicated republican. In 1807 he retumed to Venezuela by way of the United States, visiting the eastern cities and observing the workings of free instirutions. He offered the first proof of an enlightened mind by freeing the black slaves employed on his estate.

The Latin American independence movement was launched in 1808, as Napoleon's invasion of Spain unsettled Spanish authority. Bol'var himself participated in many conspiratorial meetings. On April 19, 1810, the Spanish governor was officially deprived of his powers and expelled from Venezuela, and a junta took over. To obtain help, Bol'var was sent on a mission to London. His assignment was to explain to England the plight of the revolutionary colony, to gain recognition for it, and to obtain arms, support and protection. Bol'var failed in his negotiations on all these counts, owing to the treaty alliance between England and Spain. Bol'var then played a key role in the events leading to Venezuela's initial declaration of independence from Spain. In March 1811, a national congress met in Caracas to draft a constitution. After long deliberation, it declared Venezuela's independence on 5 July 1811.

At age 28, Bol'var traded his diplomatic duties for a patriot's uniform and marched into battle as a colonel in the army of the young republic. However, the Spanish forces managed to put down the rebellion in Venezuela, and Bol'var fled to Cartagena in New Granada (present-day Colombia). There, determined to continue the struggle, he published the first of his great political statements,*El Manfiesto de Cartagena,* in which he urged the revolutionary forces to destroy the power of Spain in Venezuela.

Bol'var now emerged as the champion of strong government for the nascent republics of Hispanic America and was named commander of an expeditionary force whose task was to liberate Venezuela. In his first campaign as general, he fought six pitched battles, covered a distance of 1200 kilometres, destroyed five hostile armies, and reconquered western Venezuela - all in 90 days. On 6Aug 1813, he marched into Caracas at the head ofthe liberating army, and was given the title of *Liberator,* and assumed political dictatorship.

In 1814, the Spanish once more defeated Bol'var, ending the second Venezuelan republic. After some more sporadic warfare in New Grenada, Bol'var fled to Jamaica to take refuge as an exile. At the low point ofhis fortunes, Bol'var refused to acquiesce to failure. On 6 Sep 1815, he wrote the greatest document of his

career: *La Carta de Jamaica ("The Letter from Jamaica"),* in which he outlined a grandiose panorama from Chile and Argentina to Mexico. He proposed constitutional republics throughout Hispanic America, modelled on the government of Great Britain, with a hereditary upper house, an elected Lower House, and a president chosen for life. The last provision, to which Bol'var clung throughout his career, constituted the most dubious feature of his political thinking. Finding little support in Jamaica, Bol'var moved on to Haiti, a small republic that had freed itself from French rule, where he was given a friendly reception by President Alexandre Sabes Petion, as well as money and weapons.

In 1817 Bol'var decided to set up headquarters in the Orinoco region, which had not been devastated by war and from which the Spaniards could not easily oust him. He engaged the services of several thousand foreign soldiers and officers, mostly British and Irish, and established his capital at Angostara. In the spring of 1819 he conceived his master plan of attacking the Spanish vice royalty of New Granada. Bol'var's attack on New Granada will always be considered one of the most daring in military history. The route of the small army (about 2,500 men, including the British legion) led through flood-swept plains and icy mountains, over routes that the Spanish considered impassable. A man of tireless energy, Bol'var shared the same food, the same hardships of battle and terrain with the common foot soldier and earned the respect and admiration of his troops. The Spaniards were taken by surprise, and in the crucial Battle of Boyaca on 7 Aug 1819, the bulk of the royalist army surrendered to Bol'var. Three days later he entered Bogota. It was the turning point in the history of northern South America. In December 1819, Bol'var was made president and military dictator. He urged the legislators to proclaim the creation of a new state: the Republic of Gran Colombia, and three days later, La Republica de Colombia was established. It was a federation and, since two of its three departments, Venezuela and Quito (Ecuador), were still under royalist control, it was only a paper achievement. Bol'var knew, however, that victory was finally within his reach. A revolution in Spain had forced the Spanish king to recognise the ideals of liberalism on the home front, and his action quite naturally discouraged the Spanish forces in South America. The Battle of Carabobo (June 1821) opened the gates of Caracas, and Bol'var's Venezuelan homeland was at last free. In the autumn of 1821, a congress convened in Cucuta to draft a constitution for Colombia and elected Bol'var as president. Bol'var continued his military campaign, and at the end of 1821, Ecuador was liberated.

The territory of Gran Colombia, comprising what are now Colombia, Venezuela, and Ecuador, had now been completely recovered from Spain and its new government recognised by the United States. Only Peru remained in the hands of the Spaniards. In September 1823 he arrived in Lima, and after a series of battles, the Spanish army surrendered on 9 Dec 1824. Bol'var was now president of Gran Colombia and Peru. Only a small section of the Continent - Upper Peru (present day Bolivia) - was still defended by royalist forces. In April of 1825, Upper Peru was liberated, and the new nation chose to be called Bolivia after the name of the Liberator. For this child of his genius, Bol'var drafted a constitution that showed once more his authoritarian inclinations: a lifetime president, a legislative body without power, and a highly restricted suffrage. Bol'var was devoted to his own creation, but, as the instrument of social reform that he had envisaged, the constitution was a failure.

Bol'var had now reached the high point of his career. His power extended from the Caribbean to the Argentine-Bolivian border. Another of his favourite projects, a league of Hispanic-American states, came to fruition in 1826. He had long advocated treaties of alliance between the American republics, whose weakness he correctly apprehended. In 1826 a general American congress convened in Panama. Compared with Bol'var's original proposals, it was a fragmentary affair, since only Colombia, Peru, Central America, and Mexico sent representatives. The four nations who attended signed a treaty of alliance and invited all other nations to adhere to it. A common army and navy were planned, and a biannual assembly representing the federated states was projected. All controversies among the states were to be solved by arbitration. Despite its meagre results, the congress of Panama provided an important example for future hemispheric solidarity and understanding in South America. But Bol'var was aware that his plans for hemispheric organisation had met with only limited acceptance. His contemporaries thought in terms of individual nation-states, Bol'var in continents. In the field of domestic policy he continued to be an authoritarian republican. He thought of himself as a rallying point and anticipated civil war as soon as his words should no longer be heeded.

The last few years of Bol'var's life were marred by disagreements between and within the new republics, which culminated in revolts and civil wars. On 25 Sep 1828, a group of liberal conspirators invaded the presidential palace and tried to assassinate Bol'var. But, though this attempt on his life had failed, the storm signals increased. Bol'var's precarious health also began to fail. Reluctantly, Bol'var realised that his very existence presented a danger to the internal and external peace of the nations that owed their independence to him. In May 1830, he decided to retire to Europe, but before he could embark on the journey, he died of tuberculosis on 17 Dec 1830, in Santa Marta, Colombia.

Sources

1. Encyclopaedia Britannica, 1992.

2. Dupuy, T. N., *The Encyclopaedia of Military Biography*, I.B. Tauris & Co, London 1992.

3. Keegan, J. and Wheatcraft A., *Who's Who in Military History*, Routledge, London 1996.

4. Townson, D., *Famous Generals*, Purnell, London 1975.

5. Boughton, S., *Great Lives*, Doubleday, New York 1988.

Selected Books and Reports:

Collin S. Gray

Colin S. Gray graduated from Manchester University and holds a doctorate from Oxford University. Currently the Director of the Centre for Security Studies, University of Hull, he had also served in the President's General Advisory Committee on Arms Control and Disarmament. Gray has a distinguished career in both the government service and the academia; in 1988, he received the Distinguished Service Award for his contributions to the development of US maritime strategy.

In his book, *The Leverage of Sea Power*, Gray traces the importance of sea power from antiquity to the twentieth century. According to him, it was the leverage of sea power that enabled the Allies to mobilise their resources and defeat Germany during WWI and WW2. It was also sea power that allowed the coalition forces to wage a successful campaign against Iraq as the ground forces which needed bulky supplies for the offensive had to be supported and sustained by sea.

In *Weapons Don't Make Wars*, Gray contends that weaponry does not equal strategy, and that the two are often confused. According to him there may be an interactive relationship among policy, strategy and weaponry, but policy and strategy take the front seat. This book provides an examination of just how policy and weapons influence, or fail to influence, each other.

"If peace breaks out, can arms control be far behind?" This motto, according to Gray, describes events of the 1990s just as well as those of the 1920s. In his book, *House of Cards: Why Arms Control Must Fail*, Gray offers a history of twentieth century attempts at arms limitation and challenges the fundamental assumptions of arms control theory. He concludes that arms control has never worked because it never can.

The following books by Colin S. Gray are available in the SAFTI Library:

Canadian Defence Priorities: A Question of Relevance, 1972.

Canada's Maritime Forces, 1973.

The Geopolitics of the Nuclear Era: Heartlands, Rimlands, and the Technological Revolution, 1977.

The Future of Land-Based Missile Forces, 1977.

The MX ICBM and National Security, 1981.

Strategic Studies: A Critical Assessment, 1982.

Strategic Studies and Public Policy: The American Experience, 1982.

American Military Space Policy: Information Systems, Weapon Systems and Arms Control, 1984.

Nuclear Strategy and Strategic Planning, 1984.

Nuclear Strategy and National Style, 1986.

Maritime Strategy, Geopolitics and the Defense of the West, 1986.

The Geopolitics of Super Power, 1988.

Seapower and Strategy, 1989.

War, Peace, and Victory: Strategy and Statecraft for the Next Century, 1990.

The Leverage of Sea Power: The Strategic Advantage of Navies in War, 1992.

House of Cards: Why Arms Control Must Fail, 1992.

Weapons Don't Make War: Policy, Strategy, and Military Technology, 1993.

The Navy in the Post-Cold War World: The Uses and Value of Strategic Sea Power, 1994.

Military Operations and Maritime Preponderance: Their Relations and Interdependence, 1996.

Explorations in Strategy, 1996.